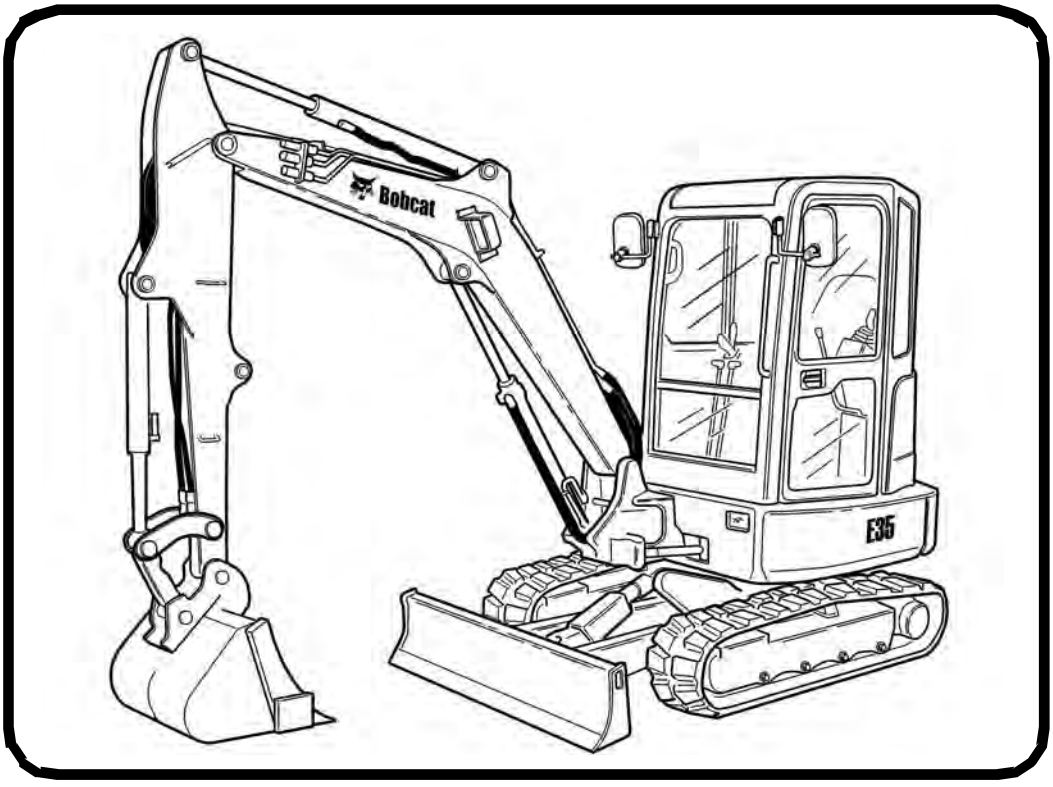
Bobcat®

Service Manual
E35 Compact Excavator

S/N A93K11001 & Above
S/N AC2P11001 & Above



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6987276 (9-13)

Printed in U.S.A.

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MAINTENANCE SAFETY

WARNING

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

W-2003-0807

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

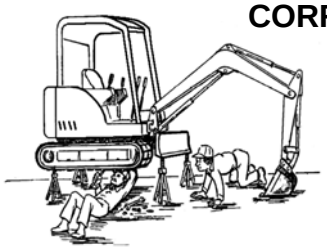
CORRECT



P-90216

Never service the Bobcat Excavator without instructions.

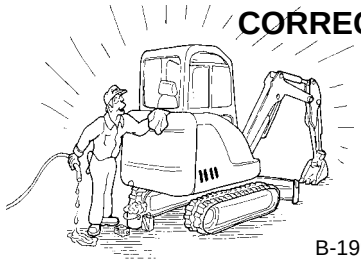
CORRECT



B-19964

Use the correct procedure to lift and support the excavator.

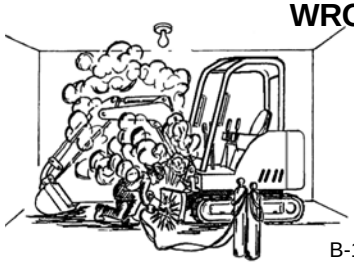
CORRECT



B-19959

Cleaning and maintenance are required daily.

WRONG



B-19965

Have good ventilation when welding or grinding painted parts.

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

WRONG

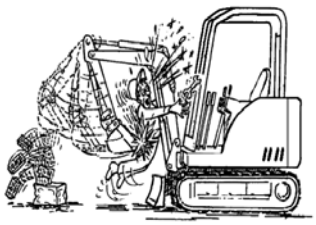


B-19960

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

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

WRONG

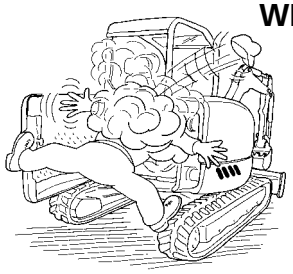


B-19966

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

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

WRONG



B-19962

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

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

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

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

WRONG



B-19958

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

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

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

WRONG



B-19798

Lead-acid batteries produce flammable and explosive gases.

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

Batteries contain acid which burns eyes or skin on contact.

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

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

MSW28-0409

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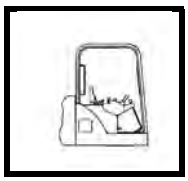
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FOREWORD

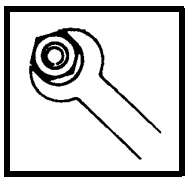
This manual is for the Bobcat excavator mechanic. It provides necessary servicing and adjustment procedures for the Bobcat excavator and its component parts and systems. Refer to the Operation & Maintenance Manual for operating instructions, starting procedure, daily checks, etc.

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

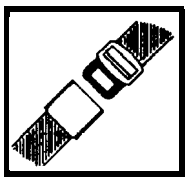
1. Check that the ROPS/TOPS/ FOPS is in good condition and is not modified.



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



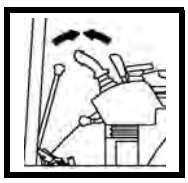
3. The seat belt must be correctly installed, functional and in good condition.



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



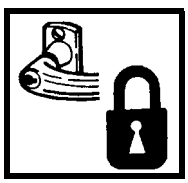
5. Travel levers, control levers and foot pedals must return to neutral. Check that the pedal locks are in working order.



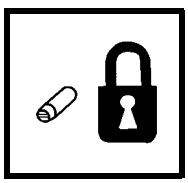
6. Check for correct function of the work lights.



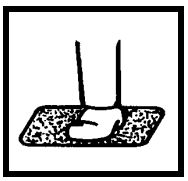
7. Enclosure door latches must open and close freely.



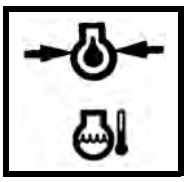
8. Attachment locking pins must function correctly and be in good condition.



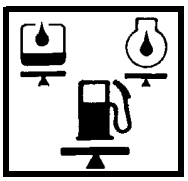
9. Safety treads must be in good condition.



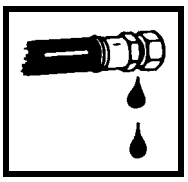
10. Check for correct function of indicator lamps.



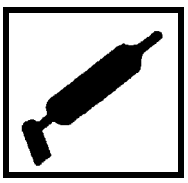
11. Check hydraulic fluid level, engine oil level and fuel supply.



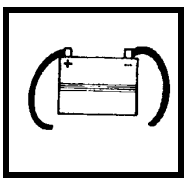
12. Inspect for fuel, oil or hydraulic fluid leaks.



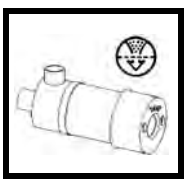
13. Lubricate the excavator.



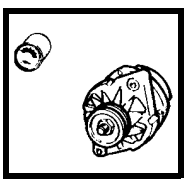
14. Check the condition of the battery and cables.



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



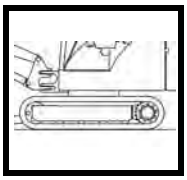
16. Check the electrical charging system.



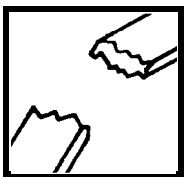
FW EXC-0509 SM

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



18. Inspect for loose or broken parts or connections.



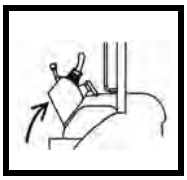
19. Check for any field modification not completed.



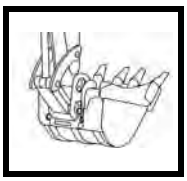
20. Operate the machine and check all functions.



21. Check the control console interlocks for correct function.



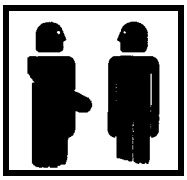
22. Inspect the X-Change™ for wear or damage. Repair or replace damaged parts.



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



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



CALIFORNIA
PROPOSITION 65 WARNING

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

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Safety Alert Symbol

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

WARNING

AVOID INJURY OR DEATH

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

W-2003-0807

IMPORTANT

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

I-2019-0284

DANGER

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

D-1002-1107

WARNING

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

W-2044-1107

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

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

SI EXC-0511 SM

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



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

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



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

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FIRE PREVENTION



Maintenance

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

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

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

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

Operation

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

Electrical



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

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

Hydraulic System

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

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

Fueling



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

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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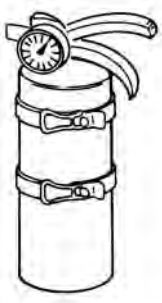
Welding And Grinding

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.

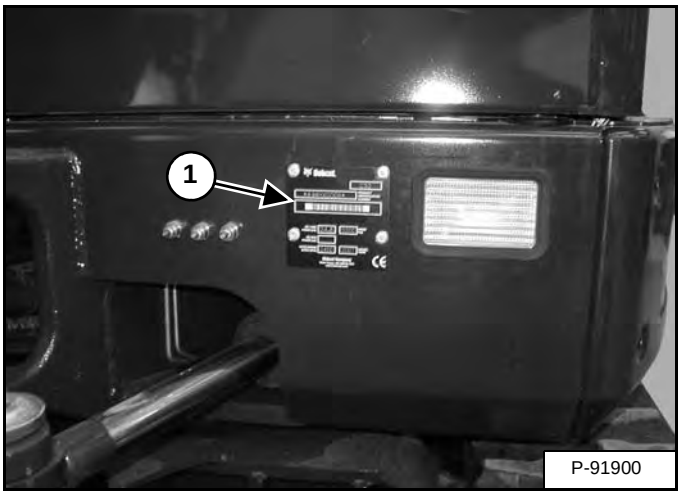
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SERIAL NUMBER LOCATIONS

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

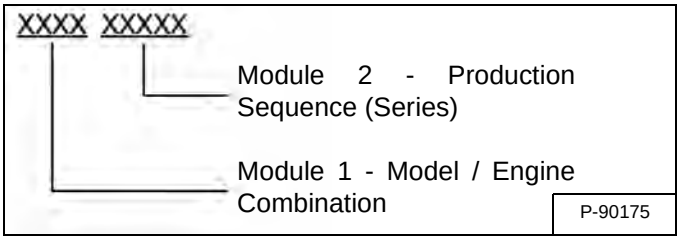
Excavator Serial Number

Figure 1



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

Figure 2



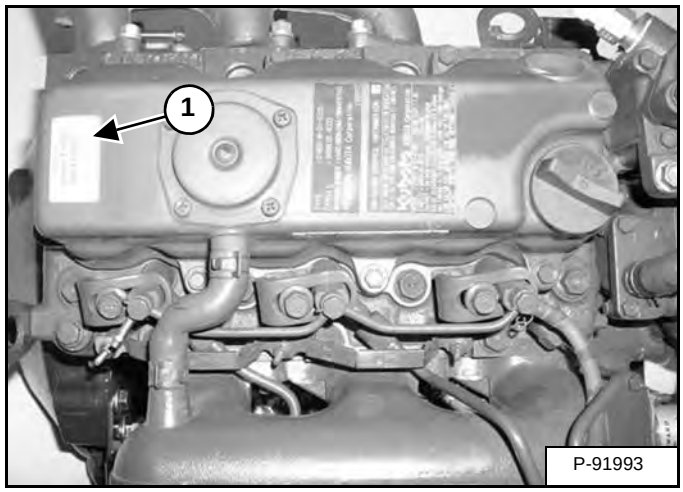
Explanation of excavator Serial Number **[Figure 2]**:

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 3

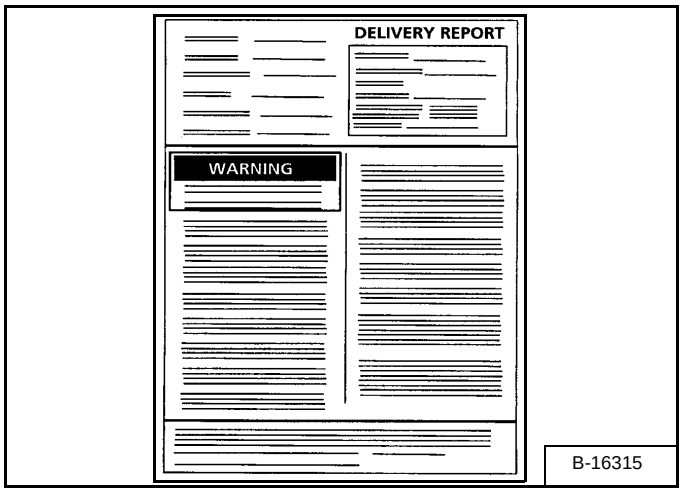


The engine serial number (Item 1) **[Figure 3]** is located on the top cover.

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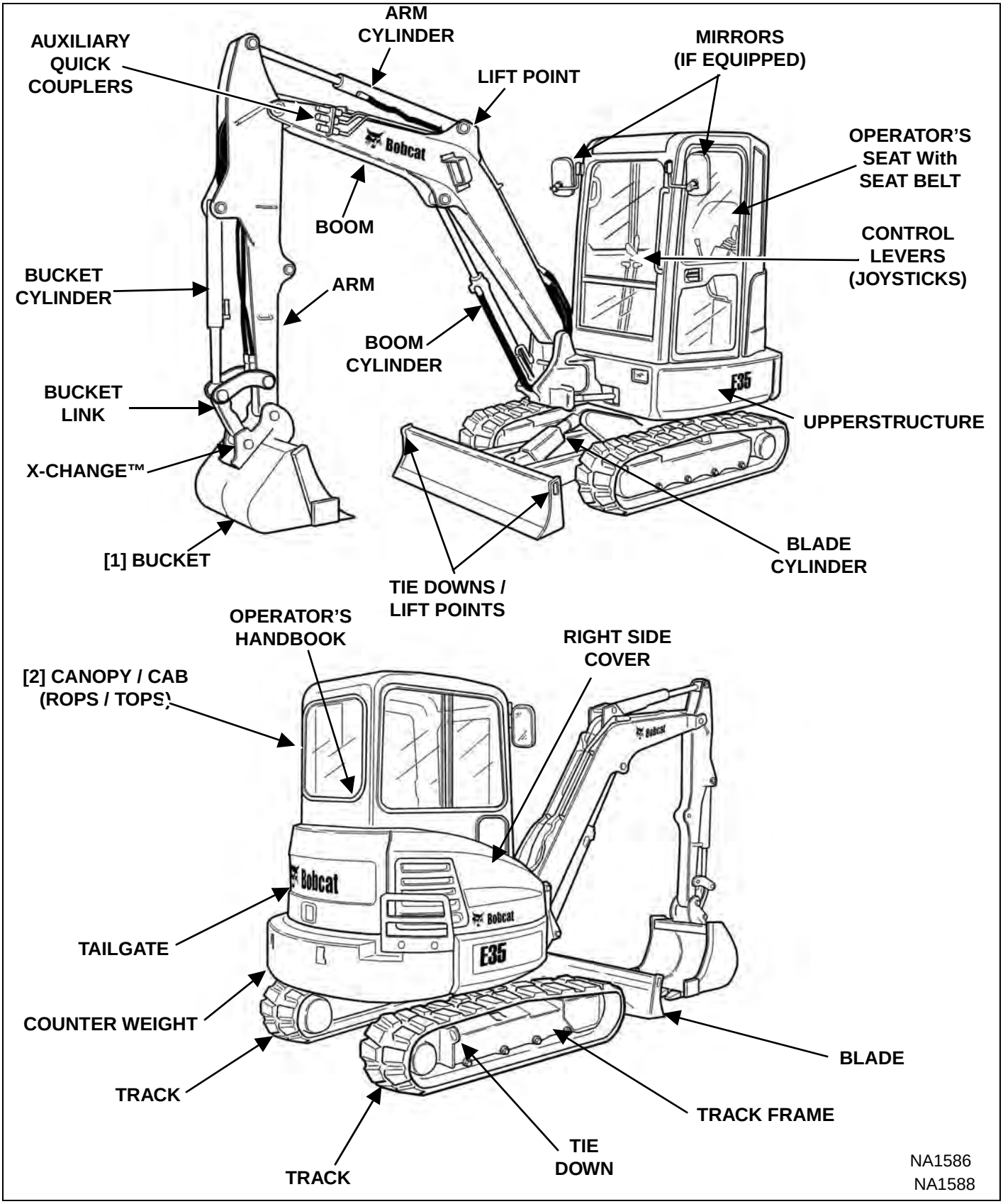
DELIVERY REPORT

Figure 4



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

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

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

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SAFETY AND MAINTENANCE

LIFTING AND BLOCKING THE EXCAVATOR 10-10-1
Procedure 10-10-1

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

OPERATOR CAB (ROPS / TOPS) 10-30-1
Description 10-30-1
Cab Door 10-30-2
Front Window 10-30-3
Front Wiper 10-30-4
Window Washer Reservoir 10-30-4
Right Side Windows 10-30-5

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LIFTING AND BLOCKING THE EXCAVATOR

Procedure

Always park the machine on a level surface.

⚠ 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

⚠ WARNING

Put jackstands under the front axles and rear corners of the frame before running the engine for service. Failure to use jackstands can allow the machine to fall or move and cause injury or death.

W-2017-0286

Figure 10-10-1

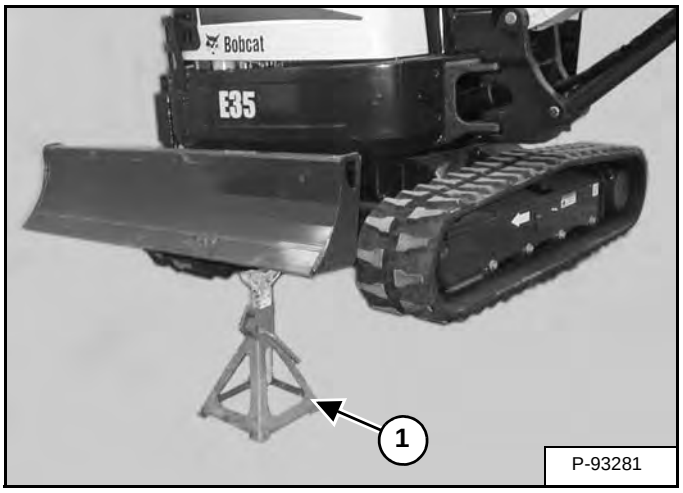
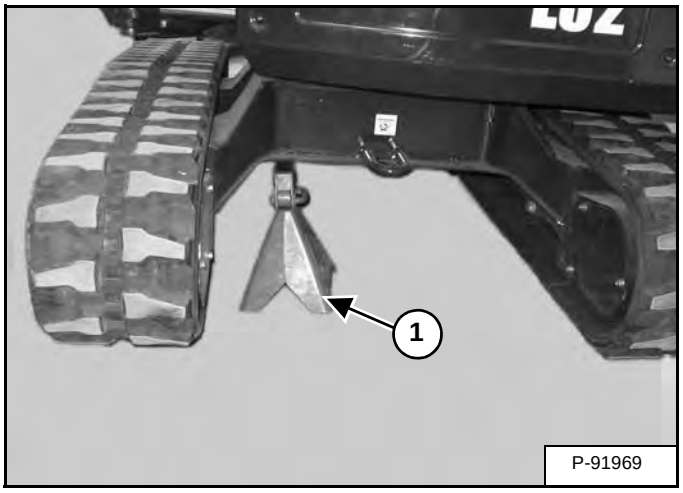


Figure 10-10-2



Raise one side of the machine (approximately 101,6 mm [4 in]) using the boom and arm **[Figure 10-10-1]** and **[Figure 10-10-2]**.

Raise the blade fully and install jack stands under the blade and track frame (Item 1) **[Figure 10-10-1]** and **[Figure 10-10-2]**. Raise the boom until all machine weight is on the jack stands.

Repeat the procedure for the other side.

Stop the engine.

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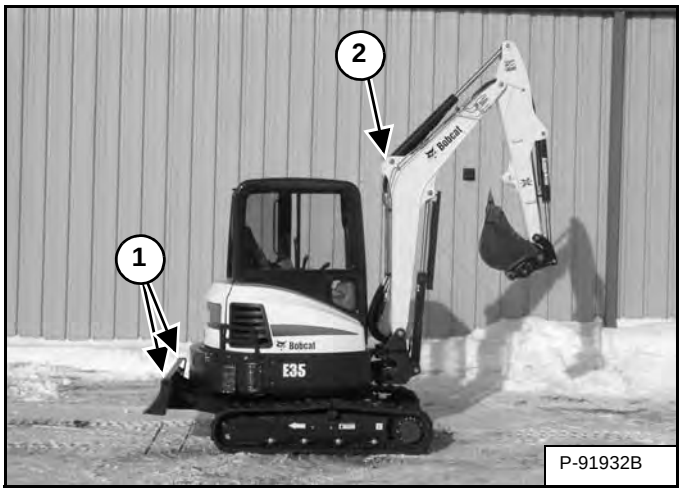


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LIFTING THE EXCAVATOR

Procedure

Figure 10-20-1



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

Raise the blade all the way.

Put all the control levers in neutral.

NOTE: For machines equipped with angle blade feature, make sure the blade is in the straight position prior to lifting.

⚠ 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 10-20-2

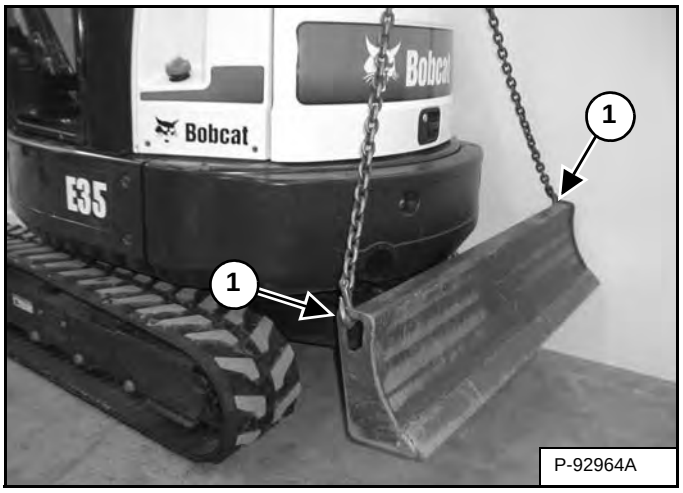
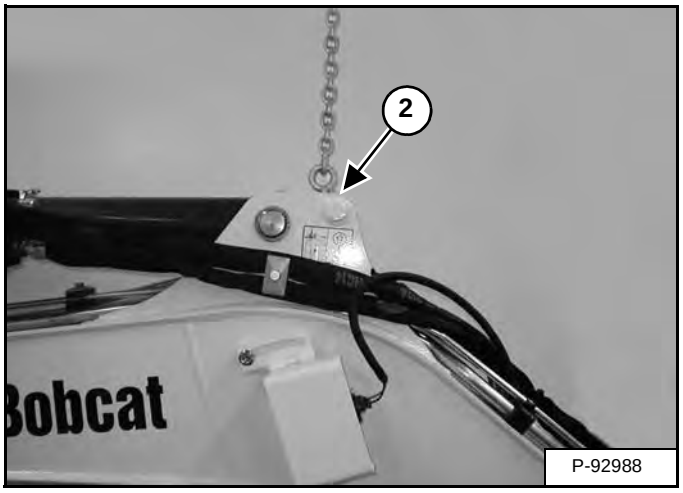


Figure 10-20-3



Fasten chains to the ends of the blade (Item 1) **[Figure 10-20-1]** and **[Figure 10-20-2]** and up to a lifting fixture above the canopy / cab. The lifting fixture must extend over the sides of the canopy / cab to prevent the chains from hitting the ROPS / TOPS.

Fasten a chain (Item 2) **[Figure 10-20-3]** from the rod to the lift fixture.

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OPERATOR CAB (ROPS / TOPS)

Description

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

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

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

⚠ WARNING

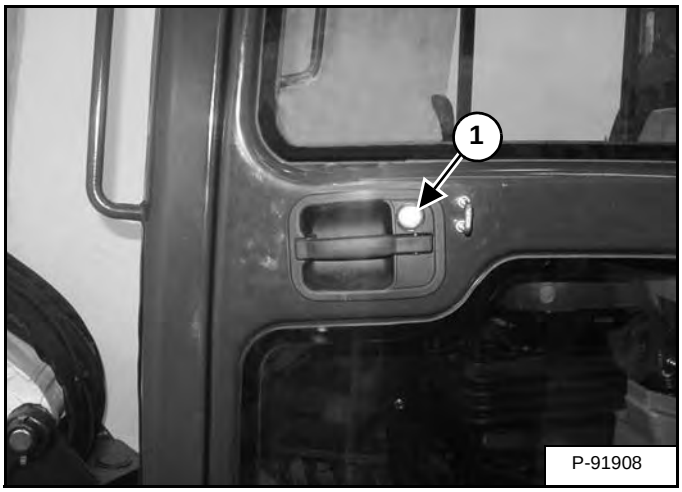
Never modify operator cab by welding, grinding, drilling holes or adding attachments unless instructed to do so by Bobcat Company. Changes to the cab can cause loss of operator protection from rollover and falling objects, and result in injury or death.

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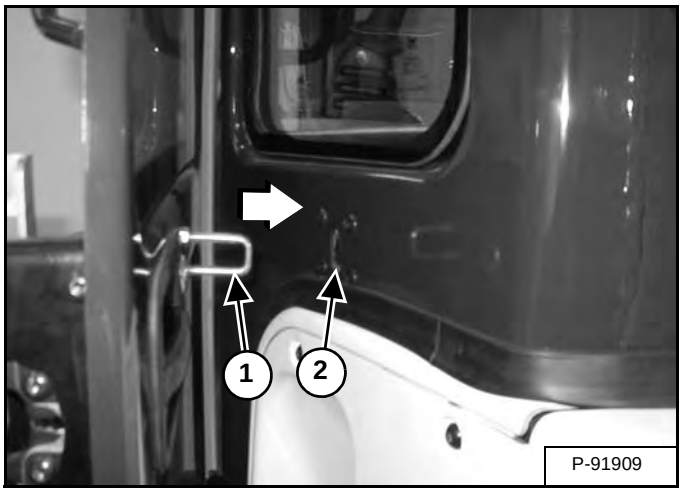
Cab Door

Figure 10-30-1



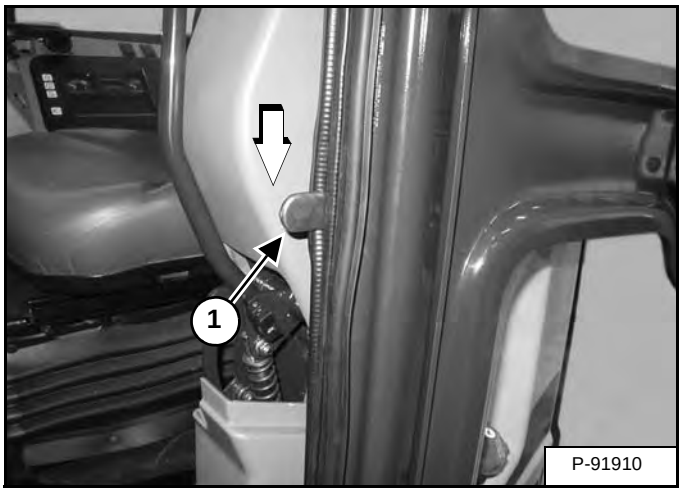
The cab door can be locked (Item 1) **[Figure 10-30-1]** with the same key as the starter switch.

Figure 10-30-2



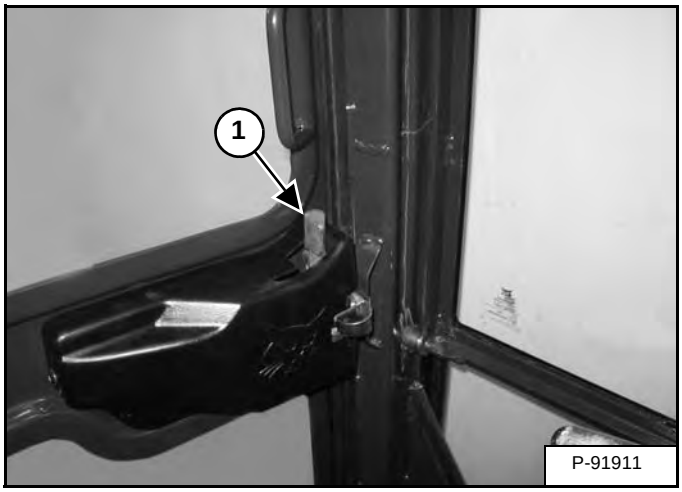
Push the door all the way open until the latch post (Item 1) engages in the latch (Item 2) **[Figure 10-30-2]** to hold the door in the open position.

Figure 10-30-3



When the door is in the open position, push down on the latch (Item 1) **[Figure 10-30-3]** and close the door.

Figure 10-30-4



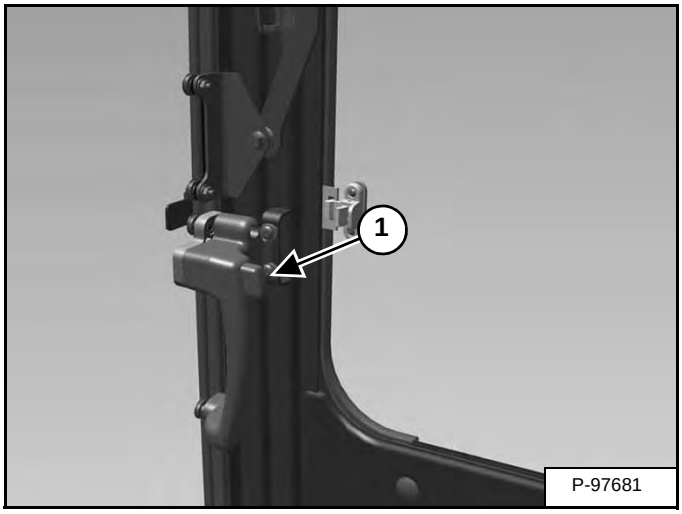
From inside the cab, open the door using handle (Item 1) **[Figure 10-30-4]**.

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Front Window

Opening The Front Window

Figure 10-30-5



Press the window latch button (Item 1) **[Figure 10-30-5]** (both sides).

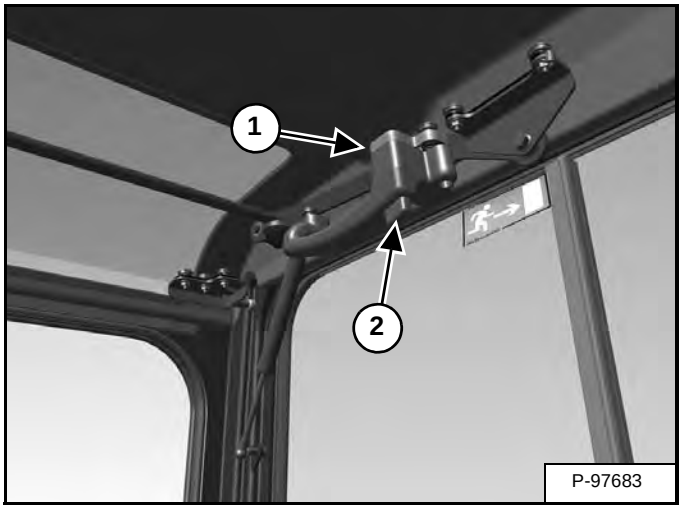
Figure 10-30-6



Use both window grab handles (Item 1) **[Figure 10-30-6]** to pull the top of the window in.

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

Figure 10-30-7



When the window is fully raised, the latch (Item 1) **[Figure 10-30-7]** (both sides) will close on the bracket in the latched position.

Pull down and forward slightly on the window to make sure it is fully latched.

Closing The Front Window

Use both window grab handles to support the window while pressing the window latch button (Item 2) **[Figure 10-30-7]** (both sides).

Use both window grab handles (Item 1) **[Figure 10-30-6]** to pull the window down fully.

Press the top of the window in until the latch locks into the latched position (both sides) **[Figure 10-30-5]**.

Pull inward and upward slightly on the window to make sure it is fully latched in the closed position.

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Front Wiper

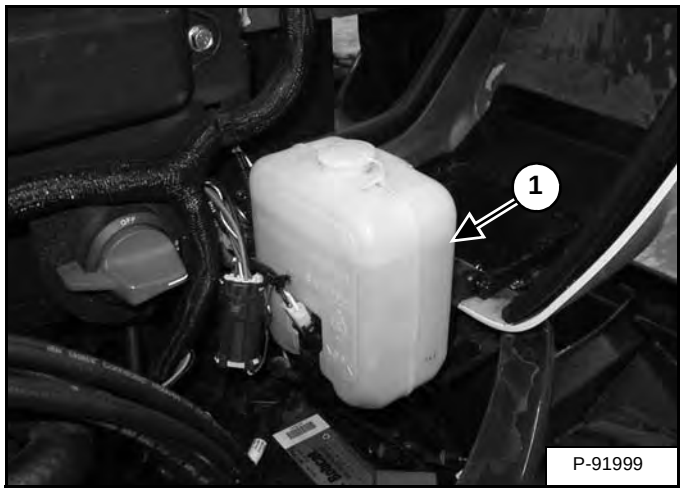
Figure 10-30-8



The front window is equipped with a wiper (Item 1) **[Figure 10-30-8]** and washer.

Window Washer Reservoir

Figure 10-30-9



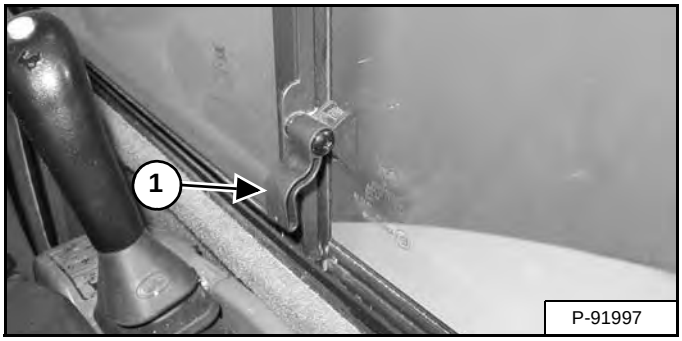
The window washer reservoir (Item 1) **[Figure 10-30-9]** is located under the right side cover.

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Right Side Windows

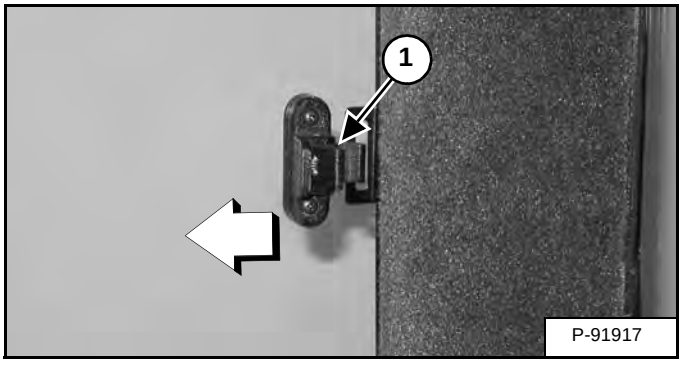
Opening The Right Rear Window

Figure 10-30-10



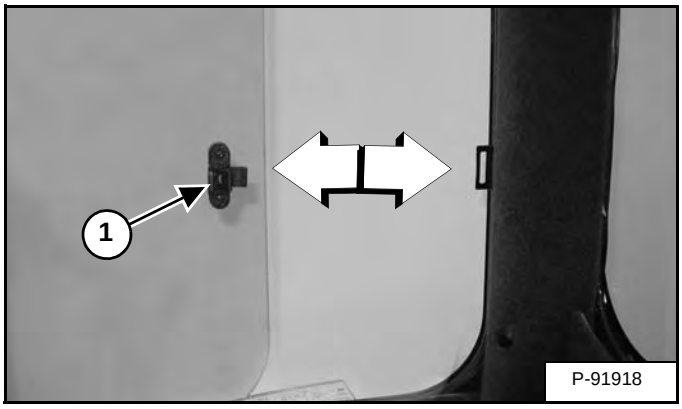
Raise the latch (Item 1) **[Figure 10-30-10]** located at the rear of the front window.

Figure 10-30-11



Pull out on the latch (Item 1) **[Figure 10-30-11]**.

Figure 10-30-12



Pull the latch (Item 1) **[Figure 10-30-12]** forward to open the window. When the window is in the open position, push down on the latch (Item 1) **[Figure 10-30-10]**.

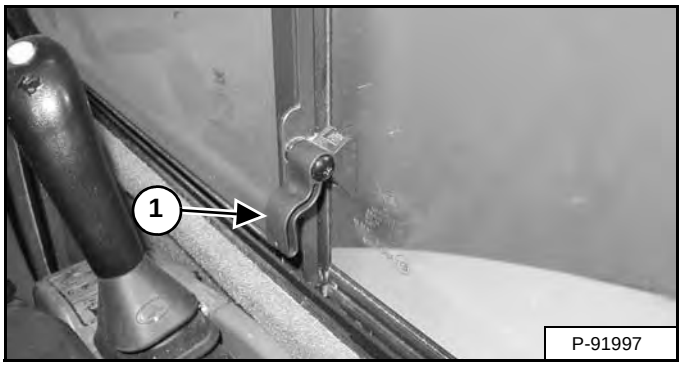
Closing The Right Rear Window

Raise the latch (Item 1) **[Figure 10-30-13]**.

Push the latch (Item 1) **[Figure 10-30-12]** back to close the window. Rotate the latch (Item 1) **[Figure 10-30-10]** down.

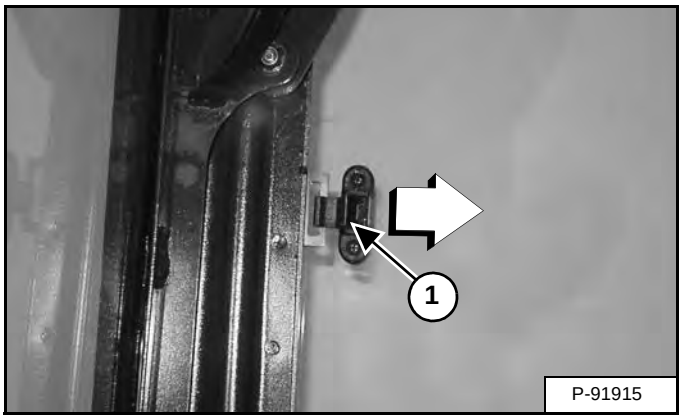
Opening The Right Front Window

Figure 10-30-13



Raise the latch (Item 1) **[Figure 10-30-13]** located at the rear of the front window.

Figure 10-30-14



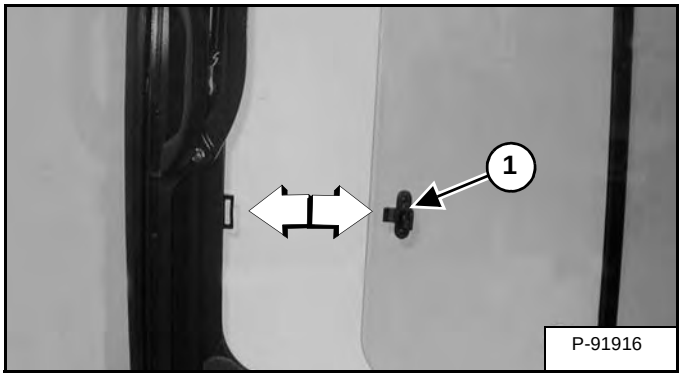
Pull back on the latch (Item 1) **[Figure 10-30-14]**.

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Right Side Windows (Cont'd)

Opening The Right Front Window (Cont'd)

Figure 10-30-15



Pull the latch (Item 1) **[Figure 10-30-15]** back to open the window.

When the window is in the open position, push down on the latch (Item 1) **[Figure 10-30-13]**.

Closing The Right Front Window

Raise the latch (Item 1) **[Figure 10-30-13]**.

Push the handle (Item 1) **[Figure 10-30-15]** forward to close the window. Rotate the latch (Item 1) **[Figure 10-30-13]** down.

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OPERATOR CANOPY (ROPS / TOPS)

Description

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

Check the ROPS / TOPS canopy, mounting, and hardware for damage. Never modify the ROPS / TOPS canopy. Replace the canopy and hardware if damaged. See your Bobcat dealer for parts.

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

⚠ WARNING

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

W-2069-0200

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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).

Disengage the auto idle feature and move the two speed travel to the low range position.

If equipped with the extendable arm, retract the arm and lock the arm in the retracted position.

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 (if equipped).

Put blocks at the front and rear of the tracks.

Fastening

Figure 10-40-2

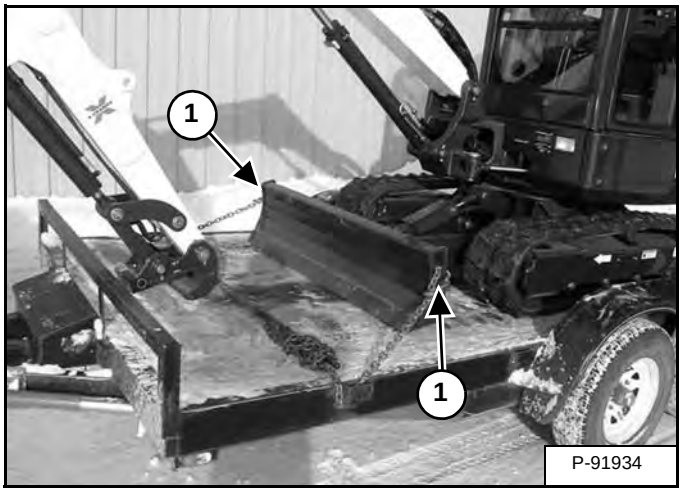
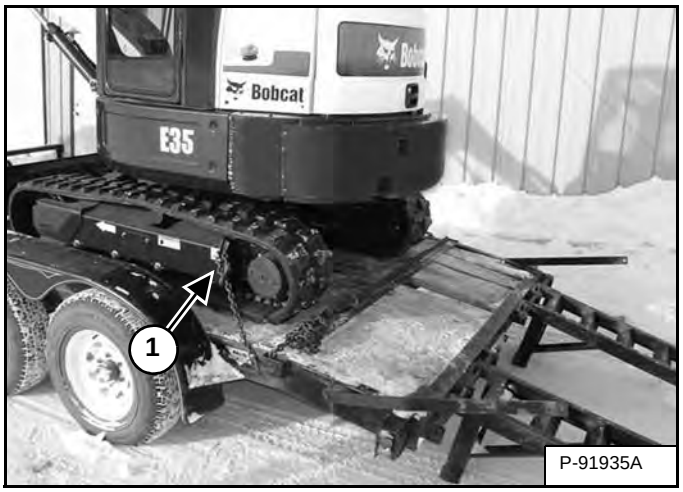


Figure 10-40-3



Fasten chains to the front corners of the blade (Item 1) **[Figure 10-40-2]** and to the tie down loop at both sides of the track frame (Item 1) **[Figure 10-40-3]** to prevent it from moving when going up or down slopes or during sudden stops.

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

WARNING

AVOID SERIOUS INJURY OR DEATH

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

W-2058-0807

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TAILGATE

Opening And Closing

WARNING

AVOID INJURY OR DEATH

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

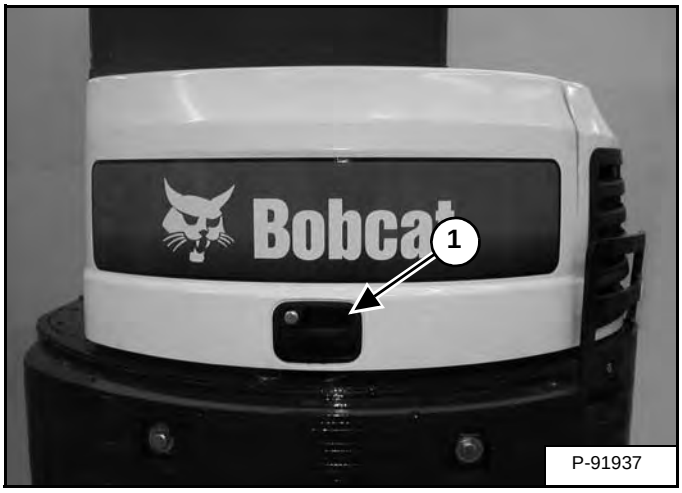
W-2012-0497

WARNING

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

W-2020-1285

Figure 10-50-1



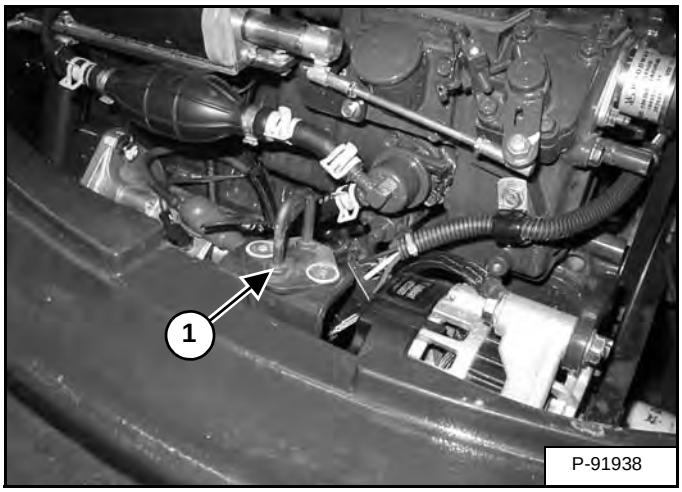
Pull the latch (Item 1) **[Figure 10-50-1]** and open the tailgate.

Push firmly to close the tailgate.

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

Adjusting The Latch

Figure 10-50-2



The tailgate latch (Item 1) **[Figure 10-50-2]** can be adjusted by loosening the two bolts, moving the latch, and tightening the two bolts.

Close the tailgate before operating the excavator.

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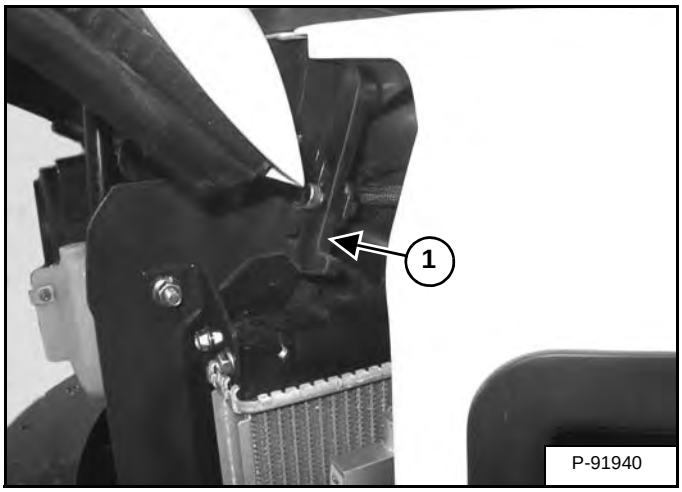


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RIGHT SIDE COVER

Opening And Closing

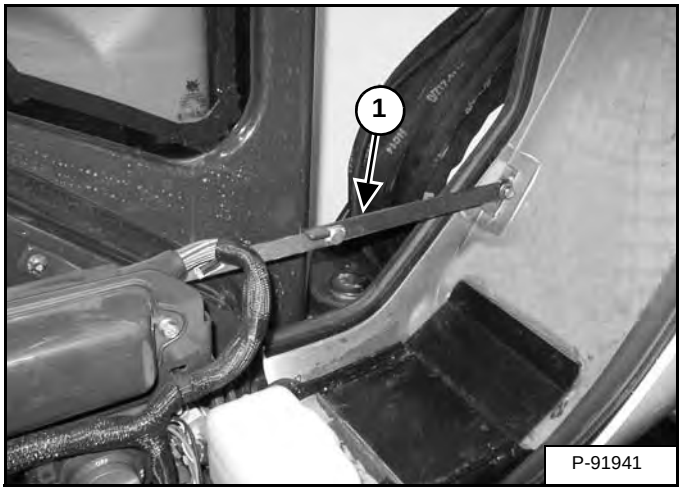
Figure 10-60-1



Open the tailgate to access the right side cover latch (Item 1) **[Figure 10-60-1]**.

Pull down and out the rubber latch (Item 1) **[Figure 10-60-1]** until it is away from the latch post.

Figure 10-60-2



Raise the right side cover and rotate forward until it is held open by the retainer (Item 1) **[Figure 10-60-2]**.

To close the right side cover, lift up on the retainer (Item 1) **[Figure 10-60-2]** while raising the right side cover. Rotate the cover back until it is in the fully closed position. Secure the right side cover with the latch (Item 1) **[Figure 10-60-1]**.

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SERVICE SCHEDULE

Maintenance Intervals

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

The service schedule is a guide for correct maintenance of the Bobcat excavator.

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2003-0807

Every 10 Hours (Before Starting The Excavator)

- **Engine Oil** - Check level and add as needed.
- **Engine Air Filters and Air System** - Check display panel. Service only when required. Check for leaks and damaged components.
- **Engine Cooling System** - Check coolant level COLD and add premixed coolant as needed.
- **Seat Belt, Seat Belt Retractors, Seat Belt Mounting hardware, Control Console Lockout** - Check the condition of seat belt and mounting hardware. Clean or replace seat belt retractors as needed. Check the control console lockout lever for proper operation. Clean dirt and debris from moving parts.
- **Motion Alarm** - Check for proper function.
- **Operator Canopy / Cab** - Check the canopy / cab condition and mounting hardware.
- **Operator Cab and HVAC Filters** - Clean filters.
- **Indicators and Lights** - Check for correct operation of all indicators and lights.
- **Safety Signs** - Check for damaged signs (decals). Replace any signs that are damaged.
- **Hydraulic Fluid** - Check fluid level and add as needed.
- **Track Tension** - Check tension and adjust as needed.
- **Pivot Points** - Grease all machinery pivot points. Grease clamp and angle blade (if equipped).
- **X-Change / Attachment Coupler** - Check for damage or loose parts (if equipped).

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.

Every 100 Hours

- **Spark Arrestor Muffler** - Clean spark chamber.

Every 250 Hours Or Every 12 Months

- **Fuel Filter** - Service at first 50 hours, then as scheduled. Replace filter.
- **Travel Motors (Final Drive)** - Check fluid level and add as needed.

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SERVICE SCHEDULE (CONT'D)

Maintenance Intervals (Cont'd)

Every 500 Hours Or Every 12 Months

- **Engine Oil and Filter** - Service at first 50 hours, then as scheduled. Replace oil and filter.
- **Cooling System** - Clean debris from radiator, fuel cooler, hydraulic fluid cooler, air conditioning condenser (if equipped).
- **Hydraulic Filter, Pilot Filter and Hydraulic Reservoir Breather Cap** - Replace the hydraulic filter, pilot filter and the reservoir breather cap.
- **Drive Belts (Alternator) (Air Conditioning - If Equipped)** - Check condition. Replace as needed. Service at first 50 hours, then as scheduled.
- **Alternator and Starter** - Service at first 50 hours, then as scheduled. Check connections.
- **Engine Valves** - Adjust the engine valve clearance.
- **HVAC** - Clean housing and coils.

Every 1000 Hours Or Every 12 Months

- **Swing Cylinder Base End** - Grease swing cylinder base end grease fitting.
- **Hydraulic Fluid and Filters** - Replace hydraulic fluid and filters.
- **Travel Motors (Final Drive)** - Service at first 50 hours, then as scheduled. Replace fluid.

Every 24 Months

- **Coolant** - Replace the coolant.

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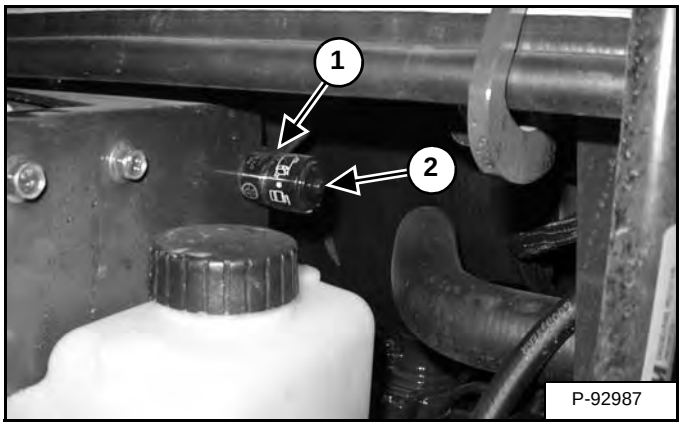
AIR CLEANER SERVICE

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

Daily Check

The air cleaner is located in the engine compartment. Open the tailgate to access the air cleaner for service. (See TAILGATE on Page 10-50-1.)

Figure 10-80-1



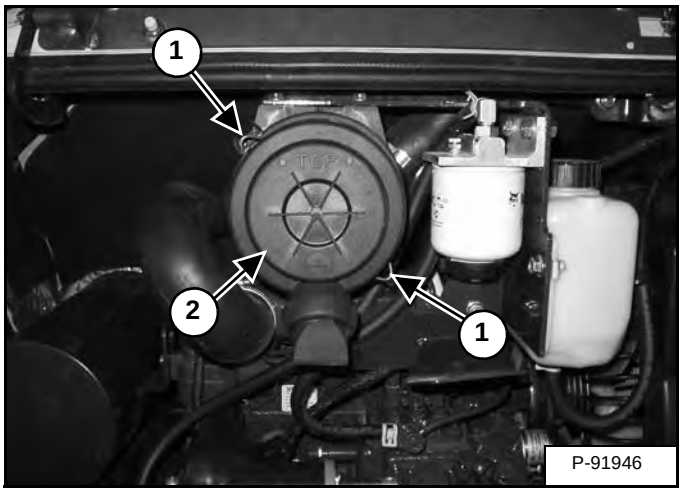
Check the condition indicator (Item 1) **[Figure 10-80-1]**. If the red ring shows in the condition indicator, the filter needs to be replaced.

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

Replacing The Filter Elements

Outer Filter

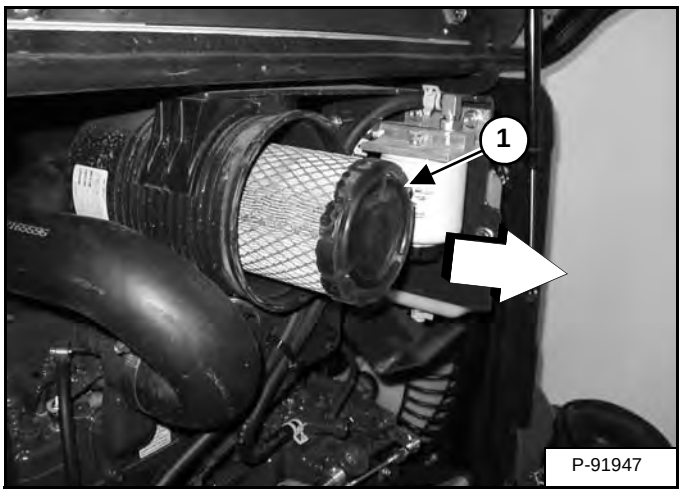
Figure 10-80-2



Release the two fasteners (Item 1) **[Figure 10-80-2]**.

Remove and clean the dust cup (Item 2) **[Figure 10-80-2]**.

Figure 10-80-3



Pull the outer filter (Item 1) **[Figure 10-80-3]** from the air cleaner housing.

Check the housing for damage.

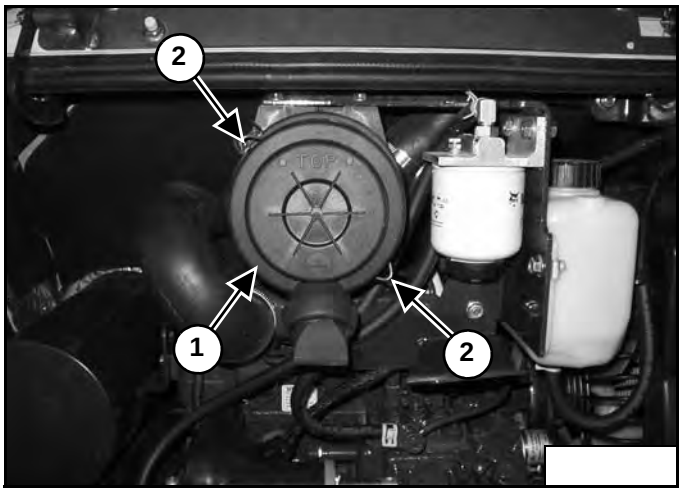
Clean the housing and the seal surface. DO NOT use compressed air.

Install a new filter.

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Replacing The Filter Elements (Cont'd)

Figure 10-80-4



Install the dust cup (Item 1) and engage the fasteners (Item 2) **[Figure 10-80-4]**.

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 2) **[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 (Item 1) **[Figure 10-80-1]** shows in the condition indicator, replace the inner filter.

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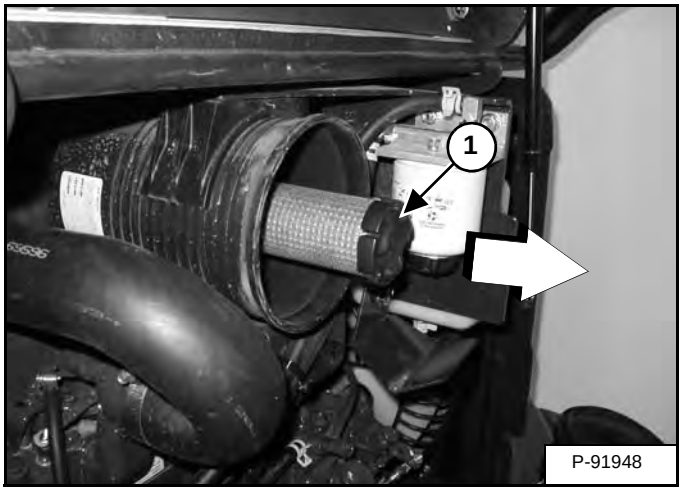
Replacing The Filters (Cont'd)

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 (Item 2) **[Figure 10-80-1]** on the end of the condition indicator. Start the engine. Run the engine at full rpm, then reduce engine speed. Stop the engine. If the red ring shows in the condition indicator, replace the inner filter.

Figure 10-80-5



Remove the dust cup, outer filter and inner filter (Item 1) **[Figure 10-80-5]**.

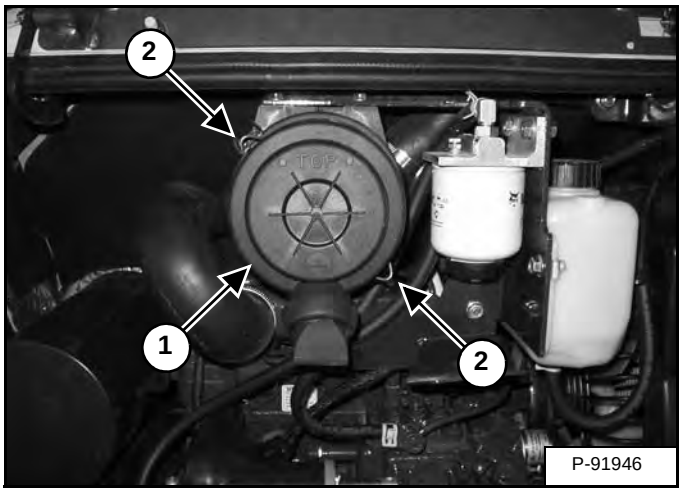
NOTE: Make sure all sealing surfaces are free of dirt and debris.

Install the new inner filter.

Install the outer filter and the dust cup.

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

Figure 10-80-6



Install the dust cup (Item 1) and engage the fasteners (Item 2) **[Figure 10-80-4]**.

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 2) **[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 (Item 1) **[Figure 10-80-1]** shows in the condition indicator, replace the inner filter.

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CAB FILTERS (S/N A93K11001 - A93K17999 AND AC2P11001 - AC2P14999)

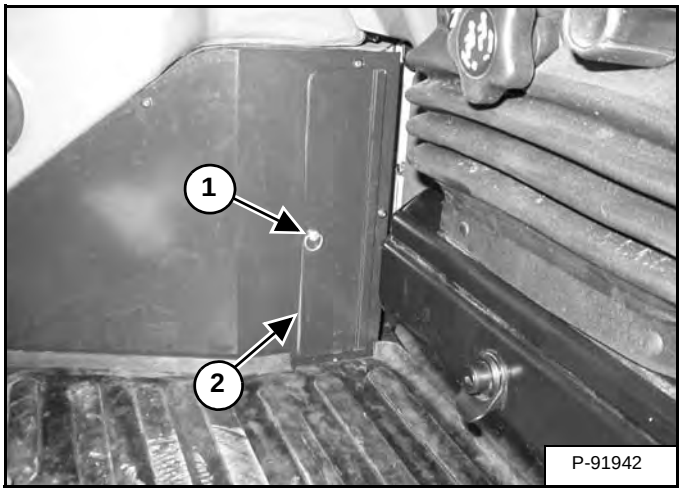
Cleaning And Maintenance

The recirculation filter and the fresh air filter must be cleaned regularly. (See SERVICE SCHEDULE on Page 10-70-1.)

The recirculation filter is located to the right of the operator seat and the fresh air filter is located under the right side cover.

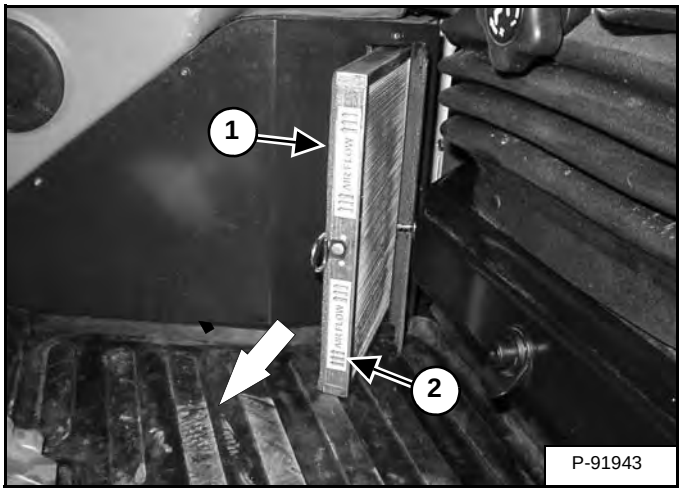
Recirculation Filter

Figure 10-90-1



Turn the fastener (Item 1) 1/4 turn and open the cover (Item 2) **[Figure 10-90-1]**.

Figure 10-90-2



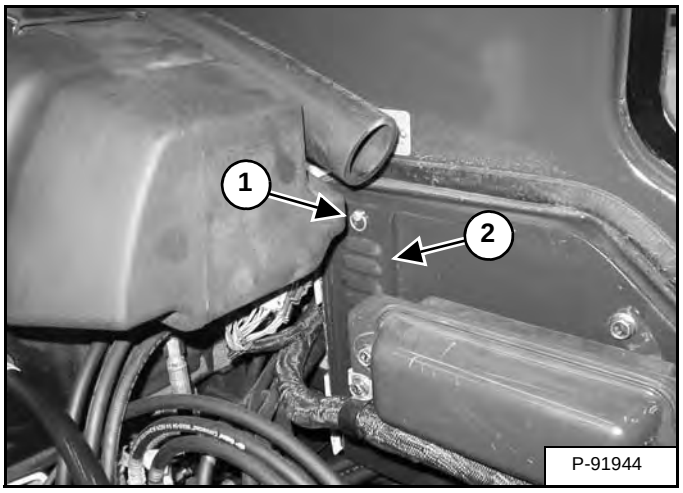
Pull the filter (Item 1) **[Figure 10-90-2]** out of the heater housing.

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

Installation: Install the filter with the arrows that indicate air flow direction (Item 2) **[Figure 10-90-2]** pointing towards the heater housing.

Fresh Air Filter

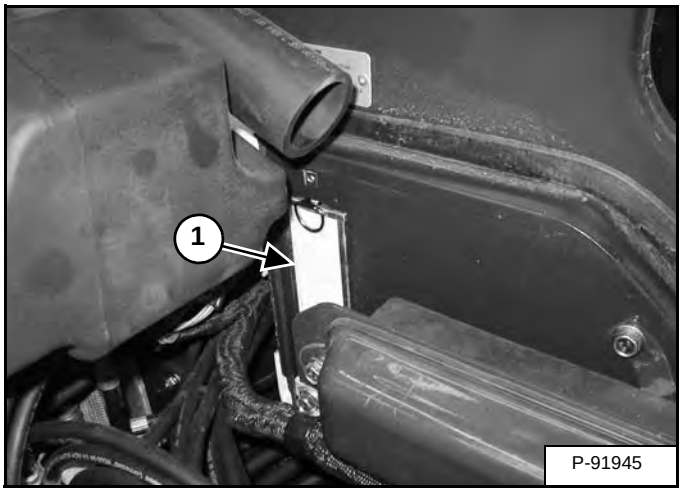
Figure 10-90-3



Open the right side cover. (See RIGHT SIDE COVER on Page 10-60-1.)

Turn the fastener (Item 1) 1/4 turn and remove the cover (Item 2) **[Figure 10-90-3]**.

Figure 10-90-4



Pull the filter (Item 1) **[Figure 10-90-4]** out of the housing.

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

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CAB FILTERS (S/N A93K18000 & ABOVE AND AC2P15000 & ABOVE)

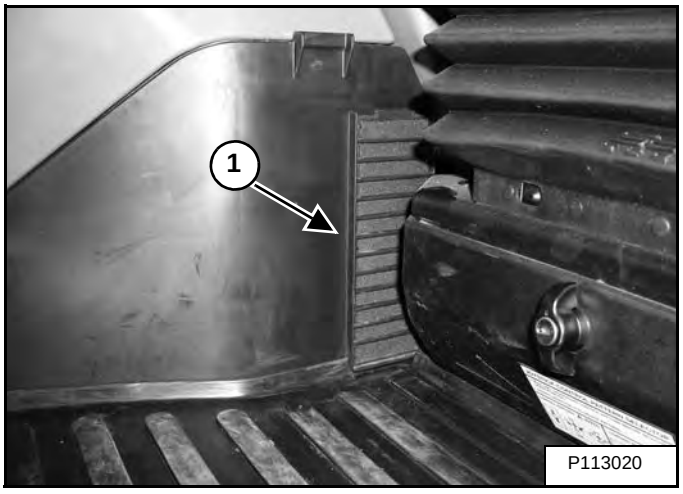
Cleaning And Maintenance

The recirculation filter and the fresh air filter must be cleaned regularly. (See SERVICE SCHEDULE on Page 10-70-1.)

The recirculation filter is located to the right of the operator seat and the fresh air filter is located under the right side cover.

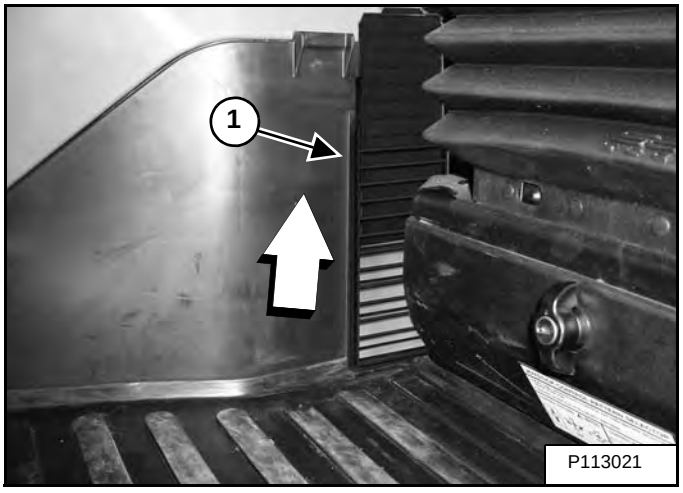
Recirculation Filter

Figure 10-91-1



The recirculation filter (Item 1) **[Figure 10-91-1]** is located to the right of the operator's seat.

Figure 10-91-2



Pull the filter (Item 1) **[Figure 10-91-2]** until removed from the housing.

Shake the filter or use low pressure air to clean the filter. Replace the filter when very dirty or if damaged.

Installation: Position the bottom of the filter (Item 1) **[Figure 10-91-2]** into the housing and slowly push the filter down fully.

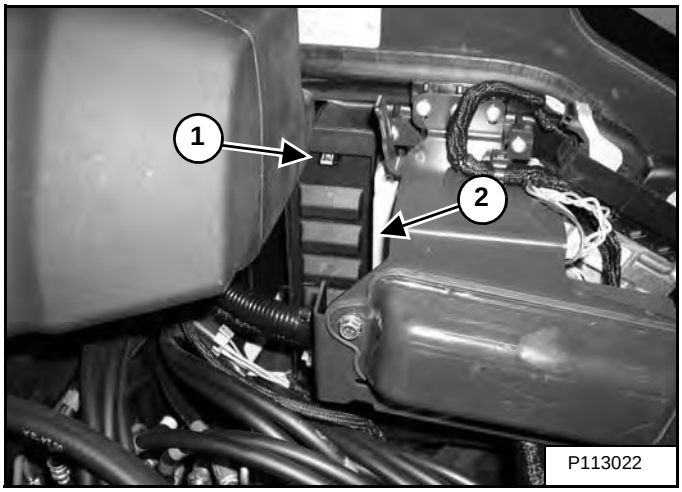
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CAB FILTERS (S/N A93K18000 & ABOVE AND AC2P15000 & ABOVE) (CONT'D)

Cleaning And Maintenance (Cont'd)

Fresh Air Filter

Figure 10-91-3

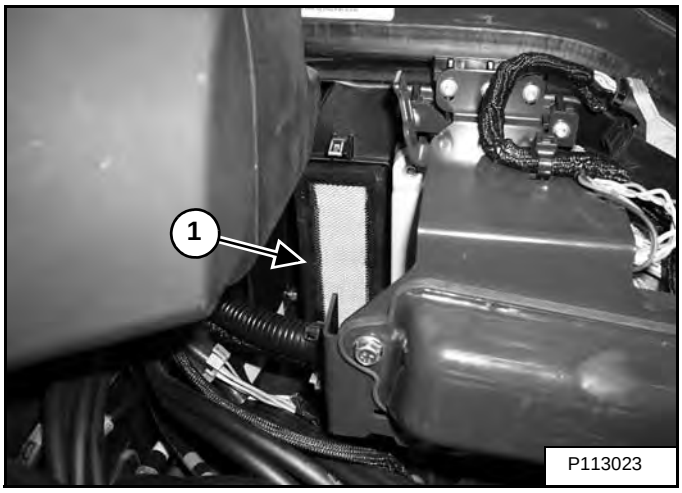


The fresh air filter is located under the right side cover.

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

Pull out on the tab (Item 1) and remove the cover (Item 2) **[Figure 10-91-3]**.

Figure 10-91-4



Pull the filter (Item 1) **[Figure 10-91-4]** out of the housing.

Shake the filter or use low pressure air to clean the filter. Do not use solvents. Replace the filter when very dirty or damaged.

Installation: Position the filter (Item 1) **[Figure 10-91-4]** into the housing and slowly push the filter in fully.

Place the bottom tabs of the filter cover (Item 2) into the frame and push the top in until the tab (Item 1) **[Figure 10-91-3]** locks to the frame.

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ENGINE COOLING SYSTEM

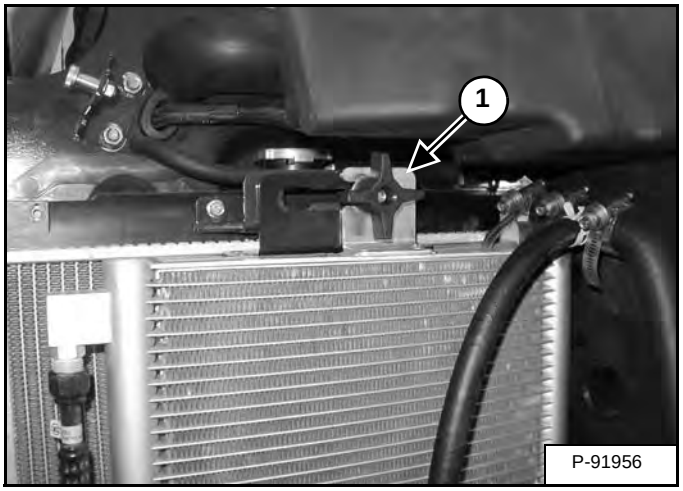
Check the cooling system every day to prevent over heating, loss of performance or engine damage. (See SERVICE SCHEDULE on Page 10-70-1.)

Cleaning

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

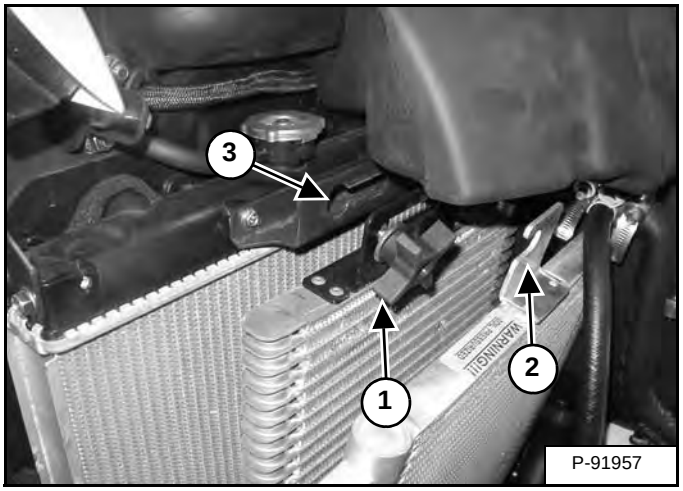
NOTE: Allow the cooling system and engine to cool before servicing or cleaning the cooling system.

Figure 10-100-1



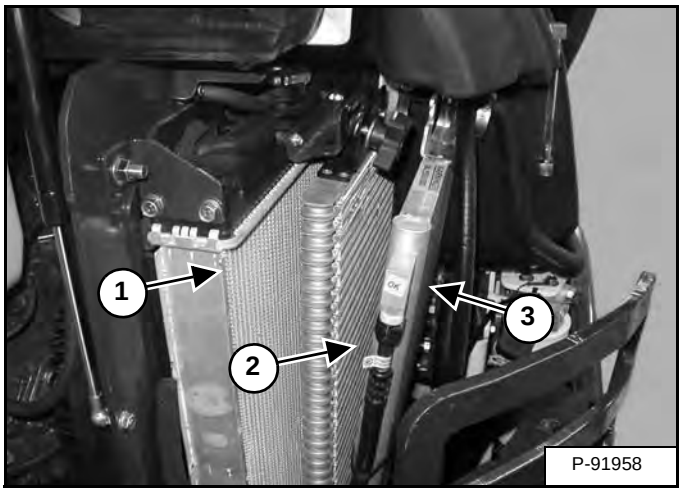
Loosen the knob (Item 1) **[Figure 10-100-1]**. Slide the knob towards the rear of the machine.

Figure 10-100-2



Slide the knob (Item 1) out of the condenser mount (Item 2) (if equipped) and the radiator mounting bracket (Item 3) **[Figure 10-100-2]**. Be sure not to damage the fins.

Figure 10-100-3



Use air pressure or water pressure to clean the radiator (Item 1), oil cooler (Item 2) and condenser (Item 3) **[Figure 10-100-3]** (if equipped). Be careful not to damage the fins when cleaning.

Position the knob (Item 1) so it fits into the radiator mount (Item 3) and the condenser mount (Item 2) **[Figure 10-100-2]** (if equipped).

Slide the knob (Item 1) toward the front of the machine until it is fully seated in the slots of the mounting brackets. Tighten the knob (Item 1) **[Figure 10-100-1]**. Be careful not to damage the fins.

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Checking Level

WARNING

AVOID BURNS

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

W-2070-1203

WARNING

AVOID INJURY OR DEATH

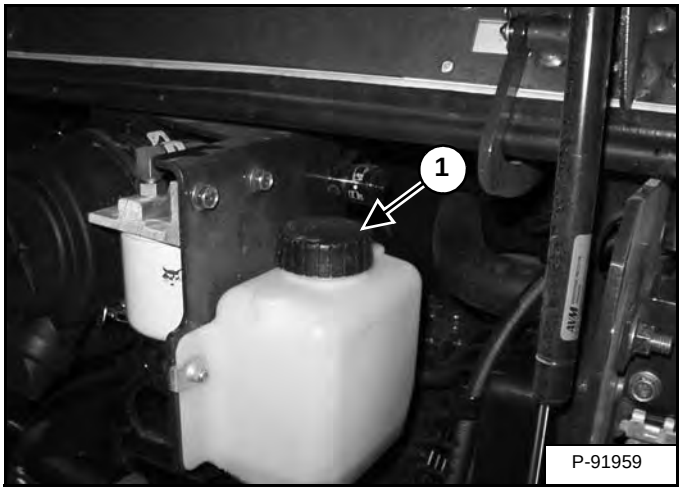
Wear safety glasses to prevent eye injury when any of the following conditions exist:

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

W-2019-0907

Open the tailgate. (See TAILGATE on Page 10-50-1.)

Figure 10-100-4



Check the coolant level in the coolant recovery tank (Item 1) **[Figure 10-100-4]**.

The coolant level must be between the MIN and MAX marks on the coolant recovery tank when the engine is cold.

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

IMPORTANT

AVOID ENGINE DAMAGE

Always use the correct ratio of water to antifreeze.

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

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

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

I-2124-0497

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Removing And Replacing Coolant

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

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

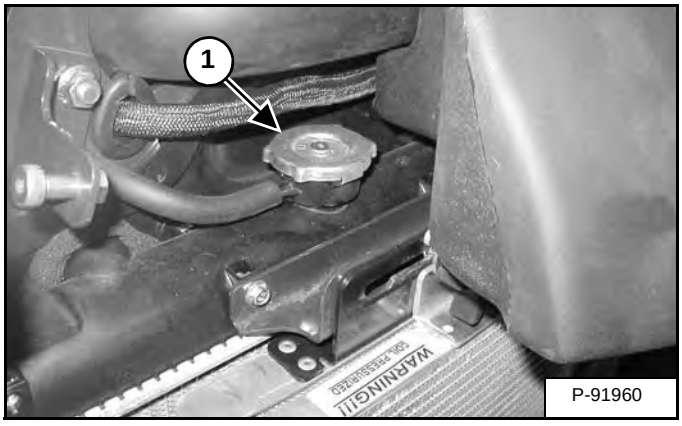
⚠ WARNING

AVOID BURNS

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

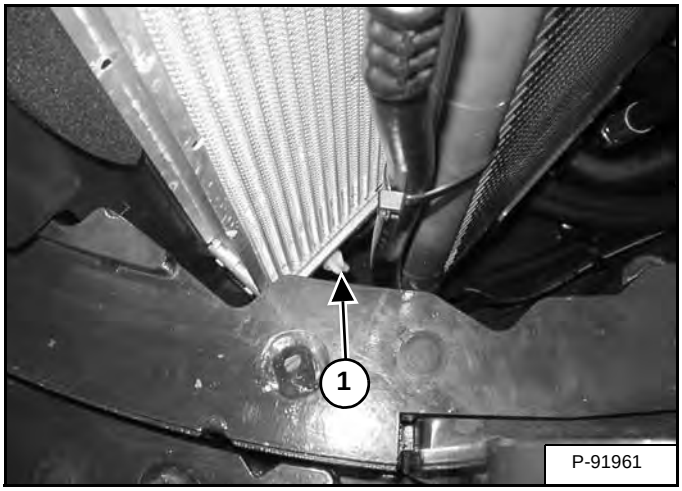
W-2070-1203

Figure 10-100-5



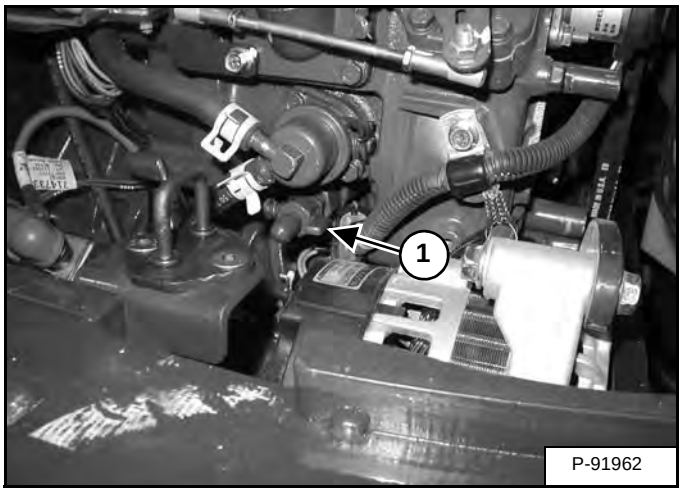
When the engine is cool, loosen and remove the radiator cap (Item 1) **[Figure 10-100-5]**.

Figure 10-100-6



Put a hose on the drain valve at the bottom of the radiator. Open the drain valve (Item 1) **[Figure 10-100-6]** and drain the coolant into a container.

Figure 10-100-7



Put a hose on the drain valve on the engine block. Open the drain valve (Item 1) **[Figure 10-100-7]** and drain the coolant into a container.

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

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

Mix the coolant in a separate container. (See Capacities on Page SPEC-10-9.)

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

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

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

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

Add premixed coolant until the level is correct.

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

Add coolant to the recovery tank as needed.

Close the tailgate.

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FUEL SYSTEM

Fuel Specifications

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

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

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

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

The following fuels may also be used in this machine:

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

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2063-0807

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2103-0508

Biodiesel Blend Fuel

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

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

Apply the following guidelines if biodiesel blend fuel is used:

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

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

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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

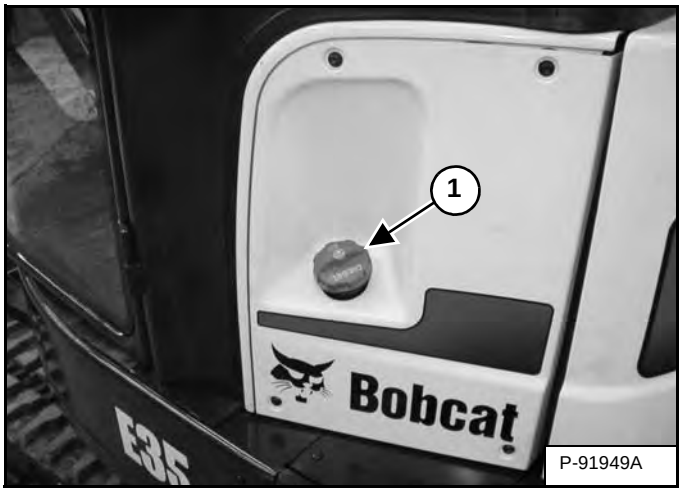
⚠ WARNING

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 10-110-1



The fuel cap uses the start key to unlock the fuel cap.

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

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

Install and tighten the fuel fill cap.

Clean up any spilled fuel.

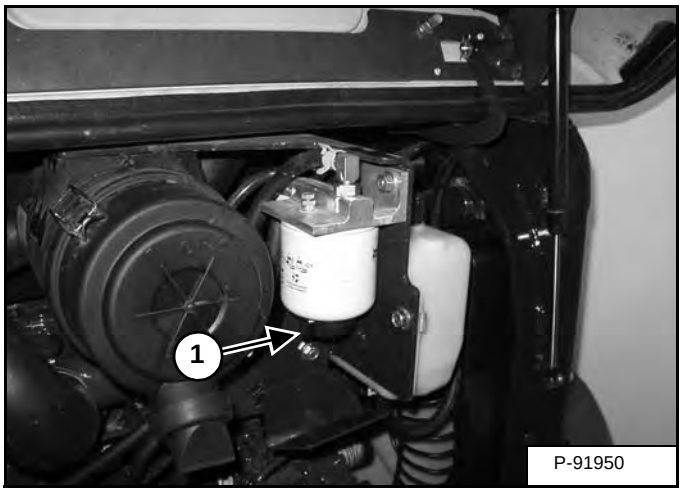
See the SERVICE SCHEDULE for the service interval when to remove water from or replace the fuel filter. (See SERVICE SCHEDULE on Page 10-70-1.)

Fuel Filters

Removing Water

Open the tailgate. (See Opening And Closing on Page 10-50-1.)

Figure 10-110-2



Loosen the drain (Item 1) **[Figure 10-110-2]** at the bottom of the filter to drain water from the filter into a container.

Clean up any spilled fuel.

Replacing Elements

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

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

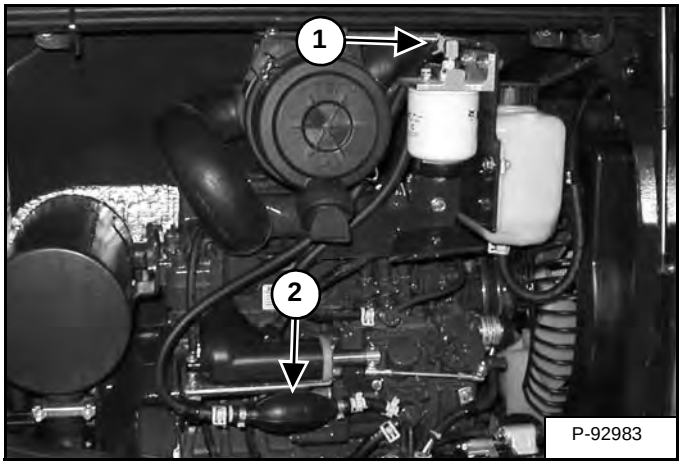
Remove the air from the fuel system. (See Removing Air From The Fuel System on Page 10-110-4.)

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Draining The Fuel Tank

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

Figure 10-110-3



Remove the hose (Item 1) **[Figure 10-110-3]** from the fuel injection pump. Route the hose to a container.

Squeeze the hand pump (priming bulb) (Item 2) **[Figure 10-110-3]** to start the fuel siphoning from the fuel tank.

Drain the fuel into a container.

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

Reinstall the hose (Item 1) **[Figure 10-110-3]** after the fuel is removed from fuel tank.

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2072-0807

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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 10-110-4

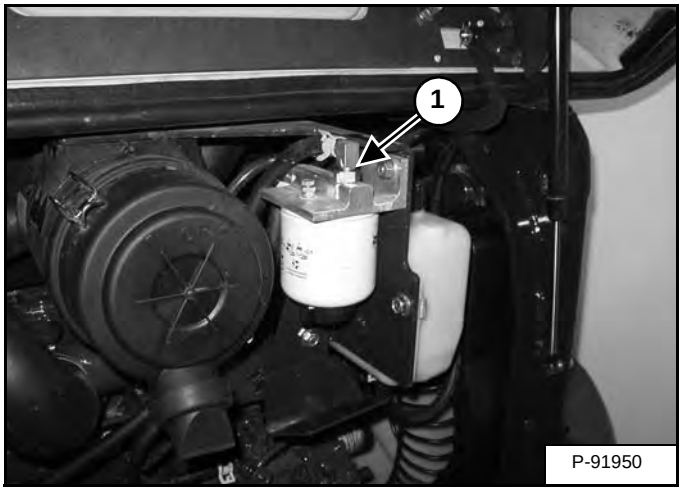
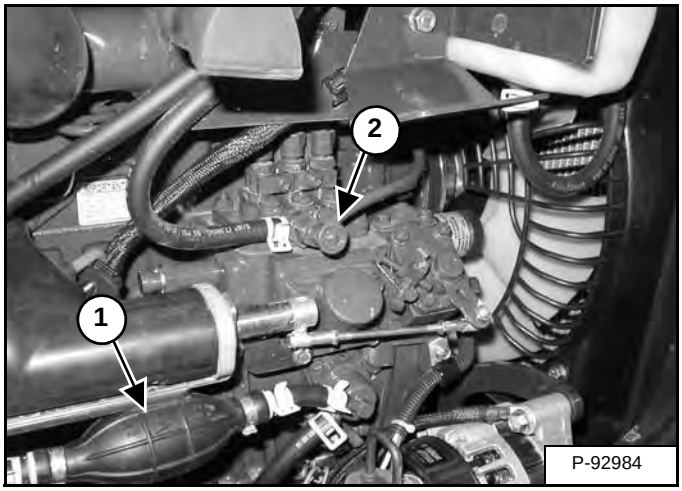


Figure 10-110-5



Open the tailgate. (See Opening And Closing on Page 10-50-1.)

Open the fuel filter vent (Item 1) **[Figure 10-110-4]** and operate the hand pump (priming bulb) (Item 1) **[Figure 10-110-5]** until the fuel flows from the vent with no air bubbles.

Close the vent (Item 1) **[Figure 10-110-4]**.

Start the engine. It may be necessary to open the vent (Item 2) **[Figure 10-110-5]** (at the fuel injection pump) 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 physician familiar with this injury.

W-2072-0807

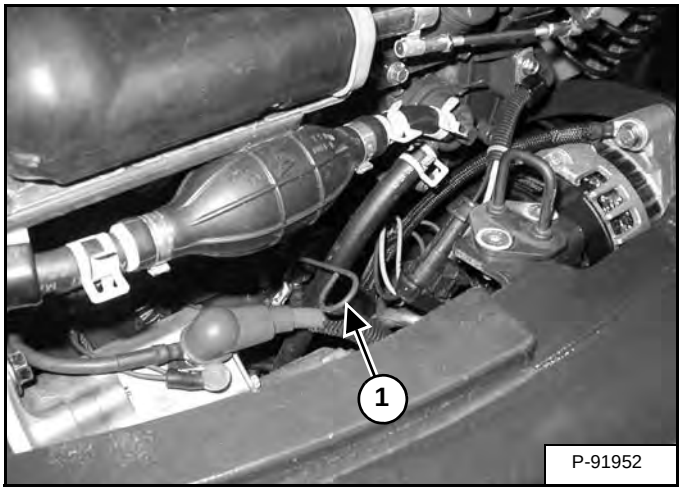
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ENGINE LUBRICATION SYSTEM

Checking And Adding Engine Oil

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

Figure 10-120-1



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

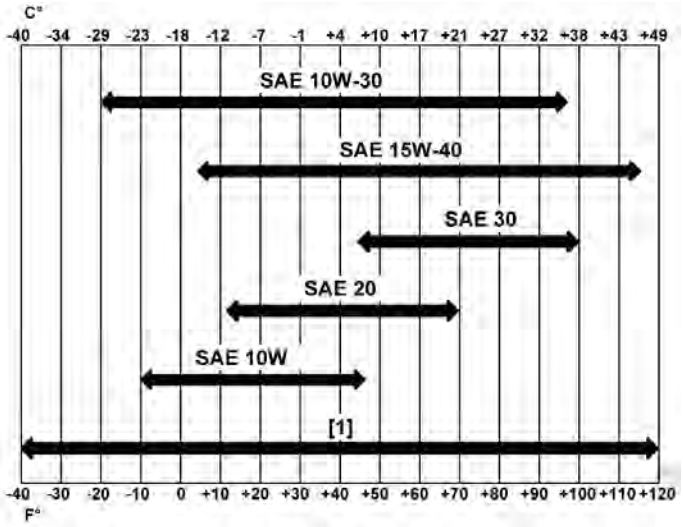
Keep the oil level between the marks on the dipstick.

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

Oil Chart

Figure 10-120-2

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



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

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

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

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2103-0508

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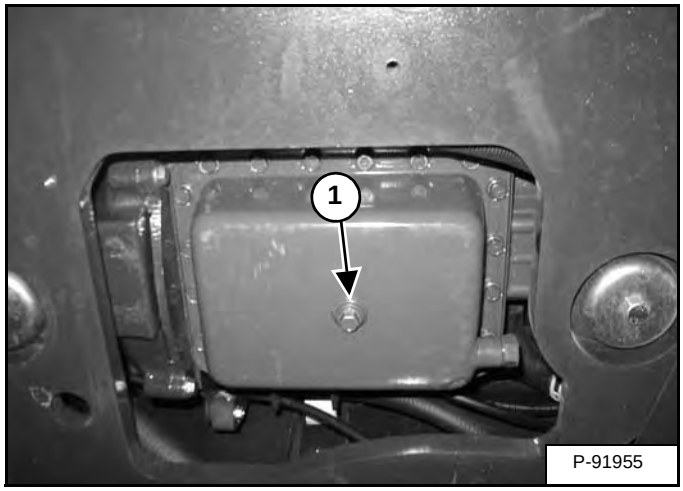
Removing And Replacing Oil And Filter

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

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

Open the tailgate. (See Opening And Closing on Page 10-50-1.)

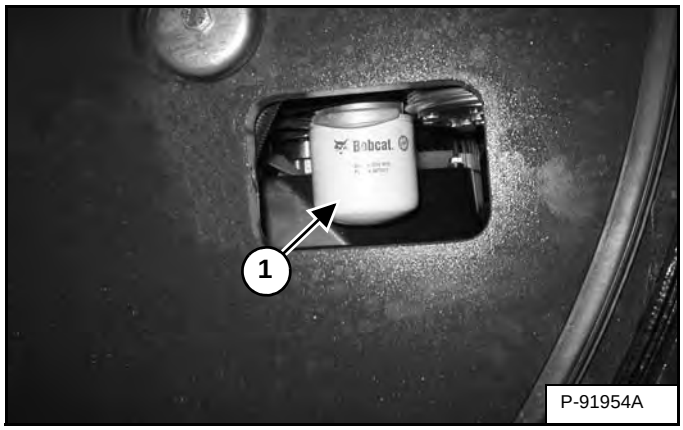
Figure 10-120-3



Place a container under the oil pan. Remove the drain plug (Item 1) **[Figure 10-120-3]** from the bottom of the engine oil pan.

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

Figure 10-120-4

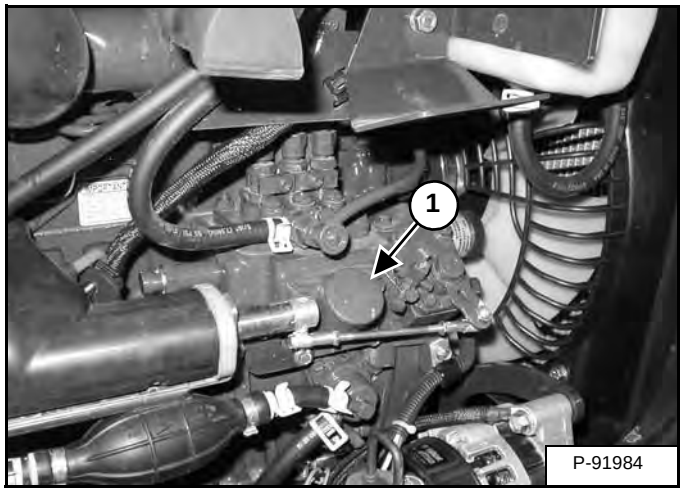


Remove the oil filter (Item 1) **[Figure 10-120-4]** and clean the filter housing surface.

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

Install and tighten the drain plug (Item 1) **[Figure 10-120-3]**.

Figure 10-120-5



Remove the fill cap (Item 1) **[Figure 10-120-5]**.

Put oil in the engine. (See Oil Chart on Page 10-120-1.)

Install the fill cap (Item 1) **[Figure 10-120-5]**.

Start the engine and let it run for several minutes.

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

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

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HYDRAULIC SYSTEM

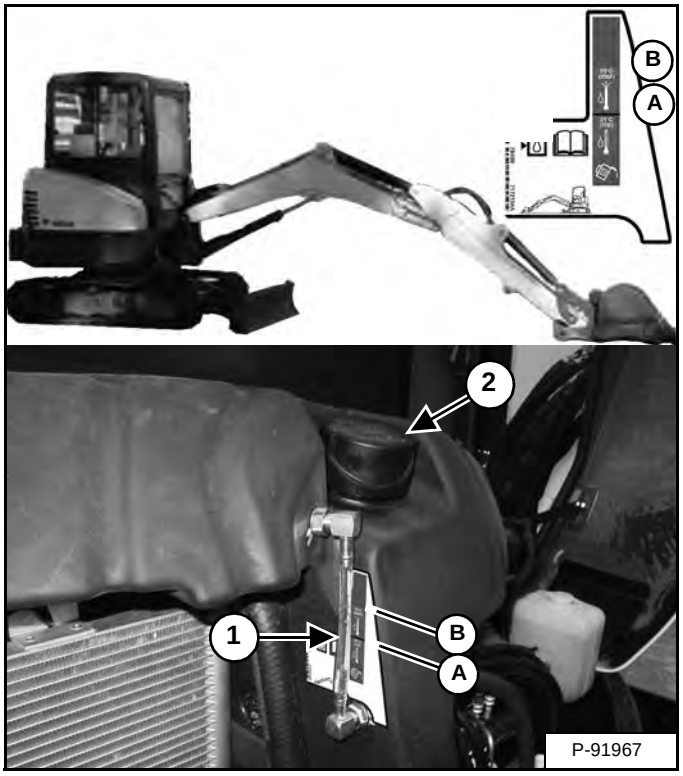
Checking And Adding Hydraulic Fluid

Put the machine on a flat level surface.

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

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

Figure 10-130-1



Park the machine in the position shown **[Figure 10-130-1]**. (The preferred method is to check the hydraulic oil when it is cold.)

Check the hydraulic oil level, it must be visible in the sight gauge (Item 1) **[Figure 10-130-1]**. The decal on the hydraulic tank shows the correct fill level.

A - Correct Oil Level COLD (Preferred)
B - Correct Oil Level HOT (Optional)

Clean the surface around the reservoir cap and remove the cap from the reservoir (Item 2) **[Figure 10-130-1]**.

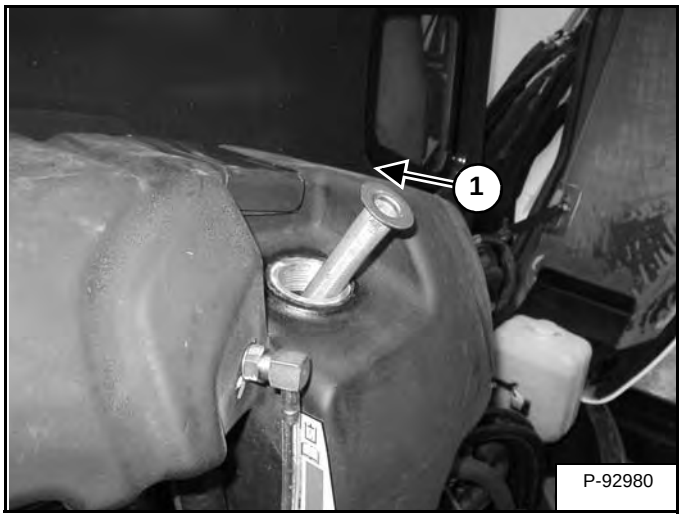
⚠ WARNING

AVOID INJURY OR DEATH

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

W-2103-0508

Figure 10-130-2



Check the condition of the fill strainer screen (Item 1) **[Figure 10-130-2]**. Clean or replace as necessary.

Be sure the screen is installed before adding fluid.

Add the correct fluid to the reservoir until it is visible in the sight gauge. (See Hydraulic / Hydrostatic Fluid Chart on Page 10-130-2.)

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

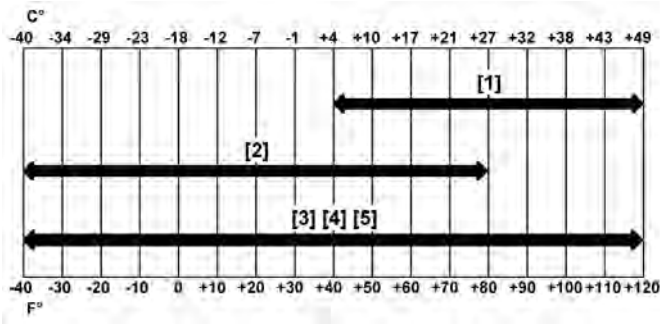
Install the cap.

Close the right side cover and tailgate.

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Hydraulic / Hydrostatic Fluid Chart

Figure 10-130-3
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 10-130-3]**.

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Removing And Replacing Hydraulic Filters

⚠ WARNING

AVOID INJURY OR DEATH

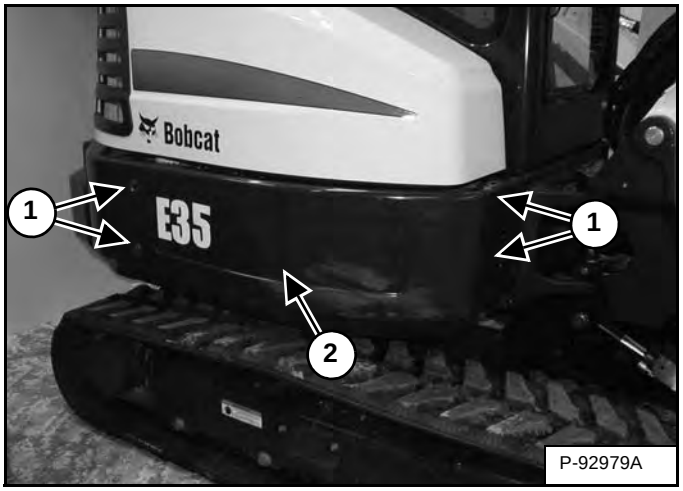
Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

Hydraulic Filter

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

Figure 10-130-4

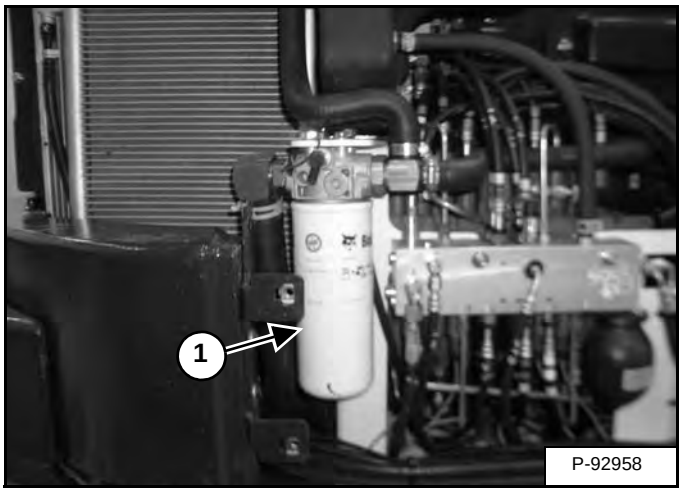


For easier access to change the hydraulic filter, remove the lower right side panel.

Remove the four bolts (Item 1) and the side panel (Item 2) **[Figure 10-130-4]**. Remove the side panel.

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

Figure 10-130-5



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

Clean the housing where the filter gasket makes contact.

Put clean hydraulic fluid on the gasket. Install the new filter and hand tighten only. Use a genuine Bobcat replacement filter.

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Removing And Replacing Hydraulic Filters (Cont'd)

⚠ 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

Case Drain Filter

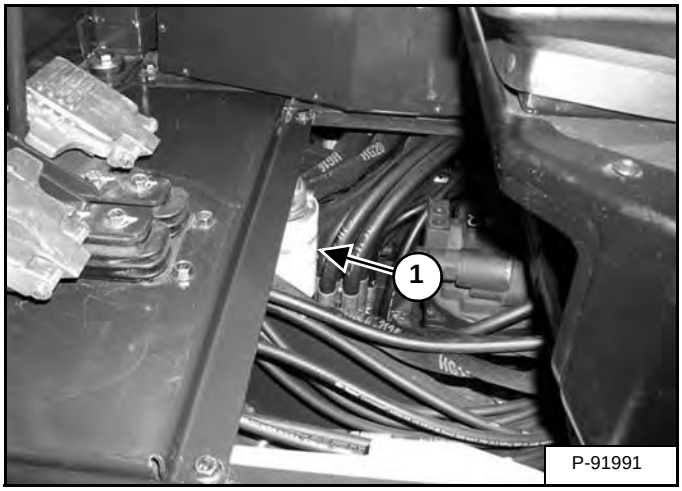
See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-70-1.)

The case drain filter is located below the floor plate.

Remove the floor mat.

Remove the floor plate.

Figure 10-130-6



Remove the case drain filter (Item 1) **[Figure 10-130-6]**.

Clean the housing where the filter gasket makes contact.

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

NOTE: When changing the case drain filter, also lubricate the boom swing cylinder base end fitting while the floor plate is removed. (See SERVICE SCHEDULE on Page 10-70-1.) and (See LUBRICATION OF THE HYDRAULIC EXCAVATOR on Page 10-140-1.)

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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.)

⚠ WARNING

AVOID INJURY OR DEATH

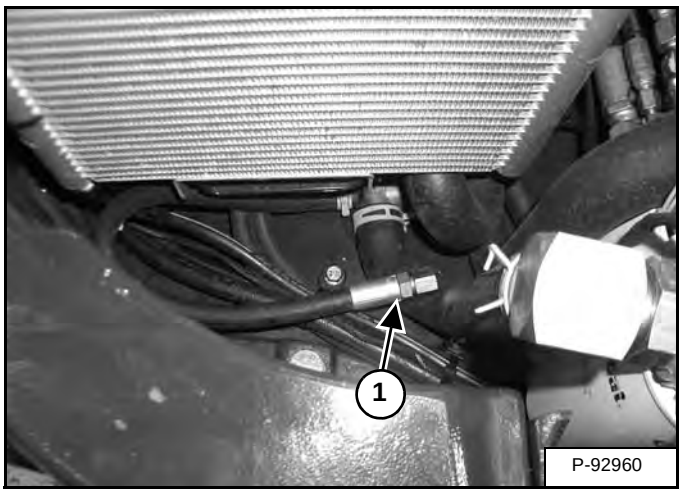
Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical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

W-2072-0807

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

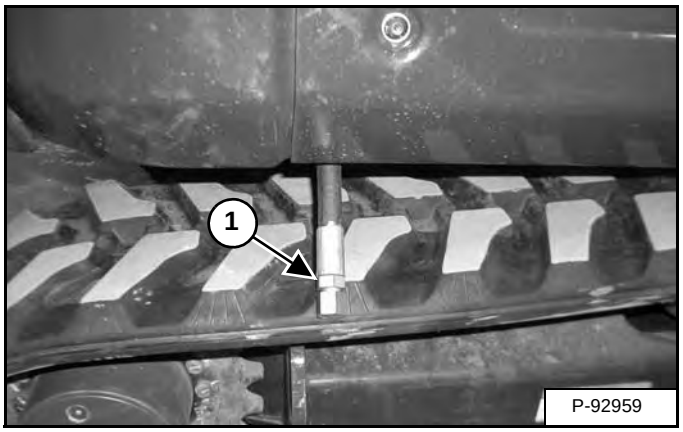
Open the tailgate. (See Opening And Closing on Page 10-50-1.)

Figure 10-130-7



The hydraulic oil drain hose (Item 1) **[Figure 10-130-7]** is located below the oil cooler in the right rear corner of the upperstructure.

Figure 10-130-8



Reposition the drain hose out the bottom of the upperstructure and remove the cap (Item 1) **[Figure 10-130-8]**.

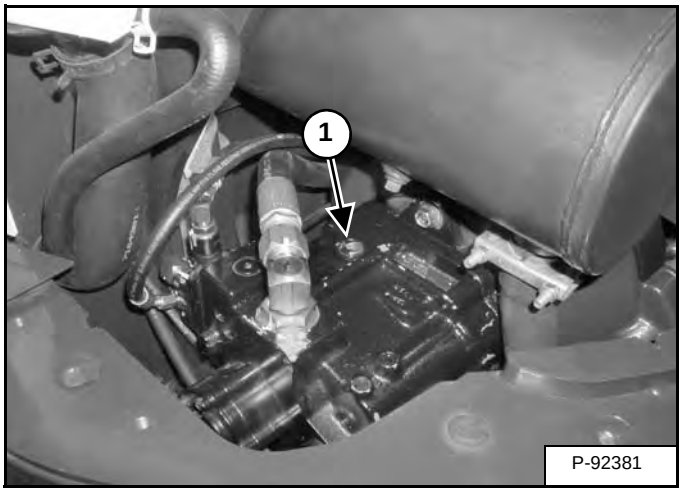
Drain the fluid into a container.

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

Install the cap (Item 1) **[Figure 10-130-7]** and position the drain hose back to the storage position.

Add fluid to the reservoir. (See Checking And Adding Hydraulic Fluid on Page 10-130-1.)

Figure 10-130-9

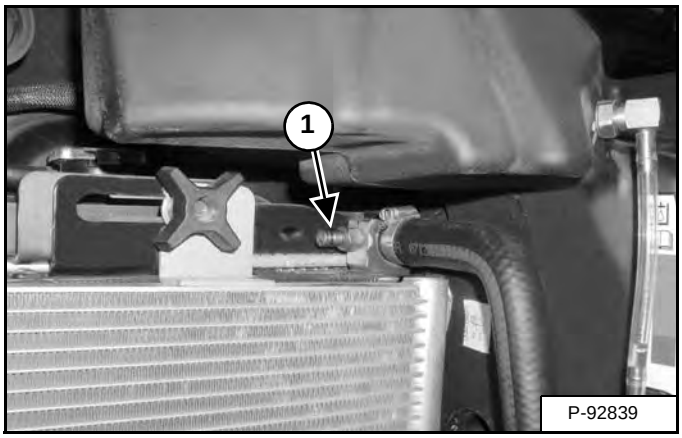


With the engine OFF, loosen the plug (Item 1) **[Figure 10-130-9]** on the hydraulic pump. Tighten the plug after a steady stream of hydraulic fluid, free of any air bubbles, drains from the plug. **DO NOT RUN THE MACHINE WITH THE PLUG OPEN.**

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Removing And Replacing Hydraulic Fluid (Cont'd)

Figure 10-130-10



There is also a port (Item 1) **[Figure 10-130-10]** on the hydraulic cooler for bleeding air. Install a diagnostic coupler and hose on this fitting and to allow air to be bled from the hydraulic system after the hydraulic fluid has been replaced.

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

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LUBRICATION OF THE HYDRAULIC EXCAVATOR

Lubrication Locations

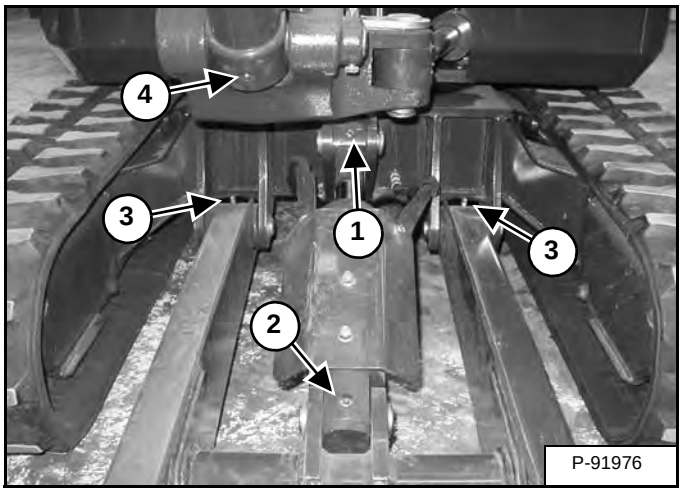
Lubricate the excavator as specified in the SERVICE SCHEDULE for the best performance of the machine. (See SERVICE SCHEDULE on Page 10-70-1.)

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

NOTE: Use Extra Heavy Gear Shield grease for grease fittings (Item 19, 20 and 21).

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

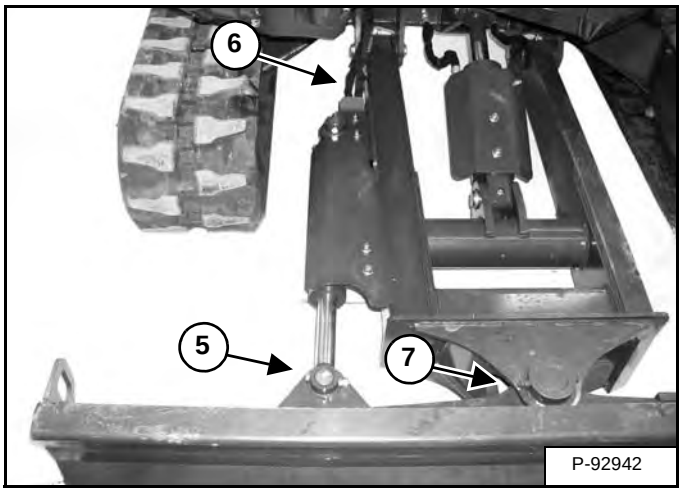
Figure 10-140-1



Ref Description (# of Fittings)

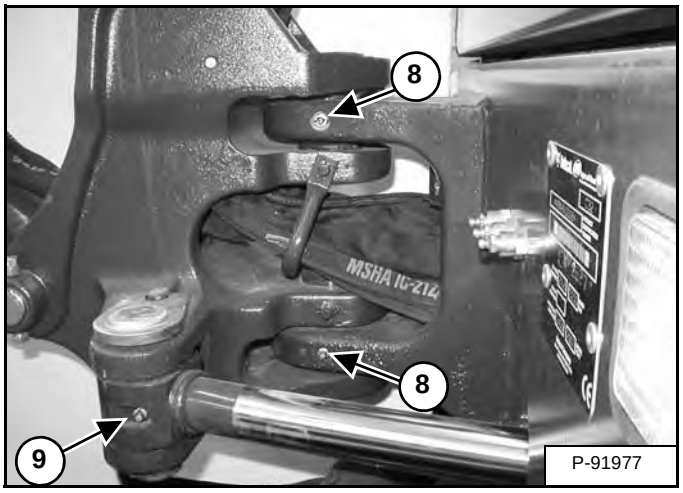
1. Blade Cylinder Rod End (1) **[Figure 10-140-1]**
2. Blade Cylinder Base End (1) **[Figure 10-140-1]**
3. Blade Pivots (2) **[Figure 10-140-1]**
4. Boom Cylinder Base End (1) **[Figure 10-140-1]**

Figure 10-140-2



5. Angle Blade Cylinder Rod End (1) **[Figure 10-140-2]** (If Equipped)
6. Angle Blade Cylinder Base End (1) **[Figure 10-140-2]** (If Equipped)
7. Angle Blade Pivot (1) **[Figure 10-140-2]** (If Equipped)

Figure 10-140-3

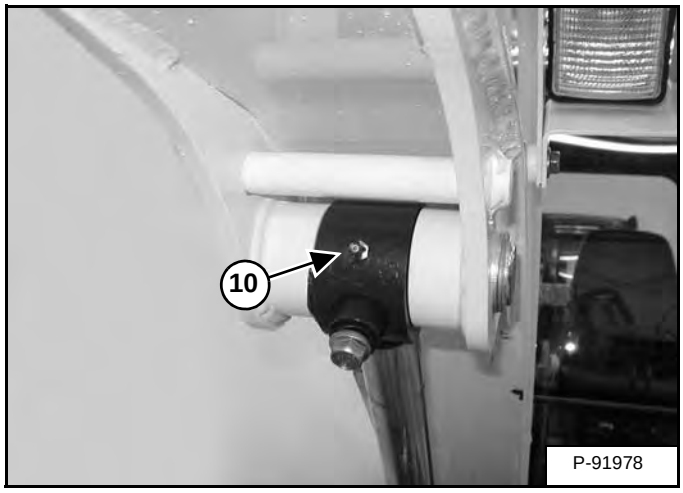


8. Boom Swing Pivot (3) **[Figure 10-140-3]**
9. Boom Swing Cylinder Rod End (1) **[Figure 10-140-3]**

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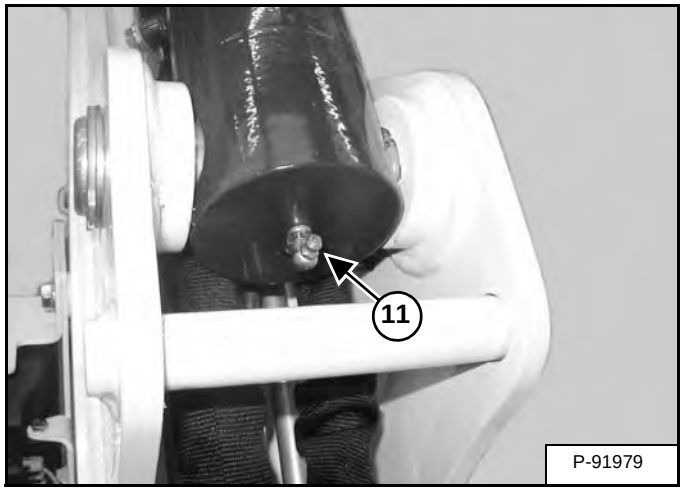
Lubrication Locations (Cont'd)

Figure 10-140-4



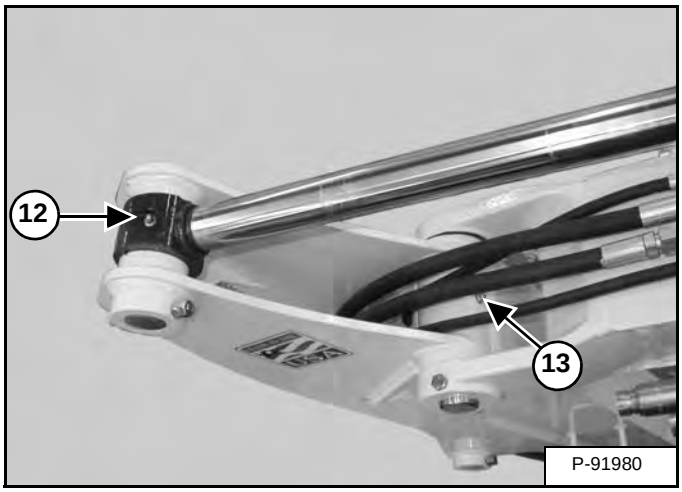
10. Boom Cylinder Rod End (1) **[Figure 10-140-4]**

Figure 10-140-5



11. Arm Cylinder Base End (1) **[Figure 10-140-5]**

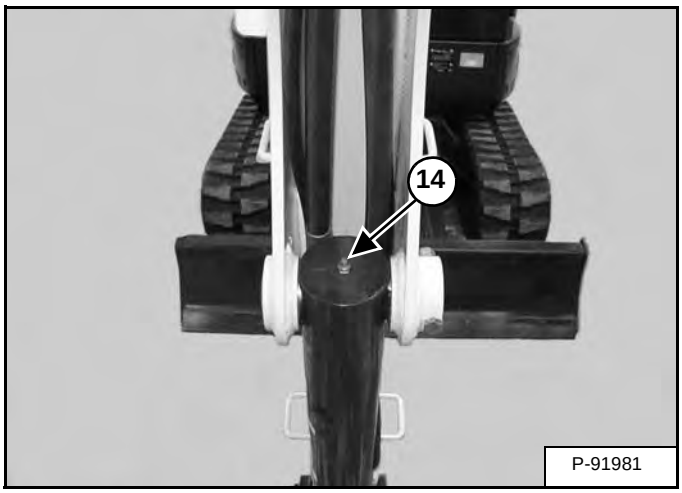
Figure 10-140-6



12. Arm Cylinder Rod End (1) **[Figure 10-140-6]**

13. Arm Pivot (1) **[Figure 10-140-6]**

Figure 10-140-7

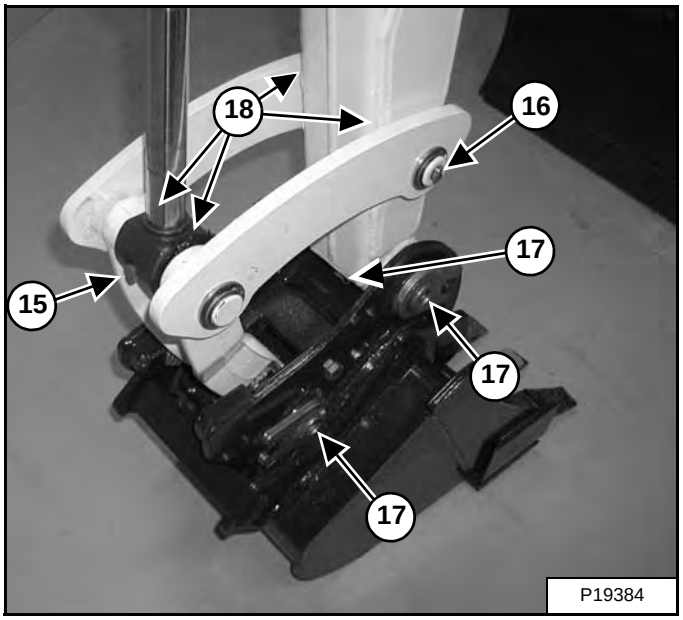


14. Bucket Cylinder Base End (1) **[Figure 10-140-7]**

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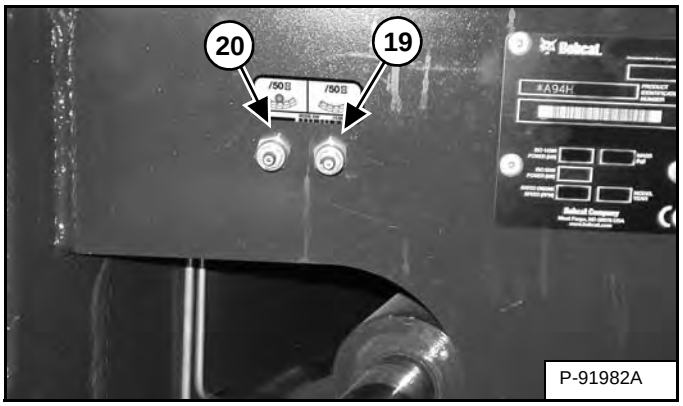
Lubrication Locations (Cont'd)

Figure 10-140-8



15. Bucket Cylinder Rod End (1) **[Figure 10-140-8]**
16. Bucket Link Pin (1) **[Figure 10-140-8]**
17. Bucket Pivot (3) **[Figure 10-140-8]**
18. Bucket Link - without extendable arm (2), with extendable arm (4) **[Figure 10-140-8]**

Figure 10-140-9

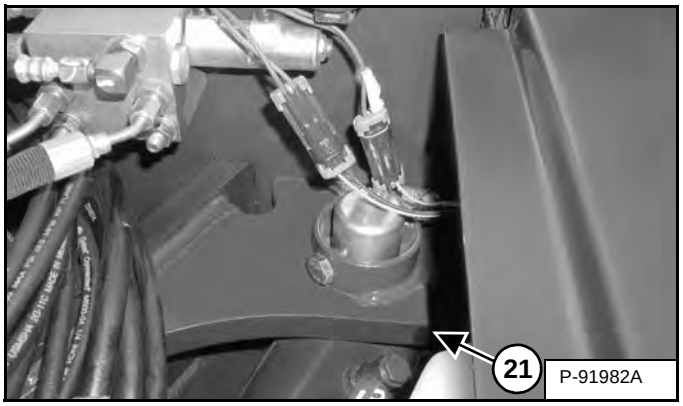


Lubricate the following locations on the hydraulic excavator **EVERY 50 HOURS**:

NOTE: Use Extra Heavy Gear Shield grease for grease fittings (Item 19, 20 and 21).

19. Swing Circle (1) **[Figure 10-140-9]**.
20. Swing Pinion (1) **[Figure 10-140-9]**. (Install 3 to 4 pumps of grease then rotate the upperstructure 90°. Install 3 to 4 pumps of grease and again rotate the upperstructure 90°. Repeat this until the slew pinion has been greased at four positions.)

Figure 10-140-10



Lubricate the following location on the hydraulic excavator **EVERY 1000 HOURS**:

NOTE: Use Extra Heavy Gear Shield grease for grease fittings (Item 20, 21 and 22).

21. Boom Swing Cylinder Base (1) **[Figure 10-140-10]**.

NOTE: The boom swing grease fitting is located on the side of base end of the cylinder.

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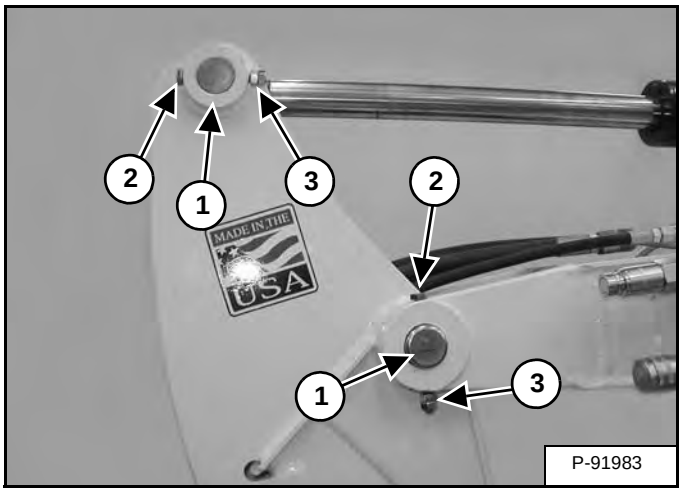


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PIVOT PINS

Inspection And Maintenance

Figure 10-150-1



The pivots and cylinders (Item 1) have a large pin held in position with a bolt (Item 2) and double nuts (Item 3) **[Figure 10-150-1]** securing the pin.

The two nuts (Item 3) are used as jam nuts to hold the bolt (Item 2) with out tightening the bolt (Item 2) to the pin boss. After the nuts (Item 3) are tightened together, the bolt (Item 2) **[Figure 10-150-1]** should be free to spin. See your Bobcat dealer for replacement parts.

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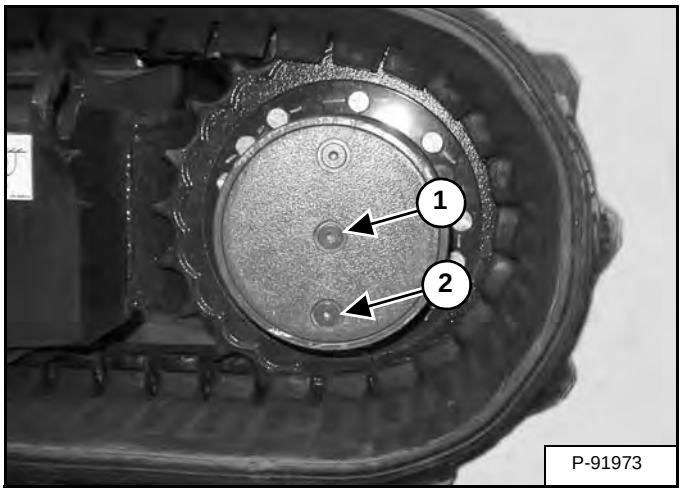


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TRAVEL MOTOR

Checking And Adding Oil

Figure 10-160-1



Park the excavator on a level surface with the plugs (Items 1 and 2) **[Figure 10-160-1]** in the vertical position as shown.

Remove the plug (Item 1) **[Figure 10-160-1]**. The lube level must be at the bottom edge of the hole.

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

Removing And Replacing Oil

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

Park the excavator on a level surface with plugs (Item 1 and 2) **[Figure 10-160-1]** in the vertical position shown. Remove both plugs and drain the lubricant into a container.

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2103-0508

Install the bottom plug (Item 2) **[Figure 10-160-1]**. Add lubricant through the center hole until the lube level is at the bottom edge of the hole.

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

Install the plug (Item 1) **[Figure 10-160-1]**.

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SPARK ARRESTER MUFFLER

Cleaning Procedure

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

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

WARNING

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

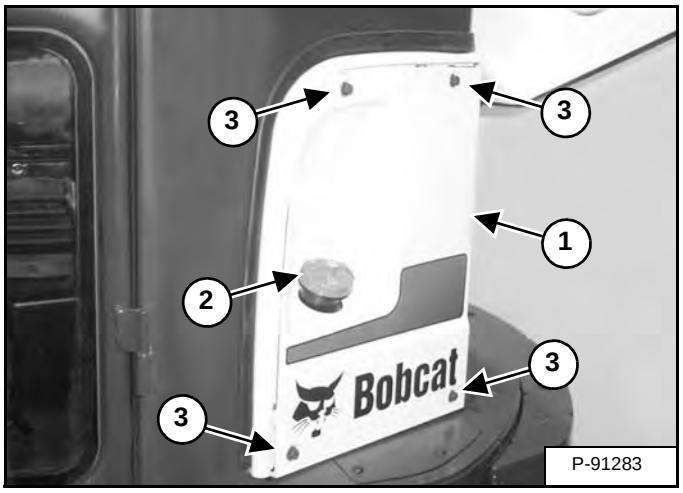
Failure to do so can cause injury or death.

W-2203-0595

Do not operate the excavator with a defective exhaust system.

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

Figure 10-170-1

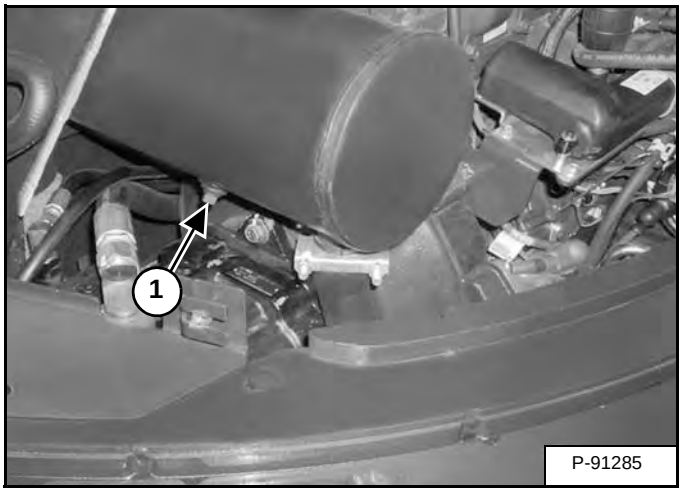


The left panel (Item 1) **[Figure 10-170-1]** will need to be removed for access to the spark arrester muffler.

Remove the fuel cap (Item 2) and the four bolts (Item 3) and remove the panel (Item 1) **[Figure 10-170-1]**.

Reinstall the fuel cap (Item 2) **[Figure 10-170-1]**.

Figure 10-170-2



Remove the plug (Item 1) **[Figure 10-170-2]** 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 plug hole (Item 1) **[Figure 10-170-2]**.

Stop the engine. Install and tighten the plug.

Reinstall the panel (Item 1) **[Figure 10-170-1]**.

Close the tailgate.

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EMERGENCY EXIT

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

Right Side Rear Window

Figure 10-180-1



Exit through the window **[Figure 10-180-1]**.

Front Window

Figure 10-180-2



Open the front window and exit **[Figure 10-180-2]**.

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

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SEAT BELT

Inspection And Maintenance

WARNING

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

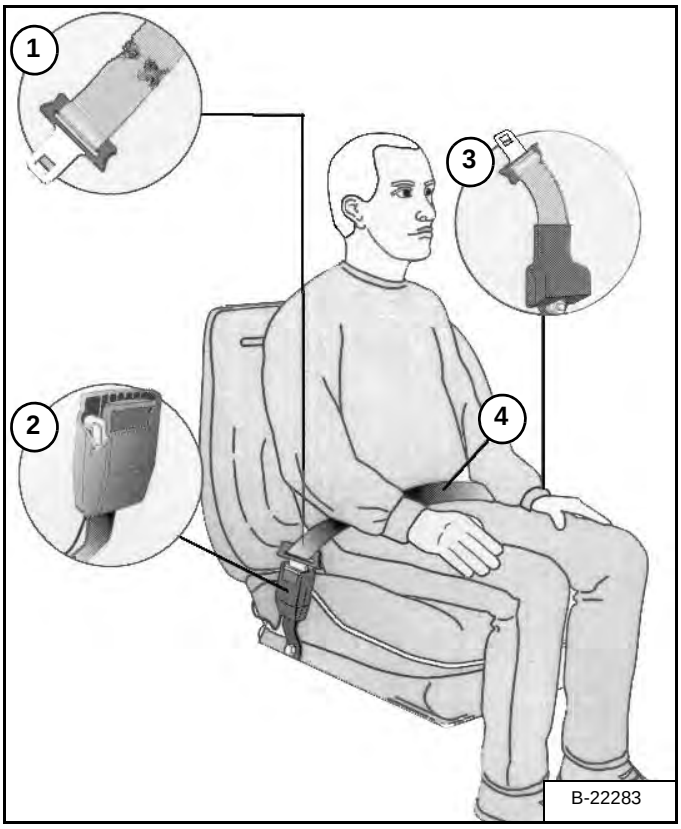
W-2466-0703

Check the seat belt daily for correct function.

Inspect the seat belt system thoroughly at least once each year or more often if the machine is exposed to severe environmental conditions or applications.

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

Figure 10-190-1



The items below are referenced in **[Figure 10-190-1]**.

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

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

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

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

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

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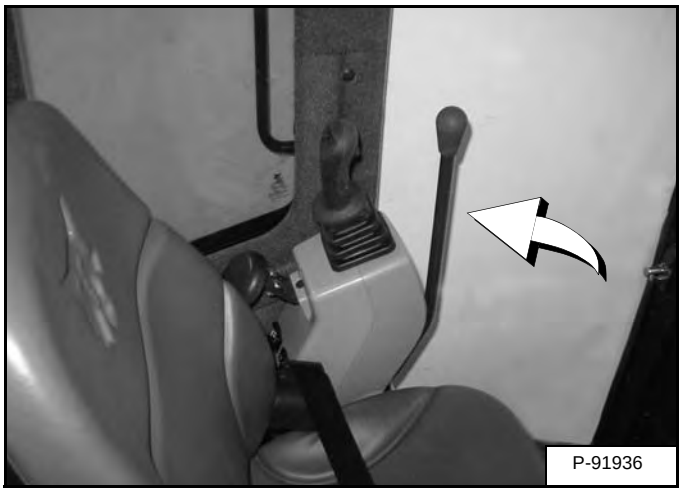


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CONTROL CONSOLE LOCKOUTS

Inspection And Maintenance

Figure 10-200-1



When the left console is raised **[Figure 10-200-1]**, the hydraulic control levers (joysticks) and traction system must not function.

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

Raise the left console **[Figure 10-200-1]**.

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

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

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

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TOWING THE EXCAVATOR

Procedure

There is not a recommended towing procedure for the excavators.

- The excavator can be lifted onto the transport vehicle.
- The excavator can be skidded a short distance for service (EXAMPLE: Move onto a transport vehicle) without damage to the hydraulic system. (The tracks will not turn.) There might be slight wear to the tracks when the excavator is skidded.
- The towing chain (or cable) must be rated at 1.5 times the weight of the excavator. (See Performance on Page SPEC-10-6.)

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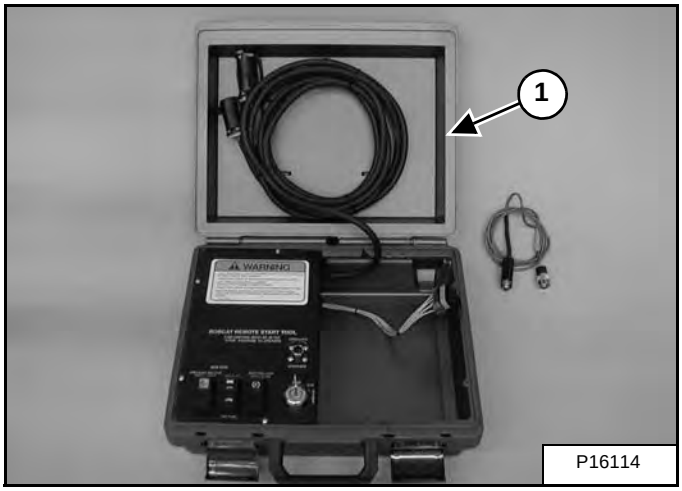
REMOTE START TOOL KIT-MEL1563

Remote Start Tool - MEL1563

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

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

Figure 10-220-1

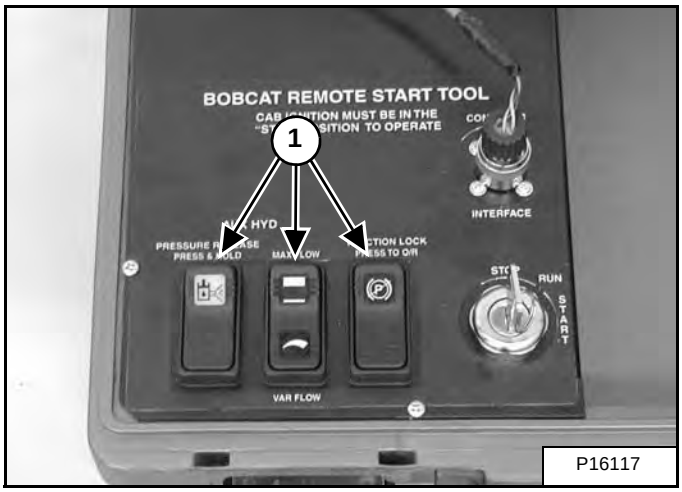


The remote start tool (Item 1) **[Figure 10-220-1]** is used for excavators.

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



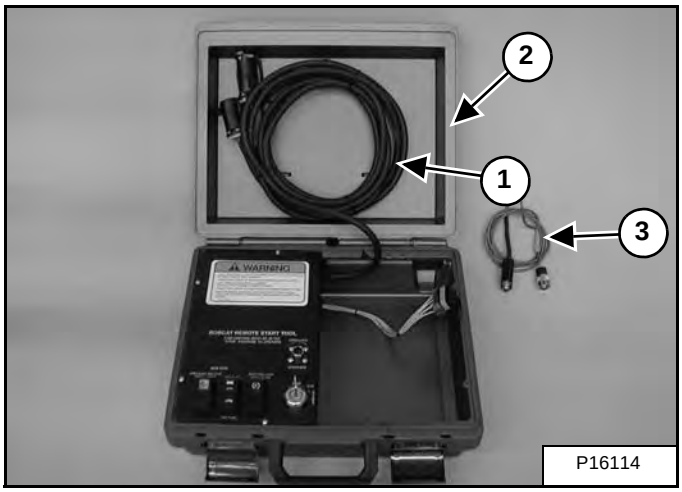
The 10-pin rectangular connector (Item 1) **[Figure 10-220-3]** is not used for an excavator application.

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REMOTE START TOOL-MEL1563 (CONT'D)

Service Tool Harness Control - MEL1565

Figure 10-220-4



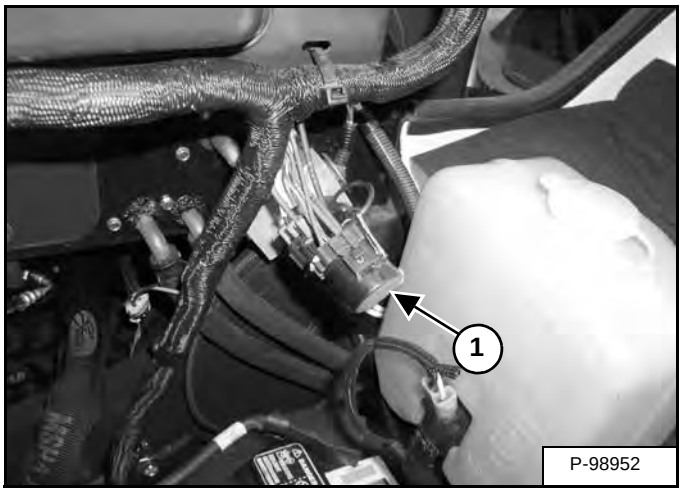
The service tool harness control (Item 1) is used to connect the remote start tool (Item 2) **[Figure 10-220-4]** to the electrical system on the excavator.

The service tool harness communicator (Item 3) **[Figure 10-220-4]** 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 10-220-5



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

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

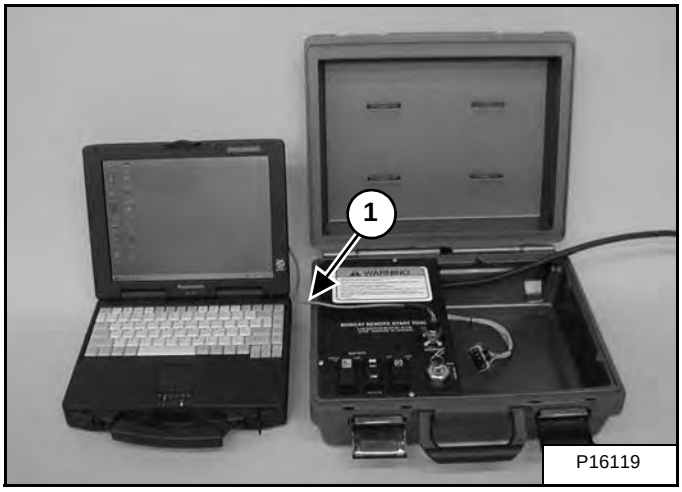
Connect the service tool harness communicator (MEL1566) to the designated serial port on the Service PC.

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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.

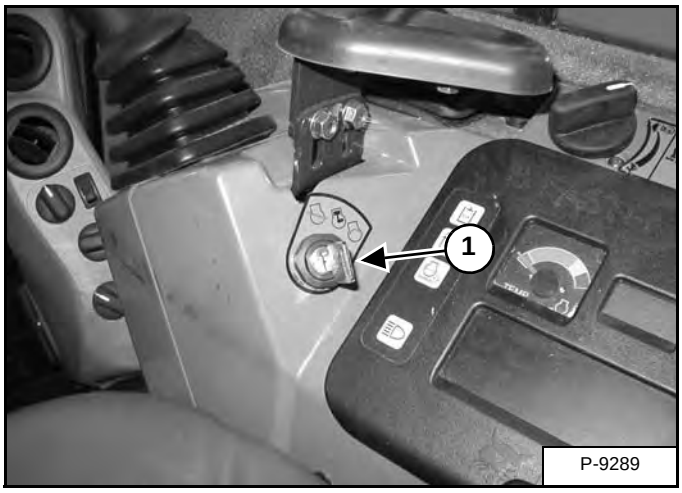
Figure 10-220-6



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

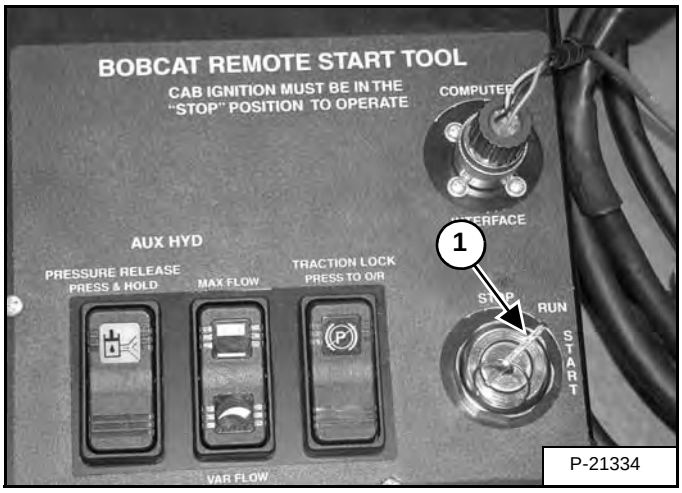
Figure 10-220-7



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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Service Tool Harness Communicator - MEL1566 (Cont'd)

Keyless Start

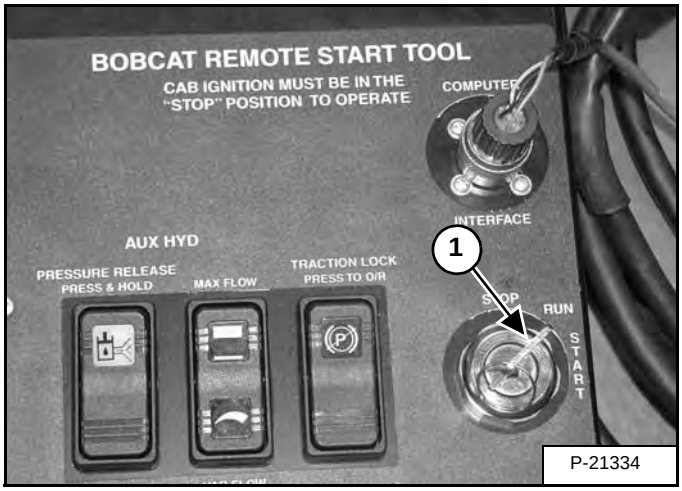
Figure 10-220-9



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 - 7217666

Description

The Remote Start Tool (Service Tool) Kit 7217666 is a replacement tool for 7003031 AND MEL1563 Remote Start Tools Kits.

The Remote Start Tool (Service Tool) Kit, P/N 7217666, 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 - 7217666

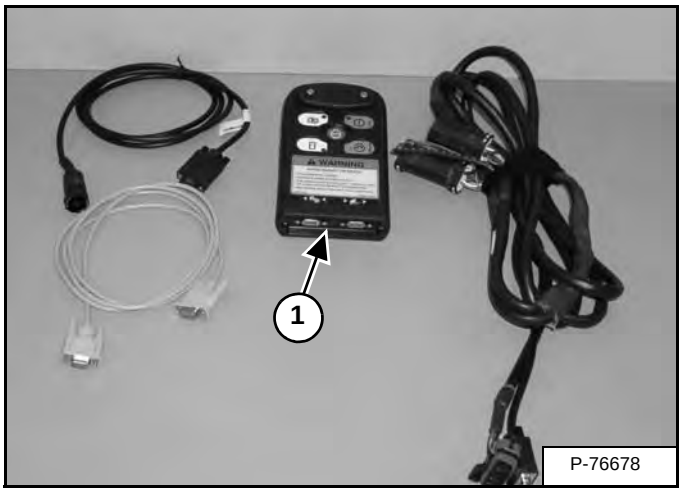
Remote Start Tool (Service Tool) - 7217666

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

Order from Bobcat Parts P/N: 7217666 - Remote Start Tool (Service Tool) Kit

Kit Includes:
7022042 - Remote Start Tool (Service Tool)
6689747 - Excavator Service Tool Harness
6689746 - Computer Service Tool Harness
6689745 - BOSS® Service Tool Harness

Figure 10-221-1

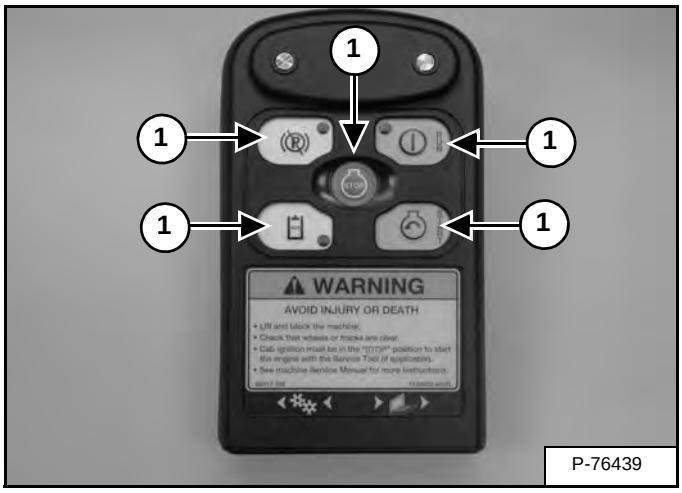


The remote start tool (Item 1) **[Figure 10-221-1]** is used for excavators.

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.

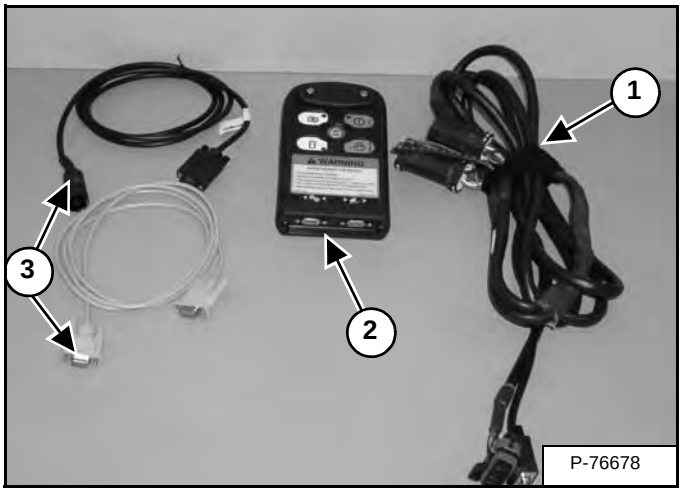
NOTE: Excavators can not be started by using the remote start tool.

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REMOTE START TOOL (SERVICE TOOL) KIT - 7217666 (CONT'D)

Excavator Service Tool Harness - 6689747

Figure 10-221-3



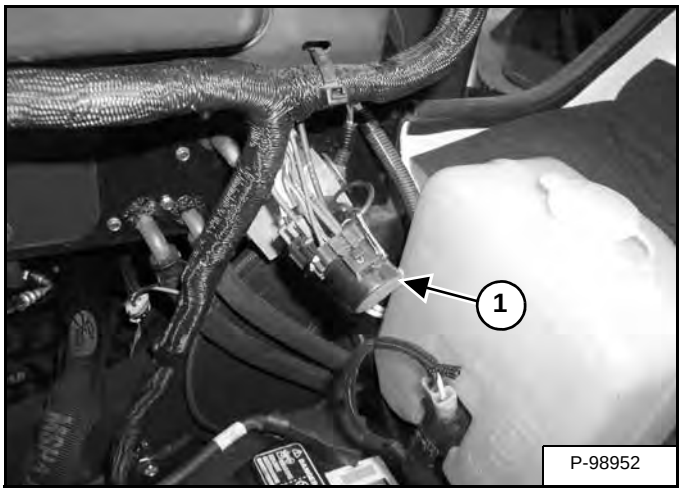
The service tool harness (Item 1) **[Figure 10-221-3]** is used to connect the remote start tool (Item 2) **[Figure 10-221-3]** to the electrical system on the excavator.

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.

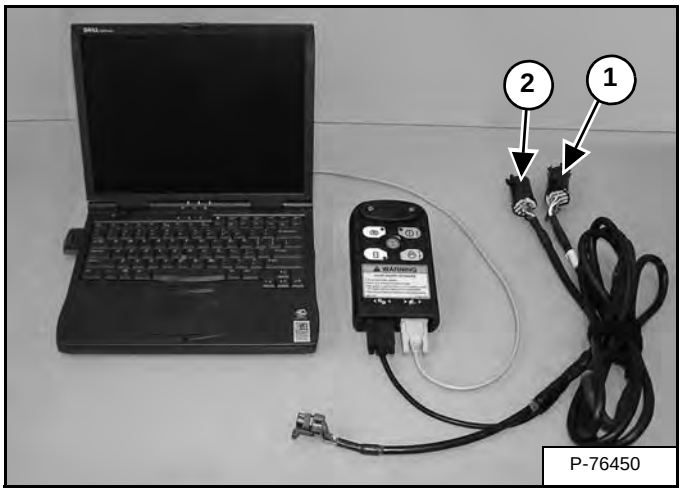
Open the right side cover.

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.

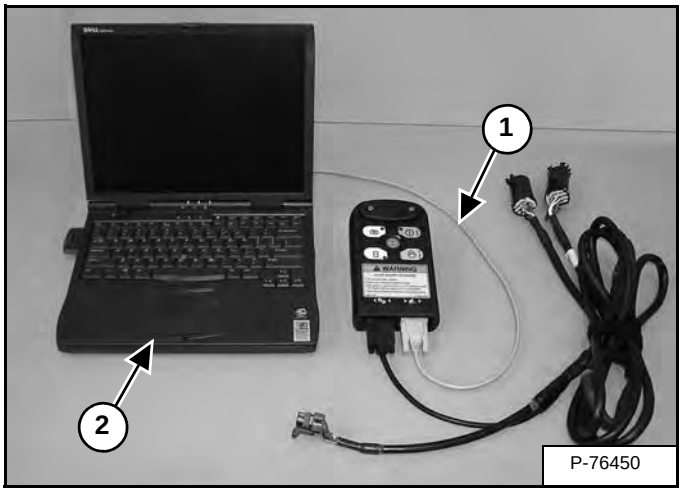
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REMOTE START TOOL (SERVICE TOOL) KIT - 7217666 (CONT'D)

Computer Service Tool Harness - 6689746

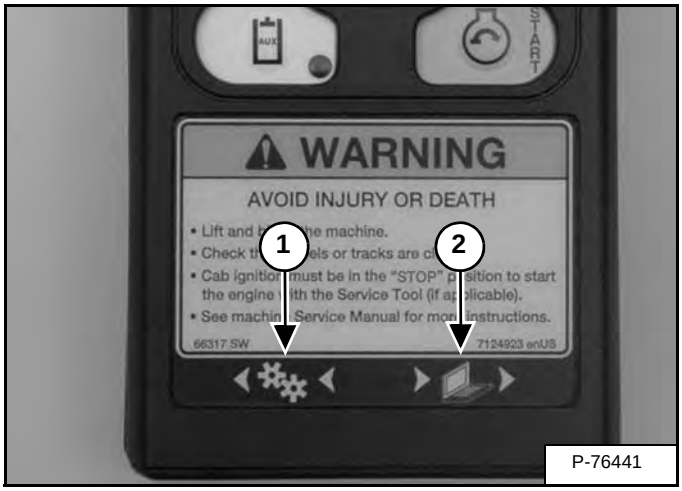
NOTE: To monitor, diagnose or load new software the Service PC must be connected to the Remote Start Tool.

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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E35 HYDRAULIC/HYDROSTATIC SCHEMATIC
S/N A93K11001 AND ABOVE

(PRINTED AUGUST 2012)
V-1346legend

Printable Version Click Here

LEGEND

1. HYDRAULIC RESERVOIR: Pressurized with Fill Strainer
   Reservoir Capacity (at Site Gauge) . . . . . 9,5 L (10.0 qt)
   System Capacity . . . . 22,7 L (24.0 qt)
2. PRESSURIZED BREATHER/FILL CAP with FILTER:
   41,4 kPa (0,41 bar) (6 psi) – Outlet
   4,1 kPa (0,04 bar) (0.6 psi) - Inlet
3. HYDRAULIC FILTER ELEMENT
   15 Micron
4. FILTER BY-PASS
   345 kPa (3.44 bar) (50 psi))
5. CASE DRAIN FILTER - with By-Pass
   Element - 40 Micron
   By-Pass – 124 – 159 kPa (1,2 – 1,6 bar) (18 - 23 psi)
6. PRESSURE SWITCH - Hydraulic
7. HYDRAULIC PISTON PUMP . . . . . 100,8 L/min (26.6 gpm) at High Engine RPM
8. ON STROKE PISTIONn
9. PUMP MARGIN SPOOL -
   1400 kPa (14 bar) (203 psi)
10. TORQUE LIMITER
11. DESTROKE PISTON
12. ORIFICE- Fine Control: 2,6 mm (0.102 in)
13. ORIFICE – PC: 0,6 mm (0.041 in)
14. HYDRAULIC GEAR PUMP
    9,5 L/min (2.5 gpm) at High Engine RPM
15. PRESSURE SWITCH – Motion Alarm (If Equipped)
16. SHUTTLE VALVE – Motion Alarm (If Equipped)
17. PRESSURE REDUCING VALVE
    2999 kPa (30 bar) (435 psi)
18. CHECK VALVE - Accumulator
19. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Boom Offset / Secondary Auxiliary Hydraulics – If Equipped)
20. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Boom Offset / Secondary Auxiliary Hydraulics – If Equipped)
21. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - Two Speed
22. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - Work group Lockout
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - Male Coupler
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - Female Coupler
25. ACCUMULATOR
26. MAIN RELIEF VALVE
    24497 kPa (245 bar) (3553 psi)
27. PRESSURE SENSOR – Auto Idle
28. FILTER – Control Valve
29. ORIFICE - 0,4 mm (0.016 in)
30. COMPENSATOR
31. PORT RELIEF VALVE (With Anti-Cavitation) - (BUCKET Cylinder) 27000 kPa (270 bar) (3916 psi)
32. PORT RELIEF VALVE (With Anti-Cavitation) - (BUCKET Cylinder) 27000 kPa (270 bar) (3916 psi)
33. PORT RELIEF VALVE (With Anti-Cavitation) - (ARM Cylinder) 27000 kPa (270 bar) (3916 psi)
34. PORT RELIEF VALVE (With Anti-Cavitation) - (ARM Cylinder) 27000 kPa (270 bar) (3916 psi)
35. PORT RELIEF VALVE - (With Anti-Cavitation Valve) - (Auxiliary Pressure Port:
    20684 kPa (206 bar) (3000 psi)
36. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Auxiliary Return Port:
    20684 kPa (206 bar) (3000 psi)
37. PORT RELIEF VALVE (With Anti-Cavitation) - (Boom Cylinder) 27000 kPa (270 bar) (3916 psi)
38. PORT RELIEF VALVE (With Anti-Cavitation) - (Boom Cylinder) 27000 kPa (270 bar) (3916 psi)
39. PORT RELIEF VALVE (With Anti-Cavitation) - (Bucket Cylinder) 27000 kPa (270 bar) (3916 psi)
40. SHUTTLE VALVE
41. FLUSHING VALVE: 2503 kPa (25 bar) (363 psi)
42. UNLOAD ORIFICE: 0,7mm (0.028 in)
43. ORIFICE – Load Sense - 1,5 mm (0.059 in)
44. CHECK VALVE: 310 kPa (3,1 bar) (45 psi)
45. CHECK VALVE: 414 kPa (4,2 bar) (60 psi)
46. DRIVE MOTOR SHUTTLE - With restrictors
47. VALVE - 2 -Speed / Auto Shift
48. PISTON – Two Speed (2)
49. CROSSPORT RELIEF VALVE (Ramp Pressure Increasing Type):
    Set @: 21594 kPa (216 Bar) (3132 psi)
    Crack Pressure: 18602 kPa (186 Bar) (2698 psi)
50. ANTI-CAVITATION VALVE (2)
51. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - Sequence Valve
52. TIMER VALVE: 2503 kPa (25 Bar) (363 psi)
53. ORIFICE - 0,4 mm (0.016 in)
54. CHECK VALVE – Brake Release
55. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - Second Auxiliary (Optional)
56. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - Second Auxiliary (2) (Optional)
57. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Secondary Auxiliary)
    17926 kPa (179 bar) (2600 psi)
58. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Secondary Auxiliary)
    17926 kPa (179 bar) (2600 psi)
59. TEST PORT - "JP3" PORT - Pressure Reducing Valve
60. FACTORY FILL PORT
61. ANTI-DRIFT VALVE
62. TEST PORT
63. ORIFICE – Straight Travel 0,8 mm (0.31 in)
64. FILTER – Hydraulic X-Change Valve
65. ORIFICE - 1,78 mm (0.070 in)
66. CHECK VALVE – Load Sense
67. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
68. CHECK VALVE
69. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Angle Blade) 3916 PSI (270 bar)
70. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Angle Blade) 3916 PSI (270 bar)
71. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Angle Blade (Optional)
72. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Angle Blade (Optional)
73. CHECK VALVE
74. DIFFERENTIAL PRESSURE SWITCH:
    276 kPa (2,76 bar) (40 psi)
    Normally Closed
75. ORIFICE - Load Holding Valve – Boom (OPTIONAL)
76. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - Load Holding Valve – Boom (OPTIONAL)
77. RELIEF VALVE - Load Holding Valve – Boom (OPTIONAL)
78. ORIFICE - Load Holding Valve – Arm (OPTIONAL)
79. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - Load Holding Valve – Arm (OPTIONAL)
80. RELIEF VALVE - Load Holding Valve – Arm (OPTIONAL)
81. ANTI-CAVITATION VALVE
82. ANTI-CAVITATION VALVE (Later Models Only)

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

V-1346legend (7-26-12)

EXTENDABLE ARM CYLINDER (OPTION)
FEMALE
MALE
DIRECT TO TANK VALVE (OPTIONAL)
ANGLE BLADE CYLINDER
BOOM CYLINDER
ARM CYLINDER
BUCKET CYLINDER
ARM LOAD HOLDING VALVE (OPTION)
BOOM LOAD HOLDING VALVE (OPTION)
TRAVEL MOTORS W/ AUTO-SHIFT
RH
LH
FWD
REV
SWIVEL JOINT
BLADE CYLINDER
SLEW MOTOR W/ BRAKE
GEAR BOX
OFFSET CYLINDER
2ND AUX FUNCTION (OPTION)
FEMALE COUPLER
MALE COUPLER
CONTROL VALVE
BUCKET
ARM
AUX
BOOM
ANGLE BLADE
TRAVEL RH
TRAVEL LH
BLADE
SLEW
OFFSET
HYDRAULIC X-CHANGE CYLINDERS (OPTIONAL)
HYDRAULIC X-CHANGE CONTROL VALVE (OPTION)
JOYSTICK PATTERN SELECTOR VALVE (U.S. OPTION)
LEFT HAND JOYSTICK
RIGHT HAND JOYSTICK
BLADE CONTROL
TRAVEL CONTROL
CASE DRAIN FILTER
HYDRAULIC RESERVOIR
PRESSURIZED BREATHER
OIL COOLER
HYDRAULIC FILTER W/ BYPASS
MANIFOLD
ACCUMULATOR

Legend
- Pressure Line
- Drain Line
- Pilot Line
- Load Sense Line

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HYDRAULIC / HYDROSTATIC SCHEMATIC
E35 (S/N A93K11001 & ABOVE)

(PRINTED AUGUST 2012)
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E35 HYDRAULIC/HYDROSTATIC SCHEMATIC
S/N AC2P11001 AND ABOVE

(PRINTED AUGUST 2012)
V-1347legend

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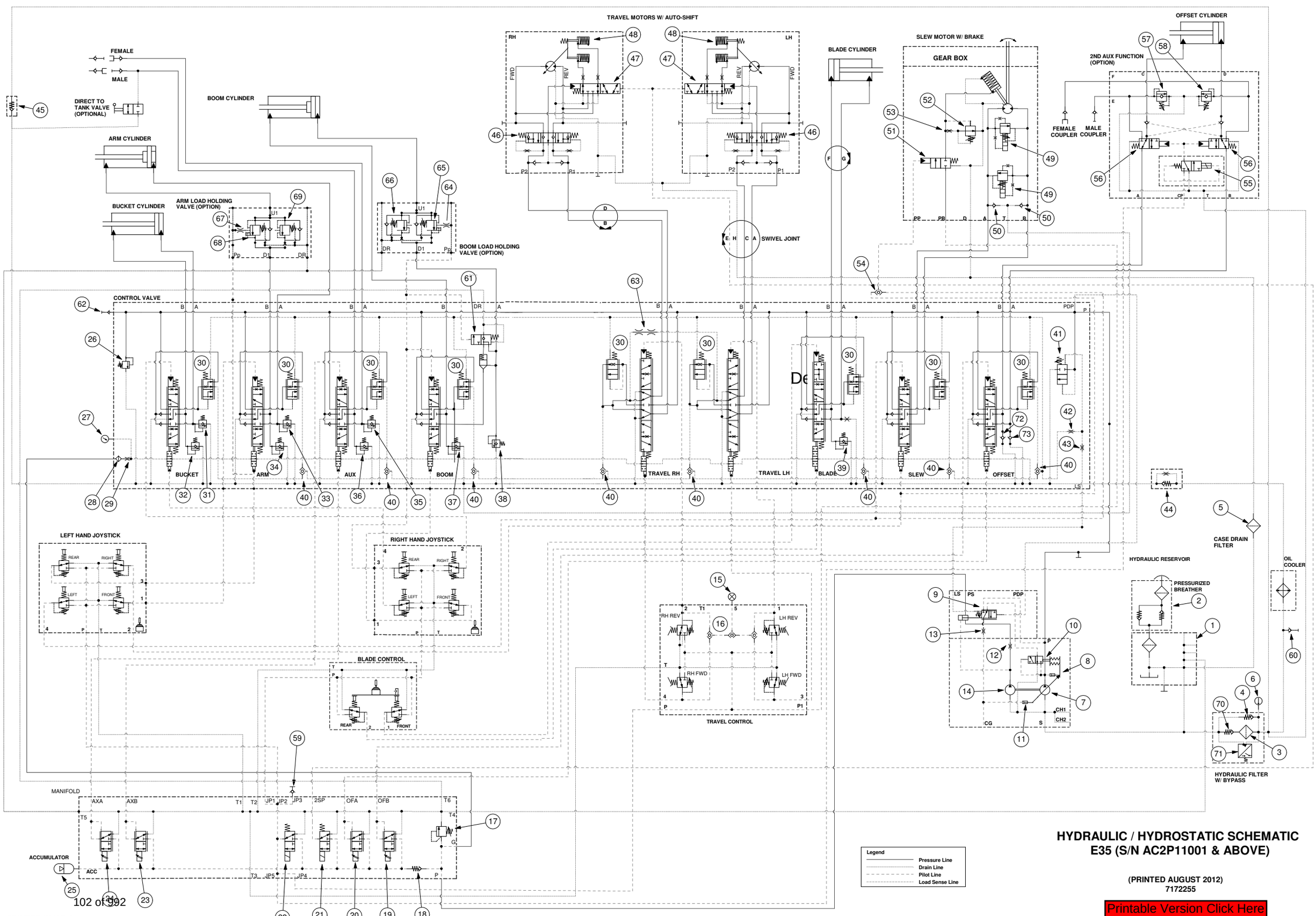
LEGEND

1. HYDRAULIC RESERVOIR: Pressurized with Fill Strainer
   Reservoir Capacity (at Site Gauge) . . . . . 9,5 L (10.0 qt)
   System Capacity . . . . 22,7 L (24.0 qt)
2. PRESSURIZED BREATHER/FILL CAP with FILTER:
   41,4 kPa (0,41 bar) (6 psi) – Outlet
   4,1 kPa (0,04 bar) (0.6 psi) - Inlet
3. HYDRAULIC FILTER ELEMENT: 15 Micron
4. FILTER BY-PASS
   345 kPa (3.44 bar) (50 psi)
5. CASE DRAIN FILTER - with By-Pass
   Element - 40 Micron
   By-Pass – 124 – 159 kPa (1,2 – 1,6 bar) (18 - 23 psi)
6. PRESSURE SWITCH - Hydraulic
7. HYDRAULIC PISTON PUMP . . . . . 100,8 L/min (26.6 gpm) at High Engine RPM
8. ON STROKE PISTION
9. PUMP MARGIN SPOOL - 1400 kPa (14 bar) (203 psi)
10. TORQUE LIMITER
11. DESTROKE PISTON
12. ORIFICE- Fine Control: 2,6 mm (0.102 in)
13. ORIFICE – PC: 0,6 mm (0.041 in)
14. HYDRAULIC GEAR PUMP
    9,5 L/min (2.5 gpm) at High Engine RPM
15. PRESSURE SWITCH – Motion Alarm (If Equipped)
16. SHUTTLE VALVE – Motion Alarm (If Equipped)
17. PRESSURE REDUCING VALVE
    2999 kPa (30 bar) (435 psi)
18. CHECK VALVE - Accumulator
19. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Boom Offset / Secondary Auxiliary Hydraulics – If Equipped)
20. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Boom Offset / Secondary Auxiliary Hydraulics – If Equipped)
21. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - Two Speed
22. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - Work group Lockout
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - Male Coupler
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - Female Coupler
25. ACCUMULATOR
26. MAIN RELIEF VALVE
    24497 kPa (245 bar) (3553 psi)
27. PRESSURE SENSOR – Auto Idle
28. FILTER – Control Valve
29. ORIFICE - 0,4 mm (0.016 in)
30. COMPENSATOR
31. PORT RELIEF VALVE (With Anti-Cavitation) - (BUCKET Cylinder) 27000 kPa (270 bar) (3916 psi)
32. PORT RELIEF VALVE (With Anti-Cavitation) - (BUCKET Cylinder) 27000 kPa (270 bar) (3916 psi)
33. PORT RELIEF VALVE (With Anti-Cavitation) - (ARM Cylinder) 27000 kPa (270 bar) (3916 psi)
34. PORT RELIEF VALVE (With Anti-Cavitation) - (ARM Cylinder) 27000 kPa (270 bar) (3916 psi)
35. PORT RELIEF VALVE - (With Anti-Cavitation Valve) - (Auxiliary Pressure Port: 20684 kPa (206 bar) (3000 psi)
36. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Auxiliary Return Port: 20684 kPa (206 bar) (3000 psi)
37. PORT RELIEF VALVE (With Anti-Cavitation) - (Boom Cylinder) 27000 kPa (270 bar) (3916 psi)
38. PORT RELIEF VALVE (With Anti-Cavitation) - (Boom Cylinder) 27000 kPa (270 bar) (3916 psi)
39. PORT RELIEF VALVE (With Anti-Cavitation) - (Bucket Cylinder) 27000 kPa (270 bar) (3916 psi)
40. SHUTTLE VALVE
41. FLUSHING VALVE: 2503 kPa (25 bar) (363 psi)
42. UNLOAD ORIFICE: 0,7mm (0.028 in)
43. ORIFICE – Load Sense - 1,5 mm (0.059 in)
44. CHECK VALVE: 310 kPa (3,1 bar) (45 psi)
45. CHECK VALVE: 414 kPa (4,2 bar) (60 psi)
46. DRIVE MOTOR SHUTTLE - With restrictors
47. VALVE - 2 -Speed / Auto Shift
48. PISTON – Two Speed (2)
49. CROSSPORT RELIEF VALVE (Ramp Pressure Increasing Type):
    Set @: 21594 kPa (216 Bar) (3132 psi)
    Crack Pressure: 18602 kPa (186 Bar) (2698 psi)
50. ANTI-CAVITATION VALVE (2)
51. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - Sequence Valve
52. TIMER VALVE: 2503 kPa (25 Bar) (363 psi)
53. ORIFICE - 0,4 mm (0.016 in)
54. CHECK VALVE – Brake Release
55. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - Second Auxiliary (Optional)
56. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - Second Auxiliary (Optional)
57. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Secondary Auxiliary) 17926 kPa (179 bar) (2600 psi)
58. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Secondary Auxiliary) 17926 kPa (179 bar) (2600 psi)
59. TEST PORT - "JP3" PORT - Pressure Reducing Valve
60. FACTORY FILL PORT
61. ANTI-DRIFT VALVE
62. TEST PORT
63. ORIFICE – Straight Travel 0,8 mm (0.31 in)
64. ORIFICE - Load Holding Valve – Boom (OPTIONAL)
65. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - Load Holding Valve – Boom (OPTIONAL)
66. RELIEF VALVE - Load Holding Valve – Boom (OPTIONAL)
67. ORIFICE - Load Holding Valve – Arm (OPTIONAL)
68. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - Load Holding Valve – Arm (OPTIONAL)
69. RELIEF VALVE - Load Holding Valve – Arm (OPTIONAL)
70. CHECK VALVE
71. DIFFERENTIAL PRESSURE SWITCH: 276 kPa (2,76 bar) (40 psi) Normally Closed
72. ANTI-CAVITATION VALVE
73. ANTI-CAVITATION VALVE (Later Models Only)

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

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HYDRAULIC / HYDROSTATIC SCHEMATIC
E35 (S/N AC2P11001 & ABOVE)

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Glossary Of Hydraulic / Hydrostatic Symbols

GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL DESCRIPTION

FLOW LINES and CONNECTIONS

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

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

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

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

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

CONNECTED JUNCTION OF OIL LINES (Flow Line Connection)

OIL LINES CROSSING (NOT Connected)

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

SYMBOL DESCRIPTION

BASIC and MISCELLANEOUS SYMBOLS

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

VARIABLE ADJUSTMENT RESTRICTION – Regulated or Variable Restriction

TEMPERATURE CONTROL – (indication of temperature)

TEMPERATURE INDICATOR – (temperature measurement – thermometer)

FILTER (strainer or screen) – For fluid conditioning

VENTED AND FILTERED RESERVOIR (reservoir open to atmosphere)

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

PRESSURE SENSOR – Varies electric signal with pressure

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

PRESSURE SWITCH – Switch activates when pressure reaches specified level

MUFFLER (silencer) – Reduces noise

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Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL	DESCRIPTION
	CYLINDER: Equipment to convert hydraulic energy into linear energy and in which the fluid pressure operates alternately in both directions (forward and backward strokes)
	DOUBLE ACTING HYDRAULIC CYLINDER, UNEQUAL DISPLACEMENT – With single piston rod
	DOUBLE ACTING HYDRAULIC CYLINDER, UNEQUAL DISPLACEMENT and CUSHION ON ONE END – With single piston rod
	PUMP: To convert mechanical energy into hydraulic energy
	FIXED CAPACITY DISPLACEMENT HYDRAULIC PUMP – With one direction of flow
	VARIABLE CAPACITY DISPLACEMENT BIDIRECTIONAL HYDRAULIC PUMP – With two directions of flow (bidirectional)
	MOTOR: To convert hydraulic energy into rotary mechanical energy
	FIXED CAPACITY DISPLACEMENT BIDIRECTIONAL HYDRAULIC MOTOR – With two directions of flow (bidirectional)

SYMBOL	DESCRIPTION
	CONTROL MECHANISMS
	CONTROL VALVE WITH DETENT (Holds Valve in Position) – device for maintaining a given position (mechanical)
	CONTROL VALVE ACTIVATED BY A PULL BUTTON (manual)
	CONTROL VALVE ACTIVATED BY A PUSH–PULL BUTTON (manual)
	CONTROL VALVE ACTIVATED BY A LEVER (manual)
	CONTROL VALVE ACTIVATED BY A PEDAL (manual)
	CONTROL VALVE WITH SPRING RETURN (mechanical)
	CONTROL VALVE ACTIVATED BY AN ELECTRIC SOLENOID (electrical)
	CONTROL VALVE ACTIVATED BY PILOT PRESSURE (indirect control, pilot actuated by application of pressure)

MS-1892-2

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Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

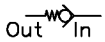
GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL DESCRIPTION

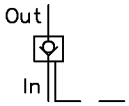
NON–RETURN VALVE, SHUTTLE VALVE: Valve which allows free flow in one direction only



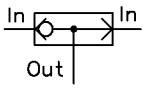
NON–RETURN VALVE (Check Valve) – Used as Replenishing Valve, Load Check Valve or Anticavitation Valve – Opens if the Inlet pressure is higher than the Outlet pressure. Often contains internal spring which has NO significant pressure value



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



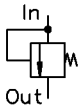
PILOT CONTROLLED NON–RETURN VALVE – It is possible to open the valve by pilot pressure



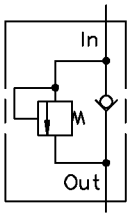
SHUTTLE VALVE – The Inlet port connected to the higher pressure is automatically connected to the Outlet port while the other Inlet port is closed

SYMBOL DESCRIPTION

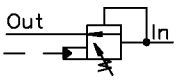
PRESSURE CONTROL VALVE: Valve ensuring the control of pressure



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



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

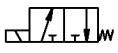


DUAL PRESSURE RELIEF VALVE – When the inlet pressure overcomes the opposing force of the spring, the valve opens permitting flow from the Outlet port. Pilot pressure provides a second pressure value.

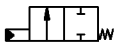
DIRECTIONAL CONTROL VALVE: Valve providing for the opening (fully or restricted) or the closing of one or more flow paths (represented by several squares)



TWO PORTS and CLOSED FLOW PATHS

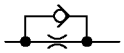


SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) – controlled by an electric solenoid (with return spring)

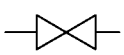


PILOT ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) – controlled by pressure (with return spring)

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



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



TOW VALVE – Normally in closed position

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Troubleshooting The Hydraulic Circuit

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

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Troubleshooting The Cylinder Circuit

PROBLEM	CAUSE	CORRECTION
Cylinder inoperable	Control console raised	Lower control console.
	Loose fittings or broken hoses	Repair or replace
	Low psi at joystick	Check, repair or replace pressure reducing valve
	Lever linkage incorrectly adjusted	Readjust
	Control console lockout switch	Readjust or replace
	Cylinder internal leakage excessive	Repair or replace
	Joystick manifold pressure reducing valve defective	Repair or replace
	Joystick internal leakage excessive	Repair or replace
Cylinder force insufficient	Lever linkage incorrectly adjusted	Readjust
	Main relief valve pressure to low	Readjust or replace
	Lever linkage incorrectly adjusted	Readjust
Cylinder speed too slow	Cylinder internal leakage excessive	Repair or replace
	Joystick manifold solenoid valve defective	Repair or replace
	Joystick manifold pressure reducing valve defective	Repair or replace
	Control valve internal leakage excessive	Repair or replace
	Low tie rod torque on 3 spool and 6 spool control valves	Tighten tie rods to correct torque
	Joystick internal leakage excessive	Repair or replace
	Low or dirty fluid	Add or replace the hydraulic fluid
	Main relief valve malfunctioning	Readjust or replace

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Troubleshooting The Swing (Upperstructure Slew) Circuit

PROBLEM	CAUSE	CORRECTION
Slew not operating	Control console raised Control console lock out switch incorrectly adjusted or defective	Lower control console. Readjust or replace
	Slew lock pin engaged	Disengage lock pin
	Joystick manifold pressure reducing valve defective	Repair or replace
	Slew motor gear defective	Repair or replace
	Joystick internal leakage excessive	Repair or replace
	Slew motor defective	Repair or replace
Slew force	Main relief valve set too low	Readjust or replace
	Slew motor relief valve pressure too low	Readjust or replace
Slew speed too low	Pump flow low	Check, repair or replace
	Blocked or restricted line to slew motor	Replace
	Joystick internal leakage excessive	Repair or replace
	Control valve internal leakage excessive	Repair or replace
	Slew motor internal leakage excessive	Repair or replace
Slew over run excessive	Control valve spool sticking	Repair or replace
	Joystick spool sticking	Repair or replace
	Slew motor relief valve set too low	Repair or replace
	Slew motor internal leakage excessive	Repair or replace
Slew motor seal leakage	Case drain line plugged	Replace

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Troubleshooting The Travel Circuit

PROBLEM	CAUSE	CORRECTION
Travel system inoperable	Lever linkage incorrectly adjusted	Readjust
	Track tension too tight	Readjust
	Defective pump	Check, repair or replace
	Travel motor counter balance spool sticking	Repair or replace
	Travel motor internal leakage excessive	Repair or replace
	Travel motor defective	Repair or replace
	Travel motor gears defective	Repair or replace
	Swivel joint defective	Repair or replace
	Main relief valve pressure too low	Readjust or replace
Travel power	Track tension too tight	Readjust
	Main relief valve pressure too low	Readjust or replace
	Swivel joint leaking	Repair or replace
	Travel motor counterbalance spool sticking	Repair or replace
	Lever linkage incorrectly adjusted	Readjust
Speed too slow	Swivel joint internal leakage excessive	Repair or replace
	Control valve internal leakage excessive	Repair or replace
	Low pump pressure	Check, repair or replace
	Travel motor internal leakage excessive	Repair or replace
Travel motor seal leakage	Return line filter plugged	Inspect, clean 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 unaligned	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
High / low shift inoperative (2-speed)	Control valve defective	Replace
	Low pressure to 2-speed valve	Readjust

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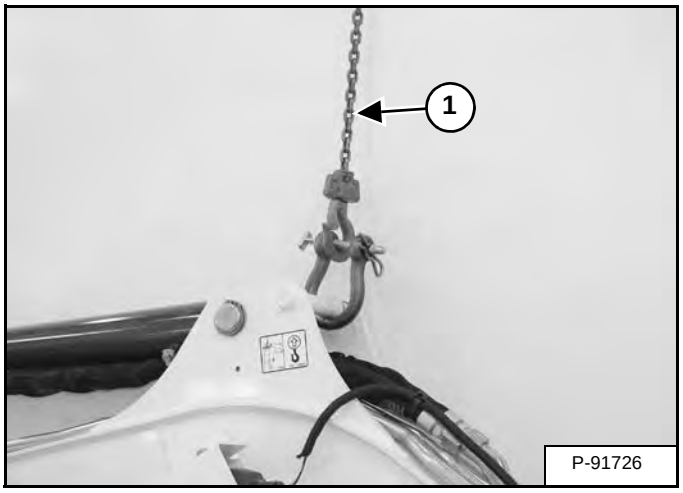
CYLINDER (BOOM) (S/N A93K13096 & ABOVE, AC2P13032 & ABOVE)

Testing

Lower the work group to the ground.

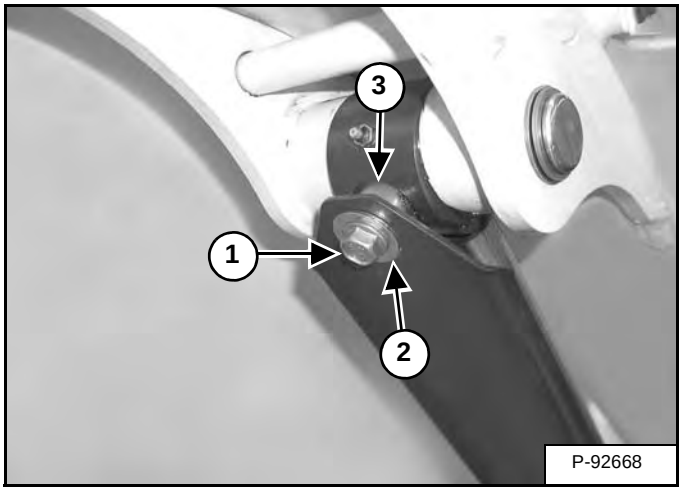
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-20-1



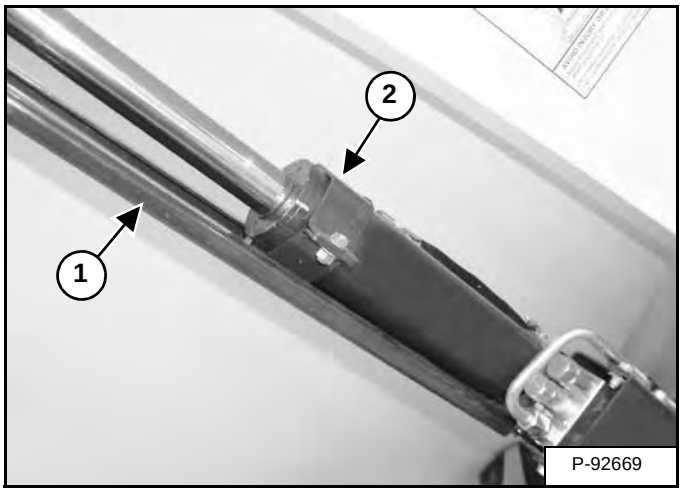
Support the boom with a chain hoist (Item 1) **[Figure 20-20-1]**.

Figure 20-20-2



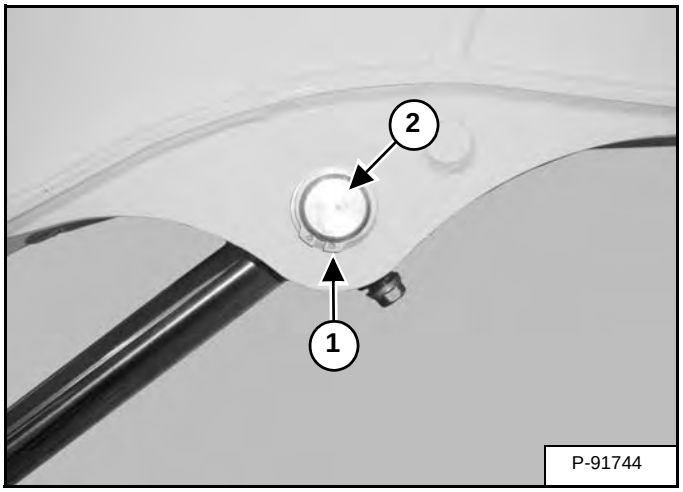
Remove the boom shield bolt (Item 1), washer (Item 2), spring washer and spacer (Item 3) **[Figure 20-20-2]**.

Figure 20-20-3



Slide the shield (Item 1) off of the bracket (Item 2) **[Figure 20-20-3]**.

Figure 20-20-4



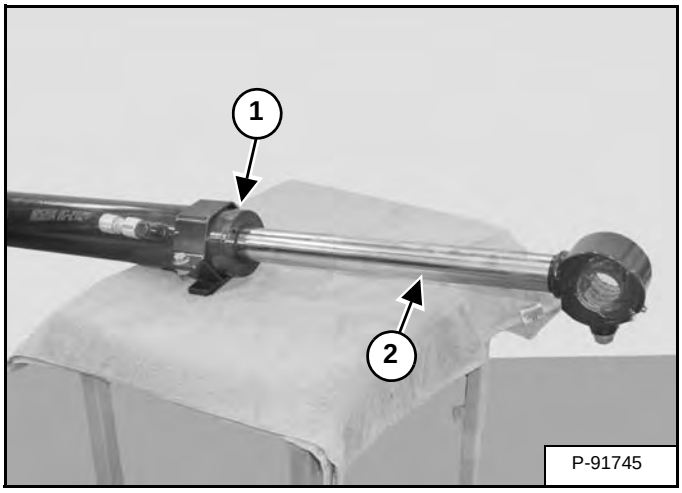
Remove the snap ring (Item 1) **[Figure 20-20-4]** and washer.

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

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Testing (Cont'd)

Figure 20-20-5



Lower the cylinder (Item 1) **[Figure 20-20-5]** until it rests on a portable work stand.

Start the engine and fully retract the cylinder rod (Item 2) **[Figure 20-20-5]**.

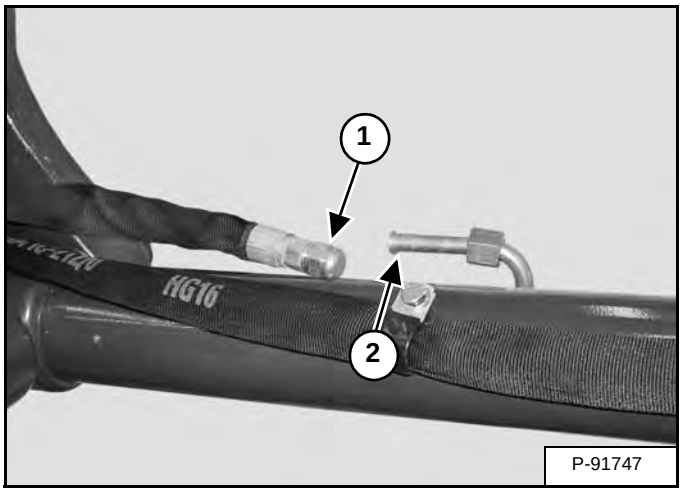
Stop the engine. Relieve hydraulic pressure.

⚠ WARNING

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

W-2145-0290

Figure 20-20-6



Remove the hose from the base end of the cylinder. Cap the hose (Item 1) **[Figure 20-20-6]**.

Start the engine and retract the boom cylinder.

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

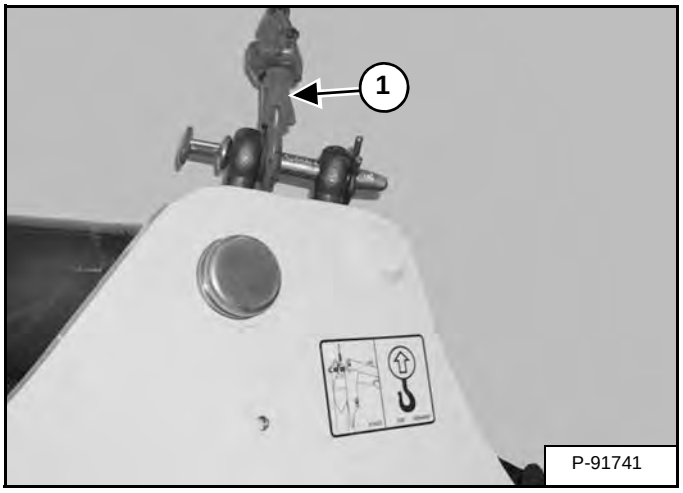
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Removal And Installation

Lower the work group to the ground.

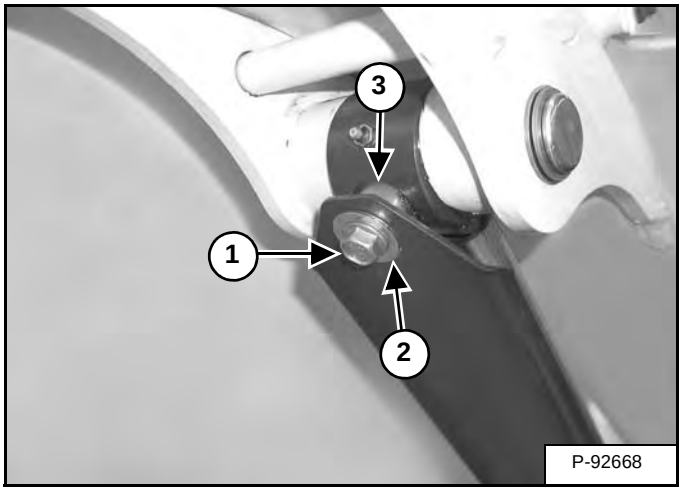
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-20-7



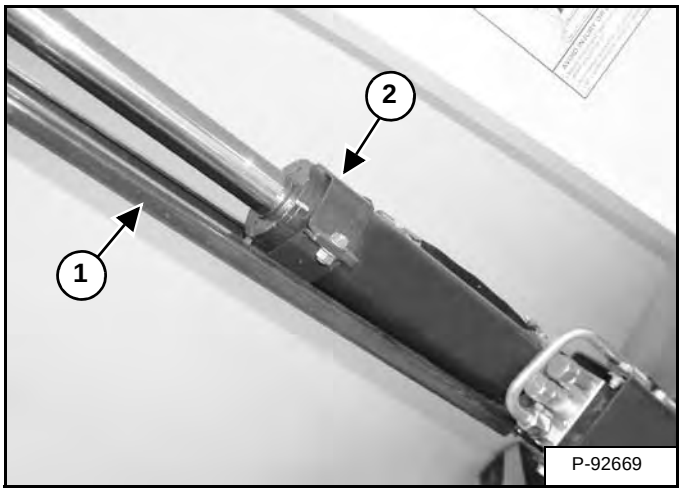
Support the boom with a chain hoist (Item 1) **[Figure 20-20-7]**.

Figure 20-20-8



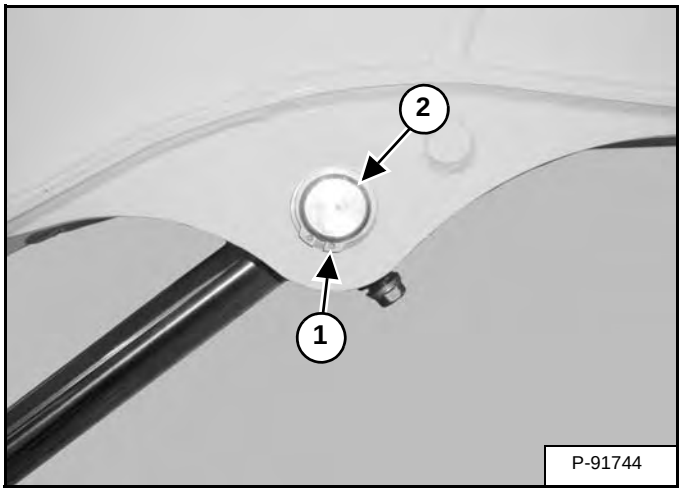
Remove the boom shield bolt (Item 1), washer (Item 2), spring washer and spacer (Item 3) **[Figure 20-20-8]**.

Figure 20-20-9



Slide the shield (Item 1) off of the bracket (Item 2) **[Figure 20-20-9]**.

Figure 20-20-10



Remove the snap ring (Item 1) **[Figure 20-20-10]** and washer.

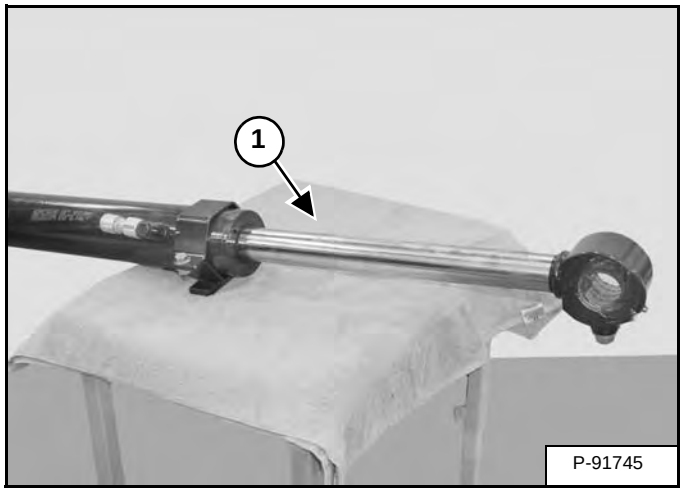
Remove the rod end pin (Item 2) **[Figure 20-20-10]**.

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CYLINDER (BOOM) (S/N A93K13096 & ABOVE, AC2P13032 & ABOVE) (CONT'D)

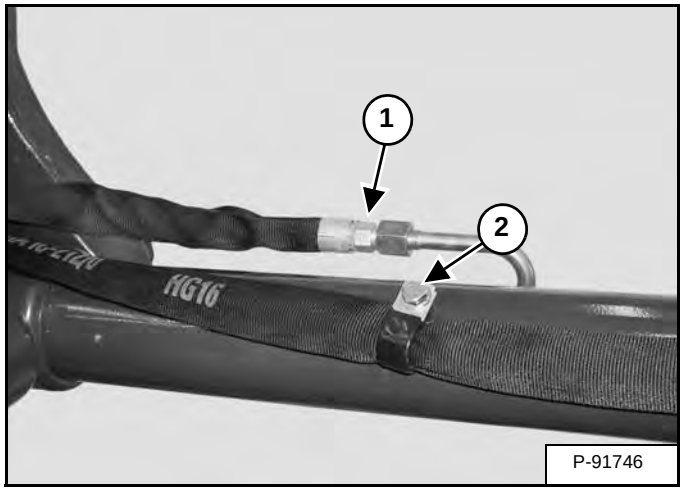
Removal And Installation (Cont'd)

Figure 20-20-11



Lower the cylinder (Item 1) **[Figure 20-20-11]** until it rests on a portable work stand.

Figure 20-20-12



Mark and remove the hose (Item 1) **[Figure 20-20-12]**.

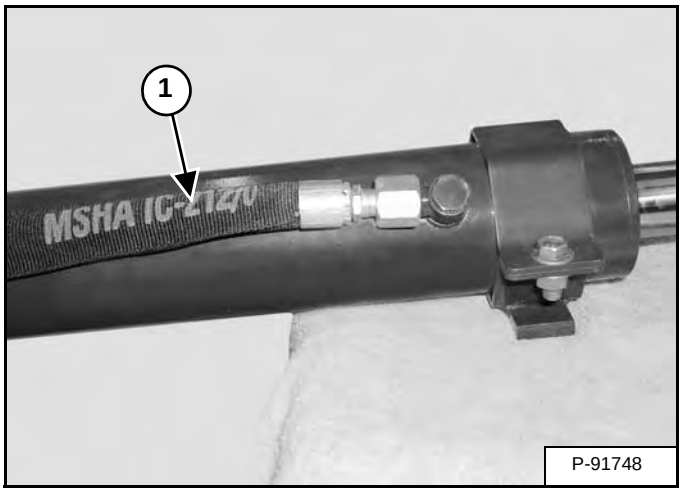
Remove the hose clamp bolt (Item 2) **[Figure 20-20-12]**.

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.

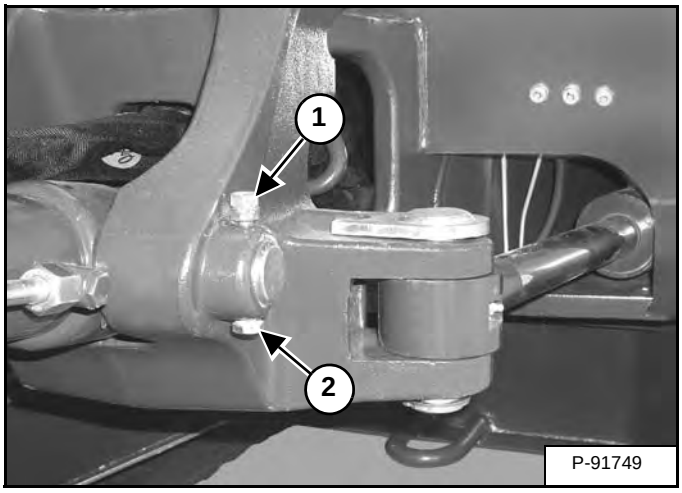
I-2003-0888

Figure 20-20-13



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

Figure 20-20-14

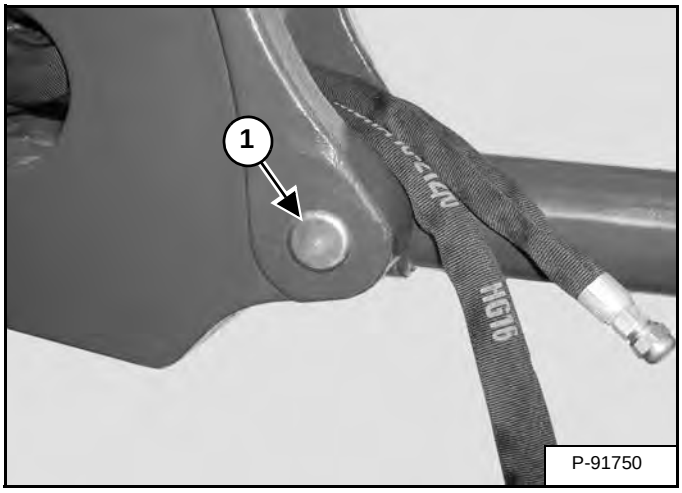


Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-20-14]**.

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Removal And Installation (Cont'd)

Figure 20-20-15



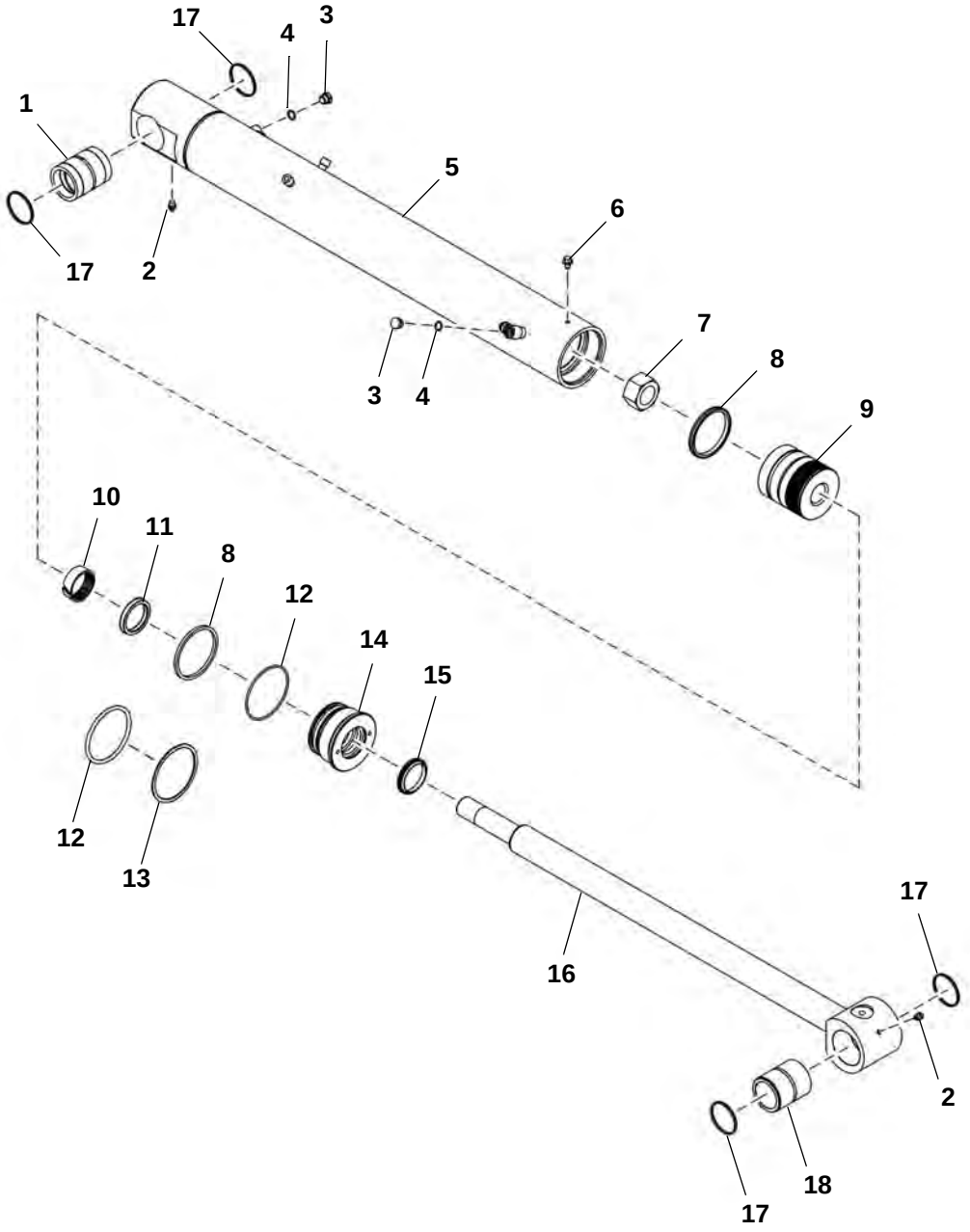
Remove the pin (Item 1) **[Figure 20-20-15]** from the base end of the cylinder.

Remove the cylinder.

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Parts Identification

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



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Disassembly

Clean the outside of the cylinder before disassembly.

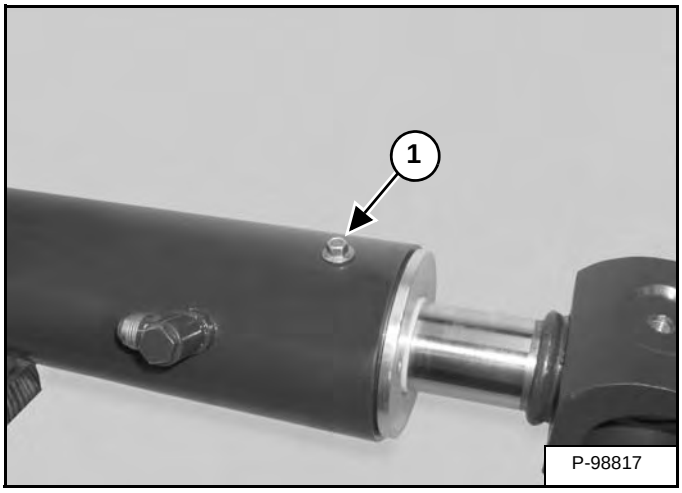
Use the following tools to disassemble the cylinder:

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.

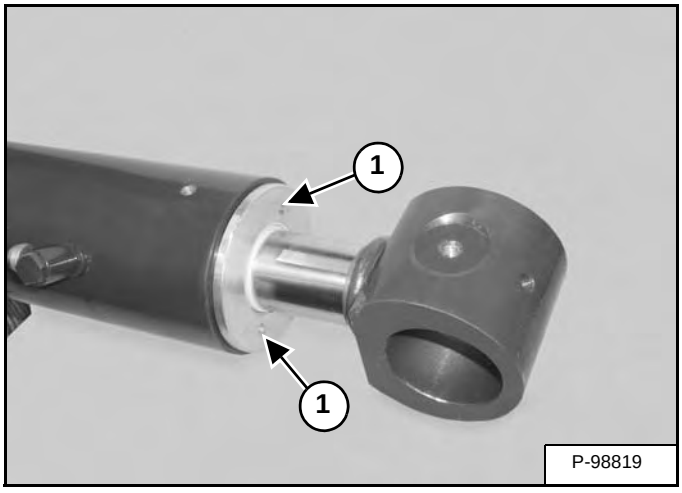
Put the base end of the cylinder in a vise.

Figure 20-20-16



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

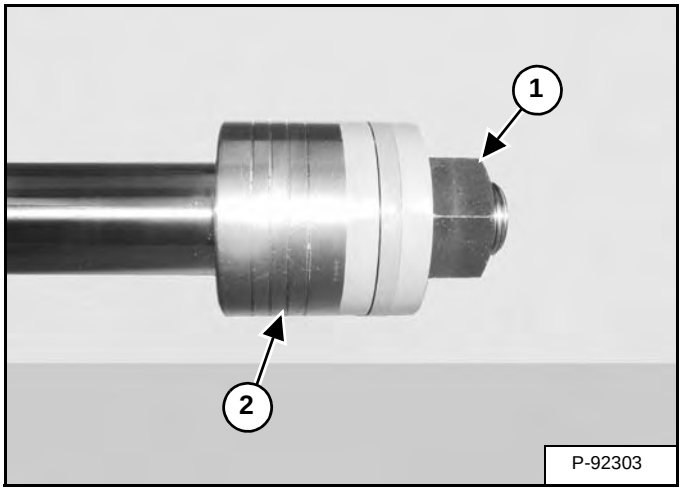
Figure 20-20-17



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

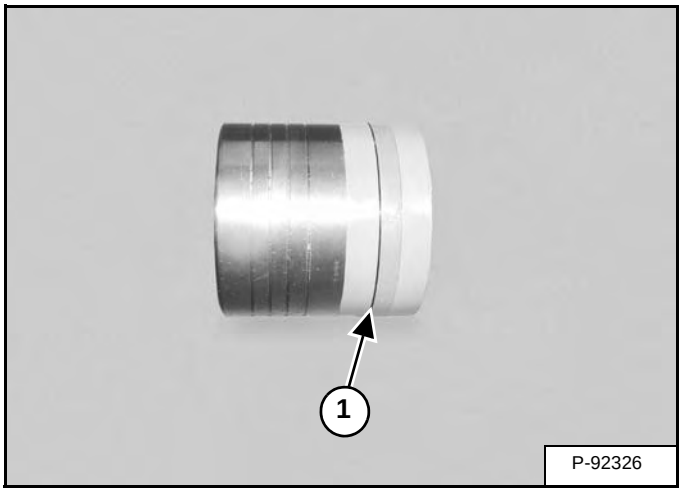
Remove the head and the rod assembly from the cylinder. Put the rod end in a vise.

Figure 20-20-18



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

Figure 20-20-19



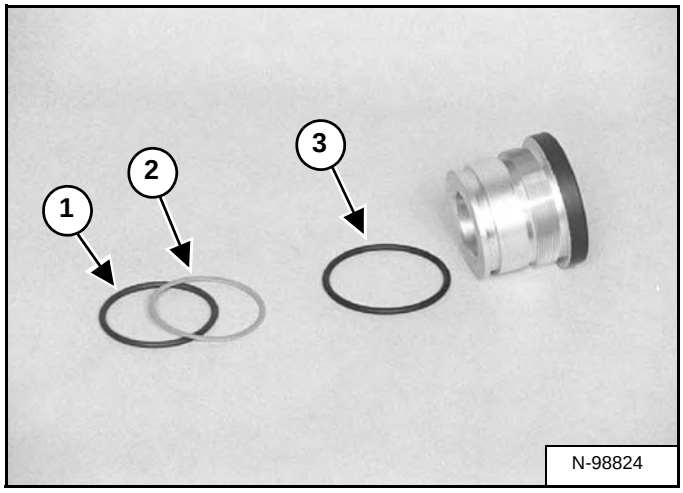
Remove the seal (Item 1) **[Figure 20-20-19]** from the piston.

NOTE: The seal is a two piece seal.

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Disassembly (Cont'd)

Figure 20-20-20

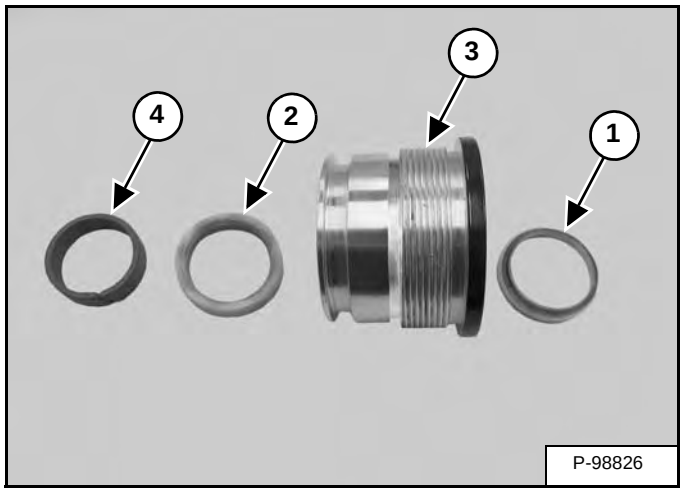


Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-20-20]**.

NOTE: The O-ring (Item 1) and back-up ring (Item 2) [Figure 20-20-20] are no longer available parts. The seal kit will contain a one piece seal that is used in place of the O-ring and back-up ring.

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

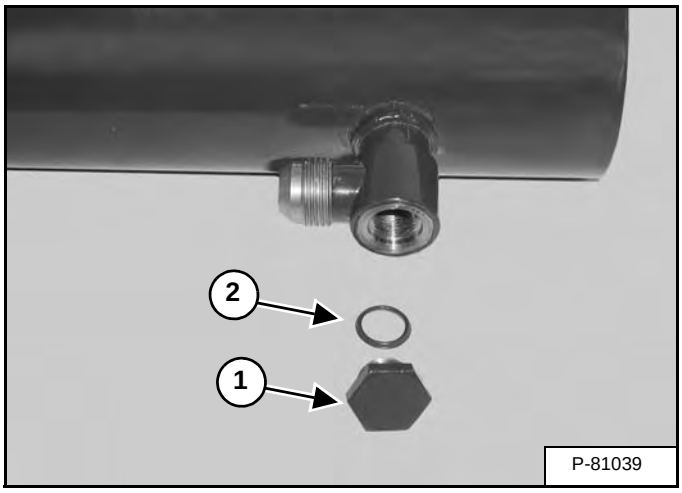
Figure 20-20-21



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

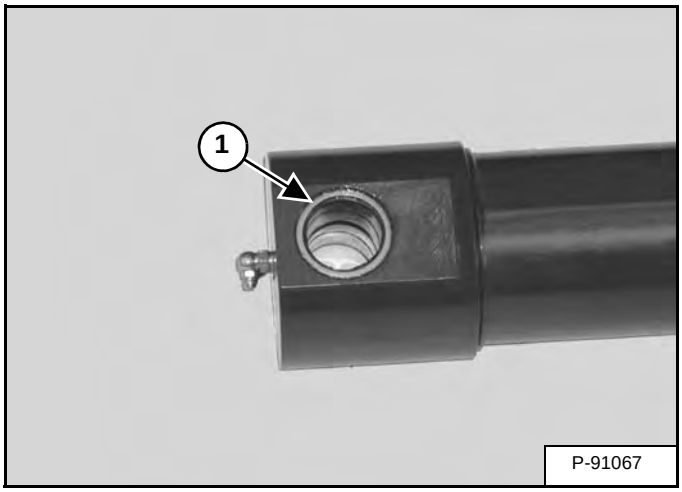
Remove the wear ring (Item 4) **[Figure 20-20-21]**.

Figure 20-20-22



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

Figure 20-20-23

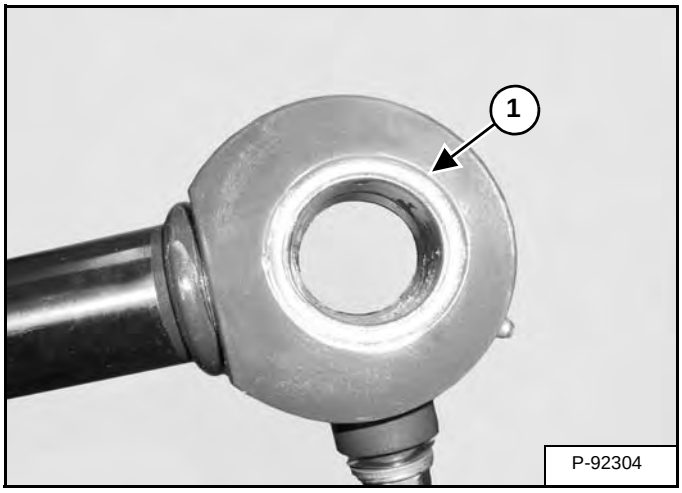


Remove the seal (Item 1) **[Figure 20-20-23]** from both sides and bushing from the cylinder base end.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

Figure 20-20-24



Remove the seal (Item 1) **[Figure 20-20-24]** from both sides and bushing from the cylinder rod end.

Dealer Copy -- Not for Resale

Assembly

Clean all parts in solvent and dry with compressed air.

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

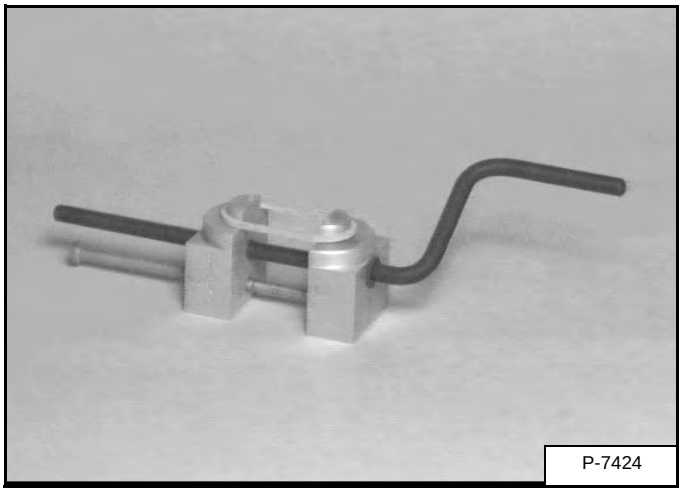
Always install new O-rings and seals.

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

Use the following tools to assemble the cylinder:

MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
MEL1396-2 - Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

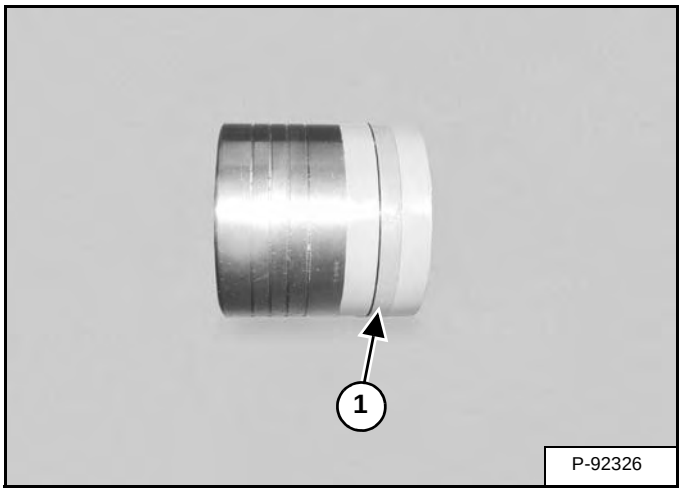
Figure 20-20-25



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

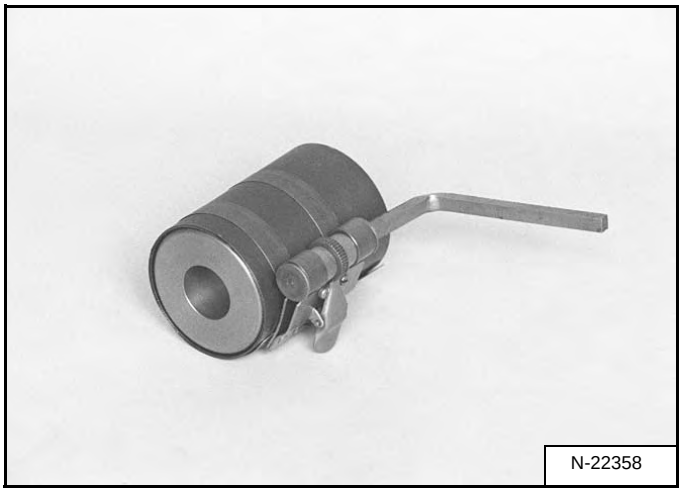
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-20-26



Install the seal (Item 1) **[Figure 20-20-26]** on the piston.

Figure 20-20-27

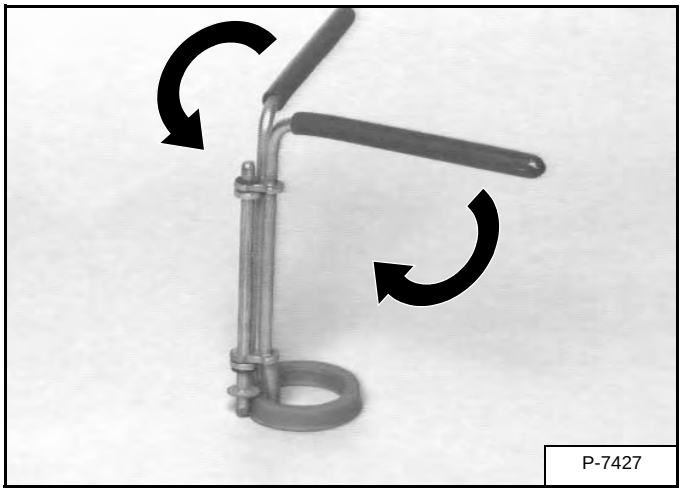


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for approximately three minutes **[Figure 20-20-27]**.

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Assembly (Cont'd)

Figure 20-20-28

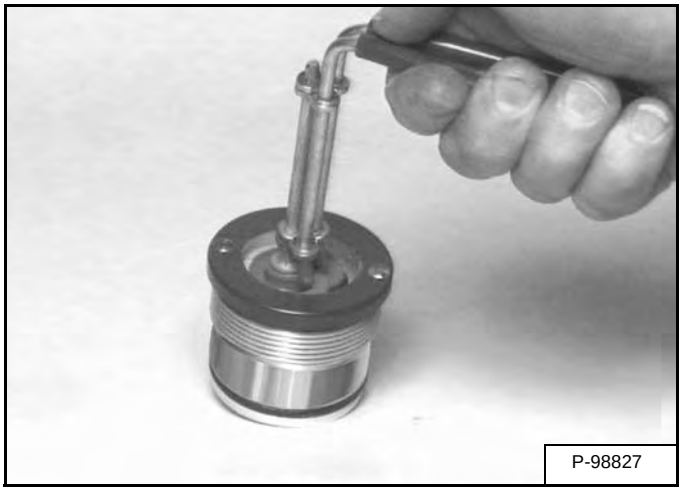


Install the rod seal on the rod seal tool **[Figure 20-20-28]**.

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

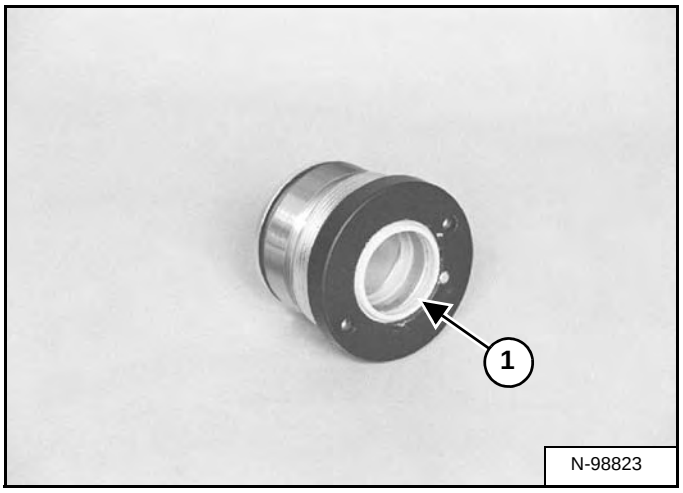
Rotate the handles to collapse the rod seal **[Figure 20-20-28]**.

Figure 20-20-29



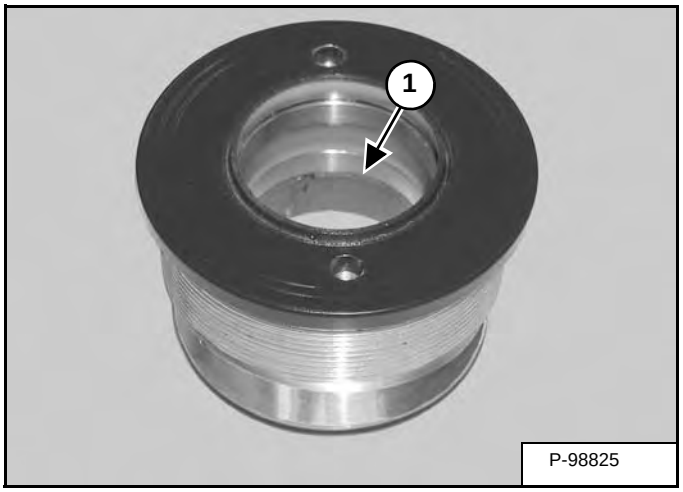
Install the rod seal in the head **[Figure 20-20-29]**.

Figure 20-20-30



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

Figure 20-20-31

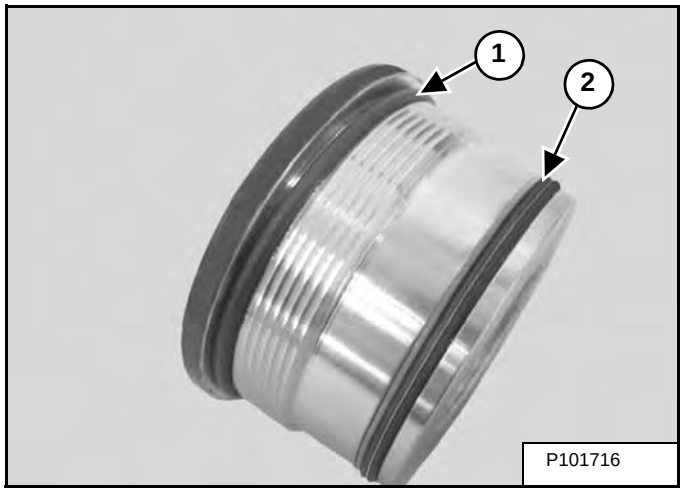


Install the wear ring (Item 1) **[Figure 20-20-31]**.

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Assembly (Cont'd)

Figure 20-20-32

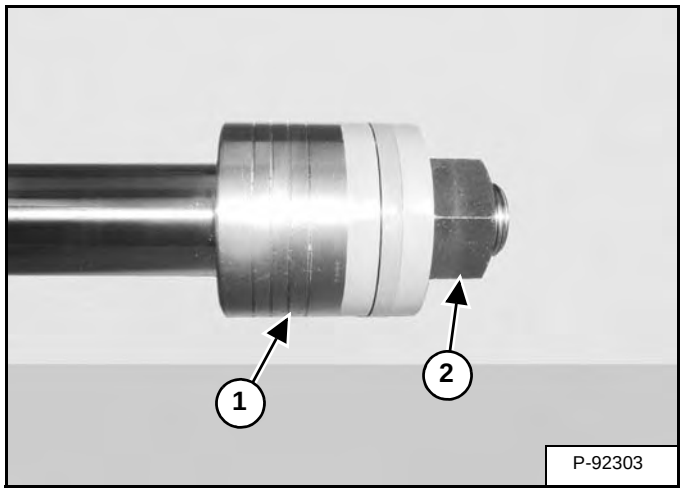


Install the O-ring (Item 1) **[Figure 20-20-32]**.

Install the seal (Item 2) **[Figure 20-20-32]**.

Install the head onto the rod.

Figure 20-20-33



Install the piston (Item 1) and nut (Item 2) **[Figure 20-20-33]**.

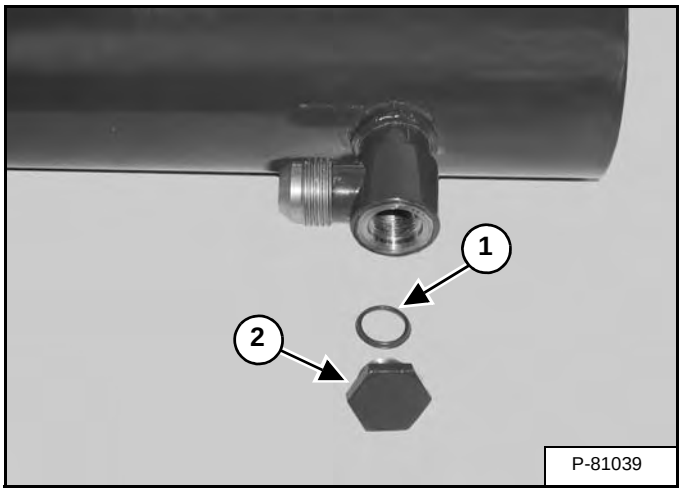
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

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

Tighten the nut to 1491 N•m (1100 ft-lb) torque.

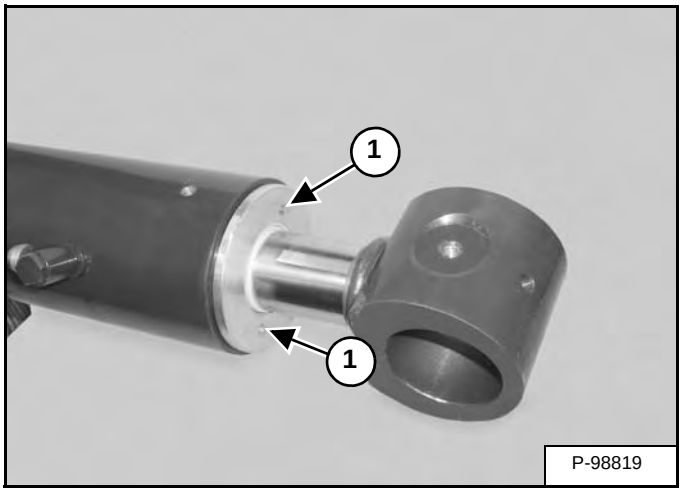
Figure 20-20-34



Install O-ring (Item 1) and plug (Item 2) **[Figure 20-20-34]**.Tighten the plug to 50 N•m (37 ft-lb) torque.

Put the base end of the cylinder in a vise.

Figure 20-20-35

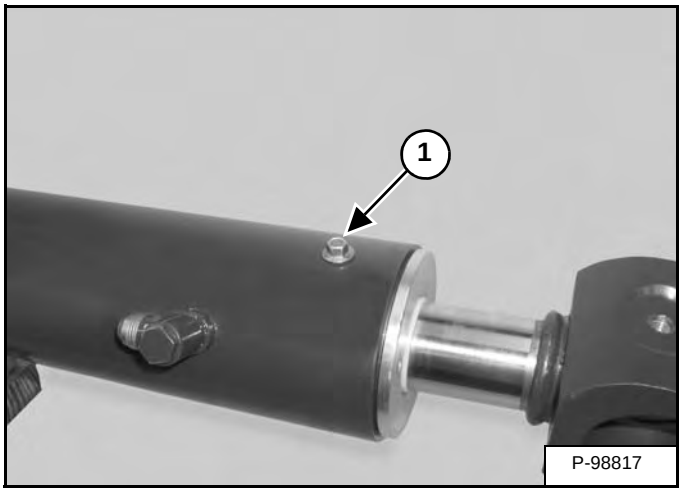


Insert the adjustable gland nut wrench into the holes (Item 1) **[Figure 20-20-35]** to tighten the head. Tighten the head until it is flush with the housing.

Dealer Copy -- Not for Resale

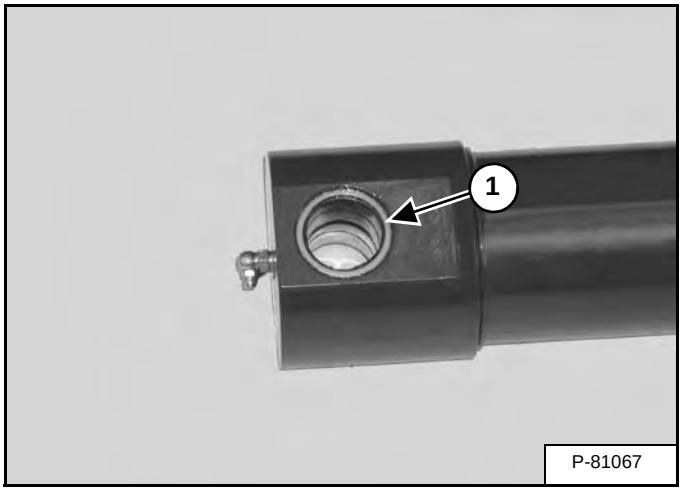
Assembly (Cont'd)

Figure 20-20-36



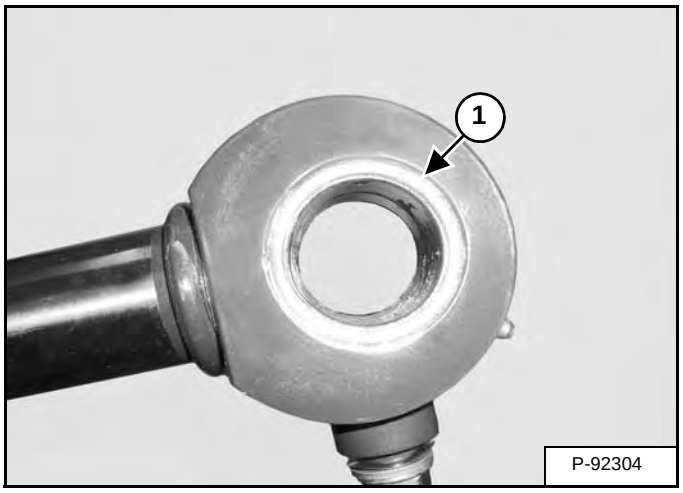
Install the bolt (Item 1) **[Figure 20-20-36]**. Tighten the bolt to 22 - 28 N•m (16 - 20 ft-lb).

Figure 20-20-37



Install the bushing (Item 1) **[Figure 20-20-37]** in the cylinder base end.

Figure 20-20-38



Install the bushing and seal (Item 1) **[Figure 20-20-38]** on both sides of the cylinder rod end.

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Dealer Copy -- Not for Resale

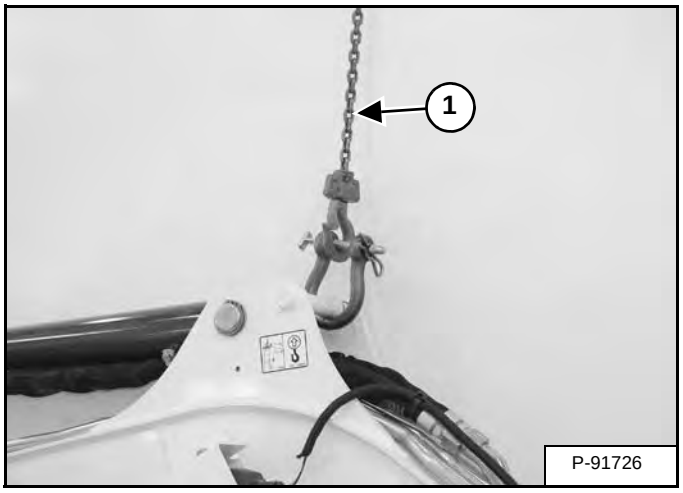
CYLINDER (BOOM) (S/N A93K13095 & BELOW, AC2P13031 & BELOW)

Testing

Lower the work group to the ground.

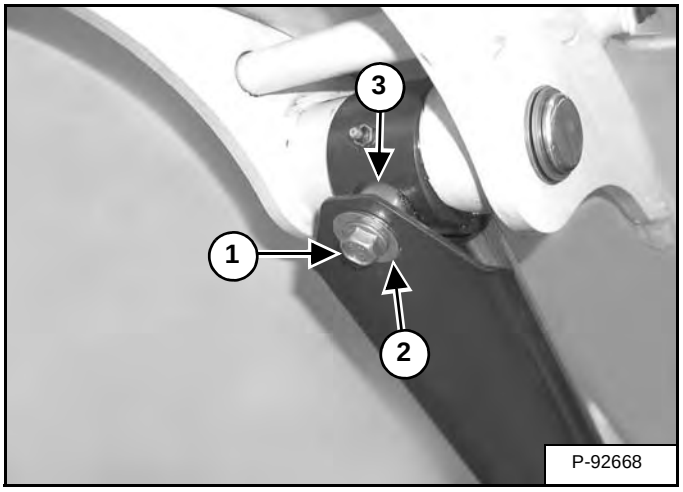
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-21-1



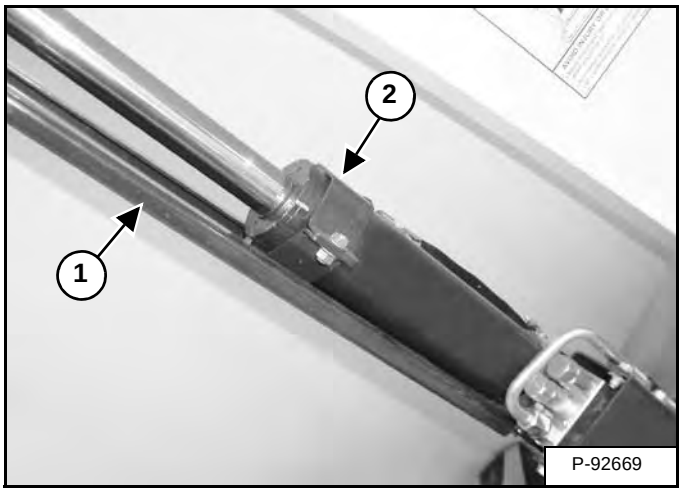
Support the boom with a chain hoist (Item 1) **[Figure 20-21-1]**.

Figure 20-21-2



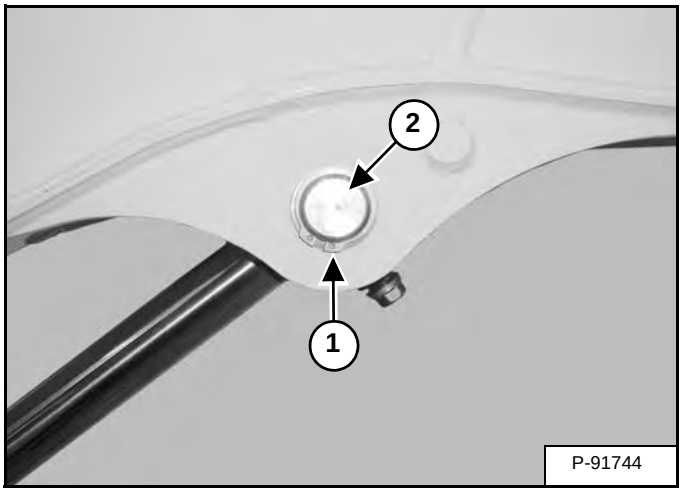
Remove the boom shield bolt (Item 1), washer (Item 2), spring washer and spacer (Item 3) **[Figure 20-21-2]**.

Figure 20-21-3



Slide the shield (Item 1) off of the bracket (Item 2) **[Figure 20-21-3]**.

Figure 20-21-4



Remove the snap ring (Item 1) **[Figure 20-21-4]** and washer.

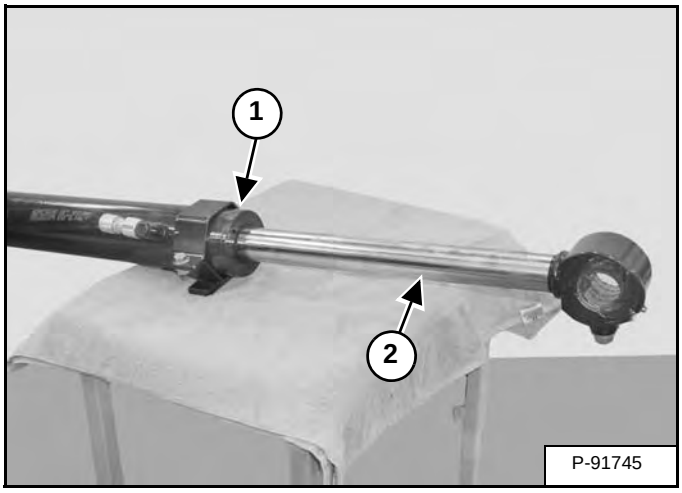
Remove the rod end pin (Item 2) **[Figure 20-21-4]**.

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CYLINDER (BOOM) (S/N A93K13095 & BELOW, AC2P13031 & BELOW) (CONT'D)

Testing (Cont'd)

Figure 20-21-5



Lower the cylinder (Item 1) **[Figure 20-21-5]** until it rests on a portable work stand.

Start the engine and fully retract the cylinder rod (Item 2) **[Figure 20-21-5]**.

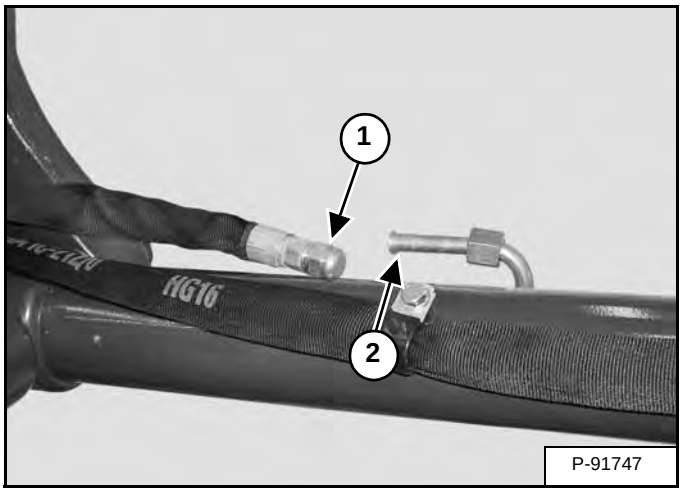
Stop the engine. Relieve hydraulic pressure.

⚠ WARNING

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

W-2145-0290

Figure 20-21-6



Remove the hose from the base end of the cylinder. Cap the hose (Item 1) **[Figure 20-21-6]**.

Start the engine and retract the boom cylinder.

If there is any oil leakage from the base end fitting (Item 2) **[Figure 20-21-6]**, remove the cylinder for repair or replacement.

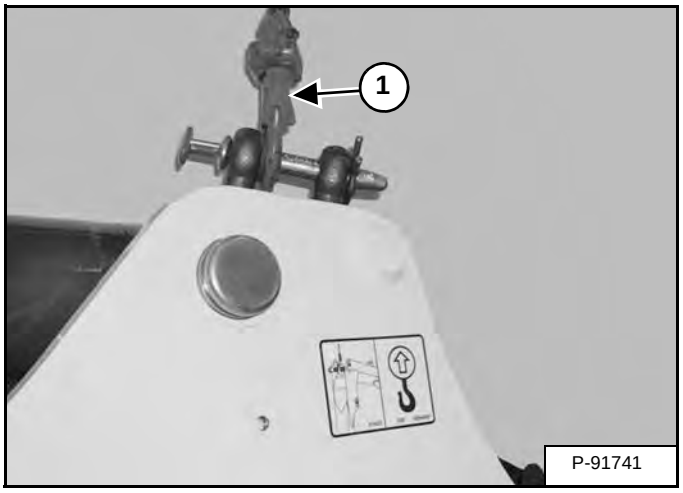
Dealer Copy -- Not for Resale

Removal And Installation

Lower the work group to the ground.

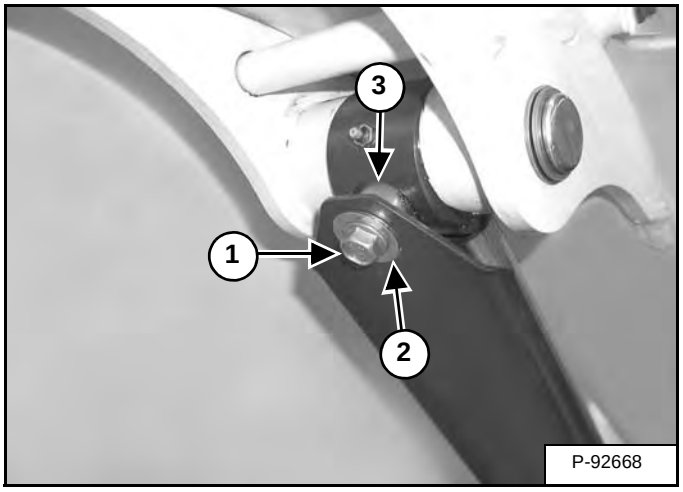
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-21-7



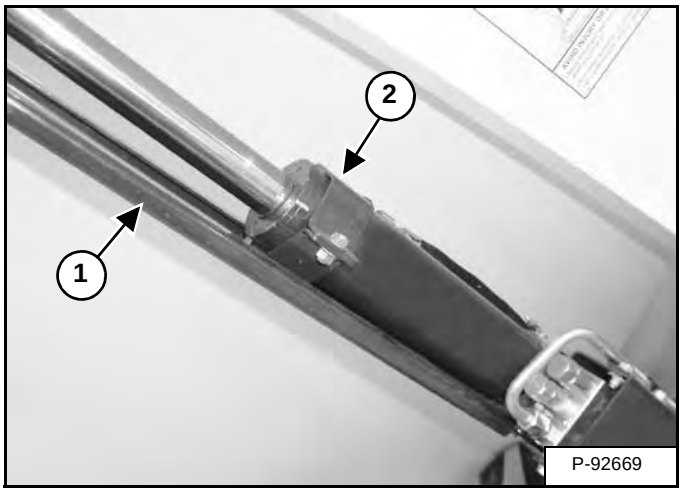
Support the boom with a chain hoist (Item 1) **[Figure 20-21-7]**.

Figure 20-21-8



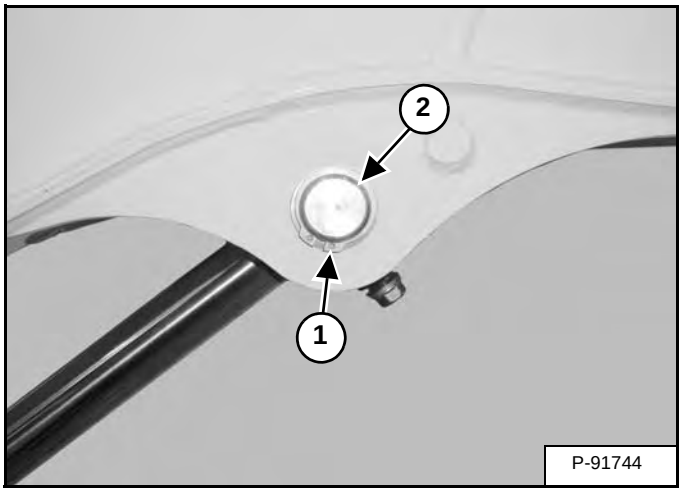
Remove the boom shield bolt (Item 1), washer (Item 2), spring washer and spacer (Item 3) **[Figure 20-21-8]**.

Figure 20-21-9



Slide the shield (Item 1) off of the bracket (Item 2) **[Figure 20-21-9]**.

Figure 20-21-10



Remove the snap ring (Item 1) **[Figure 20-21-10]** and washer.

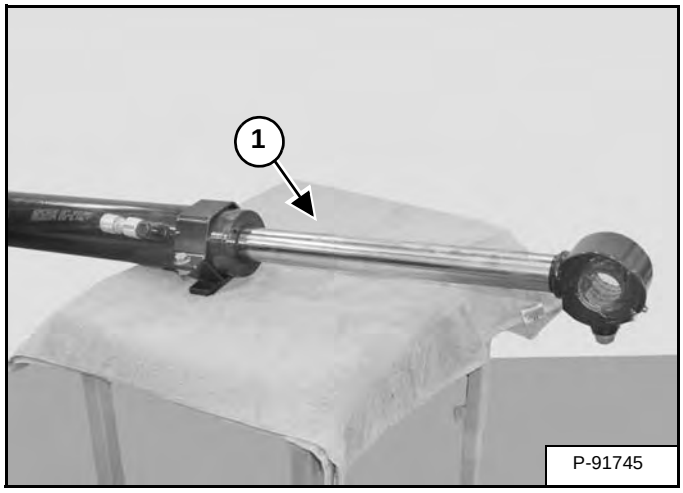
Remove the rod end pin (Item 2) **[Figure 20-21-10]**.

Dealer Copy -- Not for Resale

CYLINDER (BOOM) (S/N A93K13095 & BELOW, AC2P13031 & BELOW) (CONT'D)

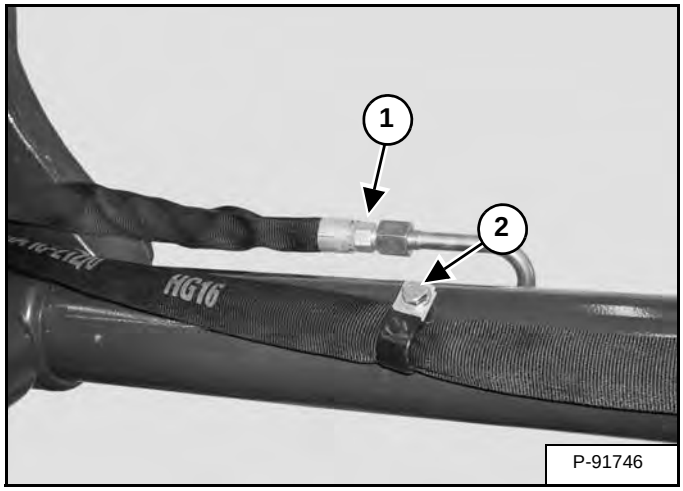
Removal And Installation (Cont'd)

Figure 20-21-11



Lower the cylinder (Item 1) **[Figure 20-21-11]** until it rests on a portable work stand.

Figure 20-21-12



Mark and remove the hose (Item 1) **[Figure 20-21-12]**.

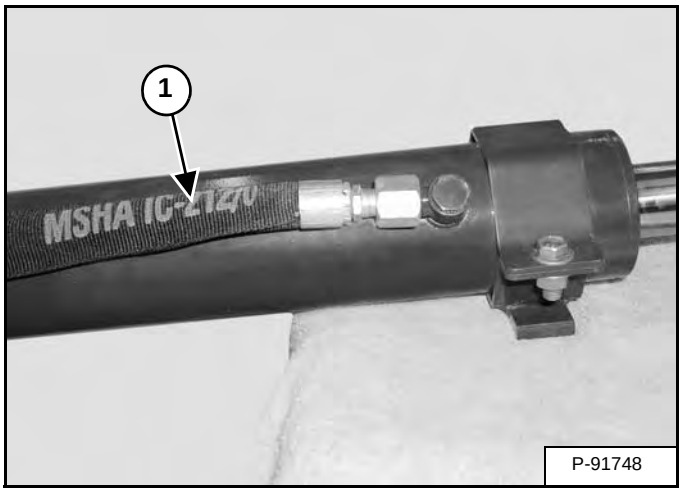
Remove the hose clamp bolt (Item 2) **[Figure 20-21-12]**.

IMPORTANT

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

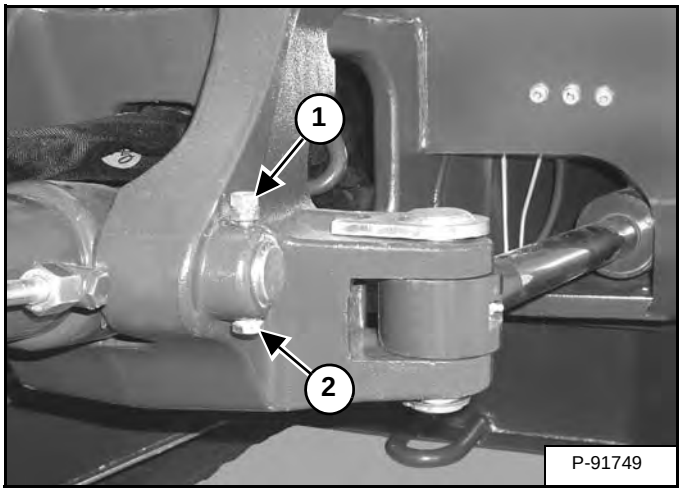
I-2003-0888

Figure 20-21-13



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

Figure 20-21-14

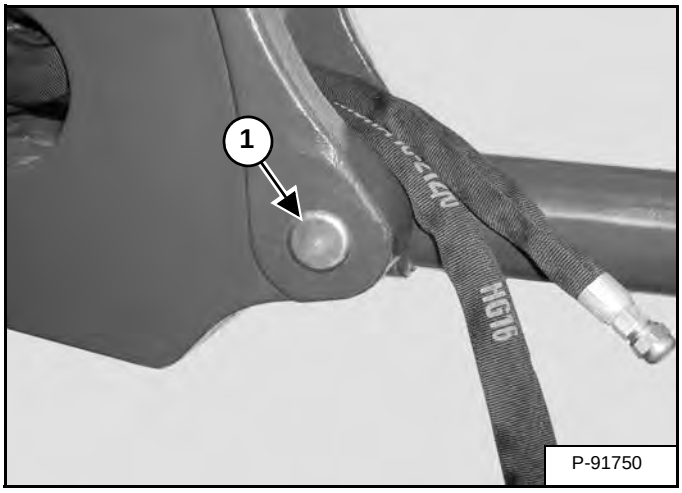


Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-21-14]**.

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Removal And Installation (Cont'd)

Figure 20-21-15



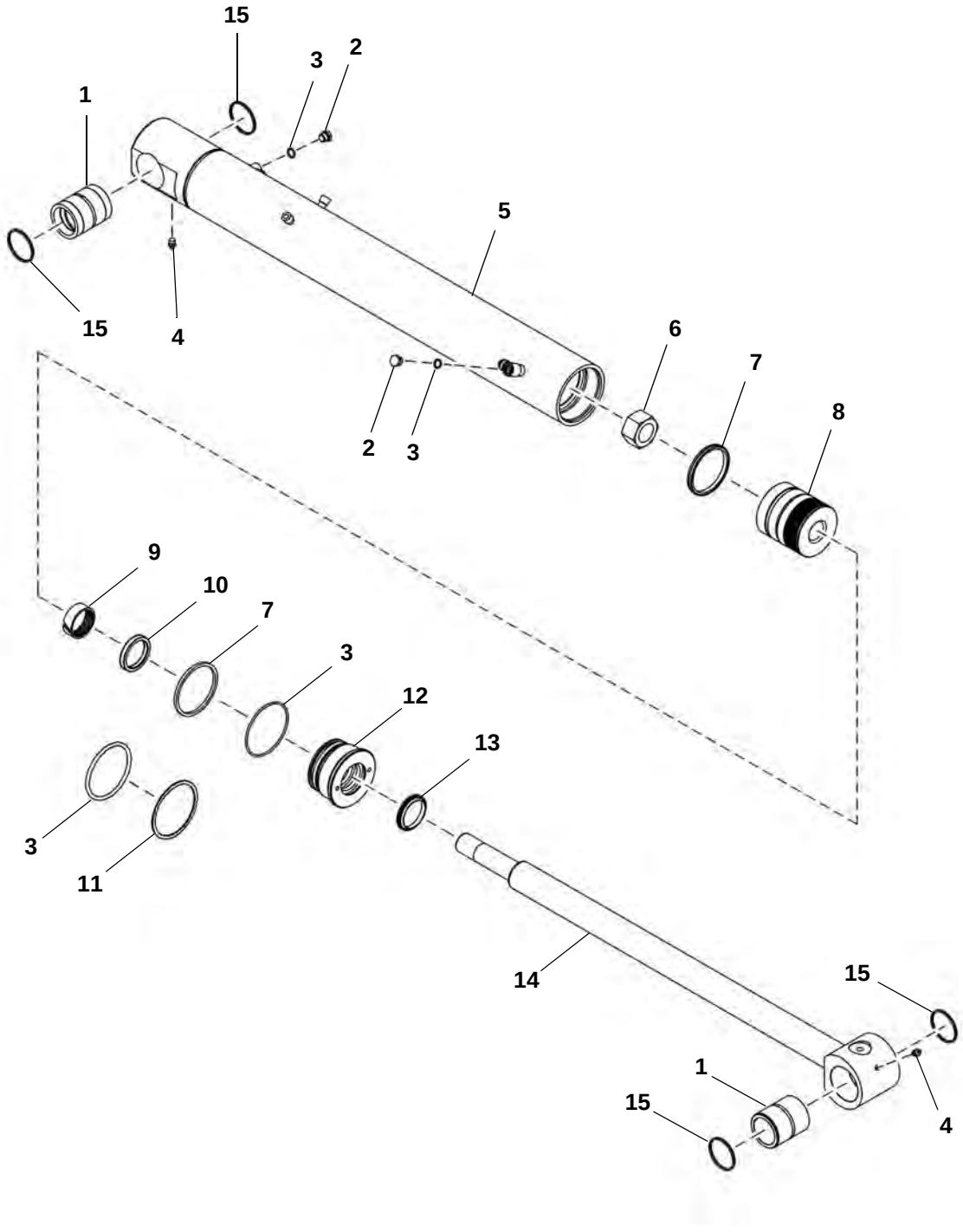
Remove the pin (Item 1) **[Figure 20-21-15]** from the base end of the cylinder.

Remove the cylinder.

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Parts Identification

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



NA5552S

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Disassembly

Clean the outside of the cylinder before disassembly.

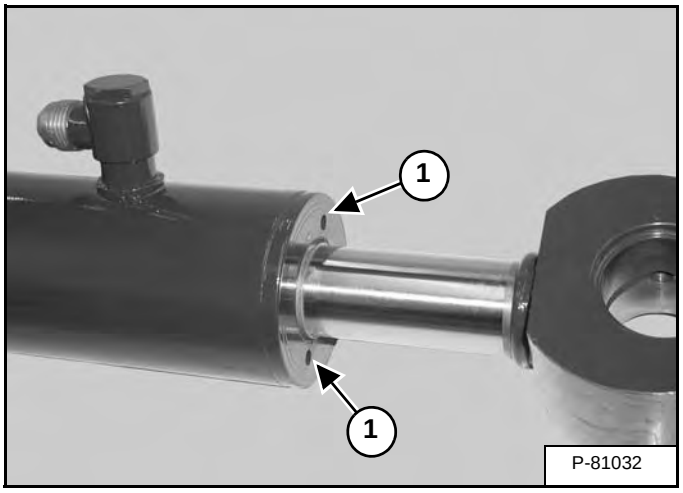
Use the following tools to disassemble the cylinder:

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.

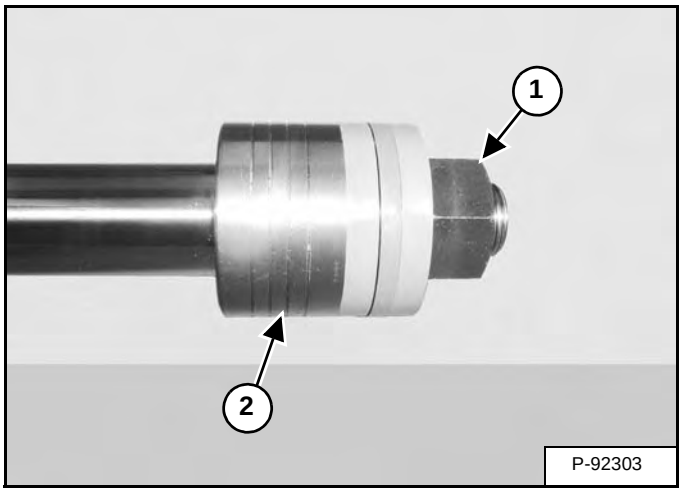
Figure 20-21-16



Insert the adjustable gland nut wrench into the holes (Item 1) **[Figure 20-21-16]** to loosen the head.

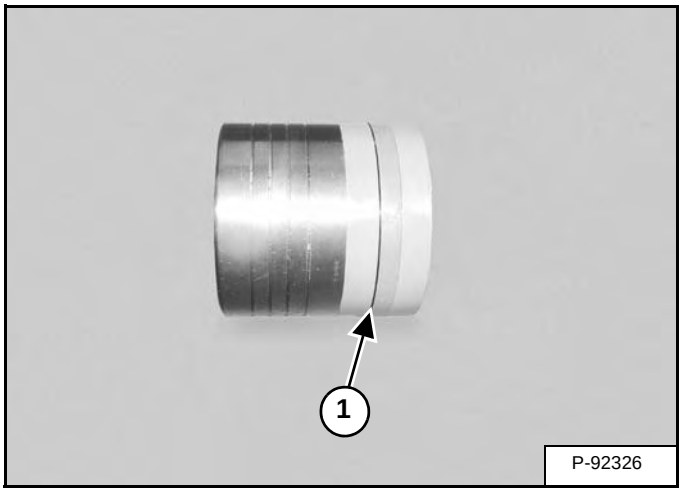
Remove the head and the rod assembly from the cylinder. Put the rod end in a vise.

Figure 20-21-17



Remove the nut (Item 1), piston (Item 2) **[Figure 20-21-17]** and head.

Figure 20-21-18



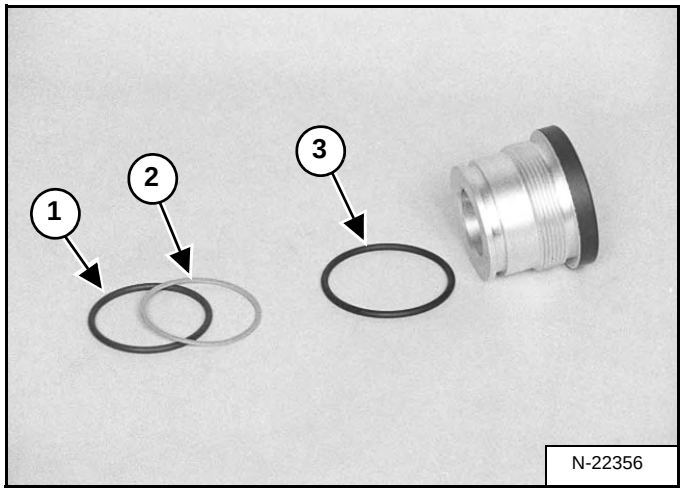
Remove the seal (Item 1) **[Figure 20-21-18]** from the piston.

NOTE: The seal is a two piece seal.

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Disassembly (Cont'd)

Figure 20-21-19

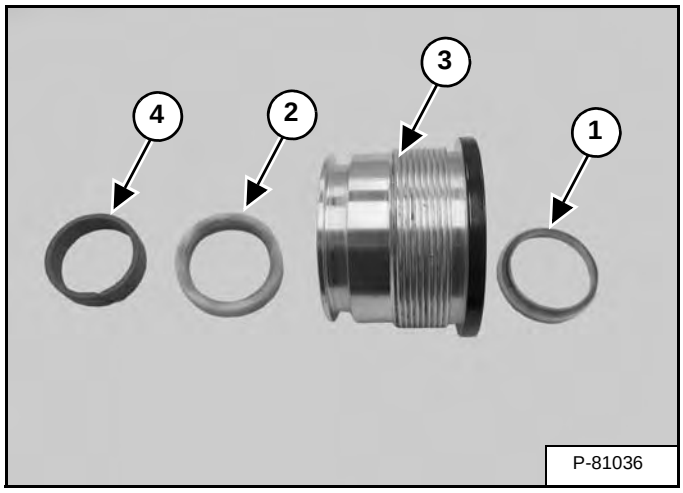


Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-21-19]**.

NOTE: The O-ring (Item 1) and back-up ring (Item 2) [Figure 20-21-19] are no longer available parts. The seal kit will contain a one piece seal that is used in place of the O-ring and back-up ring.

Remove the O-ring (Item 3) **[Figure 20-21-19]**.

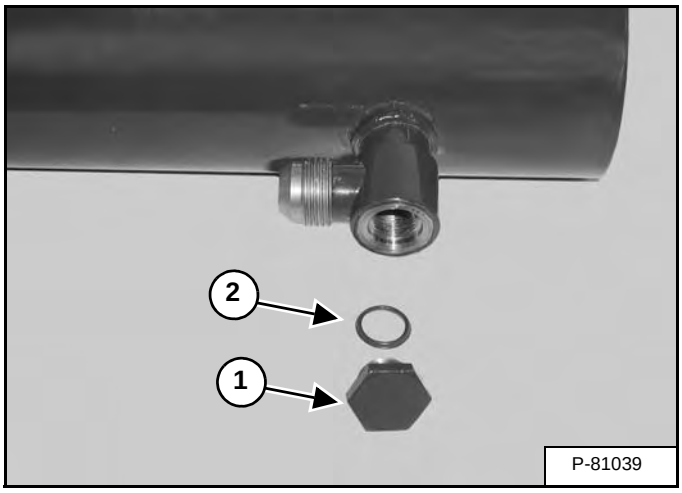
Figure 20-21-20



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

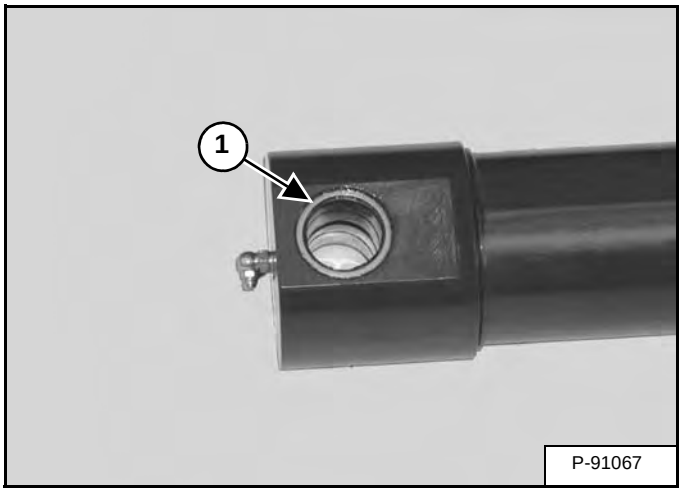
Remove the wear ring (Item 4) **[Figure 20-21-20]**.

Figure 20-21-21



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

Figure 20-21-22

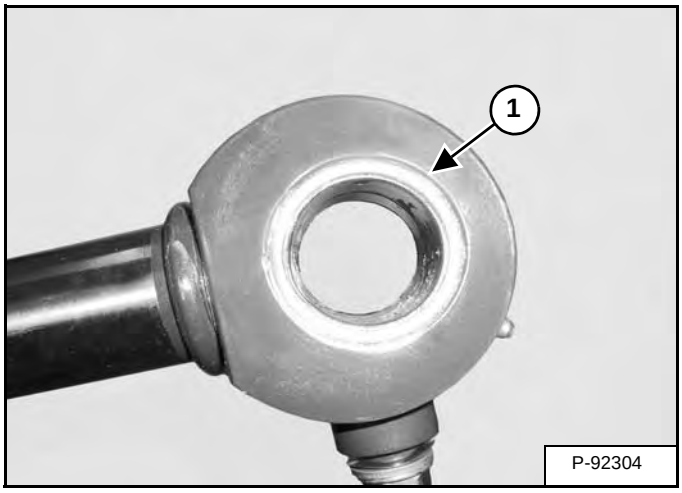


Remove the seal (Item 1) **[Figure 20-21-22]** from both sides and bushing from the cylinder base end.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

Figure 20-21-23



Remove the seal (Item 1) **[Figure 20-21-23]** from both sides and bushing from the cylinder rod end.

Dealer Copy -- Not for Resale

Assembly

Clean all parts in solvent and dry with compressed air.

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

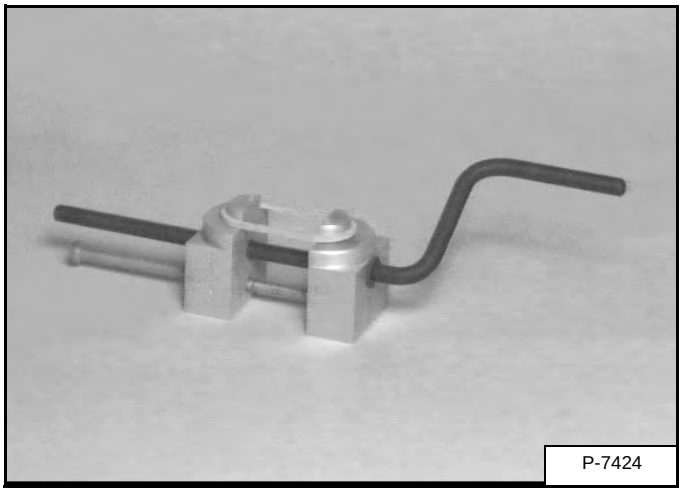
Always install new O-rings and seals.

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

Use the following tools to assemble the cylinder:

MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
MEL1396-2 - Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

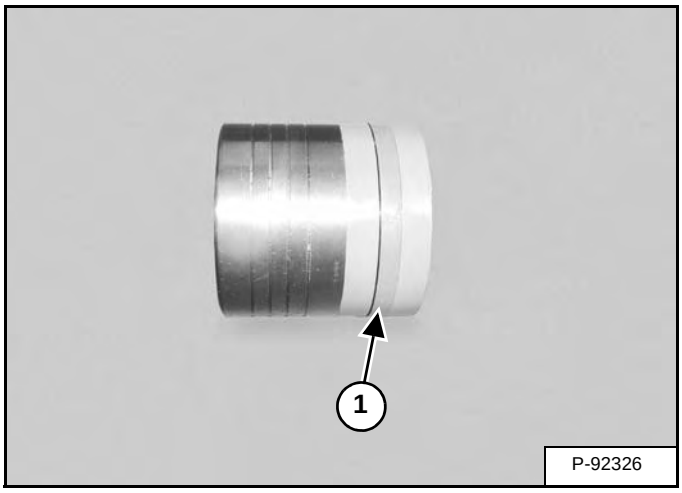
Figure 20-21-24



Install the new seal on the tool and slowly stretch it until it fits the piston **[Figure 20-21-24]**.

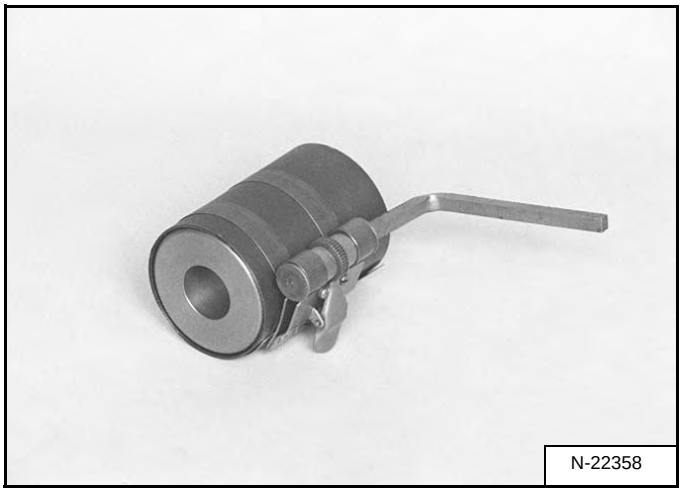
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-21-25



Install the seal (Item 1) **[Figure 20-21-25]** on the piston.

Figure 20-21-26

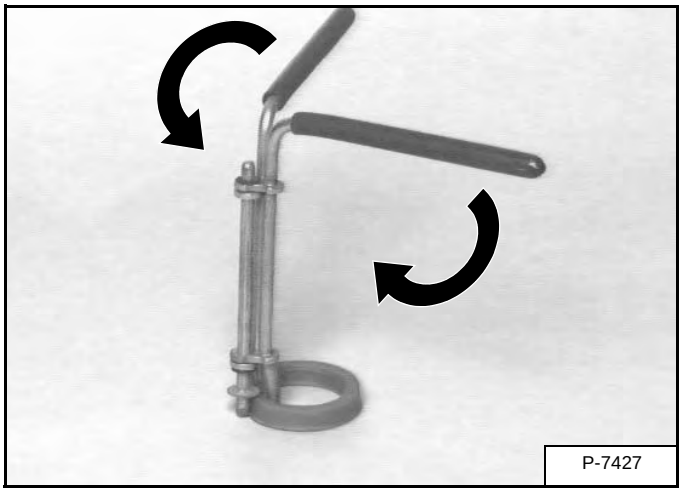


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for approximately three minutes **[Figure 20-21-26]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-21-27

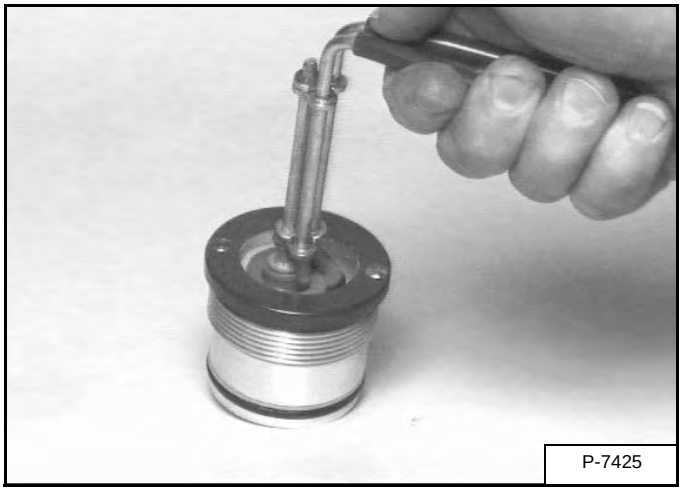


Install the rod seal on the rod seal tool **[Figure 20-21-27]**.

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

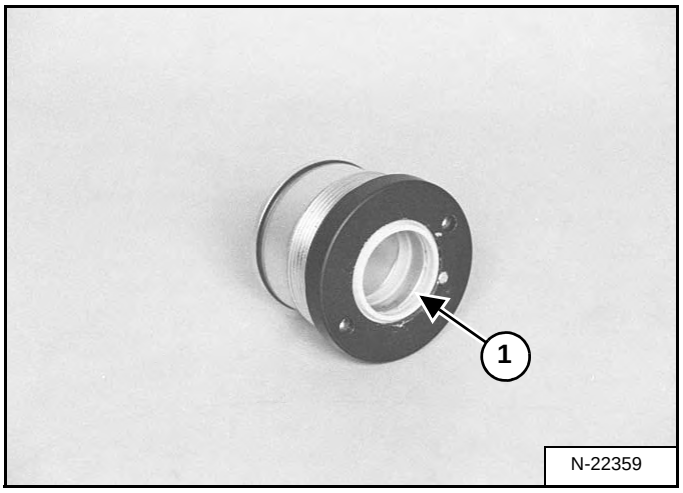
Rotate the handles to collapse the rod seal **[Figure 20-21-27]**.

Figure 20-21-28



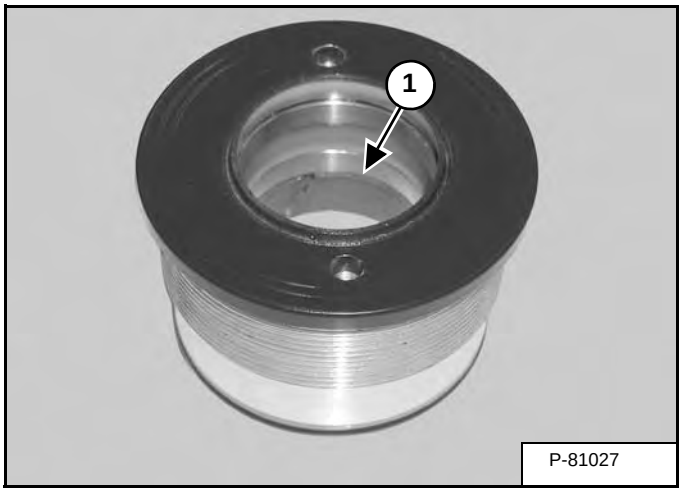
Install the rod seal in the head **[Figure 20-21-28]**.

Figure 20-21-29



Install the wiper seal with the wiper (Item 1) **[Figure 20-21-29]** toward the outside of the head.

Figure 20-21-30

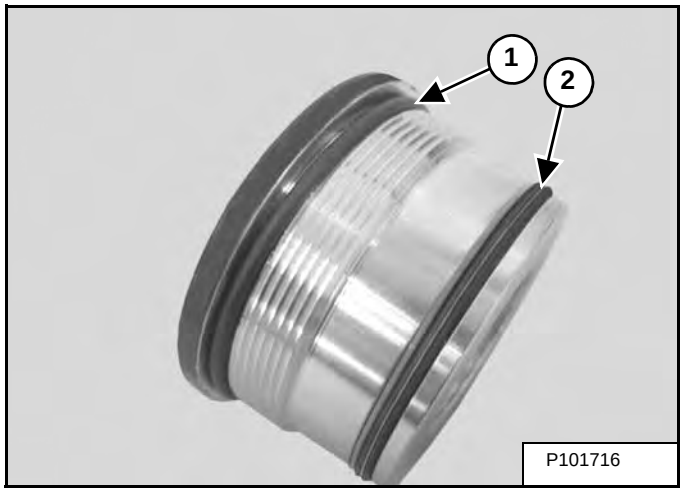


Install the wear ring (Item 1) **[Figure 20-21-30]**.

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Assembly (Cont'd)

Figure 20-21-31

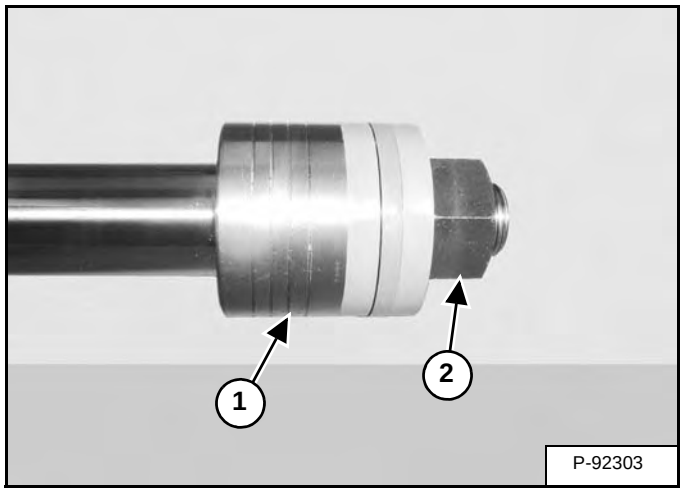


Install the O-ring (Item 1) **[Figure 20-21-31]**.

Install the seal (Item 2) **[Figure 20-21-31]**.

Install the head onto the rod.

Figure 20-21-32



Install the piston (Item 1) and nut (Item 2) **[Figure 20-21-32]**.

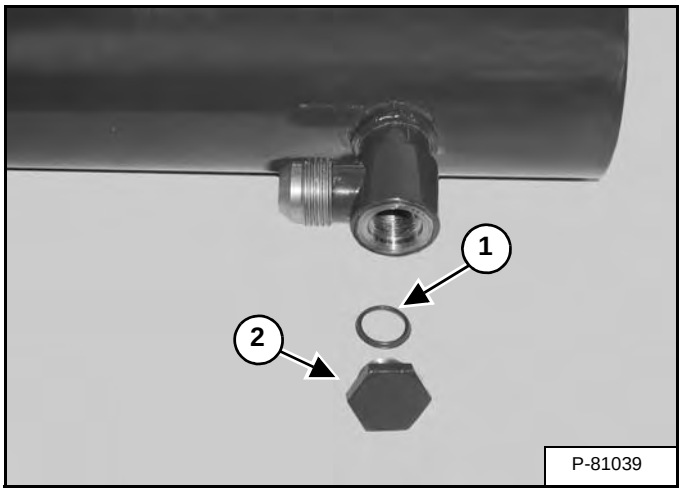
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

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

Tighten the nut to 1491 N•m (1100 ft-lb) torque.

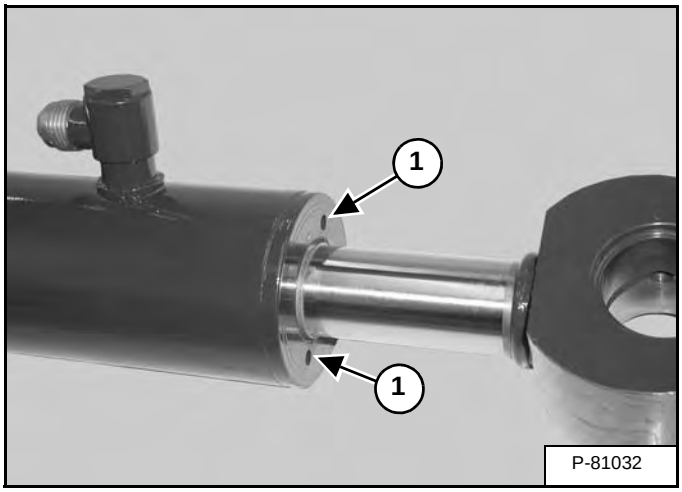
Figure 20-21-33



Install O-ring (Item 1) and plug (Item 2) **[Figure 20-21-33]**.Tighten the plug to 50 N•m (37 ft-lb) torque.

Put the base end of the cylinder in a vise.

Figure 20-21-34

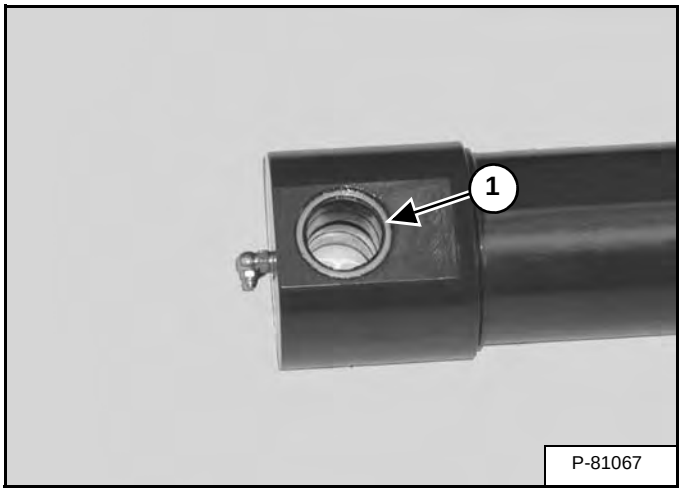


Insert the adjustable gland nut wrench into the holes (Item 1) **[Figure 20-21-34]** to tighten the head. Tighten the head to 367 N•m (250 ft-lb) torque.

Dealer Copy -- Not for Resale

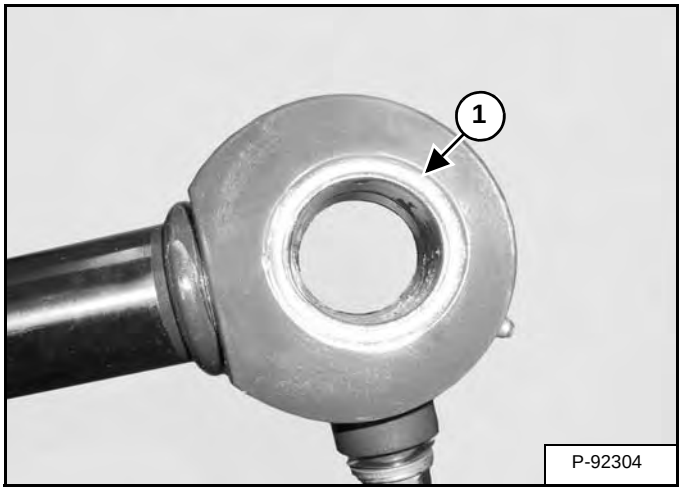
Assembly (Cont'd)

Figure 20-21-35



Install the bushing and seal (Item 1) **[Figure 20-21-35]** on both sides of the cylinder base end.

Figure 20-21-36



Install the bushing and seal (Item 1) **[Figure 20-21-36]** on both sides of the cylinder rod end.

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

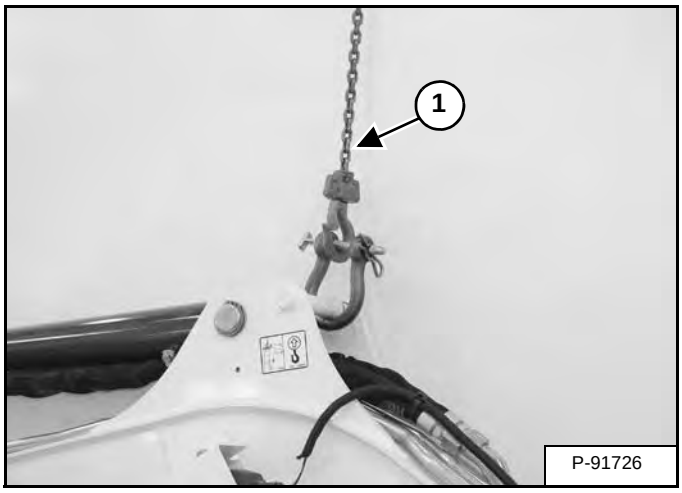
CYLINDER (ARM)

Testing

Lower the work group to the ground.

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

Figure 20-22-1



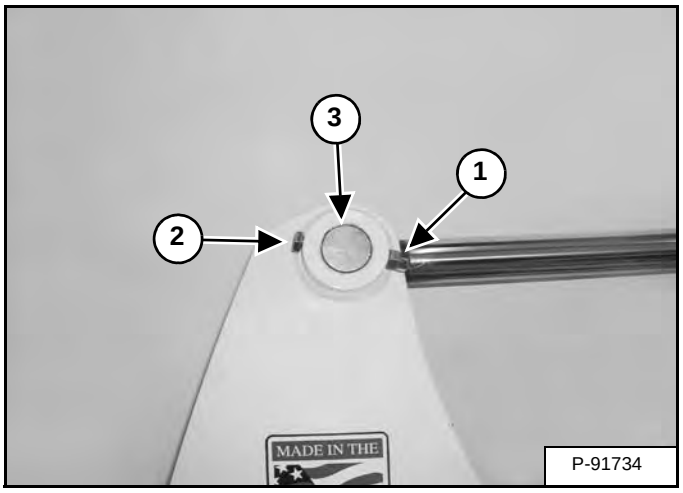
Support the boom with a chain hoist (Item 1) **[Figure 20-22-1]**.

Figure 20-22-2



Support the arm cylinder **[Figure 20-22-2]**.

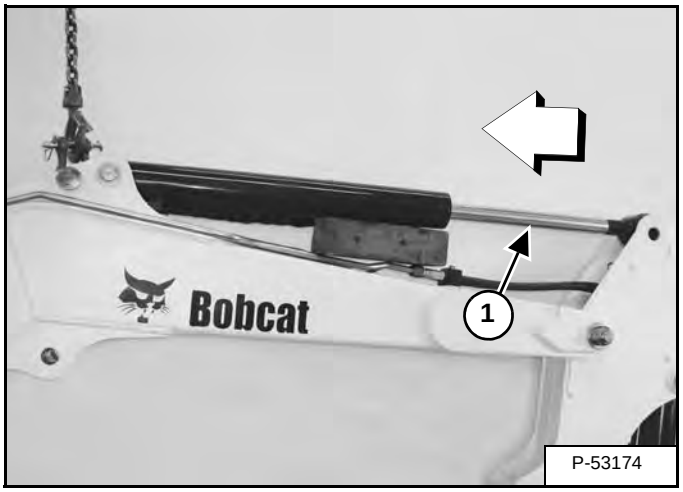
Figure 20-22-3



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-22-3]**.

Remove the rod end pin (Item 3) **[Figure 20-22-3]**.

Figure 20-22-4



Start the engine and fully retract the cylinder rod (Item 1) **[Figure 20-22-4]**.

Dealer Copy -- Not for Resale

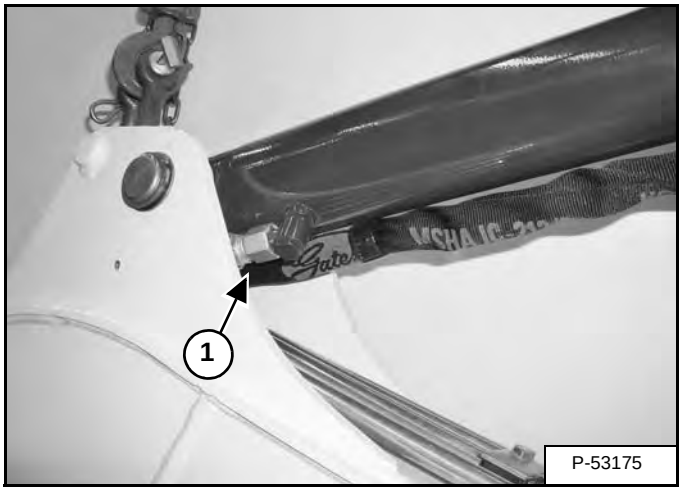
Testing (Cont'd)

⚠ WARNING

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

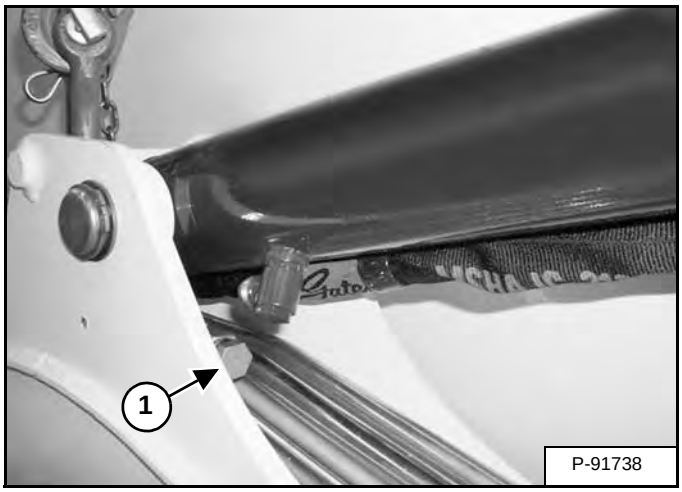
W-2145-0290

Figure 20-22-5



Remove the hose (Item 1) **[Figure 20-22-5]** from the base end of the cylinder.

Figure 20-22-6



Install a plug (Item 1) **[Figure 20-22-6]** on the hose.

Start the engine and retract the cylinder.

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

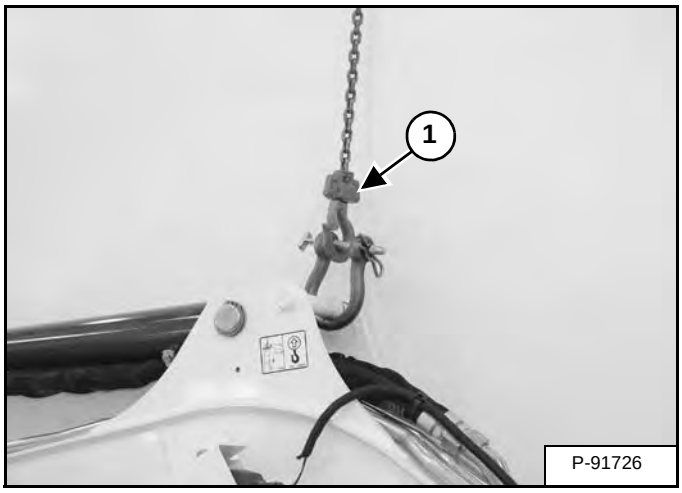
Dealer Copy -- Not for Resale

Removal And Installation

Lower the work group to the ground.

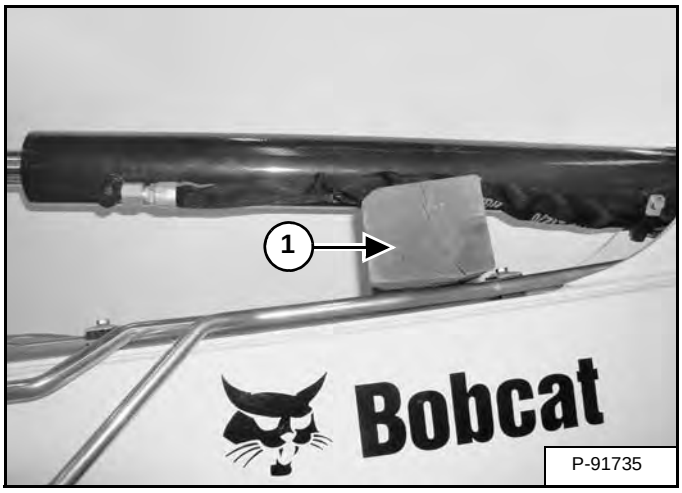
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-22-7



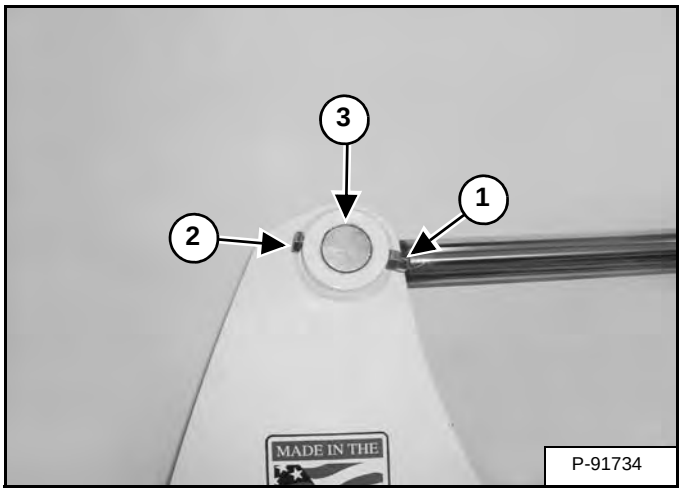
Support the boom with a chain hoist (Item 1) **[Figure 20-22-7]**.

Figure 20-22-8



Support the arm cylinder (Item 1) **[Figure 20-22-8]**.

Figure 20-22-9



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-22-9]**.

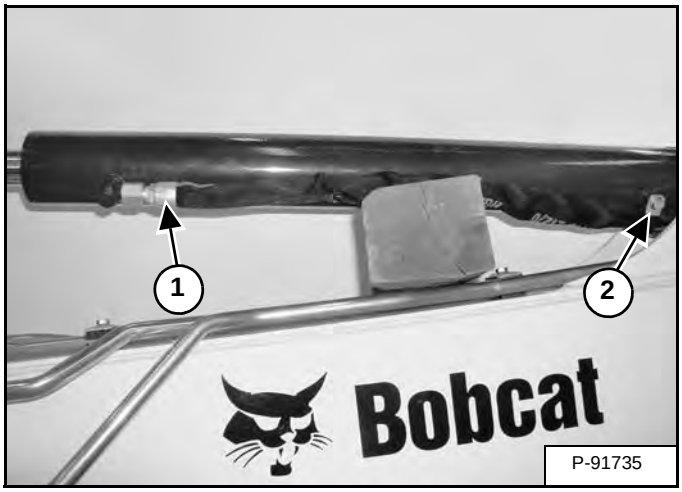
Remove the rod end pin (Item 3) **[Figure 20-22-9]**.

IMPORTANT

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

I-2003-0888

Figure 20-22-10

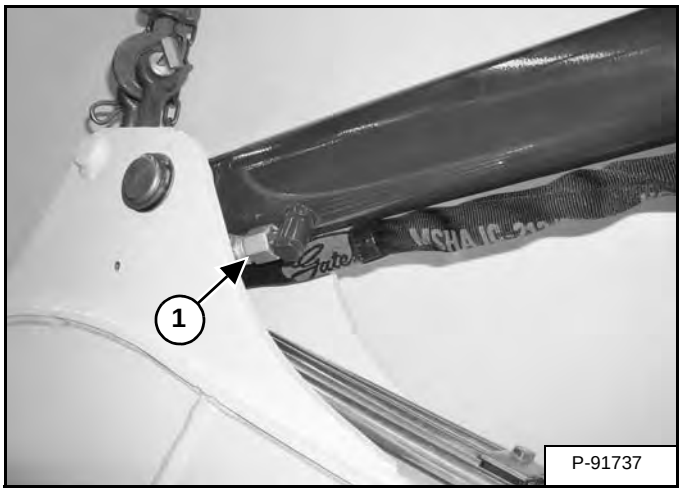


Remove the hose (Item 1) and hose clamp (Item 2) **[Figure 20-22-10]**.

Dealer Copy -- Not for Resale

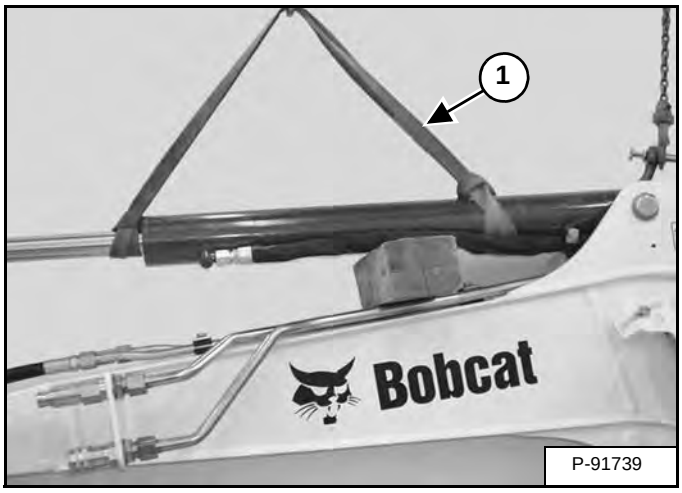
Removal And Installation (Cont'd)

Figure 20-22-11



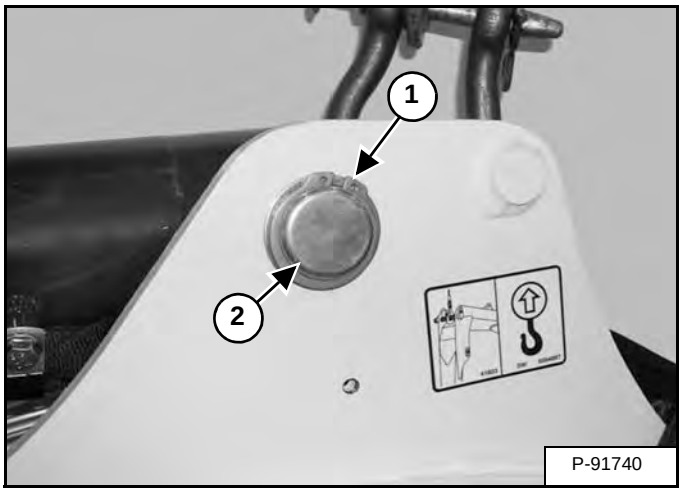
Remove the hose (Item 1) **[Figure 20-22-11]**.

Figure 20-22-12



Install a sling (Item 1) **[Figure 20-22-12]** on the cylinder.

Figure 20-22-13



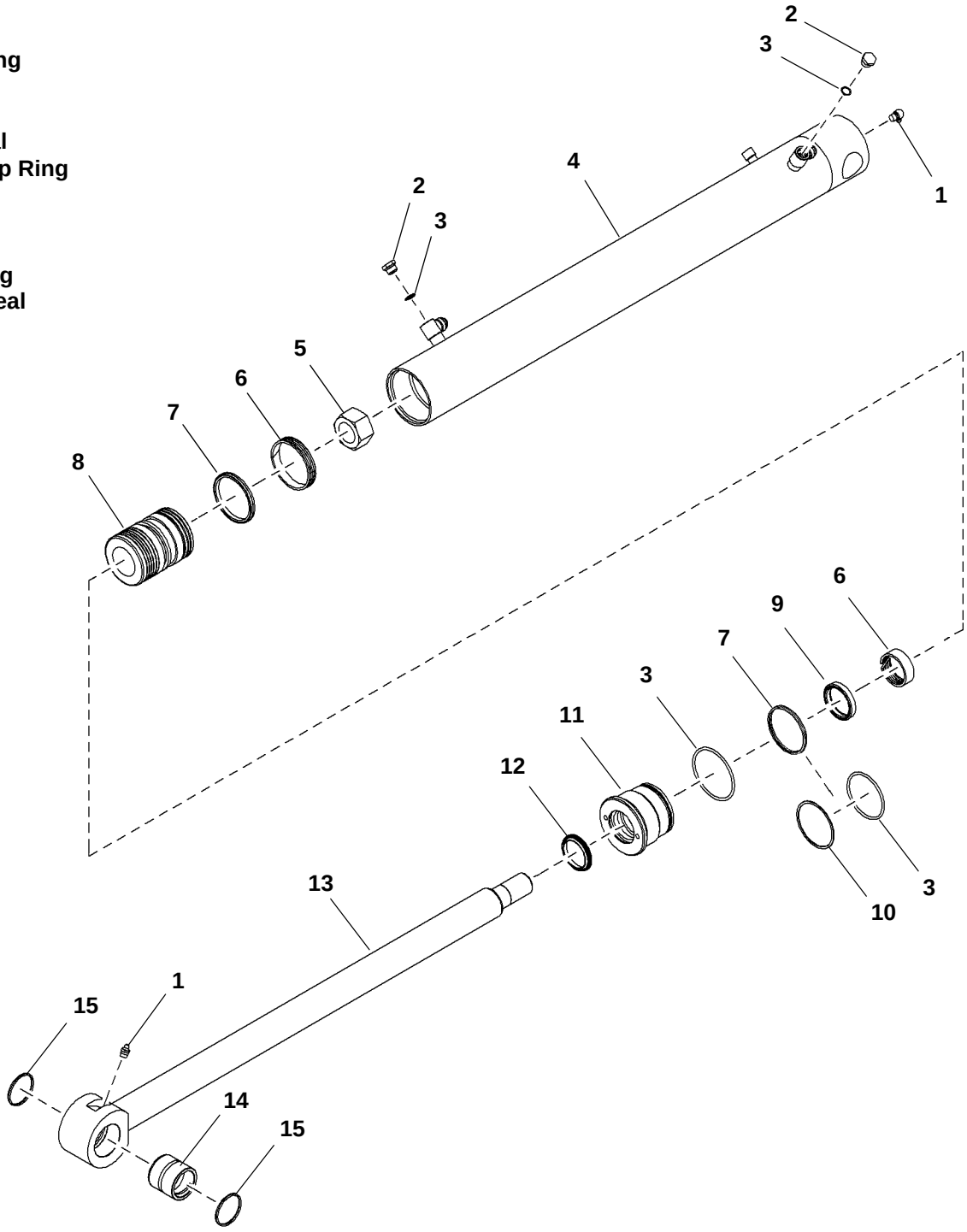
Remove the snap ring (Item 1), washer and base end pin (Item 2) **[Figure 20-22-13]**.

Remove the cylinder.

Dealer Copy -- Not for Resale

Parts Identification

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



NA2242S

Dealer Copy -- Not for Resale

Disassembly

Clean the outside of the cylinder before disassembly.

Use the following tools to disassemble the cylinder:

MEL1074 - O-ring Seal Hook

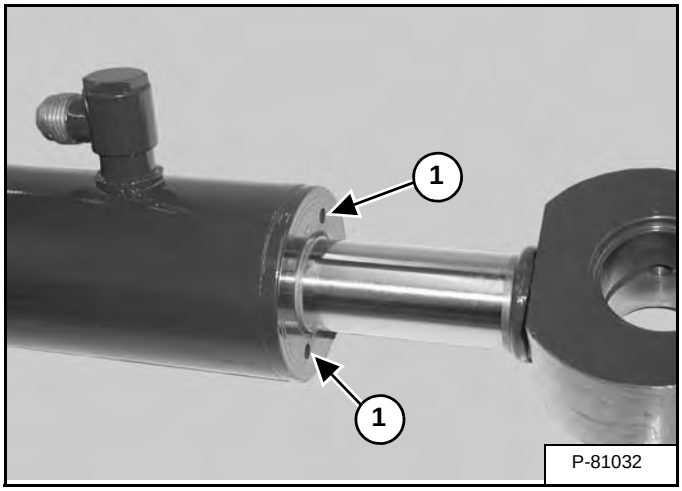
MEL1075 - Adjustable Gland Nut Wrench

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.

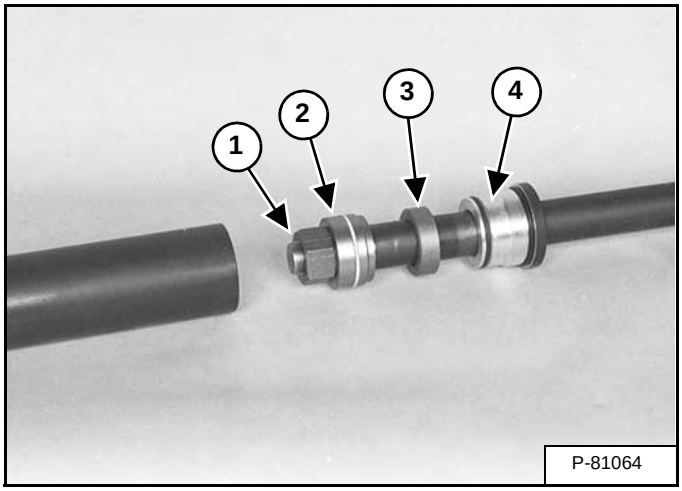
Put the base end of the cylinder in a vise.

Figure 20-22-14



Insert the adjustable gland nut wrench into the holes (Item 1) **[Figure 20-22-14]** to loosen the head.

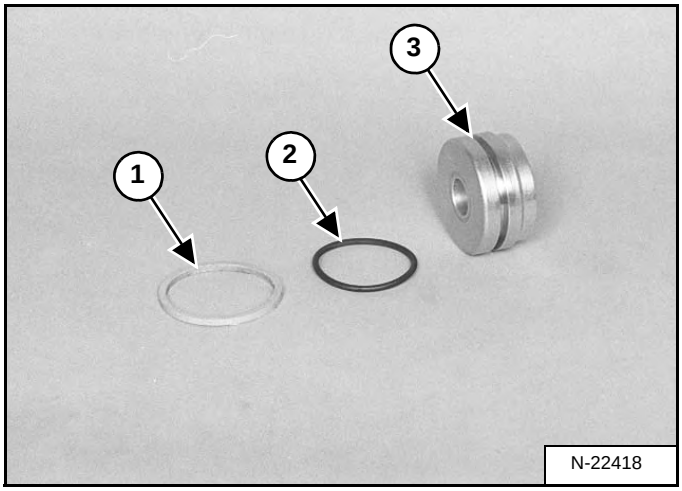
Figure 20-22-15



Remove the head and the rod assembly from the cylinder **[Figure 20-22-15]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2), spacer (Item 3) and head (Item 4) **[Figure 20-22-15]**.

Figure 20-22-16

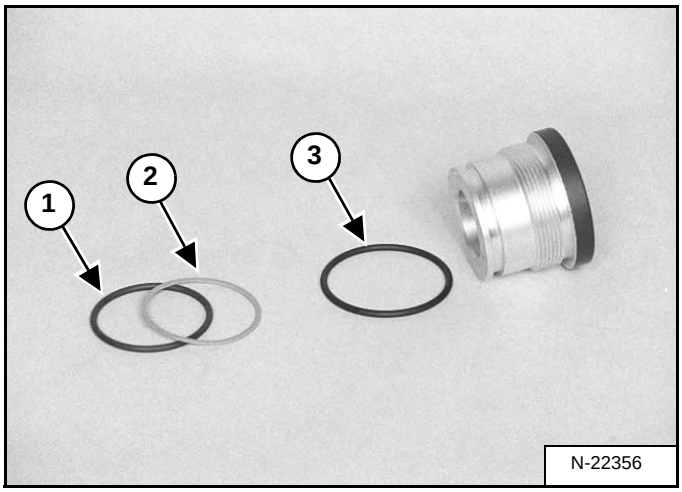


Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-22-16]**.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

Figure 20-22-17

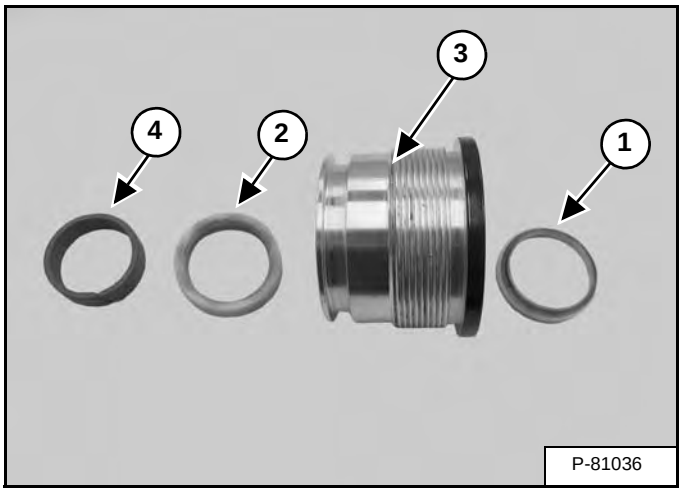


Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-22-17]**.

NOTE: The O-ring (Item 1) and back-up ring (Item 2) [Figure 20-22-17] are no longer available parts. The seal kit will contain a one piece seal that is used in place of the O-ring and back-up ring.

Remove the O-ring (Item 3) **[Figure 20-22-17]**.

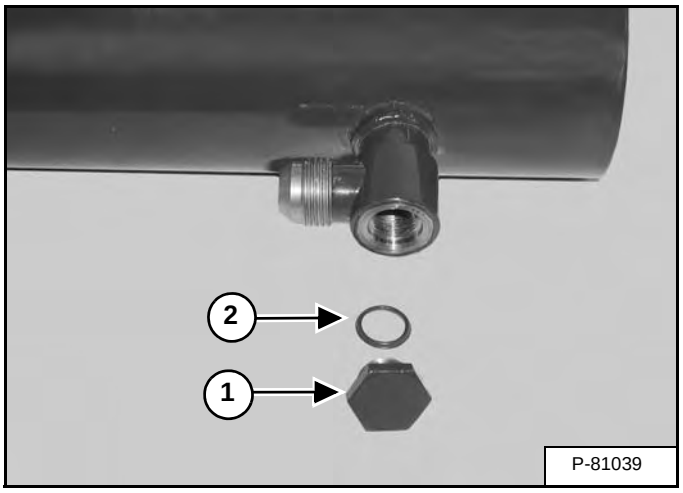
Figure 20-22-18



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-22-18]**.

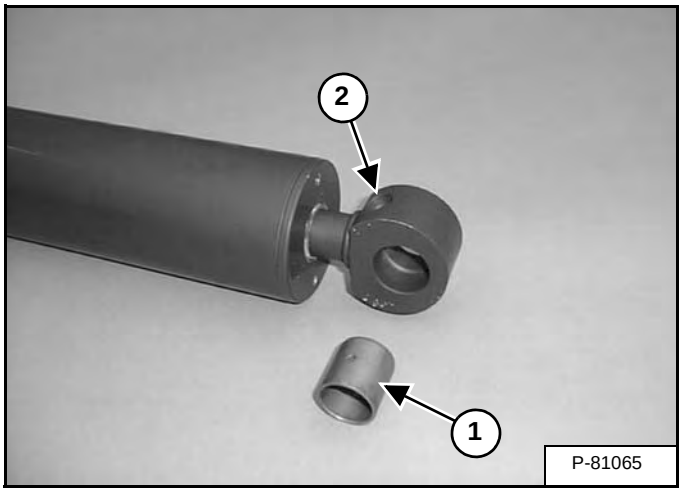
Remove the wear ring (Item 4) **[Figure 20-22-18]**.

Figure 20-22-19



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-22-19]**.

Figure 20-22-20



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

Replace the grease fitting (Item 2) **[Figure 20-22-20]** if damaged or missing.

Dealer Copy -- Not for Resale

Assembly

Clean all parts in solvent and dry with compressed air.

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

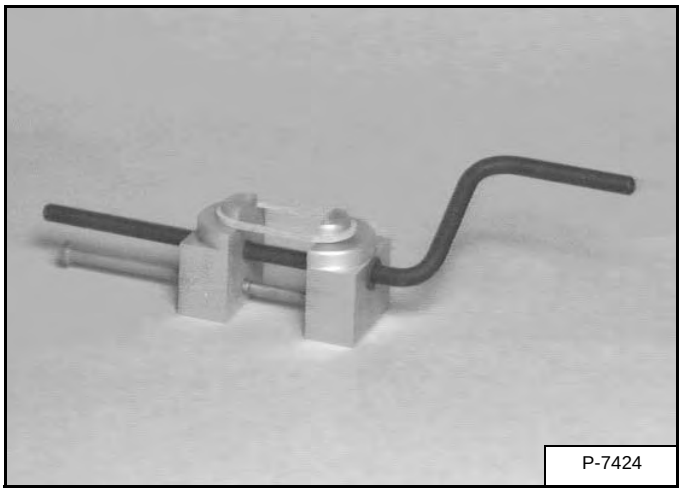
Always install new O-rings and seals during assembly.

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

Use the following tools to assemble the cylinder:

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

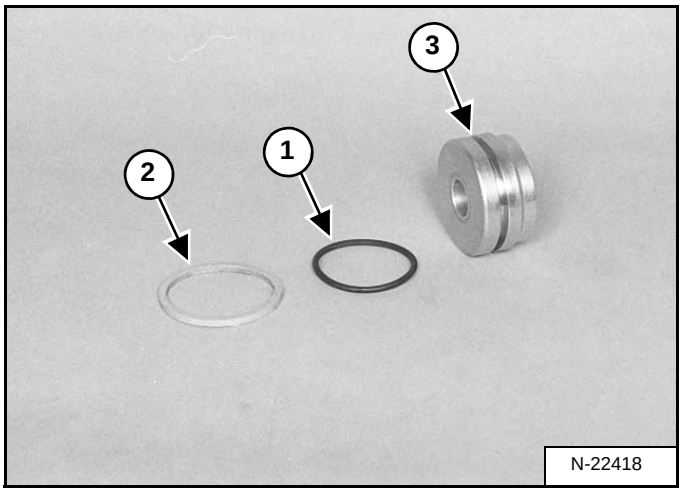
Figure 20-22-21



Install the new seal on the tool and slowly stretch it until it fits the piston **[Figure 20-22-21]**.

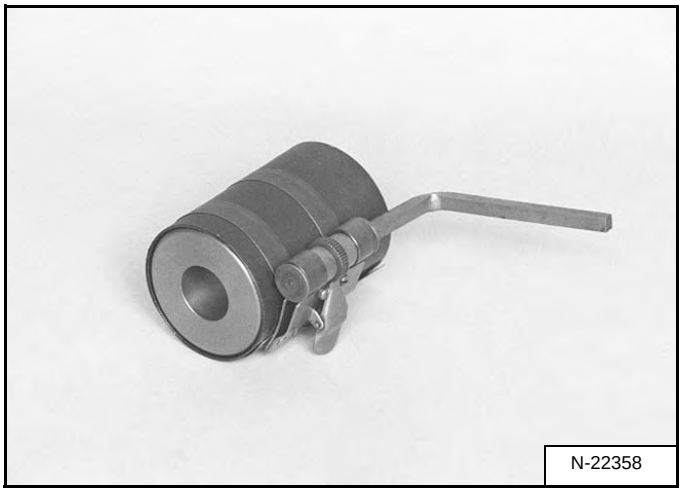
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-22-22



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

Figure 20-22-23

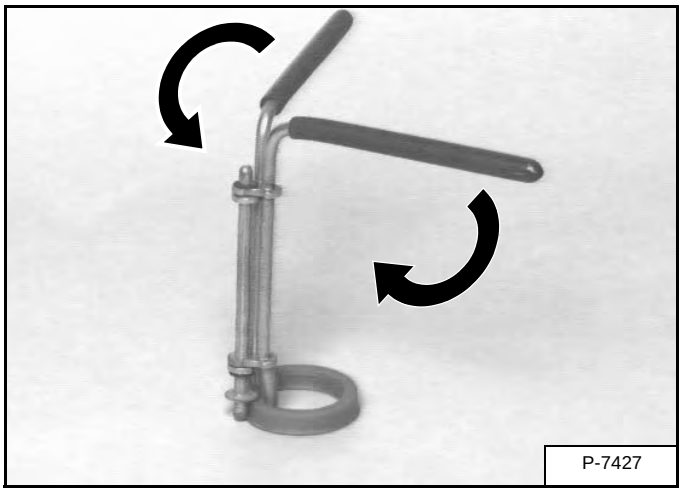


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for approximately three minutes **[Figure 20-22-23]**.

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Assembly (Cont'd)

Figure 20-22-24

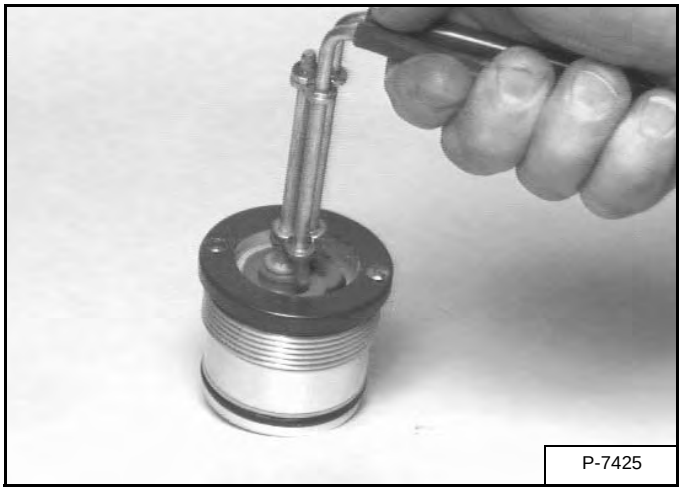


Install the rod seal on the rod seal tool **[Figure 20-22-24]**.

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

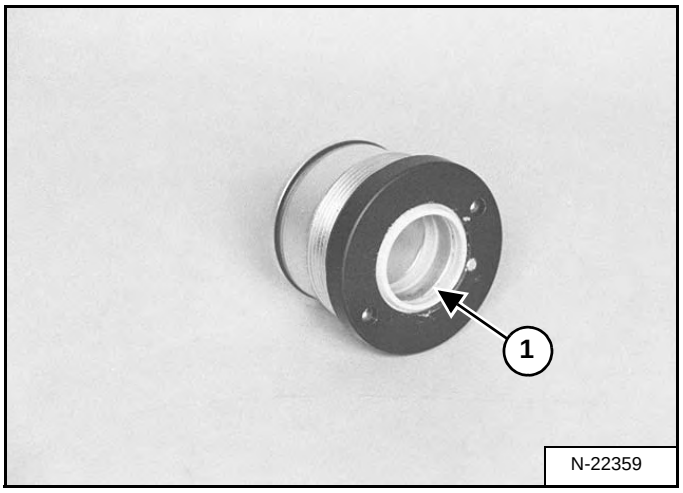
Rotate the handles to collapse the rod seal **[Figure 20-22-24]**.

Figure 20-22-25



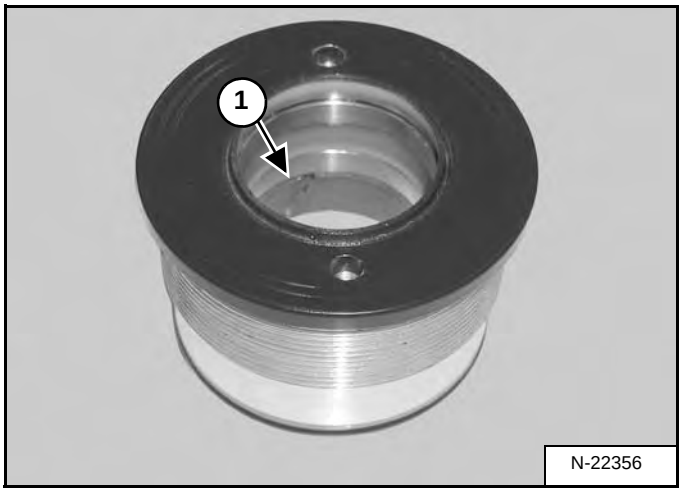
Install the rod seal in the head **[Figure 20-22-25]**.

Figure 20-22-26



Install the wiper seal with the wiper (Item 1) **[Figure 20-22-26]** toward the outside of the head.

Figure 20-22-27

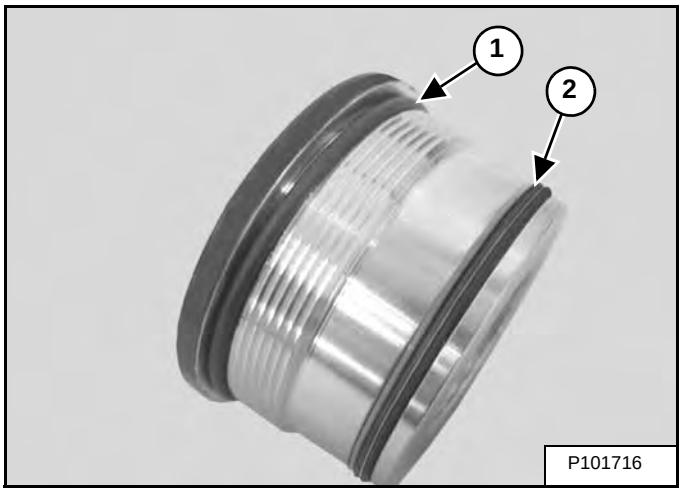


Install the wear ring (Item 1) **[Figure 20-22-27]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

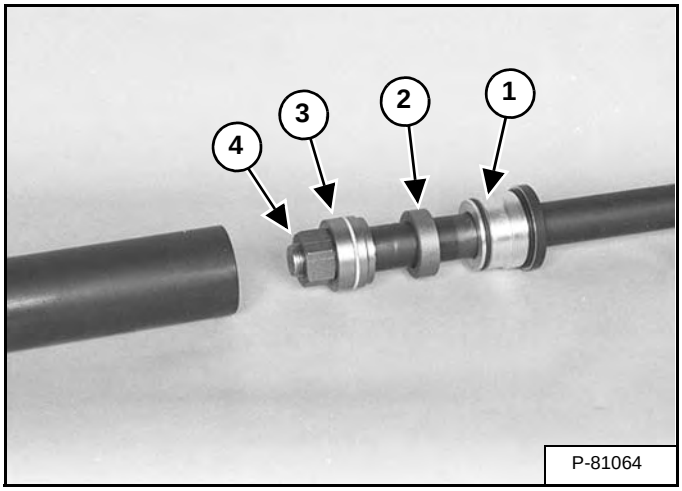
Figure 20-22-28



Install the O-ring (Item 1) **[Figure 20-22-28]**.

Install the seal (Item 2) **[Figure 20-22-28]**.

Figure 20-22-29



Install the head (Item 1), spacer (Item 2) and the piston (Item 3) **[Figure 20-22-29]** on the rod.

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

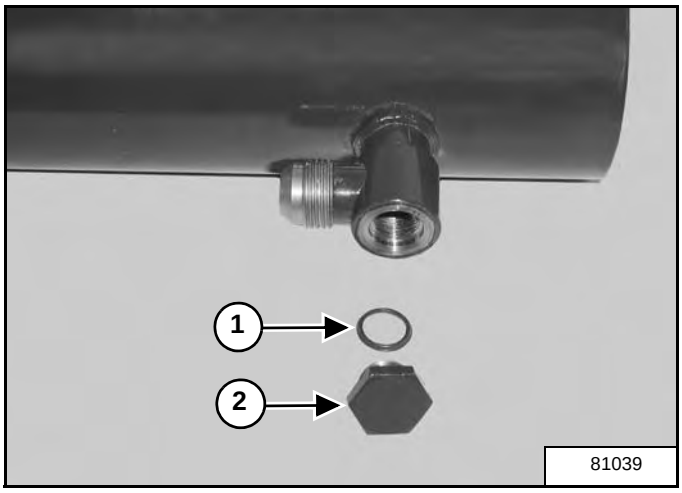
Provide an adequate support for the cylinder before tightening.

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

Install the nut (Item 4) **[Figure 20-22-29]**.

Tighten the nut to 1491 N•m (1100 ft-lb) torque.

Figure 20-22-30

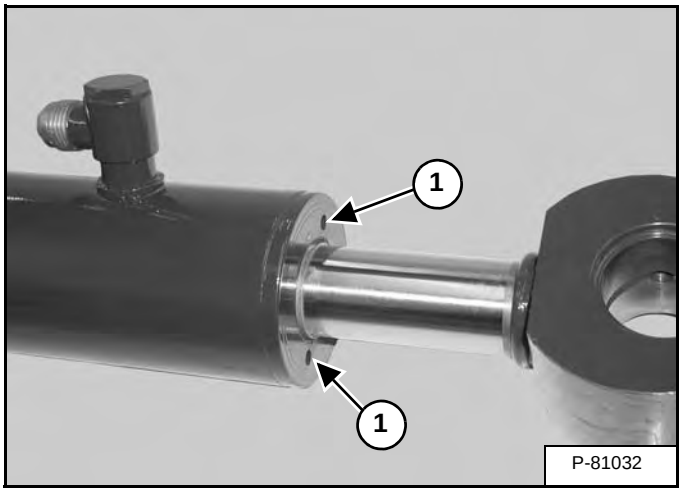


Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-22-30]**.

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

Put the base end of the cylinder in a vise.

Figure 20-22-31

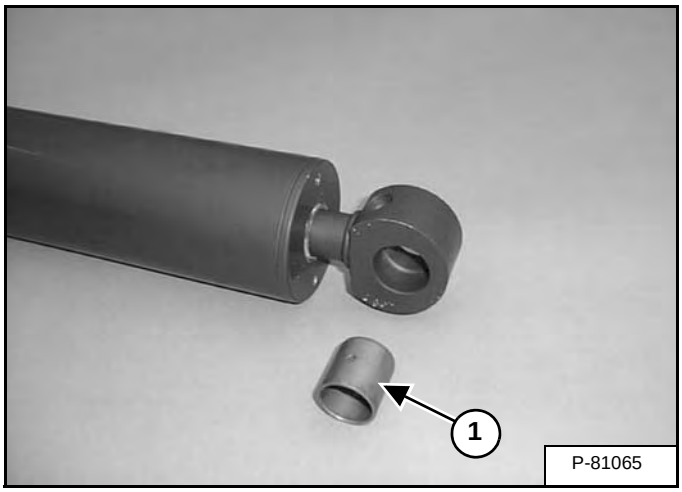


Insert the adjustable gland nut wrench into the holes (Item 1) **[Figure 20-22-31]** to tighten the head. Tighten the head until it is flush with the end of the housing.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-22-32



Install the bushing (Item 1) **[Figure 20-22-32]**. Make sure the bushing is aligned with the grease channel in the cylinder.

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

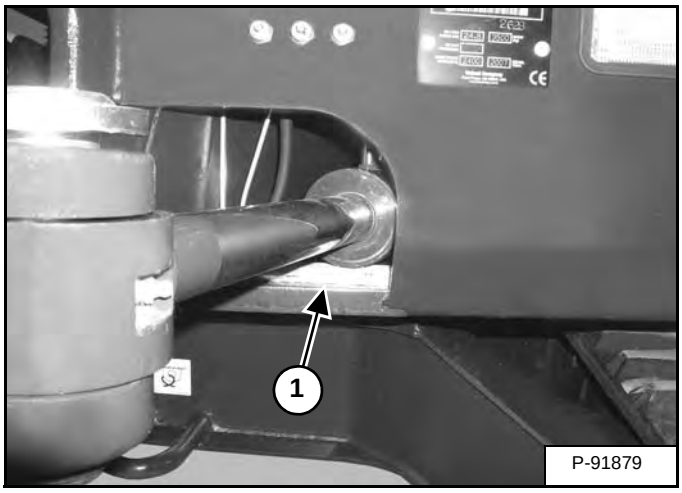
CYLINDER (BOOM SWING)

Testing

Lower the work group to the ground.

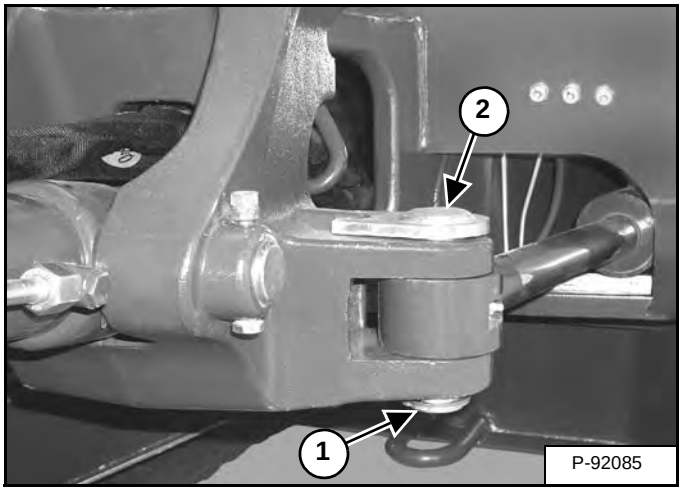
Remove the floor mat. (See Removal And Installation on Page 40-110-1.)

Figure 20-23-1



Place a block (Item 1) **[Figure 20-23-1]** under the rod end of the boom swing cylinder.

Figure 20-23-2



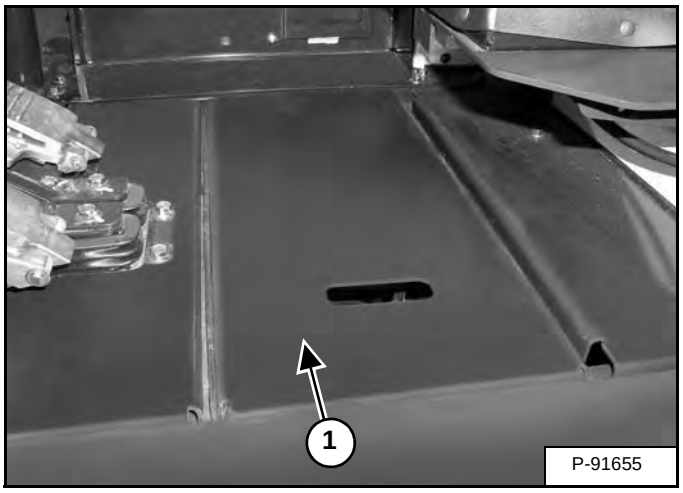
Remove the snap ring (Item 1) **[Figure 20-23-2]** and washer from the rod end pin of the cylinder.

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

Start the engine and fully retract the cylinder rod.

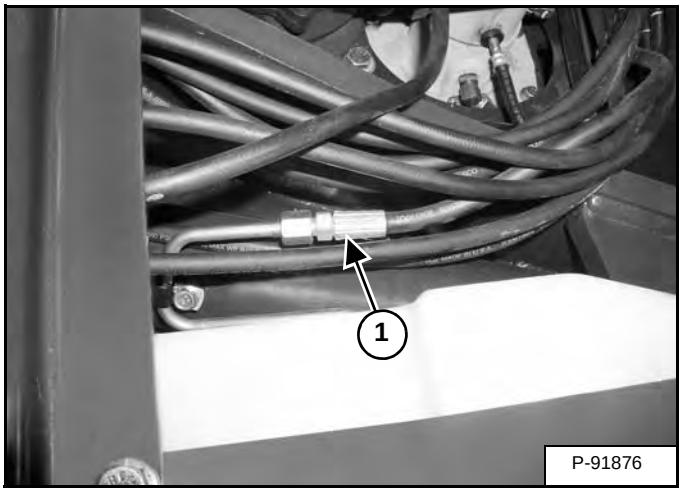
Stop the engine.

Figure 20-23-3



Remove the center floor panel (Item 1) **[Figure 20-23-3]**.

Figure 20-23-4



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

Dealer Copy -- Not for Resale

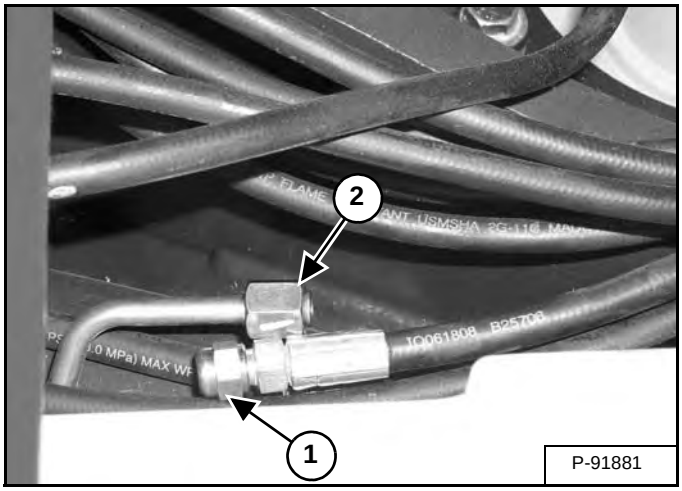
Testing (Cont'd)

⚠ WARNING

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

W-2145-0290

Figure 20-23-5



Install a cap (Item 1) **[Figure 20-23-5]** on the hose and tighten.

Start the engine and retract the cylinder.

If there is any oil leakage from the base end fitting (Item 2) **[Figure 20-23-5]** on the boom swing cylinder, remove the cylinder for repair or replacement.

Dealer Copy -- Not for Resale

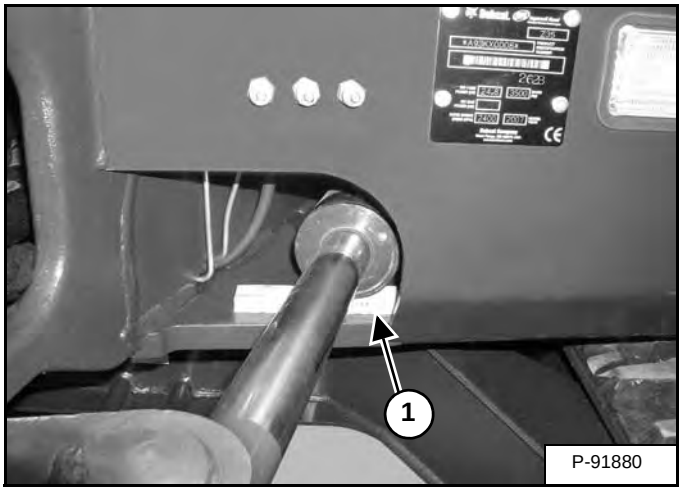
Removal And Installation

Lower the work group to the ground.

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

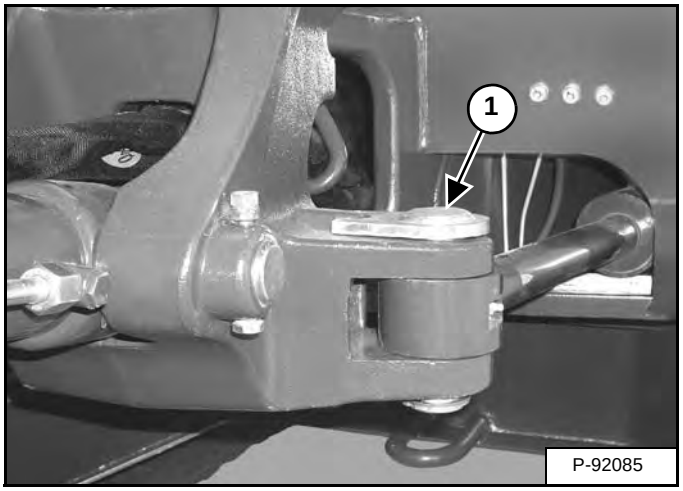
Remove the tool box cover. (See Removal And Installation on Page 40-230-1.)

Figure 20-23-6



Place a block (Item 1) **[Figure 20-23-6]** under the rod end of the boom swing cylinder.

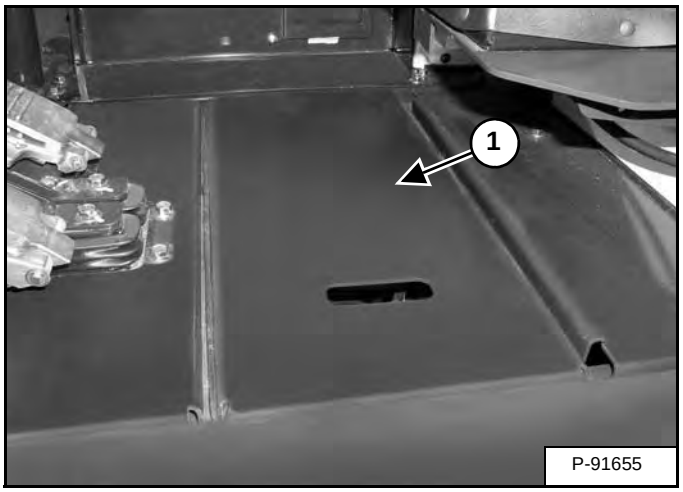
Figure 20-23-7



Remove the snap ring (Item 1) **[Figure 20-23-7]** and washer from the rod end pin of the cylinder.

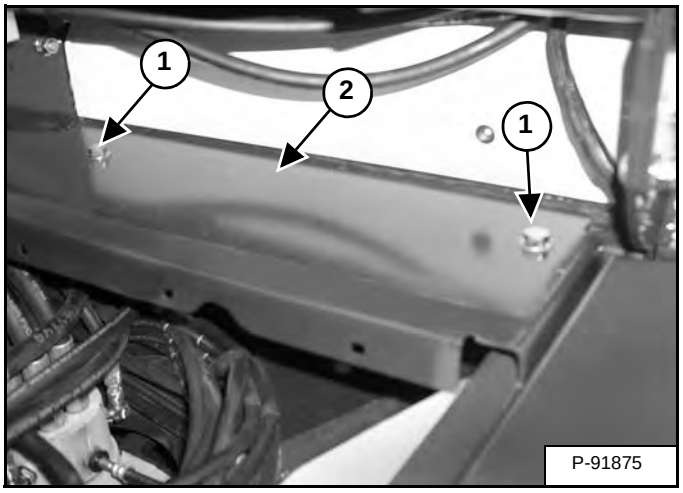
Remove the pin **[Figure 20-23-7]**.

Figure 20-23-8



Remove the center floor panel (Item 1) **[Figure 20-23-8]**.

Figure 20-23-9

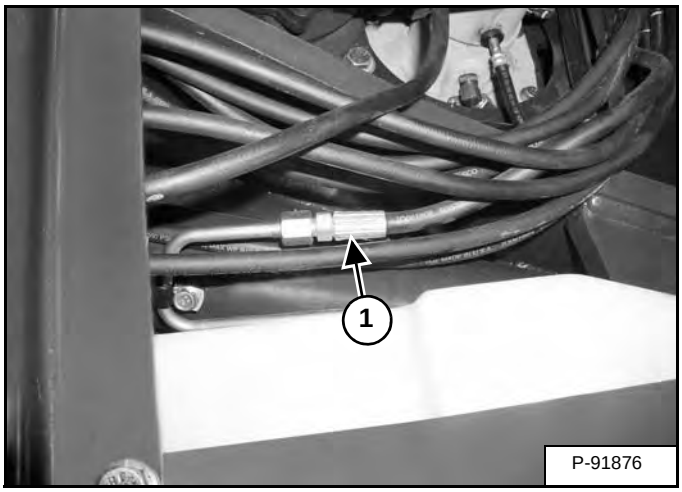


Remove the two bolts (Item 1) and rear floor panel (Item 2) **[Figure 20-23-9]**.

Dealer Copy -- Not for Resale

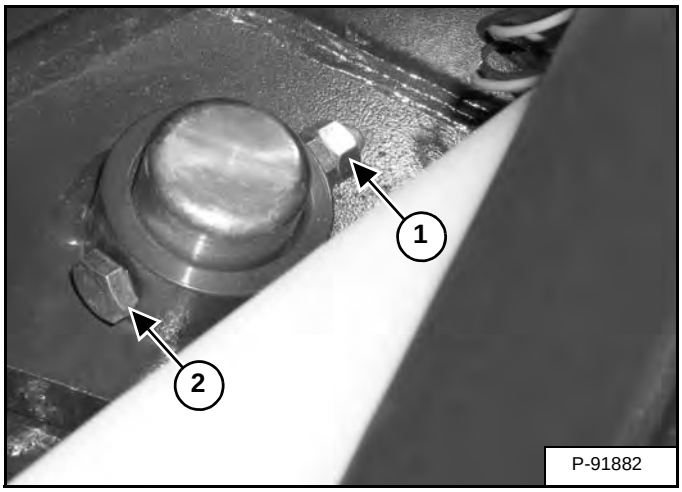
Removal And Installation (Cont'd)

Figure 20-23-10



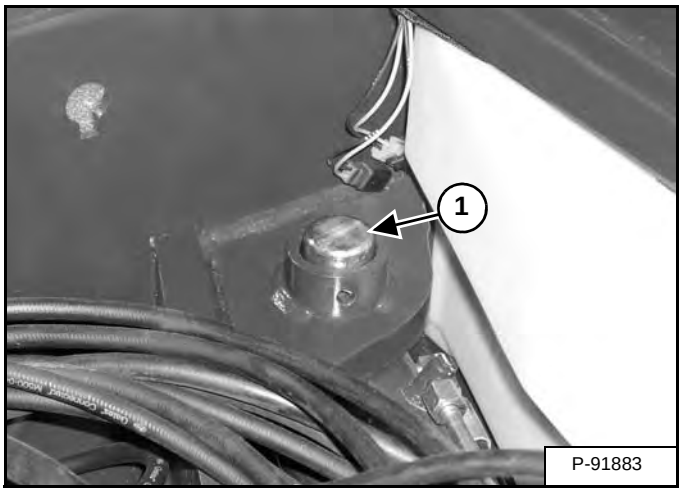
Remove the hose (Item 1) **[Figure 20-23-10]** from the base end of the cylinder.

Figure 20-23-11



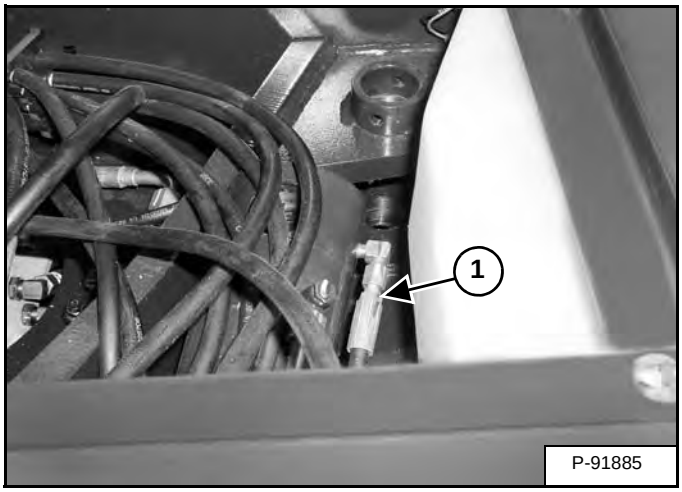
Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-23-11]**.

Figure 20-23-12



Remove the pin (Item 1) **[Figure 20-23-12]** from the base end of the cylinder.

Figure 20-23-13

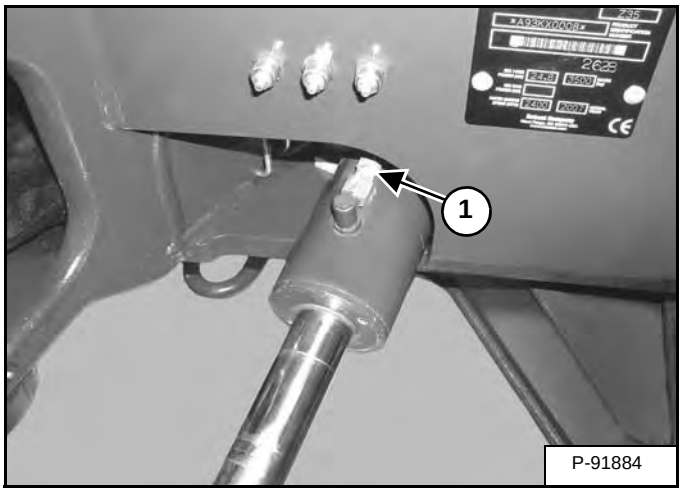


Slide the cylinder forward and remove the grease fitting hose (Item 1) **[Figure 20-23-13]**.

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Removal And Installation (Cont'd)

Figure 20-23-14



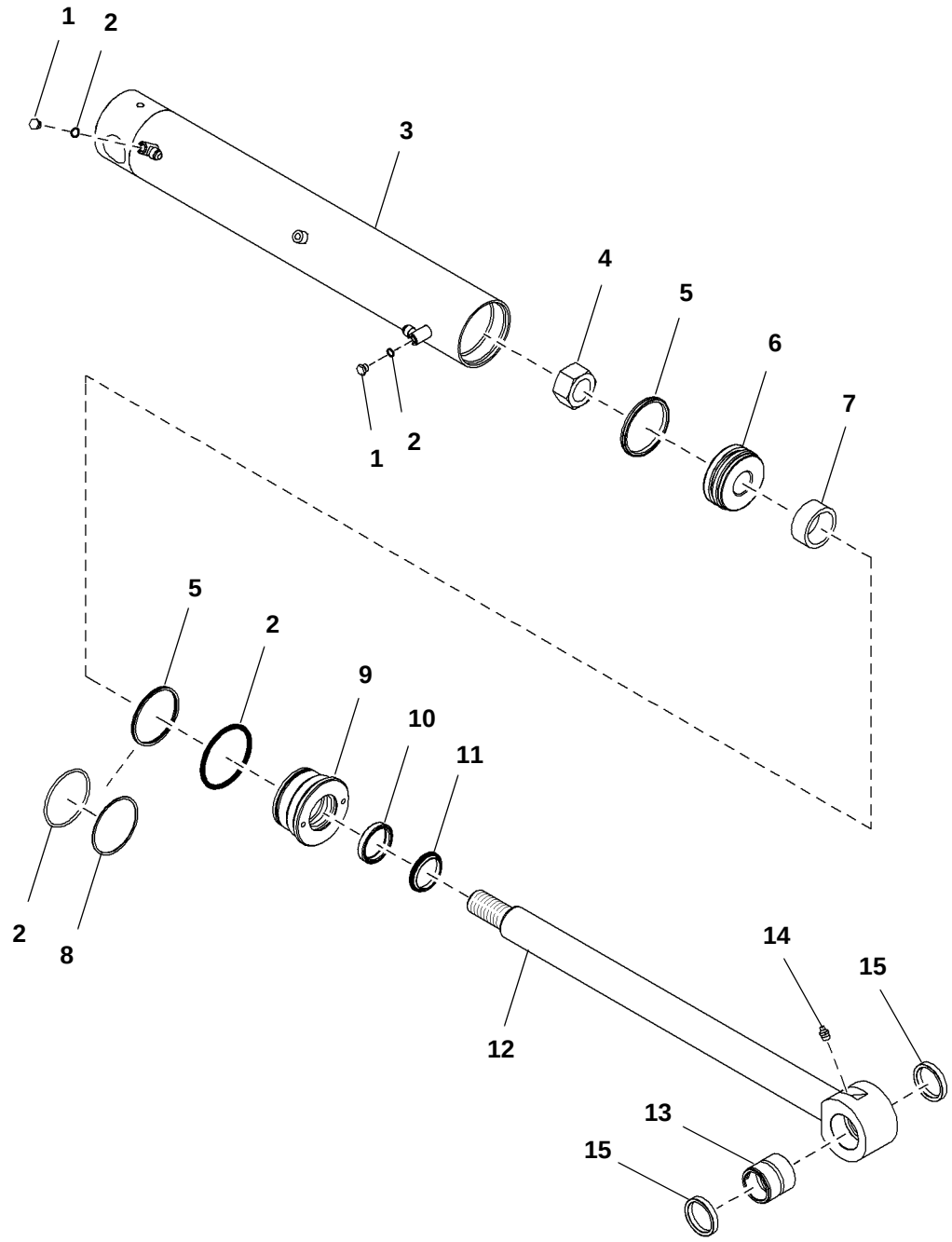
Remove the hose (Item 1) **[Figure 20-23-14]**

Remove the cylinder.

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Parts Identification

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



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Disassembly

Clean the outside of the cylinder before disassembly.

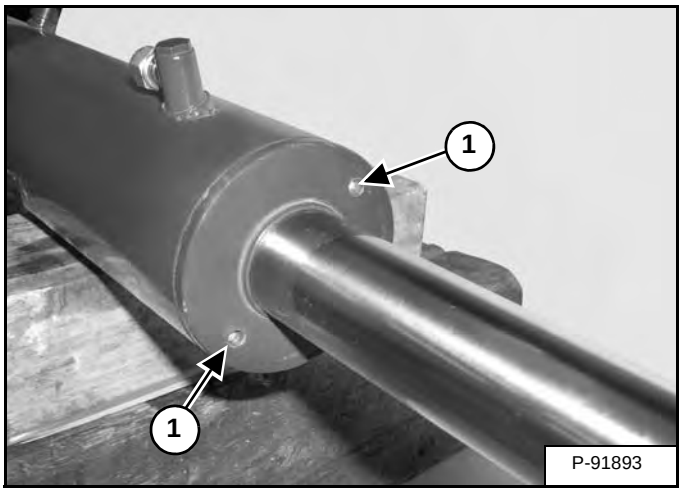
Use the following tools to disassemble the cylinder:

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.

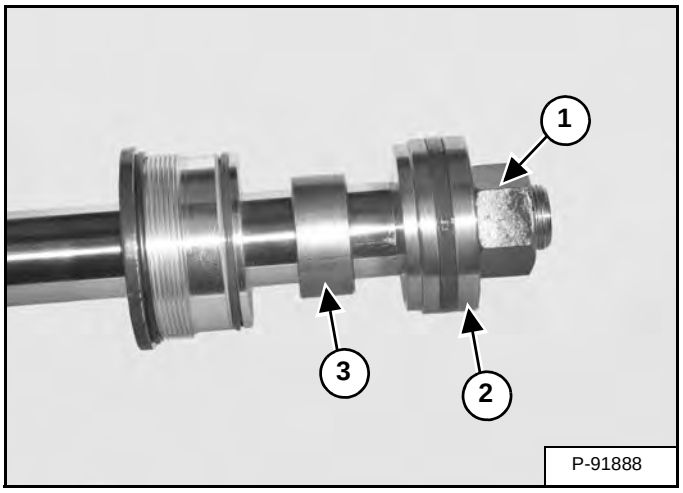
Put the base end of the cylinder in a vise.

Figure 20-23-15



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-23-15]** to loosen the head.

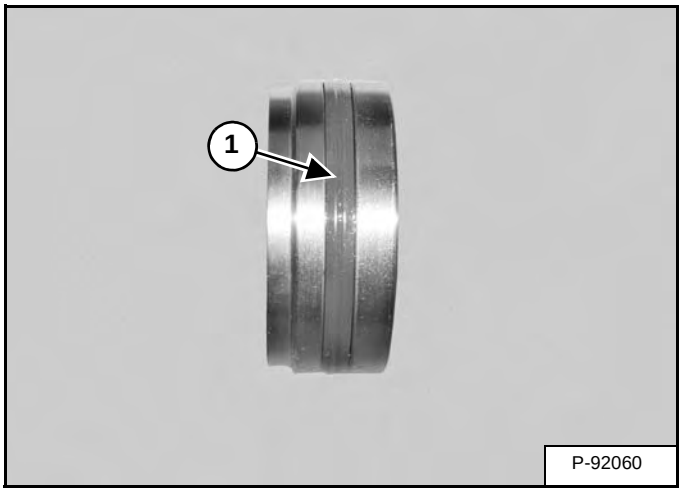
Figure 20-23-16



Remove the head and the rod assembly from the cylinder **[Figure 20-23-16]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-23-16]**.

Figure 20-23-17

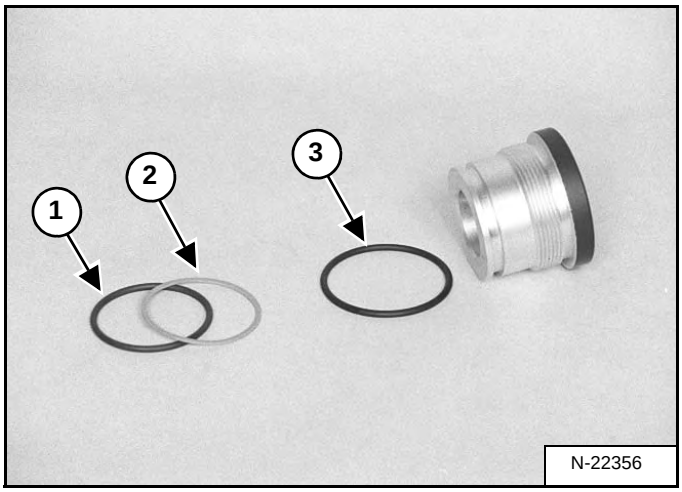


Remove the seal (Item 1) **[Figure 20-23-17]** from the piston.

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Disassembly (Cont'd)

Figure 20-23-18

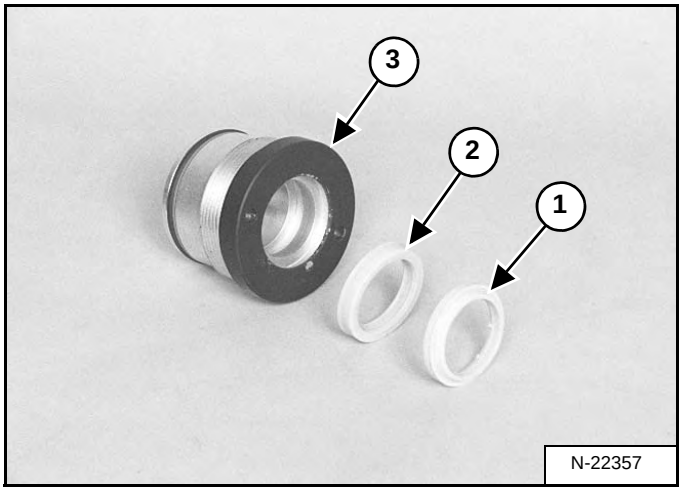


Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-23-18]** from the head.

NOTE: The O-ring (Item 1) and back-up ring (Item 2) [Figure 20-23-18] are no longer available parts. The seal kit will contain a one piece seal that is used in place of the O-ring and back-up ring.

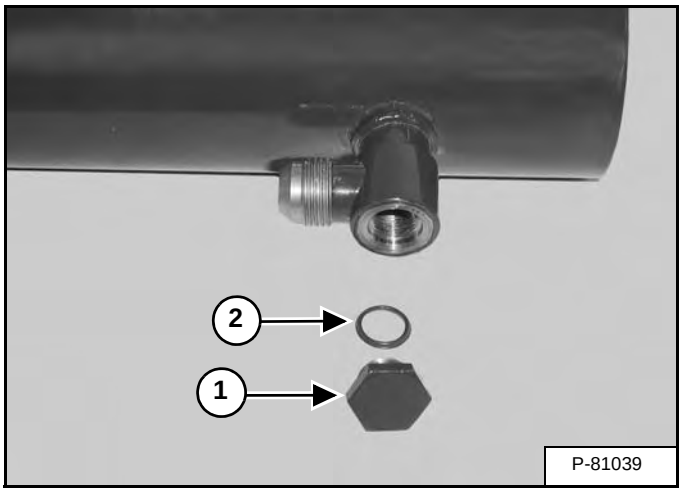
Remove the O-ring (Item 3) **[Figure 20-23-18]**.

Figure 20-23-19



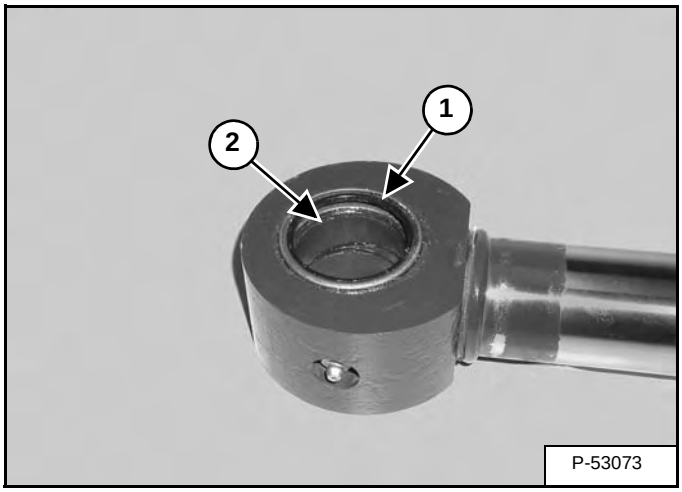
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-23-19]**.

Figure 20-23-20



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

Figure 20-23-21



Remove the dust seals (Item 1) and bushing (Item 2) **[Figure 20-23-21]**.

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Assembly

Clean all parts in solvent and dry with compressed air.

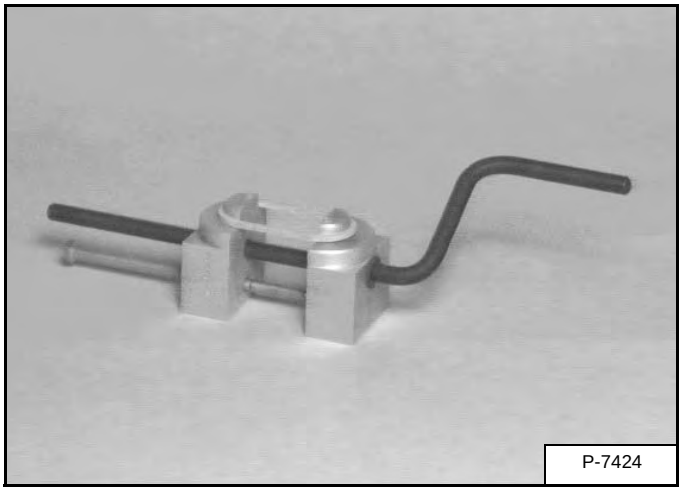
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Use the following tools to assemble the cylinder:

MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
MEL1396-2 - Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

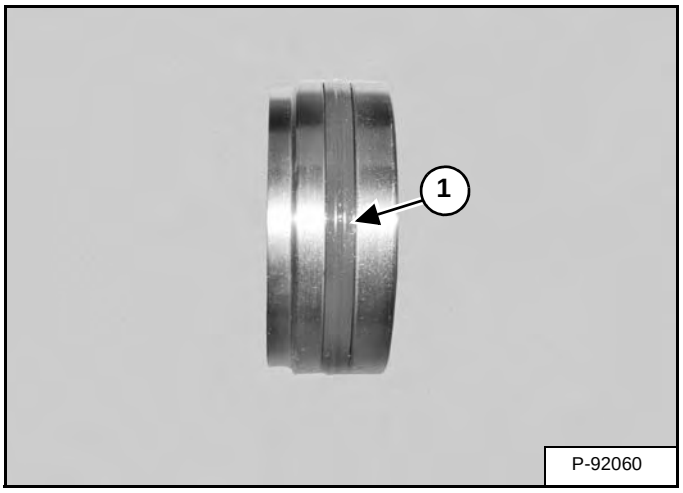
Figure 20-23-22



Install the new seal on the tool and slowly stretch it until it fits the piston **[Figure 20-23-22]**.

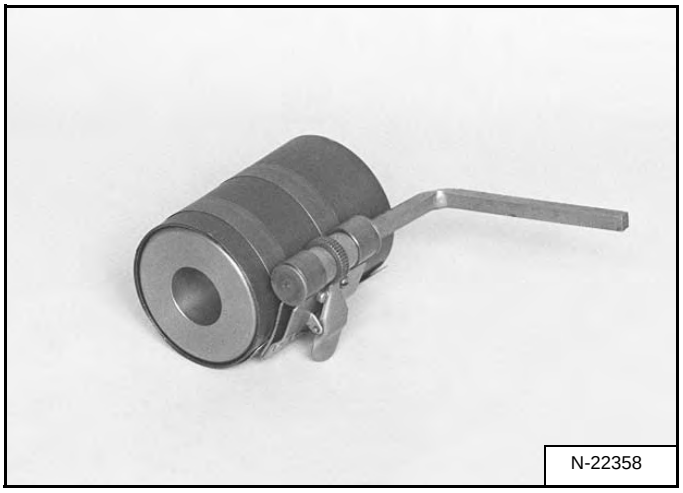
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-23-23



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

Figure 20-23-24

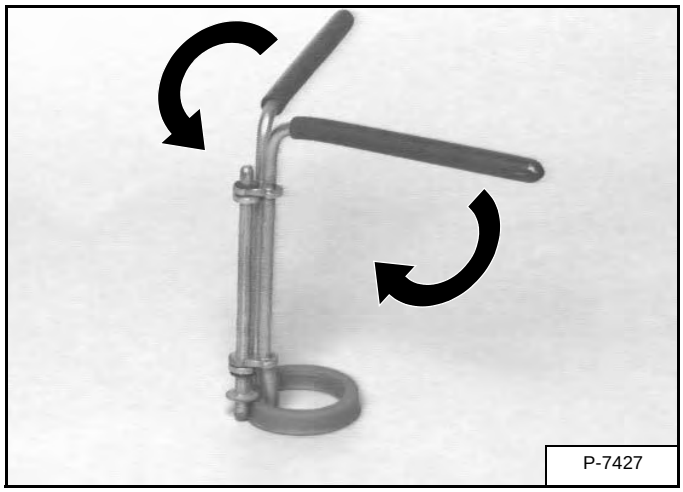


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-23-24]**.

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Assembly (Cont'd)

Figure 20-23-25

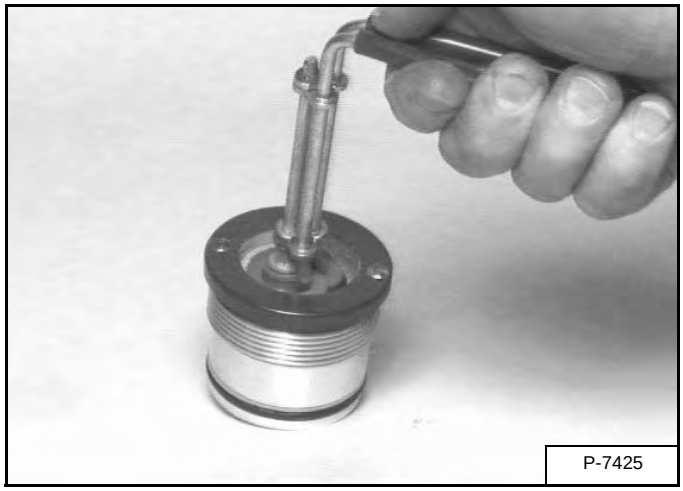


Install the rod seal on the rod seal tool **[Figure 20-23-25]**.

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

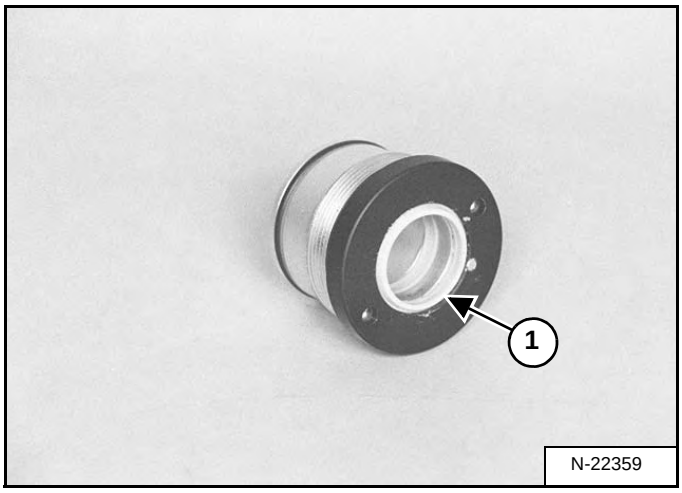
Rotate the handles to collapse the rod seal **[Figure 20-23-25]**.

Figure 20-23-26



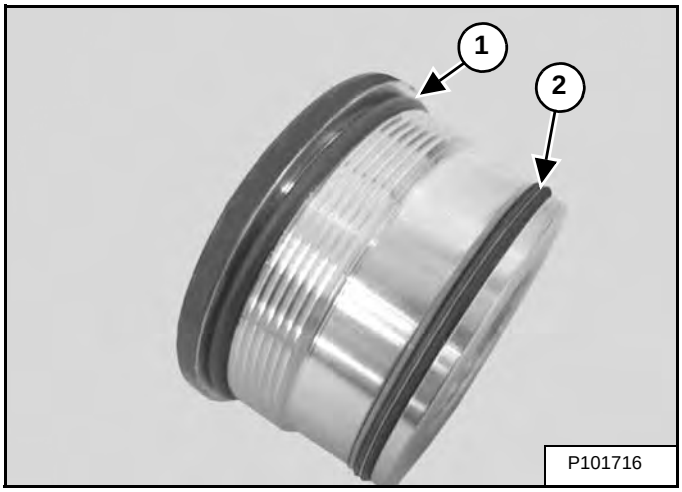
Install the rod seal in the head **[Figure 20-23-26]**.

Figure 20-23-27



Install the wiper seal with the wiper (Item 1) **[Figure 20-23-27]** toward the outside of the head.

Figure 20-23-28



Install the O-ring (Item 1) **[Figure 20-23-28]**.

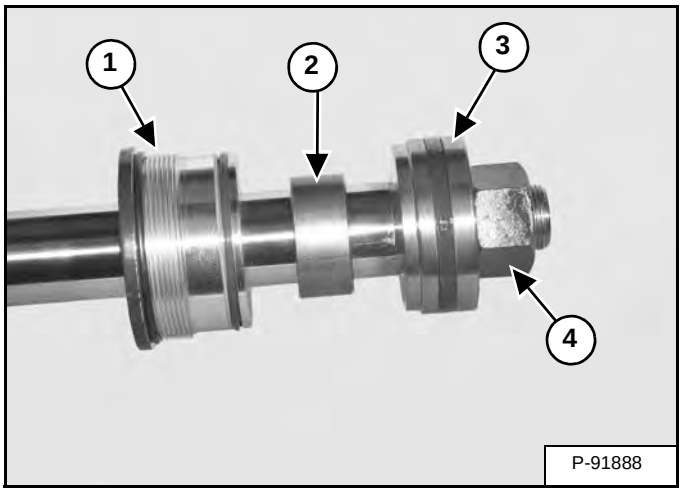
Install the seal (Item 2) **[Figure 20-23-28]**.

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CYLINDER (BOOM SWING) (CONT'D)

Assembly (Cont'd)

Figure 20-23-29



Install the head (Item 1), spacer (Item 2) and the piston (Item 3) **[Figure 20-23-29]** on the rod as shown.

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

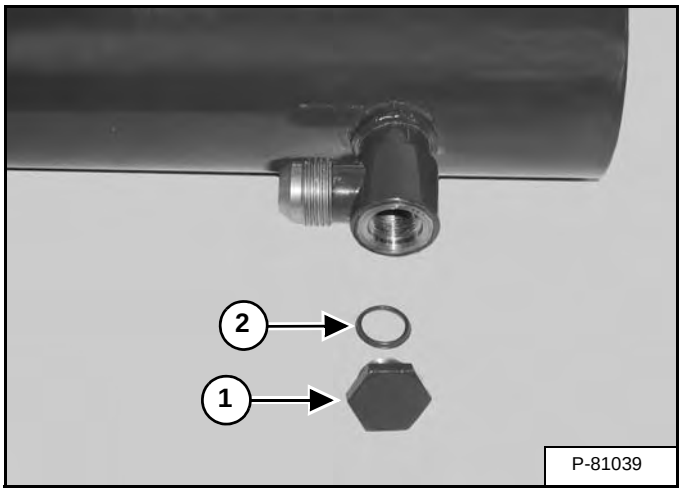
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

Install the nut (Item 4) **[Figure 20-23-29]**.

Tighten the nut to 1491 N•m (1100 ft-lb) torque.

Figure 20-23-30

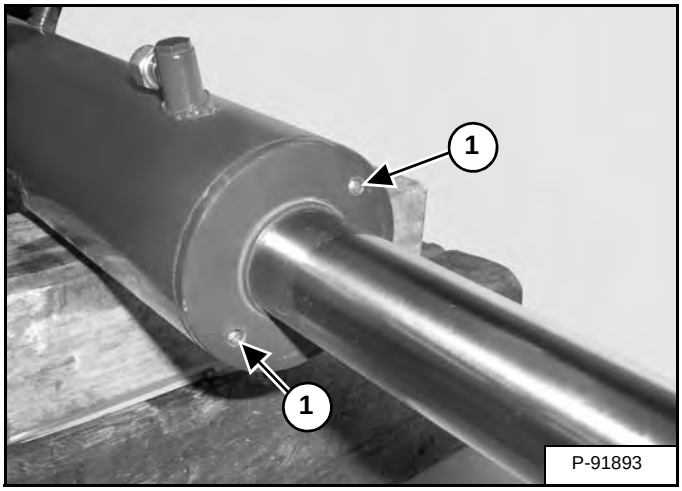


Install plug (Item 1) and O-ring (Item 2) **[Figure 20-23-30]**.

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

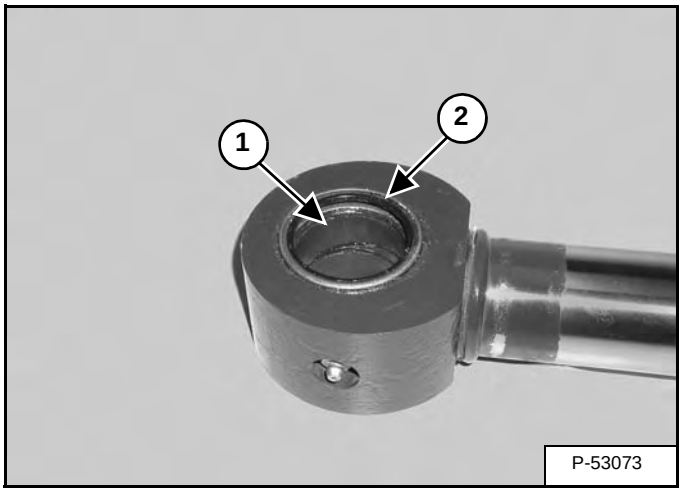
Put the base end of the hydraulic cylinder in a vise.

Figure 20-23-31



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-23-31]** to tighten the head. Head to be torqued until flush with end of housing.

Figure 20-23-32



Install the bushing (Item 1) **[Figure 20-23-32]**. The bushing must be aligned with the grease channel in the rod end of the cylinder.

Install the dust seal (Item 2) **[Figure 20-23-32]** on both sides of the rod end.

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CYLINDER (BUCKET)

Testing

Lower the work group to the ground.

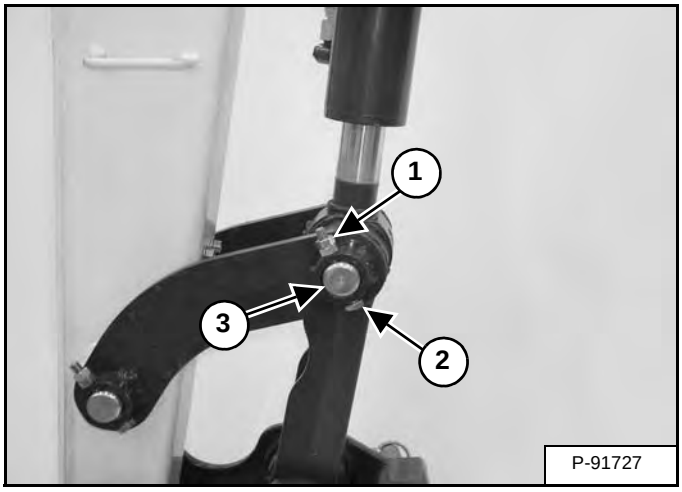
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-24-1



Support the boom using a chain hoist **[Figure 20-24-1]**.

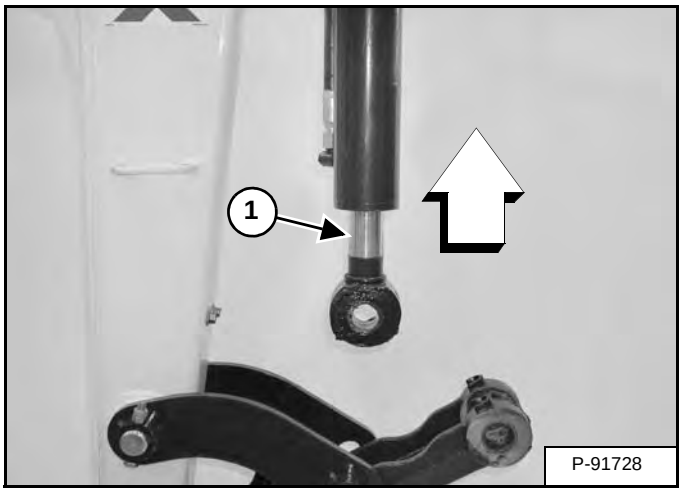
Figure 20-24-2



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-24-2]**.

Remove the pin (Item 3) **[Figure 20-24-2]**.

Figure 20-24-3



Start the engine and fully retract the cylinder rod (Item 1) **[Figure 20-24-3]**.

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CYLINDER (BUCKET) (CONT'D)

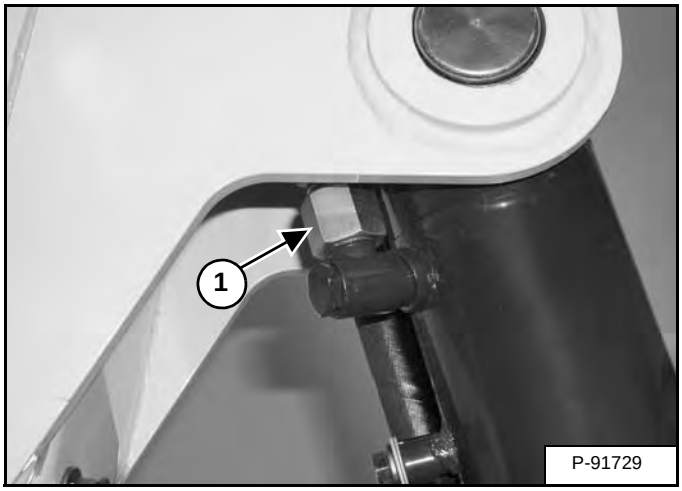
Testing (Cont'd)

⚠ WARNING

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

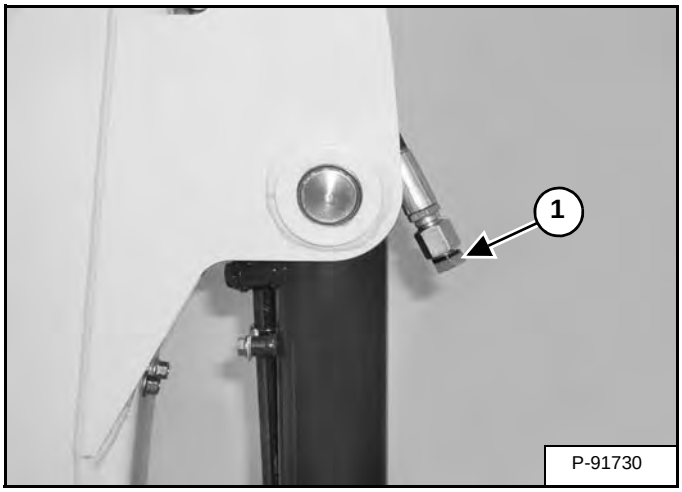
W-2145-0290

Figure 20-24-4



Remove the hose (Item 1) **[Figure 20-24-4]** from the base end of the cylinder.

Figure 20-24-5



Install a plug (Item 1) **[Figure 20-24-5]** on the hose.

Start the engine and retract the cylinder.

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

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CYLINDER (BUCKET) (CONT'D)

Removal And Installation

Lower the work group to the ground.

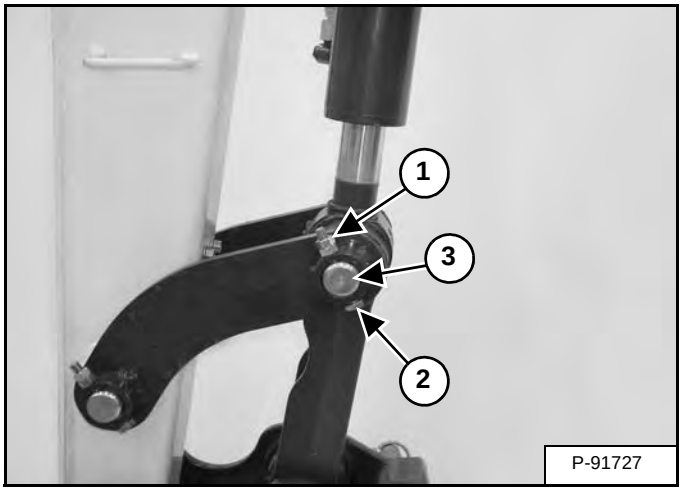
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-24-6



Support the boom using a chain hoist **[Figure 20-24-6]**.

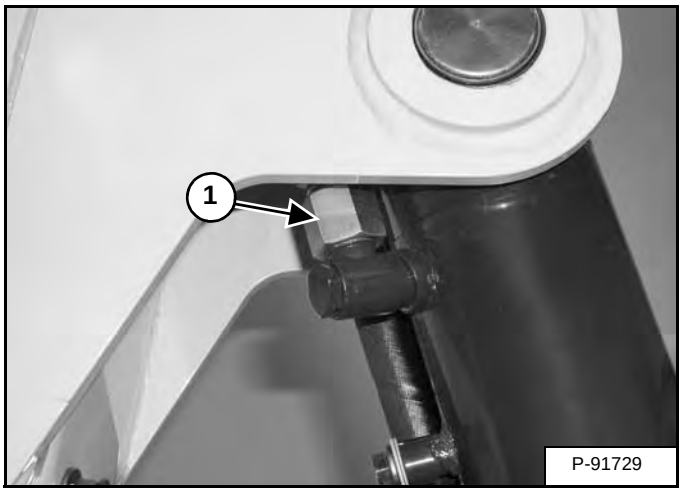
Figure 20-24-7



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-24-7]**.

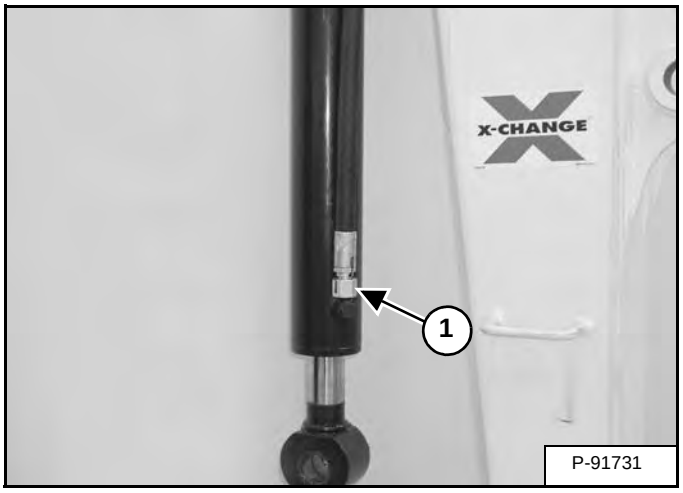
Remove the pin (Item 3) **[Figure 20-24-7]**.

Figure 20-24-8



Remove the hose (Item 1) **[Figure 20-24-8]**.

Figure 20-24-9



Remove the hose (Item 1) **[Figure 20-24-9]**.

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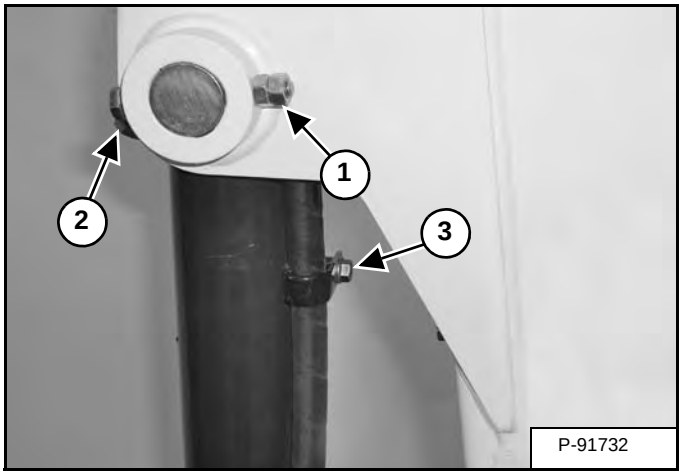
Removal And Installation (Cont'd)

IMPORTANT

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

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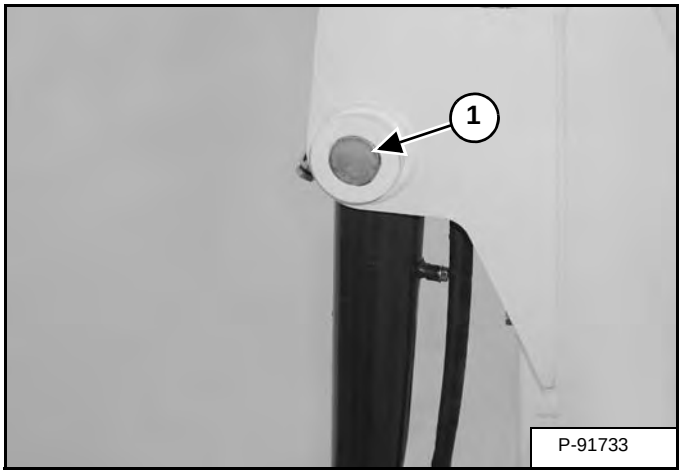
Figure 20-24-10



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-24-10]**.

Remove the hose clamp (Item 3) **[Figure 20-24-10]**.

Figure 20-24-11



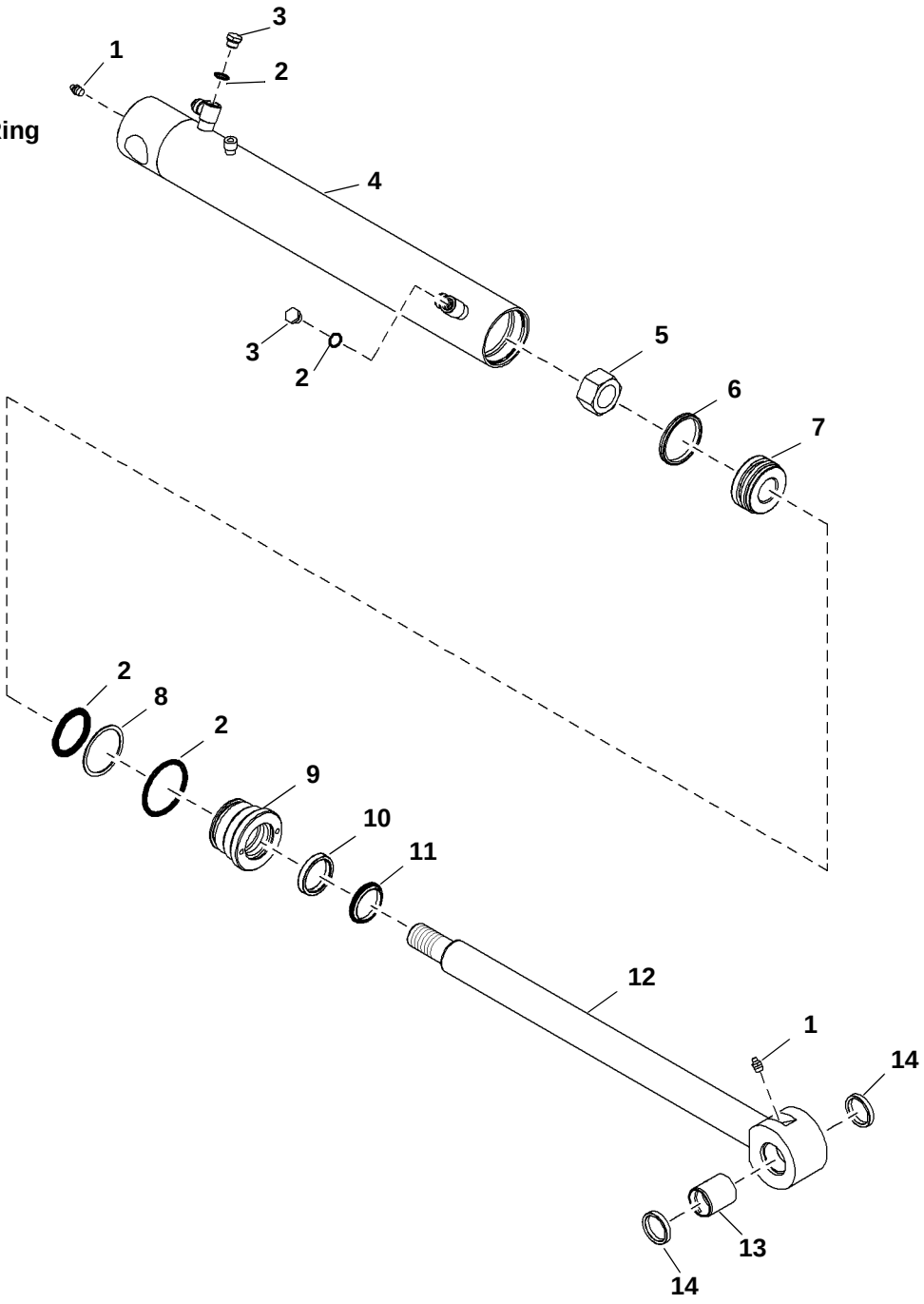
Remove the pin (Item 1) **[Figure 20-24-11]**.

Remove the cylinder.

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Parts Identification

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



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Disassembly

Clean the outside of the cylinder before disassembly.

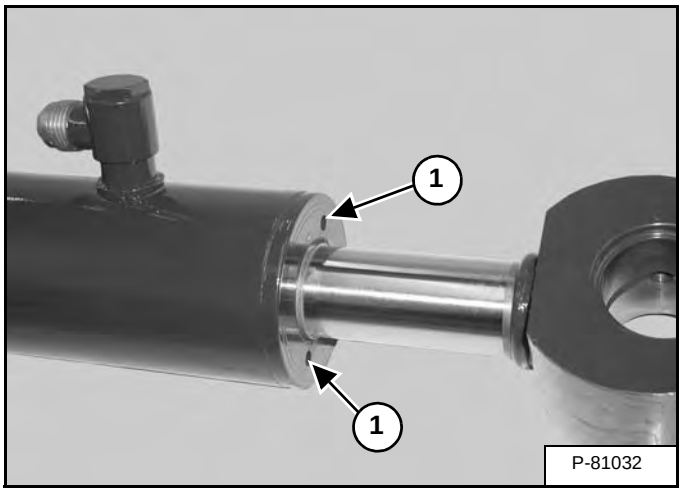
Use the following tools to disassemble the cylinder:

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.

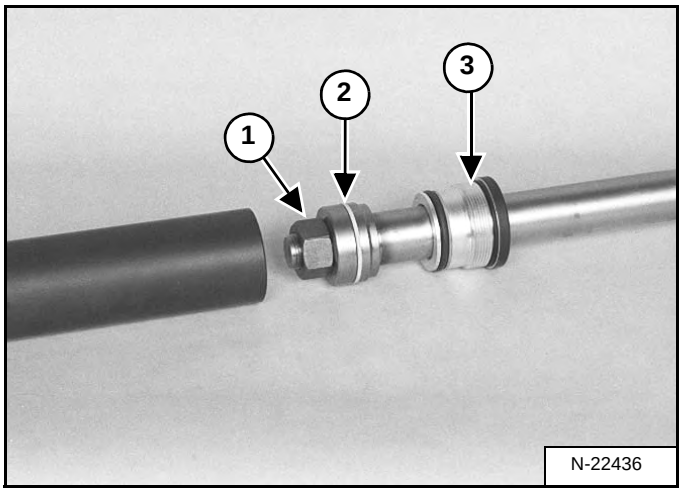
Put the base end of the cylinder in a vise.

Figure 20-24-12



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-24-12]** to loosen the head.

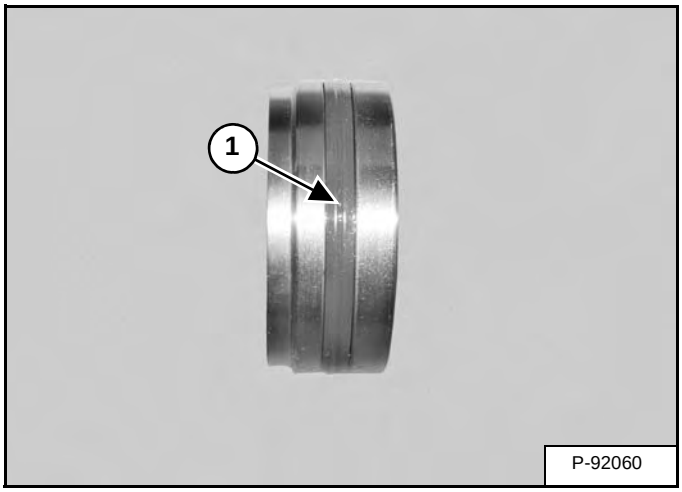
Figure 20-24-13



Remove the head and the rod assembly from the cylinder **[Figure 20-24-13]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-24-13]**.

Figure 20-24-14

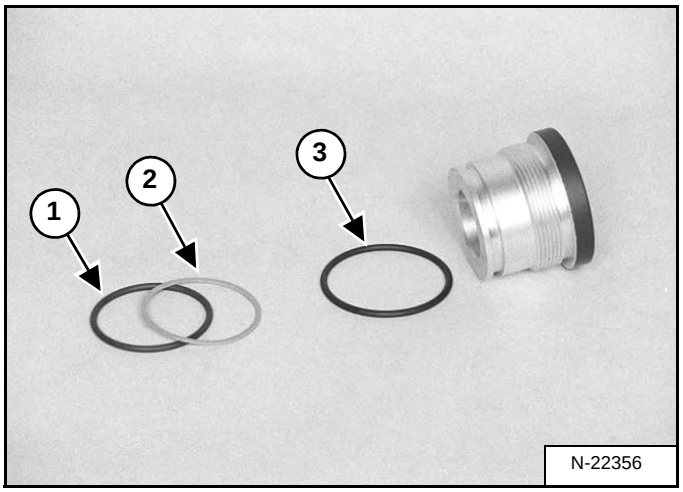


Remove the seal (Item 1) **[Figure 20-24-14]** from the piston.

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Disassembly (Cont'd)

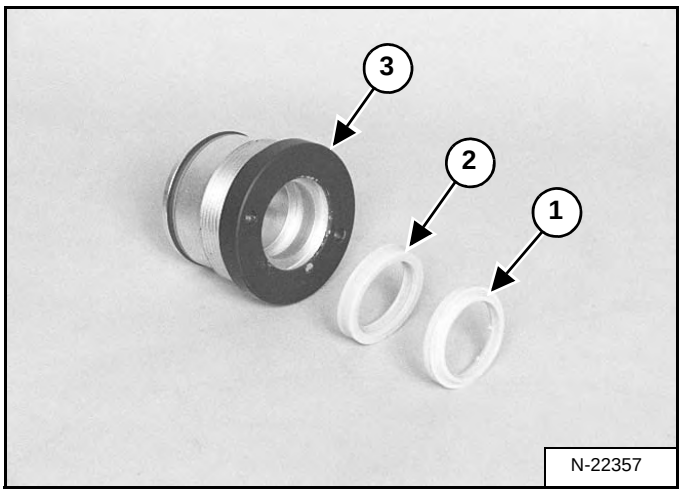
Figure 20-24-15



Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-24-15]** from the head.

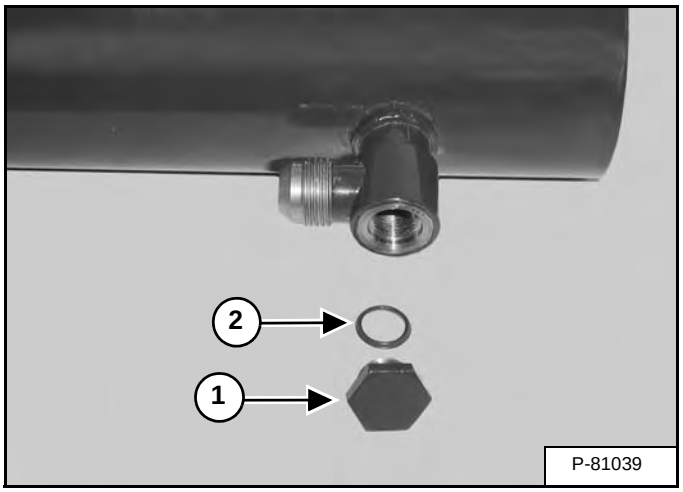
Remove the O-ring (Item 3) **[Figure 20-24-15]**.

Figure 20-24-16



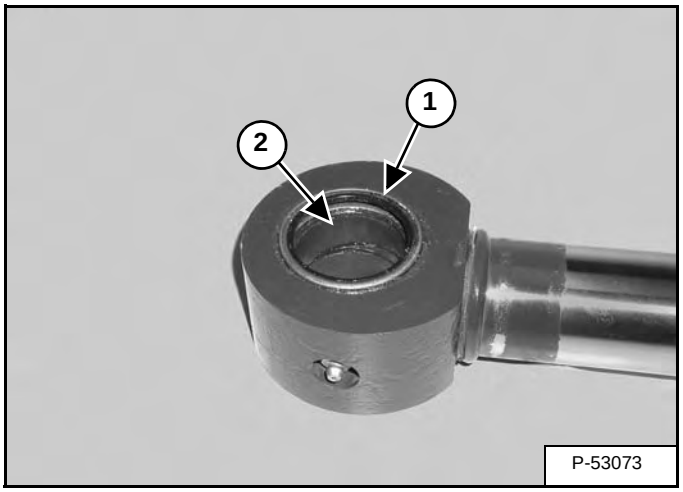
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-24-16]**.

Figure 20-24-17



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-24-17]**.

Figure 20-24-18



Remove the dust seals (Item 1) and bushing (Item 2) **[Figure 20-24-18]**.

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Assembly

Clean all parts in solvent and dry with compressed air.

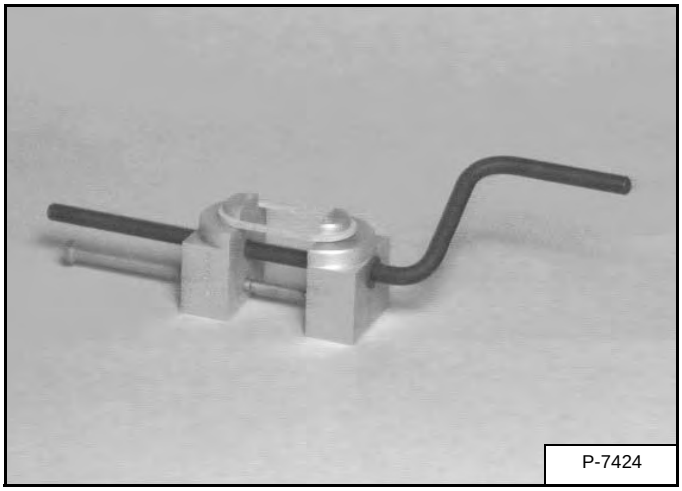
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Use the following tools to assemble the cylinder:

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

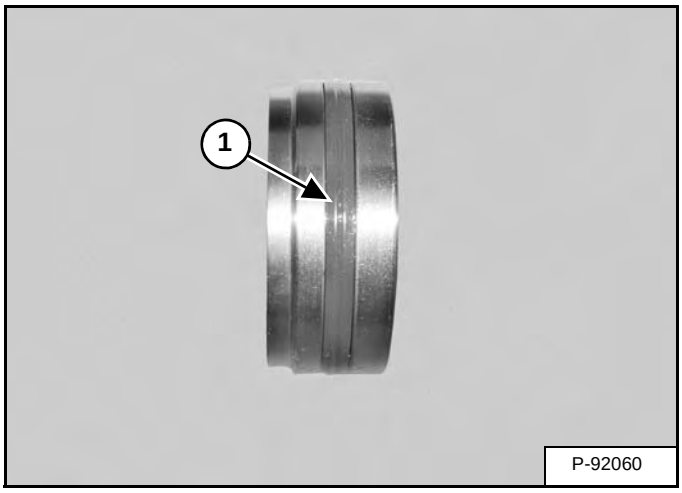
Figure 20-24-19



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-24-19]**.

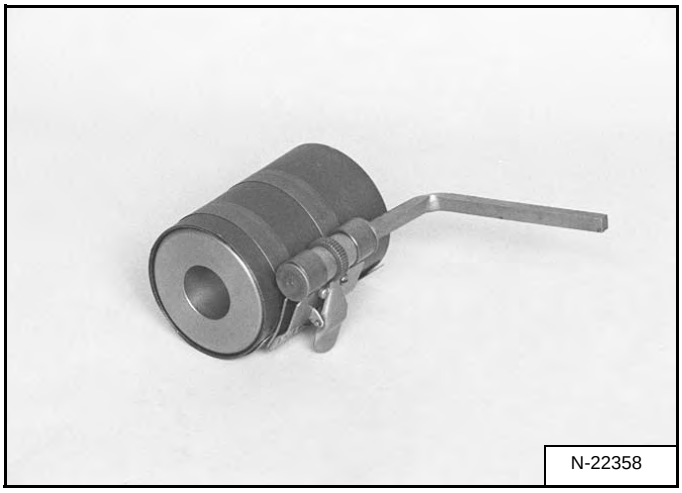
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-24-20



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

Figure 20-24-21

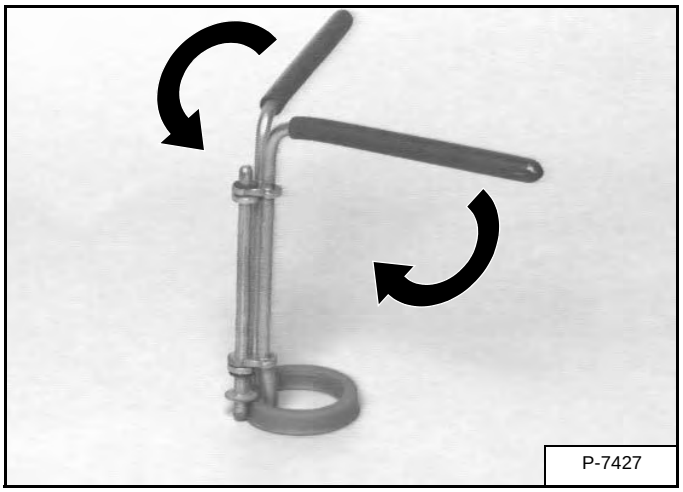


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-24-21]**.

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Assembly (Cont'd)

Figure 20-24-22

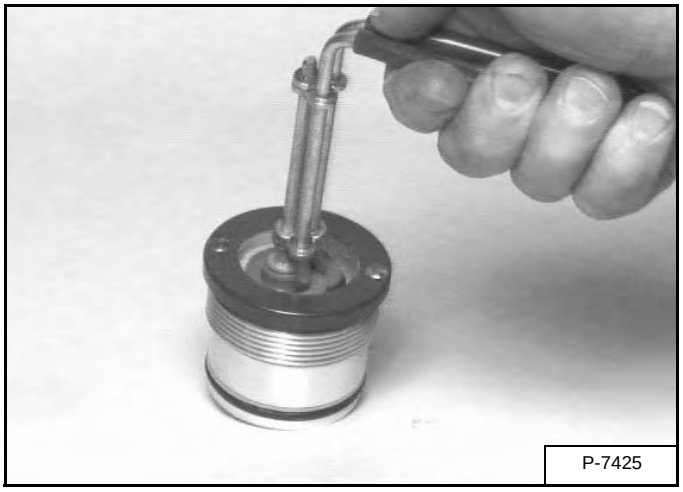


Install the rod seal on the rod seal tool **[Figure 20-24-22]**.

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

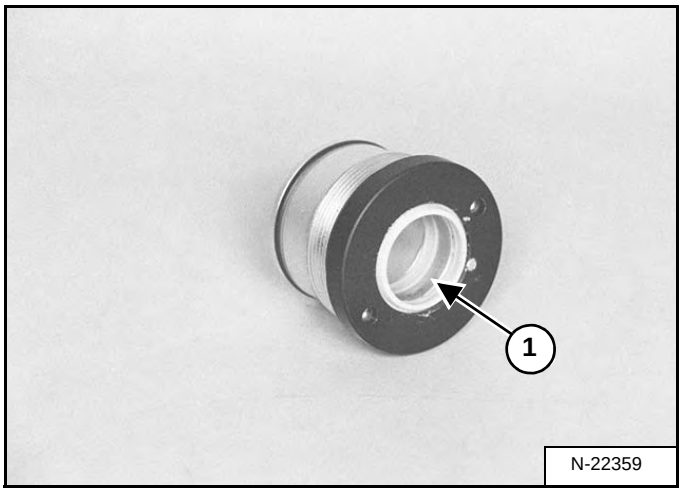
Rotate the handles to collapse the rod seal **[Figure 20-24-22]**.

Figure 20-24-23



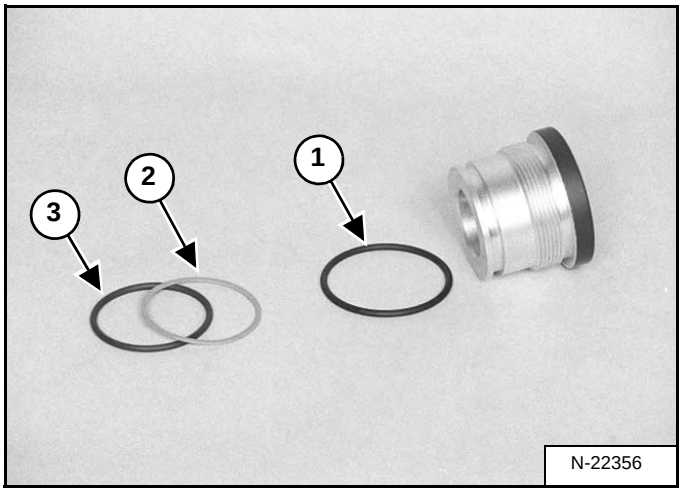
Install the rod seal in the head **[Figure 20-24-23]**.

Figure 20-24-24



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

Figure 20-24-25



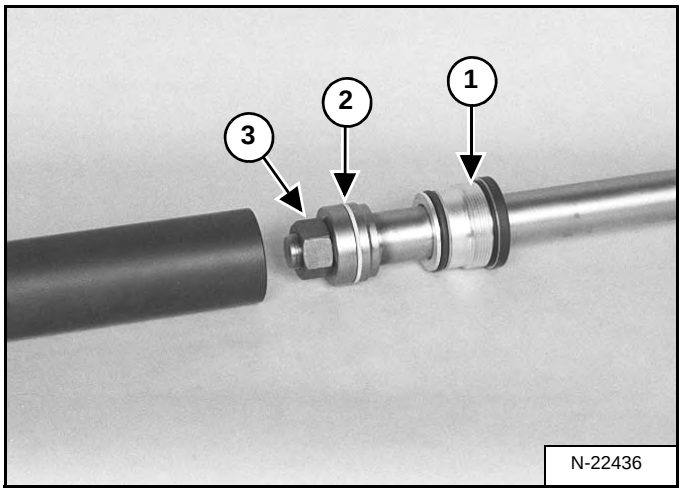
Install the O-ring (Item 1) **[Figure 20-24-25]**.

Install the back-up ring (Item 2) and O-ring (Item 3) **[Figure 20-24-25]**.

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Assembly (Cont'd)

Figure 20-24-26



Install the head (Item 1) and the piston (Item 2) **[Figure 20-24-26]** on the rod as shown.

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

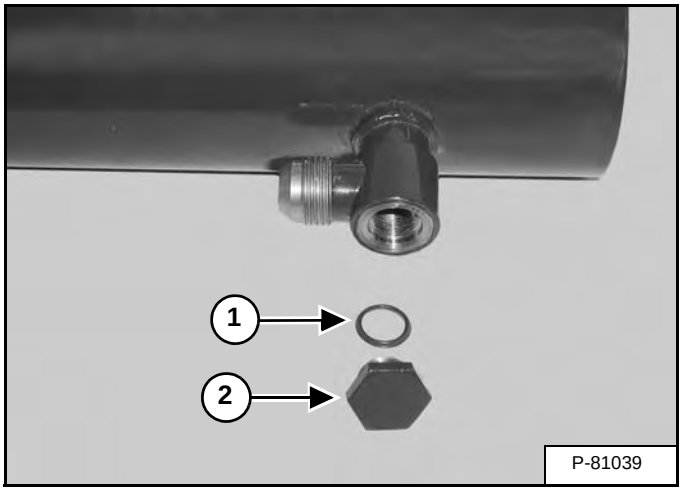
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-24-26]**.

Tighten the nut to 1491 N•m (1100 ft-lb) torque.

Figure 20-24-27

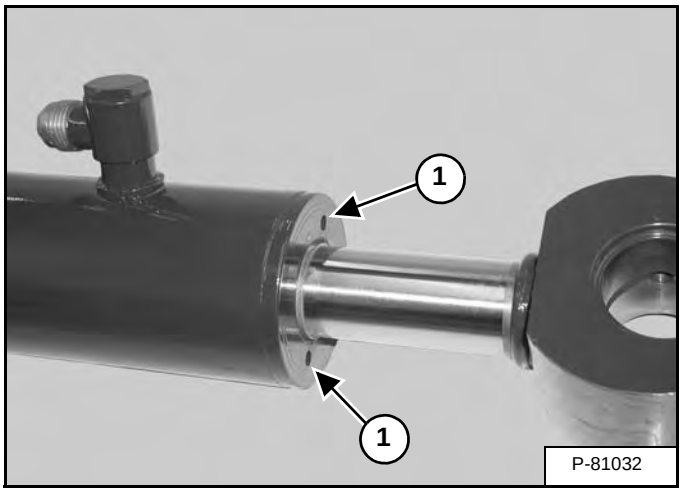


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-24-27]**.

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

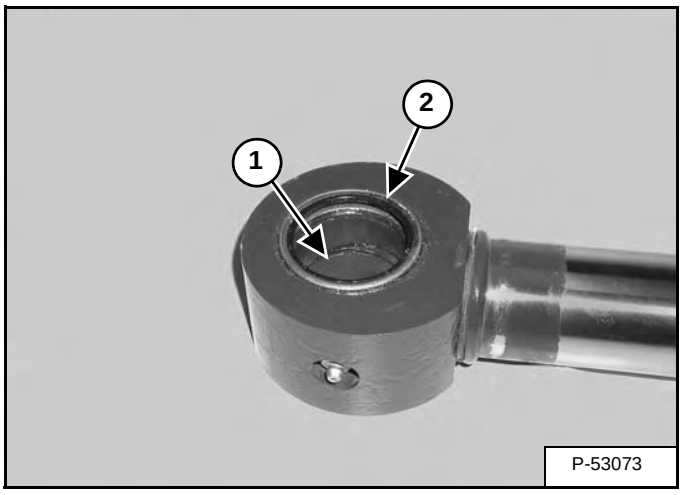
Put the base end of the cylinder in a vise.

Figure 20-24-28



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-24-28]** to tighten the head. Head to be torqued until flush with the end of the housing.

Figure 20-24-29



Install the bushing (Item 1) **[Figure 20-24-29]**. The bushing must be aligned with the grease channel in the rod end of the cylinder.

Install the dust seal (Item 2) **[Figure 20-24-29]** on both sides of the rod end.

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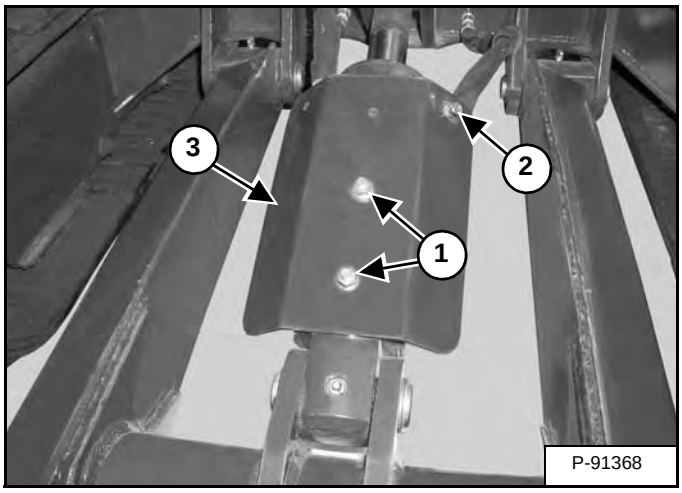
CYLINDER (BLADE)

Testing

Lower the work group 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 20-25-1

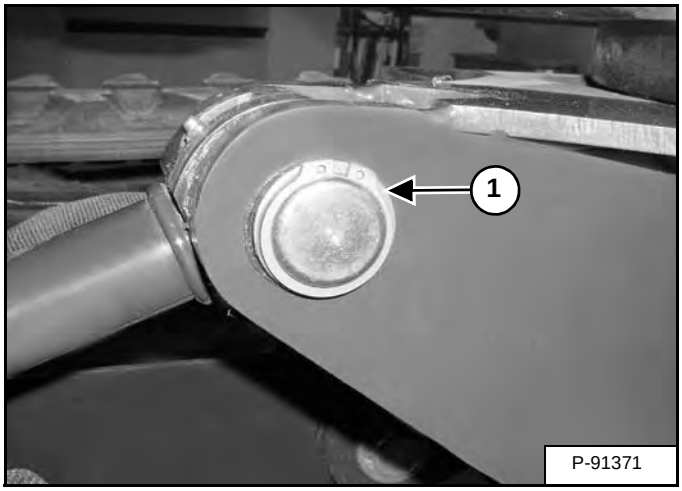


Remove the two nuts (Item 1) **[Figure 20-25-1]** from the studs.

Remove the bolt and nut (Item 2) **[Figure 20-25-1]** from the cylinder shield.

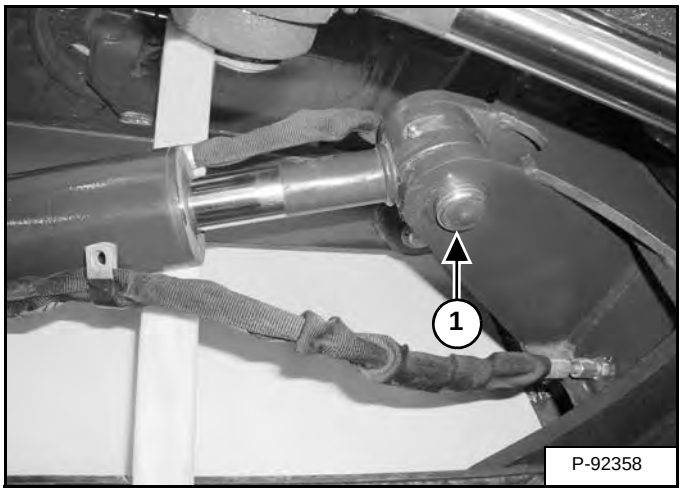
Remove the shield (Item 3) **[Figure 20-25-1]**.

Figure 20-25-2



Remove the snap ring (Item 1) **[Figure 20-25-2]** and washer from the cylinder rod end.

Figure 20-25-3



Support the cylinder and remove the pin (Item 1) **[Figure 20-25-3]**.

Figure 20-25-4



Start the engine and retract the blade cylinder **[Figure 20-25-4]**.

Stop the engine. Move the blade lever in both directions to release hydraulic pressure.

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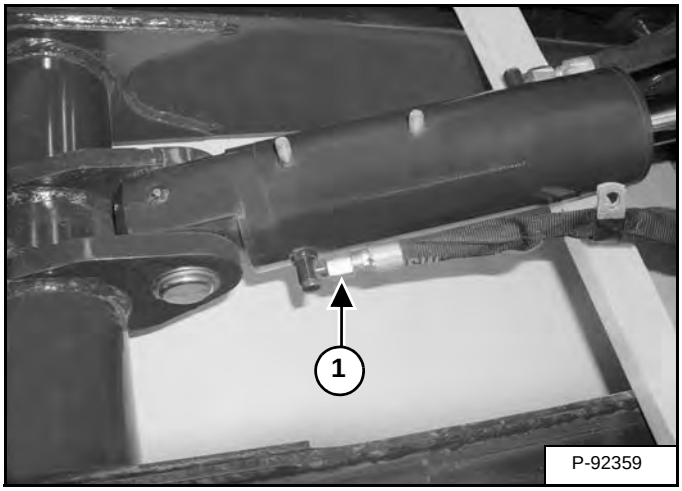
Testing (Cont'd)

⚠ WARNING

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

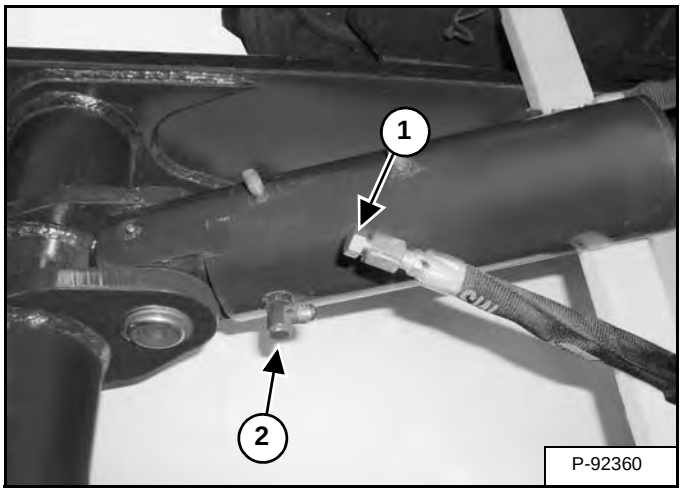
W-2145-0290

Figure 20-25-5



Remove the blade cylinder base and end hose (Item 1) **[Figure 20-25-5]**.

Figure 20-25-6



Install a plug (Item 1) **[Figure 20-25-6]** on the hose fitting and tighten.

Start the engine and retract the blade cylinder.

If there is any leakage from the base end fitting (Item 2) **[Figure 20-25-6]** on the blade cylinder, remove the cylinder for repair or replacement.

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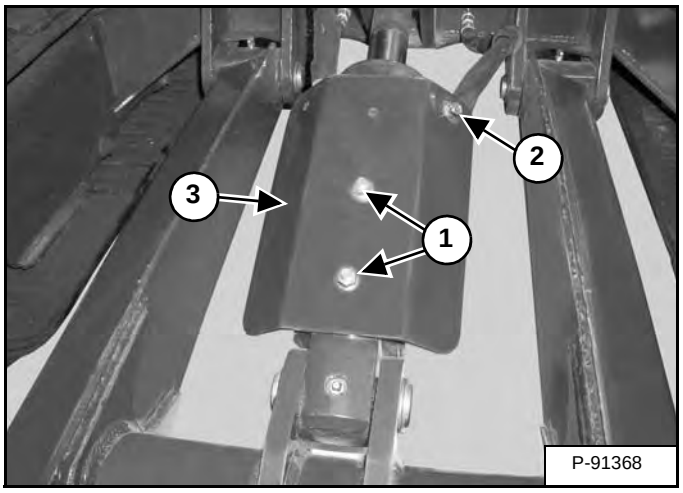
CYLINDER (BLADE) (CONT'D)

Removal And Installation

Lower the work group 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 20-25-7

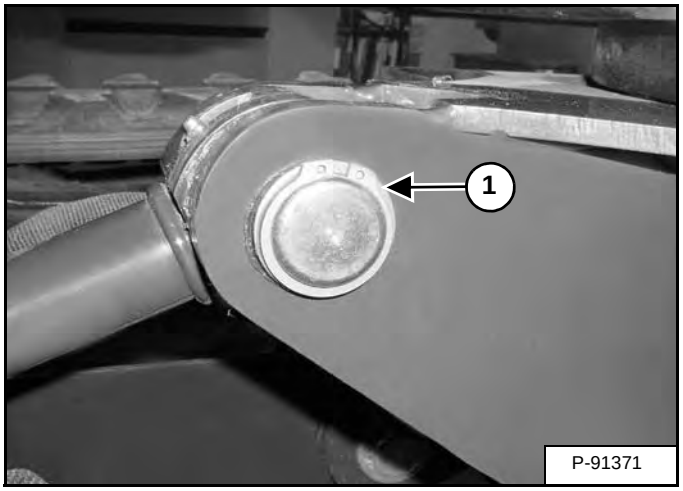


Remove the two nuts (Item 1) **[Figure 20-25-7]** from the studs.

Remove the bolt (Item 2) **[Figure 20-25-7]** and nut from the cylinder shields.

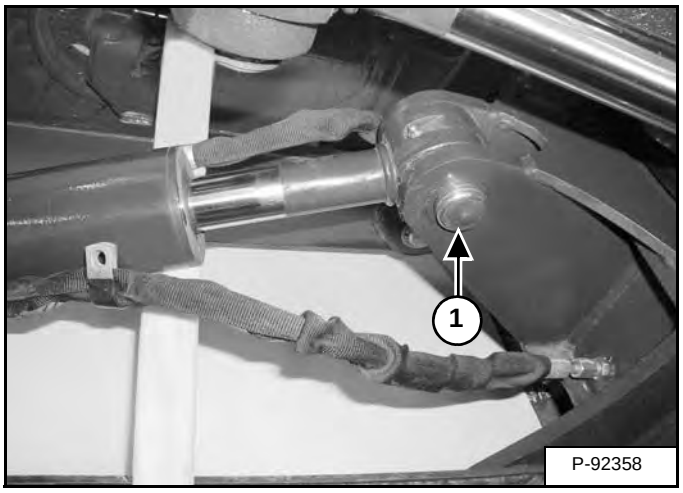
Remove the shield (Item 3) **[Figure 20-25-7]**.

Figure 20-25-8



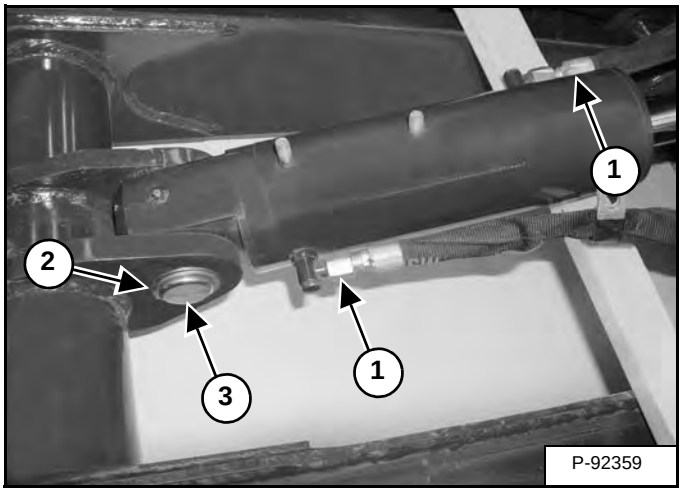
Remove the snap ring (Item 1) **[Figure 20-25-8]** and washer from the cylinder rod end.

Figure 20-25-9



Support the cylinder and remove the pin (Item 1) **[Figure 20-25-9]**.

Figure 20-25-10



Remove the hoses (Item 1) **[Figure 20-25-10]**.

Remove the base end snap ring and washer (Item 2) **[Figure 20-25-10]**.

Remove the base end pin (Item 3) **[Figure 20-25-10]** and remove the blade cylinder.

IMPORTANT

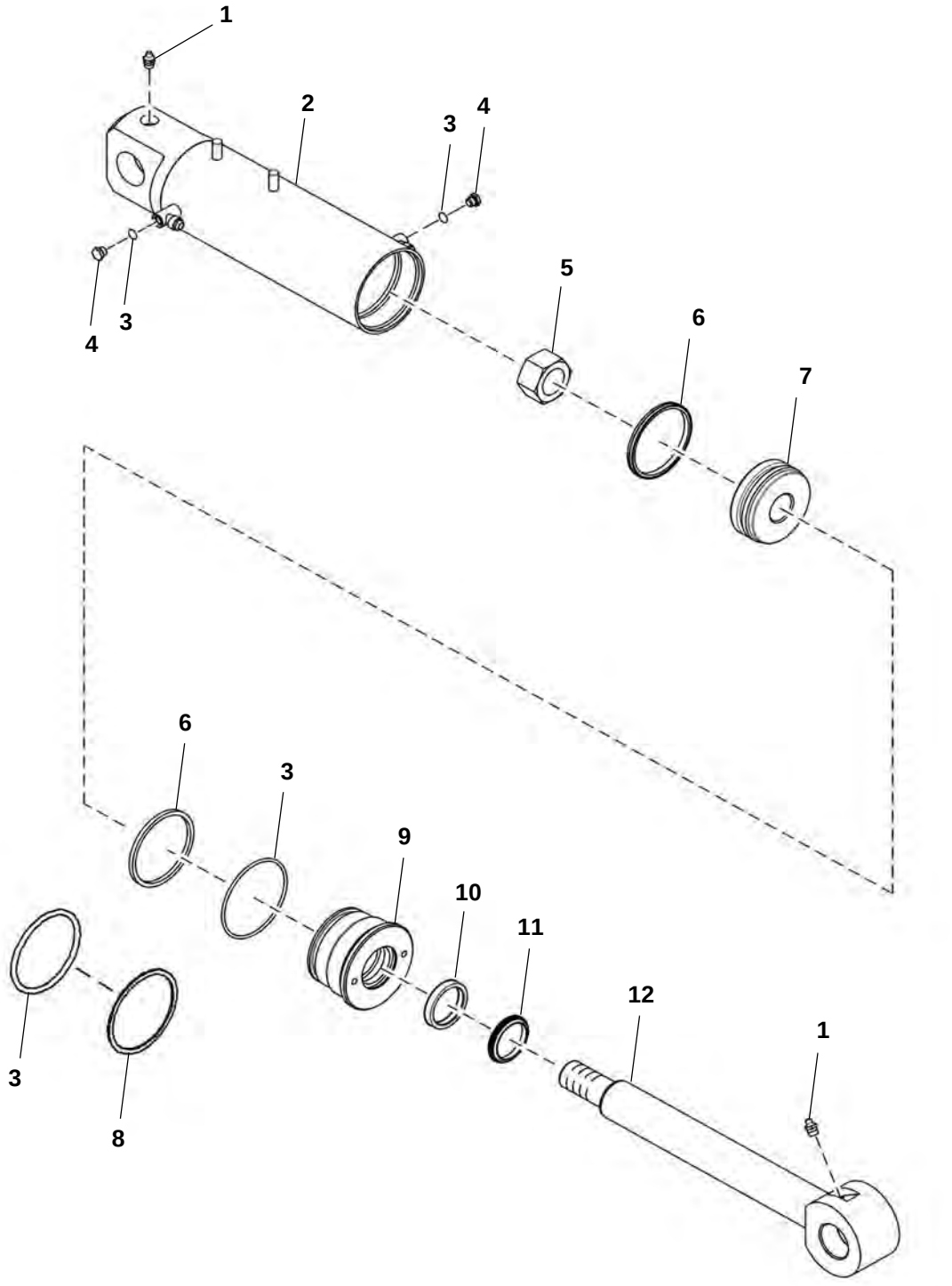
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

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Parts Identification

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



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Disassembly

Clean the outside of the cylinder before disassembly.

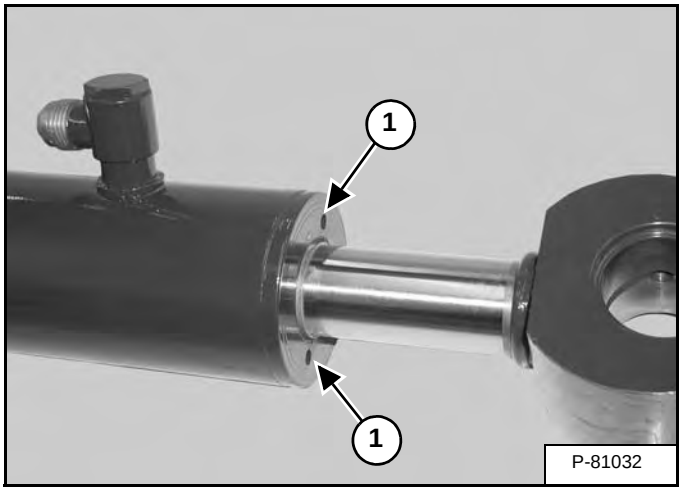
Use the following tools to disassemble the cylinder:

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.

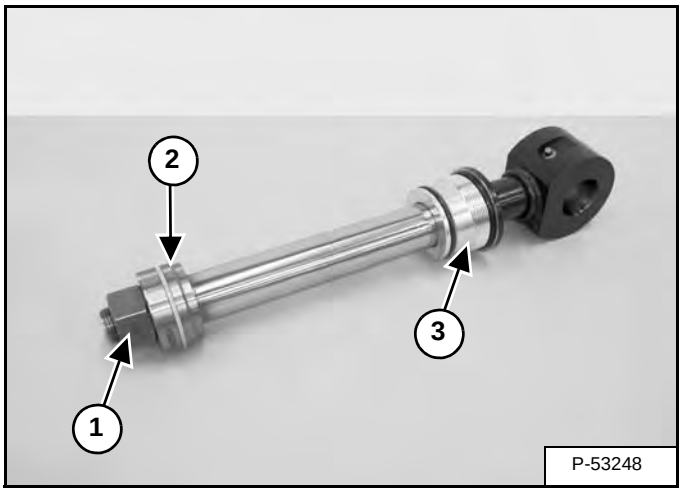
Put the base end of the cylinder in a vise.

Figure 20-25-11



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-25-11]** to loosen the head.

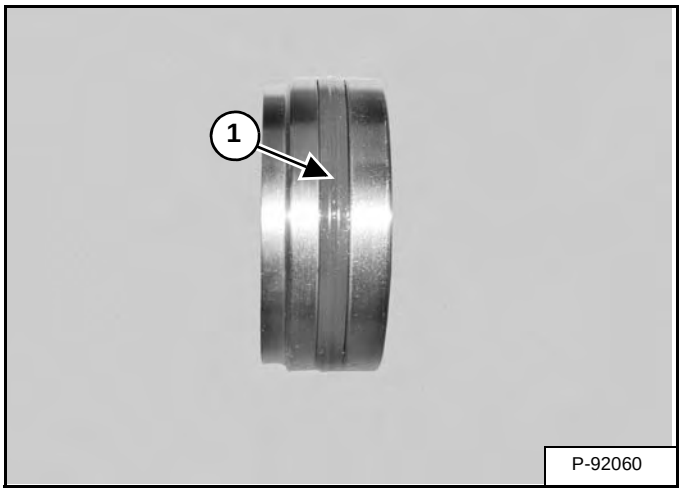
Figure 20-25-12



Remove the head and the rod assembly from the cylinder **[Figure 20-25-12]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-25-12]**.

Figure 20-25-13

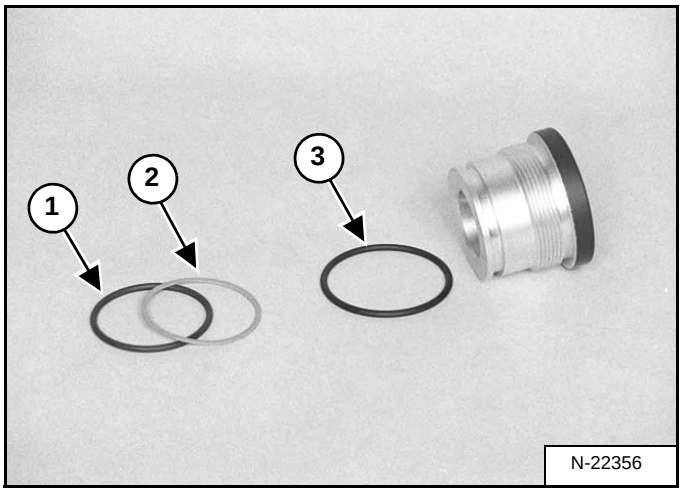


Remove the seal (Item 1) **[Figure 20-25-13]** from the piston.

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Disassembly (Cont'd)

Figure 20-25-14

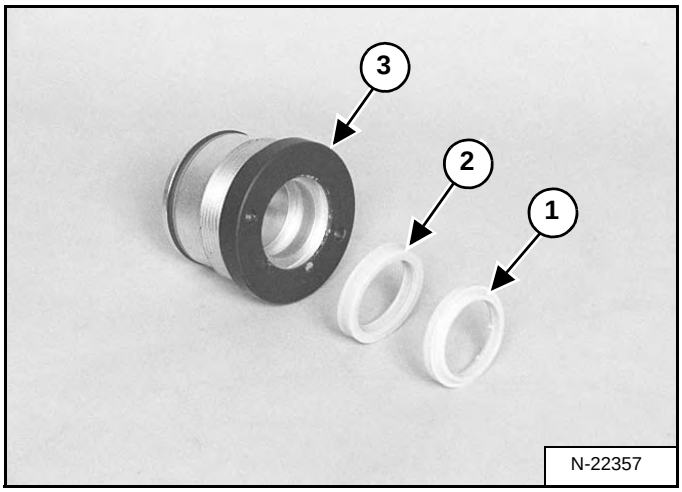


Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-25-14]**.

NOTE: The O-ring (Item 1) and back-up ring (Item 2) [Figure 20-25-14] are no longer available parts. The seal kit will contain a one piece seal that is used in place of the O-ring and back-up ring.

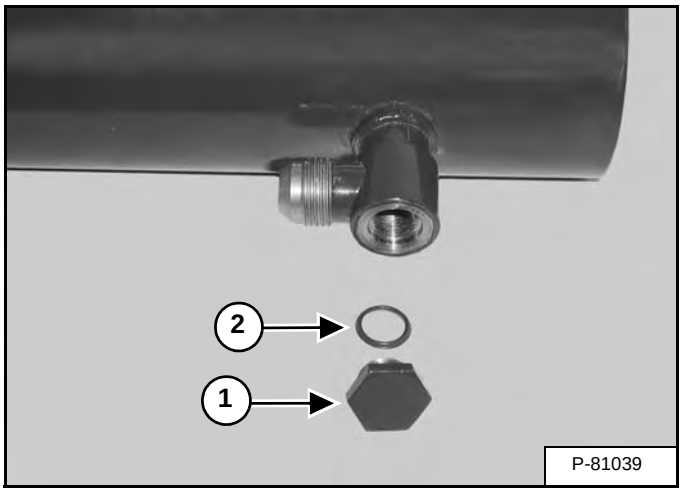
Remove the O-ring (Item 3) **[Figure 20-25-14]**.

Figure 20-25-15



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-25-15]**.

Figure 20-25-16



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-25-16]**.

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Assembly

Clean all parts in solvent and dry with compressed air.

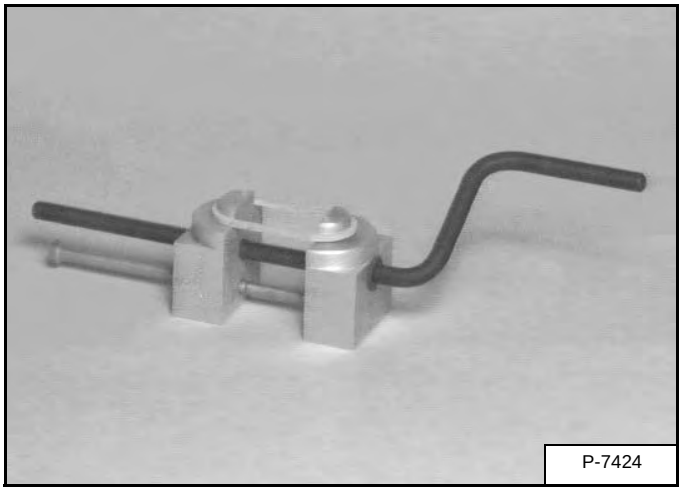
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Use the following tools to assemble the cylinder:

MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
MEL1396-2 - Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

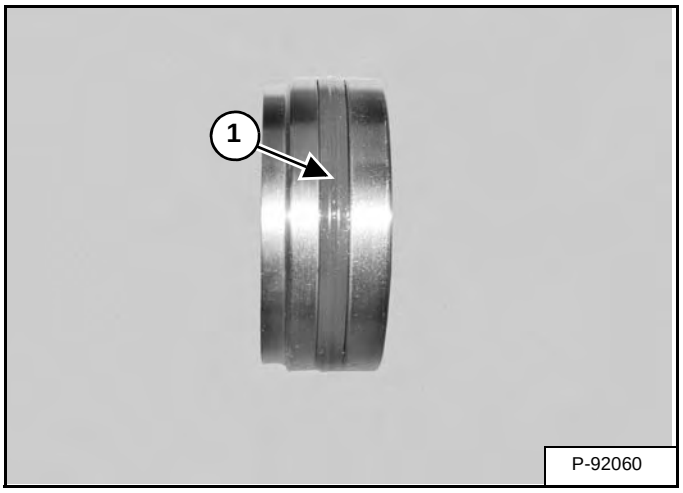
Figure 20-25-17



Install the new seal on the tool and slowly stretch it until it fits the piston **[Figure 20-25-17]**.

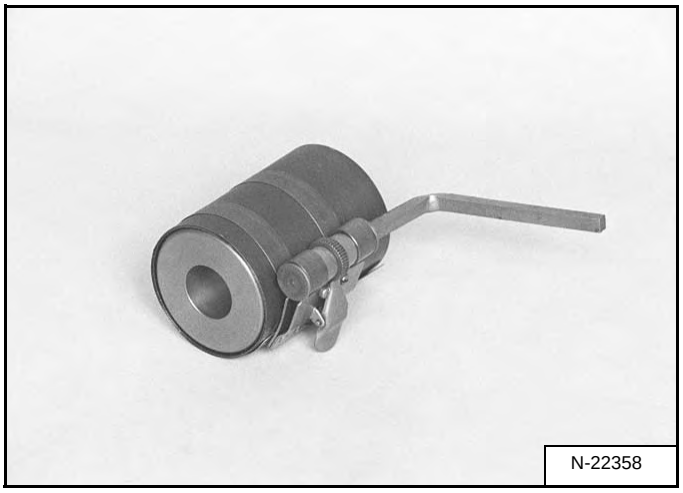
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-25-18



Install the seal (Item 1) **[Figure 20-25-18]** on the piston.

Figure 20-25-19

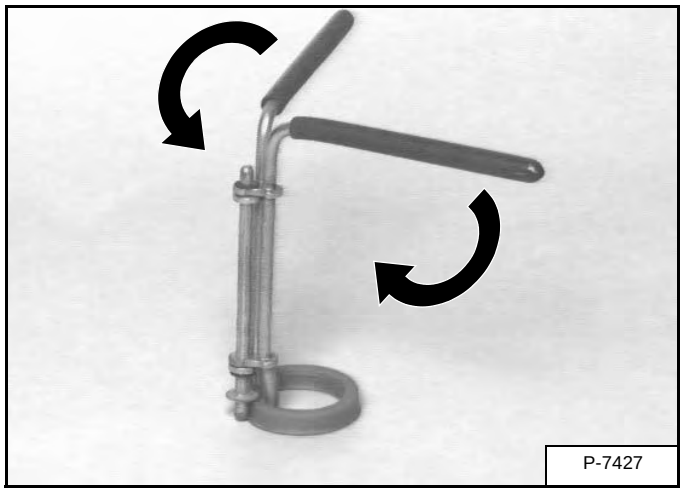


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-25-19]**.

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Assembly (Cont'd)

Figure 20-25-20

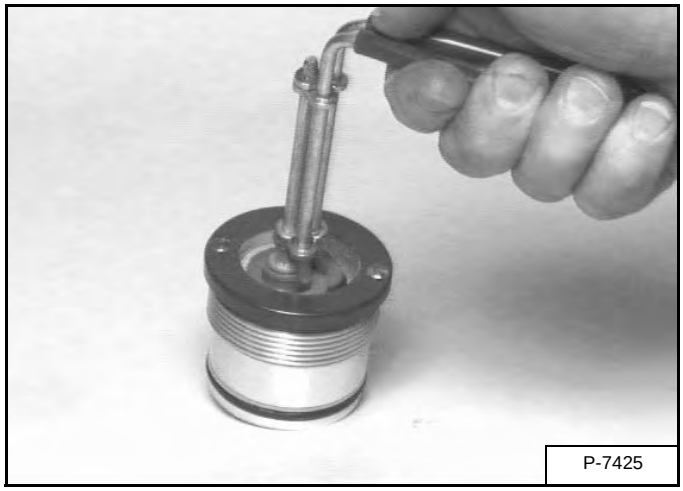


Install the rod seal on the rod seal tool **[Figure 20-25-20]**.

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

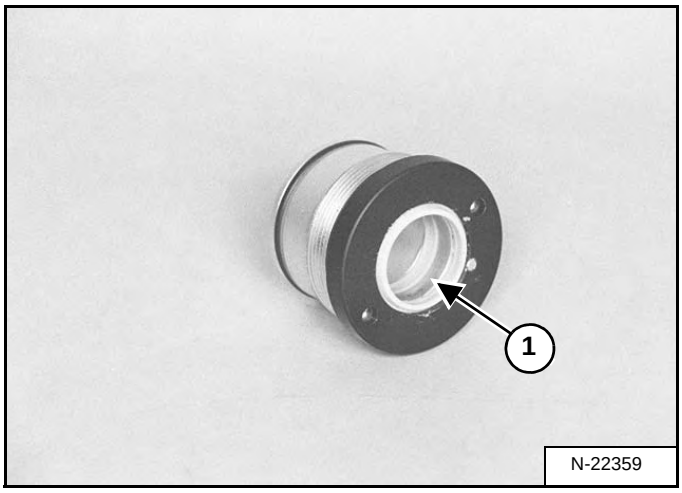
Rotate the handles to collapse the rod seal **[Figure 20-25-20]**.

Figure 20-25-21



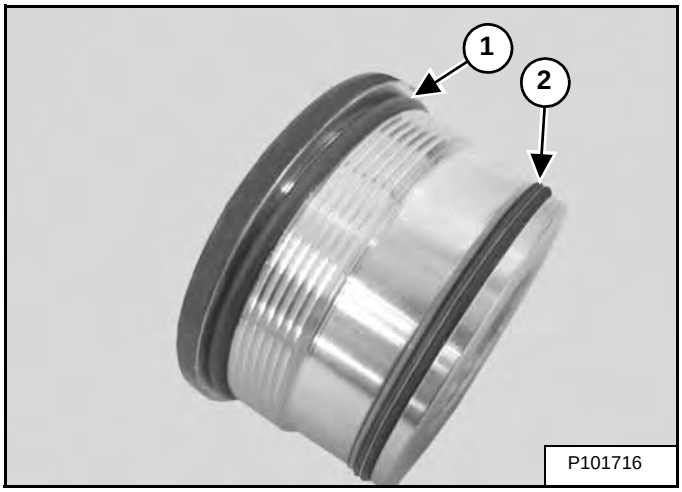
Install the rod seal in the head **[Figure 20-25-21]**.

Figure 20-25-22



Install the wiper seal with the wiper (Item 1) **[Figure 20-25-22]** toward the outside of the head.

Figure 20-25-23



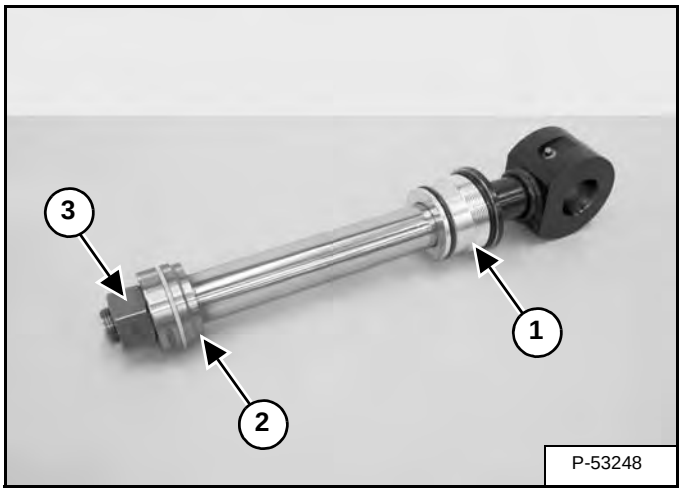
Install the O-ring (Item 1) **[Figure 20-25-23]**.

Install the seal (Item 2) **[Figure 20-25-23]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-25-24



Install the head (Item 1) and piston (Item 2) **[Figure 20-25-24]** on the rod.

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

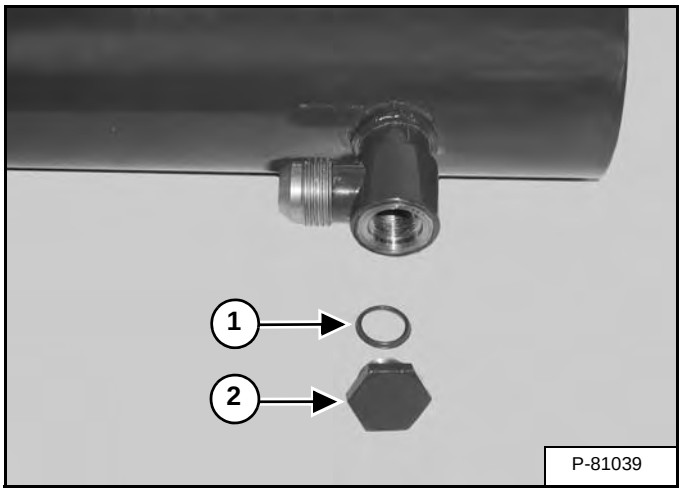
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-25-24]**.

Tighten the nut to 1491 N•m (1100 ft-lb) torque.

Figure 20-25-25

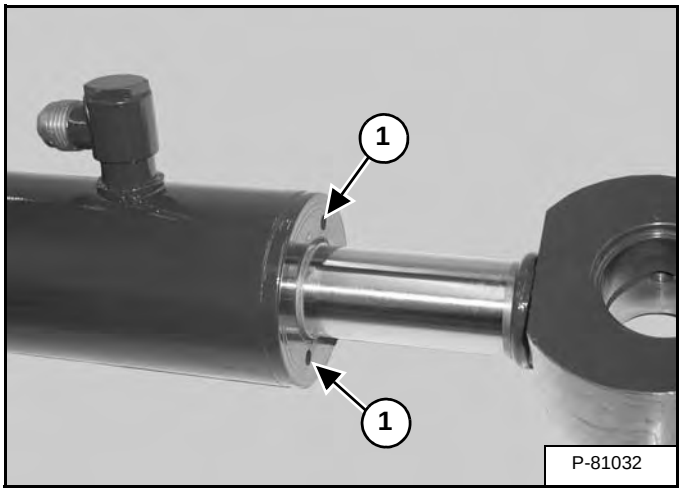


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-25-25]**.

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

Put the base end of the cylinder in a vise.

Figure 20-25-26



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-25-26]** to tighten the head. Head to be torqued until flush with the end of the housing.

Dealer Copy -- Not for Resale

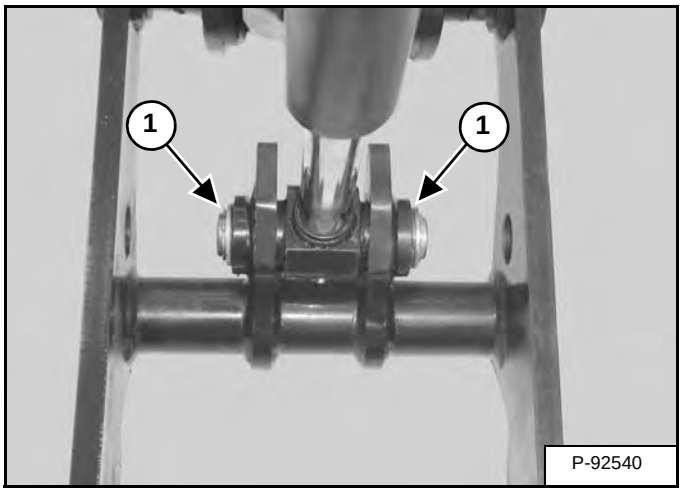


Dealer Copy -- Not for Resale

CYLINDER (CLAMP)

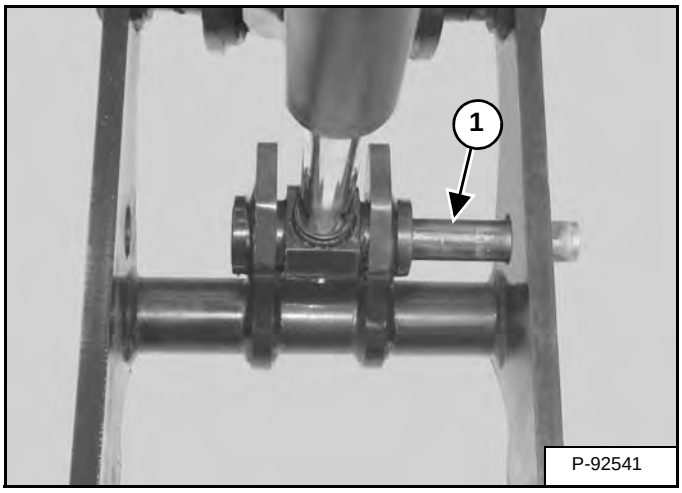
Testing

Figure 20-26-1



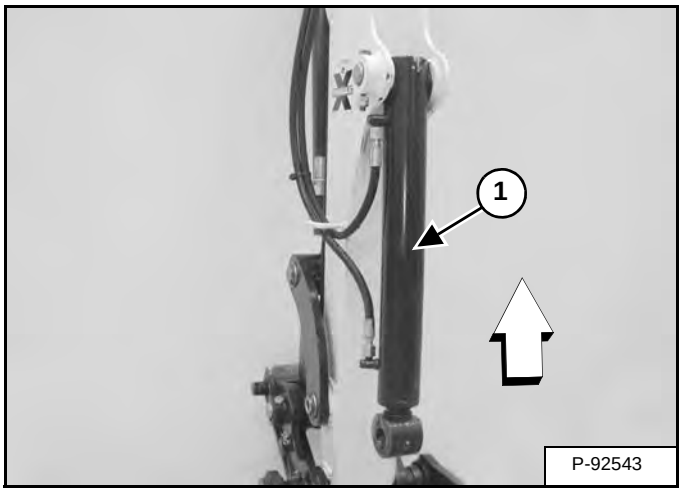
Remove the snap ring (Item 1) **[Figure 20-26-1]** and washer from the clamp cylinder pin.

Figure 20-26-2



Remove the pin (Item 1) **[Figure 20-26-2]** from the rod end of the clamp cylinder.

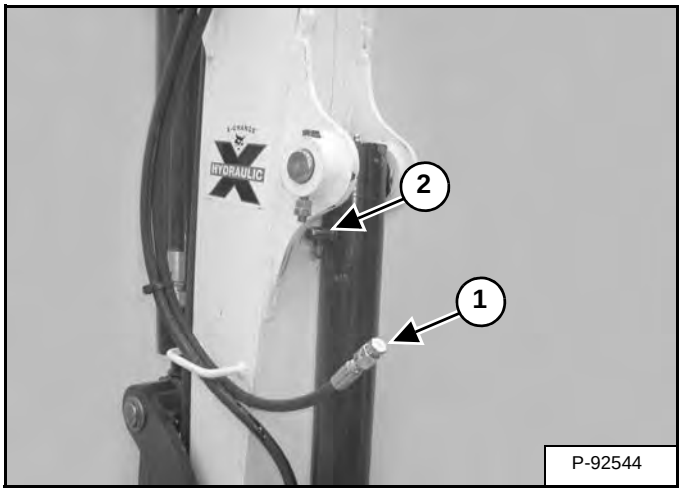
Figure 20-26-3



Start the engine and retract the clamp cylinder (Item 1) **[Figure 20-26-3]**.

Stop the engine.

Figure 20-26-4



Disconnect the hydraulic hose (Item 1) **[Figure 20-26-4]** from the base end of the cylinder.

Plug the hose (Item 1) **[Figure 20-26-4]**.

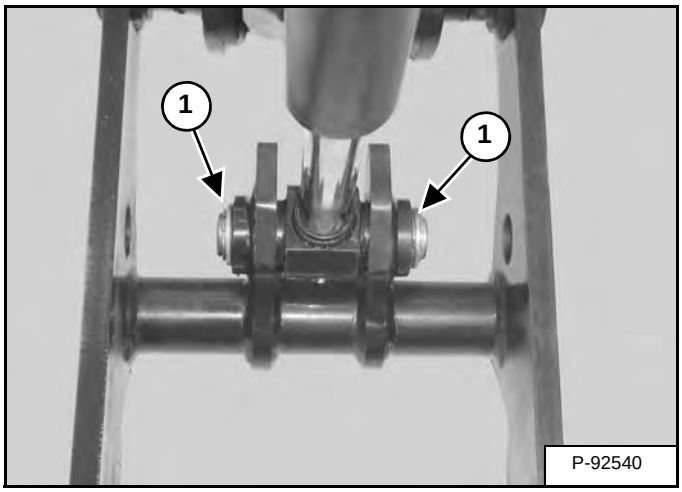
Start the engine and retract the cylinder.

If there is any oil leakage from the base end fitting (Item 2) **[Figure 20-26-4]** on the cylinder, remove the cylinder for repair or replacement.

Dealer Copy -- Not for Resale

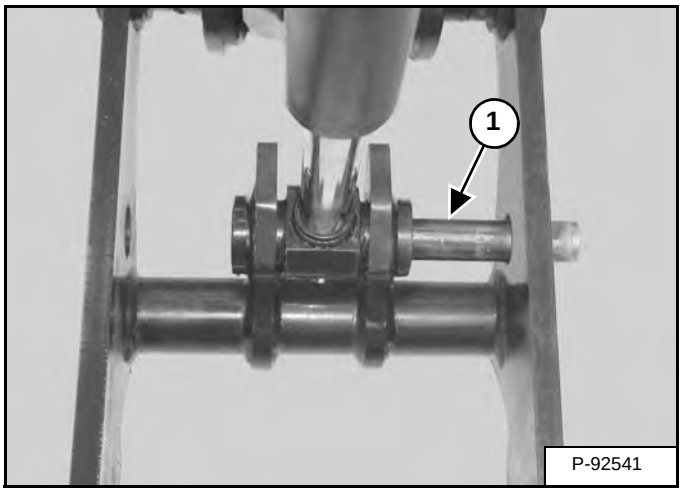
Removal And Installation

Figure 20-26-5



Remove the snap rings (Item 1) **[Figure 20-26-5]** and washers.

Figure 20-26-6

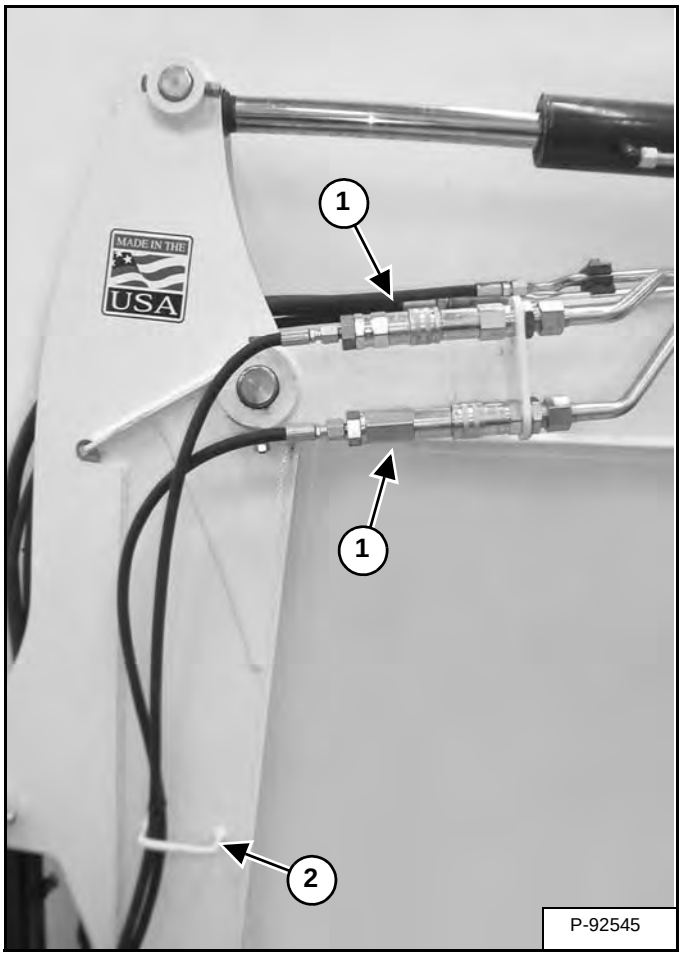


Remove the pin (Item 1) **[Figure 20-26-6]**.

Start the engine and retract the cylinder.

Stop the engine.

Figure 20-26-7

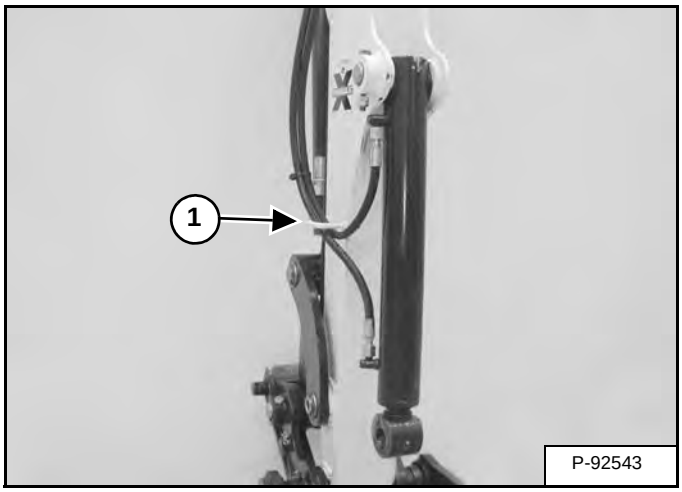


Disconnect the quick couplers (Item 1) and remove the hoses from the top hose guide (Item 2) **[Figure 20-26-7]**.

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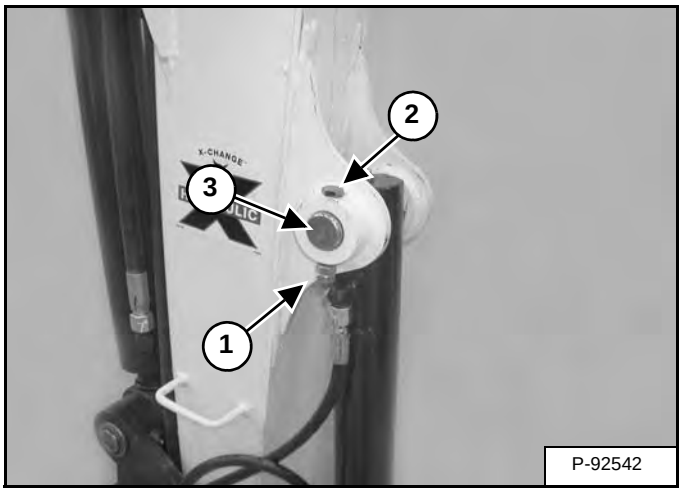
Removal And Installation (Cont'd)

Figure 20-26-8



Remove the hoses from the bottom hose guide (Item 1) **[Figure 20-26-8]**.

Figure 20-26-9



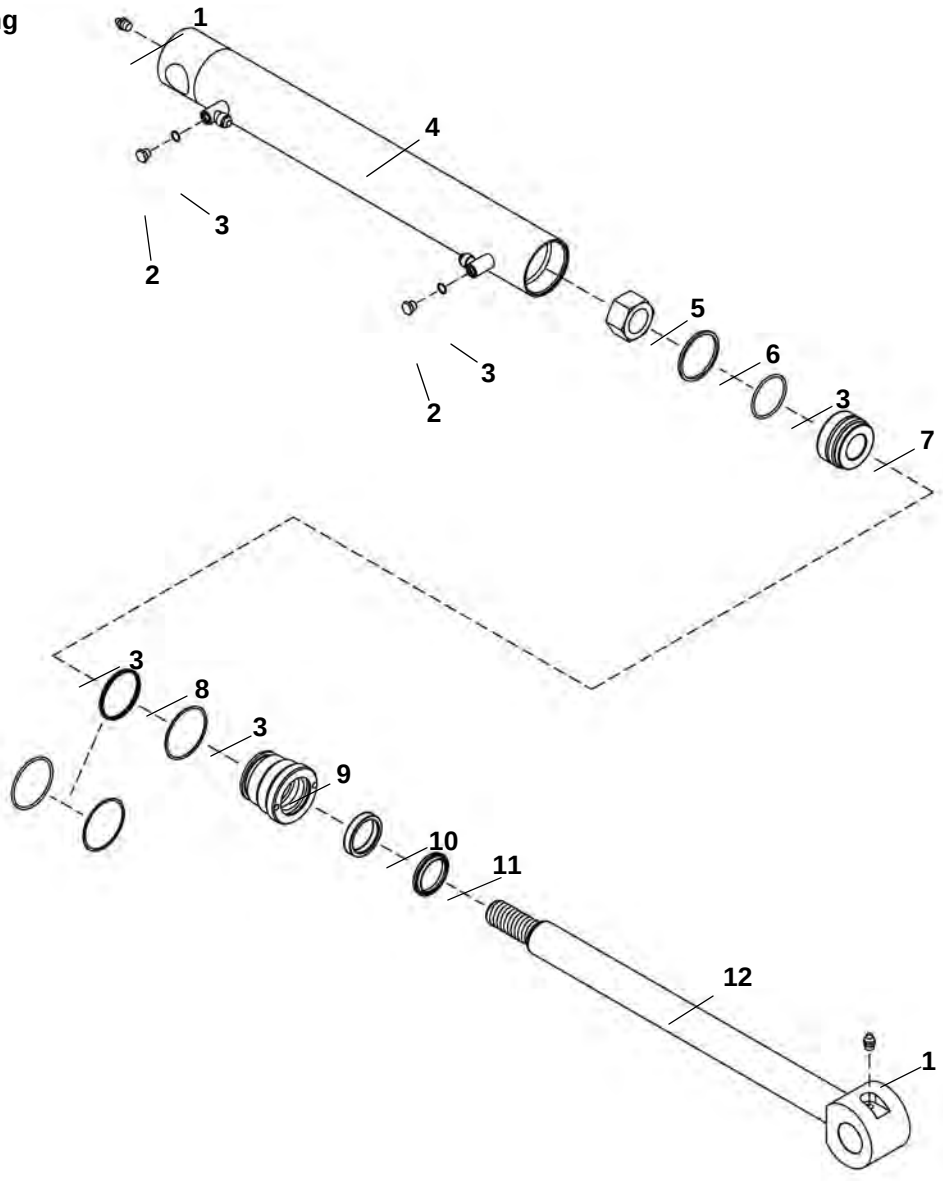
Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-26-9]**.

Remove the pin (Item 3) **[Figure 20-26-9]** and remove the cylinder.

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Parts Identification

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



PE3415S

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CYLINDER (CLAMP) (CONT'D)

Disassembly

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

Clean the outside of the clamp cylinder before disassembly.

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

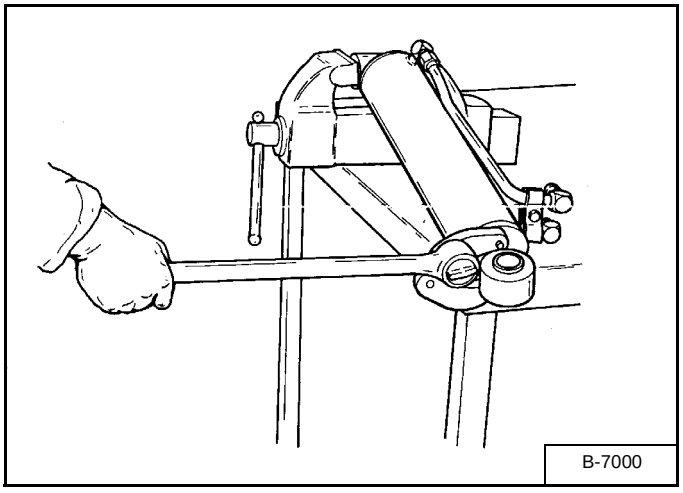
MEL1075 - Adjustable Gland Nut Wrench
MEL1074 - O-ring Seal Hook
MEL1396 - Seal Installation Tool
MEL1033 - Rod Seal Installation Tool

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

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

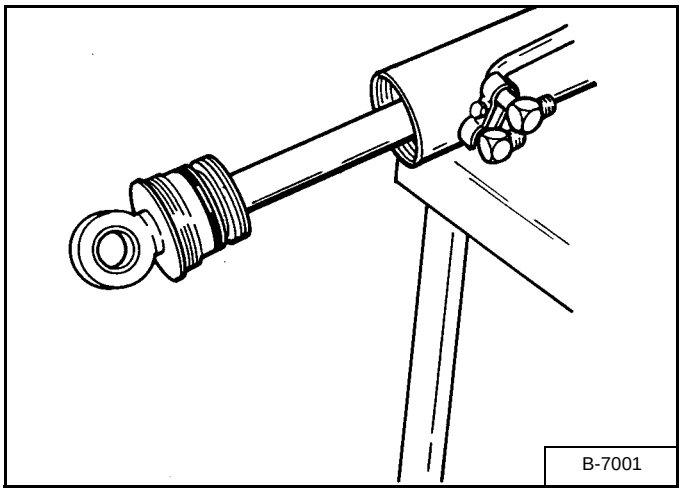
Put the base end of the cylinder in a vise.

Figure 20-26-10



Use the adjustable gland nut wrench to loosen the head **[Figure 20-26-10]**.

Figure 20-26-11

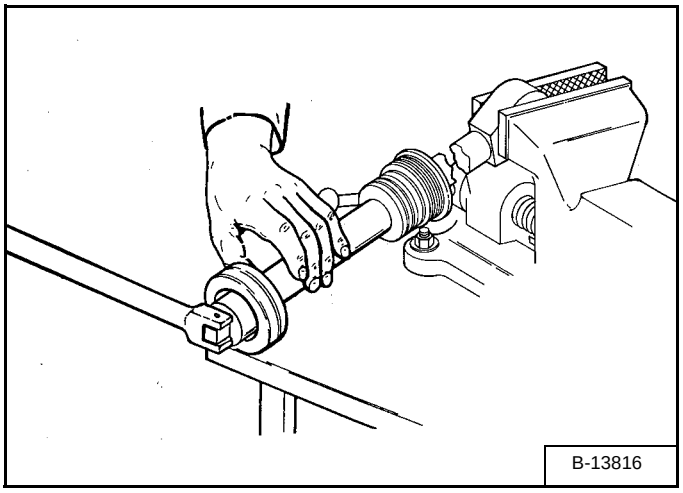


Remove the rod assembly from the cylinder housing **[Figure 20-26-11]**.

Remove the cylinder housing from the vise.

Put the rod end in the vise.

Figure 20-26-12



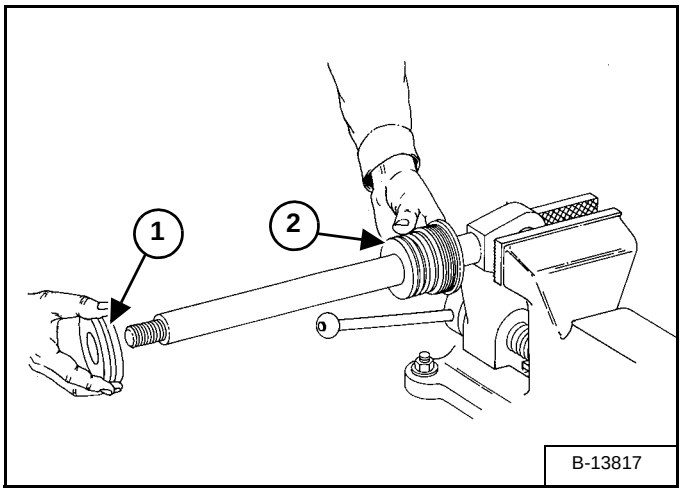
Loosen the nut from the piston end of the rod **[Figure 20-26-12]**.

Dealer Copy -- Not for Resale

CYLINDER (CLAMP) (CONT'D)

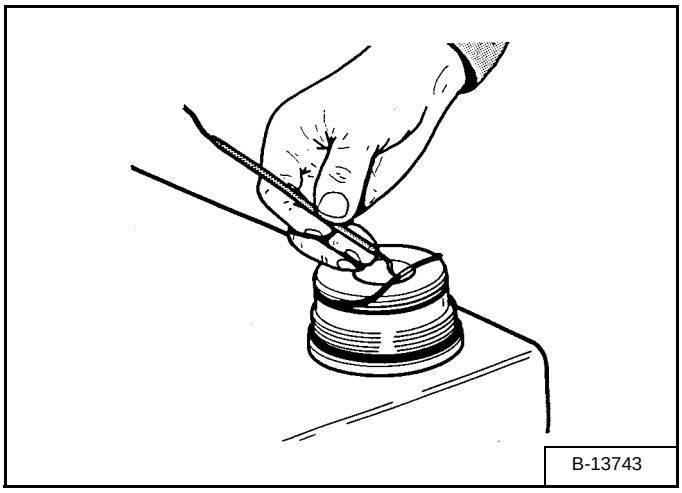
Disassembly (Cont'd)

Figure 20-26-13



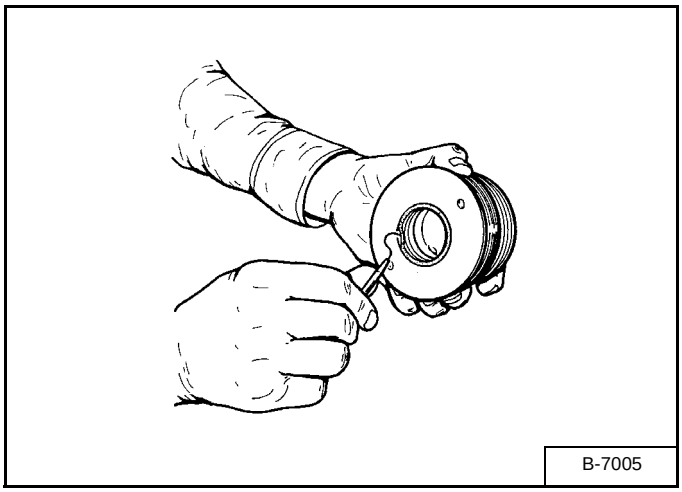
Remove the piston (Item 1) and head (Item 2) **[Figure 20-26-13]**.

Figure 20-26-14



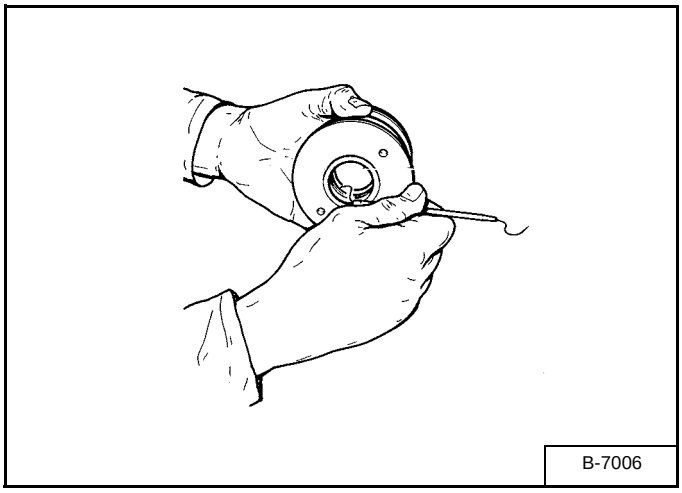
Remove the O-ring and back-up ring from the head with seal hook **[Figure 20-26-14]**.

Figure 20-26-15



Remove the wiper seal **[Figure 20-26-15]**.

Figure 20-26-16

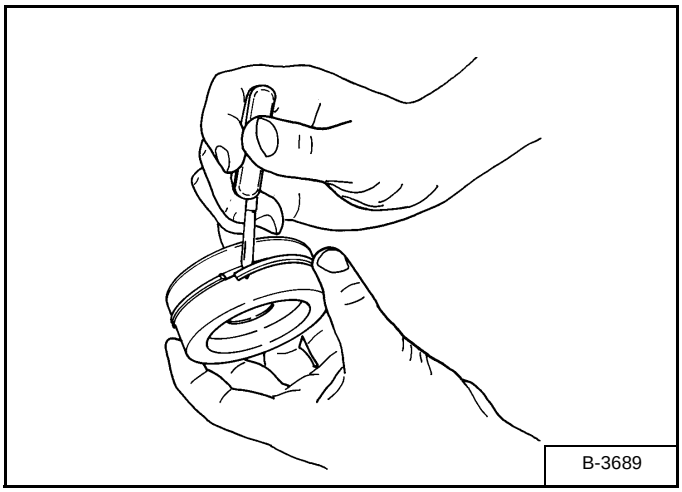


Remove the oil seal from the head **[Figure 20-26-16]**.

Dealer Copy -- Not for Resale

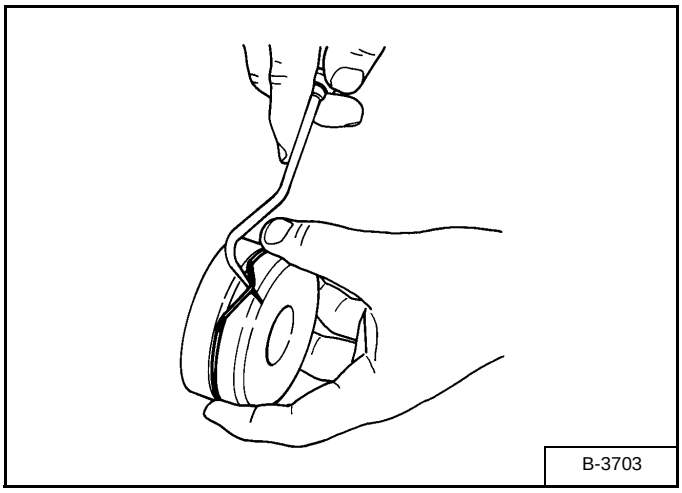
Disassembly (Cont'd)

Figure 20-26-17



Cut the old teflon seal and remove the seal from the piston **[Figure 20-26-17]**.

Figure 20-26-18



Remove the O-ring from the piston **[Figure 20-26-18]**.

Dealer Copy -- Not for Resale

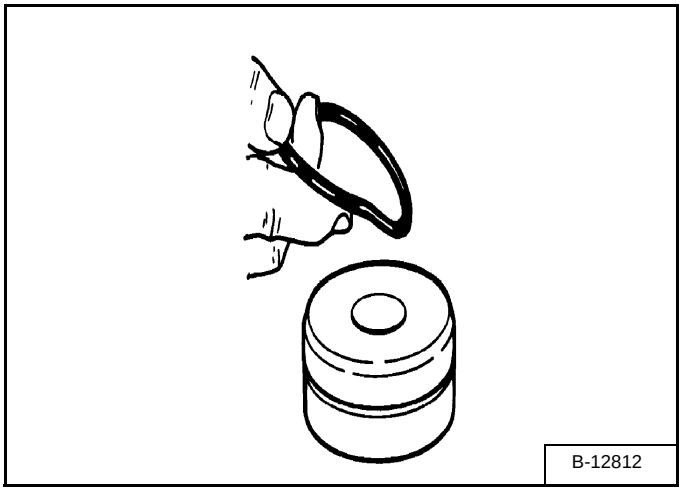
Assembly

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.

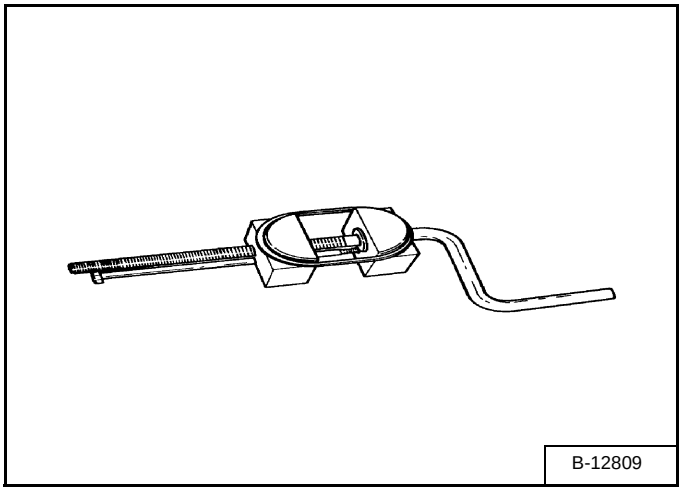
Figure 20-26-19



Install the O-ring on the piston **[Figure 20-26-19]**.

NOTE: Do not overstretch the seal.

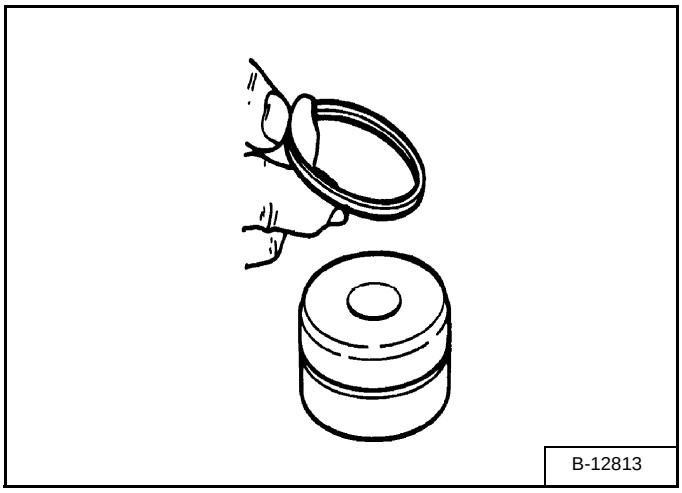
Figure 20-26-20



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

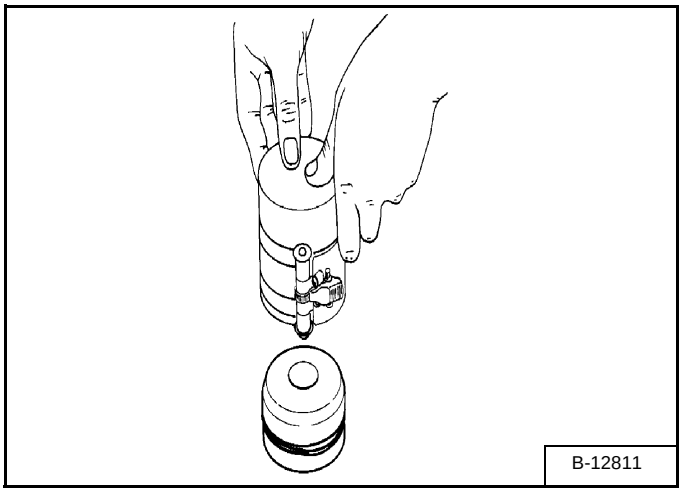
Allow the seal to stretch for 30 seconds before removing it from the tool.

Figure 20-26-21



Install the seal on the piston **[Figure 20-26-21]**.

Figure 20-26-22



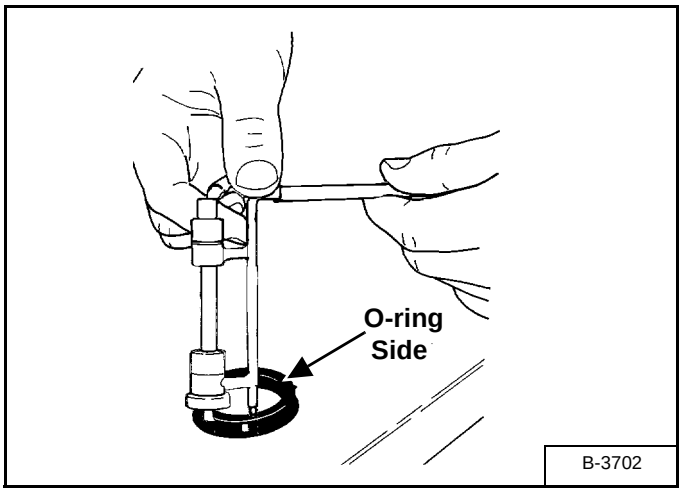
Use a ring compressor to compress the seal to the correct size **[Figure 20-26-22]**.

Leave the piston in the ring compressor for three minutes.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

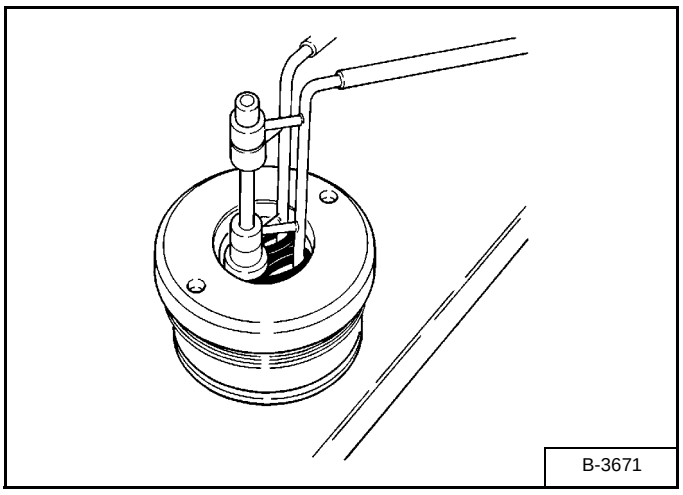
Figure 20-26-23



Install the oil seal on the rod seal tool **[Figure 20-26-23]**.

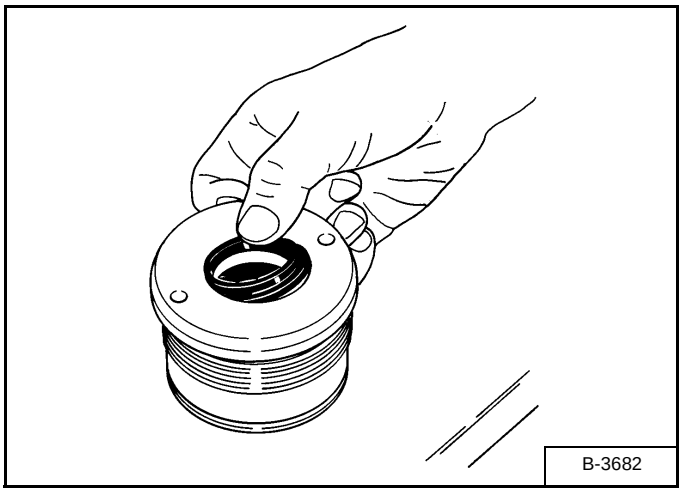
NOTE: The O-ring side of the oil seal goes toward the inside of the cylinder.

Figure 20-26-24



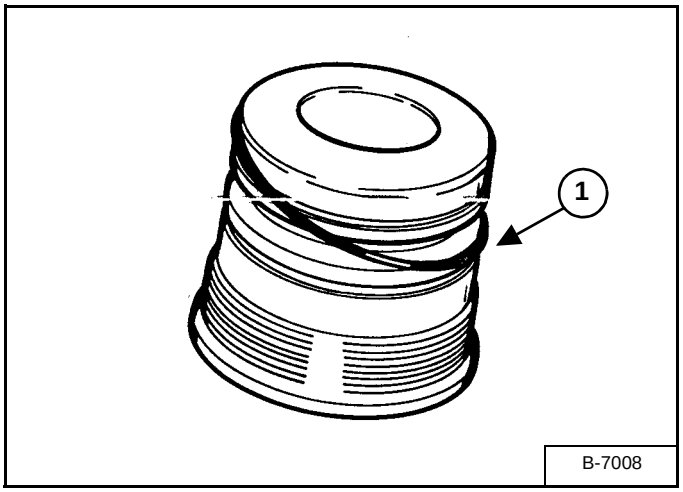
Install the oil seal in the head **[Figure 20-26-24]**.

Figure 20-26-25



Install the wiper seal with the lip toward the outside of the head **[Figure 20-26-25]**.

Figure 20-26-26

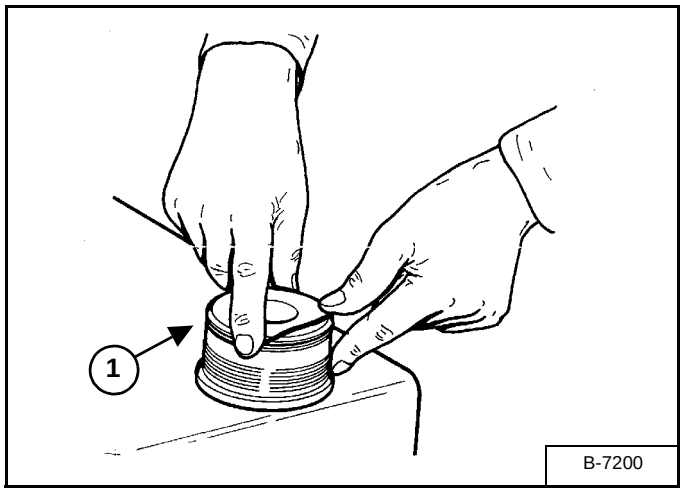


Install the O-ring (Item 1) **[Figure 20-26-26]** on the head.

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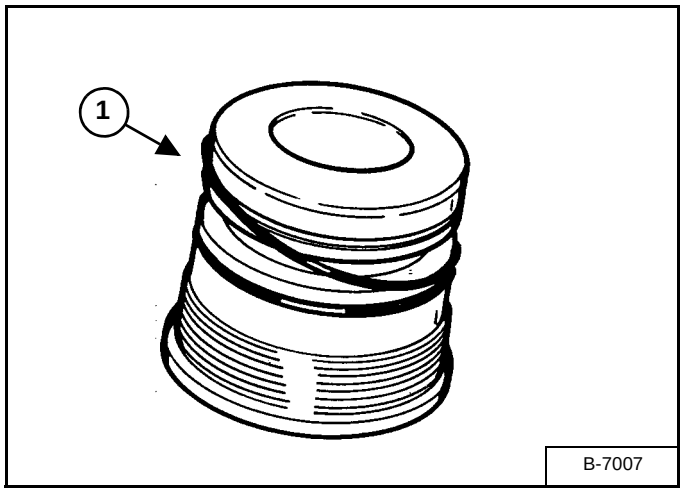
Assembly (Cont'd)

Figure 20-26-27



Install the back-up ring (Item 1) **[Figure 20-26-27]** on the head.

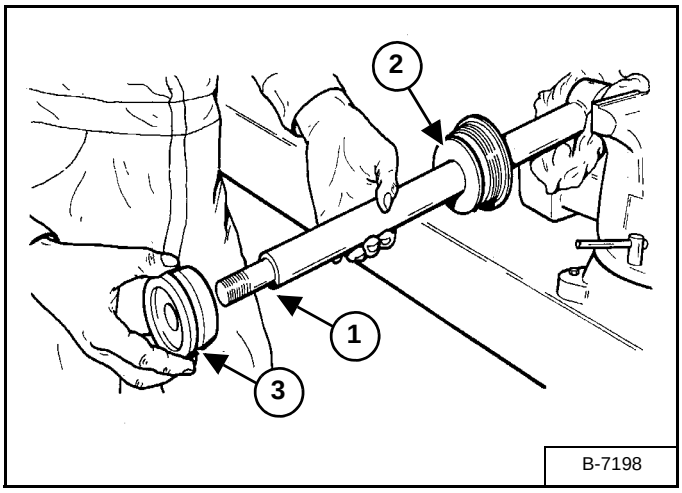
Figure 20-26-28



Install the O-ring (Item 1) **[Figure 20-26-28]** on the head.

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

Figure 20-26-29



Inspect the beveled edge of the rod for nicks or sharp edges (Item 1) **[Figure 20-26-29]**. Remove these with a file prior to installing the head on the rod or damage to the seals may occur.

Install the head (Item 2) **[Figure 20-26-29]** on the rod.

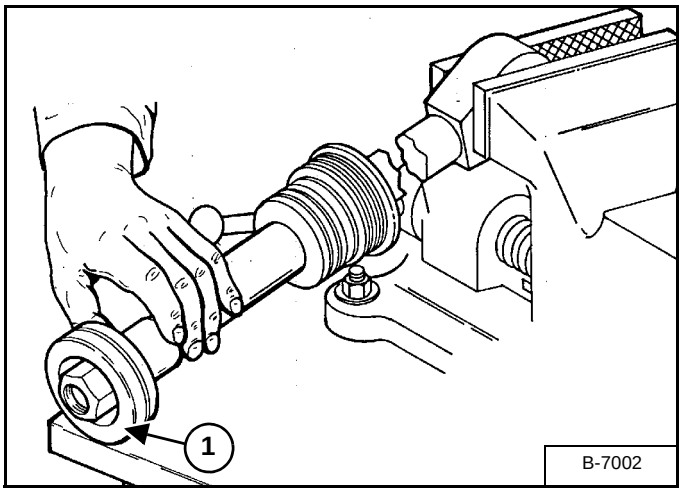
Install the piston (Item 3) **[Figure 20-26-29]** on the rod.

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

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-26-30



Install the nut (Item 1) **[Figure 20-26-30]**.

If the thread size of the nut is 22,2 mm (0.875 in), tighten the nut to 407 N•m (300 ft-lb) torque.

If the thread size of the nut is 28,6 mm (1.125 in), tighten the nut to 1152 N•m (850 ft-lb) torque.

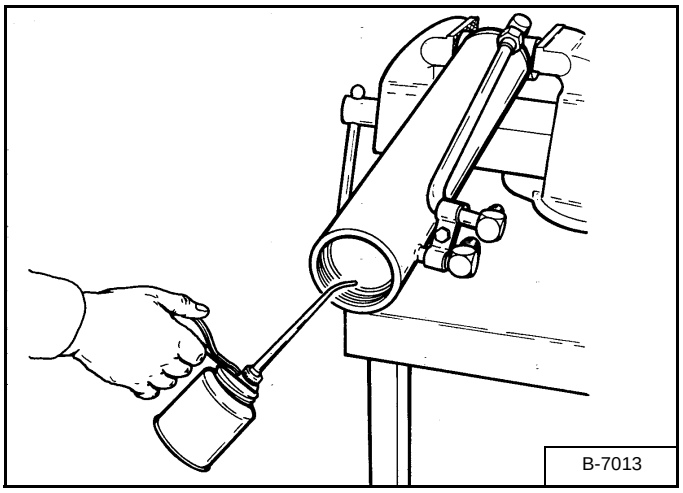
Inspect the inside of the cylinder housing for nicks and scratches. If the cylinder housing has minor scuffing the cylinder housing can be honed. Use a flexible hone and lubricate with oil during the honing process.

The following hones can be ordered from OTC Service Tools:

MEL1418 - 50,8 mm (2 in)
OEM6275 - 69,9 - 76,2 mm (2-3/4 - 3 in)
OEM6270 - 76,2 - 88,9 mm (3 - 3-1/2 in)
OEM6271 - 88,9 - 101,6 mm (3-1/2 - 4 in)

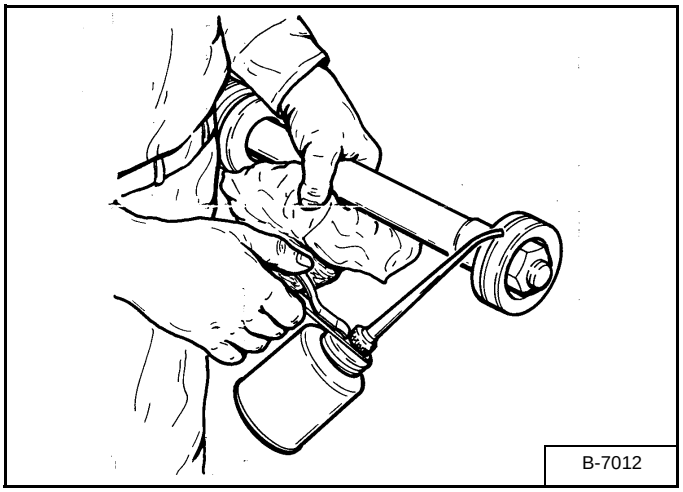
Thoroughly wash the inside of the housing after the honing process.

Figure 20-26-31



Apply oil to the seal surface of the housing **[Figure 20-26-31]**.

Figure 20-26-32

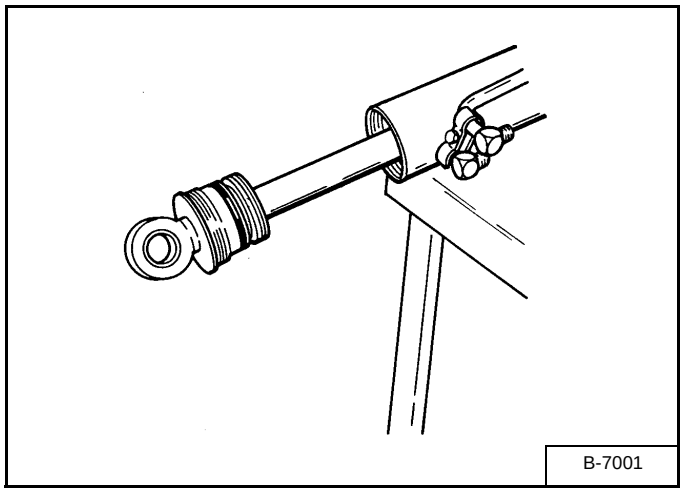


Apply oil to the Teflon seal on the piston **[Figure 20-26-32]**.

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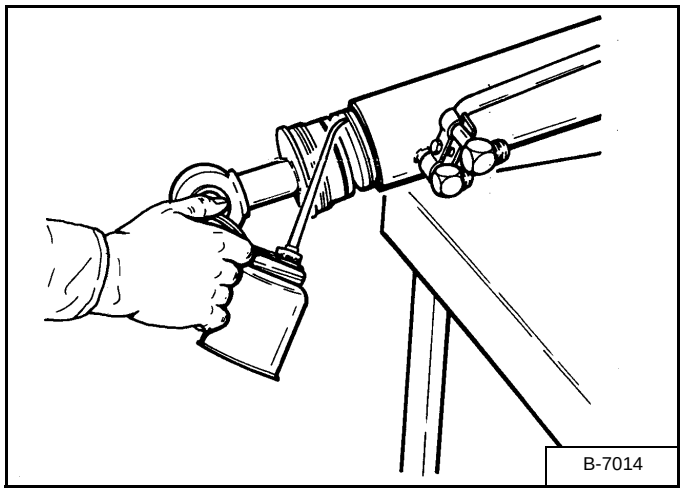
Assembly (Cont'd)

Figure 20-26-33



Install the rod assembly in the housing **[Figure 20-26-33]**.

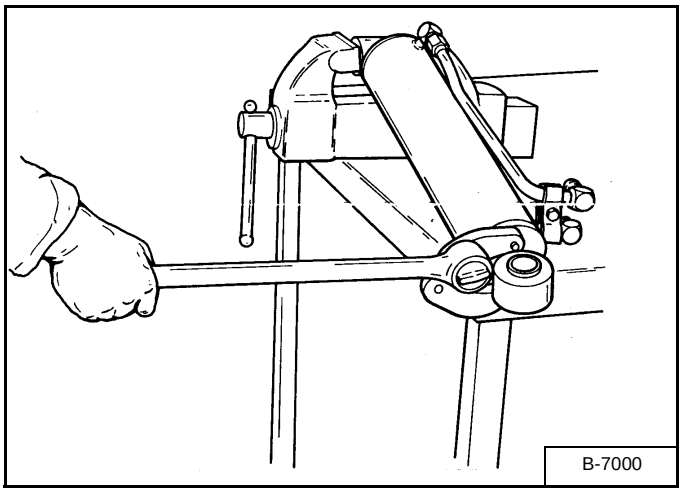
Figure 20-26-34



Apply oil to the seals on the head **[Figure 20-26-34]**.

Apply oil to the threads of the head.

Figure 20-26-35



Use the adjustable gland nut wrench to tighten the head **[Figure 20-26-35]**.

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

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

Dealer Copy -- Not for Resale

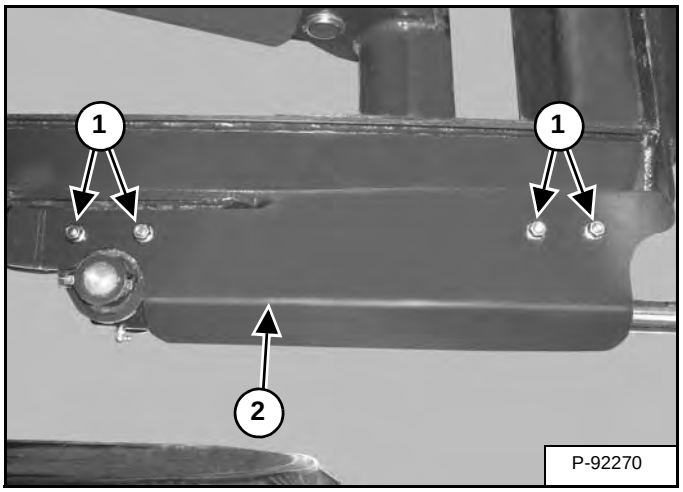
CYLINDER (ANGLE BLADE)

Testing

Lower the boom / bucket and blade to the ground.

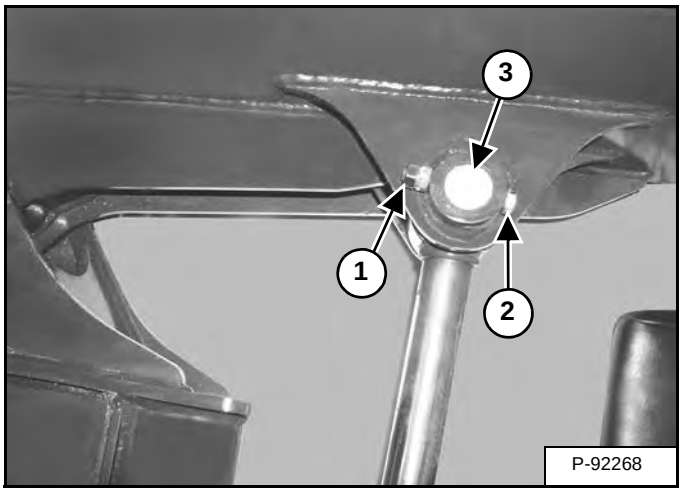
With the engine off, turn the key to the ON position, lower the console and move the blade lever. Press and hold the two speed button to activate angle blade mode, move the lever again to relieve hydraulic pressure.

Figure 20-27-1



Remove the nuts (Item 1) and shield (Item 2) **[Figure 20-27-1]**.

Figure 20-27-2



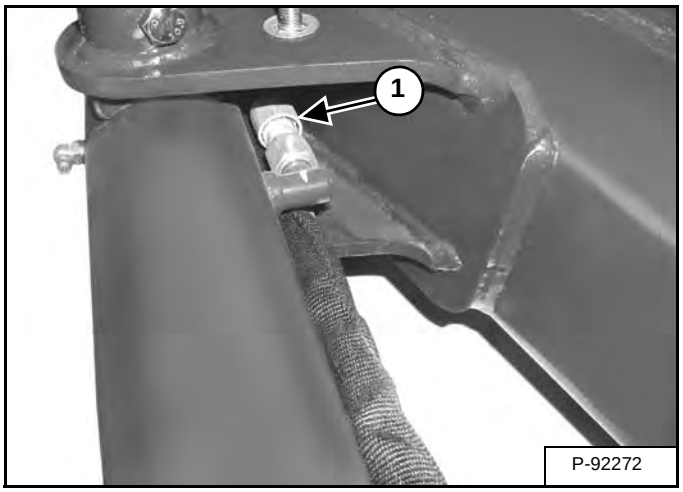
Remove the nuts (Item 1), bolt (Item 2) and pin (Item 3) **[Figure 20-27-2]** from the rod end of the angle blade cylinder.

Start the engine and retract the angle blade cylinder.

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

Stop the engine.

Figure 20-27-3

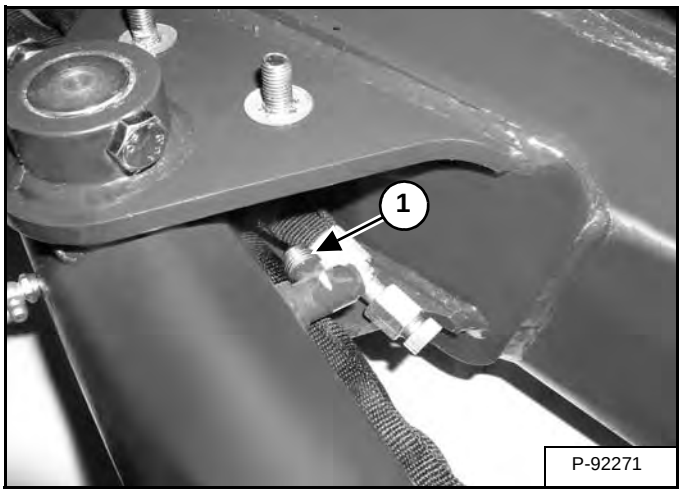


Reposition the cylinder and remove the hose (Item 1) **[Figure 20-27-3]** from the base end of the angle blade cylinder.

Install a plug in the hose.

Start the engine, and retract the angle blade cylinder.

Figure 20-27-4



If there is any leakage from the base end fitting (Item 1) **[Figure 20-27-4]**, remove the cylinder for repair or replacement.

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ANGLE BLADE CYLINDER (CONT'D)

Removal And Installation

Lower the bucket and blade to the ground.

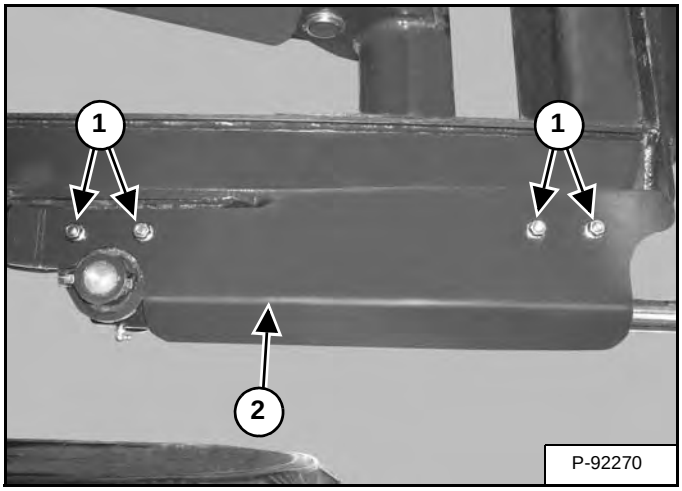
With the engine off, turn the key to the ON position, lower the console and move the blade lever. Press and hold the two speed button to activate angle blade mode, move the lever again to relieve hydraulic pressure.

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.

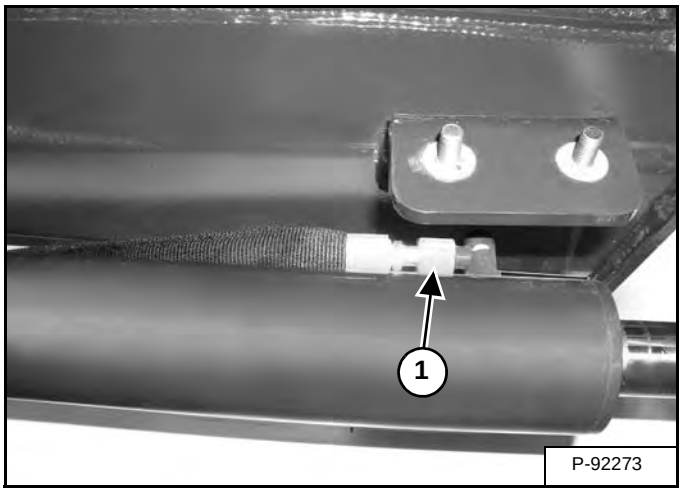
I-2003-0888

Figure 20-27-5



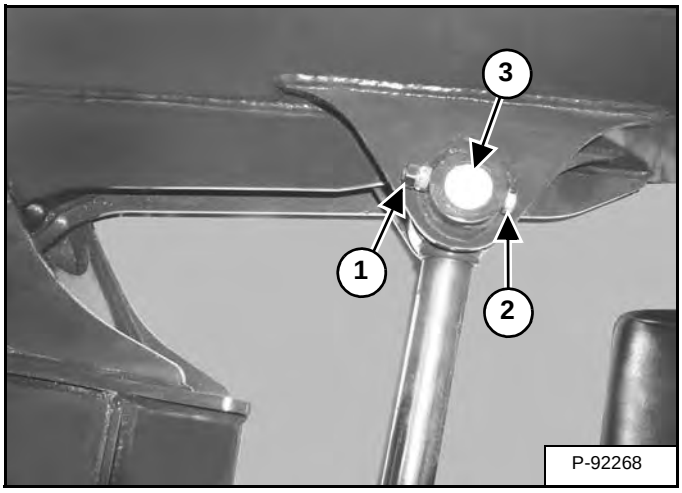
Remove the nuts (Item 1) and shield (Item 2) **[Figure 20-27-5]**.

Figure 20-27-6



Remove the hose (Item 1) **[Figure 20-27-6]**.

Figure 20-27-7

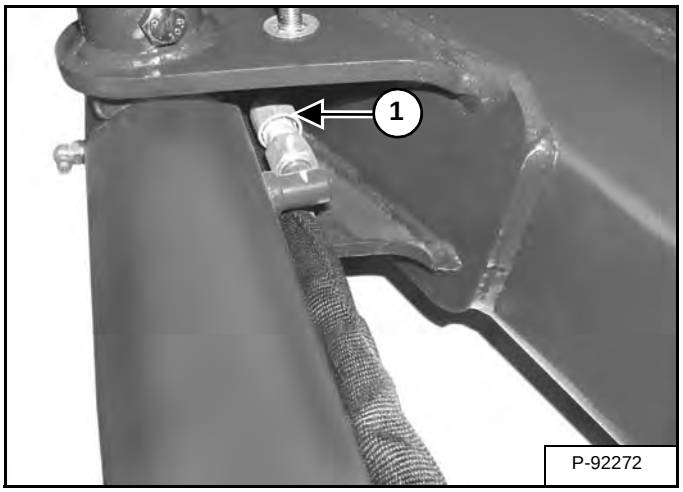


Remove the nuts (Item 1), bolt (Item 2) and pin (Item 3) **[Figure 20-27-7]** from the rod end of the angle blade cylinder.

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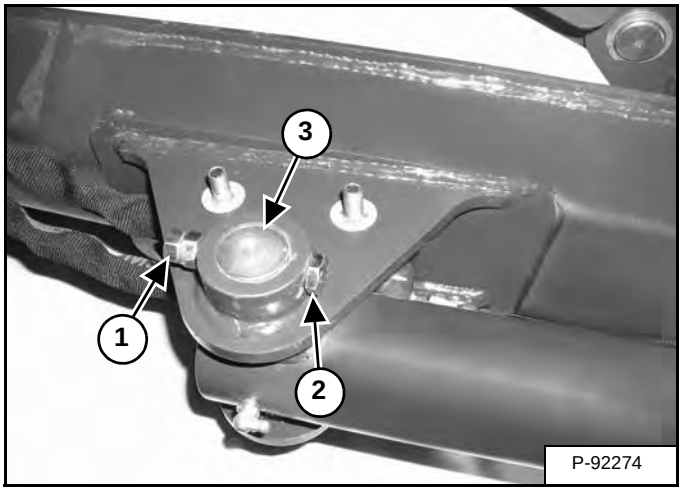
Removal And Installation (Cont'd)

Figure 20-27-8



Reposition the cylinder and remove the hose (Item 1), **[Figure 20-27-8]** from the base end of the angle blade cylinder.

Figure 20-27-9



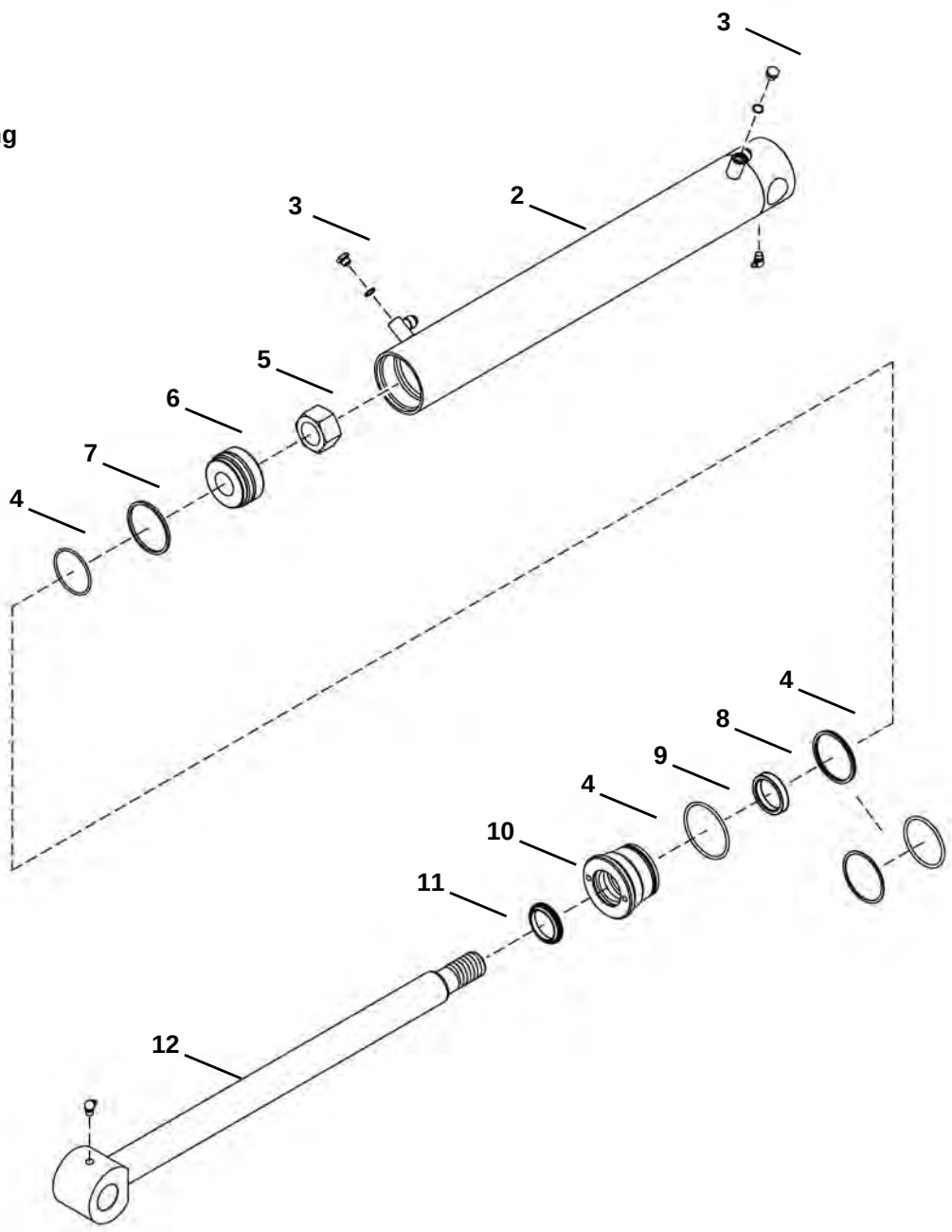
Remove the nut (Item 1), bolt (Item 2) and pin (Item 3) **[Figure 20-27-9]** from the base end of the angle blade cylinder.

Remove the cylinder.

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Parts Identification

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



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Disassembly

Clean the outside of the angle blade cylinder before disassembly.

Use the following tools to disassemble the cylinder:

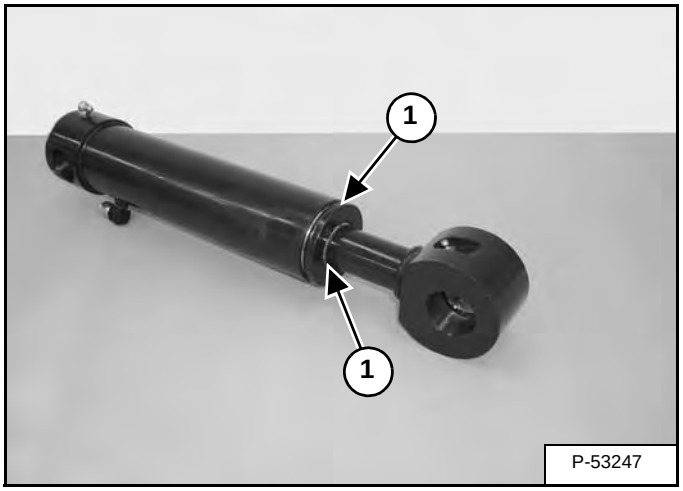
MEL1074 - O-ring Seal Hook
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

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.

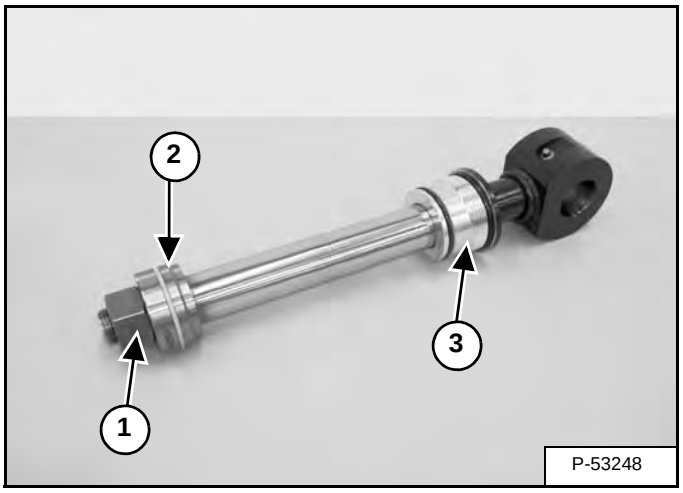
NOTE: Photo's may appear different, but the procedures are the same.

Figure 20-27-10



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-27-10]** to loosen the head.

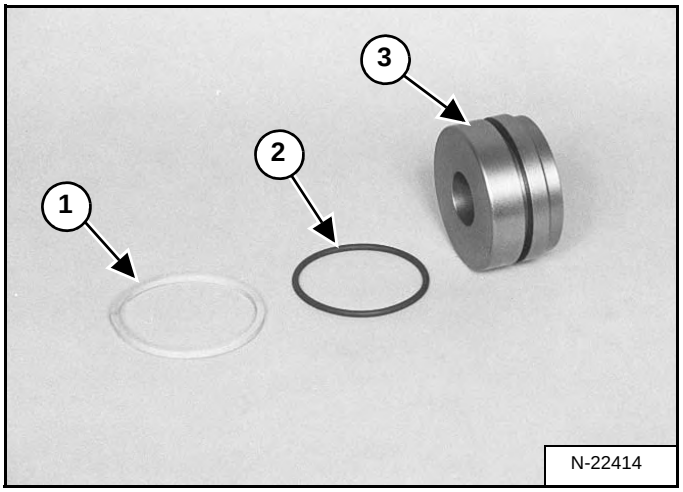
Figure 20-27-11



Remove the head and the rod assembly from the cylinder **[Figure 20-27-11]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-27-11]**.

Figure 20-27-12

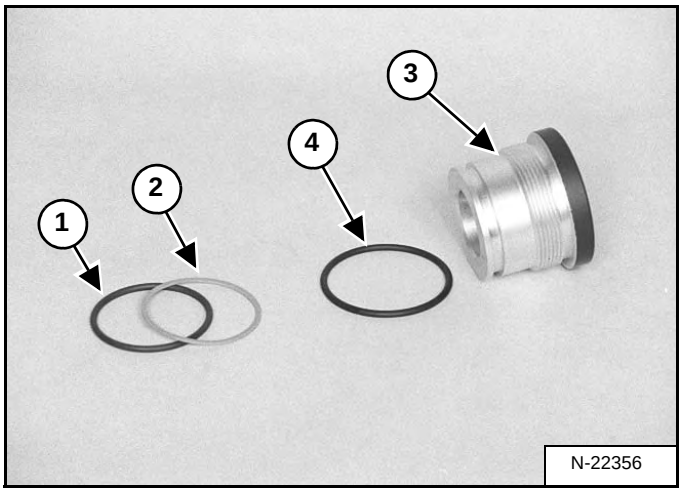


Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-27-12]**.

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Disassembly (Cont'd)

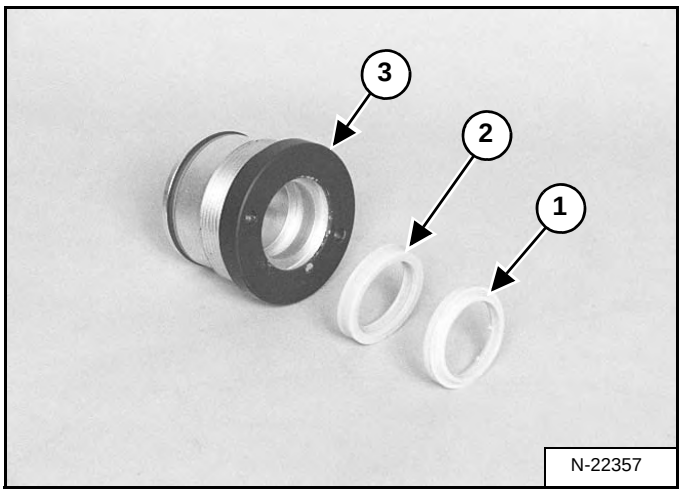
Figure 20-27-13



Remove the O-ring (Item 1) and the back-up ring (Item 2) from the head (Item 3) **[Figure 20-27-13]**.

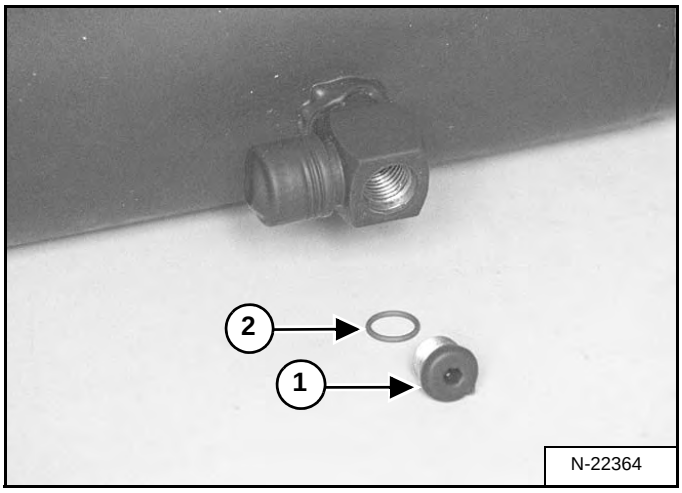
Remove the O-ring (Item 4) **[Figure 20-27-13]**.

Figure 20-27-14



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-27-14]**.

Figure 20-27-15



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-27-15]** from both fittings.

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Assembly

Clean all parts in solvent and dry with compressed air.

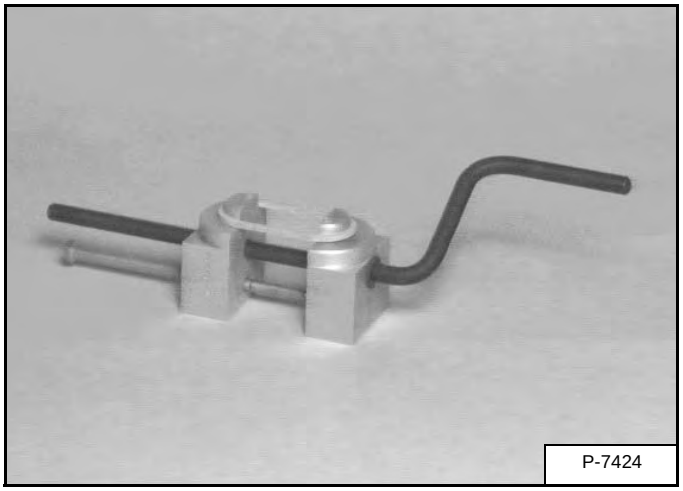
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Use the following tools to assemble the cylinder:

MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
MEL1396-2 - Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

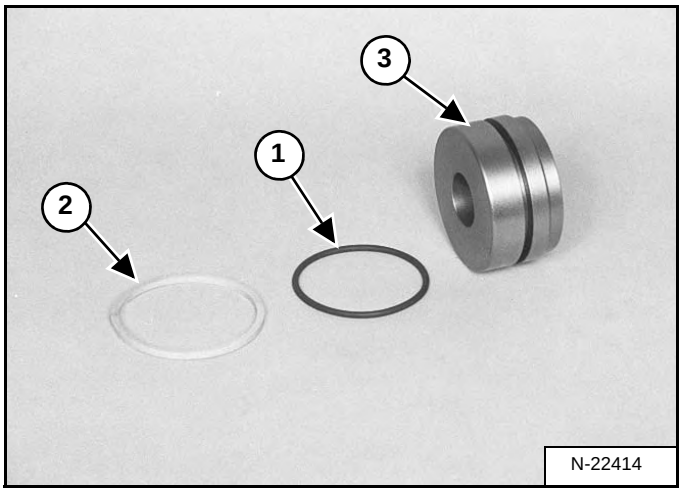
Figure 20-27-16



Install the new seal on the tool and slowly stretch it until it fits the piston **[Figure 20-27-16]**.

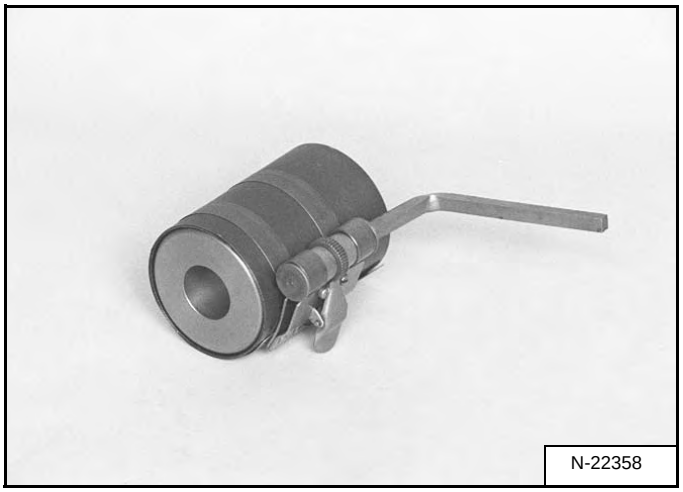
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-27-17



Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-27-17]**.

Figure 20-27-18

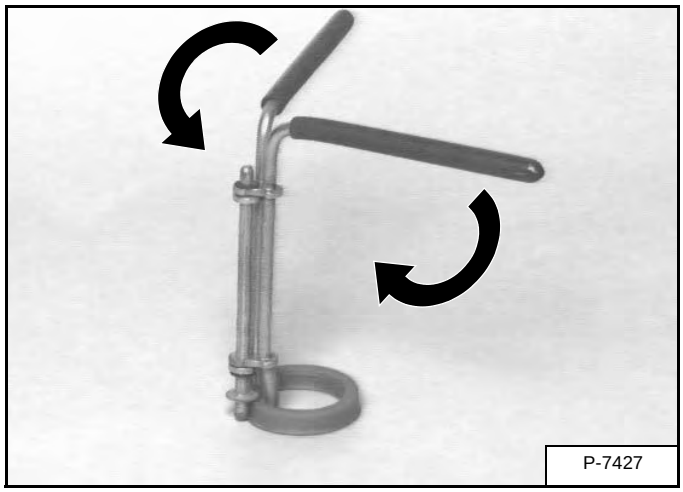


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-27-18]**.

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Assembly (Cont'd)

Figure 20-27-19

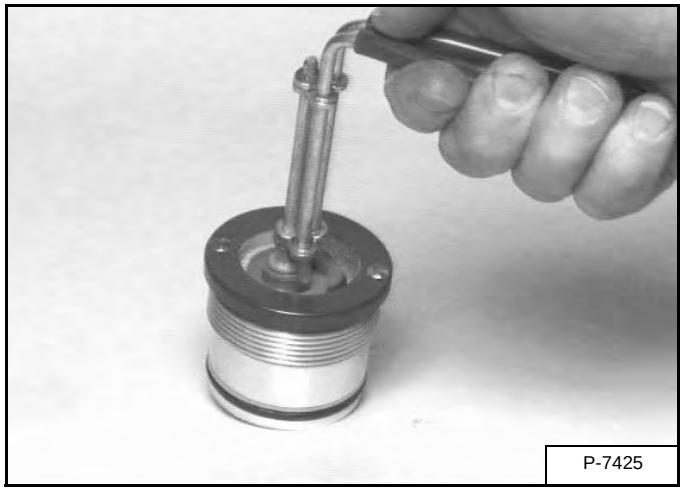


Install the rod seal on the rod seal tool **[Figure 20-27-19]**.

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

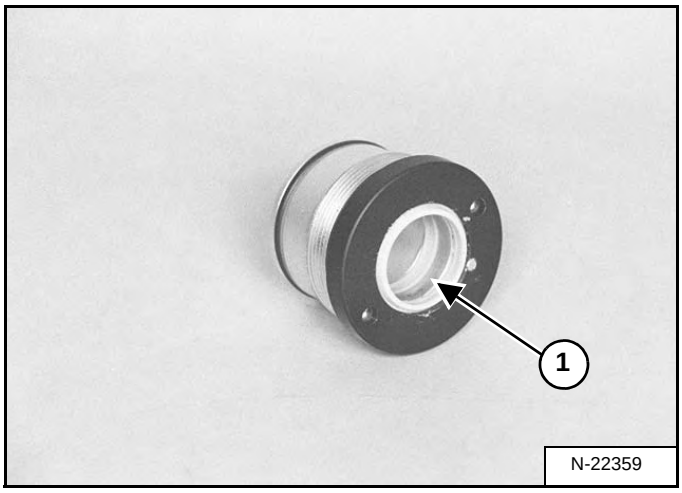
Rotate the handles to collapse the rod seal **[Figure 20-27-19]**.

Figure 20-27-20



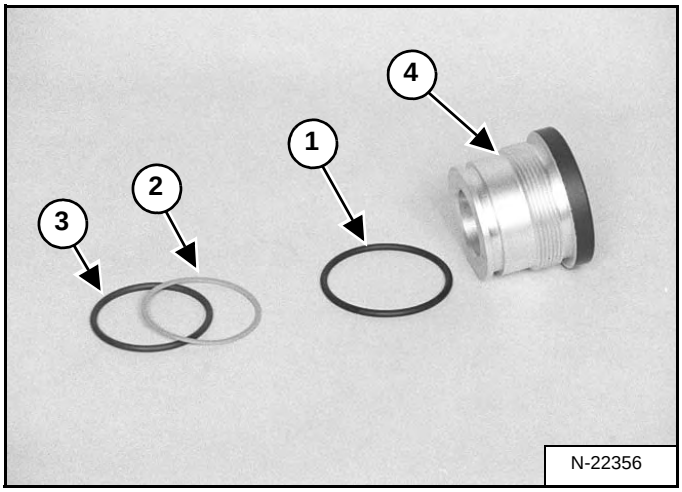
Install the rod seal in the head **[Figure 20-27-20]**.

Figure 20-27-21



Install the wiper seal with the wiper (Item 1) **[Figure 20-27-21]** toward the outside of the head.

Figure 20-27-22



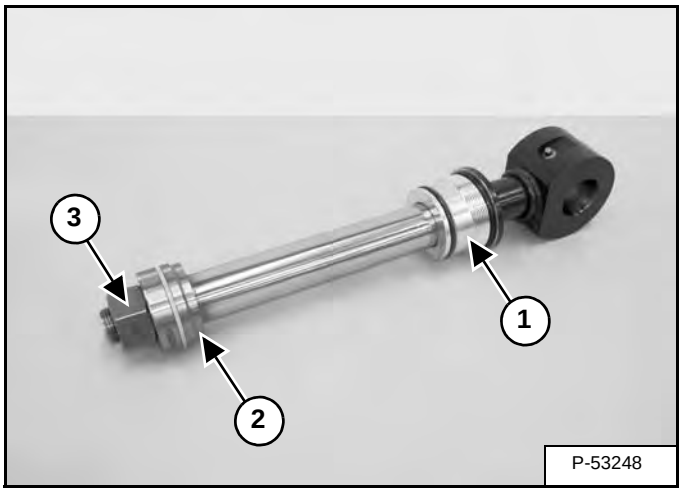
Install the O-ring (Item 1) **[Figure 20-27-22]**.

Install the back-up ring (Item 2) and O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-27-22]**.

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Assembly (Cont'd)

Figure 20-27-23



Install the head (Item 1) and the piston (Item 2) **[Figure 20-27-23]** on the rod as shown.

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

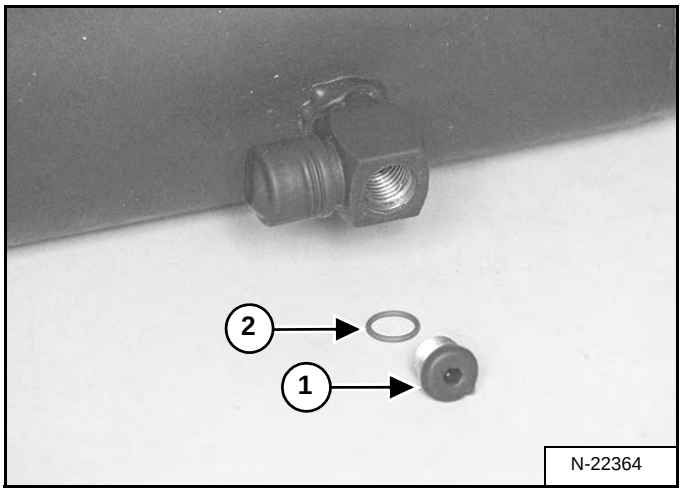
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-27-23]**.

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

Figure 20-27-24

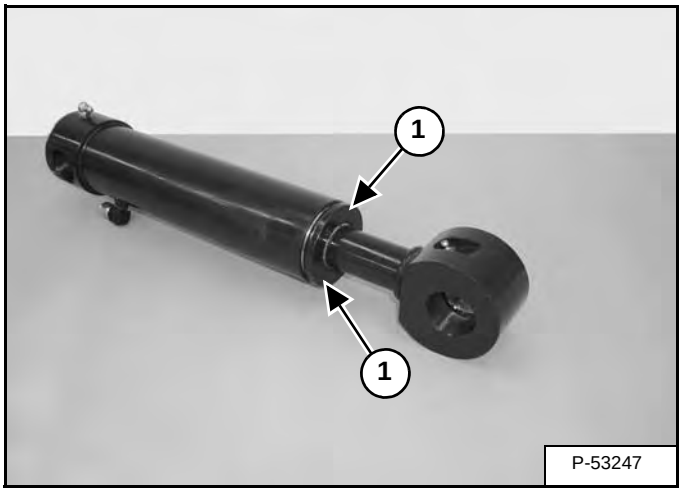


Install plug (Item 1) and O-ring (Item 2) **[Figure 20-27-24]**.

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

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

Figure 20-27-25



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-27-25]** to tighten the head. Head to be torqued until flush with end of housing.

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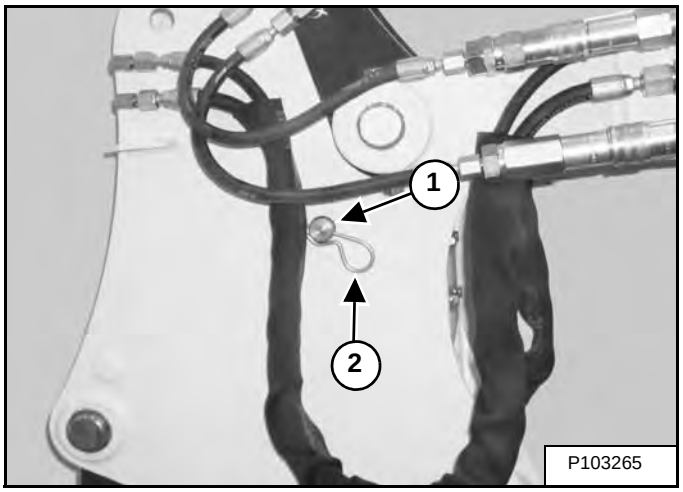


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CYLINDER (EXTENDABLE ARM)

Testing

Figure 20-28-1



Fully retract the cylinder and install the pin (Item 1). Install the retainer (Item 2) **[Figure 20-28-1]** on both sides of the pin.

Lower the work group to the ground.

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

Figure 20-28-2



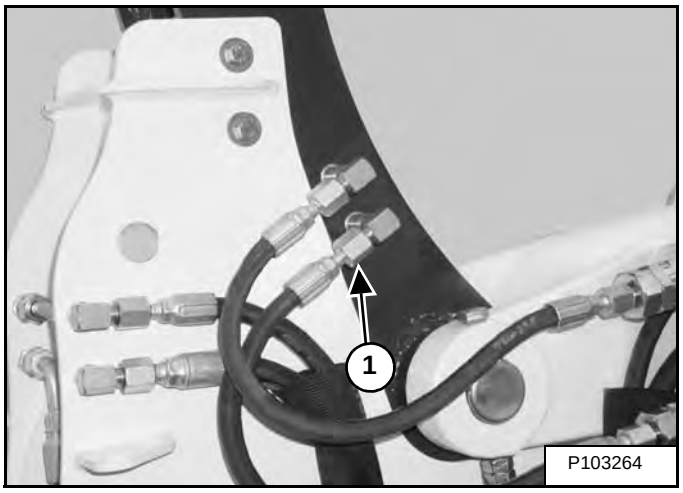
Support the boom using a chain hoist **[Figure 20-28-2]**.

⚠ 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.

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Figure 20-28-3

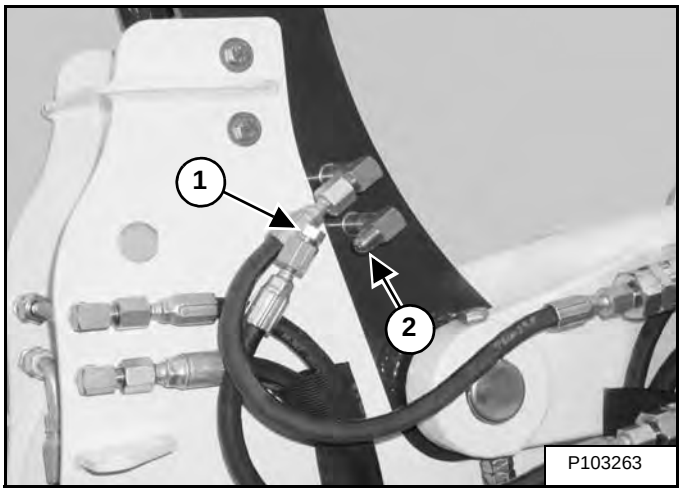


Remove the hose (Item 1) **[Figure 20-28-3]** from the base end of the cylinder.

Dealer Copy -- Not for Resale

Testing (Cont'd)

Figure 20-28-4



Install a plug (Item 1) **[Figure 20-28-4]** on the hose.

Start the engine and retract the cylinder.

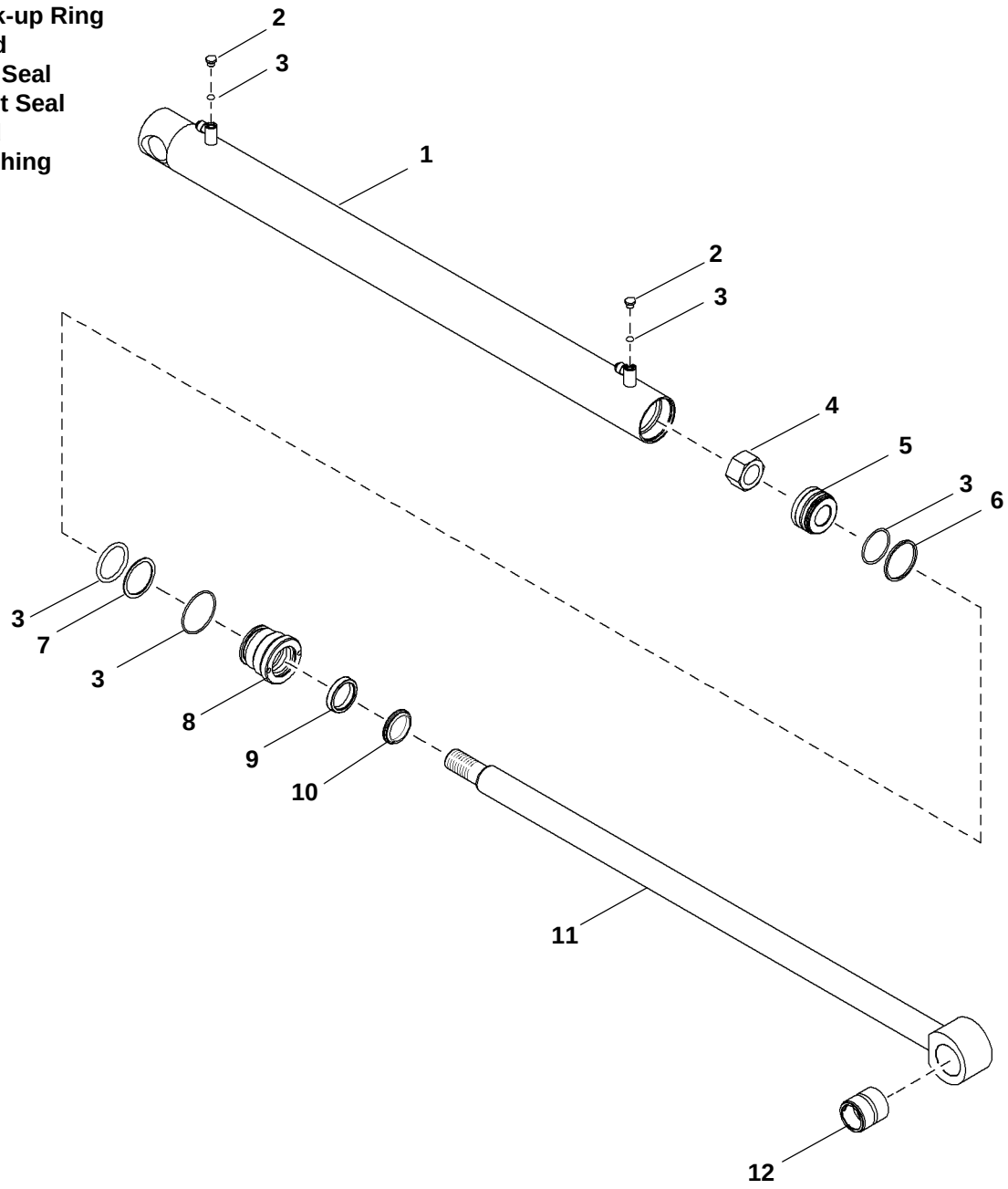
If there is any leakage from the base end fitting (Item 2) **[Figure 20-28-4]** on the cylinder, remove the cylinder for repair or replacement.

See Extendable Arm to remove the cylinder. (See Disassembly And Assembly on Page 40-161-4.)

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Parts Identification

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



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Disassembly

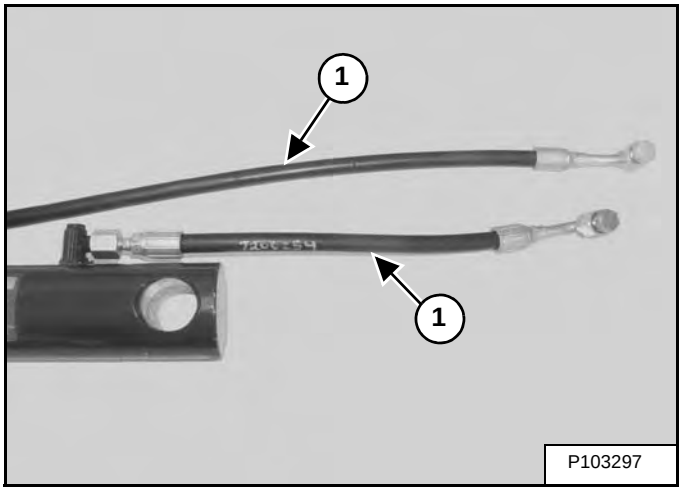
Clean the outside of the cylinder before disassembly.

Use the following tools to disassemble the cylinder:

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

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

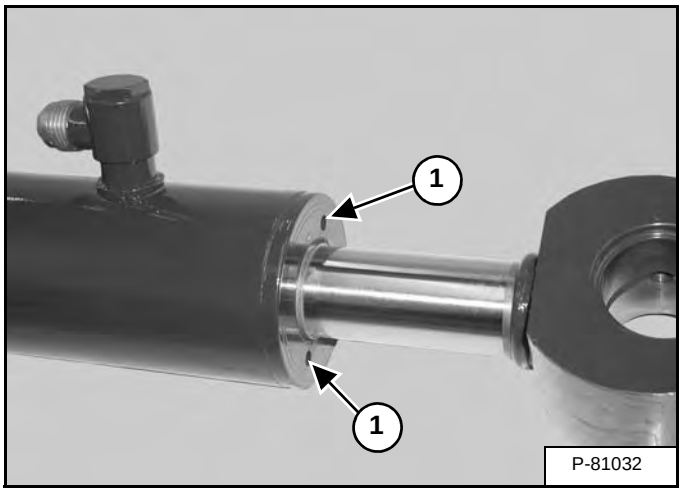
Figure 20-28-5



Remove the hoses (Item 1) **[Figure 20-28-5]** from the cylinder.

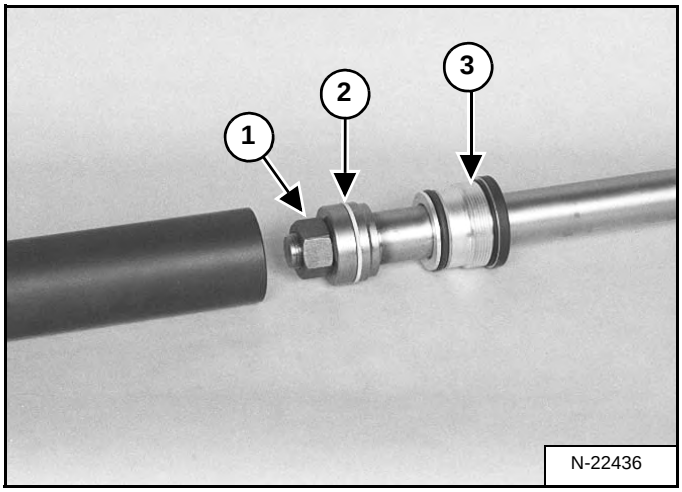
Put the base end of the cylinder in a vise.

Figure 20-28-6



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-28-6]** to loosen the head.

Figure 20-28-7



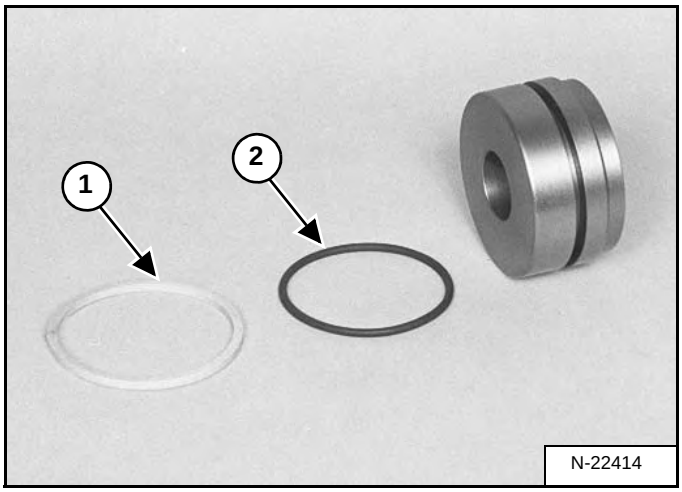
Remove the head and the rod assembly from the cylinder **[Figure 20-28-7]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-28-7]**.

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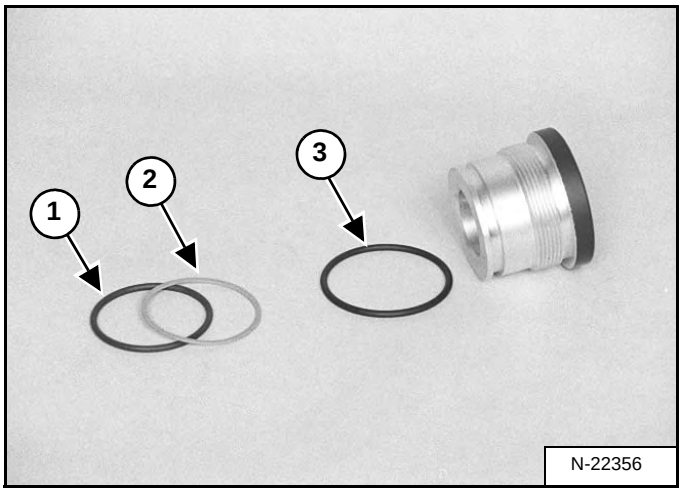
Disassembly (Cont'd)

Figure 20-28-8



Remove the seal (Item 1) and O-ring (Item 2) **[Figure 20-28-8]** from the piston.

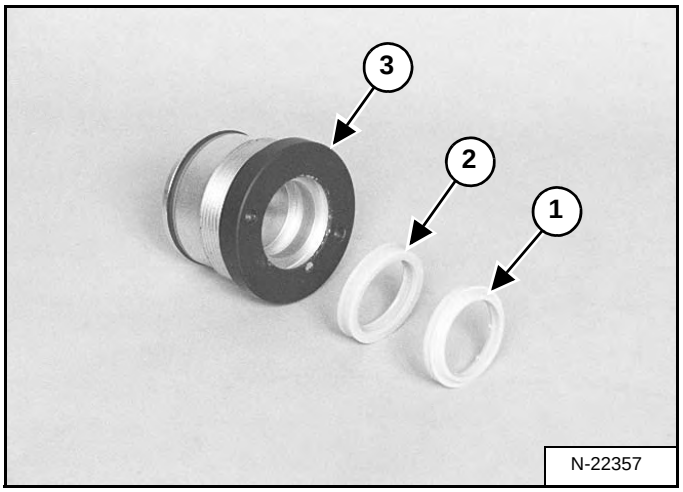
Figure 20-28-9



Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-28-9]** from the head.

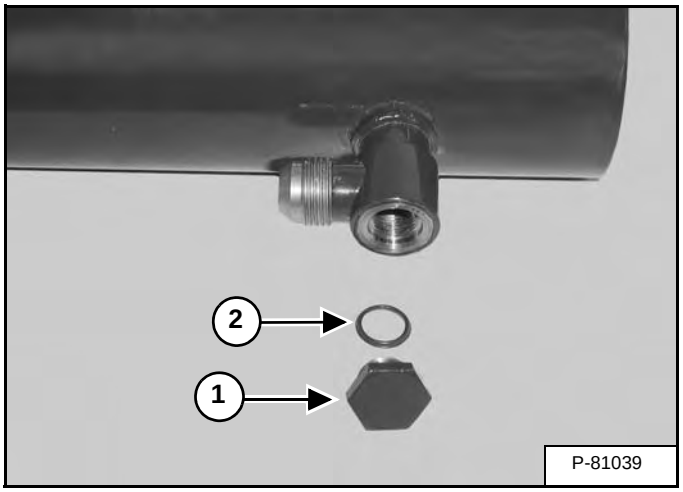
Remove the O-ring (Item 3) **[Figure 20-28-9]**.

Figure 20-28-10



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-28-10]**.

Figure 20-28-11

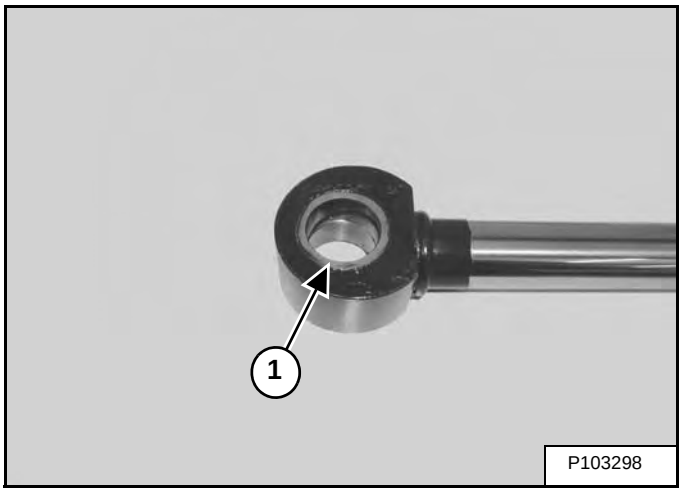


Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-28-11]**.

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Disassembly (Cont'd)

Figure 20-28-12



Remove the bushing (Item 1) **[Figure 20-28-12]**.

Dealer Copy -- Not for Resale

Assembly

Clean all parts in solvent and dry with compressed air.

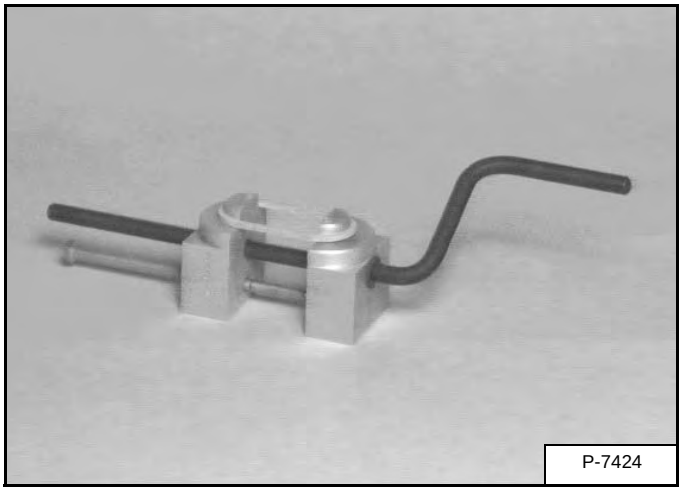
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Use the following tools to assemble the cylinder:

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

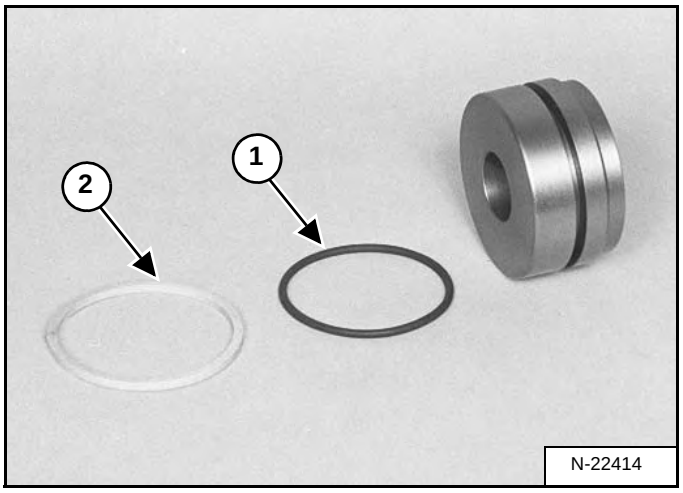
Figure 20-28-13



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-28-13]**.

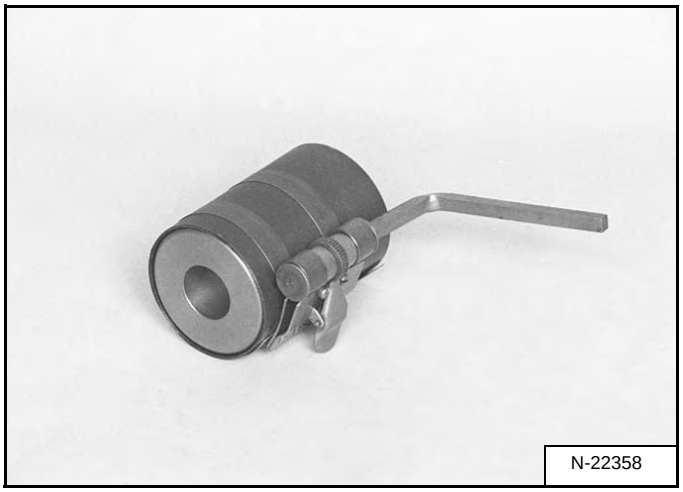
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-28-14



Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-28-14]** on the piston.

Figure 20-28-15

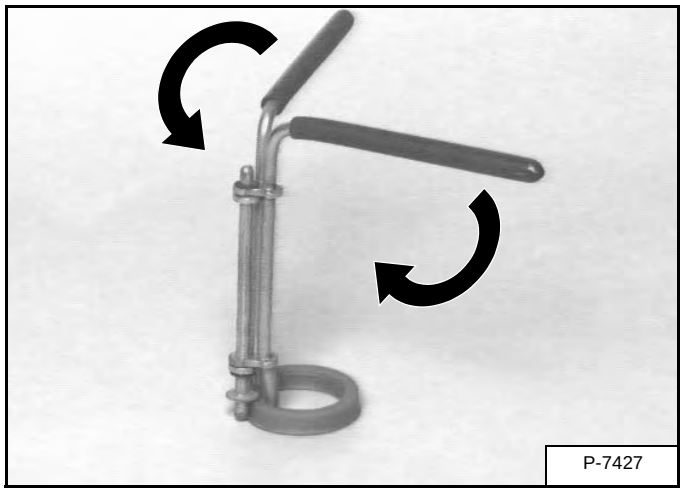


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-28-15]**.

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Assembly (Cont'd)

Figure 20-28-16

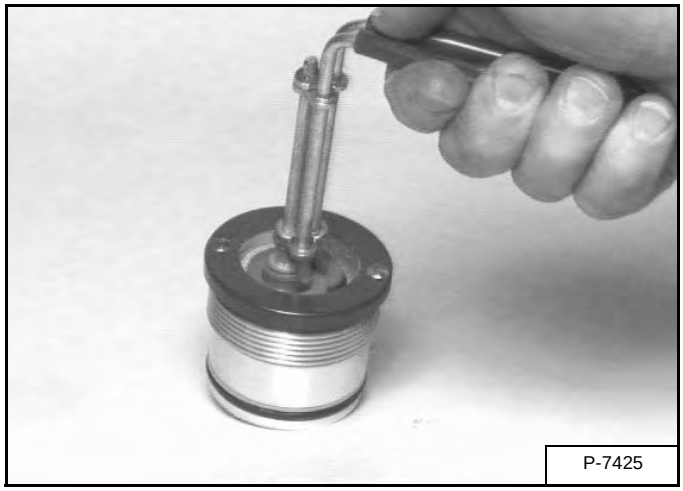


Install the rod seal on the rod seal tool **[Figure 20-28-16]**.

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

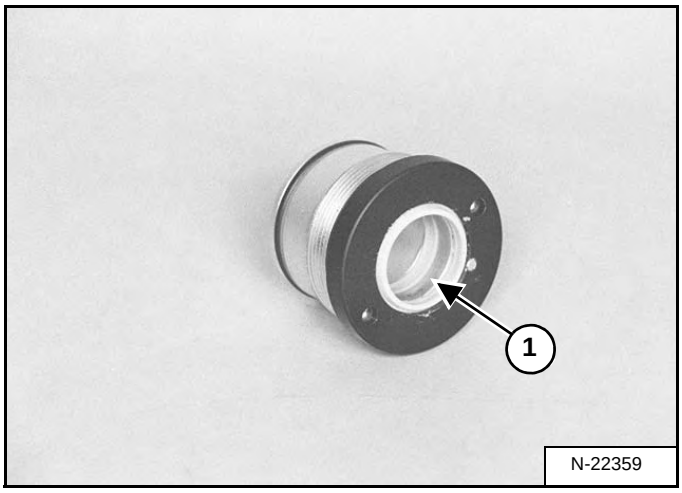
Rotate the handles to collapse the rod seal **[Figure 20-28-16]**.

Figure 20-28-17



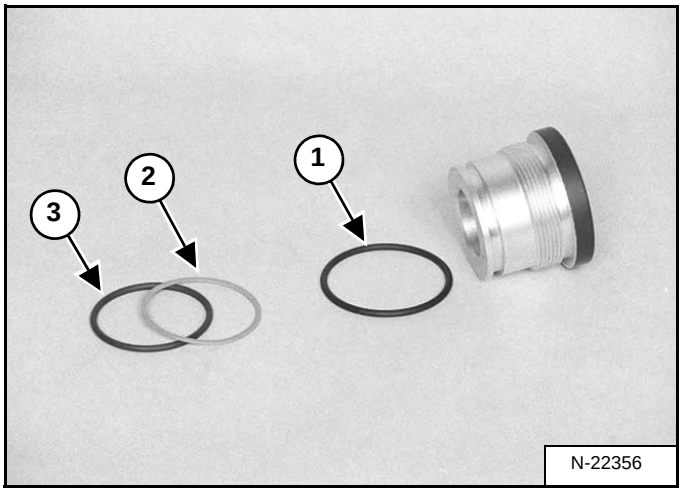
Install the rod seal in the head **[Figure 20-28-17]**.

Figure 20-28-18



Install the wiper seal with the wiper (Item 1) **[Figure 20-28-18]** toward the outside of the head.

Figure 20-28-19



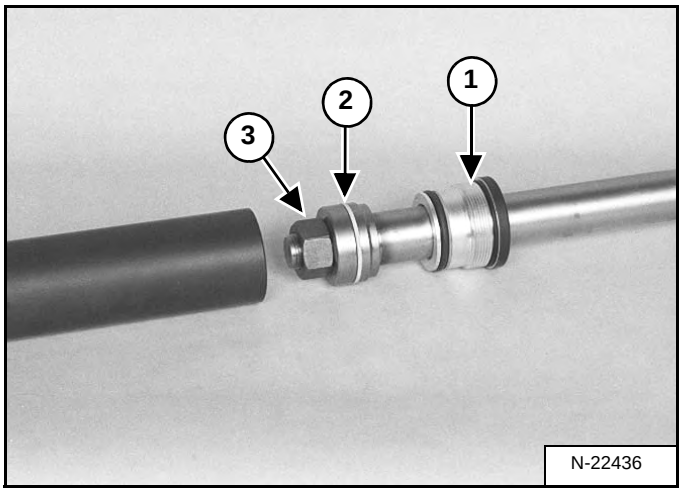
Install the O-ring (Item 1) **[Figure 20-28-19]**.

Install the back-up ring (Item 2) and O-ring (Item 3) **[Figure 20-28-19]**.

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Assembly (Cont'd)

Figure 20-28-20



Install the head (Item 1) and the piston (Item 2) **[Figure 20-28-20]** on the rod as shown.

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

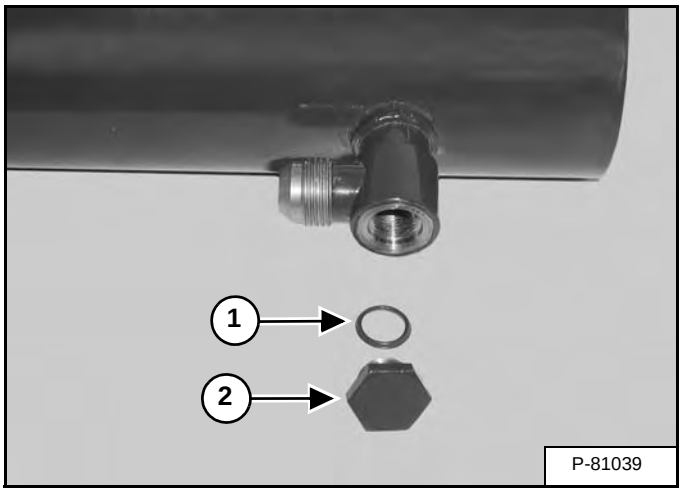
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-28-20]**.

Tighten the nut to 153 N•m (850 ft-lb) torque.

Figure 20-28-21

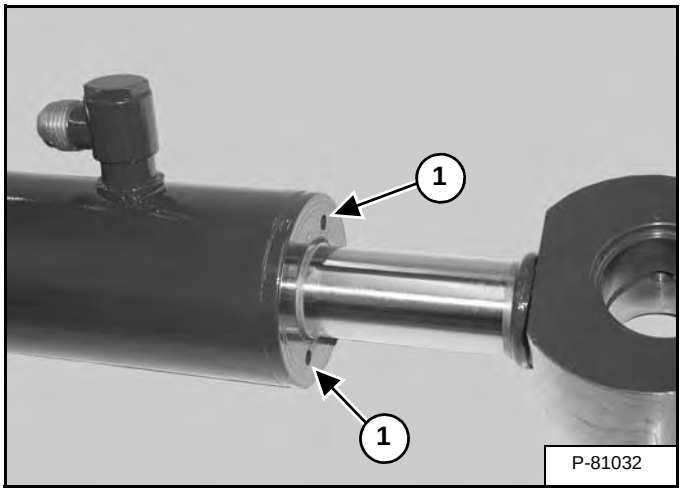


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-28-21]**.

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

Put the base end of the cylinder in a vise.

Figure 20-28-22

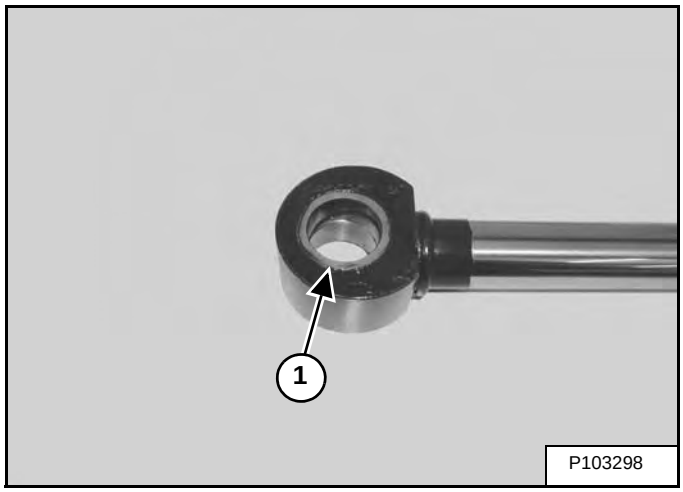


Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-28-22]** to tighten the head. Head to be torqued until flush with the end of the housing.

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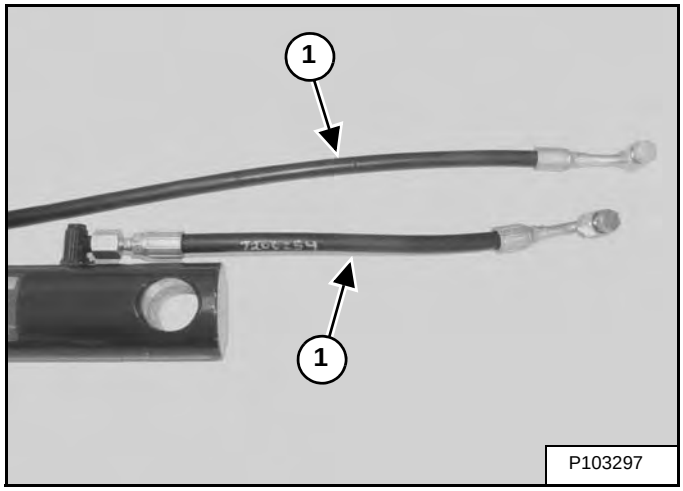
Assembly (Cont'd)

Figure 20-28-23



Install the bushing (Item 1) **[Figure 20-28-23]**. The bushing must be aligned with the grease channel in the rod end of the cylinder.

Figure 20-28-24



Install the hoses (Item 1) **[Figure 20-28-24]** as shown to align the hoses with the bulkhead fittings on the inner arm assembly. Hose orientation can not be changed after the cylinder is installed.

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VALVE (MAIN RELIEF)

Description

The main relief valve limits the hydraulic system pressure by opening at a certain pressure and allowing the hydraulic oil to flow back to the hydraulic reservoir.

The hydraulic system pressure is regulated by several components. The main relief valve must be adjusted during the pump testing procedure for accurate relief valve settings. (See HYDRAULIC PUMP on Page 20-50-1.)

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VALVE (PORT RELIEF)

Testing And Adjusting Port Relief Valve Pressure

IMPORTANT

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

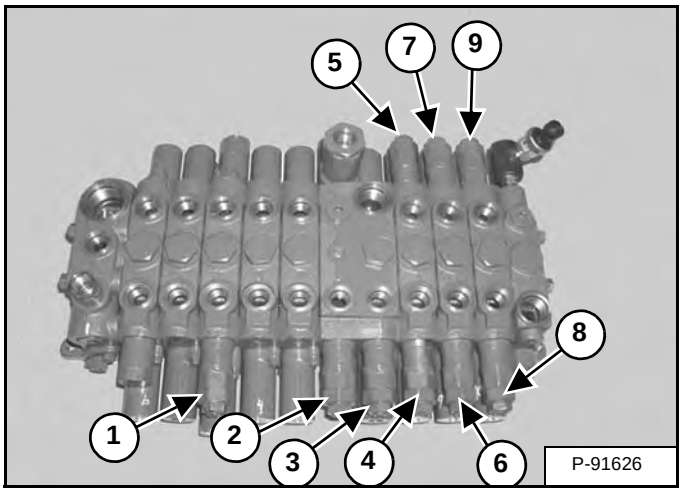
I-2003-0888

When testing the port relief valves with a hydraulic hand pump, slowly pressurize the valve. If the hand pump is pumped fast, the pressure will be altered by as much as 348 kPa (3,5 bar) (50 psi).

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

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

Figure 20-31-1



Blade Port Relief set at:

Base End (Item 1) **[Figure 20-31-1]** 27000 kPa (270 bar) (3916 psi)

Boom Port Relief set at:

Base End (Item 2) **[Figure 20-31-1]** 28999 kPa (290 bar) (4206 psi)

Rod End (Item 3) **[Figure 20-31-1]** 28999 kPa (290 bar) (4206 psi)

Auxiliary Port Relief set at:

Male Quick Coupler (Item 4) **[Figure 20-31-1]** 20595 kPa (206 bar) (2987 psi)

Female Quick Coupler (Item 5) **[Figure 20-31-1]** 20595 kPa (206 bar) (2987 psi)

Arm Port Relief set at:

Rod End (Item 6) **[Figure 20-31-1]** 27000 kPa (270 bar) (3916 psi)

Base End (Item 7) **[Figure 20-31-1]** 27000 kPa (270 bar) (3916 psi)

Bucket Port Relief set at:

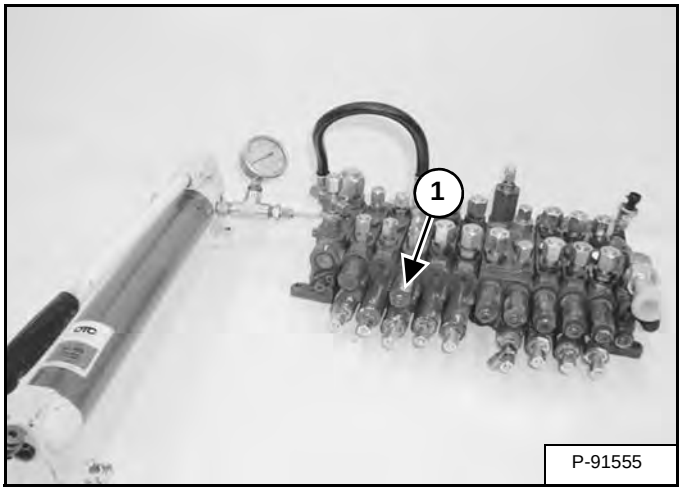
Rod End (Item 8) **[Figure 20-31-1]** 27000 kPa (270 bar) (3916 psi)

Base End (Item 9) **[Figure 20-31-1]** 27000 kPa (270 bar) (3916 psi)

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Testing And Adjusting Port Relief Valve Pressure (Cont'd)

Figure 20-31-2



Install the hand pump hose and a 34474 kPa (345 bar) (5000 psi) pressure gauge into the valve section work port in which the port relief valve is located **[Figure 20-31-2]**.

NOTE: The valve is shown removed from the excavator for photo clarity.

Slowly pressurize this section with the hand pump until the port relief valve opens and make a note of the pressure reading.

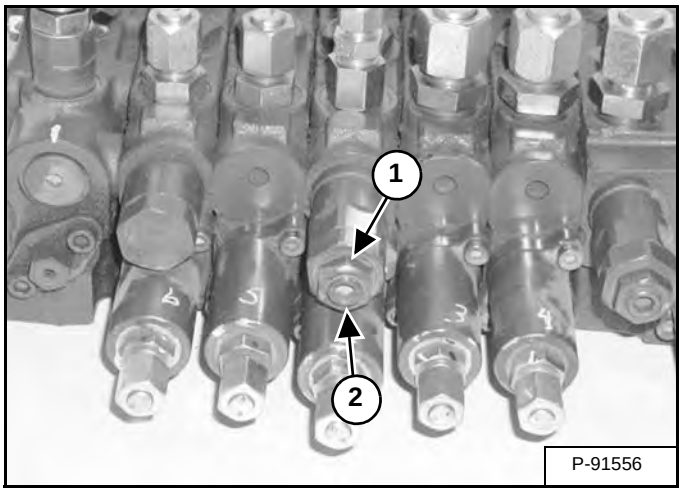
IMPORTANT

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

I-2019-0284

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

Figure 20-31-3



Loosen the lock nut (Item 1) **[Figure 20-31-2]** and **[Figure 20-31-3]**.

Turn the adjusting screw (Item 2) **[Figure 20-31-3]** clockwise to increase the pressure and counterclockwise to reduce the pressure.

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VALVE (CROSS PORT RELIEF)

Testing

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

MEL1355 - Test Kit includes the following:
MEL1355-3 - 34474 kPa (345 bar) (5000 psi) Gauge
MEL1355-12 - Coupler
MEL1355-9 - Thermometer

System Pressures At Gauge Port Specifications

TEST CONDITIONS

1. Engine High Idle Speed

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

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

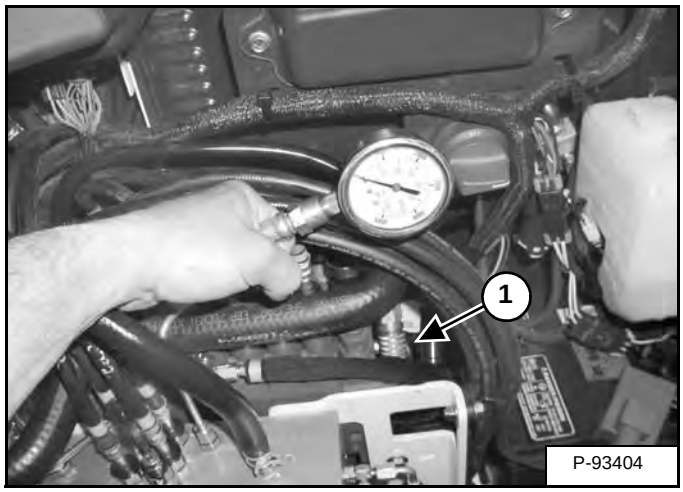
SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET (psi)	ACCEPTABLE RANGE (psi)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	MANIFOLD JP3	428	406 - 450
SYSTEM STANDBY PRESSURE	NONE - CONSOLE DOWN	THROUGH NEUTRAL	VALVE PPS2	363	363 - 435
MAIN RELIEF	ANY EXCEPT SLEW AND AUXILIARY	P1	VALVE PPS2	3553	3553 - 3626
SWING MOTOR - CROSS PORT RELIEF	SLEW RIGHT	P1	VALVE PPS2	3495	3423 - 3626
SWING MOTOR - CROSS PORT RELIEF	SLEW LEFT	P1	VALVE PPS2	3495	3423 - 3626

Open the right side cover.

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Testing (Cont'd)

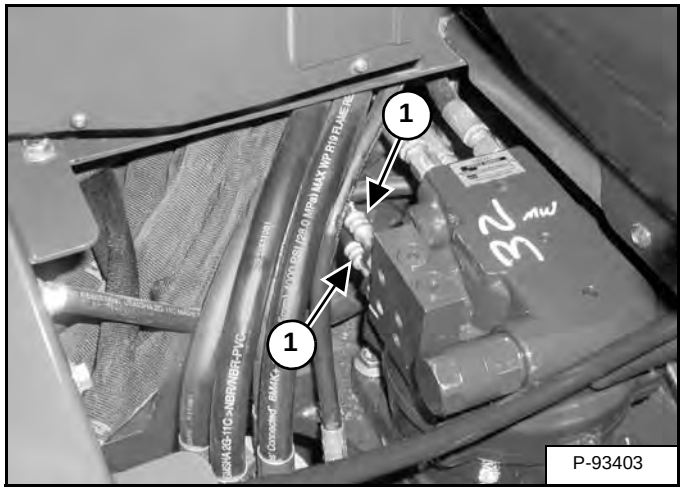
Figure 20-32-1



Connect the test gauge coupler and 34474 kPa (345 bar) (5000 psi) gauge from the test kit to the PPS2 diagnostic coupler (Item 1) **[Figure 20-32-1]**.

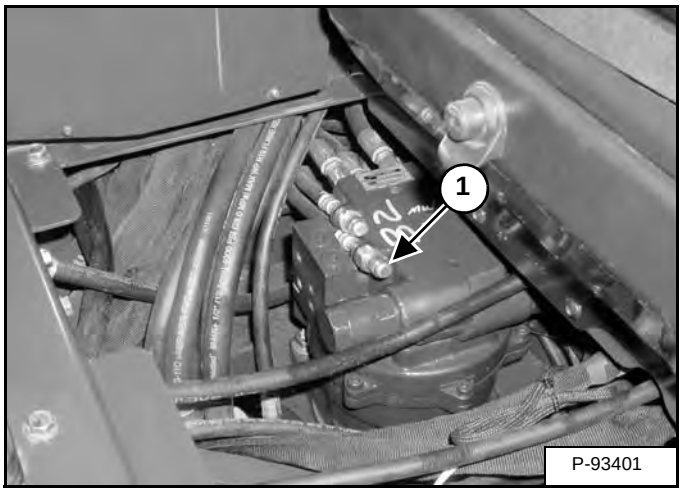
Remove the floor mat and floor plate. (See Removal And Installation on Page 40-110-1.)

Figure 20-32-2



Disconnect the two hoses and fittings (Item 1) **[Figure 20-32-2]** from the swing motor.

Figure 20-32-3



Install caps (Item 1) **[Figure 20-32-3]** on both hoses.

Lower the control console and fasten the seat belt.

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

Engage the upperstructure slew right function. Record the pressure on the gauge.

Engage the upperstructure slew left function. Record the pressure on the gauge.

The crossport relief valve pressure should be as follows:

A target pressure of 24097 kPa (241 bar) (3495 psi) with an acceptable range of 23601 - 25000 kPa (236 - 250 bar) (3423 - 3626 psi).

Stop the engine.

If the crossport relief valve does not meet specifications, remove, clean and inspect the valve. Reinstall the valve and retest. If the valve still does not meet specifications, replace the valve.

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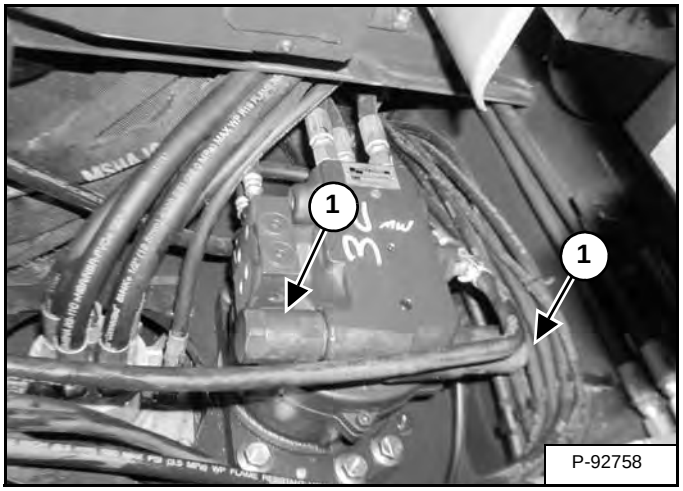
Removal And Installation

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-130-5.)

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

Remove the tool box. (See Removal And Installation on Page 40-230-1.)

Figure 20-32-4

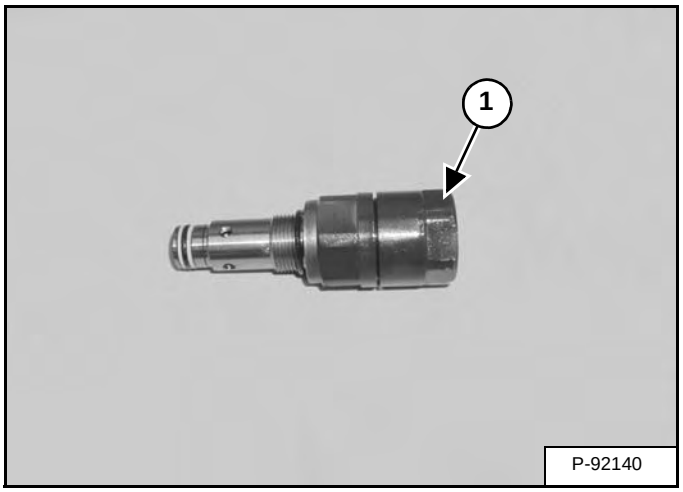


Mark and remove the crossport relief valves (Item 1) **[Figure 20-32-4]**.

NOTE: Install the valves in the original location.

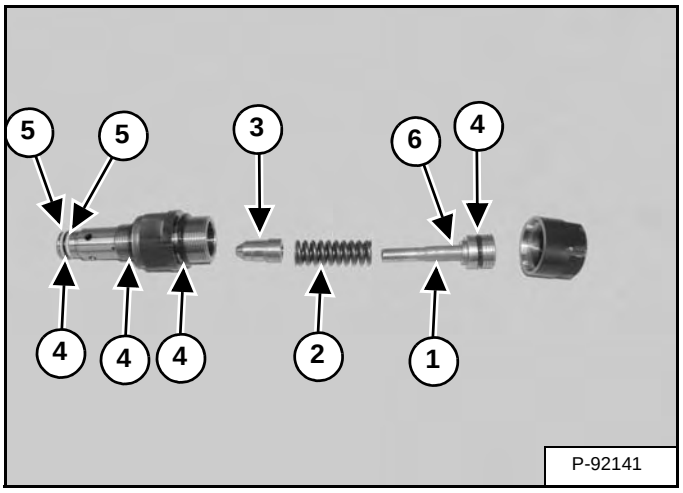
Cross Port Relief Valve Disassembly And Assembly

Figure 20-32-5



Remove the cap (Item 1) **[Figure 20-32-5]**.

Figure 20-32-6



Remove the spool (Item 1), spring (Item 2) and poppet (Item 3). Remove the O-rings (Item 4) and back-up rings (Item 5) **[Figure 20-32-6]**.

NOTE: Shims (Item 6) [Figure 20-32-6] may be installed on the spool. Always install the same number of shims that were removed.

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VALVE (PILOT PRESSURE RELIEF)

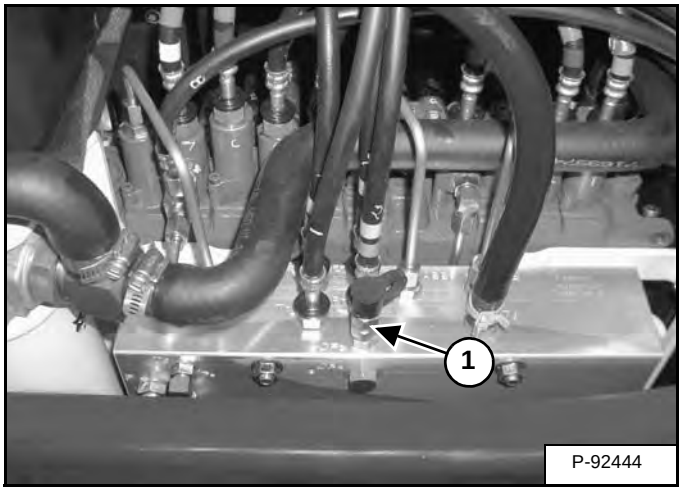
Testing And Adjusting The Pilot Pressure Relief Valve

The pilot pressure valve supplies lower hydraulic pressure to joysticks.

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

MEL1355 - Test Kit includes the following
MEL1355-2 - 6894,8 kPa (68,9 bar) (1000 psi) Gauge
MEL1355-9 - Thermometer

Figure 20-33-1

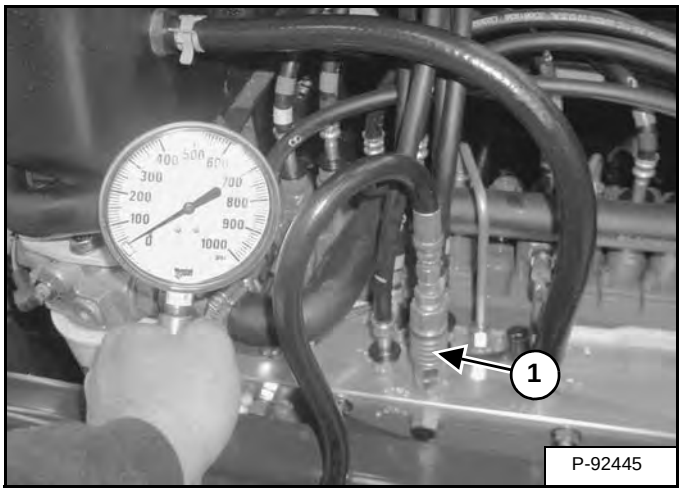


The diagnostic port (Item 1) **[Figure 20-33-1]** will be used to check the pressure reducing valve.

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

Open the right side cover.

Figure 20-33-2



Install a 6894,8 kPa (68,9 bar) (1000 psi) gauge on the diagnostic port (Item 1) **[Figure 20-33-2]**.

Lower the control console and fasten the seat belt.

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

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

Engage the bucket curl circuit and fully curl the bucket.

The pilot pressure relief valve pressure should be as follows:

A target pressure of 2951 kPa (30 bar) (428 psi) with an acceptable range of 2799 - 3103 kPa (28 - 31 bar) (406 - 450 psi).

Move the engine speed control to low idle speed.

Stop the engine.

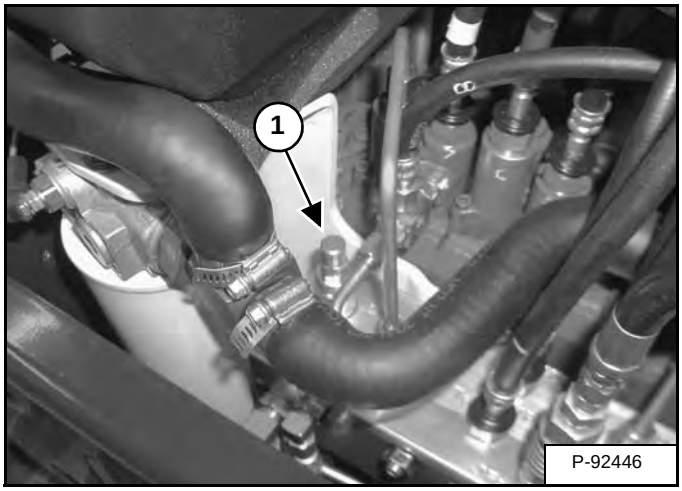
With the engine off, and the key in the run position, lower the left console and move both joysticks to relieve hydraulic pressure.

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VALVE (PILOT PRESSURE RELIEF) (CONT'D)

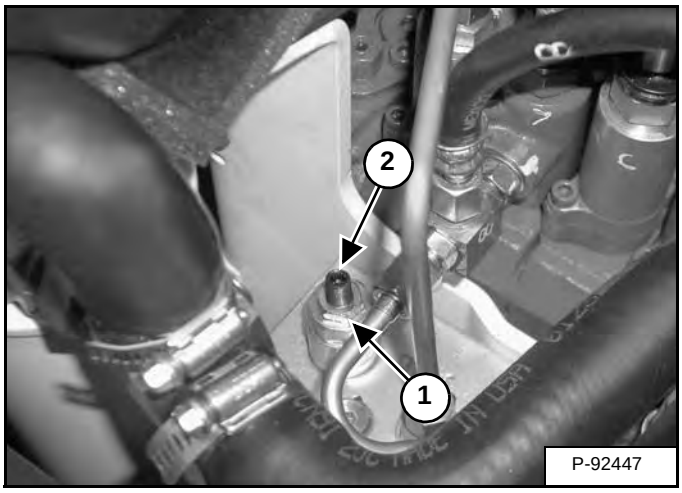
Testing And Adjusting The Pilot Pressure Relief Valve (Cont'd)

Figure 20-33-3



Remove the cap (Item 1) **[Figure 20-33-3]**.

Figure 20-33-4



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

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

NOTE: 1/4 turn is approximately 275,8 kPa (2,8 bar) (40 psi).

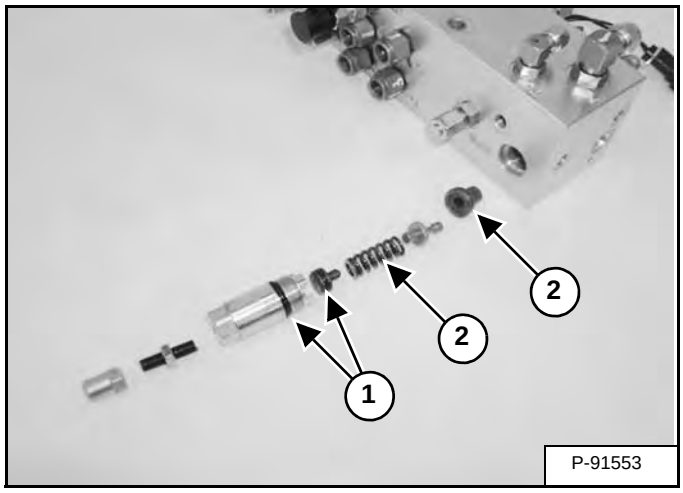
Tighten the nut (Item 1) **[Figure 20-33-4]**.

Retest the pilot pressure relief valve after adjustment.

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

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

Figure 20-33-5



Inspect the valve (Item 1) **[Figure 20-33-5]** on the manifold assembly to verify no damage. If damaged replace the manifold assembly.

Inspect the O-rings (Item 2) **[Figure 20-33-5]** on the valve. If O-rings are worn or damaged, replace O-rings. (See Disassembly And Assembly on Page 20-60-4.)

Re-install the valve in the manifold assembly.

Repeat the pilot pressure relief valve test.

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

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HYDRAULIC CONTROL VALVE

Description

The hydraulic control valve is a nine section closed center system and has one main relief valve. The main relief valve operates at 24476 kPa (245 bar) (3550 psi). The bucket, blade, and arm section have 27000 kPa (270 bar) (3916 psi) work port reliefs. The boom section has 28999 kPa (290 bar) (4206 psi) work port reliefs.

The auxiliary section has 20553 kPa (206 bar) (2981 psi) work port reliefs.

Removal And Installation

Lower the work group to the ground.

Stop the engine.

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

Remove the hydraulic reservoir. (See Removal And Installation on Page 20-140-1.)

Remove the hydraulic filter. (See Removing And Replacing Hydraulic Fluid on Page 10-130-5.)

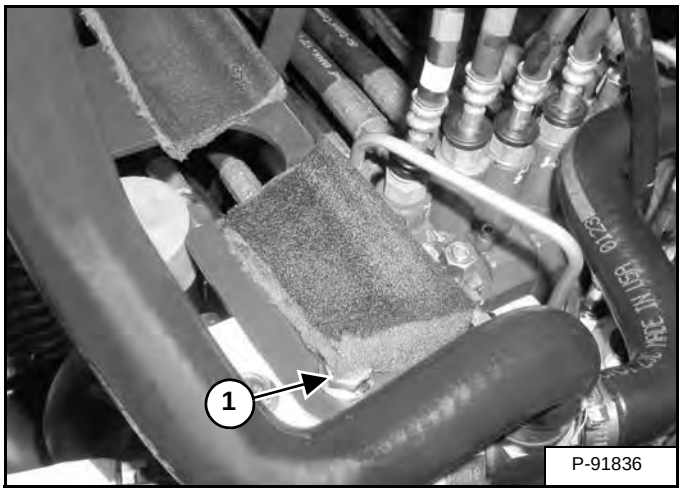
Remove the right upperstructure cover. (See Removal And Installation on Page 40-80-1.)

IMPORTANT

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

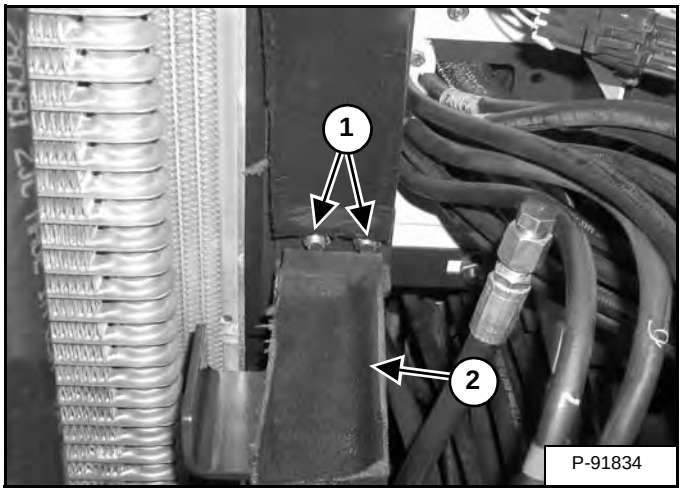
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Figure 20-40-1



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

Figure 20-40-2

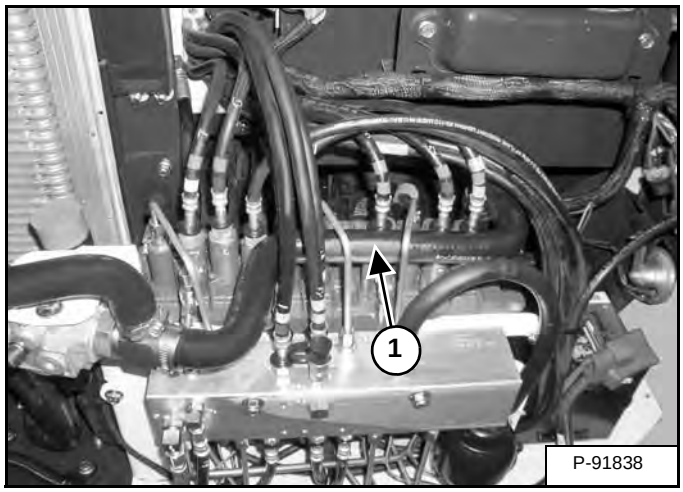


Remove the two nuts (Item 1) and reservoir support (Item 2) **[Figure 20-40-2]**.

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Removal And Installation (Cont'd)

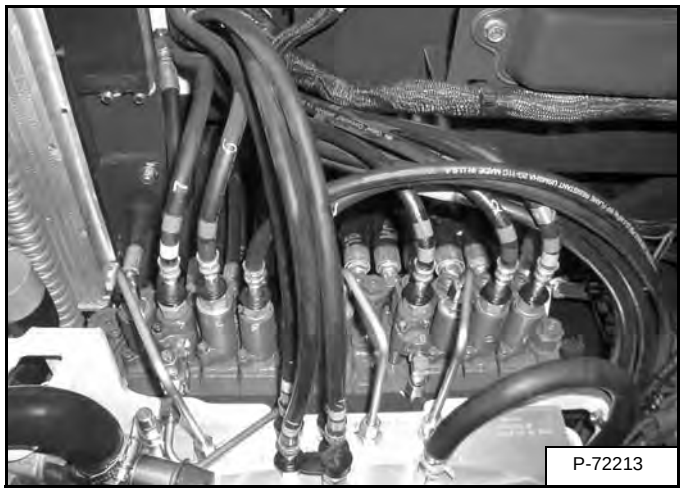
Figure 20-40-3



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

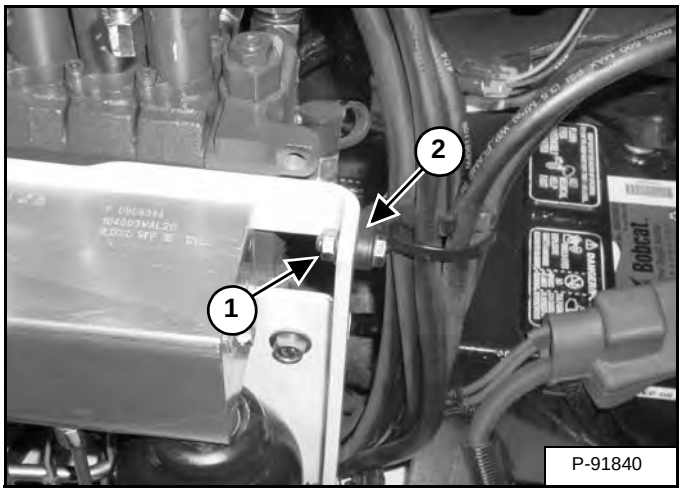
Mark all tubelines and hoses for proper installation.

Figure 20-40-4



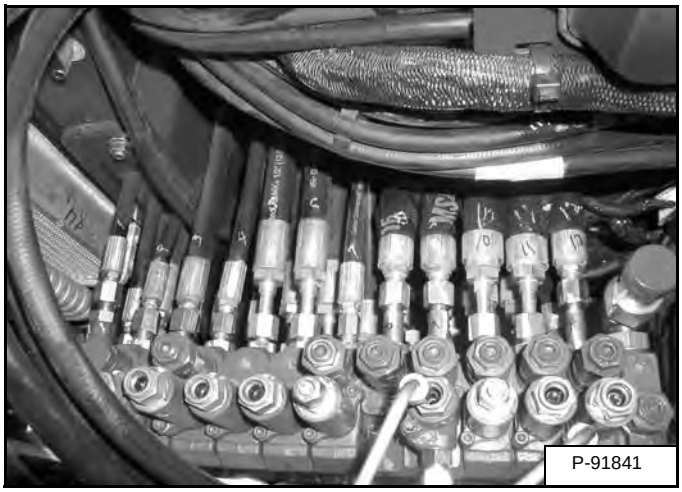
Remove the pilot pressure hoses and tubelines from the valve **[Figure 20-40-4]**.

Figure 20-40-5



Remove the nut (Item 1) and reposition the hose clamp (Item 2) **[Figure 20-40-5]**.

Figure 20-40-6

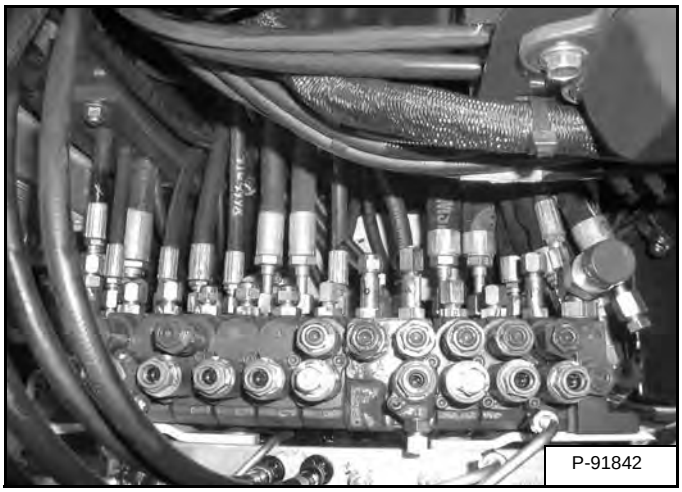


Remove the high pressure hoses **[Figure 20-40-6]**.

Dealer Copy -- Not for Resale

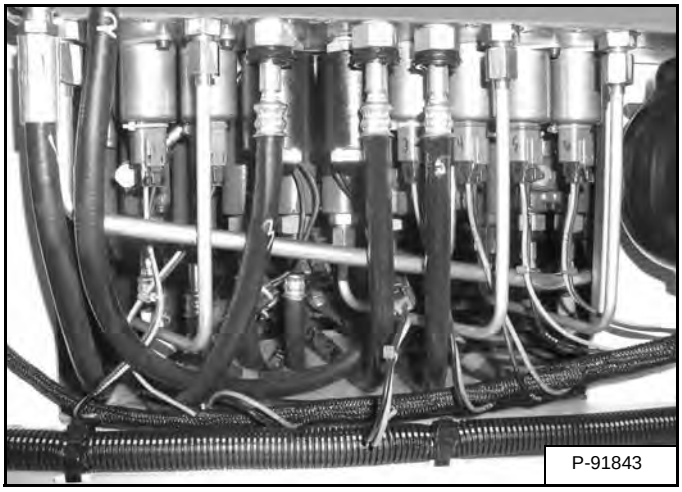
Removal And Installation (Cont'd)

Figure 20-40-7



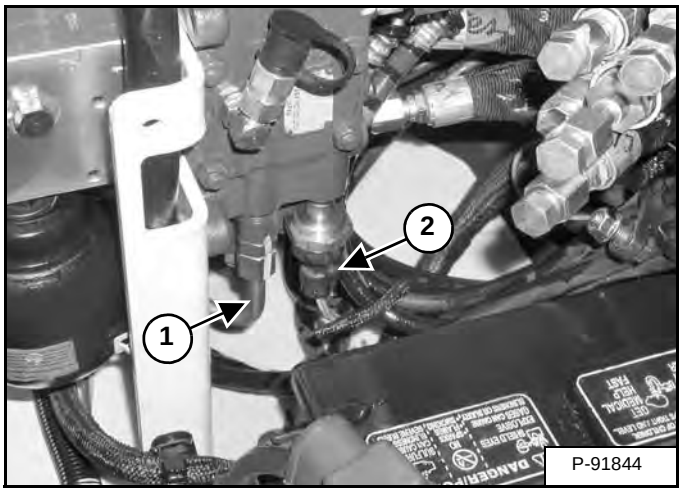
Continue to remove the high pressure hoses **[Figure 20-40-7]**.

Figure 20-40-8



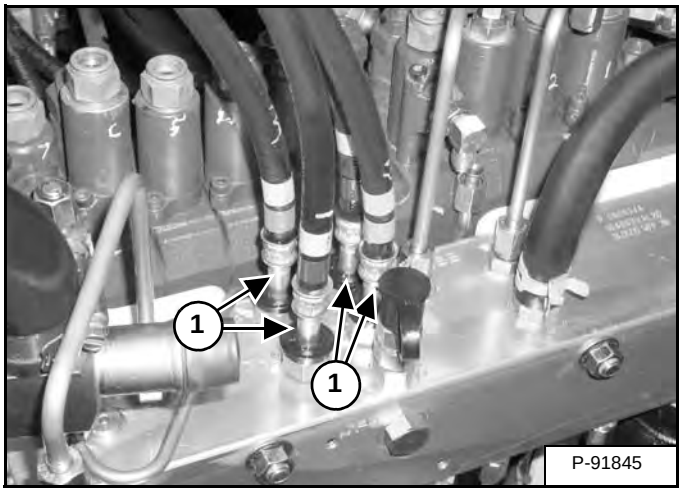
Remove the pilot pressure hoses and tubelines from the valve **[Figure 20-40-8]**.

Figure 20-40-9



Remove the tubeline (Item 1). Disconnect the wire harness (Item 2) **[Figure 20-40-9]**.

Figure 20-40-10

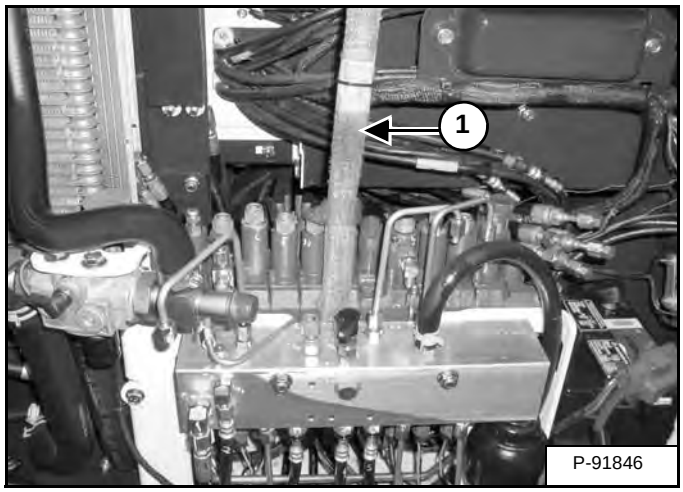


Remove the four hoses (Item 1) **[Figure 20-40-10]** from the top of the manifold. Reposition the hoses to provide clearance to remove the valve.

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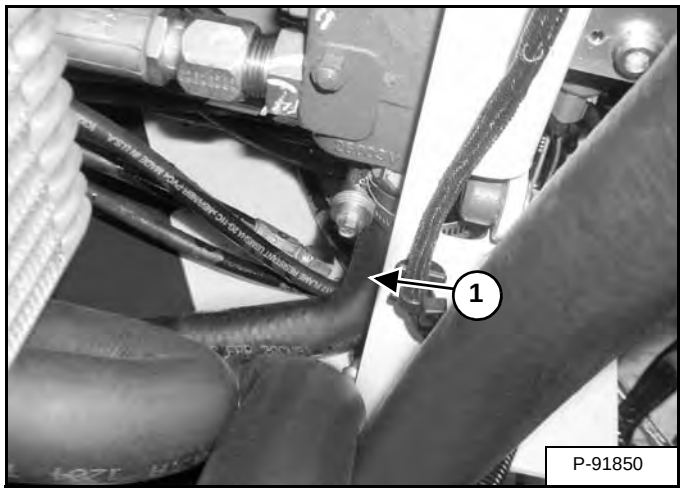
Removal And Installation (Cont'd)

Figure 20-40-11



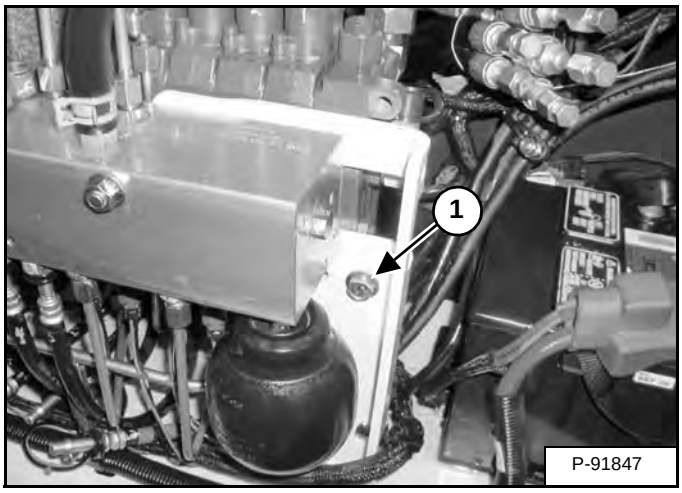
Install a sling (Item 1) **[Figure 20-40-11]** on the valve.

Figure 20-40-12



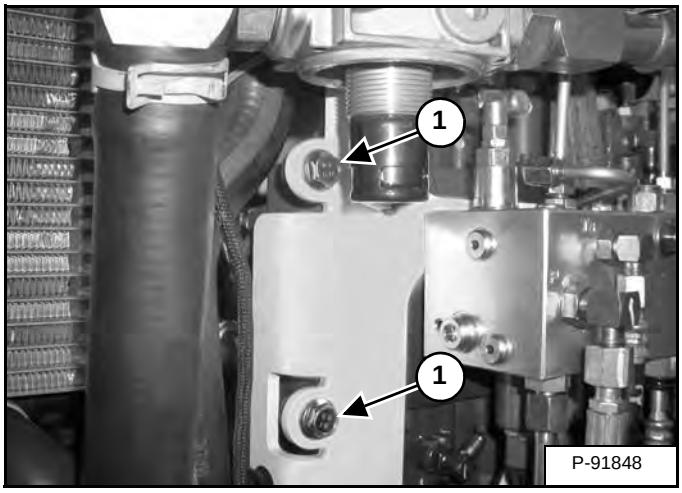
Remove the inlet hose (Item 1) **[Figure 20-40-12]**.

Figure 20-40-13



Remove the bolt (Item 1) **[Figure 20-40-13]**.

Figure 20-40-14

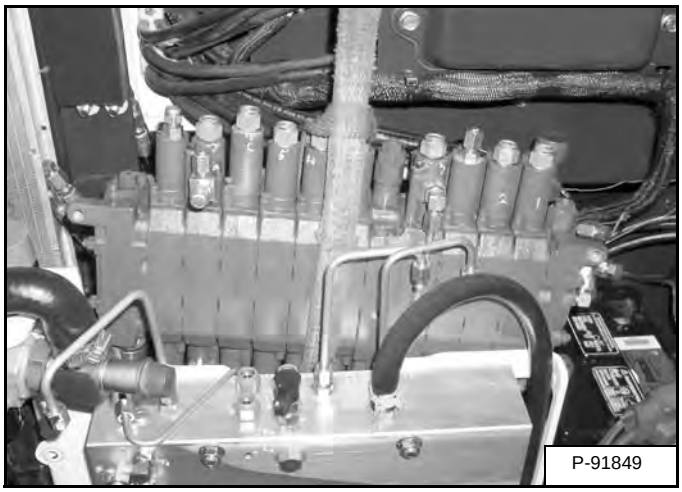


Remove the bolts (Item 1) **[Figure 20-40-14]**.

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Removal And Installation (Cont'd)

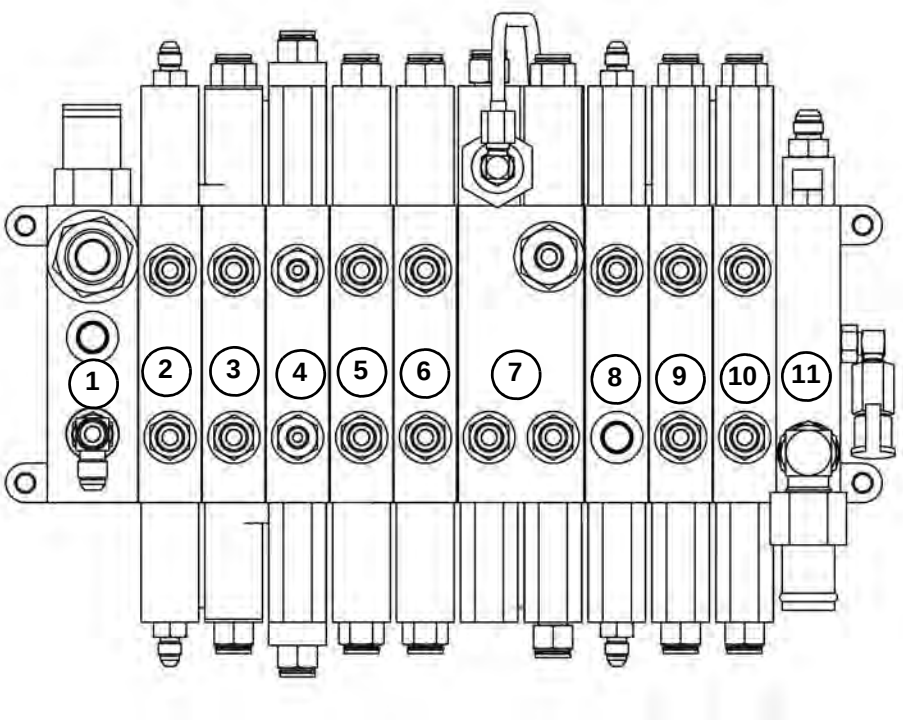
Figure 20-40-15



Remove the valve from the excavator **[Figure 20-40-15]**.

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Parts Identification



NA1539

1. **Inlet Valve Section**
2. **Boom Offset Valve Section**
3. **Slew Valve Section**
4. **Blade Valve Section**
5. **Left Travel Valve Section**
6. **Right Travel Valve Section**
7. **Boom Valve Section**
8. **Auxiliary Valve Section**
9. **Arm Valve Section**
10. **Bucket Valve Section**
11. **Outlet Valve Section**

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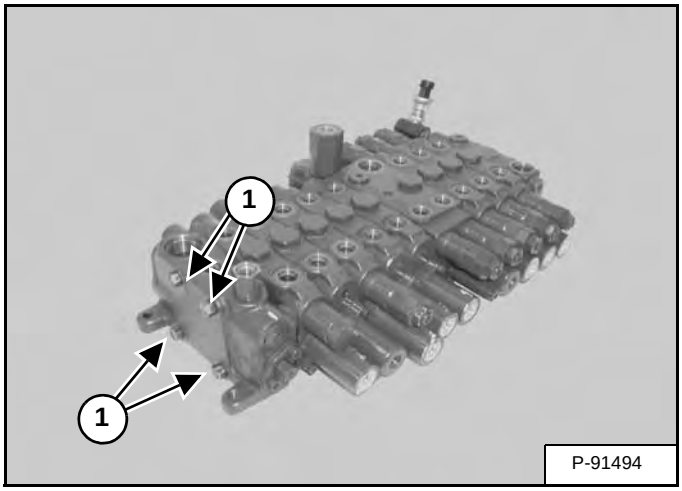
Disassembly

IMPORTANT

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

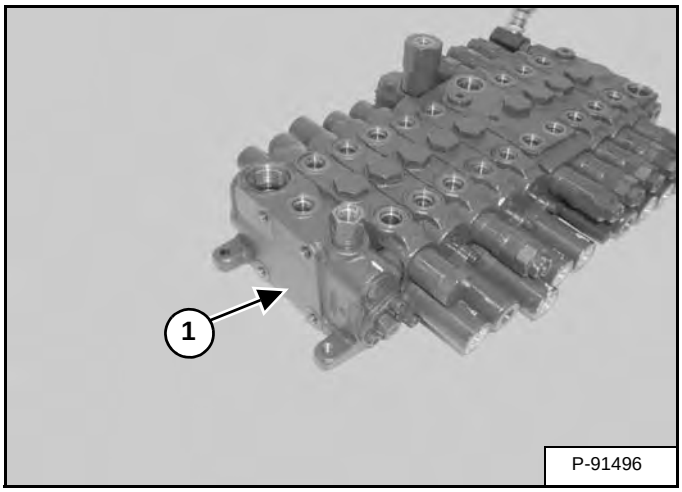
I-2003-0888

Figure 20-40-16



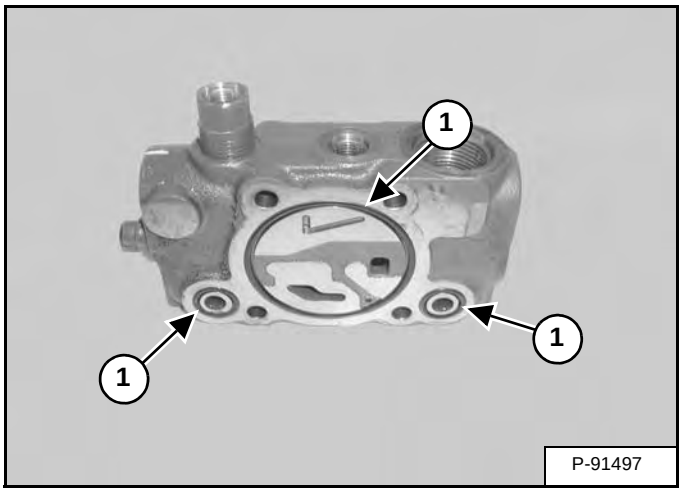
Remove the four nuts (Item 1) **[Figure 20-40-16]**.

Figure 20-40-17



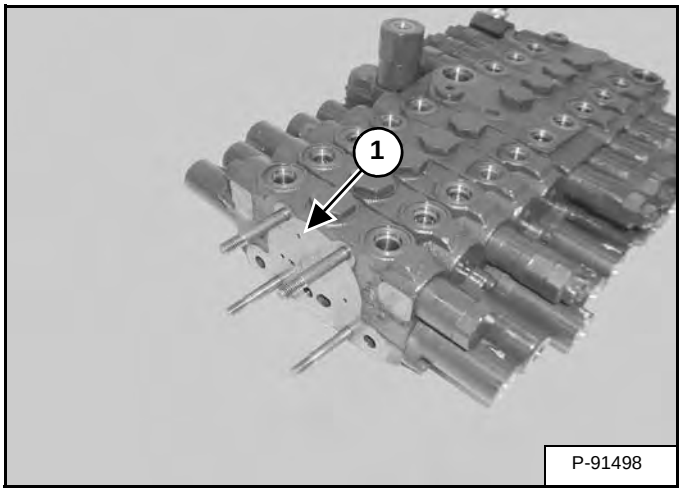
Remove the inlet (Item 1) **[Figure 20-40-17]**.

Figure 20-40-18



Remove the three O-rings (Item 1) **[Figure 20-40-18]**.

Figure 20-40-19

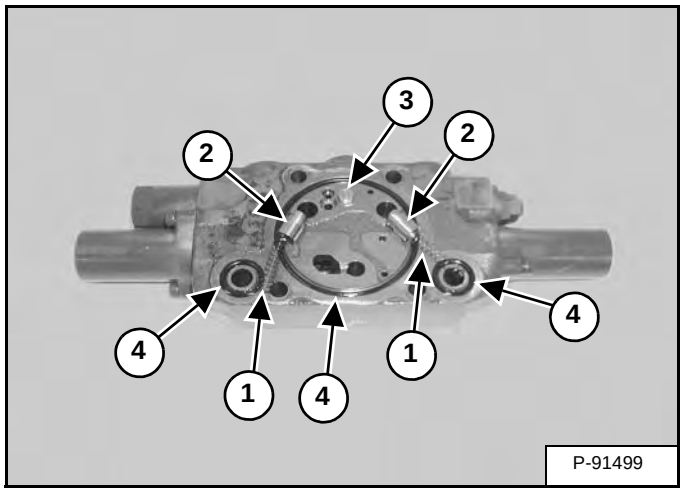


Remove the boom swing valve section (Item 1) **[Figure 20-40-19]**.

Dealer Copy -- Not for Resale

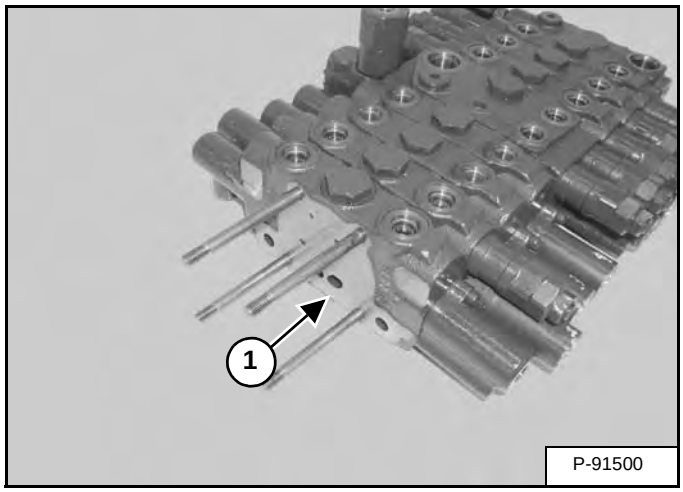
Disassembly (Cont'd)

Figure 20-40-20



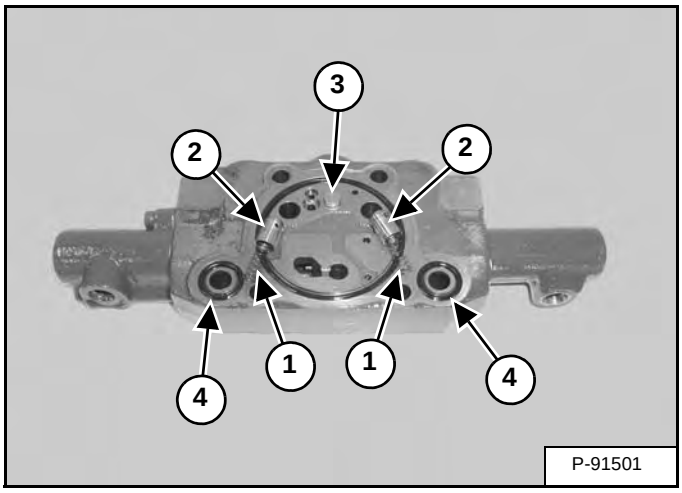
Remove the springs (Item 1), poppets (Item 2) and shuttle valve (Item 3). Remove the O-rings (Item 4) **[Figure 20-40-20]**.

Figure 20-40-21



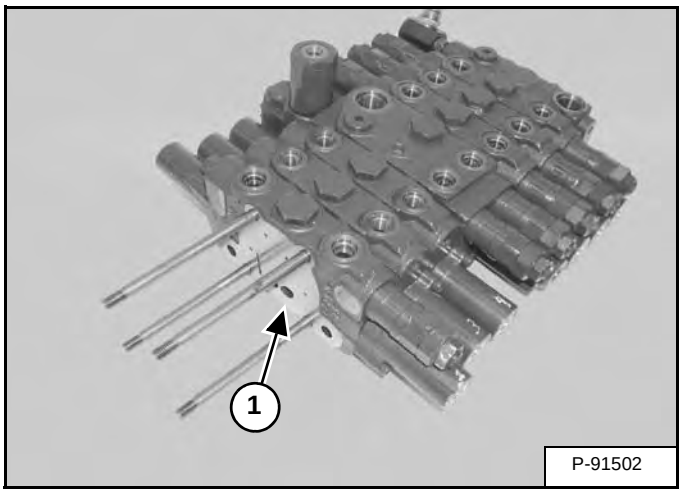
Remove the slew valve section (Item 1) **[Figure 20-40-21]**.

Figure 20-40-22



Remove the springs (Item 1), poppets (Item 2) and shuttle valve (Item 3). Remove the O-rings (Item 4) **[Figure 20-40-22]**.

Figure 20-40-23

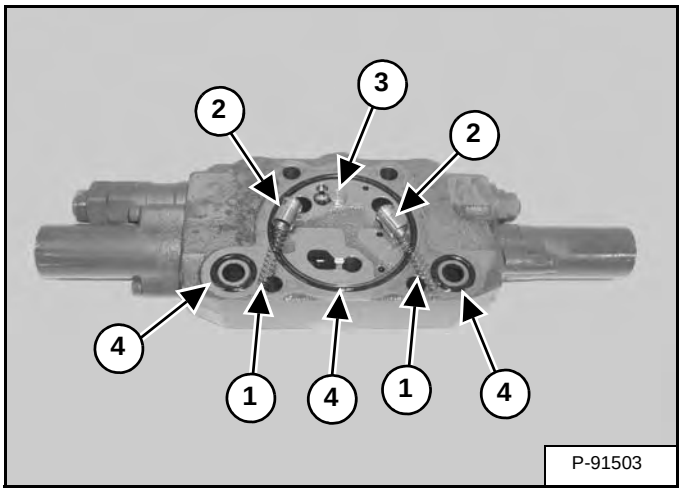


Remove the blade valve section (Item 1) **[Figure 20-40-23]**.

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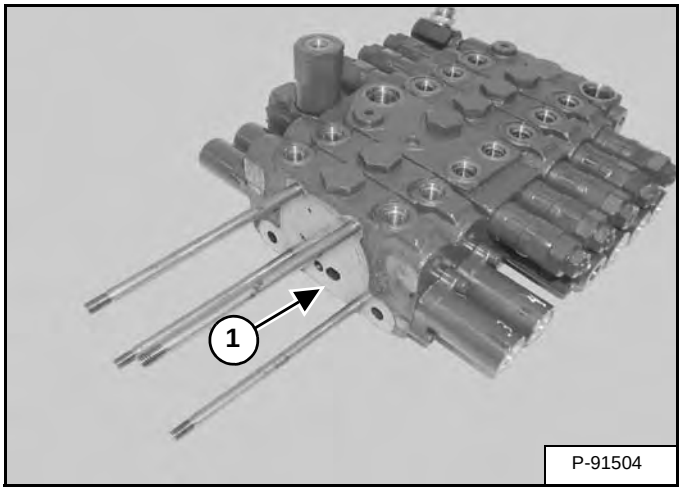
Disassembly (Cont'd)

Figure 20-40-24



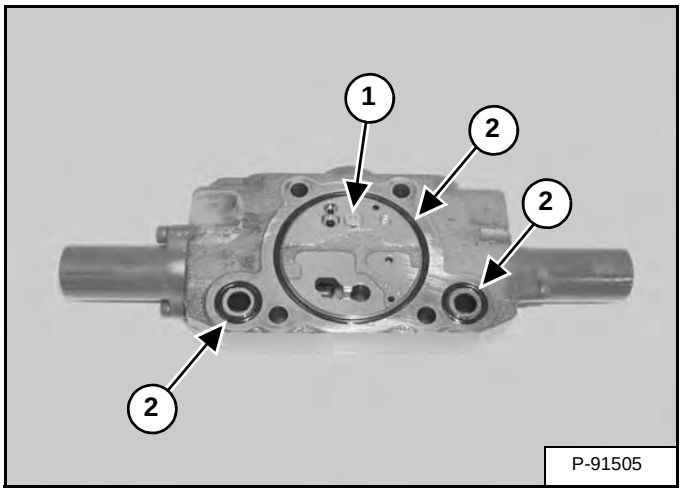
Remove the springs (Item 1), poppets (Item 2) and shuttle valve (Item 3). Remove the O-rings (Item 4) **[Figure 20-40-24]**.

Figure 20-40-25



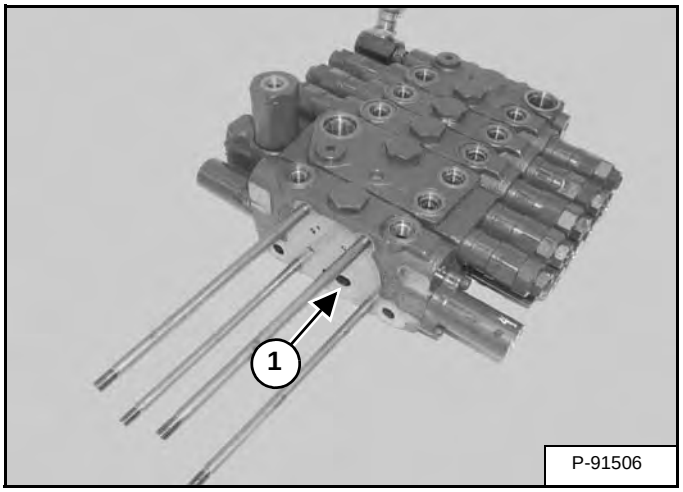
Remove the left hand travel valve section (Item 1) **[Figure 20-40-25]**.

Figure 20-40-26



Remove the shuttle valve (Item 1) and O-rings (Item 2) **[Figure 20-40-26]**.

Figure 20-40-27

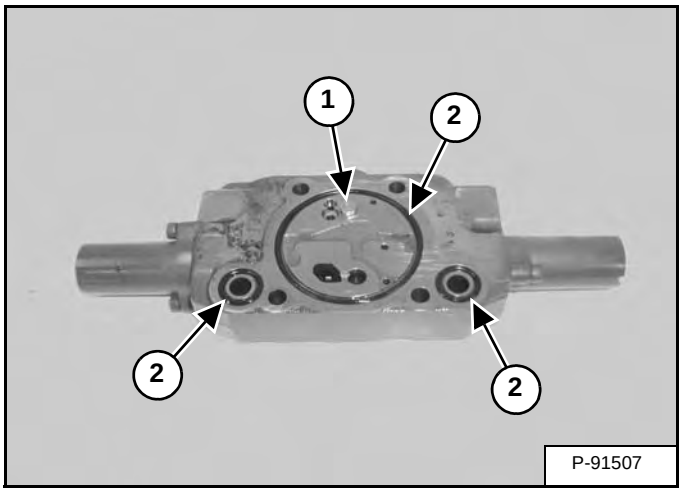


Remove the right hand travel valve section (Item 1) **[Figure 20-40-27]**.

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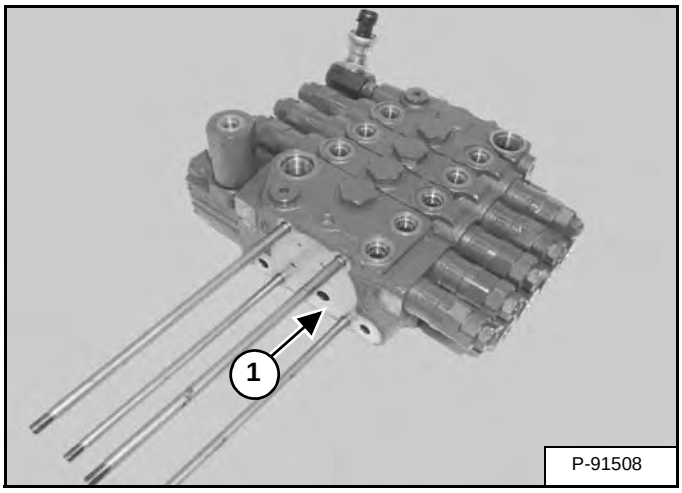
Disassembly (Cont'd)

Figure 20-40-28



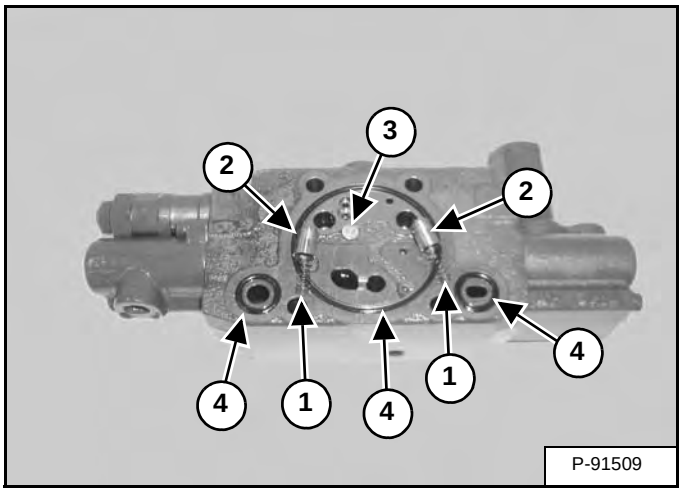
Remove the shuttle valve (Item 1) and O-rings (Item 2) **[Figure 20-40-28]**.

Figure 20-40-29



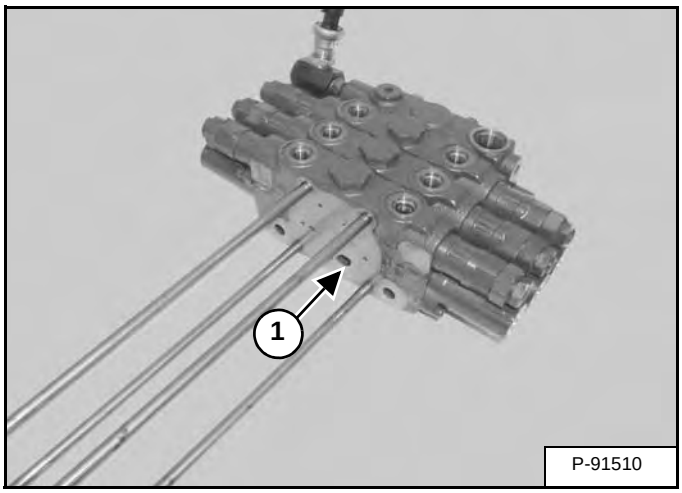
Remove the boom valve section (Item 1) **[Figure 20-40-29]**.

Figure 20-40-30



Remove the springs (Item 1), poppets (Item 2) and shuttle valve (Item 3). Remove the O-rings (Item 4) **[Figure 20-40-30]**.

Figure 20-40-31

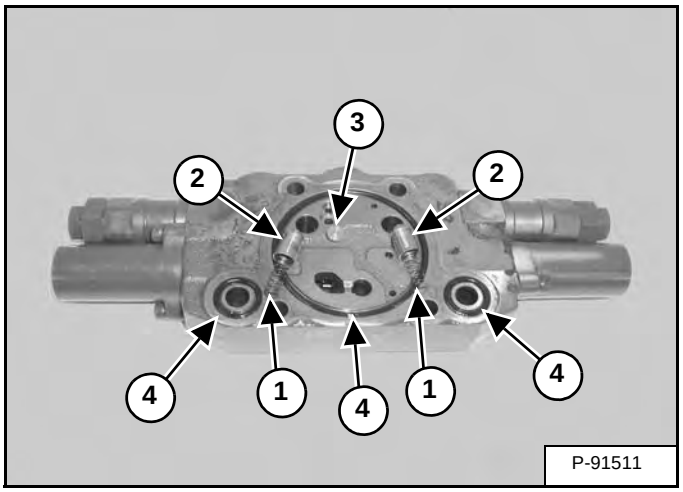


Remove the auxiliary hydraulic valve section (Item 1) **[Figure 20-40-31]**.

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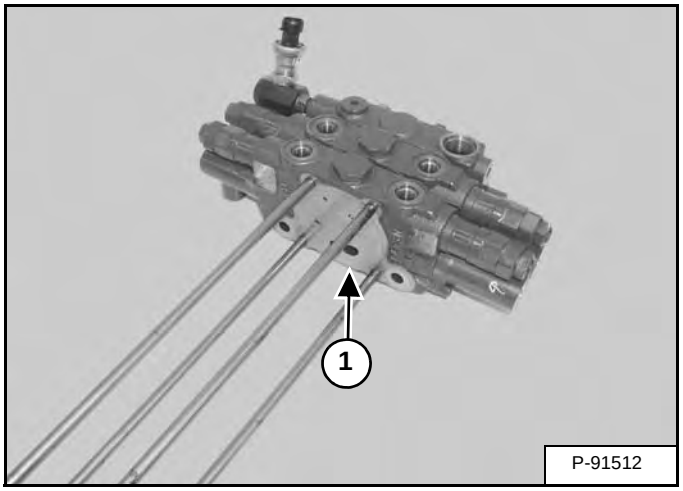
Disassembly (Cont'd)

Figure 20-40-32



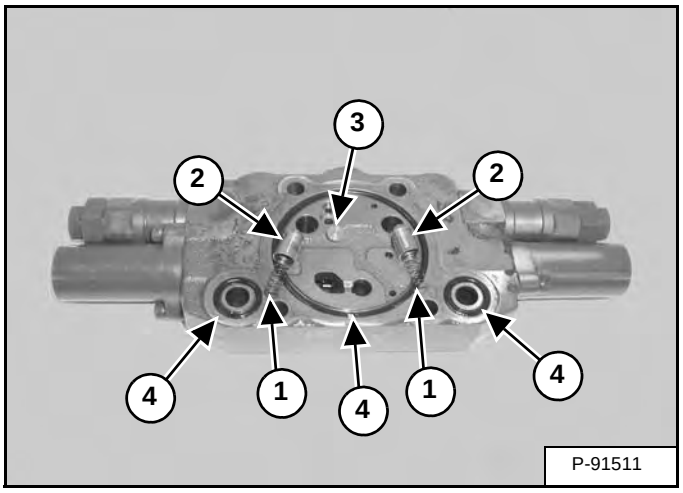
Remove the spring (Item 1), poppets (Item 2) and shuttle valve (Item 3). Remove the O-rings (Item 4) **[Figure 20-40-32]**.

Figure 20-40-33



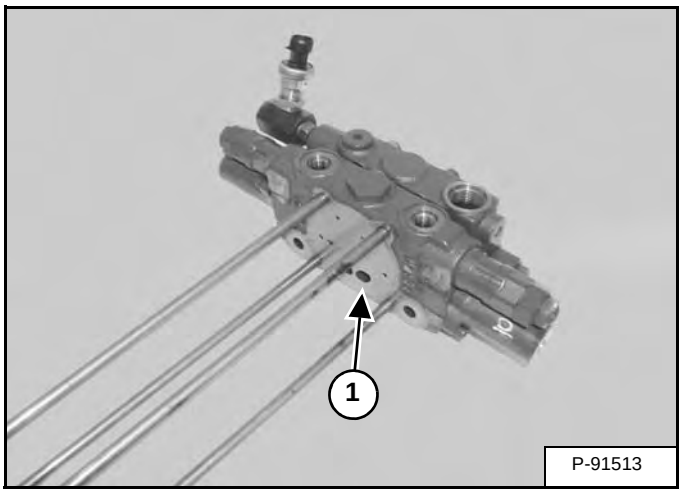
Remove the arm valve section (Item 1) **[Figure 20-40-33]**.

Figure 20-40-34



Remove the springs (Item 1), poppets (Item 2) and shuttle valve (Item 3). Remove the O-rings (Item 4) **[Figure 20-40-34]**.

Figure 20-40-35

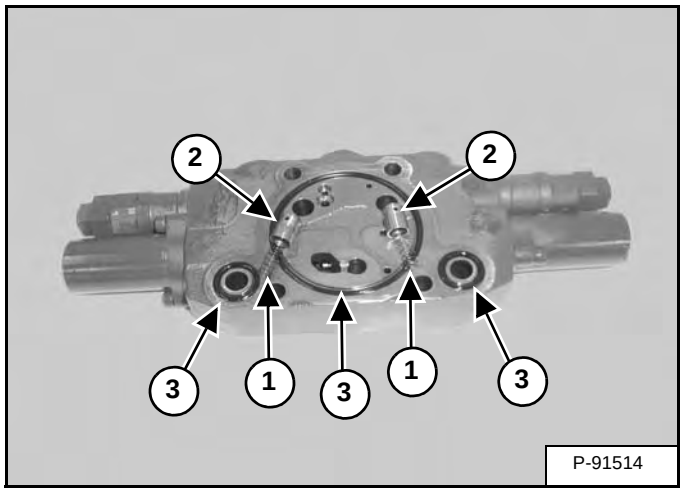


Remove the bucket valve section (Item 1) **[Figure 20-40-35]**.

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Disassembly (Cont'd)

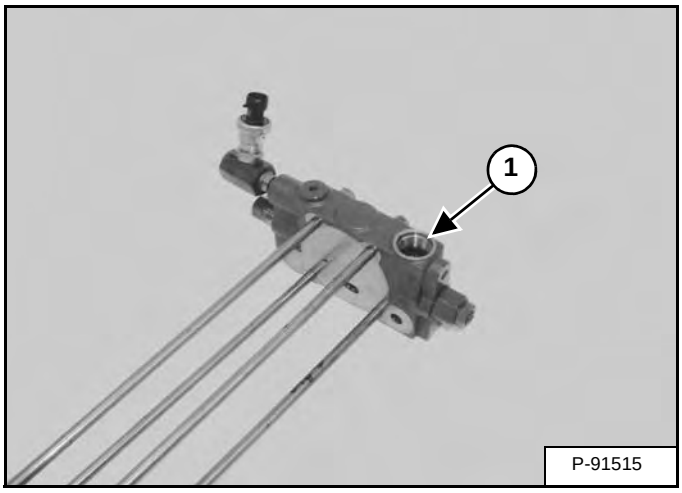
Figure 20-40-36



Remove the springs (Item 1) and poppets (Item 2). Remove the O-rings (Item 3) **[Figure 20-40-36]**.

NOTE: The bucket valve section does not have a shuttle valve.

Figure 20-40-37



Remove the outlet valve section (Item 1) **[Figure 20-40-37]**.

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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.

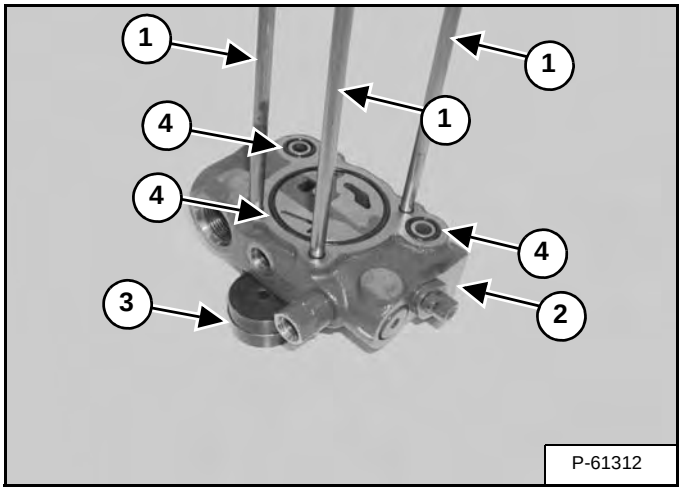
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Clean all parts in solvent and dry with compressed air.

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

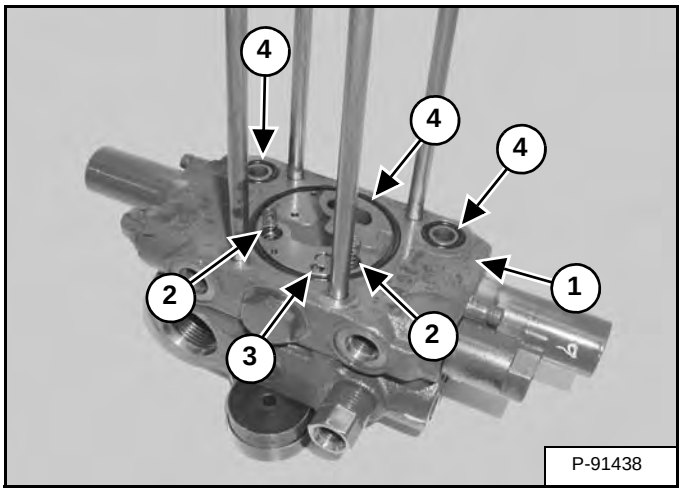
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-38



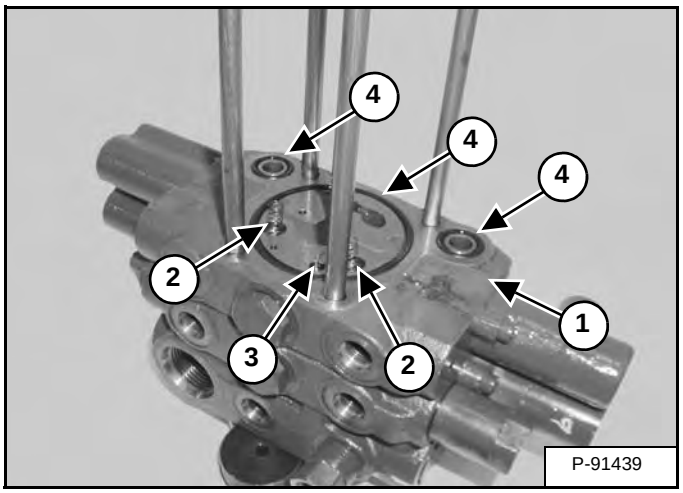
Install the tie rods (Item 1) through the inlet valve section (Item 2). Place the valve (Item 2) on end and use spacers (Item 3) to level the valve. Install the O-rings (Item 4) **[Figure 20-40-38]**.

Figure 20-40-39



Install the boom swing valve section (Item 1). Install the poppets and springs (Item 2), shuttle valve (Item 3) and O-rings (Item 4) **[Figure 20-40-39]**.

Figure 20-40-40

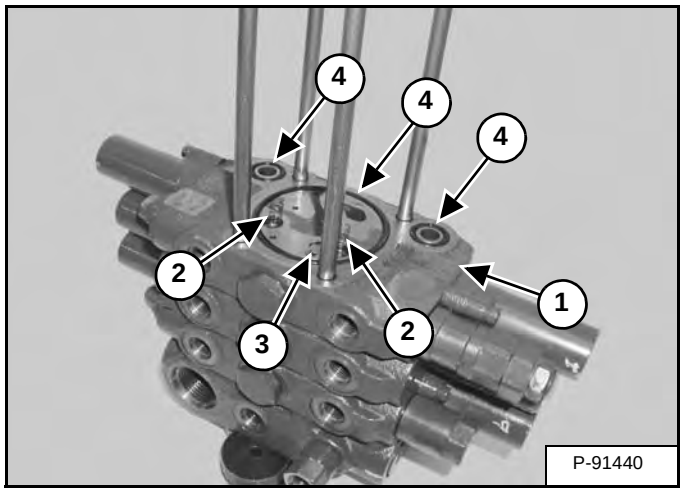


Install the slew valve section (Item 1). Install the poppets and springs (Item 2), shuttle valve (Item 3) and O-rings (Item 4) **[Figure 20-40-40]**.

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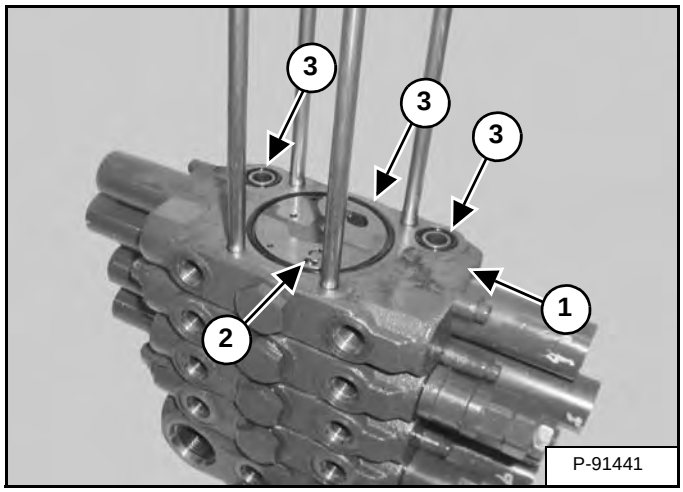
Assembly (Cont'd)

Figure 20-40-41



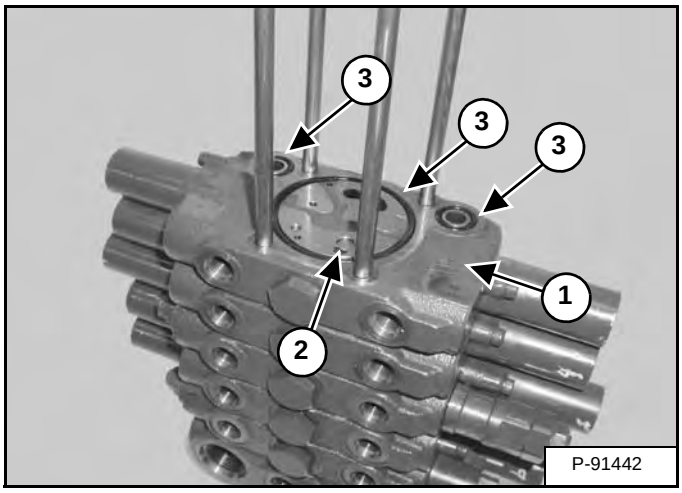
Install the blade valve section (Item 1). Install the poppets and springs (Item 2), shuttle valve (Item 3) and O-rings (Item 4) **[Figure 20-40-41]**.

Figure 20-40-42



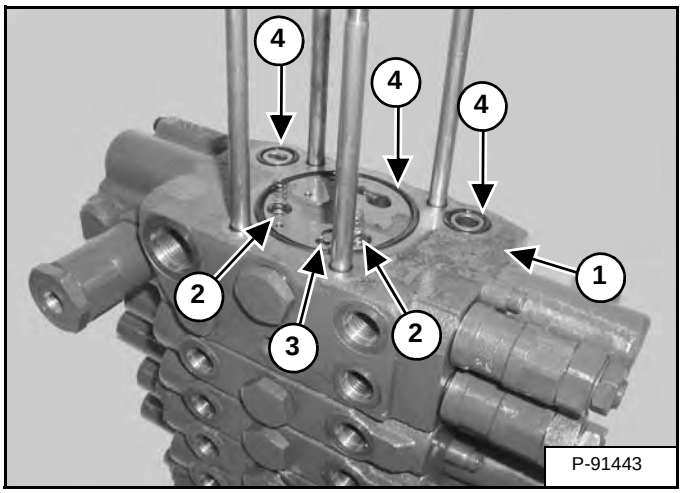
Install the left travel valve section (Item 1). Install the shuttle valve (Item 2) and O-rings (Item 3) **[Figure 20-40-42]**.

Figure 20-40-43



Install the right travel valve section (Item 1). Install the shuttle valve (Item 2) and O-rings (Item 3) **[Figure 20-40-43]**.

Figure 20-40-44

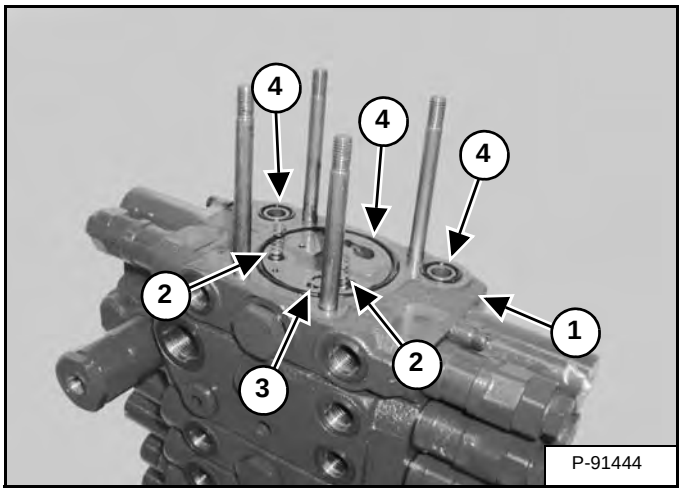


Install the boom valve section (Item 1). Install the poppets and springs (Item 2), shuttle valve (Item 3) and O-rings (Item 4) **[Figure 20-40-44]**.

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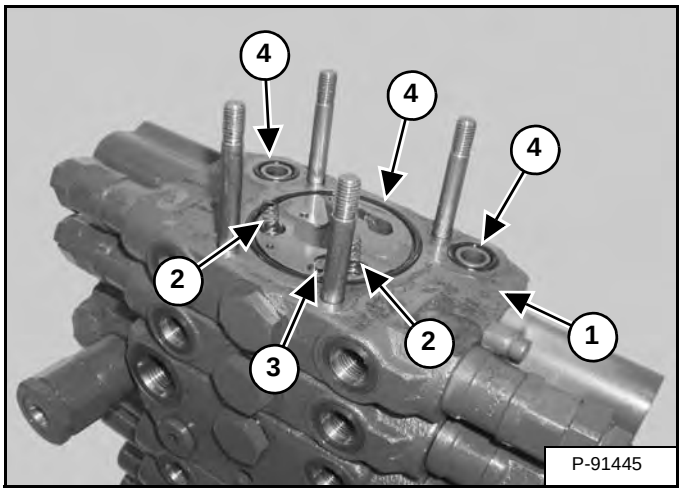
Assembly (Cont'd)

Figure 20-40-45



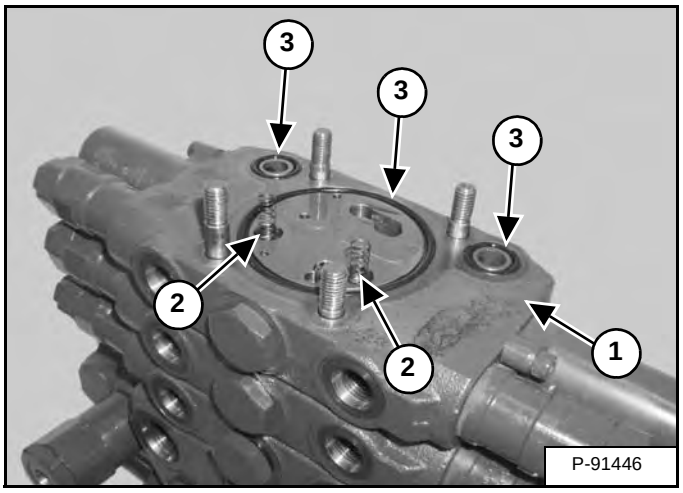
Install the auxiliary valve section (Item 1). Install the poppets and springs (Item 2), shuttle valve (Item 3) and O-rings (Item 4) **[Figure 20-40-45]**.

Figure 20-40-46



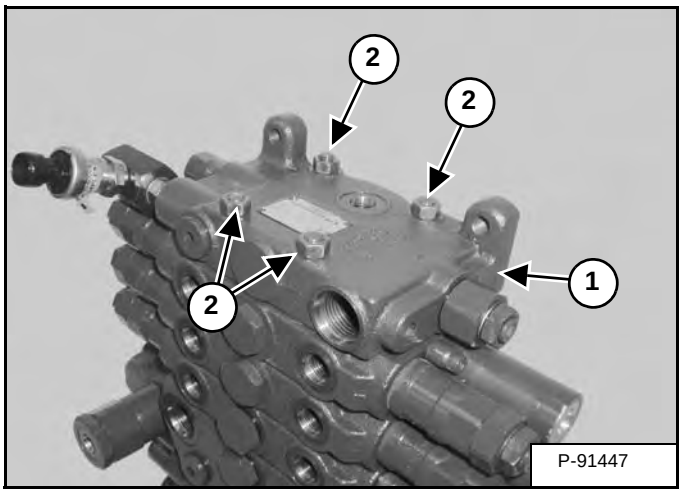
Install the arm valve section (Item 1). Install the poppets and springs (Item 2), shuttle valve (Item 3) and O-rings (Item 4) **[Figure 20-40-46]**.

Figure 20-40-47



Install the bucket valve section (Item 1). Install the poppets and springs (Item 2) and O-rings (Item 3) **[Figure 20-40-47]**.

Figure 20-40-48

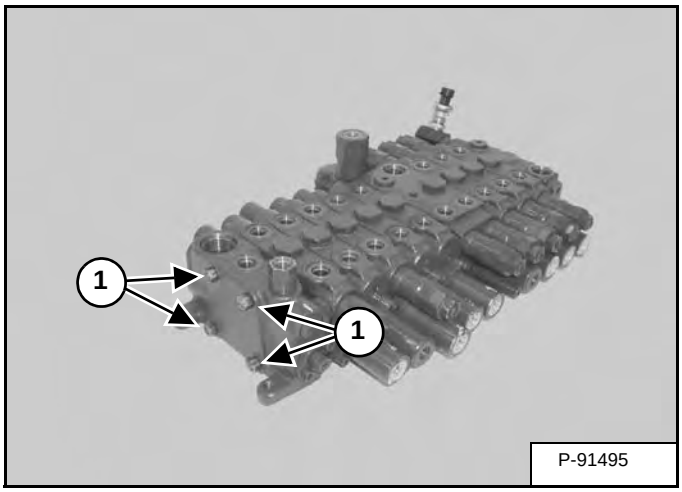


Install the outlet valve section (Item 1). Install the nuts (Item 2) **[Figure 20-40-48]**.

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Assembly (Cont'd)

Figure 20-40-49

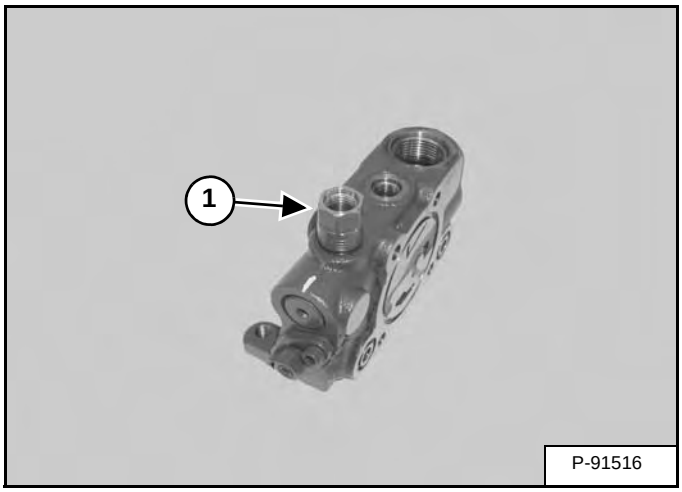


Position the valve as shown and tighten the nuts (Item 1) **[Figure 20-40-49]** in a criss cross pattern to 19 N•m (14 ft-lb) torque.

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Inlet Valve Section Disassembly And Assembly

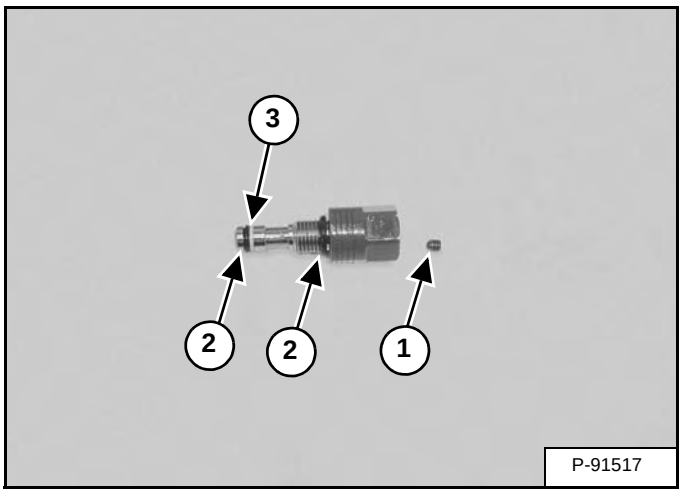
Figure 20-40-50



Remove the fitting (Item 1) **[Figure 20-40-50]**.

Installation: Tighten the fitting to 28,5 - 30 N•m (21 - 22 ft-lb) torque.

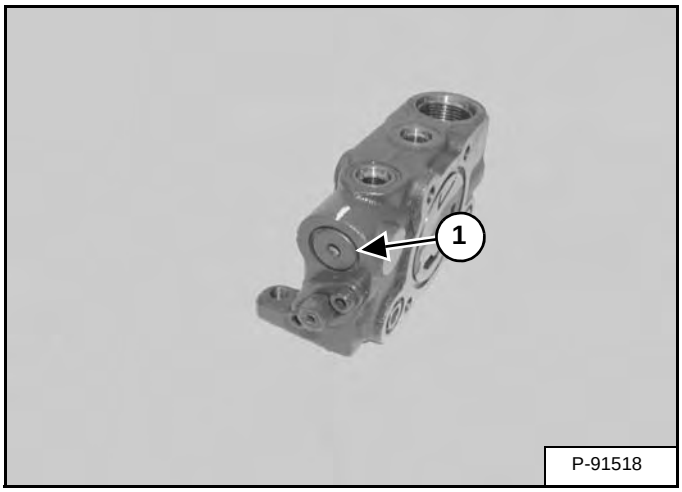
Figure 20-40-51



Remove the orifice (Item 1). Remove the O-rings (Item 2) and back-up ring (Item 3) **[Figure 20-40-51]**.

Installation: Tighten the orifice to 3 - 3,5 N•m (27 - 31 in-lb) torque.

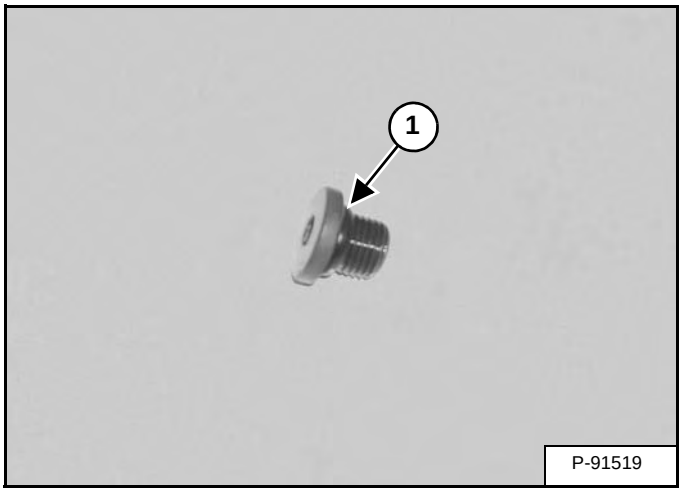
Figure 20-40-52



Remove the plug (Item 1) **[Figure 20-40-52]**.

Installation: Tighten the plug to 28,5 - 30 N•m (21 - 22 ft-lb) torque.

Figure 20-40-53

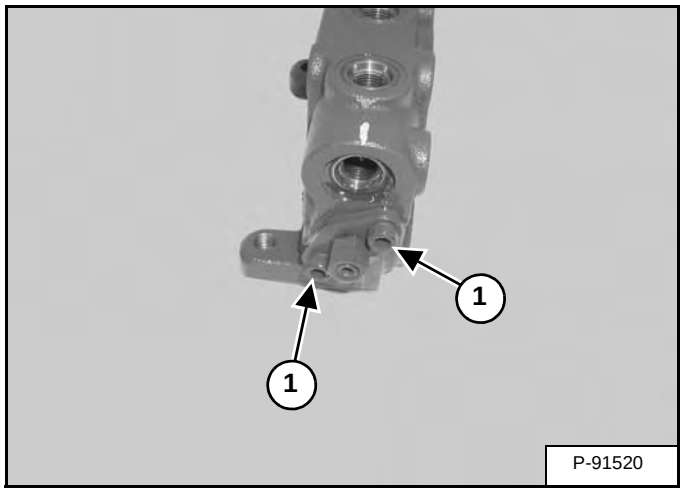


Remove the O-ring (Item 1) **[Figure 20-40-53]** from the plug.

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Inlet Valve Section Disassembly And Assembly (Cont'd)

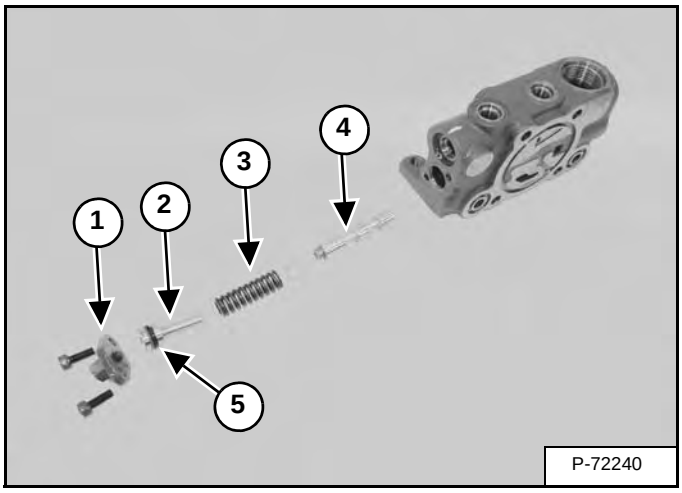
Figure 20-40-54



Remove the bolts (Item 1) **[Figure 20-40-54]**.

Installation: Tighten the bolts to 9 - 11 N•m (6.6 - 8 ft-lb) torque.

Figure 20-40-55

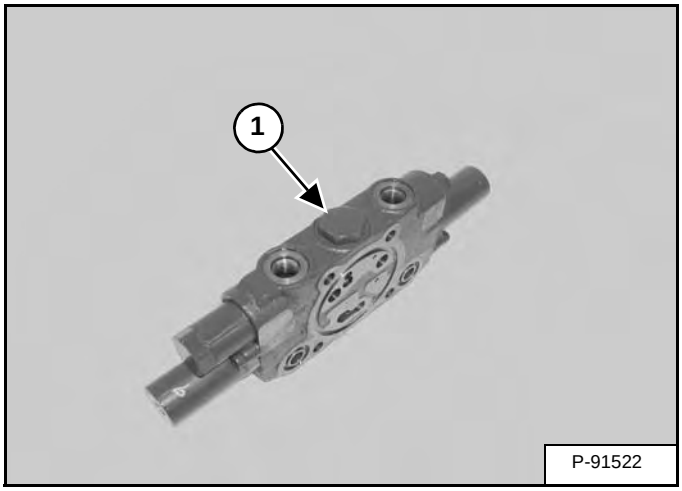


Remove the adjuster (Item 1), spring seat (Item 2), spring (Item 3) and spool (Item 4). Remove the O-ring (Item 5) **[Figure 20-40-55]**.

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Boom Swing Valve Section Disassembly And Assembly

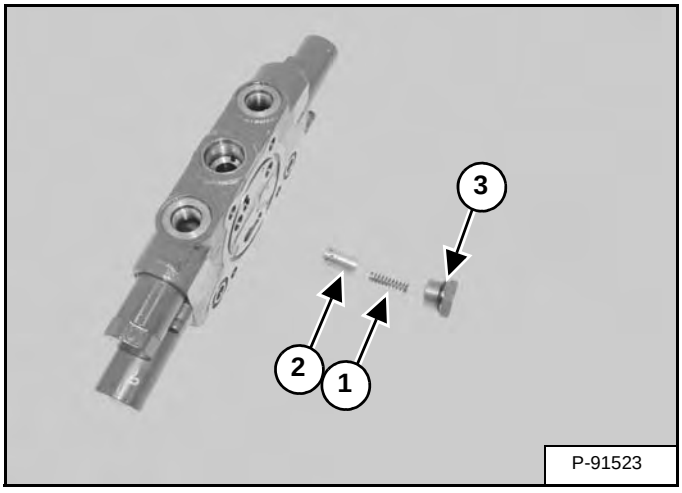
Figure 20-40-56



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

Installation: Tighten the plug to 69 - 78 N•m (51 - 58 ft-lb) torque.

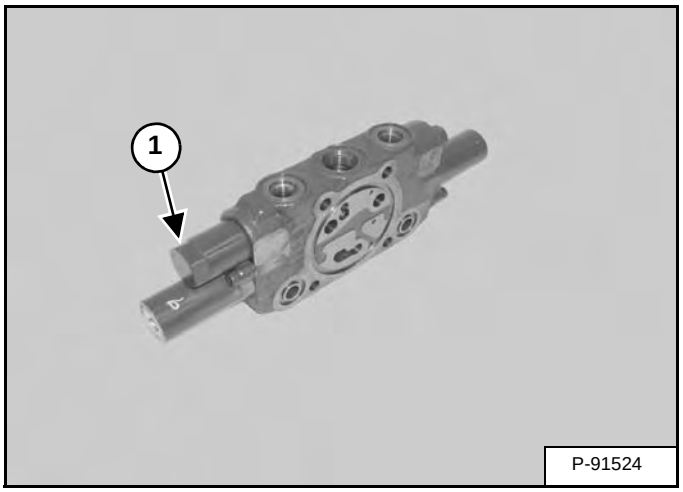
Figure 20-40-57



Remove the spring (Item 1) and compensator valve (Item 2). Remove the O-ring (Item 3) **[Figure 20-40-57]**.

NOTE: The compensator valve must be installed in the valve section it was removed from. Installing the incorrect compensator valve will cause poor hydraulic valve performance.

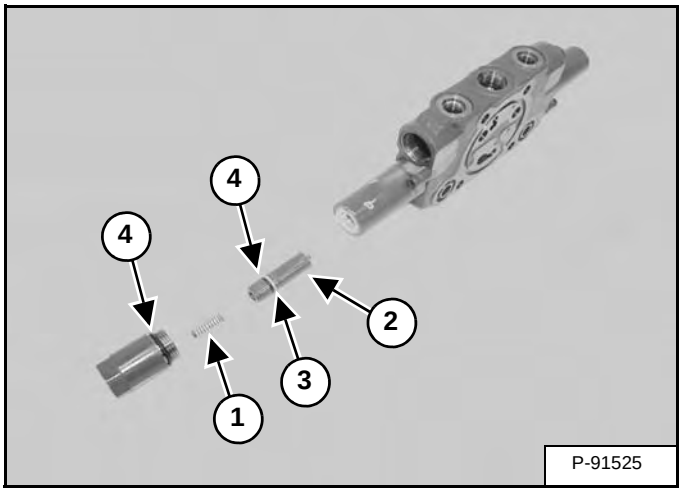
Figure 20-40-58



Remove the anti cavitation valve (Item 1) **[Figure 20-40-58]**.

Installation: Tighten the valve to 69 - 78 N•m (51 - 58 ft-lb) torque.

Figure 20-40-59

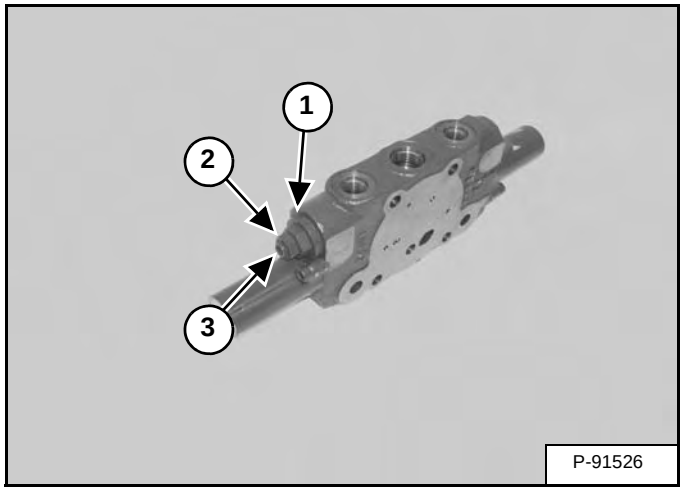


Remove the spring (Item 1) and spool (Item 2). Remove the back-up ring (Item 3) and O-rings (Item 4) **[Figure 20-40-59]**.

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

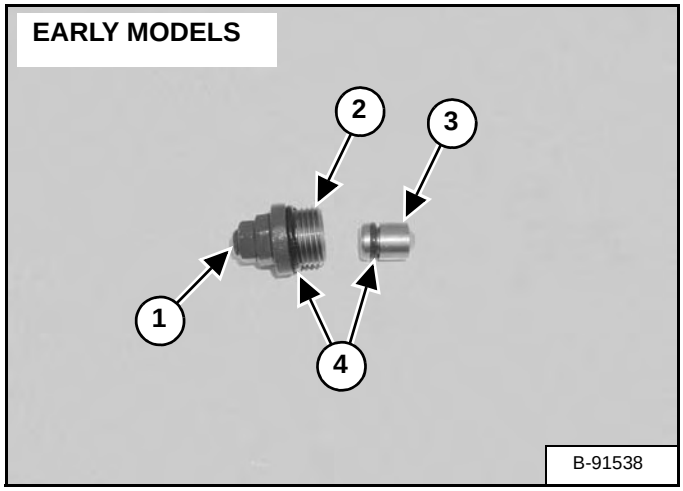
Figure 20-40-60



Early Models: Remove the shut off valve (Item 1) **[Figure 20-40-60]**.

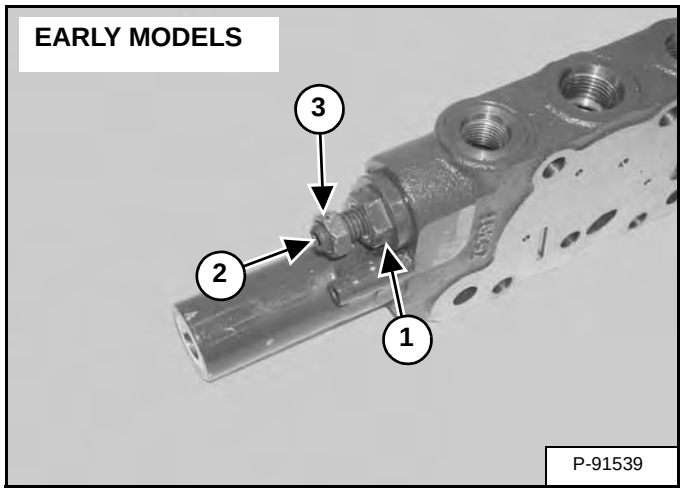
Later Models: Remove the anti cavitation valve (Item 1) **[Figure 20-40-60]**.

Figure 20-40-61



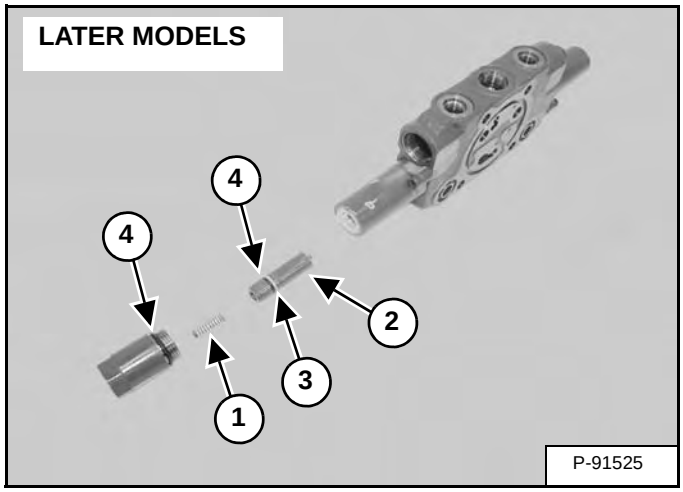
Early Models With Shut Off Valve: Remove the adjustment screw (Item 1) and lock nut from the valve body (Item 2). Remove the poppet (Item 3) from the body (Item 2). Remove the O-rings (Item 4) **[Figure 20-40-61]** from the poppet and the body.

Figure 20-40-62



Installation (Early Models With Shut Off Valve): Install the poppet in the valve body. Tighten the valve body (Item 1) to 59 - 69 N•m (44 - 51 ft-lb) torque. Install the adjustment screw (Item 2). Tighten the screw to 19 - 21 N•m (14 - 15 ft-lb) torque. Install the locknut (Item 3) **[Figure 20-40-62]** on the adjustment screw. Tighten the nut to 19 - 21 N•m (14 - 15 ft-lb) torque.

Figure 20-40-63



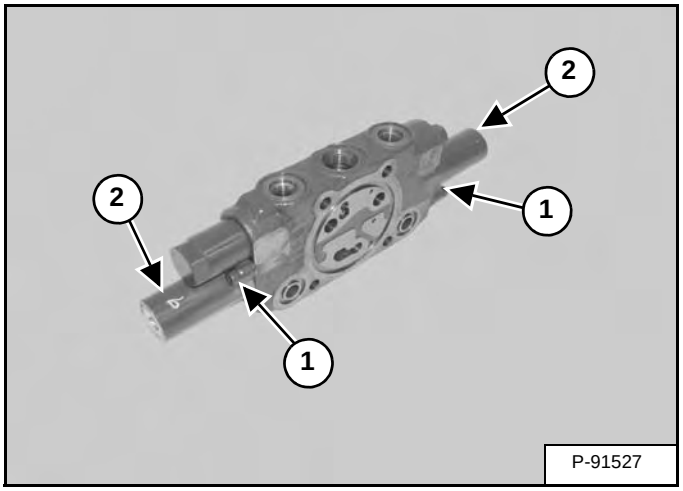
Later Models With Anti Cavitation Valve: Remove the spring (Item 1) and spool (Item 2). Remove the back-up ring (Item 3) and O-rings (Item 4) **[Figure 20-40-63]**.

Installation: Tighten the valve (Item 4) **[Figure 20-40-63]** to 69 - 78 N•m (51 - 58 ft-lb) torque.

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

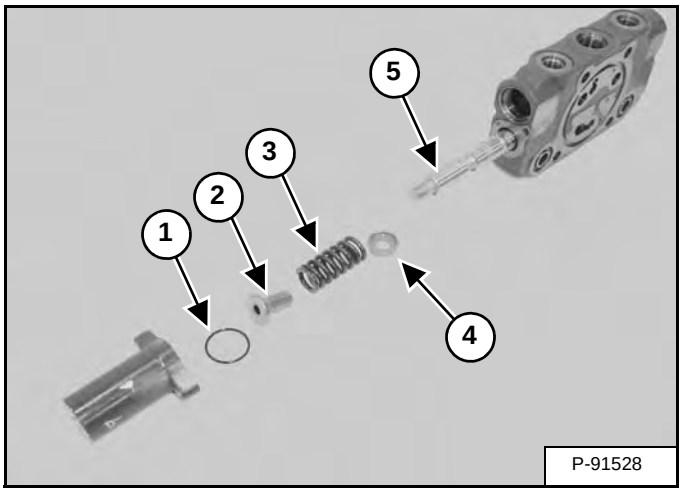
Figure 20-40-64



Remove the screws (Item 1) from both end caps. Remove the end caps (Item 2) **[Figure 20-40-64]**.

Installation: Tighten the screws to 7,5 N•m (5.5 ft-lb) torque.

Figure 20-40-65



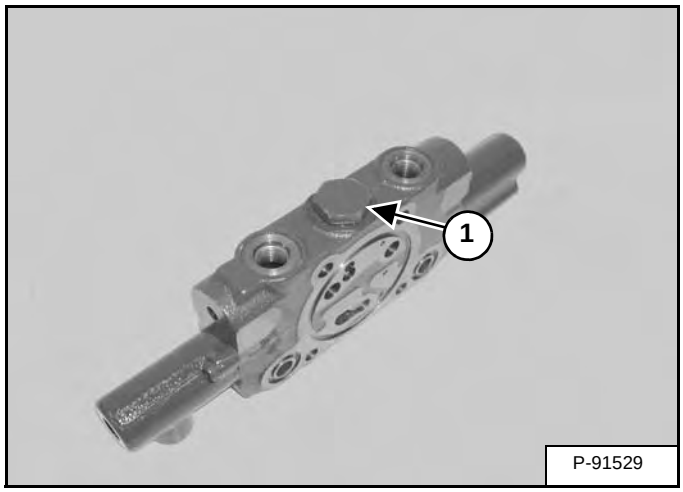
Remove the O-ring (Item 1), spring seat (Item 2), spring (Item 3) and spring seat (Item 4) from both ends of the valve. Remove the spool (Item 5) **[Figure 20-40-65]**.

NOTE: The spool is not symmetrical. Incorrect spool installation will cause poor hydraulic valve performance.

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Slew Valve Section Disassembly And Assembly

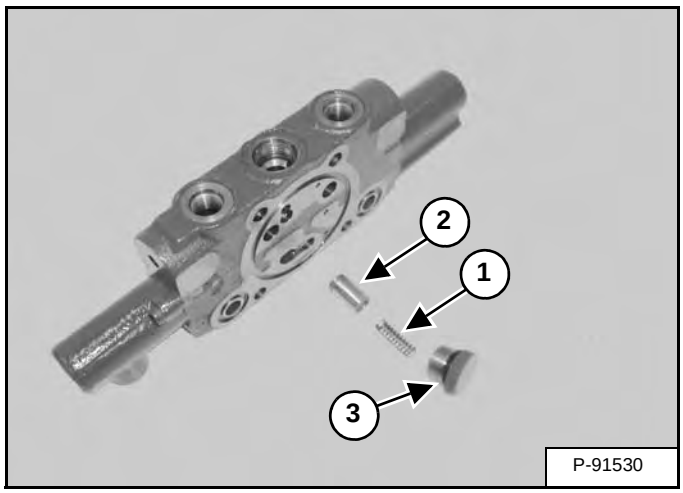
Figure 20-40-66



Remove the plug (Item 1) **[Figure 20-40-66]**.

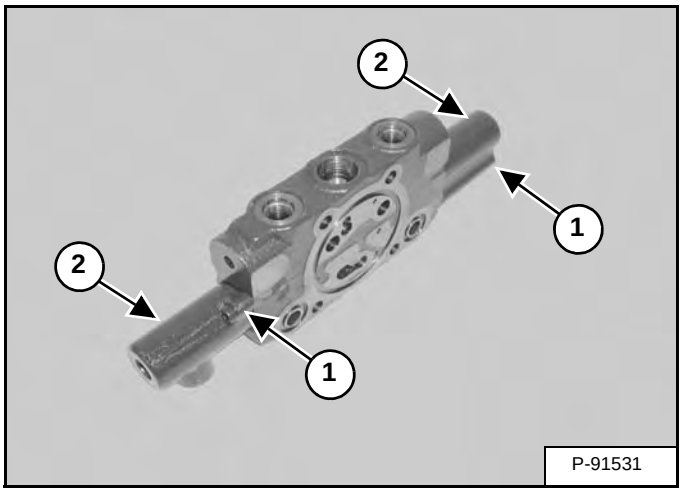
Installation: Tighten the plug to 69 - 78 N•m (51 - 58 ft-lb) torque.

Figure 20-40-67



Remove the spring (Item 1) and valve (Item 2). Remove the O-ring (Item 3) **[Figure 20-40-67]**.

Figure 20-40-68

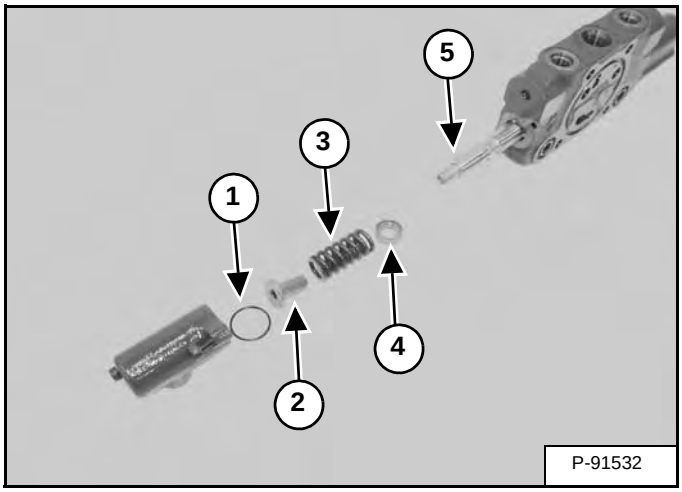


Remove the screws (Item 1) **[Figure 20-40-68]** from both end caps.

Remove the end caps (Item 2) **[Figure 20-40-68]**

Installation: Tighten the screws to 7,5 N•m (5.5 ft-lb) torque.

Figure 20-40-69



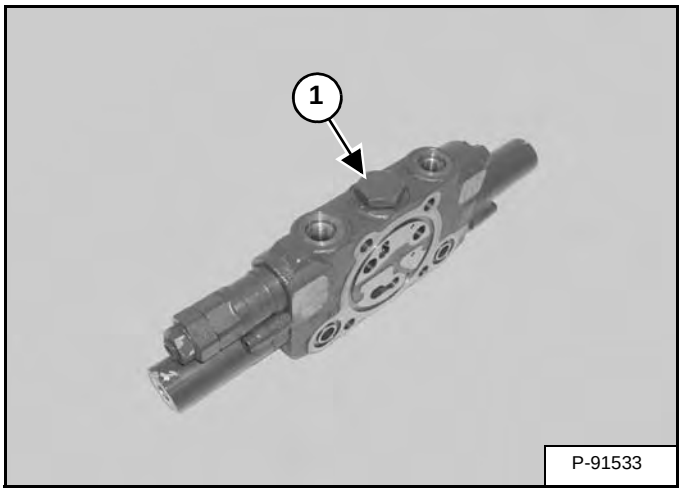
Remove the O-ring (Item 1), spring seat (Item 2), spring (Item 3) and spring seat (Item 4) from both ends of the valve. Remove the spool (Item 5) **[Figure 20-40-69]**.

NOTE: The spool is not symmetrical. Incorrect spool installation will cause poor hydraulic valve performance.

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Blade Valve Section Disassembly And Assembly

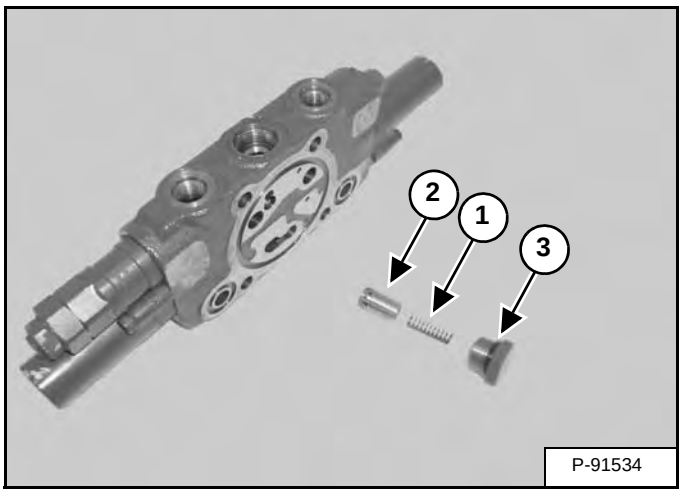
Figure 20-40-70



Remove the plug (Item 1) **[Figure 20-40-70]**.

Installation: Tighten the plug to 69 - 78 N•m (51 - 58 ft-lb) torque.

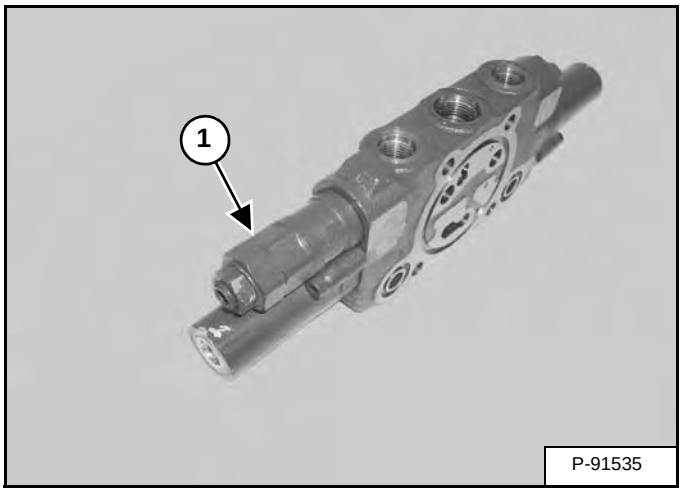
Figure 20-40-71



Remove the spring (Item 1) and compensator valve (Item 2). Remove the O-ring (Item 3) **[Figure 20-40-71]**.

NOTE: The compensator valve must be installed in the valve section it was removed from. Installing the incorrect compensator valve will cause poor hydraulic valve performance.

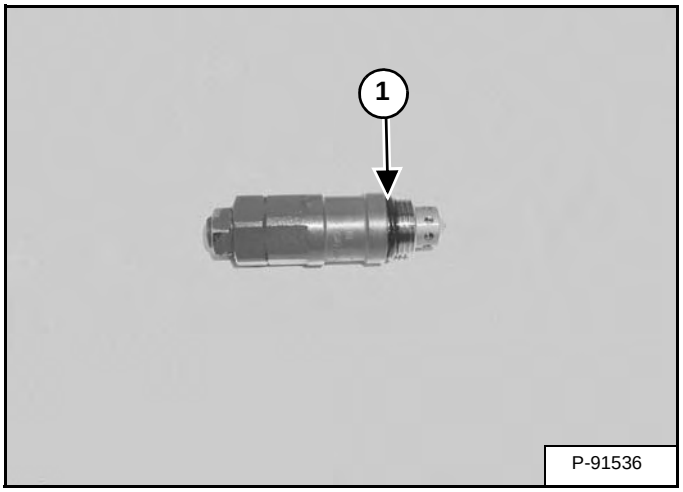
Figure 20-40-72



Remove the relief valve (Item 1) **[Figure 20-40-72]**.

Installation: Tighten the relief valve to 69 - 79 N•m (51 - 58 ft-lb) torque.

Figure 20-40-73

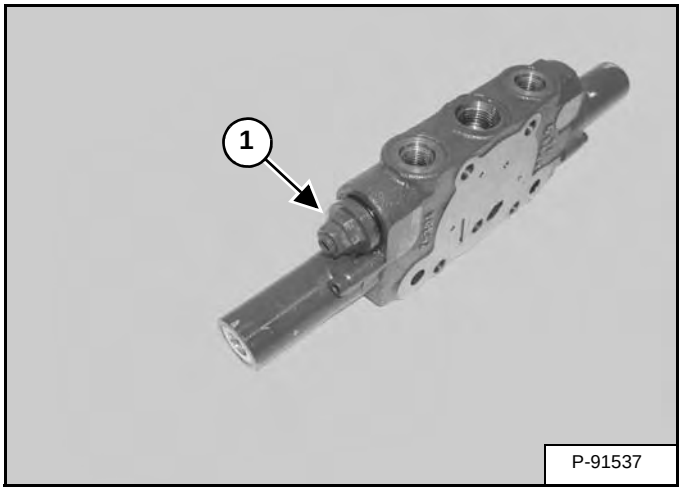


Remove the O-ring (Item 1) **[Figure 20-40-73]**.

Dealer Copy -- Not for Resale

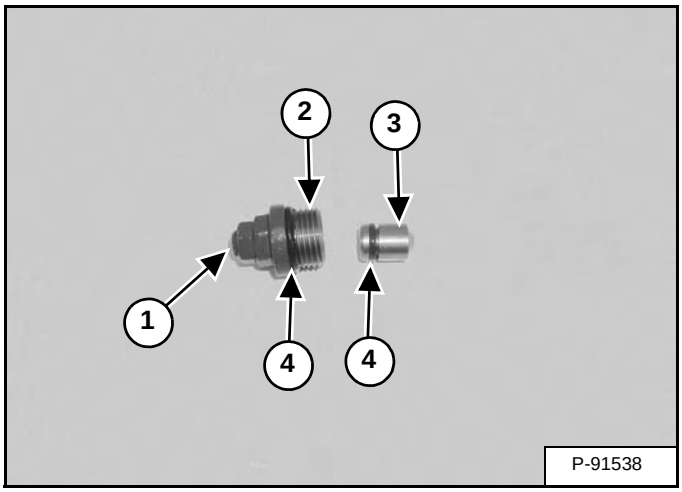
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-74



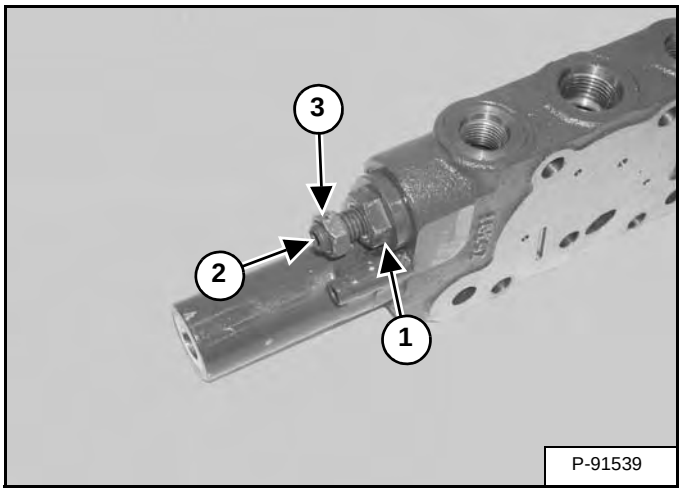
Remove the shut off valve (Item 1) **[Figure 20-40-74]**.

Figure 20-40-75



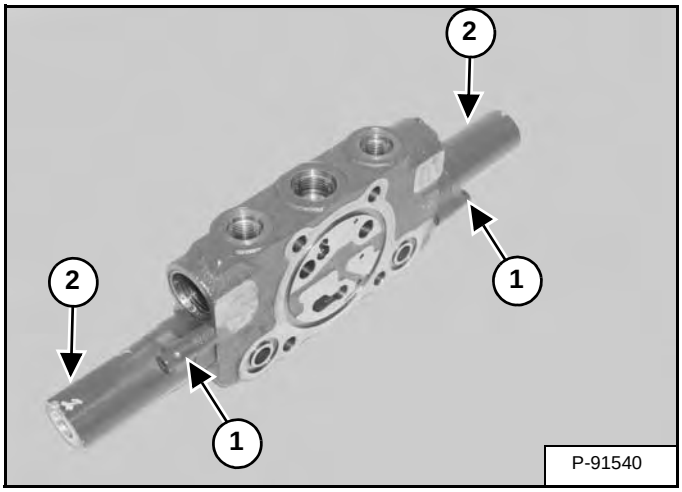
Remove the adjustment screw (Item 1) and lock nut from the valve body (Item 2). Remove the poppet (Item 3) from the body (Item 2). Remove the O-rings (Item 4) **[Figure 20-40-75]** from the poppet and the body.

Figure 20-40-76



Installation: Install the poppet in the valve body. Tighten the valve body (Item 1) to 59 - 69 N•m (44 - 51 ft-lb) torque. Install the adjustment screw (Item 2). Tighten the screw to 19 - 21 N•m (14 - 15 ft-lb) torque. Install the locknut (Item 3) **[Figure 20-40-76]** on the adjustment screw. Tighten the nut to 19 - 21 N•m (14 - 15 ft-lb) torque.

Figure 20-40-77



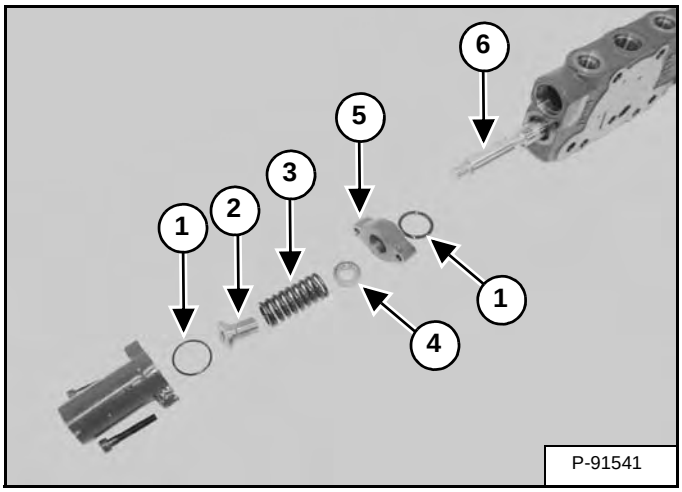
Remove the screws (Item 1) from both end caps. Remove the end caps (Item 2) **[Figure 20-40-77]**.

Installation: Tighten the screws to 7,5 N•m (5.5 ft-lb) torque.

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Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-78



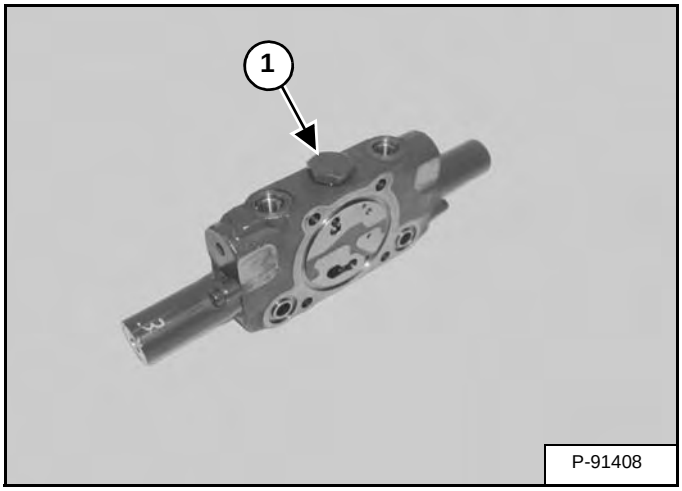
Remove the O-rings (Item 1), spring seat (Item 2), spring (Item 3), spring seat (Item 4) and spacer (Item 5) from both ends of the valve. Remove the spool (Item 6) **[Figure 20-40-78]**.

NOTE: The spool is not symmetrical. Incorrect spool installation will cause poor hydraulic valve performance.

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Right And Left Travel Valve Section Disassembly And Assembly

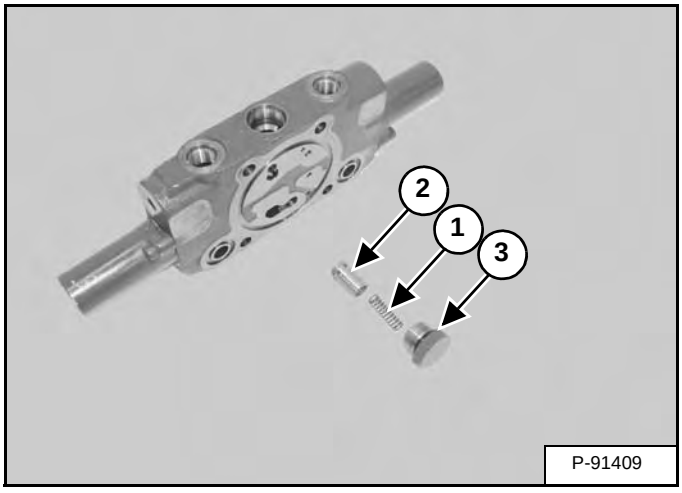
Figure 20-40-79



Remove the plug (Item 1) **[Figure 20-40-79]**.

Installation: Tighten the plug to 69 - 78 N•m (51 - 58 ft-lb) torque.

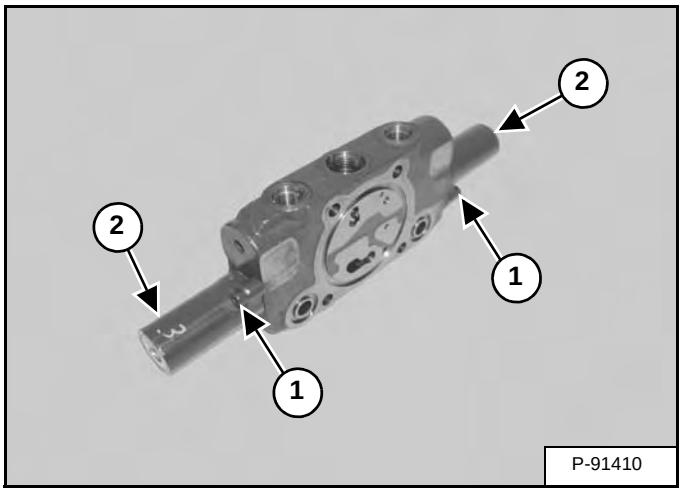
Figure 20-40-80



Remove the spring (Item 1) and compensator valve (Item 2). Remove the O-ring (Item 3) **[Figure 20-40-80]**.

NOTE: The compensator valve must be installed in the valve section it was removed from. Installing the incorrect compensator valve will cause poor hydraulic valve performance.

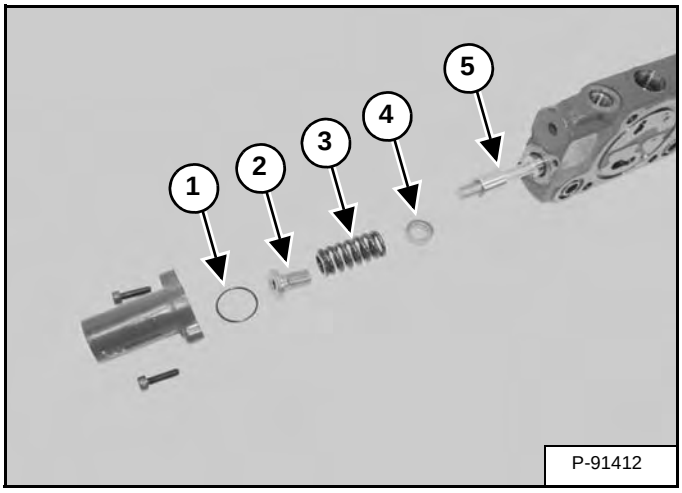
Figure 20-40-81



Remove the screws (Item 1) from both end caps. Remove the end caps (Item 2) **[Figure 20-40-81]**.

Installation: Tighten the screws to 7,5 N•m (5.5 ft-lb) torque.

Figure 20-40-82



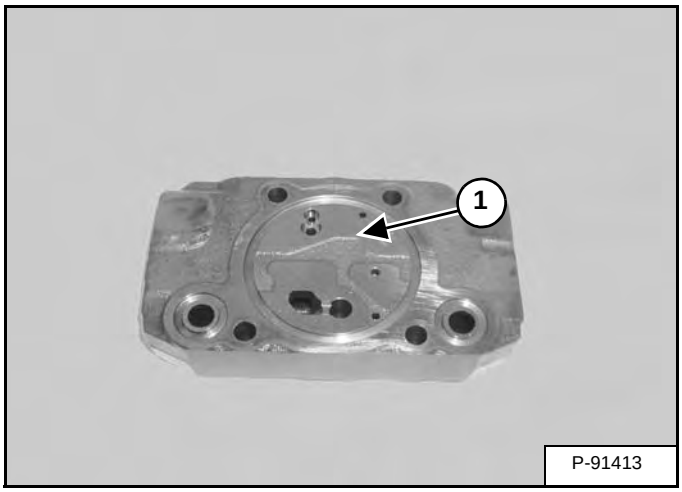
Remove the O-ring (Item 1), spring seat (Item 2), spring (Item 3) and spring seat (Item 4) from both ends of the valve. Remove the spool (Item 5) **[Figure 20-40-82]**.

NOTE: The spool is not symmetrical. Incorrect spool installation will cause poor hydraulic valve performance.

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

Figure 20-40-83



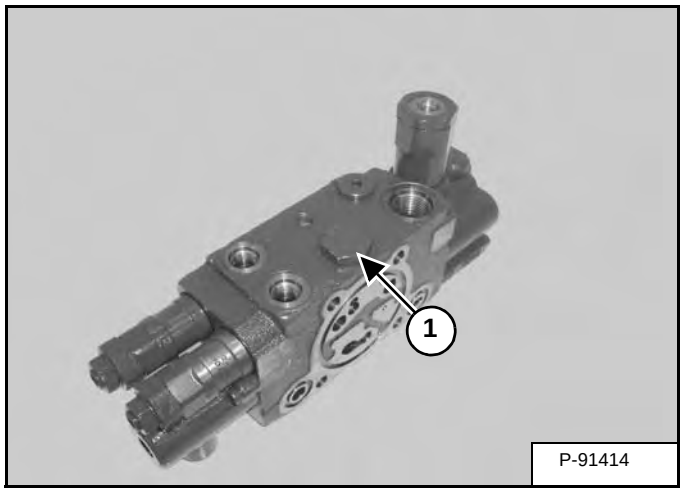
Remove the orifice (Item 1) **[Figure 20-40-83]**.

Installation: Tighten the orifice to 7,5 N•m (5.5 ft-lb) torque.

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Boom Valve Section Disassembly And Assembly

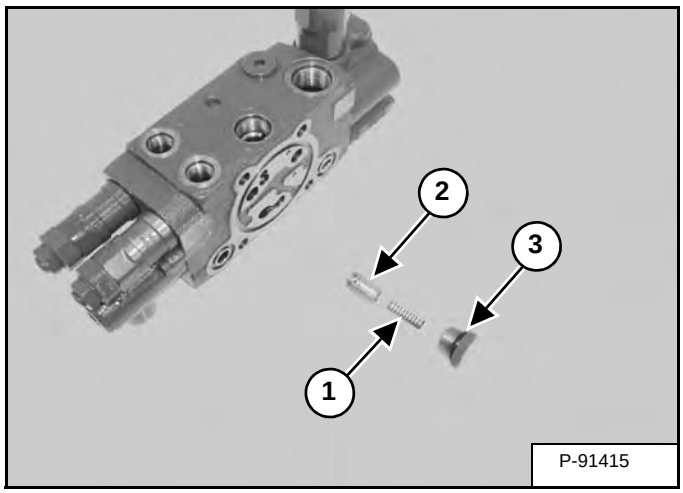
Figure 20-40-84



Remove the plug (Item 1) **[Figure 20-40-84]**.

Installation: Tighten the plug to 69 - 78 N•m (51 - 58 ft-lb) torque.

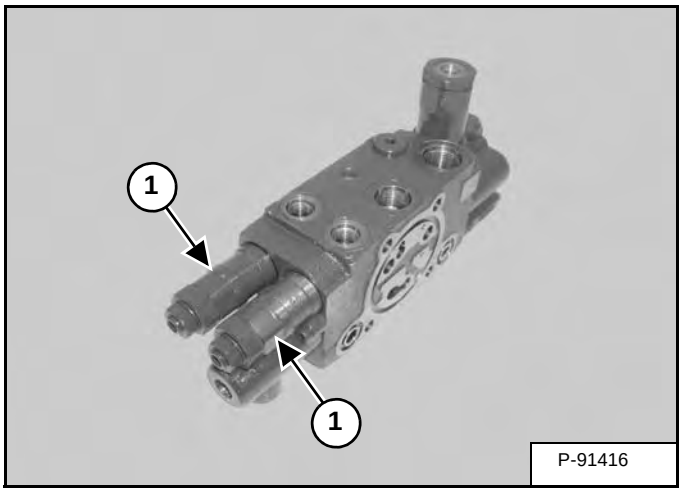
Figure 20-40-85



Remove the spring (Item 1) and compensator valve (Item 2). Remove the O-ring (Item 3) **[Figure 20-40-85]**.

NOTE: The compensator valve must be installed in the valve section it was removed from. Installing the incorrect compensator valve will cause poor hydraulic valve performance.

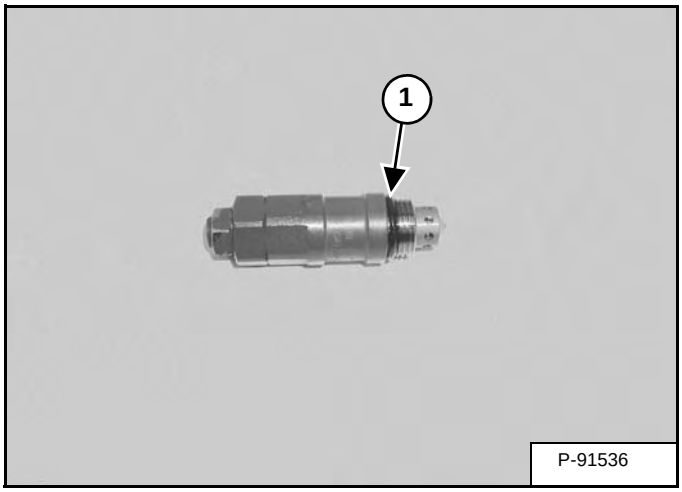
Figure 20-40-86



Remove the relief valves (Item 1) **[Figure 20-40-86]**.

Installation: Tighten the relief valves to 69 - 78 N•m (51 - 58 ft-lb) torque.

Figure 20-40-87

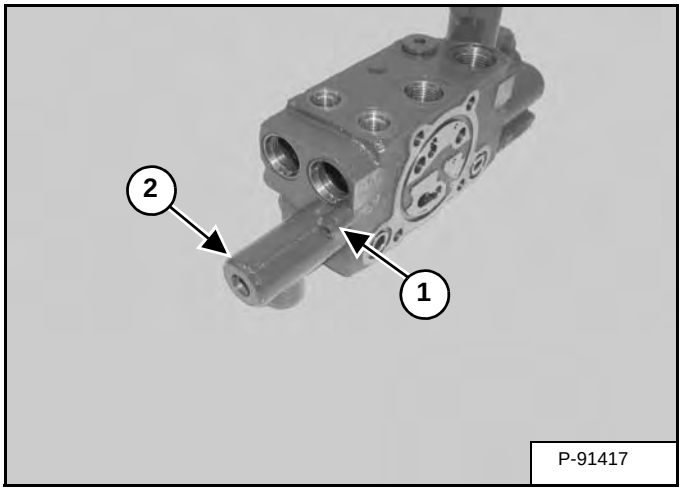


Remove the O-ring (Item 1) **[Figure 20-40-87]**.

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Boom Valve Section Disassembly And Assembly (Cont'd)

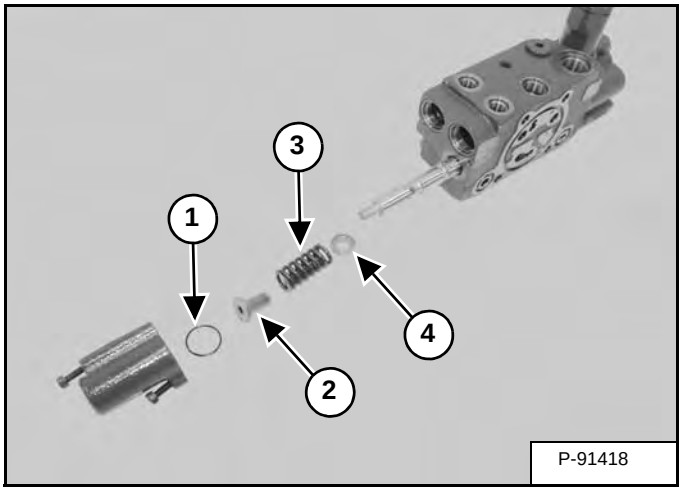
Figure 20-40-88



Remove the screws (Item 1) and end cap (Item 2) **[Figure 20-40-88]**.

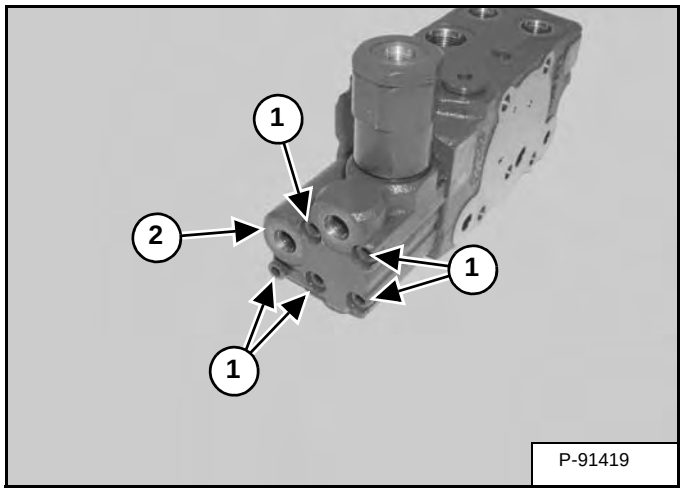
Installation: Tighten the screws to 7,5 N•m (5.5 ft-lb) torque.

Figure 20-40-89



Remove the O-ring (Item 1), spring seat (Item 2), spring (Item 3) and spring seat (Item 4) **[Figure 20-40-89]**.

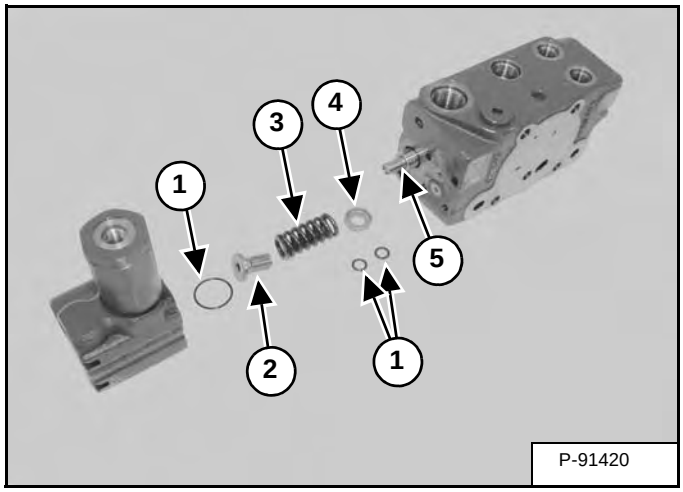
Figure 20-40-90



Remove the screws (Item 1) and end cap / anti-drift assembly (Item 2) **[Figure 20-40-90]**.

Installation: Tighten the screws to 9 - 11 N•m (7 - 8 ft-lb) torque.

Figure 20-40-91



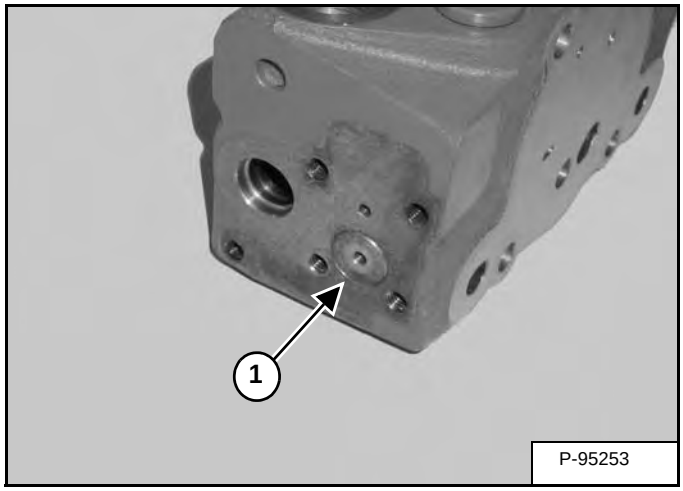
Remove the O-rings (Item 1), spring seat (Item 2), spring (Item 3) and spring seat (Item 4). Remove the spool (Item 5) **[Figure 20-40-91]**.

NOTE: The spool is not symmetrical. Incorrect spool installation will cause poor hydraulic valve performance.

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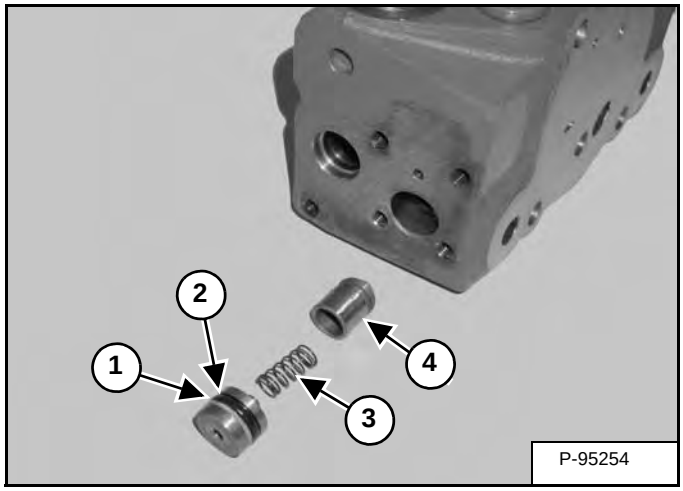
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-92



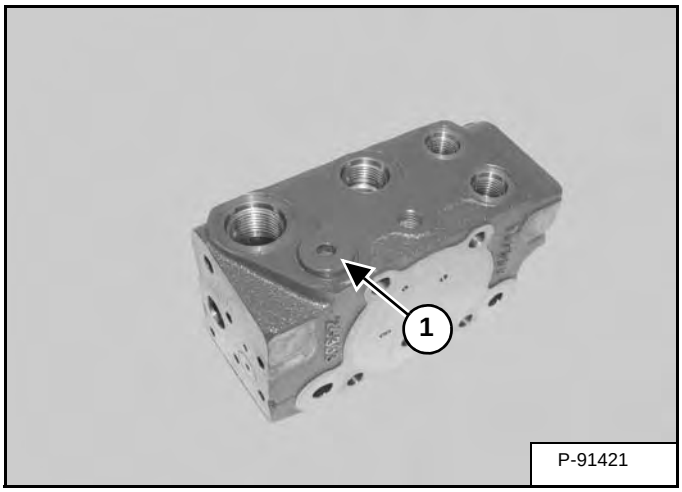
Pull out on and remove the plug (Item 1) **[Figure 20-40-92]**.

Figure 20-40-93



Remove the back-up ring (Item 1), O-ring (Item 2), spring (Item 3) and poppet (Item 4) **[Figure 20-40-93]**.

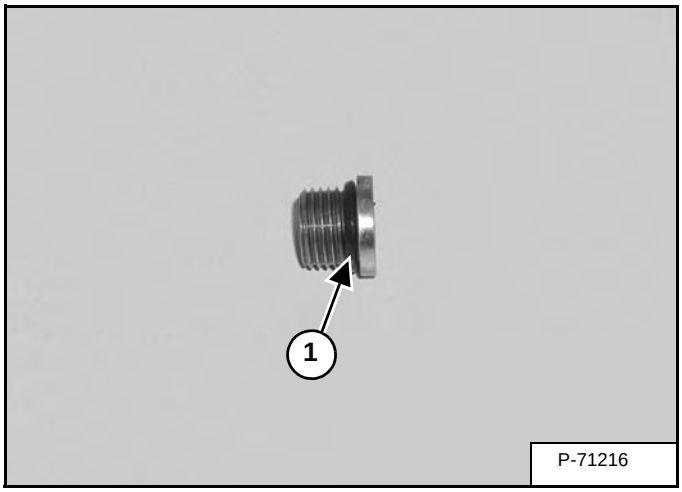
Figure 20-40-94



Remove the plug (Item 1) **[Figure 20-40-94]**.

Installation: Tighten the plug to 69 - 78 N•m (51 - 58 ft-lb) torque.

Figure 20-40-95

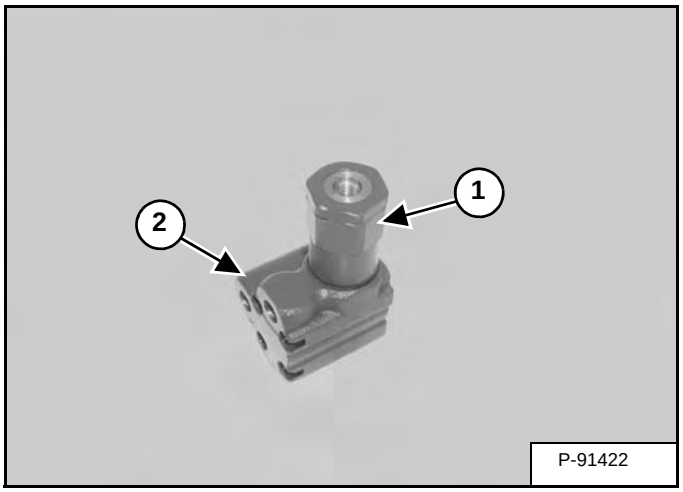


Remove the O-ring (Item 1) **[Figure 20-40-95]**.

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Boom Valve Section Disassembly And Assembly (Cont'd)

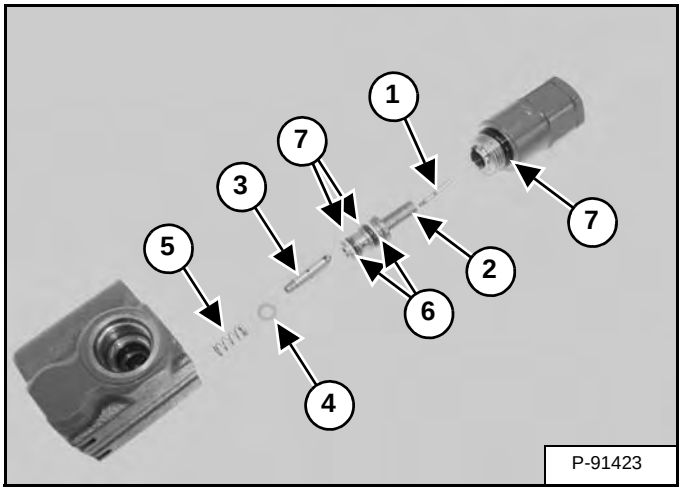
Figure 20-40-96



Remove the anti-drift valve (Item 1) from the end cap (Item 2) **[Figure 20-40-96]**.

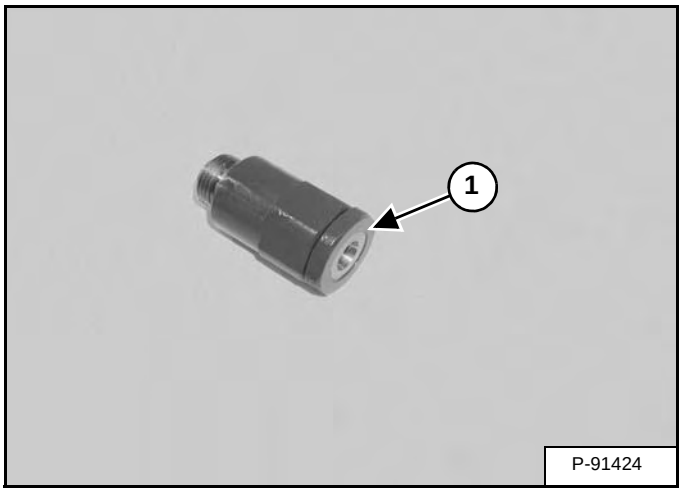
Installation: Tighten the valve to 69 - 78 N•m (51 - 58 ft-lb) torque.

Figure 20-40-97



Remove the outer spool (Item 1), spool carrier (Item 2), inner spool (Item 3), spring seat (Item 4) and spring (Item 5). Remove the back-up rings (Item 6) and O-rings (Item 7) **[Figure 20-40-97]**.

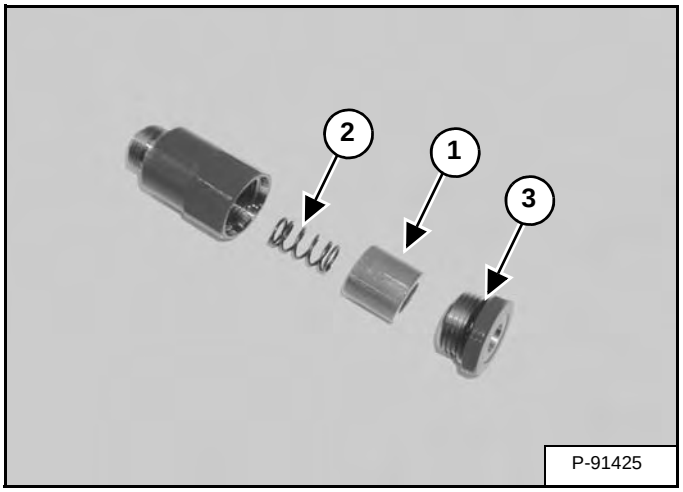
Figure 20-40-98



Remove the cover (Item 1) **[Figure 20-40-98]**.

Installation: Tighten the plug to 69 - 78 N•m (51 - 58 ft-lb) torque.

Figure 20-40-99

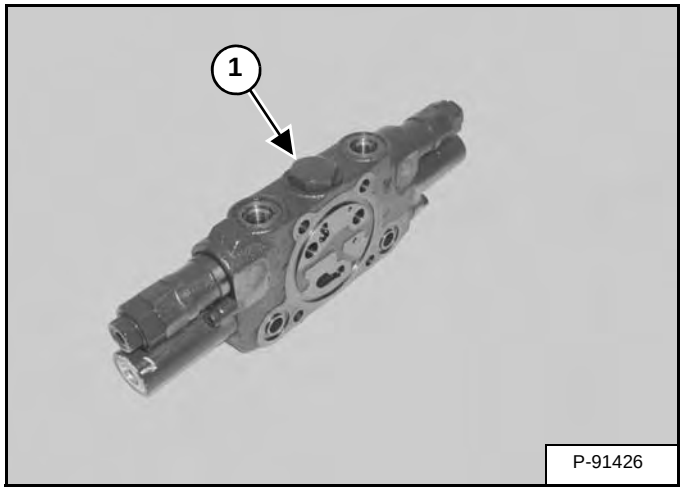


Remove the spacer (Item 1) and spring (Item 2). Remove the O-ring (Item 3) **[Figure 20-40-99]**.

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Auxiliary, Arm, Bucket And Angle Blade Valve Section Disassembly And Assembly

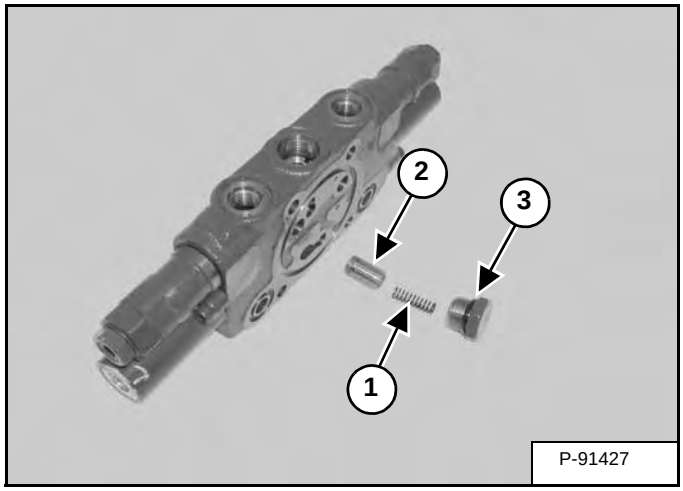
Figure 20-40-100



Remove the plug (Item 1) **[Figure 20-40-100]**.

Installation: Tighten the plug to 69 - 78 N•m (51 - 58 ft-lb) torque.

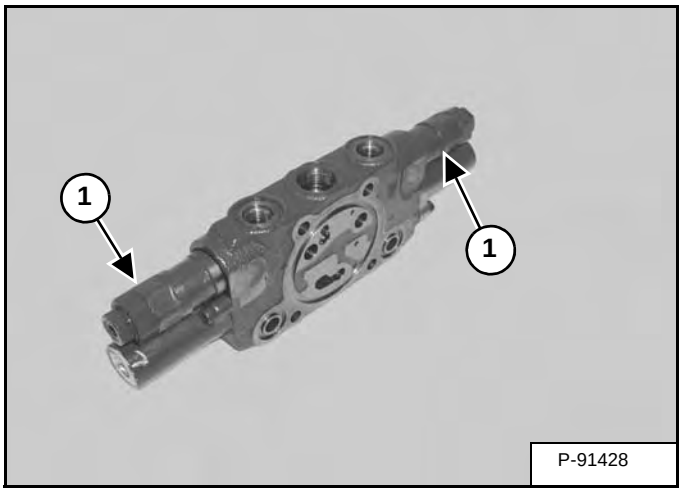
Figure 20-40-101



Remove the spring (Item 1) and compensator valve (Item 2). Remove the O-ring (Item 3) **[Figure 20-40-101]**.

NOTE: The compensator valve must be installed in the valve section it was removed from. Installing the incorrect compensator valve will cause poor hydraulic valve performance.

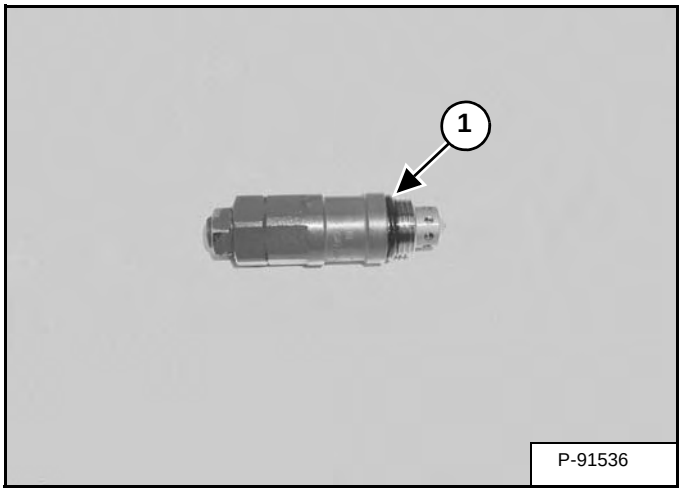
Figure 20-40-102



Remove the relief valves (Item 1) **[Figure 20-40-102]**

Installation: Tighten the relief valves to 69 - 79 N•m (51 - 58 ft-lb) torque.

Figure 20-40-103

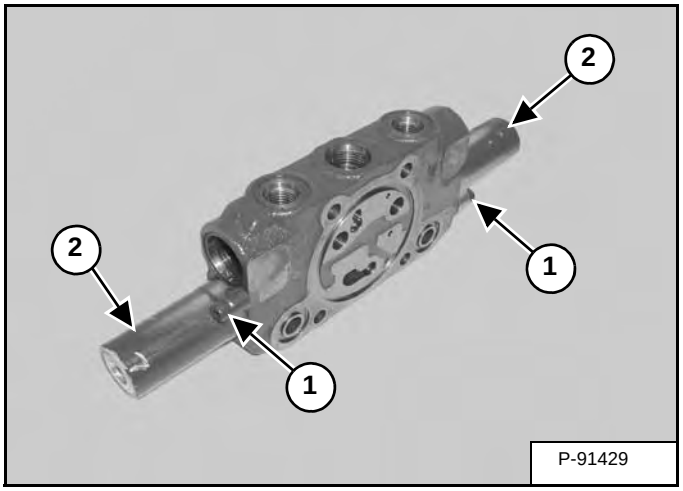


Remove the O-ring (Item 1) **[Figure 20-40-103]** from both relief valves.

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Auxiliary, Arm, Bucket And Angle Blade Valve Section Disassembly And Assembly (Cont'd)

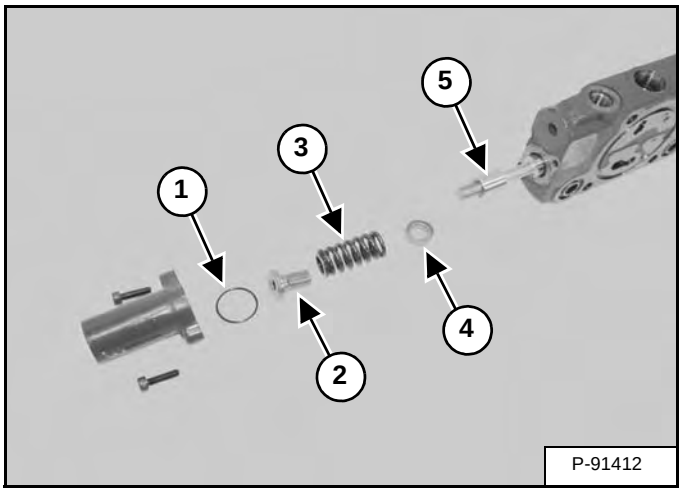
Figure 20-40-104



Remove the screws (Item 1) from both end caps. Remove the end caps (Item 2) **[Figure 20-40-104]**.

Installation: Tighten the screws to 7,5 N•m (5.5 ft-lb) torque.

Figure 20-40-105



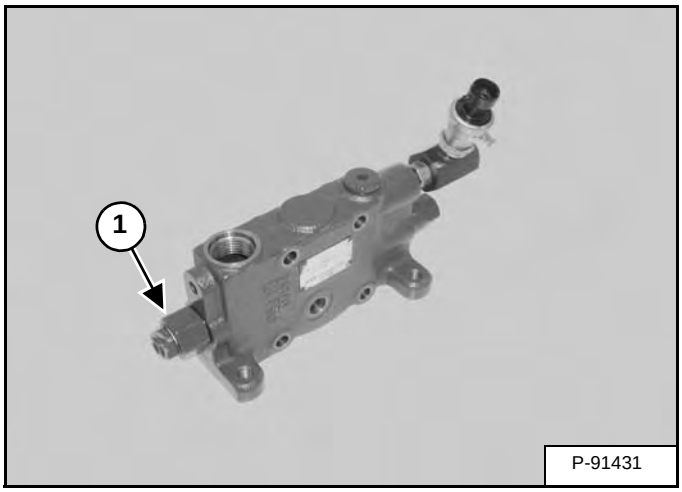
Remove the O-ring (Item 1), spring seat (Item 2), spring (Item 3) and spring seat (Item 4) from both ends of the valve. Remove the spool (Item 5) **[Figure 20-40-105]**.

NOTE: The spool is not symmetrical. Incorrect spool installation will cause poor hydraulic valve performance.

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Outlet Valve Section Disassembly And Assembly

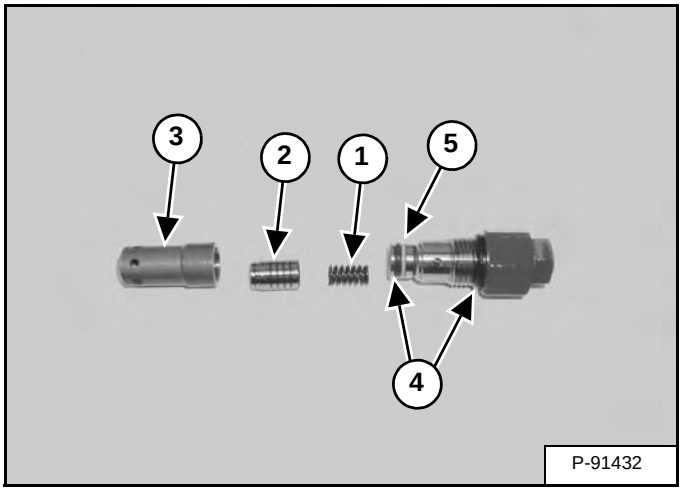
Figure 20-40-106



Remove the main relief valve (Item 1) **[Figure 20-40-106]**.

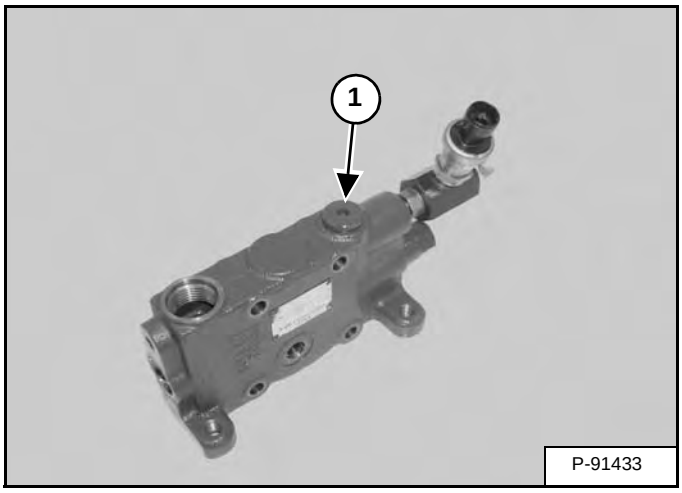
Installation: Tighten the main relief valve to 69 - 78 N•m (51 - 58 ft-lb) torque.

Figure 20-40-107



Remove the spring (Item 1), poppet (Item 2) and sleeve (Item 3). Remove the O-rings (Item 4) and back-up ring (Item 5) **[Figure 20-40-107]**.

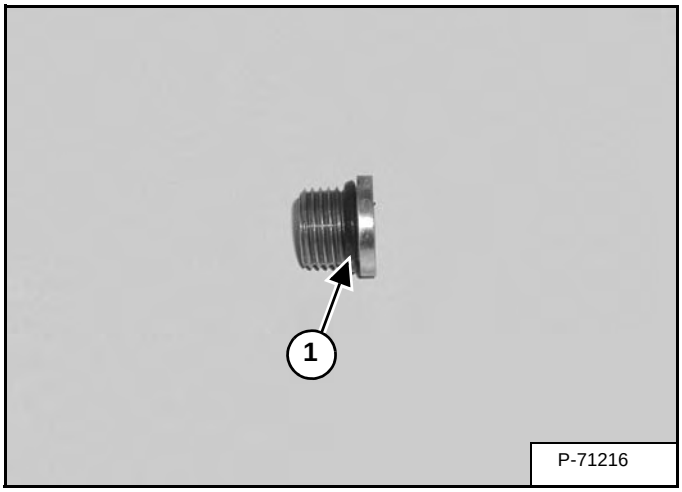
Figure 20-40-108



Remove the plug (Item 1) **[Figure 20-40-108]**.

Installation: Tighten the plug to 28,5 - 30 N•m (21 - 22 ft-lb) torque.

Figure 20-40-109

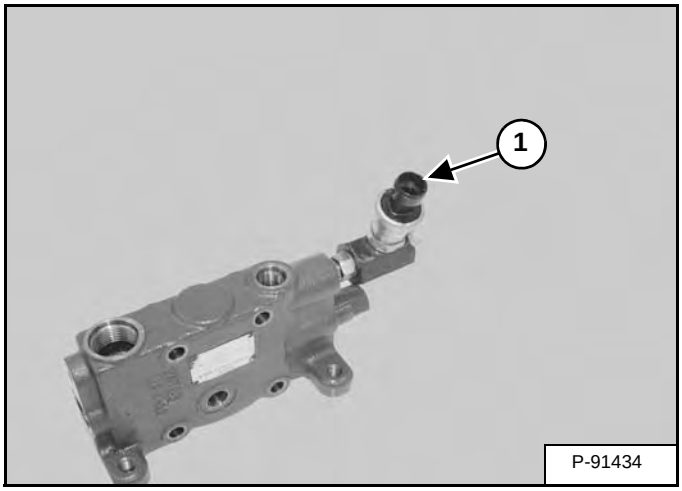


Remove the O-ring (Item 1) **[Figure 20-40-109]** from the plug.

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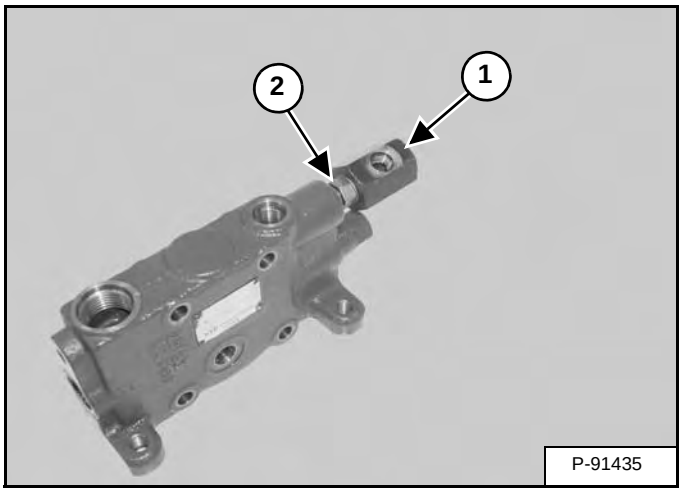
Outlet Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-110



Remove the sending unit (Item 1) **[Figure 20-40-110]**.

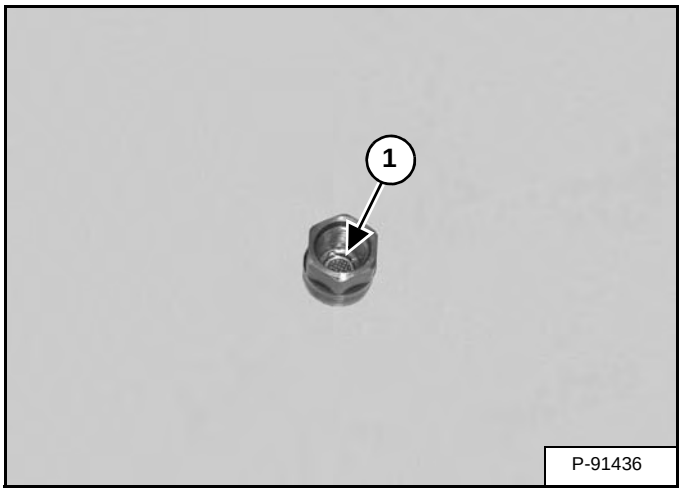
Figure 20-40-111



Remove the fittings (Item 1) and (Item 2) **[Figure 20-40-111]**.

Installation: Tighten the fittings to 28,5 - 30 N•m (21 - 22 ft-lb) torque.

Figure 20-40-112



Inspect the screen (Item 1) **[Figure 20-40-112]** for damage and contamination.

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HYDRAULIC PUMP

Hydraulic Pump Work Sheet

(Please review pump procedure as illustrated in “Pump Testing”. (See Pump Testing on Page 20-50-3.)

The outline listed below, gives the five adjustments for setting the hydraulic pump. The adjustments are listed in the order in which they ***MUST*** be performed. Below each adjustment is a list of the steps. Behind each adjustment is the page location within the Service Manual for the complete adjustment procedure.

1. Run engine at High Idle. Record no load engine rpm. (See Specifications on Page 60-10-2.)

_____ **ENGINE RPM**

2. Adjust Engine rpm (If necessary).

I. Test Fitting Installation (See Test Fitting Installation on Page 20-50-3.)

3. Remove the cap from the hydraulic pump outlet and install the quick coupler. Connect the hydraulic tester inlet hose to the quick coupler.

4. Remove the cap from the hydraulic control valve outlet section and install the quick coupler. Connect the hydraulic tester outlet hose to the quick coupler.

5. Remove the cap from the tee fitting on the hydraulic control valve inlet section. Install the adapter hose on the fitting. If equipped with the hydraulic X-change, remove the line from the tee fitting and install a plug in the line. Install the adapter hose on the tee fitting.

6. Install a jumper hose with a test port between the hydraulic control valve test port located in the outlet section and the adapter hose.

7. With the engine at High Idle, turn the hydraulic tester flow control clockwise until 6895 kPa (69 bar) (1000 psi) is shown on the gauge. Restrict the oil flow until the oil temperature is at a minimum of 66°C (150°F).

8. Turn the hydraulic tester flow control counter clockwise until all restriction is removed.

II. Pump Margin Pressure Adjustment (See Pump Margin Pressure Adjustment on Page 20-50-6.)

9. Remove the jumper hose from the hydraulic control valve test port and adapter hose.

10. Install a **3447 kPa (34,5 bar) (500 psi) Gauge** on the hydraulic control valve test port.

11. Run engine at High Idle.

12. Restrict the flow on the hydraulic tester to 38 L/min (10 U.S. gpm) and record the pressure. Adjust the spool as necessary to obtain a minimum of 1379 kPa (13,8 bar)(200 psi).

_____ **PM PRESSURE**

III. Main Relief Valve Adjustment (See Main Relief Valve Adjustment on Page 20-50-7.)

13. Install **34474 kPa (345 bar) (5000 psi) Gauge** on the hydraulic control valve test port.

14. Turn the hydraulic tester flow control clockwise until maximum restriction.

15. Run the engine at high idle, raise the blade and dead-head in the UP position.

16. Adjust main relief valve as necessary to get 24476 ± 517 kPa (245 ± 5,2 bar) (3550 ± 75 psi).

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Hydraulic Pump Work Sheet (Cont'd)

17. Record pressure

_____ **MRV PRESSURE**

18. Remove the 34474 kPa (345 bar) (5000 psi) gauge, from the hydraulic control valve test port.

IV. Torque Limiter Adjustment (See Torque Limiter Adjustment on Page 20-50-8.)

19. Install jumper hose with a test port, between the hydraulic control valve diagnostic port on the outlet section and the adapter hose installed on the hydraulic control valve inlet section.

20. Install a **34474 kPa (345 bar) (5000 psi) Gauge** to the test port on the jumper hose.

21. Adjust the hydraulic tester to 8963 kPa (89,4 bar) (1300 psi).

22. Adjust the torque limiter to obtain 87 - 95 L/min (23 - 25 U.S. gpm).

23. Record flow and engine rpm.

_____ **FLOW**

_____ **ENGINE RPM**

24. Remove the jumper hose.

25. Remove the hydraulic tester.

26. Remove the adapter hose and install the cap or hydraulic X-change hose (if equipped).

V. Direct Gear Pump Test (See Direct Gear Pump Test on Page 20-50-9.)

27. Remove the hose from the manifold.

28. Install the inlet of the tester to the hose removed from the manifold.

29. Install the outlet of the tester to the manifold.

30. Run engine at High Idle.

31. Turn the hydraulic tester flow control clockwise until 10342 kPa (103,4 bar) (1500 psi) is shown on the gauge.

32. Record the flow. There must be a minimum of 7,6 L/min (2 U.S. gpm).

_____ **GEAR PUMP FLOW**

33. Remove the hydraulic tester.

ALL PUMP ADJUSTMENTS ARE NOW COMPLETED

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Pump Testing

The testing of the piston pump must be done in the following order:

Pump Margin Pressure Adjustment
Main Relief Valve Adjustment
Torque Limiter Adjustment
Direct Gear Pump Test

Test Fitting Installation

The following tools will be needed to do the procedure:

MEL10003 - Hydraulic Tester
3447 kPa (34 bar) (500 psi) Gauge
34474 kPa (345 bar) (5000 psi) Gauge

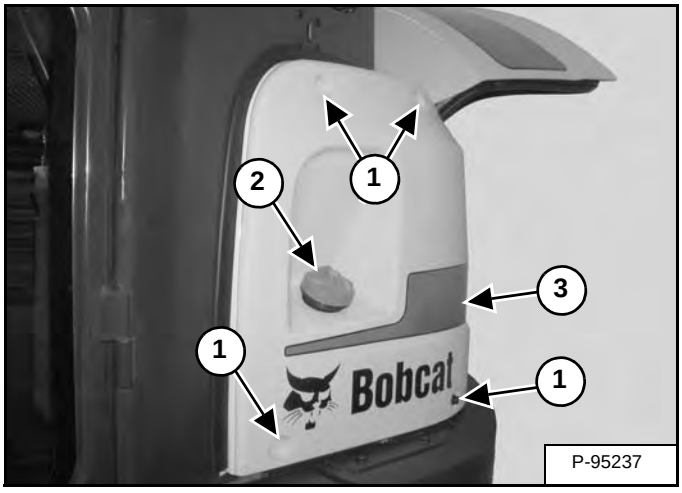
Adapter Hose - 71 mm (18 in) long hose with a test coupler on one end and -6 female jic swivel on the opposite end (obtain adapter hose locally).

Record the no load engine rpm, registered on the right hand operator panel display.

See high idle specification. (See Engine on Page SPEC-10-7.)

Stop the engine and adjust the engine rpm if necessary.

Figure 20-50-1

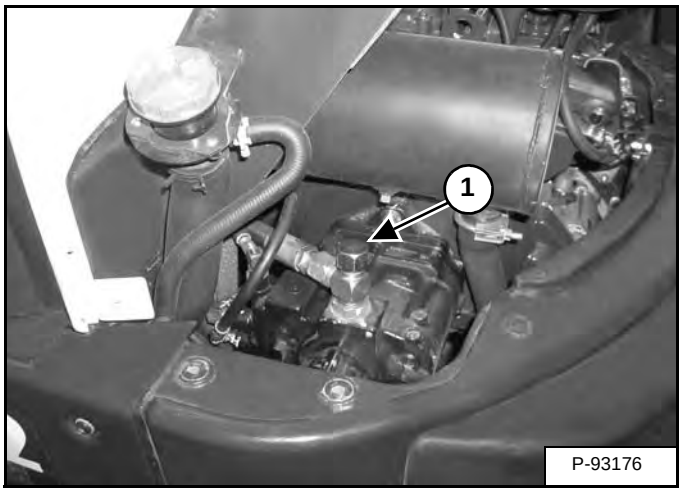


Remove the four bolts (Item 1), fuel cap (Item 2) nut and side cover (Item 3) **[Figure 20-50-1]**.

Reinstall the fuel cap (Item 2) **[Figure 20-50-1]**.

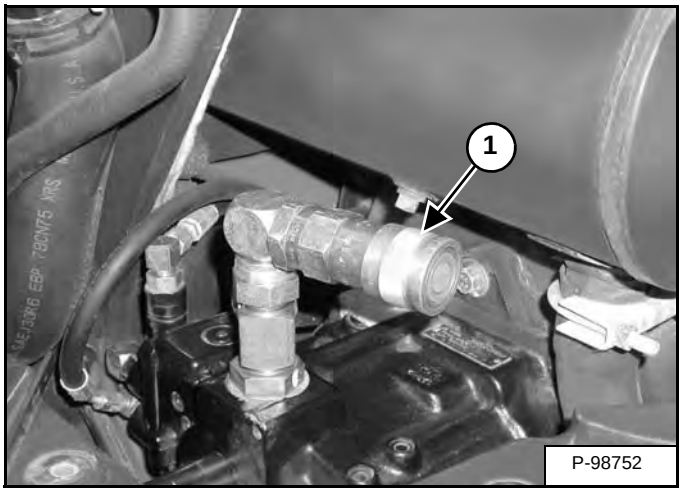
NOTE: Reinstall the fuel cap to prevent any contamination from entering the fuel tank.

Figure 20-50-2



Remove the cap (Item 1) **[Figure 20-50-2]** from the hydraulic pump outlet.

Figure 20-50-3

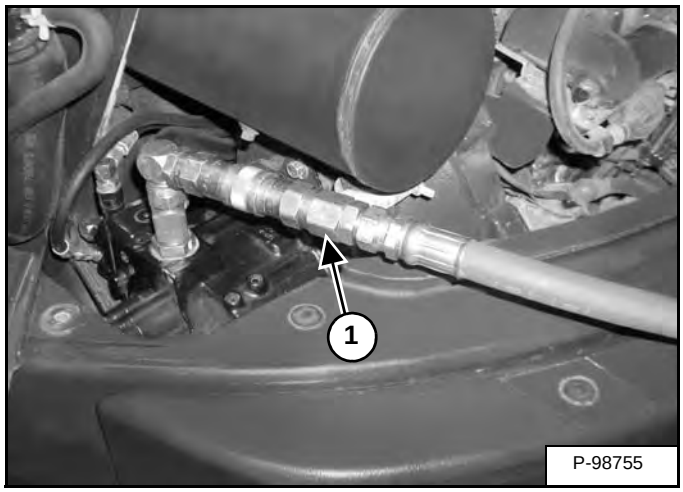


Install a test coupler (Item 1) **[Figure 20-50-3]** on the hydraulic pump outlet.

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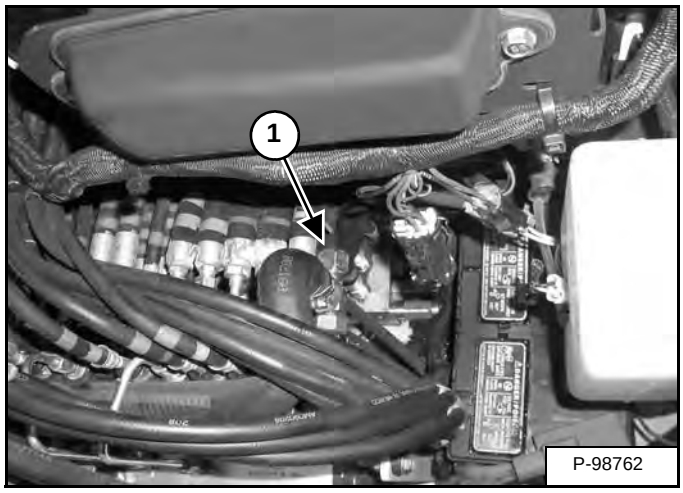
Pump Testing (Cont'd)

Figure 20-50-4



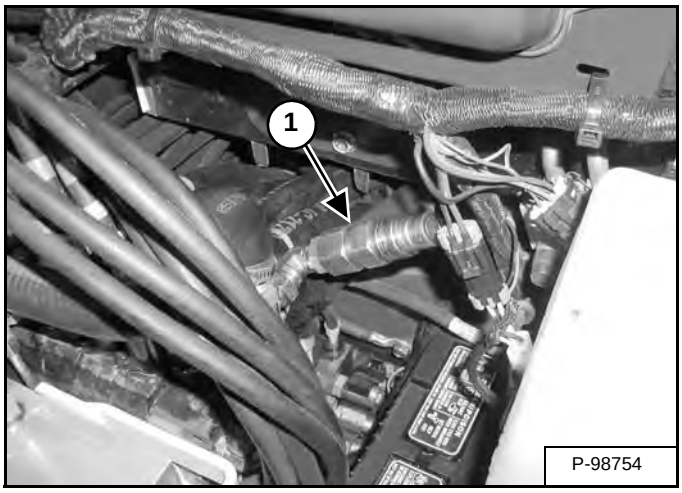
Install the hydraulic tester inlet hose (Item 1) **[Figure 20-50-4]** on the hydraulic pump coupler.

Figure 20-50-5



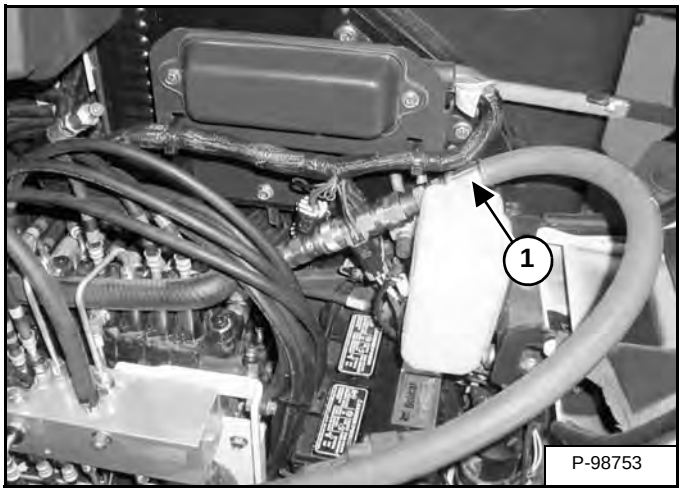
Remove the cap (Item 1) **[Figure 20-50-5]** from the hydraulic control valve outlet section.

Figure 20-50-6



Install a test coupler (Item 1) **[Figure 20-50-6]** on the hydraulic control valve.

Figure 20-50-7

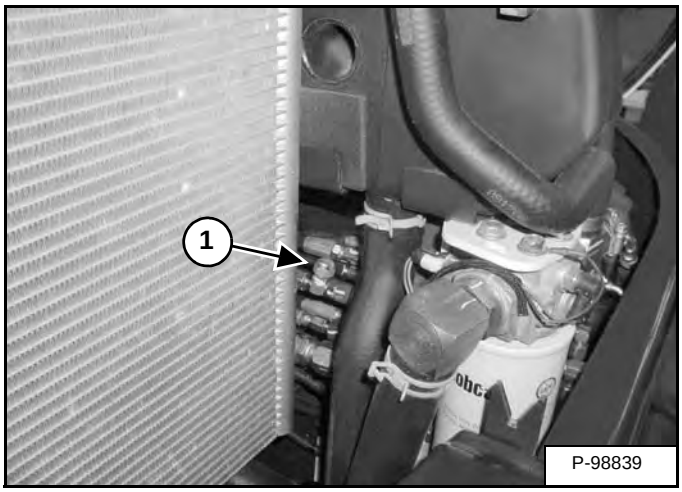


Install the hydraulic tester outlet hose (Item 1) **[Figure 20-50-7]** on the hydraulic control valve coupler.

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Pump Testing (Cont'd)

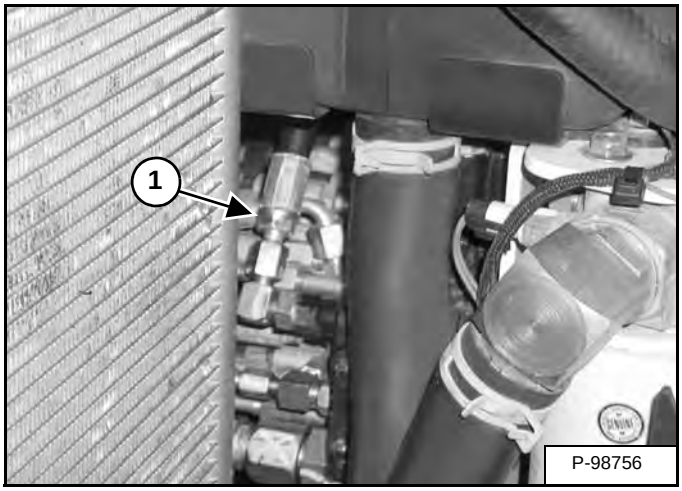
Figure 20-50-8



Remove the cap from the tee fitting (Item 1) **[Figure 20-50-8]** on the hydraulic control valve inlet section.

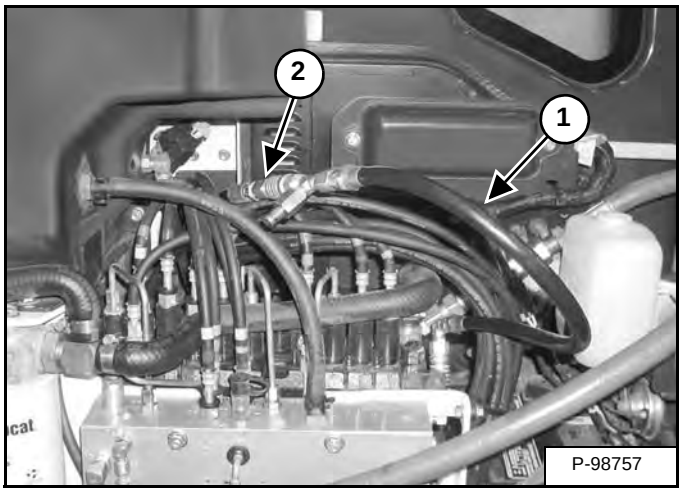
NOTE: If the excavator is equipped with a hydraulic X-Change, remove and plug the hose from the tee fitting.

Figure 20-50-9



Install the adapter hose (Item 1) **[Figure 20-50-9]**.

Figure 20-50-10

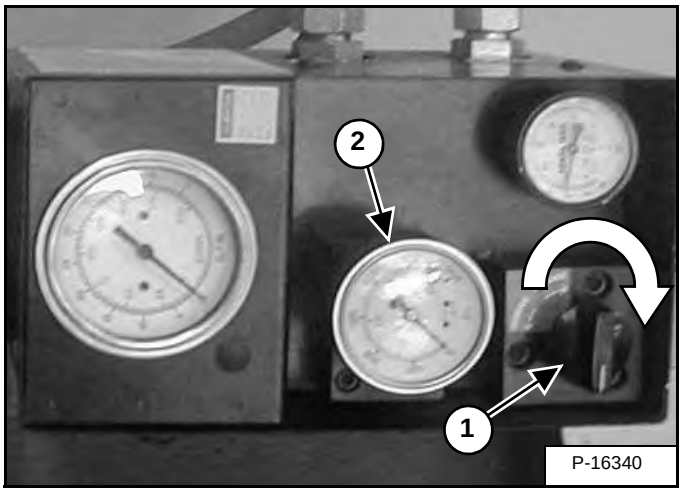


Install the jumper hose with the tee fitting (Item 1) on the hydraulic control valve outlet test port and on the adapter hose (Item 2) **[Figure 20-50-10]**.

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Pump Testing (Cont'd)

Figure 20-50-11



With the engine at high idle, turn the hydraulic tester flow control (Item 1) clockwise until 6995 kPa (69 bar) (1000 psi) is shown on the gauge (Item 2) **[Figure 20-50-11]**.

Continue the procedure until the hydraulic oil is at a minimum of 66°C (150°F).

Test Fittings are Now Installed.

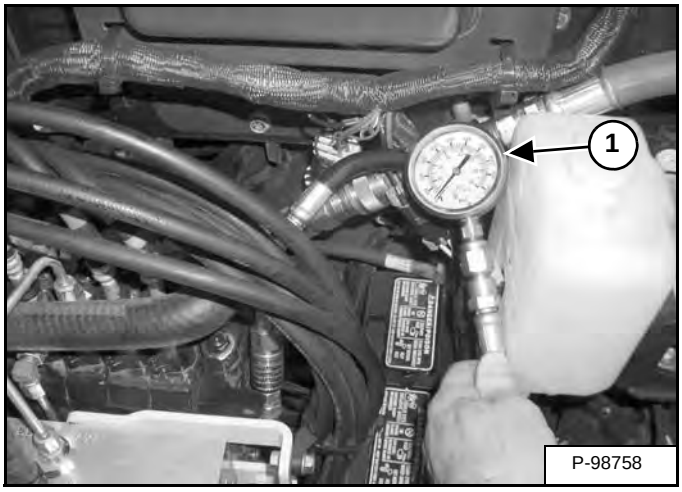
The values read at the Hydraulic Tester (MEL10003) are based on the use of 19,05 mm (0.75 in) hoses on the tester. Different size hoses will cause variation in the readings.

Turn the hydraulic tester flow control counter-clockwise until all restriction is removed.

Pump Margin Pressure Adjustment

Remove the jumper hose from the hydraulic control valve test port and adapter hose.

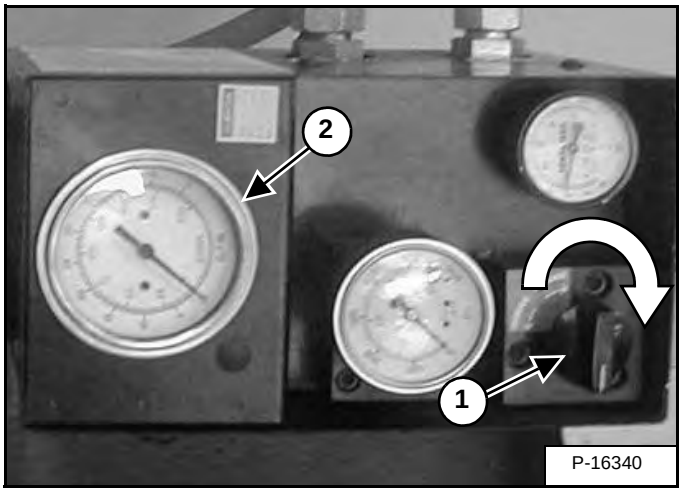
Figure 20-50-12



Install a 3447 kPa (34,5 bar) (500 psi) gauge on the hydraulic control valve test port (Item 1) **[Figure 20-50-12]**.

Run the engine at High Idle.

Figure 20-50-13



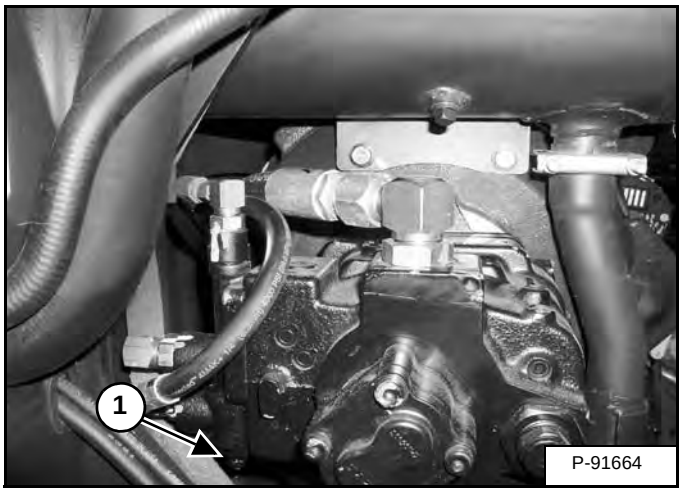
Turn the hydraulic tester flow control (Item 1) clockwise until 38 L/min (10 U.S. gpm) is shown on the gage (Item 2) **[Figure 20-50-13]**.

Record the pressure.

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Pump Testing (Cont'd)

Figure 20-50-14

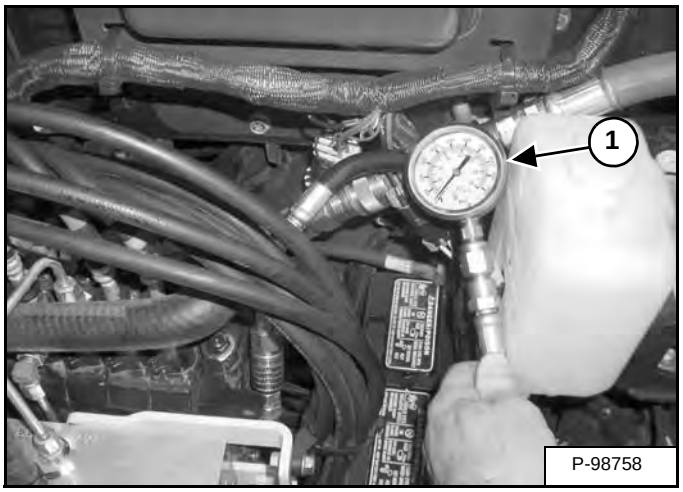


Loosen the lock nut and adjust the spool (Item 1) **[Figure 20-50-14]** as necessary to obtain a minimum of 1379 kPa (13,8 bar) (200 psi) on the gauge.

Pump Margin Pressure Test is now completed.

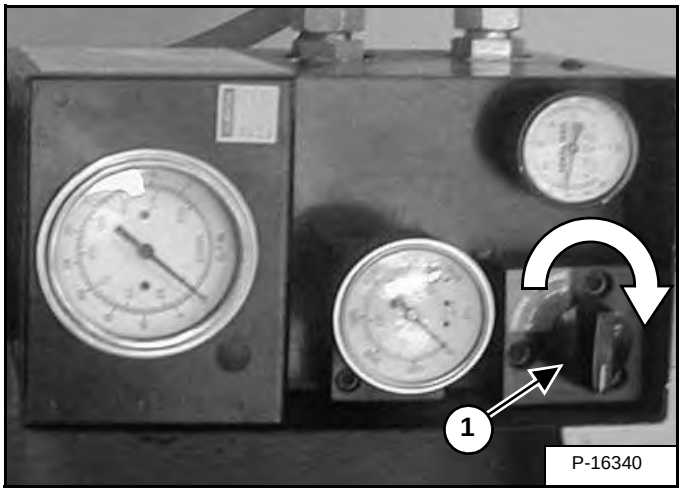
Main Relief Valve Adjustment

Figure 20-50-15



Install a 34474 kPa (345 bar) (5000 psi) (Item 1) **[Figure 20-50-15]** on the hydraulic control valve test port.

Figure 20-50-16



Turn the hydraulic tester flow control (Item 1) **[Figure 20-50-16]** clockwise until maximum restriction.

Start the engine and run at high idle.

Raise the blade until the blade cylinder is fully retracted and the relief valve opens.

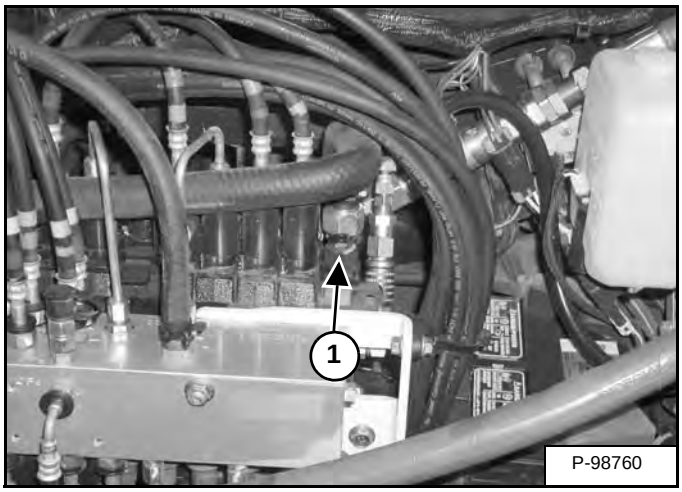
Have another person check the pressure gauge and record the pressure.

The main relief valve should be **24476 ± 517 kPa** (**245 ± 5,2 bar) (3550 ± 75 psi)**.

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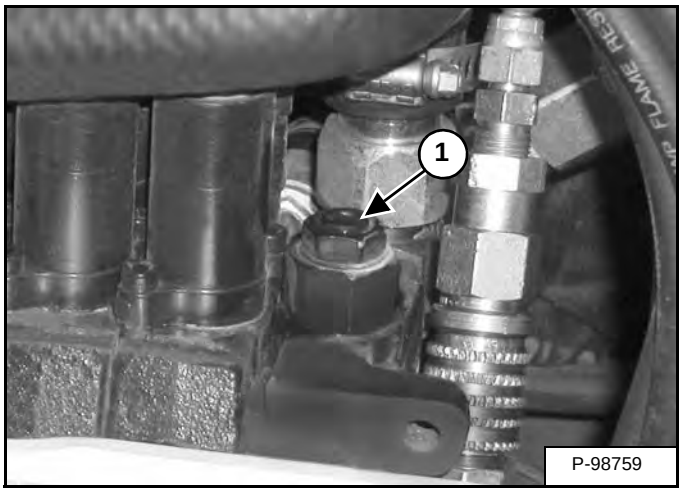
Pump Testing (Cont'd)

Figure 20-50-17



Loosen the lock nut (Item 1) **[Figure 20-50-17]**.

Figure 20-50-18



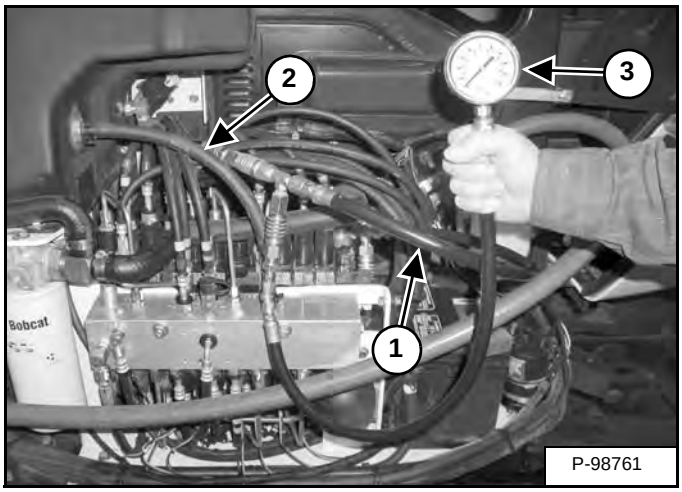
Turn the adjustment screw (Item 1) in to increase pressure and out to decrease pressure **[Figure 20-50-18]**.

When the main relief pressure is set, tighten the lock nut.

Main Relief Valve Adjustment is now completed.

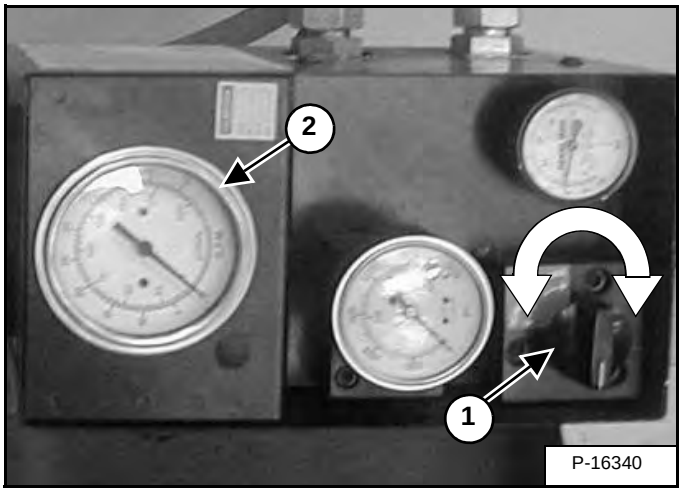
Torque Limiter Adjustment

Figure 20-50-19



Connect a jumper hose (Item 1) to the adapter hose (Item 2) and hydraulic control valve test port. Install a 34474 kPa (345 bar) (5000 psi) gauge (Item 3) **[Figure 20-50-19]** on the jumper hose.

Figure 20-50-20



Turn the hydraulic tester flow control (Item 1) **[Figure 20-50-20]** counterclockwise so there is no restriction on the hydraulic system.

Start the engine and run at high idle.

If equipped with air conditioning, turn air conditioning on and turn temperature switch to the lowest setting.

Turn the hydraulic tester flow control (Item 1) **[Figure 20-50-20]** clockwise until the gauge (Item 3) **[Figure 20-50-19]** reads **8963 kPa (89,6 bar) (1300 psi)**.

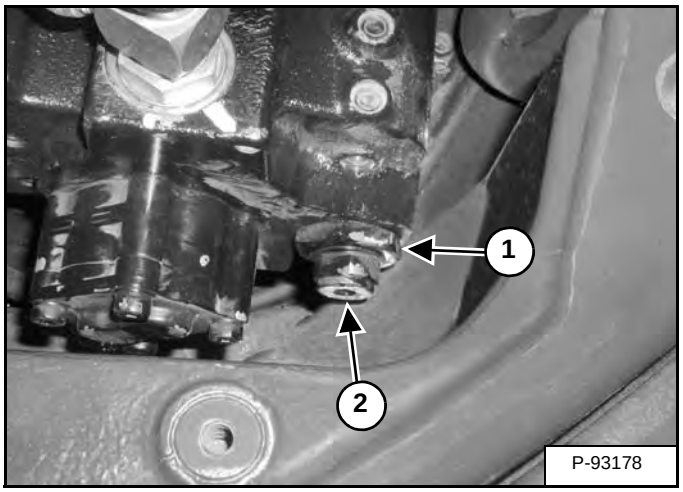
Record the amount of flow at the tester gauge (Item 2) **[Figure 20-50-20]**, which is the *flow at low pressure*.

The flow should be **87 - 95 L/min (23 - 25 U.S. gpm)**.

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Pump Testing (Cont'd)

Figure 20-50-21



If the flow at low pressure must be adjusted, stop the engine and loosen the lock nut (Item 1). Turn the adjustment (Item 2) **[Figure 20-50-21]** in to increase flow and out to decrease flow.

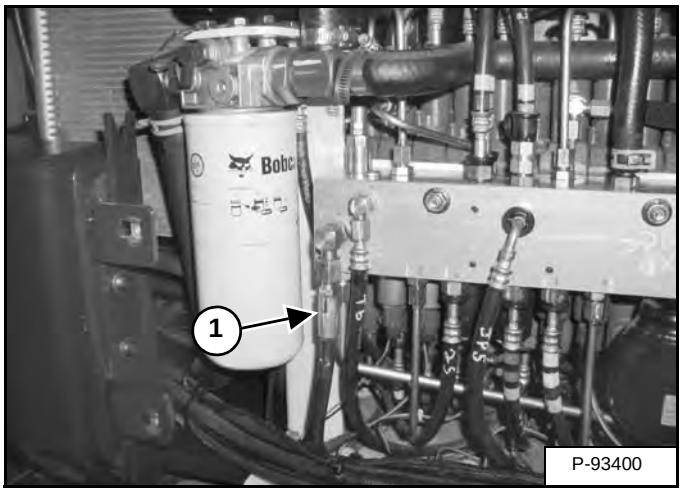
Torque Limiter Adjustment is now completed.

Remove the hydraulic tester, all test fittings and hoses from the excavator.

Install the cap or hydraulic X-change line on the tee fitting of the hydraulic control valve inlet section.

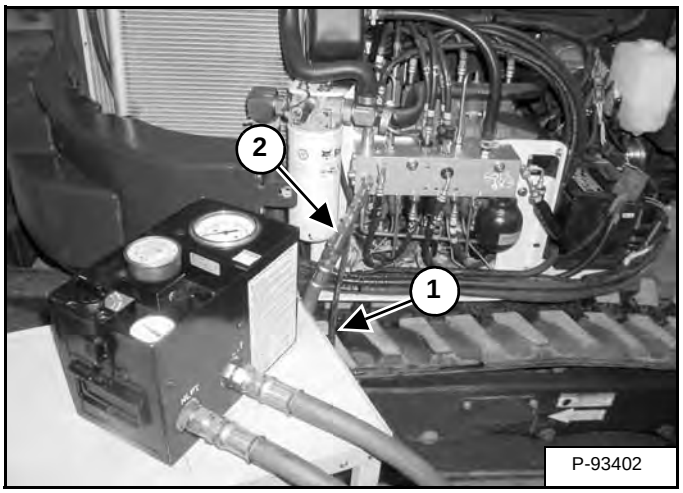
Direct Gear Pump Test

Figure 20-50-22



Remove the hose (Item 1) **[Figure 20-50-22]** from the manifold.

Figure 20-50-23



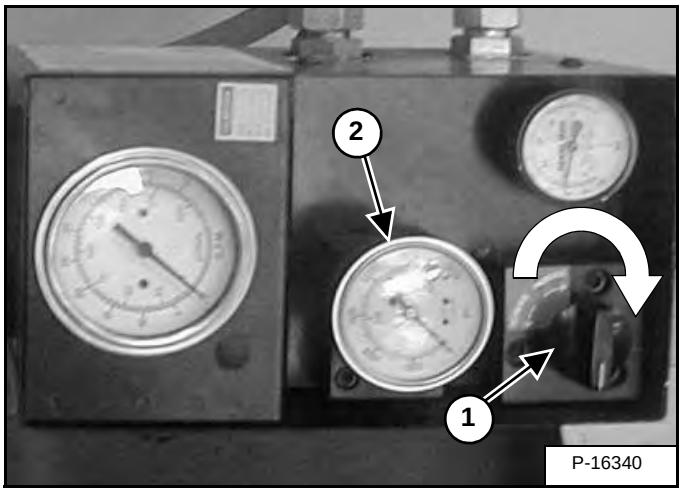
Install the inlet hose (Item 1) of the hydraulic tester to the hose removed from the manifold. Install the outlet hose (Item 2) **[Figure 20-50-23]** to the manifold.

Run the engine at High Idle.

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Pump Testing (Cont'd)

Figure 20-50-24



Turn the hydraulic tester flow control (Item 1) clockwise until 10342 kPa (103,4 bar) (1500 psi) is shown on the gauge (Item 2) **[Figure 20-50-24]**.

There must be a minimum of 7,6 L/min (2 U.S. gpm).

Remove the hydraulic tester and all test fittings from the excavator.

ALL PUMP ADJUSTMENTS ARE NOW COMPLETED.

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Description

The hydraulic pump consists of a gear pump and a piston pump. The gear pump supplies pilot pressure to the manifold and the piston pump supplies high pressure to the control valve.

IMPORTANT

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

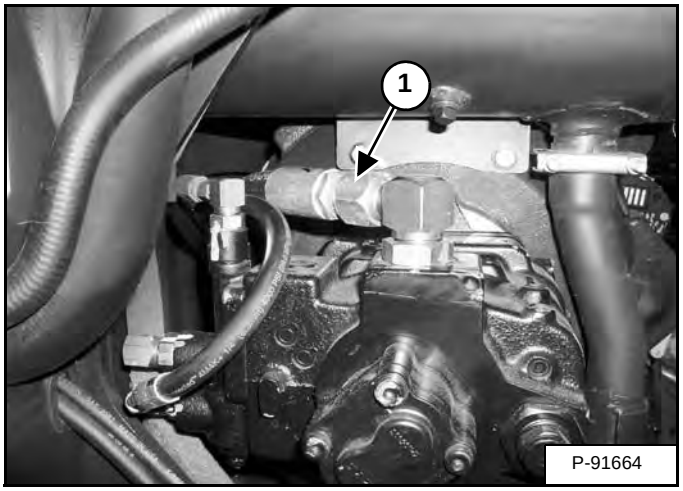
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Removal And Installation

Remove Counterweight. (See Removal And Installation on Page 40-90-1.)

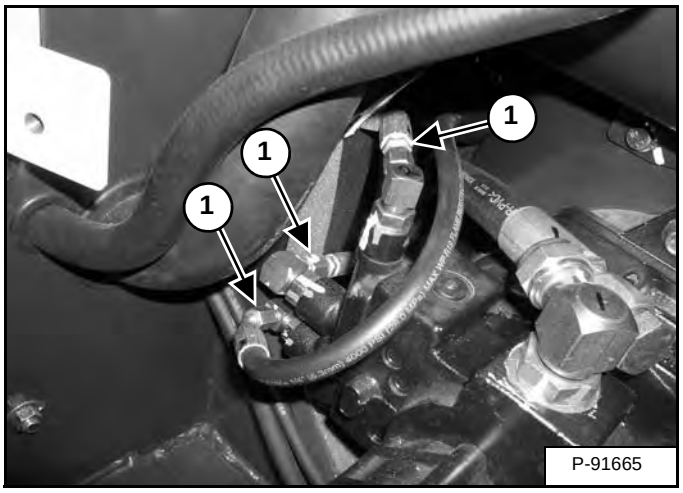
Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-130-5.)

Figure 20-50-25



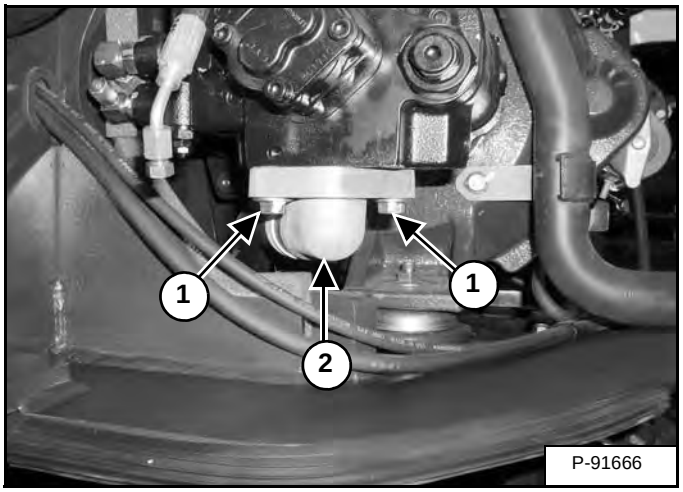
Mark and remove the hose (Item 1) **[Figure 20-50-25]**.

Figure 20-50-26



Mark and remove the three hoses (Item 1) **[Figure 20-50-26]**.

Figure 20-50-27

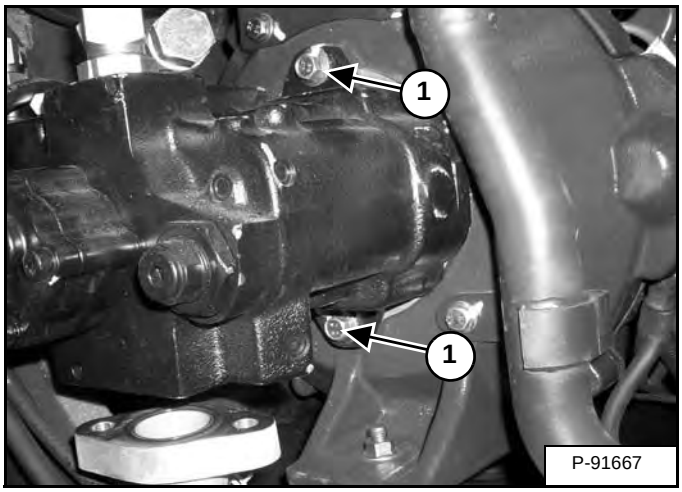


Remove the two bolts (Item 1) and inlet (Item 2) **[Figure 20-50-27]**.

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Removal And Installation (Cont'd)

Figure 20-50-28

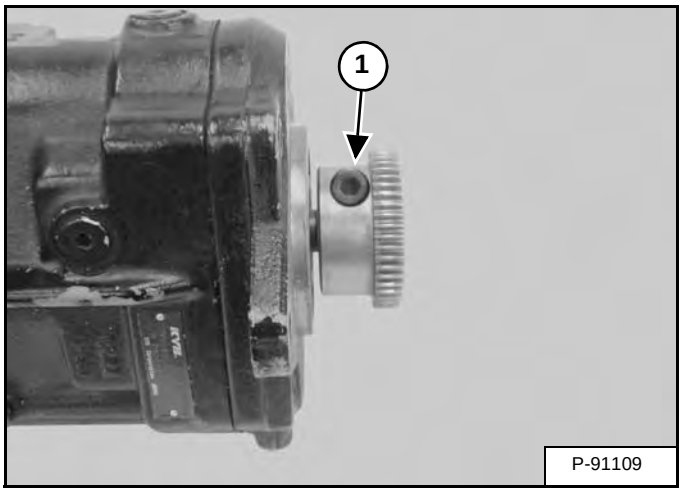


Remove the two bolts (Item 1) **[Figure 20-50-28]**.

Installation: Tighten the bolts to 75 - 85 N•m (55 - 60 ft-lb) torque.

Pump Installation: Whenever the hydraulic system has been drained and refilled, the hydraulic pump must be purged of air. (See Hydraulic Pump Start Up on Page 20-50-13.)

Figure 20-50-29



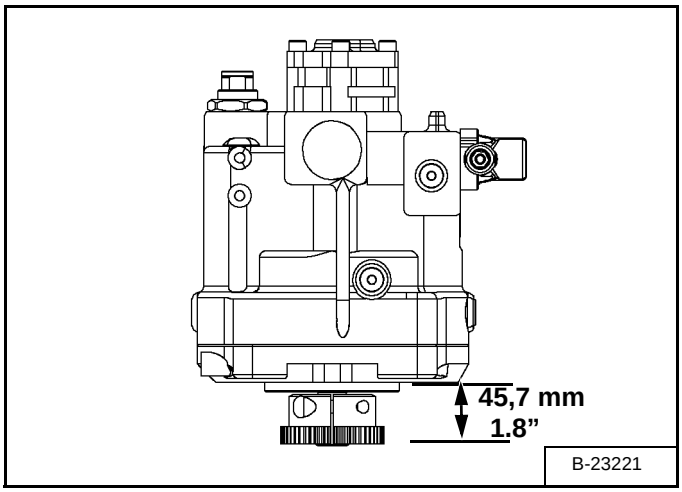
Remove the bolt (Item 1) **[Figure 20-50-29]** from the coupler.

Slide the coupler off of the pump shaft.

Installation: Tighten the bolt (Item 1) **[Figure 20-50-29]** to 49 - 60 N•m (36 - 44 ft-lb) torque.

Coupler Removal And Installation

Figure 20-50-30



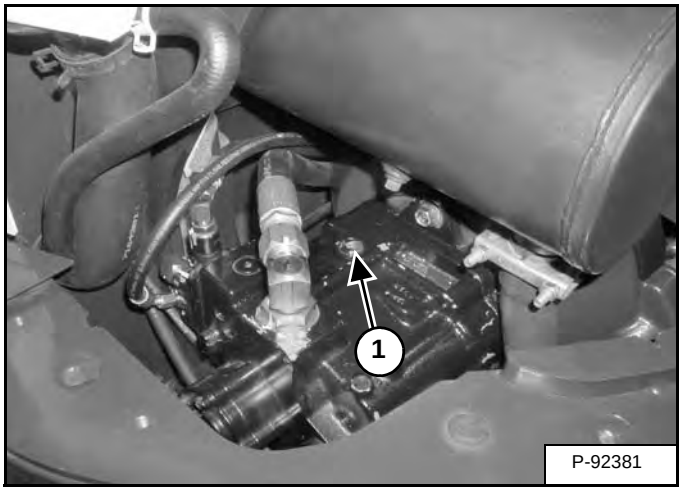
When installing the coupler, maintain 45,7 mm (1.80 in) over all length from the pump housing to the coupler edge **[Figure 20-50-30]**.

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Hydraulic Pump Start Up

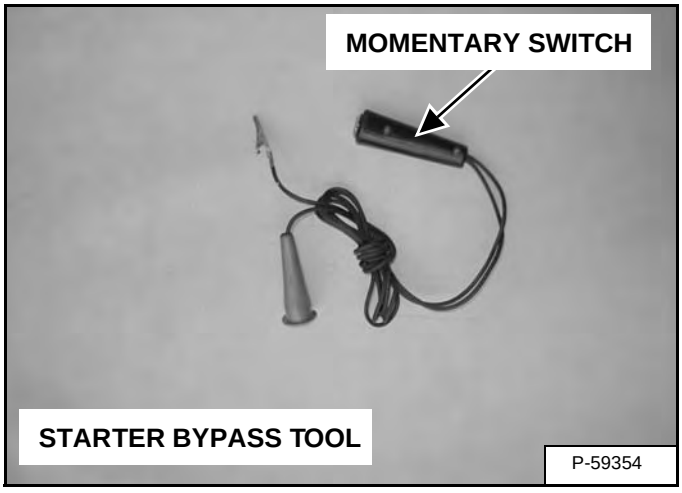
NOTE: This procedure is to prevent a dry start up of the hydraulic pump.

Figure 20-50-31



Loosen the case plug (Item 1) **[Figure 20-50-31]** until all the air is purged from the pump housing.

Figure 20-50-32



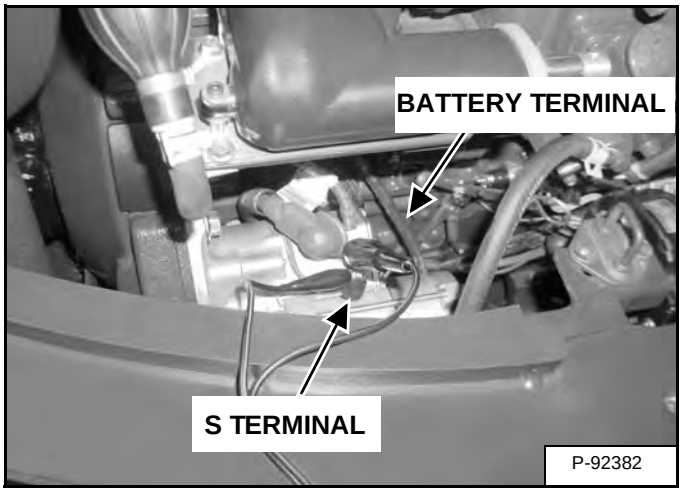
To crank the engine without starting, the machine key switch can be bypassed. Obtain a starter bypass tool from a local source which can be used as a universal connection to remotely crank the engine without starting **[Figure 20-50-32]**.

The starter bypass tool consists of two wires, each with a clamp. The momentary switch, when depressed, will allow current to pass through the circuit.

Figure 20-50-33



Figure 20-50-34



Connect the starter bypass tool to the starter solenoid battery terminal and S terminal. Crank the engine for 15 seconds, then stop for at least 30 seconds. Again, crank the engine for 15 seconds. Remove the starter bypass tool **[Figure 20-50-33]** and **[Figure 20-50-34]**.

Start the excavator from the operator cab and run the engine at low idle for 1 - 2 minutes without operating the hydraulics.

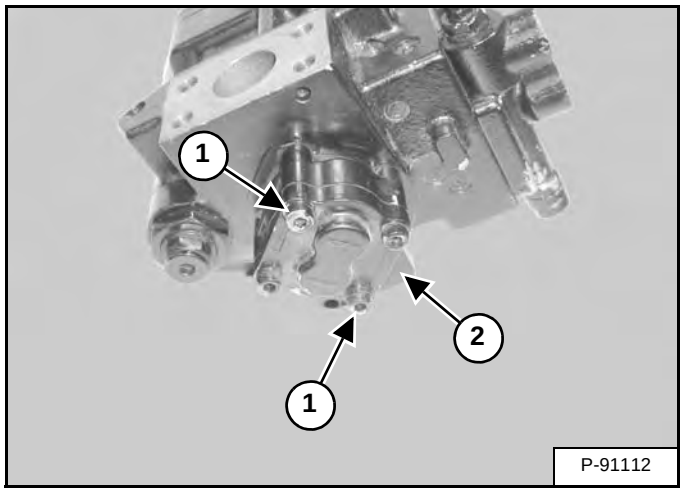
After operating the engine at low idle, operate the hydraulic systems several times or until air is purged from the system. **Avoid running over the relief valve setting at the end of cylinder stroke.**

With the excavator parked on a level surface, check and fill the hydraulic reservoir as required. Check for hydraulic leaks. (See Removing And Replacing Hydraulic Fluid on Page 10-130-5.)

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Gear Pump Disassembly And Assembly

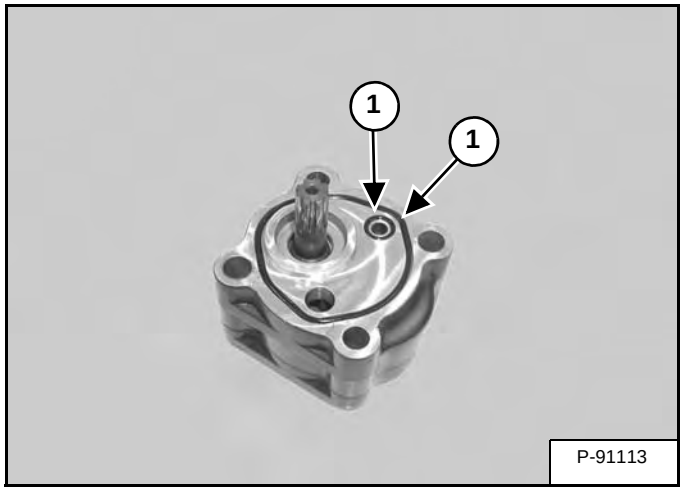
Figure 20-50-35



Remove the two bolts (Item 1) and gear pump (Item 2) **[Figure 20-50-35]**.

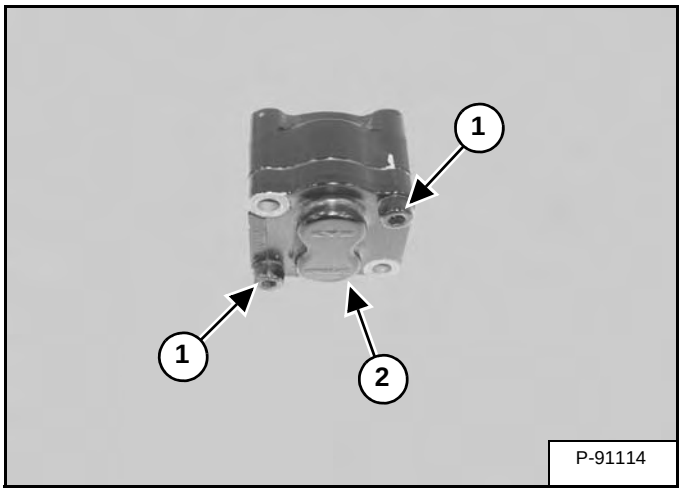
Installation: Tighten the bolts to 26 - 32 N•m (19 - 24 ft-lb) torque.

Figure 20-50-36



Remove the O-rings (Item 1) **[Figure 20-50-36]**.

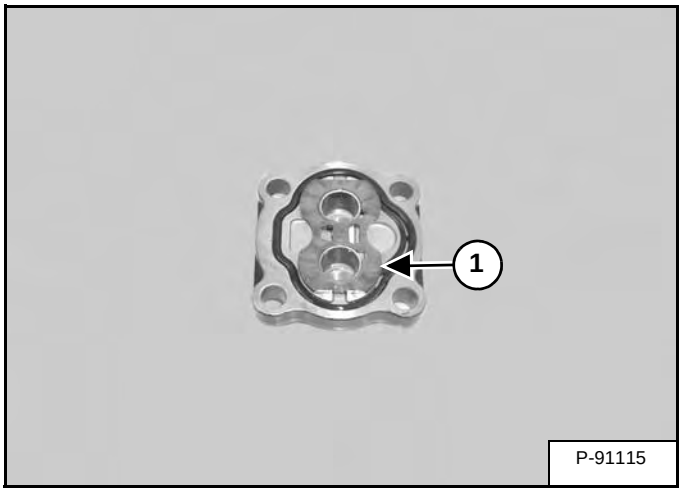
Figure 20-50-37



Remove the two bolts (Item 1) and cover (Item 2) **[Figure 20-50-37]**.

Installation: Tighten the bolts to 26 - 32 N•m (19 - 24 ft-lb) torque.

Figure 20-50-38

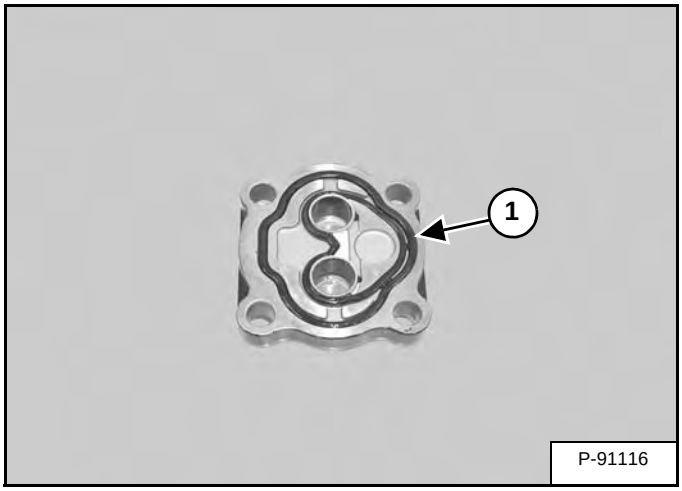


Remove the thrust plate (Item 1) **[Figure 20-50-38]**.

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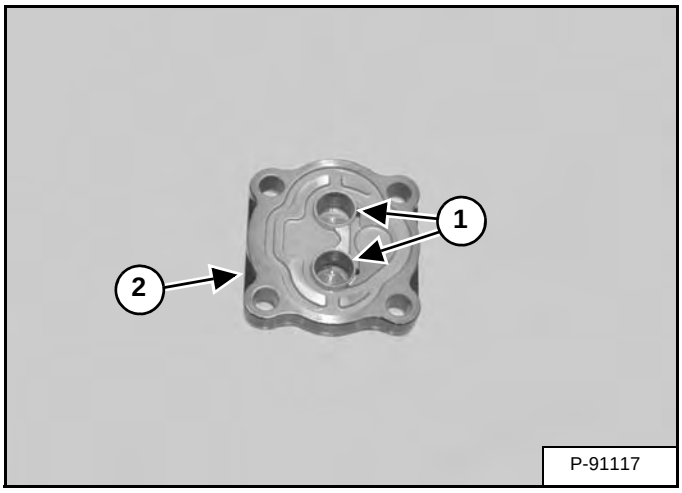
Gear Pump Disassembly And Assembly (Cont'd)

Figure 20-50-39



Remove the O-rings (Item 1) **[Figure 20-50-39]**.

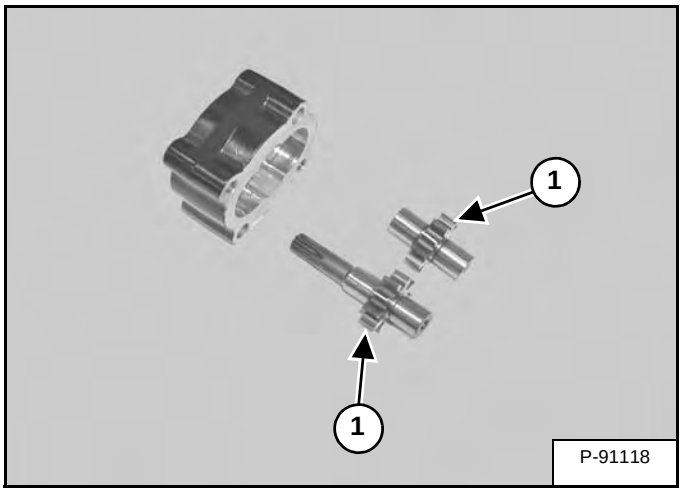
Figure 20-50-40



Inspect the bushings (Item 1) **[Figure 20-50-40]** for wear or damage.

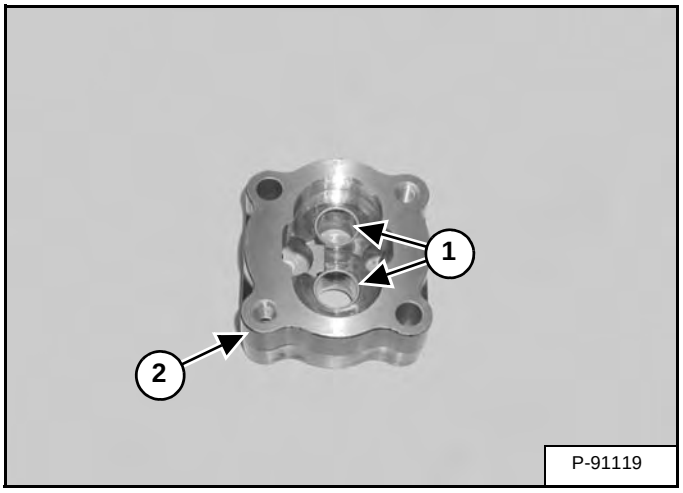
NOTE: The bushings are not serviceable. If the bushings are worn or damaged, replace the cover assembly (Item 2) [Figure 20-50-40].

Figure 20-50-41



Remove the gears (Item 1) **[Figure 20-50-41]**.

Figure 20-50-42



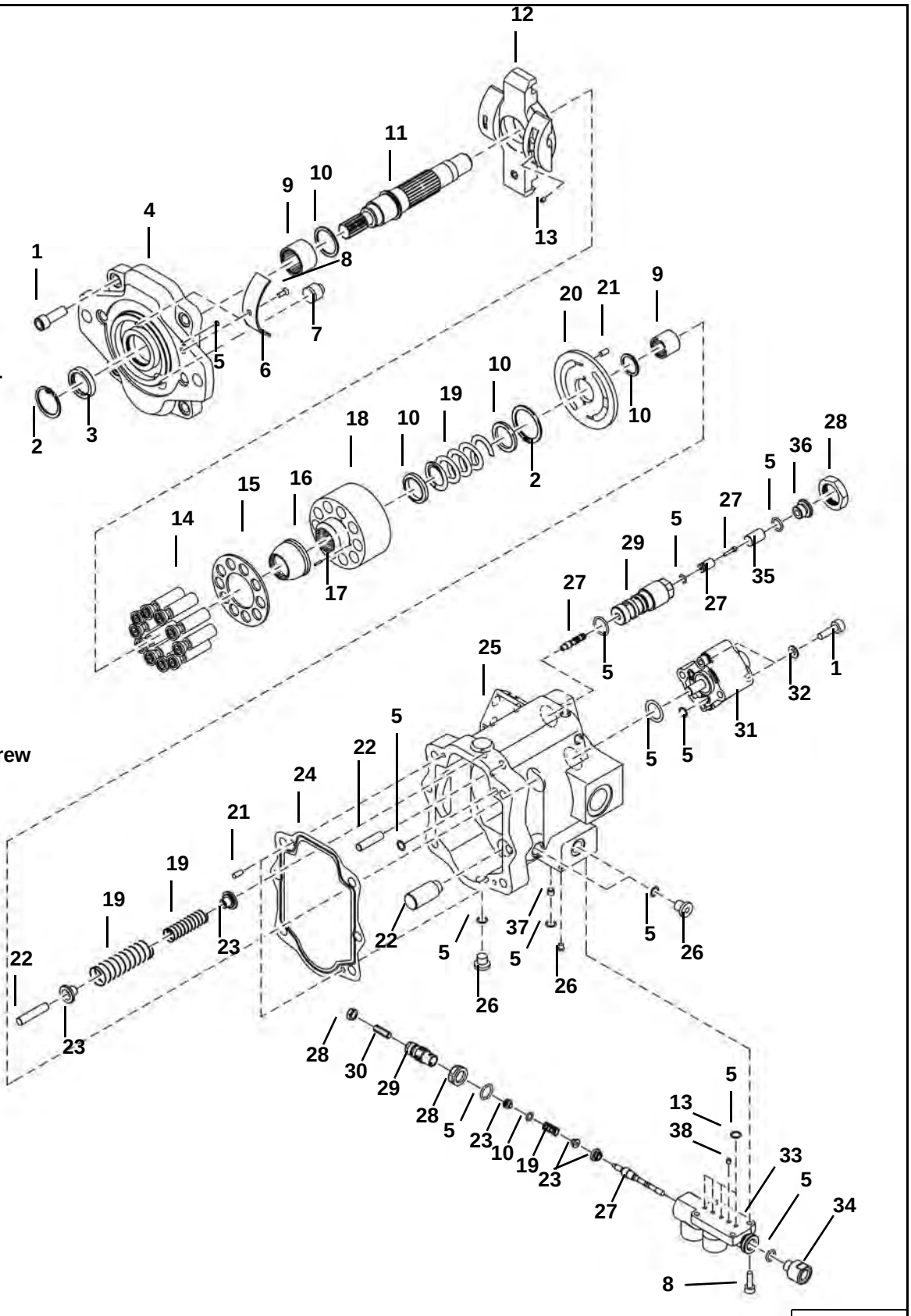
Inspect the bushings (Item 1) **[Figure 20-50-42]** for wear or damage.

NOTE: The bushings are not serviceable. if the bushings are worn or damaged, replace the housing assembly (Item 2) [Figure 20-50-42].

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Piston Pump Parts Identification

1. Bolt
2. Snap Ring
3. Seal
4. Flange
5. O-ring
6. Bushing
7. Piston
8. Screw
9. Bearing
10. Washer
11. Shaft
12. Swash Plate
13. Orifice
14. Pistons
15. Piston Retainer
16. Retainer Guide
17. Pin
18. Cylinder Block
19. Spring
20. Valve Plate
21. Dowel Pin
22. Piston
23. Spring Seat
24. Gasket
25. Housing
26. Plug
27. Spool
28. Nut
29. Body
30. Adjustment Screw
31. Gear Pump
32. Washer
33. Control Body
34. Fitting / Orifice
35. Spacer
36. Adjuster
37. Fine Control Orifice
38. PC Orifice



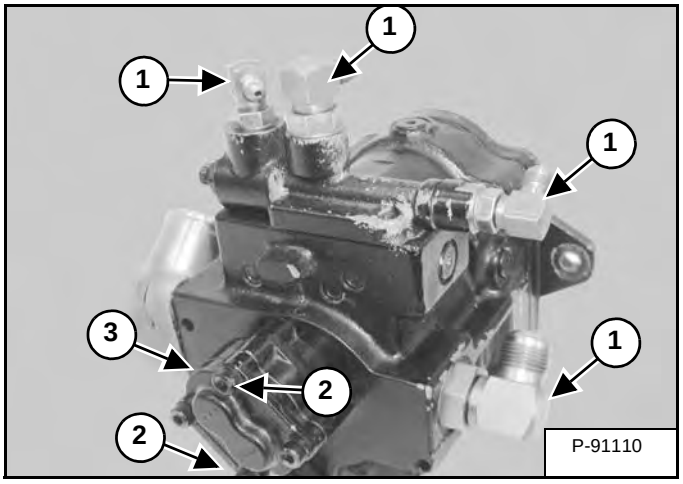
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Piston Pump Disassembly And Assembly

Clean the outside of the hydraulic pump before disassembly.

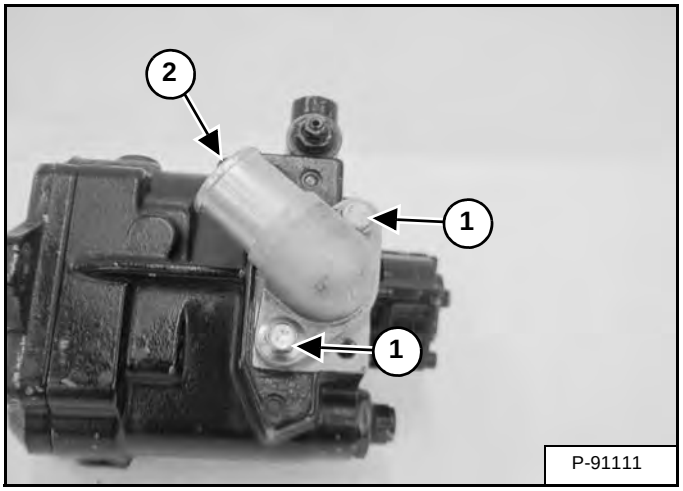
Figure 20-50-43



Remove the fittings (Item 1). Remove the two bolts (Item 2) and remove the gear pump (Item 3) **[Figure 20-50-43]**.

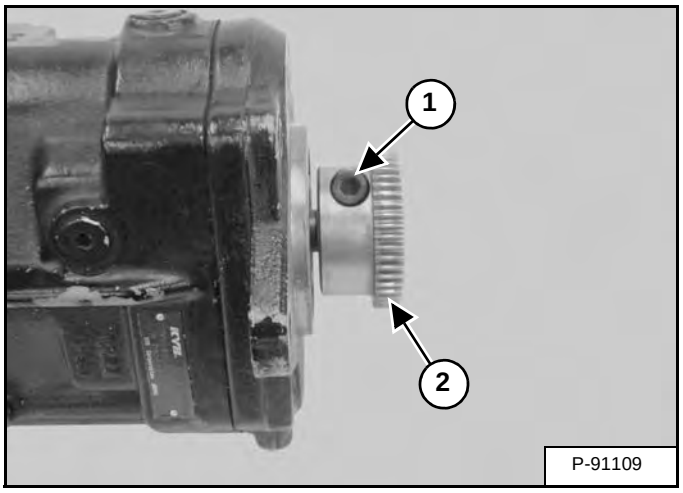
Installation: Tighten the bolts to 26 - 32 N•m (19 - 24 ft-lb) torque.

Figure 20-50-44



Remove the two bolts (Item 1), inlet housing (Item 2) **[Figure 20-50-44]** and O-ring.

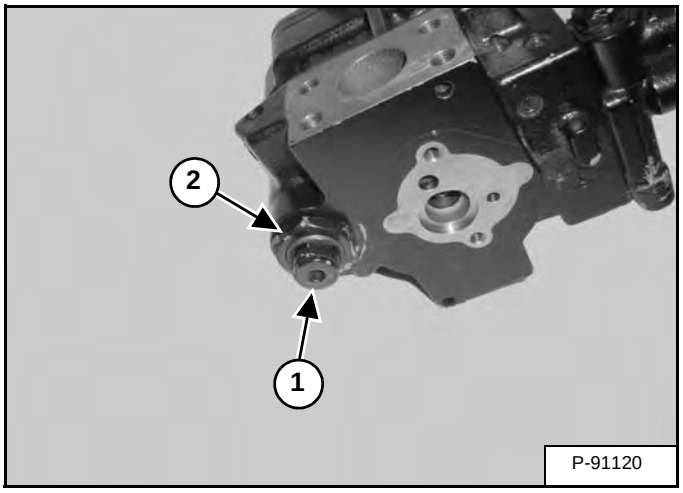
Figure 20-50-45



Remove the bolt (Item 1) and coupler (Item 2) **[Figure 20-50-45]**.

Installation: See Coupler Removal And Installation. (See Coupler Removal And Installation on Page 20-50-12.)

Figure 20-50-46

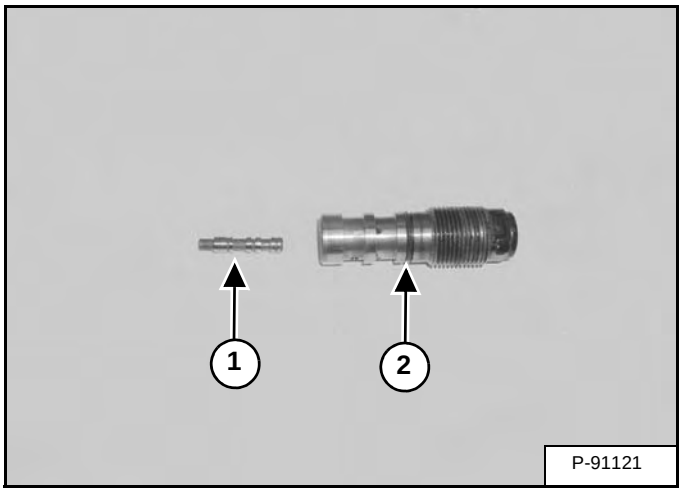


Measure and record the height of the adjustment screw (Item 1). Loosen the lock nut (Item 2) **[Figure 20-50-46]** and remove the adjustment screw.

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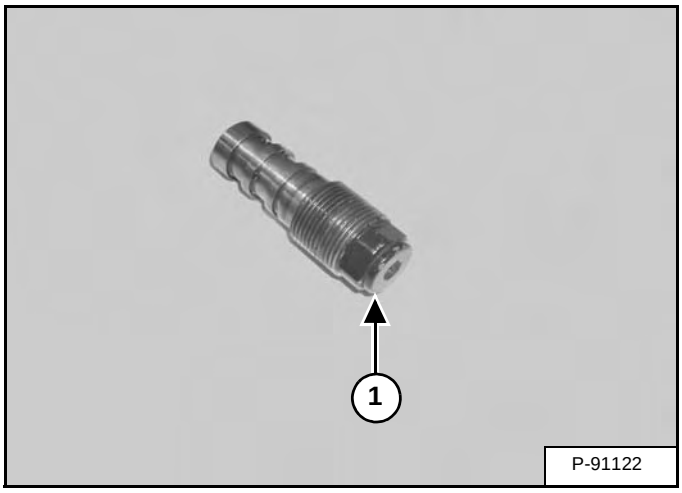
Piston Pump Disassembly And Assembly (Cont'd)

Figure 20-50-47



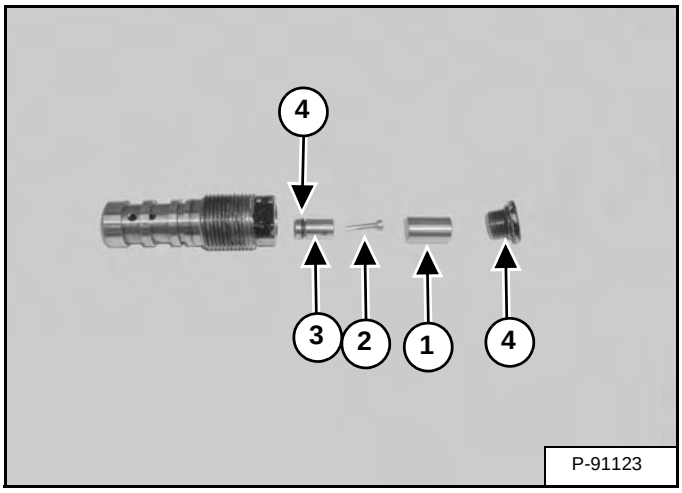
Remove the spool (Item 1) and O-ring (Item 2) **[Figure 20-50-47]**.

Figure 20-50-48



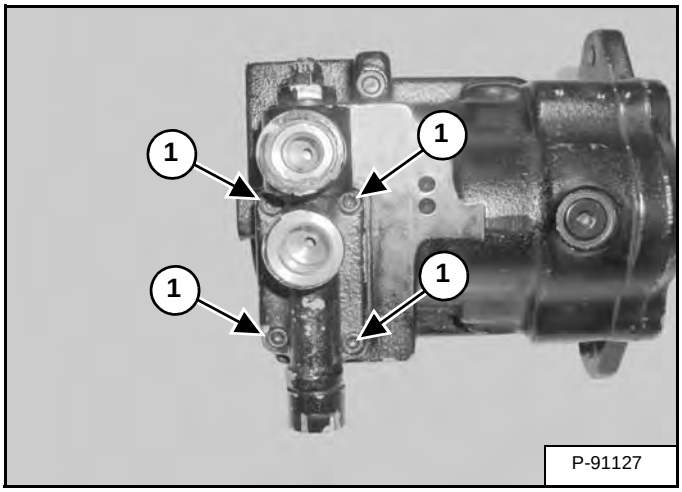
Remove the plug (Item 1) **[Figure 20-50-48]**.

Figure 20-50-49



Remove the collar (Item 1), pin (Item 2), and servo piston (Item 3). Remove the O-rings (Item 4) **[Figure 20-50-49]**.

Figure 20-50-50



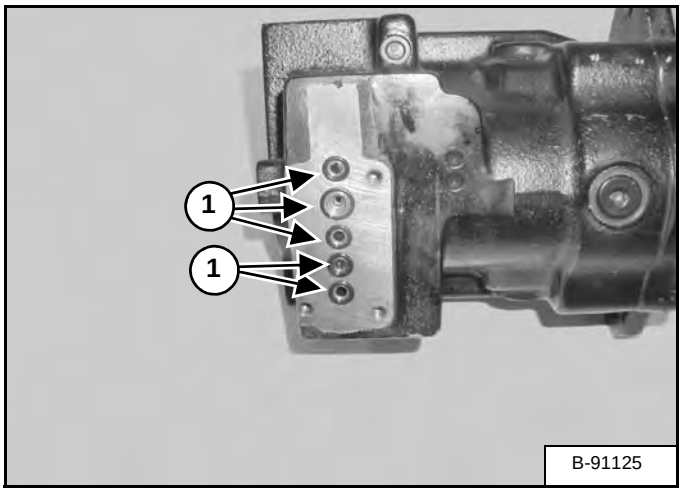
Remove the four bolts (Item 1) **[Figure 20-50-50]** and remove the control.

Installation: Tighten the bolts to 11,4 - 13,9 N•m (8.4 - 10.3 ft-lb) torque.

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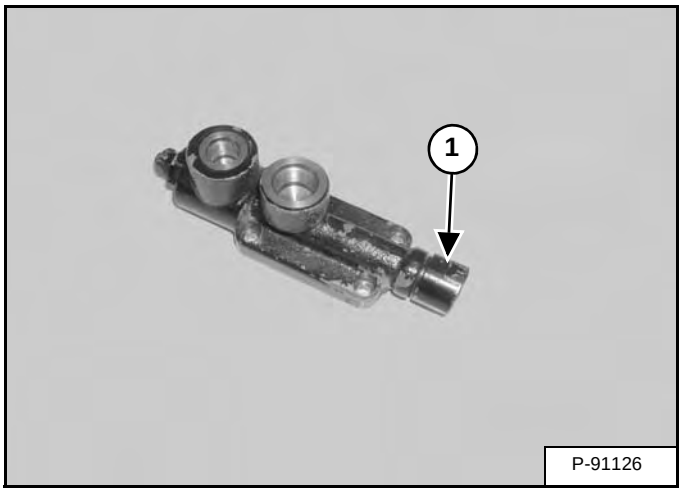
Piston Pump Disassembly And Assembly (Cont'd)

Figure 20-50-51



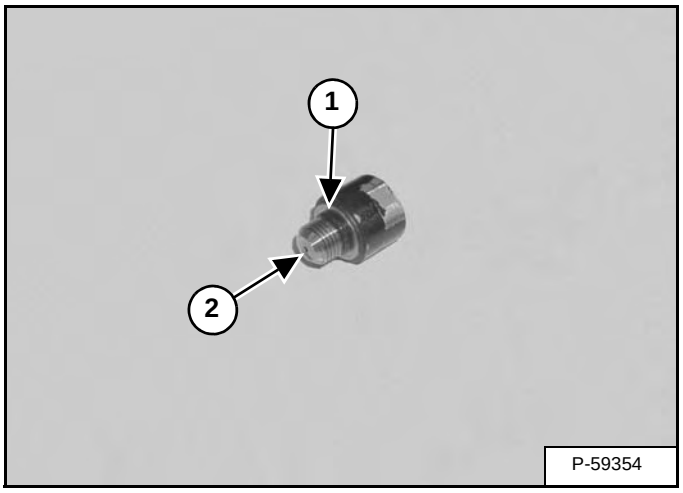
Remove the five O-rings (Item 1) **[Figure 20-50-51]**.

Figure 20-50-52



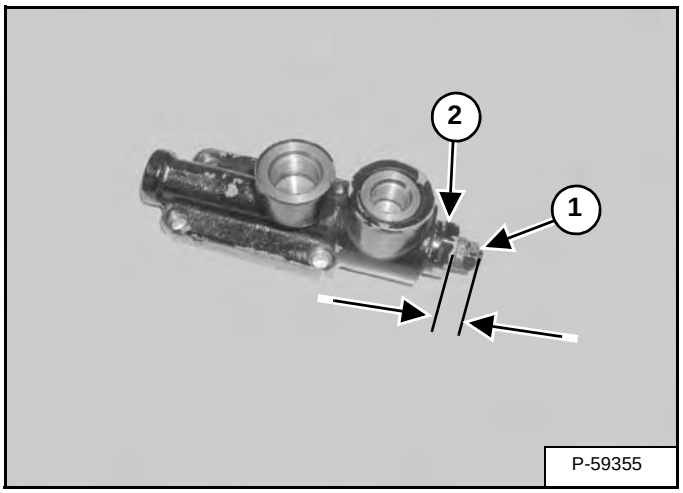
Remove fitting (Item 1) **[Figure 20-50-52]**.

Figure 20-50-53



Remove the O-ring (Item 1) from the fitting. Inspect the orifice (Item 2) **[Figure 20-50-53]** for damage and contamination.

Figure 20-50-54

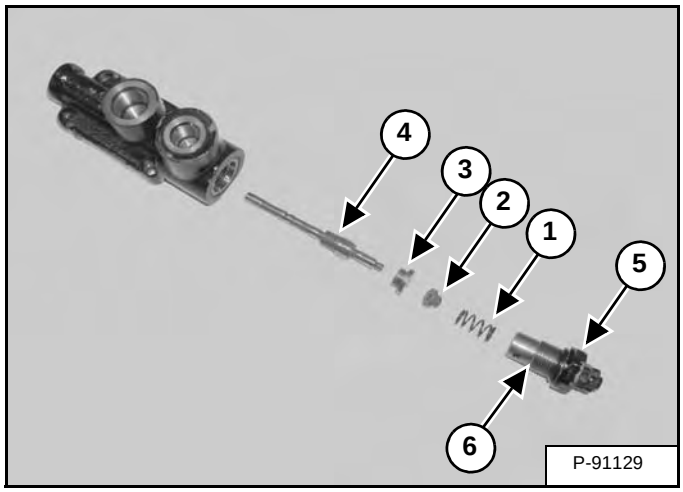


Measure and record the length of the adjustment screw (Item 1). Loosen the lock nut (Item 2) **[Figure 20-50-54]** and remove the adjustment assembly.

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Piston Pump Disassembly And Assembly (Cont'd)

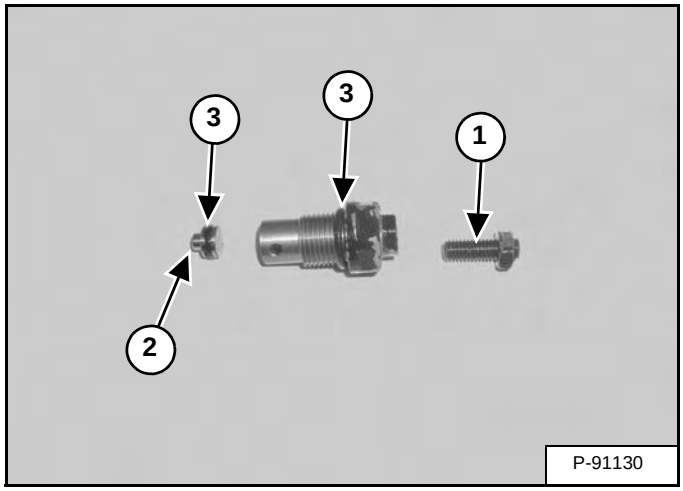
Figure 20-50-55



Remove the spring (Item 1), spring seat (Item 2), bushing (Item 3) and spool (Item 4) **[Figure 20-50-55]**.

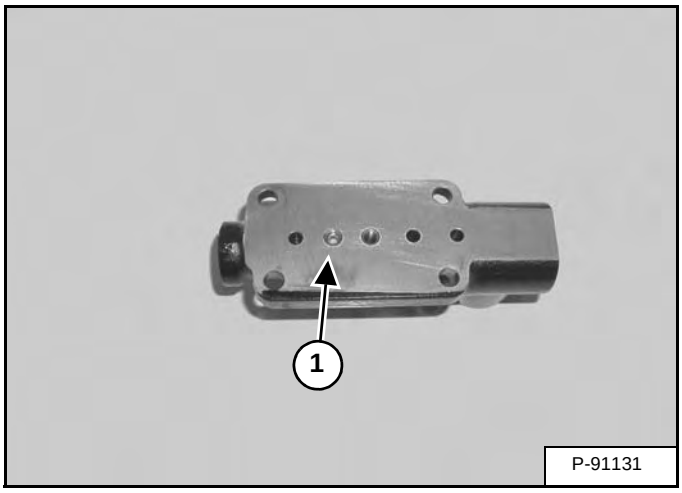
Installation: With the lock nut (Item 5) loose, tighten the body (Item 6) **[Figure 20-50-55]** until it bottoms out in the control.

Figure 20-50-56



Remove the small adjustment screw (Item 1). Remove the bushing (Item 2). Remove the O-rings (Item 3) **[Figure 20-50-56]**.

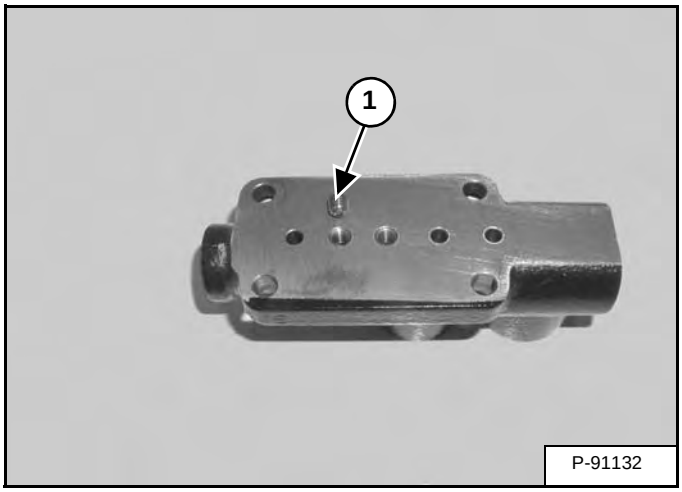
Figure 20-50-57



Remove the orifice (Item 1) **[Figure 20-50-57]**.

Installation: Tighten the PC orifice to 2,2 - 2,7 N•m (20 - 24 in-lb) torque.

Figure 20-50-58

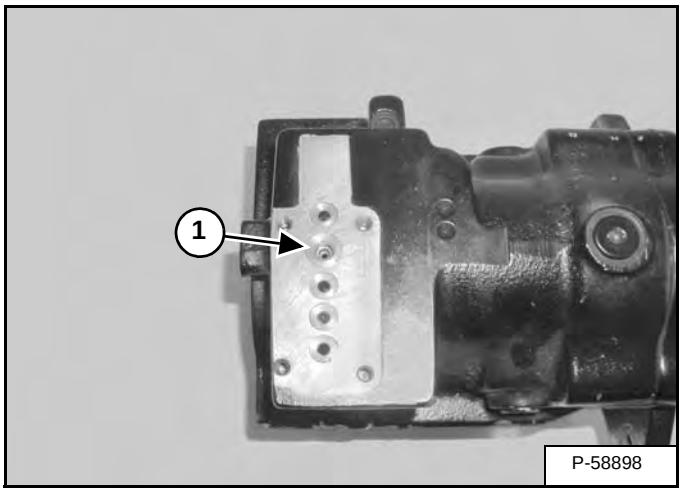


Inspect the orifice (Item 1) **[Figure 20-50-58]** for damage and contamination.

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Piston Pump Disassembly And Assembly (Cont'd)

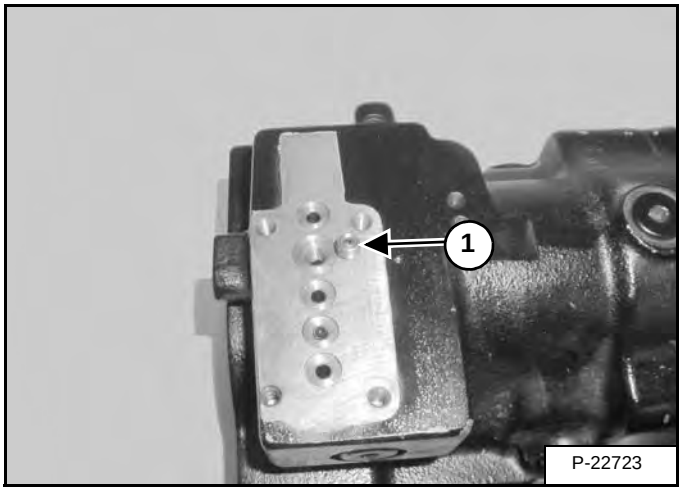
Figure 20-50-59



Remove the FINE CONTROL orifice (Item 1) **[Figure 20-50-59]**.

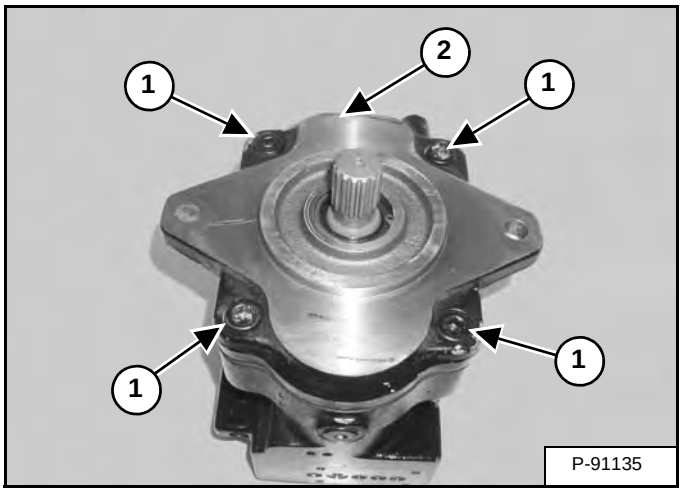
Installation: Tighten the orifice to 2,2 - 2,7 N•m (20 - 24 in-lb) torque.

Figure 20-50-60



Inspect the orifice (Item 1) **[Figure 20-50-60]** for damage and contamination.

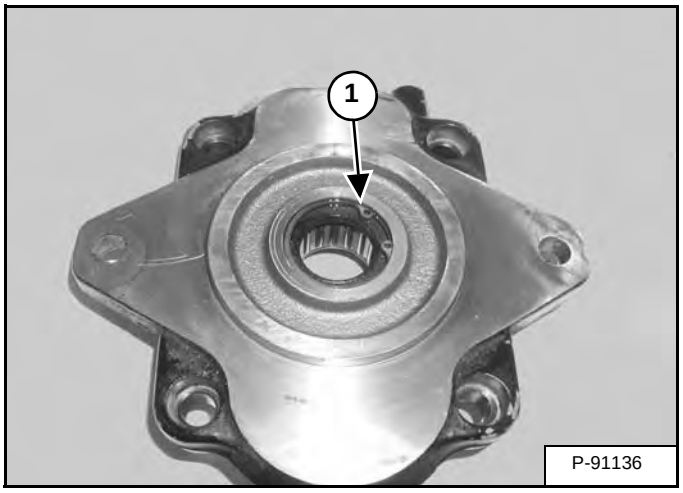
Figure 20-50-61



Stand the pump shaft end up. Remove the four bolts (Item 1) and flange (Item 2) **[Figure 20-50-61]**.

Installation: Tighten the bolts to 96,2 - 117,6 N•m (71 - 86.7 ft-lb) torque.

Figure 20-50-62

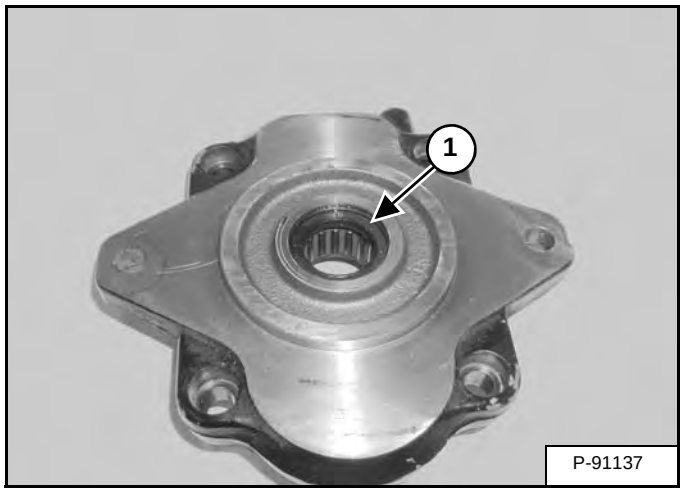


Remove the snap ring (Item 1) **[Figure 20-50-62]**.

Dealer Copy -- Not for Resale

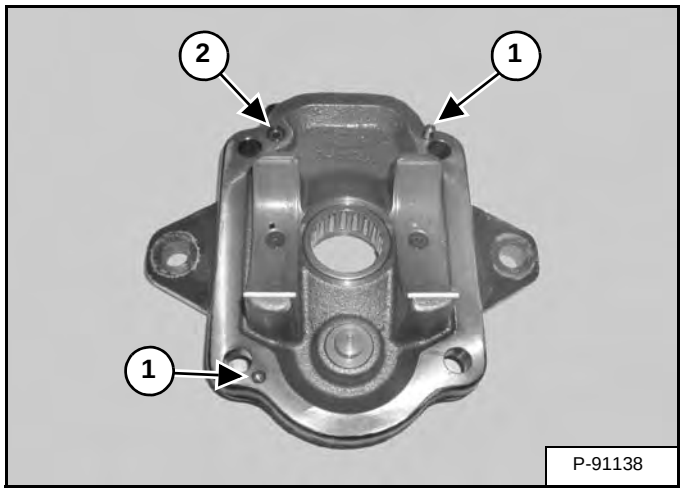
Piston Pump Disassembly And Assembly (Cont'd)

Figure 20-50-63



Remove the oil seal (Item 1) **[Figure 20-50-63]**.

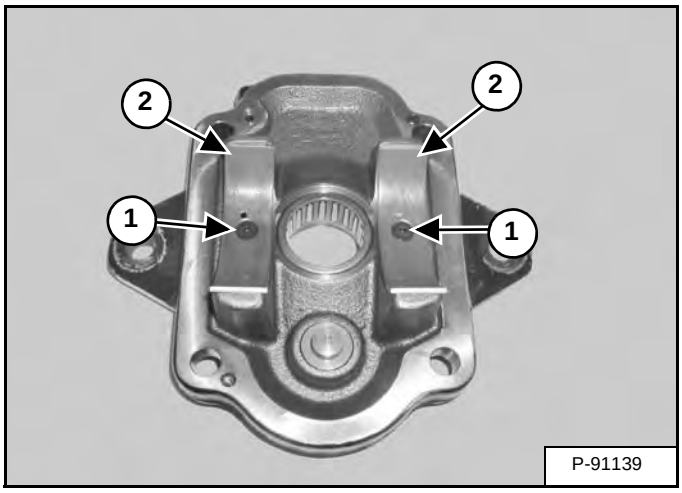
Figure 20-50-64



Remove the dowel pins (Item 1) and O-ring (Item 2) **[Figure 20-50-64]**.

NOTE: The dowel pins may stay in either the housing or flange during disassembly.

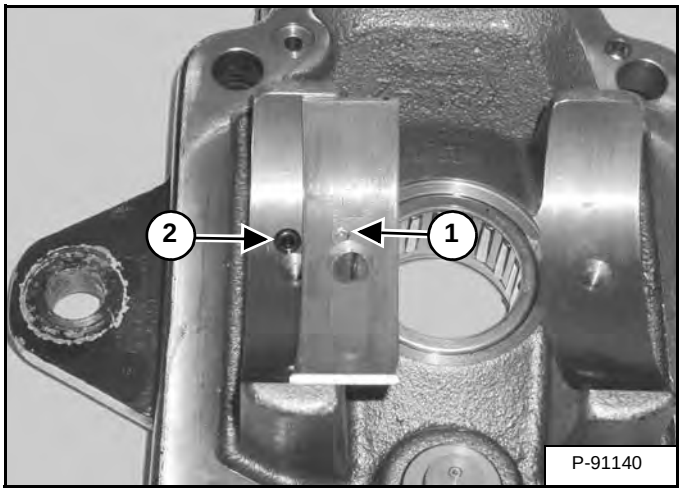
Figure 20-50-65



Remove screws (Item 1) and remove the bushings (Item 2) **[Figure 20-50-65]**.

Installation: Tighten the screws to 5,3 - 6,5 N•m (47 - 58 in-lb) torque.

Figure 20-50-66

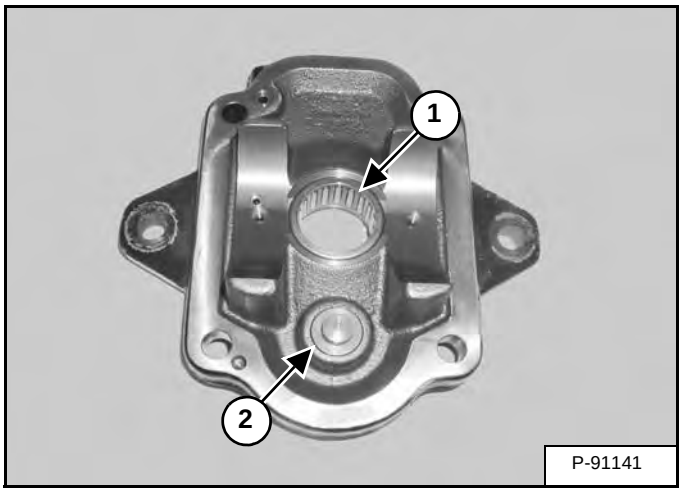


When installing the bushing, the oil hole (Item 1) in the bushing must be aligned with the oil hole (Item 2) **[Figure 20-50-66]** in the flange.

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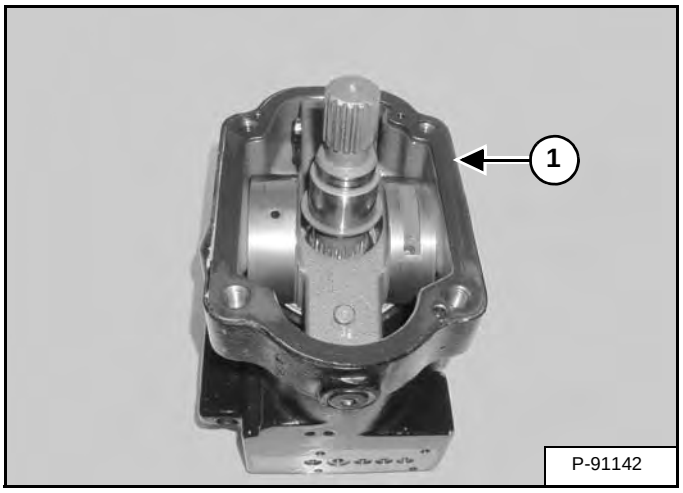
Piston Pump Disassembly And Assembly (Cont'd)

Figure 20-50-67



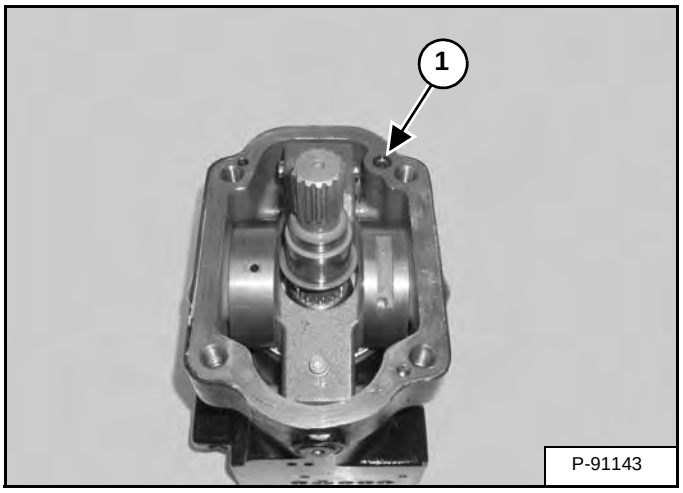
Remove the needle bearing (Item 1) and stop (Item 2) **[Figure 20-50-67]**.

Figure 20-50-68



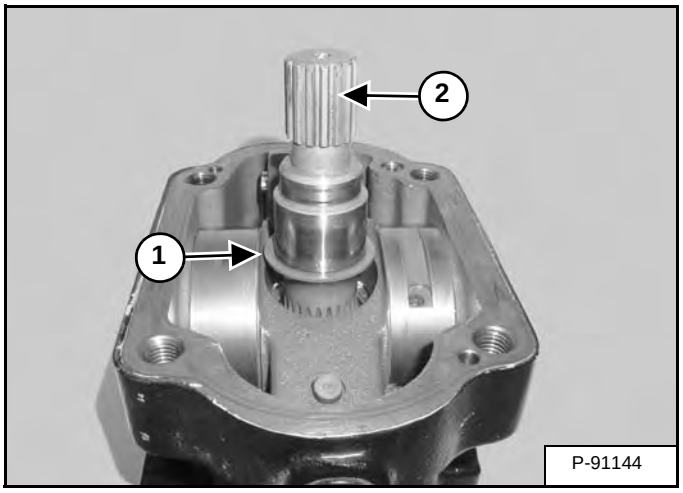
Remove the gasket (Item 1) **[Figure 20-50-68]**.

Figure 20-50-69



Remove the O-ring (Item 1) **[Figure 20-50-69]**.

Figure 20-50-70

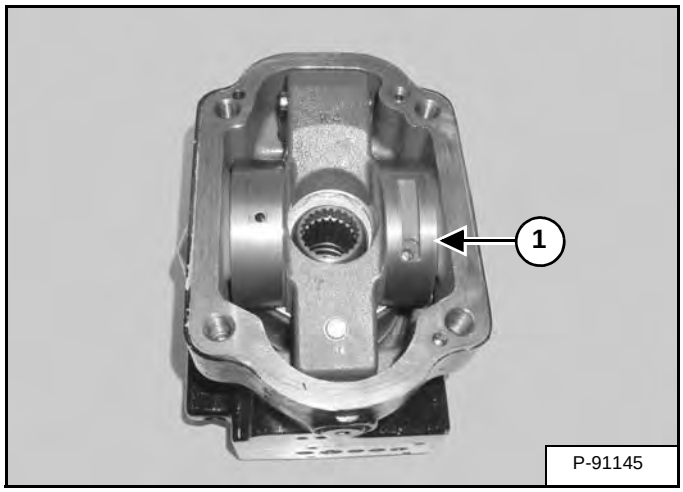


Remove the thrust washer (Item 1) and shaft (Item 2) **[Figure 20-50-70]**.

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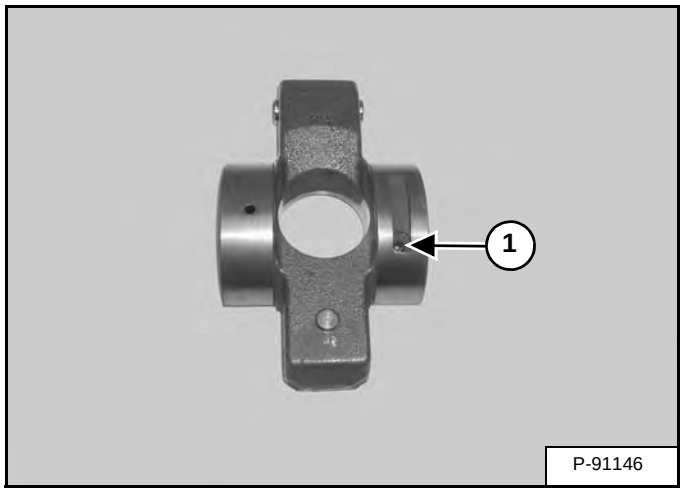
Piston Pump Disassembly And Assembly (Cont'd)

Figure 20-50-71



Remove the swash plate (Item 1) **[Figure 20-50-71]**.

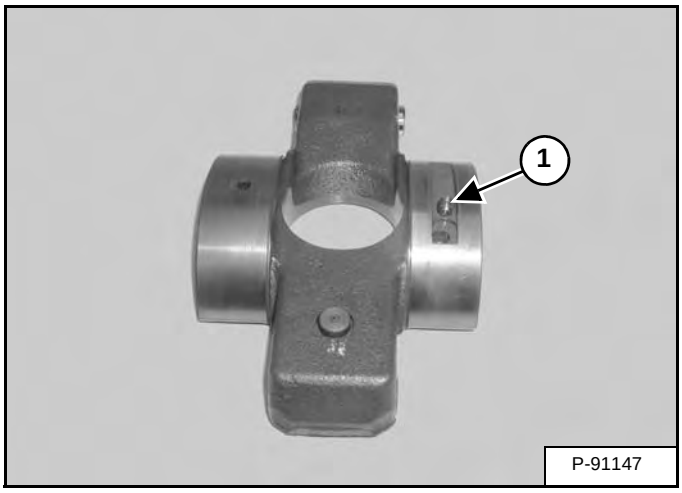
Figure 20-50-72



Remove the orifice (Item 1) **[Figure 20-50-72]**.

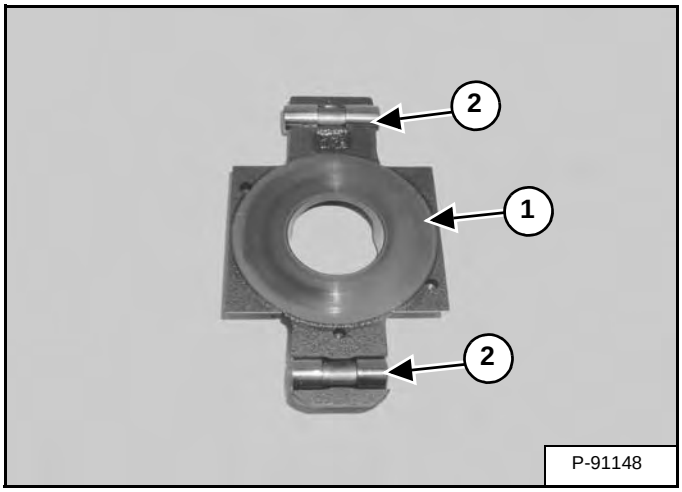
Installation: Tighten the orifice to 2,2 - 2,7 N•m (20 - 24 in-lb) torque.

Figure 20-50-73



Inspect the orifice (Item 1) **[Figure 20-50-73]** for damage and contamination.

Figure 20-50-74

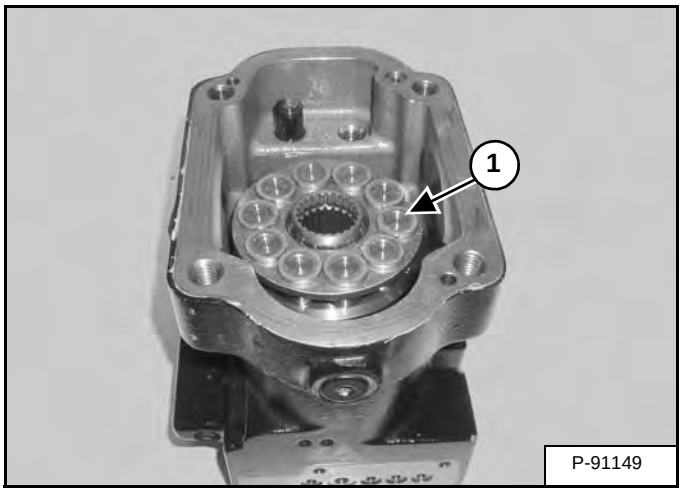


Inspect the face (Item 1) and pins (Item 2) **[Figure 20-50-74]** of the swash plate.

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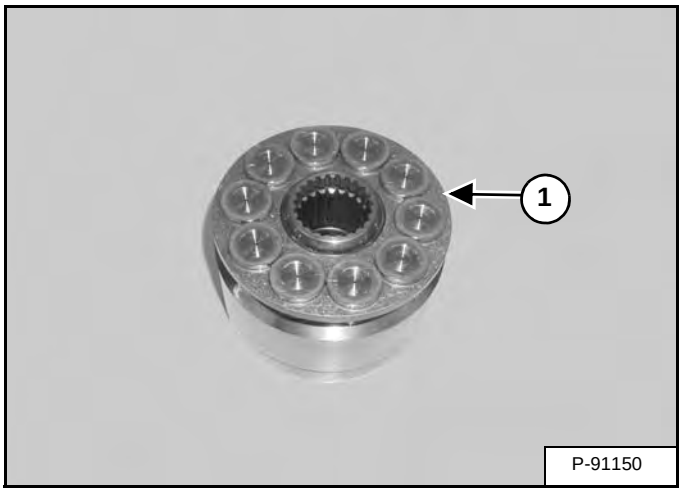
Piston Pump Disassembly And Assembly (Cont'd)

Figure 20-50-75



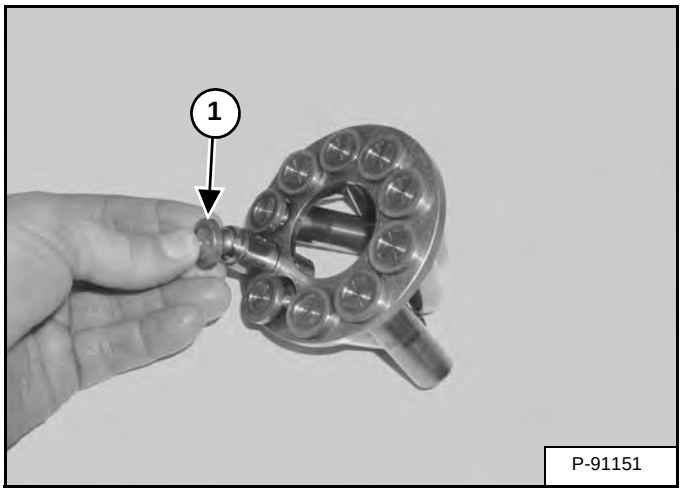
Remove the rotating group (Item 1) **[Figure 20-50-75]**.

Figure 20-50-76



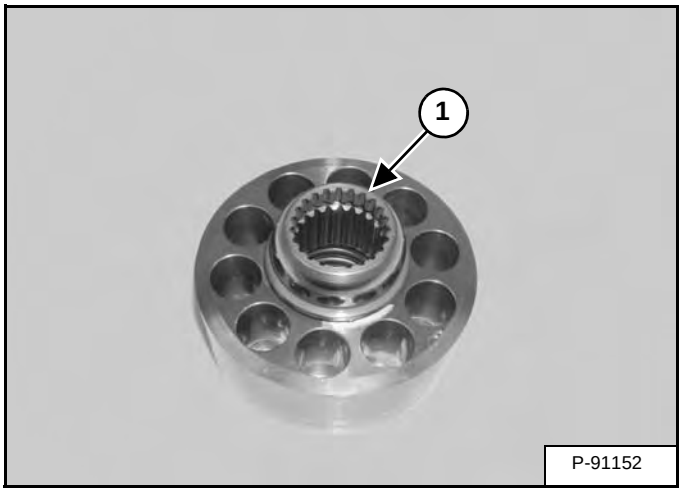
Remove the piston / retainer assembly (Item 1) **[Figure 20-50-76]**.

Figure 20-50-77



Remove the pistons (Item 1) **[Figure 20-50-77]** from the retainer.

Figure 20-50-78

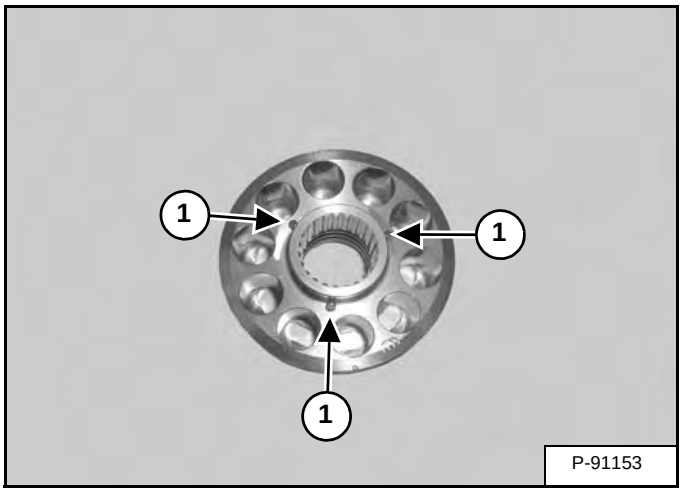


Remove the retainer guide (Item 1) **[Figure 20-50-78]**.

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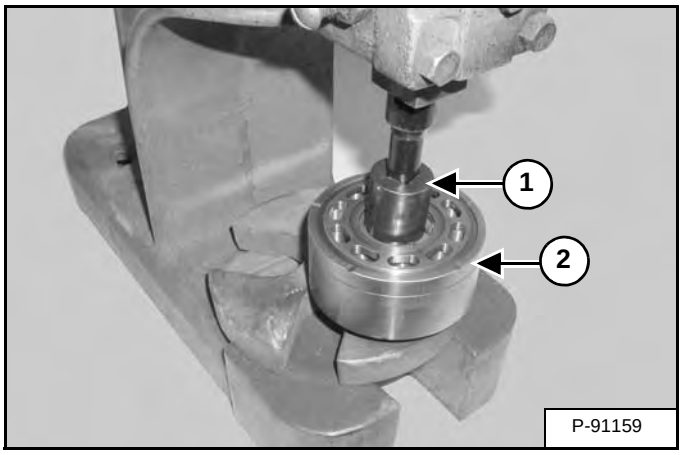
Piston Pump Disassembly And Assembly (Cont'd)

Figure 20-50-79



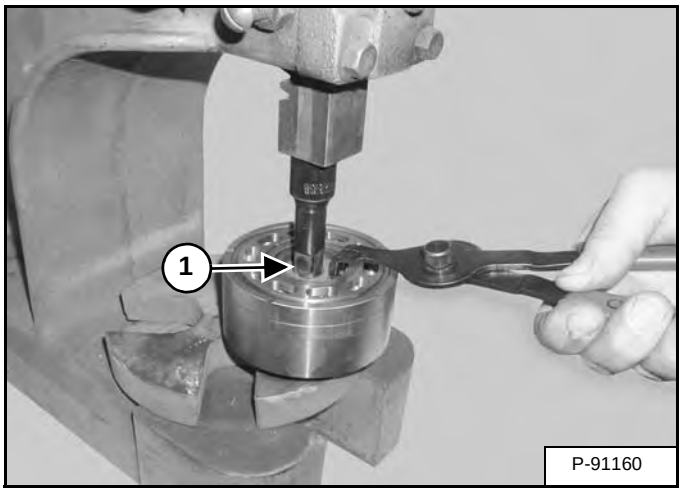
Remove the three pins (Item 1) **[Figure 20-50-79]**.

Figure 20-50-80



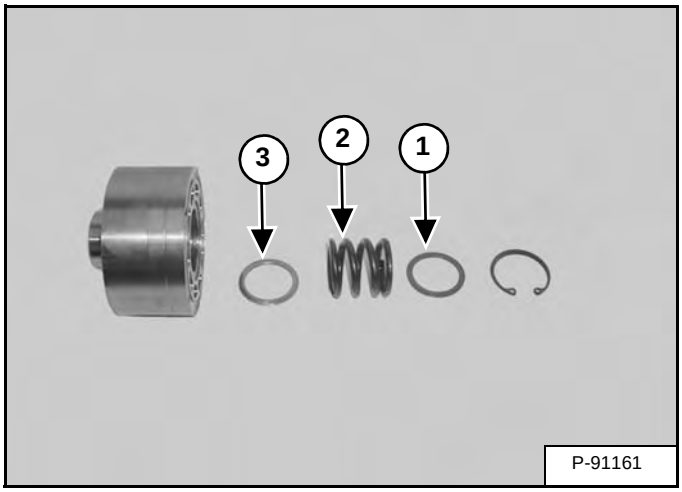
Using a press and an appropriate sized spacer (Item 1), compress the spring in the cylinder block (Item 2) **[Figure 20-50-80]**.

Figure 20-50-81



Remove the snap ring (Item 1) **[Figure 20-50-81]**. Remove the cylinder block from the press.

Figure 20-50-82

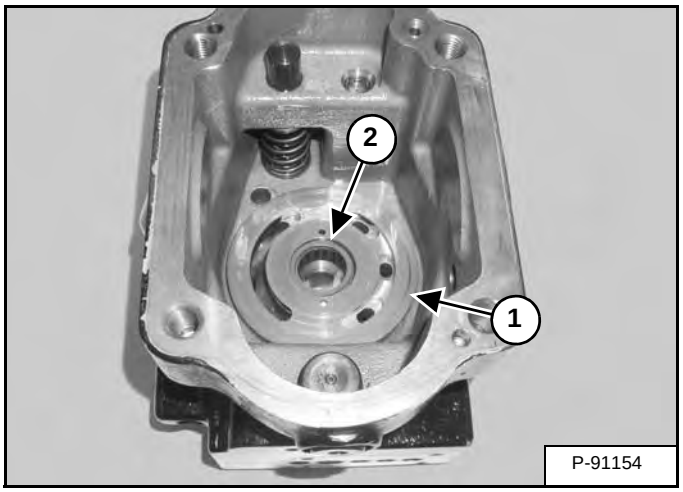


Remove the top washer (Item 1), spring (Item 2) and bottom washer (Item 3) **[Figure 20-50-82]**.

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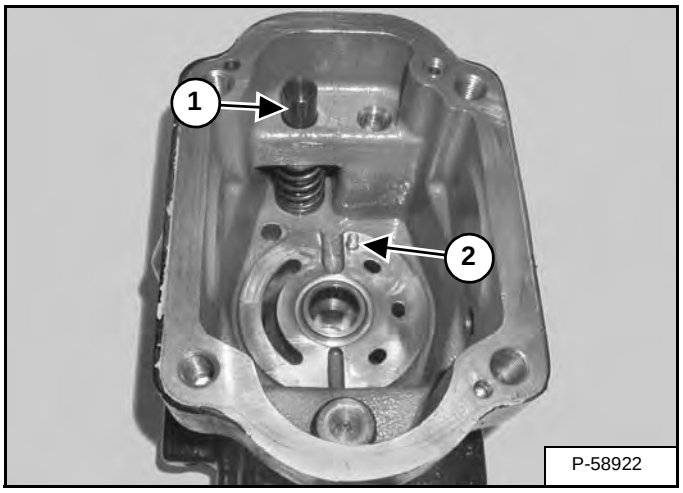
Piston Pump Disassembly And Assembly (Cont'd)

Figure 20-50-83



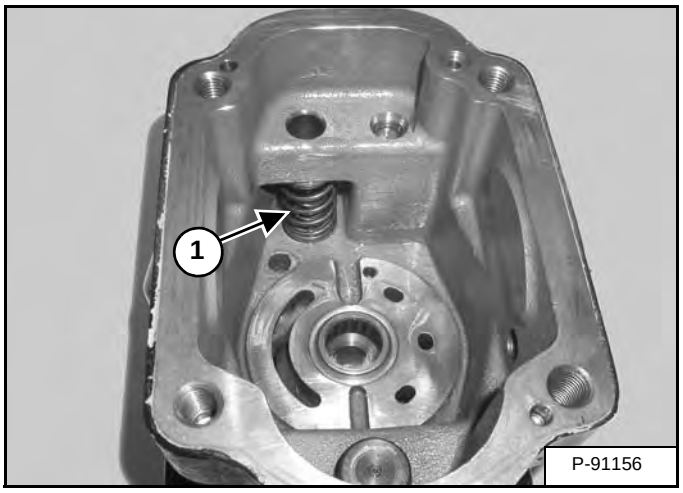
Remove the valve plate (Item 1) and thrust washer (Item 2) **[Figure 20-50-83]**.

Figure 20-50-84



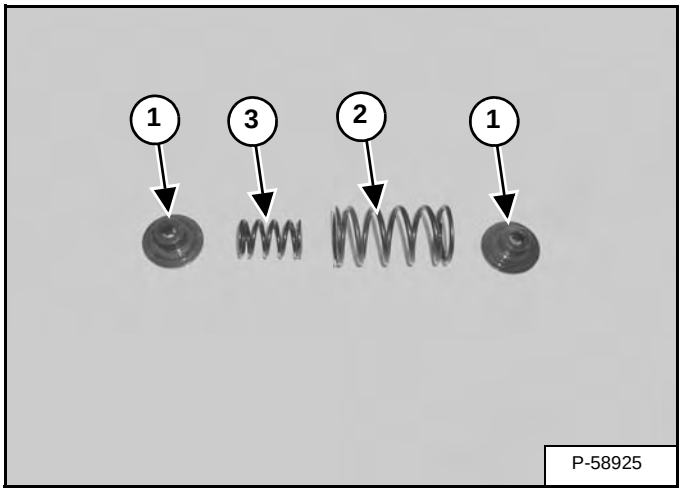
Remove the piston (Item 1) and valve plate dowel pin (Item 2) **[Figure 20-50-84]**.

Figure 20-50-85



Slightly compress and remove the spring assembly (Item 1) **[Figure 20-50-85]**.

Figure 20-50-86

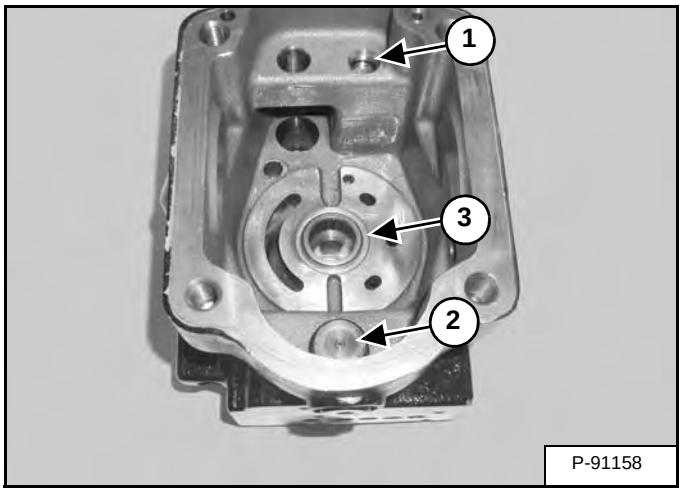


Remove the spring seats (Item 1), large spring (Item 2) and small spring (Item 3) **[Figure 20-50-86]**.

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Piston Pump Disassembly And Assembly (Cont'd)

Figure 20-50-87



Remove the piston (Item 1). Remove the destroking piston (Item 2). Remove the needle bearing (Item 3) **[Figure 20-50-87]**.

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MANIFOLD ASSEMBLY / ACCUMULATOR (WITHOUT ANGLE BLADE)

Description

The manifold body contains two boom offset solenoids, two speed solenoid, system bypass solenoid and two auxiliary hydraulic solenoids.

There is a 2999 kPa (30 bar) (435 psi) pilot relief valve.

The body is connected to the accumulator.

The manifold supplies target pressure of 2999 kPa (30 bar) (435 psi) with an acceptable range of 2799 - 3102 kPa (28 - 31 bar) (406 - 450 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

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

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-130-5.)

Remove the right upperstructure cover. (See Removal And Installation on Page 40-80-1.)

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

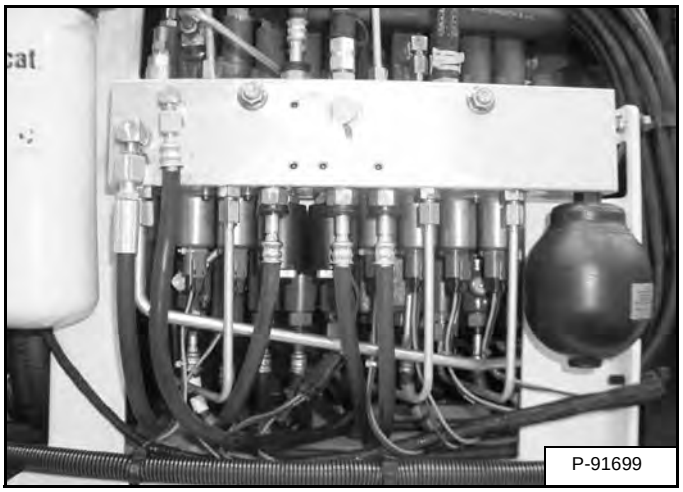
⚠ WARNING

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

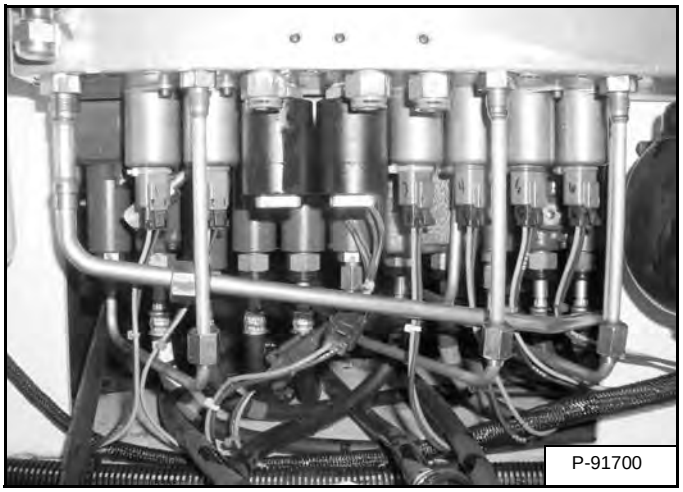
Mark the hoses and wire harness for correct installation.

Figure 20-60-1



Remove the hoses and tubelines from the bottom of the manifold **[Figure 20-60-1]**.

Figure 20-60-2

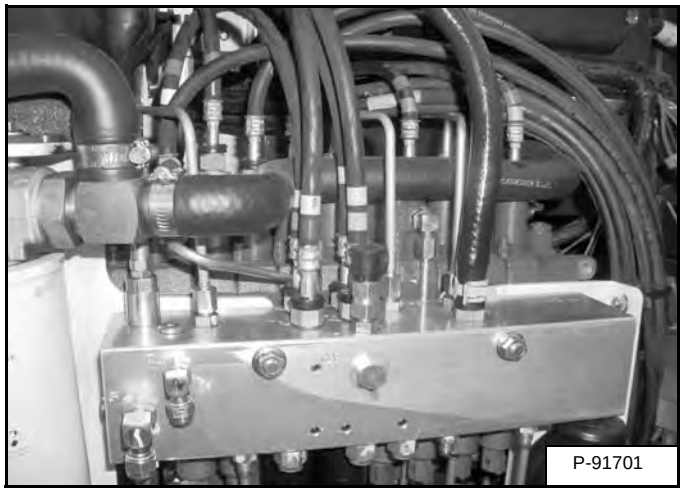


Disconnect the wire harness from the coils **[Figure 20-60-2]**.

Dealer Copy -- Not for Resale

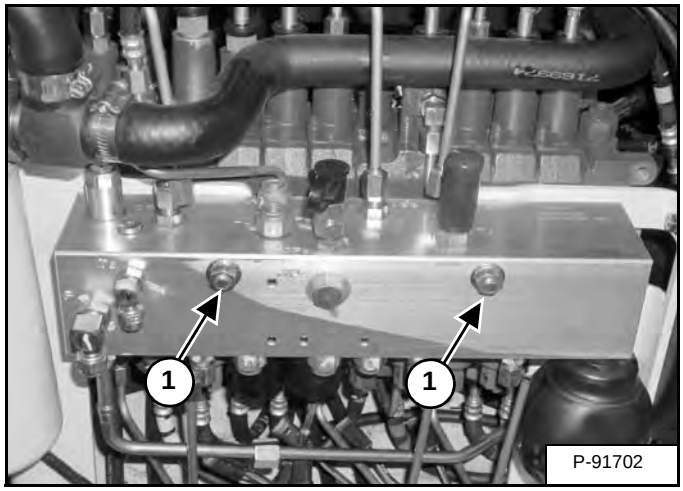
Removal And Installation (Cont'd)

Figure 20-60-3



Remove the hoses and tubelines from the top of the manifold **[Figure 20-60-3]**.

Figure 20-60-4

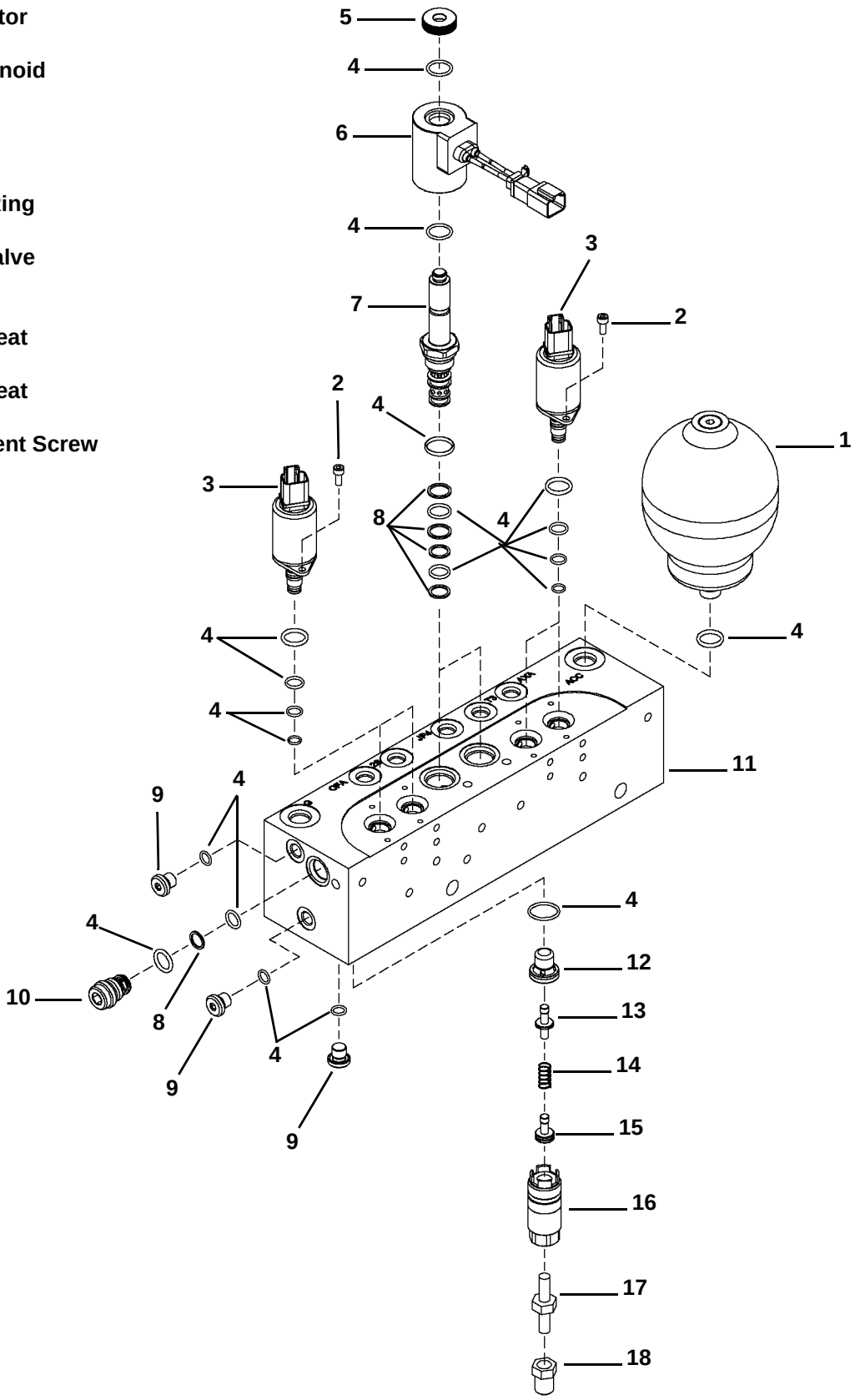


Remove the nuts (Item 1) **[Figure 20-60-4]** and remove the manifold.

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Parts Identification

1. Accumulator
2. Screw
3. Coil / Solenoid
4. O-ring
5. Nut
6. Coil
7. Solenoid
8. Back-up Ring
9. Plug
10. Check Valve
11. Manifold
12. Seat
13. Spring Seat
14. Spring
15. Spring Seat
16. Body
17. Adjustment Screw
18. Cap



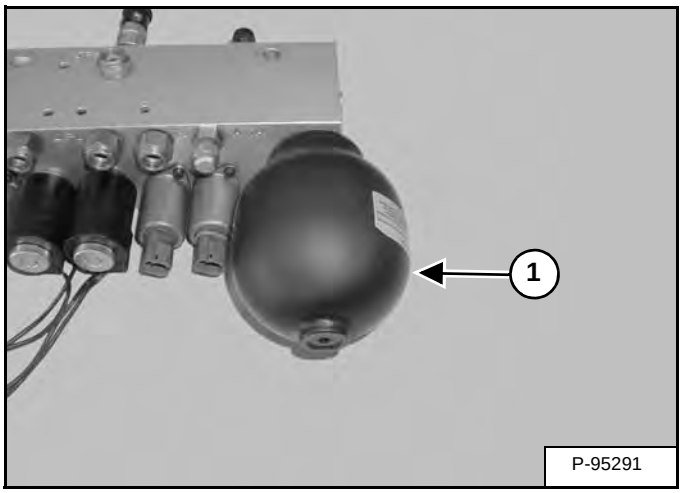
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Disassembly And Assembly

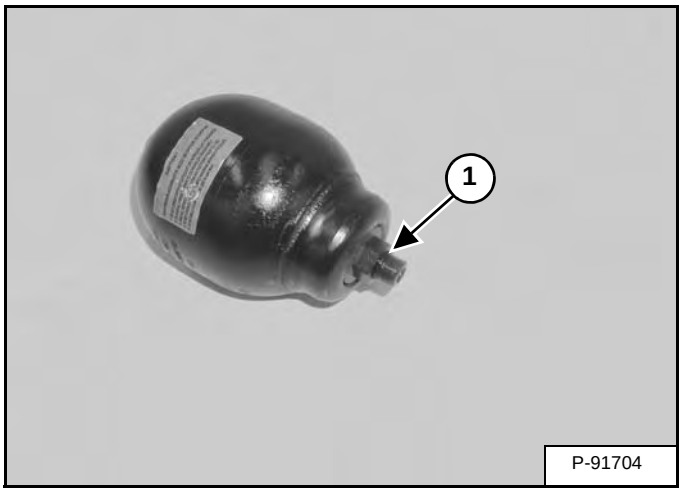
Clean the outside of the manifold assembly / accumulator before disassembly.

Figure 20-60-5



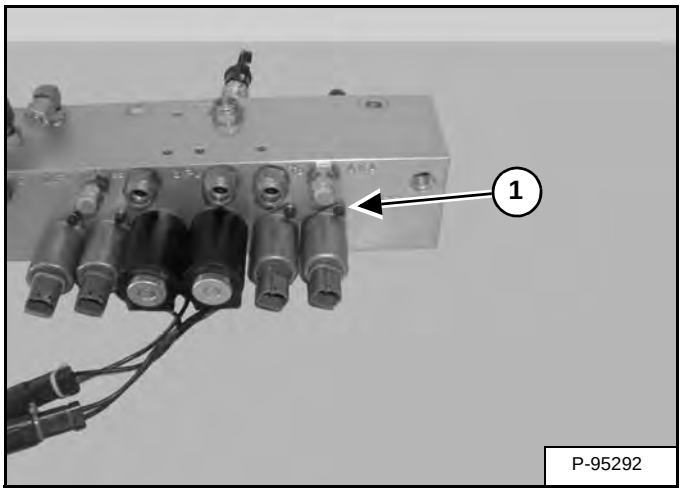
Remove the accumulator (Item 1) **[Figure 20-60-5]** from the manifold.

Figure 20-60-6



Remove the O-ring (Item 1) **[Figure 20-60-6]**.

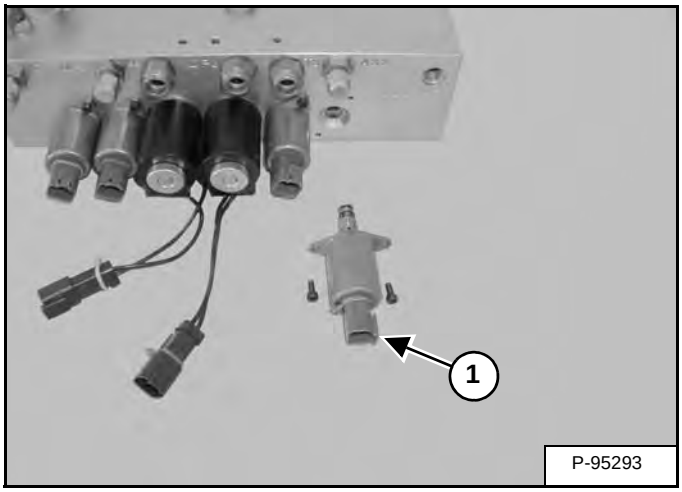
Figure 20-60-7



Remove the screws (Item 1) **[Figure 20-60-7]**.

Installation: Tighten the screws to 3 N•m (27 in-lb) torque.

Figure 20-60-8

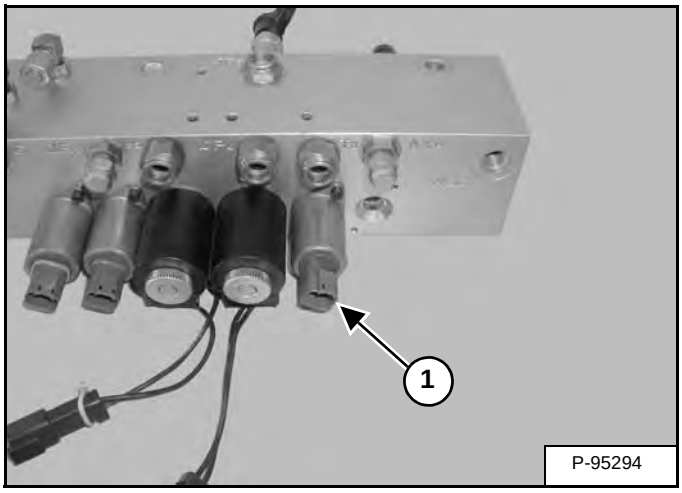


Remove the solenoid (Item 1) **[Figure 20-60-8]**.

Dealer Copy -- Not for Resale

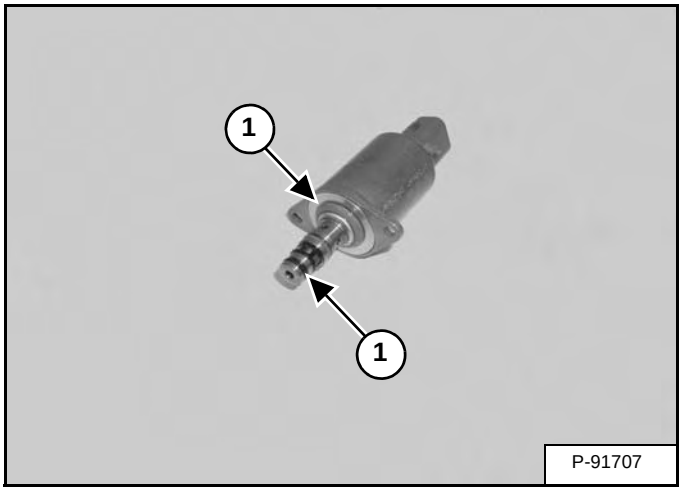
Disassembly And Assembly (Cont'd)

Figure 20-60-9



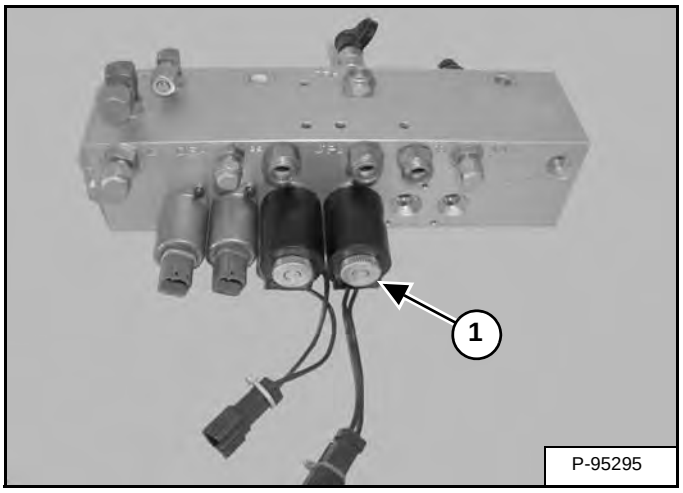
Repeat the procedure for the next solenoid (Item 1) **[Figure 20-60-9]**.

Figure 20-60-10



Remove the O-rings (Item 1) **[Figure 20-60-10]** from the solenoids.

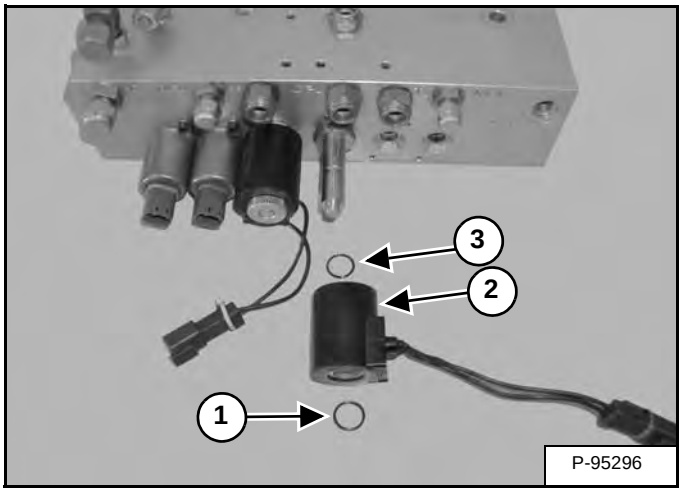
Figure 20-60-11



Remove the nut (Item 1) **[Figure 20-60-11]**.

Installation: Tighten the nut to 4,1 - 6,1 N•m (36 - 54 in-lb) torque.

Figure 20-60-12

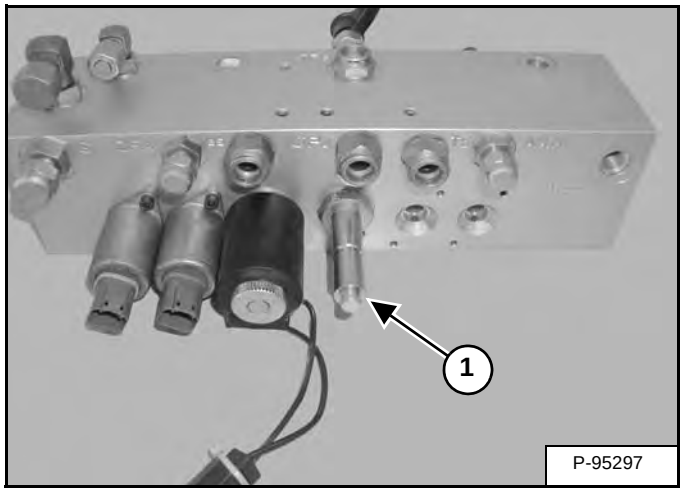


Remove the O-ring (Item 1), coil (Item 2) and O-ring (item 3) **[Figure 20-60-12]**.

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Disassembly And Assembly (Cont'd)

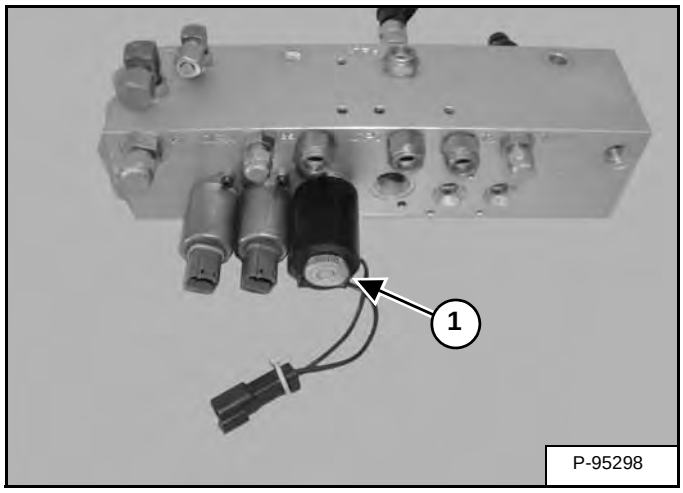
Figure 20-60-13



Remove the spool (Item 1) **[Figure 20-60-13]**.

Installation: Tighten the spool to 30 N•m (22 ft-lb) torque.

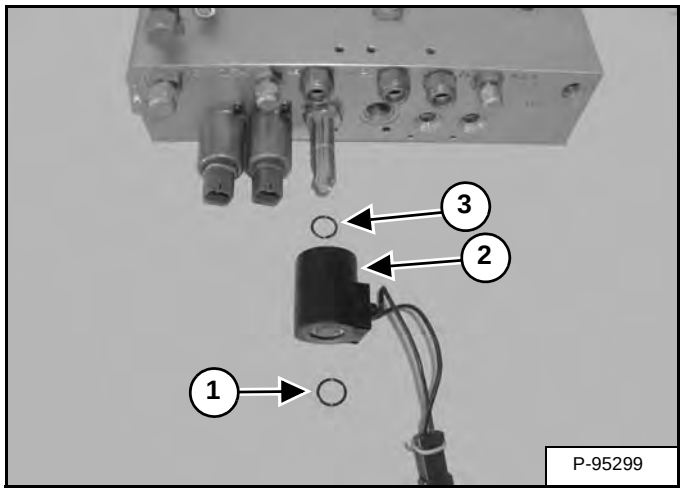
Figure 20-60-14



Remove the nut (Item 1) **[Figure 20-60-14]**.

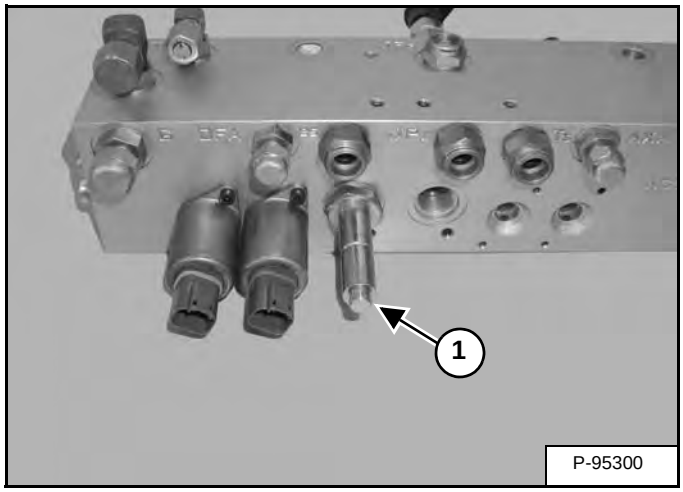
Installation: Tighten the nut to 4,1 - 6,1 N•m (36 - 54 in-lb) torque.

Figure 20-60-15



Remove the O-ring (Item 1), coil (Item 2) and O-ring (Item 3) **[Figure 20-60-15]**.

Figure 20-60-16



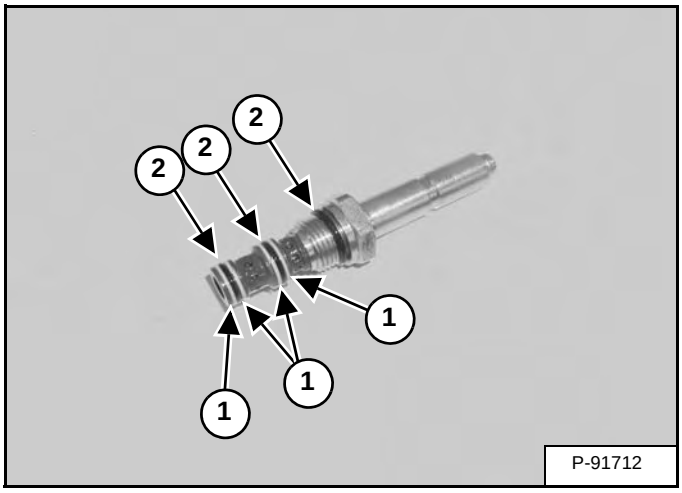
Remove the spool (Item 1) **[Figure 20-60-16]**.

Installation: Tighten the spool to 30 N•m (22 ft-lb) torque.

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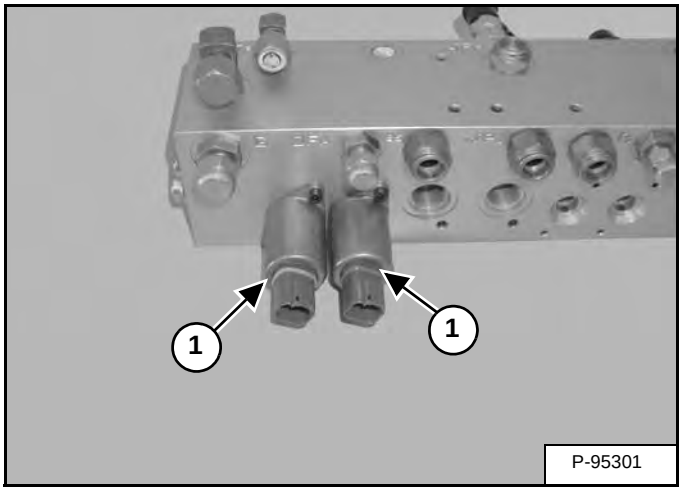
Disassembly And Assembly (Cont'd)

Figure 20-60-17



Remove the back-up rings (Item 1) and O-rings (Item 2) **[Figure 20-60-17]** from both spools.

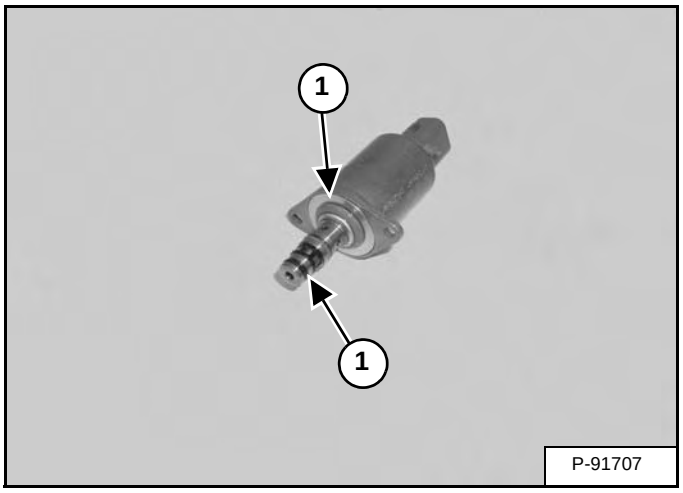
Figure 20-60-18



Remove the screws and solenoids (Item 1) **[Figure 20-60-18]**.

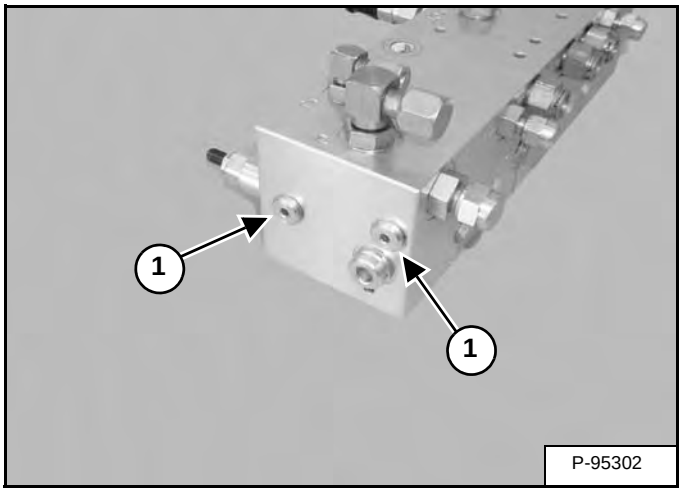
Installation: Tighten the screws to 3 N•m (27 in-lb) torque.

Figure 20-60-19



Remove the O-rings (Item 1) **[Figure 20-60-19]**.

Figure 20-60-20

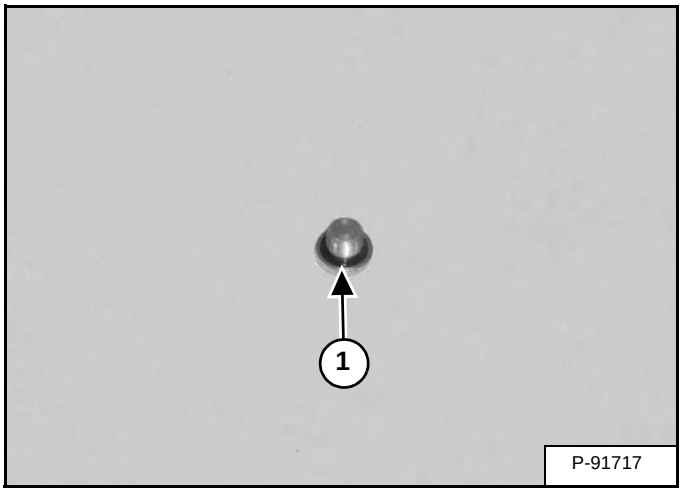


Remove the plugs (Item 1) **[Figure 20-60-20]**.

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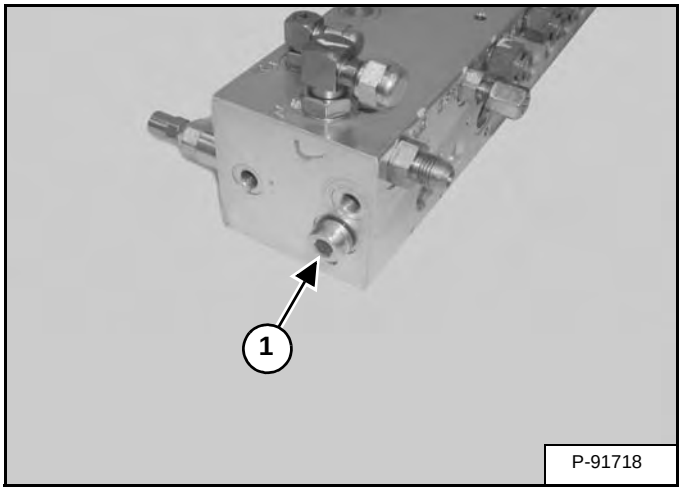
Disassembly And Assembly (Cont'd)

Figure 20-60-21



Remove the O-ring (Item 1) **[Figure 20-60-21]** from both plugs.

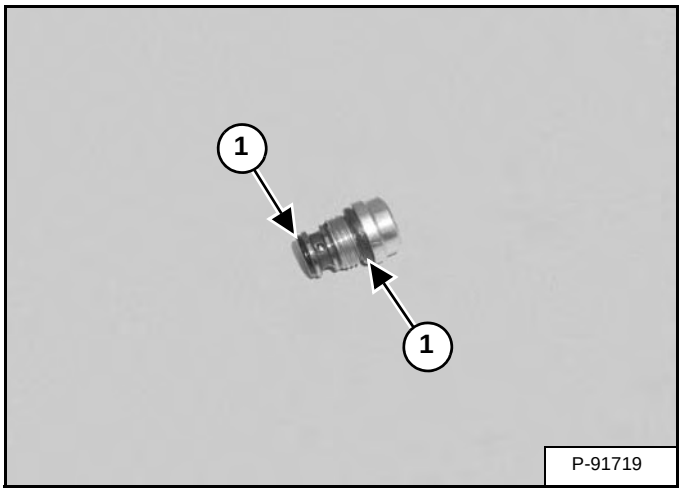
Figure 20-60-22



Remove the check valve assembly (Item 1) **[Figure 20-60-22]**.

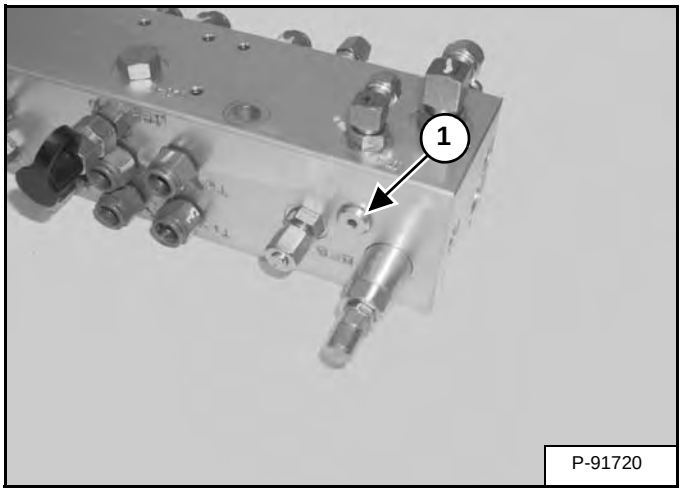
Installation: Tighten the plug to 40 N•m (29 ft-lb) torque.

Figure 20-60-23



Remove the O-rings (Item 1) **[Figure 20-60-23]**.

Figure 20-60-24

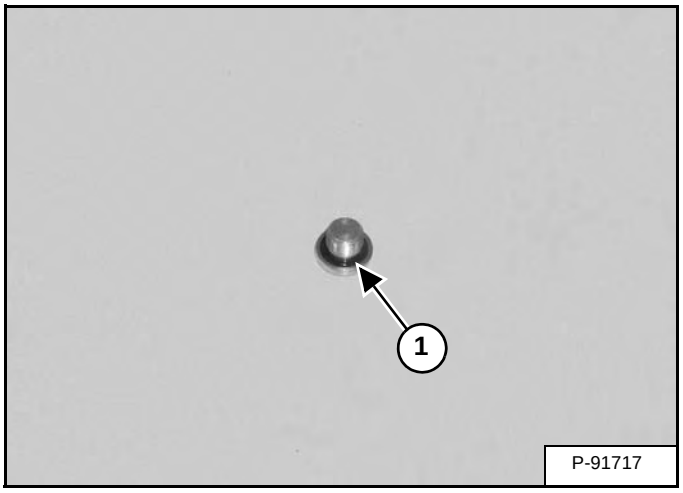


Remove the plug (Item 1) **[Figure 20-60-24]**.

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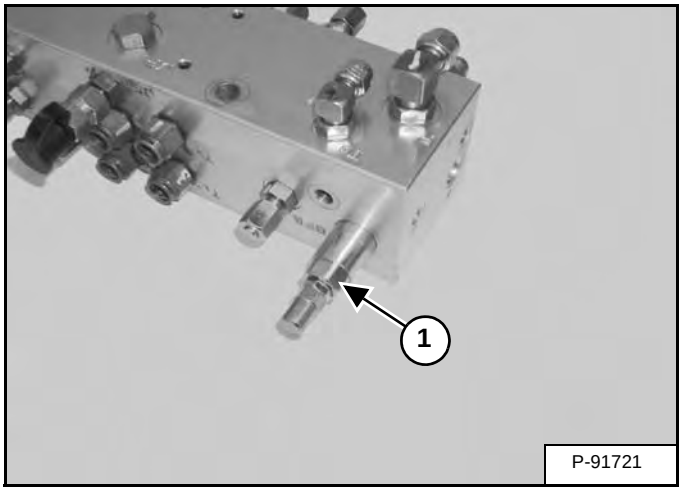
Disassembly And Assembly (Cont'd)

Figure 20-60-25



Remove the O-ring (Item 1) **[Figure 20-60-25]** from the plug.

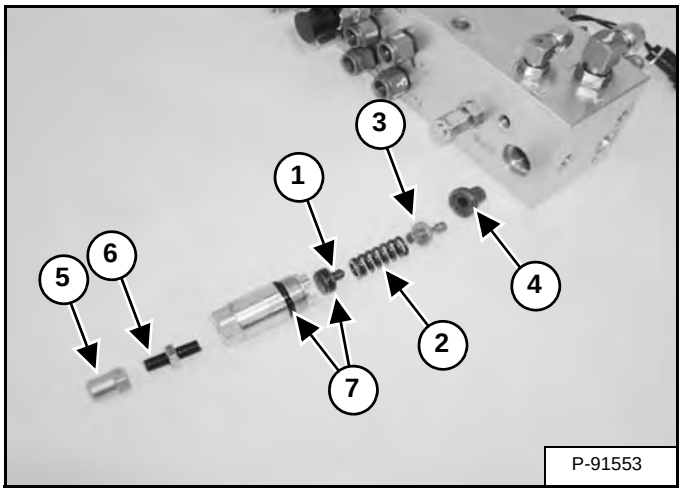
Figure 20-60-26



Remove the pilot relief valve (Item 1) **[Figure 20-60-26]**.

Installation: Tighten the pilot relief valve to 30 N•m (22 ft-lb) torque.

Figure 20-60-27



Remove the spring seat (Item 1), spring (Item 2), spring seat (Item 3) and seat (Item 4). Remove the cap (Item 5) and remove the adjustment screw (Item 6). Remove the O-rings (Item 7) **[Figure 20-60-27]**.

Clean all parts in solvent and dry with compressed air.

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

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

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MANIFOLD ASSEMBLY / ACCUMULATOR (WITH ANGLE BLADE)

Description

The manifold body contains two boom offset solenoids, two speed solenoid, system bypass solenoid, two angle blade solenoids (if equipped with angle blade) and two auxiliary hydraulic solenoids.

There is a 2999 kPa (30 bar) (435 psi) pilot relief valve.

The body is connected to the accumulator.

The manifold supplies target pressure of 2999 kPa (30 bar) (435 psi) with an acceptable range of 2799 - 3103 kPa (28 - 31 bar) (406 - 450 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

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

Drain the hydraulic reservoir. (See Checking And Adding Hydraulic Fluid on Page 10-130-1.)

Remove the right upperstructure cover. (See Removal And Installation on Page 40-80-1.)

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

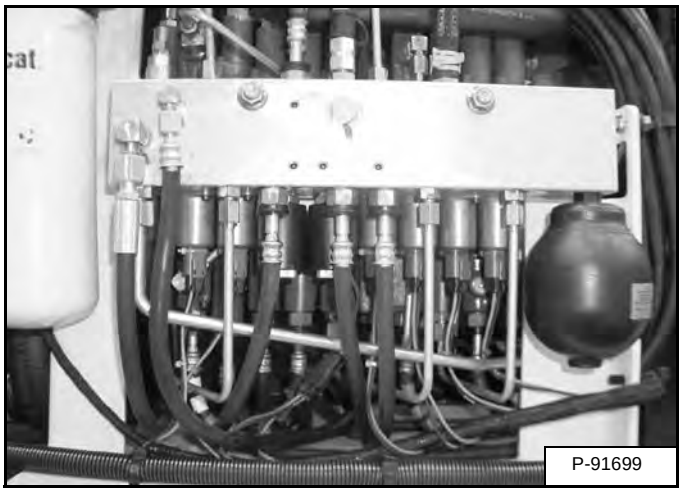
⚠ WARNING

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

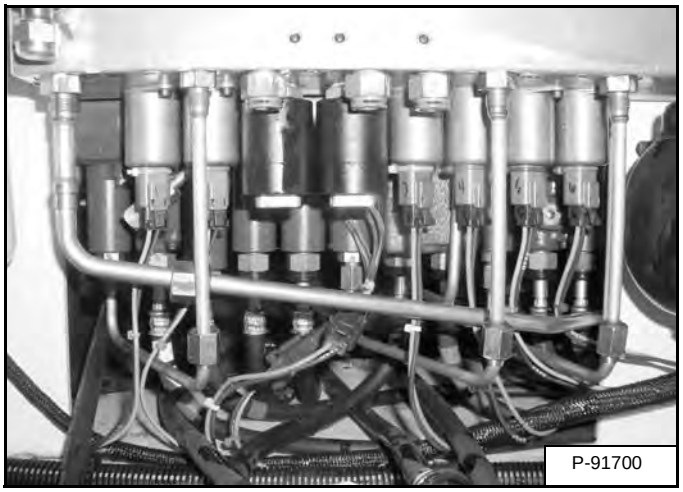
Mark the hoses and wire harness for correct installation.

Figure 20-61-1



Remove the hoses and tubelines from the bottom of the manifold **[Figure 20-61-1]**.

Figure 20-61-2

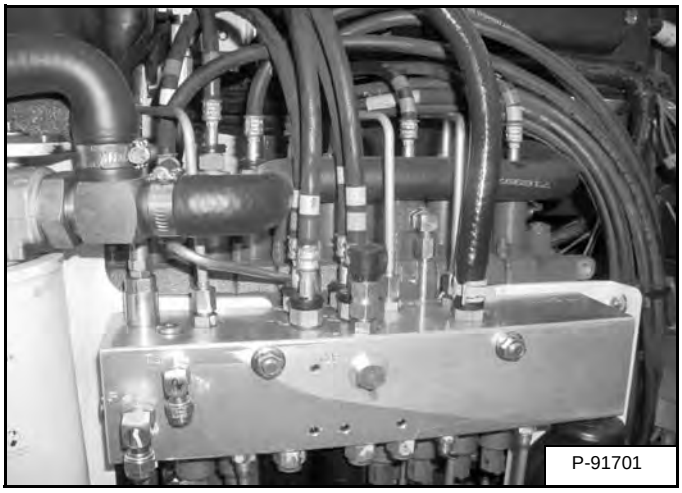


Disconnect the wire harness from the coils **[Figure 20-61-2]**.

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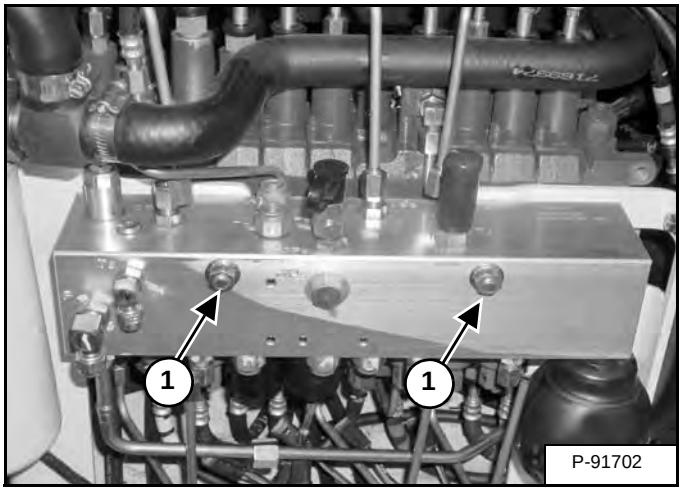
Removal And Installation (Cont'd)

Figure 20-61-3



Remove the hoses and tubelines from the top of the manifold **[Figure 20-61-3]**.

Figure 20-61-4

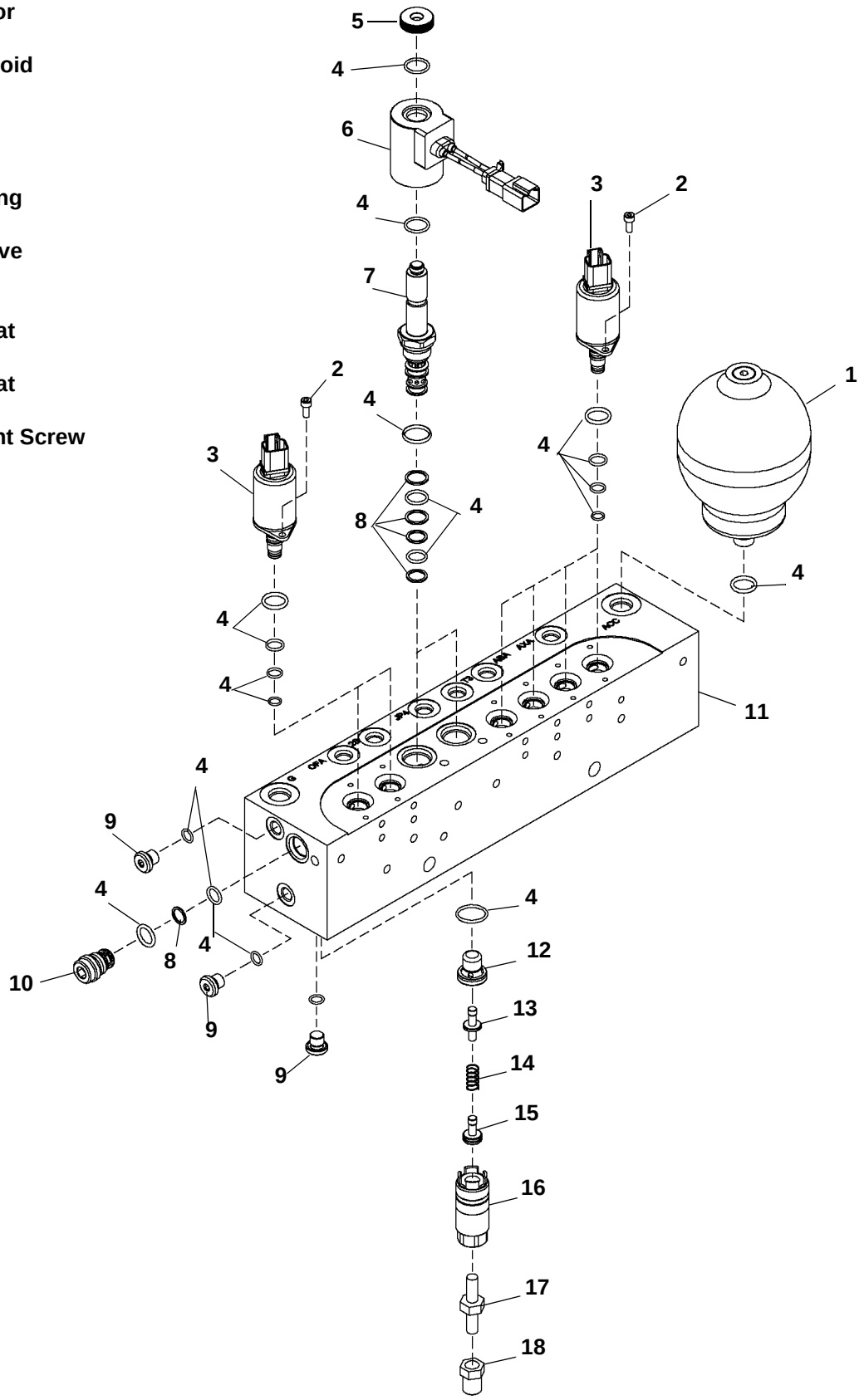


Remove the nuts (Item 1) **[Figure 20-61-4]** and remove the manifold.

Dealer Copy -- Not for Resale

Parts Identification

1. Accumulator
2. Screw
3. Coil / Solenoid
4. O-ring
5. Nut
6. Coil
7. Solenoid
8. Back-up Ring
9. Plug
10. Check Valve
11. Manifold
12. Seat
13. Spring Seat
14. Spring
15. Spring Seat
16. Body
17. Adjustment Screw
18. Cap



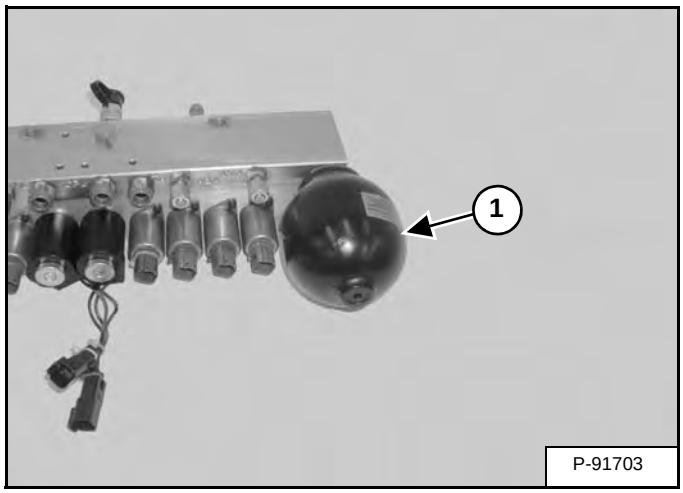
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Dealer Copy -- Not for Resale

Disassembly And Assembly

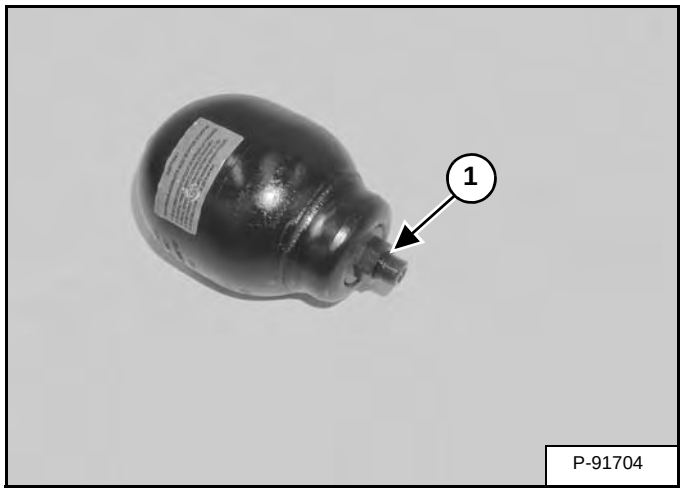
Clean the outside of the manifold assembly / accumulator before disassembly.

Figure 20-61-5



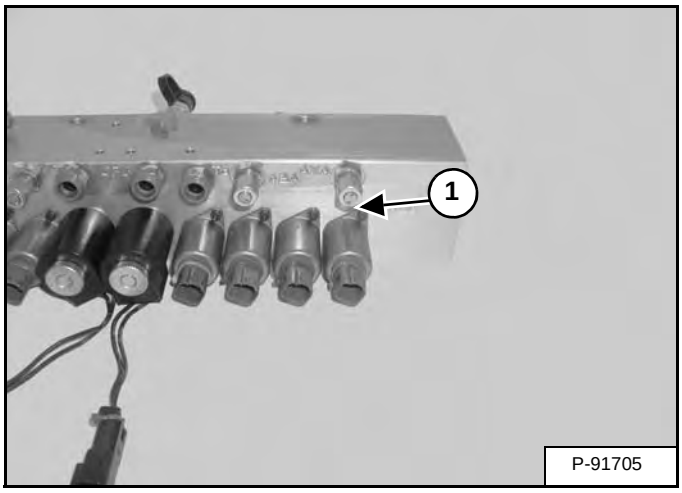
Remove the accumulator (Item 1) **[Figure 20-61-5]** from the valve body.

Figure 20-61-6



Remove the O-ring (Item 1) **[Figure 20-61-6]**.

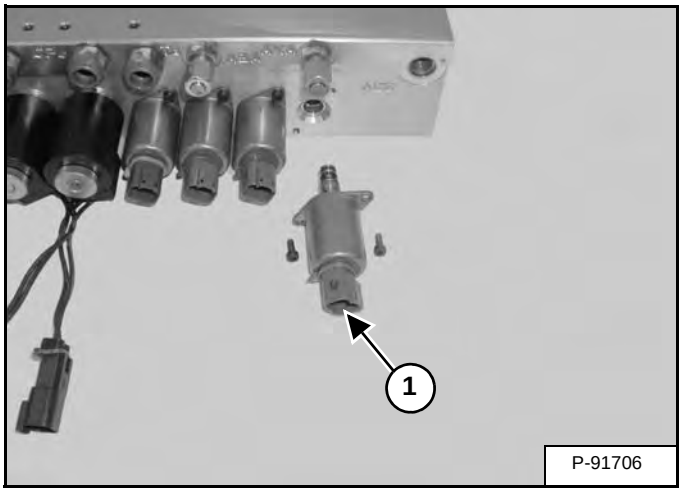
Figure 20-61-7



Remove the screws (Item 1) **[Figure 20-61-7]**.

Installation: Tighten the screws to 3 N•m (27 in-lb) torque.

Figure 20-61-8

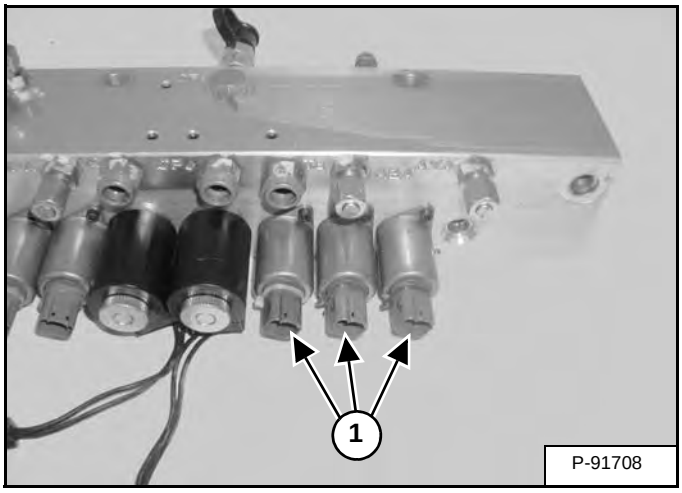


Remove the solenoid (Item 1) **[Figure 20-61-8]**.

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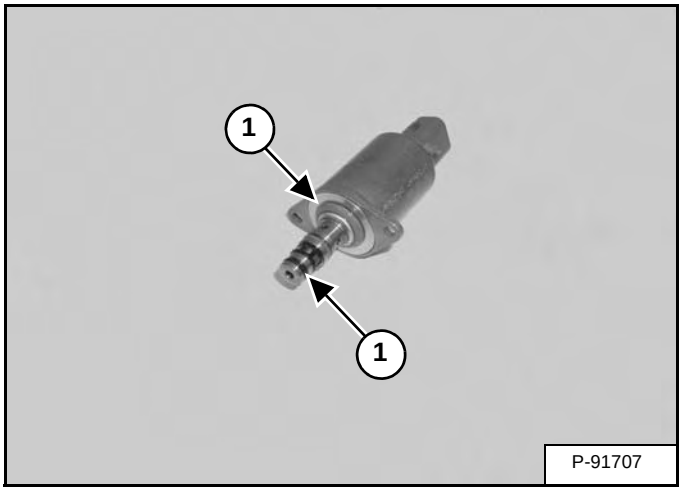
Disassembly And Assembly (Cont'd)

Figure 20-61-9



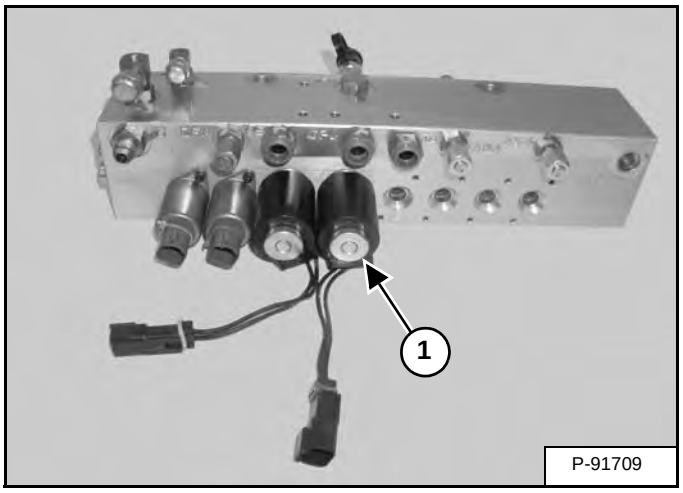
Repeat the procedure for the three solenoid (Item 1) **[Figure 20-61-9]**.

Figure 20-61-10



Remove the O-rings (Item 1) **[Figure 20-61-10]** from the solenoids.

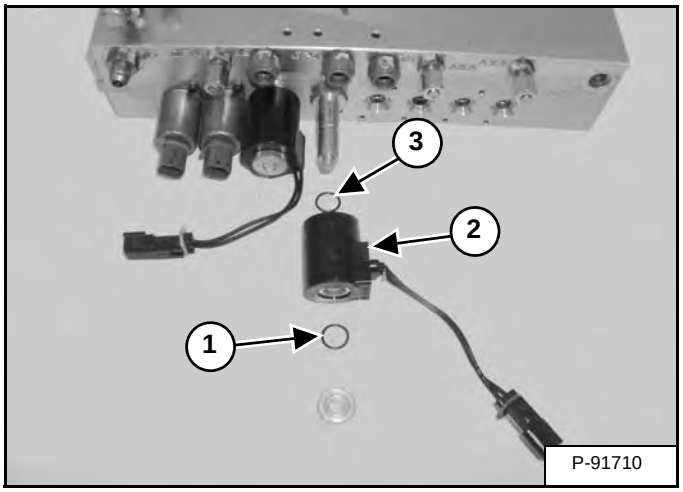
Figure 20-61-11



Remove the nut (Item 1) **[Figure 20-61-11]**.

Installation: Tighten the nut to 4,1 - 6,1 N•m (36 - 54 in-lb) torque.

Figure 20-61-12

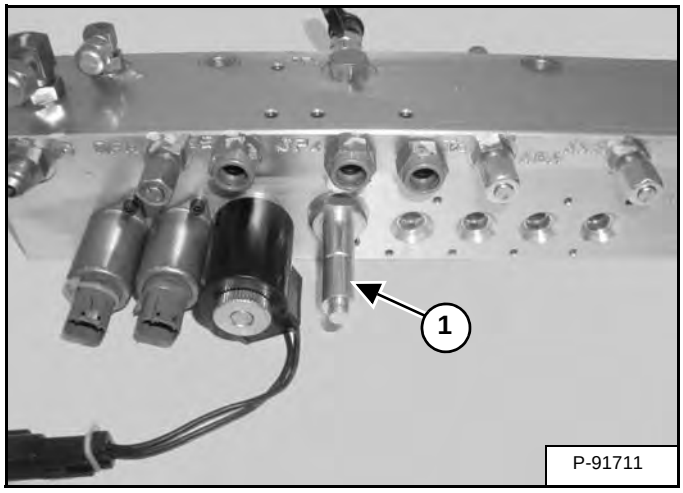


Remove the O-ring (Item 1), coil (Item 2) and O-ring (Item 3) **[Figure 20-61-12]**.

Dealer Copy -- Not for Resale

Disassembly And Assembly (Cont'd)

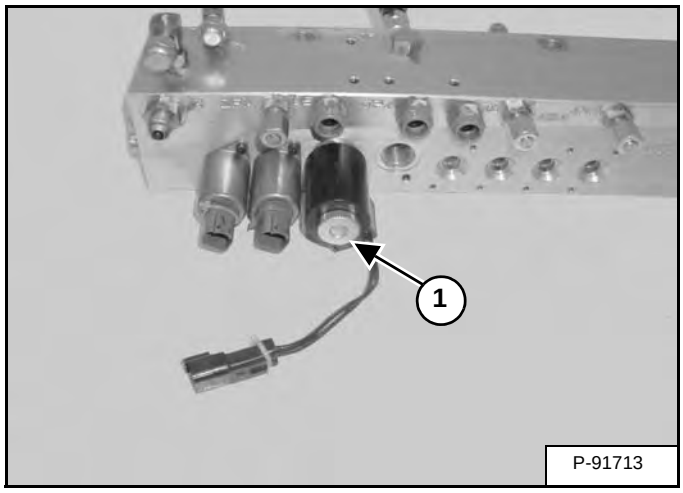
Figure 20-61-13



Remove the spool (Item 1) **[Figure 20-61-13]**.

Installation: Tighten the spool to 30 N•m (22 ft-lb) torque.

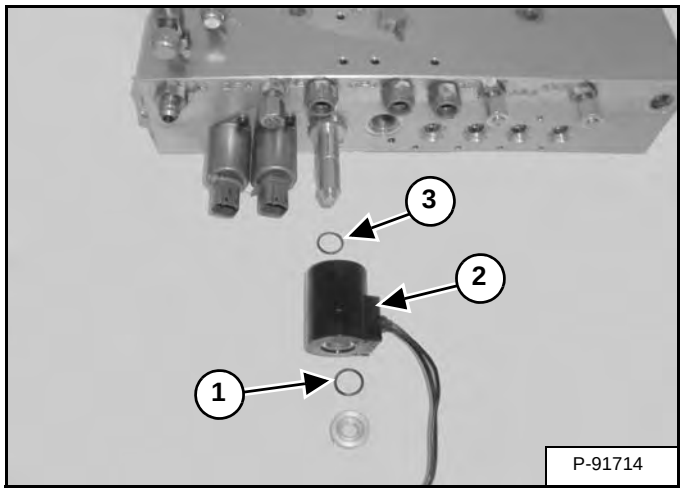
Figure 20-61-14



Remove the nut (Item 1) **[Figure 20-61-14]**.

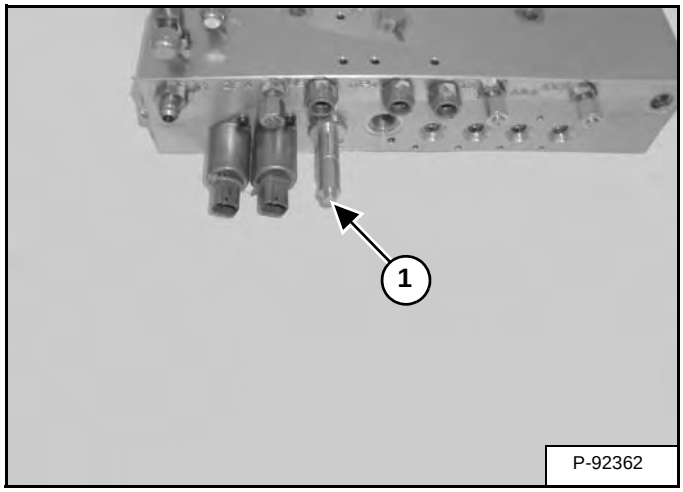
Installation: Tighten the nut to 4,1 - 6,1 N•m (36 - 54 in-lb) torque.

Figure 20-61-15



Remove the O-ring (Item 1), coil (Item 2) and O-ring (Item 3) **[Figure 20-61-15]**.

Figure 20-61-16



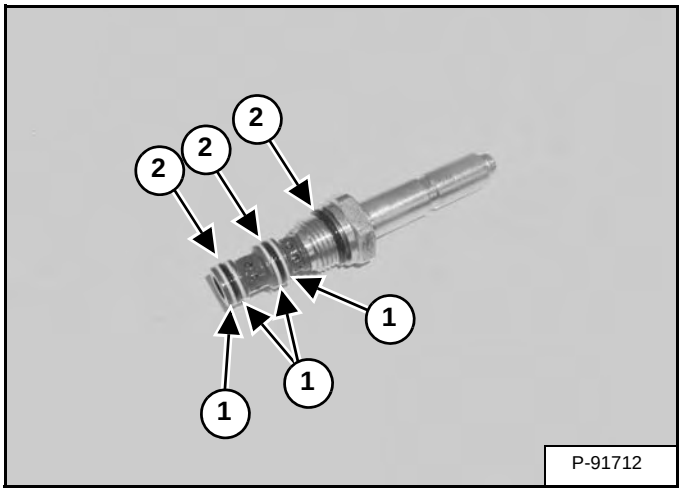
Remove the spool (Item 1) **[Figure 20-61-16]**.

Installation: Tighten the spool to 30 N•m (22 ft-lb) torque.

Dealer Copy -- Not for Resale

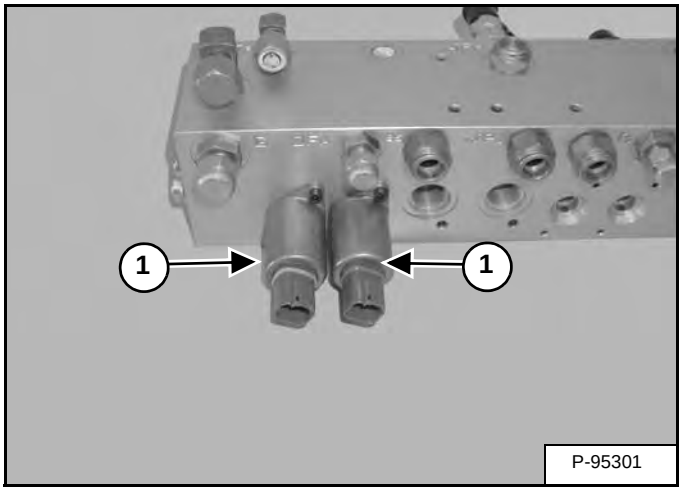
Disassembly And Assembly (Cont'd)

Figure 20-61-17



Remove the back-up rings (Item 1) and O-rings (Item 2) **[Figure 20-61-17]** from both spools.

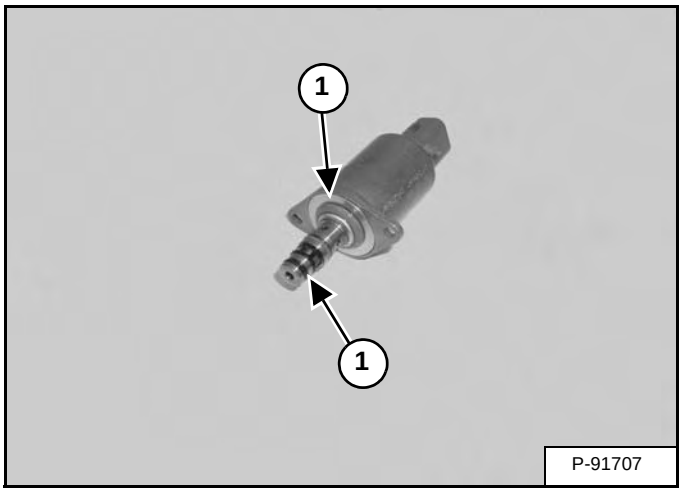
Figure 20-61-18



Remove the screws and solenoids (Item 1) **[Figure 20-61-18]**.

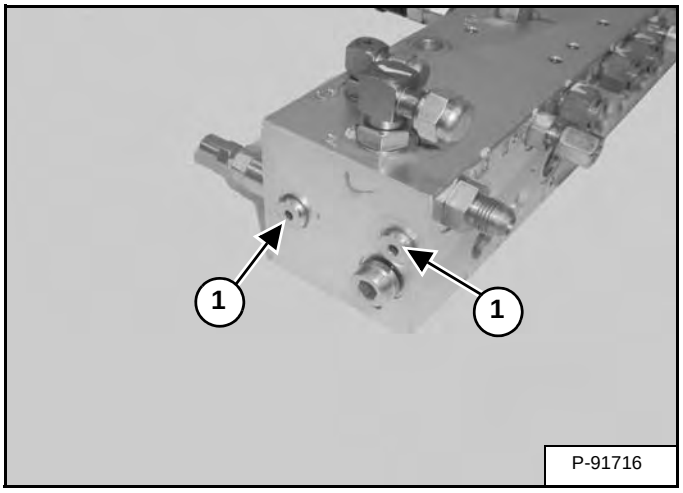
Installation: Tighten the screws to 3 N•m (27 in-lb) torque.

Figure 20-61-19



Remove the O-rings (Item 1) **[Figure 20-61-19]**.

Figure 20-61-20

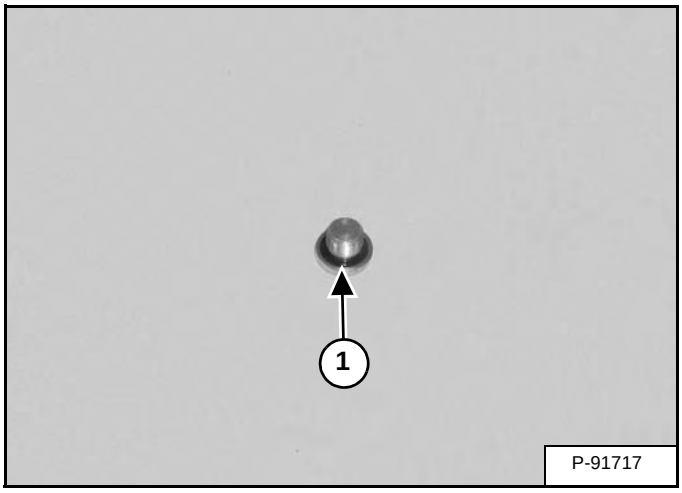


Remove the plugs (Item 1) **[Figure 20-61-20]**.

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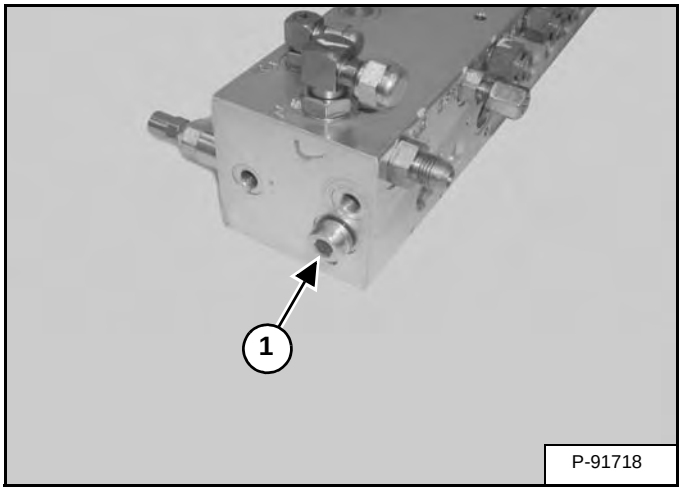
Disassembly And Assembly (Cont'd)

Figure 20-61-21



Remove the O-ring (Item 1) **[Figure 20-61-21]** from both plugs.

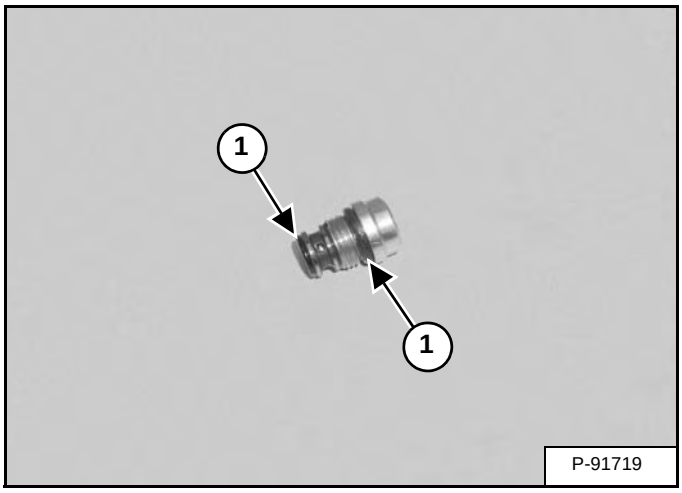
Figure 20-61-22



Remove the check valve assembly (Item 1) **[Figure 20-61-22]**.

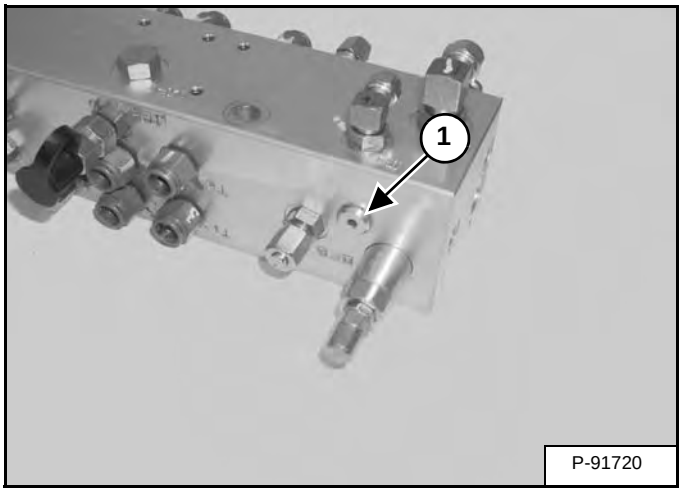
Installation: Tighten the plug to 40 N•m (29 ft-lb) torque.

Figure 20-61-23



Remove the O-rings (Item 1) **[Figure 20-61-23]**.

Figure 20-61-24

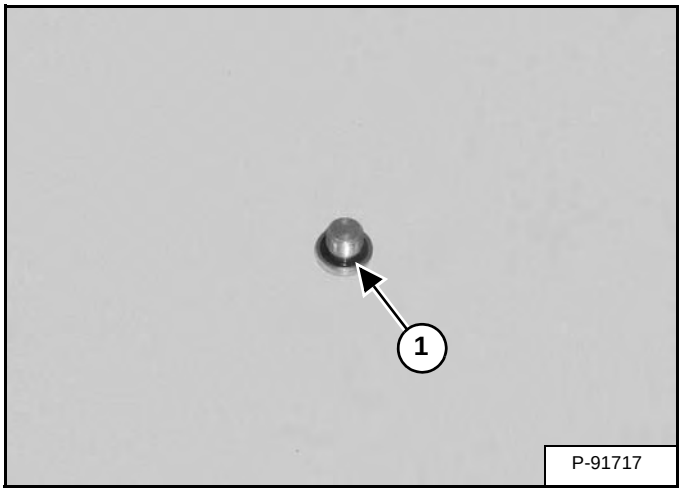


Remove the plug (Item 1) **[Figure 20-61-24]**.

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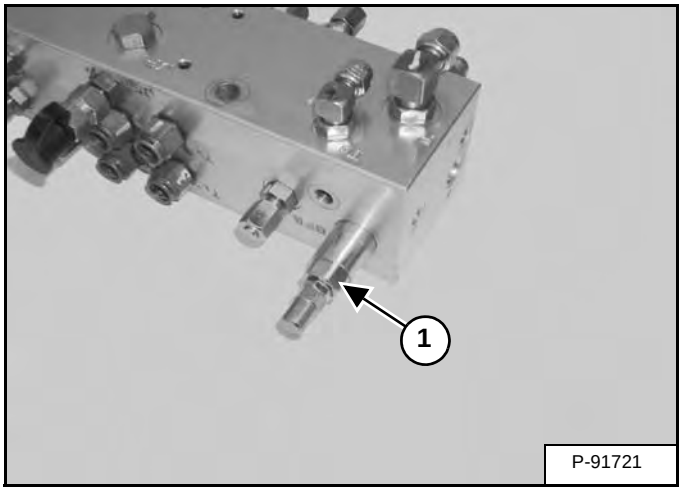
Disassembly And Assembly (Cont'd)

Figure 20-61-25



Remove the O-ring (Item 1) **[Figure 20-61-25]** from the plug.

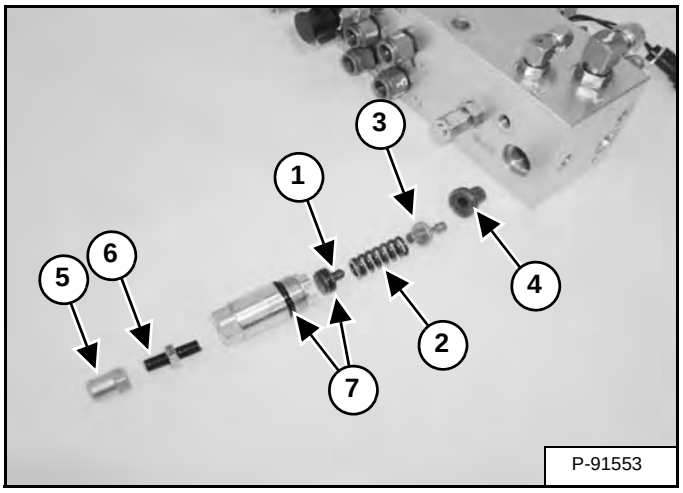
Figure 20-61-26



Remove the pilot relief valve (Item 1) **[Figure 20-61-26]**.

Installation: Tighten the pilot relief valve to 30 N•m (22 ft-lb) torque.

Figure 20-61-27



Remove the spring seat (Item 1), spring (Item 2), spring seat (Item 3) and seat (Item 4). Remove the cap (Item 5) and remove the adjustment screw (Item 6). Remove the O-rings (Item 7) **[Figure 20-61-27]**.

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.

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Dealer Copy -- Not for Resale

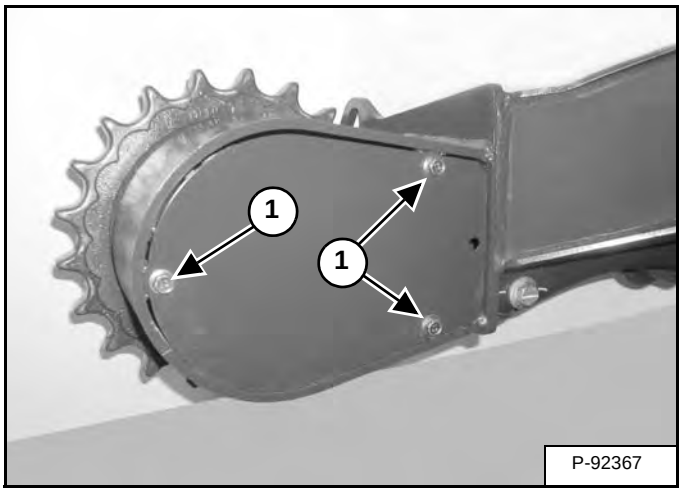
TRAVEL MOTOR

Removal And Installation

Lift and block the side of the track frame where the travel motor will be removed.

Release the track tension and remove the track. (See Track Removal And Installation on Page 30-20-4.)

Figure 20-70-1



Remove the bolts (Item 1) **[Figure 20-70-1]** from the track frame cover.

Remove the cover.

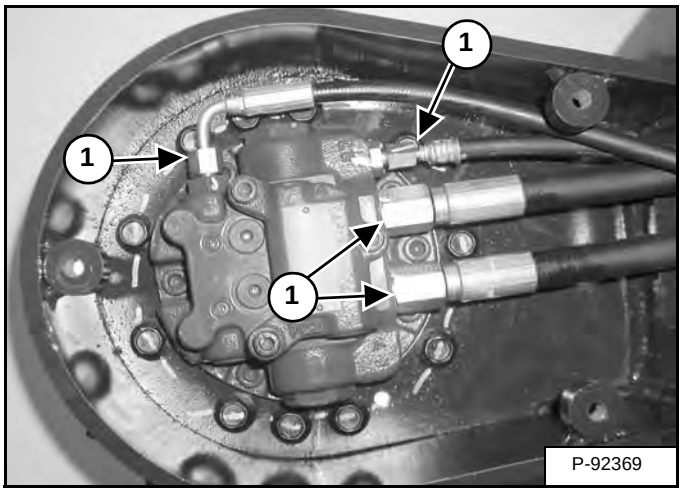
IMPORTANT

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

I-2003-0888

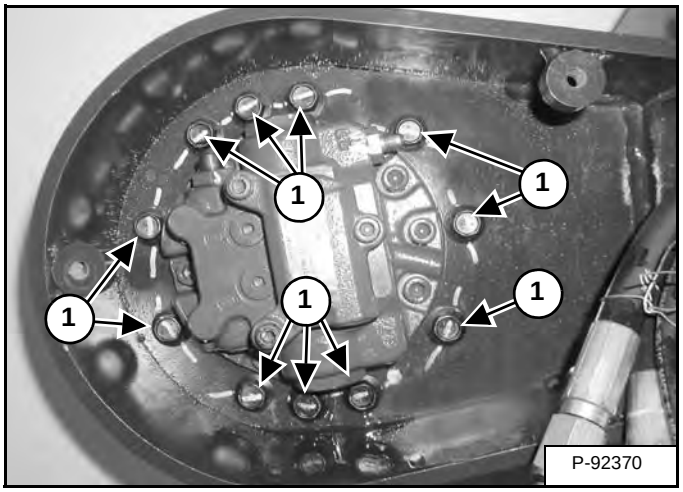
Mark the hoses for correct installation.

Figure 20-70-2



Remove the hoses (Item 1) **[Figure 20-70-2]** from the travel motor.

Figure 20-70-3



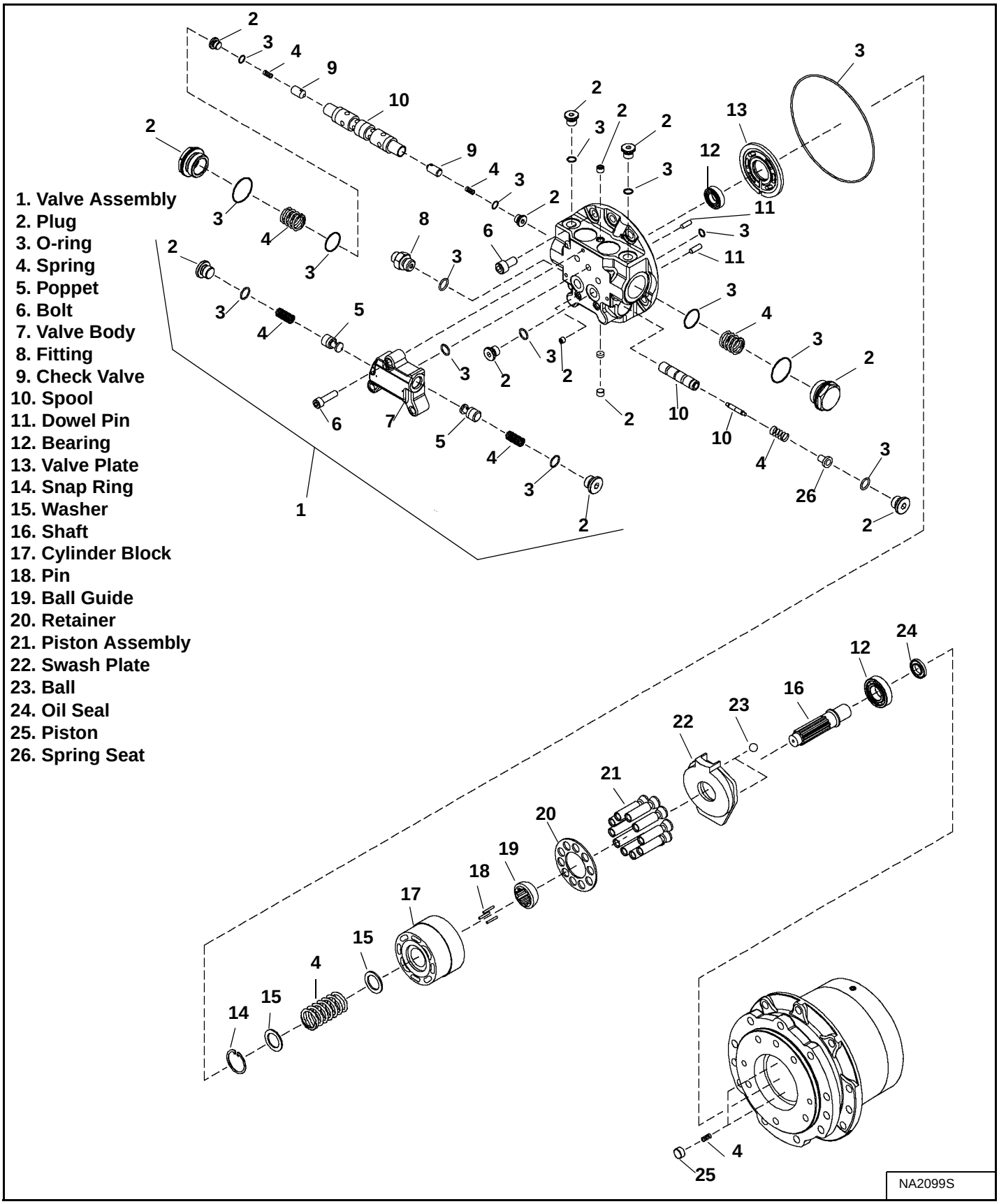
Remove the bolts (Item 1) **[Figure 20-70-3]** from the travel motor.

Installation: Apply thread lock (Loctite® 242) to the bolts and tighten to 105 - 115 N•m (78 - 85 ft-lb) torque.

Remove the travel motor from the track frame.

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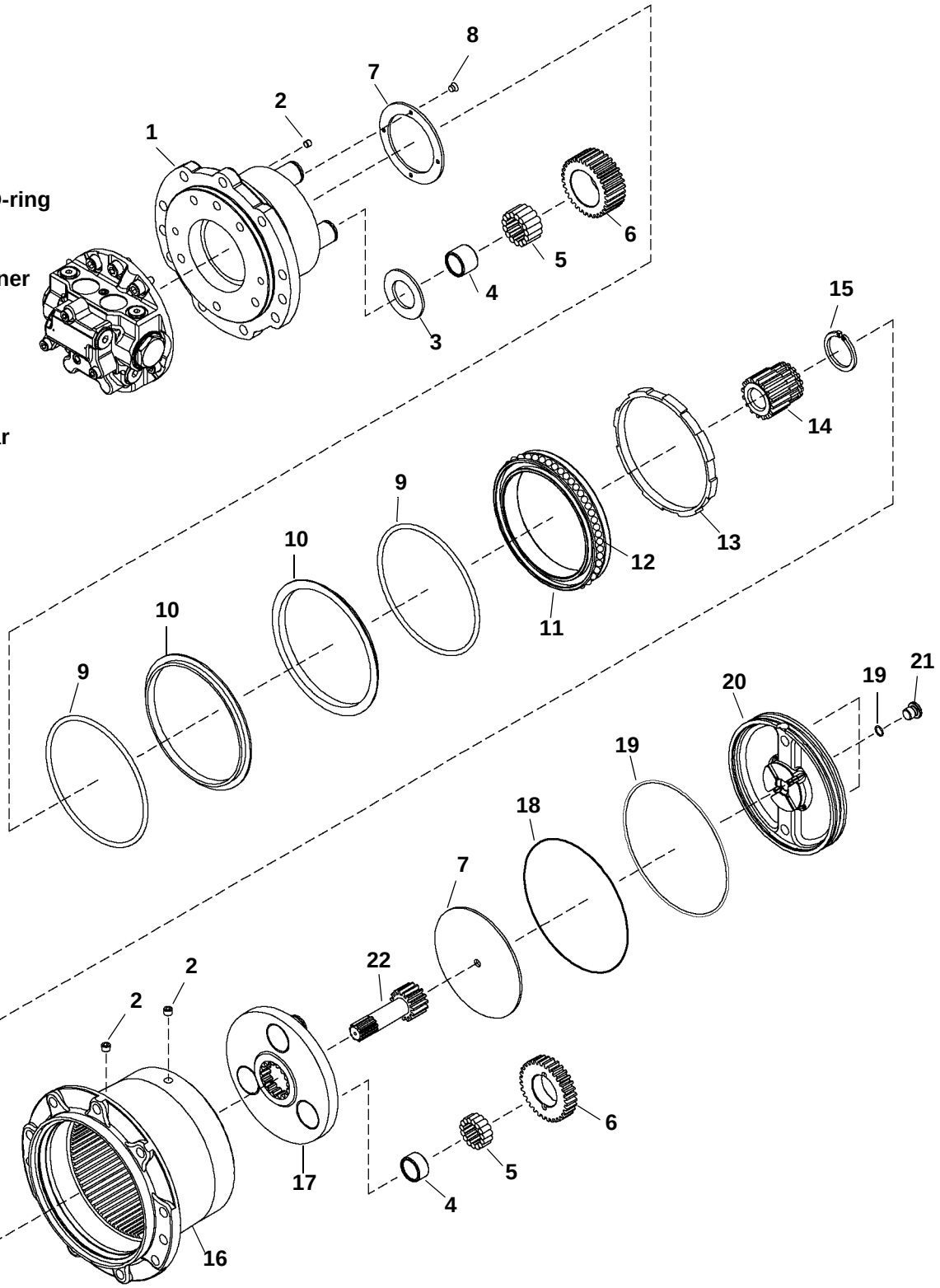
Parts Identification Hydraulic Motor



Dealer Copy -- Not for Resale

Parts Identification Gear Reduction Hub

1. Hub
2. Set Screw
3. Thrust Washer
4. Inner Race
5. Bearing
6. Planetary Gear
7. Thrust Plate
8. Screw
9. Floating Seal O-ring
10. Floating Seal
11. Bearing
12. Bearing Retainer Balls
13. Nut
14. Sun Gear
15. Snap Ring
16. Housing
17. Planetary Gear Carrier
18. Wire Retainer
19. O-ring
20. Cover
21. Plug
22. Pinion Shaft

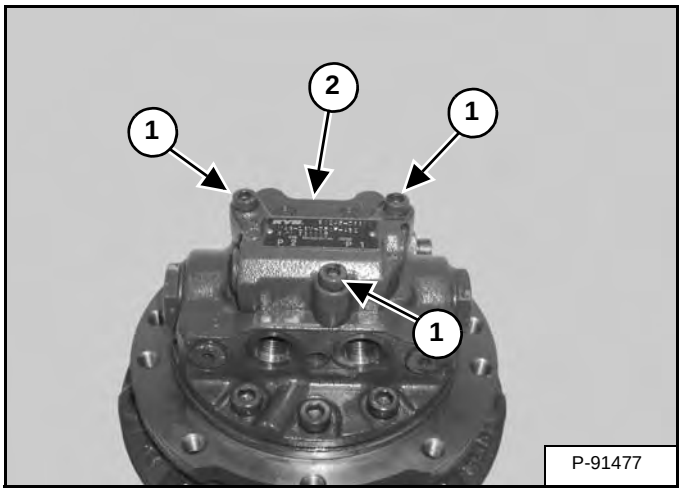


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Dealer Copy -- Not for Resale

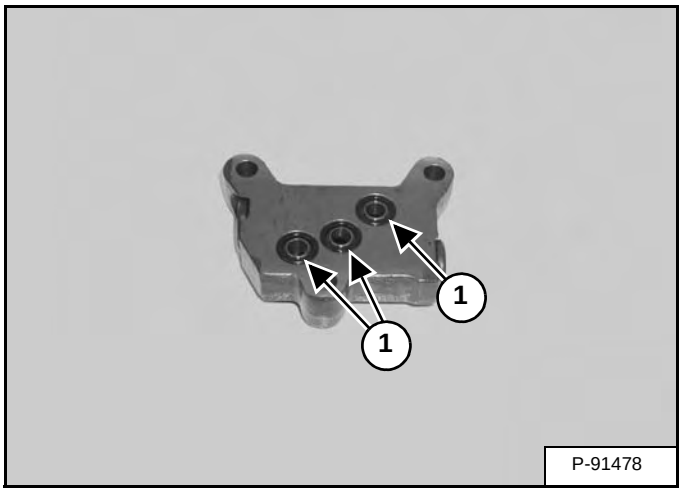
Disassembly

Figure 20-70-4



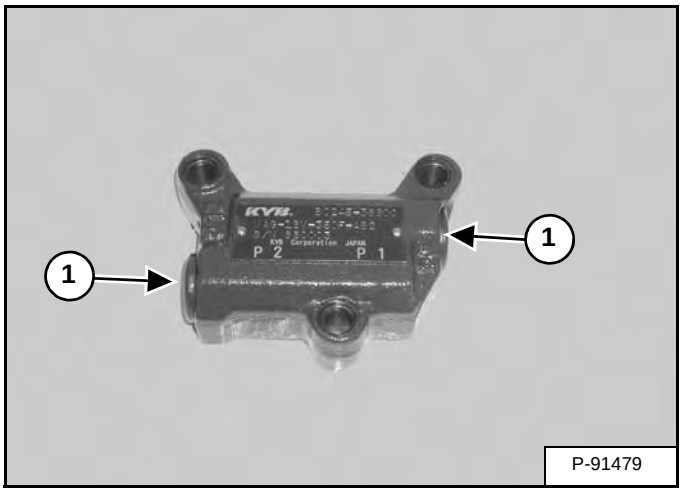
Remove the three bolts (Item 1) and remove the valve (Item 2) **[Figure 20-70-4]**.

Figure 20-70-5



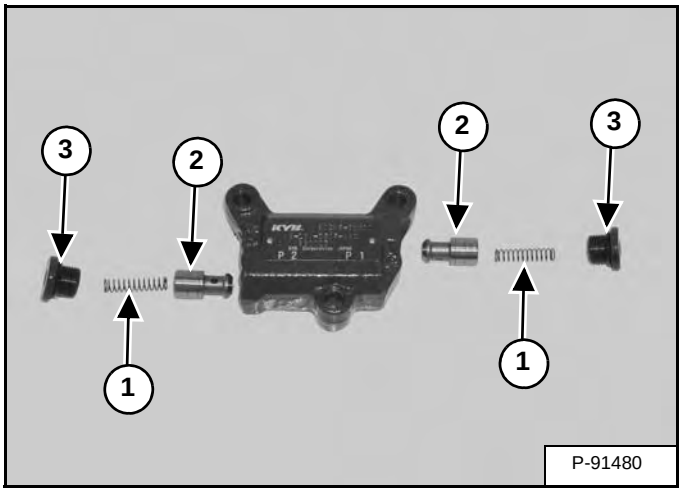
Remove the O-rings (Item 1) **[Figure 20-70-5]**.

Figure 20-70-6



Remove the plugs (Item 1) **[Figure 20-70-6]**.

Figure 20-70-7

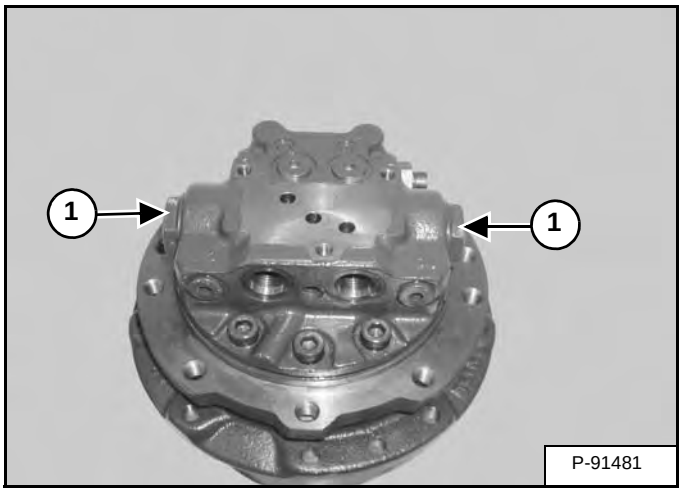


Remove the springs (Item 1) and poppets (Item 2). Remove the O-rings (Item 3) **[Figure 20-70-7]** from the plugs.

Dealer Copy -- Not for Resale

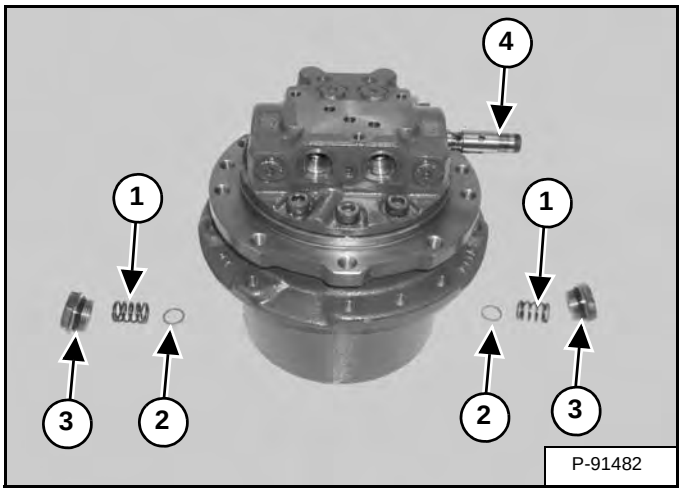
Disassembly (Cont'd)

Figure 20-70-8



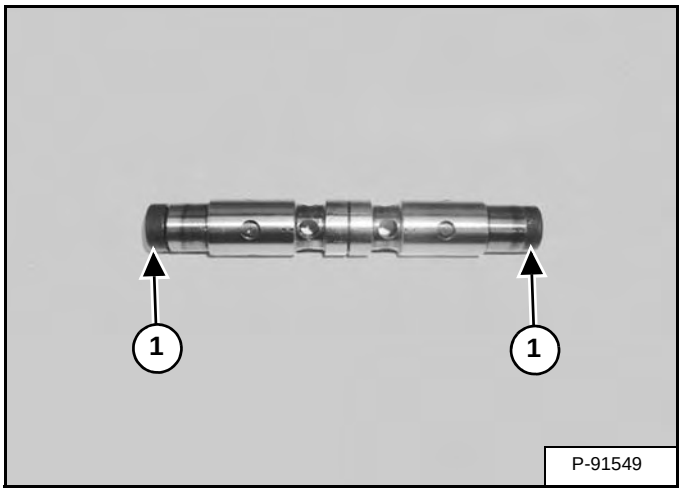
Remove the plugs (Item 1) **[Figure 20-70-8]**.

Figure 20-70-9



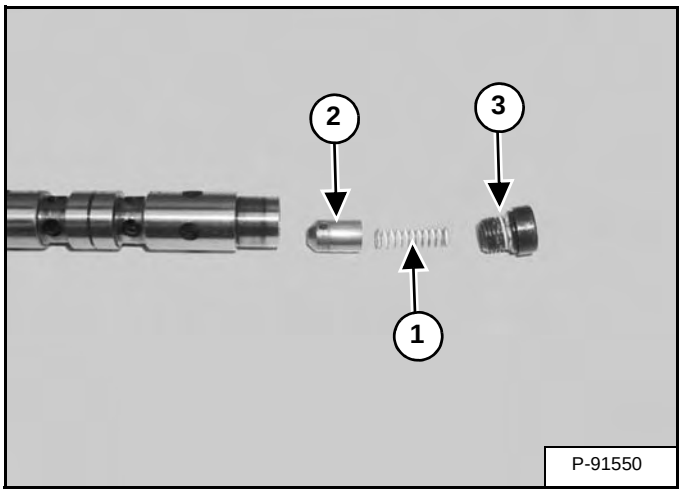
Remove the springs (Item 1) and spring seats (Item 2). Remove the O-rings (Item 3) from the plugs. Remove the spool (Item 4) **[Figure 20-70-9]** from the housing.

Figure 20-70-10



Heat the plugs (Item 1) **[Figure 20-70-10]** to melt the thread adhesive and remove the plugs from both ends of the spool.

Figure 20-70-11

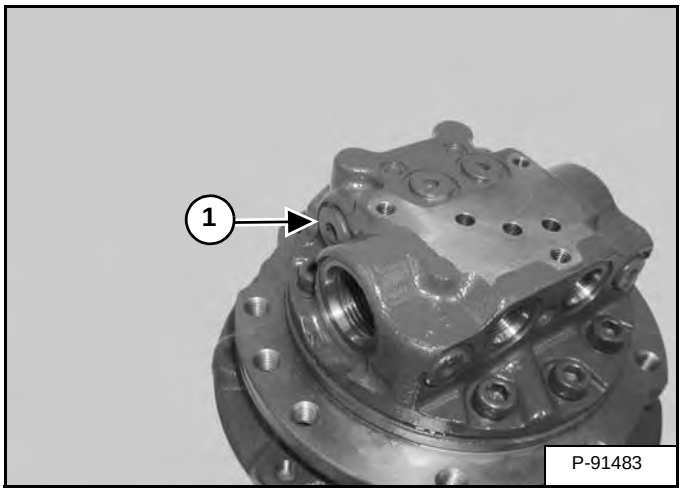


Remove the spring (Item 1) and check valve (Item 2) from both ends of the valve. Remove the O-ring (Item 3) **[Figure 20-70-11]** from both plugs.

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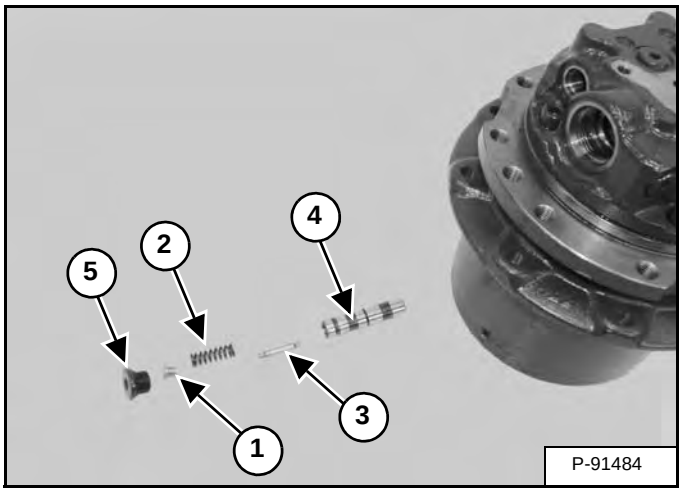
Disassembly (Cont'd)

Figure 20-70-12



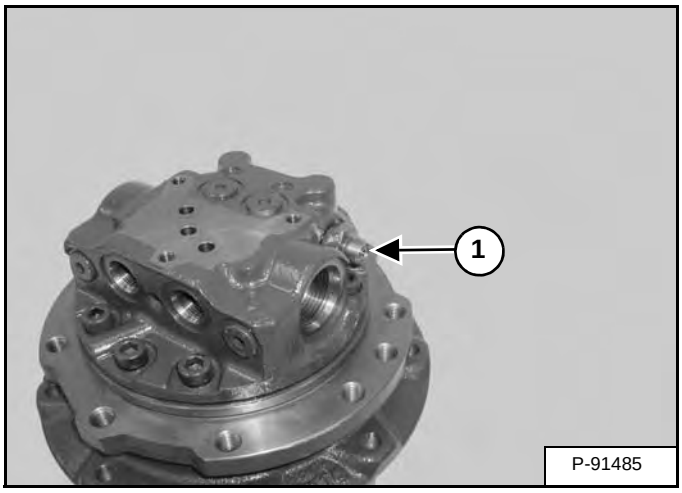
Remove the plug (Item 1) **[Figure 20-70-12]**.

Figure 20-70-13



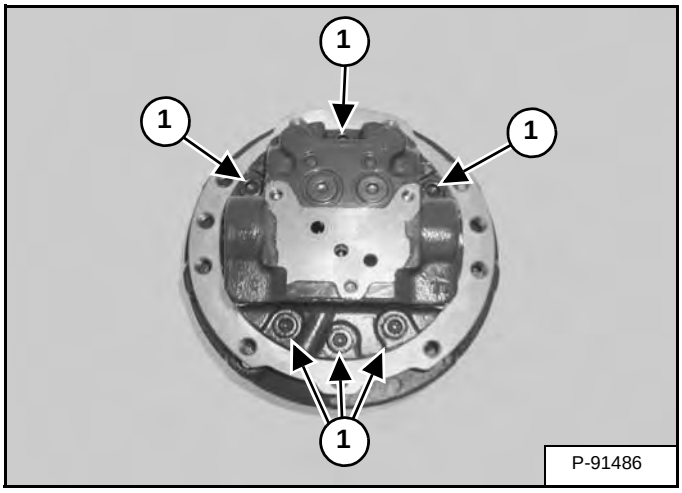
Remove the spring seat (Item 1), spring (Item 2), inner spool (Item 3) and outer spool (Item 4). Remove the O-ring (Item 5) **[Figure 20-70-13]** from the plug.

Figure 20-70-14



Remove the fitting (Item 1) **[Figure 20-70-14]**.

Figure 20-70-15

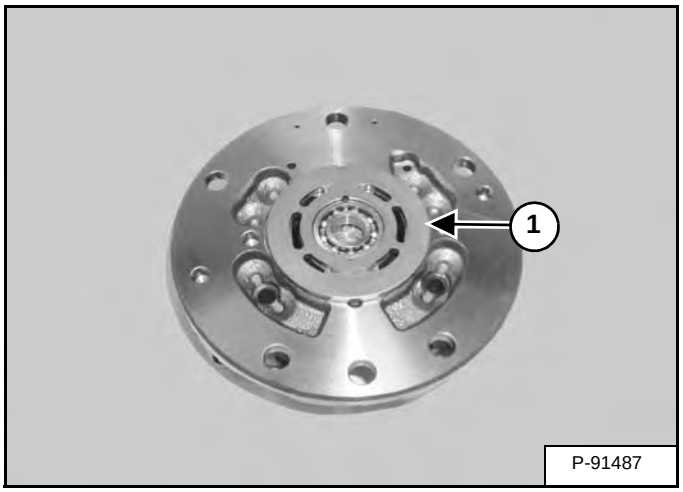


Remove the bolts (Item 1) **[Figure 20-70-15]** and remove the end cap.

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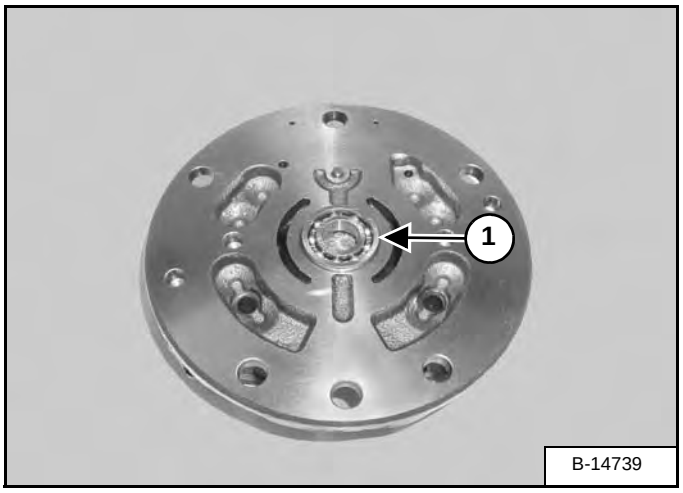
Disassembly (Cont'd)

Figure 20-70-16



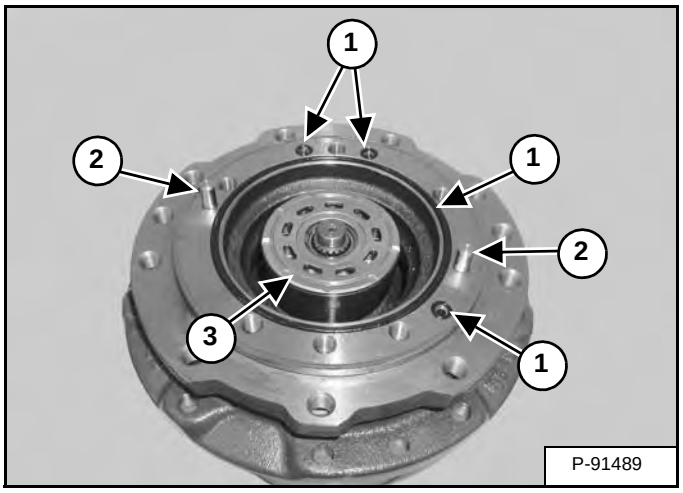
Remove the valve plate (Item 1) **[Figure 20-70-16]**.

Figure 20-70-17



Remove the bearing (Item 1) **[Figure 20-70-17]**.

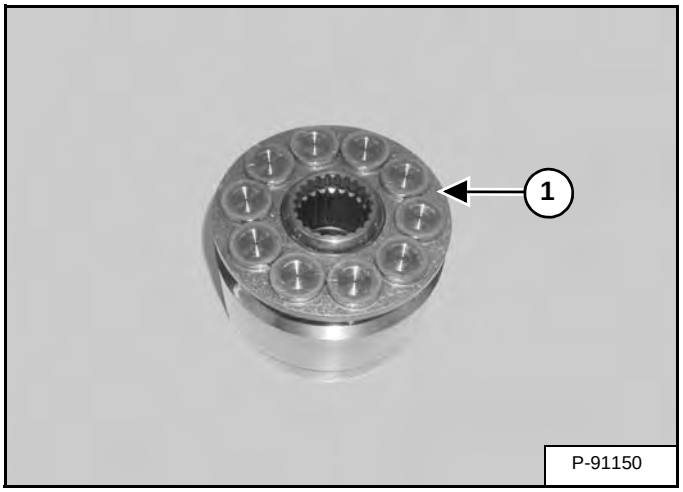
Figure 20-70-18



Remove the O-rings (Item 1). Remove the dowel pins (Item 2) **[Figure 20-70-18]**.

Remove the rotating group (Item 3) **[Figure 20-70-18]**.

Figure 20-70-19



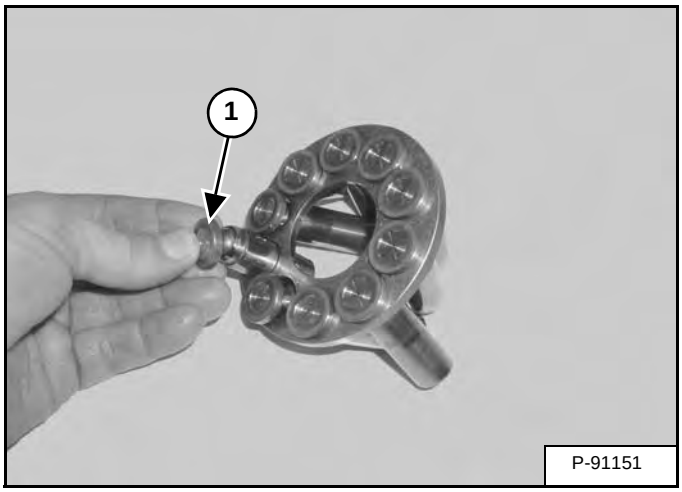
Remove the piston assemblies / retainer (Item 1) **[Figure 20-70-19]** from the cylinder block.

NOTE: It is not important that the pistons are installed in the original bores.

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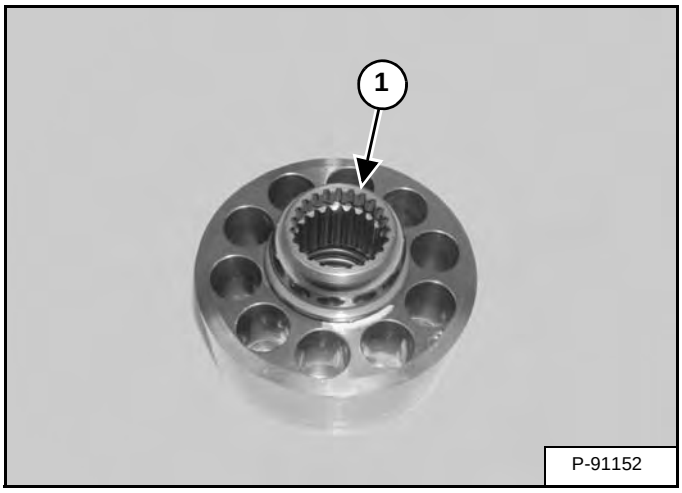
Disassembly (Cont'd)

Figure 20-70-20



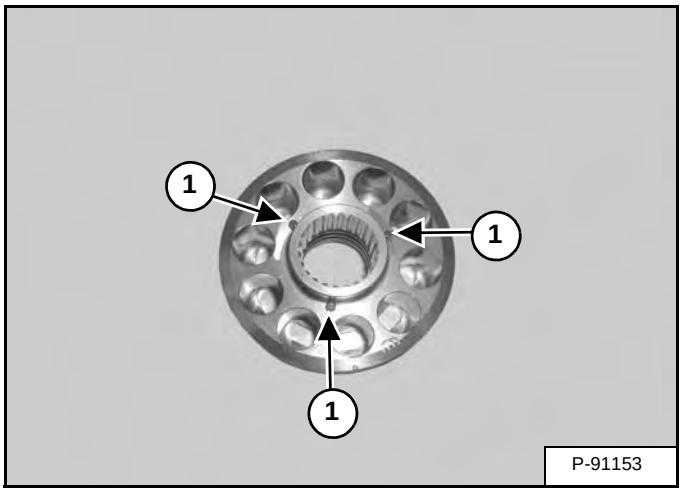
Remove the piston assemblies (Item 1) **[Figure 20-70-20]** from the retainer.

Figure 20-70-21



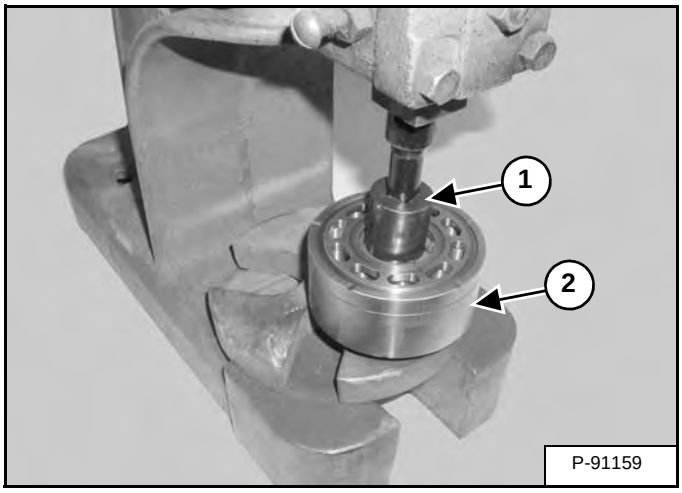
Remove the ball guide (Item 1) **[Figure 20-70-21]**.

Figure 20-70-22



Remove the three pins (Item 1) **[Figure 20-70-22]**.

Figure 20-70-23

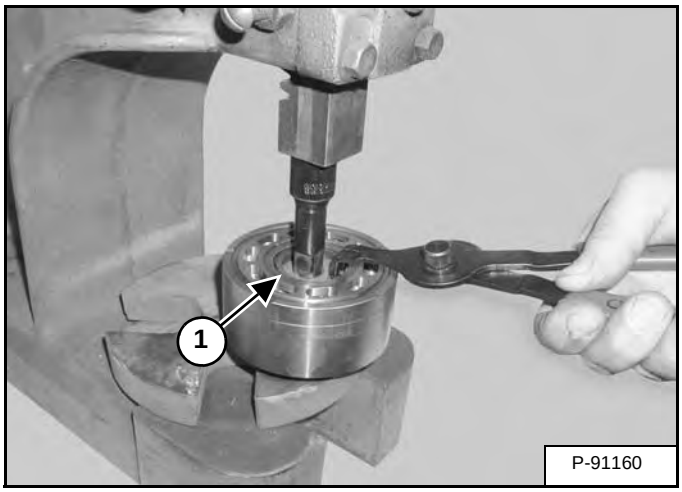


Using a press and an appropriate sized spacer (Item 1), compress the spring in the cylinder block (Item 2) **[Figure 20-70-23]**.

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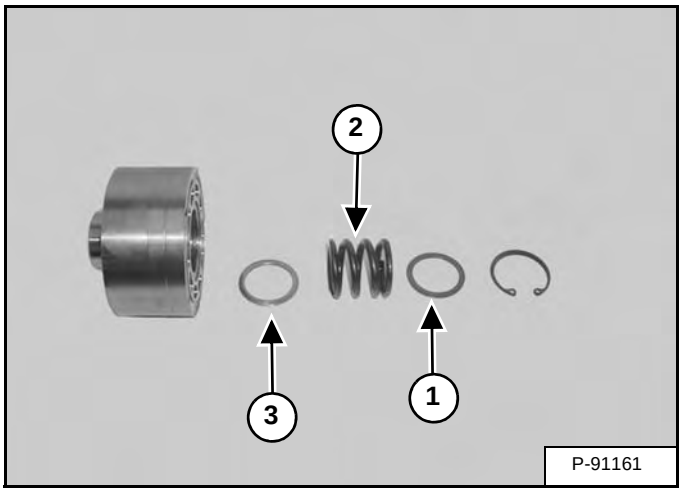
Disassembly (Cont'd)

Figure 20-70-24



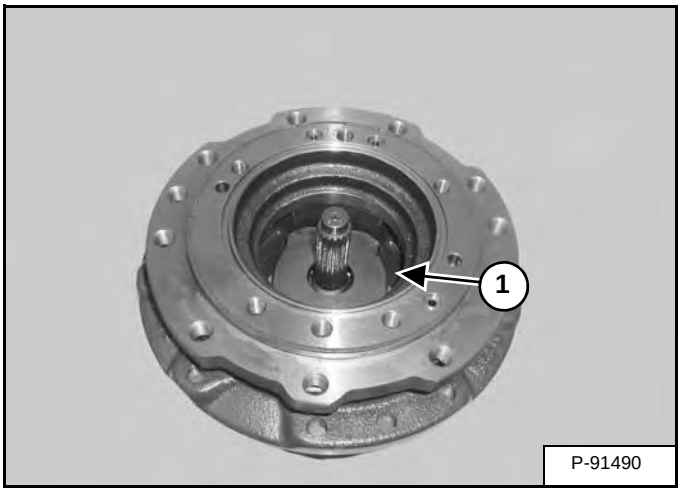
Remove the snap ring (Item 1) **[Figure 20-70-24]**. Remove the cylinder block from the press.

Figure 20-70-25



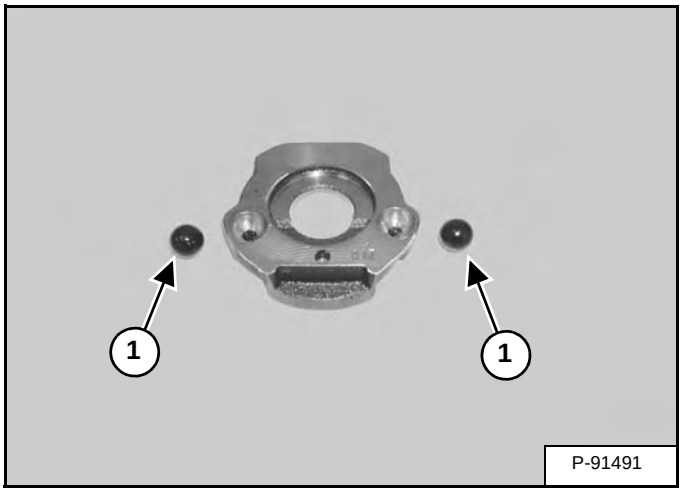
Remove the top washer (Item 1), spring (Item 2) and bottom washer (Item 3) **[Figure 20-70-25]**.

Figure 20-70-26



Remove the swash plate (Item 1) **[Figure 20-70-26]**.

Figure 20-70-27

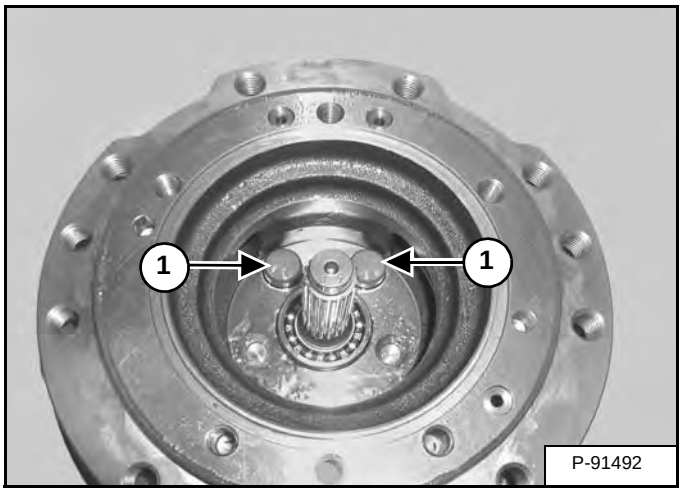


Remove the steel balls (Item 1) **[Figure 20-70-27]** from the bottom of the swash plate.

Dealer Copy -- Not for Resale

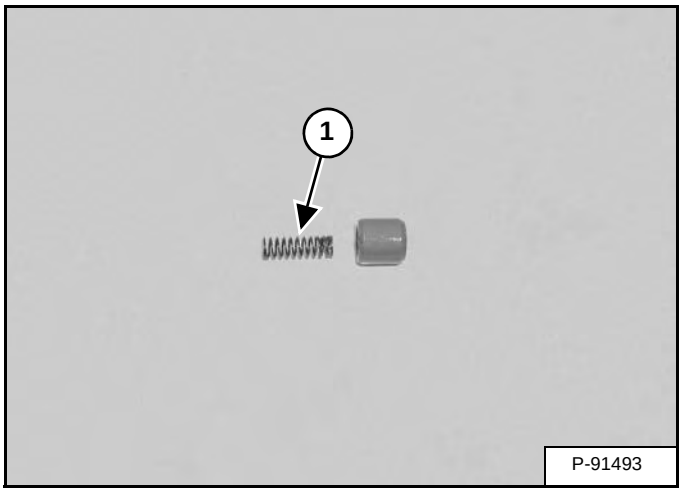
Disassembly (Cont'd)

Figure 20-70-28



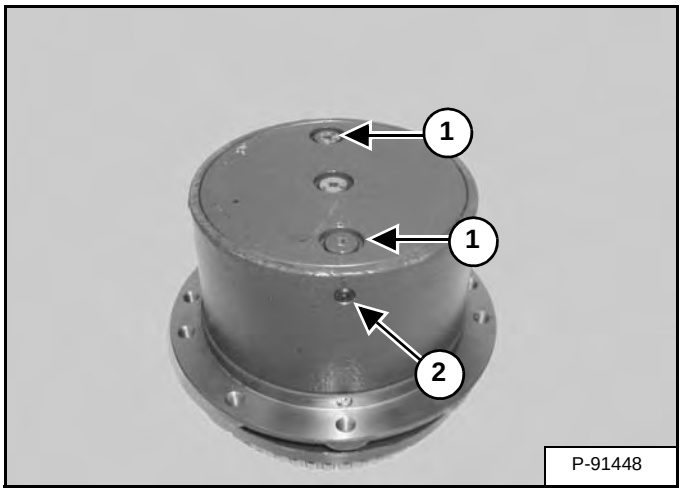
Remove the piston assemblies (Item 1) **[Figure 20-70-28]**.

Figure 20-70-29



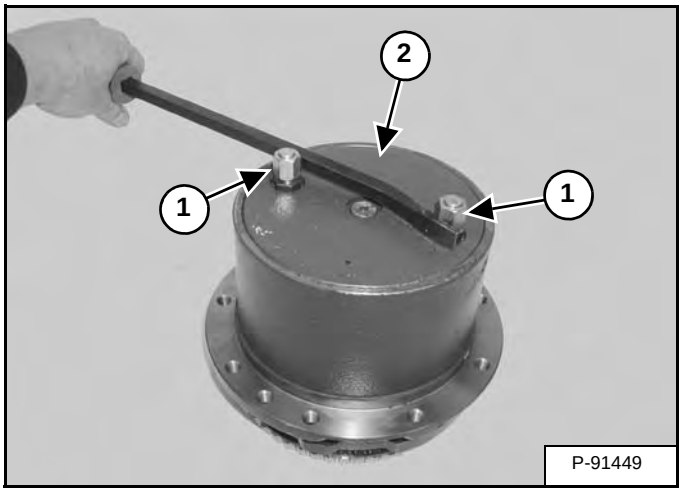
Remove the spring (Item 1) **[Figure 20-70-29]** from the piston.

Figure 20-70-30



Remove the two plugs (Item 1) from the cover. Remove the pipe plug (Item 2) **[Figure 20-70-30]**.

Figure 20-70-31

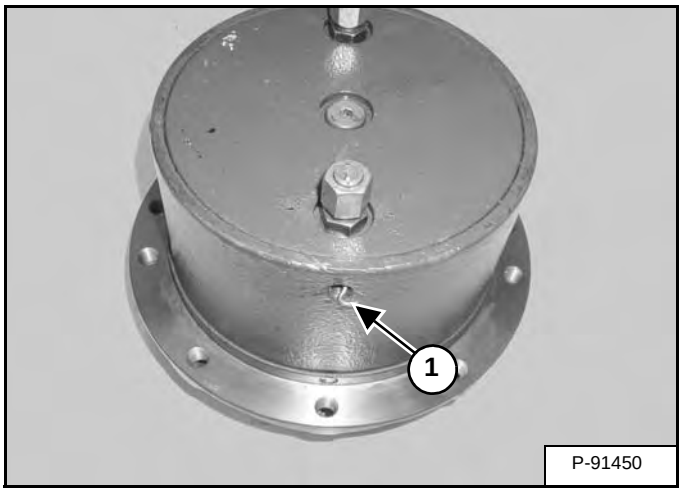


Install a cap and fitting (Item 1) in both ports. Use a bar between the fittings and turn the cover (Item 2) **[Figure 20-70-31]**.

Dealer Copy -- Not for Resale

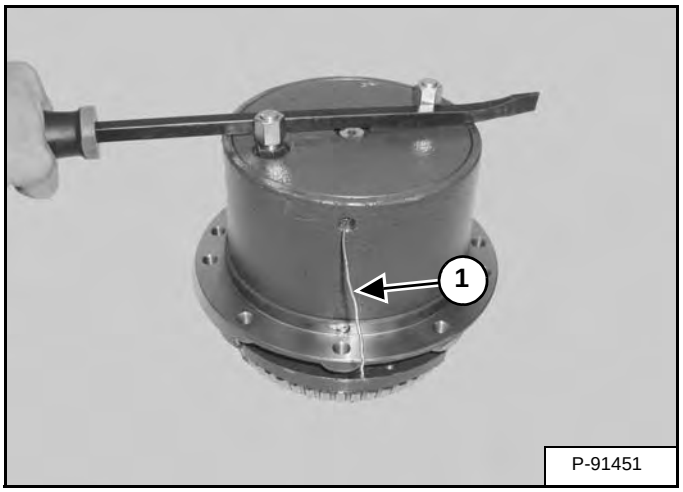
Disassembly (Cont'd)

Figure 20-70-32



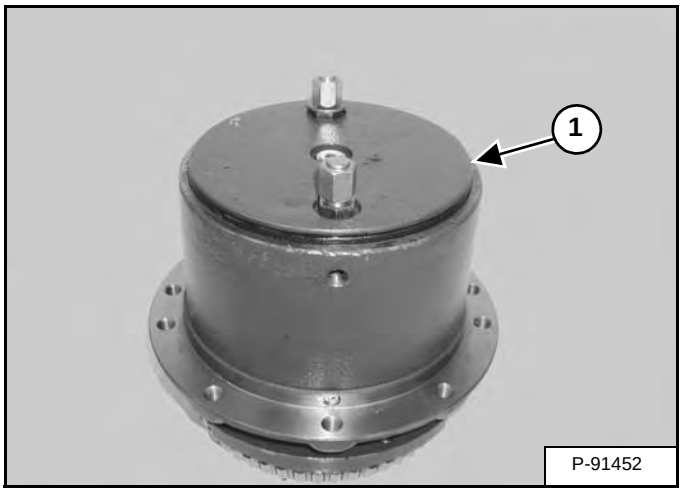
Turn the cover until the wire (Item 1) **[Figure 20-70-32]** is visible in the pipe plug hole. Pull the end of the wire out of the housing.

Figure 20-70-33



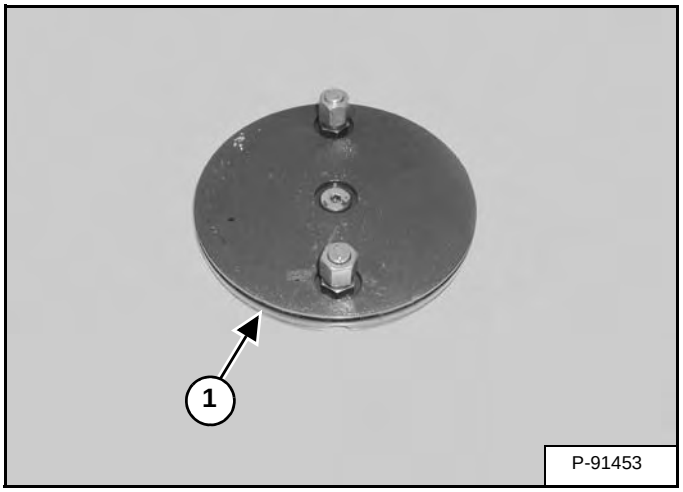
Continue to turn the cover in a counter clockwise direction while pulling the wire (Item 1) **[Figure 20-70-33]** out of the housing.

Figure 20-70-34



After the wire is fully removed lift up on and remove the cover (Item 1) **[Figure 20-70-34]**.

Figure 20-70-35

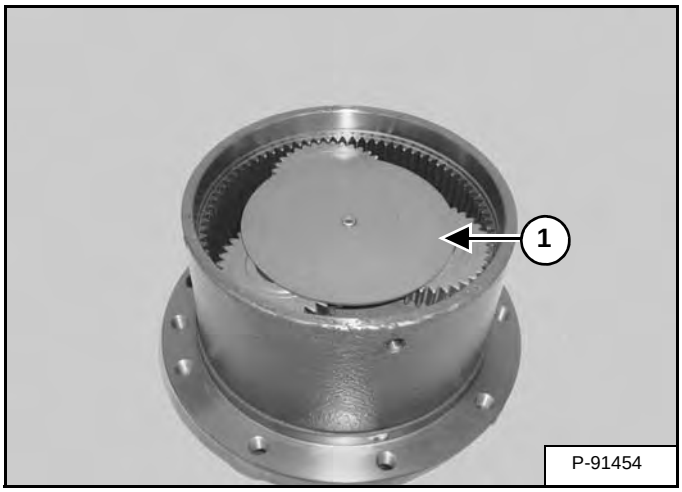


Remove the O-ring (Item 1) **[Figure 20-70-35]** from the cover.

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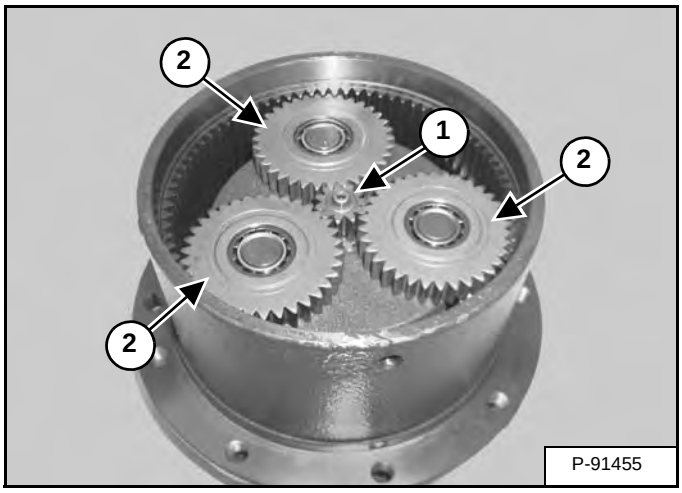
Disassembly (Cont'd)

Figure 20-70-36



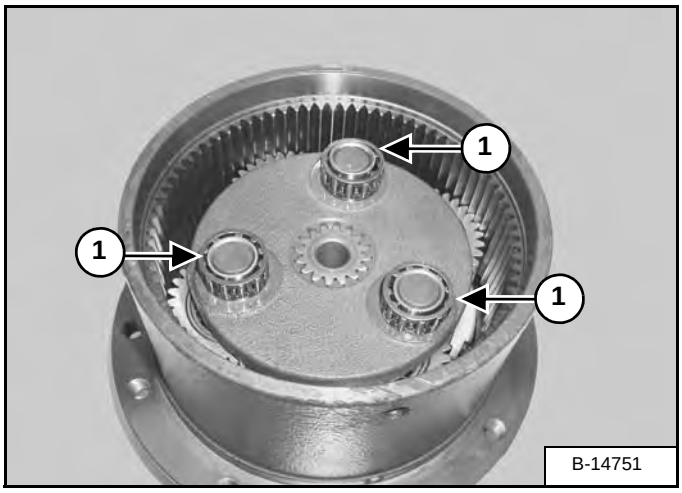
Remove the thrust plate (Item 1) **[Figure 20-70-36]**.

Figure 20-70-37



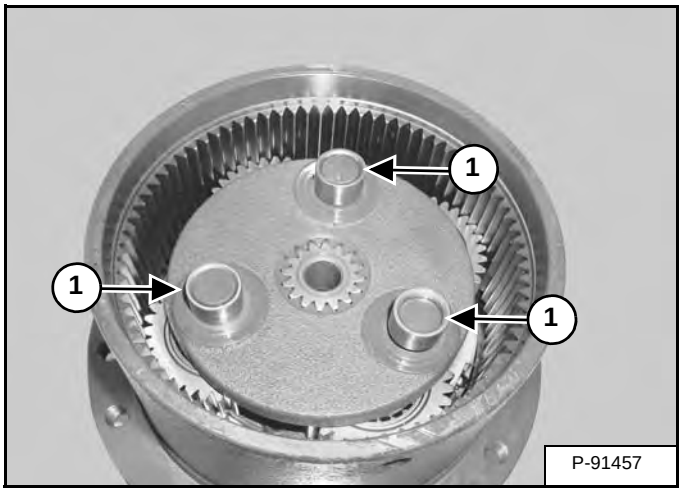
Remove the sun gear (Item 1) and planetary gears (Item 2) **[Figure 20-70-37]**.

Figure 20-70-38



Remove the bearings (Item 1) **[Figure 20-70-38]**.

Figure 20-70-39

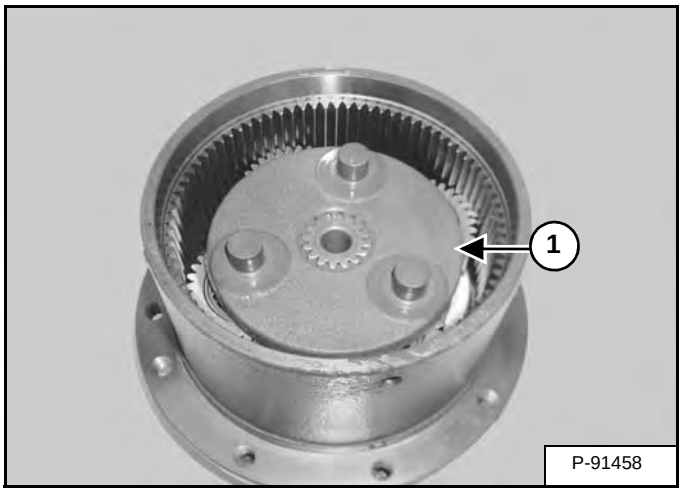


Remove the bearing inner races (Item 1) **[Figure 20-70-39]**.

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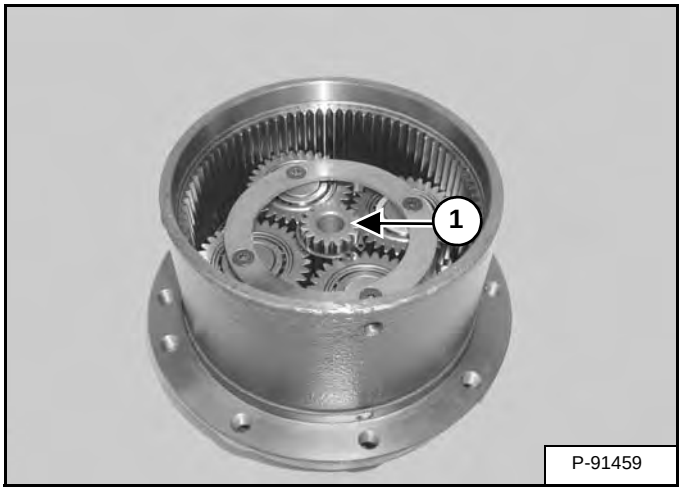
Disassembly (Cont'd)

Figure 20-70-40



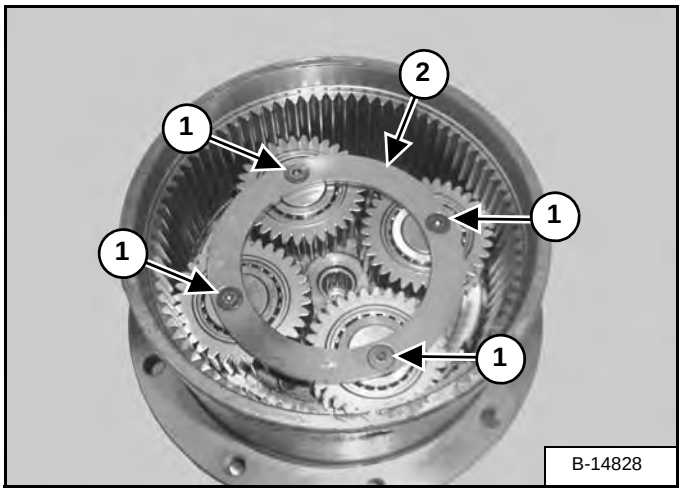
Remove the planetary gear carrier (Item 1) **[Figure 20-70-40]**.

Figure 20-70-41



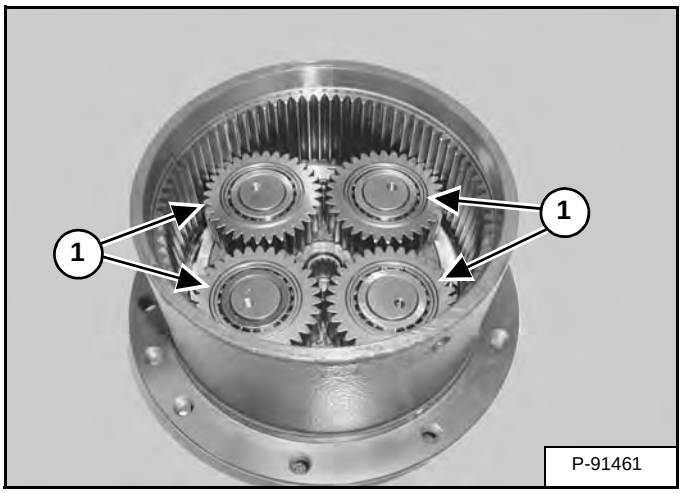
Remove the sun gear (Item 1) **[Figure 20-70-41]**.

Figure 20-70-42



Heat the screw heads (Item 1) to melt the thread adhesive. Remove the screws and thrust plate (Item 2) **[Figure 20-70-42]**.

Figure 20-70-43

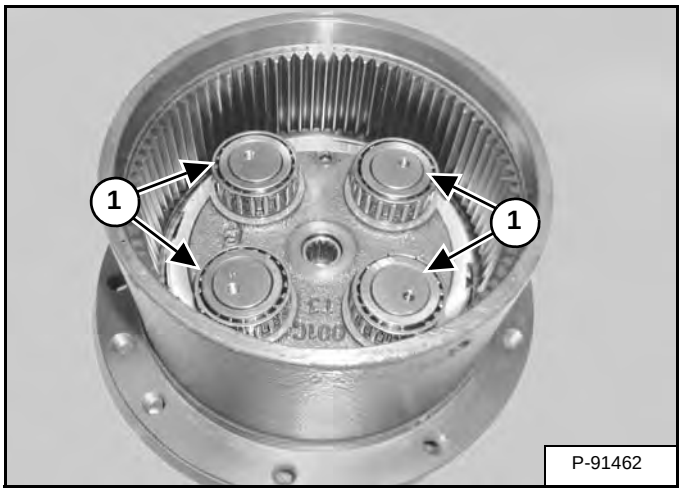


Remove the planetary gears (Item 1) **[Figure 20-70-43]**.

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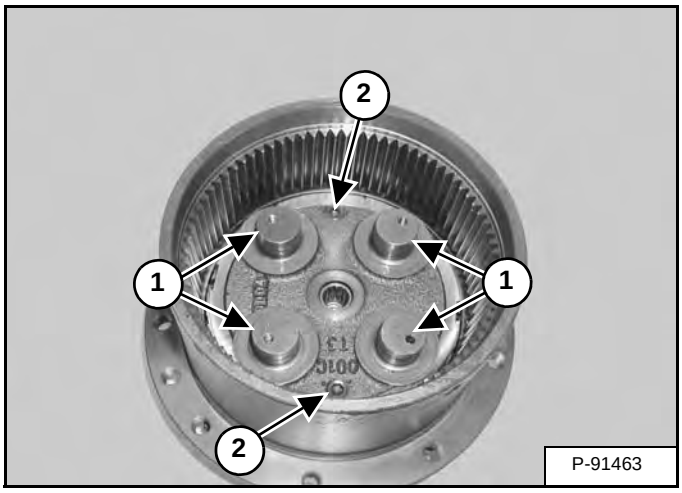
Disassembly (Cont'd)

Figure 20-70-44



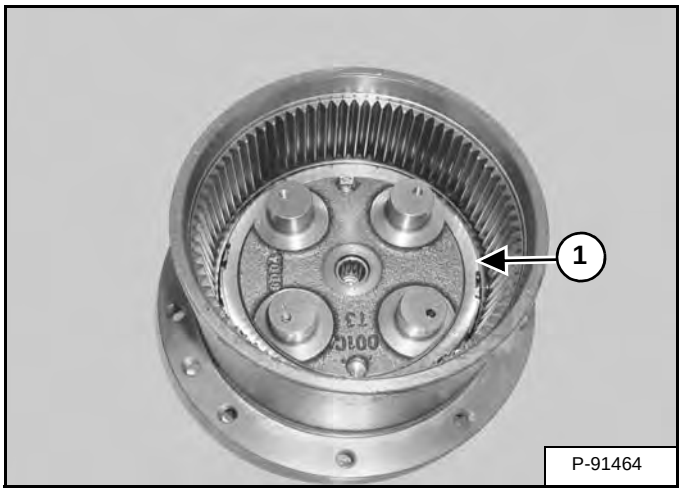
Remove the bearings (Item 1) **[Figure 20-70-44]**.

Figure 20-70-45



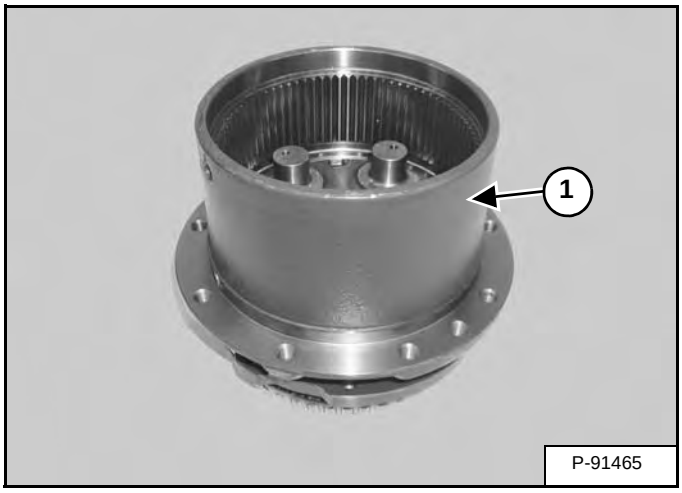
Remove the thrust washers (Item 1). Remove the plugs (Item 2) **[Figure 20-70-45]**.

Figure 20-70-46



Remove the nut (Item 1) **[Figure 20-70-46]**.

Figure 20-70-47

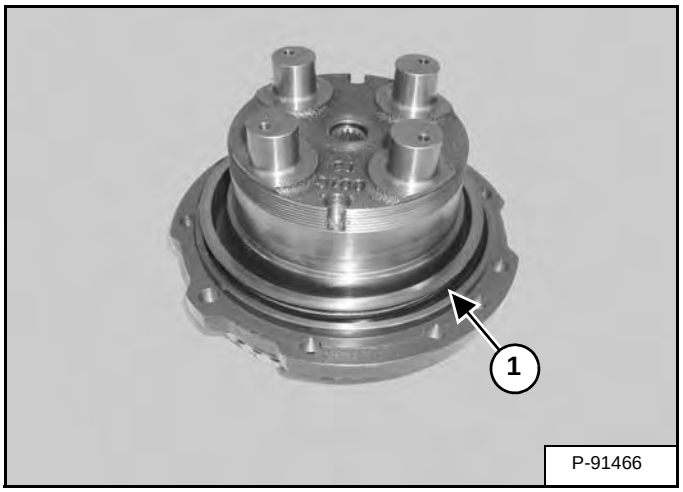


Remove the housing (Item 1) **[Figure 20-70-47]** from the hub.

Dealer Copy -- Not for Resale

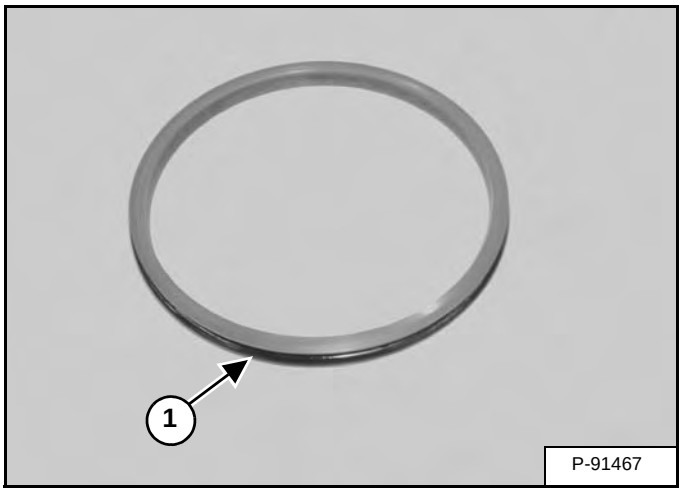
Disassembly (Cont'd)

Figure 20-70-48



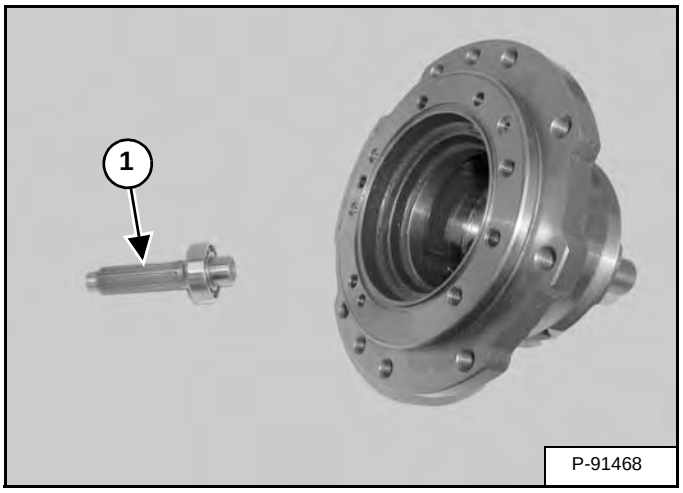
Remove the floating seal (Item 1) **[Figure 20-70-48]**.

Figure 20-70-49



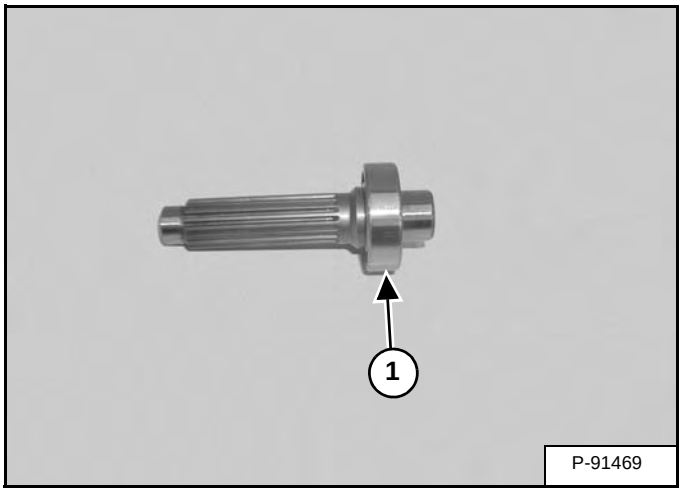
Remove the O-ring (Item 1) **[Figure 20-70-49]** from the seal ring.

Figure 20-70-50



Remove the shaft / bearing assembly (Item 1) **[Figure 20-70-50]**.

Figure 20-70-51

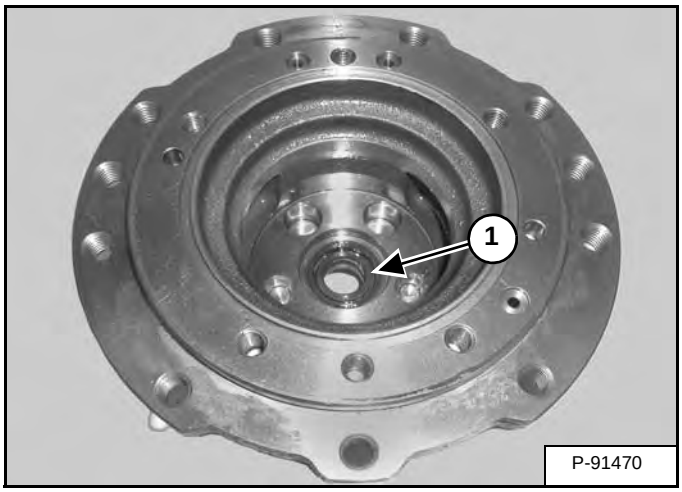


Remove the bearing (Item 1) **[Figure 20-70-51]** from the shaft.

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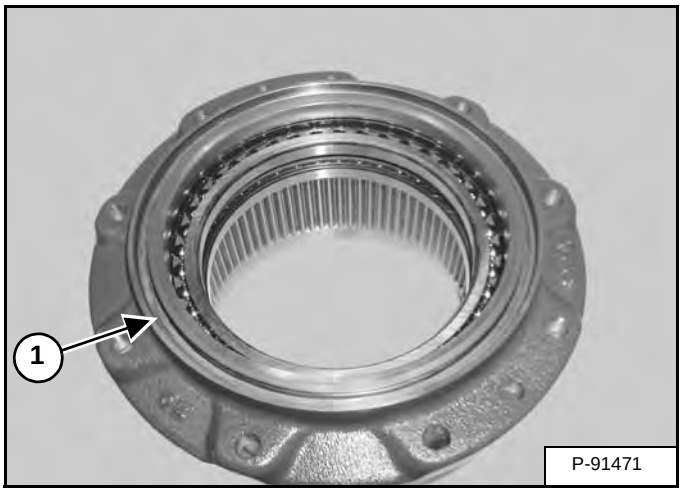
Disassembly (Cont'd)

Figure 20-70-52



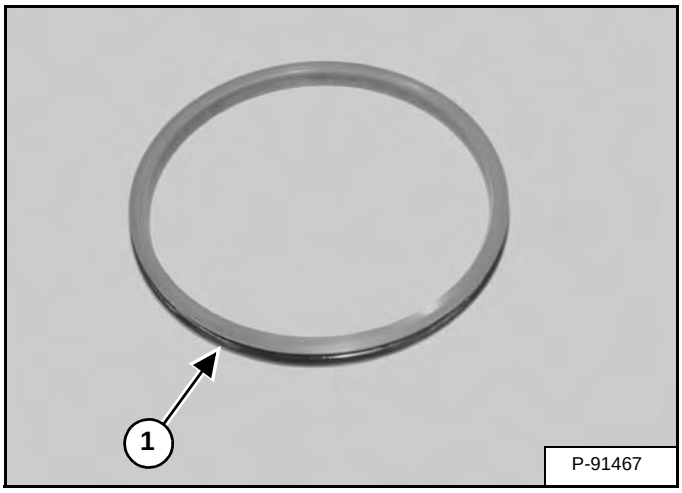
Remove the seal (Item 1) **[Figure 20-70-52]**.

Figure 20-70-53



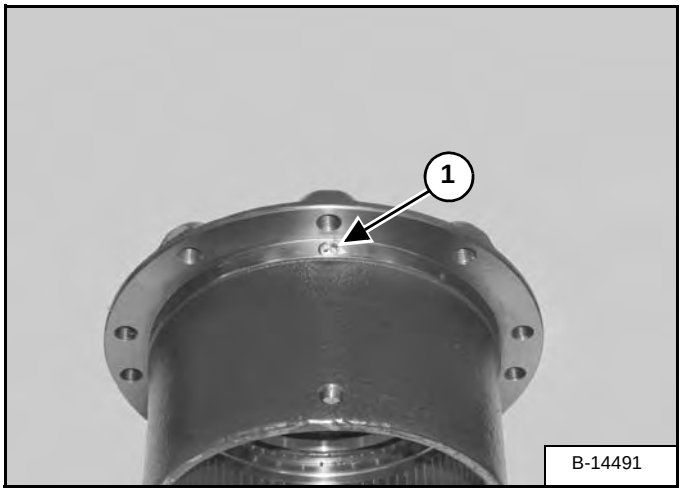
Remove the floating seal (Item 1) **[Figure 20-70-53]**.

Figure 20-70-54



Remove the O-ring (Item 1) **[Figure 20-70-54]** from the seal ring.

Figure 20-70-55

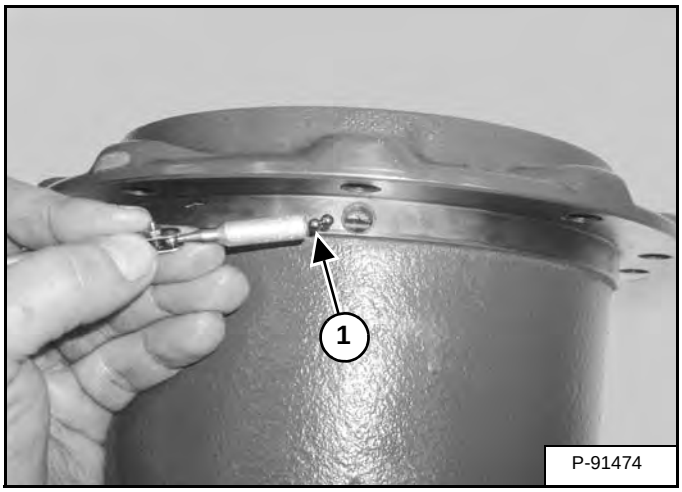


Remove the plug (Item 1) **[Figure 20-70-55]**.

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Disassembly (Cont'd)

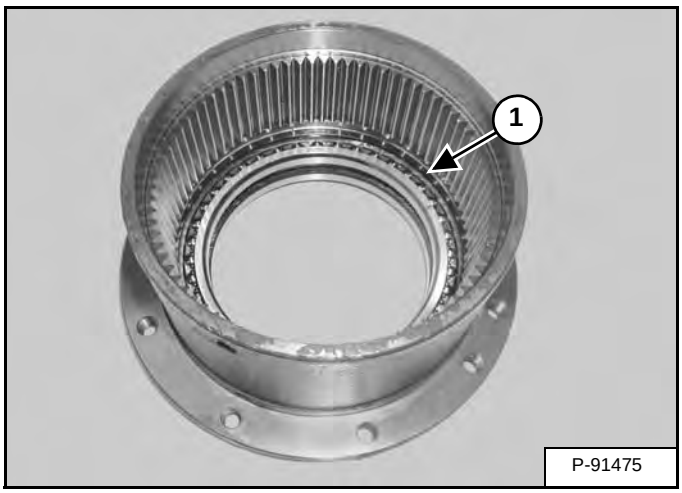
Figure 20-70-56



Remove the steel balls (Item 1) **[Figure 20-70-56]** retaining the bearing to the housing.

NOTE: There are 132 steel balls.

Figure 20-70-57



After all the steel balls have been removed, tap the bearing (Item 1) **[Figure 20-70-57]** out of the housing.

Dealer Copy -- Not for Resale

Assembly

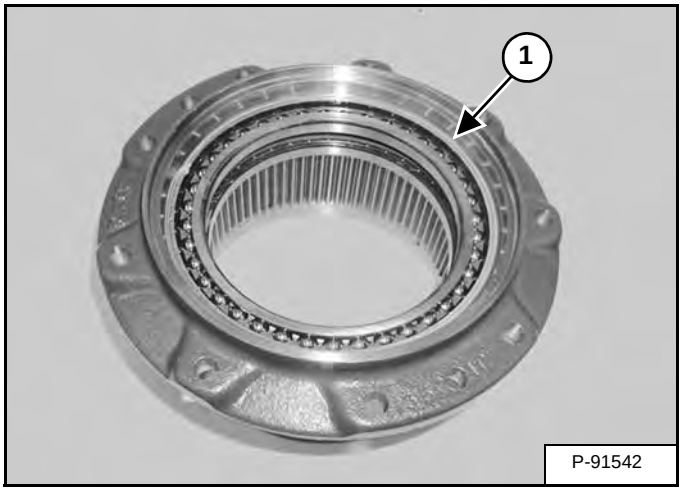
Clean all parts in solvent and dry with compressed air. Inspect all parts and replace any that are damaged.

Apply oil to all O-rings (as noted) and light grease to the ball and roller bearings before installation.

The following tools will be needed to assemble the travel motor:

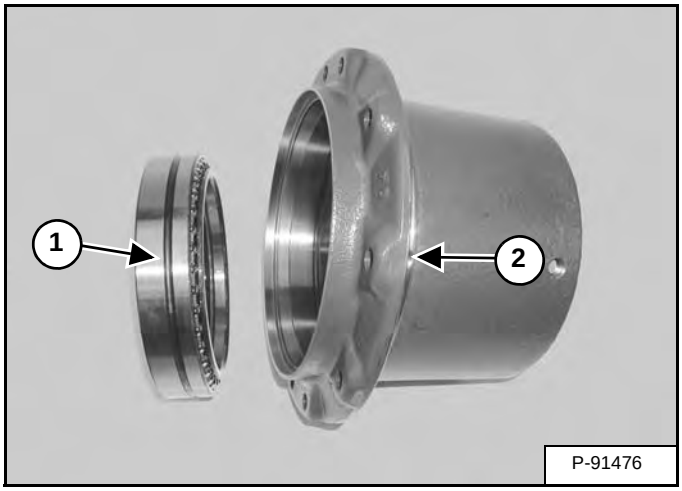
MEL1412 - Seal Installation Tool

Figure 20-70-58



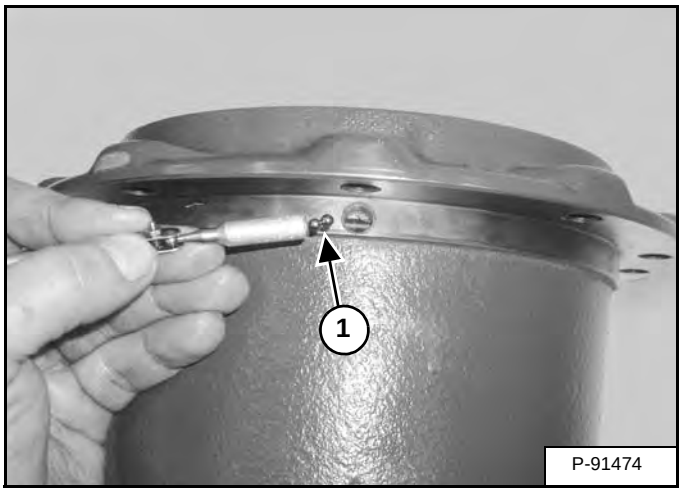
Install the bearing (Item 1) **[Figure 20-70-58]** in the housing.

Figure 20-70-59



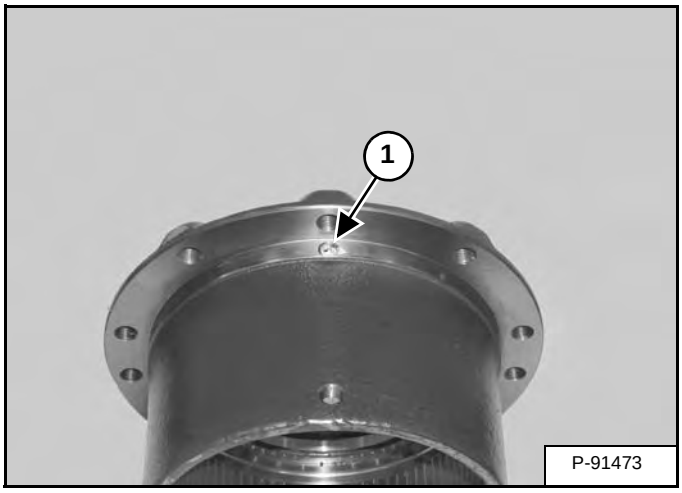
Seat the bearing until the groove (Item 1) in the bearing race is visible through the hole (Item 2) **[Figure 20-70-59]** in the housing.

Figure 20-70-60



Install the steel balls (Item 1) **[Figure 20-70-60]**.

Figure 20-70-61



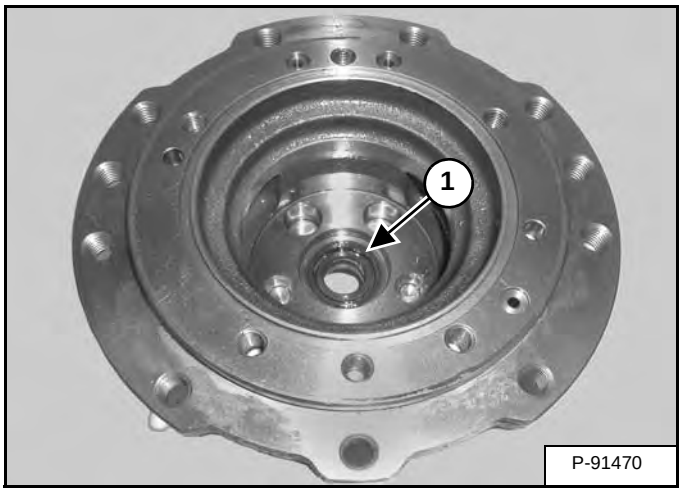
Install the plug (Item 1) **[Figure 20-70-61]**.

Tighten the plug to 6,8 - 8,8 N•m (4.4 - 7.2 ft-lb) torque.

Dealer Copy -- Not for Resale

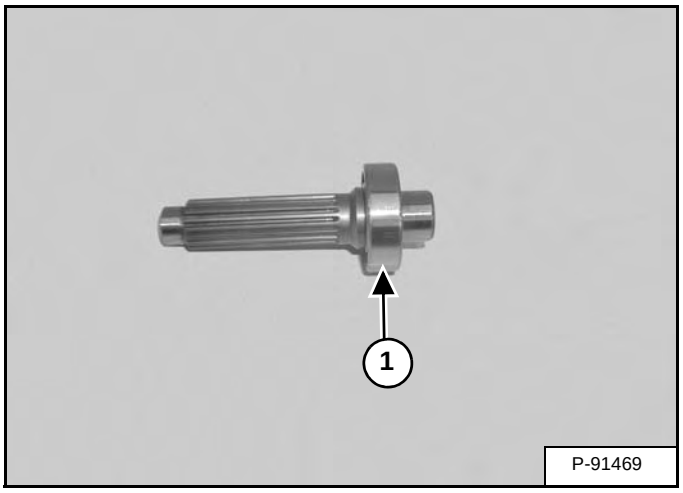
Assembly (Cont'd)

Figure 20-70-62



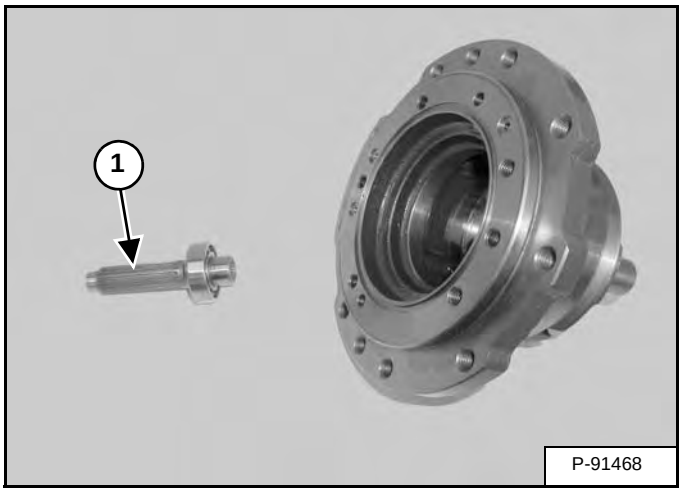
Install the oil seal (Item 1) **[Figure 20-70-62]**.

Figure 20-70-63



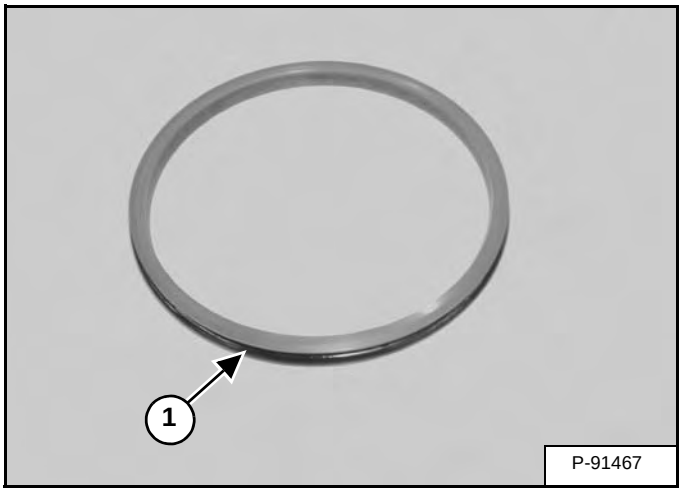
Install the bearing (Item 1) **[Figure 20-70-63]**.

Figure 20-70-64



Install the shaft / bearing assembly in the hub (Item 1) **[Figure 20-70-64]**.

Figure 20-70-65



Install the O-ring (Item 1) **[Figure 20-70-65]** on the seal rings.

NOTE: Inspect the seal ring for burrs before installing the O-ring. Install the O-ring making sure it is not twisted. To remove any twists, gently pull a section of the O-ring and let it snap back.

The O-ring, seal rings, motor assembly and housing must be clean and free of any dust, oil film or foreign matter.

Dealer Copy -- Not for Resale

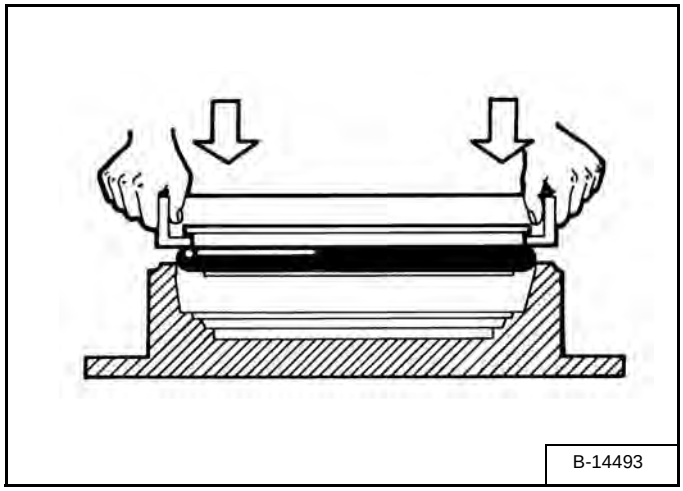
Assembly (Cont'd)

Install the seal seating tool (MEL1412) on the seal ring and O-ring assembly.

The O-ring and seal ring assembly has to be lubricated with alcohol so the O-ring will slip past the housing retaining ring and seal uniformly in the motor housing radius. Do not use oil to lubricate the O-ring.

Dip the O-ring and seal ring assembly in a pan of alcohol.

Figure 20-70-66



Shake off the excess alcohol and install the seal ring assembly on the hub **[Figure 20-70-66]**.

Use firm even pressure on the installation tool (MEL1412) to install the O-ring in the motor housing.

Repeat the procedure for the housing.

Figure 20-70-67

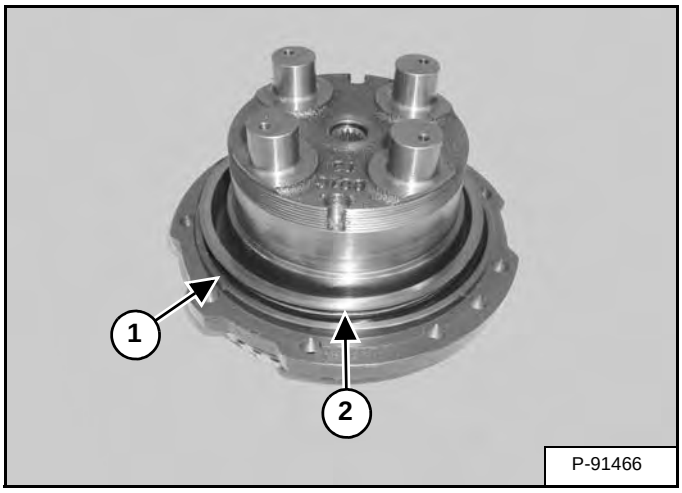
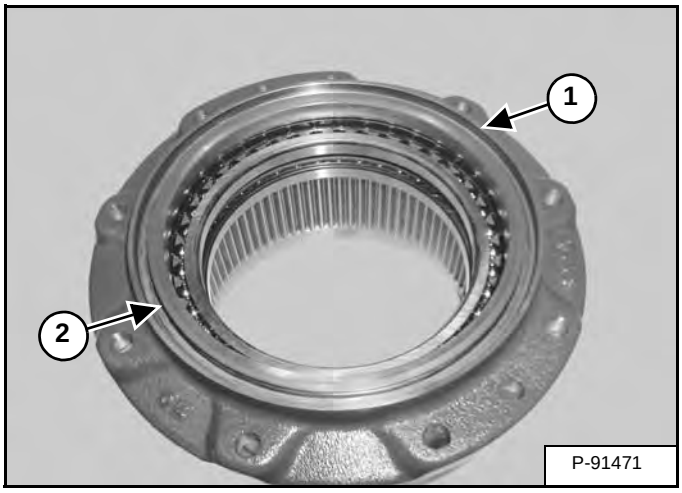


Figure 20-70-68



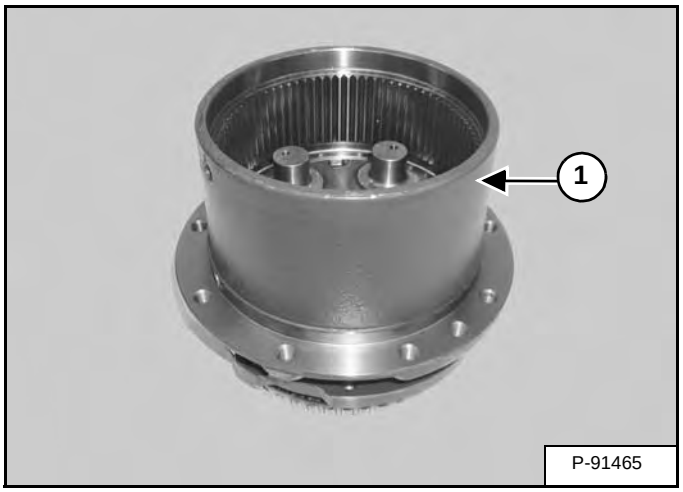
After the seal ring (Item 1) **[Figure 20-70-67]** and **[Figure 20-70-68]** is installed, check the stand out height in four places, 90° apart.

Apply a light film of oil to the seal ring lapped face (Item 2) **[Figure 20-70-67]** and **[Figure 20-70-68]**.

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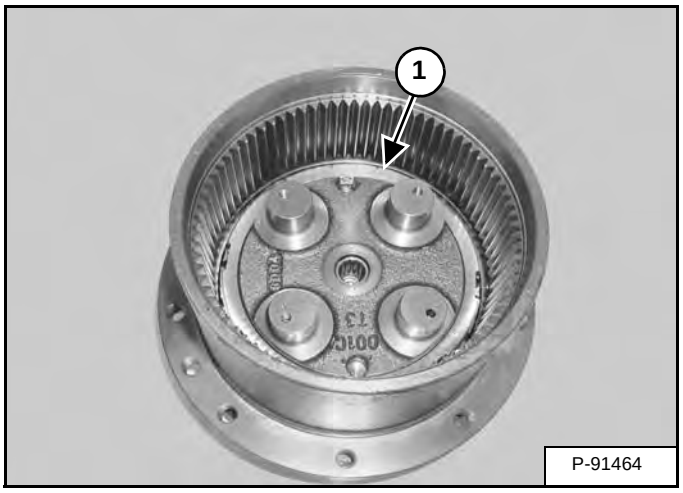
Assembly (Cont'd)

Figure 20-70-69



Install the housing (Item 1) **[Figure 20-70-69]** on the hub.

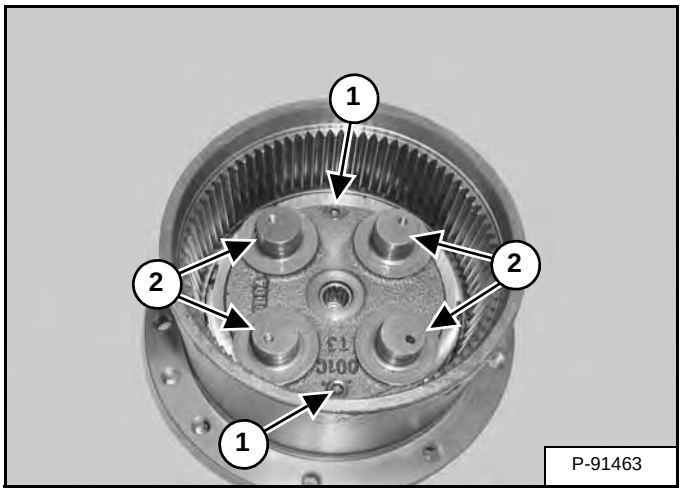
Figure 20-70-70



Install the nut (Item 1) **[Figure 20-70-70]**.

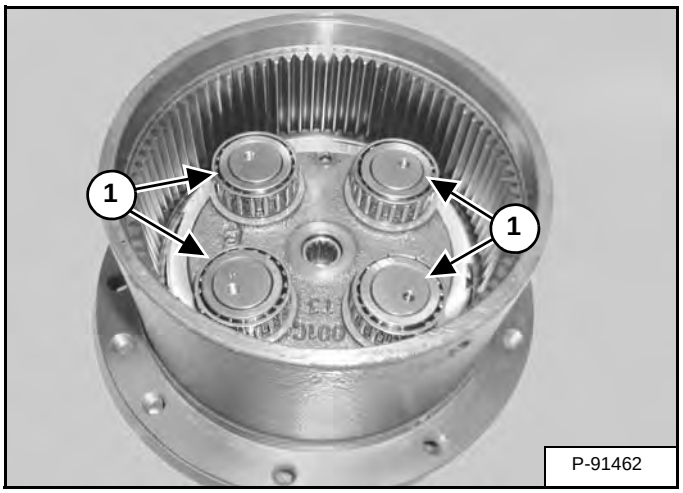
Tighten the nut to 186,2 - 205,8 N•m (138 - 152 ft-lb) torque.

Figure 20-70-71



Install the plugs (Item 1). Tighten the plugs to 9,8 - 19,6 N•m (7.3 - 14.5 ft-lb) torque. Install the thrust washers (Item 2) **[Figure 20-70-71]**.

Figure 20-70-72

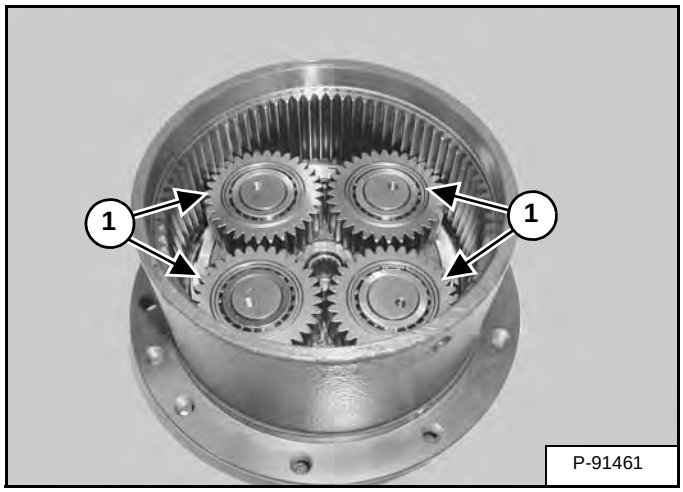


Install the bearings (Item 1) **[Figure 20-70-72]**.

Dealer Copy -- Not for Resale

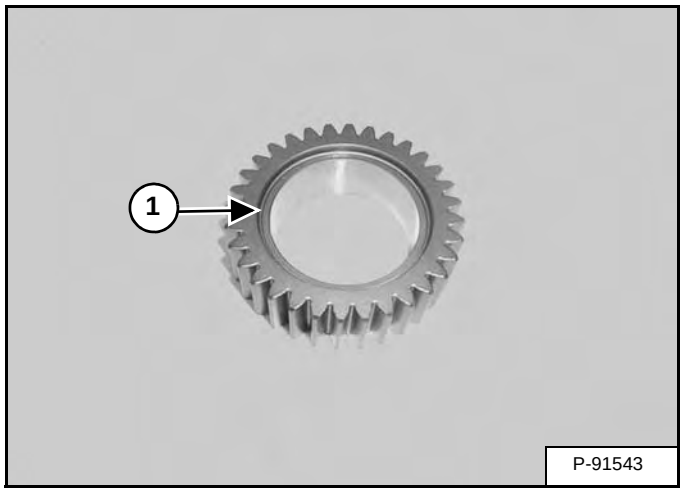
Assembly (Cont'd)

Figure 20-70-73



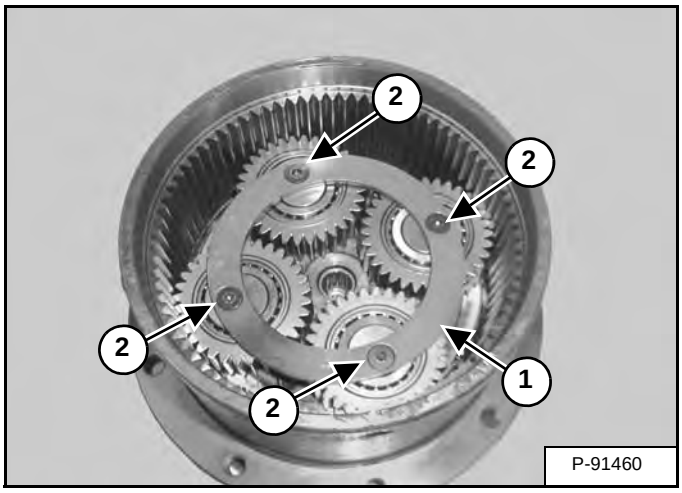
Install the gears (Item 1) **[Figure 20-70-73]**.

Figure 20-70-74



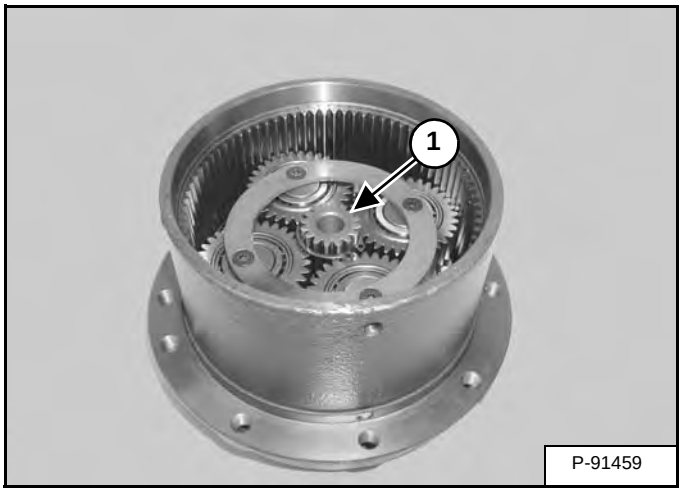
NOTE: Install the gears with the bevel (Item 1) [Figure 20-70-74] towards the thrust washer.

Figure 20-70-75



Install the thrust plate (Item 1). Apply Loctite® 271 to the threads of the screws (Item 2) **[Figure 20-70-75]**. Install and tighten the screws to 12,1 - 13,3 N•m (9 - 10 ft-lb) torque.

Figure 20-70-76

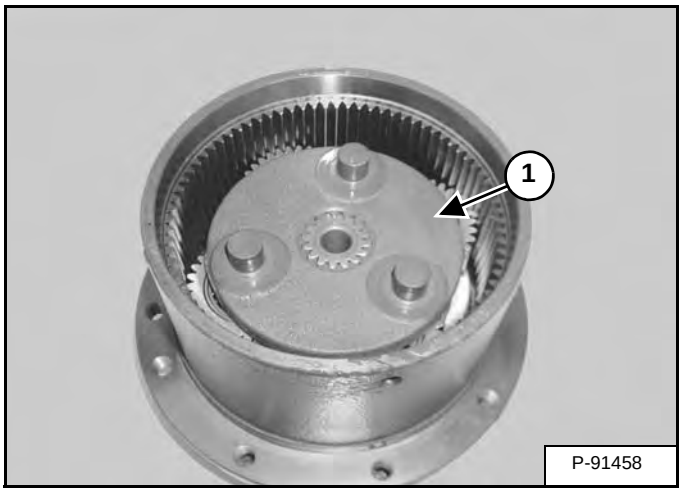


Install the sun gear / snap ring assembly (Item 1) **[Figure 20-70-76]**.

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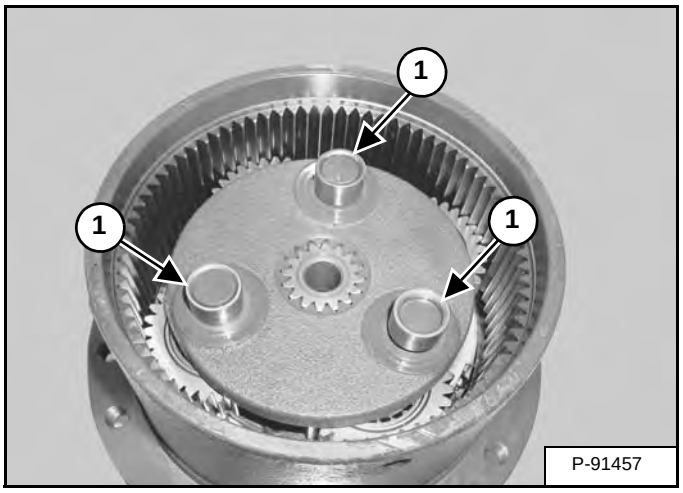
Assembly (Cont'd)

Figure 20-70-77



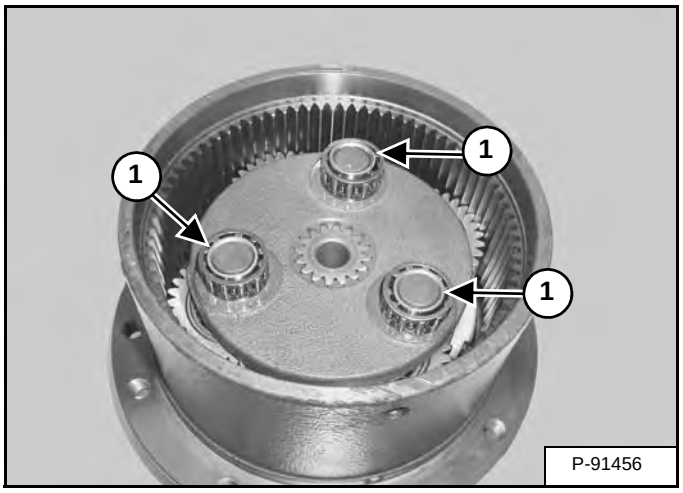
Install the planetary gear carrier (Item 1) **[Figure 20-70-77]**.

Figure 20-70-78



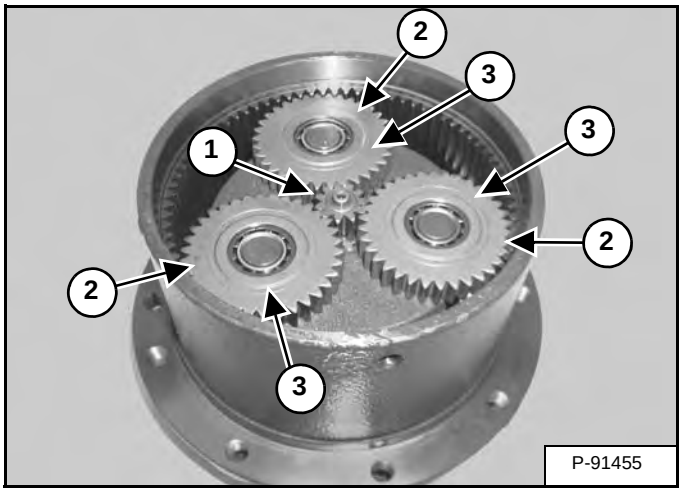
Install the races (Item 1) **[Figure 20-70-78]**.

Figure 20-70-79



Install the bearings (Item 1) **[Figure 20-70-79]**.

Figure 20-70-80



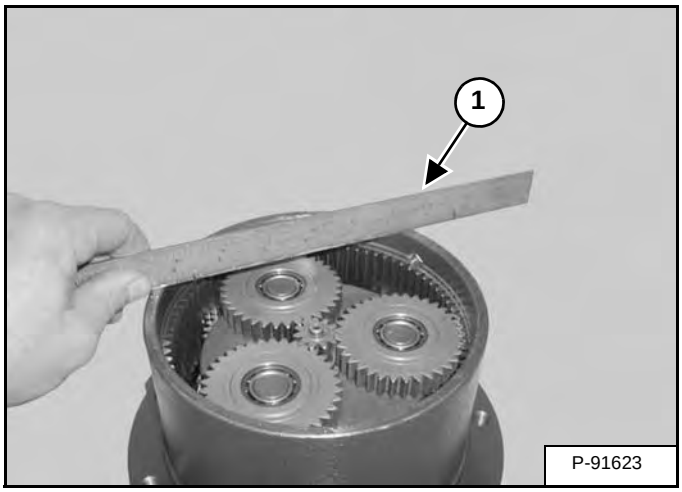
Install the sun gear (Item 1). Install the planetary gears (Item 2) **[Figure 20-70-80]**.

NOTE: Install the gears with the thrust surface (Item 3) [Figure 20-70-80] towards the cover side of the motor.

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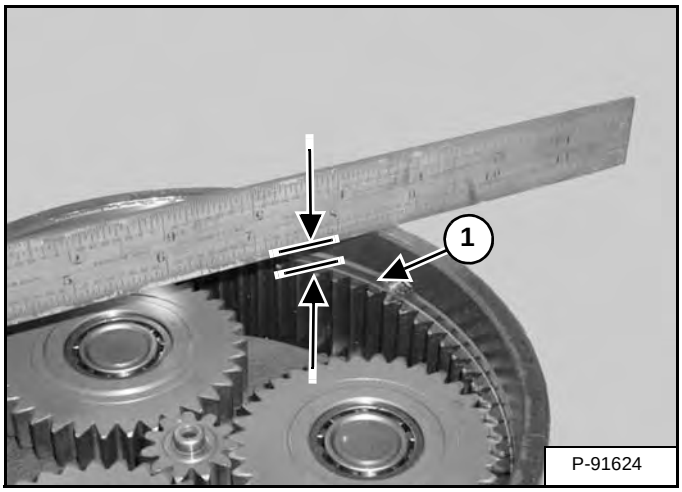
Assembly (Cont'd)

Figure 20-70-81



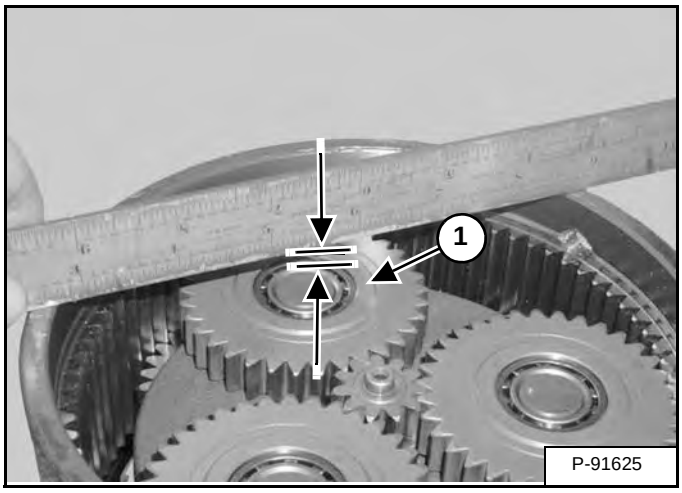
Place a straight edge (Item 1) **[Figure 20-70-81]** across the top of the housing.

Figure 20-70-82



Measure down from the bottom of the straight edge to the top of the housing teeth (Item 1) **[Figure 20-70-82]**.

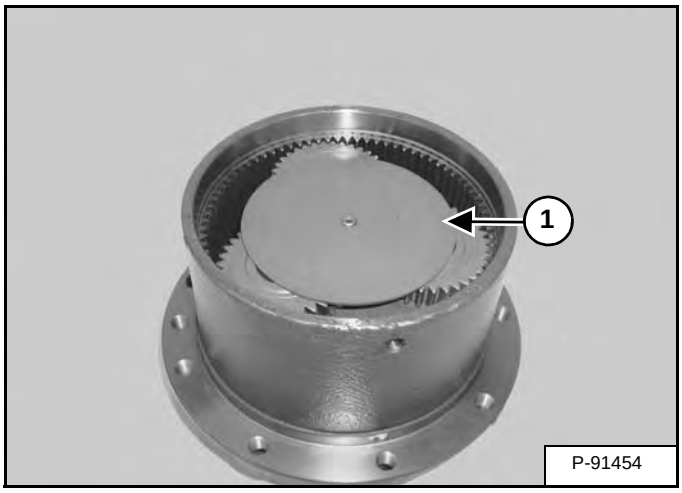
Figure 20-70-83



Measure down from the bottom of the straight edge to the thrust surface (Item 1) **[Figure 20-70-83]** on the top of the gear.Calculate the difference between the two measurements and select the correct thrust plate.

Difference	0,3 - 0,7 mm	0,8 - 1,3 mm	1,4 - 1,8 mm
Thrust Plate Thickness	1,8 mm	2,3 mm	2,8 mm

Figure 20-70-84

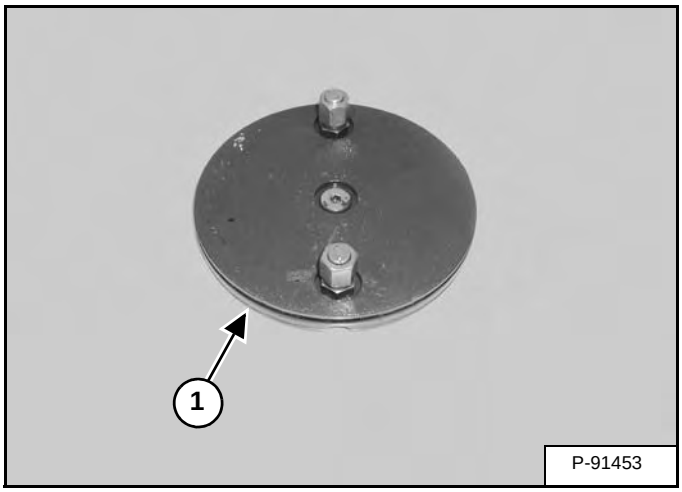


Install the correct thrust plate (Item 1) **[Figure 20-70-84]**.

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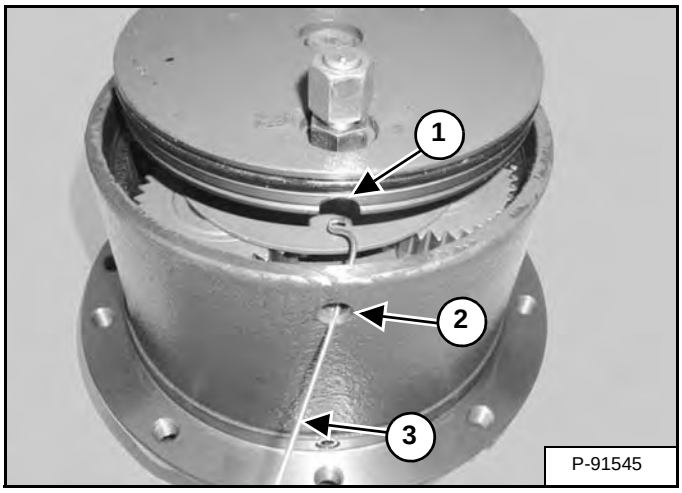
Assembly (Cont'd)

Figure 20-70-85



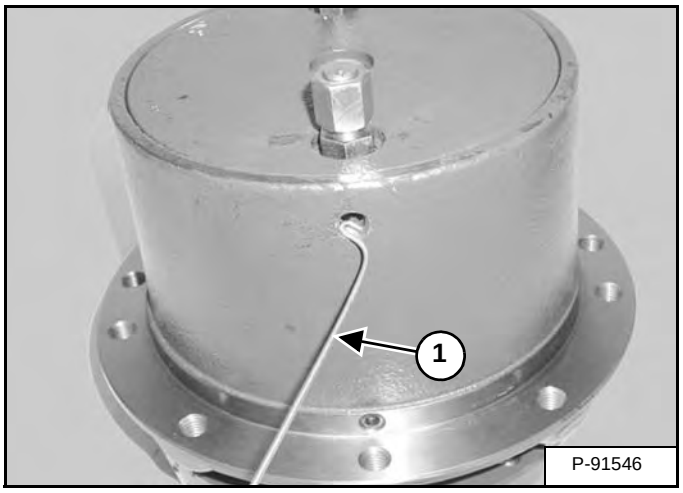
Install the O-ring (Item 1) **[Figure 20-70-85]** on the cover.

Figure 20-70-86



Install the cover with the cut out (Item 1) aligned with the hole (Item 2) in the housing. The lock wire (Item 3) is installed through the housing and the hook end of the wire must engage the cut out (Item 1) **[Figure 20-70-86]** on the cover.

Figure 20-70-87



Install the lock wire (Item 1) **[Figure 20-70-87]**.

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Assembly (Cont'd)

Figure 20-70-88

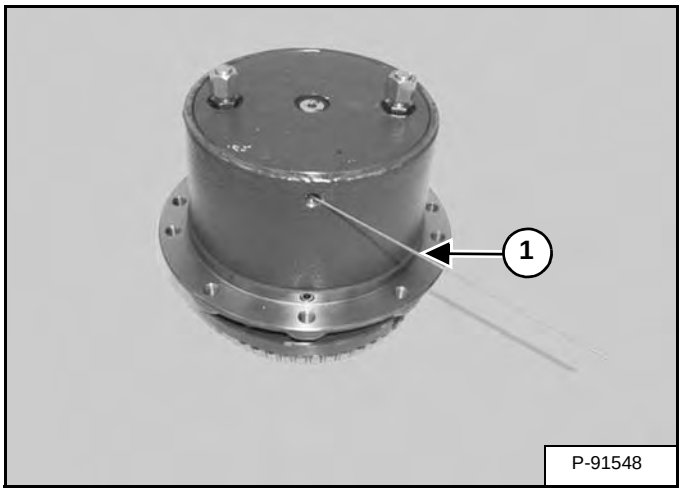
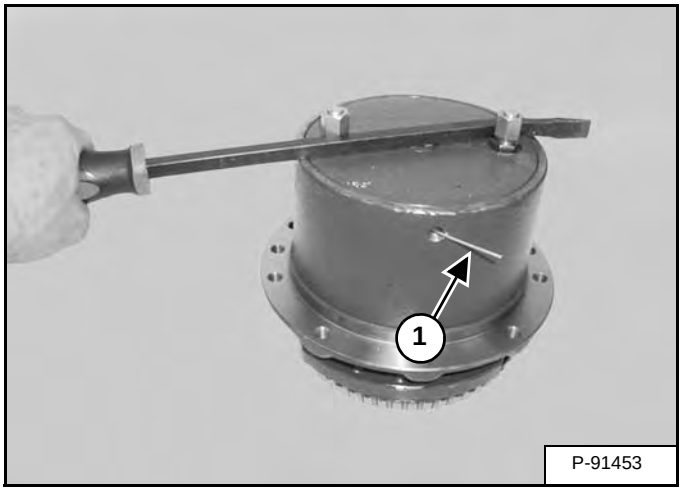
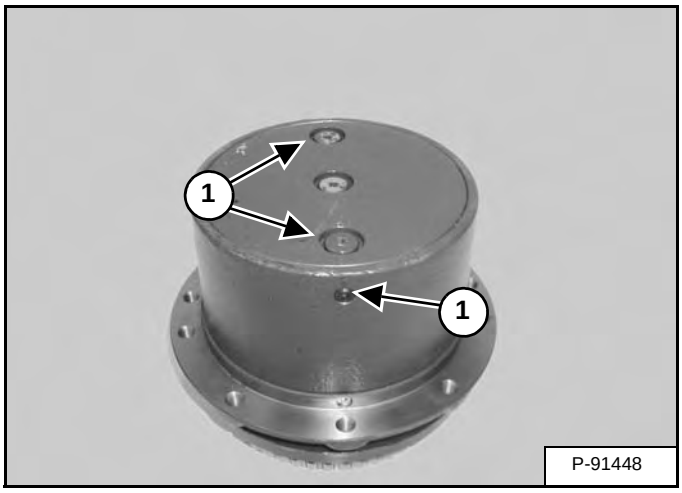


Figure 20-70-89



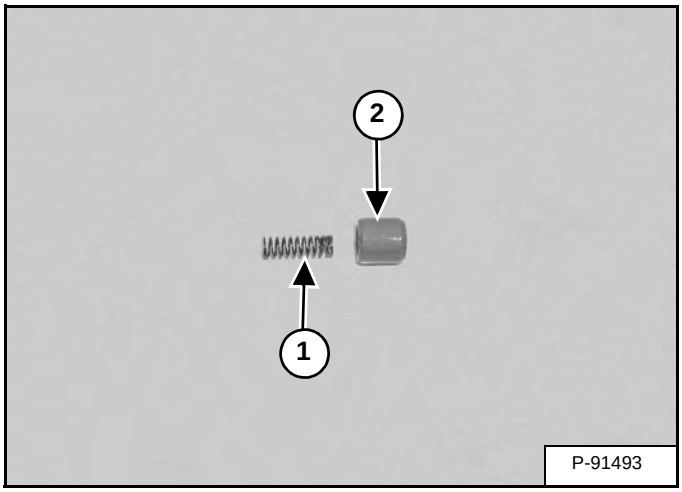
Rotate cover 3/4 of a turn clockwise. Cut off the remaining wire (Item 1) **[Figure 20-70-88]**. Continue to turn the cover until the wire (Item 1) **[Figure 20-70-89]** is inside the housing.

Figure 20-70-90



Install the plugs (Item 1) **[Figure 20-70-90]**. Tighten the plug to 6,8 - 8,8 N•m (4.4 - 7.2 ft-lb) torque.

Figure 20-70-91

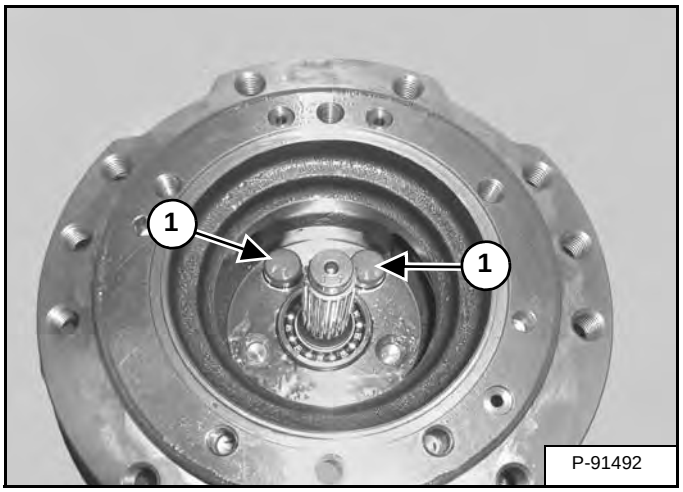


Install the springs (Item 1) in both of the pistons (Item 2) **[Figure 20-70-91]**.

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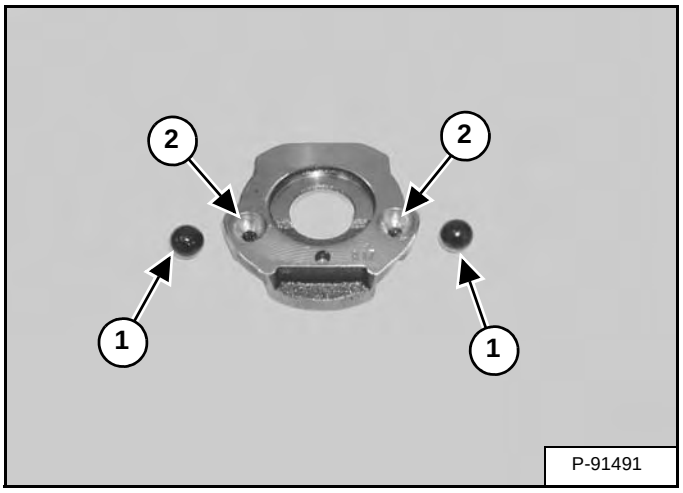
Assembly (Cont'd)

Figure 20-70-92



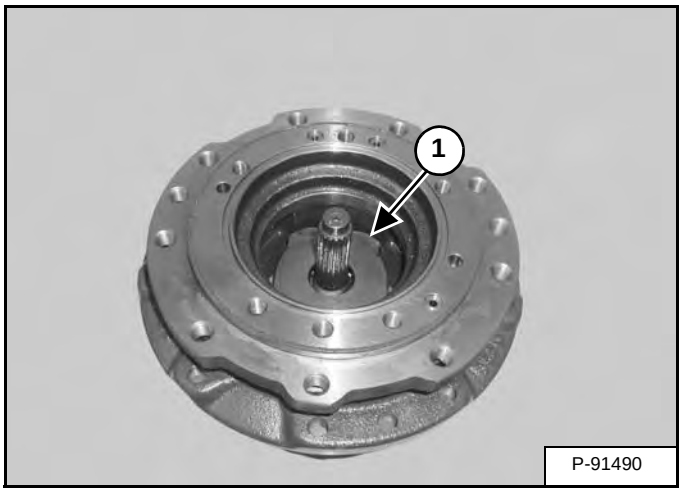
Install the piston / spring assembly (Item 1) **[Figure 20-70-92]** in the piston bores.

Figure 20-70-93



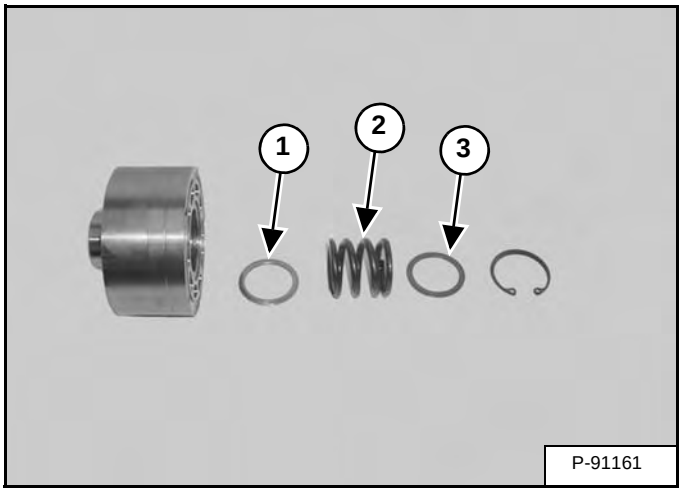
Install the steel balls (Item 1) in the sockets (Item 2) **[Figure 20-70-93]** on the swash plate.

Figure 20-70-94



Install the swash plate assembly (Item 1) **[Figure 20-70-94]** in the housing.

Figure 20-70-95

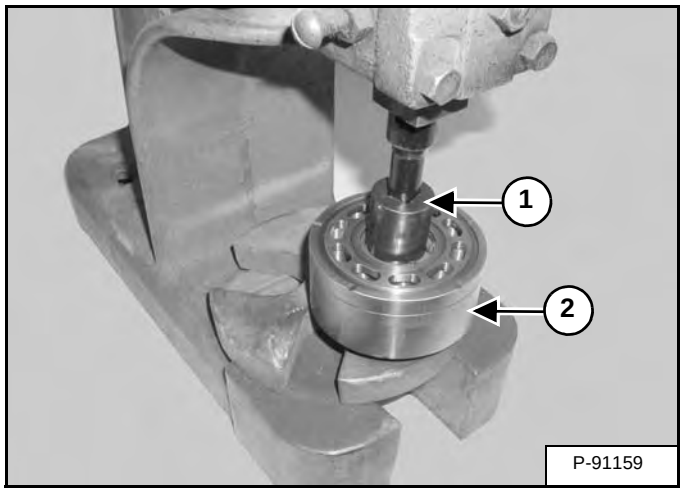


Install the bottom washer (Item 1), spring (Item 2) and top washer (Item 3) **[Figure 20-70-95]**.

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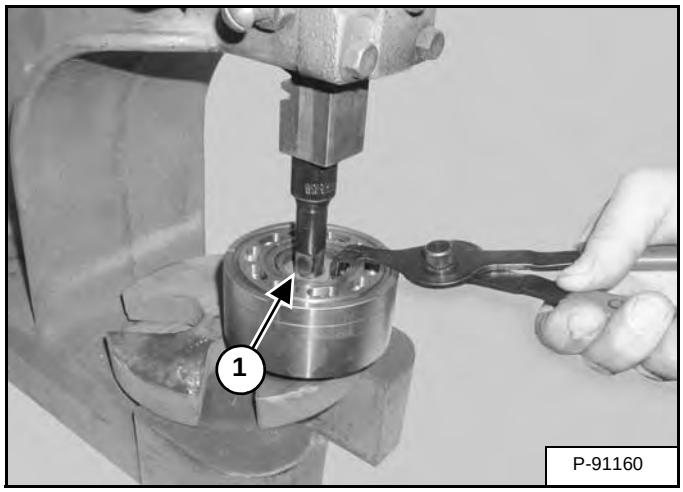
Assembly (Cont'd)

Figure 20-70-96



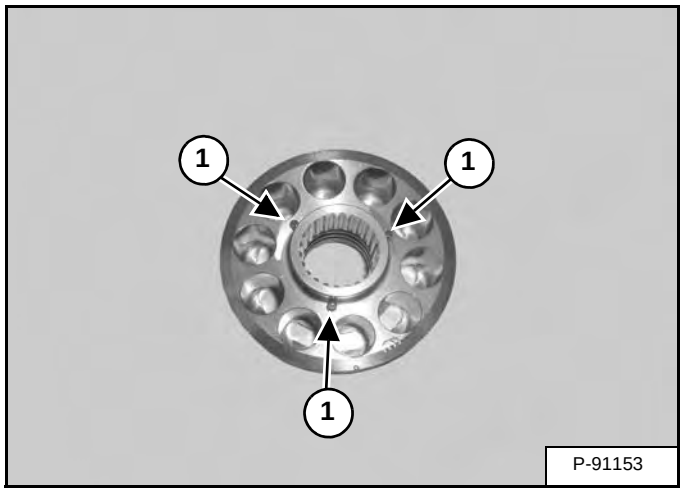
Using a press and an appropriate sized spacer (Item 1), compress the spring in the cylinder block (Item 2) **[Figure 20-70-96]**.

Figure 20-70-97



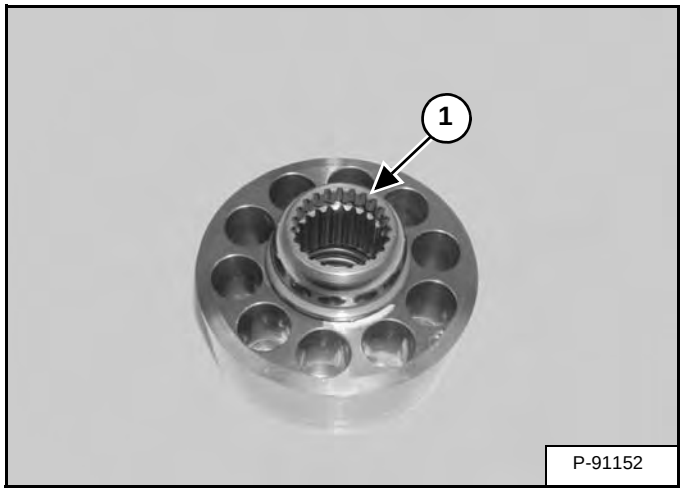
Install the snap ring (Item 1) **[Figure 20-70-97]** in the cylinder block. Remove the cylinder block from the press.

Figure 20-70-98



Install the three pins (Item 1) **[Figure 20-70-98]** in the cylinder block.

Figure 20-70-99

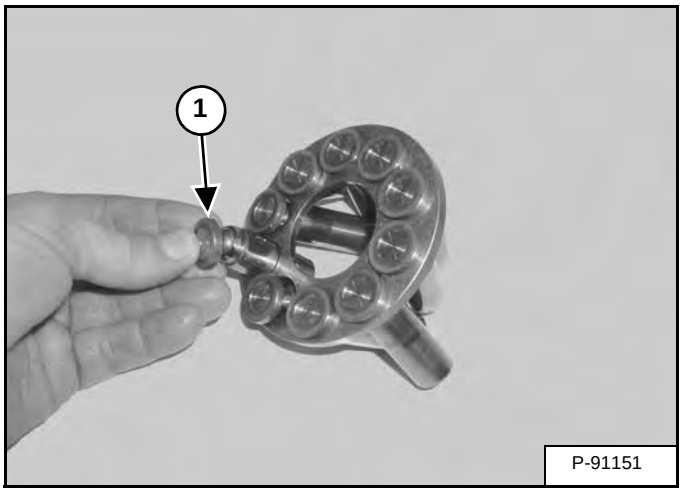


Install the ball guide (Item 1) **[Figure 20-70-99]**.

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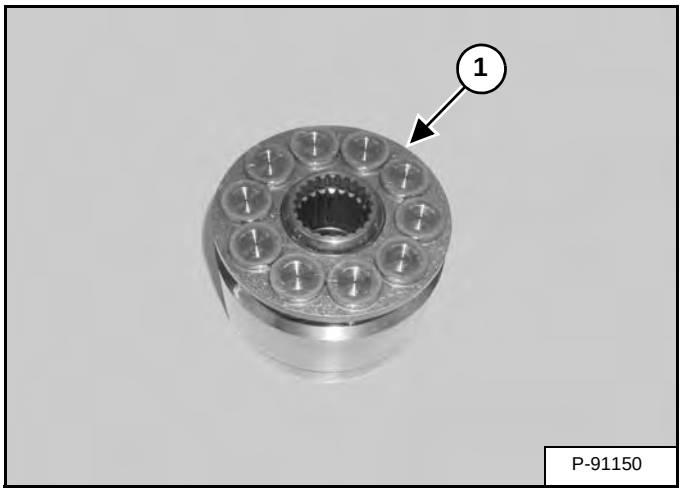
Assembly (Cont'd)

Figure 20-70-100



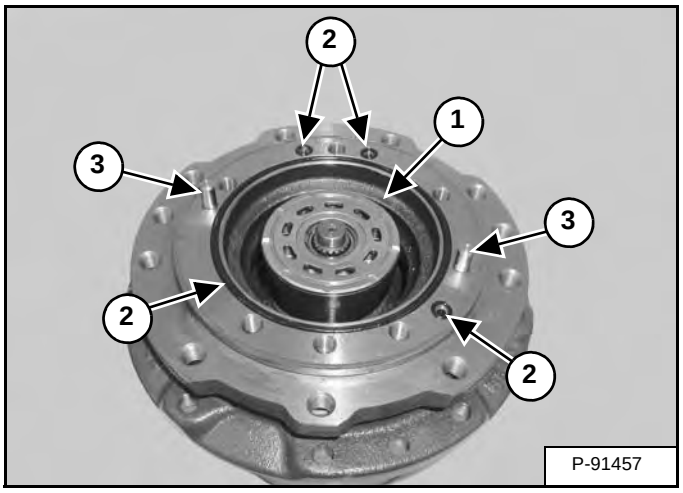
Install the piston assemblies (Item 1) **[Figure 20-70-100]** in the retainer.

Figure 20-70-101



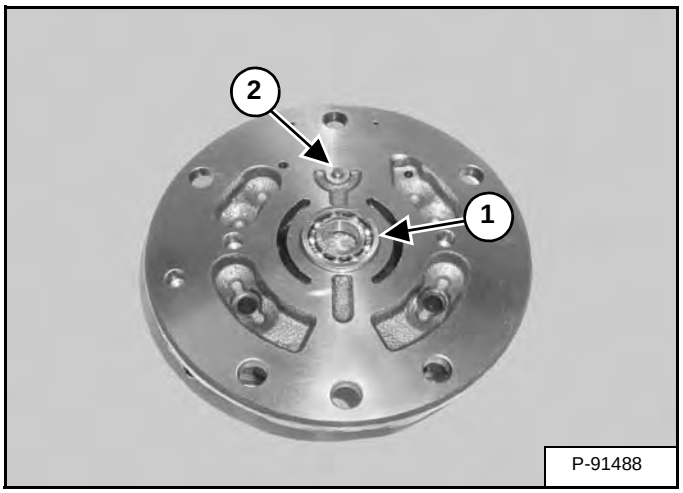
Install the piston assemblies / retainer (Item 1) **[Figure 20-70-101]** in the cylinder block.

Figure 20-70-102



Install the rotating group (Item 1) in the housing. Install the O-rings (Item 2) and dowel pins (Item 3) **[Figure 20-70-102]**.

Figure 20-70-103

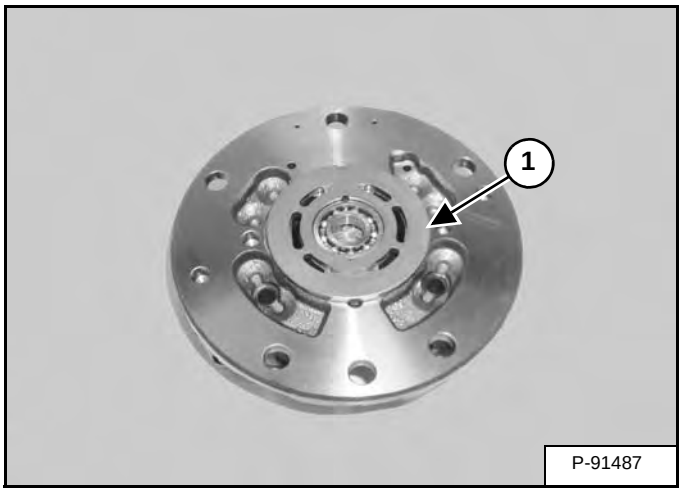


Install the bearing (Item 1). Install the pin (Item 2) **[Figure 20-70-103]**.

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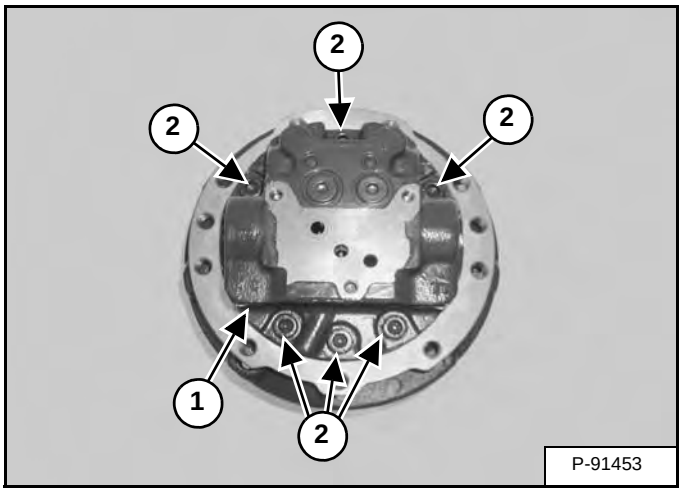
Assembly (Cont'd)

Figure 20-70-104



Install the valve plate (Item 1) **[Figure 20-70-104]**.

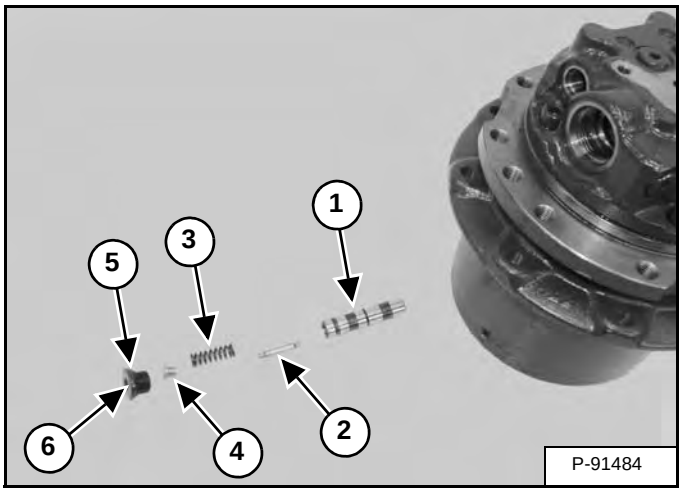
Figure 20-70-105



Install the end cap (Item 1) and bolts (Item 2) **[Figure 20-70-105]**.

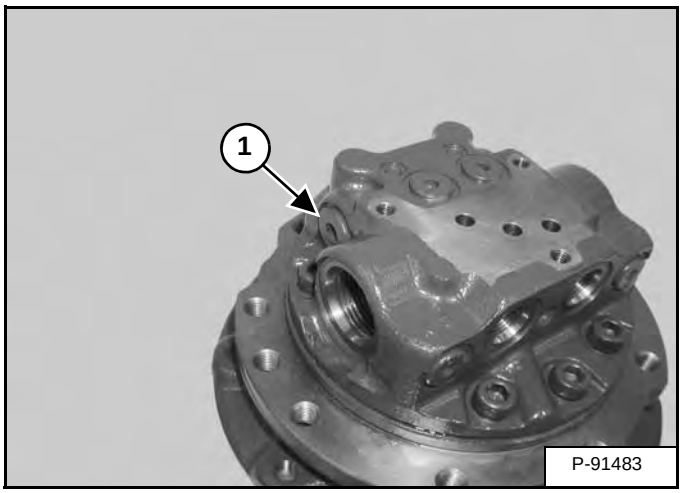
Tighten the bolts to 58,8 - 68,6 N•m (43.4 - 50.5 ft-lb) torque.

Figure 20-70-106



Install the outer spool (Item 1), inner spool (Item 2), spring (Item 3) and spring seat (Item 4). Install the O-ring (Item 5) on the plug (Item 6) **[Figure 20-70-106]**.

Figure 20-70-107

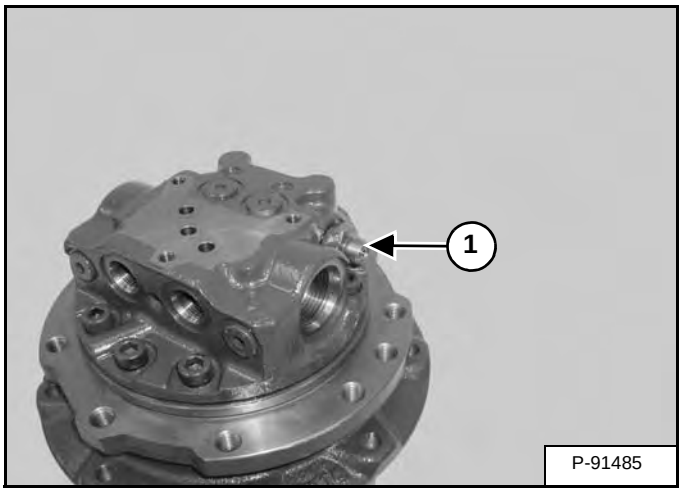


Install the plug (Item 1) **[Figure 20-70-107]**. Tighten the plug to 49 - 58,8 N•m (36.2 - 43.4 ft-lb) torque.

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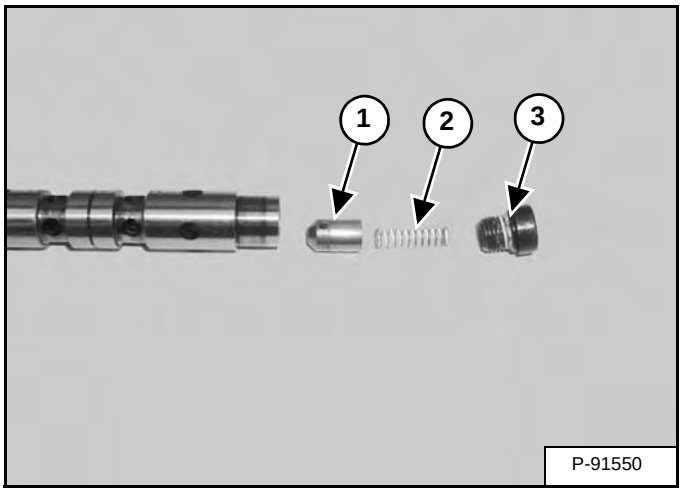
Assembly (Cont'd)

Figure 20-70-108



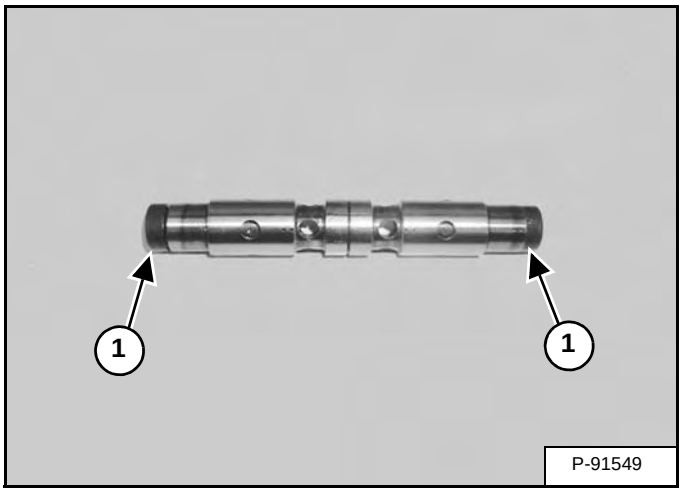
Install the fitting (Item 1) **[Figure 20-70-108]**.

Figure 20-70-109



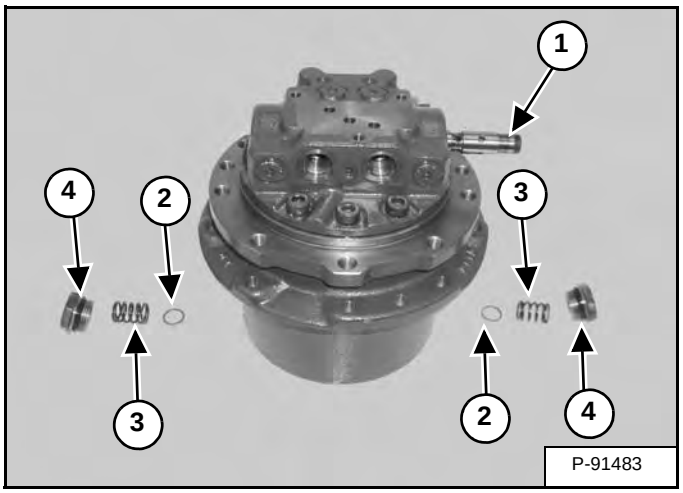
Install the check valves (Item 1) and springs (Item 2) in both ends of the spool. Install the O-rings (Item 3) **[Figure 20-70-109]** on the plugs.

Figure 20-70-110



Apply Loctite® 271 to the plug threads and install the plugs (Item 1) **[Figure 20-70-110]**. Tighten the plugs to 21,8 - 34,4 N•m (16 - 25 ft-lb) torque.

Figure 20-70-111

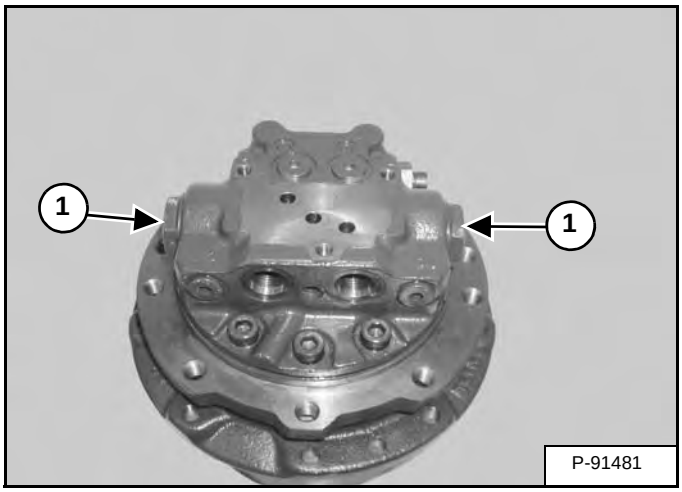


Install the spool (Item 1). Install the spring seats (Item 2) and springs (Item 3). Install the O-rings (Item 4) **[Figure 20-70-111]** on the plugs.

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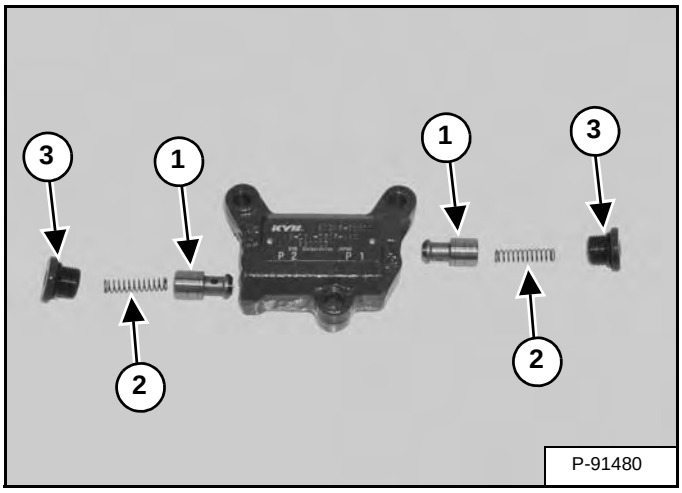
Assembly (Cont'd)

Figure 20-70-112



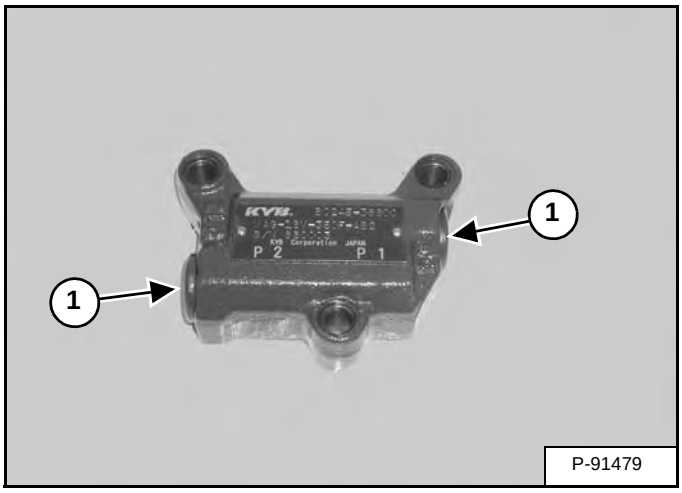
Install the plugs (Item 1) **[Figure 20-70-112]**. Tighten the plugs to 235 - 245 N•m (173 - 181 ft-lb) torque.

Figure 20-70-113



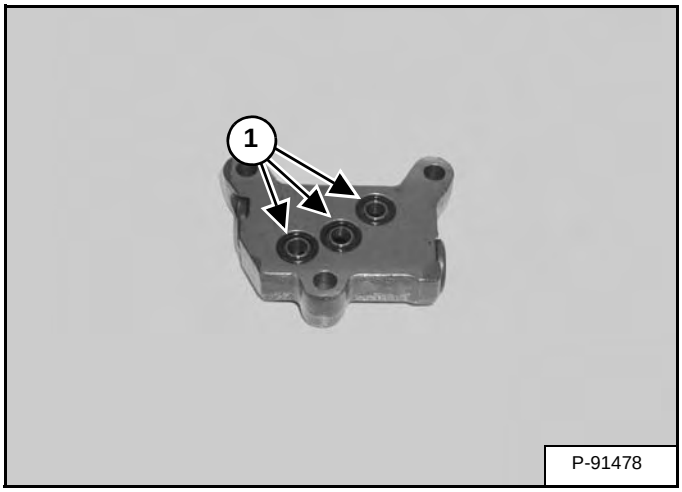
Install the poppets (Item 1) and springs (Item 2). Install the O-rings (Item 3) **[Figure 20-70-113]** on the plugs.

Figure 20-70-114



Install the plugs (Item 1) **[Figure 20-70-114]**. Tighten the plugs to 49 - 59 N•m (36 - 43 ft-lb) torque.

Figure 20-70-115

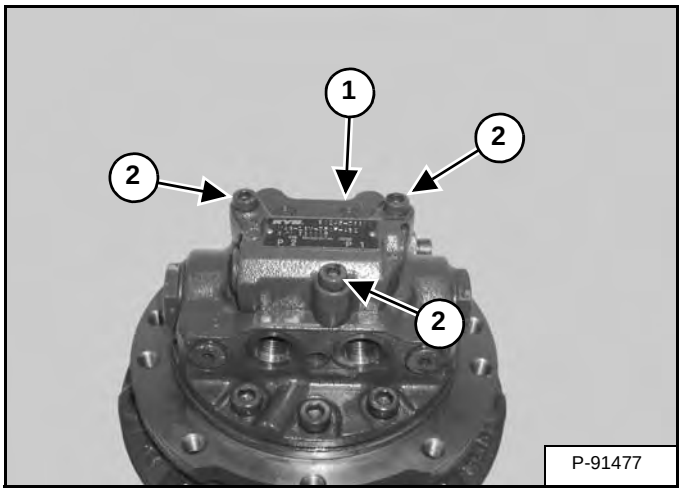


Install the O-rings (Item 1) **[Figure 20-70-115]**.

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Assembly (Cont'd)

Figure 20-70-116



Install the valve (Item 1) on the motor. Install the bolts (Item 2) **[Figure 20-70-116]**. Tighten the bolts to 35 - 39 N•m (26 - 29 ft-lb) torque.

Dealer Copy -- Not for Resale

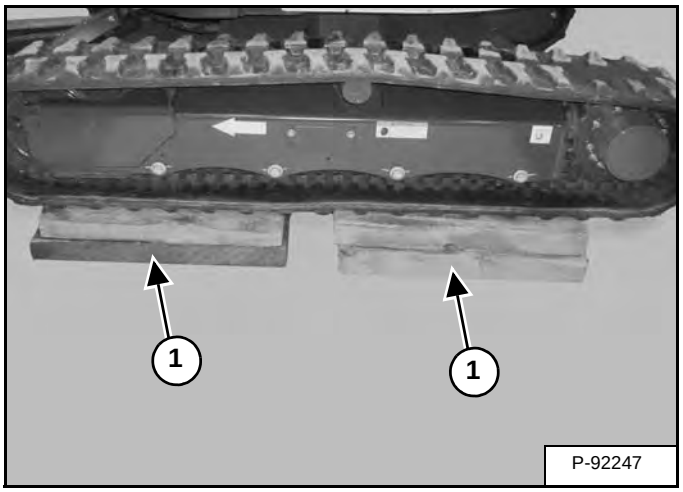


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SWIVEL JOINT

Removal And Installation

Figure 20-80-1

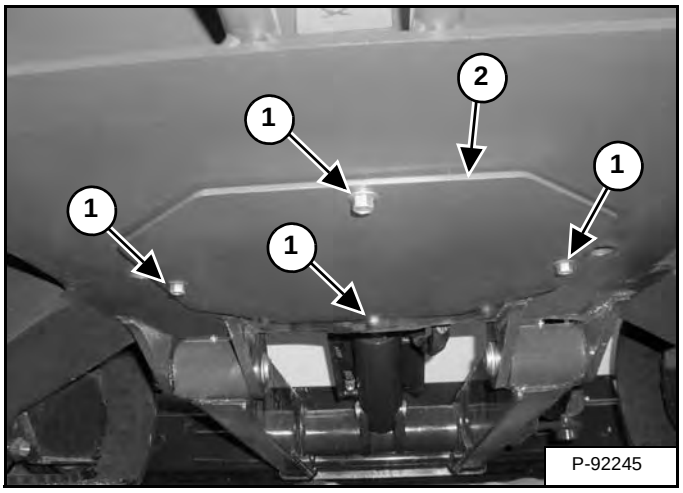


Block the excavator up as shown (Item 1) **[Figure 20-80-1]**.

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

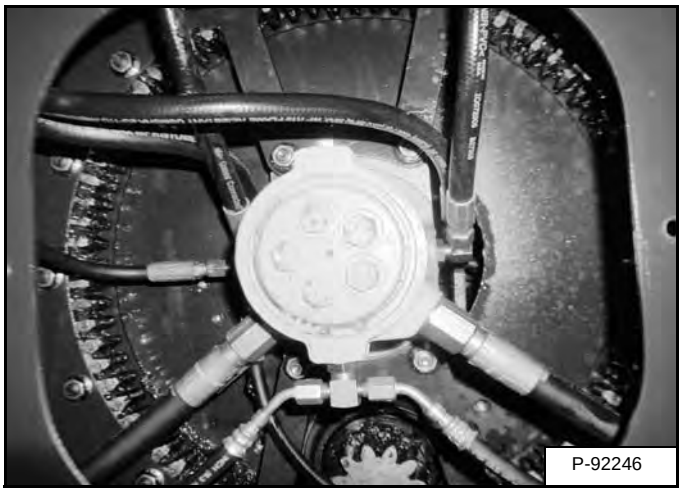
Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-130-5.)

Figure 20-80-2



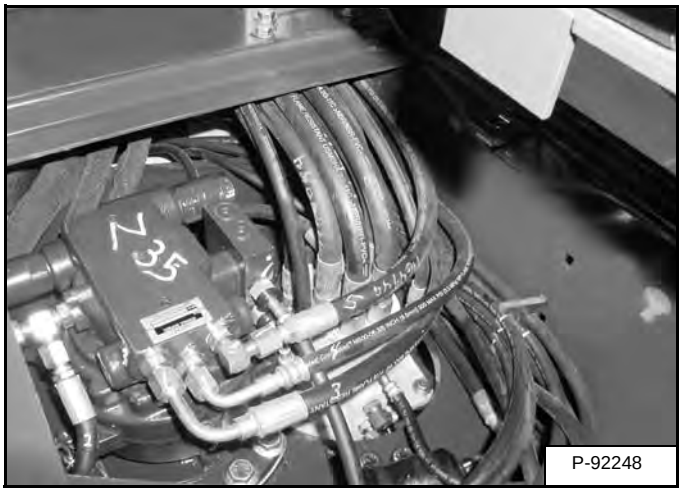
Remove the four bolts (Item 1) and remove the cover (Item 2) **[Figure 20-80-2]**.

Figure 20-80-3



Mark and remove the hoses from the bottom of the swivel joint **[Figure 20-80-3]**.

Figure 20-80-4

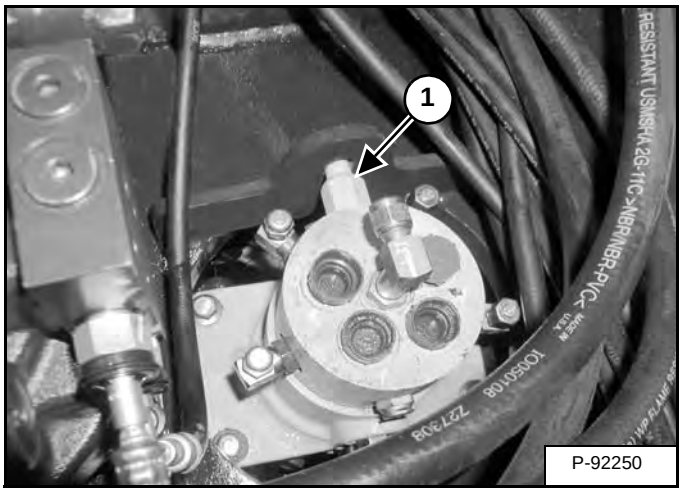


Remove the hoses from the top and side of the swivel joint **[Figure 20-80-4]**.

Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

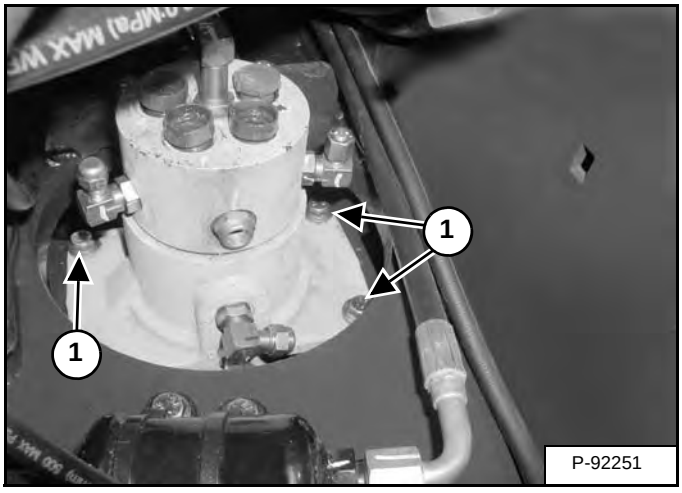
Figure 20-80-5



Remove the swivel stop (Item 1) **[Figure 20-80-5]**.

Installation: Apply Loctite® 242 to the swivel stop threads before installation. Tighten the stop to 125 - 140 N•m (90 - 100 ft-lb) torque.

Figure 20-80-6



Remove the four bolts (Item 1) **[Figure 20-80-6]** and nuts from the swivel joint.

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

Lower the swivel joint out the bottom of the excavator.

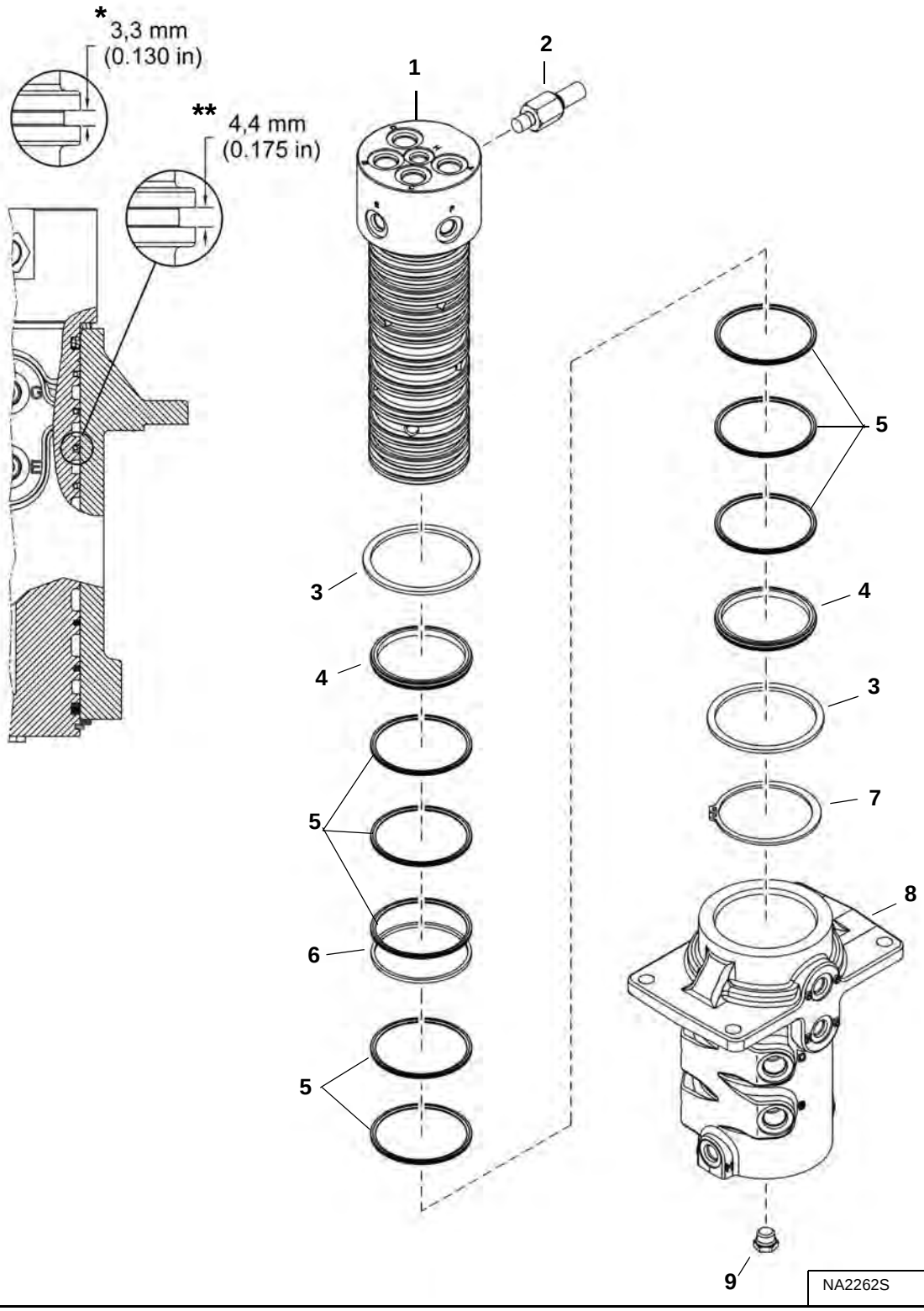
Dealer Copy -- Not for Resale

Parts Identification

1. Rotor
2. Stop
3. Wear Ring
4. Crown Seal
5. Seal
6. Back-up Ring
7. Snap Ring
8. Housing
9. Plug

***** Early rotors without back-up ring

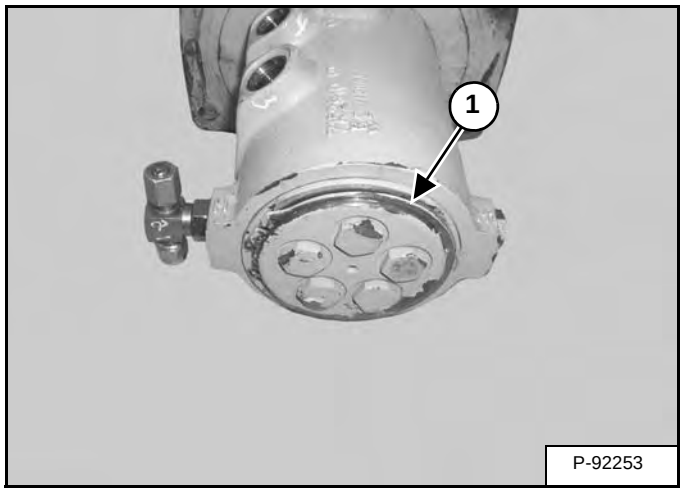
****** Late rotors with back-up ring.



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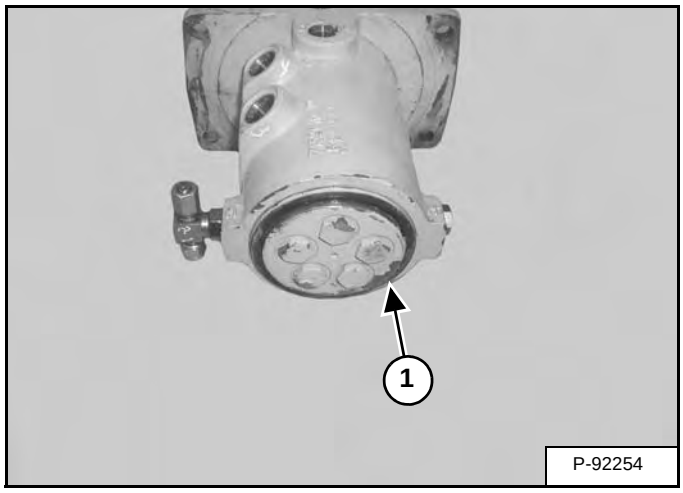
Disassembly And Assembly

Figure 20-80-7



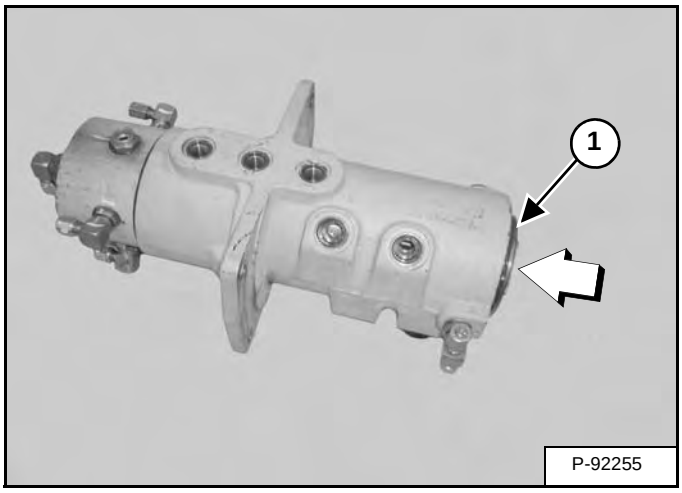
Remove the snap ring (Item 1) **[Figure 20-80-7]**.

Figure 20-80-8



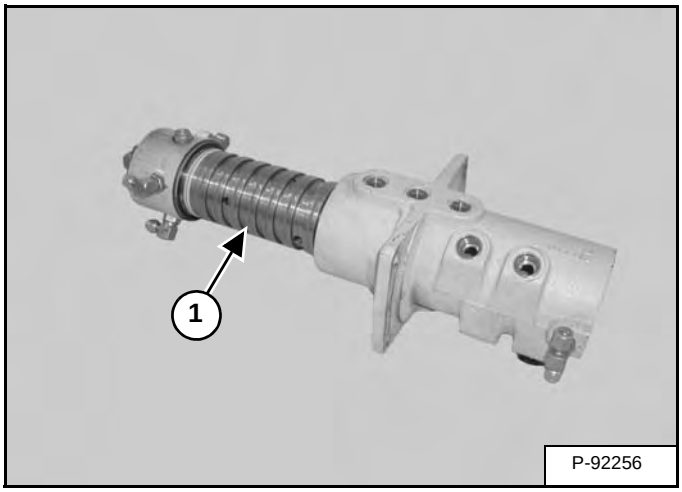
Remove the nylon ring (Item 1) **[Figure 20-80-8]**.

Figure 20-80-9



Tap the rotor (Item 1) **[Figure 20-80-9]** out of the housing.

Figure 20-80-10

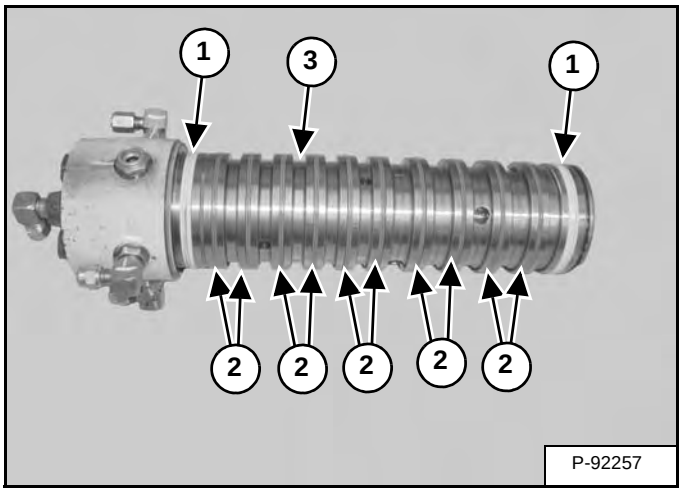


Continue to remove the rotor (Item 1) **[Figure 20-80-10]** until the rotor is out of the housing.

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Disassembly And Assembly (Cont'd)

Figure 20-80-11



Remove the crown seals (Item 1) and remove the seals (Item 2) **[Figure 20-80-11]**.

Remove the back-up rings (Item 3) **[Figure 20-80-11]** if equipped.

NOTE: The back-up ring is only installed on rotors with a grove dimension of 4,4 mm (0.175 in) on the third seal groove.

Assembly: Heat the crown seals and seals in hydraulic oil for three minutes at 54°C (130°F) before installing the seals on the rotor.

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Dealer Copy -- Not for Resale

SWING MOTOR

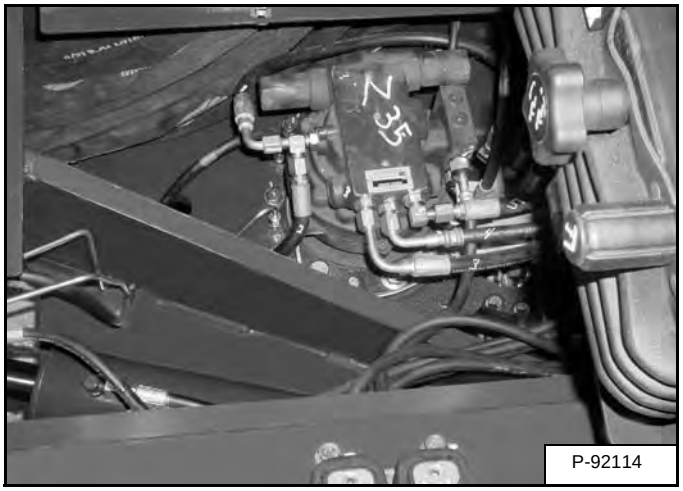
Removal And Installation

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-130-5.)

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

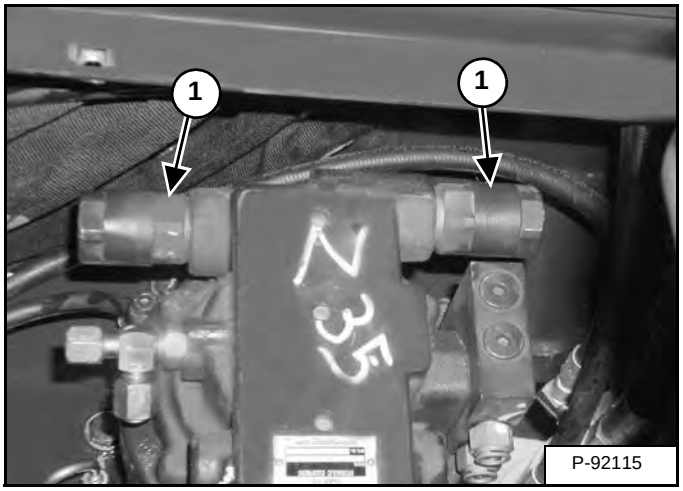
Remove the tool box. (See Removal And Installation on Page 40-230-1.)

Figure 20-90-1



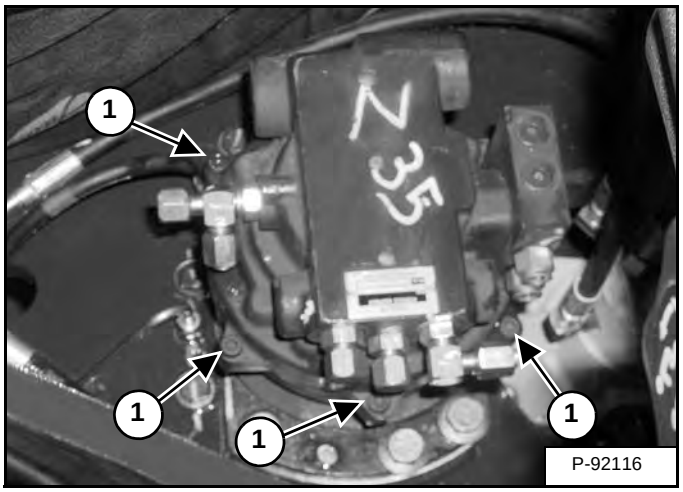
Remove the hoses from the swing motor **[Figure 20-90-1]**.

Figure 20-90-2



Remove the counterbalance valves (Item 1) **[Figure 20-90-2]**.

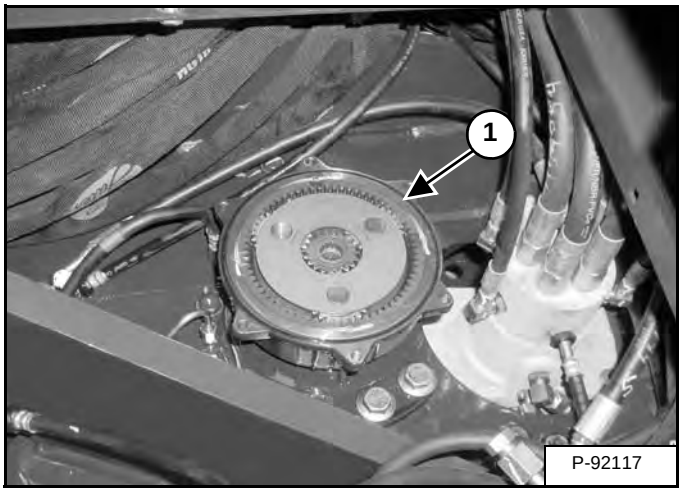
Figure 20-90-3



Remove the six bolts (Item 1) **[Figure 20-90-3]**.

Installation: Tighten the bolts to 35 - 39 N•m (25.5 - 28.5 ft-lb) torque.

Figure 20-90-4

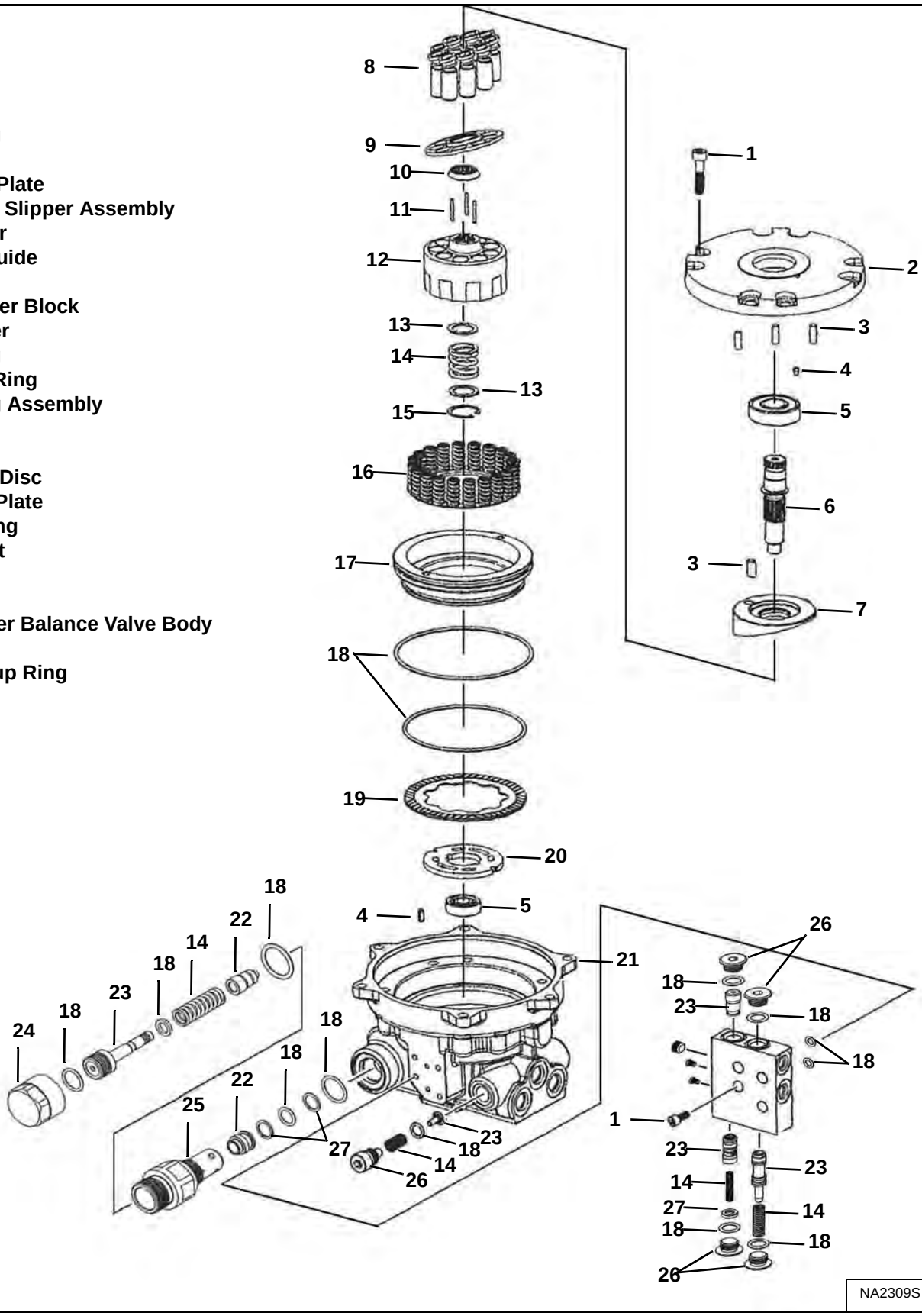


Remove the swing motor. Remove the O-ring (Item 1) **[Figure 20-90-4]** from the swing motor drive carrier.

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Parts Identification

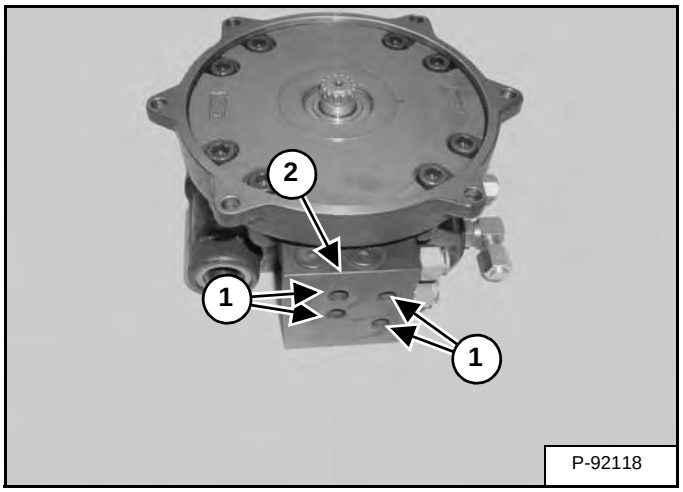
1. Bolt
2. Cover
3. Pin
4. Screen
5. Bearing
6. Shaft
7. Swash Plate
8. Piston / Slipper Assembly
9. Retainer
10. Ball Guide
11. Pin
12. Cylinder Block
13. Washer
14. Spring
15. Snap Ring
16. Spring Assembly
17. Piston
18. O-ring
19. Brake Disc
20. Valve Plate
21. Housing
22. Poppet
23. Spool
24. Cap
25. Counter Balance Valve Body
26. Plug
27. Back-up Ring



Dealer Copy -- Not for Resale

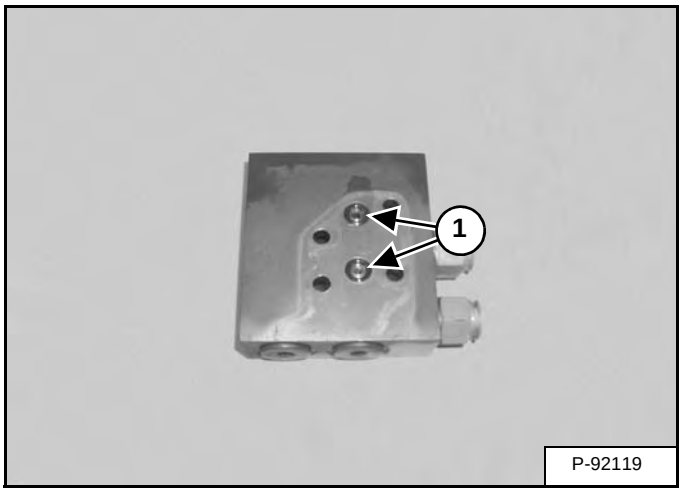
Disassembly And Assembly

Figure 20-90-5



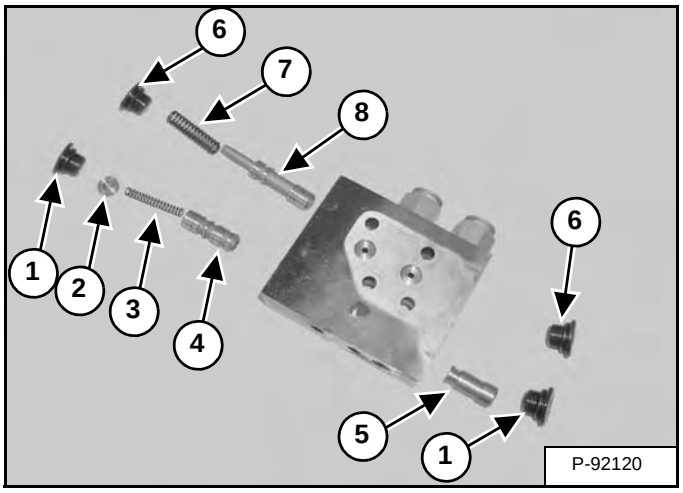
Remove the bolts (Item 1) and remove the counter balance valve (Item 2) **[Figure 20-90-5]**.

Figure 20-90-6



Remove the O-rings (Item 1) **[Figure 20-90-6]**.

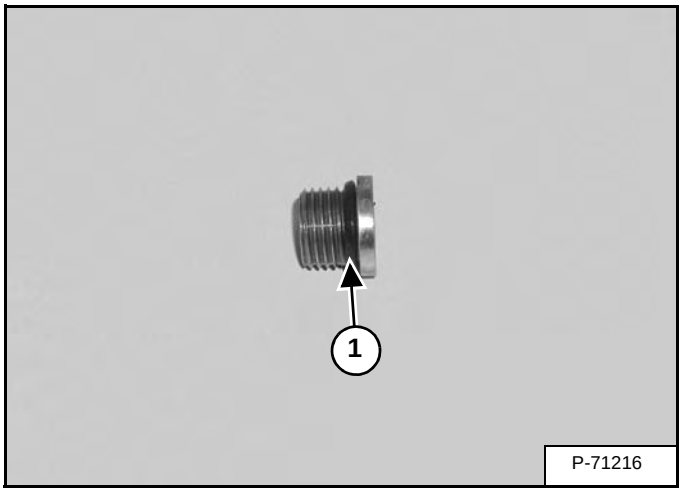
Figure 20-90-7



Remove the plugs (Item 1). Remove the spring seat (Item 2), spring (Item 3), spool (Item 4) and spacer (Item 5) **[Figure 20-90-7]**.

Remove the plugs (Item 6), spring (Item 7) and spool (Item 8) **[Figure 20-90-7]**.

Figure 20-90-8

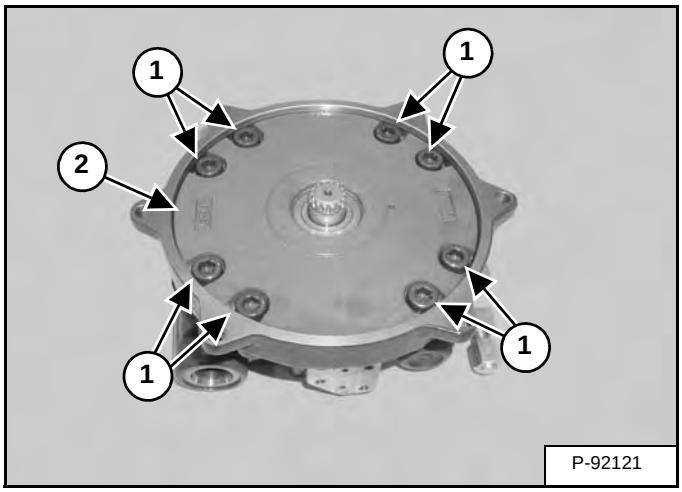


Remove the O-rings (Item 1) **[Figure 20-90-8]** from the plugs.

Dealer Copy -- Not for Resale

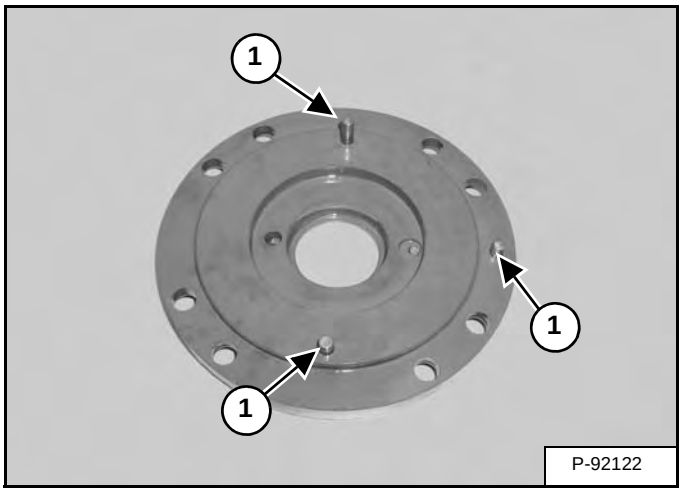
Disassembly And Assembly (Cont'd)

Figure 20-90-9



Remove the bolts (Item 1) and cover (Item 2) **[Figure 20-90-9]**.

Figure 20-90-10



Remove the dowel pins (Item 1) **[Figure 20-90-10]**.

Figure 20-90-11

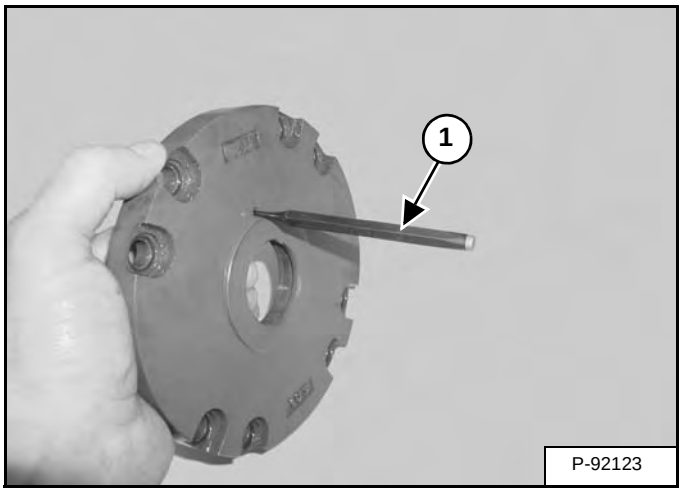
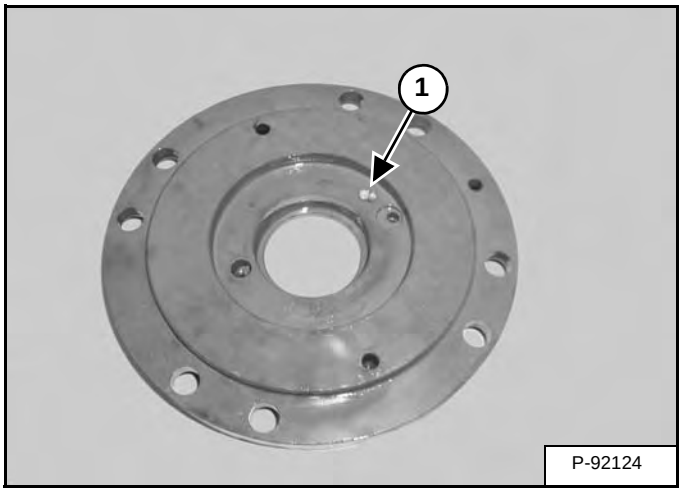


Figure 20-90-12

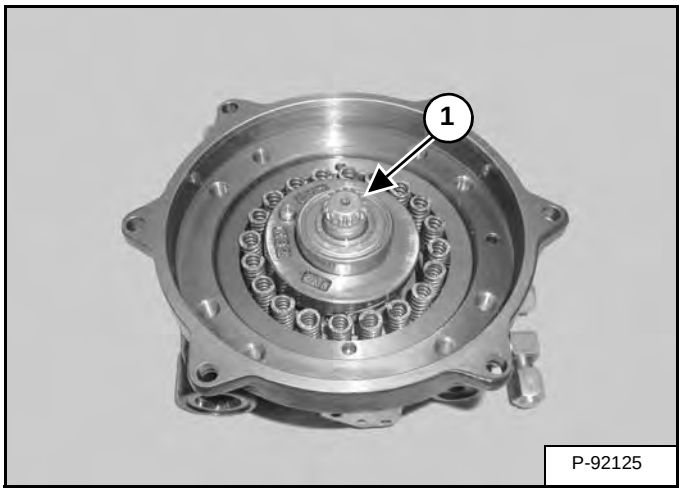


Use a punch (Item 1) **[Figure 20-90-11]** to push the screen (Item 1) **[Figure 20-90-12]** out of the cover.

Dealer Copy -- Not for Resale

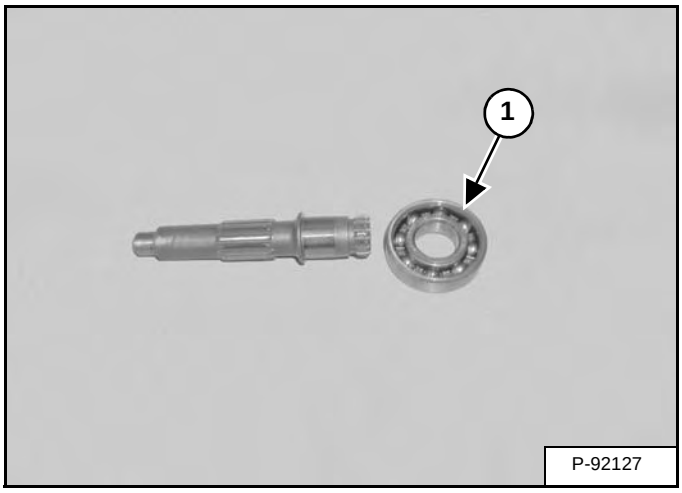
Disassembly And Assembly (Cont'd)

Figure 20-90-13



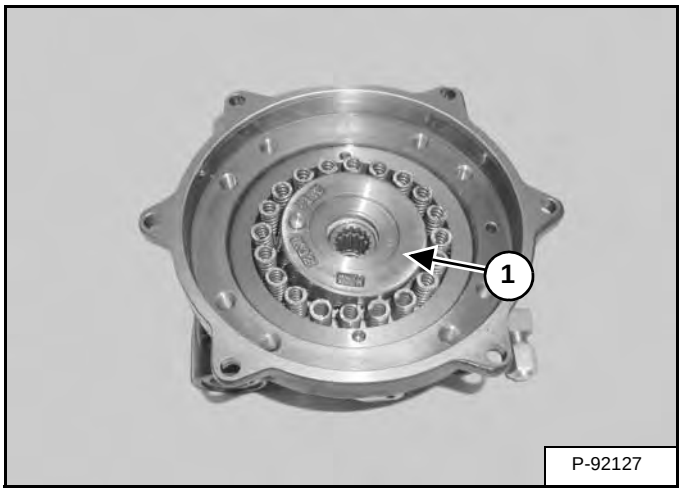
Remove the shaft / bearing assembly (Item 1) **[Figure 20-90-13]**.

Figure 20-90-14



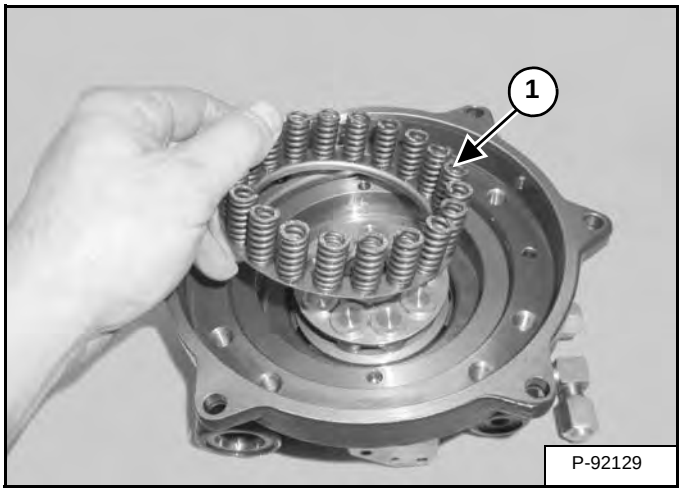
Remove the bearing (Item 1) **[Figure 20-90-14]** from the shaft.

Figure 20-90-15



Remove the swash plate (Item 1) **[Figure 20-90-15]**.

Figure 20-90-16

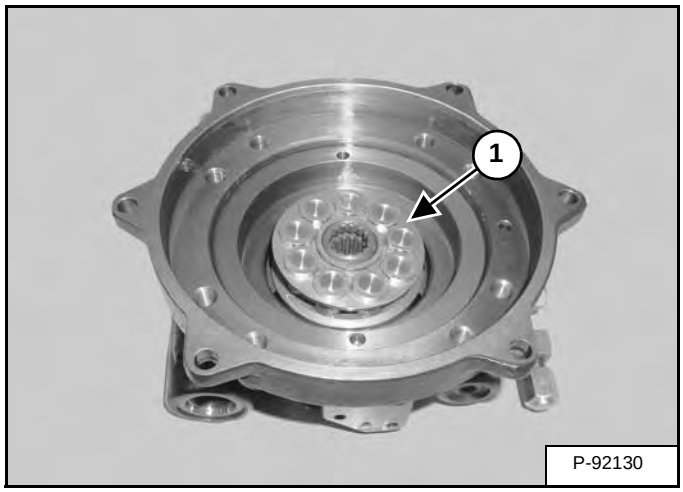


Remove the spring assembly (Item 1) **[Figure 20-90-16]**.

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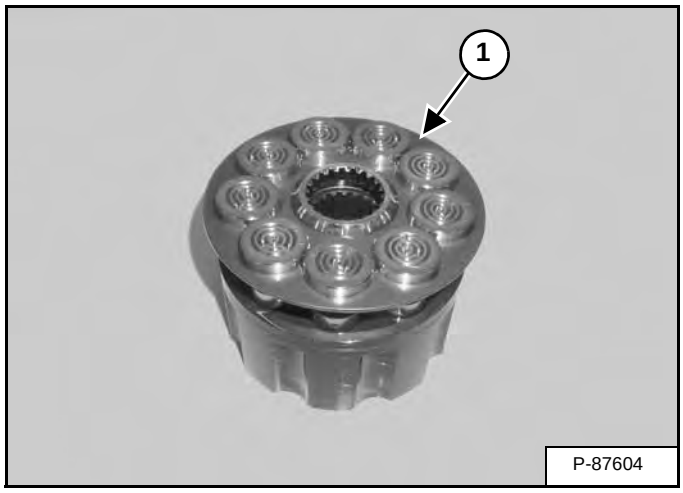
Disassembly And Assembly (Cont'd)

Figure 20-90-17



Remove the rotating group (Item 1) **[Figure 20-90-17]**.

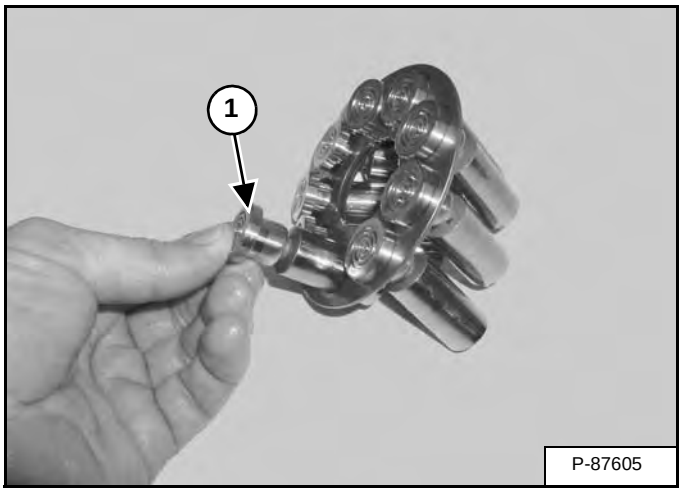
Figure 20-90-18



Remove the piston assemblies / retainer (Item 1) **[Figure 20-90-18]** from the cylinder block.

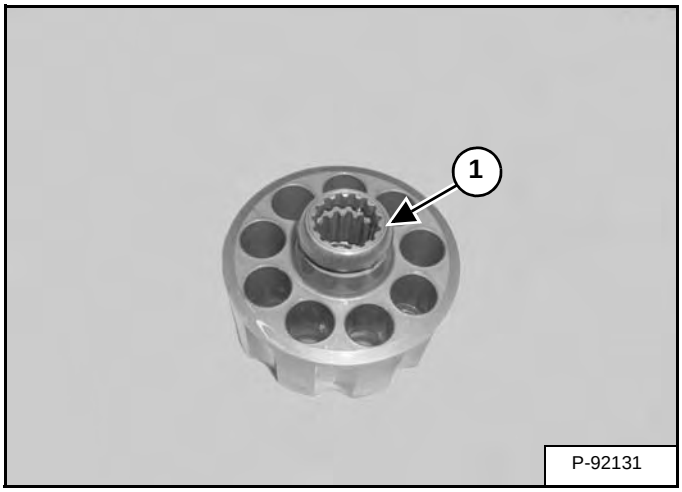
NOTE: It is not important that the pistons are installed in the original bores.

Figure 20-90-19



Remove the piston assemblies (Item 1) **[Figure 20-90-19]** from the retainer.

Figure 20-90-20

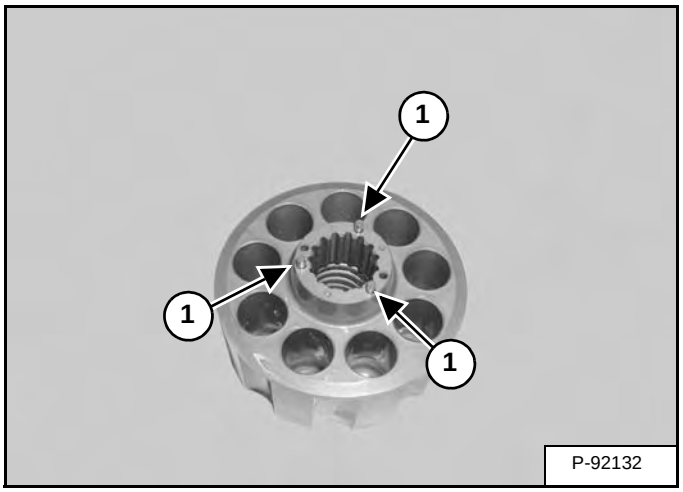


Remove the ball guide (Item 1) **[Figure 20-90-20]**.

Dealer Copy -- Not for Resale

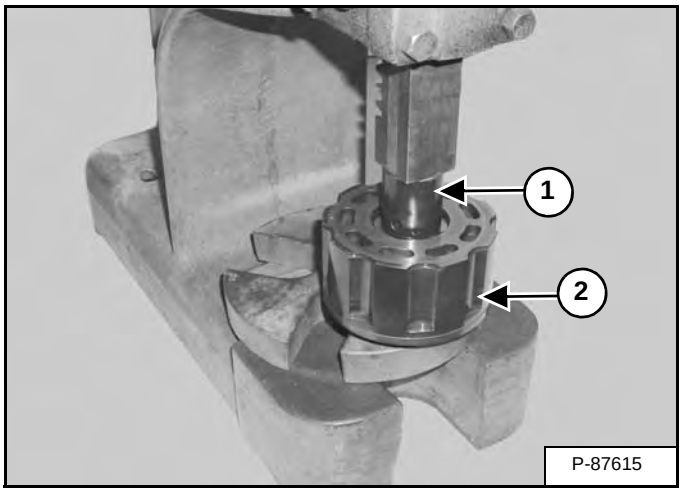
Disassembly And Assembly (Cont'd)

Figure 20-90-21



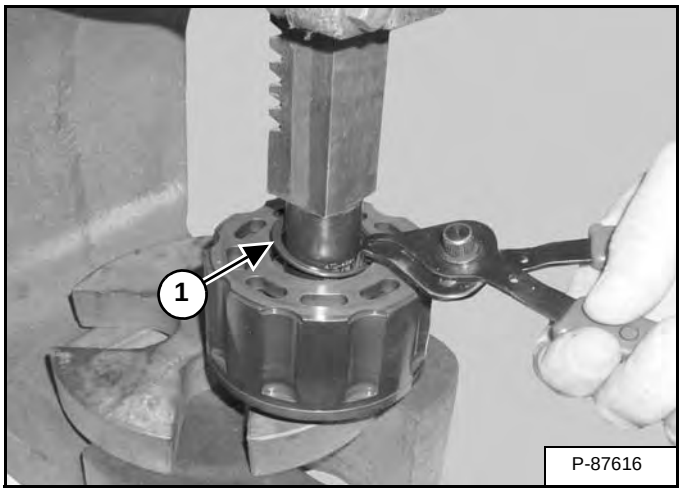
Remove the three pins (Item 1) **[Figure 20-90-21]**.

Figure 20-90-22



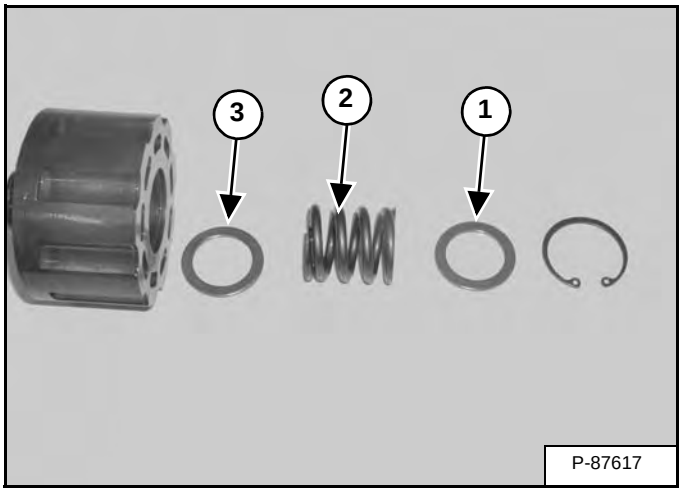
Using a press and an appropriate sized spacer (Item 1), compress the spring in the cylinder block (Item 2) **[Figure 20-90-22]**.

Figure 20-90-23



Remove the snap ring (Item 1) **[Figure 20-90-23]**. Remove the cylinder block from the press.

Figure 20-90-24

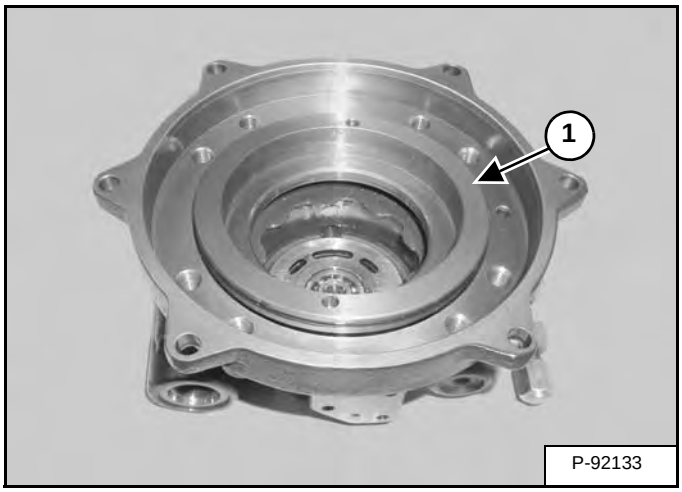


Remove the top washer (Item 1), spring (Item 2) and bottom washer (Item 3) **[Figure 20-90-24]**.

Dealer Copy -- Not for Resale

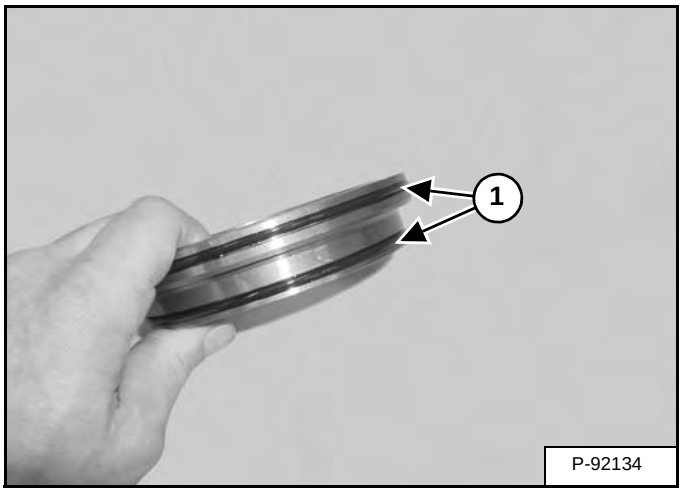
Disassembly And Assembly (Cont'd)

Figure 20-90-25



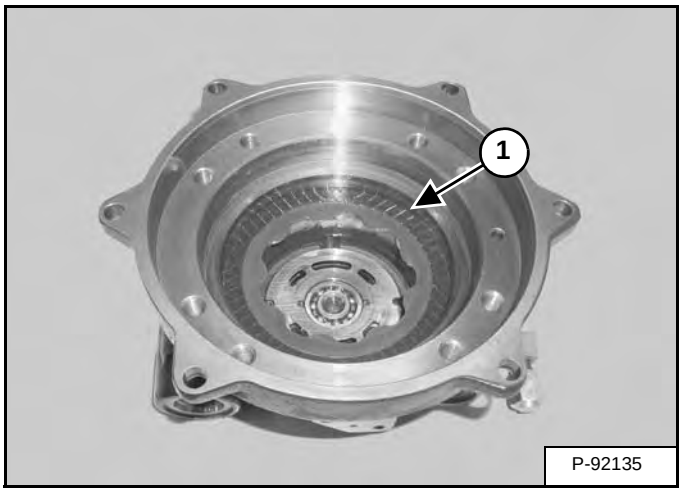
Remove the brake piston (Item 1) **[Figure 20-90-25]**.

Figure 20-90-26



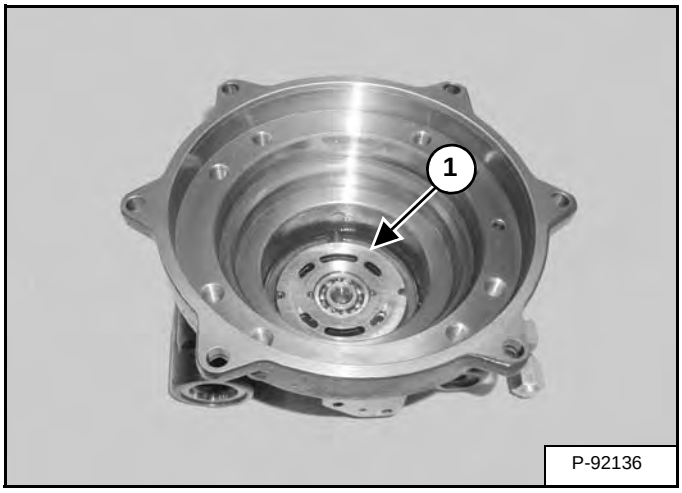
Remove the O-rings (Item 1) **[Figure 20-90-26]**.

Figure 20-90-27



Remove the brake disk (Item 1) **[Figure 20-90-27]**.

Figure 20-90-28

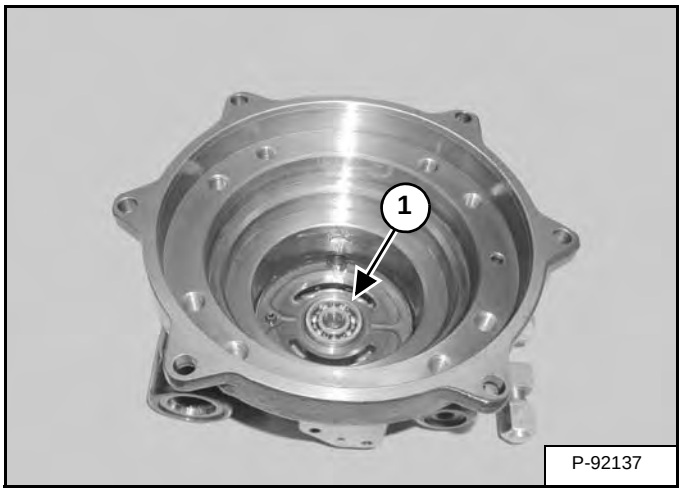


Remove the valve plate (Item 1) **[Figure 20-90-28]**.

Dealer Copy -- Not for Resale

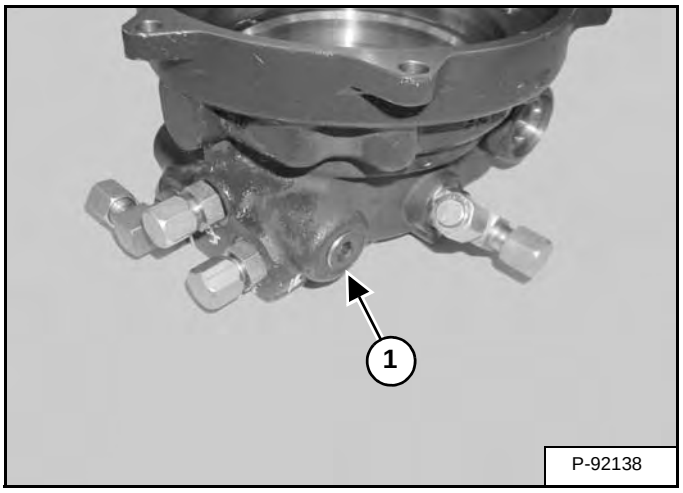
Disassembly And Assembly (Cont'd)

Figure 20-90-29



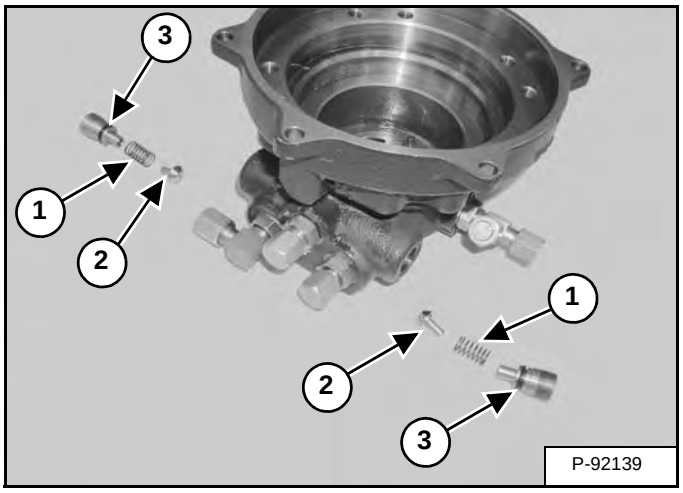
Remove the bearing (Item 1) **[Figure 20-90-29]**.

Figure 20-90-30



Remove the plug (Item 1) **[Figure 20-90-30]** from both sides of the housing.

Figure 20-90-31



Remove the spring (Item 1) and poppet (Item 2). Remove the O-rings (Item 3) **[Figure 20-90-31]**.

Dealer Copy -- Not for Resale



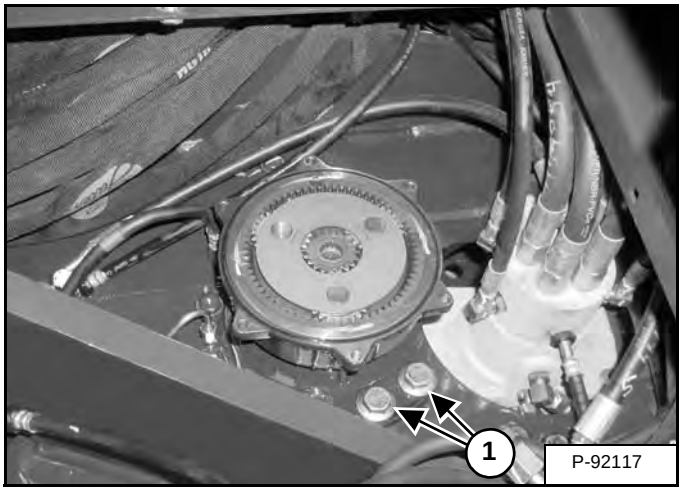
Dealer Copy -- Not for Resale

SWING MOTOR (DRIVE CARRIER)

Removal And Installation

Remove the swing motor. (See Removal And Installation on Page 20-90-1.)

Figure 20-91-1



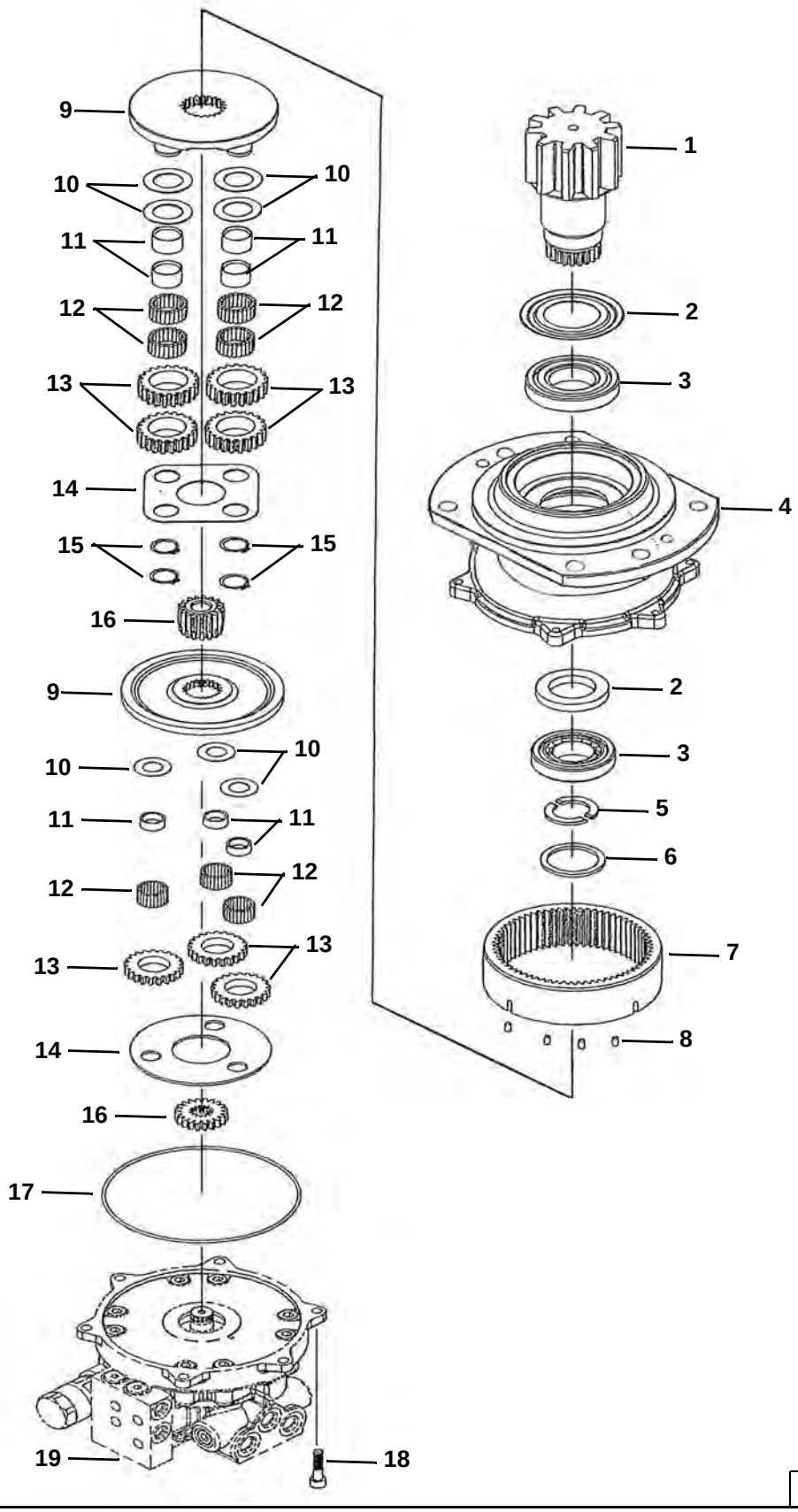
Remove the six bolts (Item 1) **[Figure 20-91-1]** and remove the carrier.

Installation: Tighten the bolts to 255 - 285 N•m (188 - 210 ft-lb) torque.

Dealer Copy -- Not for Resale

Parts Identification

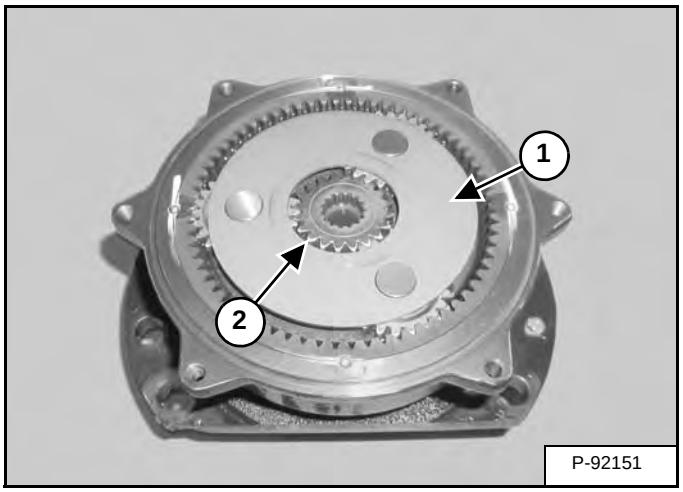
1. Shaft
2. Seal
3. Bearing
4. Housing
5. Split Ring
6. Retainer
7. Internal Gear
8. Pin
9. Carrier
10. Thrust Washer
11. Race
12. Bearing
13. Planetary Gear
14. Thrust Plate
15. Snap Ring
16. Sun Gear
17. O-ring
18. Bolt
19. Swing Motor



Dealer Copy -- Not for Resale

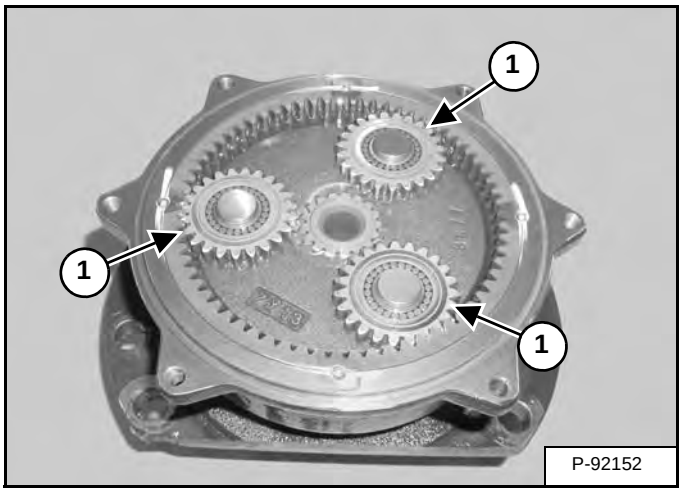
Disassembly And Assembly

Figure 20-91-2



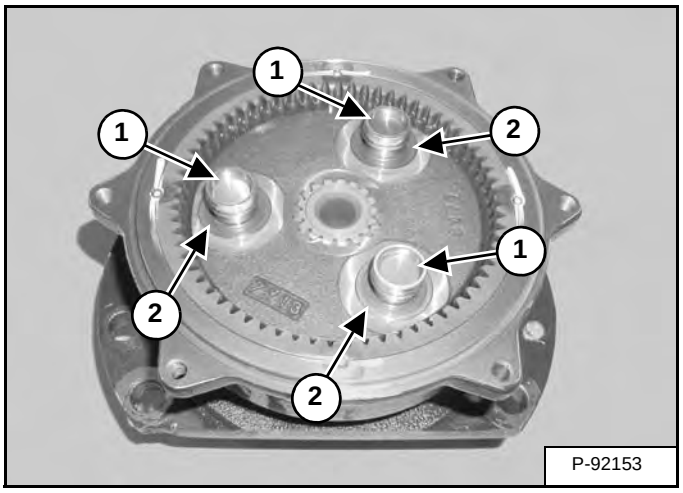
Remove the thrust plate (Item 1) and sun gear (Item 2) **[Figure 20-91-2]**.

Figure 20-91-3



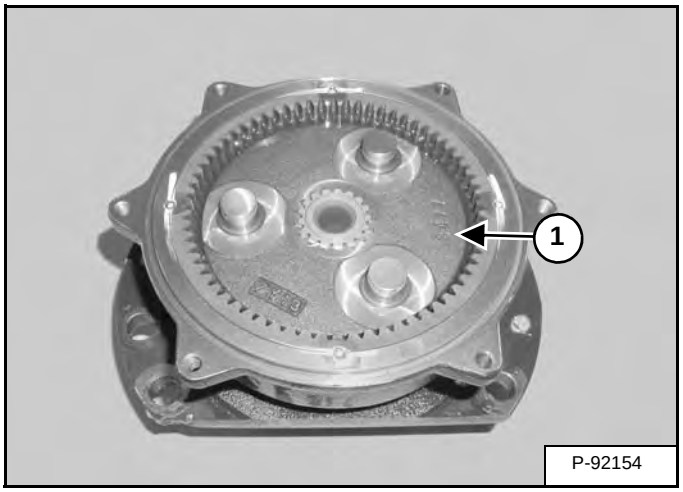
Remove the planetary gears (Item 1) **[Figure 20-91-3]** and roller bearings.

Figure 20-91-4



Remove the bearing races (Item 1) and thrust washers (Item 2) **[Figure 20-91-4]**.

Figure 20-91-5

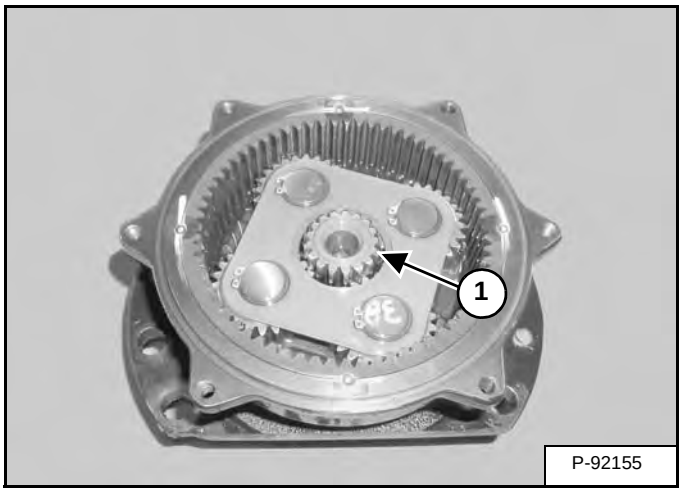


Remove the carrier (Item 1) **[Figure 20-91-5]**.

Dealer Copy -- Not for Resale

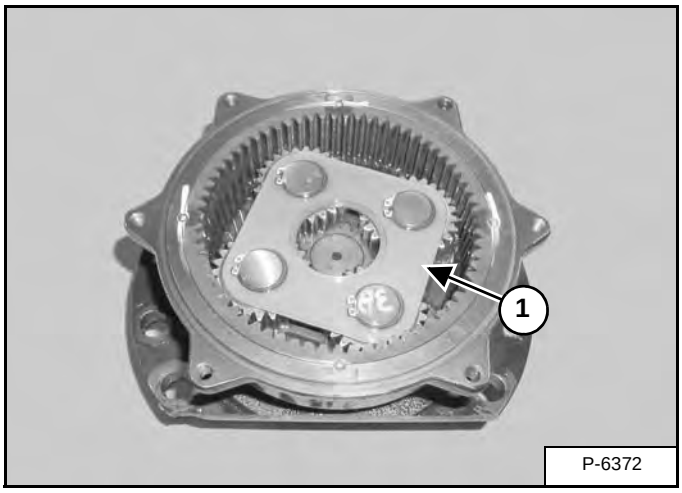
Disassembly And Assembly (Cont'd)

Figure 20-91-6



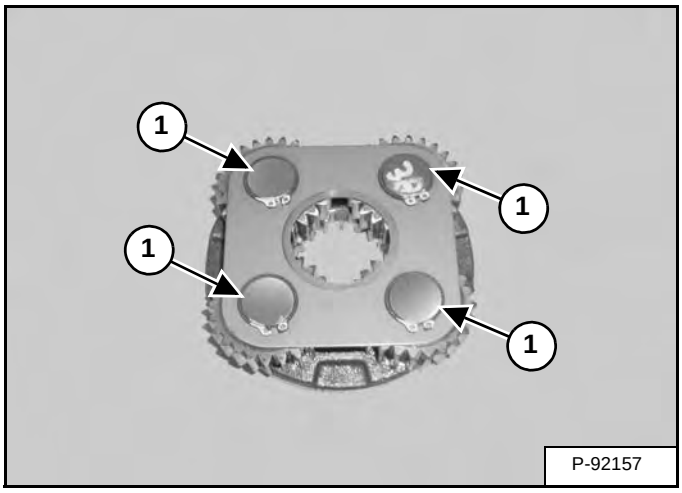
Remove the sun gear (Item 1) **[Figure 20-91-6]**.

Figure 20-91-7



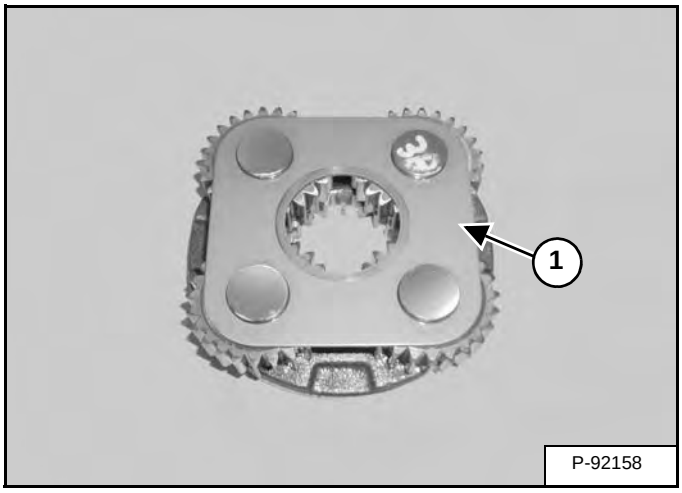
Remove the carrier / gear assembly (Item 1) **[Figure 20-91-7]**.

Figure 20-91-8



Remove the snap rings (Item 1) **[Figure 20-91-8]**.

Figure 20-91-9

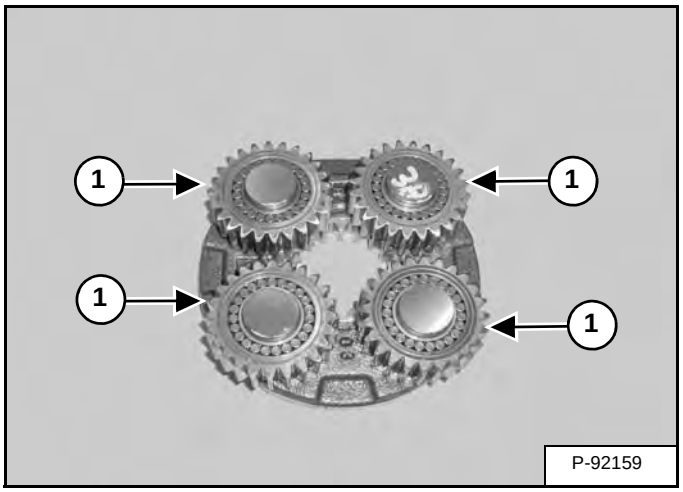


Remove the plate (Item 1) **[Figure 20-91-9]**.

Dealer Copy -- Not for Resale

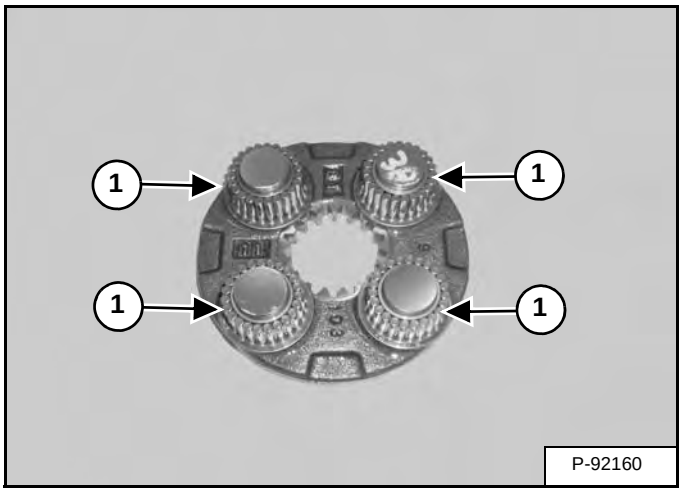
Disassembly And Assembly (Cont'd)

Figure 20-91-10



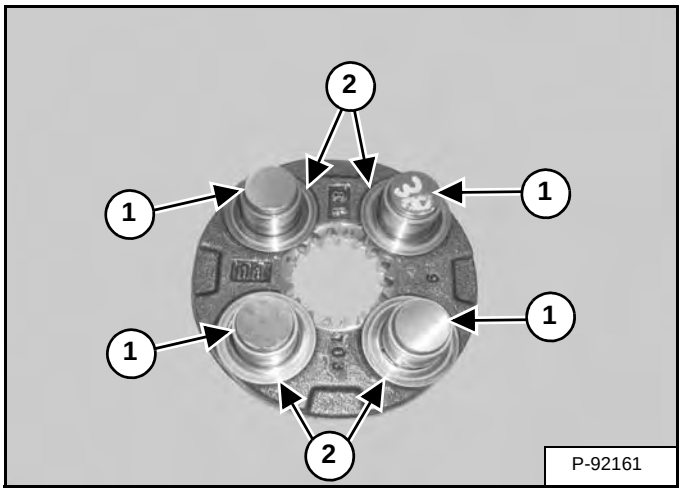
Remove the planetary gears (Item 1) **[Figure 20-91-10]**.

Figure 20-91-11



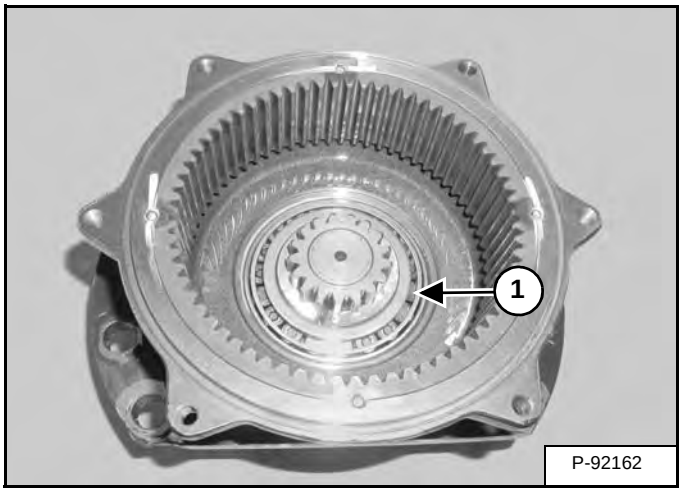
Remove the bearings (Item 1) **[Figure 20-91-11]**.

Figure 20-91-12



Remove the races (Item 1) and thrust washers (Item 2) **[Figure 20-91-12]**.

Figure 20-91-13

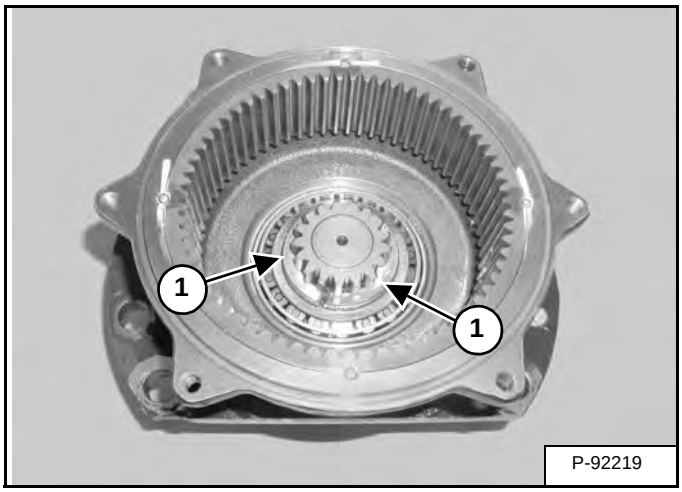


Remove the retainer (Item 1) **[Figure 20-91-13]**.

Dealer Copy -- Not for Resale

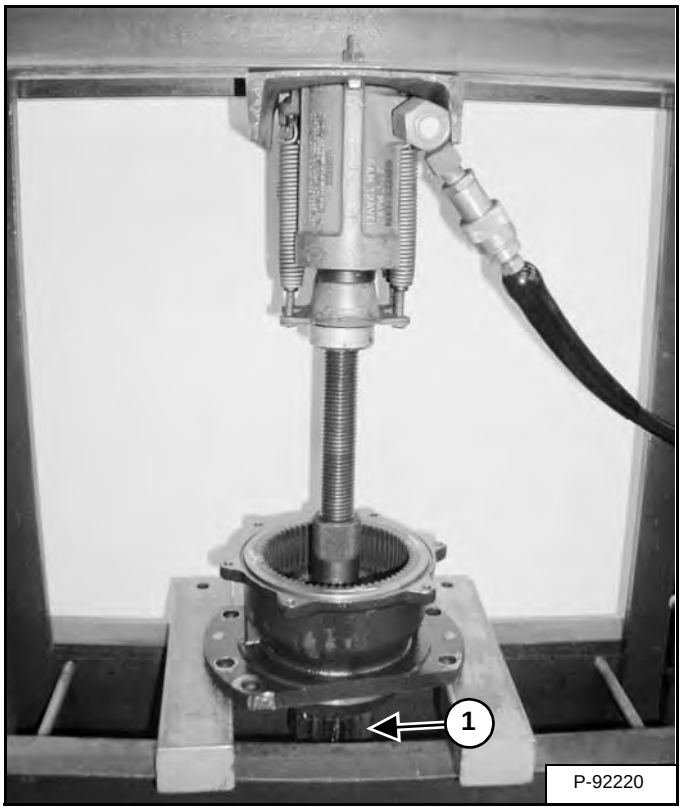
Disassembly And Assembly (Cont'd)

Figure 20-91-14



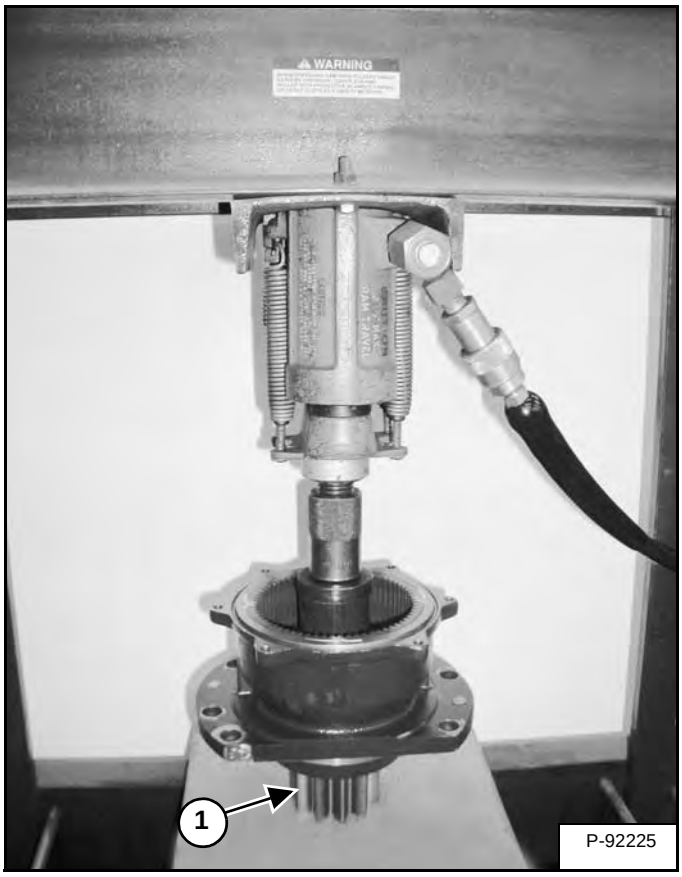
Remove the split rings (Item 1) **[Figure 20-91-14]**.

Figure 20-91-15



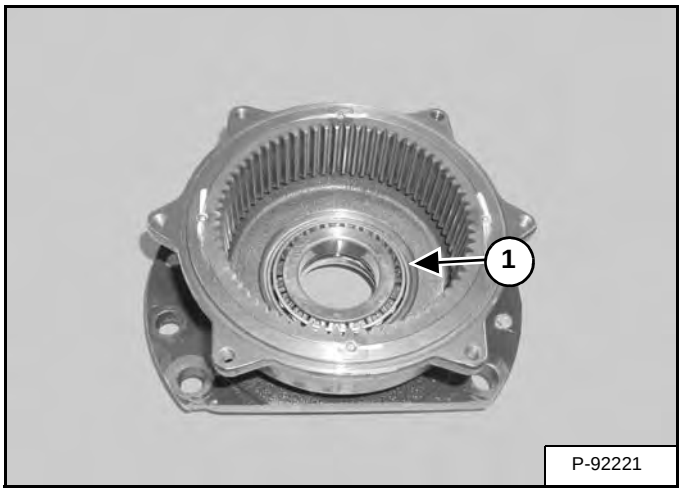
Press the shaft assembly (Item 1) **[Figure 20-91-15]** out of the housing.

Figure 20-91-16



Installation: Place the shaft assembly (Item 1) **[Figure 20-91-16]** in the housing and press the bearing on to the shaft until the split rings can be installed on the shaft.

Figure 20-91-17

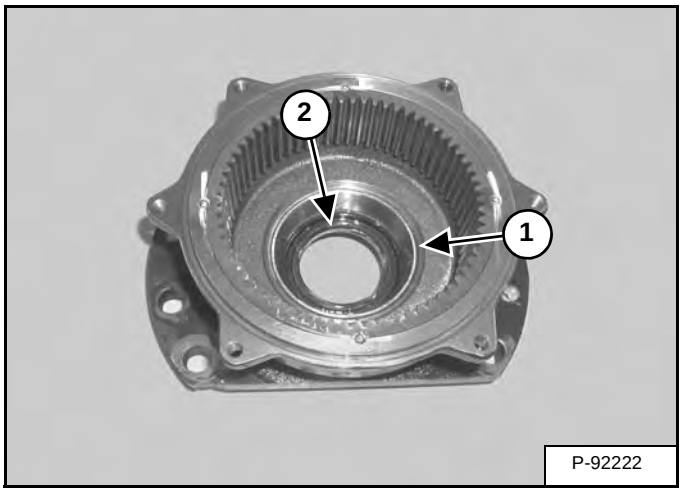


Remove the bearing (Item 1) **[Figure 20-91-17]** from the housing.

Dealer Copy -- Not for Resale

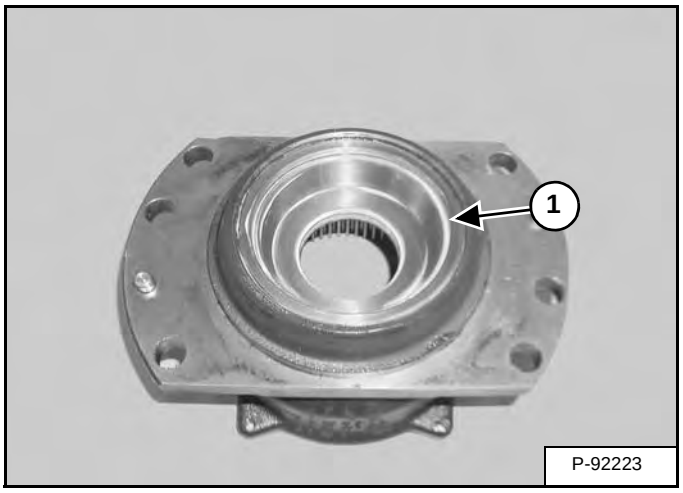
Disassembly And Assembly (Cont'd)

Figure 20-91-18



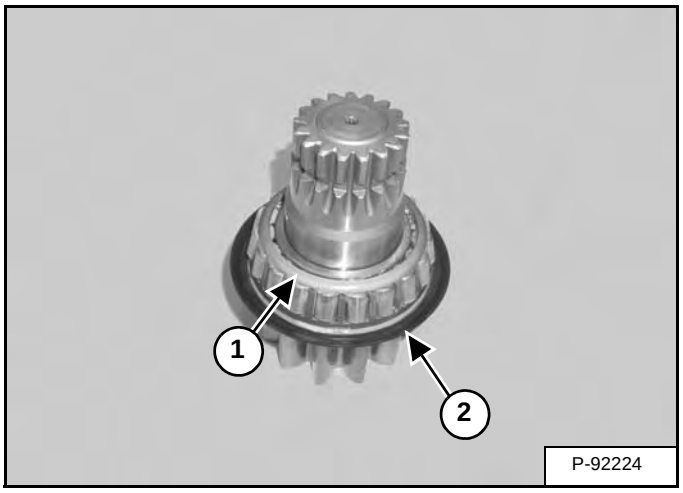
Remove the bearing race (Item 1) and seal (Item 2) **[Figure 20-91-18]**.

Figure 20-91-19



Turn the housing over and remove the bearing race (Item 1) **[Figure 20-91-19]**.

Figure 20-91-20



Remove the bearing (Item 1) and seal (Item 2) **[Figure 20-91-20]** from the shaft.

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CONTROL PATTERN SELECTOR VALVE

Removal And Installation

Remove the tool box. (See Removal And Installation on Page 40-230-1.)

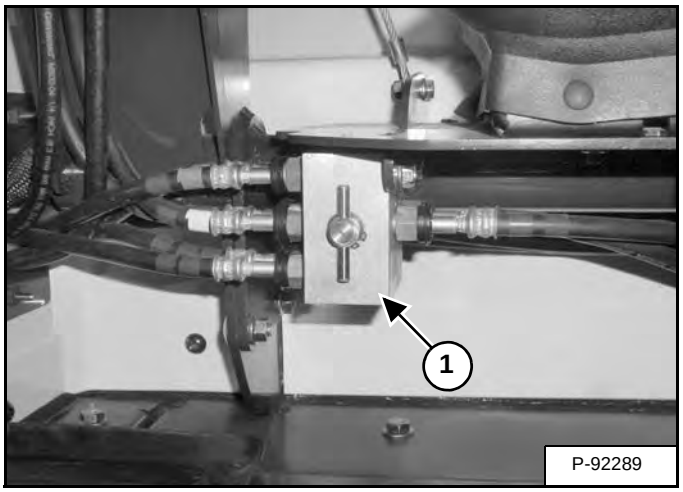
Mark all hydraulic hoses for proper installation.

IMPORTANT

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

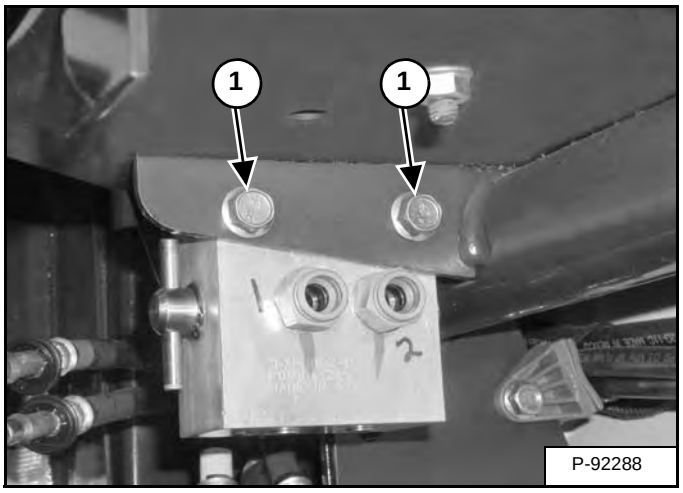
I-2003-0888

Figure 20-100-1



Remove the eight hydraulic hoses from the control pattern selector valve (Item 1) **[Figure 20-100-1]**.

Figure 20-100-2



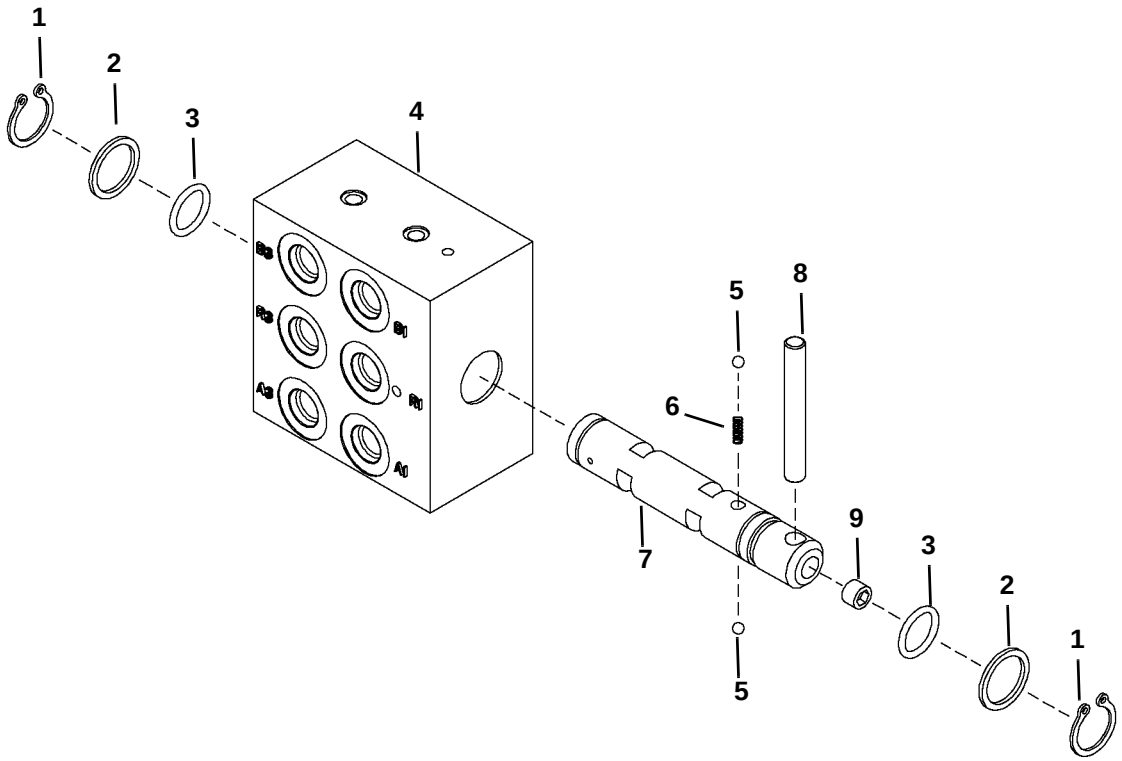
Remove the bolts (Item 1) **[Figure 20-100-2]**.

Remove the control pattern selector valve from the excavator.

Dealer Copy -- Not for Resale

Parts Identification

1. Snap Ring
2. Nylon Washer
3. O-ring
4. Body
5. Ball
6. Spring
7. Spool
8. Handle
9. Plug



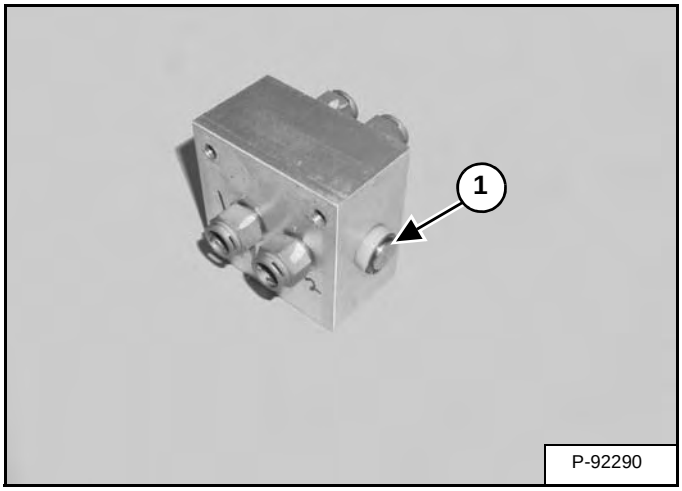
NA2118

Dealer Copy -- Not for Resale

Disassembly And Assembly

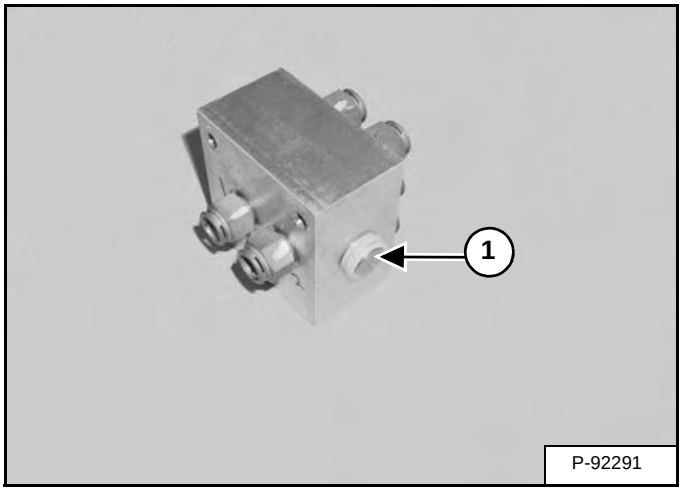
Clean the outside of the valve before disassembly.

Figure 20-100-3



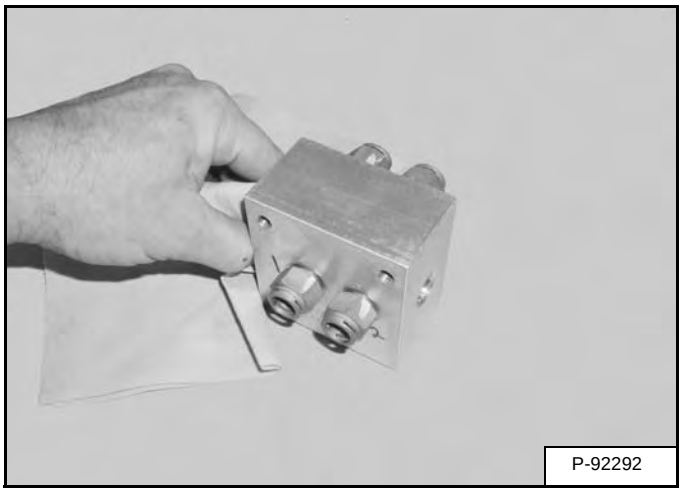
Remove the snap ring (Item 1) **[Figure 20-100-3]**.

Figure 20-100-4



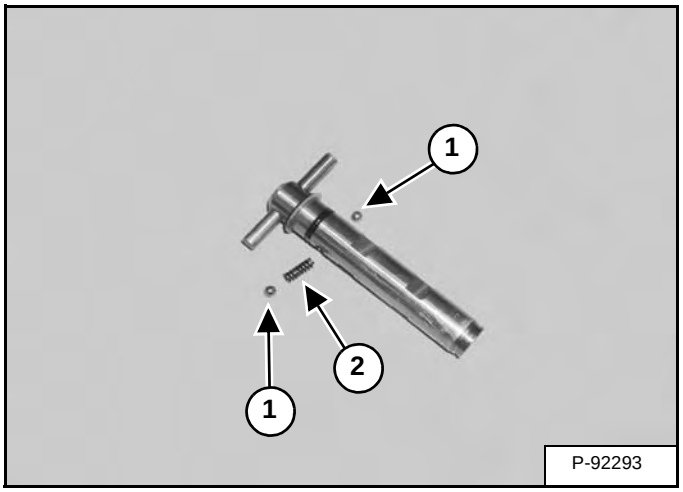
Remove the nylon washers (Item 1) **[Figure 20-100-4]**.

Figure 20-100-5



Wrap a shop towel around the spool and pull the spool out of the valve **[Figure 20-100-5]**.

Figure 20-100-6

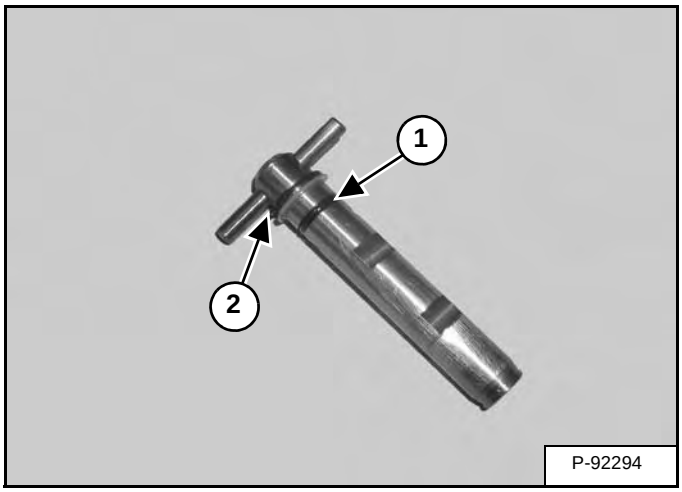


Remove the detent balls (Item 1) and spring (Item 2) **[Figure 20-100-6]**.

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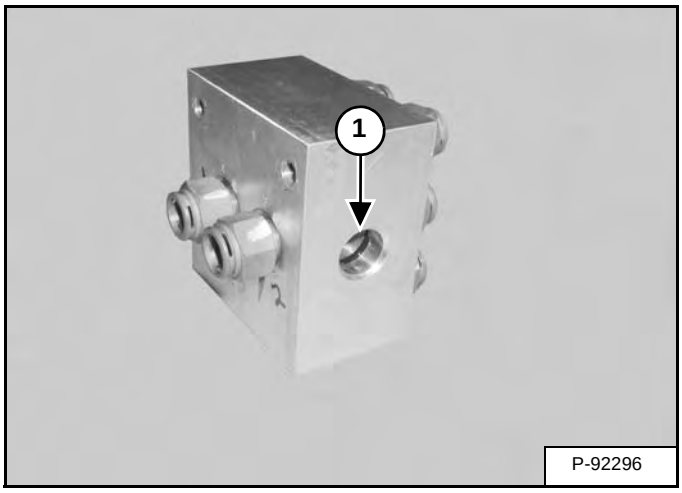
Disassembly And Assembly (Cont'd)

Figure 20-100-7



Remove the O-ring (Item 1) and nylon washer (Item 2) **[Figure 20-100-7]**.

Figure 20-100-8



Remove the O-ring (Item 1) **[Figure 20-100-8]** from the valve body.

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RIGHT CONTROL LEVER (JOYSTICK)

Testing

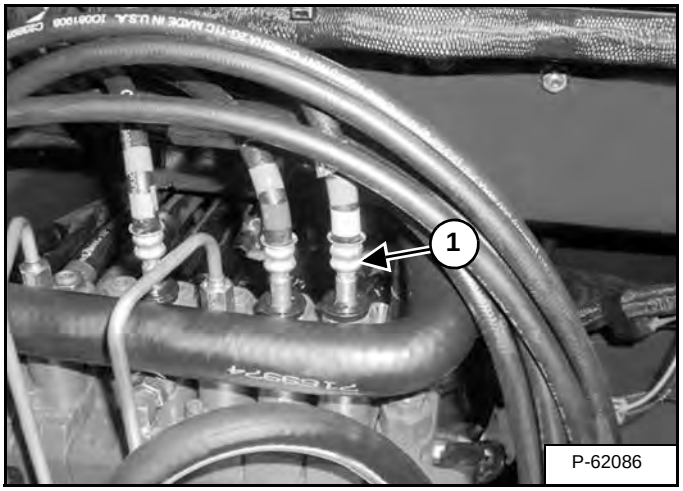
The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

Stop the engine.

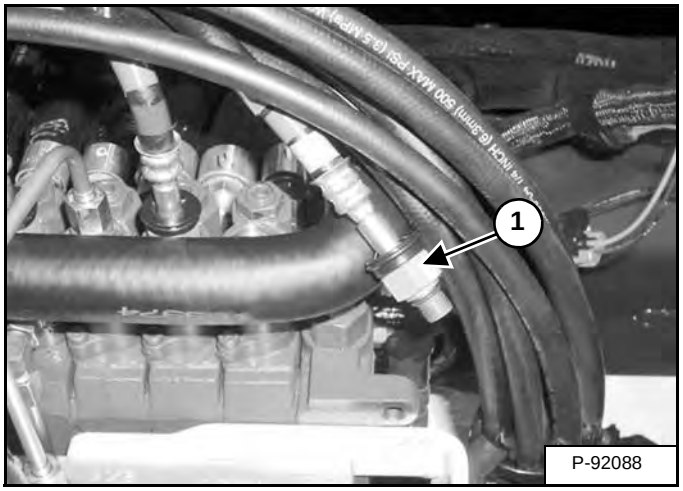
Open the right side cover.

Figure 20-110-1



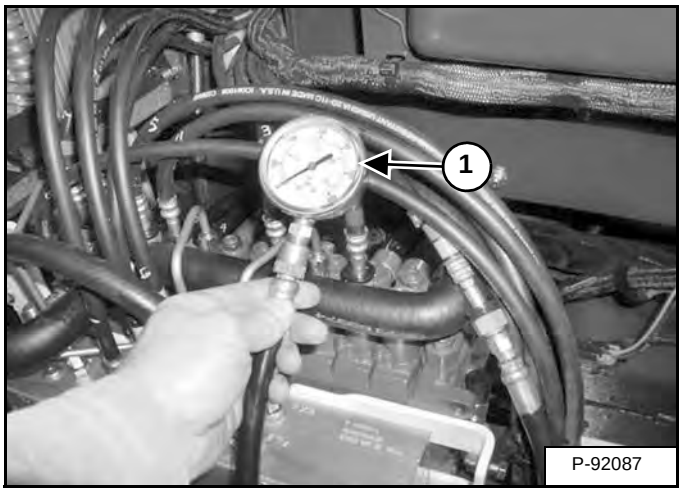
At the control valve assembly, find the pilot line (Item 1) **[Figure 20-110-1]** of the control lever (joystick) that is to be checked. (Boom, Arm, Slew, Bucket)

Figure 20-110-2



Disconnect the hydraulic hose (Item 1) **[Figure 20-110-2]** and fitting from the control valve.

Figure 20-110-3



From the test kit Install a 3447 kPa (35 bar) (500 psi) gauge (Item 1) **[Figure 20-110-3]** on the pilot line. Start the excavator, and warm the hydraulic oil to operating temperature.

Engage the circuit to be tested. Record the operating pressure.

The operating pressure should be approximately 2799 - 3103 kPa (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 pilot pressure relief valve, clean, install and retest. (See Testing And Adjusting The Pilot Pressure Relief Valve on Page 20-33-1.)

If the pressure is still incorrect replace the pilot pressure relief reducing valve. (See Testing And Adjusting The Pilot Pressure Relief Valve on Page 20-33-1.)

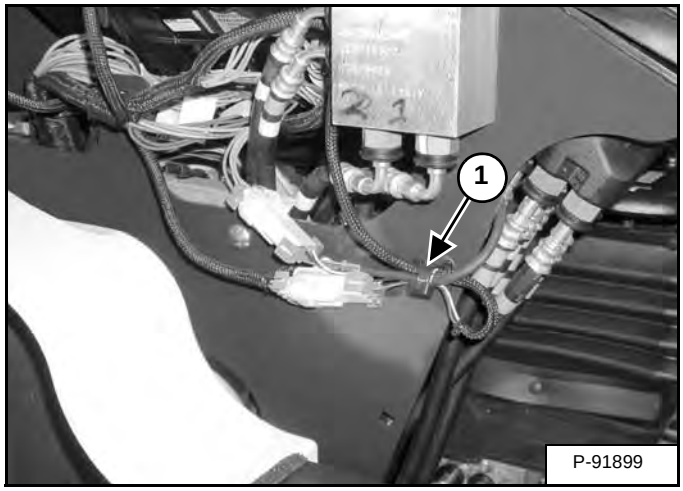
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RIGHT CONTROL LEVER (JOYSTICK) (CONT'D)

Handle Removal And Installation

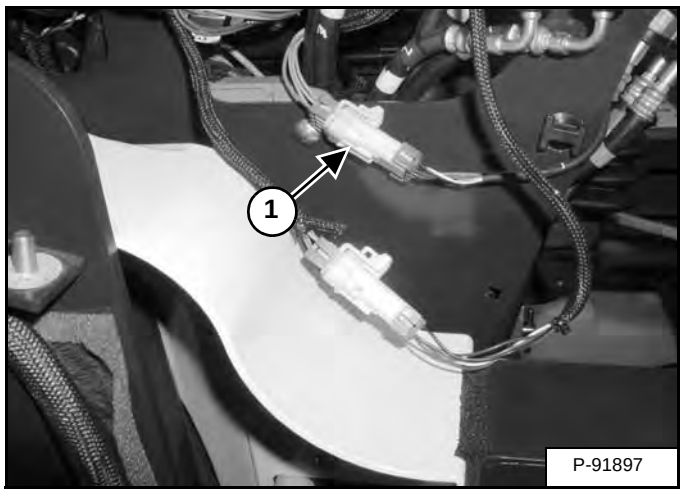
Remove the right console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 20-110-4



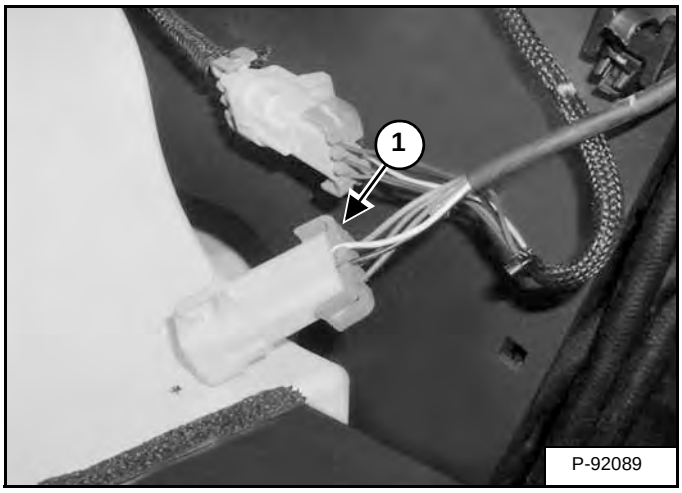
Cut and remove the cable tie (Item 1) **[Figure 20-110-4]**.

Figure 20-110-5



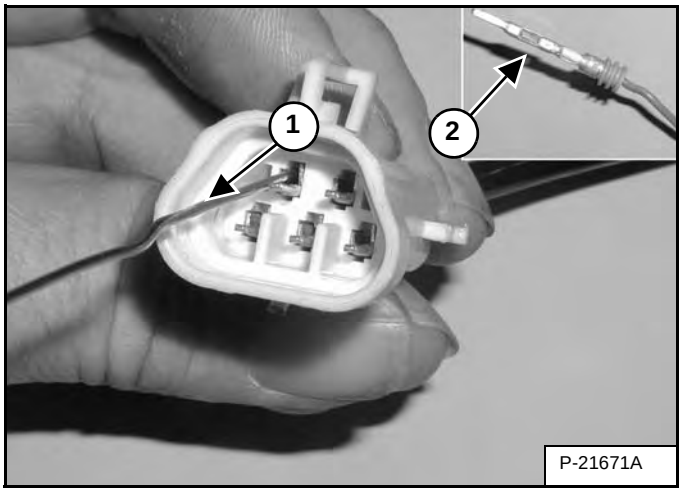
Disconnect the electrical connector (Item 1) **[Figure 20-110-5]** from the excavator wiring harness.

Figure 20-110-6



Remove the lock (Item 1) **[Figure 20-110-6]** from the electrical connector.

Figure 20-110-7



With a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 20-110-7]**.

Carefully remove the individual wires from the back of the electrical connector.

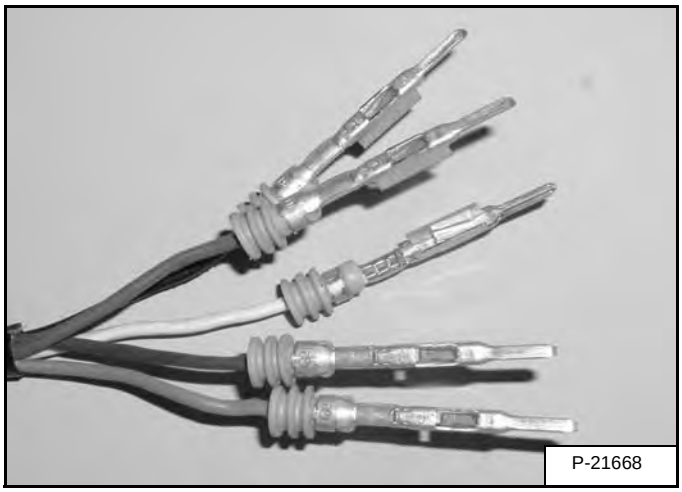
Installation: Use a small piece of wire and re-bend the tab (Item 2) **[Figure 20-110-7]** on each wire before installing the electrical connector.

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RIGHT CONTROL LEVER (JOYSTICK) (CONT'D)

Handle Removal And Installation (Cont'd)

Figure 20-110-8

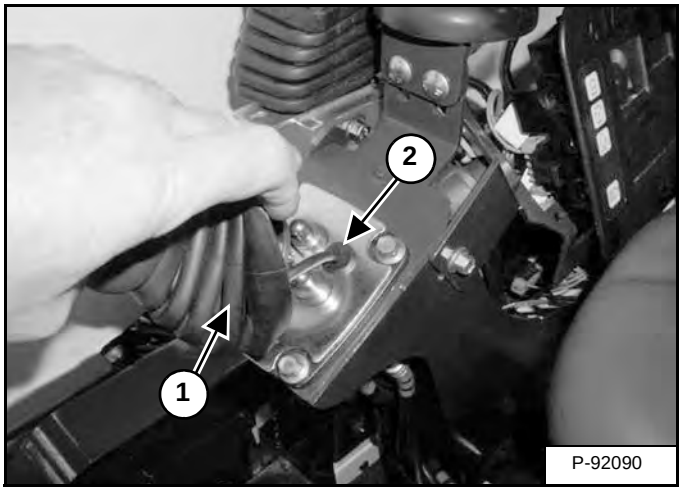


Installation: The wires **[Figure 20-110-8]** must be installed in the proper locations in the wire connector, listed below.

A Green
B Brown
C Red
D Black
E White

Check each wire to be certain the tab locks into position.

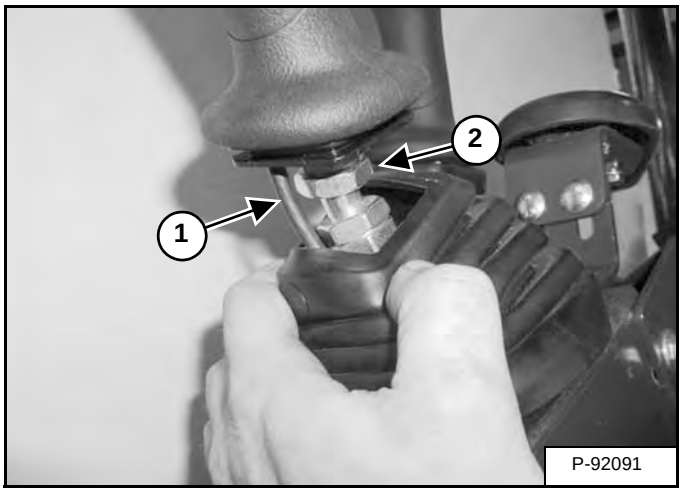
Figure 20-110-9



Raise the boot (Item 1) and pull the grommet (Item 2) **[Figure 20-110-9]** up out of the housing.

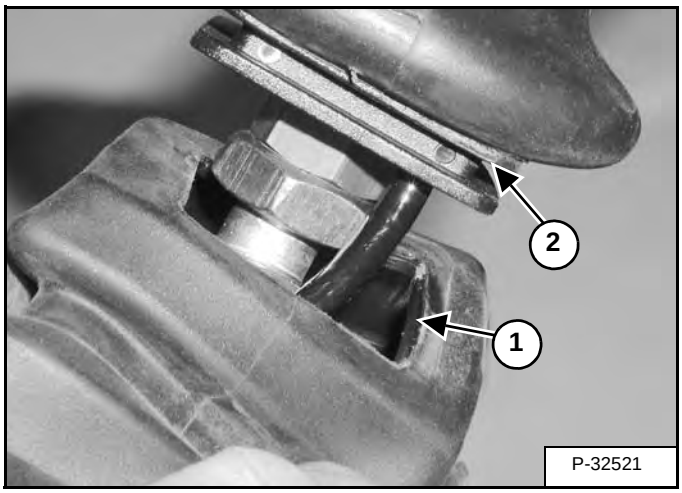
Remove the wire and grommet.

Figure 20-110-10



Pull the boot down and pull the wire harness (Item 1) out of the boot. Loosen the nut (Item 2) **[Figure 20-110-10]** and remove the handle.

Figure 20-110-11



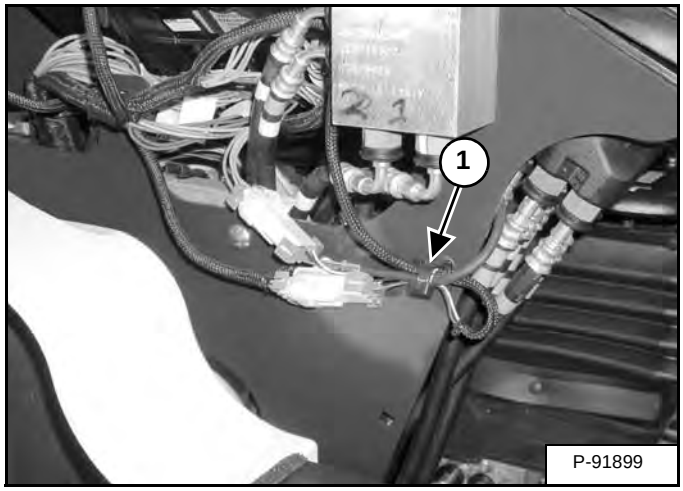
Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-110-11]**.

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Joystick Assembly Removal And Installation

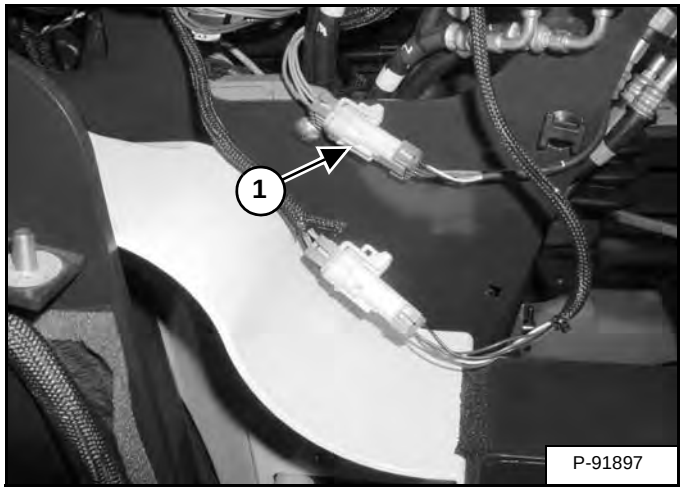
Remove the console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 20-110-12



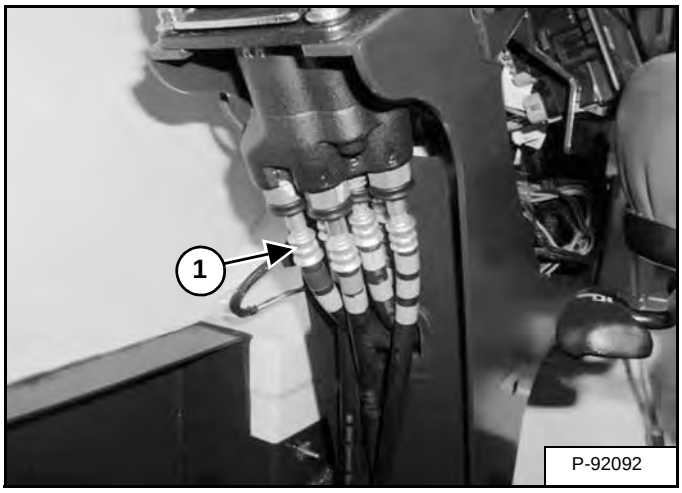
Cut and remove the cable tie (Item 1) **[Figure 20-110-12]**.

Figure 20-110-13



Disconnect the wire harness (Item 1) **[Figure 20-110-13]**.

Figure 20-110-14



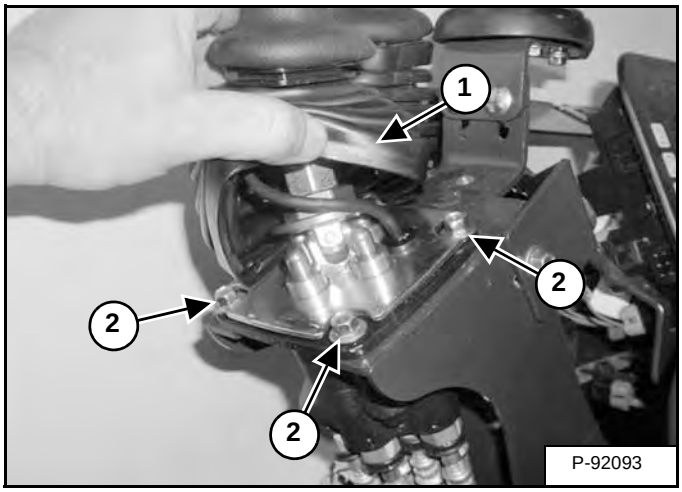
Mark and remove the hoses (Item 1) **[Figure 20-110-14]**.

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 20-110-15



Pull the boot (Item 1) **[Figure 20-110-15]** up from the mounting plate.

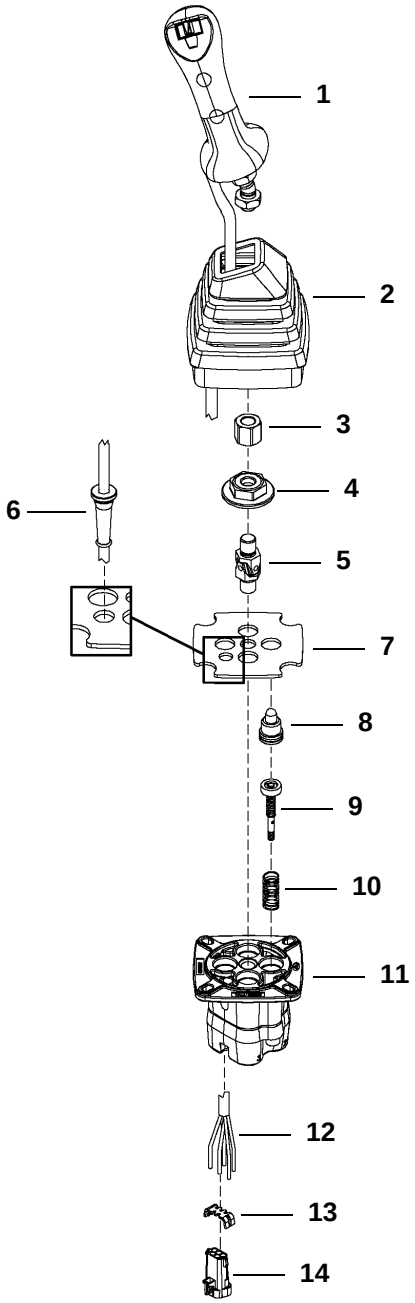
Remove the bolts (Item 2) **[Figure 20-110-15]**.

Remove the joystick assembly.

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Parts Identification

1. Handle
2. Dust Boot
3. Coupler
4. Control Plate
5. U-Joint
6. Grommet
7. Plate
8. Plunger
9. Spool
10. Spring
11. Housing
12. Wire Harness
13. Lock
14. Connector



MS-1352

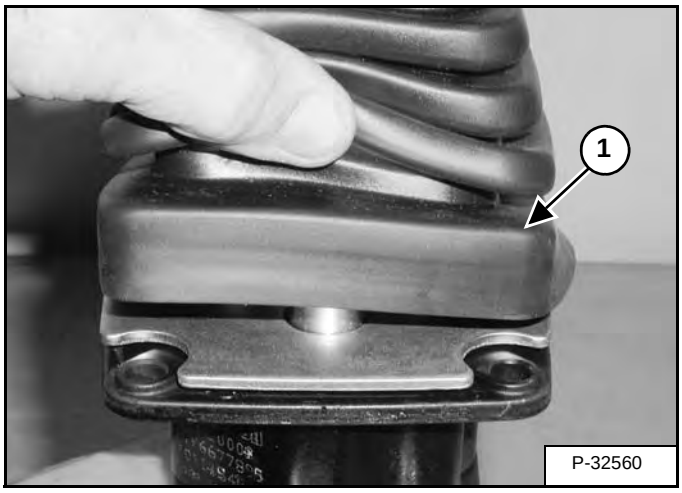
Dealer Copy -- Not for Resale

Disassembly

Remove the right handle. (See Handle Removal And Installation on Page 20-110-2.)

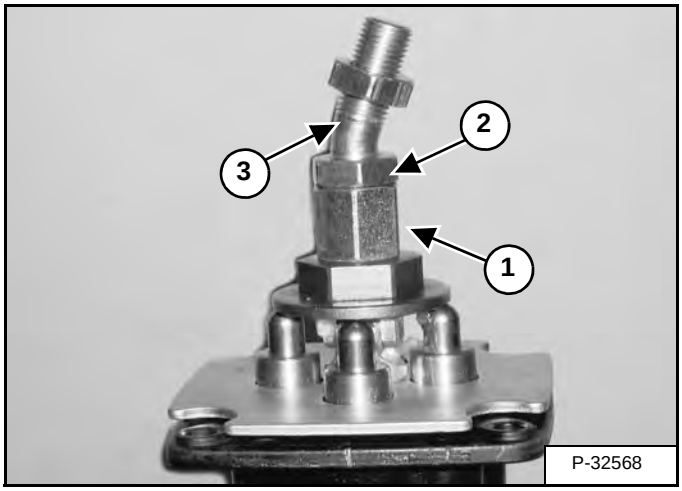
Clean the outside of the control lever before disassembly.

Figure 20-110-16



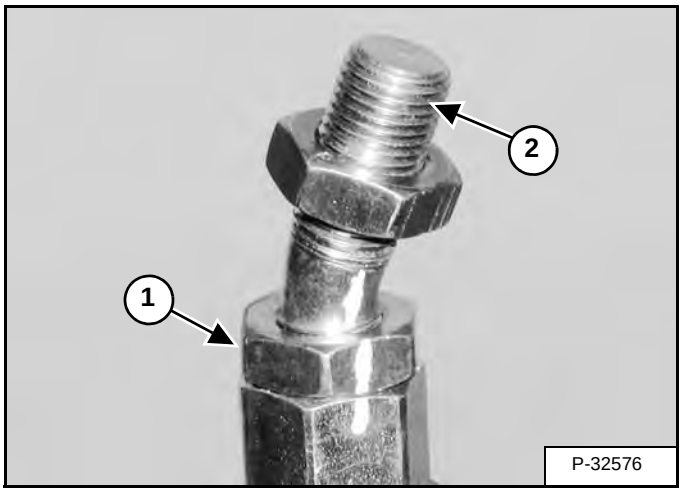
Remove the boot (Item 1) **[Figure 20-110-16]**.

Figure 20-110-17



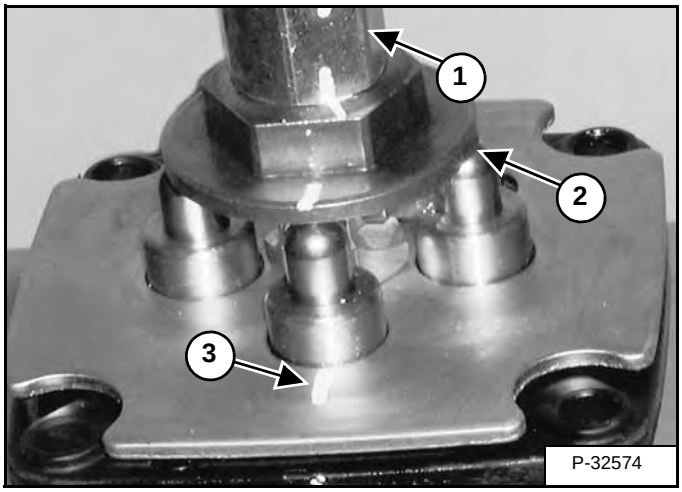
Mark the coupler (Item 1), nut (Item 2), and connector (Item 3) **[Figure 20-110-17]** for ease of assembly.

Figure 20-110-18



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-110-18]**.

Figure 20-110-19

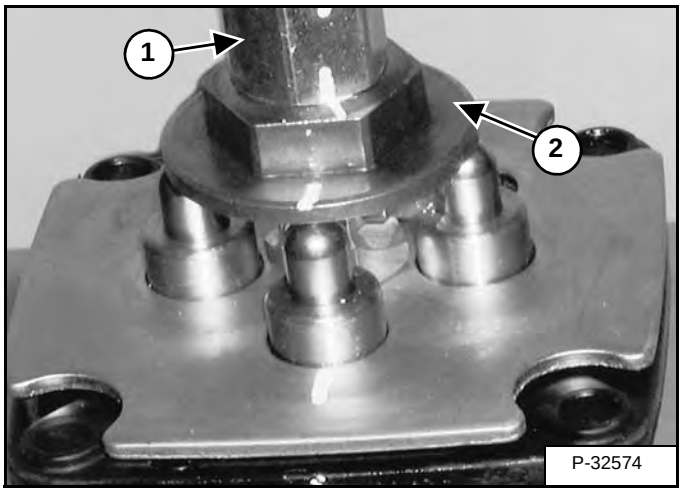


Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-110-19]** for ease of assembly.

Dealer Copy -- Not for Resale

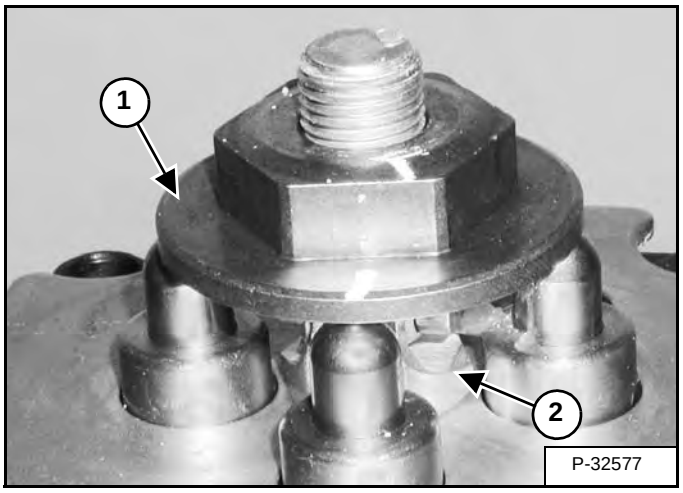
Disassembly (Cont'd)

Figure 20-110-20



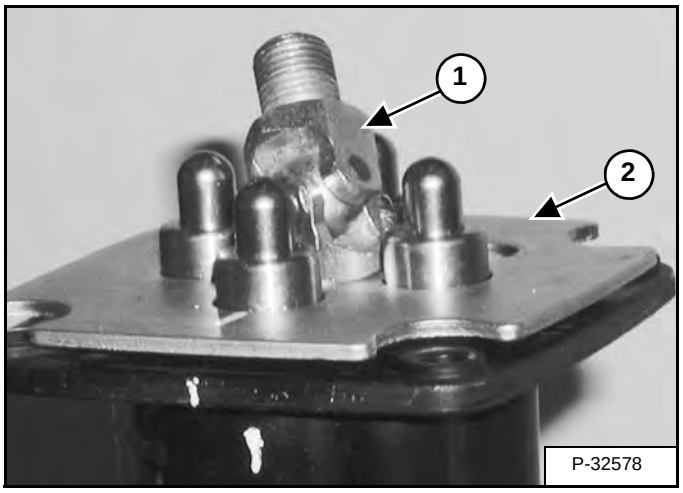
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-110-20]**.

Figure 20-110-21



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-110-21]**.

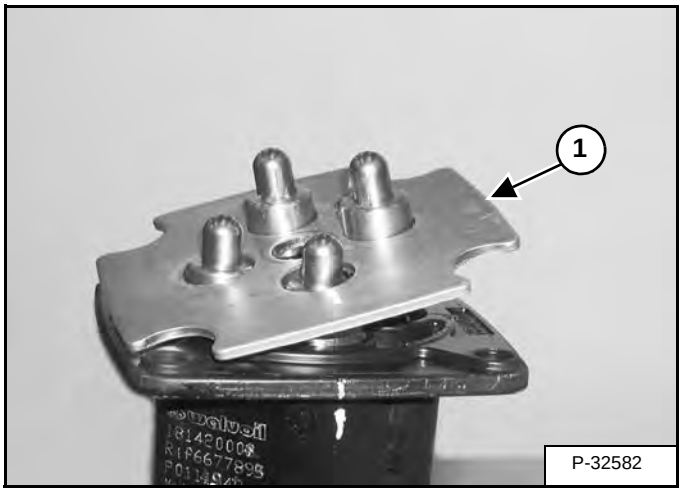
Figure 20-110-22



Mark the plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-110-22]**.

NOTE: The plate (Item 2) [Figure 20-110-22] is spring loaded and will come up as the U-joint is removed.

Figure 20-110-23

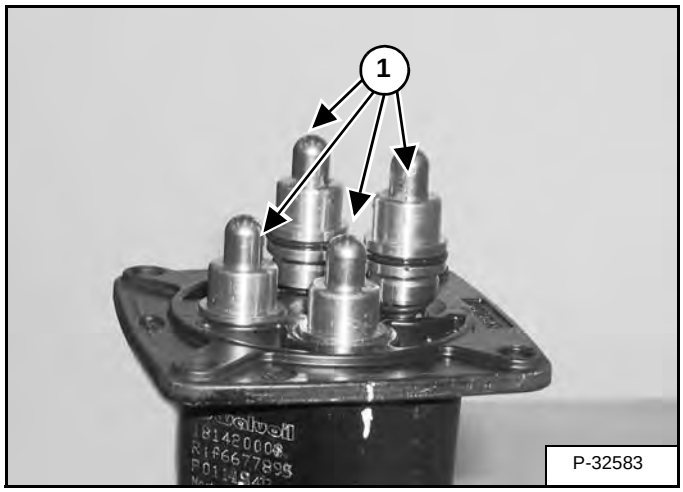


Remove the plate (Item 1) **[Figure 20-110-23]**.

Dealer Copy -- Not for Resale

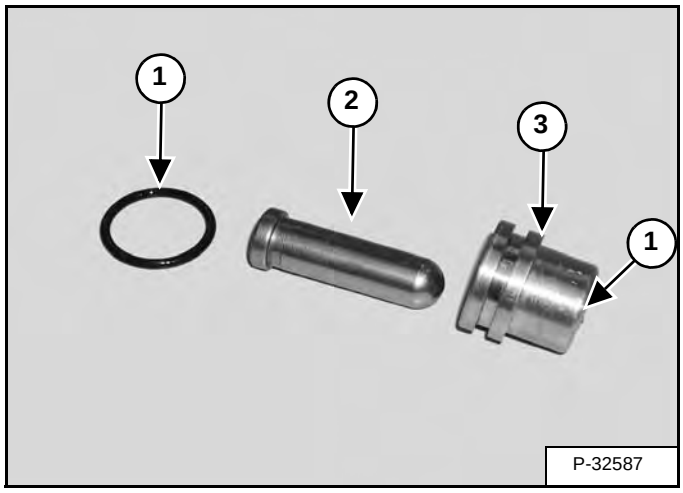
Disassembly (Cont'd)

Figure 20-110-24



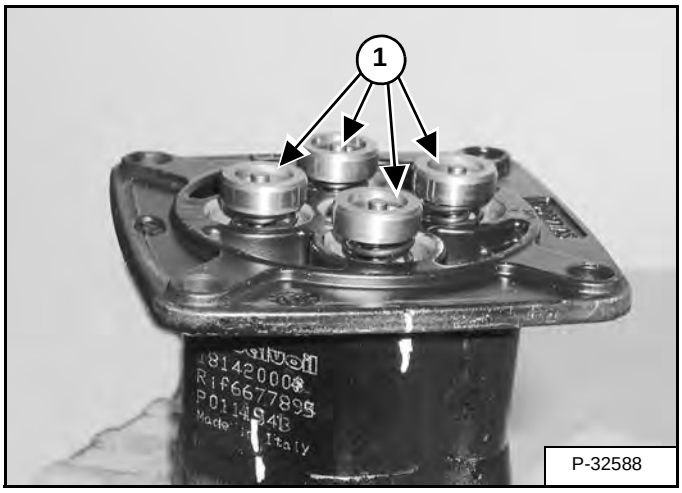
Remove the plunger assemblies (Item 1) **[Figure 20-110-24]**.

Figure 20-110-25



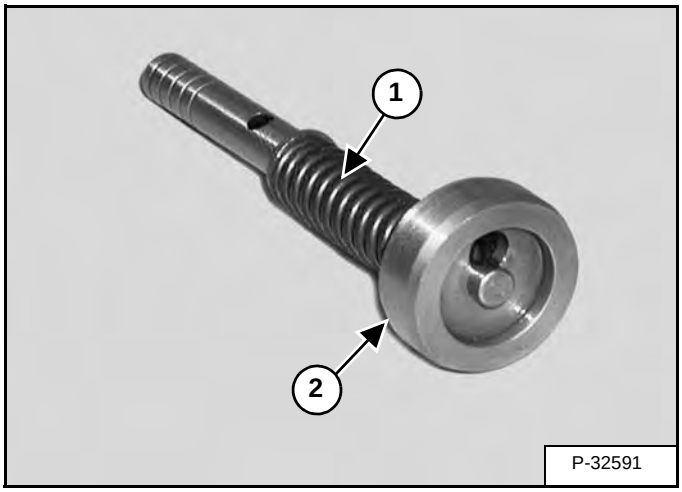
Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-110-25]**.

Figure 20-110-26



Remove the spool assemblies (Item 1) **[Figure 20-110-26]**.

Figure 20-110-27

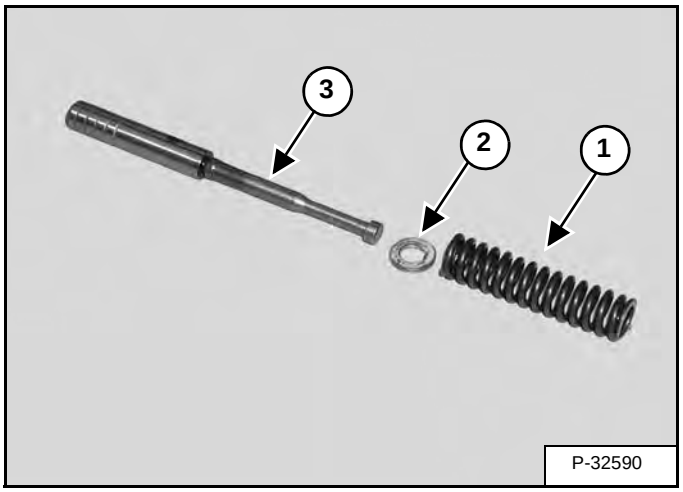


Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-110-27]**.

Dealer Copy -- Not for Resale

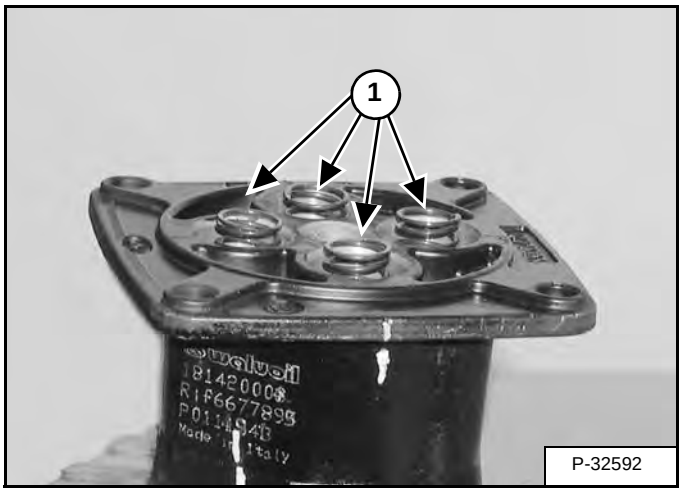
Disassembly (Cont'd)

Figure 20-110-28



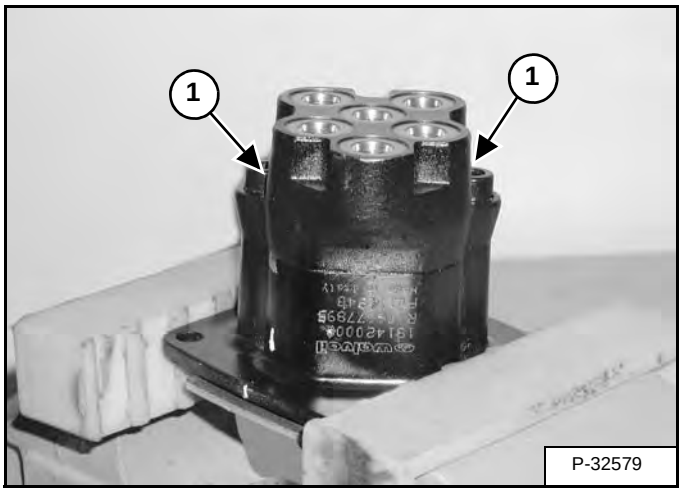
Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-110-28]**.

Figure 20-110-29



Remove the springs (Item 1) **[Figure 20-110-29]** from the housing.

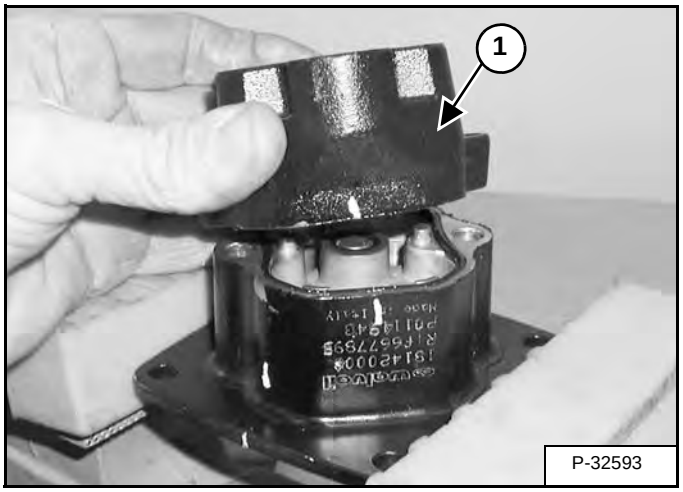
Figure 20-110-30



Clamp the housing in a vise that is equipped with padded jaws **[Figure 20-110-30]**.

Remove the two bolts (Item 1) **[Figure 20-110-30]**.

Figure 20-110-31

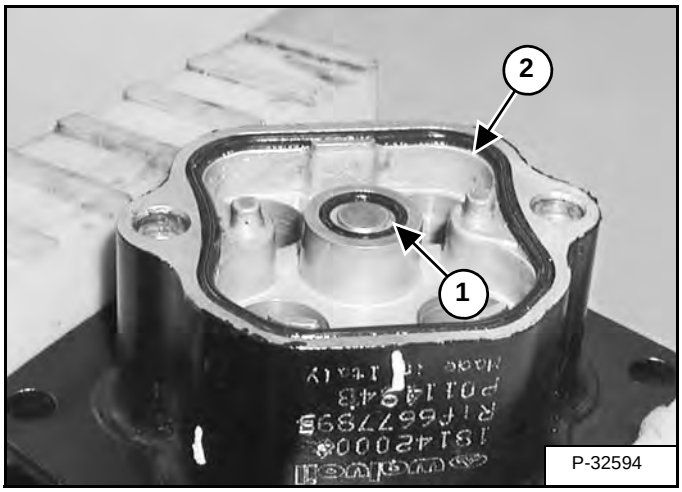


Remove the end cap (Item 1) **[Figure 20-110-31]**.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

Figure 20-110-32



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-110-32]**.

Dealer Copy -- Not for Resale

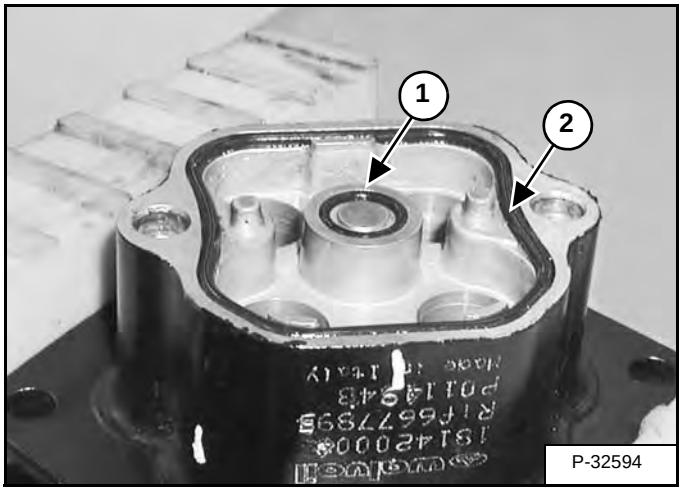
Assembly

Clean all parts in solvent and dry with compressed air.

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

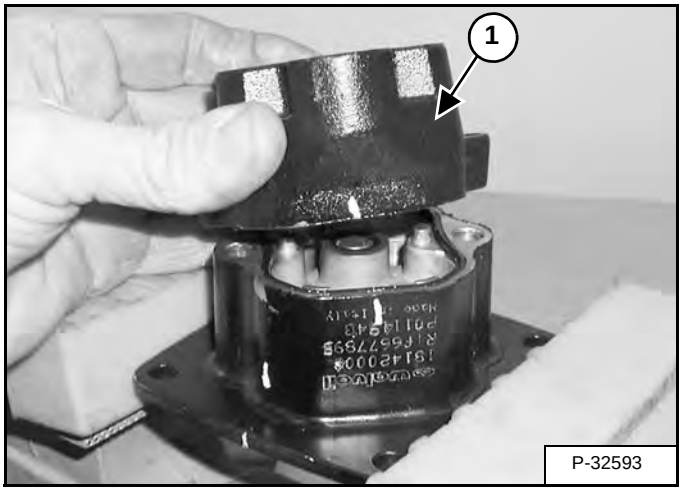
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-110-33



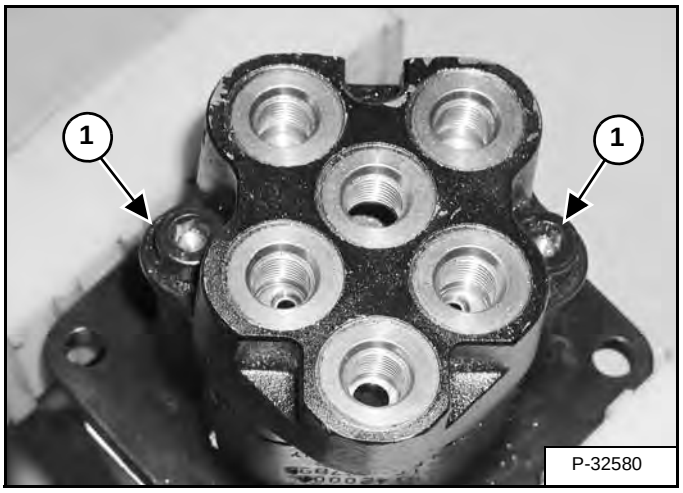
Clamp the housing in a vise equipped with padded jaws. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-110-33]**.

Figure 20-110-34



Install the end cap (Item 1) **[Figure 20-110-34]**.

Figure 20-110-35



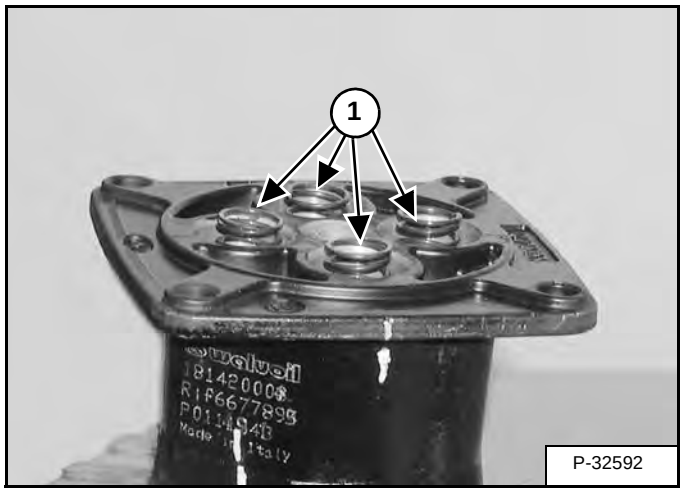
Install the two bolts (Item 1) **[Figure 20-110-35]**.

Turn the housing over.

Dealer Copy -- Not for Resale

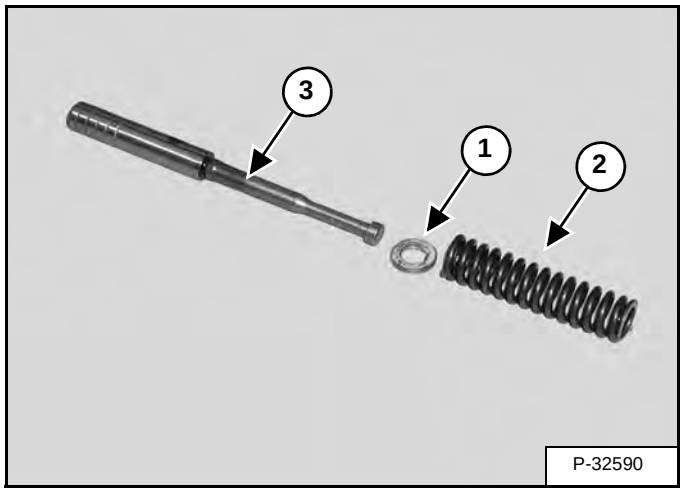
Assembly (Cont'd)

Figure 20-110-36



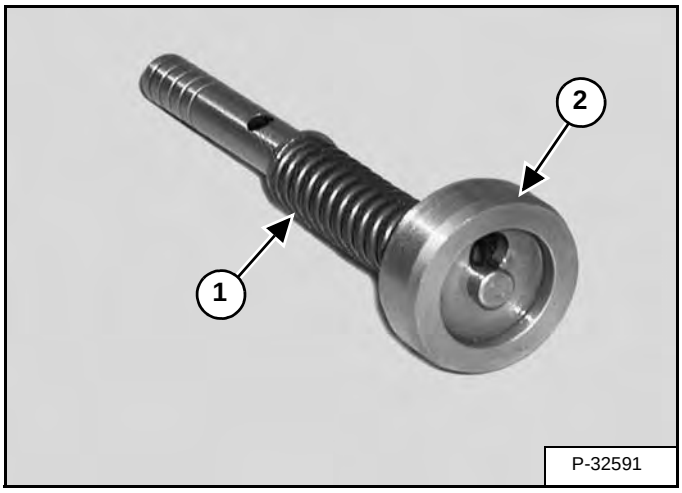
Install the springs (Item 1) **[Figure 20-110-36]**.

Figure 20-110-37



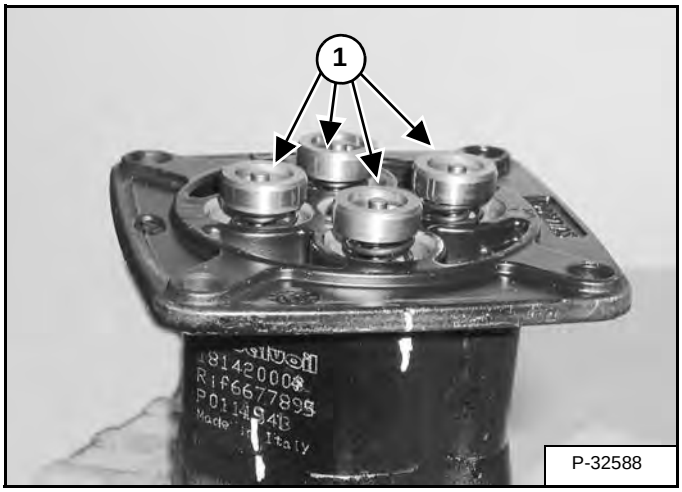
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-110-37]**.

Figure 20-110-38



Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-110-38]**.

Figure 20-110-39

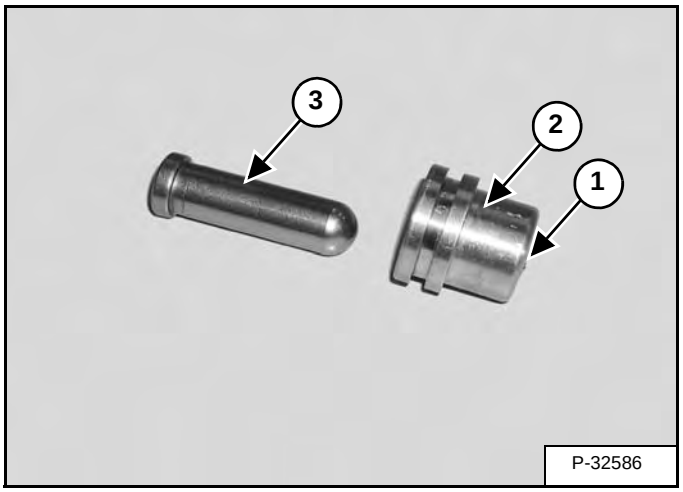


Install the spool assemblies (Item 1) **[Figure 20-110-39]** into the housing.

Dealer Copy -- Not for Resale

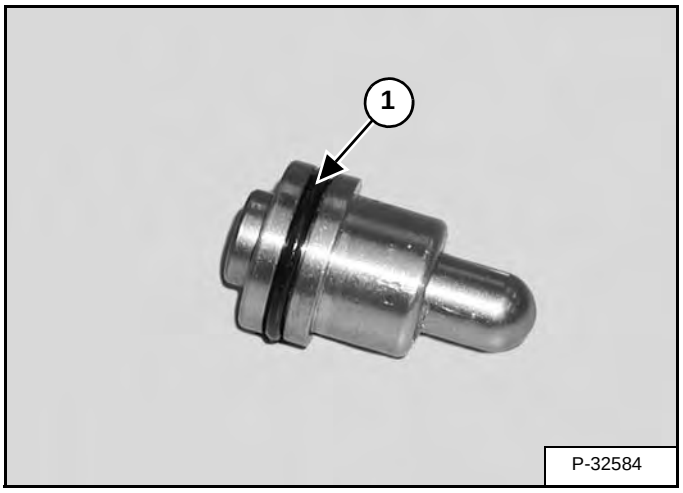
Assembly (Cont'd)

Figure 20-110-40



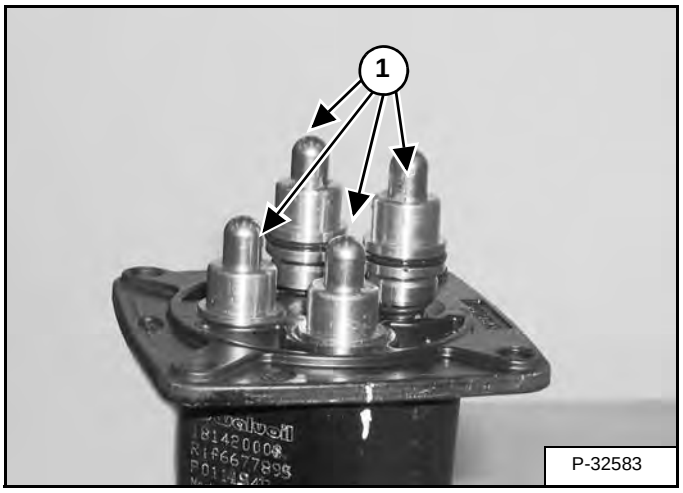
Install the O-ring (Item 1) into the bushing (Item 2). Install the plunger (Item 3) **[Figure 20-110-40]** into the bushing.

Figure 20-110-41



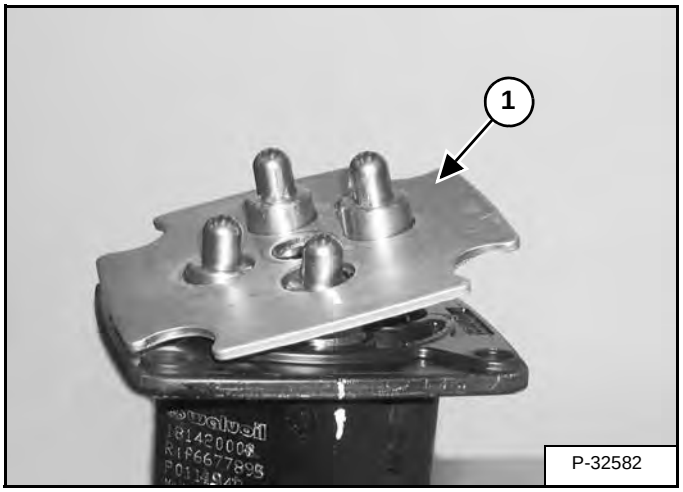
Install the O-ring (Item 1) **[Figure 20-110-41]** on the bushing.

Figure 20-110-42



Install the plunger assemblies (Item 1) **[Figure 20-110-42]** into the housing.

Figure 20-110-43



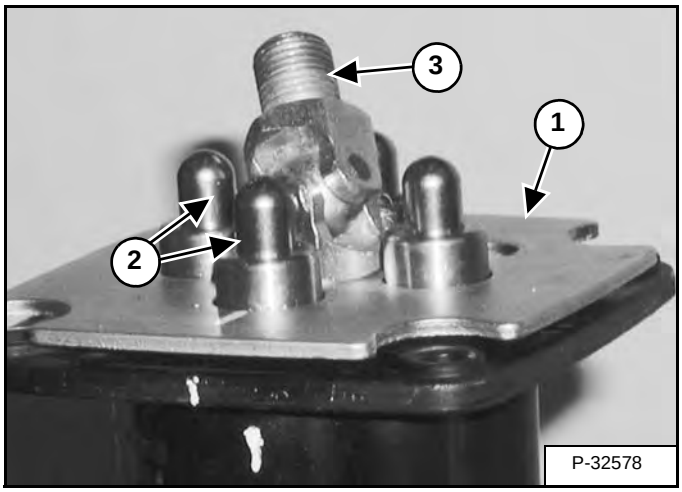
Install the plate (Item 1) **[Figure 20-110-43]**.

NOTE: Spring pressure can dislodge the plunger assemblies until the plate is secured in place.

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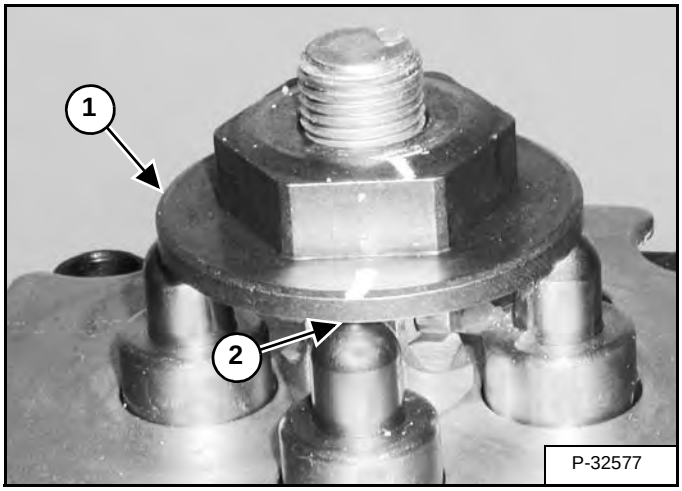
Assembly (Cont'd)

Figure 20-110-44



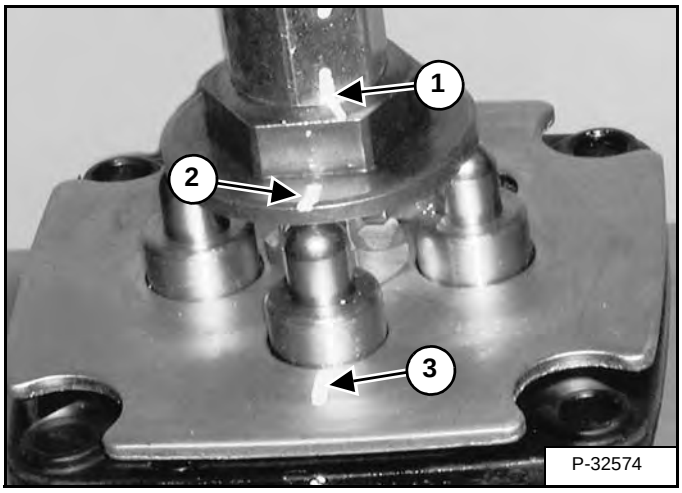
Press down on the plate (Item 1) keeping the plunger assemblies (Item 2) fully seated and install the U-joint (Item 3) **[Figure 20-110-44]**.

Figure 20-110-45



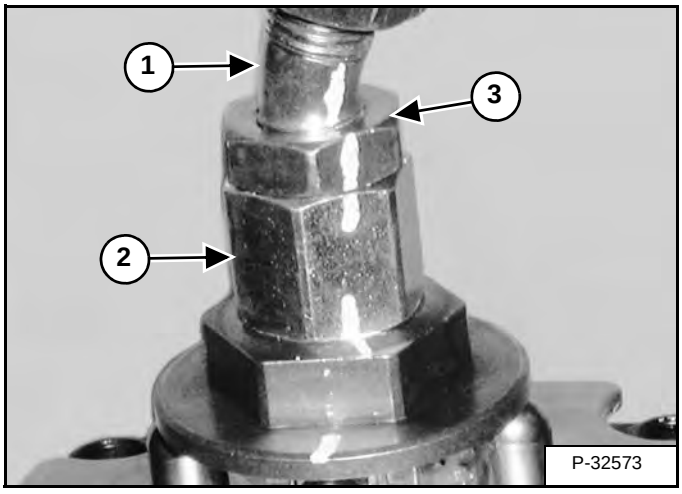
Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-110-45]**.

Figure 20-110-46



Align the coupler (Item 1) with the control plate (Item 2) and plate (Item 3) **[Figure 20-110-46]**. Tighten the coupler.

Figure 20-110-47



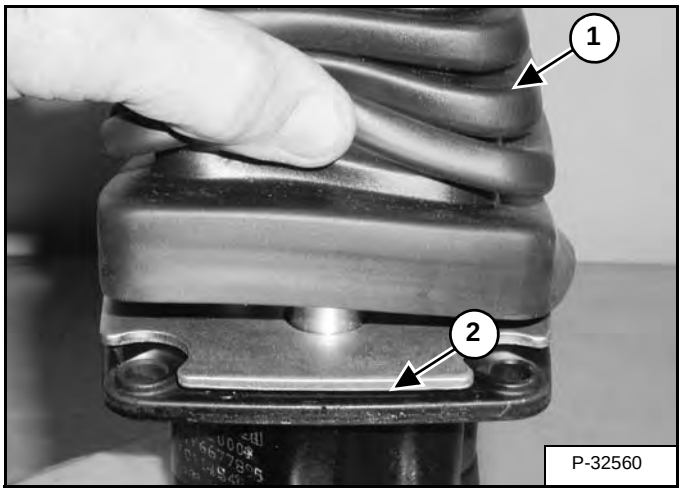
Install the connector (Item 1) **[Figure 20-110-47]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-110-47]**.

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Assembly (Cont'd)

Figure 20-110-48



Install the tabs of the boot (Item 1) in between the joystick flange and mounting plate (Item 2) **[Figure 20-110-48]**.

Install the handle. (See Handle Removal And Installation on Page 20-110-2.)

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LEFT CONTROL LEVER (JOYSTICK)

Testing

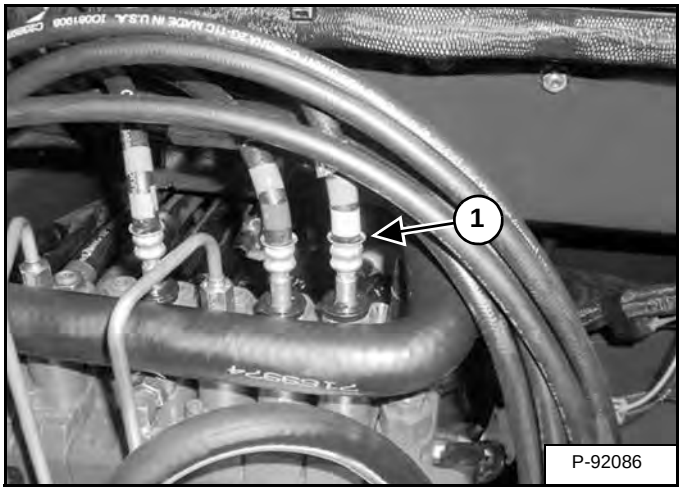
The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

Stop the engine.

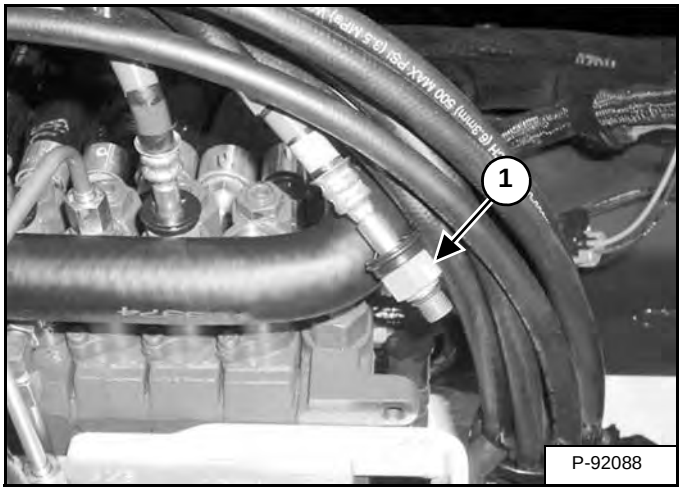
Open the right side cover.

Figure 20-120-1



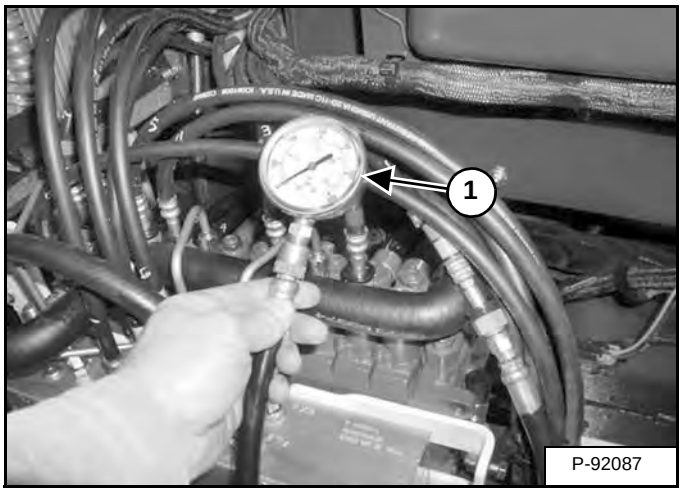
At the control valve assembly (Item 1) **[Figure 20-120-1]**, find the pilot line of the control lever (joystick) that is to be checked. (Boom, Arm, Slew, Bucket)

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 3447 kPa (35 bar) (500 psi) gauge (Item 1) **[Figure 20-120-3]** on the pilot line. Start the excavator, and warm the hydraulic oil to operating temperature.

Engage the circuit to be tested. Record the operating pressure.

The operating pressure should be approximately 2799 - 3103 kPa (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 pilot pressure relief valve, clean, install and retest. (See Testing And Adjusting The Pilot Pressure Relief Valve on Page 20-33-1.)

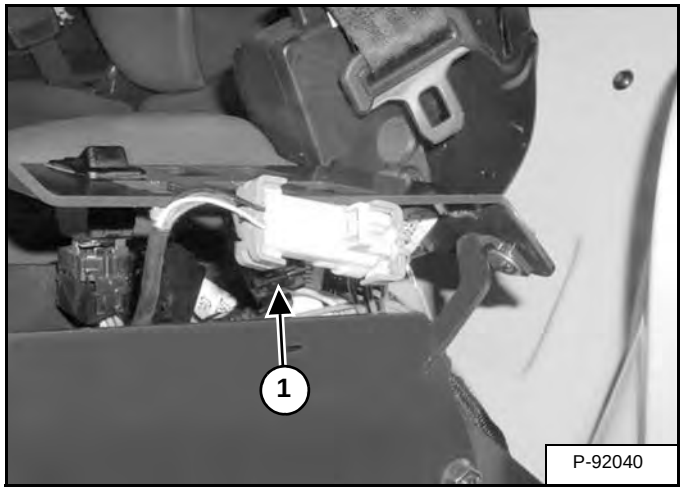
If the pressure is still incorrect replace the pilot pressure relief valve. (See Testing And Adjusting The Pilot Pressure Relief Valve on Page 20-33-1.)

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Handle Removal And Installation

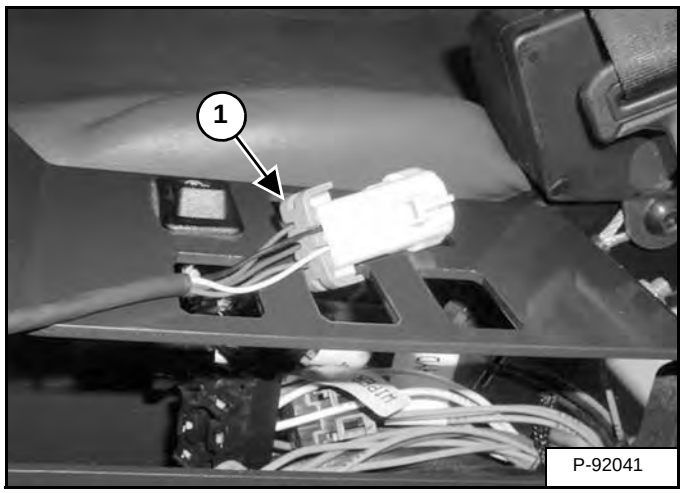
Remove the left console cover. (See Console Removal And Installation on Page 40-60-7.)

Figure 20-120-4



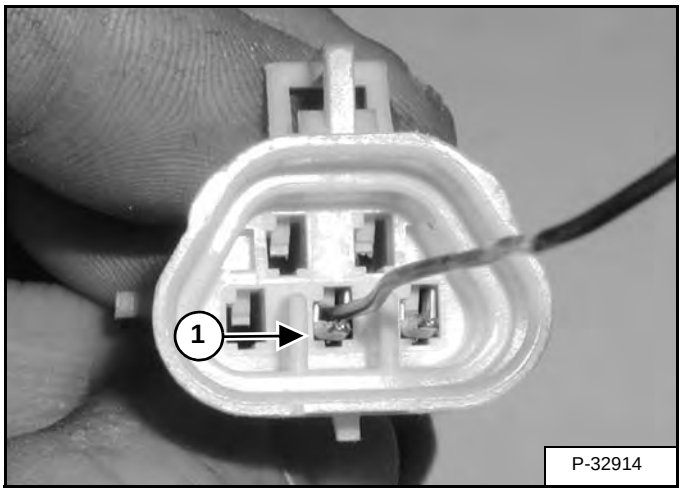
Disconnect the wire harness (Item 1) **[Figure 20-120-4]**.

Figure 20-120-5



Remove the lock (Item 1) **[Figure 20-120-5]** from the electrical connector.

Figure 20-120-6



Using a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 20-120-6]**.

Carefully remove the individual wires from the back of the electrical connector.

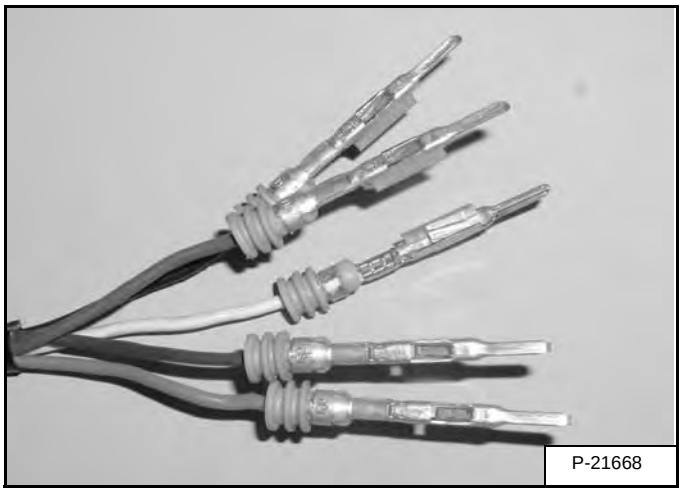
Remove the control handle (joystick) assembly from the excavator.

Installation: Use a small piece of wire and rebend the tab on each wire before installing it in the electrical connector.

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Handle Removal And Installation (Cont'd)

Figure 20-120-7

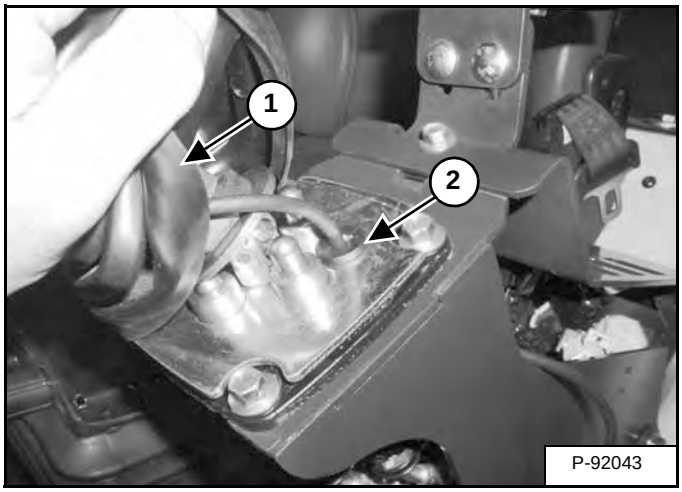


Installation: The wires **[Figure 20-120-7]** must be installed in the proper locations in the wire connector, listed below.

A Green	C Red	E White
B Brown	D Black	

Check each wire to be certain the tab locks into position.

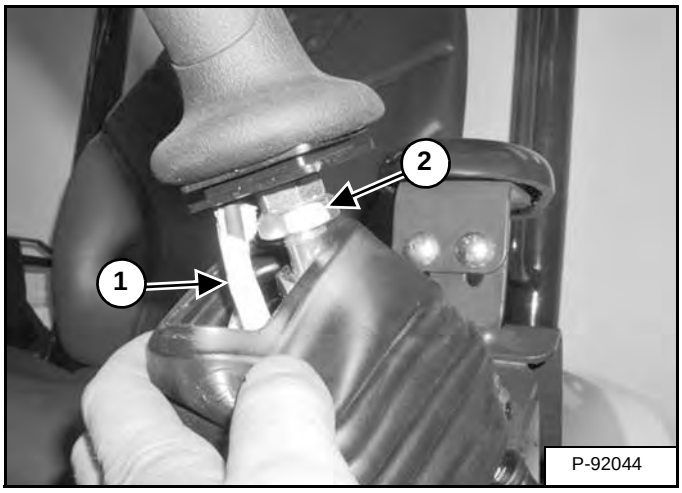
Figure 20-120-8



Raise the boot (Item 1) and pull the grommet (Item 2) up **[Figure 20-120-8]** out of the housing.

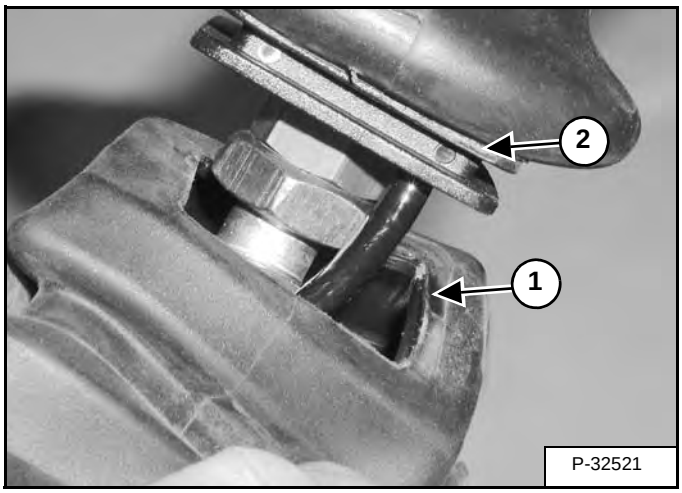
Remove the wire and grommet.

Figure 20-120-9



Pull the boot down and pull the wire harness (Item 1) out of the boot. Loosen the nut (Item 2) **[Figure 20-120-9]** and remove the handle.

Figure 20-120-10



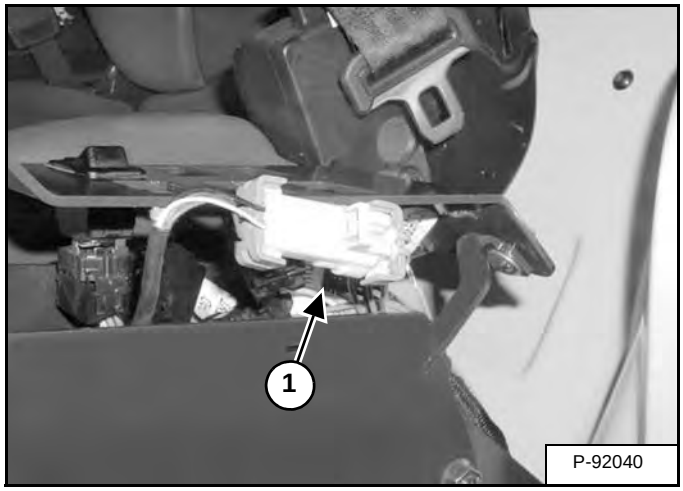
Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-120-10]**.

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Joystick Assembly Removal And Installation

Remove the left console cover. (See Console Removal And Installation on Page 40-60-7.)

Figure 20-120-11



Disconnect the wire harness (Item 1) **[Figure 20-120-11]**.

Figure 20-120-12



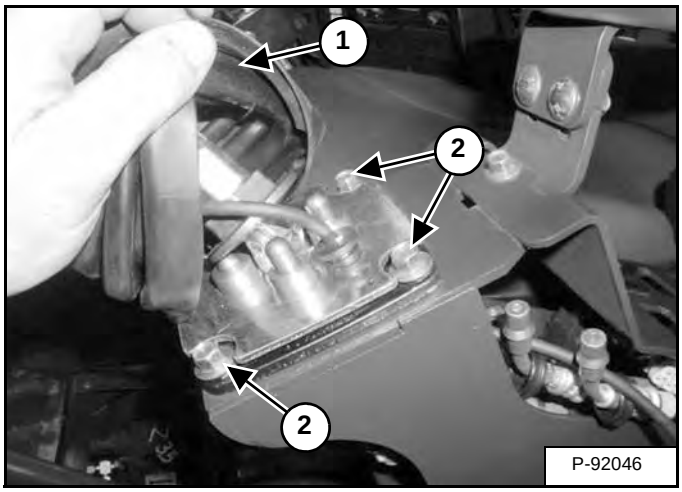
Mark and remove the hoses **[Figure 20-120-12]**.

IMPORTANT

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

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Figure 20-120-13



Pull the boot (Item 1) **[Figure 20-120-13]** up from the mounting plate.

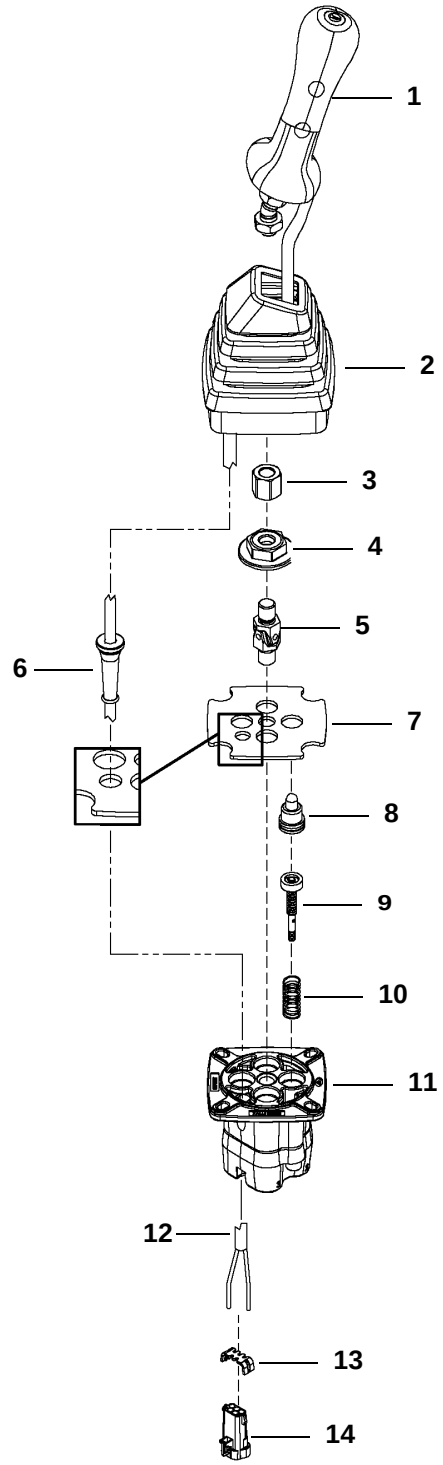
Remove the bolts (Item 2) **[Figure 20-120-13]**.

Remove the joystick assembly.

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Parts Identification

1. Handle
2. Boot
3. Coupler
4. Control Plate
5. U-Joint
6. Grommet
7. Plate
8. Plunger
9. Spool
10. Spring
11. Housing
12. Wire Harness
13. Lock
14. Connector



NA1481

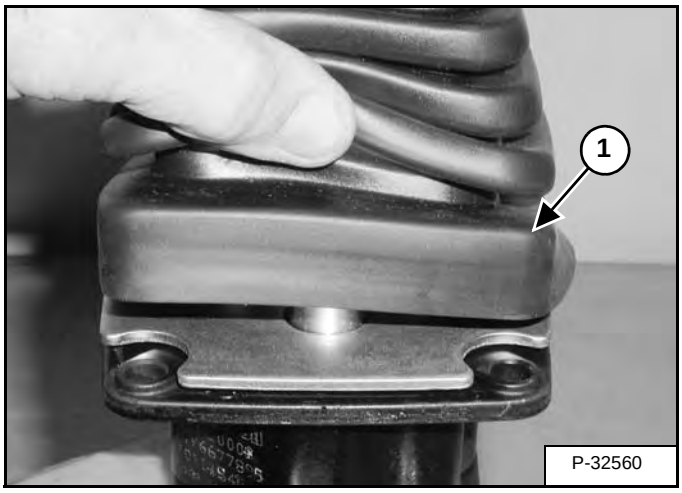
Dealer Copy -- Not for Resale

Disassembly

Remove the left handle. (See Handle Removal And Installation on Page 20-120-2.)

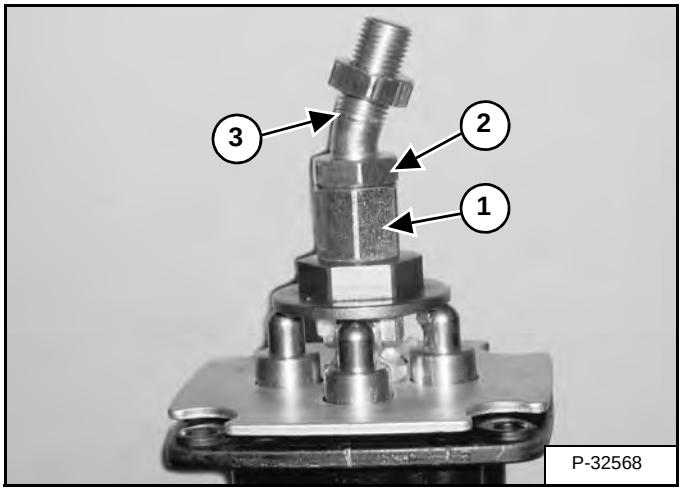
Clean the outside of the control lever before disassembly.

Figure 20-120-14



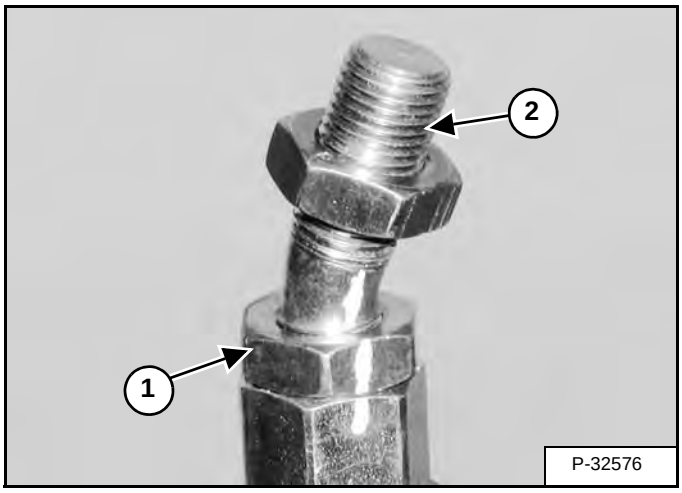
Remove the boot (Item 1) **[Figure 20-120-14]**.

Figure 20-120-15



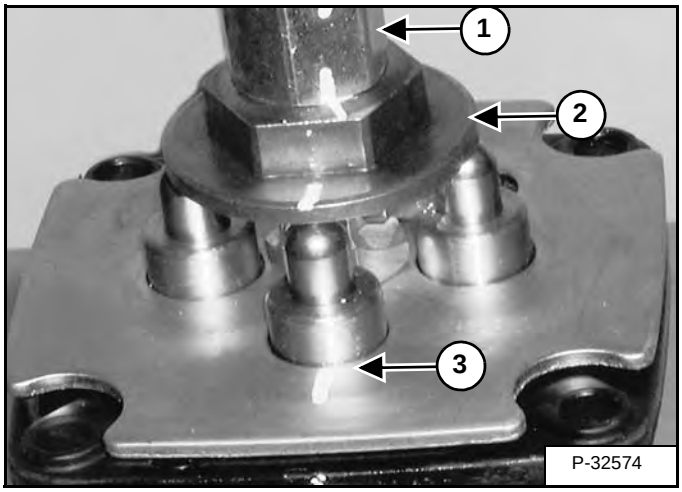
Mark the coupler (Item 1), nut (Item 2), and connector (Item 3) **[Figure 20-120-15]** for ease of assembly.

Figure 20-120-16



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-120-16]**.

Figure 20-120-17

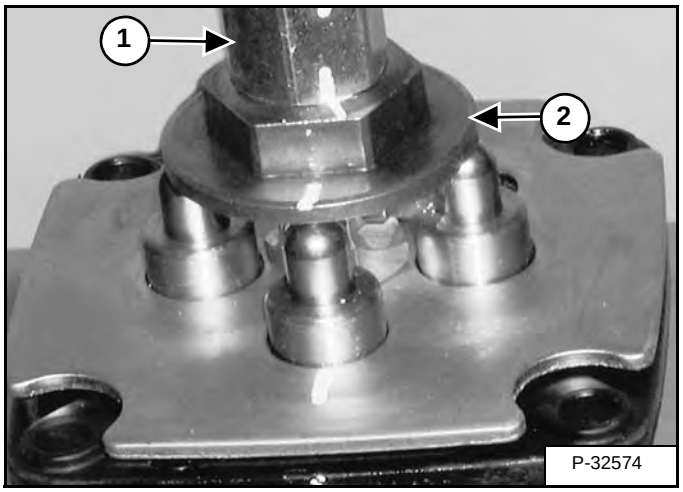


Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-120-17]** for ease of assembly.

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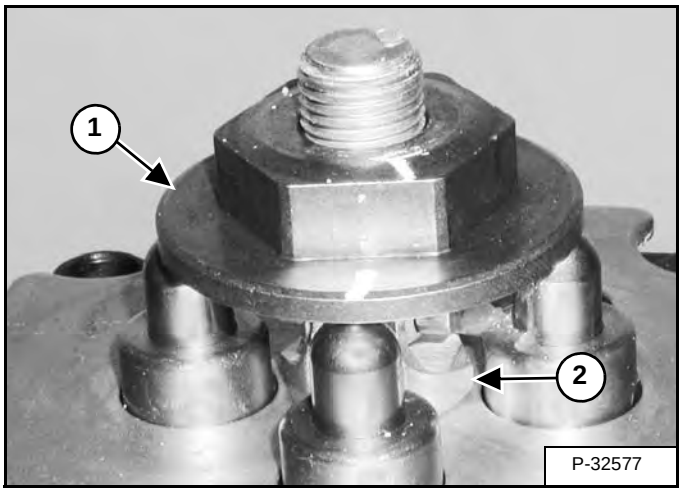
Disassembly (Cont'd)

Figure 20-120-18



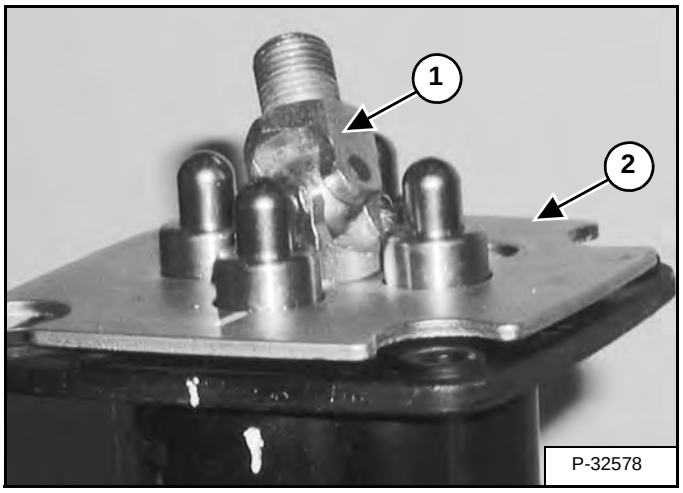
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-120-18]**.

Figure 20-120-19



Remove the control plate (Item 1) from the U-joint (Item 2) **[Figure 20-120-19]**.

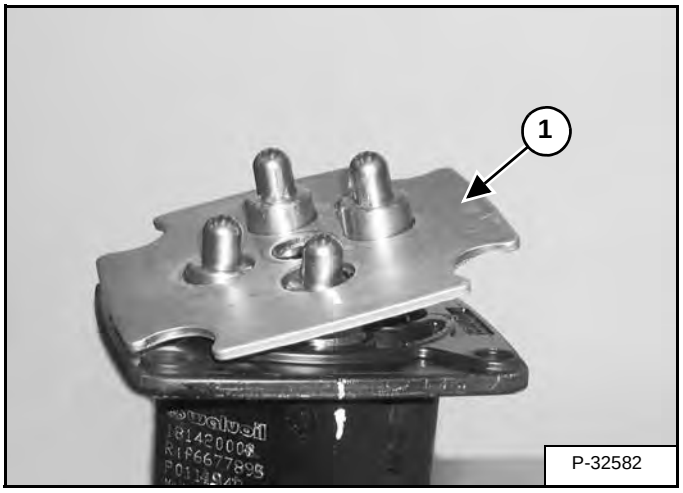
Figure 20-120-20



Mark the plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-120-20]**.

NOTE: The plate (Item 2) [Figure 20-120-20] is spring loaded and will come up as the U-joint is removed.

Figure 20-120-21

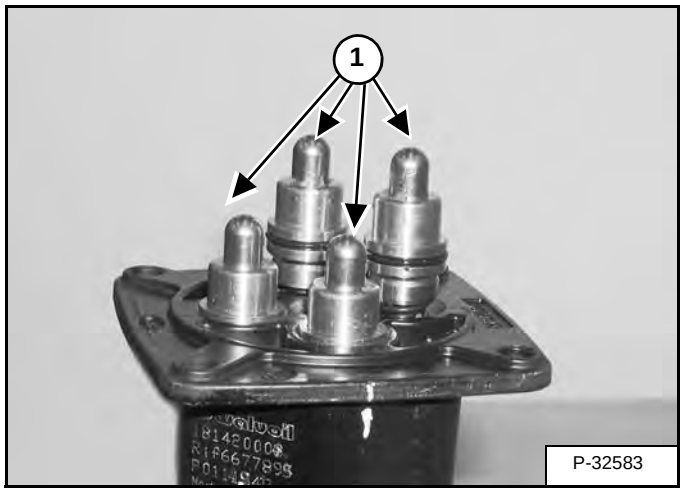


Remove the plate (Item 1) **[Figure 20-120-21]**.

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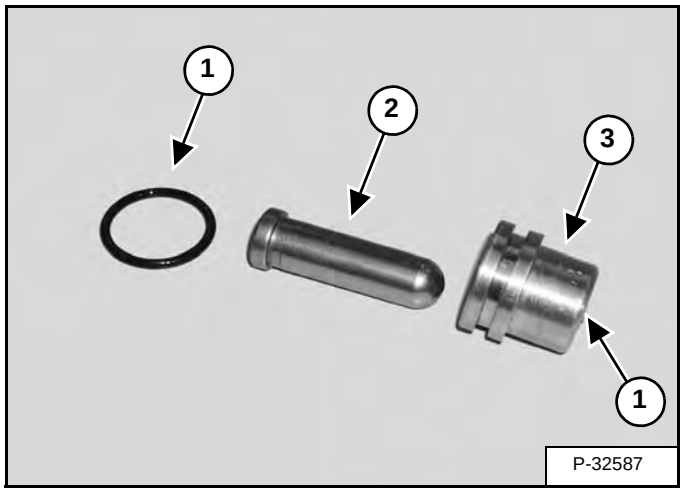
Disassembly (Cont'd)

Figure 20-120-22



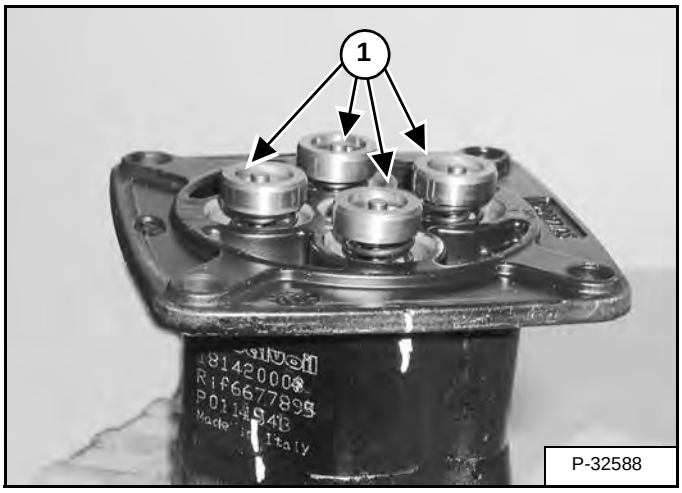
Remove the plunger assemblies (Item 1) **[Figure 20-120-22]**.

Figure 20-120-23



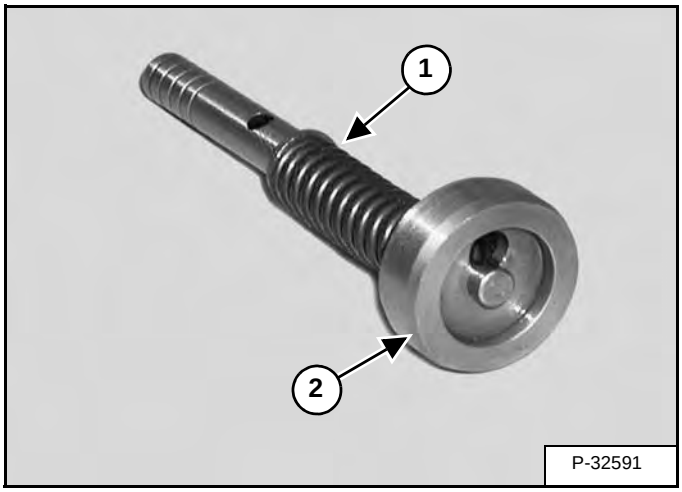
Remove the O-rings (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-120-23]**.

Figure 20-120-24



Remove the spool assemblies (Item 1) **[Figure 20-120-24]**.

Figure 20-120-25

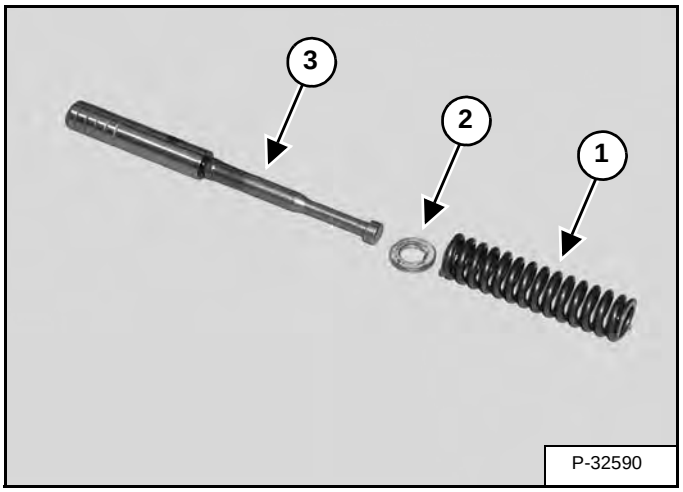


Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-120-25]**.

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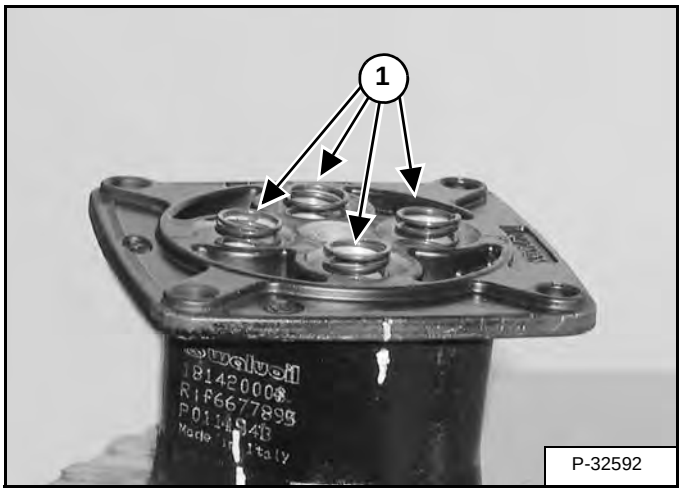
Disassembly (Cont'd)

Figure 20-120-26



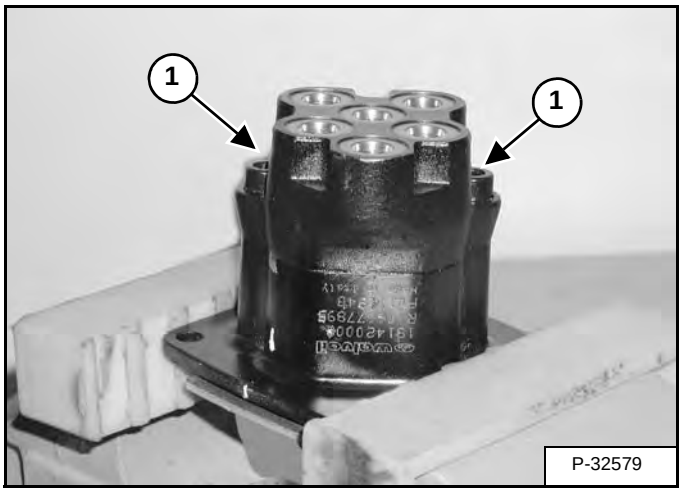
Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-120-26]**.

Figure 20-120-27



Remove the springs (Item 1) **[Figure 20-120-27]** from the housing.

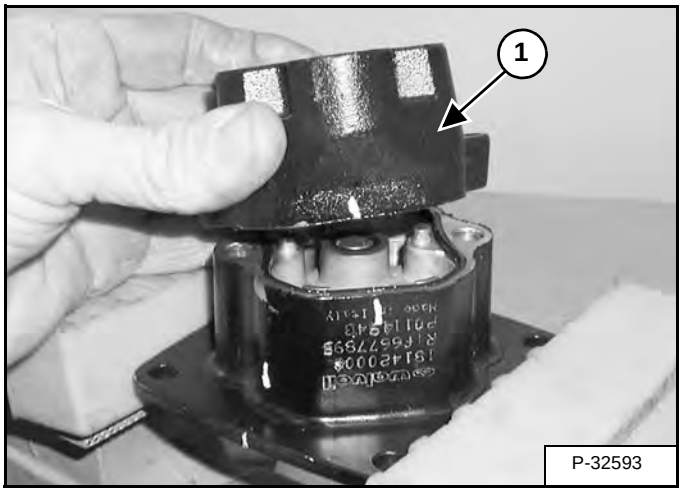
Figure 20-120-28



Clamp the housing in a vise that is equipped with padded jaws **[Figure 20-120-28]**.

Remove the two bolts (Item 1) **[Figure 20-120-28]**.

Figure 20-120-29

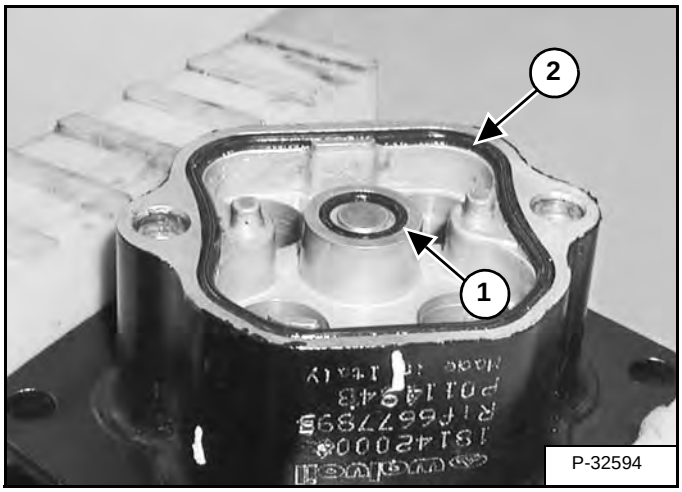


Remove the end cap (Item 1) **[Figure 20-120-29]**.

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Disassembly (Cont'd)

Figure 20-120-30



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-120-30]**.

Dealer Copy -- Not for Resale

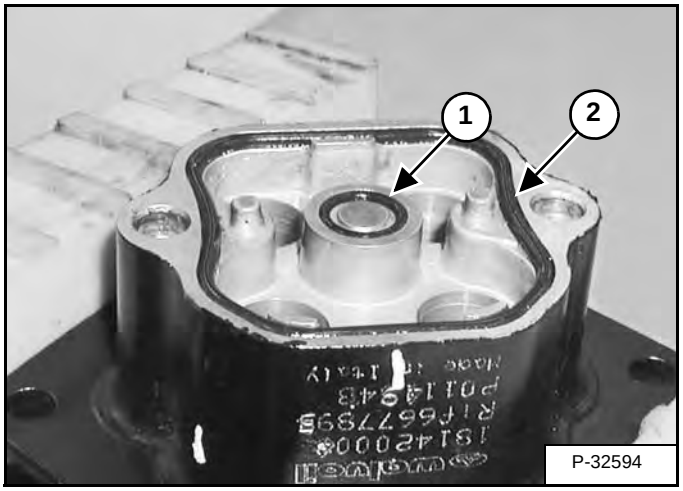
Assembly

Clean all parts in solvent and dry with compressed air.

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

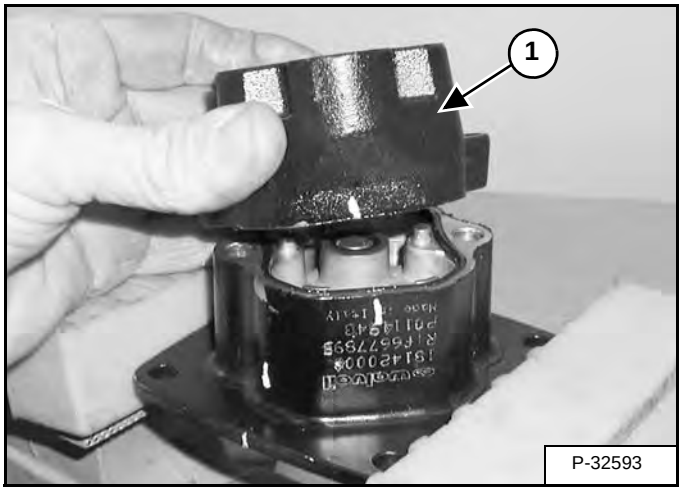
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-120-31



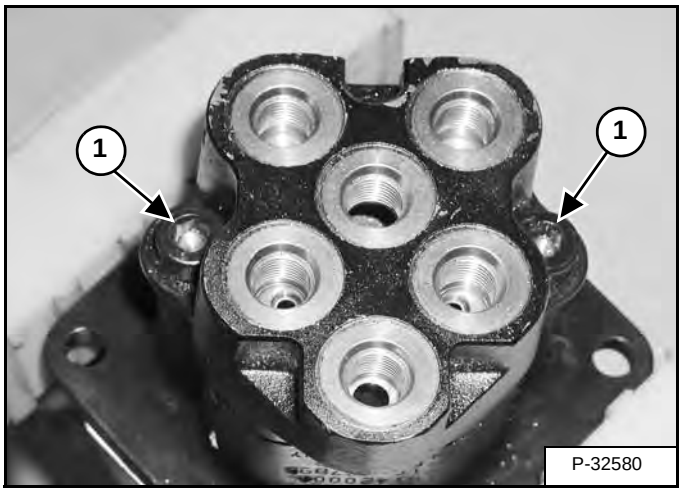
Clamp the housing in a vise equipped with padded jaws. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-120-31]**.

Figure 20-120-32



Install the end cap (Item 1) **[Figure 20-120-32]**.

Figure 20-120-33



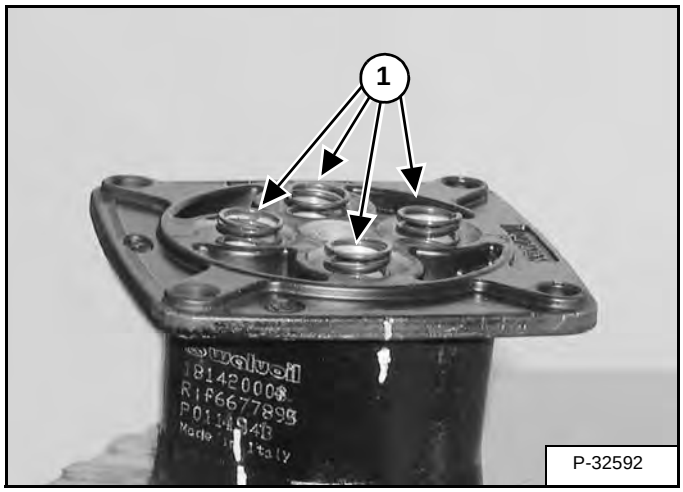
Install the bolts (Item 1) **[Figure 20-120-33]**.

Turn the housing over.

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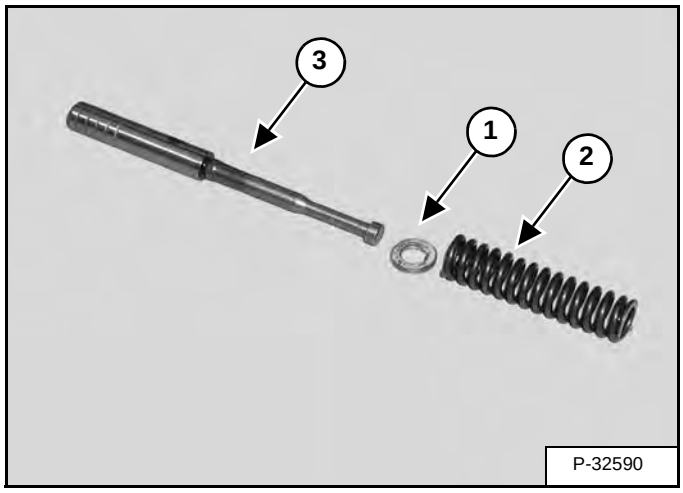
Assembly (Cont'd)

Figure 20-120-34



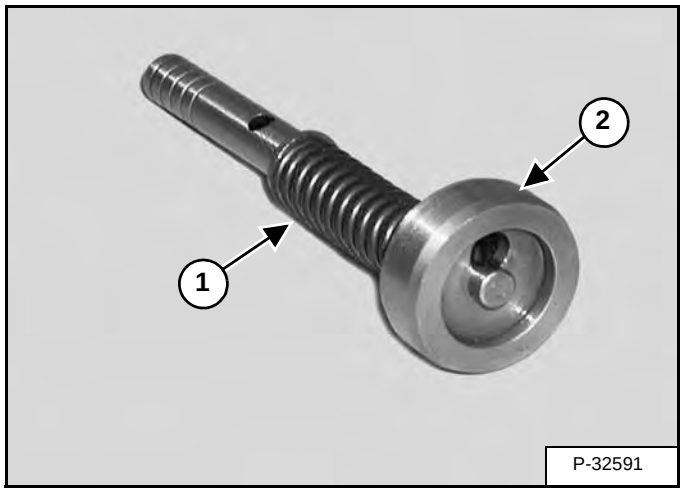
Install the springs (Item 1) **[Figure 20-120-34]**.

Figure 20-120-35



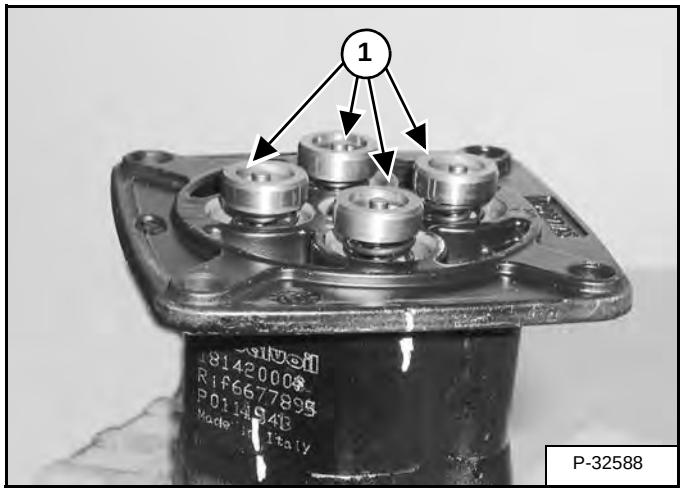
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-120-35]**.

Figure 20-120-36



Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-120-36]**.

Figure 20-120-37

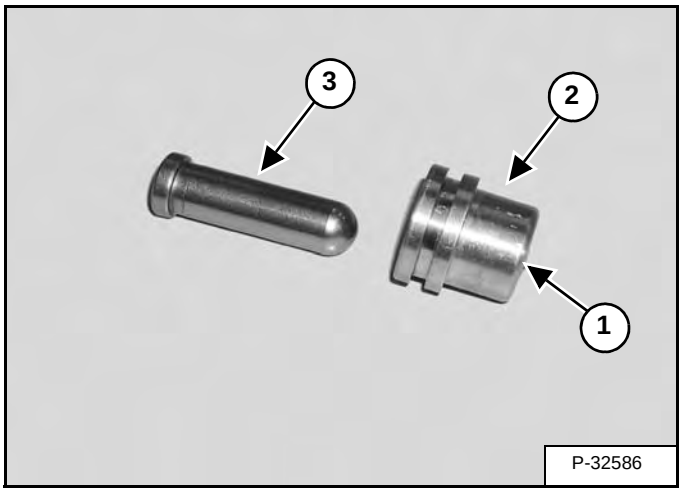


Install the spool assemblies (Item 1) **[Figure 20-120-37]** into the housing.

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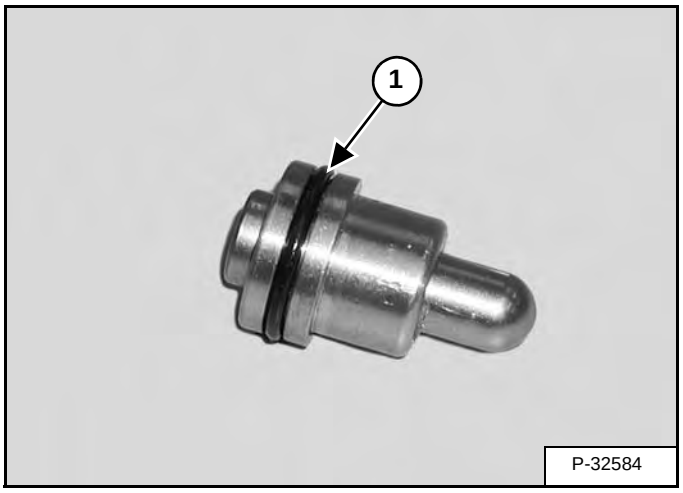
Assembly (Cont'd)

Figure 20-120-38



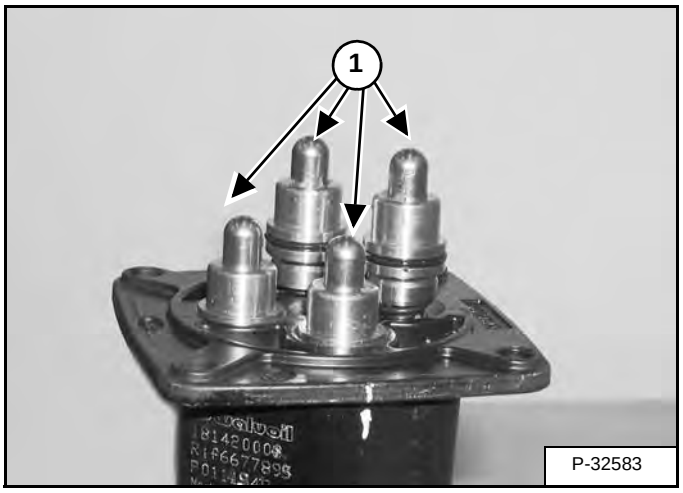
Install the O-ring (Item 1) into the bushing (Item 2). Install the plunger (Item 3) **[Figure 20-120-38]** into the bushing.

Figure 20-120-39



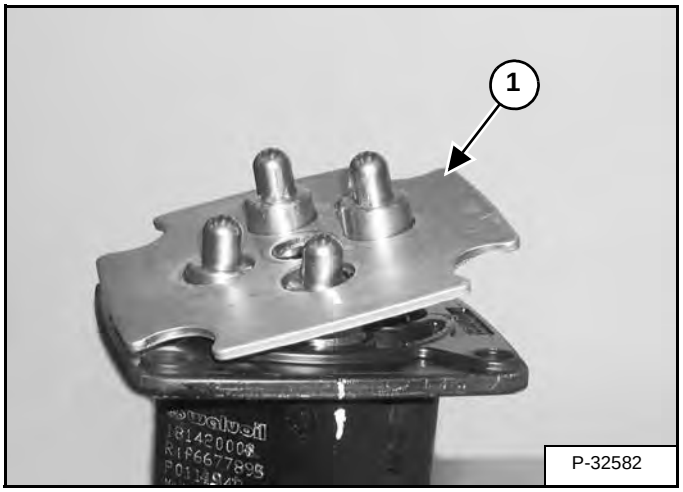
Install the O-ring (Item 1) **[Figure 20-120-39]** on the bushing.

Figure 20-120-40



Install the plunger assemblies (Item 1) **[Figure 20-120-40]** into the housing.

Figure 20-120-41



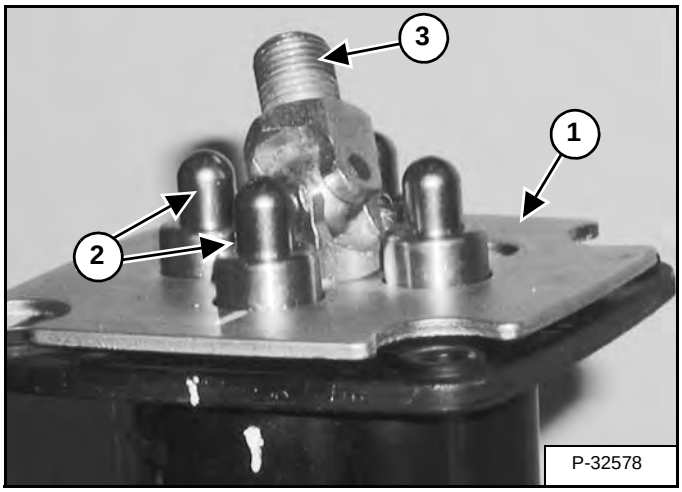
Install the plate (Item 1) **[Figure 20-120-41]**.

NOTE: Spring pressure can dislodge the plunger assemblies until the plate is secured in place.

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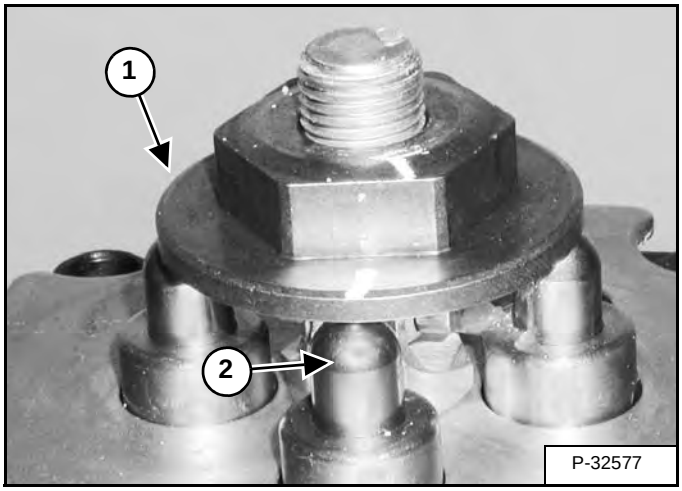
Assembly (Cont'd)

Figure 20-120-42



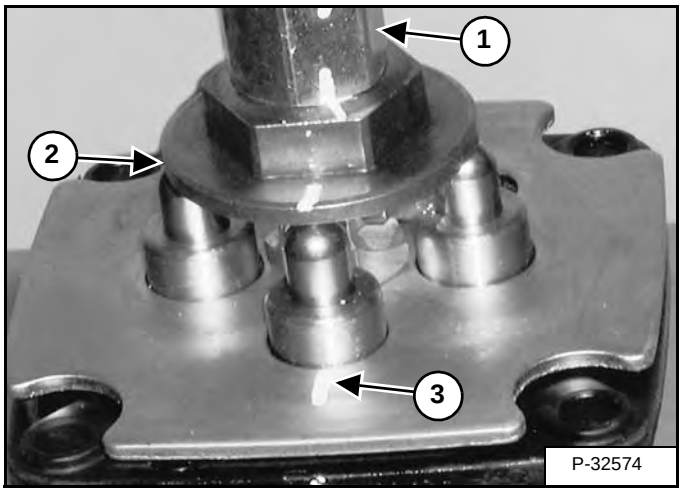
Press down on the plate (Item 1) keeping the plunger assemblies (Item 2) fully seated and install the U-joint (Item 3) **[Figure 20-120-42]**.

Figure 20-120-43



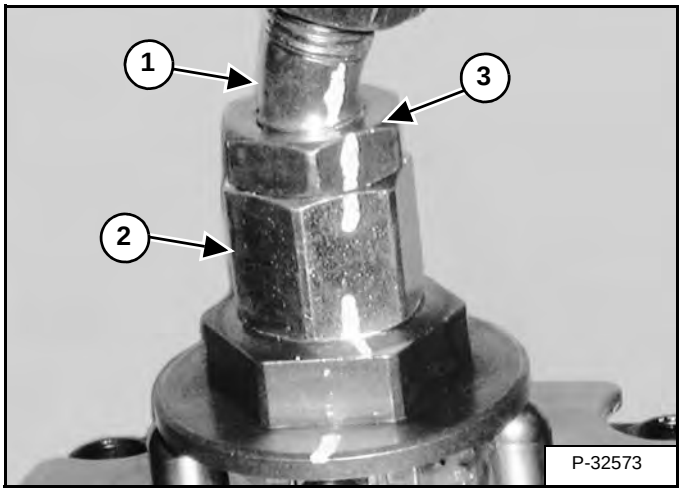
Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-120-43]**.

Figure 20-120-44



Align the coupler (Item 1) with the control plate (Item 2) and plate (Item 3) **[Figure 20-120-44]**. Tighten the coupler.

Figure 20-120-45



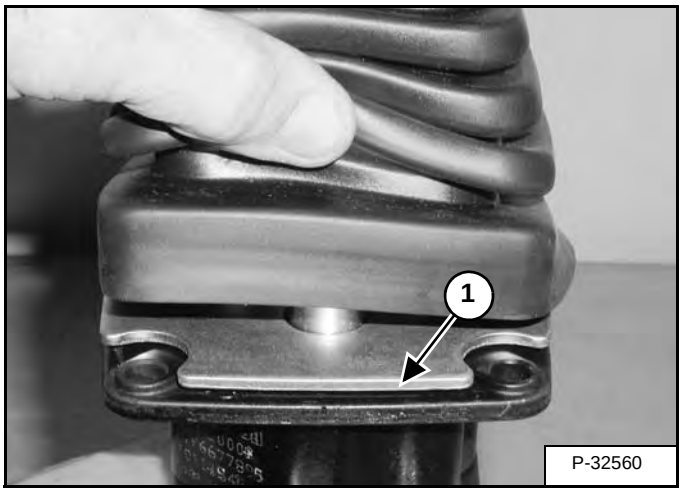
Install the connector (Item 1) **[Figure 20-120-45]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-120-45]**.

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Assembly (Cont'd)

Figure 20-120-46



Install the tabs of the boot in between the joystick flange and the mounting plate (Item 1) **[Figure 20-120-46]**.

Install the handle. (See Handle Removal And Installation on Page 20-120-2.)

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HYDRAULIC FILTER MOUNT

Removal And Installation

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-130-5.)

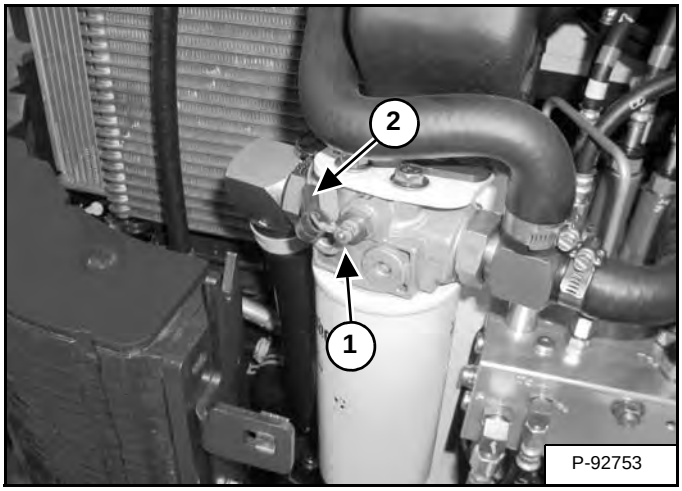
IMPORTANT

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

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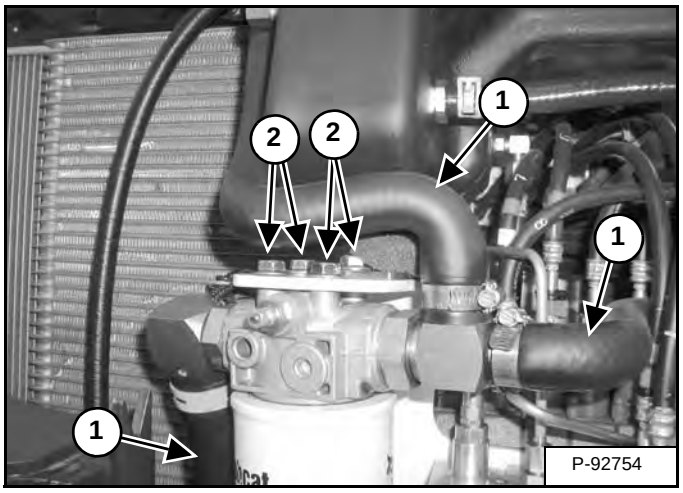
Remove the right upperstructure cover. (See Removal And Installation on Page 40-80-1.)

Figure 20-130-1



Loosen the nut (Item 1) and remove the wire harness (Item 2) **[Figure 20-130-1]**.

Figure 20-130-2



Remove the three hoses (Item 1) **[Figure 20-130-2]**.

Remove the four bolts (Item 2) **[Figure 20-130-2]** and remove the filter mount assembly.

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HYDRAULIC RESERVOIR

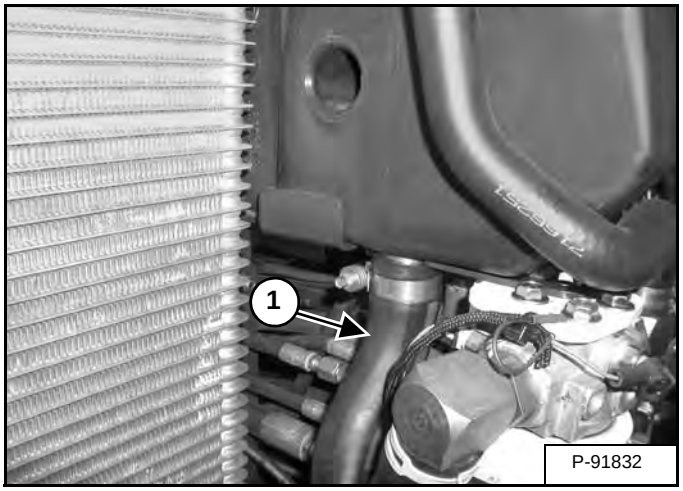
Removal And Installation

Drain the reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-130-5.)

Remove the right upperstructure cover. (See Removal And Installation on Page 40-80-1.)

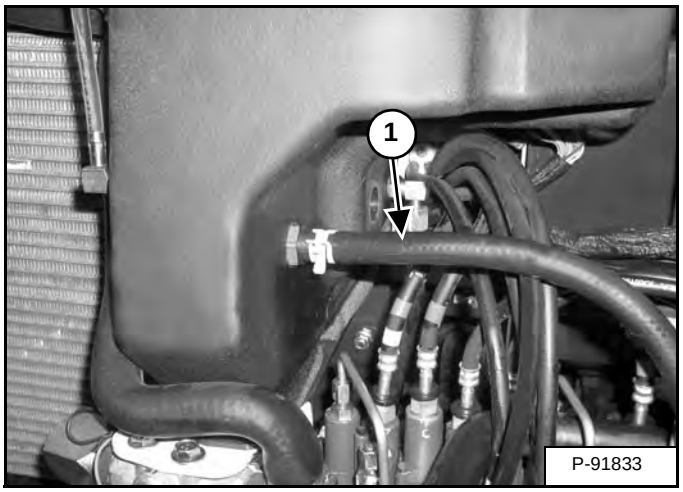
Remove the filter. (See Removing And Replacing Hydraulic Filters on Page 10-130-3.)

Figure 20-140-1



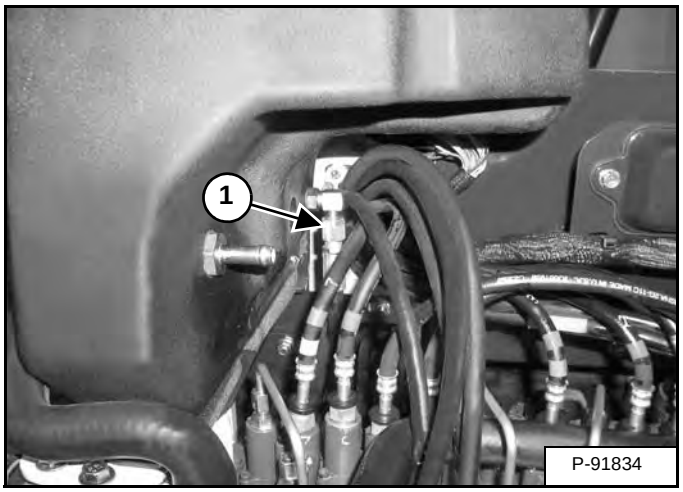
Remove the suction hose (Item 1) **[Figure 20-140-1]**.

Figure 20-140-2



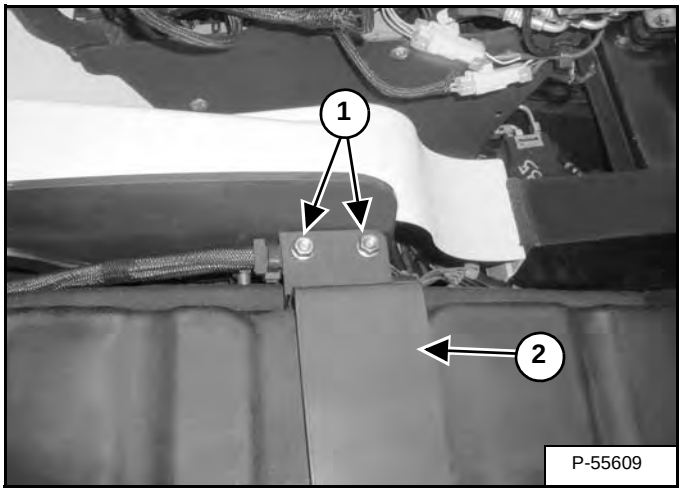
Remove the hose (Item 1) **[Figure 20-140-2]**.

Figure 20-140-3



Remove the hose (Item 1) **[Figure 20-140-3]**.

Figure 20-140-4



Remove the nuts (Item 1) and bracket (Item 2) **[Figure 20-140-4]**. Remove the reservoir.

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OIL COOLER

Removal And Installation

IMPORTANT

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

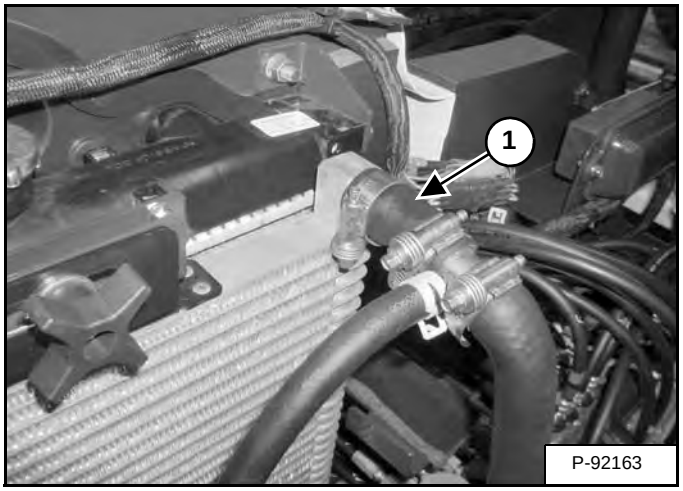
I-2003-0888

Open the right side cover.

Open the tailgate.

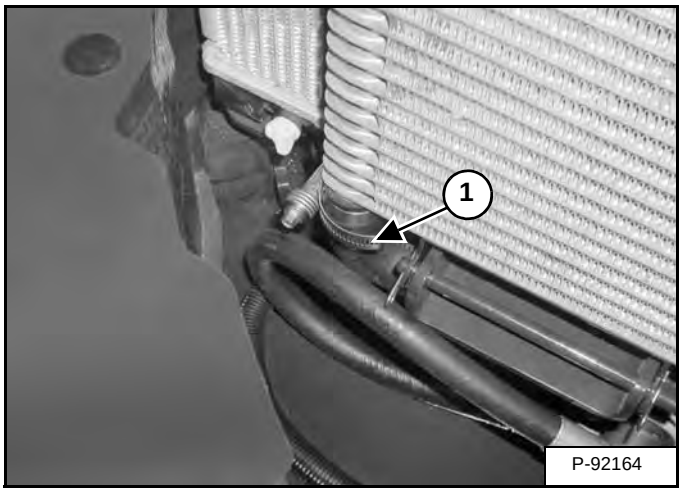
Remove the hydraulic reservoir. (See Removal And Installation on Page 20-140-1.)

Figure 20-150-1



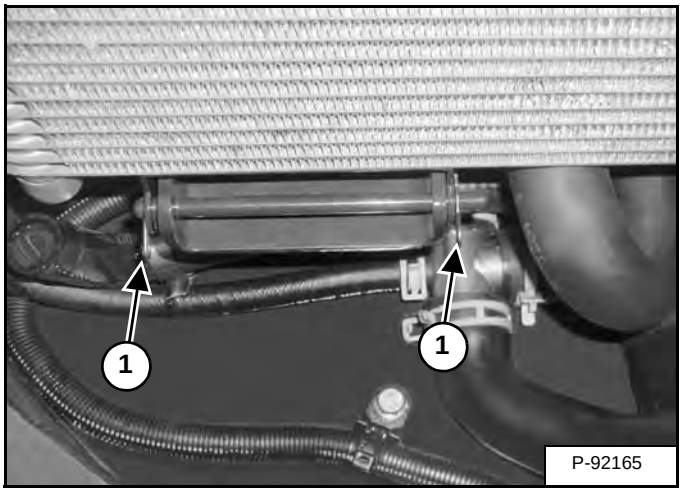
Remove the top hose (Item 1) **[Figure 20-150-1]**.

Figure 20-150-2



Remove the bottom hose (Item 1) **[Figure 20-150-2]**.

Figure 20-150-3

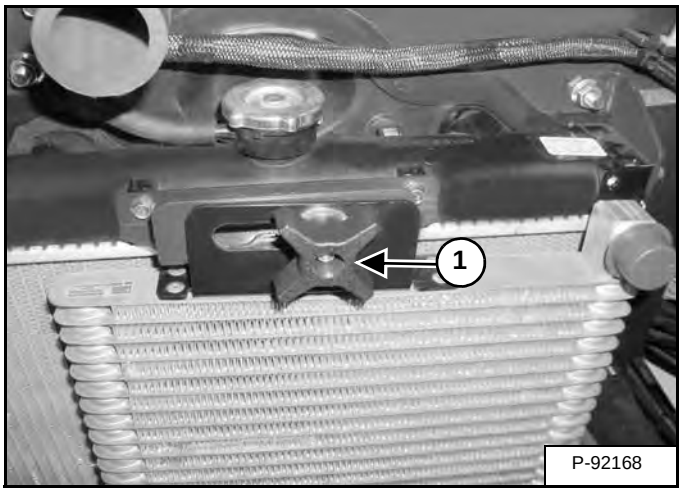


Remove the clips (Item 1) **[Figure 20-150-3]**.

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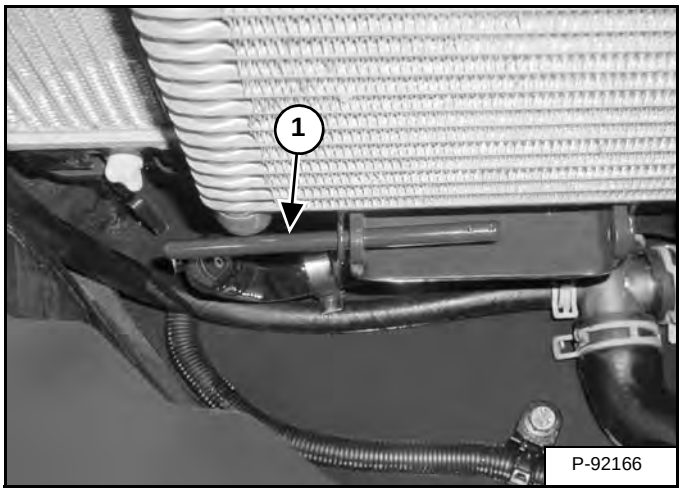
Removal And Installation (Cont'd)

Figure 20-150-4



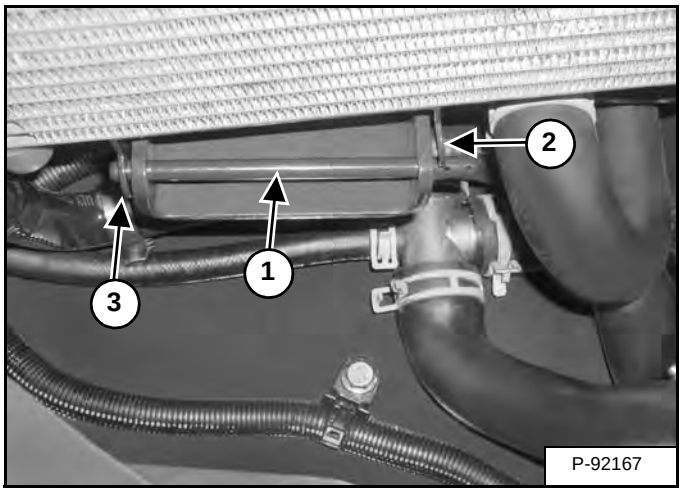
Loosen the lock (Item 1) **[Figure 20-150-4]**.

Figure 20-150-5



Tilt the cooler slightly away from the radiator. Slide the pivot rod (Item 1) **[Figure 20-150-5]** towards the rear of the excavator.

Figure 20-150-6



Raise the front of the cooler and slide the rod (Item 1) towards the front of the excavator. Slide the rod under the mounting ear (Item 2) of the cooler. Continue to slide the rod forward until it is no longer engaging the rear mounting ear (Item 3) **[Figure 20-150-6]** of the cooler.

Remove the cooler.

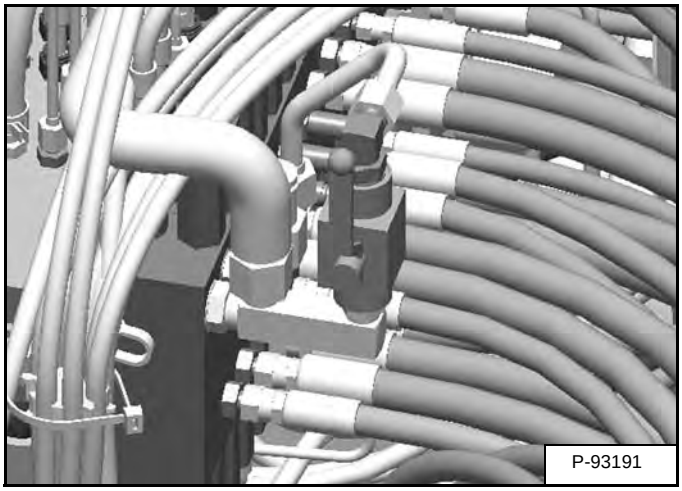
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DIRECT TO TANK VALVE

Removal And Installation

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-130-5.)

Figure 20-160-1



Remove the hoses from the direct to tank valve and remove valve from the excavator **[Figure 20-160-1]**.

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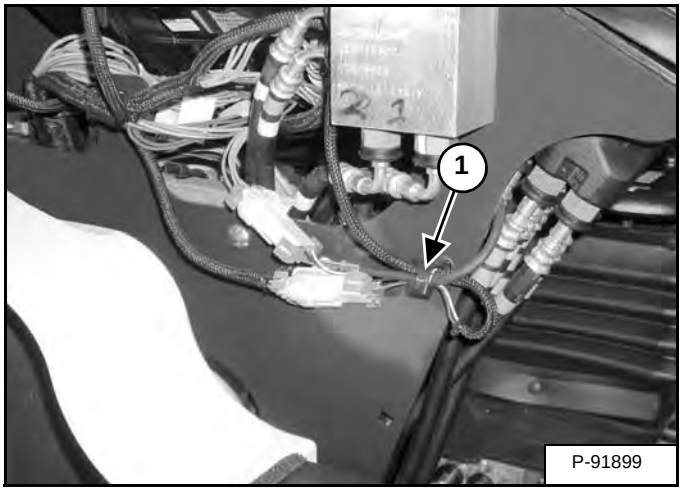
Dealer Copy -- Not for Resale

BLADE CONTROL LEVER

Handle Removal And Installation

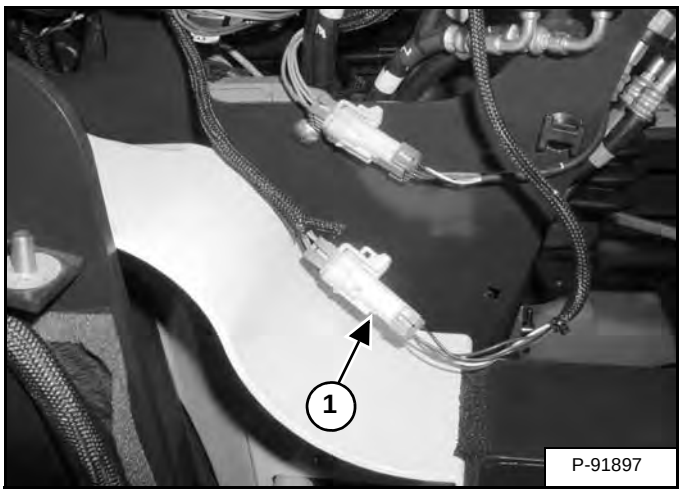
Remove the right console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 20-170-1



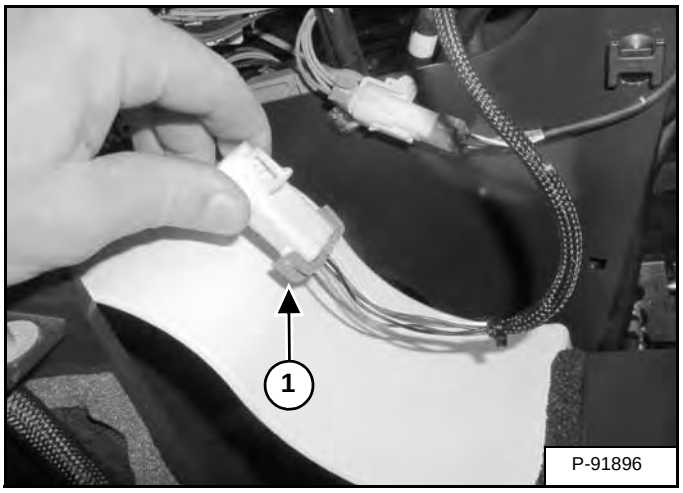
Cut and remove the cable tie (Item 1) **[Figure 20-170-1]**.

Figure 20-170-2



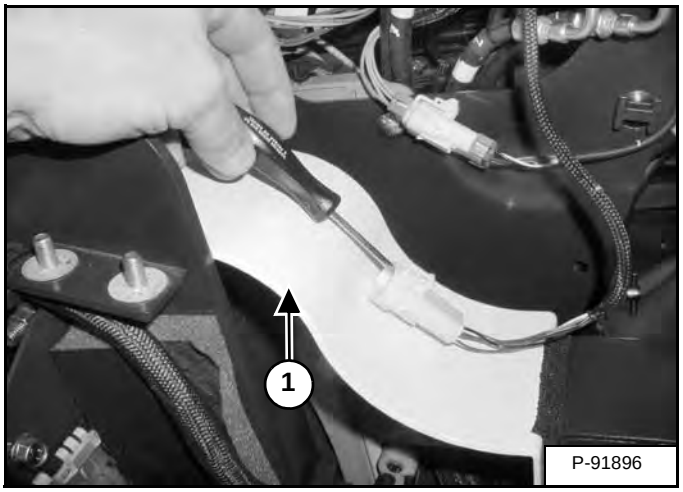
Disconnect the wire harness (Item 1) **[Figure 20-170-2]**.

Figure 20-170-3



Remove the connector lock (Item 1) **[Figure 20-170-3]** from the connector.

Figure 20-170-4



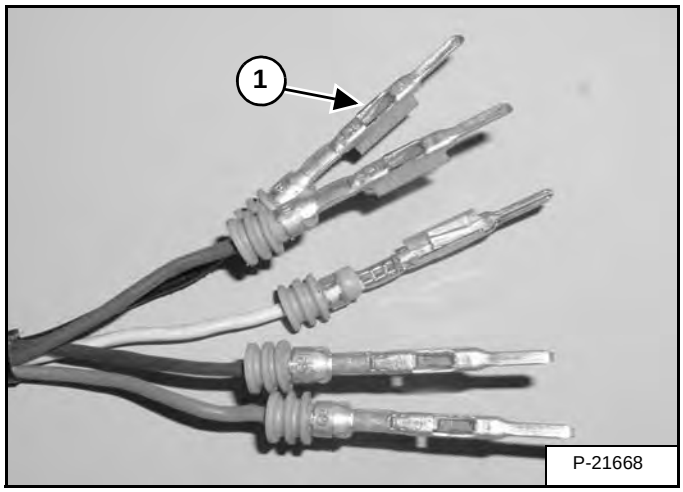
Depress the wire terminal tabs and remove the wires from the back of the electrical connector (Item 1) **[Figure 20-170-4]**.

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BLADE CONTROL LEVER (CONT'D)

Handle Removal And Installation (Cont'd)

Figure 20-170-5



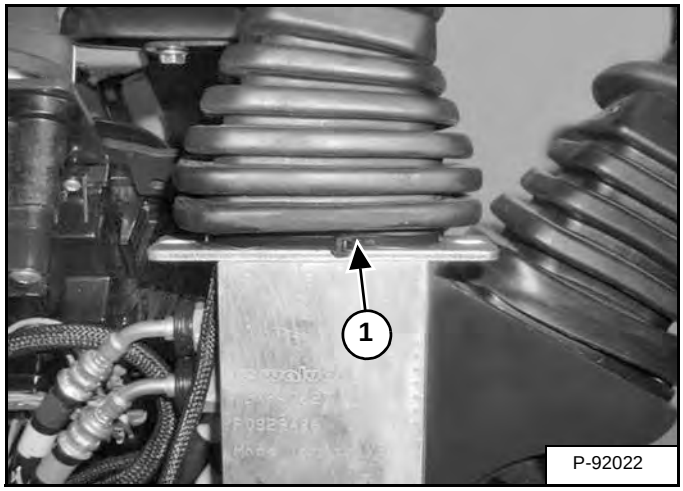
Installation: Re-bend the tab (Item 1) **[Figure 20-170-5]** on each wire before installing the electrical connector.

Installation: The wires must be installed in the proper locations in the wire connector, listed below:

A Green
B Brown
C Red
D Black
E White

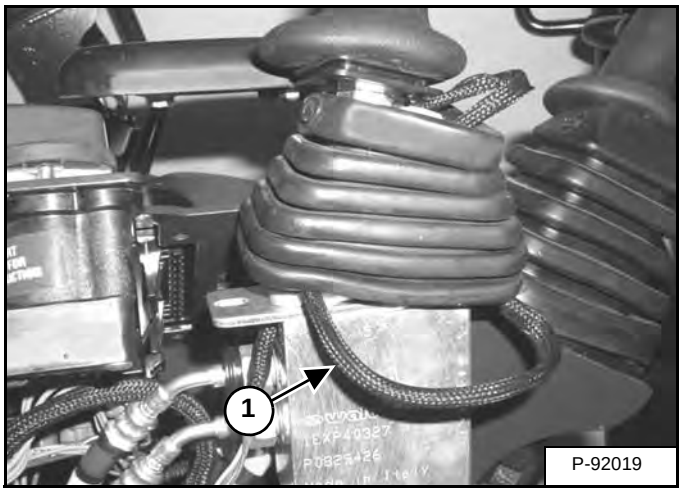
Check each wire to be certain the tab locks into position.

Figure 20-170-6



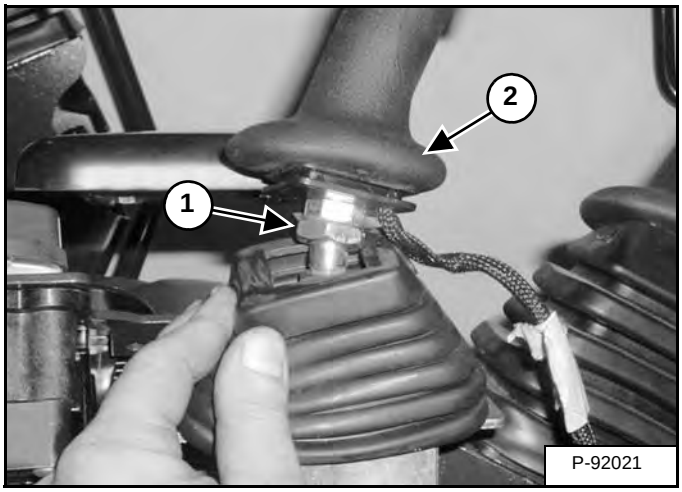
Cut and remove the cable tie (Item 1) **[Figure 20-170-6]**.

Figure 20-170-7



Route the harness (Item 1) **[Figure 20-170-7]** out through the top of the dust boot.

Figure 20-170-8



Loosen the locknut (Item 1) and remove the handle (Item 2) **[Figure 20-170-8]**.

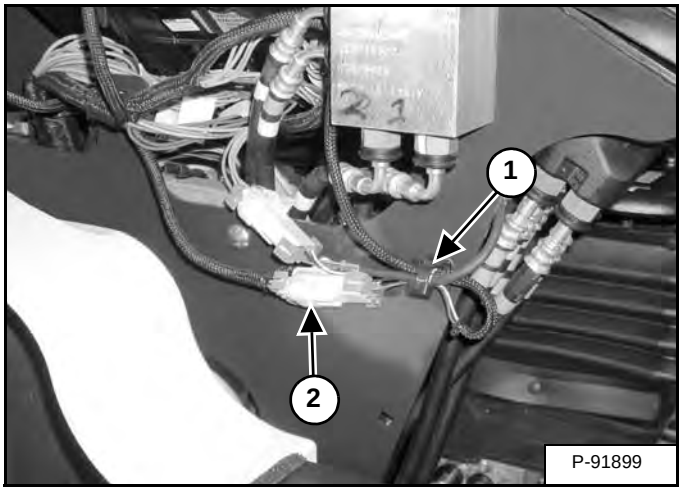
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BLADE CONTROL LEVER (CONT'D)

Removal And Installation

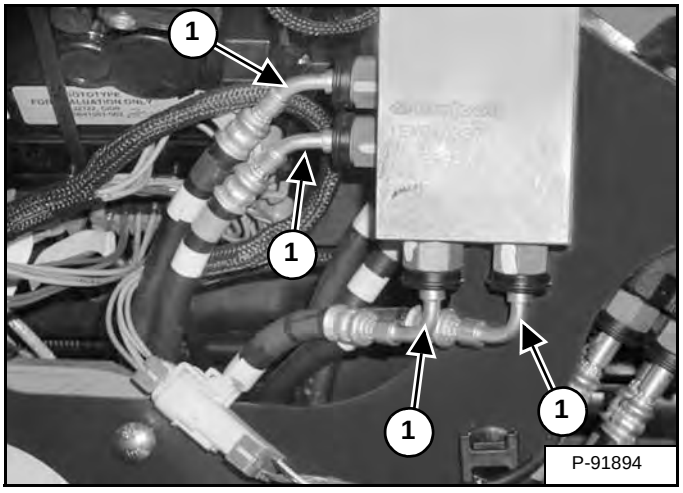
Remove the right console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 20-170-9



Cut and remove the cable tie (Item 1). Disconnect the wire harness (Item 2) **[Figure 20-170-9]**.

Figure 20-170-10



Mark and remove the four hoses (Item 1) **[Figure 20-170-10]**.

Figure 20-170-11

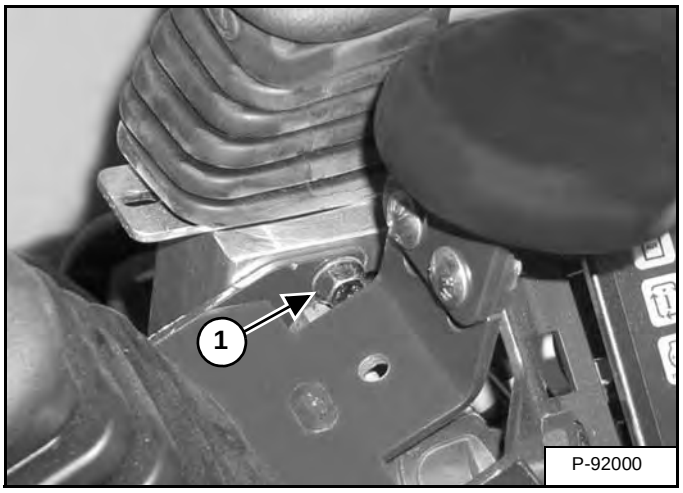
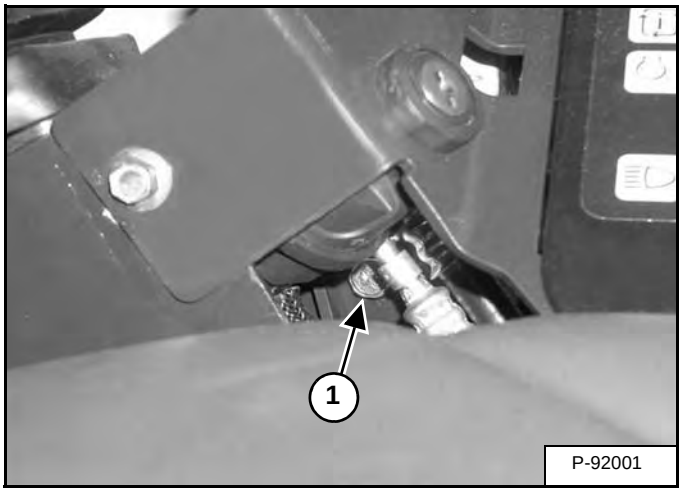


Figure 20-170-12



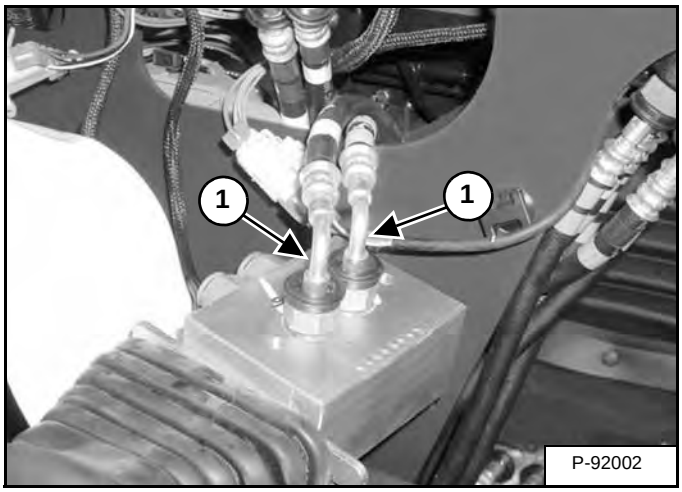
Remove the bolts (Item 1) **[Figure 20-170-11]** and **[Figure 20-170-12]**.

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BLADE CONTROL LEVER (CONT'D)

Removal And Installation (Cont'd)

Figure 20-170-13



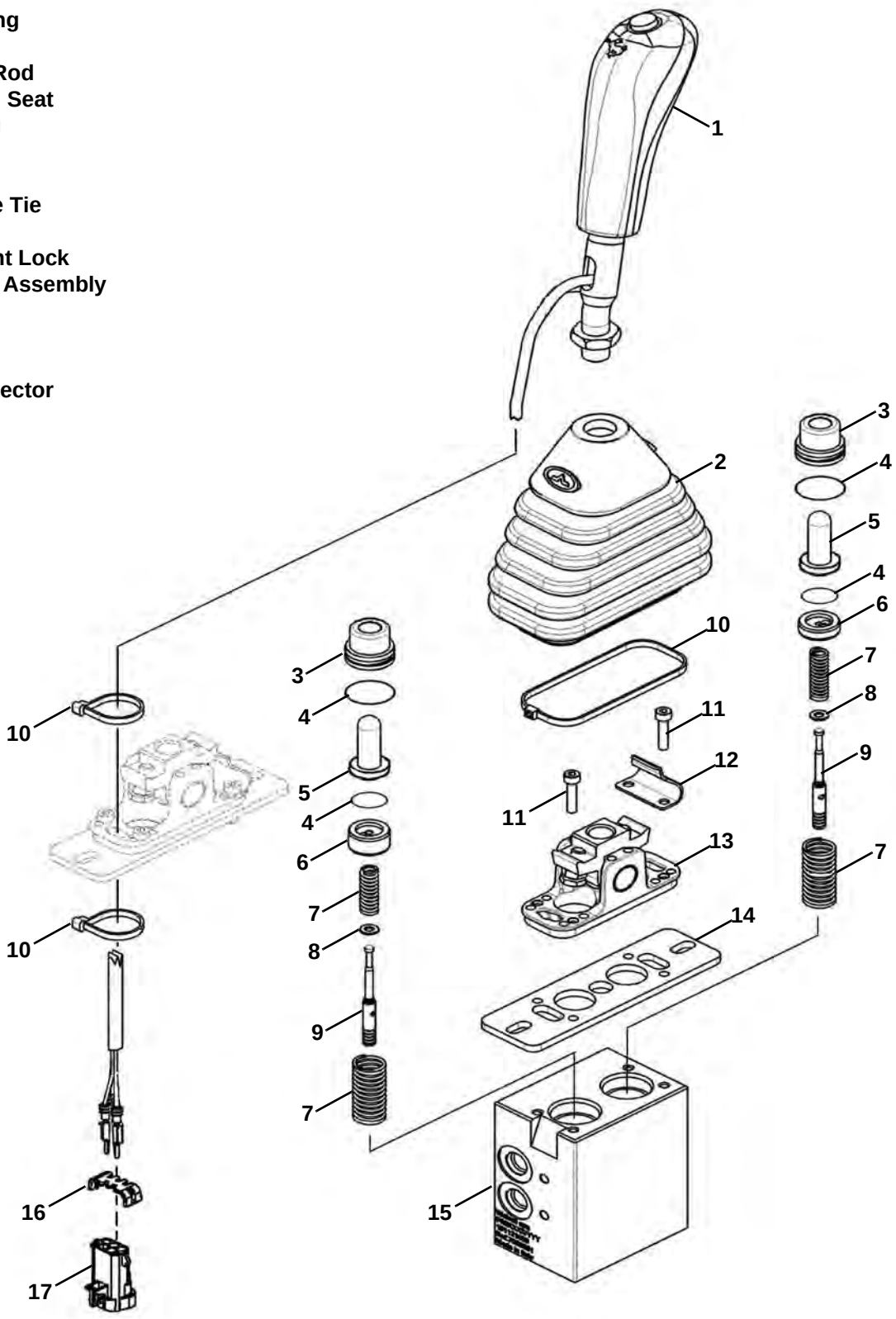
Tilt the control away from the console and remove the two hoses (Item 1) **[Figure 20-170-13]**.

Remove the control.

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Parts Identification

1. Handle
2. Boot
3. Bushing
4. O-ring
5. Push Rod
6. Spring Seat
7. Spring
8. Shim
9. Spool
10. Cable Tie
11. Bolt
12. Detent Lock
13. Pivot Assembly
14. Plate
15. Body
16. Lock
17. Connector

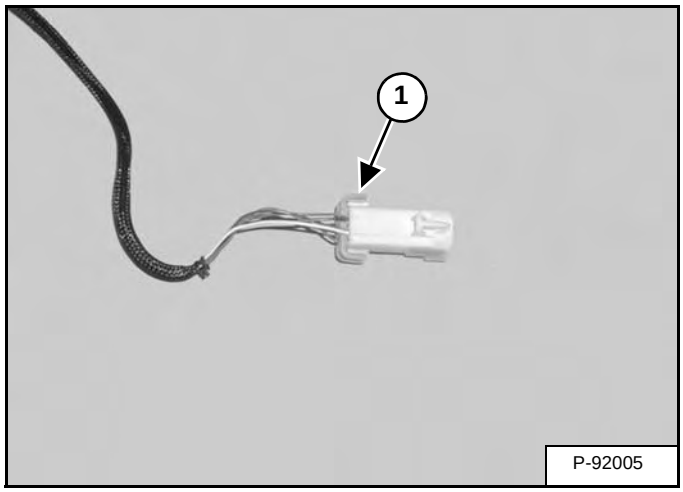


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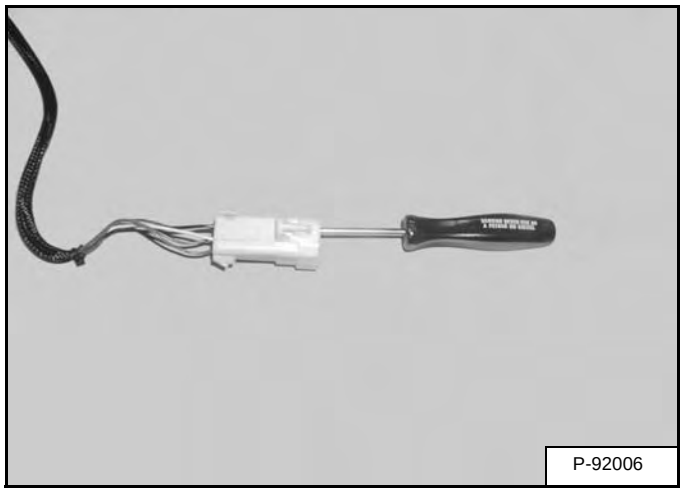
Disassembly And Assembly

Figure 20-170-14



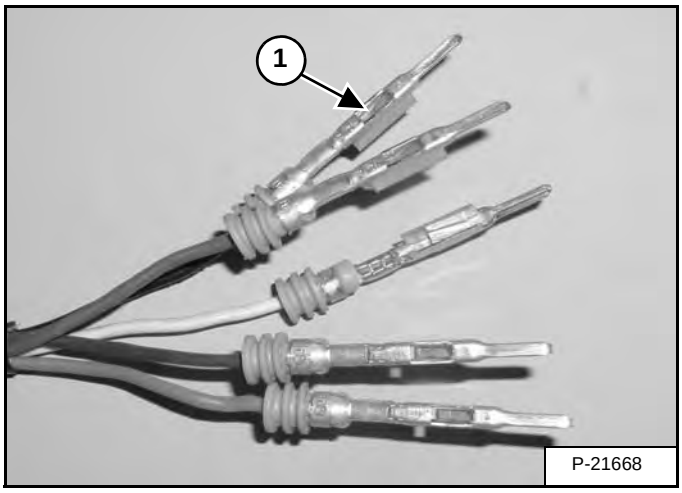
Remove the connector lock (Item 1) **[Figure 20-170-15]**.

Figure 20-170-15



Depress the wire terminal tabs and remove the wires from the back of the electrical connector **[Figure 20-170-15]**.

Figure 20-170-16



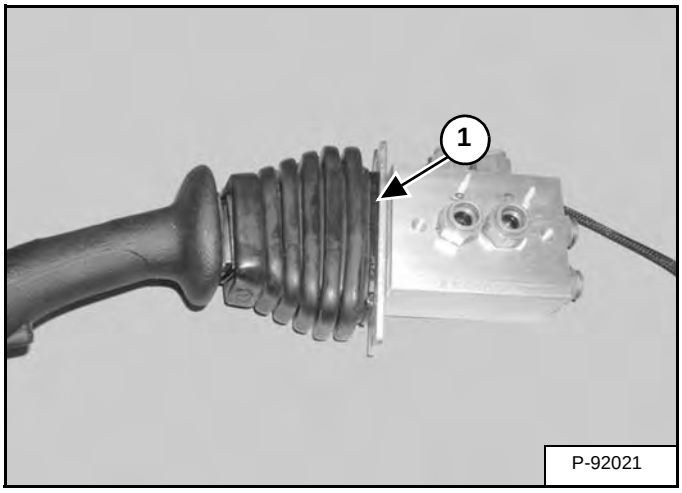
Installation: Re-bed the tab (Item 1) **[Figure 20-170-16]** on each wire before installing the electrical connector.

Installation: The wires must be installed in the proper locations in the wire connector, listed below.

A Green
B Brown
C Red
D Black
E White

Check each wire to be certain the tab locks into position.

Figure 20-170-17

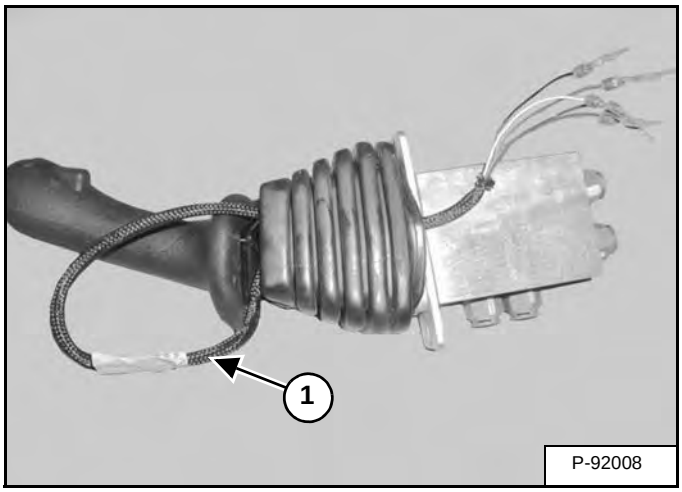


Cut and remove the cable tie (Item 1) **[Figure 20-170-17]**.

Dealer Copy -- Not for Resale

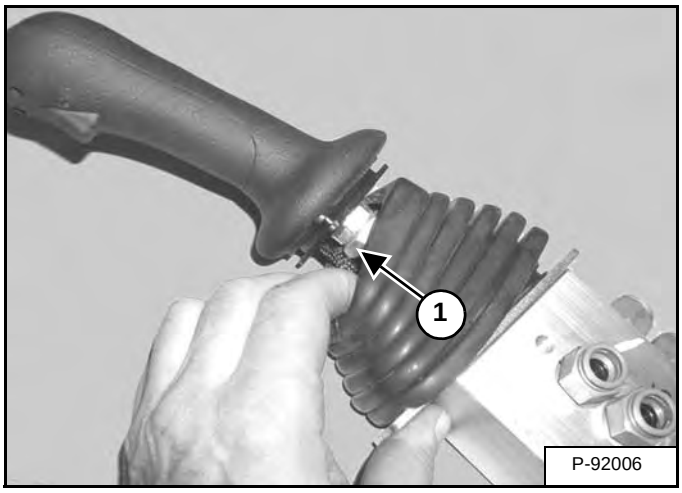
Disassembly And Assembly (Cont'd)

Figure 20-170-18



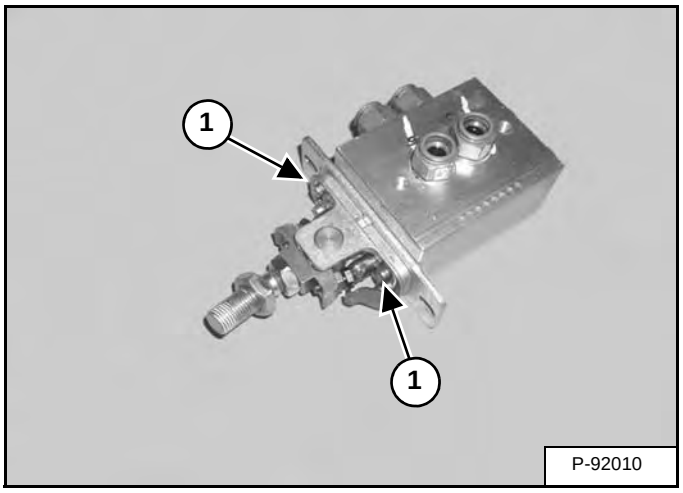
Route the harness (Item 1) **[Figure 20-170-18]** through the top of the dust boot.

Figure 20-170-19



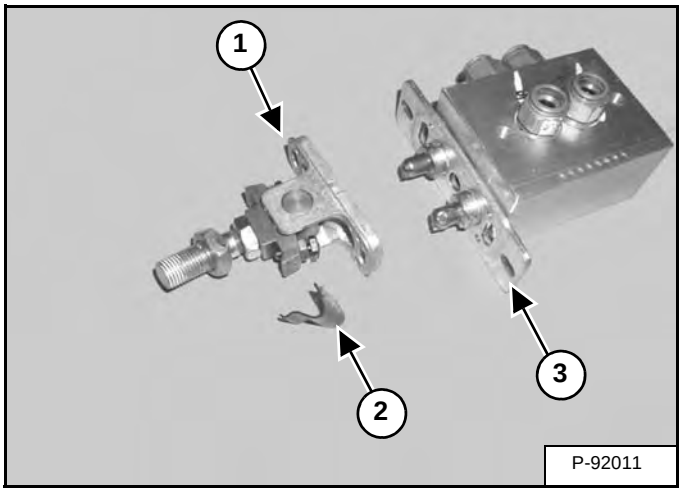
Loosen the nut (Item 1) **[Figure 20-170-19]** and remove the handle and dust boot.

Figure 20-170-20



Remove the four bolts (Item 1) **[Figure 20-170-20]**.

Figure 20-170-21

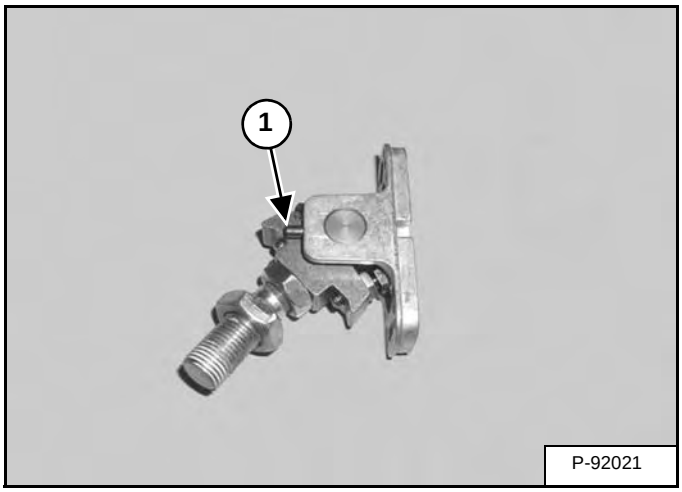


Remove the pivot assembly (Item 1), detent lock (Item 2), and plate (Item 3) **[Figure 20-170-21]**.

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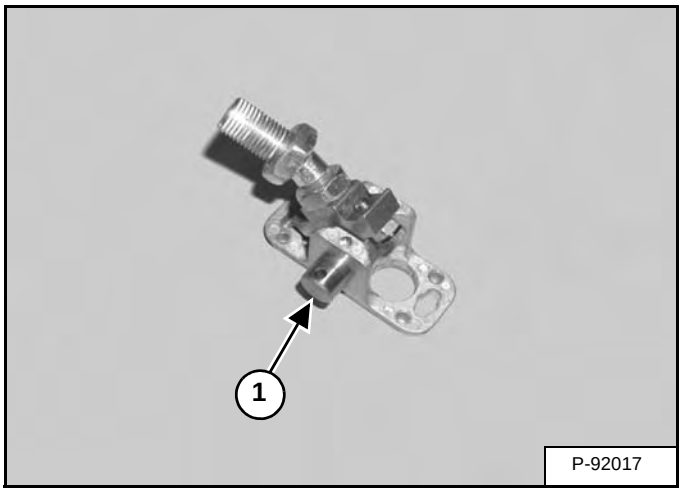
Disassembly And Assembly (Cont'd)

Figure 20-170-22



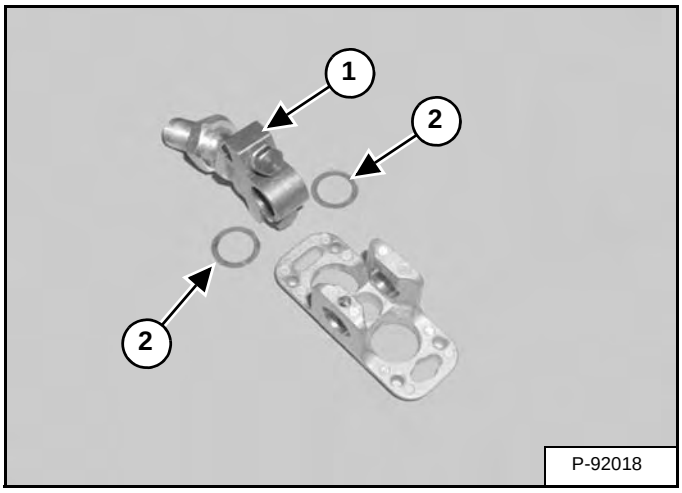
Remove the roll pin (Item 1) **[Figure 20-170-22]**.

Figure 20-170-23



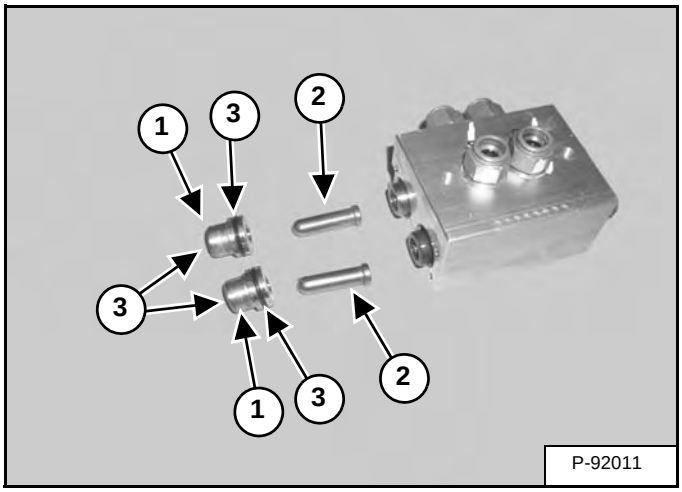
Remove the pivot pin (Item 1) **[Figure 20-170-23]**.

Figure 20-170-24



Remove the lever (Item 1). Remove the shim (Item 2) **[Figure 20-170-24]** from both sides of the lever.

Figure 20-170-25

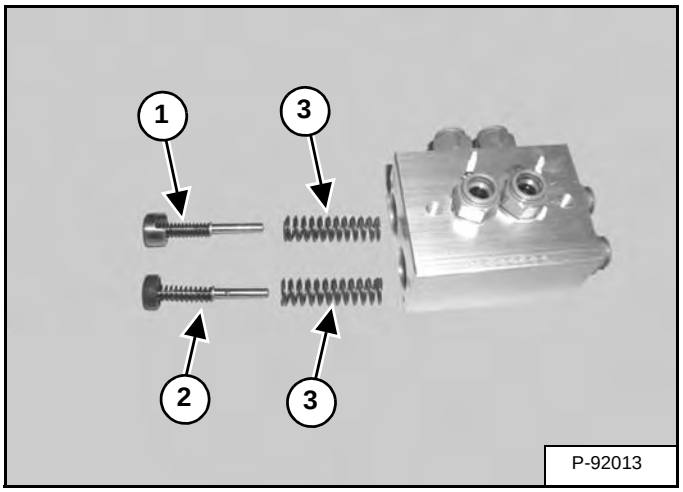


Remove the bushings (Item 1) and push rods (Item 2). Remove the O-rings (Item 3) **[Figure 20-170-25]** from the ID and OD of the bushings.

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Disassembly And Assembly (Cont'd)

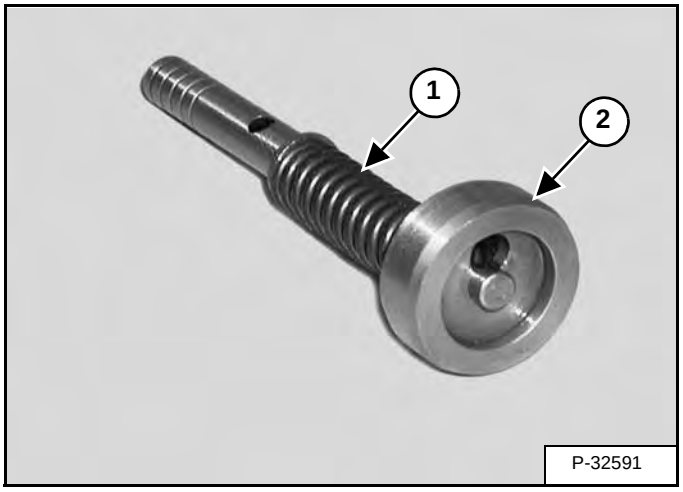
Figure 20-170-26



Remove the blade raise spool assembly (Item 1), blade lower / float spool assembly (Item 2) and springs (Item 3) **[Figure 20-170-26]**.

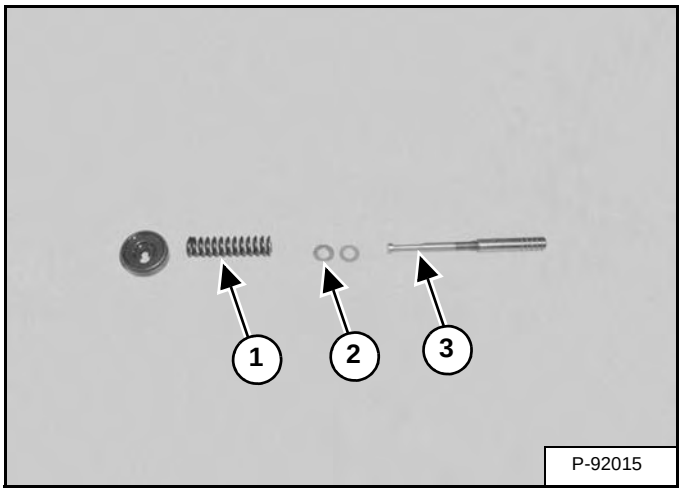
NOTE: The spool assemblies must be installed in the correct bores or the float function of the blade will not work correctly.

Figure 20-170-27



Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-170-27]**.

Figure 20-170-28



Remove the spring (Item 1) and shims (Item 2) from the spool (Item 3) **[Figure 20-170-28]**.

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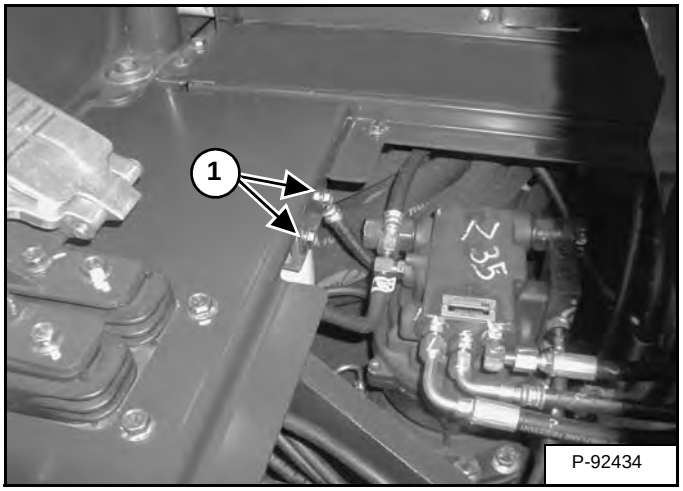
Dealer Copy -- Not for Resale

CASE DRAIN FILTER MOUNT

Removal And Installation

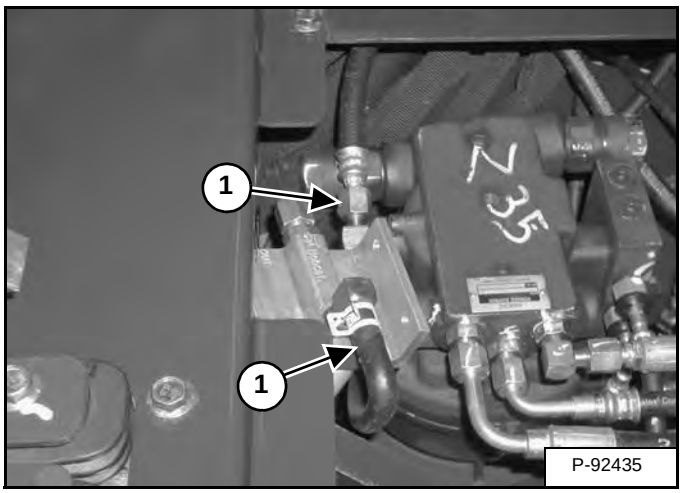
Remove the floor mat and center floor plate. (See Removal And Installation on Page 40-110-1.)

Figure 20-180-1



Remove the bolts (Item 1) **[Figure 20-180-1]**.

Figure 20-180-2



Tip the filter mount towards the rear of the excavator. Remove the hoses (Item 1) **[Figure 20-180-2]** and remove the filter mount.

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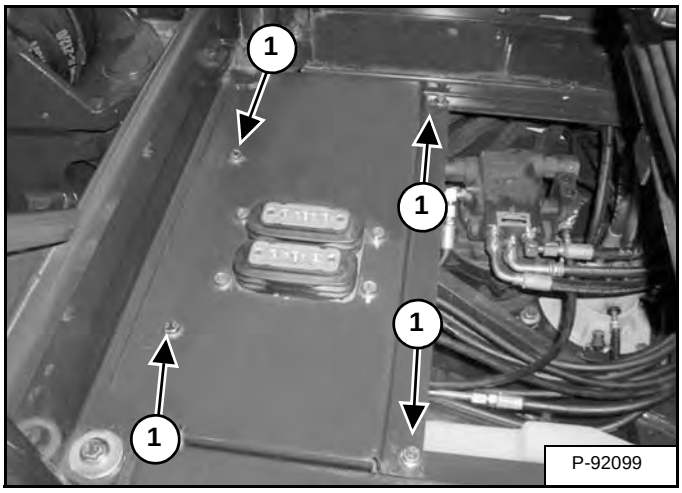
TRAVEL CONTROL VALVE

Removal And Installation

Remove the travel levers. (See Removal And Installation on Page 40-100-1.)

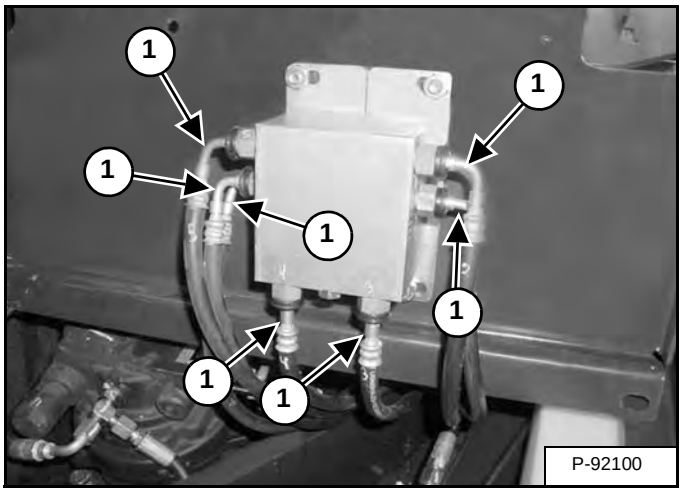
Remove the floor mat and center floor plate. (See Removal And Installation on Page 40-110-1.)

Figure 20-190-1



Remove the bolts (Item 1) **[Figure 20-190-1]** from the front floor plate.

Figure 20-190-2



Tip the plate towards the operators seat. Mark and remove the hoses (Item 1) **[Figure 20-190-2]**.

IMPORTANT

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

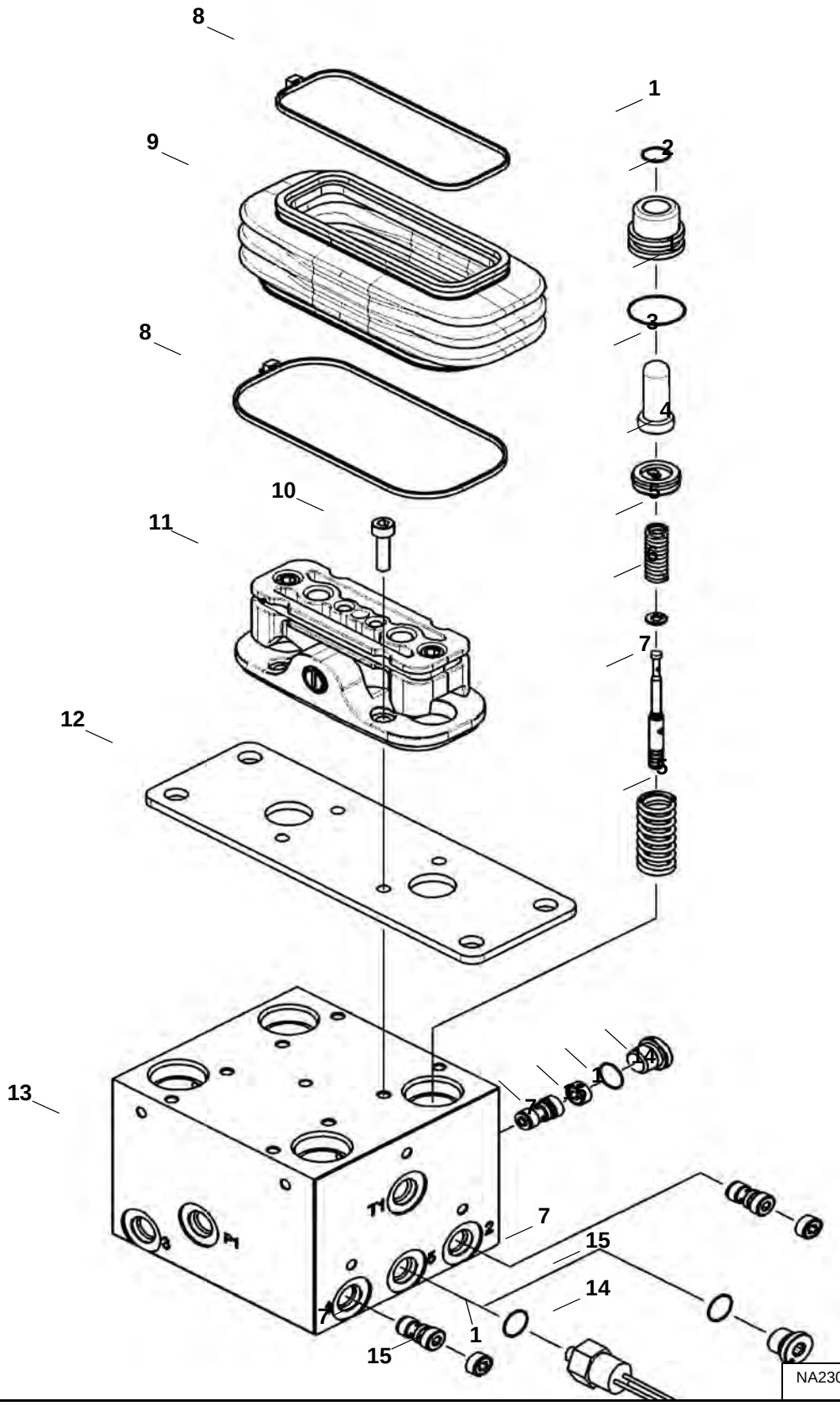
I-2003-0888

Remove the valve / floor plate assembly.

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Parts Identification

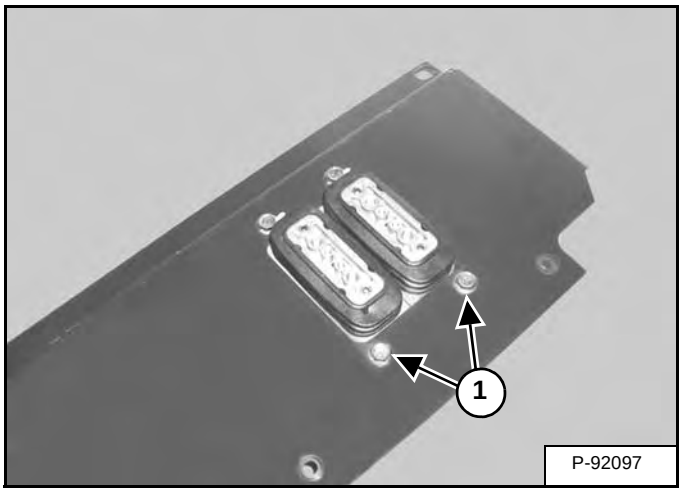
1. O-ring
2. Bushing
3. Plunger
4. Spring Seat
5. Spring
6. Shim
7. Spool
8. Cable Tie
9. Dust Boot
10. Screw
11. Pivot Assembly
12. Plate
13. Valve Body
14. Plug
15. Nut



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Disassembly And Assembly

Figure 20-190-3

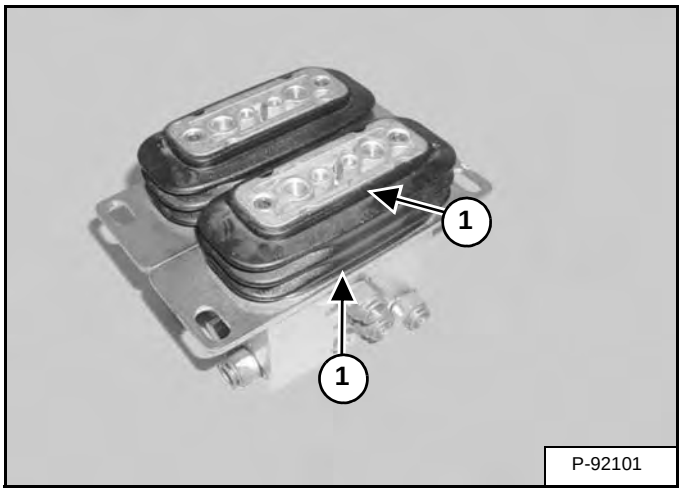


Remove the bolts (Item 1) **[Figure 20-190-3]** and nuts. Remove the valve from the floor pan.

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

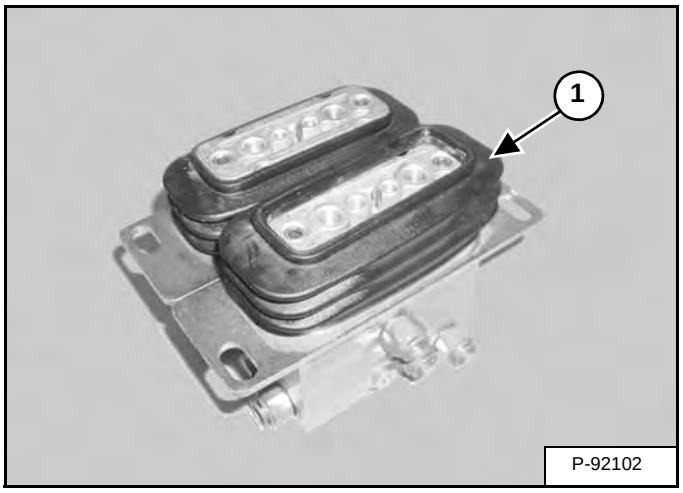
NOTE: The procedure is shown on the left travel side of the valve. The procedure is the same for both sides of the valve.

Figure 20-190-4



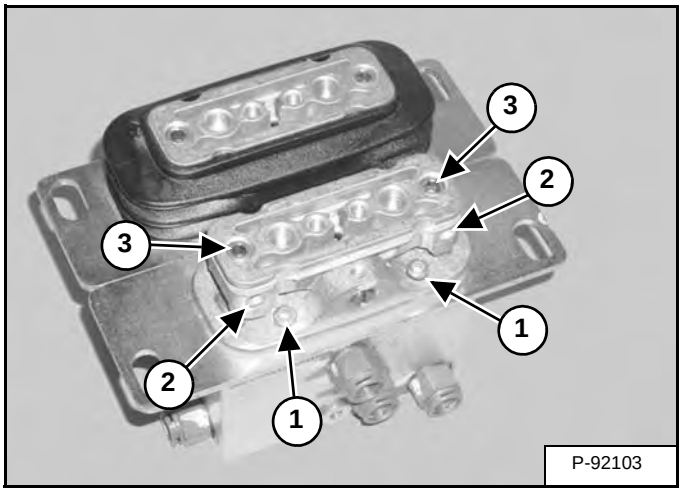
Cut and remove the cable ties (Item 1) **[Figure 20-190-4]**.

Figure 20-190-5



Remove the dust boot (Item 1) **[Figure 20-190-5]**.

Figure 20-190-6



Remove the four screws (Item 1) **[Figure 20-190-6]** and remove the pivot assembly.

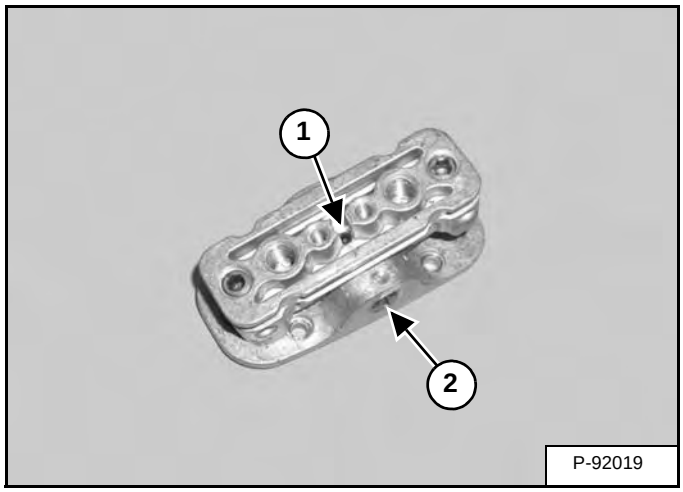
Installation: After installing the pivot assembly loosen the screws (Item 2). Turn the adjustment screws (Item 3) **[Figure 20-190-6]** until there is no end play in the pivot assembly.

Tighten the screws (Item 2) **[Figure 20-190-6]** after the adjustment is complete.

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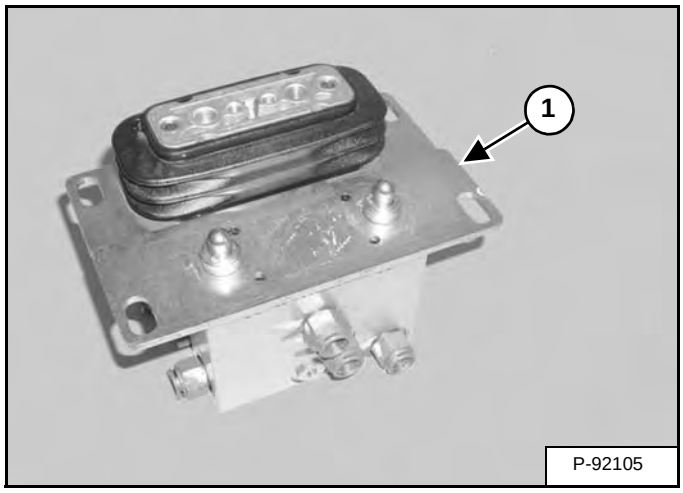
Disassembly And Assembly (Cont'd)

Figure 20-190-7



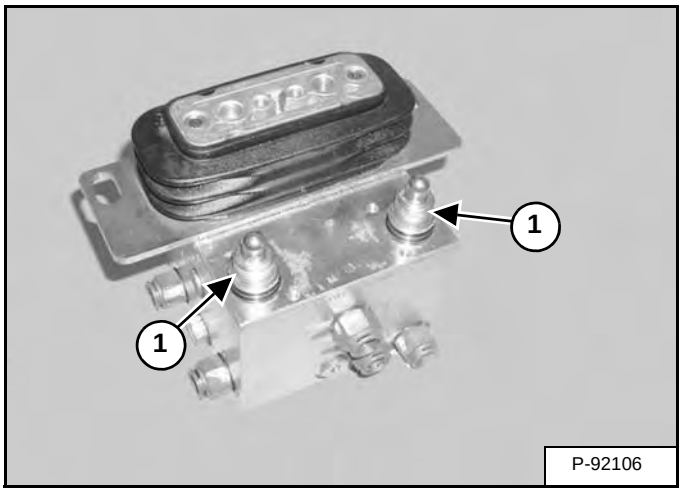
Loosen the screw (Item 1) and remove the pivot pin (Item 2) **[Figure 20-190-7]**.

Figure 20-190-8



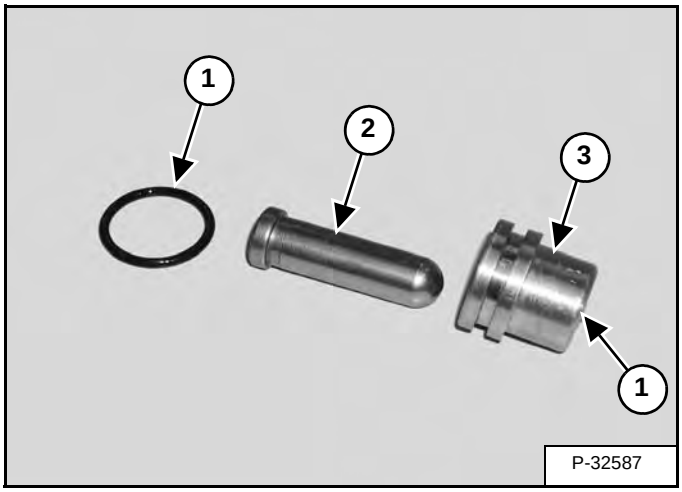
Remove the plate (Item 1) **[Figure 20-190-8]**.

Figure 20-190-9



Remove the plunger assemblies (Item 1) **[Figure 20-190-9]**.

Figure 20-190-10

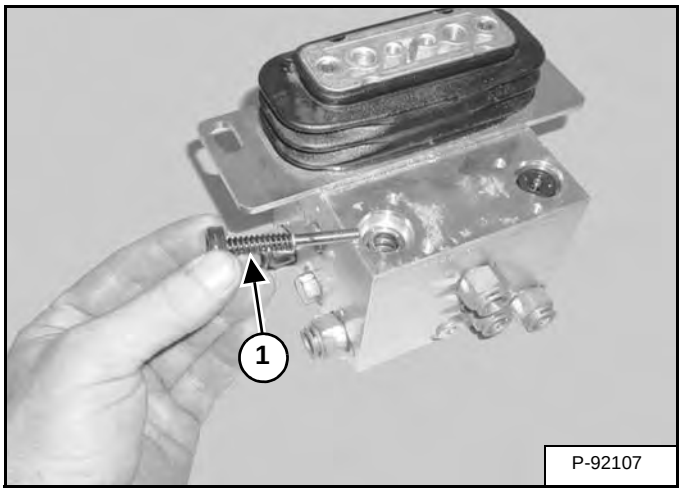


Remove the O-rings (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-190-10]**.

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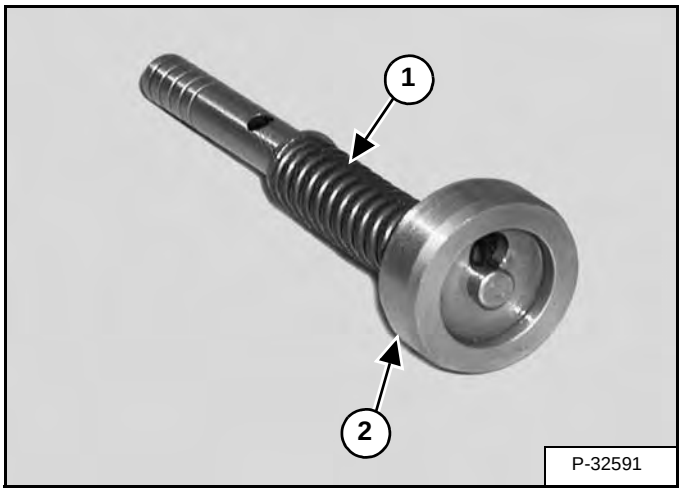
Disassembly And Assembly (Cont'd)

Figure 20-190-11



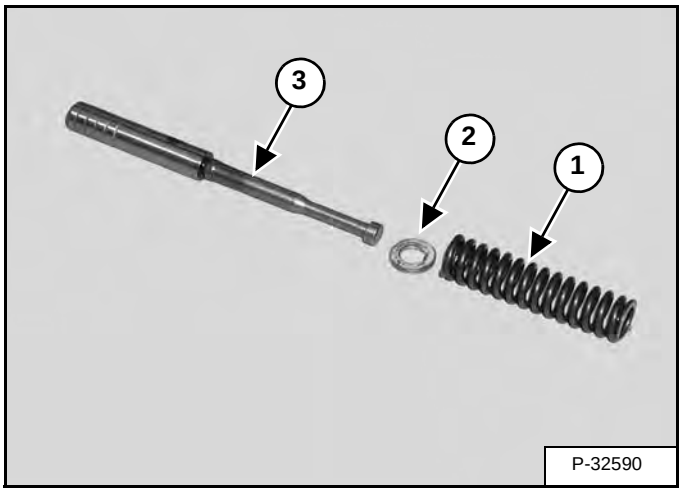
Remove the spool assemblies (Item 1) **[Figure 20-190-11]**.

Figure 20-190-12



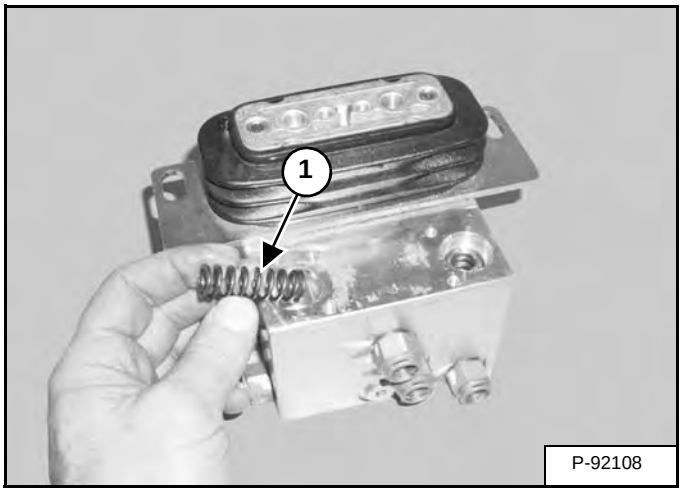
Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-190-12]**.

Figure 20-190-13



Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-190-13]**.

Figure 20-190-14



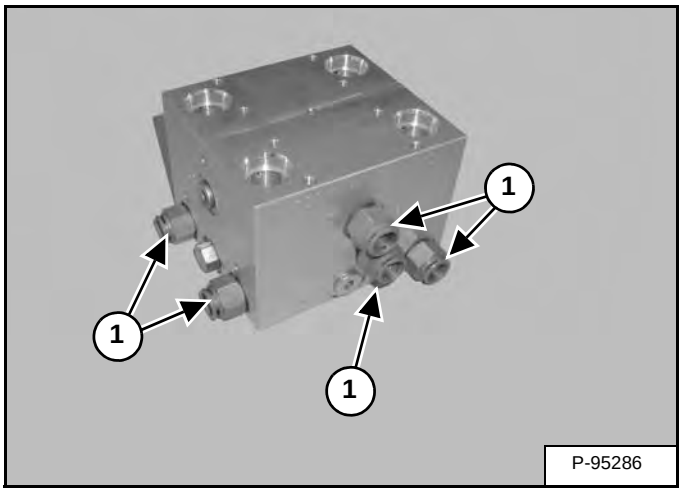
Remove the spring (Item 1) **[Figure 20-190-14]**.

Repeat the procedure for the right travel side of the valve.

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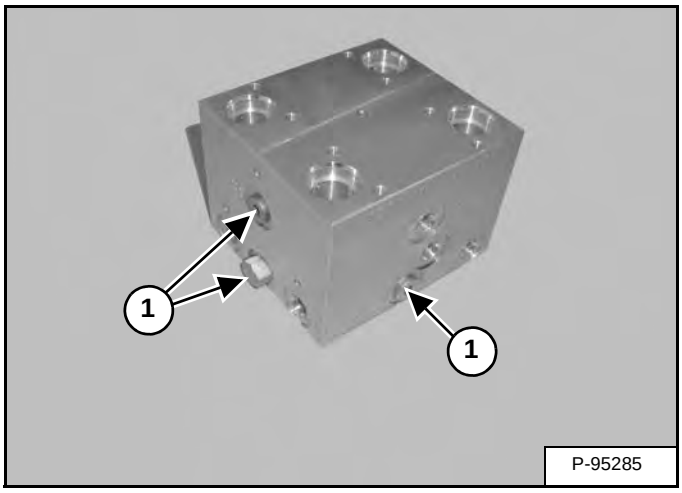
Disassembly And Assembly (Cont'd)

Figure 20-190-15



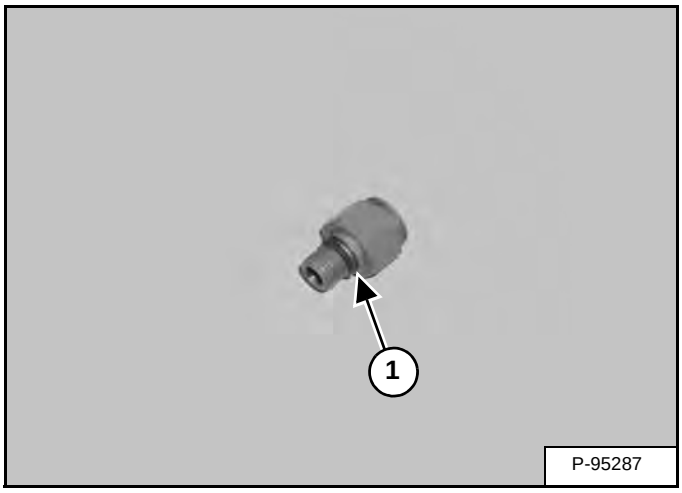
Remove the fittings (Item 1) **[Figure 20-190-15]**.

Figure 20-190-16



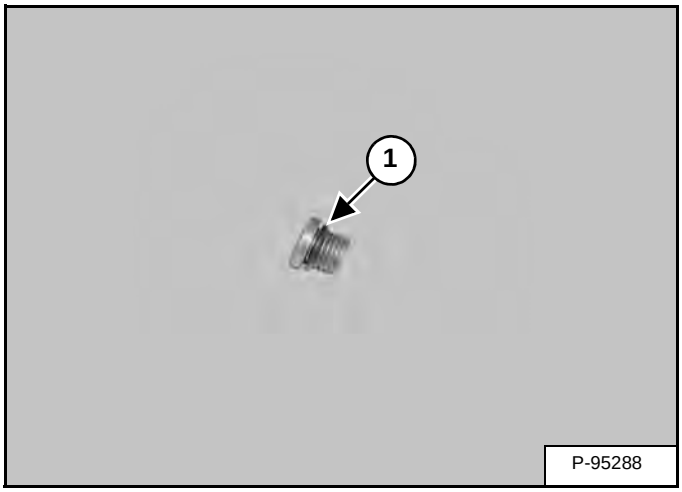
Remove the plugs (Item 1) **[Figure 20-190-16]**.

Figure 20-190-17



Remove the O-rings (Item 1) **[Figure 20-190-17]** from the fittings.

Figure 20-190-18

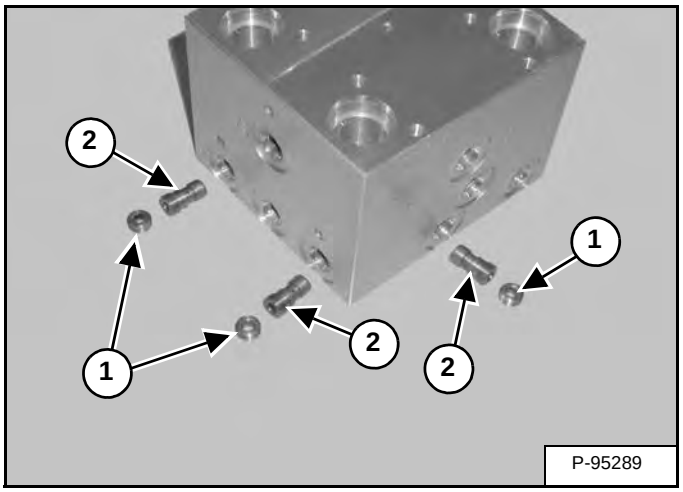


Remove the O-rings (Item 1) **[Figure 20-190-18]** from the plugs.

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Disassembly And Assembly (Cont'd)

Figure 20-190-19

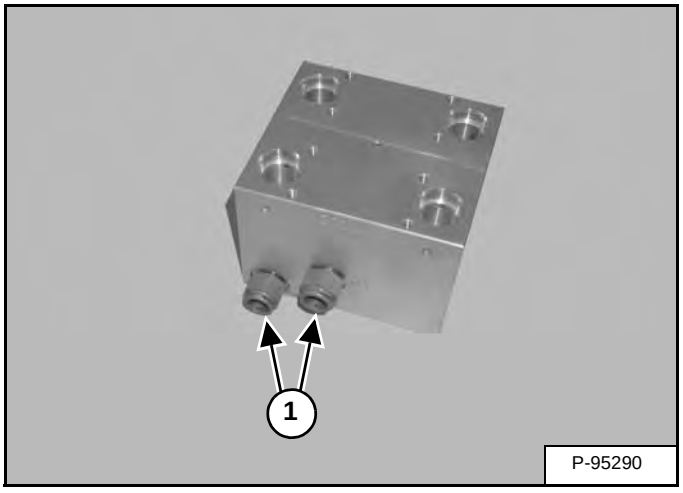


Remove the nut (Item 1) **[Figure 20-190-19]**.

Installation: Tighten the nut to 9,8 N•m (7.2 ft-lb) torque.

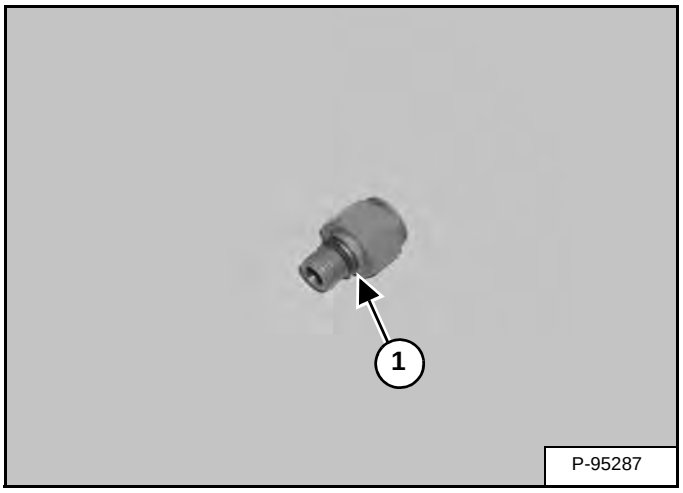
Remove the spool (Item 2) **[Figure 20-190-19]**.

Figure 20-190-20



Remove the fittings (Item 1) **[Figure 20-190-20]**.

Figure 20-190-21



Remove the O-ring (Item 1) **[Figure 20-190-21]** from both fittings.

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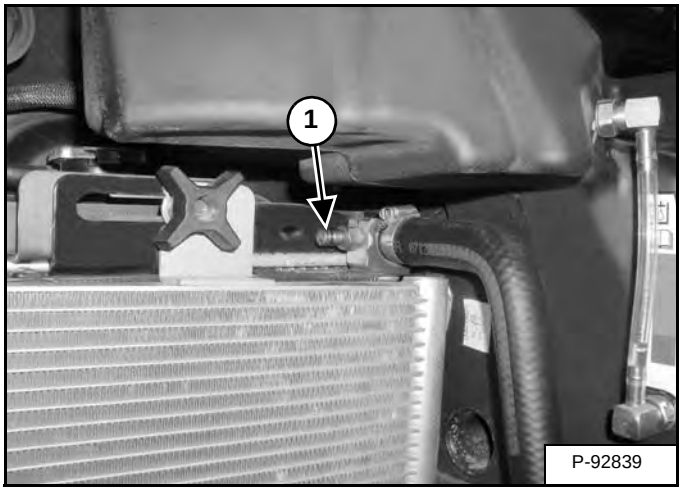
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REMOVING AIR FROM THE HYDRAULIC SYSTEM

Procedure

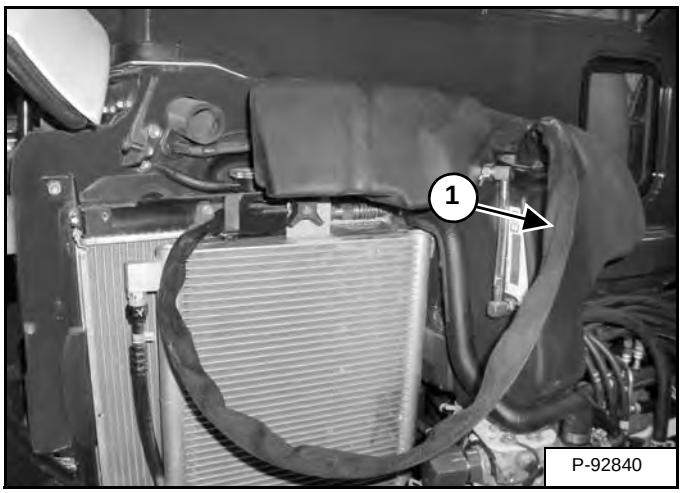
Open the right side cover.

Figure 20-200-1



Install a female quick coupler and hose on the male quick coupler (Item 1) **[Figure 20-200-1]**.

Figure 20-200-2



Remove the fill cap from the reservoir. Route the hose (Item 1) **[Figure 20-200-2]** into the reservoir.

NOTE: Be sure the hydraulic system is filled with oil before starting the excavator to prevent damage to the system.

Start the excavator.

The excavator piston pump has a minimum displacement stop, approximately 20,4 L/min (5.4 U.S. gpm) which is being circulated through the valve even when all functions are in neutral.

If additional air has gotten into some of the circuits (motors or cylinders), the excavator can be operated with the bleed tool in place.

NOTE: When the excavator is operated with bleed hose in place, the reservoir cap is removed. The hydraulic system must be protected from contamination and spill.

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HYDRAULIC X-CHANGE MANIFOLD

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

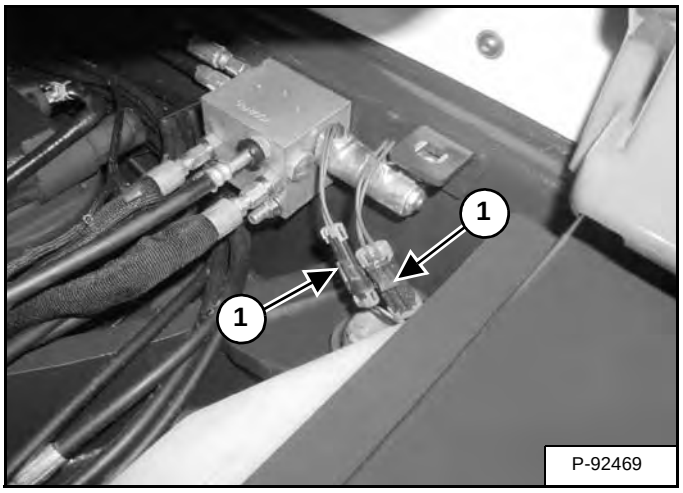
Lower the work group to the ground.

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

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

Remove the tool box. (See Removal And Installation on Page 40-230-1.)

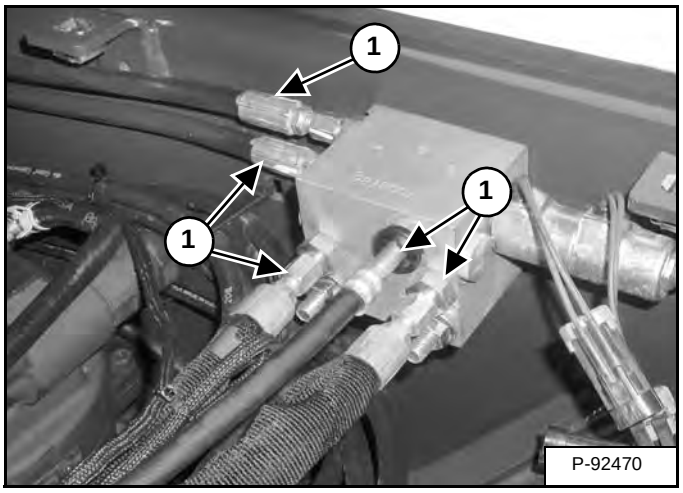
Figure 20-210-1



Disconnect the wire harness (Item 1) **[Figure 20-210-1]**.

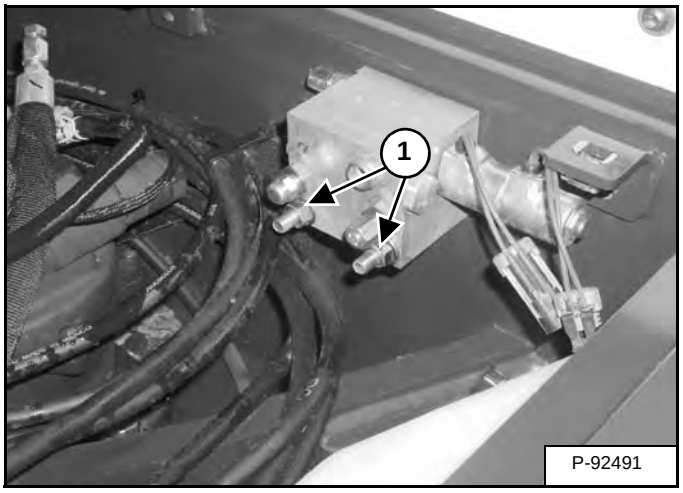
Mark all hoses for proper installation.

Figure 20-210-2



Remove the hoses (Item 1) **[Figure 20-210-2]**.

Figure 20-210-3

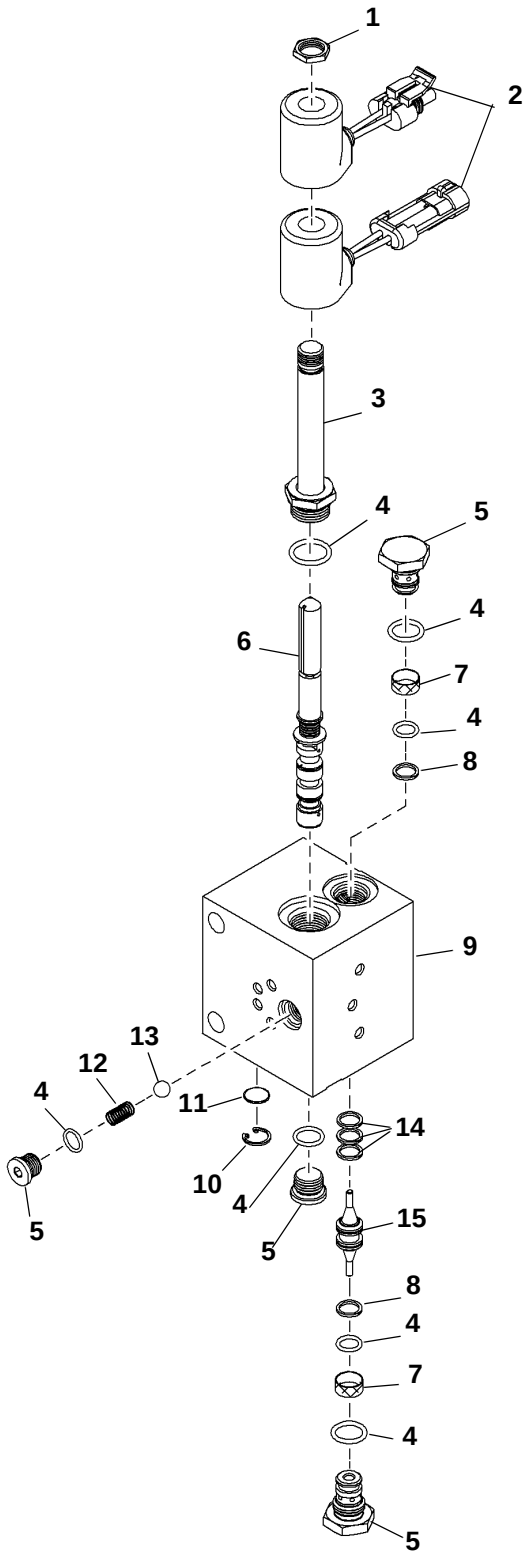


Remove the nuts (Item 1) **[Figure 20-210-3]**. Remove the manifold.

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Parts Identification

1. Nut
2. Coil
3. Solenoid
4. O-ring
5. Plug
6. Stem
7. Screen
8. Back-up Ring
9. Body
10. Snap Ring
11. Screen
12. Spring
13. Ball
14. Seal Assembly
15. Spool



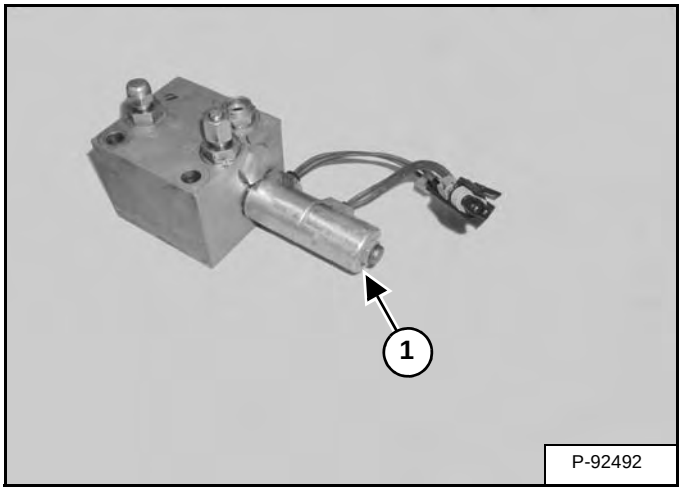
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Disassembly And Assembly

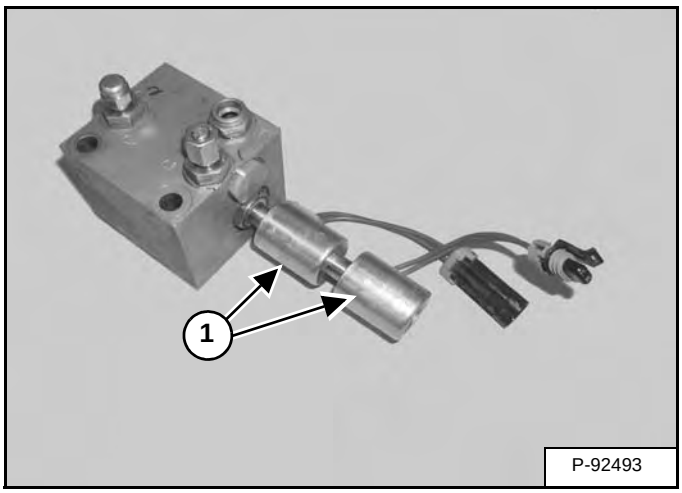
Clean the outside of the hydraulic X-Change manifold before disassembly.

Figure 20-210-4



Remove the nut (Item 1) **[Figure 20-210-4]**.

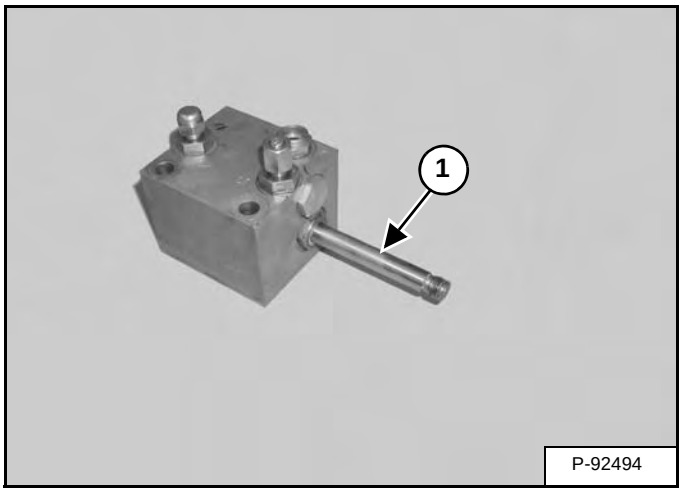
Figure 20-210-5



Remove the two solenoids (Item 1) **[Figure 20-210-5]**.

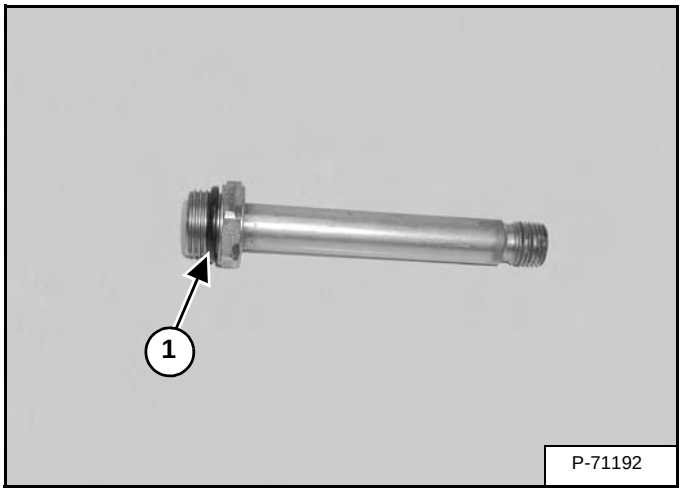
NOTE: Mark the solenoids for correct assembly.

Figure 20-210-6



Remove the spool (Item 1) **[Figure 20-210-6]**.

Figure 20-210-7

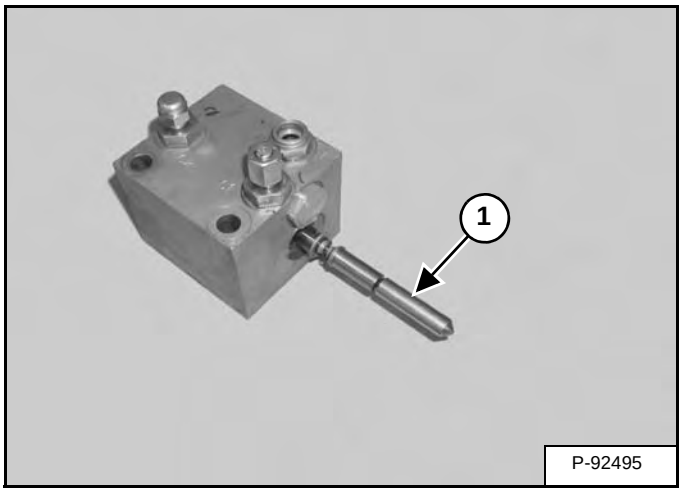


Remove the O-ring (Item 1) **[Figure 20-210-7]** from the spool.

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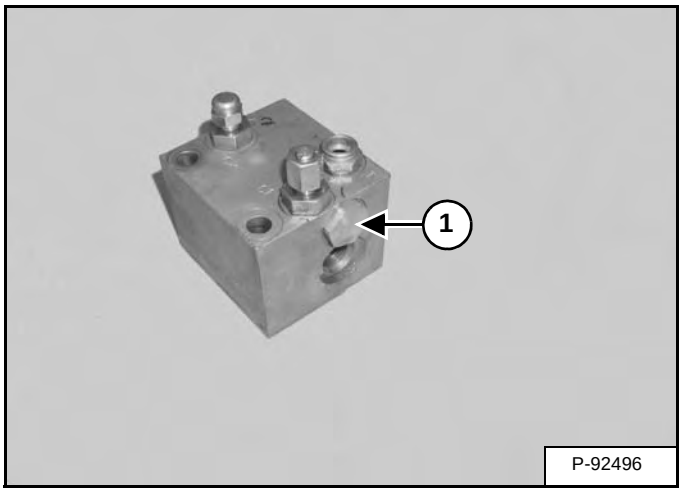
Disassembly And Assembly (Cont'd)

Figure 20-210-8



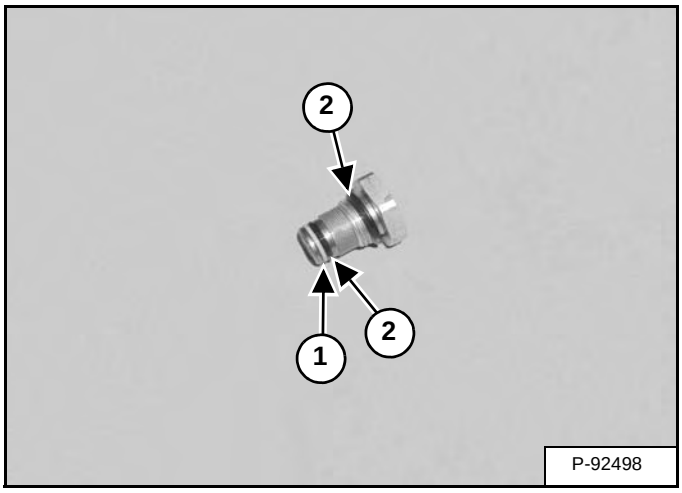
Remove the actuator assembly (Item 1) **[Figure 20-210-8]**.

Figure 20-210-9



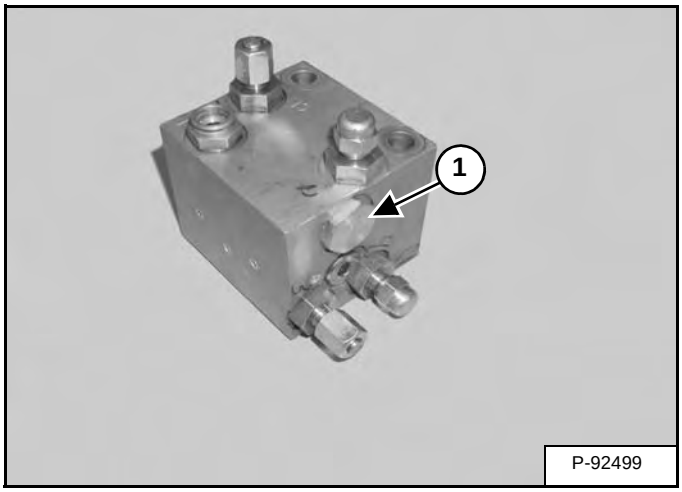
Remove the plug (Item 1) **[Figure 20-210-9]**.

Figure 20-210-10



Remove the back-up ring (Item 1) and O-rings (Item 2) **[Figure 20-210-10]**.

Figure 20-210-11

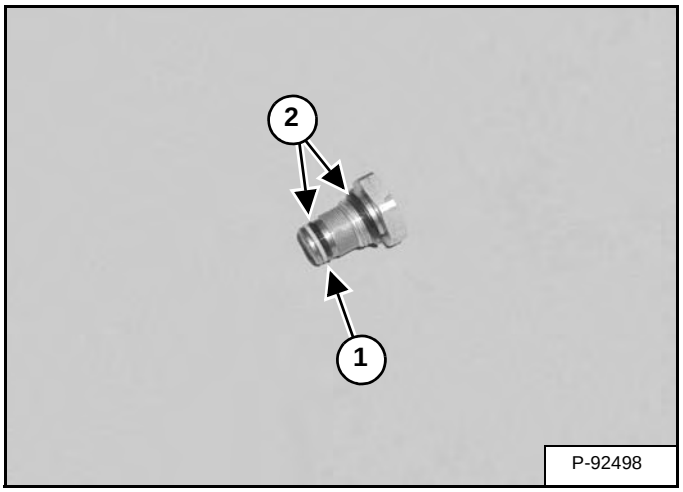


Remove the plug (Item 1) **[Figure 20-210-11]**.

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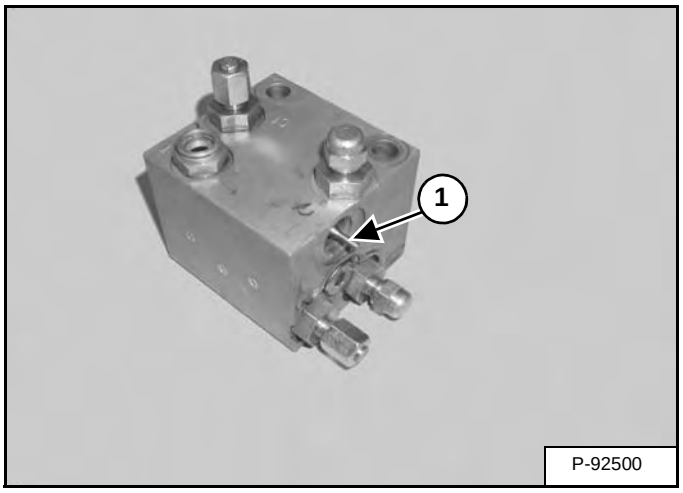
Disassembly And Assembly (Cont'd)

Figure 20-210-12



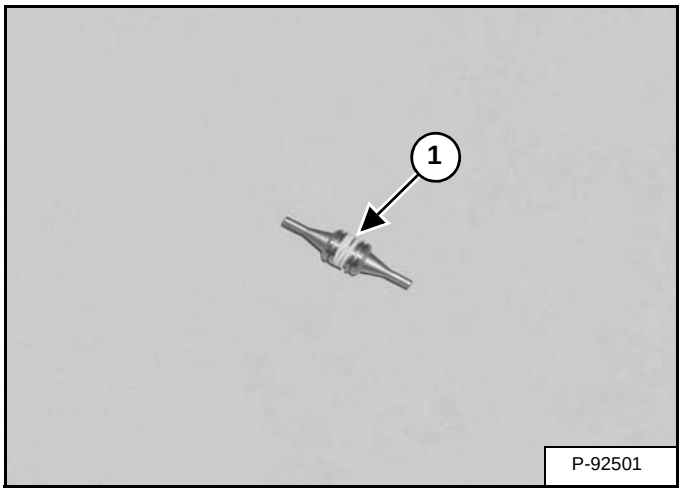
Remove the back-up ring (Item 1) and O-rings (Item 2) **[Figure 20-210-12]**.

Figure 20-210-13



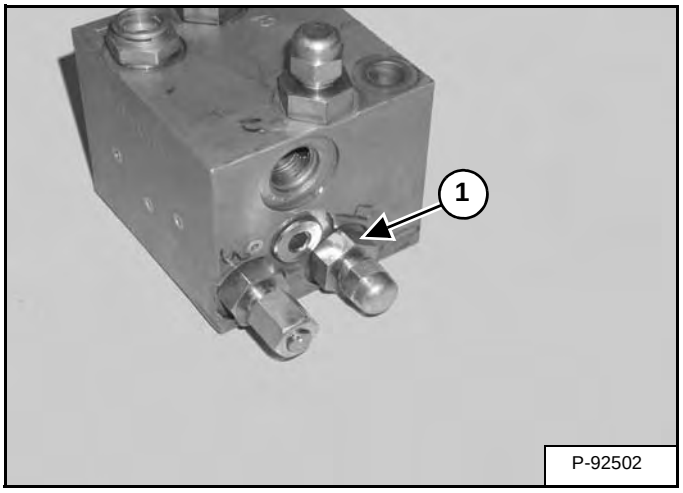
Remove the spool (Item 1) **[Figure 20-210-13]**.

Figure 20-210-14



Remove the rings (Item 1) **[Figure 20-210-14]**.

Figure 20-210-15

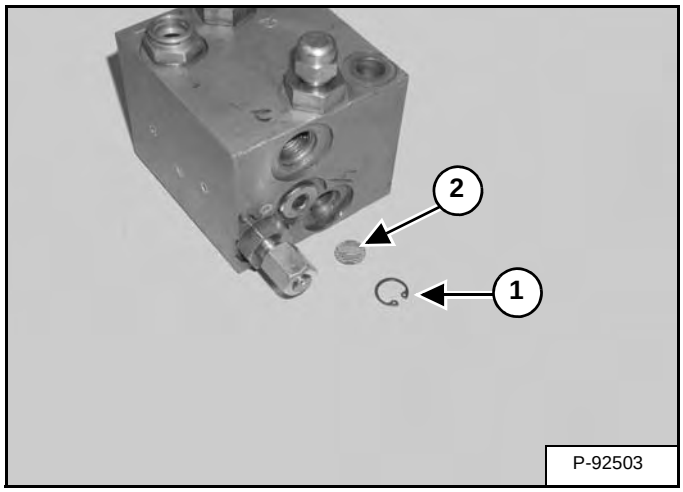


Remove the fitting (Item 1) **[Figure 20-210-15]** from the "S" port.

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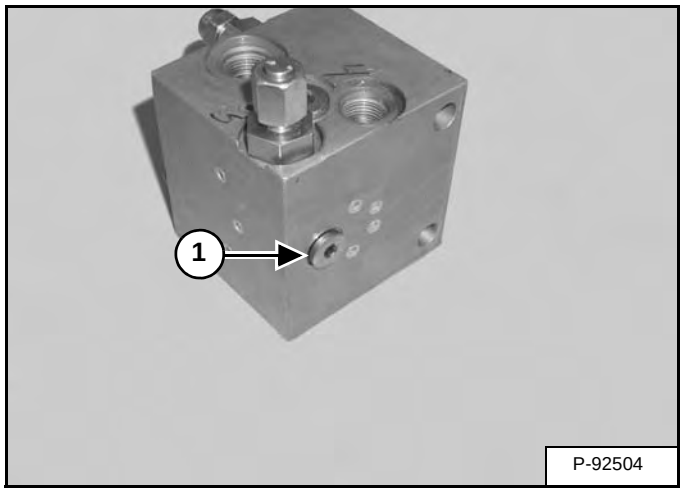
Disassembly And Assembly (Cont'd)

Figure 20-210-16



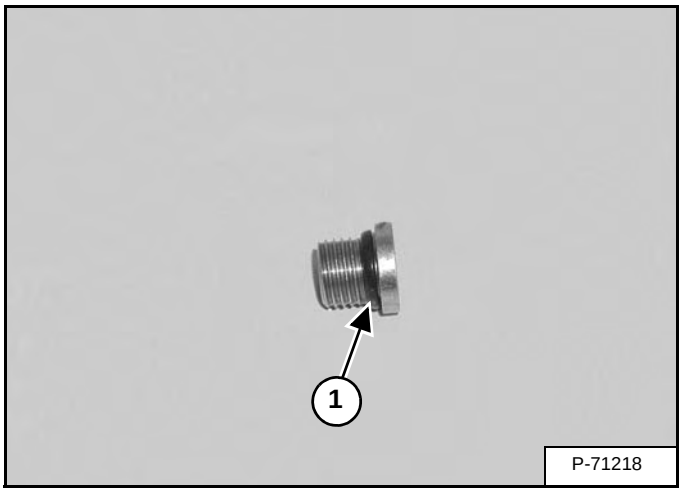
Remove the snap ring (Item 1) and screen (Item 2) **[Figure 20-210-16]** from the "S" port.

Figure 20-210-17



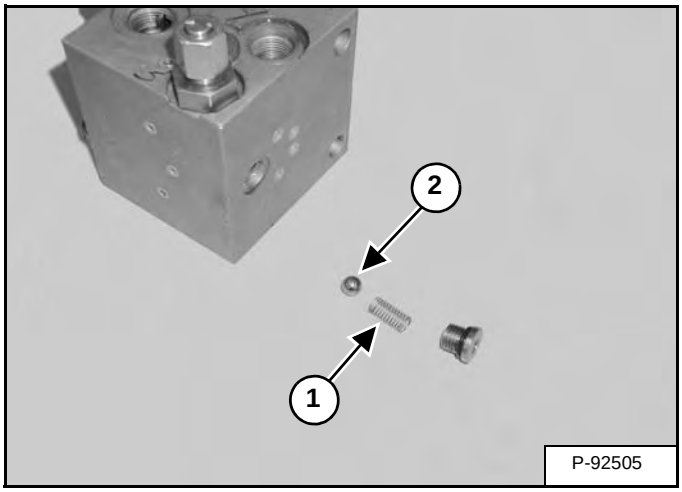
Remove the plug (Item 1) **[Figure 20-210-17]**.

Figure 20-210-18



Remove the O-ring (Item 1) **[Figure 20-210-18]** from the plug.

Figure 20-210-19



Remove the spring (Item 1) and ball (Item 2) **[Figure 20-210-19]** from the manifold.

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.

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SECONDARY AUXILIARY VALVE

Removal And Installation

Lower the work group to the ground.

Stop the engine.

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

IMPORTANT

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

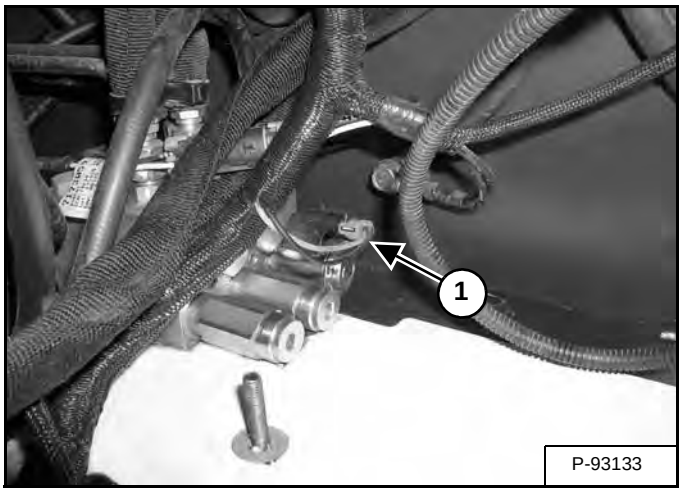
I-2003-0888

Remove the right upperstructure cover. (See Removal And Installation on Page 40-80-1.)

Remove the battery. (See Removal And Installation on Page 50-20-2.)

Remove the hydraulic reservoir. (See Removal And Installation on Page 20-140-1.)

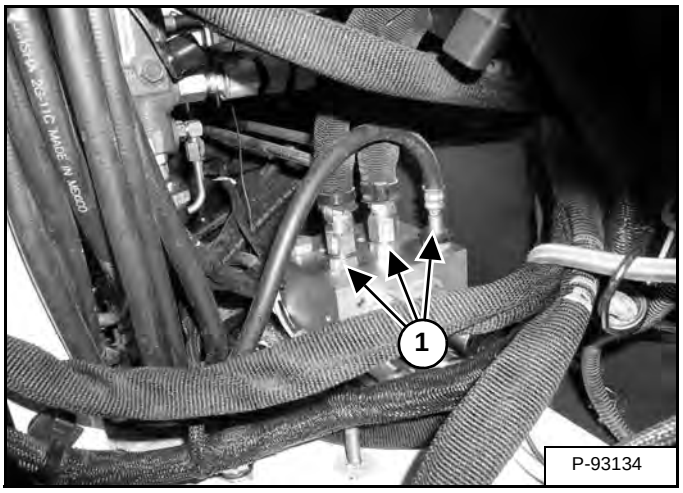
Figure 20-220-1



Disconnect the harness (Item 1) **[Figure 20-220-1]**.

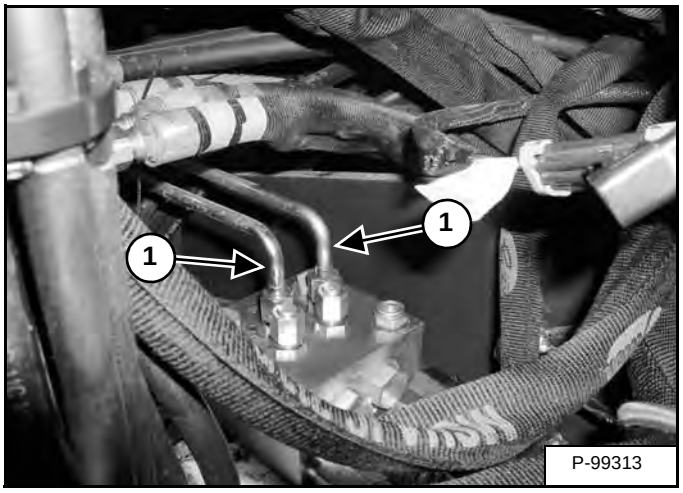
Mark all hoses for proper installation.

Figure 20-220-2



Remove the hoses (Item 1) **[Figure 20-220-2]**.

Figure 20-220-3

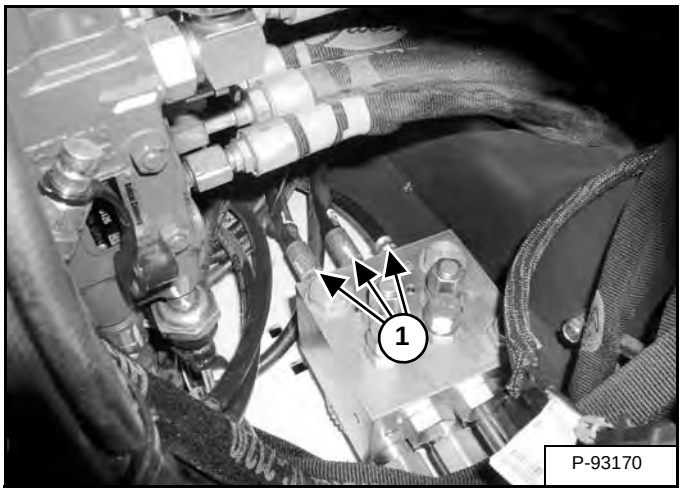


Remove the tubelines (Item 1) **[Figure 20-220-3]**.

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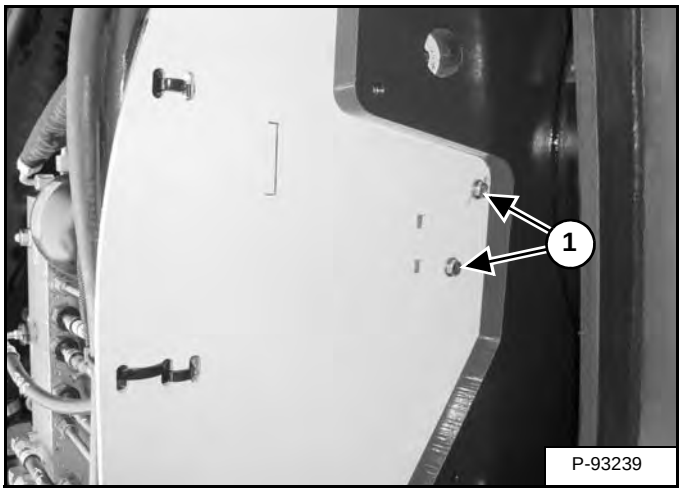
Removal And Installation (Cont'd)

Figure 20-220-4



Remove the hoses (Item 1) **[Figure 20-220-4]**.

Figure 20-220-5



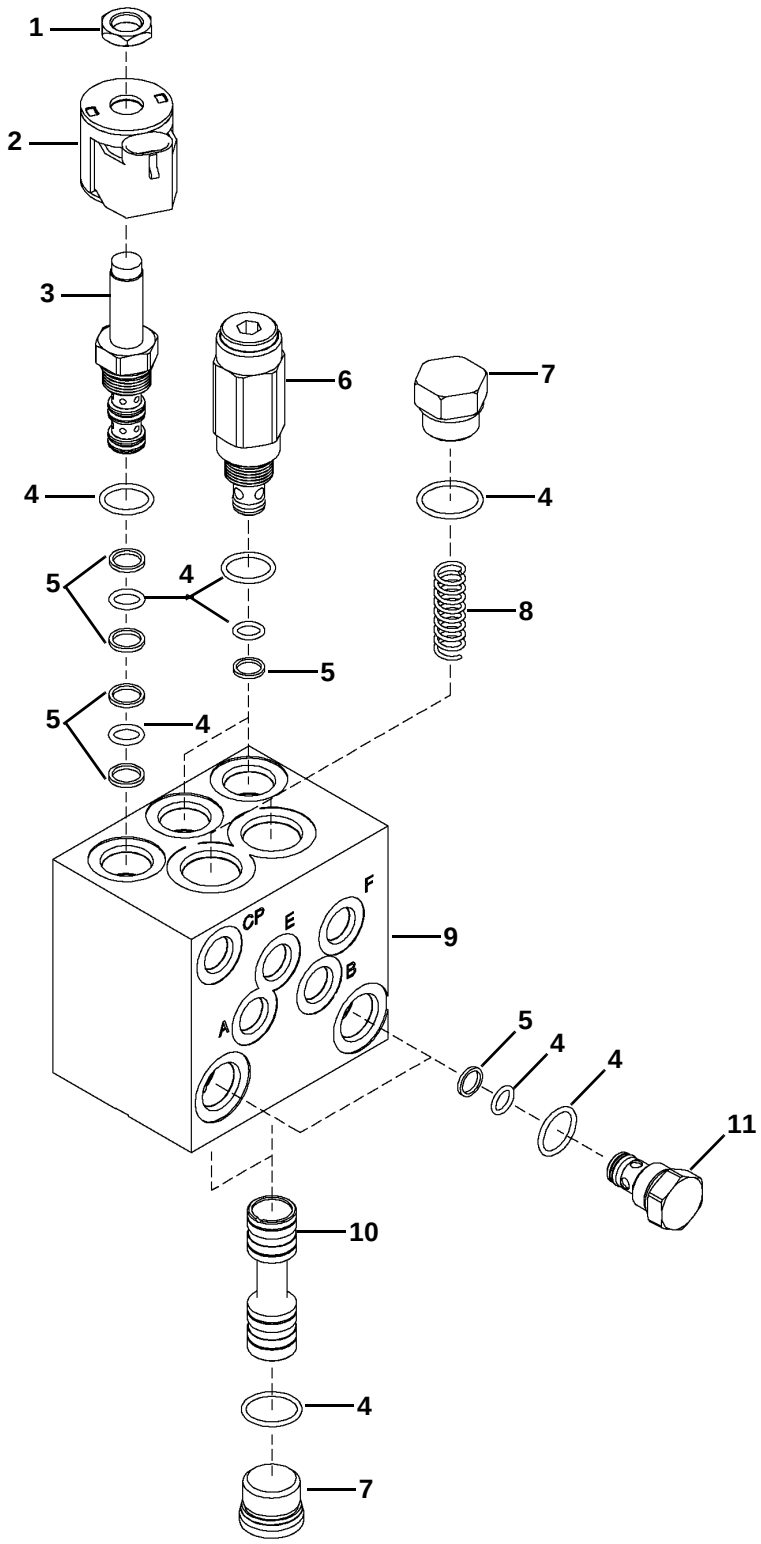
Remove the bolts (Item 1) **[Figure 20-220-5]**.

Remove the valve.

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Parts Identification

1. Nut
2. Coil
3. Solenoid
4. O-ring
5. Back-up Ring
6. Relief Valve
7. Plug
8. Spring
9. Body
10. Spool
11. Check Valve

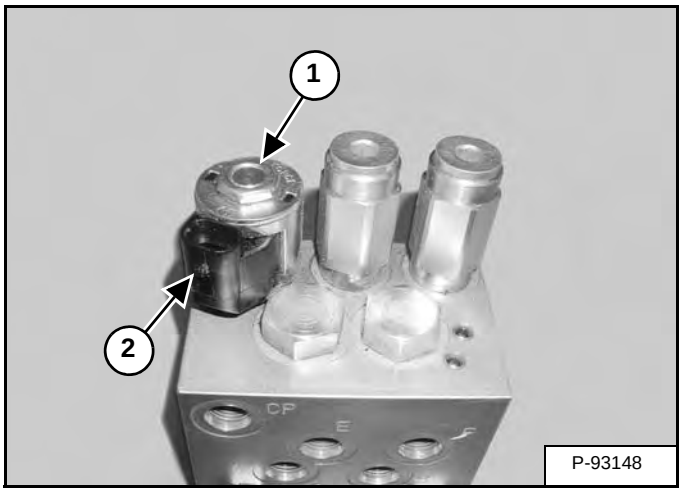


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Disassembly And Assembly

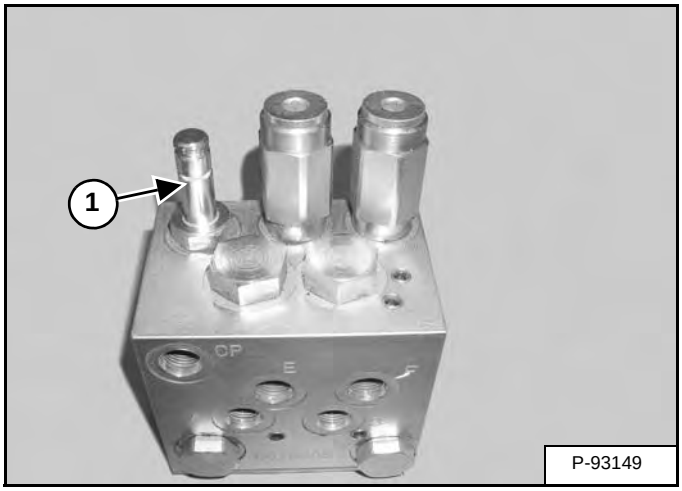
Figure 20-220-6



Remove the nut (Item 1) and coil (Item 2) **[Figure 20-220-6]**.

Installation: Tighten the nut to 5 - 8 N•m (4 - 6 ft-lb) torque.

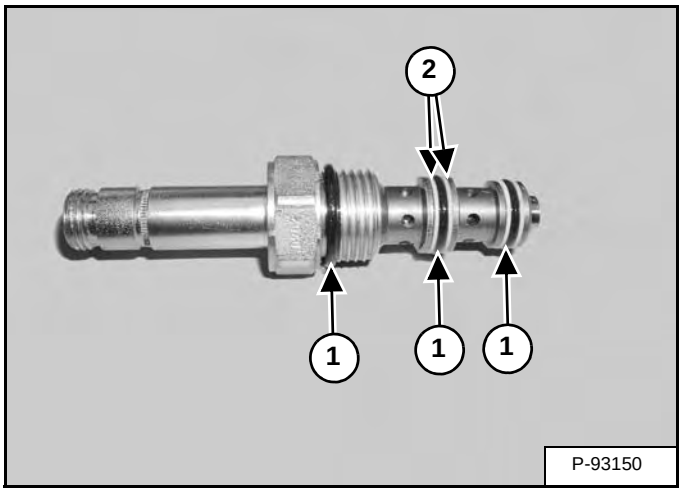
Figure 20-220-7



Remove the solenoid (Item 1) **[Figure 20-220-7]**.

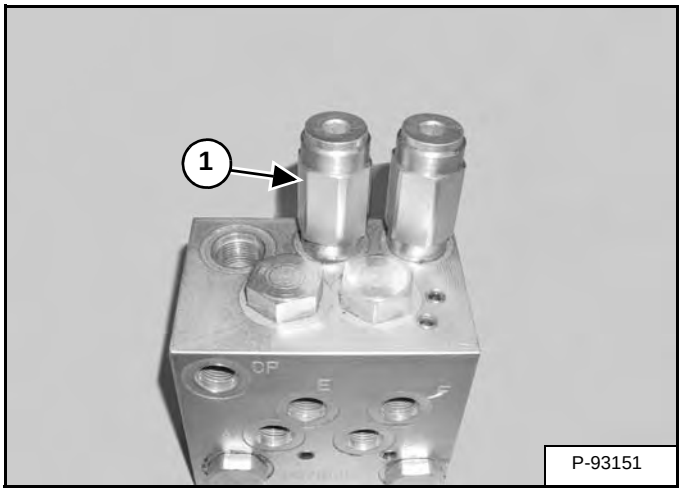
Installation: Tighten the solenoid to 41 - 47 N•m (30 - 35 ft-lb) torque.

Figure 20-220-8



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-220-8]**.

Figure 20-220-9

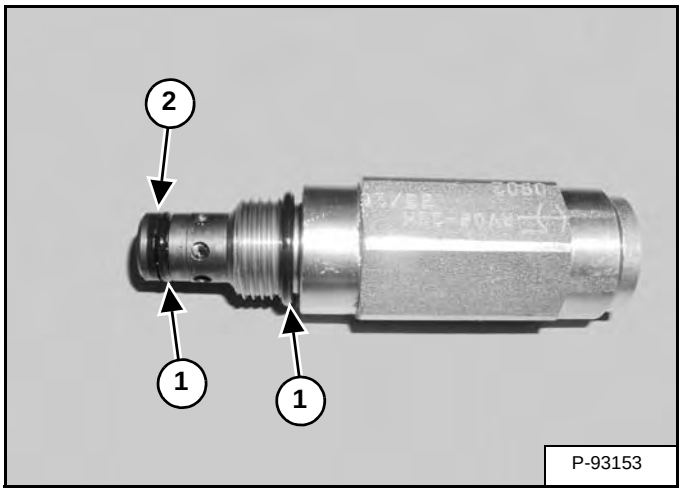


Remove the valve (Item 1) **[Figure 20-220-9]**.

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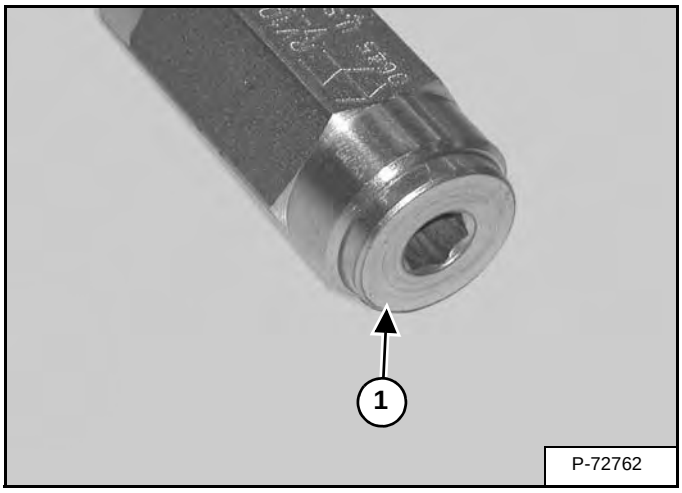
Disassembly And Assembly (Cont'd)

Figure 20-220-10



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-220-10]**.

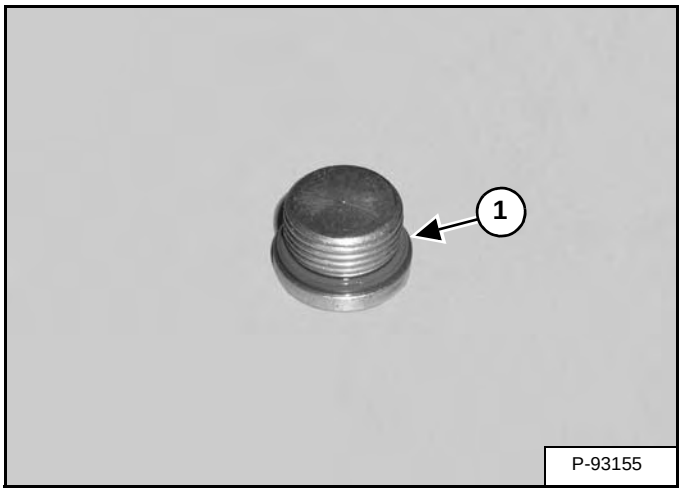
Figure 20-220-11



Remove the plug (Item 1) **[Figure 20-220-11]**.

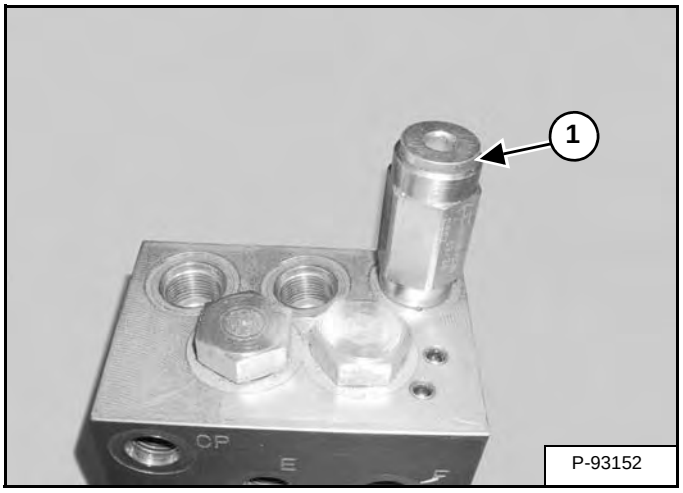
Installation: Tighten the plug to 27,1 N•m (20 ft-lb) torque.

Figure 20-220-12



Remove the O-ring (Item 1) **[Figure 20-220-12]**

Figure 20-220-13



Remove the valve (Item 1) **[Figure 20-220-13]**.

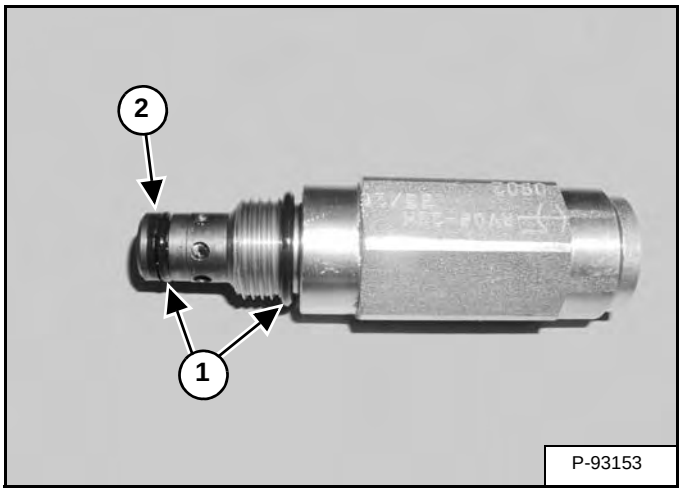
Installation: Tighten the valve to 41 - 47 N•m (30 - 35 ft-lb) torque.

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SECONDARY AUXILIARY VALVE (CONT'D)

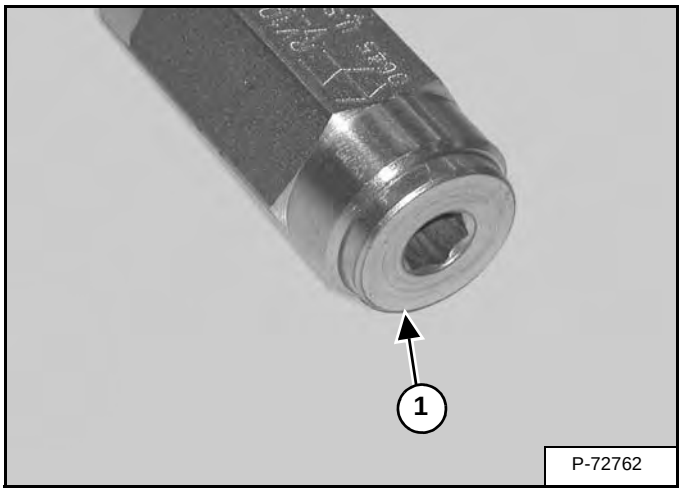
Disassembly And Assembly (Cont'd)

Figure 20-220-14



Remove the O-ring (Item 1) and back-up rings (Item 2) **[Figure 20-220-14]**.

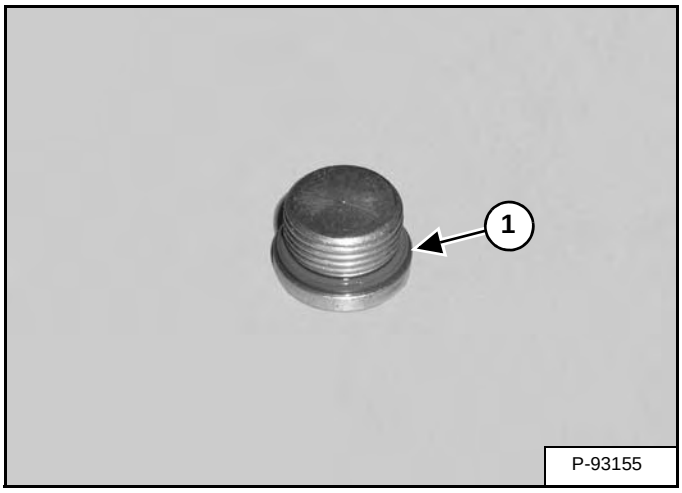
Figure 20-220-15



Remove the plug (Item 1) **[Figure 20-220-15]**.

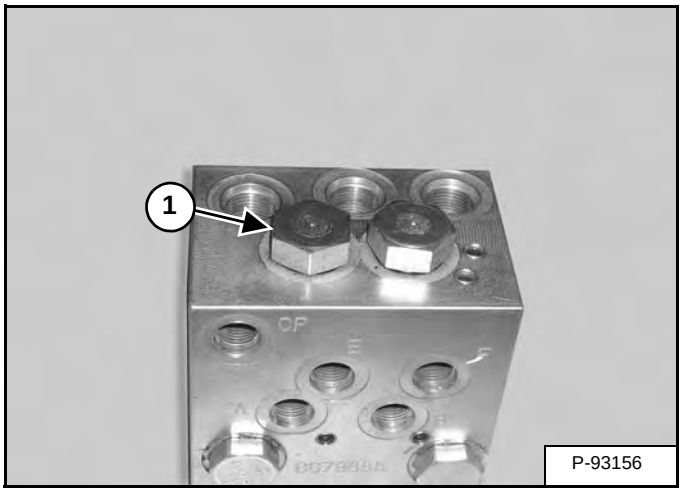
Tighten the plug to 27,1 N•m (20 ft-lb) torque.

Figure 20-220-16



Remove the O-ring (Item 1) **[Figure 20-220-16]**.

Figure 20-220-17

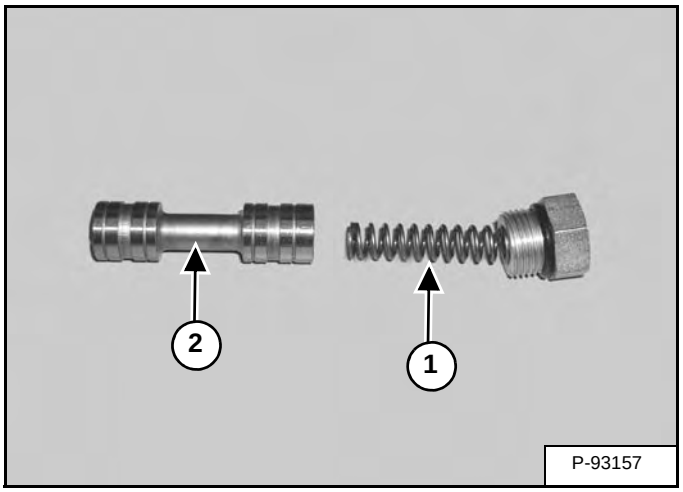


Remove the plug (Item 1) **[Figure 20-220-17]**.

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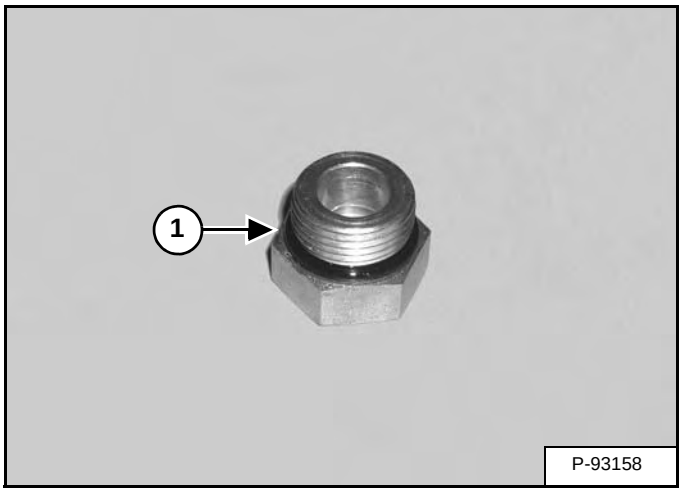
Disassembly And Assembly (Cont'd)

Figure 20-220-18



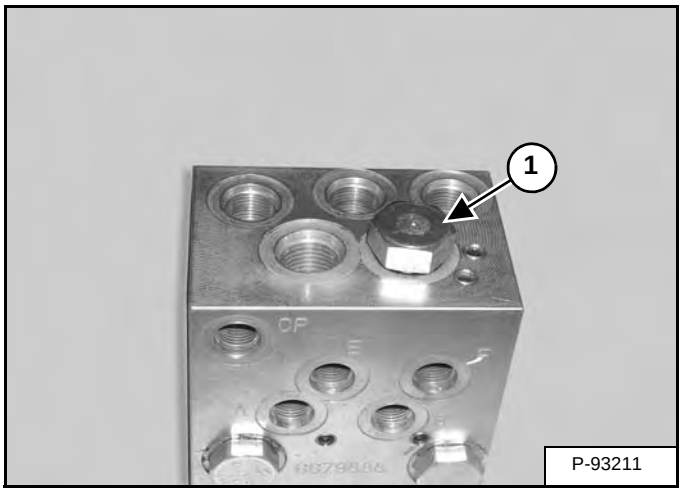
Remove the spring (Item 1) and spool (Item 2) **[Figure 20-220-18]**.

Figure 20-220-19



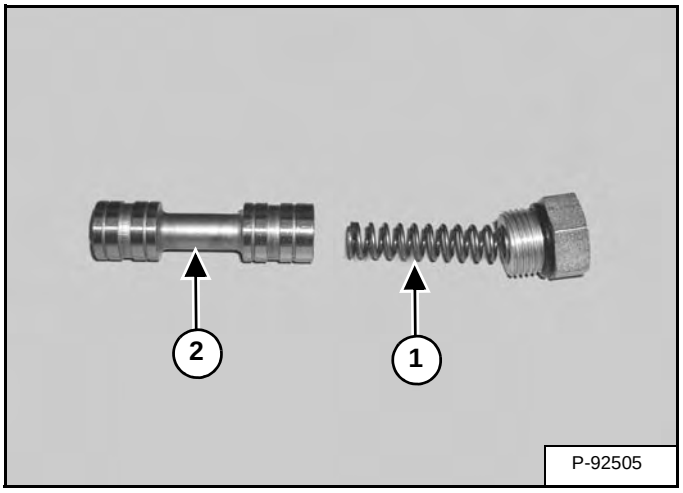
Remove the O-ring (Item 1) **[Figure 20-220-19]**.

Figure 20-220-20



Remove the plug (Item 1) **[Figure 20-220-20]**.

Figure 20-220-21

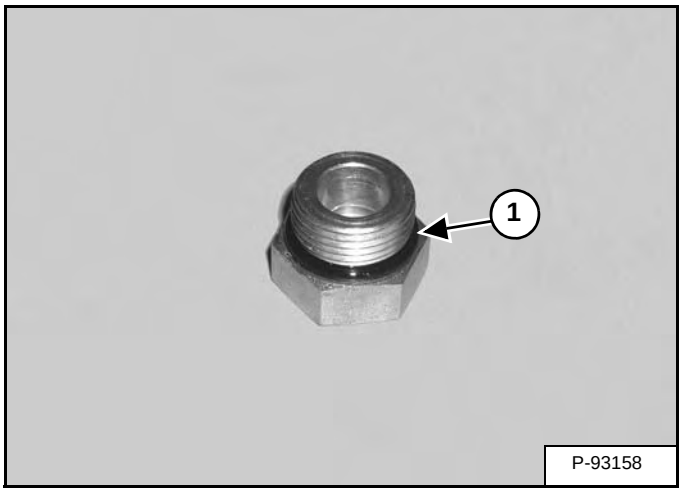


Remove the spring (Item 1) and spool (Item 2) **[Figure 20-220-21]**.

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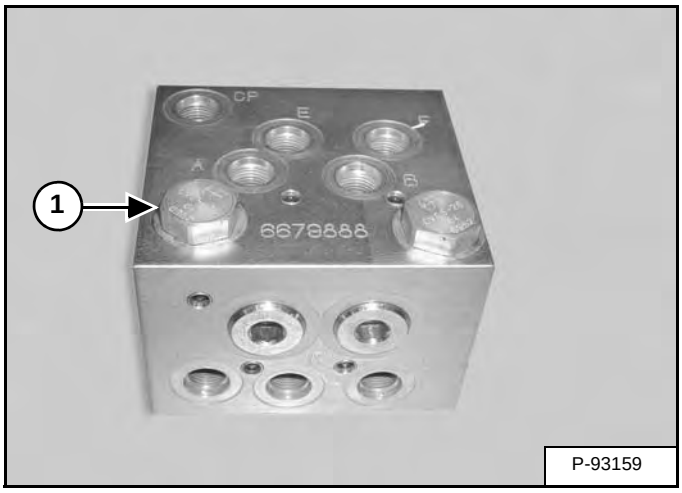
Disassembly And Assembly (Cont'd)

Figure 20-220-22



Remove the O-ring (Item 1) **[Figure 20-220-22]**.

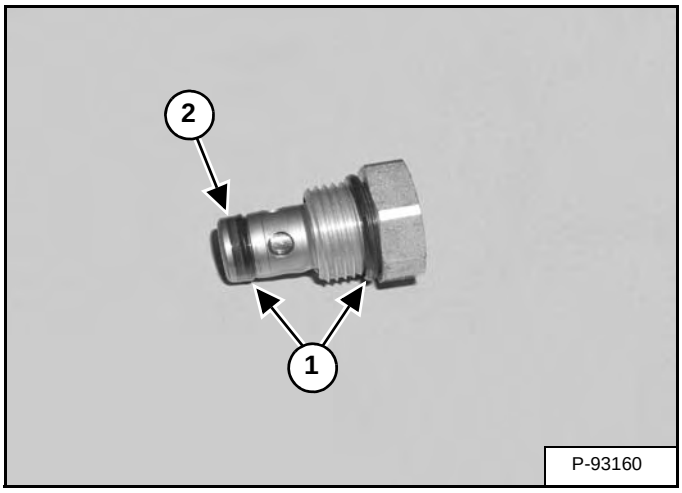
Figure 20-220-23



Remove the check valve (Item 1) **[Figure 20-220-23]**.

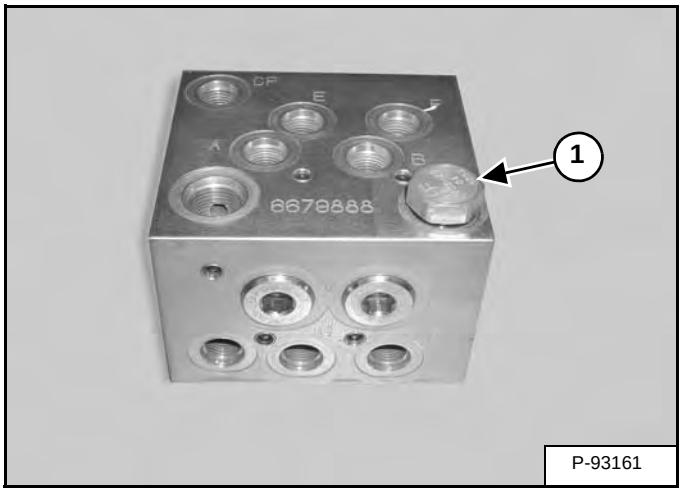
Tighten the check valve to 41 - 47 N•m (30 - 35 ft-lb) torque.

Figure 20-220-24



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-220-24]**.

Figure 20-220-25



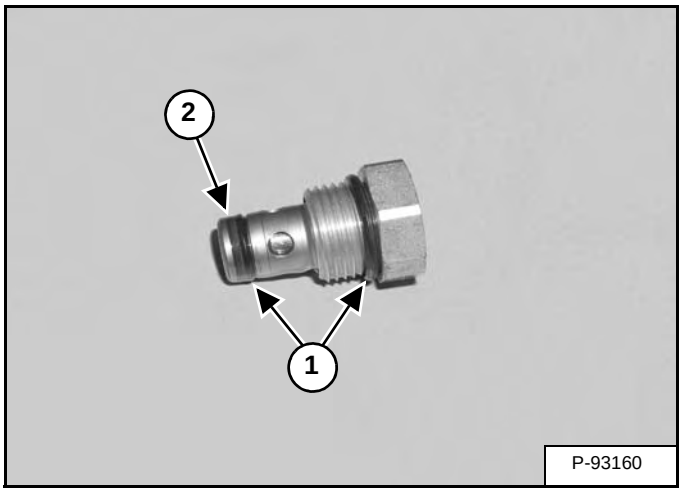
Remove the check valve (Item 1) **[Figure 20-220-25]**.

Tighten the check valve to 41 - 47 N•m (30 - 35 ft-lb) torque.

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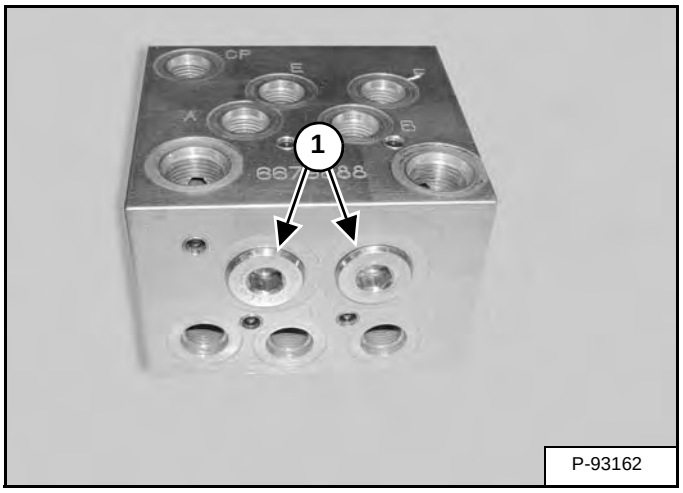
Disassembly And Assembly (Cont'd)

Figure 20-220-26



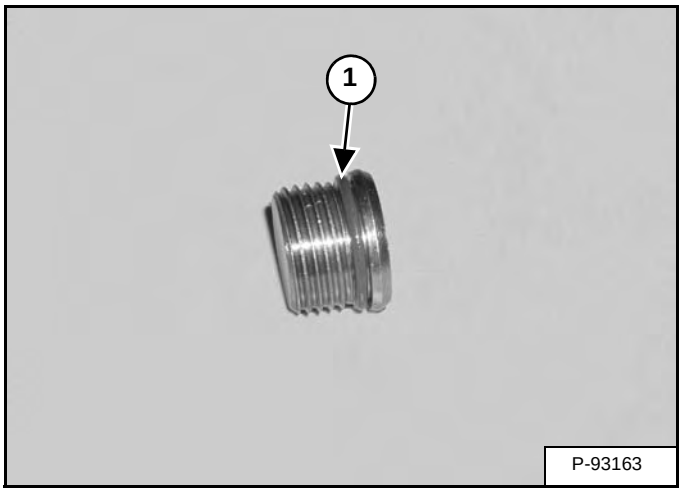
Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-220-26]**.

Figure 20-220-27



Remove the plugs (Item 1) **[Figure 20-220-27]**.

Figure 20-220-28



Remove the O-rings (Item 1) **[Figure 20-220-28]**.

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. Lubricate the O-rings with clean hydraulic fluid before installation.

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Dealer Copy -- Not for Resale

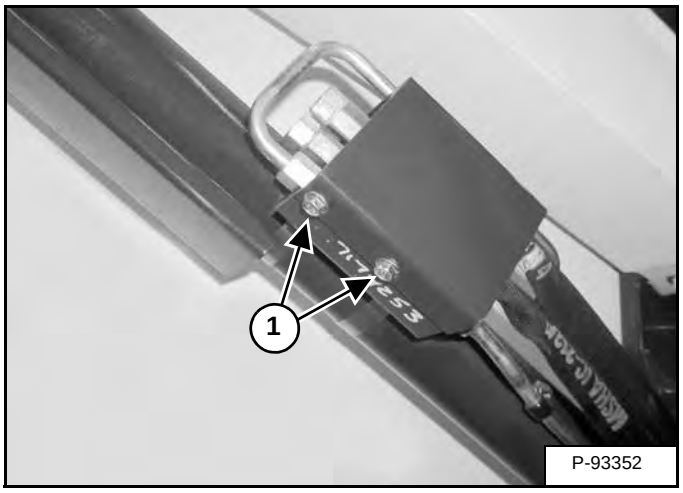
VALVE (BOOM LOCK) (S/N AC2P11001 & ABOVE)

Removal And Installation

Lower the work group to the ground.

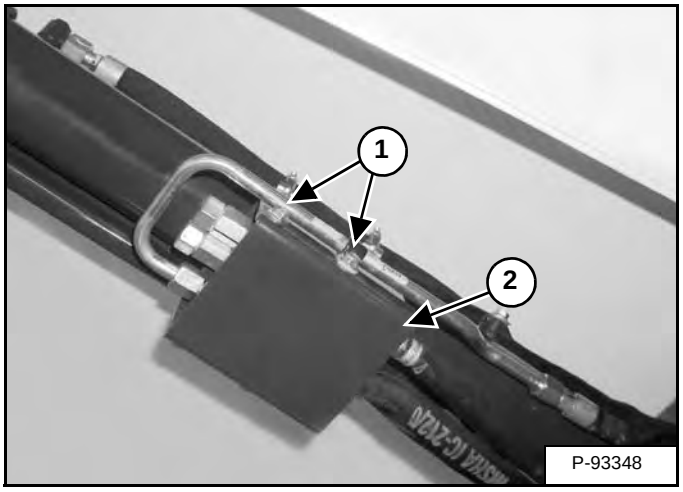
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-230-1



Remove the bolts (Item 1) **[Figure 20-230-1]**.

Figure 20-230-2



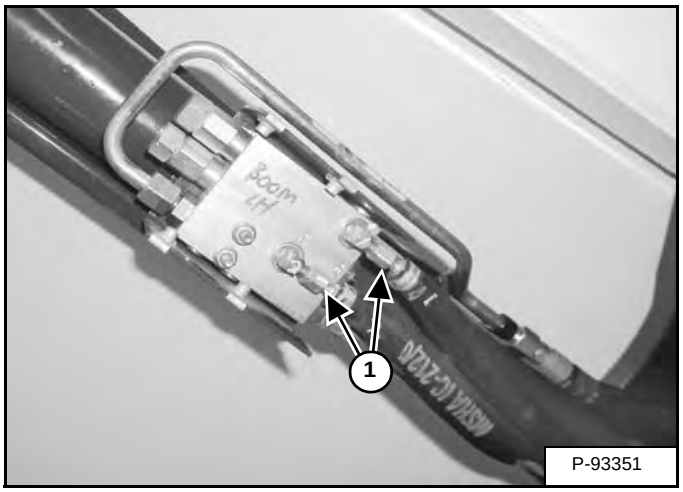
Remove the bolts (Item 1) and cover (Item 2) **[Figure 20-230-2]**.

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.

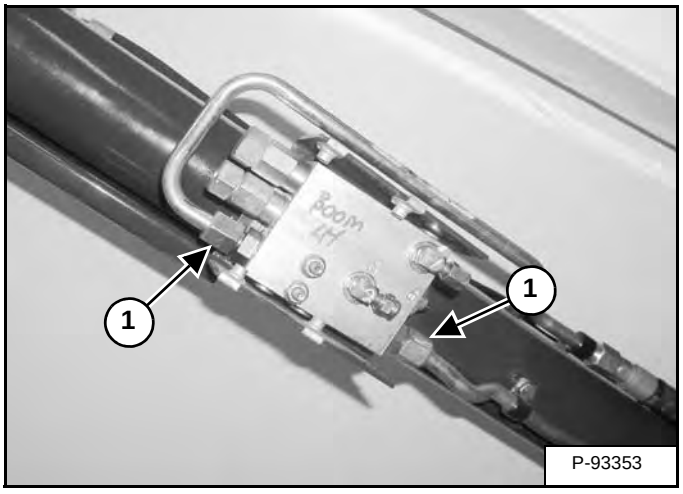
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Figure 20-230-3



Remove the hoses (Item 1) **[Figure 20-230-3]**.

Figure 20-230-4

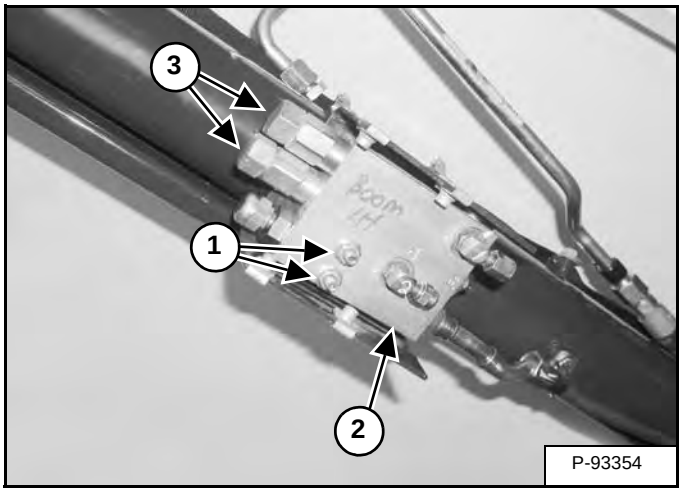


Remove the tubelines (Item 1) **[Figure 20-230-4]**.

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Removal And Installation (Cont'd)

Figure 20-230-5



Remove the nuts (Item 1) and bolts. Remove the valve (Item 2) **[Figure 20-230-5]**.

The lock valve is not serviceable. If the relief valves (Item 3) **[Figure 20-230-5]** have been tampered with, the complete valve assembly must be replaced.

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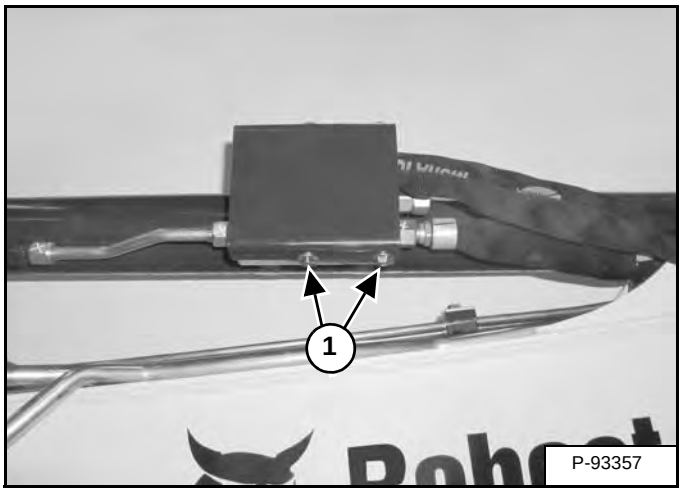
VALVE (ARM LOCK) (S/N AC2P11001 & ABOVE)

Removal And Installation

Lower the work equipment to the ground.

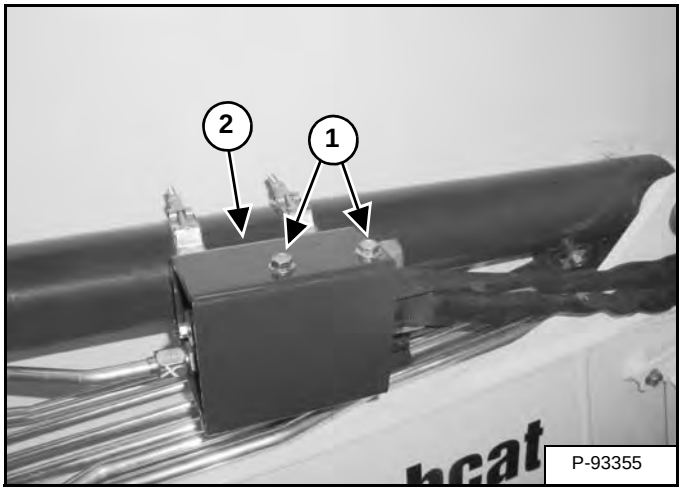
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-231-1



Remove the bolts (Item 1) **[Figure 20-231-1]**.

Figure 20-231-2



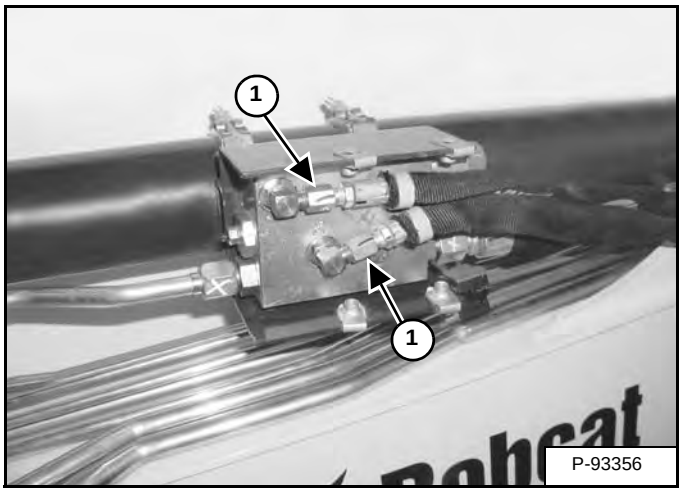
Remove the bolts (Item 1) and cover (Item 2) **[Figure 20-231-2]**.

IMPORTANT

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

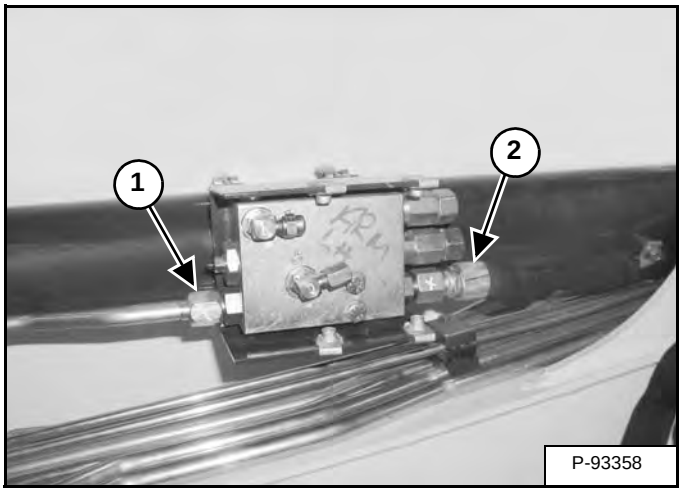
I-2003-0888

Figure 20-231-3



Remove the hoses (Item 1) **[Figure 20-231-3]**.

Figure 20-231-4

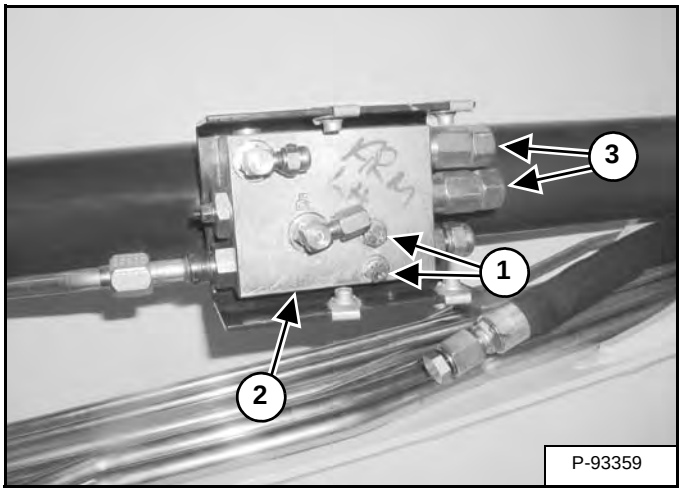


Remove the tubeline (Item 1) and hose (Item 2) **[Figure 20-231-4]**.

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Removal And Installation (Cont'd)

Figure 20-231-5



Remove the bolts (Item 1) and nuts. Remove the valve (Item 2) **[Figure 20-231-5]**.

The lock valve is not serviceable. If the relief valves (Item 3) **[Figure 20-231-5]** have been tampered with, the complete valve assembly must be replaced.

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UNDERCARRIAGE

BLADE 30-10-1
Removal And Installation 30-10-1

ANGLE BLADE 30-11-1
Removal And Installation 30-11-1

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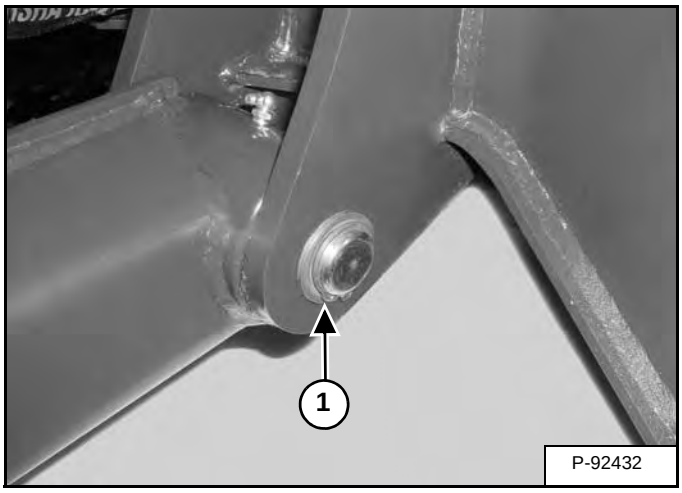
BLADE

Removal And Installation

Lower the blade and bucket to the ground.

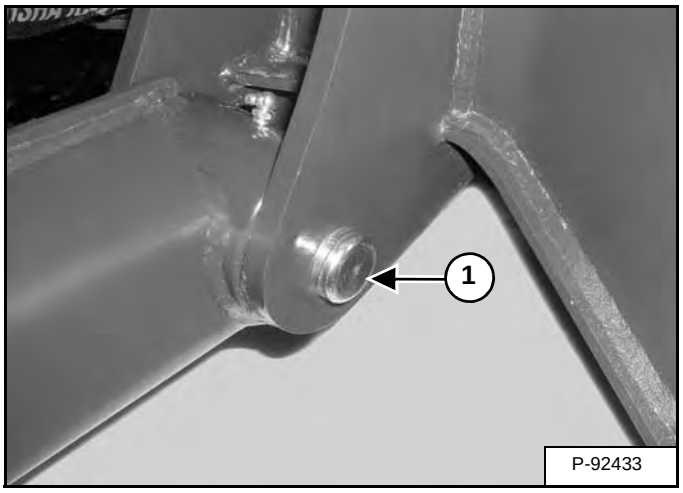
Remove the blade cylinder. (See Removal And Installation on Page 20-25-3.)

Figure 30-10-1



Remove the snap ring (Item 1) **[Figure 30-10-1]** and washer from the blade arm pivot pin (both sides).

Figure 30-10-2



Remove the blade arm pivot pin (Item 1) **[Figure 30-10-2]** (both sides).

Remove the blade.

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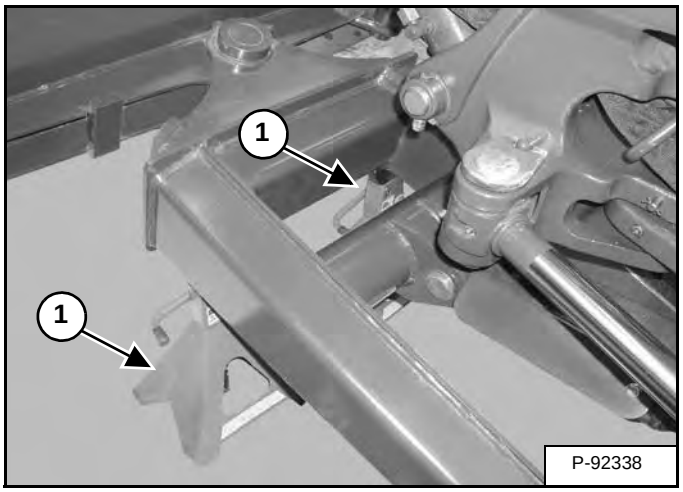


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ANGLE BLADE

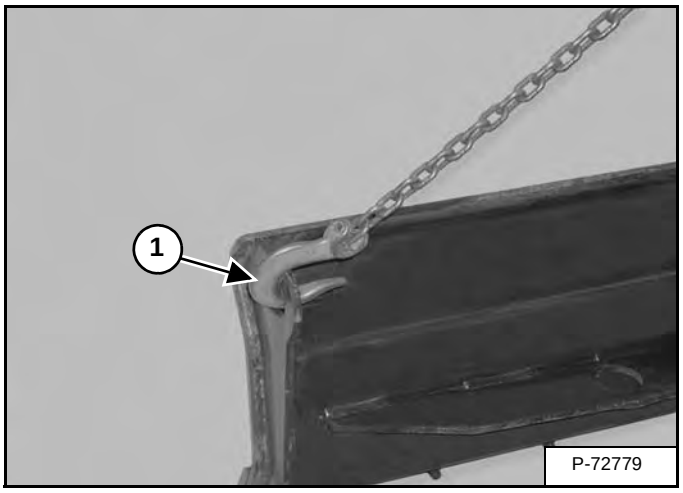
Removal And Installation

Figure 30-11-1



Raise the blade fully and install jackstands (Item 1) **[Figure 30-11-1]** under the blade arms.

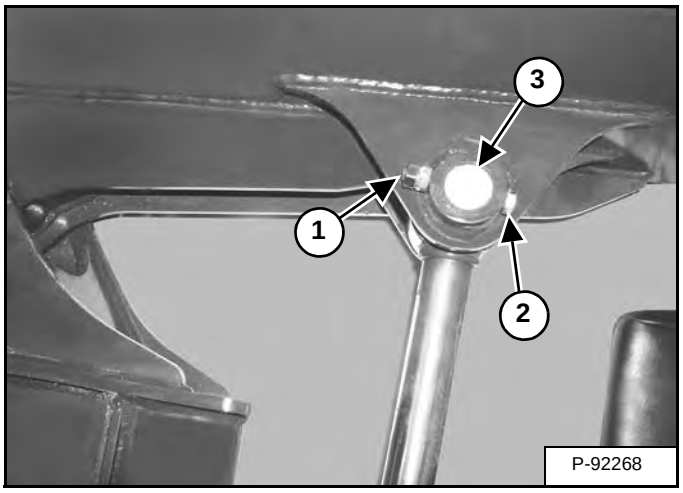
Figure 30-11-2



Attach a chain (Item 1) **[Figure 30-11-2]** and hoist to both ends of the blade.

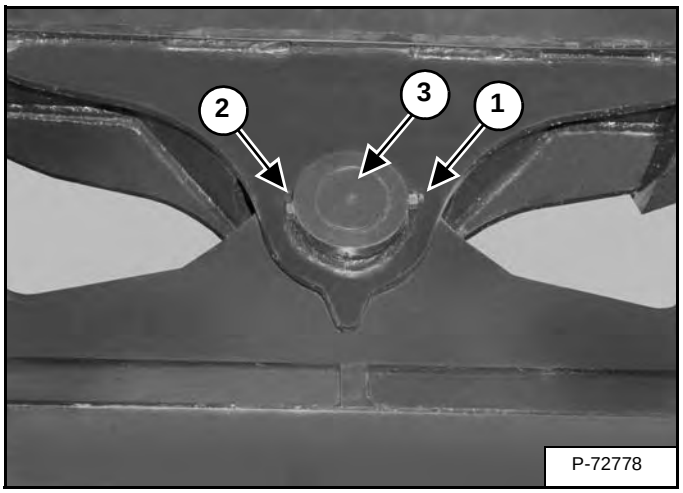
Apply slight upward pressure on the blade.

Figure 30-11-3



Remove the nuts (Item 1), bolt (Item 2) and pin (Item 3) **[Figure 30-11-3]** from the rod end of the angle blade cylinder.

Figure 30-11-4



Remove the nut (Item 1), bolt (Item 2) and pin (Item 3) **[Figure 30-11-4]**.

Remove the angle blade.

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TRACK UNDERCARRIAGE COMPONENTS (RUBBER TRACK)

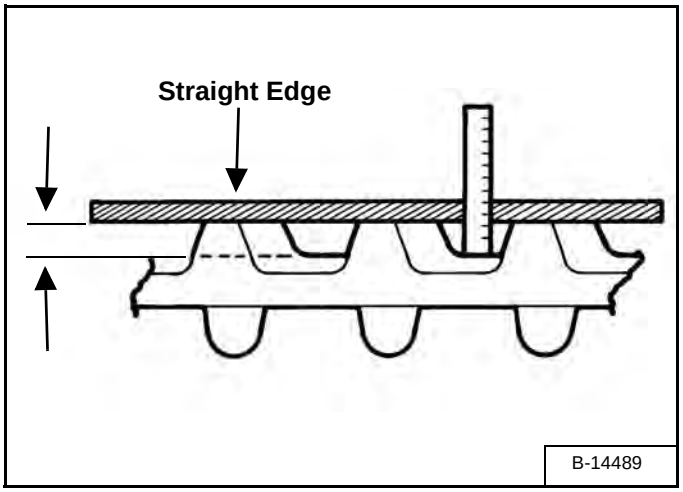
Description

The track undercarriage components consist of the front idler, top roller, bottom rollers, drive motor and track frame.

Track Lug Height

The lug height of a new rubber track is 23,0 mm (0.9 in).

Figure 30-20-1



To find the percentage of wear on a excavator track, measure the height of the lug by placing a straight edge across the top of three lugs and 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)

$$\frac{0.7}{0.9} \times 100 = 78$$

78% of the track lug is remaining with 22% wear on the track lugs.

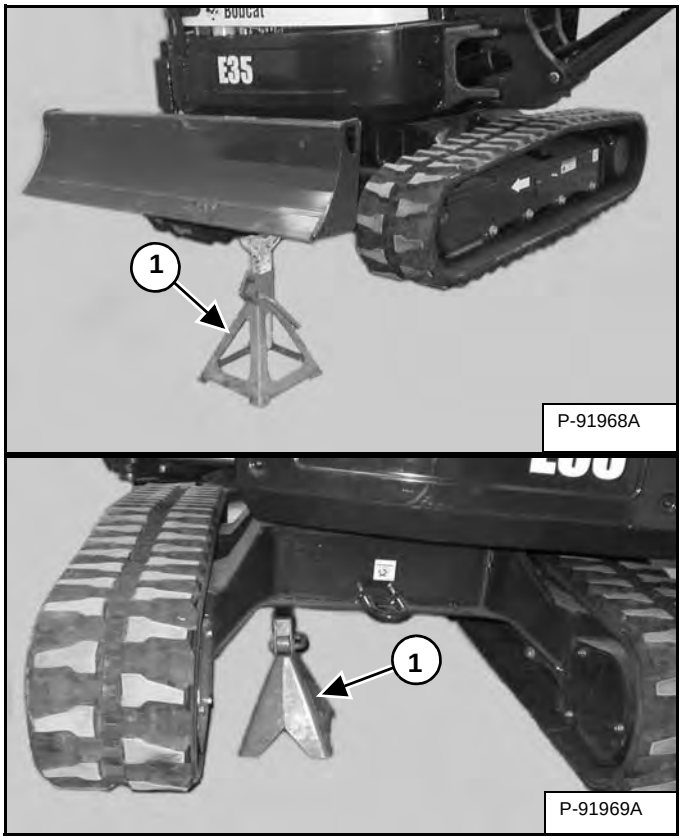
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TRACK UNDERCARRIAGE COMPONENTS (RUBBER TRACK) (CONT'D)

Checking Tension

NOTE: The wear of the pins and bushings on the undercarriage vary with the working conditions and the different types of soil conditions. It is necessary to inspect track tension and maintain the correct tension. See SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-70-1.)

Figure 30-20-2



Raise one side of the machine (Approximately four inches) using the boom and arm.

Raise the blade fully and install jackstands under the blade and track frame (Item 1) **[Figure 30-20-2]**. Lower the boom until all machine weight is on the jackstands.

Stop the engine.

⚠ WARNING

AVOID INJURY

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

W-2142-0903

Rubber Track Clearance

Figure 30-20-3

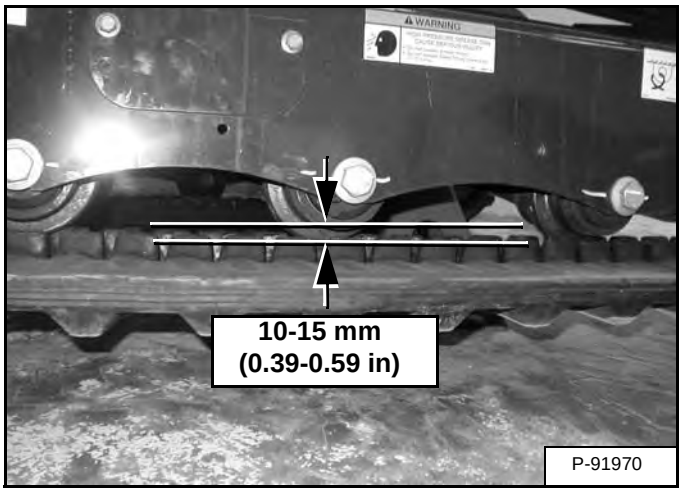
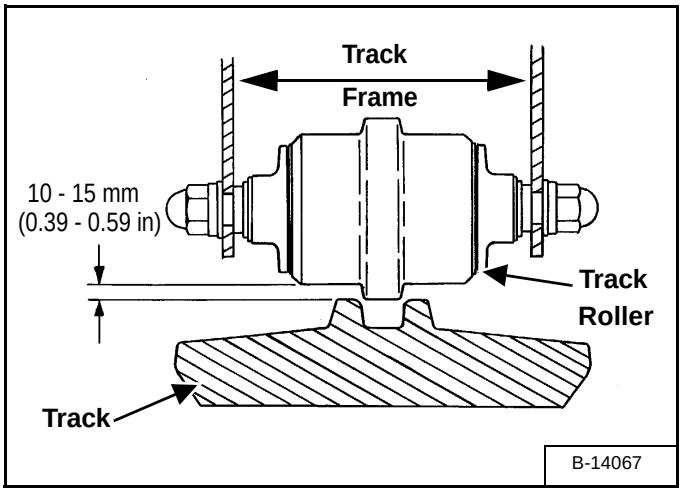


Figure 30-20-4



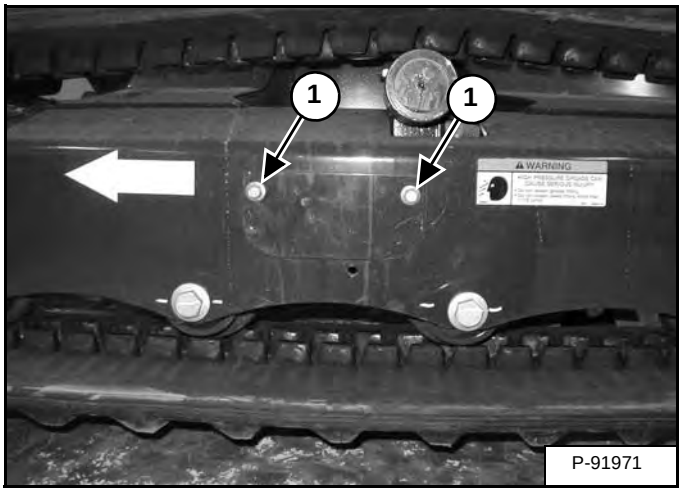
Measure the clearance at the middle track roller. Do not get fingers into pinch points between the track and the track roller. Use a bolt or a dowel of the appropriate size to check the gap between the contact edge of the roller and the top edge of the track guide **[Figure 30-20-3]** and **[Figure 30-20-4]**.

Rubber Track Clearance - 10 - 15 mm (0.39 - 0.59 in).

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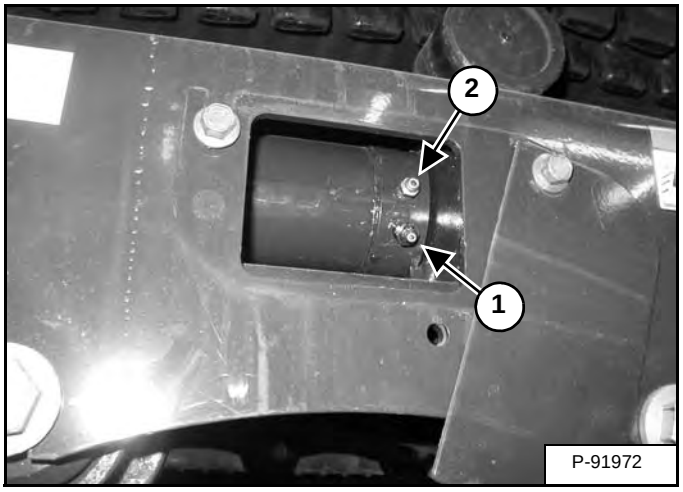
Adjusting Tension

Figure 30-20-5



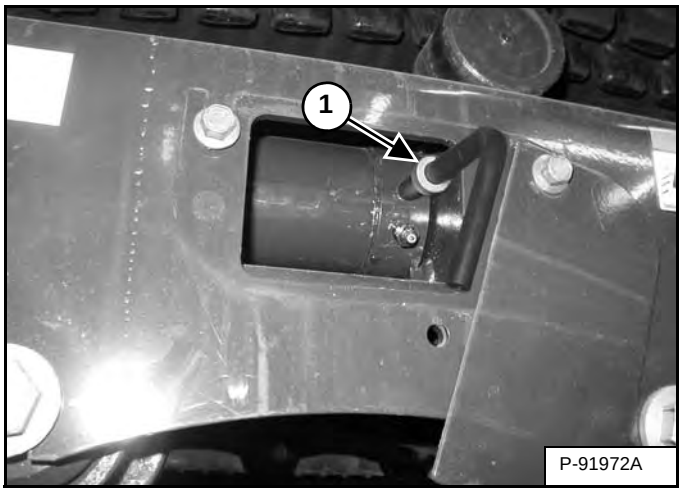
Loosen the two bolts on the cover (Item 1) **[Figure 30-20-5]**. Pivot the cover downward.

Figure 30-20-6



Add grease to the fitting (Item 1) **[Figure 30-20-6]** until the track tension is correct.

Figure 30-20-7



Use tool MEL1560 (Item 1) **[Figure 30-20-7]** to loosen the bleed fitting (Item 2) **[Figure 30-20-6]** to release tension from the track.

NOTE: Do not loosen the grease fitting (Item 1) [Figure 30-20-6].

Repeat the procedure for the other side.

⚠ WARNING

HIGH PRESSURE GREASE CAN CAUSE SERIOUS INJURY

- **Do not loosen grease fitting.**
- **Do not loosen bleed fitting more than 1 - 1/2 turns.**

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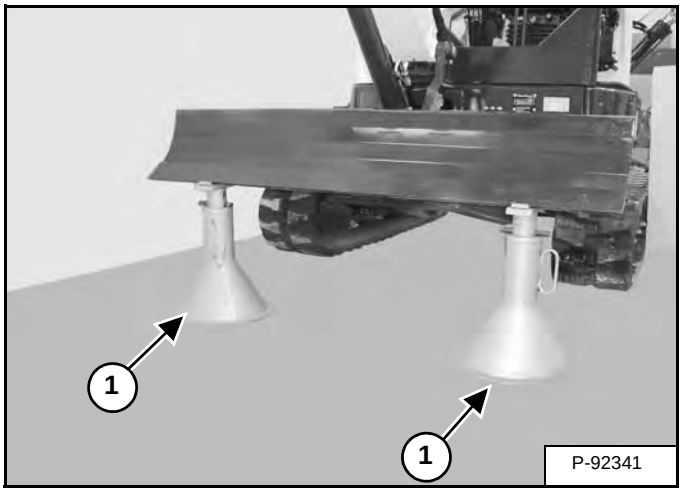
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Track Removal And Installation

Lift and block both sides of the machine as follows:

Raise the blade fully.

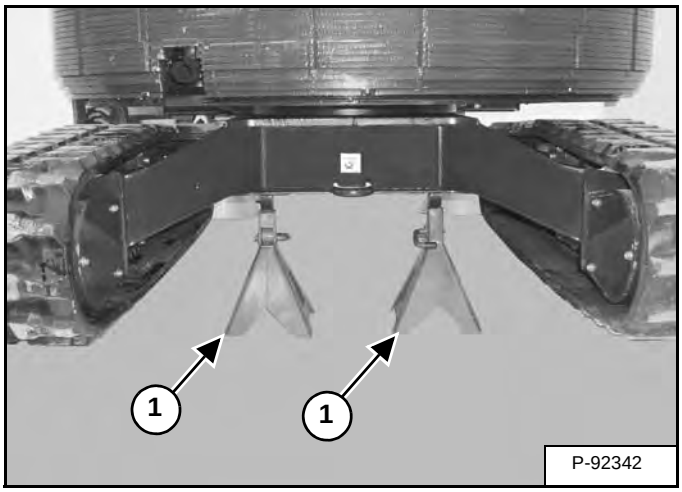
Figure 30-20-8



Use the boom and arm to lift the blade end of the machine up about 75 mm (3.0 in) and install jack stands (Item 1) **[Figure 30-20-8]** under the blade.

Raise the boom.

Figure 30-20-9



Swing the upperstructure 180° and use the boom and arm to slowly lift the opposite end of the undercarriage and install jack stands under the undercarriage (Item 1) **[Figure 30-20-9]**.

Raise the boom until the weight of the machine is supported by the jackstands.

⚠ WARNING

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

W-2218-1195

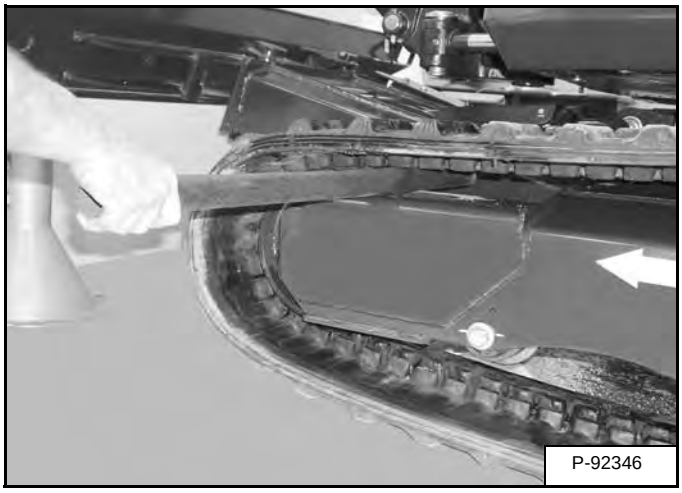
Stop the engine.

Release track tension (See Adjusting Tension on Page 30-20-3.)

Start the engine.

Slowly turn the track in the forward direction.

Figure 30-20-10

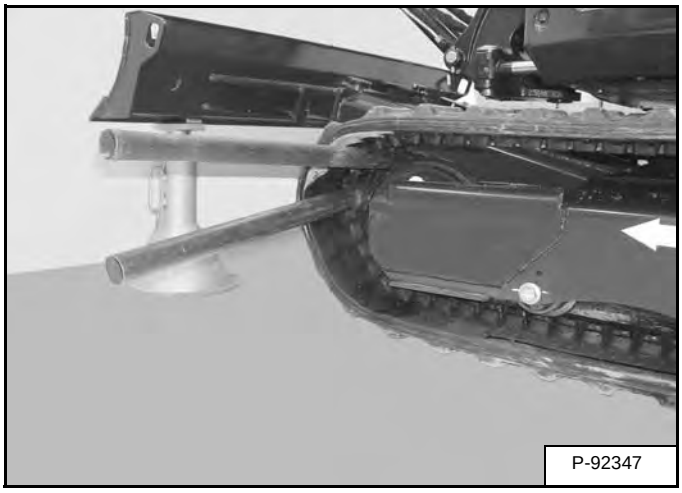


Insert a steel rod or pipe (Approximately 30 mm [1.250 in] diameter) between the track and the idler wheel **[Figure 30-20-10]**.

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Track Removal And Installation (Cont'd)

Figure 30-20-11



Insert a second steel rod or pipe, at a distance of two lugs, between the track and the idler wheel **[Figure 30-20-11]**. Continue to turn the track until the first pipe contacts the track frame.

Stop the engine.

Figure 30-20-12



Insert a pry bar between the track and the idler wheel and pry out on the track until the track slides off the idler wheel **[Figure 30-20-12]**.

Remove the track.

To install the rubber track:

Put the track over the rear drive sprocket lugs.

Put the front of the track onto the front idler wheel.

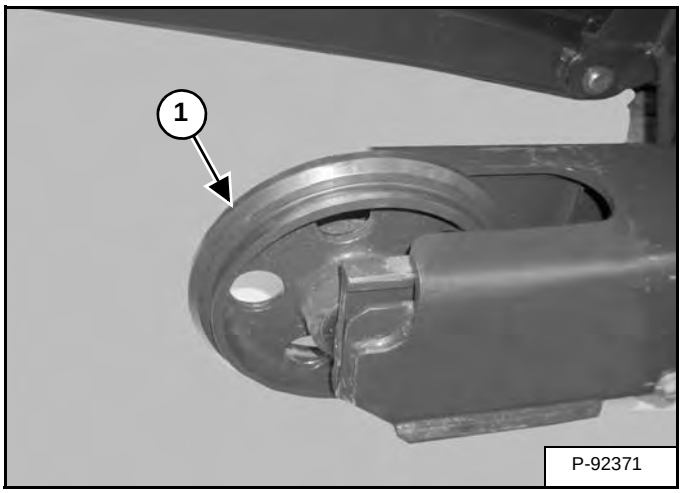
Adding grease to the track tensioner. (See Adjusting Tension on Page 30-20-3.)

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Idler Removal And Installation

Remove the track. (See Track Removal And Installation on Page 30-20-4.)

Figure 30-20-13

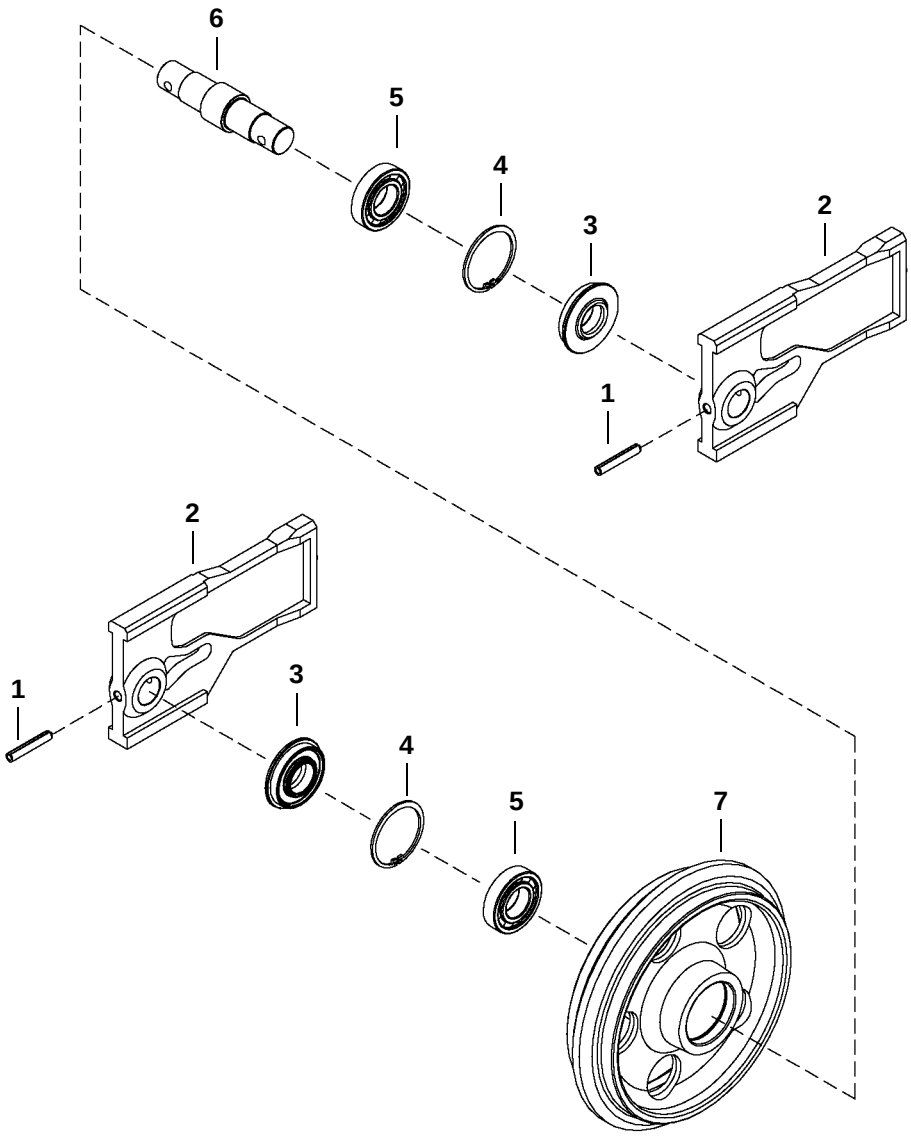


Slide the track idler (Item 1) **[Figure 30-20-13]** out of the track frame.

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Parts Identification

1. Roll Pin
2. Block
3. Seal
4. Snapring
5. Bearing
6. Shaft
7. Idler



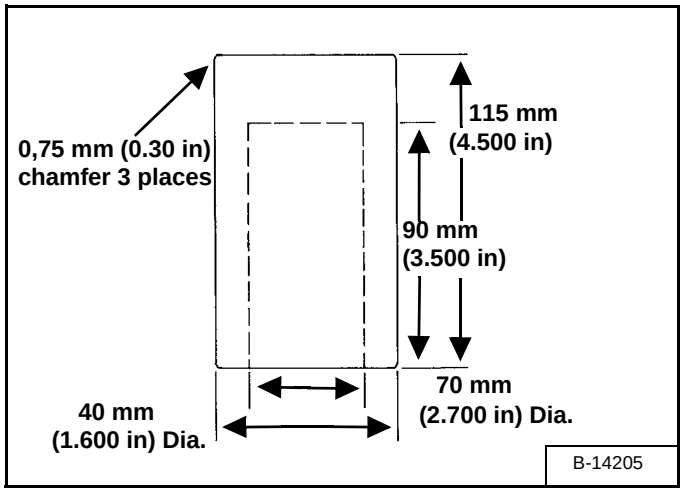
PE1801S

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Track Idler Disassembly

The following tools must be fabricated for this procedure:

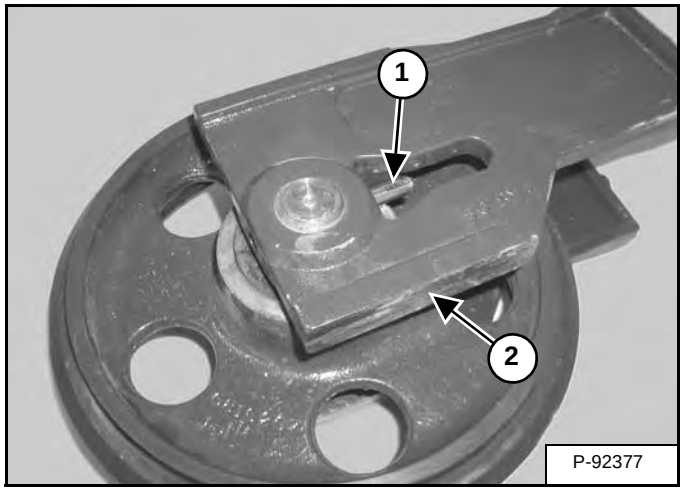
Figure 30-20-14



1. Driver Tool - see figure **[Figure 30-20-14]**.

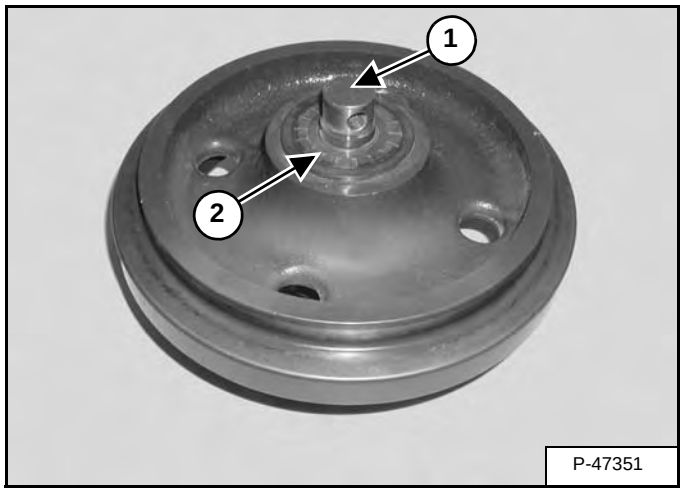
2. Support Fixture - Tube, 90 mm ID x 6,35 mm wall x 162,4 mm long (3.0 in ID x 0.250 in wall x 6.0 in long).

Figure 30-20-15



Remove the roll pin (Item 1) and block (Item 2) from both sides of the shaft **[Figure 30-20-15]**.

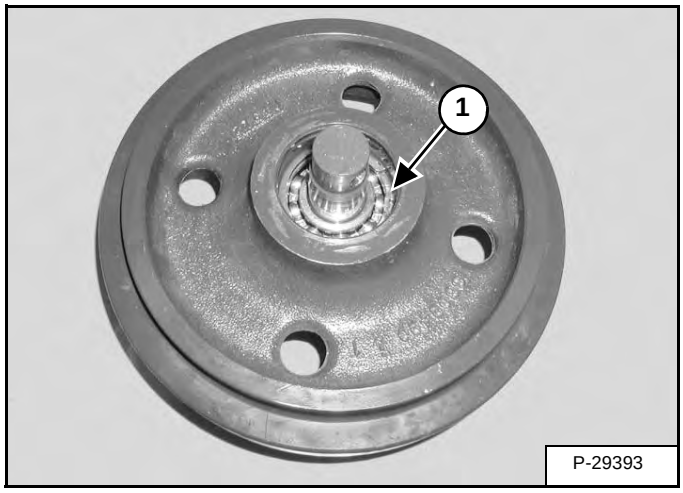
Figure 30-20-16



Remove any corrosion or paint from both ends of the exposed shaft (Item 1) **[Figure 30-20-16]** that could affect seal removal or damage the new seal during installation.

Remove the seal (Item 2) **[Figure 30-20-16]** from both sides of the idler.

Figure 30-20-17

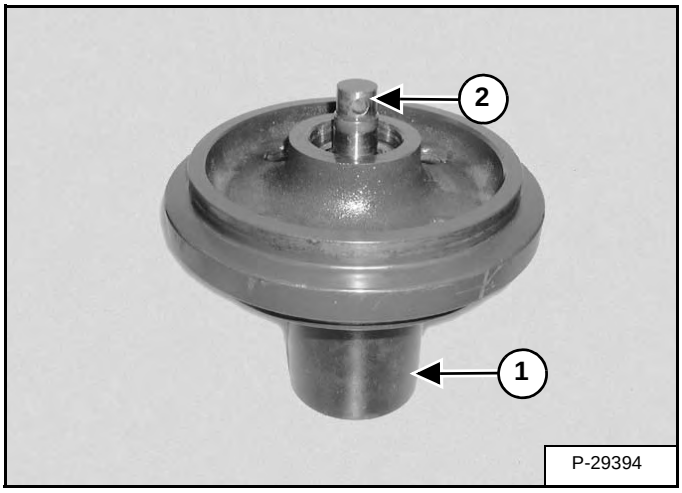


Remove the snap ring (Item 1) **[Figure 30-20-17]** from both sides of the idler.

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Track Idler Disassembly (Cont'd)

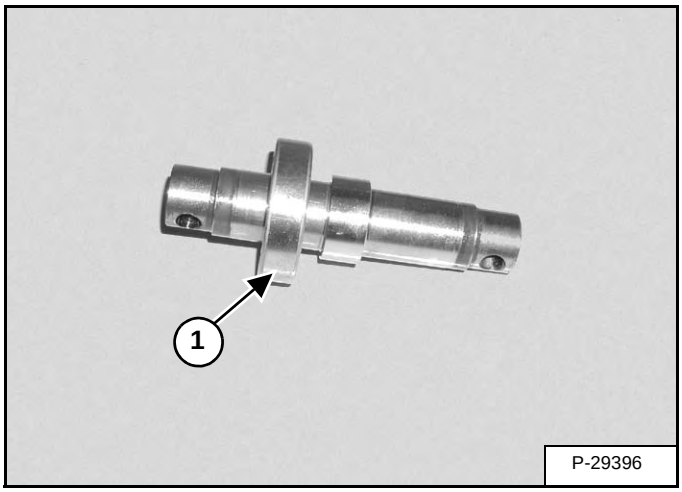
Figure 30-20-18



Place the idler on the support fixture (Item 1) **[Figure 30-20-18]**.

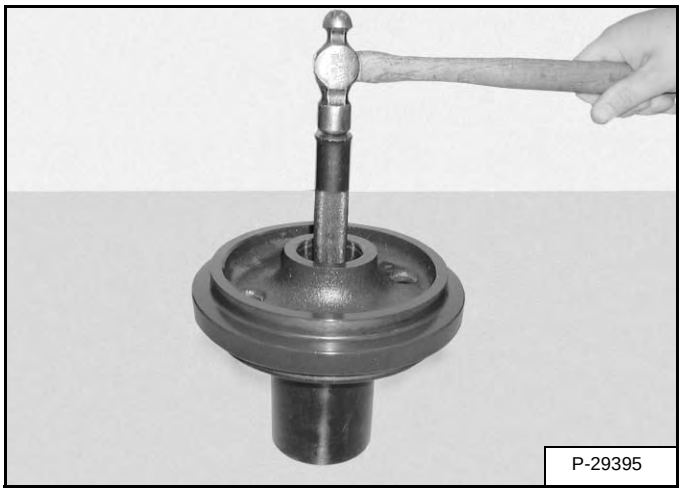
Using a soft faced hammer, tap the shaft (Item 2) **[Figure 30-20-18]** and bearing out the bottom of the idler.

Figure 30-20-19



Slide the bearing (Item 1) **[Figure 30-20-19]** off the shaft.

Figure 30-20-20



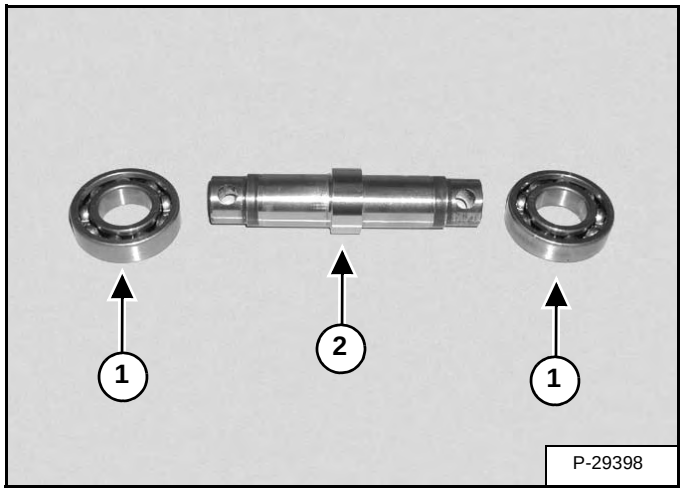
Turn the idler over, and using a bearing driver, remove the second bearing (Item 1) **[Figure 30-20-20]**.

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Track Idler Assembly

Clean all parts in solvent and dry with compressed air.

Figure 30-20-21

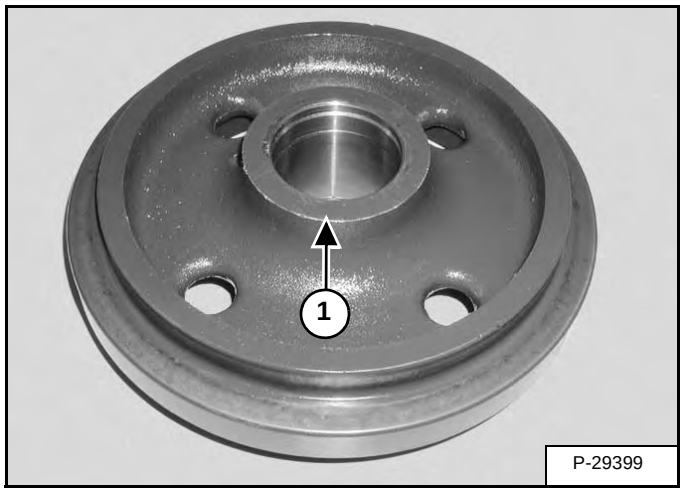


Inspect the bearings (Item 1) and shaft (Item 2) **[Figure 30-20-21]** for wear or damage.

The bearings are sealed. If the bearings do not roll smoothly, or if the seals are damaged, replace the bearings.

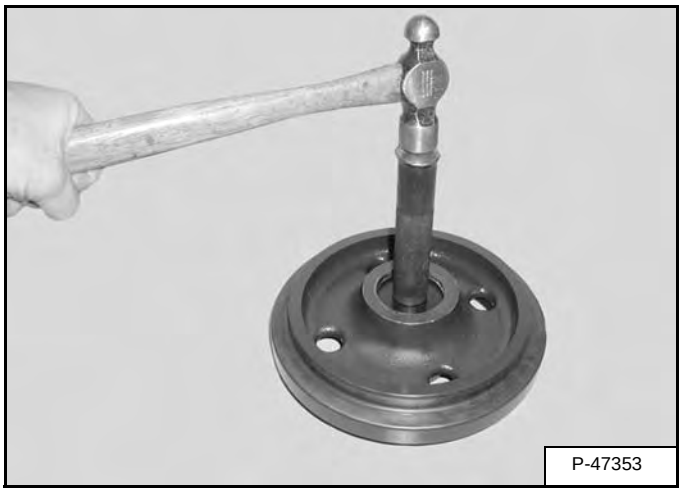
Replace any worn or damaged parts.

Figure 30-20-22



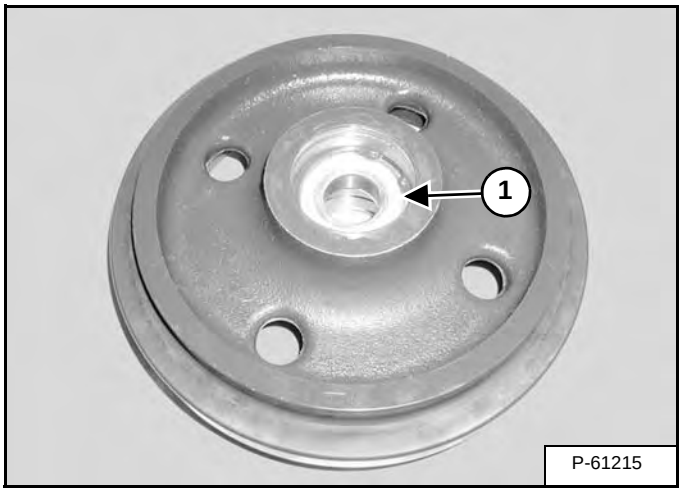
Remove all paint and corrosion from the seal surface (Item 1) **[Figure 30-20-22]** on both sides of the idler.

Figure 30-20-23



Using a bearing driver, install the bearing in the idler **[Figure 30-20-23]**.

Figure 30-20-24

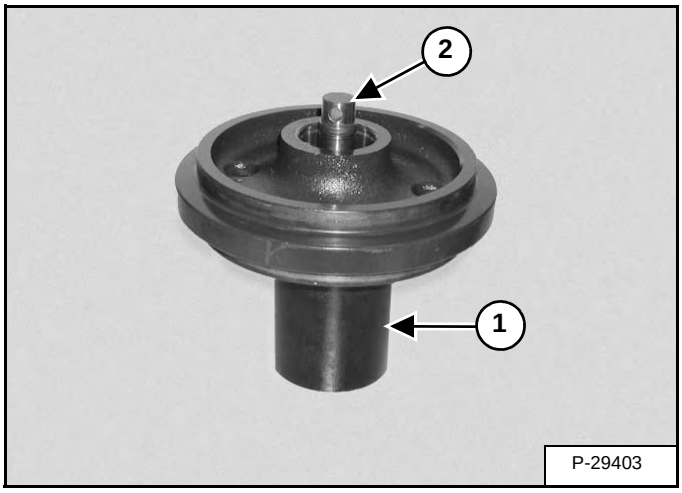


Install the snap ring (Item 1) **[Figure 30-20-24]**.

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Track Idler Assembly (Cont'd)

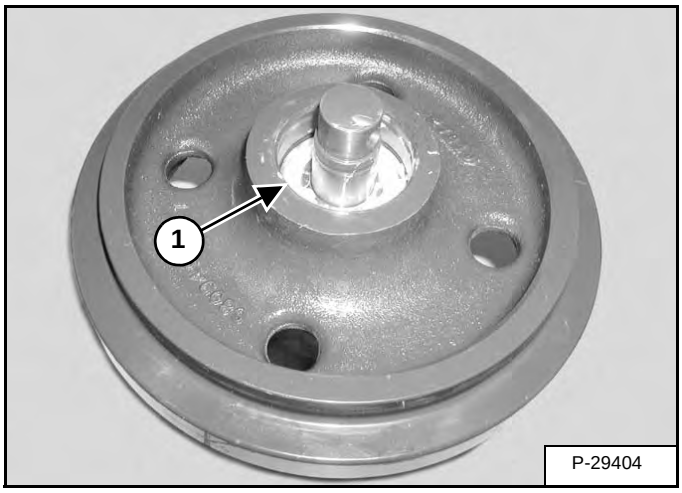
Figure 30-20-25



Turn the idler over and place the idler on the support fixture (Item 1) **[Figure 30-20-25]**.

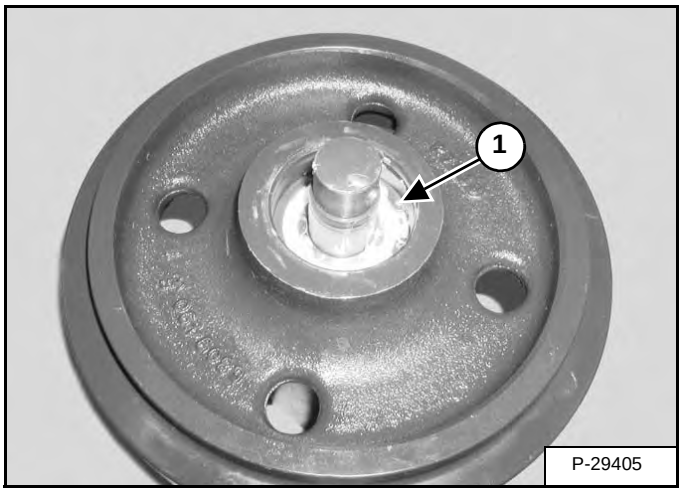
Install the shaft (Item 2) **[Figure 30-20-25]**.

Figure 30-20-26



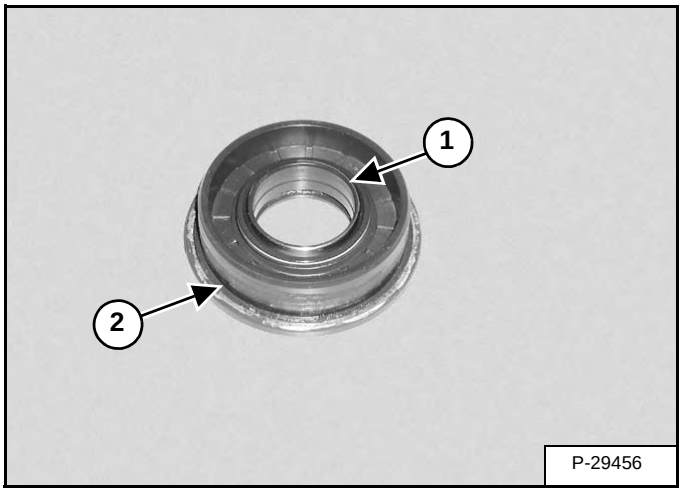
Install the bearing (Item 1) **[Figure 30-20-26]**. Use a brass drift to seat the bearing.

Figure 30-20-27



Install the snap ring (Item 1) **[Figure 30-20-27]**.

Figure 30-20-28



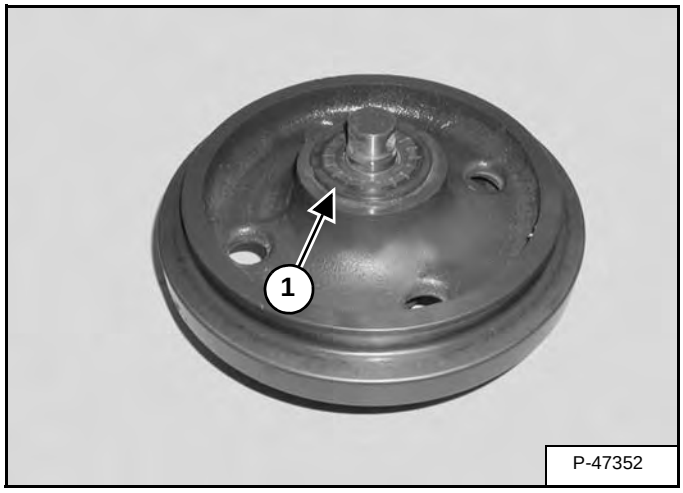
Apply assembly lube to the inside diameter (Item 1) **[Figure 30-20-28]** of the seal.

Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-20-28]** of the seal.

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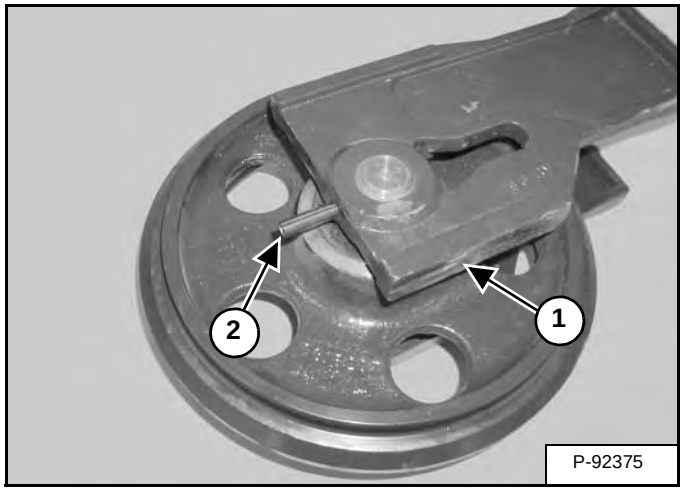
Track Idler Assembly (Cont'd)

Figure 30-20-29



Using the driving tool, install the seal (Item 1) **[Figure 30-20-29]** on both sides of the idler.

Figure 30-20-30



Install the block (Item 1) and roll pin (Item 2) **[Figure 30-20-30]** on both sides of the shaft.

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Track Tensioner Removal And Installation

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 1) **[Figure 30-20-31]**.

⚠ WARNING



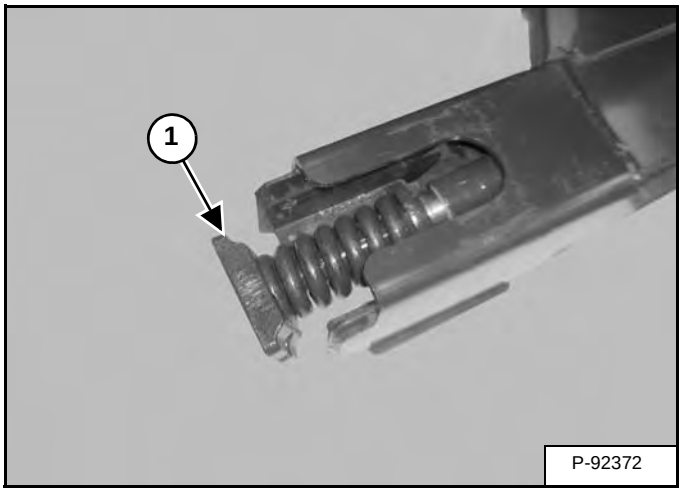
P-62574

AVOID INJURY OR DEATH

- **Spring loaded components under pressure can cause serious injury or death.**
- **Do not disassemble the coil spring assembly**

W-2617-1004

Figure 30-20-31



Remove the recoil spring (Item 1) **[Figure 30-20-31]**.

Figure 30-20-32

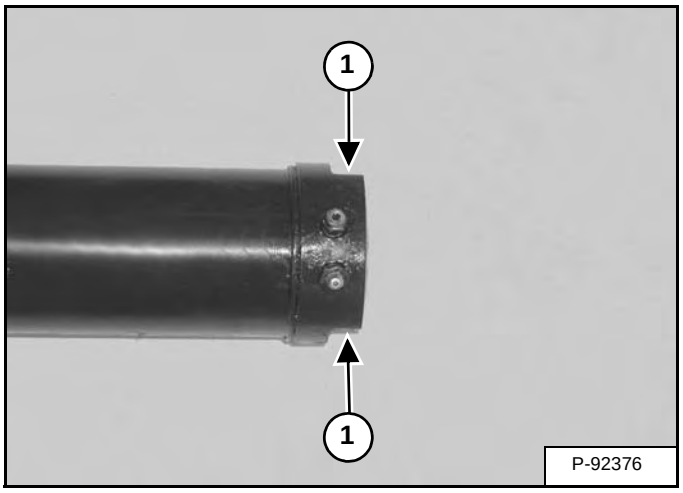
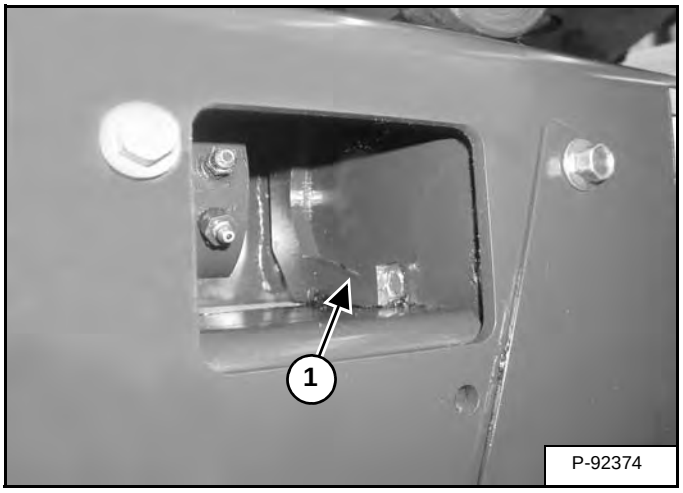


Figure 30-20-33

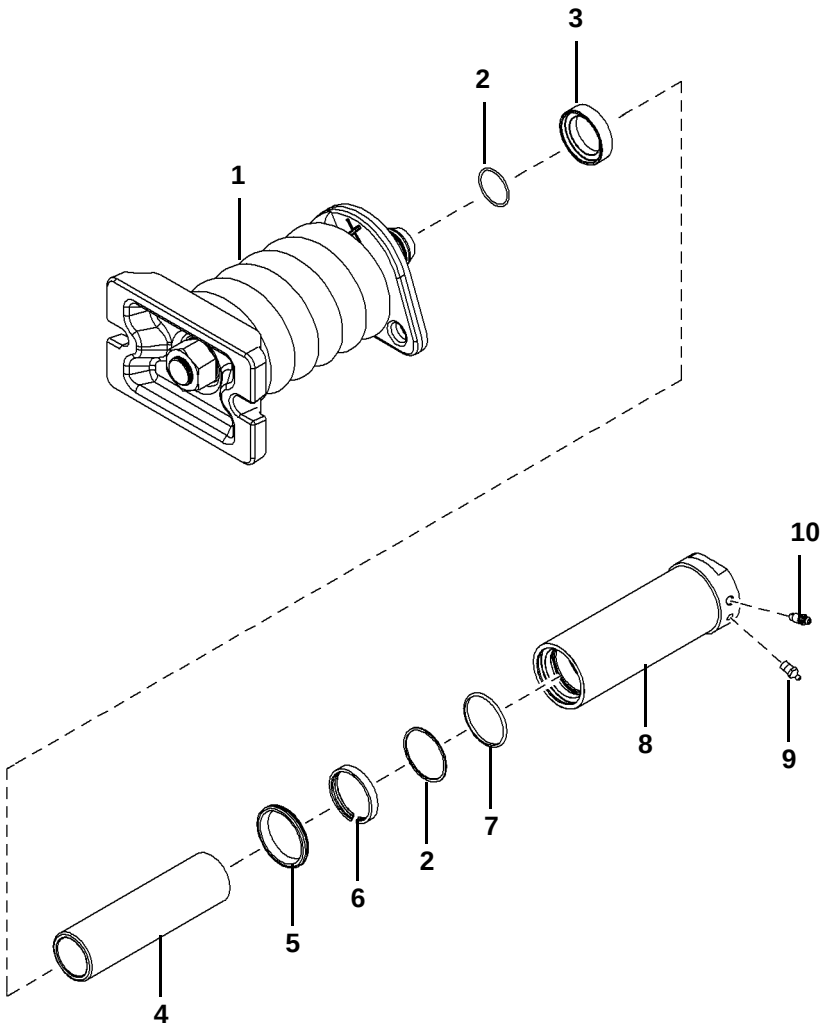


The flat sides (Item 1) **[Figure 30-20-32]** of the recoil spring grease cylinder must engage the mount (Item 1) **[Figure 30-20-33]** of the track frame.

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Track Tensioner Parts Identification

1. Coil Spring Assembly
2. O-ring
3. Spacer (Steel Track Only)
4. Shaft
5. Wiper Seal
6. Back-up Ring
7. Wear Ring
8. Tube
9. Grease Fitting
10. Bleed Fitting



PE-3893S

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Track Tensioner Disassembly And Assembly

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 2) **[Figure 30-20-34]**.

⚠ WARNING



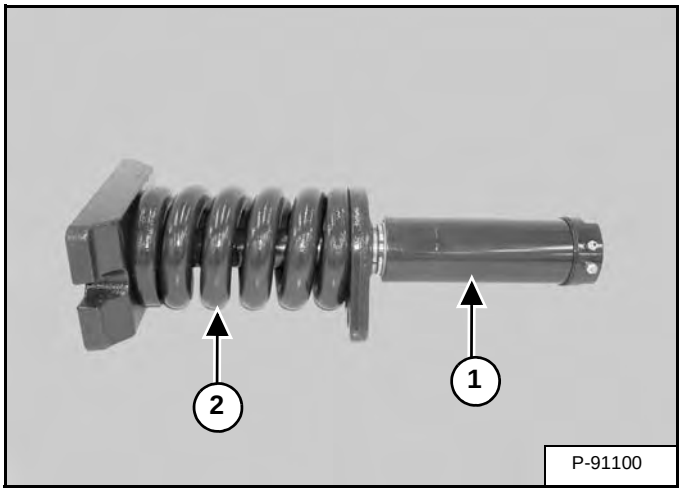
P-62574

AVOID INJURY OR DEATH

- **Spring loaded components under pressure can cause serious injury or death.**
- **Do not disassemble the coil spring assembly**

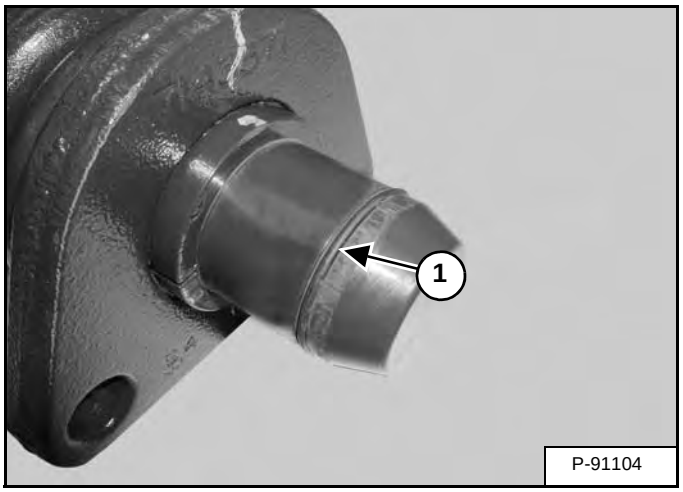
W-2617-1004

Figure 30-20-34



Remove the cylinder (Item 1) from the coil spring assembly (Item 2) **[Figure 30-20-34]**.

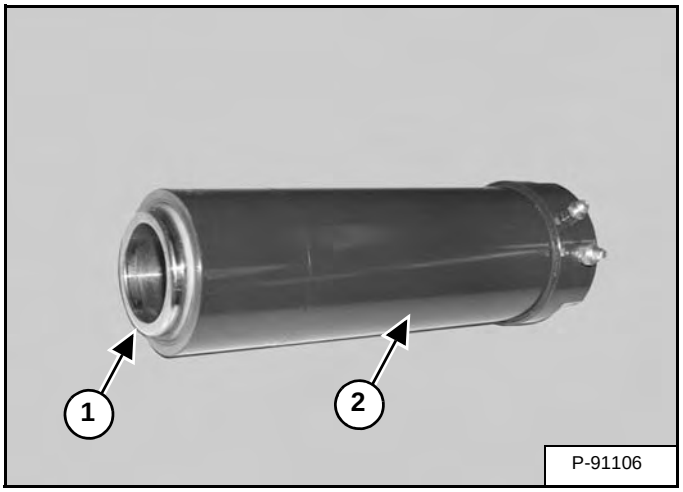
Figure 30-20-35



Remove the O-ring (Item 1) **[Figure 30-20-35]** from the cylinder.

Installation: Apply oil to the O-ring before installation.

Figure 30-20-36

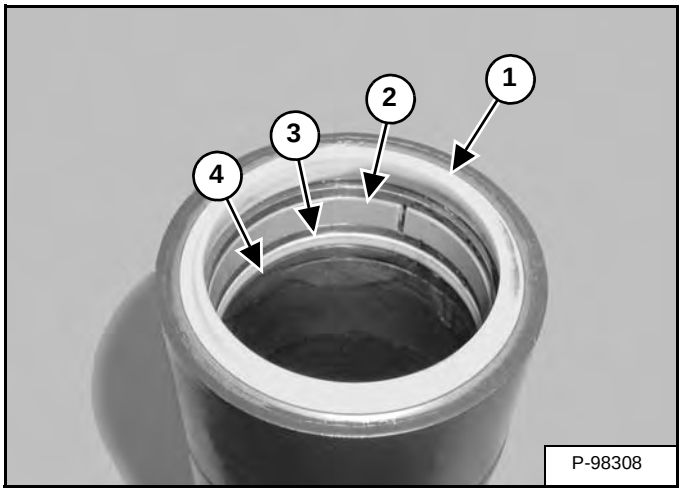


Remove the shaft (Item 1) from the tube (Item 2) **[Figure 30-20-36]**.

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Track Tensioner Disassembly And Assembly (Cont'd)

Figure 30-20-37

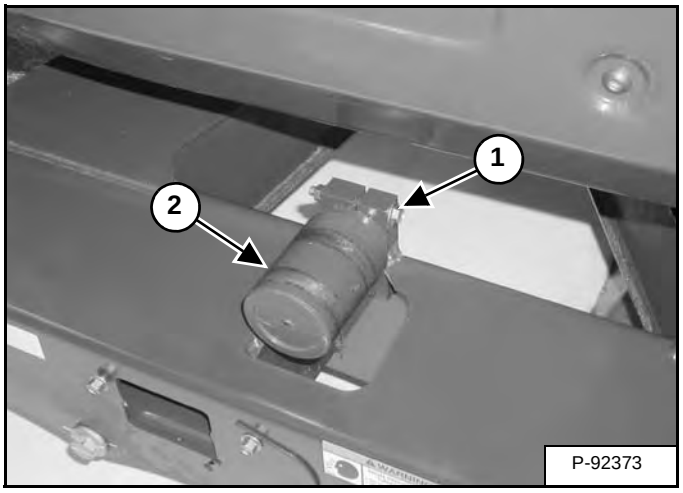


Remove the wiper seal (Item 1), wear ring (Item 2) and back-up ring (Item 3) and O-ring (Item 4) **[Figure 30-20-37]**.

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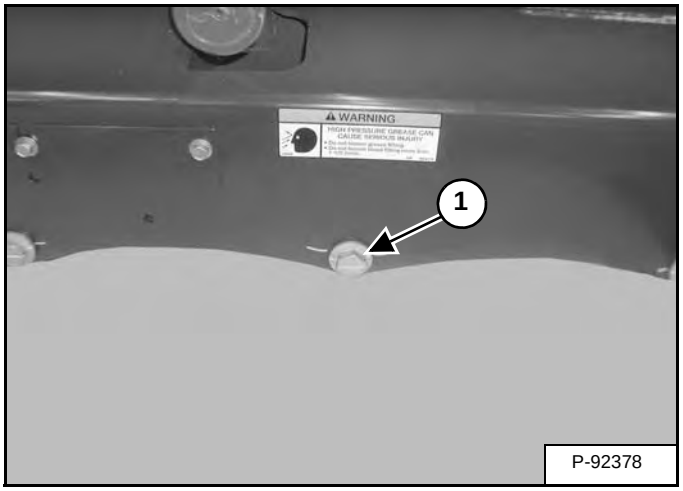
Roller Removal And Installation

Figure 30-20-38



Loosen the bolt (Item 1) and nut. Remove the top roller (Item 2) **[Figure 30-20-38]**.

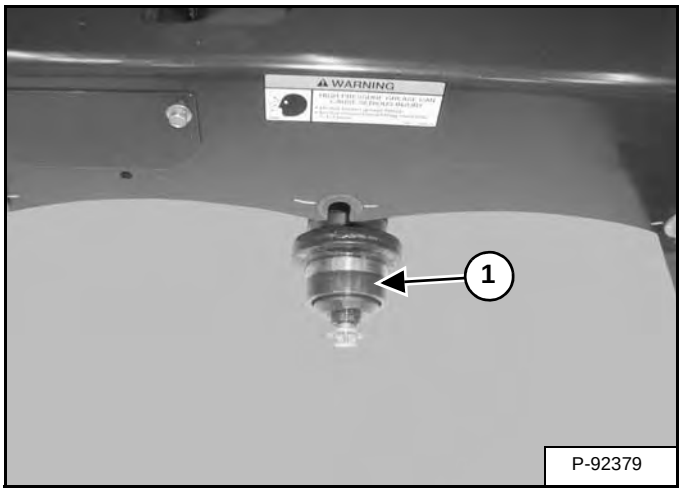
Figure 30-20-39



Loosen the bolts (Item 1) **[Figure 30-20-39]** on the track roller on both sides of the track frame.

Installation: Tighten the bolts to 544 - 604 N•m (401 - 445 ft-lb) torque.

Figure 30-20-40



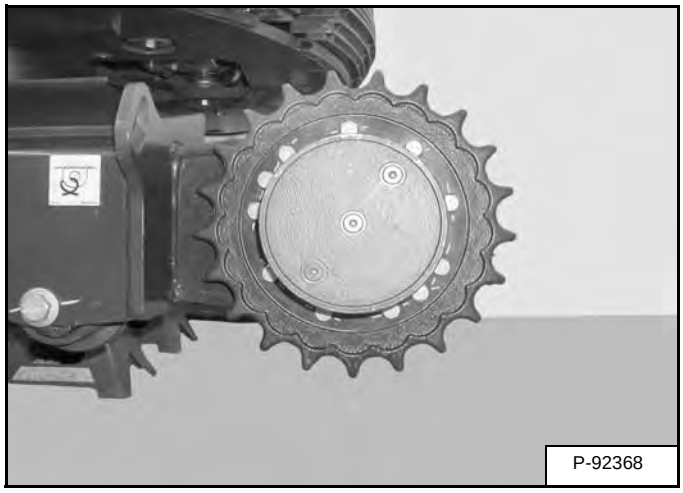
Remove the bottom roller (Item 1) **[Figure 30-20-40]**.

NOTE: The top and bottom rollers are not serviceable. Replace the roller if it is damaged.

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Sprocket Removal And Installation

Figure 30-20-41



Remove the drive sprocket bolts **[Figure 30-20-41]**.

Installation: Put thread adhesive (Loctite® 242) on the bolts and tighten to 108 N•m (80 ft-lb) torque.

Remove the drive sprocket from the travel motor.

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TRACK UNDERCARRIAGE COMPONENTS (STEEL TRACK)

Description

The track undercarriage components consist of the front idler, top roller, bottom rollers, drive motor and track frame.

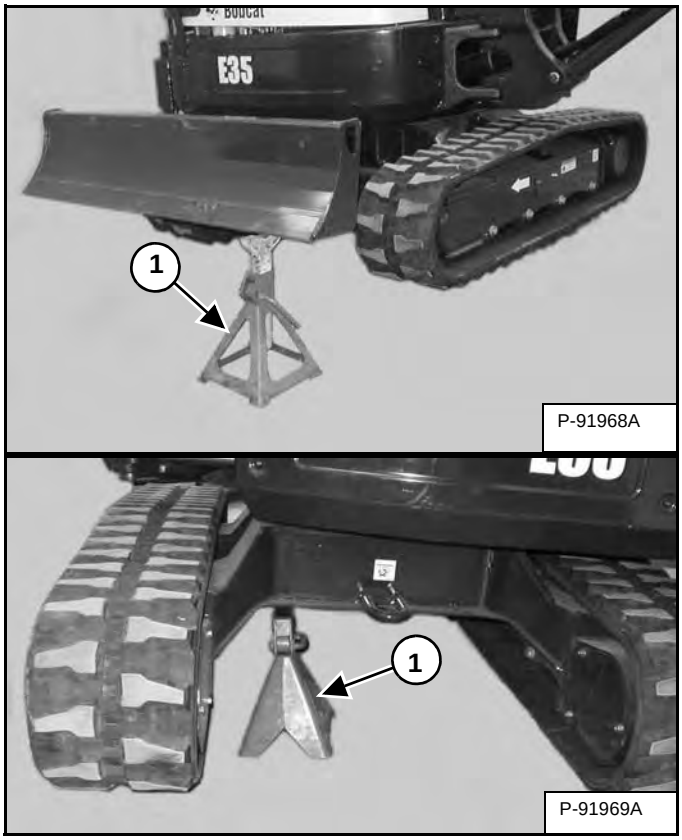
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TRACK UNDERCARRIAGE COMPONENTS (STEEL TRACK) (CONT'D)

Checking Tension

NOTE: The wear of the pins and bushings on the undercarriage vary with the working conditions and the different types of soil conditions. It is necessary to inspect track tension and maintain the correct tension. See SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-70-1.)

Figure 30-21-1



Raise one side of the machine (Approximately four inches) using the boom and arm.

Raise the blade fully and install jackstands under the blade and track frame (Item 1) **[Figure 30-21-1]**. Lower the boom until all machine weight is on the jackstands.

Stop the engine.

⚠ WARNING

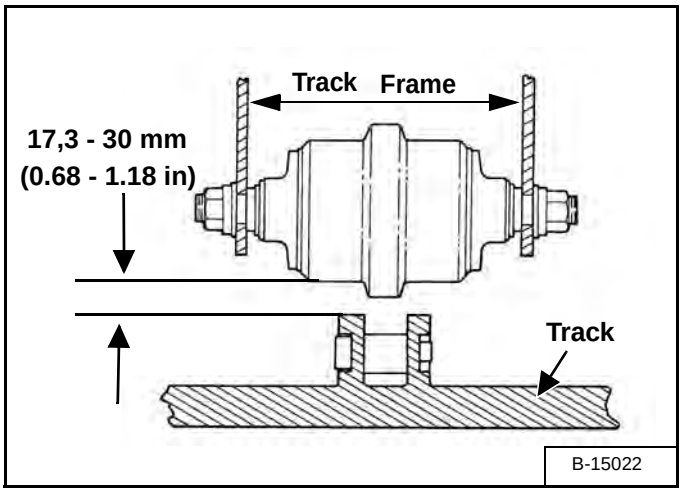
AVOID INJURY

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

W-2142-0903

Steel Track Clearance

Figure 30-21-2



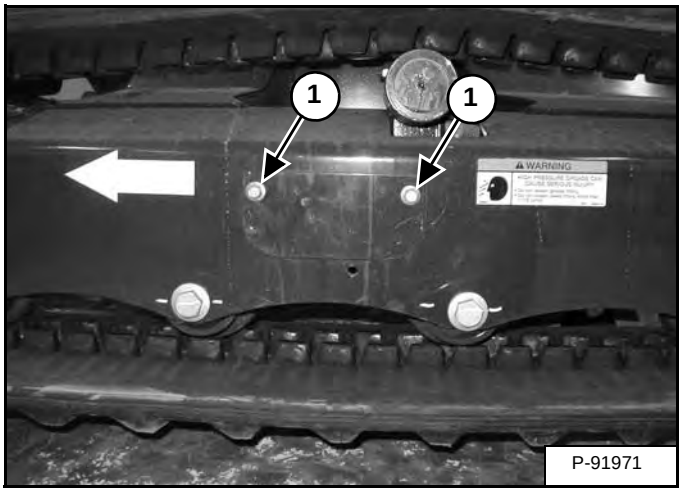
Measure the track clearance at the middle track roller. Do not get fingers into pinch points between the track and the track roller. Us a bolt or dowel of the appropriate size to check the gap between the contact edge of the roller and the top edge of the track guide **[Figure 30-21-2]**.

Steel Track Clearance - 17,3 - 30 mm (0.68 - 1.18 in).

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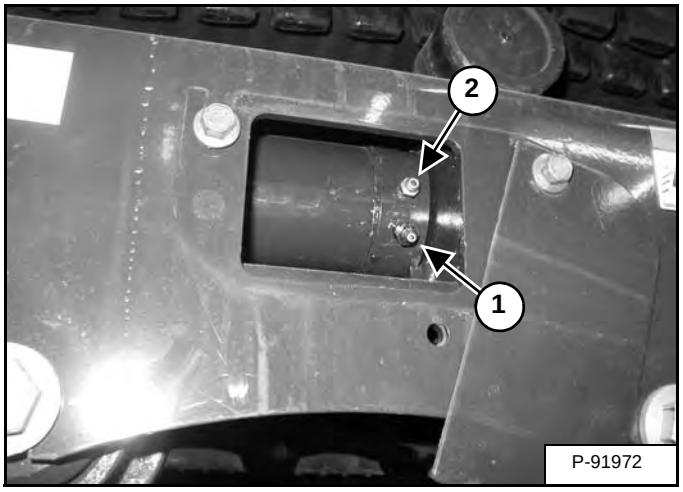
Adjusting Tension

Figure 30-21-3



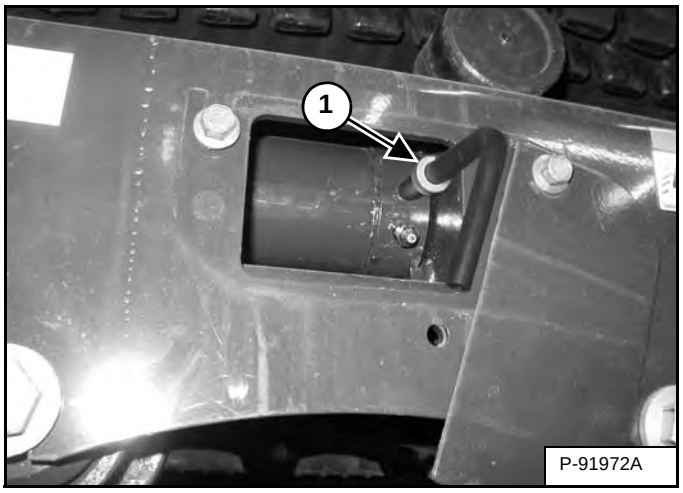
Loosen the two bolts from the cover (Item 1) **[Figure 30-21-3]**. Pivot the cover downward.

Figure 30-21-4



Add grease to the fitting (Item 1) **[Figure 30-21-4]** until the track tension is correct.

Figure 30-21-5



Use tool MEL1560 (Item 1) **[Figure 30-21-5]** to loosen the bleed fitting (Item 2) **[Figure 30-21-4]** to release tension from the track.

NOTE: Do not loosen the grease fitting (Item 1) [Figure 30-21-4].

Repeat the procedure for the other side.

⚠ WARNING

HIGH PRESSURE GREASE CAN CAUSE SERIOUS INJURY

- **Do not loosen grease fitting.**
- **Do not loosen bleed fitting more than 1 - 1/2 turns.**

W-2781-0109

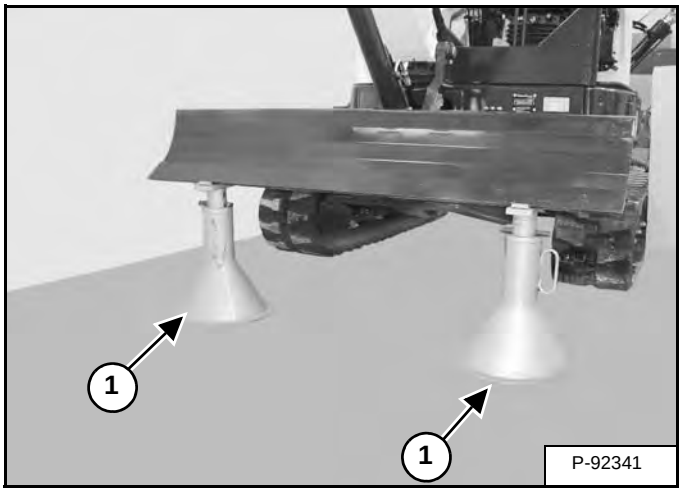
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Track Removal And Installation

Lift and block both sides of the machine as follows:

Raise the blade fully.

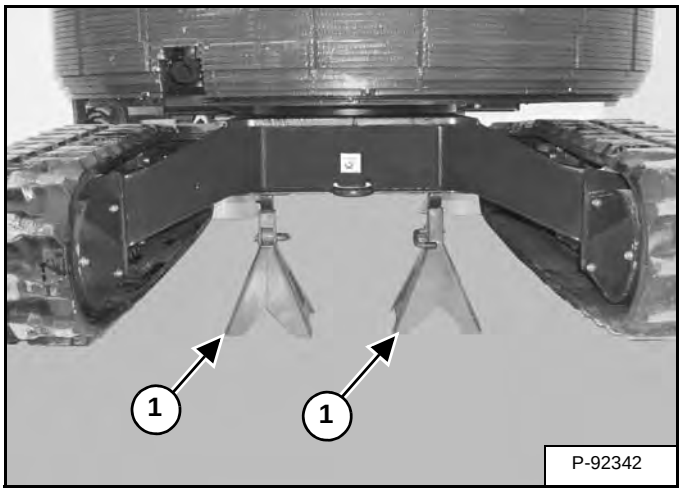
Figure 30-21-6



Use the boom and arm to lift the blade end of the machine up about 75 mm (3.0 in) and install jack stands (Item 1) **[Figure 30-21-6]** under the blade.

Raise the boom.

Figure 30-21-7



Swing the upperstructure 180° and use the boom and arm to slowly lift the opposite end of the undercarriage and install jack stands under the undercarriage (Item 1) **[Figure 30-21-7]**.

Raise the boom until the weight of the machine is supported by the jackstands.

⚠ WARNING

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

W-2218-1195

Stop the engine.

Release track tension (See Adjusting Tension on Page 30-21-3.)

With the excavator raised and the bleed fitting loosened, start the excavator. (See Adjusting Tension on Page 30-21-3.)

Slowly turn the track. This will force more grease out of the grease spring.

Stop the engine.

⚠ WARNING

AVOID INJURY OR DEATH

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

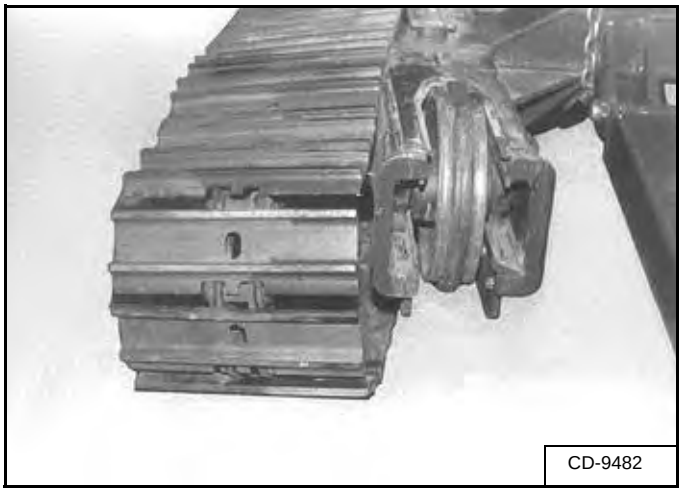
W-2173-0195

The track can be removed either as a complete assembly or by removing a connecting pin and separating the track.

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Track Removal And Installation (Cont'd)

Figure 30-21-8



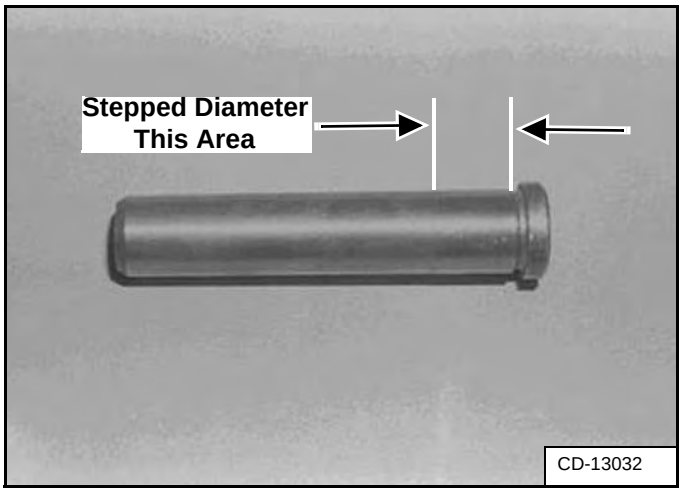
To remove the track as a compete assembly, install a pry bar between the track and the front idler wheel and pry out on the track **[Figure 30-21-8]**.

Installation: Put the track over the drive sprocket lugs. Then position the front of the track over the front idler wheel.

See Adjustment for adding grease to the grease spring and for checking track clearance. (See Adjusting Tension on Page 30-21-3.)

To remove the track by removing a connecting pin:

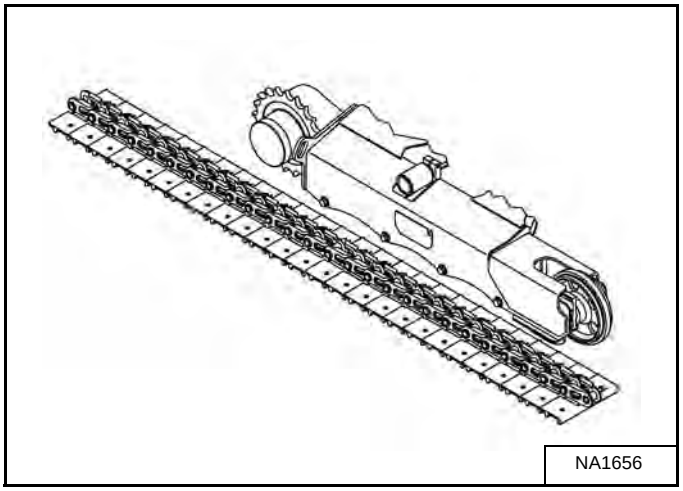
Figure 30-21-9



There is no master link or master connecting pin with this track. The connecting pins have a stepped diameter **[Figure 30-21-9]**. The smaller diameter is a slip fit into the track connecting links and the larger diameter is a press fit.

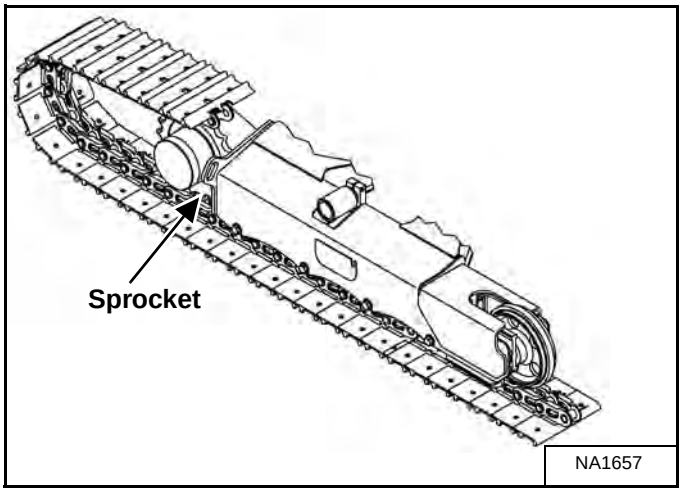
To remove a connecting pin, hold a heavy steel block on the connecting link near the pin being removed. Use a heavy hammer and a punch to drive out the connecting pin.

Figure 30-21-10



Installation: Put the steel track under the track frame so the front end of the track extends approximately three links in front of idler wheel **[Figure 30-21-10]**.

Figure 30-21-11

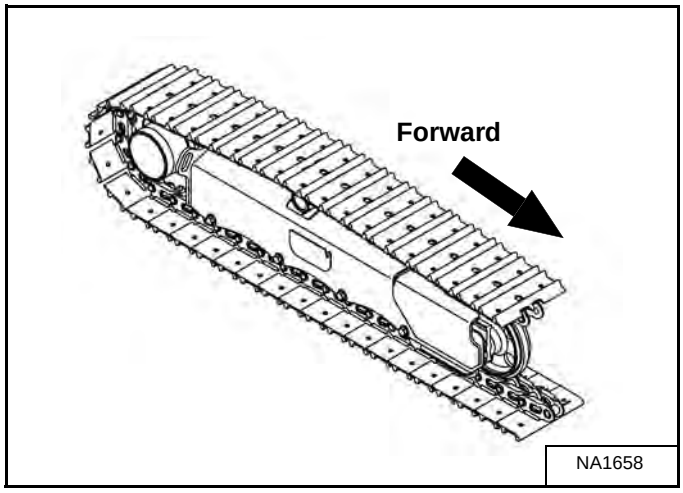


Pull the opposite end of the track up and forward and position the end links of the steel track onto the sprocket **[Figure 30-21-11]**.

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Track Removal And Installation (Cont'd)

Figure 30-21-12



With the help of a second person, start the excavator. Use the travel lever (on which side the track is being installed) to slowly turn the drive motor in the forward direction. Hold the end of the track upwards as the drive motor slowly moves the track forward. Guide the end of the track over the top of the roller and up to the front idler wheel **[Figure 30-21-12]**.

Stop the engine.

⚠ WARNING

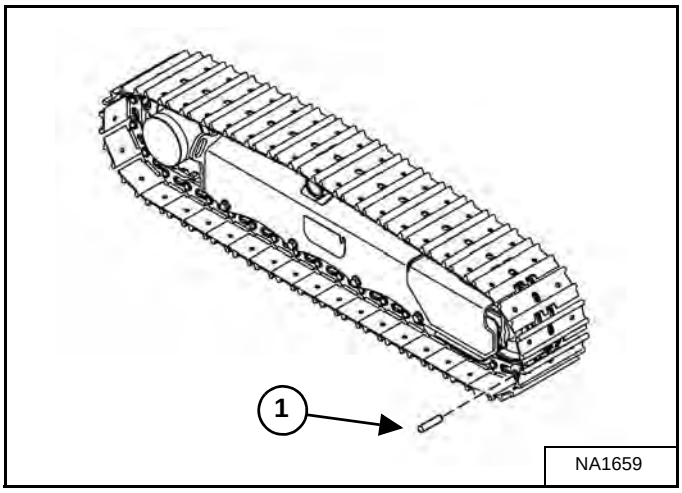
AVOID INJURY OR DEATH

Drive motor must be operated slowly to avoid any sudden movements that could cause injury or death.

W-2174-0195

Position the two ends of the track together and use a drift pin to hold the links together.

Figure 30-21-13



Insert the connecting link pin (Item 1) **[Figure 30-21-13]** into the track link hole. Tap the end of the pin until the press fit diameter contacts the connecting link hole.

Hold a heavy steel block on the back side of the track connecting link and use a hammer to drive the connecting link pin into the track link until the head of the pin is flush with the track link.

See Adjustment for adding grease to the grease spring and for checking track clearance. (See Adjusting Tension on Page 30-21-3.)

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Idler Removal And Installation

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 1) **[Figure 30-21-14]**.

⚠ WARNING



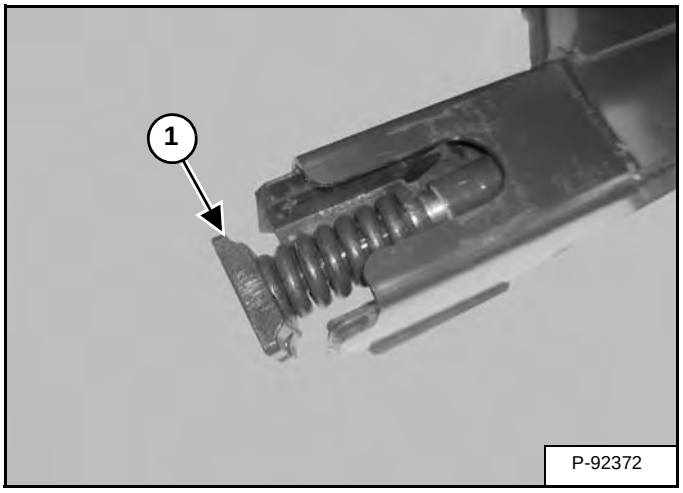
P-62574

AVOID INJURY OR DEATH

- **Spring loaded components under pressure can cause serious injury or death.**
- **Do not disassemble the coil spring assembly**

W-2617-1004

Figure 30-21-14

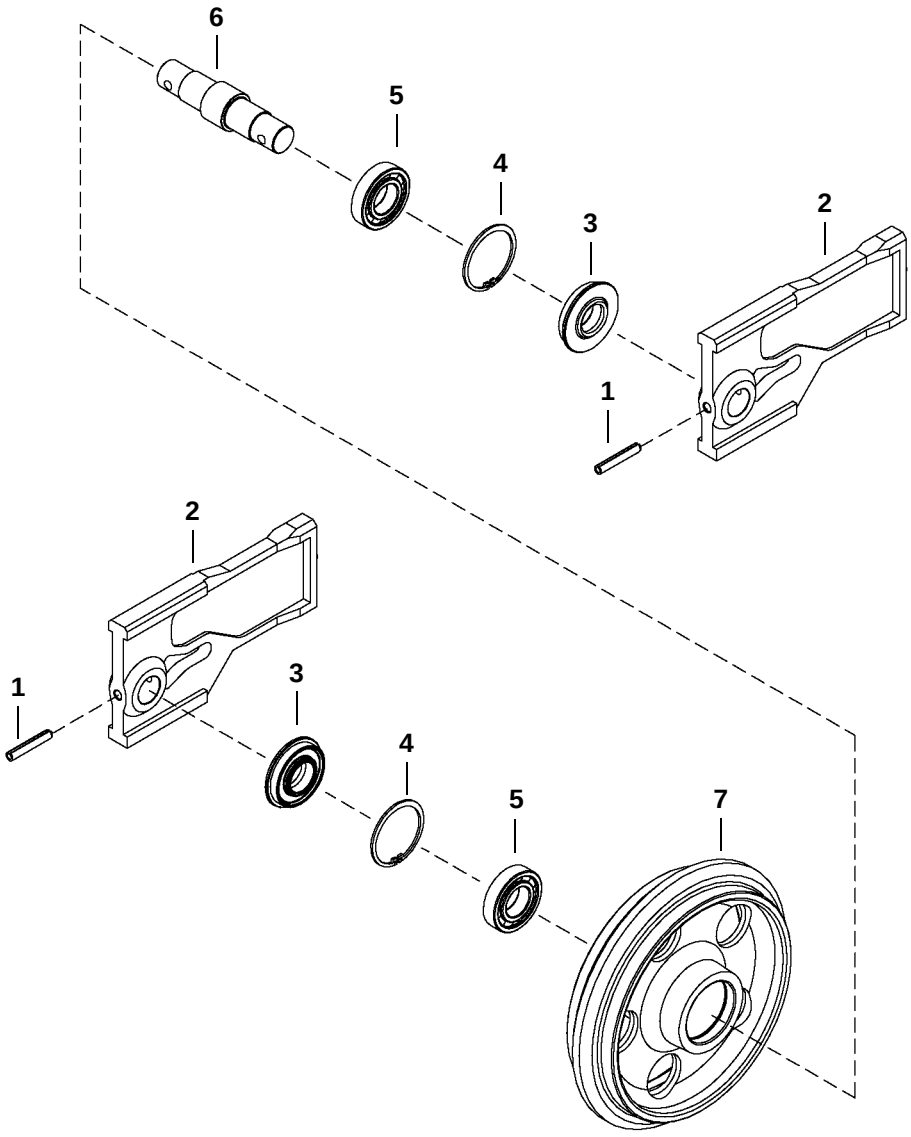


Remove the recoil spring (Item 1) **[Figure 30-21-14]**.

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Idler Parts Identification

1. Roll Pin
2. Block
3. Seal
4. Snapring
5. Bearing
6. Shaft
7. Idler



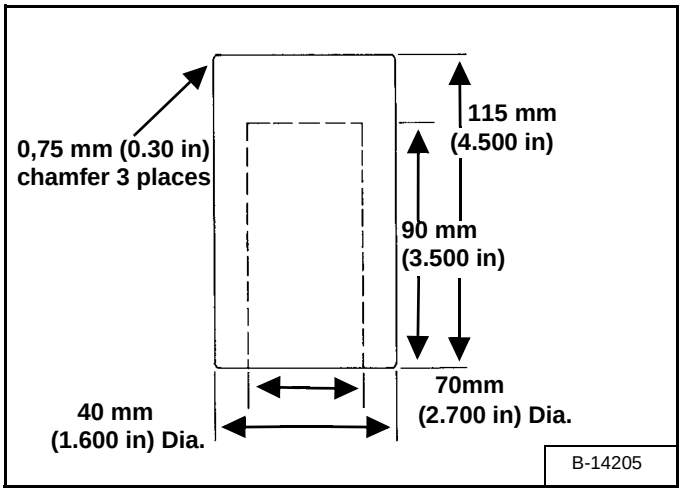
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Track Idler Disassembly

The following tools must be fabricated for this procedure:

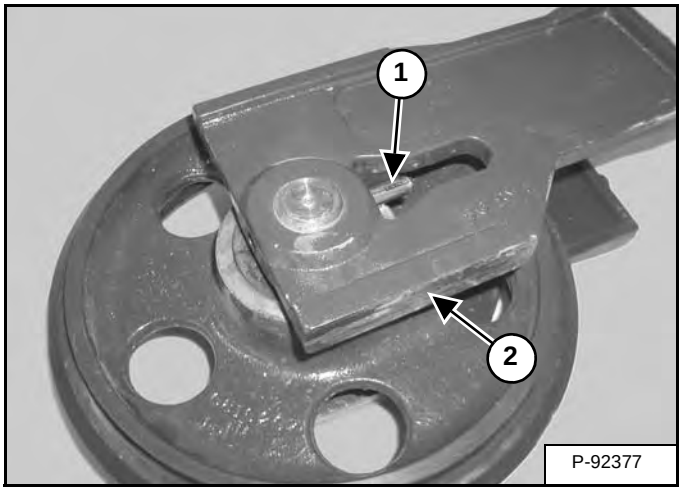
Figure 30-21-15



1. Driver Tool - see figure **[Figure 30-21-15]**.

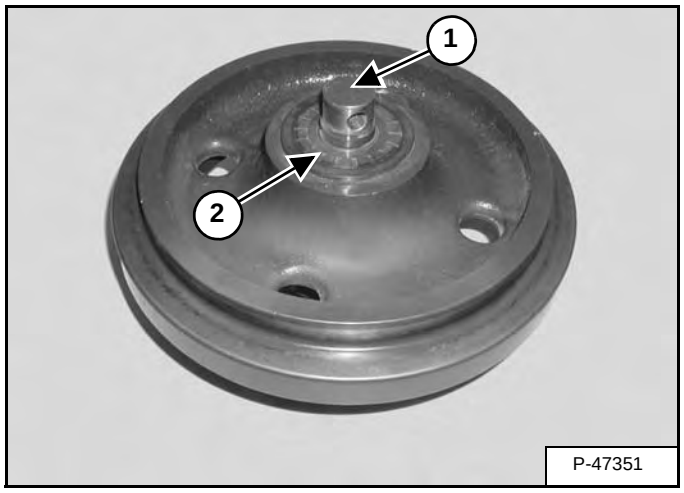
2. Support Fixture - Tube, 90 mm ID x 6,35 mm wall x 162,4 mm long (3.0 in ID x 0.250 in wall x 6.0 in long).

Figure 30-21-16



Remove the roll pin (Item 1) and block (Item 2) from both sides of the shaft **[Figure 30-21-16]**.

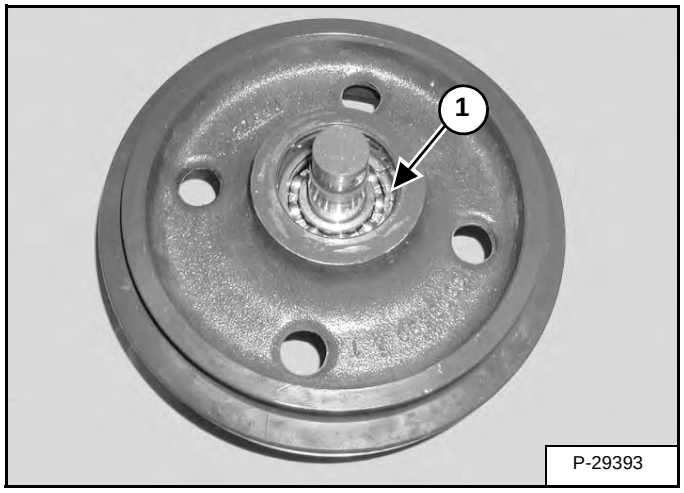
Figure 30-21-17



Remove any corrosion or paint from both ends of the exposed shaft (Item 1) **[Figure 30-21-17]** that could affect seal removal or damage the new seal during installation.

Remove the seal (Item 2) **[Figure 30-21-17]** from both sides of the idler.

Figure 30-21-18

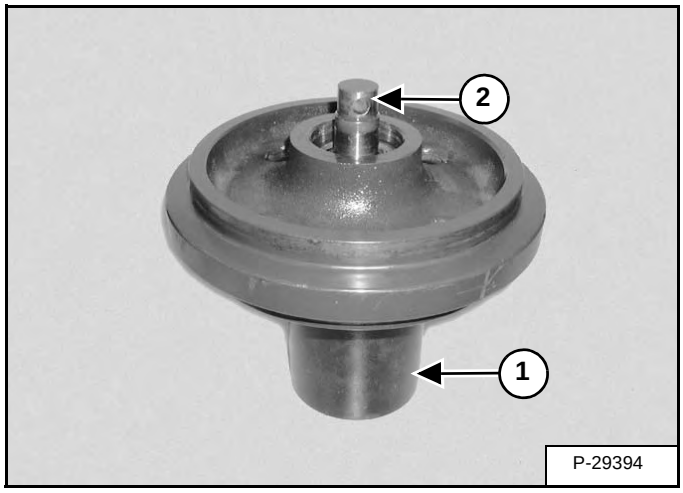


Remove the snap ring (Item 1) **[Figure 30-21-18]** from both sides of the idler.

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Track Idler Disassembly (Cont'd)

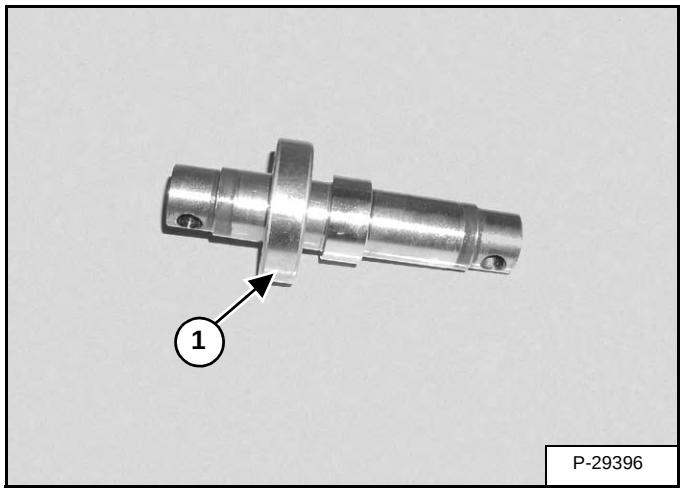
Figure 30-21-19



Place the idler on the support fixture (Item 1) **[Figure 30-21-19]**.

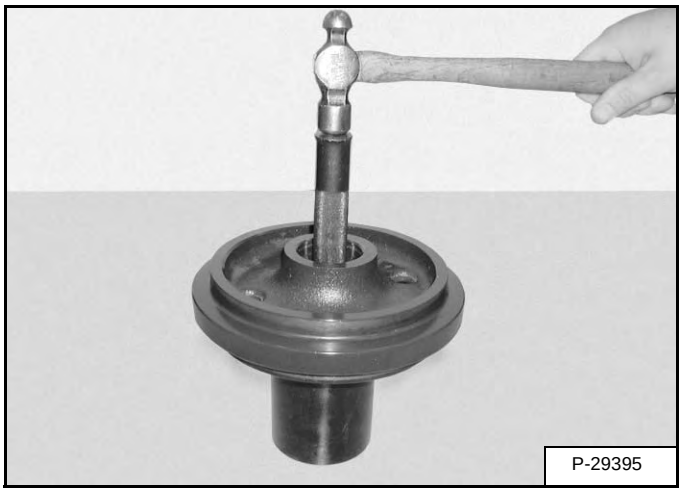
Using a soft faced hammer, tap the shaft (Item 2) **[Figure 30-21-19]** and bearing out the bottom of the idler.

Figure 30-21-20



Slide the bearing (Item 1) **[Figure 30-21-20]** off the shaft.

Figure 30-21-21



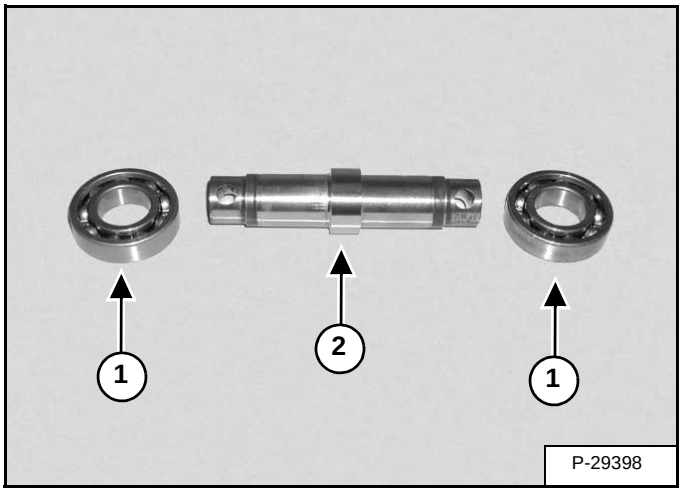
Turn the idler over, and using a bearing driver, remove the second bearing (Item 1) **[Figure 30-21-21]**.

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Track Idler Assembly

Clean all parts in solvent and dry with compressed air.

Figure 30-21-22

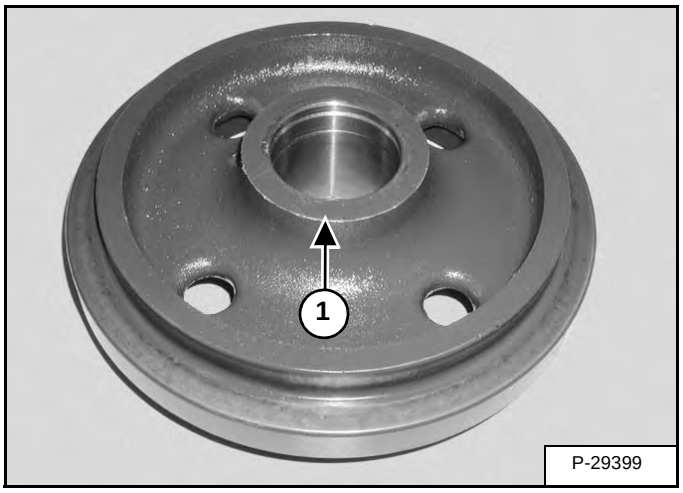


Inspect the bearings (Item 1) and shaft (Item 2) **[Figure 30-21-22]** for wear or damage.

The bearings are sealed. If the bearings do not roll smoothly, or if the seals are damaged, replace the bearings.

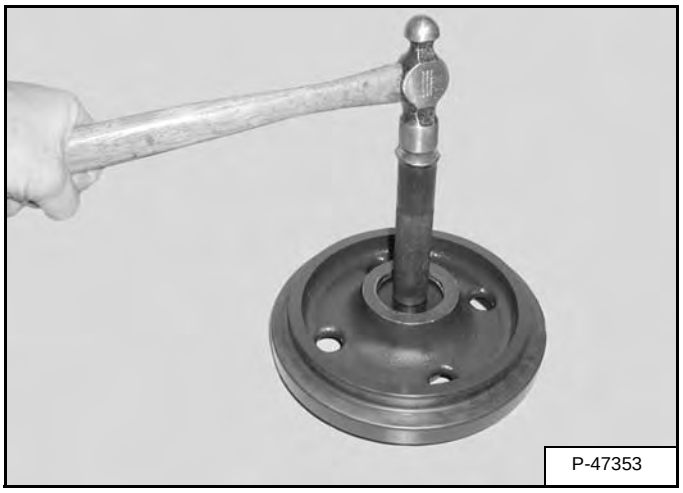
Replace any worn or damaged parts.

Figure 30-21-23



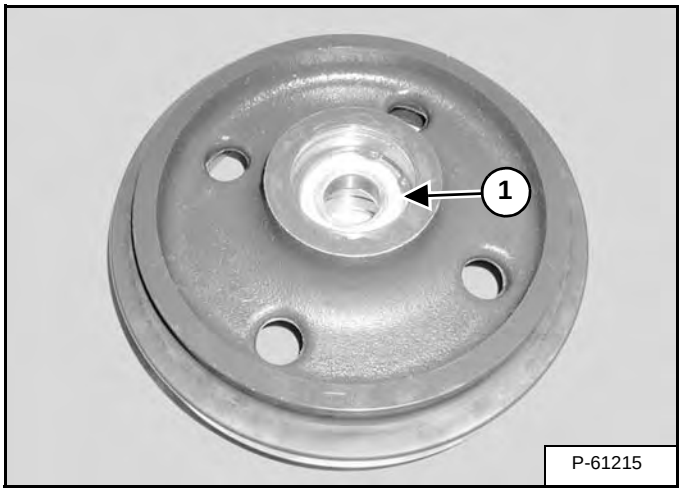
Remove all paint and corrosion from the seal surface (Item 1) **[Figure 30-21-23]** on both sides of the idler.

Figure 30-21-24



Using a bearing driver, install the bearing in the idler **[Figure 30-21-24]**.

Figure 30-21-25

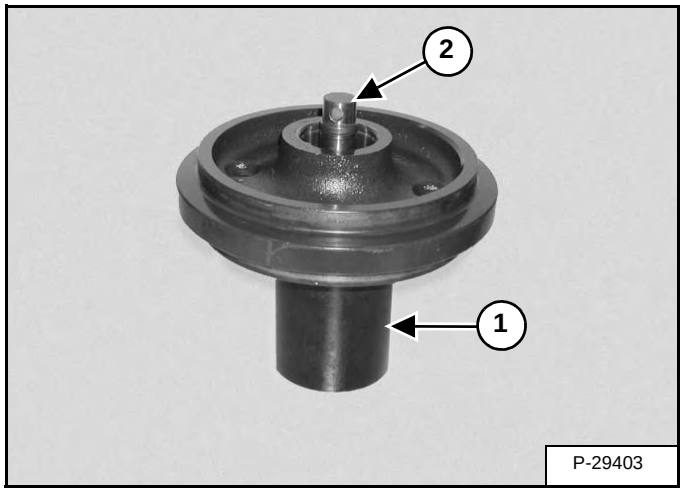


Install the snap ring (Item 1) **[Figure 30-21-25]**.

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Track Idler Assembly (Cont'd)

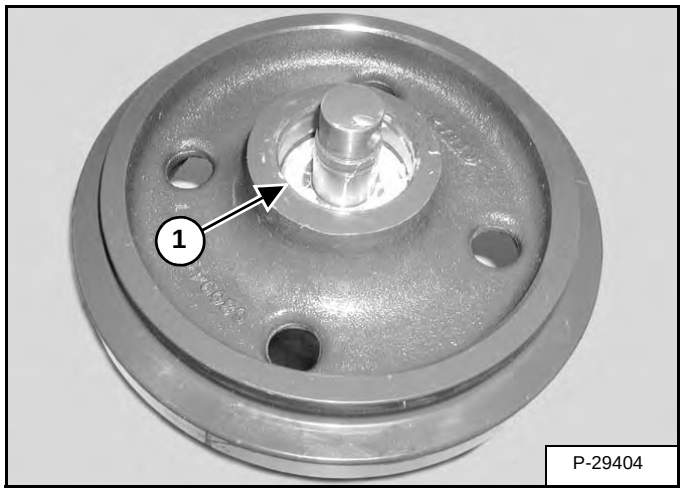
Figure 30-21-26



Turn the idler over and place the idler on the support fixture (Item 1) **[Figure 30-21-26]**.

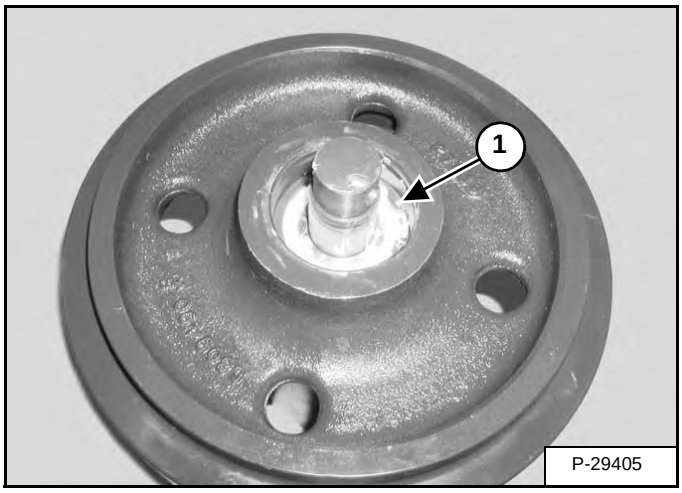
Install the shaft (Item 2) **[Figure 30-21-26]**.

Figure 30-21-27



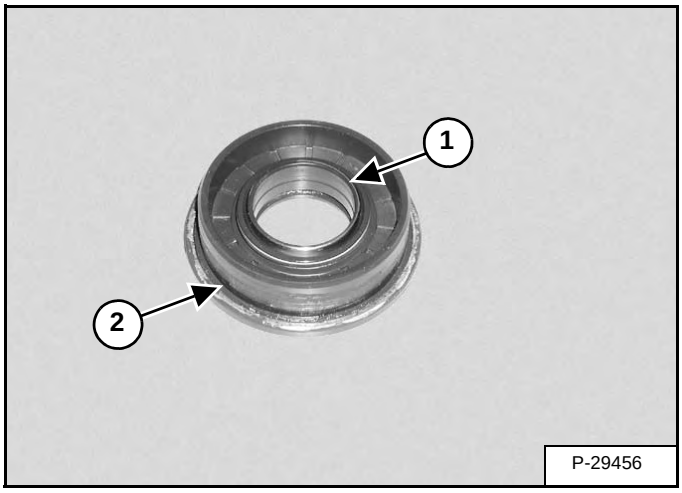
Install the bearing (Item 1) **[Figure 30-21-27]**. Use a brass drift to seat the bearing.

Figure 30-21-28



Install the snap ring (Item 1) **[Figure 30-21-28]**.

Figure 30-21-29



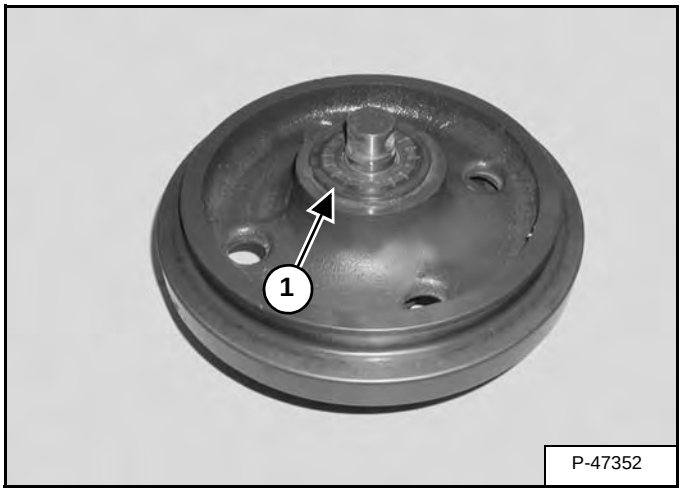
Apply assembly lube to the inside diameter (Item 1) **[Figure 30-21-29]** of the seal.

Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-21-29]** of the seal.

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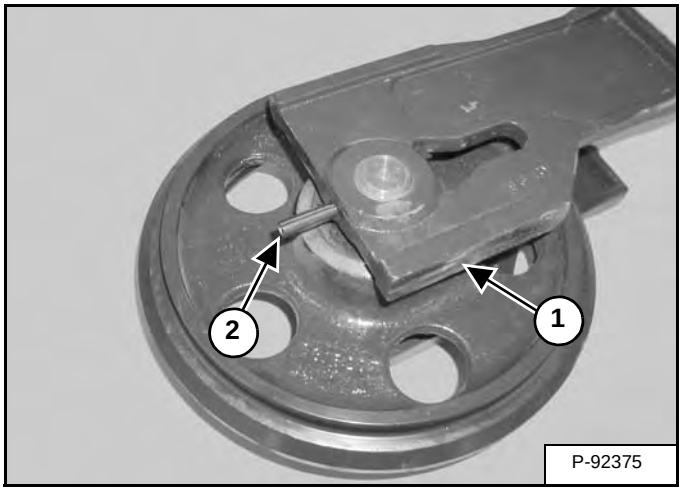
Track Idler Assembly (Cont'd)

Figure 30-21-30



Using the driving tool, install the seal (Item 1) **[Figure 30-21-30]** on both sides of the idler.

Figure 30-21-31



Install the block (Item 1) and roll pin (Item 2) **[Figure 30-21-31]** on both sides of the shaft.

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Track Tensioner Disassembly And Assembly

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 1) **[Figure 30-21-14]**.

⚠ WARNING



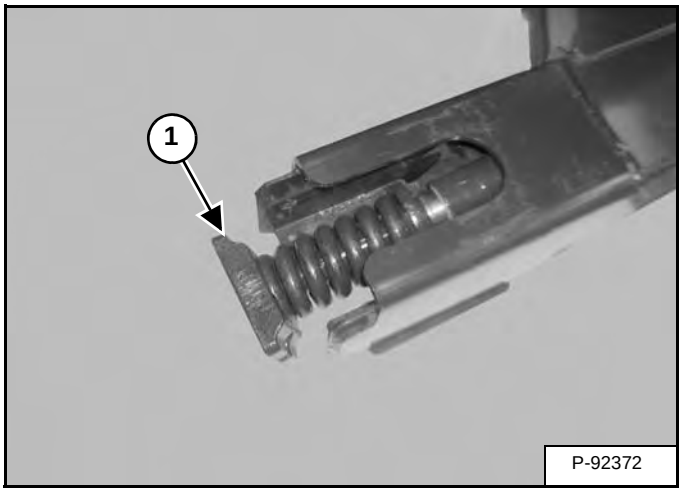
P-62574

AVOID INJURY OR DEATH

- **Spring loaded components under pressure can cause serious injury or death.**
- **Do not disassemble the coil spring assembly**

W-2617-1004

Figure 30-21-32



Remove the recoil spring (Item 1) **[Figure 30-21-14]**.

Figure 30-21-33

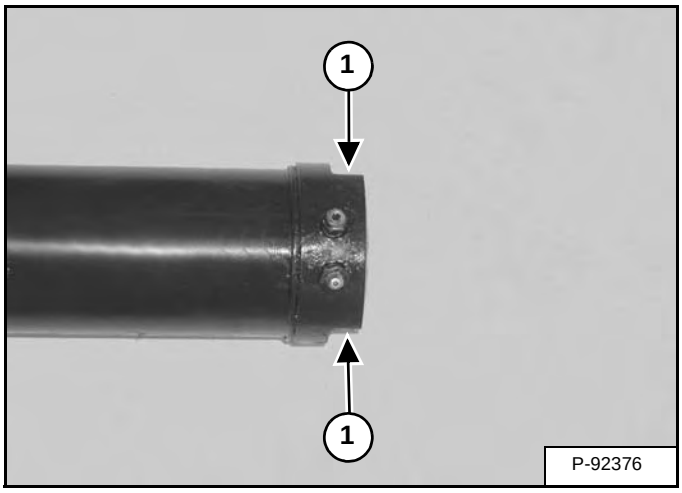
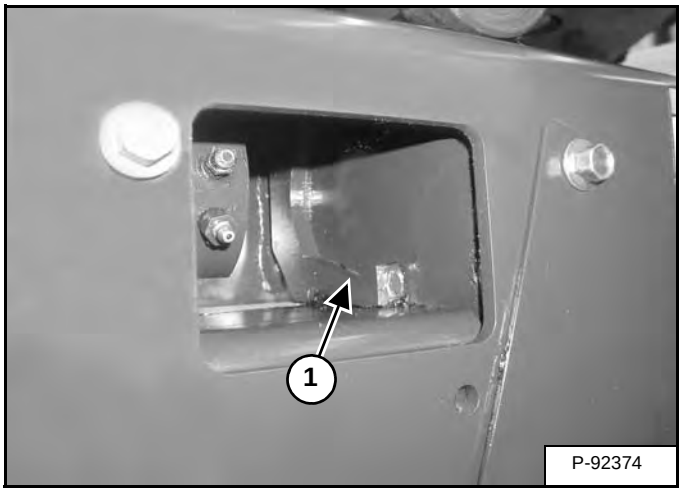


Figure 30-21-34

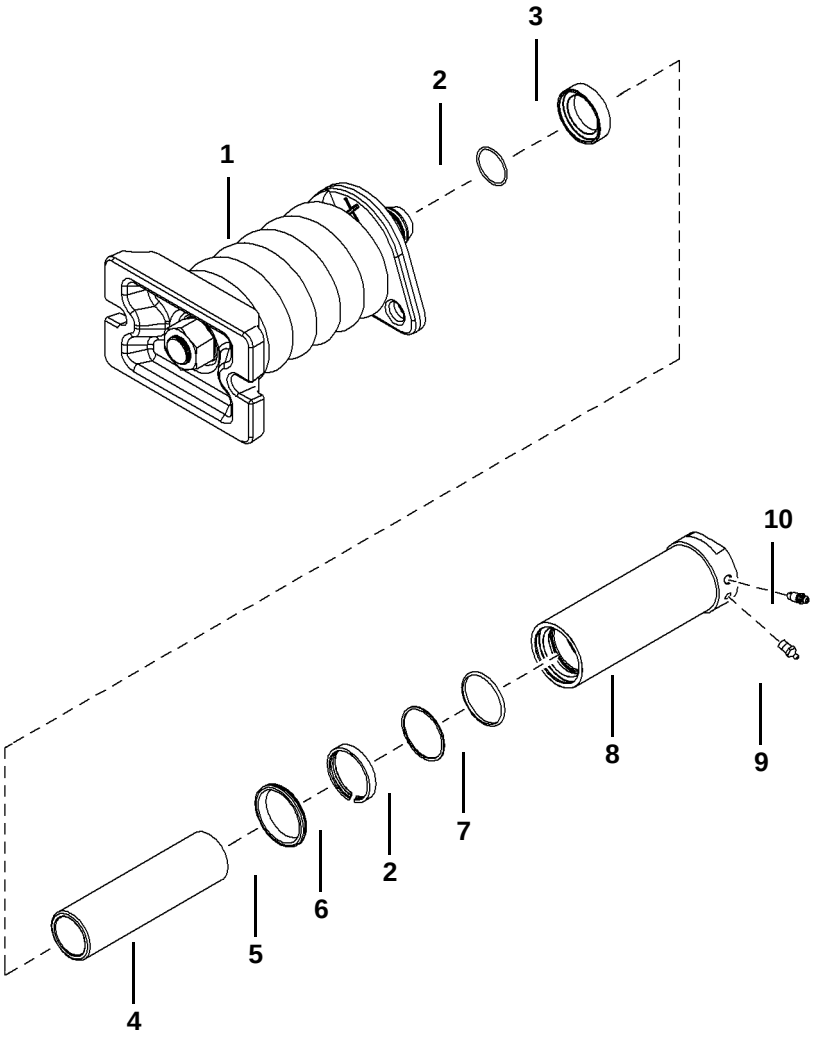


The flat sides (Item 1) **[Figure 30-21-33]** of the recoil spring grease cylinder must engage the mount (Item 1) **[Figure 30-21-34]** of the track frame.

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Track Tensioner Cylinder Parts Identification

1. Coil Spring Assembly
2. O-ring
3. Spacer
4. Shaft
5. Wiper Seal
6. Back-up Ring
7. Wear Ring
8. Tube
9. Grease Fitting
10. Bleed Fitting



PE-3893S

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Track Tensioner Disassembly And Assembly

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 2) **[Figure 30-21-35]**.

⚠ WARNING



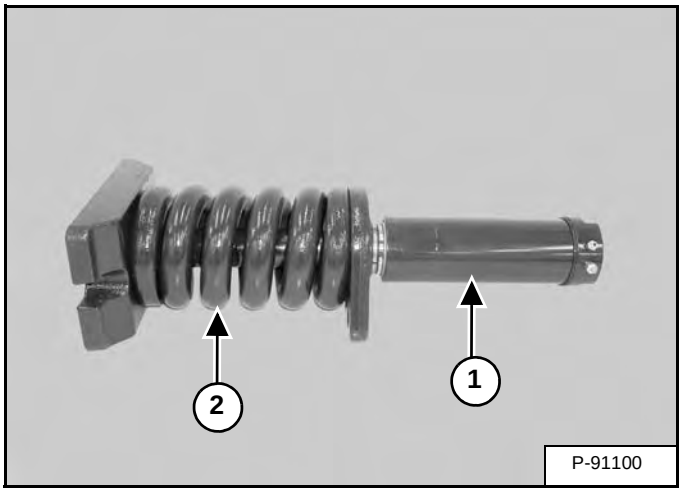
P-62574

AVOID INJURY OR DEATH

- **Spring loaded components under pressure can cause serious injury or death.**
- **Do not disassemble the coil spring assembly**

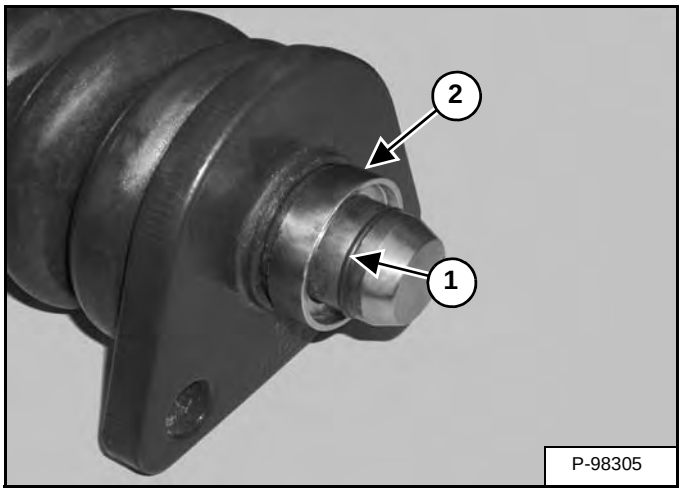
W-2617-1004

Figure 30-21-35



Remove the cylinder (Item 1) from the coil spring assembly (Item 2) **[Figure 30-21-35]**.

Figure 30-21-36

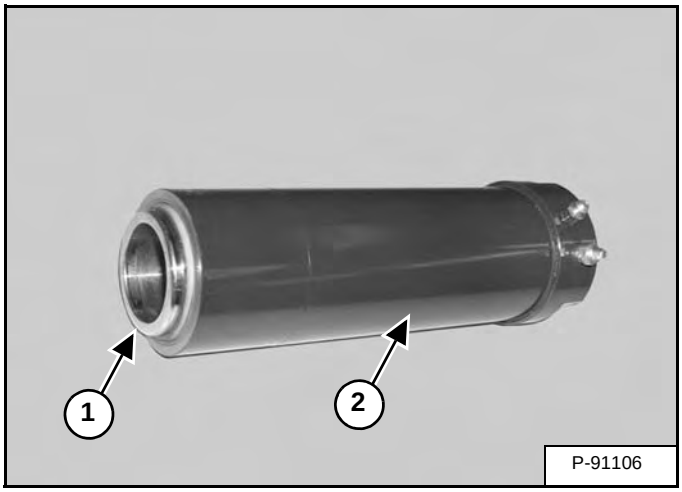


Remove the O-ring (Item 1) **[Figure 30-21-36]** from the cylinder.

Installation: Apply oil to the O-ring before installation.

Remove the spacer (Item 2) **[Figure 30-21-36]**.

Figure 30-21-37

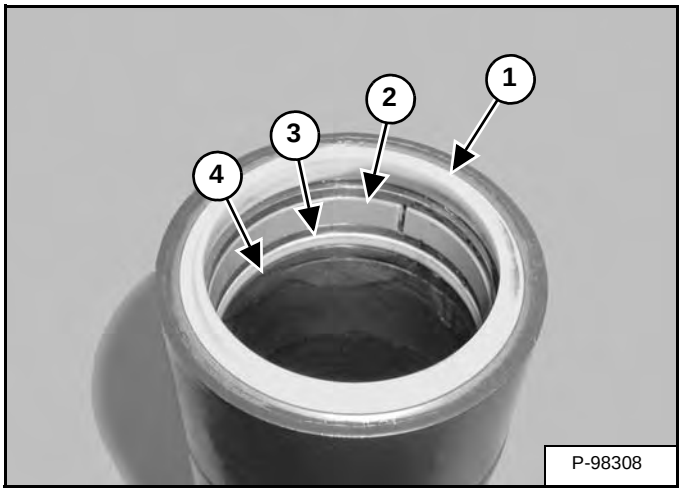


Remove the shaft (Item 1) from the tube (Item 2) **[Figure 30-21-37]**.

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Track Tensioner Disassembly And Assembly (Cont'd)

Figure 30-21-38

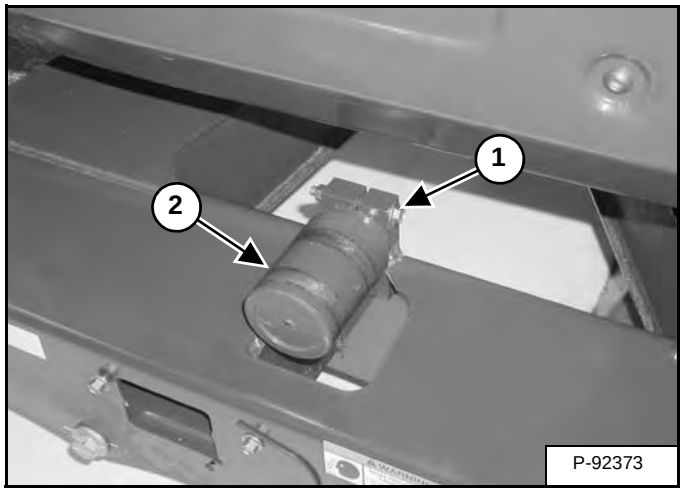


Remove the wiper seal (Item 1), wear ring (Item 2) and back-up ring (Item 3) and O-ring (Item 4) **[Figure 30-21-38]**.

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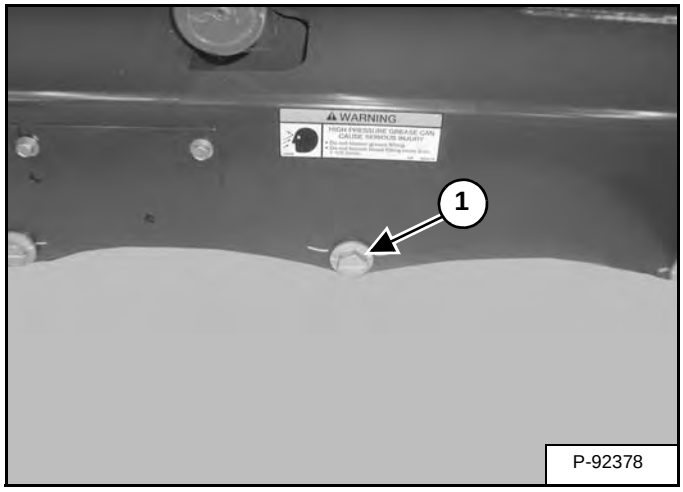
Roller Removal And Installation

Figure 30-21-39



Loosen the bolt (Item 1) and nut. Remove the top roller (Item 2) **[Figure 30-21-39]**.

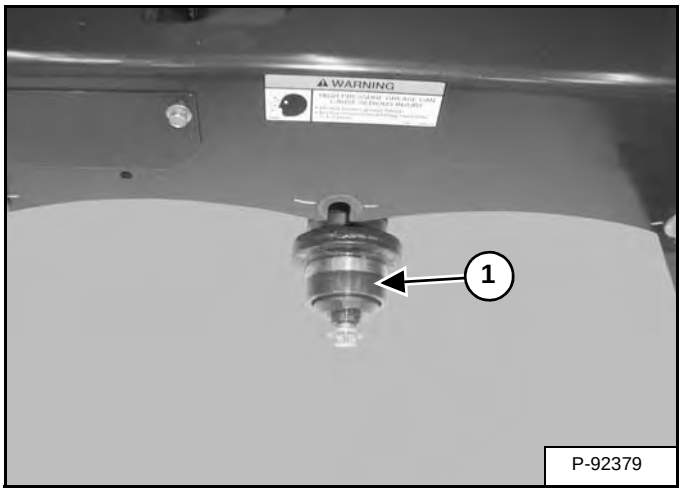
Figure 30-21-40



Loosen the bolts (Item 1) **[Figure 30-21-40]** on the track roller on both sides of the track frame.

Installation: Tighten the bolts to 544 - 604 N•m (401 - 445 ft-lb) torque.

Figure 30-21-41



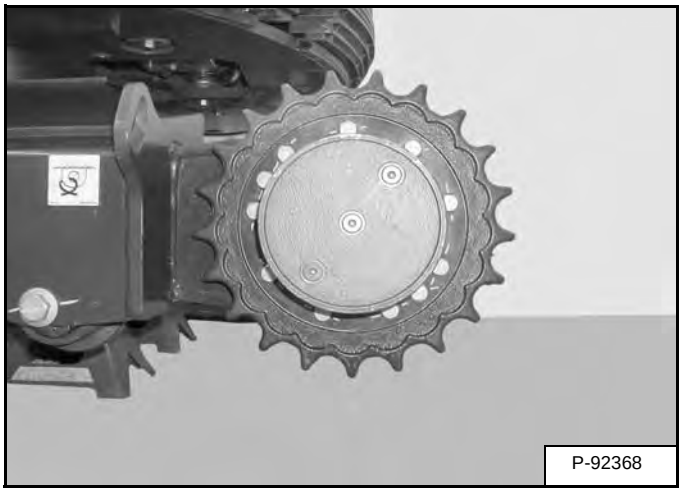
Remove the bottom roller (Item 1) **[Figure 30-21-41]**.

NOTE: The top and bottom rollers are not serviceable. Replace the roller if it is damaged.

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Sprocket Removal And Installation

Figure 30-21-42



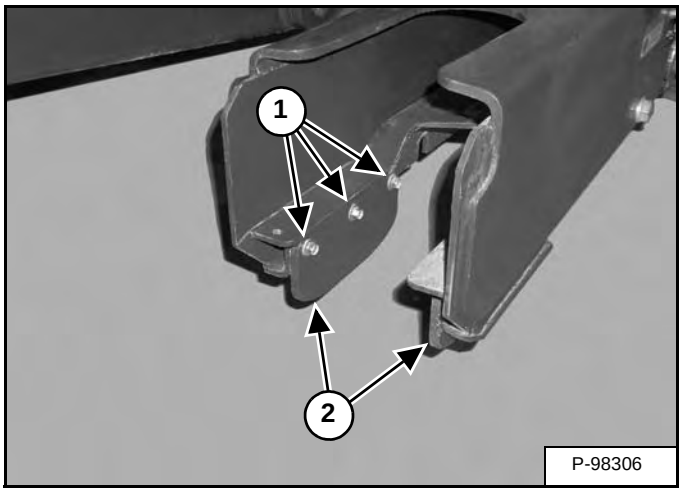
Remove the drive sprocket bolts **[Figure 30-21-42]**.

Installation: Put thread adhesive (Loctite® 242) on the bolts and tighten to 108 N•m (80 ft-lb) torque.

Remove the drive sprocket from the travel motor.

Guide Plate Removal And Installation

Figure 30-21-43



Remove the bolts (Item 1) and guide plates (Item 2) **[Figure 30-21-43]** from the track frame.

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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 Steel Cords

Figure 30-30-1

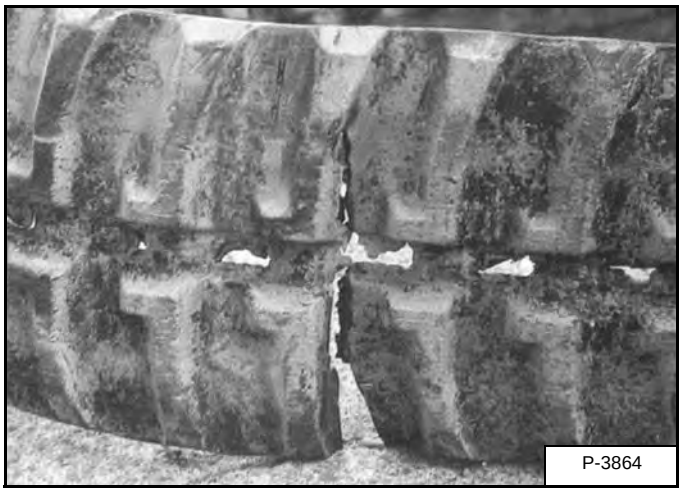
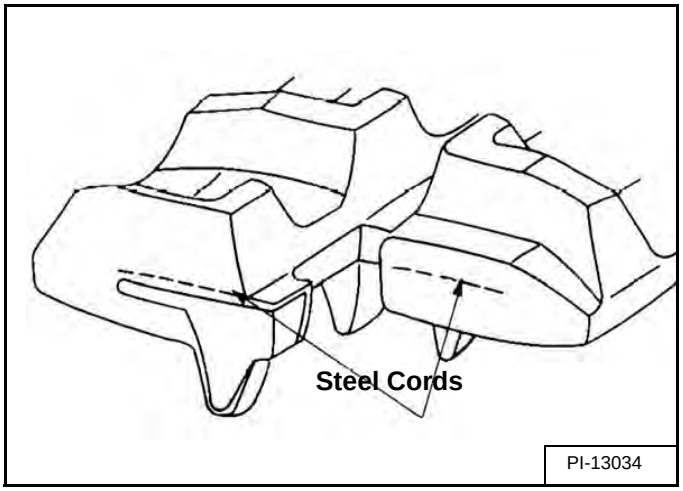


Figure 30-30-2



Damage:

Embedded steel cords are cut off **[Figure 30-30-1]** and **[Figure 30-30-2]**.

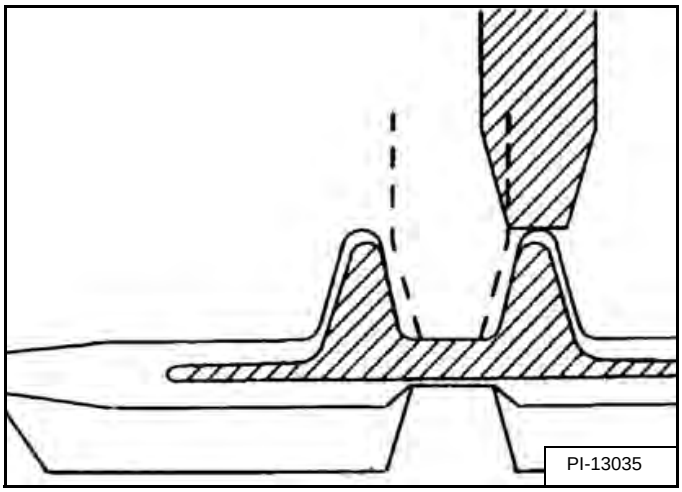
Replacement:

Replacement is required.

Causes of the damage:

When applied to rubber tracks under the following circumstances, tension in excess of the breaking strength of the embedded steel cords causes steel cords to be cut:

Figure 30-30-3



When the rubber track is detracting, the idler or sprocket rides on the projections of the embedded metal **[Figure 30-30-3]**.

When the rubber track is detracted, projections of rubber tracks get stuck between the frame of the undercarriage.

The rubber track is clogged with stones or foreign obstacles.

When moisture invades through a cut on the lug side rubber surface, the embedded steel cords will corrode. The deterioration of the design strength may lead to the breaking off of the steel cords.

Prevention:

The following preventions should be taken to minimize the risk of this damage:

Periodical checking on site of the recommended track tension.

Avoiding quick turns on bumpy and rocky fields.

Drive carefully to avoid having stones and other articles clog the rubber tracks.

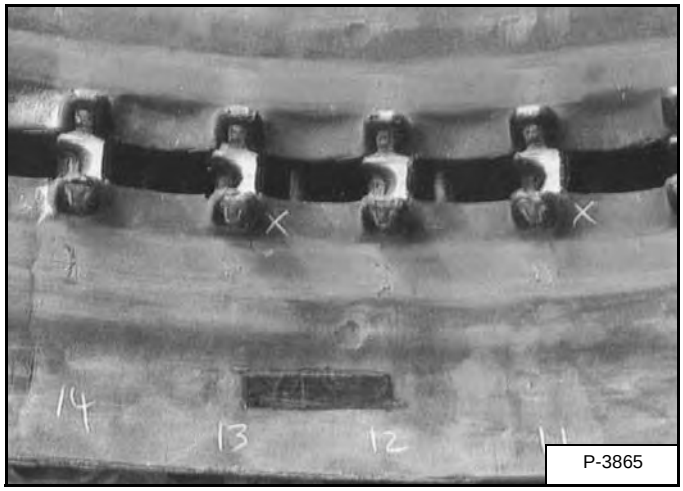
Driving over sharp objects should be avoided. If this is impossible, do not make turns while driving over sharp objects.

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Track Damage Identification (Cont'd)

Abrasion Of Embedded Metals

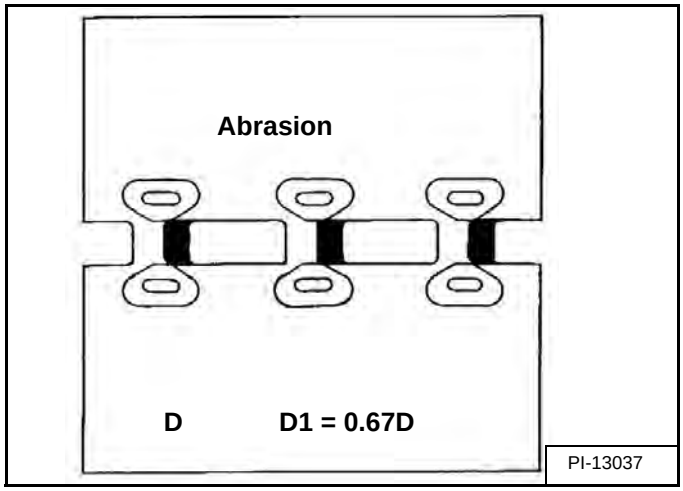
Figure 30-30-4



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 their abrasion:

Rubber tracks are driven with an extraordinary heavy load on them.

Rubber tracks are used on sandy fields.

Prevention:

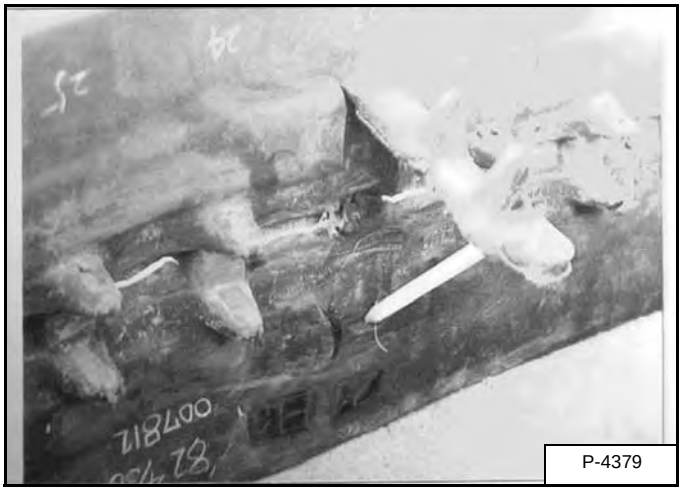
As long as rubber tracks are used under normal operating conditions, abnormal abrasion is unlikely to occur. The level of abrasion should be carefully checked when the machines are used for dozing which generate a heavy load for rubber tracks, and when they are operated under a sandy field condition for a long time.

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Track Damage Identification (Cont'd)

Separation Of Embedded Metals

Figure 30-30-6



Damage:

Extraordinary outer forces applied to embedded metals cause their separation from the rubber track's body **[Figure 30-30-6]**.

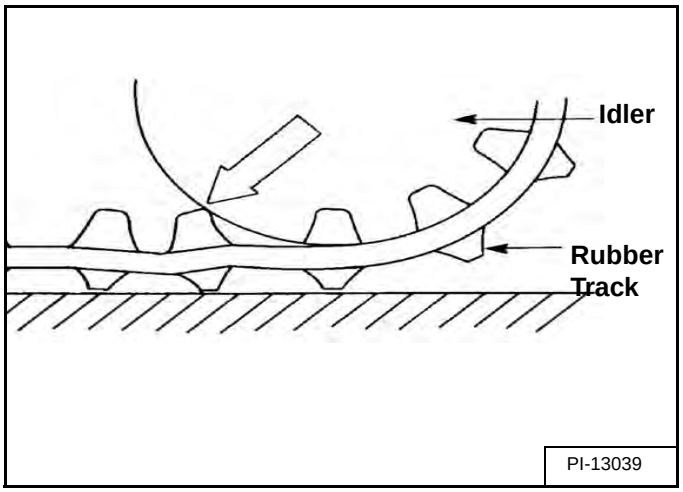
Replacement:

Even a partial separation of embedded metals requires replacement of the track.

Causes of the damage:

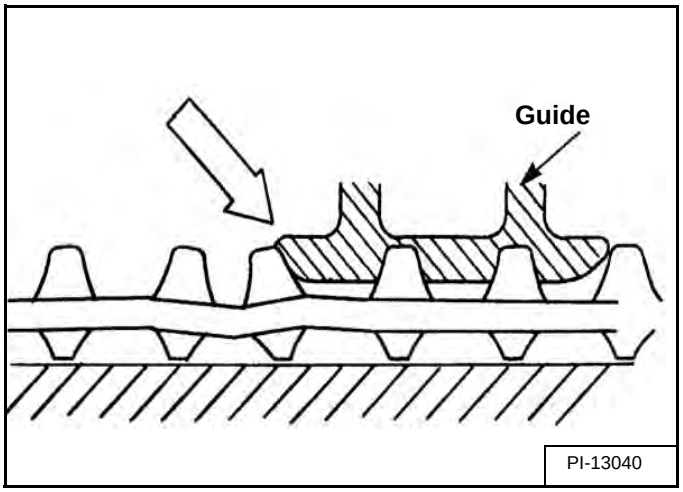
Embedded metals are adhered between the steel cords and the rubber body. The following cases generate external forces greater than the adhesion strength, causing separation of the embedded metals:

Figure 30-30-7



When the idler continually rides on the projections of embedded metals, the embedded metals will eventually peel off **[Figure 30-30-7]**.

Figure 30-30-8



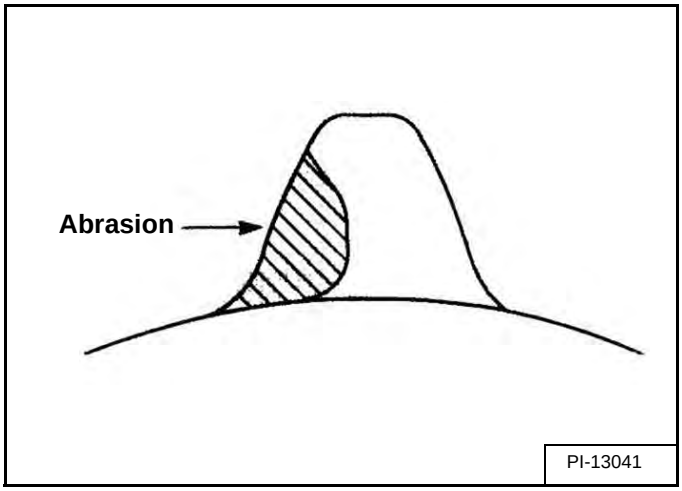
When a rubber track is detracted, it becomes stuck between the guide or the undercarriage frame, causing the separation of embedded metals **[Figure 30-30-8]**.

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Track Damage Identification (Cont'd)

Separation Of Embedded Metals

Figure 30-30-9



Abnormally worn sprockets will pull embedded metals out **[Figure 30-30-9]**.

Prevention:

Similar to the prevention against the cutting of the steel cords:

Track tension should be periodically checked.

Quick turns on bumpy and rocky fields should be avoided.

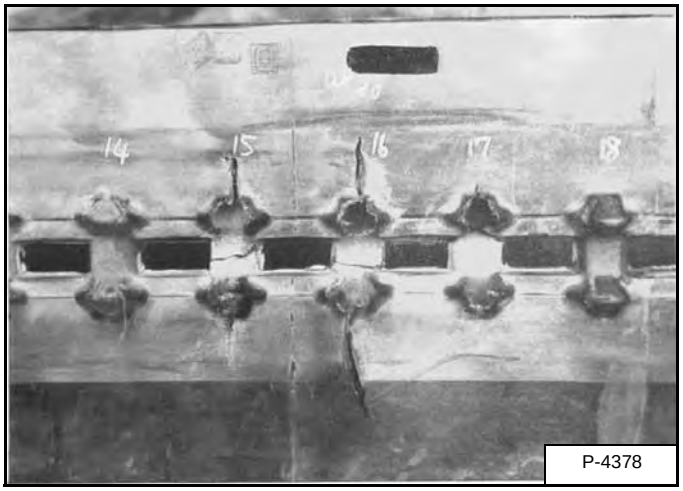
If abnormal wear of sprockets is observed, they should be immediately replaced.

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Track Damage Identification (Cont'd)

Separation Of Embedded Metals Due To Corrosion

Figure 30-30-10



Damage:

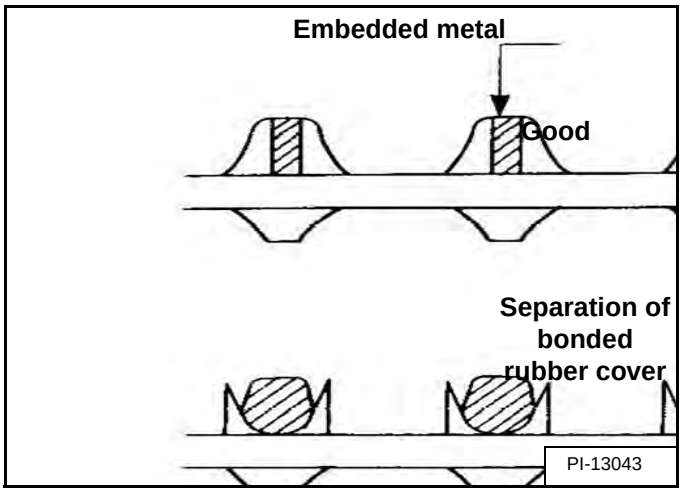
Due to corrosion of embedded metals, the adhesion to the rubber body deteriorates, resulting in complete separation **[Figure 30-30-10]**.

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). The tracks should be washed with plenty of water. After being completely dried, they should be stored correctly.

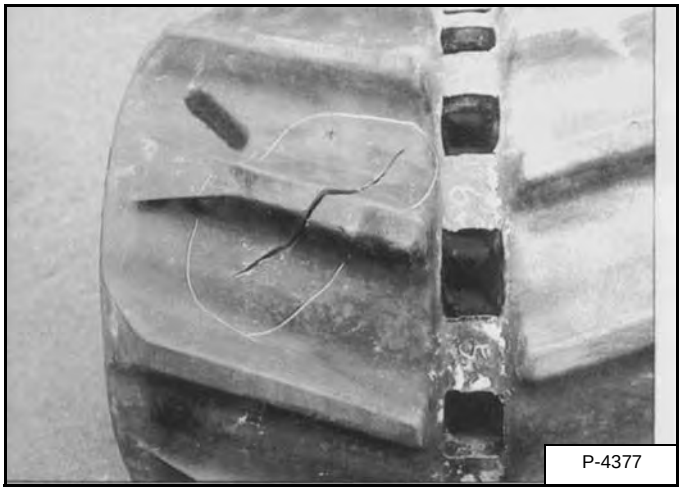
When the bonded rubber cover is separated from the embedded metal projections and the metals in the rubber body become loose, it is time to consider replacement of the rubber track.

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Track Damage Identification (Cont'd)

Cuts On The Lug Side Rubber

Figure 30-30-12



Damage:

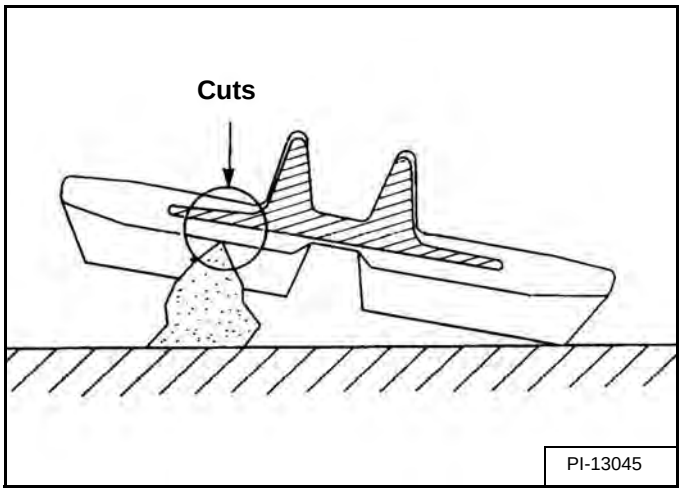
Cuts on the lug side rubber often occurs as one of the most typical failure modes **[Figure 30-30-12]**

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 steel cords' breakage due to their corrosion. It is highly recommended to repair the cuts with cold vulcanization rubber as soon as they are observed **[Figure 30-30-13]**.

Prevention:

Machine operators are requested to drive with great attention to the ground's surface especially in terrains of the following type:

Construction sites

Demolition sites

Paths covered with rocks and wood

Concrete ridges

Stumpy fields

When operating on terrains as mentioned above, high speed, quick turns and overloading should be avoided.

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Track Damage Identification (Cont'd)

Cracks On The Lug Side Rubber Due To Fatigue

Figure 30-30-14

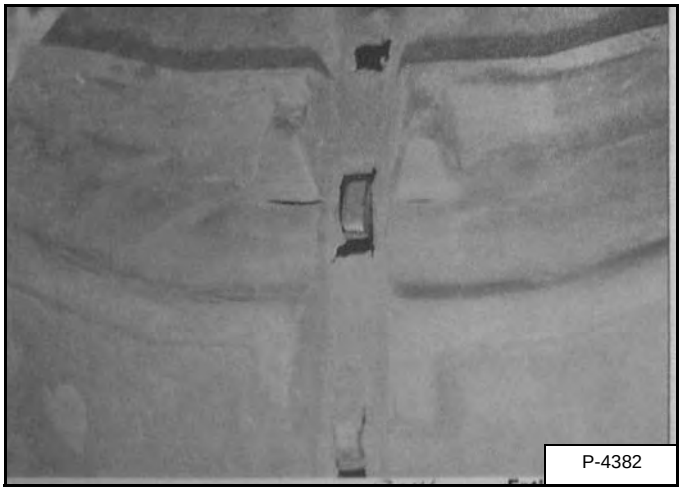
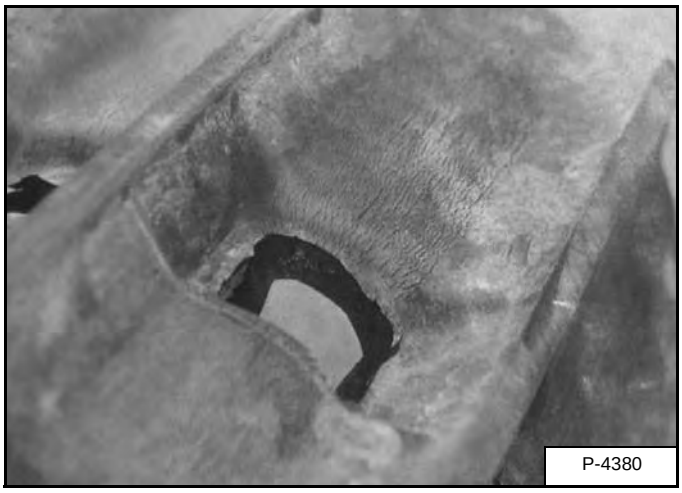


Figure 30-30-15



Damage:

Small cracks around the root of the lug as a result from operation fatigue **[Figure 30-30-14]** and **[Figure 30-30-15]**.

Replacement:

When the cracks reach so deep that they expose the steel cords, track replacement is required.

Causes of the damage:

Because of wound stress applied to rubber tracks around the undercarriage parts during operation, the fatigue especially causes cracks on the lug side rubber surface. Once the cracks occur, they gradually deteriorate with even small external cracks. When operating near seashores or under cold temperatures, rubber tracks are more likely to suffer from ozone cracks.

Prevention:

Rubber tracks are designed with special rubber compounds to prevent cracks due to fatigue. External injuries on the lug side rubber sometimes cause more chance of cracking. Machine operators should observe soil conditions when driving, so as not to cause external injuries to the lug side rubber. In order to minimize the occurrence of ozone cracks, attention should be paid to the following instructions for maintenance:

Avoid exposing stored tracks to direct sun light.

Avoid exposing stored tracks to direct rain and snow fall.

Store tracks in well ventilated warehouses.

Use the tracks at least once a month.

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Track Damage Identification (Cont'd)

Lug Abrasion

Figure 30-30-16

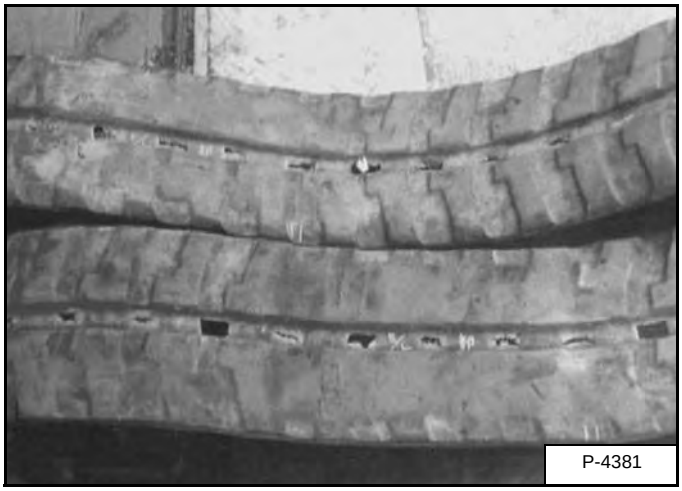
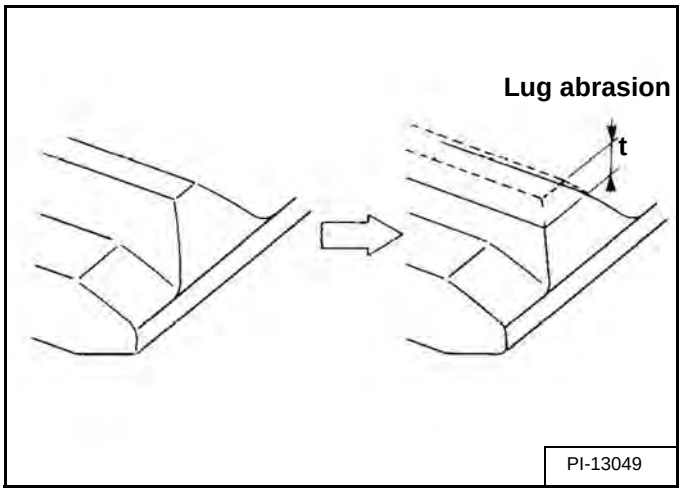


Figure 30-30-17



Damage:

As its service time proceeds, the lug side inevitably undergoes abrasion **[Figure 30-30-16]** and **[Figure 30-30-17]**.

Replacement:

No replacement is required.

Causes of the damage:

Lug abrasion is inevitable. Even if lug abrasion is proceeding, the rubber track can be used. As the traction performance deteriorates accordingly, it is highly recommended to replace the abraded tracks with new ones when the lug height becomes less than 5 mm (0.197 in).

Prevention:

In order to prevent the rubber track from abnormal or premature abrasion, following operating conditions should be avoided:

Making quick and repeated turns on concrete and asphalt roads

Driving up and down hilly paths with slippage

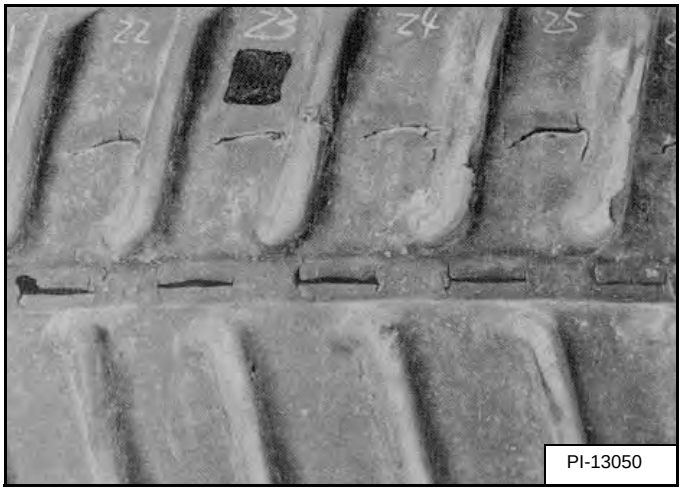
Making frequent turns on paths covered with rocks and wood

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Track Damage Identification (Cont'd)

Cracks And Cuts On The Lug Side Rubber

Figure 30-30-18



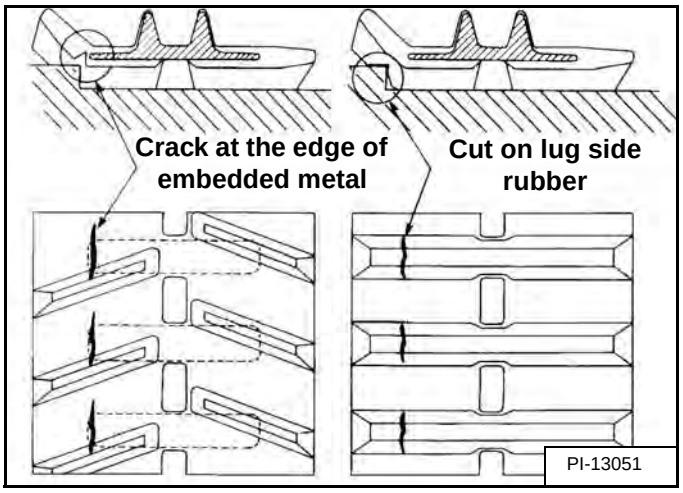
Damage:

Sometimes cracks and cuts on the lug side rubber at the edges of the embedded metals can be observed **[Figure 30-30-18]**.

Replacement:

No replacement is required unless the cuts on the lug side rubber are discovered all around the edges of the embedded metals, as this will result in a complete cut off.

Figure 30-30-19



Causes of the damage:

When rubber tracks drive over sharp projections, intensive stress is applied to the lug side rubber surface, especially at the edges of embedded metals, causing cracks and cuts in the area around the embedded metals **[Figure 30-30-19]**.

Prevention:

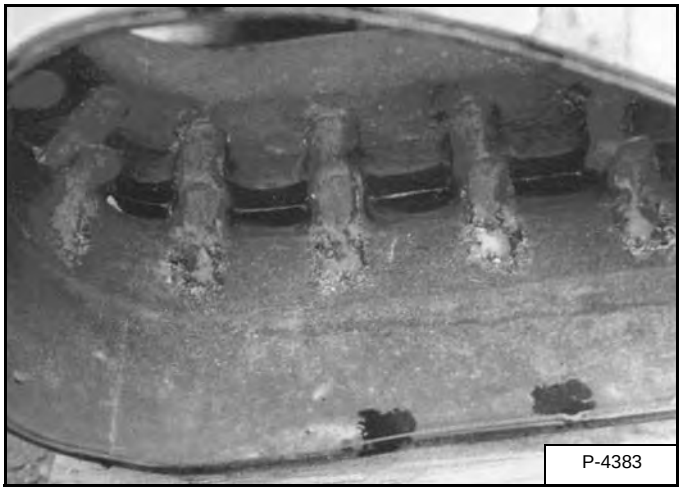
To avoid extensive stress applied to the lug root where metals are embedded, machine operators are requested to avoid driving over stumps and ridges.

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Track Damage Identification (Cont'd)

Abrasion Of The Track Roller Side

Figure 30-30-20



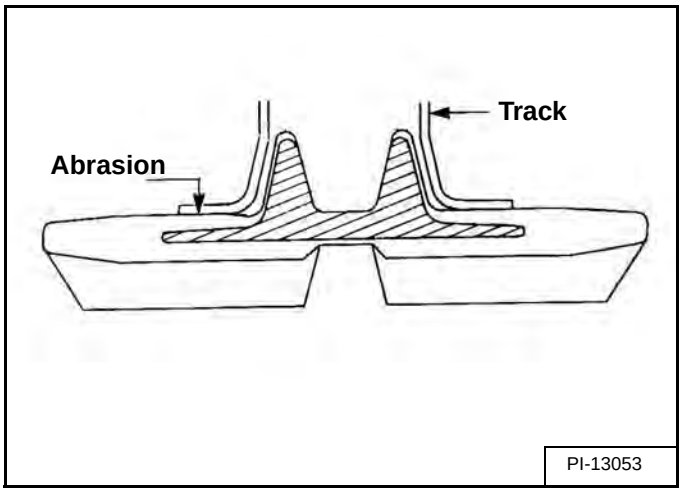
Damage:

The rubber surface on which track rollers run is gradually abraded. It will end in the exposure of the embedded metals **[Figure 30-30-20]**.

Replacement:

It is recommended to replace the rubber track when more than half of the embedded metals are completely exposed.

Figure 30-30-21



Causes of the damage:

The abrasion of the track roller side rubber surface occurs because of sand and gravel being clogged between the rubber and the outside surface of the track rollers. The stress pushes the sand and gravel against the side of the rubber track 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 Track Roller Side

Figure 30-30-22

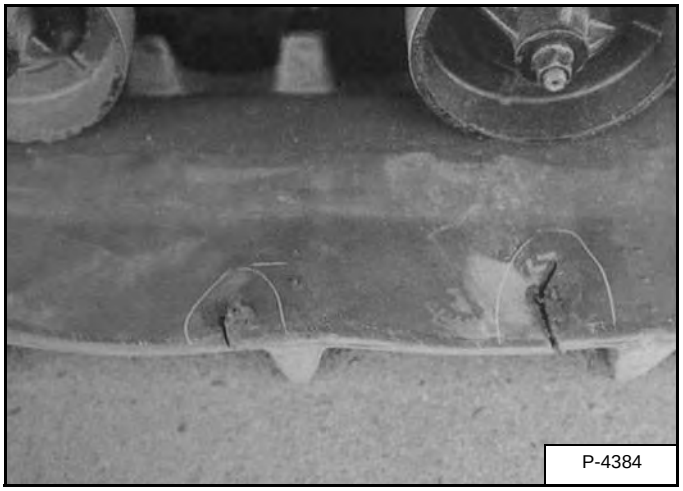
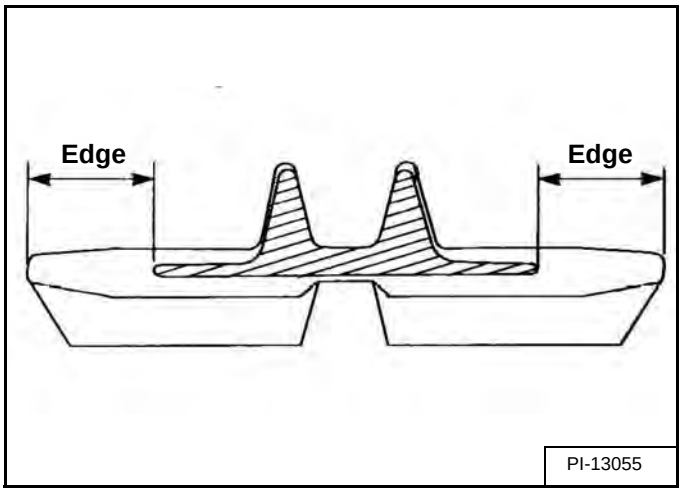


Figure 30-30-23



Damage:

Both edges of the rubber track have no special reinforcements. It sometimes occurs during operation that they are cut or torn off **[Figure 30-30-22]** and **[Figure 30-30-23]**.

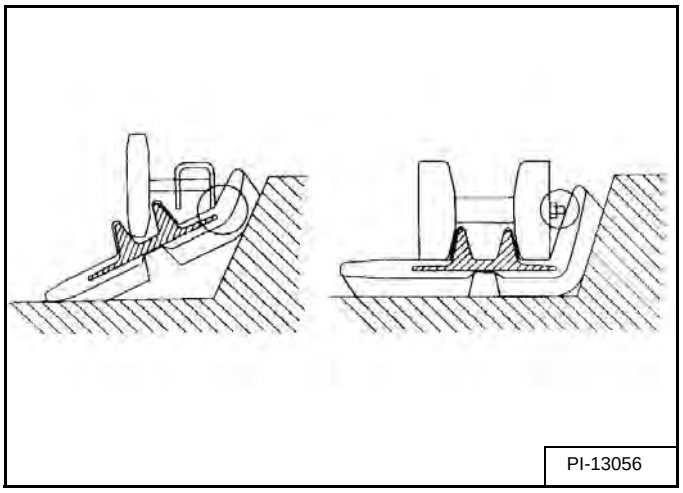
Replacement:

In such case, the rubber track does not have to be replaced.

Causes of the damage:

This damage is caused by objects on the field or by interference with the machine frame.

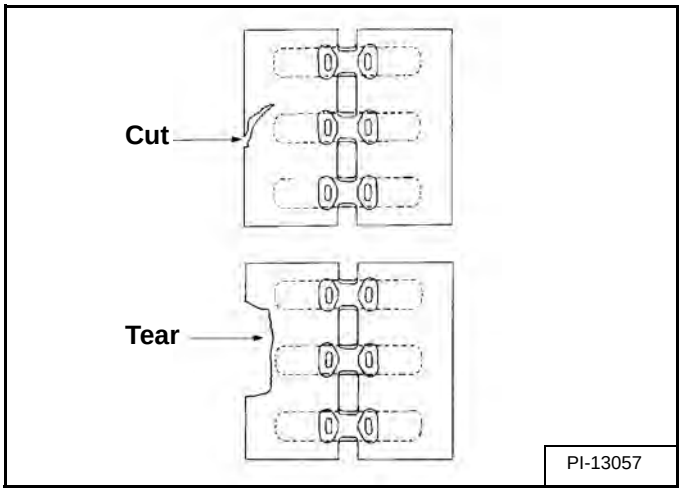
Figure 30-30-24



In case of damage by objects on the operating ground:

The edges of rubber track are often deformed largely due to a bumpy ground surface, stones and other objects, which cause extensive stress on the edges resulting in the damage. When a machine drives over concrete ridges, this type of damage easily occurs **[Figure 30-30-24]**.

Figure 30-30-25



In case of damage by interference with the machine frame:

If a machine continues operating with rubber tracks being detracted, the rubber tracks may get caught up in the machine frame or undercarriage parts resulting in damage. When a machine travels along side slopes, the rubber tracks are deformed so much that they come into contact with the machine frame and undercarriage parts, which causes cutting, gouging and rubbing of rubber tracks in the end **[Figure 30-30-25]**.

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Track Damage Identification (Cont'd)

Cuts On The Edges Of 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 retracking.

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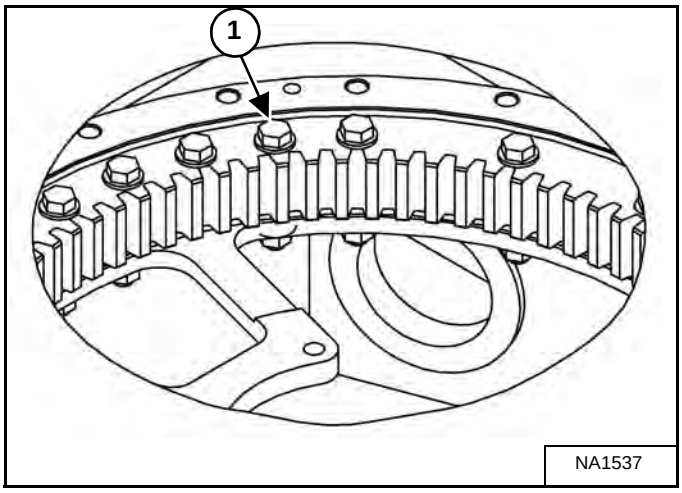
SWING CIRCLE GEAR

Swing Bearing Removal

Remove the upperstructure. (See Removal on Page 40-10-1.)

Mark the swing bearing to track frame.

Figure 30-40-1



Remove the 24 bolts (Item 1) **[Figure 30-40-1]** and nuts that hold the swing bearing to the track frame.

Remove the swing bearing.

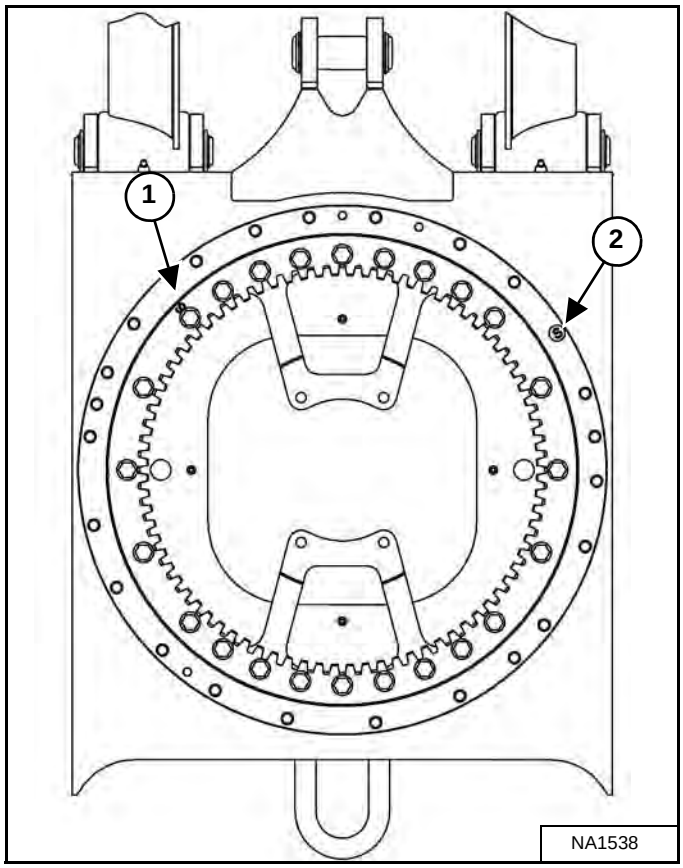
Clean and inspect the grease cover for damage. Replace as necessary.

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SWING CIRCLE GEAR (CONT'D)

Swing Bearing Installation

Figure 30-40-2

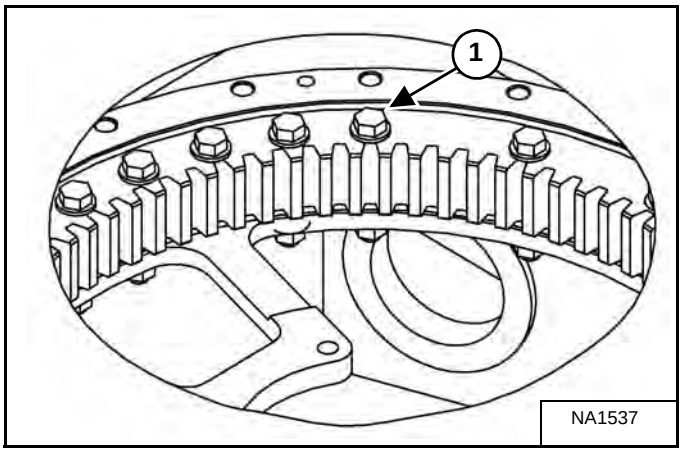


If reusing the existing swing bearing, use the alignment marks to put the swing bearing in the correct location. If installing a new swing bearing find the inner race soft zone (Item 1) and outer race soft zone area (Item 2) **[Figure 30-40-2]**.

Install the swing bearing so the inside soft zone (Item 1) is at the left hand side of the excavator and the outside soft zone (Item 2) **[Figure 30-40-2]** to the right side of the excavator.

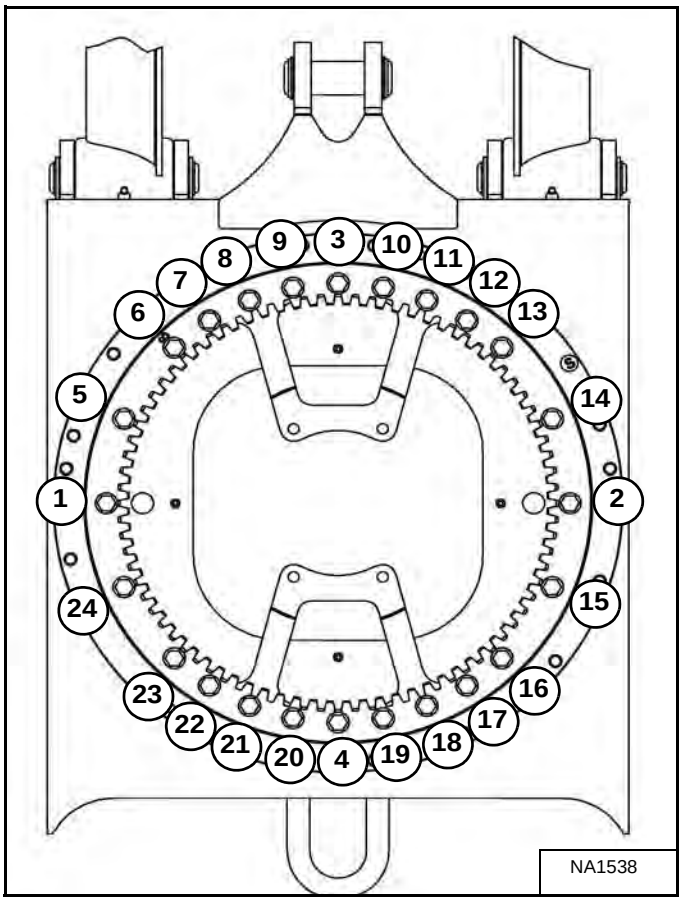
NOTE: Do not put the soft zone to the front or rear of the excavator.

Figure 30-40-3



Install the swing bearing bolts (Item 1) **[Figure 30-40-3]** and nuts.

Figure 30-40-4



Tighten the bolts in the correct sequence (#1 to #24) to 105 - 115 N•m (78 - 85 ft-lb) torque **[Figure 30-40-4]**.

Retorque bolts (#1 to #4) after all bolts have been torqued.

Put lubriplate grease or equivalent on the swing bearing gear.

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UPPERSTRUCTURE

Removal

Lower the blade all the way.

Put all the control levers in neutral.

Remove the boom. (See Removal And Installation on Page 40-150-1.)

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

Remove the counter weight. (See Removal And Installation on Page 40-90-1.)

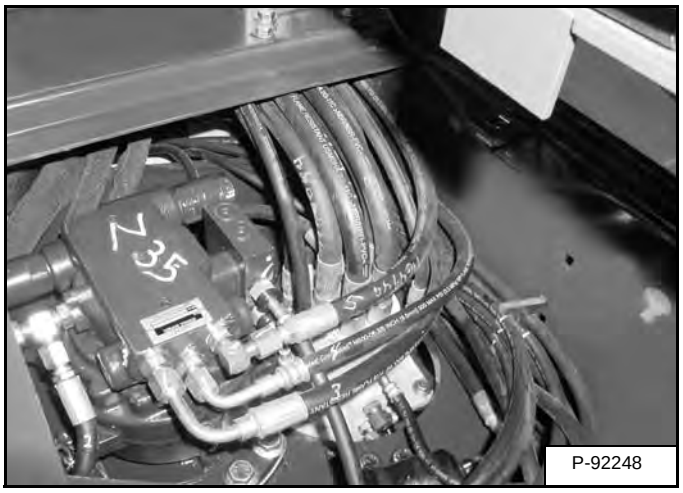
Remove the travel control valve. (See Removal And Installation on Page 20-190-1.)

Remove the hydraulic control valve. (See Removal And Installation on Page 20-40-1.)

Remove the fuel tank. (See FUEL TANK on Page 40-120-1.)

Remove the engine. (See Engine Removal And Installation on Page 60-10-11.)

Figure 40-10-1

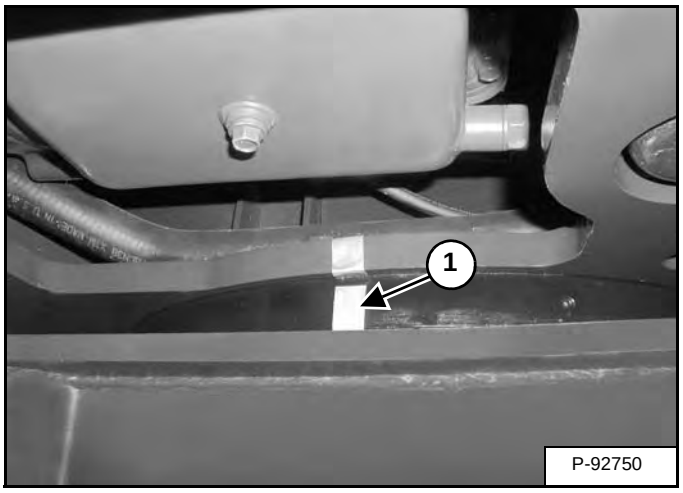


Remove the hoses from the top of the swivel joint **[Figure 40-10-1]**.

Remove the swing motor. (See Removal And Installation on Page 20-90-1.)

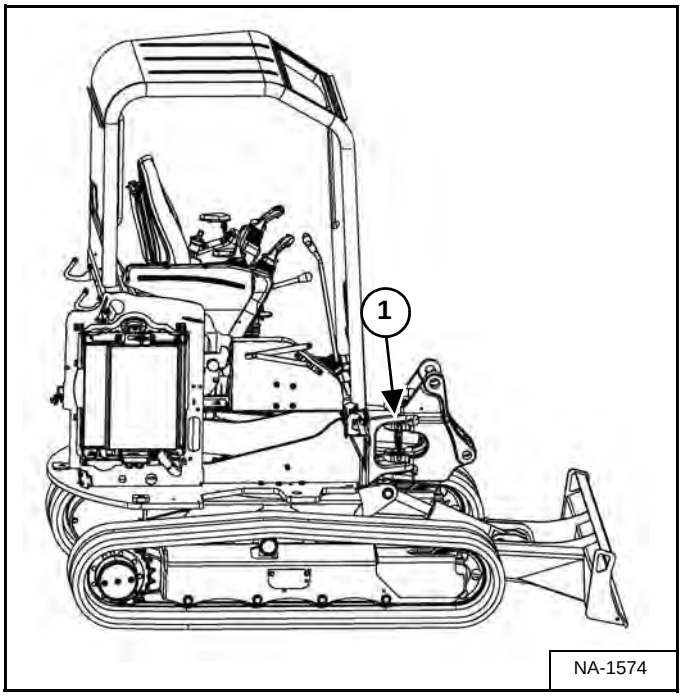
Remove the swing motor drive carrier. (See Removal And Installation on Page 20-91-1.)

Figure 40-10-2



Mark the upperstructure to swing bearing and to the track frame for assembly (Item 1) **[Figure 40-10-2]**.

Figure 40-10-3

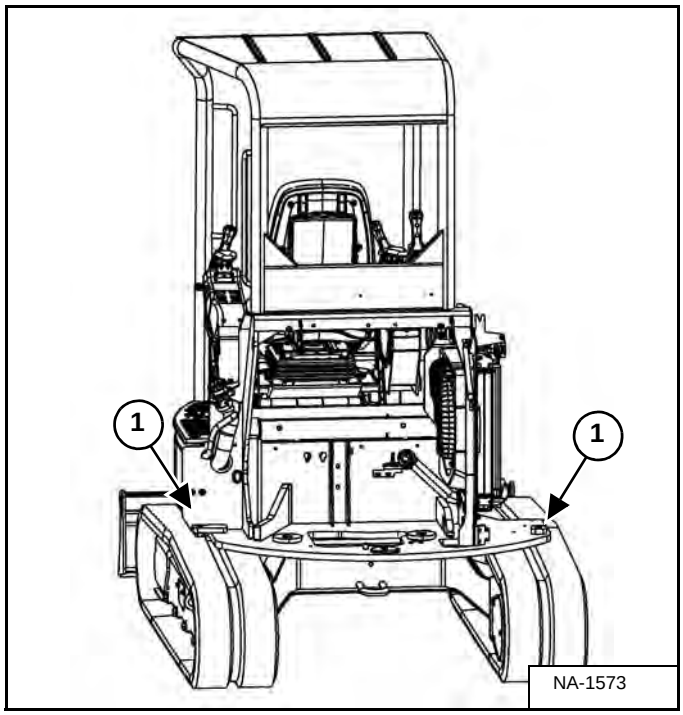


Fasten a chain through the front of the excavator frame (Item 1) **[Figure 40-10-3]**.

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Removal (Cont'd)

Figure 40-10-4

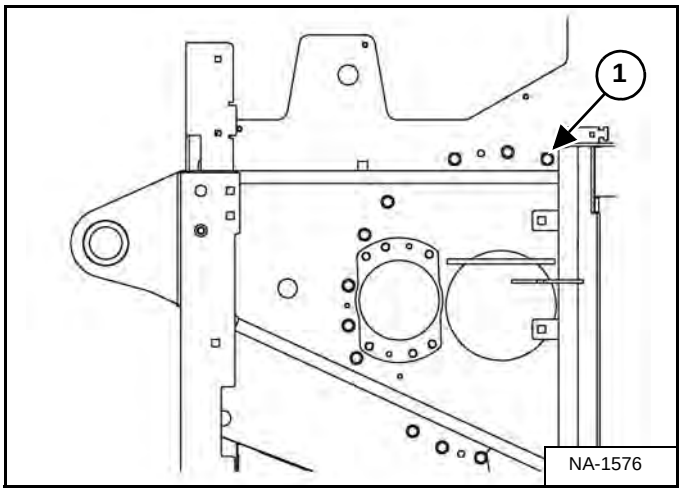


Fasten chains to the counter weight mounts (Item 1) **[Figure 40-10-4]**.

Install the front and rear lifting chains to a lifting fixture above the canopy / cab.

The lifting fixture must extend over the side of the canopy / cab to prevent the chains from hitting the ROPS / TOPS.

Figure 40-10-5



Partially disassemble the upperstructure from the swing bearing by removing all but four bolts which are spaced at 90° from each other (Item 1) **[Figure 40-10-5]**.

NOTE: For disassembly safety a minimum of four evenly spaced bolts must remain installed, to be removed later.

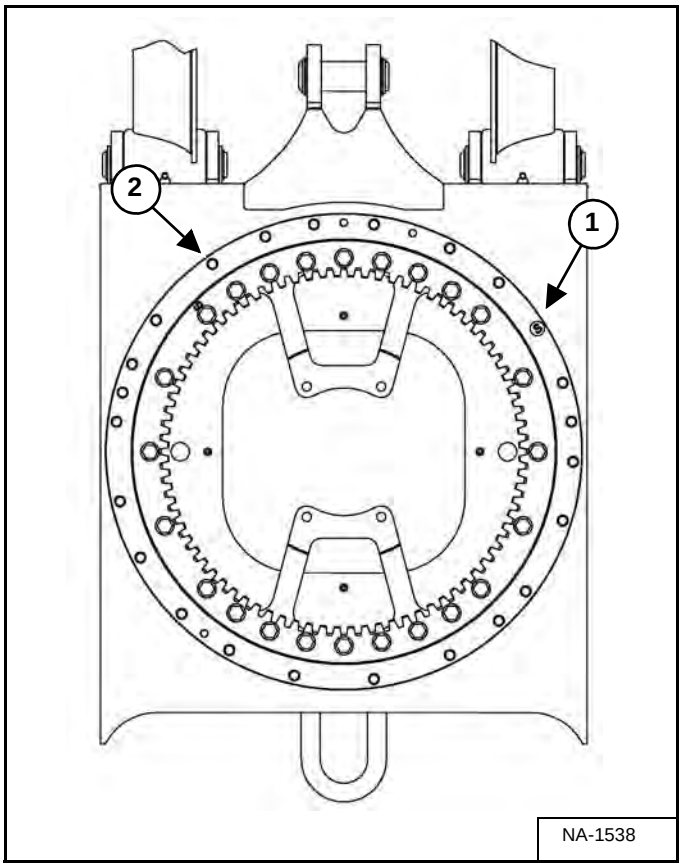
Apply a small amount of lifting pressure to the upperstructure with the lift sling. Remove the four remaining bolts holding the upperstructure to the swing bearing.

Lift the upperstructure off of the swing bearing. Put the upperstructure on suitable supporting stands or blocks.

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Installation

Figure 40-10-6

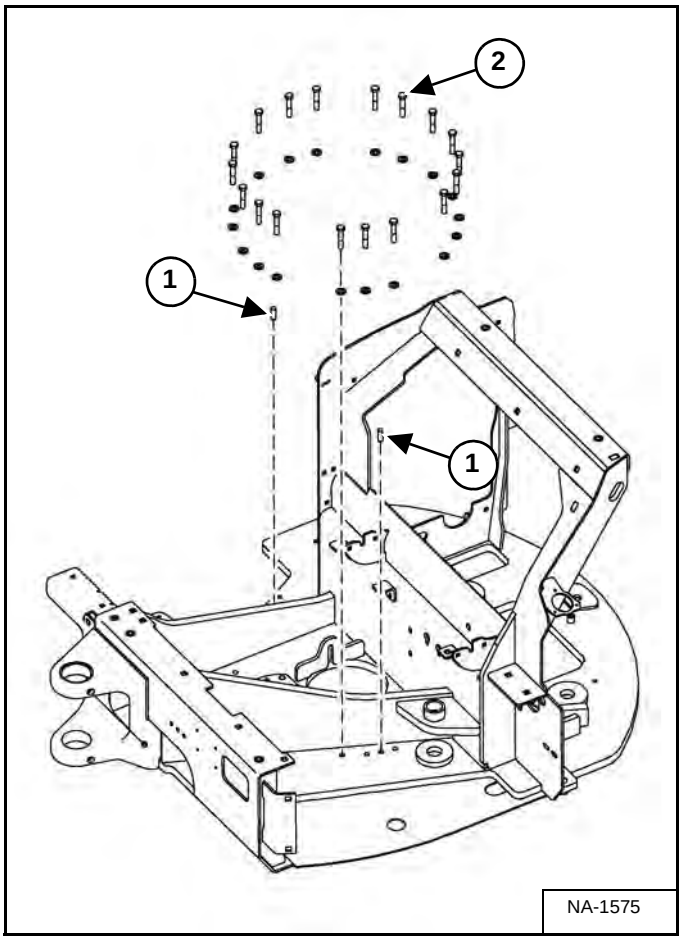


Rotate the swing bearing so the outside soft zone (Item 1) **[Figure 40-10-6]** is to the right hand side as shown.

Use a tap in the holes (Item 2) **[Figure 40-10-6]** of the swing bearing to remove any dried thread lock adhesive.

Install the upperstructure onto the swing bearing using the alignment marks.

Figure 40-10-7



Install the dowel pins (Item 1) **[Figure 40-10-7]**.

Install the bolts (Item 2) **[Figure 40-10-7]** and washers. Tighten the bolts to 105 - 115 N•m (78 - 85 ft-lb) torque.

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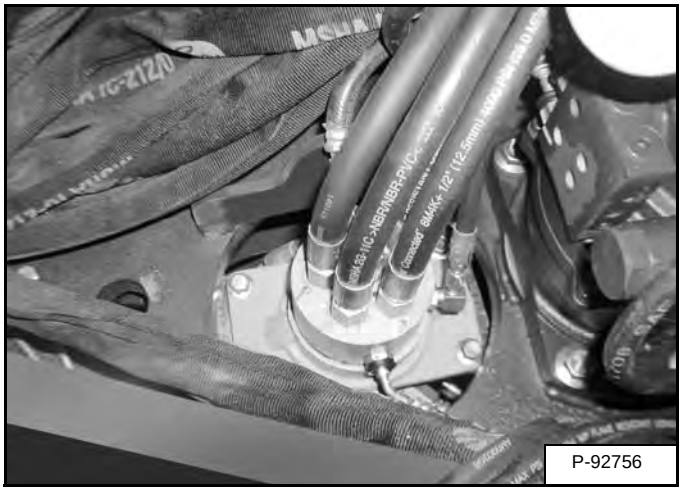
Installation (Cont'd)

Install the swing motor drive carrier. (See Removal And Installation on Page 20-91-1.)

Check the backlash between the gears by moving the frame back and forth at several points throughout 360° of frame rotation. There must be some backlash present.

Install the swing motor. (See Removal And Installation on Page 20-90-1.)

Figure 40-10-8



Install the hoses **[Figure 40-10-8]** on the swivel joint.

Remove the chains and lifting fixture.

Install the engine. (See Engine Removal And Installation on Page 60-10-11.)

Install the fuel tank. (See FUEL TANK on Page 40-120-1.)

Install the hydraulic control valve. (See Removal And Installation on Page 20-40-1.)

Install the travel control valve. (See Removal And Installation on Page 20-190-1.)

Install the counterweight. (See Removal And Installation on Page 40-90-1.)

Install the right side cover. (See Removal And Installation on Page 40-220-1.)

Install the boom. (See Removal And Installation on Page 40-150-1.)

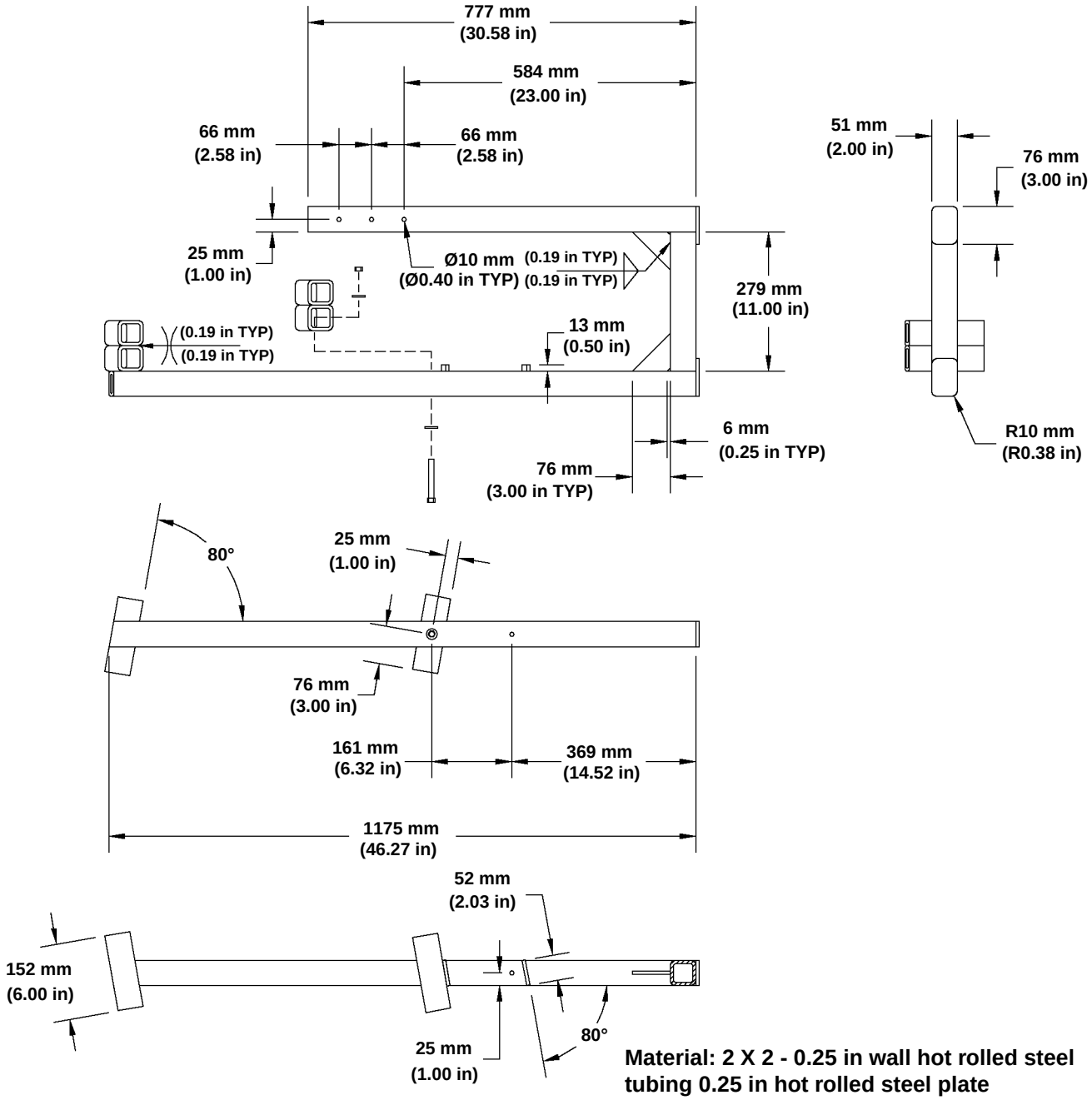
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ROPS CANOPY

Removal And Installation

Build the service lifting bracket used to remove and install the ROPS canopy. Use the dimensions shown **[Figure 40-20-1]** to build the service lifting bracket.

Figure 40-20-1

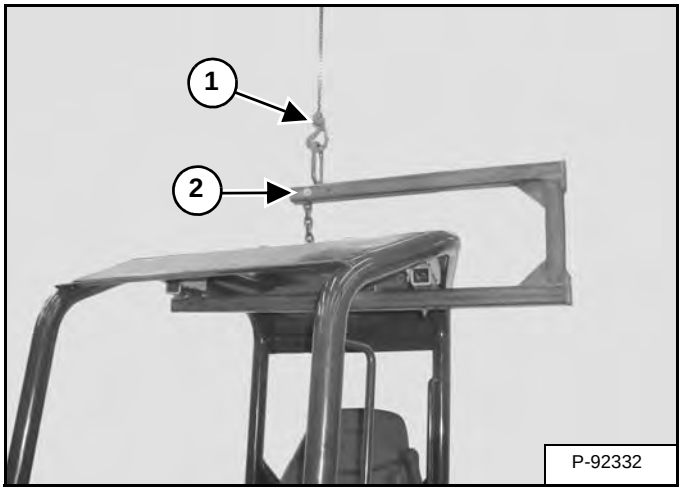


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Removal And Installation (Cont'd)

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

Figure 40-20-2



Install the chain hoist (Item 1) in the end hole of the lifting bracket (Item 2) **[Figure 40-20-2]**.

Install the cab / canopy service lifting bracket on the canopy **[Figure 40-20-2]**.

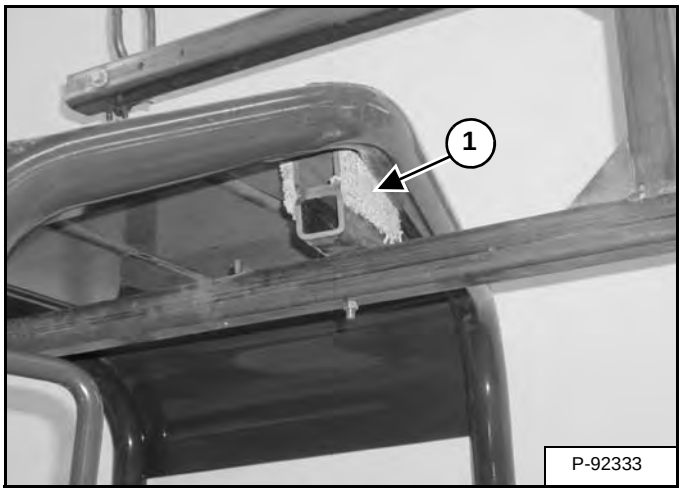
NOTE: Use a chain hoist of sufficient capacity.

⚠ WARNING

Never use the cab / canopy service lifting bracket to lift the excavator. The bracket is not strong enough and can fail causing serious injury or death.

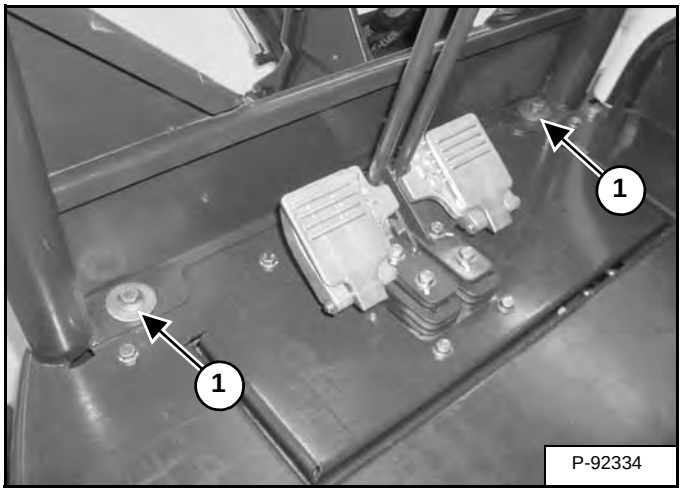
W-2384-1000

Figure 40-20-3



Adjust the lifting bracket to the proper width by moving the bracket (Item 1) **[Figure 40-20-3]**.

Figure 40-20-4



Remove the bolts and washers (Item 1) **[Figure 40-20-4]** from the front of the canopy.

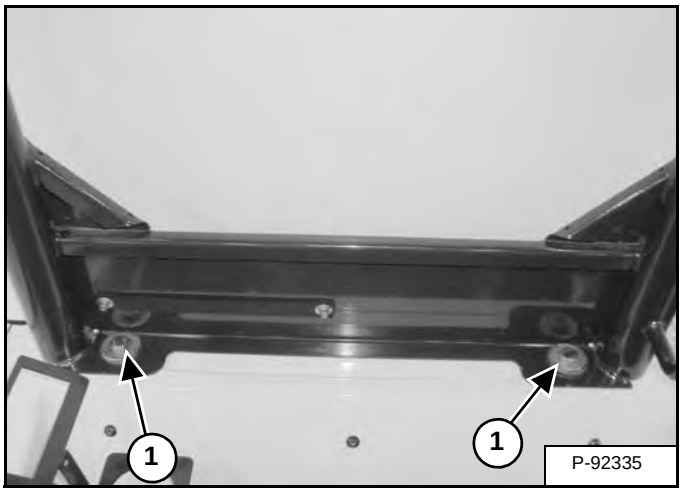
Installation: Tighten the bolts to 160 - 180 N•m (118 - 133 ft-lb) torque.

Remove the canopy.

Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

Figure 40-20-5



Remove the bolts and washers (Item 1) **[Figure 40-20-5]** from the rear of the canopy.

Installation: Tighten the bolts to 160 - 180 N•m (118 - 133 ft-lb) torque.

Raise the hoist.

Remove the canopy.

Dealer Copy -- Not for Resale

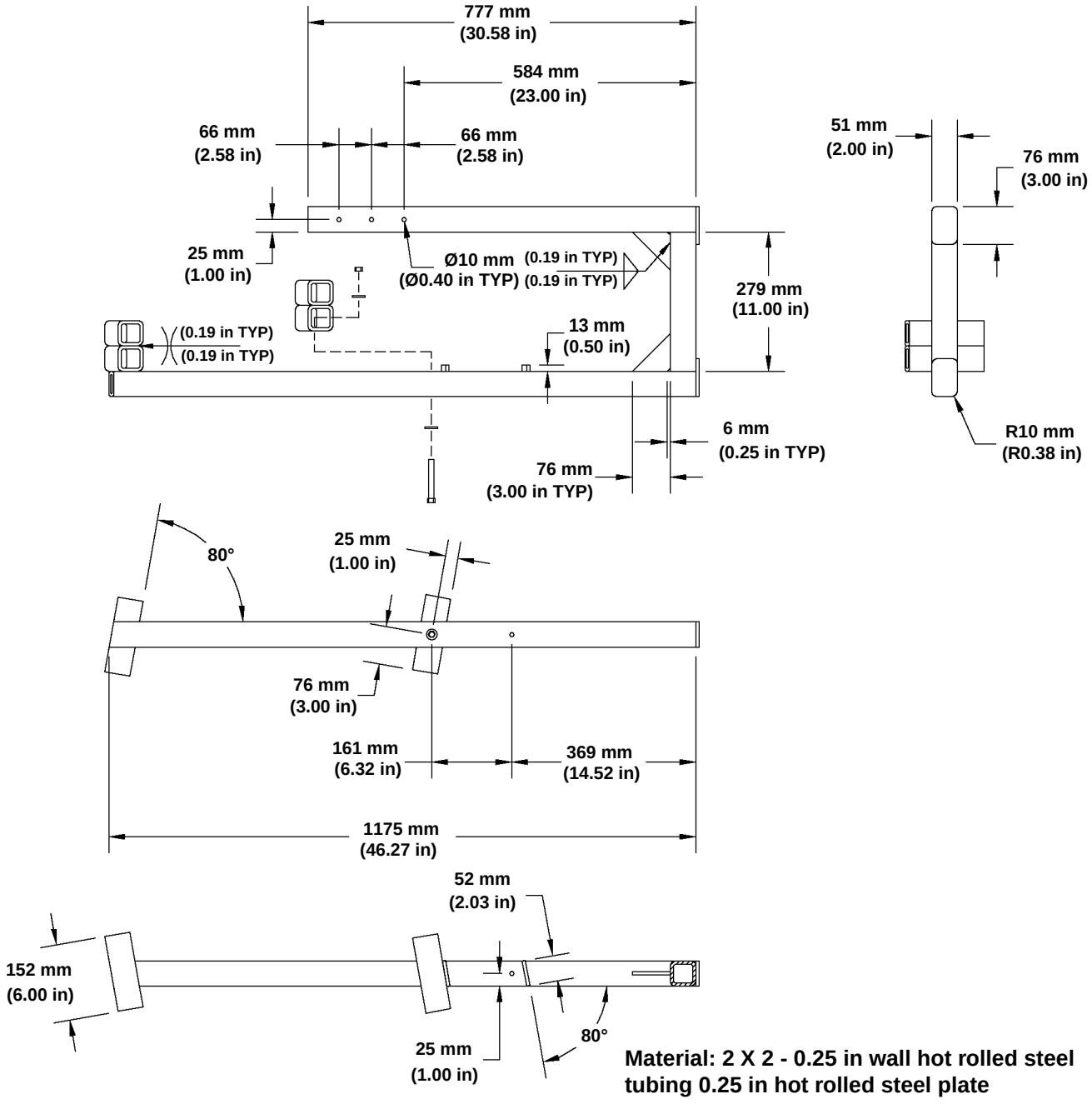


Dealer Copy -- Not for Resale

Removal And Installation

Build the service lifting bracket used to remove and install the cab. Use the dimensions shown **[Figure 40-30-1]** to build the service lifting bracket.

Figure 40-30-1



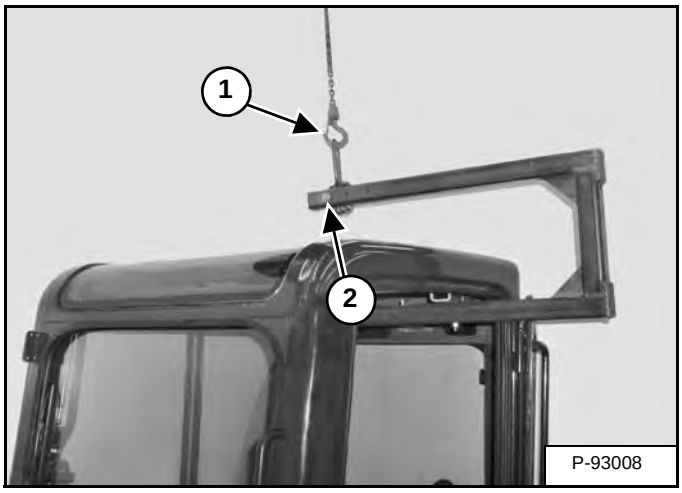
Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

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

Removal the upperstructure light. (See Removal And Installation on Page 50-50-1.)

Figure 40-30-2



Install the chain hoist (Item 1) in the end hole of the lifting bracket (Item 2) **[Figure 40-30-2]**.

Install the cab / canopy service lifting bracket on the cab **[Figure 40-30-2]**.

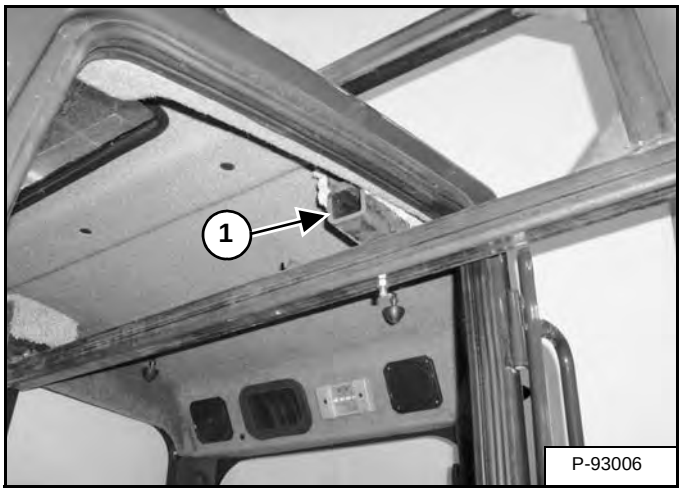
NOTE: Use a chain hoist of sufficient capacity.

⚠ WARNING

Never use the cab / canopy service lifting bracket to lift the excavator. The bracket is not strong enough and can fail causing serious injury or death.

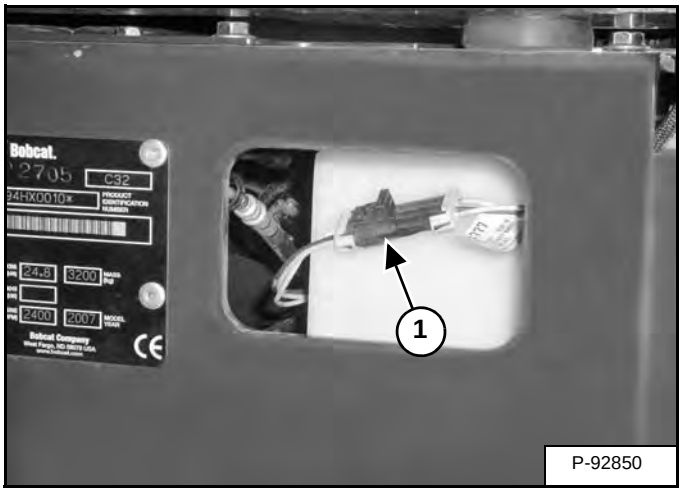
W-2384-1000

Figure 40-30-3



Adjust the lifting bracket to the proper width by moving the bracket (Item 1) **[Figure 40-30-3]**.

Figure 40-30-4

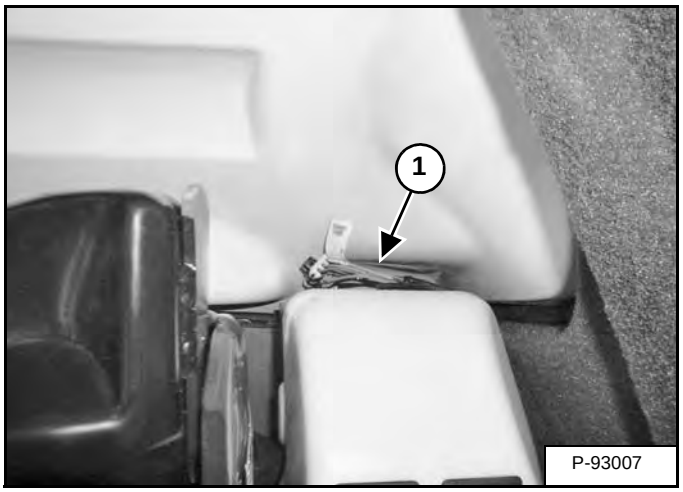


Disconnect the wire harness (Item 1) **[Figure 40-30-4]**.

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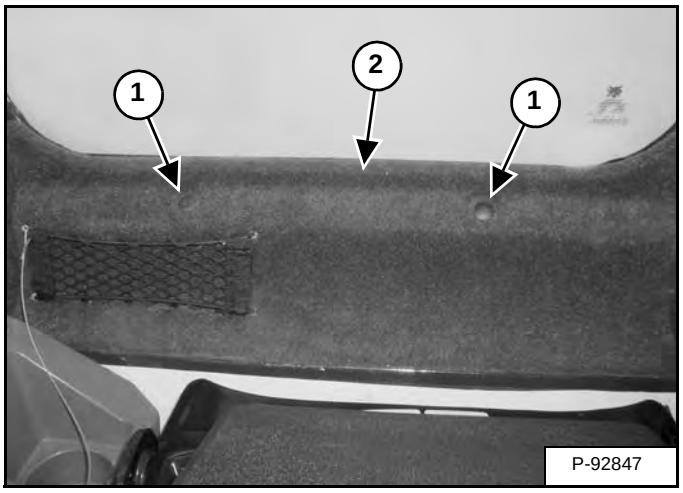
Removal And Installation (Cont'd)

Figure 40-30-5



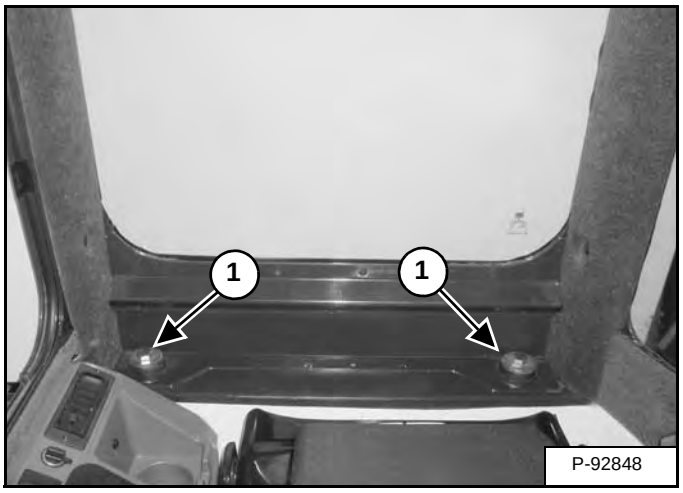
Disconnect both wire harnesses (Item 1) **[Figure 40-30-5]** from the bottom of the left console.

Figure 40-30-6



Remove the fasteners (Item 1) and remove the cover (Item 2) **[Figure 40-30-6]**.

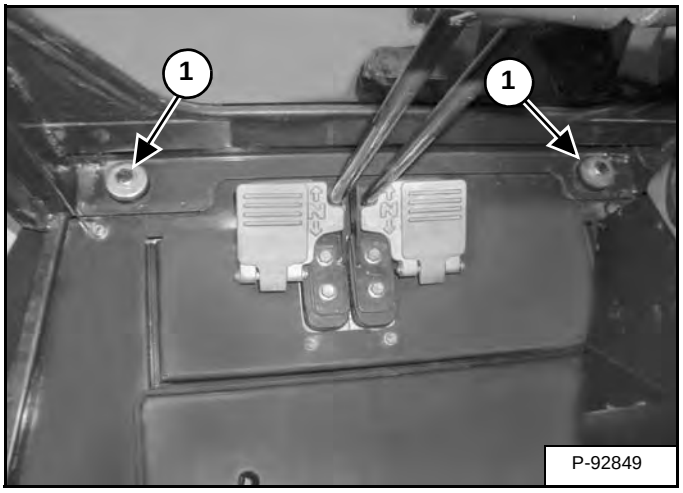
Figure 40-30-7



Remove the bolts and washers (Item 1) **[Figure 40-30-7]** from the rear of the cab.

Installation: Tighten the bolts to 160 - 180 N•m (118 - 133 ft-lb) torque.

Figure 40-30-8



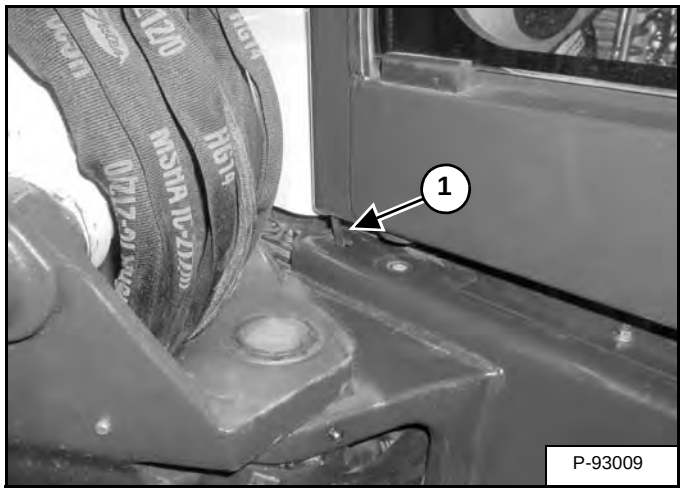
Remove the bolts and washers (Item 1) **[Figure 40-30-8]** from the front of the cab.

Installation: Tighten the bolts to 160 - 180 N•m (118 - 133 ft-lb) torque.

Dealer Copy -- Not for Resale

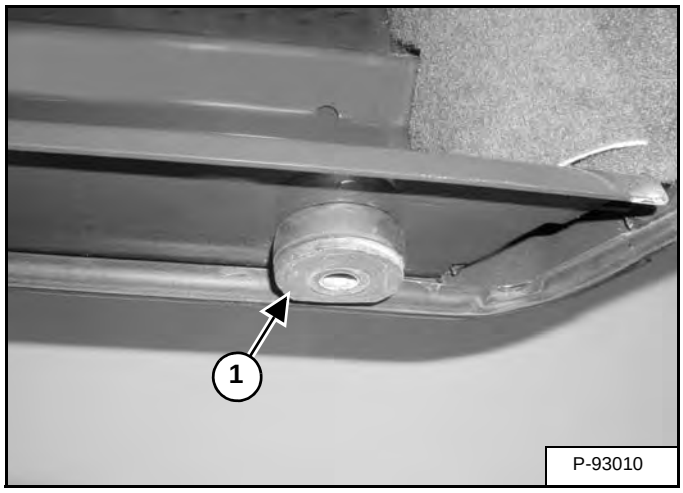
Removal And Installation (Cont'd)

Figure 40-30-9



Disconnect the wiper washer hose and guide the hose (Item 1) **[Figure 40-30-9]** through the upperstructure.

Figure 40-30-10



Installation: Install the cab mounts (Item 1) **[Figure 40-30-10]** on the four corners of the cab.

Door Removal And Installation

Figure 40-30-11



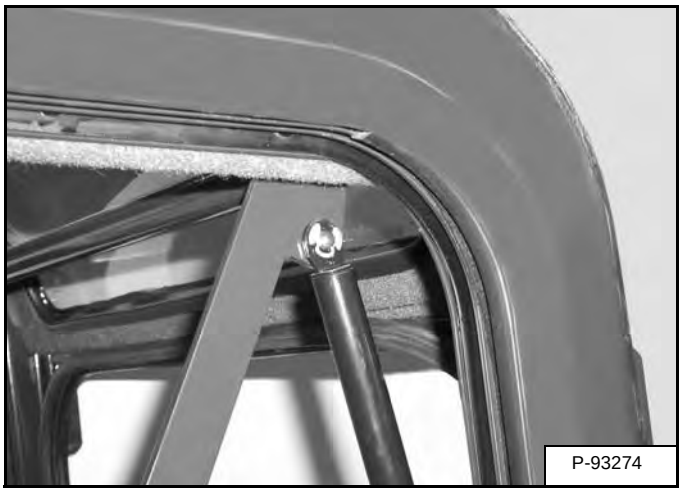
The door can be removed from the cab by slowly swinging the door back and forth while lifting up on the door **[Figure 40-30-11]**.

Installation: Align the hinges and swing the door back and forth until the door weight settles the hinges to full engagement.

Dealer Copy -- Not for Resale

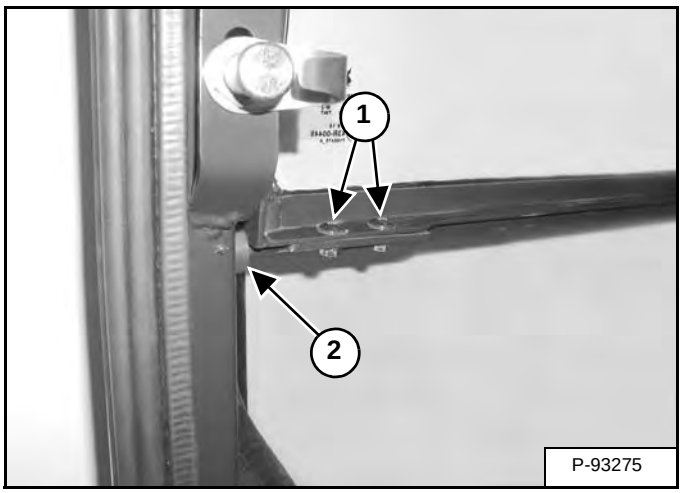
Front Window Removal And Installation

Figure 40-30-12



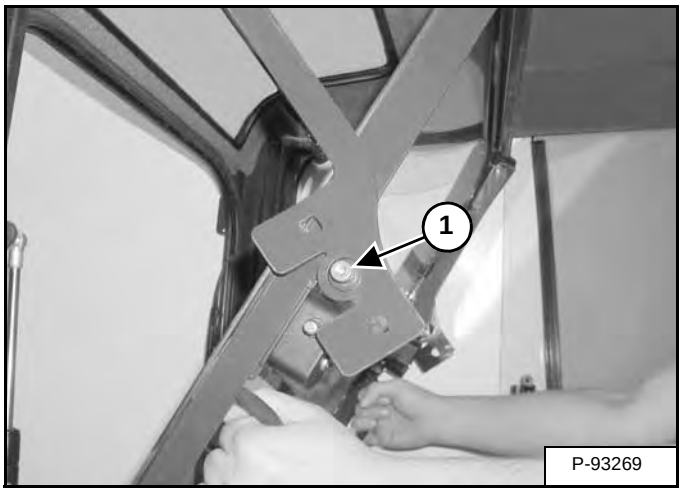
With a second person supporting the window, partially raise the window. Remove the clips (Item 1) **[Figure 40-30-12]** from the gas strut on both sides of the window. Remove the gas strut from the mount.

Figure 40-30-13



Remove the two screws (Item 1) and remove the roller (Item 2) **[Figure 40-30-13]**.

Figure 40-30-14



Remove the shoulder bolts (Item 1) **[Figure 40-30-14]** and nuts from both sides of the window.

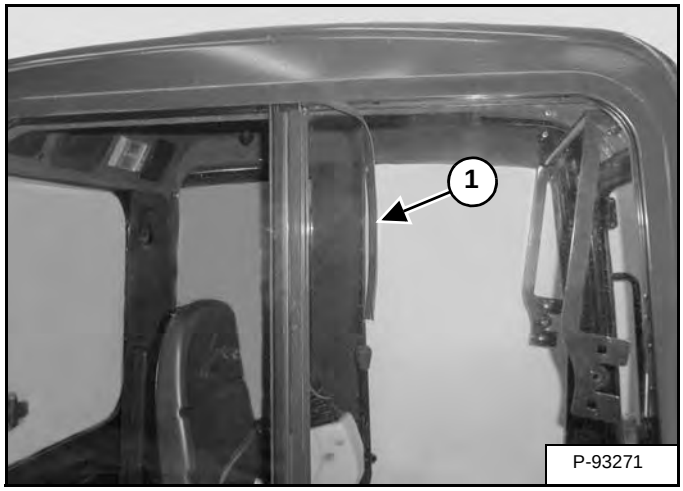
Remove the front window.

Dealer Copy -- Not for Resale

Right Side Rear Sliding Window Removal And Installation

Close and latch the front and rear sliding windows.

Figure 40-30-15



Use a pick to pull the felt (Item 1) **[Figure 40-30-15]** from the top window channel.

Unlatch the rear sliding window and slide the window open until it stops.

Figure 40-30-16



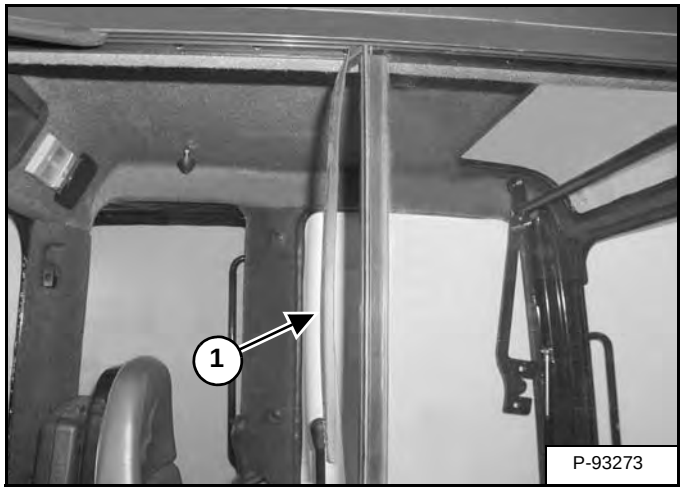
Lift the window up into the top channel and tilt the bottom edge out **[Figure 40-30-16]**. Remove the window from the cab.

Right Side Front Sliding Window Removal And Installation

NOTE: The rear sliding window must be removed before the front sliding window can be removed.

Unlatch the front sliding window and slide the window open until it stops.

Figure 40-30-17



Use a pick to pull the felt (Item 1) **[Figure 40-30-17]** from the inside top window channel.

Figure 40-30-18



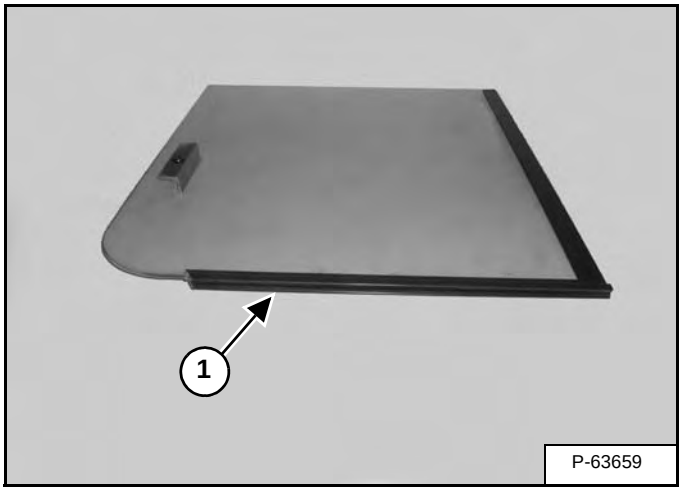
Lift the window up into the top channel and tilt the bottom edge out **[Figure 40-30-18]**. Remove the window from the cab.

Dealer Copy -- Not for Resale

Right Side Front And Rear Sliding Window Weather Strip Removal And Installation

Remove the window.

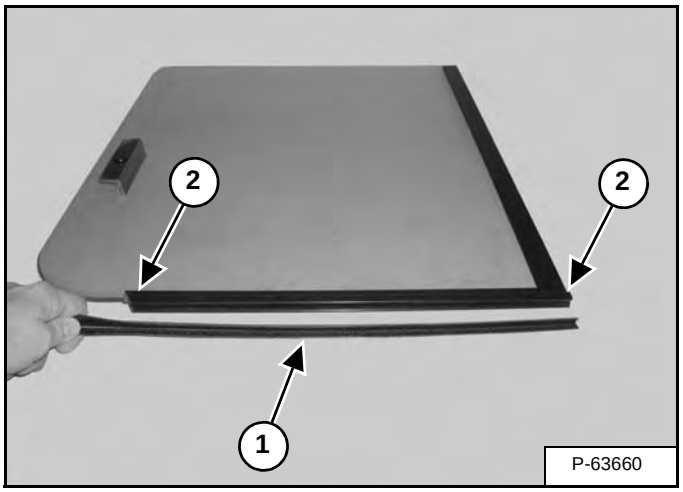
Figure 40-30-19



Remove the weather strip (Item 1) **[Figure 40-30-19]** from the bottom channel of the window.

Installation: Clean the bottom channel. Apply a bead of adhesive in the channel.

Figure 40-30-20

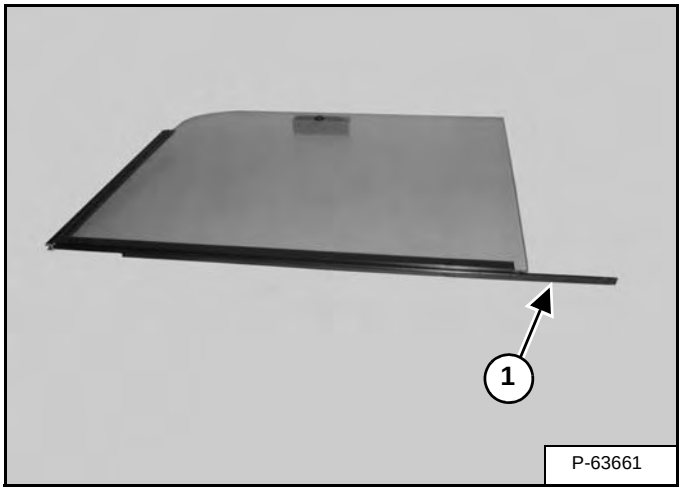


Install the new weather strip (Item 1). Cut the weather strip flush with the ends of the window channel (Item 2) **[Figure 40-30-20]**.

Right Side Front And Rear Sliding Window Wiper Strip Removal And Installation

Remove the window.

Figure 40-30-21



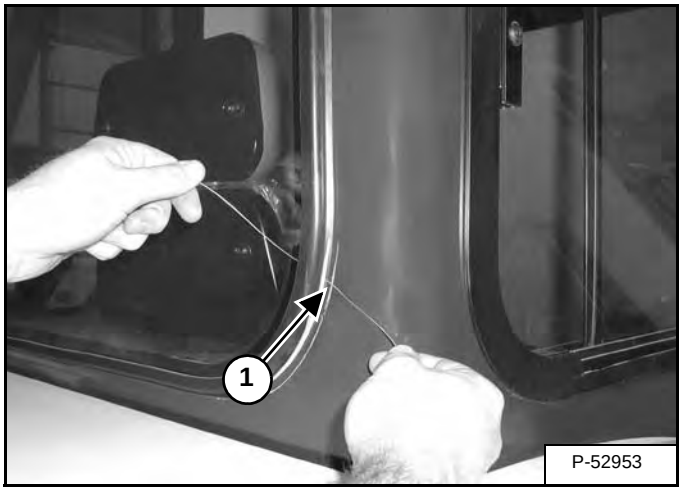
Remove the wiper strip (Item 1) **[Figure 40-30-21]** from the window channel.

Dealer Copy -- Not for Resale

Glass Removal

Use the following procedure to remove the glass from the cab and right side window assembly.

Figure 40-30-22



Push a small diameter wire (Item 1) **[Figure 40-30-22]** through the adhesive. Pull the wire around the perimeter of the glass to cut the adhesive.

Remove the glass.

NOTE: The right side window frame is aluminum and will be destroyed when removed.

Dealer Copy -- Not for Resale

Glass Installation

Top And Rear Glass

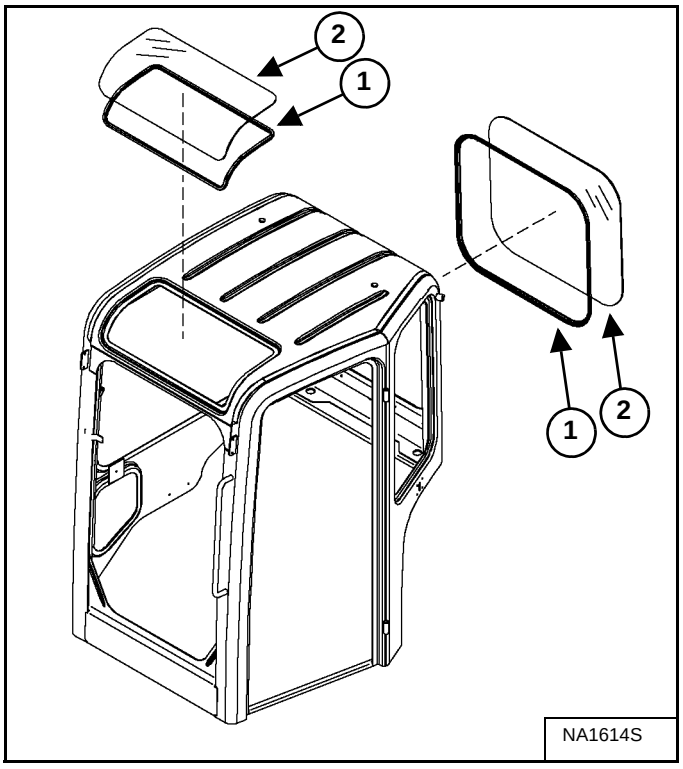
Remove the majority of the old urethane adhesive from the perimeter of the cab.

NOTE: Leave a thin film (0,79 mm (0.03 in) thick) of the old urethane on the cab frame, fresh urethane will bond to the remaining film.

Prime and paint any bare metal or scratches.

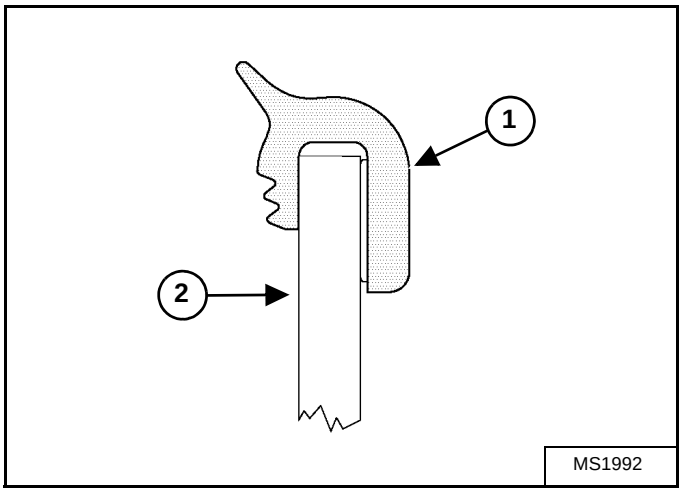
Clean the metal surfaces with general purposes adhesive cleaner. Clean the glass surface with glass cleaner

Figure 40-30-23



Install the seal (Item 1) on the glass (Item 2) **[Figure 40-30-23]** and **[Figure 40-30-24]**.

Figure 40-30-24



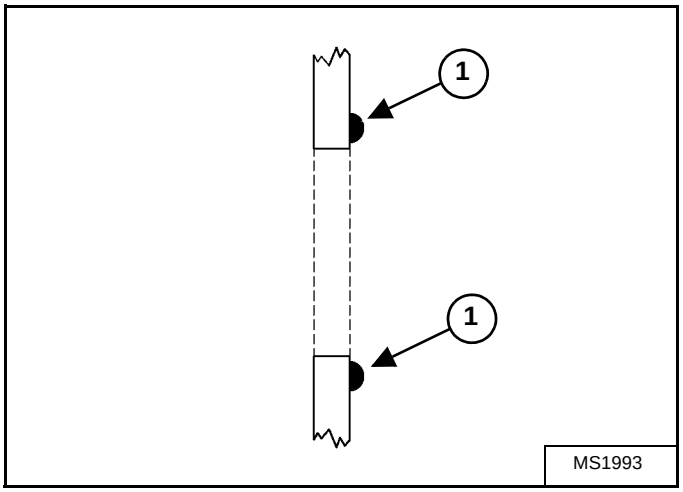
Shake the combo primer for one minute.

Apply one coat of the combo primer to the perimeter of the cab and glass (Item 2) **[Figure 40-30-24]**.

Allow the combo primer to dry for at least 15 minutes. Excess primer can be removed from the glass using a razor blade.

Cut the tip of the adhesive tube to the desired shape and size to provide a bead height sufficient to give good contact with the glass around the entire perimeter.

Figure 40-30-25



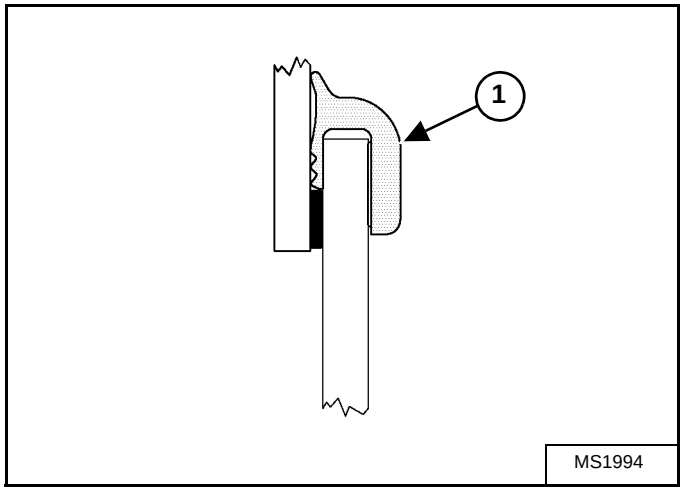
Apply a 6,4 X 9,5 mm (0.25 X 0.375 in) bead of urethane adhesive (Item 1) **[Figure 40-30-25]** to the perimeter of the cab.

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Glass Installation (Cont'd)

Top And Rear Glass (Cont'd)

Figure 40-30-26



Install the glass and seal assembly (Item 1) **[Figure 40-30-26]**. Press the glass into the cab to make complete contact with the adhesive. Tape the glass in place.

Allow the adhesive to cure for a minimum of eight hours at 24°C (75°F) and 20% relative humidity.

Remove the tape after the adhesive is cured.

Right And Left Side Glass

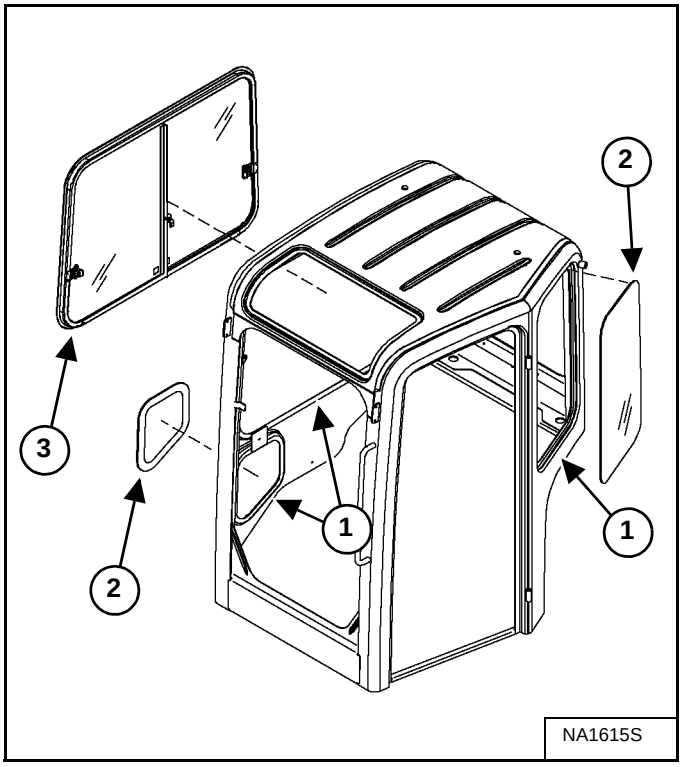
Remove the majority of the old urethane adhesive from the perimeter of the cab.

Prime and paint any bare metal or scratches.

Clean the metal surfaces with general purposes adhesive cleaner. Clean the glass surface with glass cleaner.

Shake the combo primer for one minute.

Figure 40-30-27



Apply the combo primer to the perimeter of the cab opening (Item 1), glass (Item 2) and window frame **[Figure 40-30-27]**.

Allow the combo primer to dry for at least 15 minutes. Excess primer can be removed from the glass using a razor blade.

IMPORTANT

If the glass has direct contact with the metal frame, the glass may break due to machine vibration.

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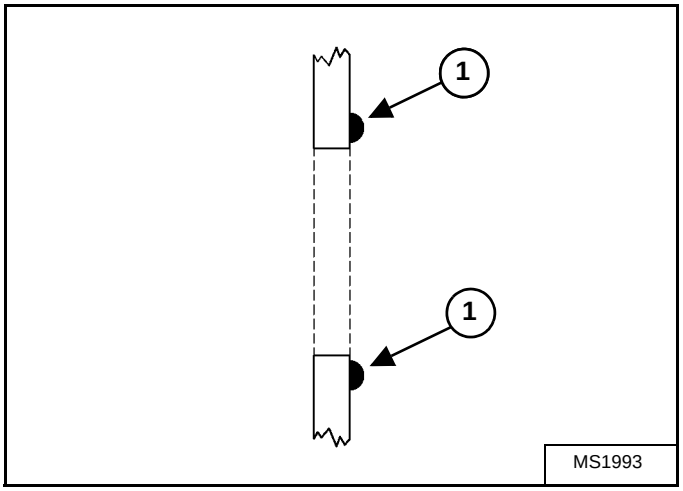
Cut the tip of the adhesive tube to the desired shape and size to provide a bead height sufficient to give good contact with the glass around the entire perimeter.

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Glass Installation (Cont'd)

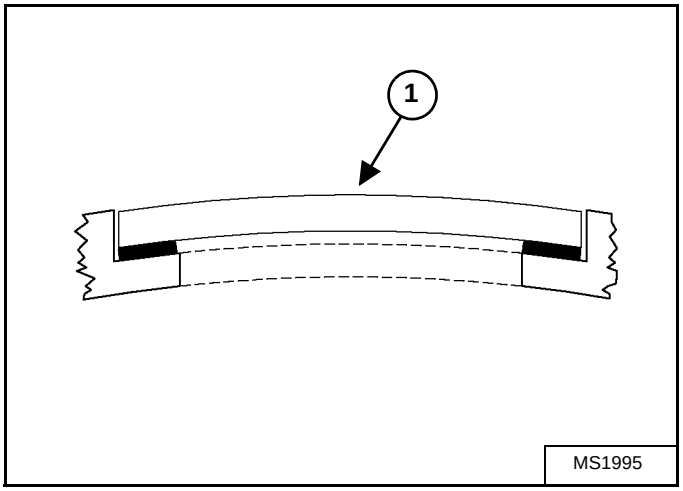
Right And Left Side Glass (Cont'd)

Figure 40-30-28



Apply a 6,4 X 9,5 mm (0.25 X 0.375 in) bead of urethane adhesive (Item 1) **[Figure 40-30-28]** to the perimeter of the cab.

Figure 40-30-29



Install the glass (Item 1) **[Figure 40-30-29]**. Press the glass into the cab to make complete contact with the adhesive. Tape the glass in place.

Allow the adhesive to cure for a minimum of eight hours at 24°C (75°F) and 25% relative humidity.

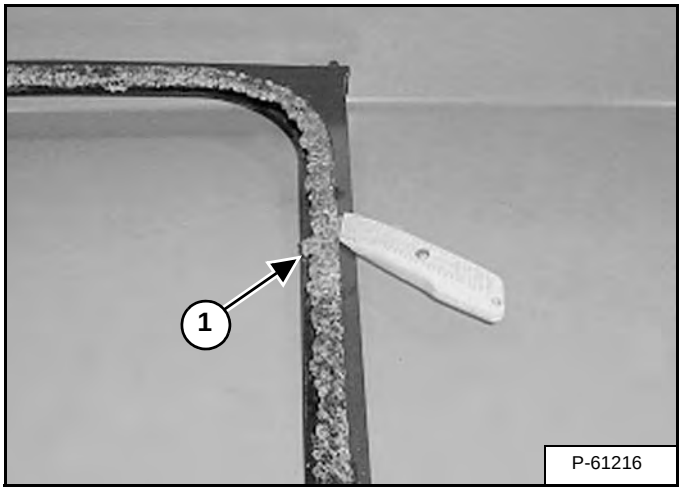
Remove the tape after the adhesive is cured.

Door And Front Window Glass

NOTE: The door and front windows are supplied as kits that include the glass, urethane adhesive, combo primer, glass cleaner and bumpers for correctly installing the new glass.

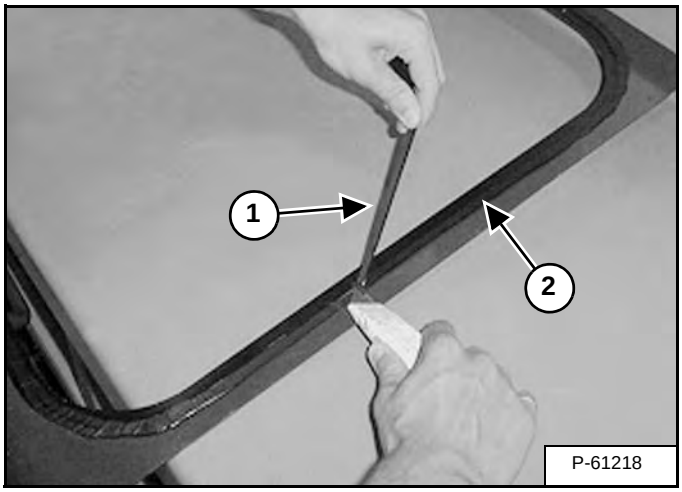
Remove the front window or door that is to be repaired from the excavator.

Figure 40-30-30



Remove the broken glass (Item 1) **[Figure 40-30-30]**.

Figure 40-30-31



Cut and remove the old urethane adhesive (Item 1) and leaving less than a 0,79 mm (0.03 in) thick layer (Item 2) **[Figure 40-30-31]** for the new adhesive to bond to.

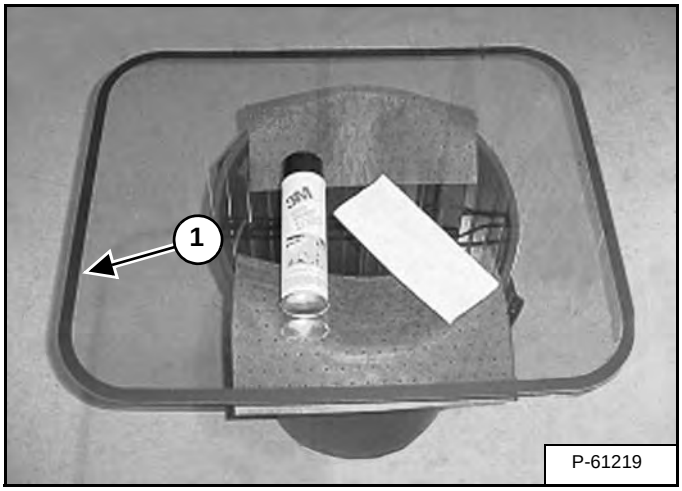
NOTE: Use care not to scratch the paint on the frame.

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Glass Installation (Cont'd)

Door And Front Window Glass (Cont'd)

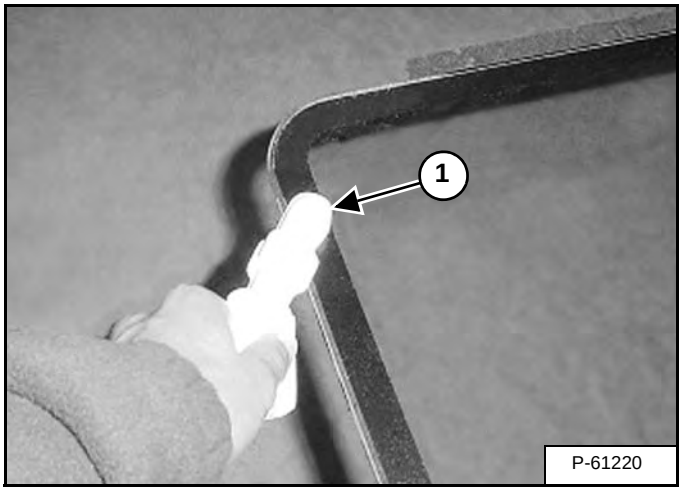
Figure 40-30-32



Place the glass on a flat surface with the painted side of the glass (Item 1) **[Figure 40-30-32]** facing up.

Thoroughly clean the entire glass with glass cleaner.

Figure 40-30-33



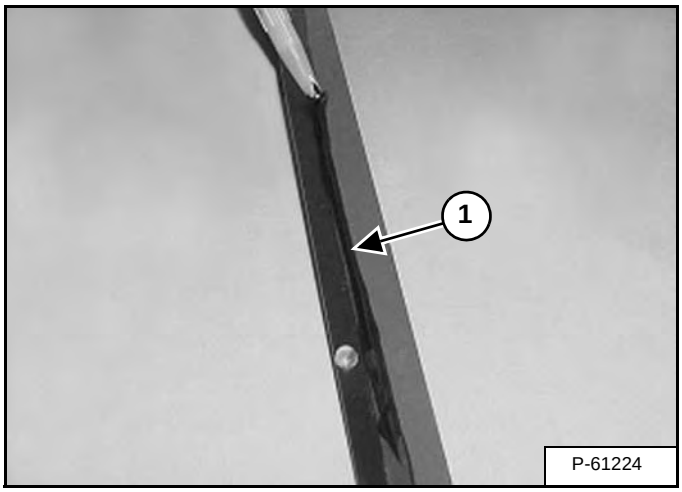
Apply one coat of combo primer (Item 1) **[Figure 40-30-33]** on the painted edge of the glass.

Apply the combo primer to any scratches on the door / front window frame in the area where the glass is installed.

Allow the primer to dry for a minimum of 15 minutes.

Excess primer may be removed from the glass using a razor blade.

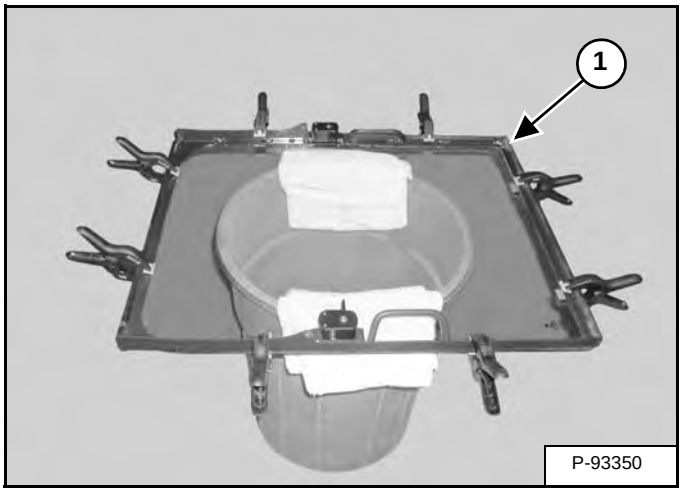
Figure 40-30-34



Apply a 6,4 X 9,5 mm (0.25 X 0.375 in) bead of urethane adhesive (Item 1) **[Figure 40-30-34]** around the front window / door frame.

Apply the adhesive directly on top of the old adhesive.

Figure 40-30-35



Place the frame (Item 1) **[Figure 40-30-35]** and **[Figure 40-30-36 on Page 40-30-13]** on the glass. The frame must be centered on the glass, and the glass must not have direct contact with the front window/door frame.

IMPORTANT

If the glass has direct contact with the metal frame, the glass may break due to machine vibration.

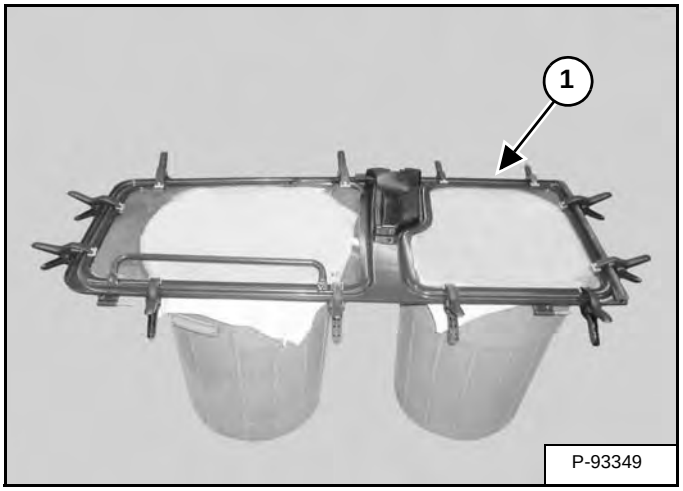
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Glass Installation (Cont'd)

Door And Front Window Glass (Cont'd)

Figure 40-30-36



Place the frame and glass together (Item 1) **[Figure 40-30-35 on Page 40-30-12]** and **[Figure 40-30-36]**.

Place the clamps over the frame.

Allow the adhesive to cure for a minimum of eight hours at 24°C (75°F) and 25% relative humidity before removing the clamps.

Install the front window. (See Front Window Removal And Installation on Page 40-30-5.)

Install the door. (See Door Removal And Installation on Page 40-30-4.)

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SEAT

Removal And Installation

Figure 40-40-1

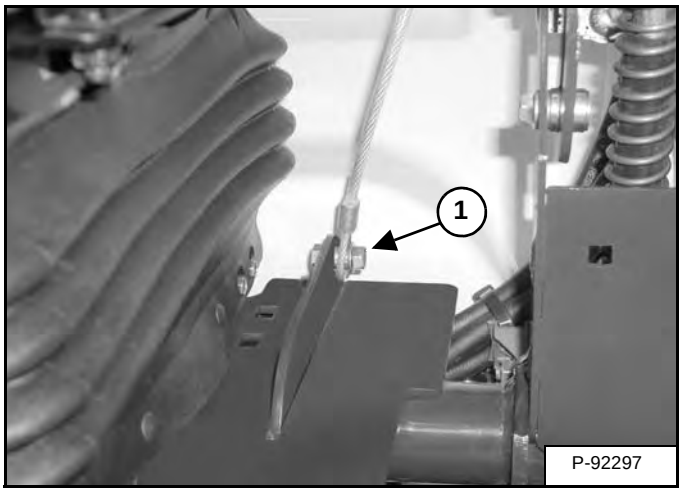
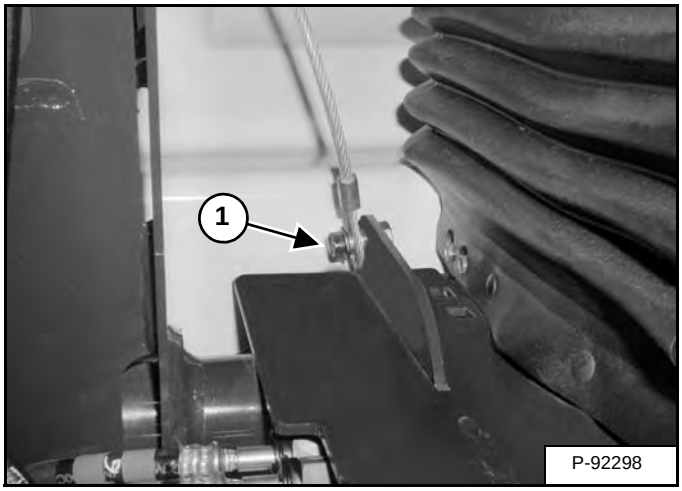


Figure 40-40-2



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

Figure 40-40-3

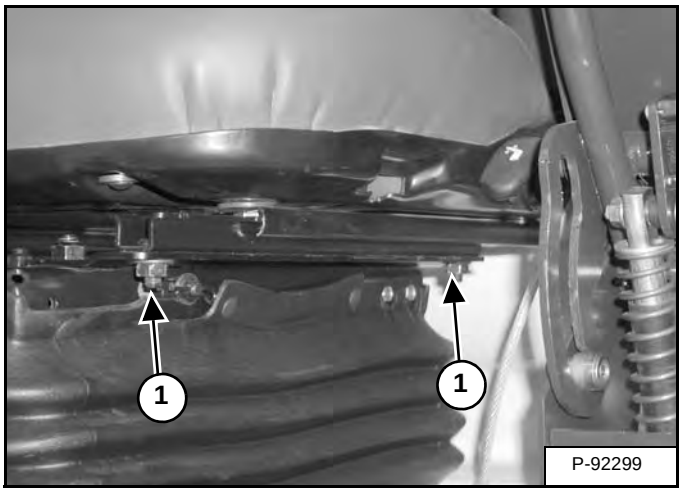
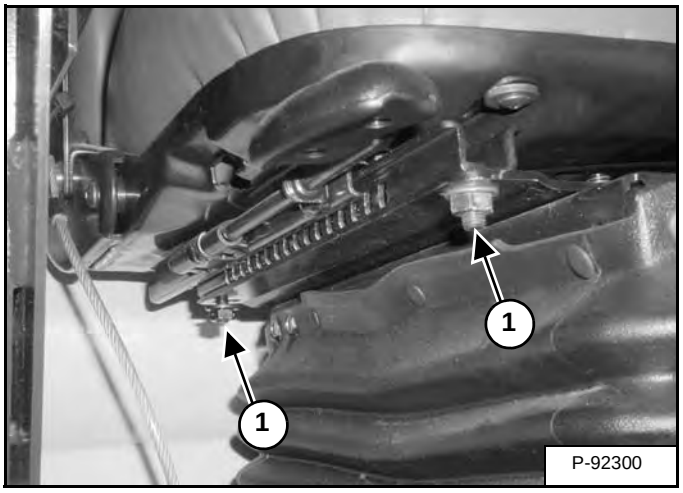


Figure 40-40-4



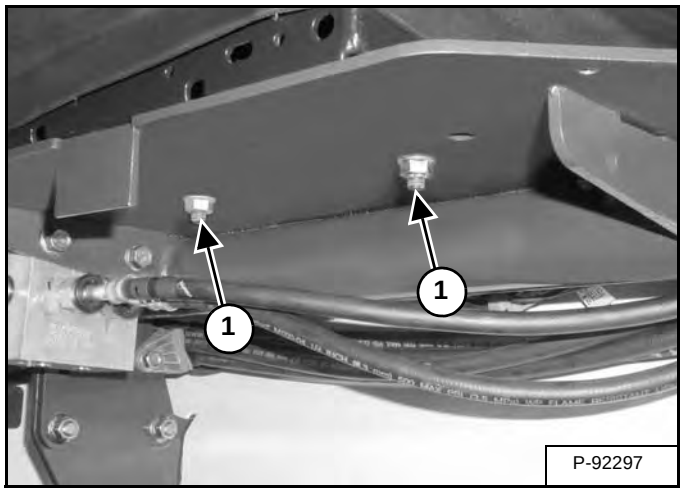
Remove the nuts (Item 1) **[Figure 40-40-3]** and **[Figure 40-40-4]** from the seat rails.

Remove the seat.

Dealer Copy -- Not for Resale

Seat Mount Removal And Installation

Figure 40-40-5



Remove the four nuts (Item 1) **[Figure 40-40-1]**.

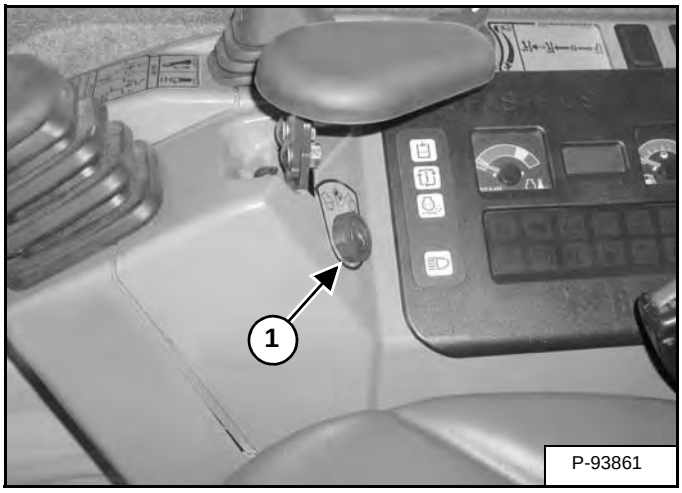
Remove the seat mount.

Dealer Copy -- Not for Resale

RIGHT CONSOLE (S/N A93K11001 - A93K17999 AND AC2P11001 - AC2P14999)

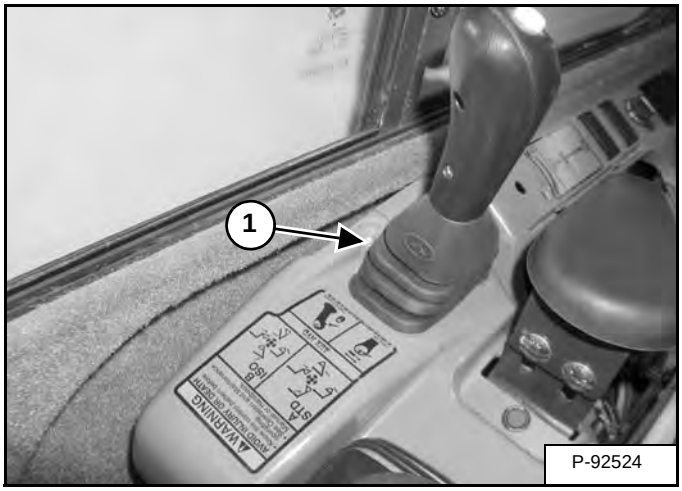
Console Cover Removal And Installation

Figure 40-50-1



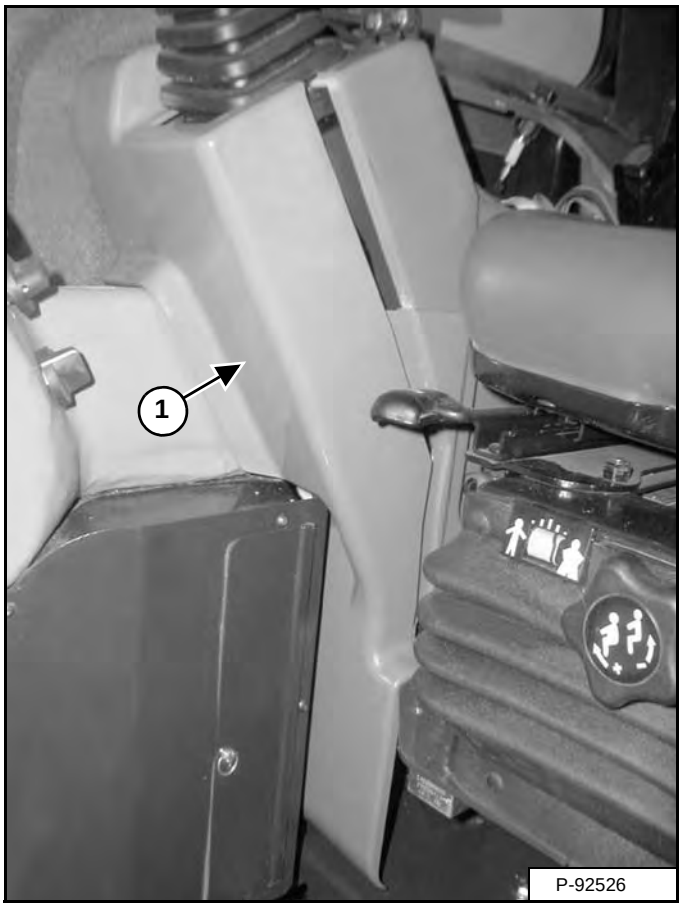
Remove the nut (Item 1) **[Figure 40-50-1]** from the key switch. Lower the switch into the console.

Figure 40-50-2



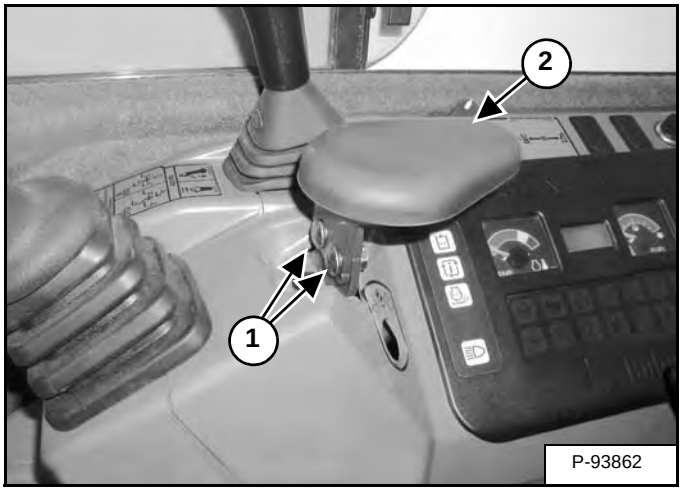
Remove the screw (Item 1) **[Figure 40-50-2]**.

Figure 40-50-3



Pull the cover (Item 1) **[Figure 40-50-3]** towards the front of the excavator and remove the cover.

Figure 40-50-4

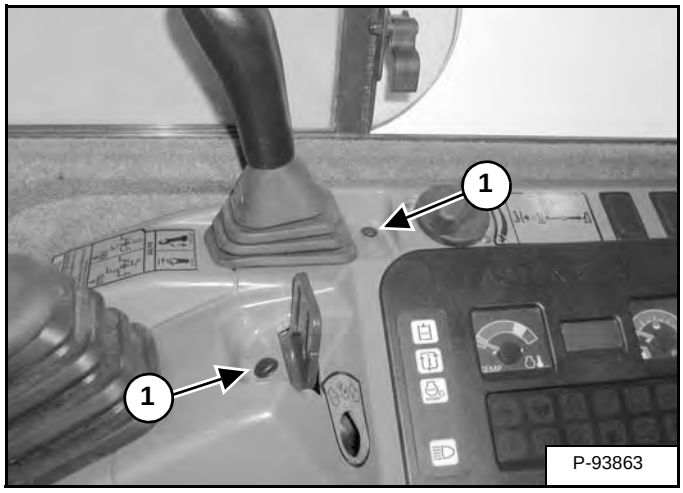


Remove the two bolts (Item 1) and nuts. Remove the arm rest (Item 2) **[Figure 40-50-4]**.

Dealer Copy -- Not for Resale

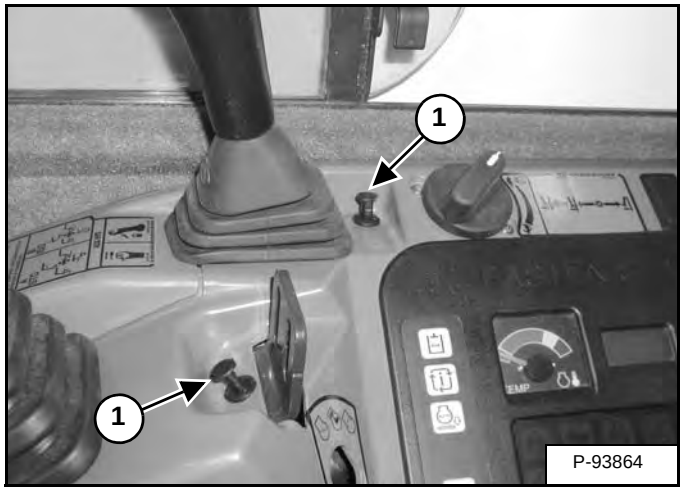
Console Cover Removal And Installation (Cont'd)

Figure 40-50-5



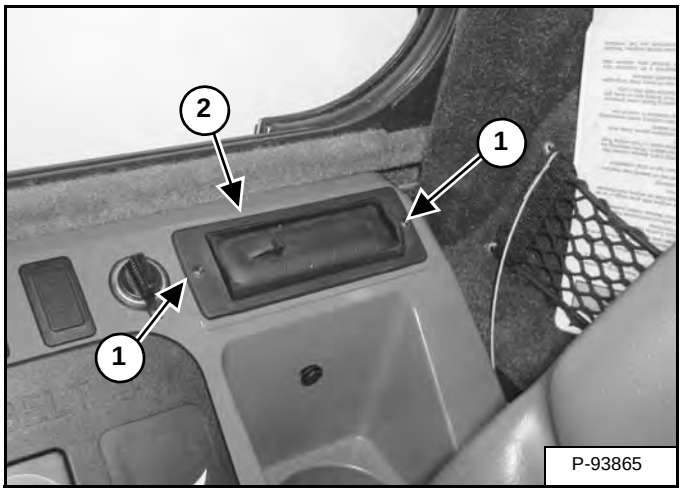
Pull up on the center pin (Item 1) **[Figure 40-50-5]**.

Figure 40-50-6



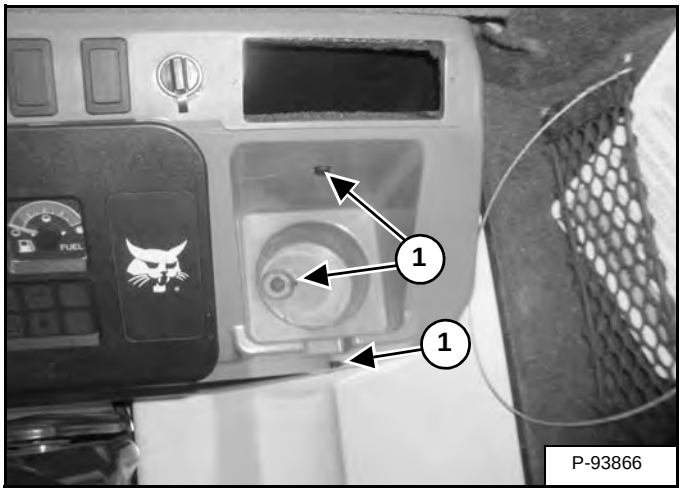
Remove the pin assembly (Item 1) **[Figure 40-50-6]**.

Figure 40-50-7



Remove the two screws (Item 1). Remove the louver (Item 2) **[Figure 40-50-7]**.

Figure 40-50-8

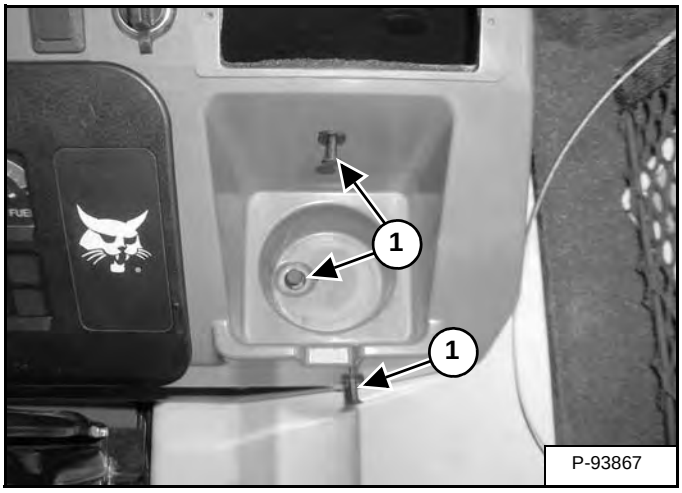


Pull up on the center pin (Item 1) **[Figure 40-50-8]**.

Dealer Copy -- Not for Resale

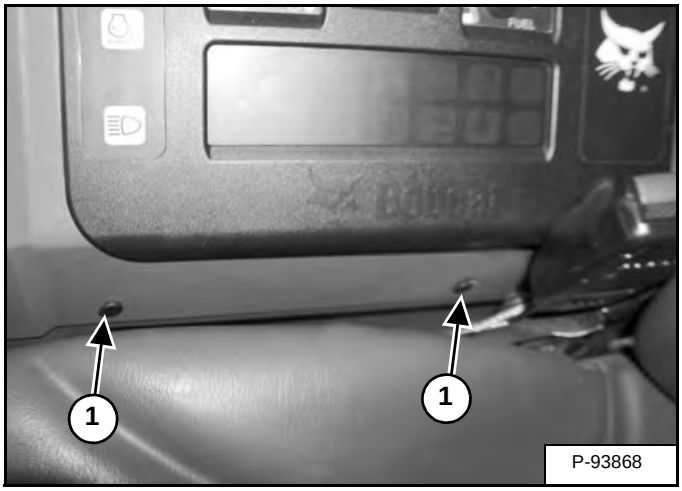
Console Cover Removal And Installation (Cont'd)

Figure 40-50-9



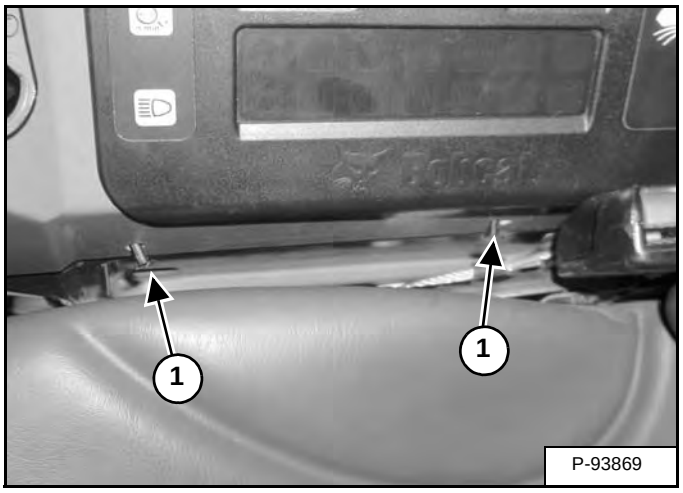
Remove the pin assembly (Item 1) **[Figure 40-50-9]**.

Figure 40-50-10



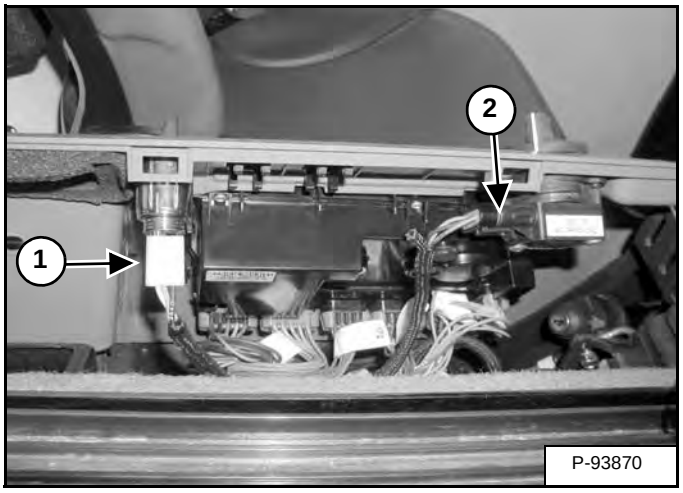
Pull up on the center pin (Item 1) **[Figure 40-50-10]**.

Figure 40-50-11



Remove the pin assembly (Item 1) **[Figure 40-50-11]**.

Figure 40-50-12



Tilt the cover forward and disconnect the auxiliary power outlet wire harness (Item 1) and the engine speed control wire harness (Item 2) **[Figure 40-50-12]**.

Dealer Copy -- Not for Resale

Console Cover Removal And Installation (Cont'd)

Figure 40-50-13

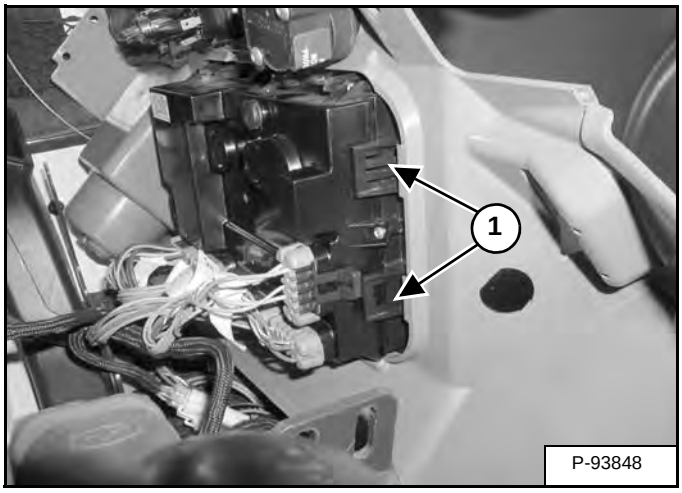
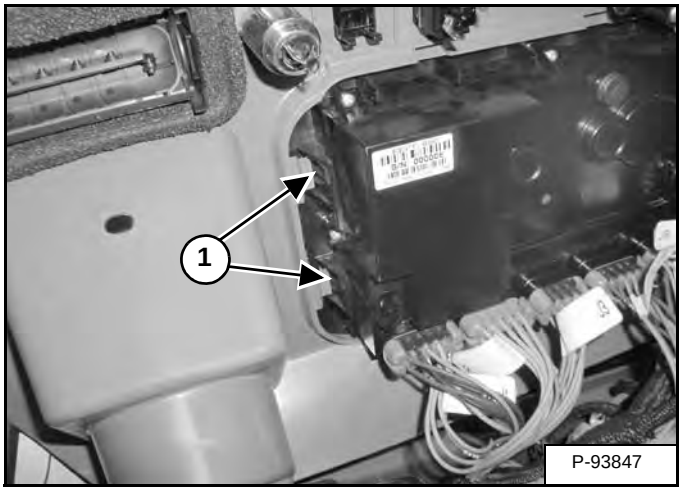
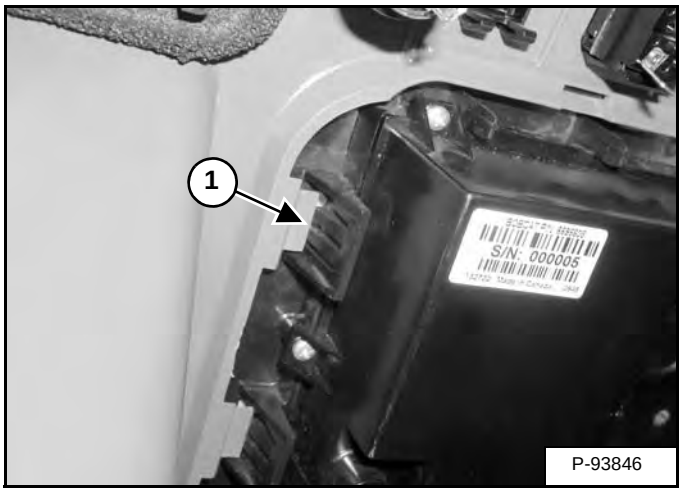


Figure 40-50-14



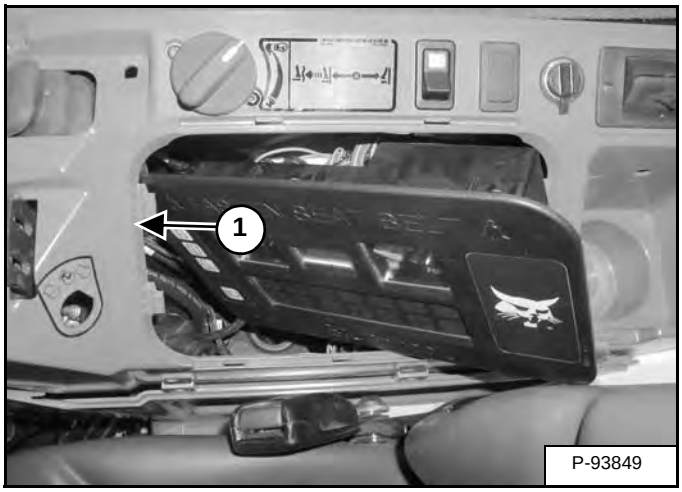
Depress the tabs (Item 1) **[Figure 40-50-13]** and **[Figure 40-50-14]** on the controller.

Figure 40-50-15



Installation: The tabs (Item 1) **[Figure 40-50-15]** must fully engage the console cover.

Figure 40-50-16

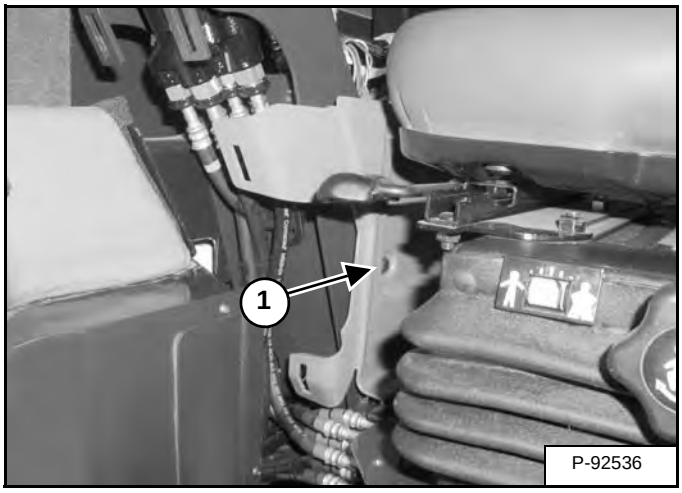


Remove the cover (Item 1) **[Figure 40-50-16]**.

Dealer Copy -- Not for Resale

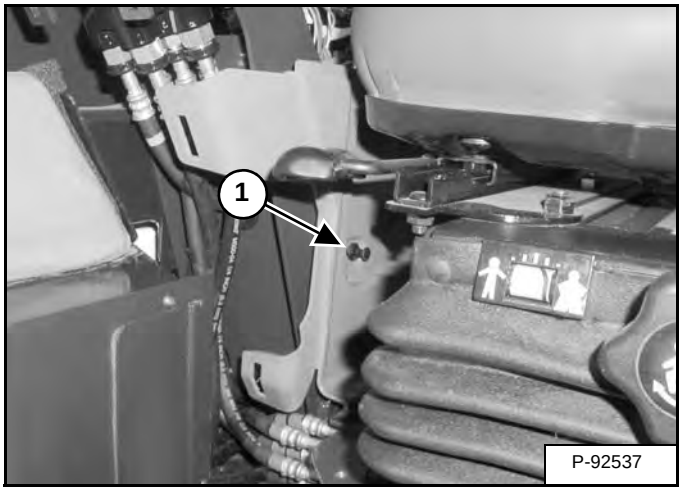
Console Cover Removal And Installation (Cont'd)

Figure 40-50-17



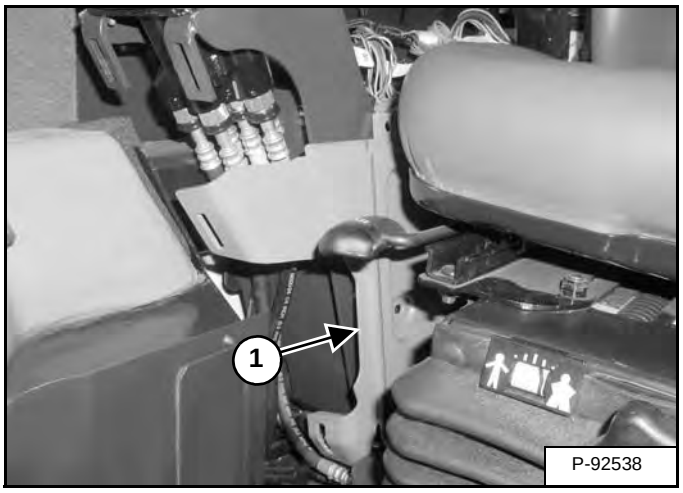
Pull up on the center pin (Item 1) **[Figure 40-50-17]**.

Figure 40-50-18



Remove the pin assembly (Item 1) **[Figure 40-50-18]**.

Figure 40-50-19



Remove the cover (Item 1) **[Figure 40-50-19]**

Dealer Copy -- Not for Resale



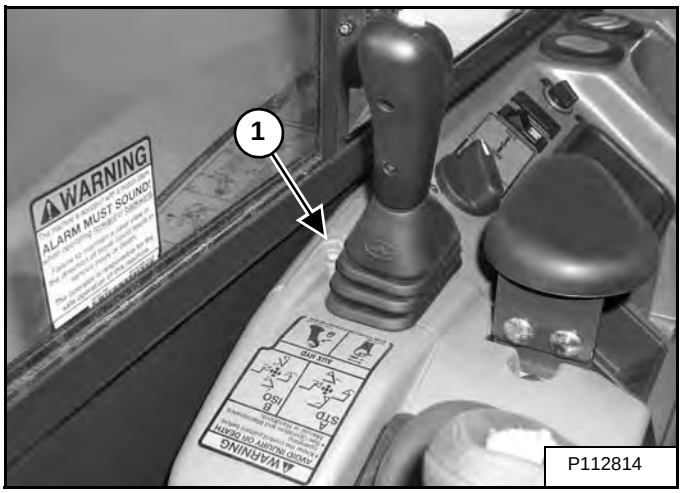
Dealer Copy -- Not for Resale

RIGHT CONSOLE (S/N A93K18000 & ABOVE AND S/N AC2P15000 & ABOVE)

Console Cover Removal And Installation

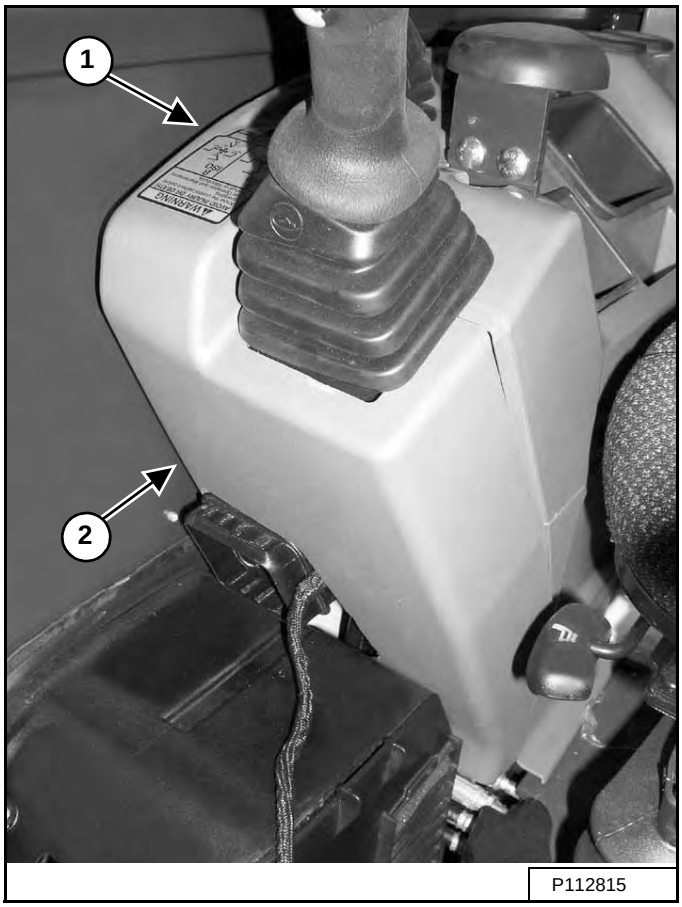
Remove the instrument panel / controller. (See Removal And Installation on Page 50-101-1.)

Figure 40-51-1



Remove the screw (Item 1) **[Figure 40-51-1]**.

Figure 40-51-2



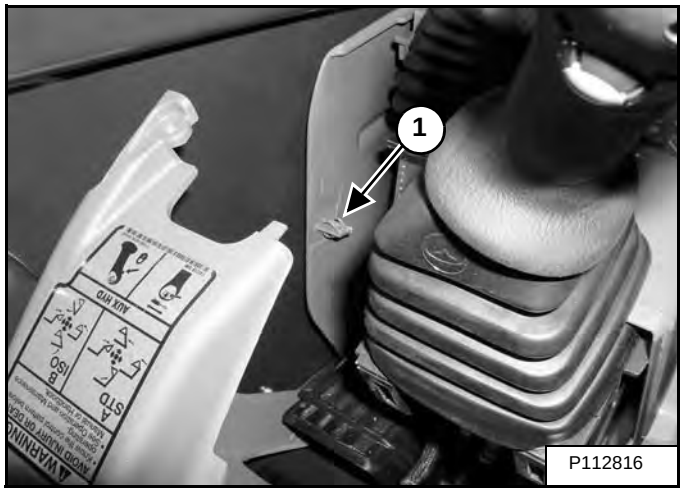
Pull the side cover (Item 1) away from the front cover (Item 2) **[Figure 40-51-2]**.

Pull the front cover (Item 2) **[Figure 40-51-2]** towards the front of the excavator and remove the cover.

Dealer Copy -- Not for Resale

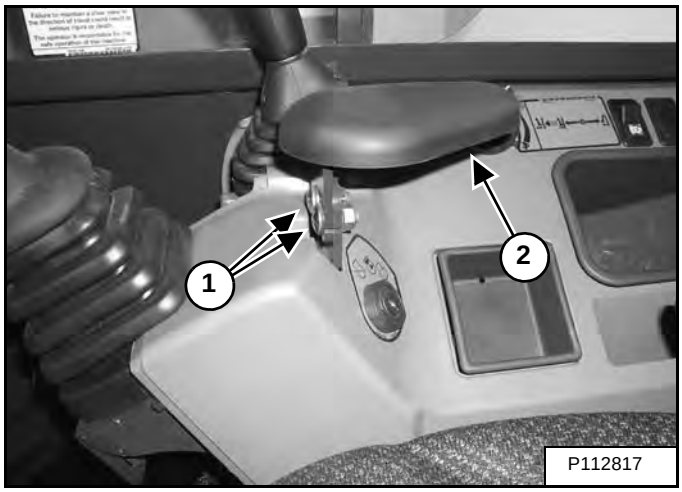
Console Cover Removal And Installation (Cont'd)

Figure 40-51-3



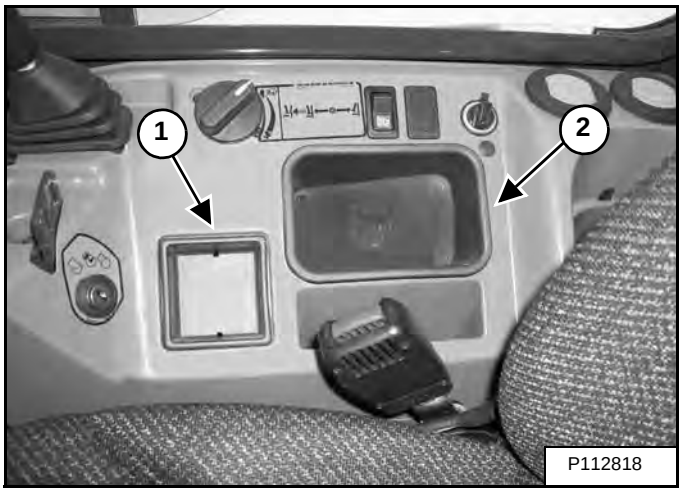
Installation: Install the tab (Item 1) **[Figure 40-51-3]** of the side cover into the front cover.

Figure 40-51-4



Remove the two bolts (Item 1) and nuts. Remove the arm rest (Item 2) **[Figure 40-51-4]**.

Figure 40-51-5



Pull up on and remove the storage containers (Item 1) and (Item 2) **[Figure 40-51-5]**.

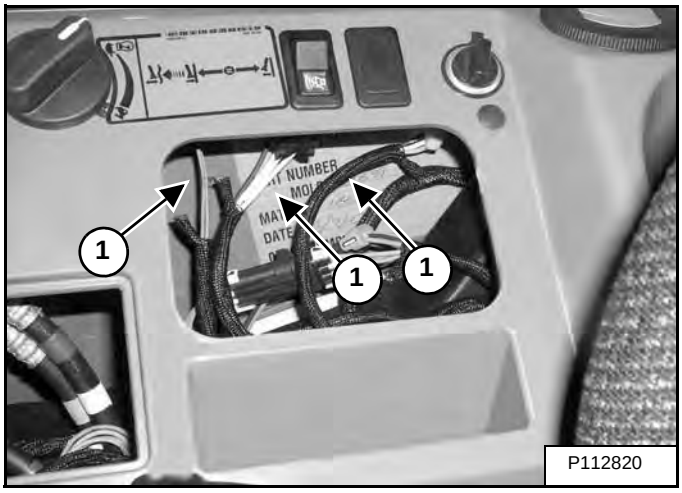
Note: The excavator may be equipped with a radio instead of the storage container (Item 2) [Figure 40-51-5]. Pull up on and remove the radio.

Dealer Copy -- Not for Resale

RIGHT CONSOLE (S/N A93K18000 & ABOVE AND S/N AC2P15000 & ABOVE) (CONT'D)

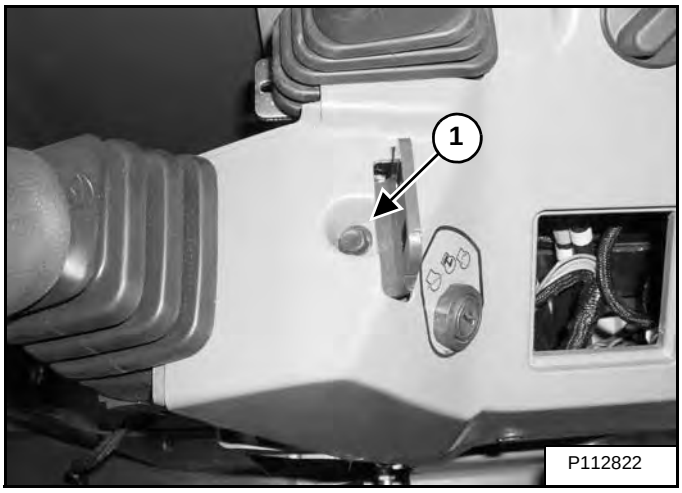
Console Cover Removal And Installation (Cont'd)

Figure 40-51-6



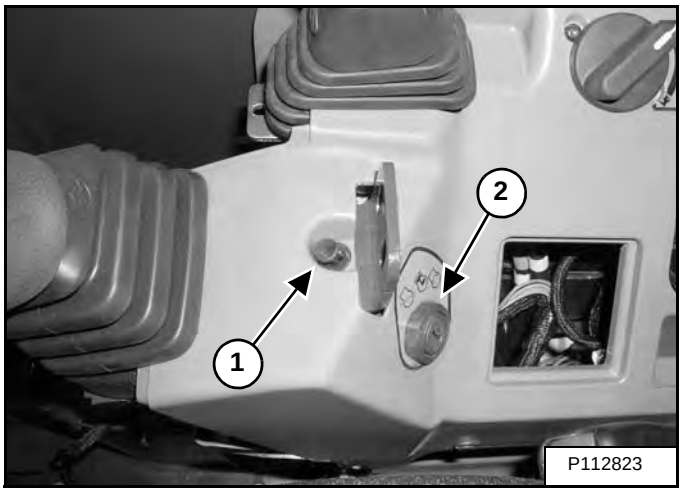
Disconnect the wire harness (Item 1) **[Figure 40-51-6]** from the engine speed control, switches and auxiliary power outlet.

Figure 40-51-7



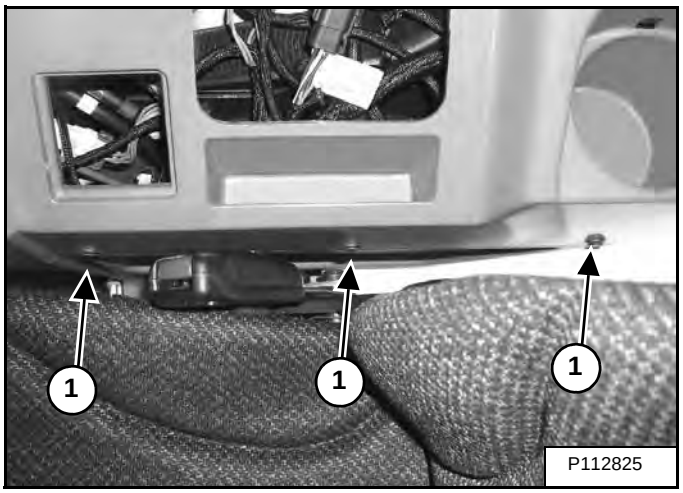
Pull up on the center pin (Item 1) **[Figure 40-51-7]**.

Figure 40-51-8



Remove the pin assembly (Item 1). Remove the nut (Item 2) **[Figure 40-51-8]** from the key switch. Lower the switch into the console.

Figure 40-51-9

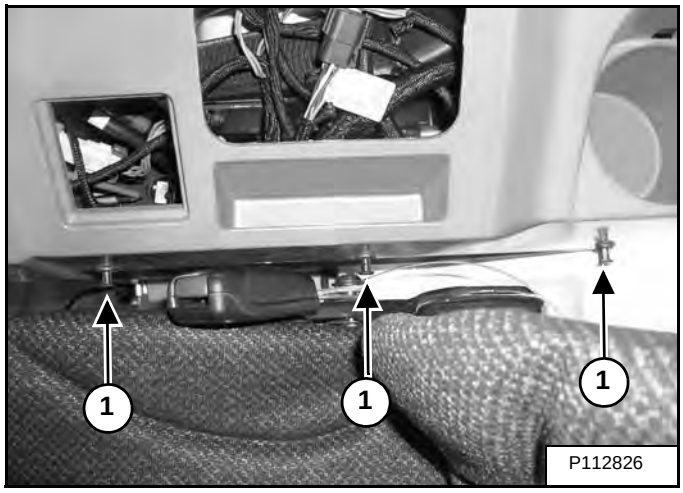


Pull up on the center pin (Item 1) **[Figure 40-51-9]**.

Dealer Copy -- Not for Resale

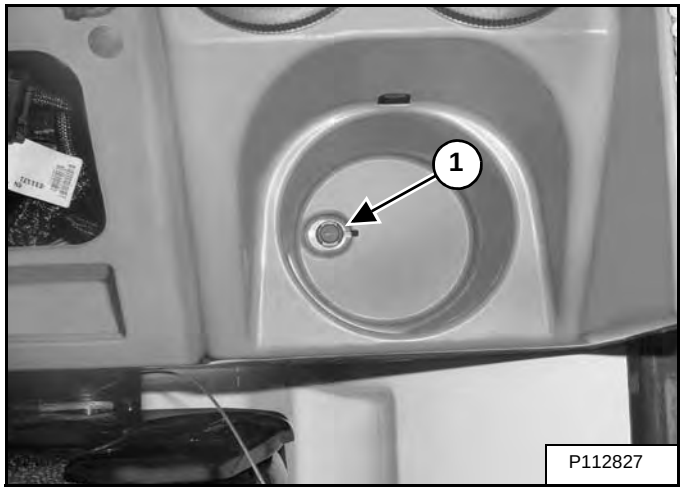
Console Cover Removal And Installation (Cont'd)

Figure 40-51-10



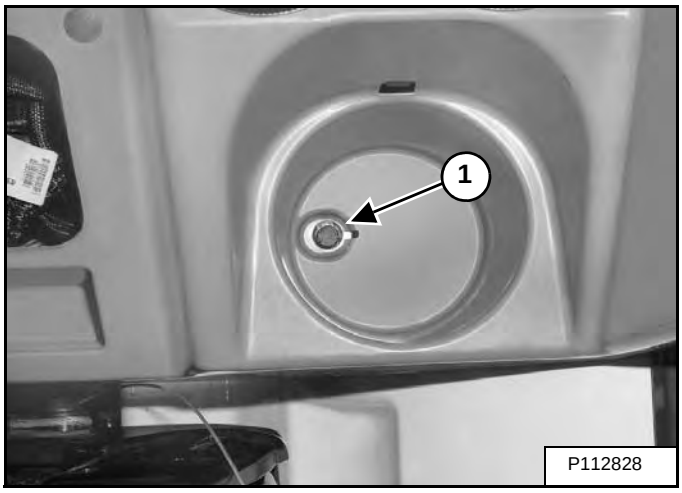
Remove the pin assembly (Item 1) **[Figure 40-51-10]**.

Figure 40-51-11



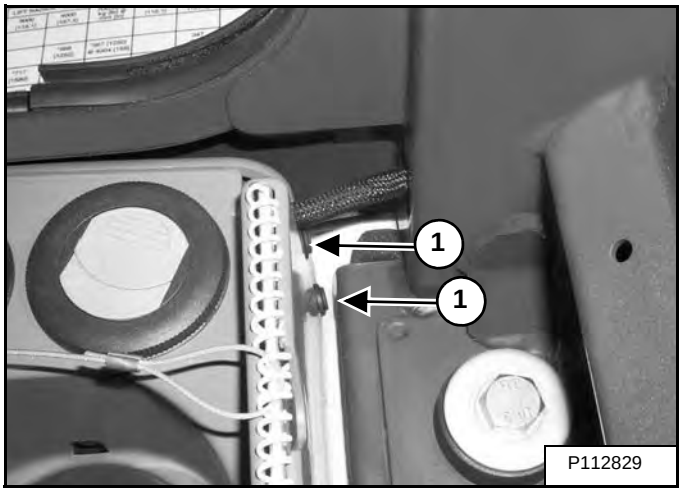
Pull up on the center pin (Item 1) **[Figure 40-51-11]**.

Figure 40-51-12



Remove the pin assembly (Item 1) **[Figure 40-51-12]**.

Figure 40-51-13

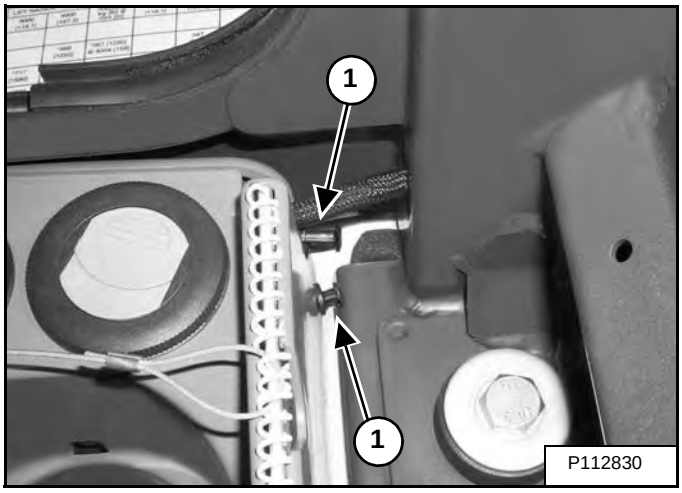


Pull up on the center pin (Item 1) **[Figure 40-51-13]**.

Dealer Copy -- Not for Resale

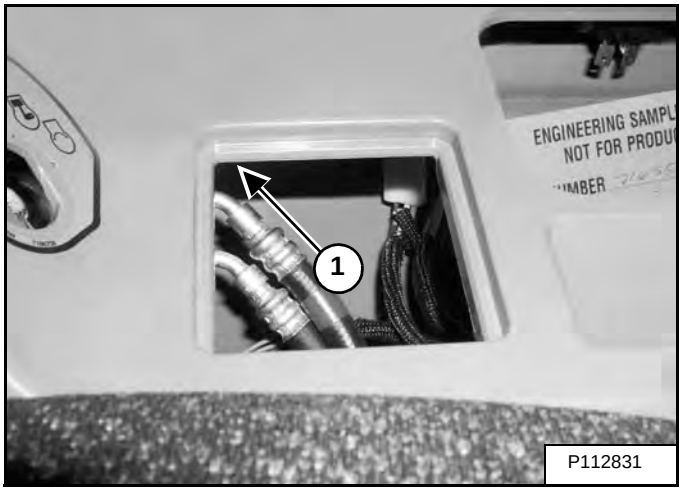
Console Cover Removal And Installation (Cont'd)

Figure 40-51-14



Remove the pin assembly (Item 1) **[Figure 40-51-14]**.

Figure 40-51-15



Loosen the nut (Item 1) **[Figure 40-51-15]** and bolt located under the console cover. Remove the cover.

Dealer Copy -- Not for Resale

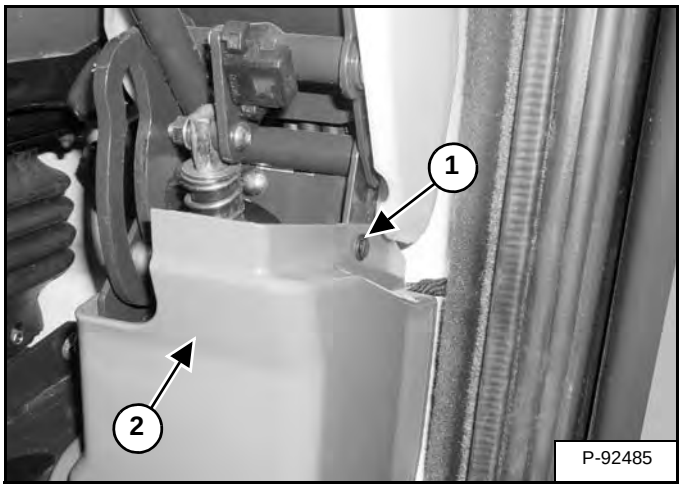


Dealer Copy -- Not for Resale

LEFT CONSOLE

Lower Console Cover Removal And Installation

Figure 40-60-1



Pull out on the center of the plastic fastener assembly (Item 1) **[Figure 40-60-1]** (both sides).

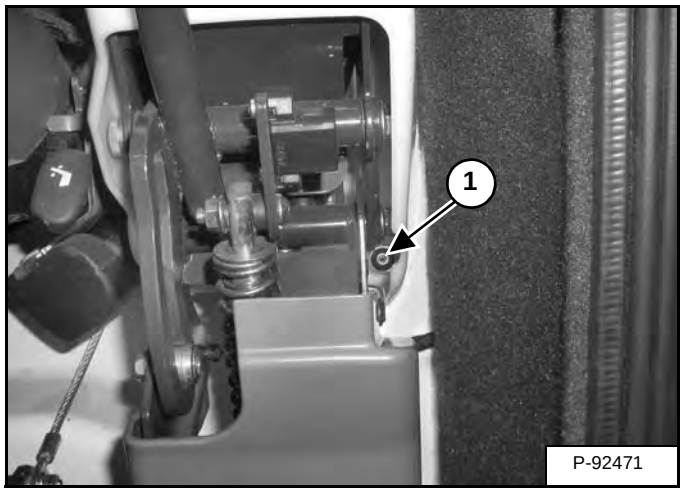
Remove the fastener assembly and cover (Item 2) **[Figure 40-60-1]**.

Dealer Copy -- Not for Resale

LEFT CONSOLE (CONT'D)

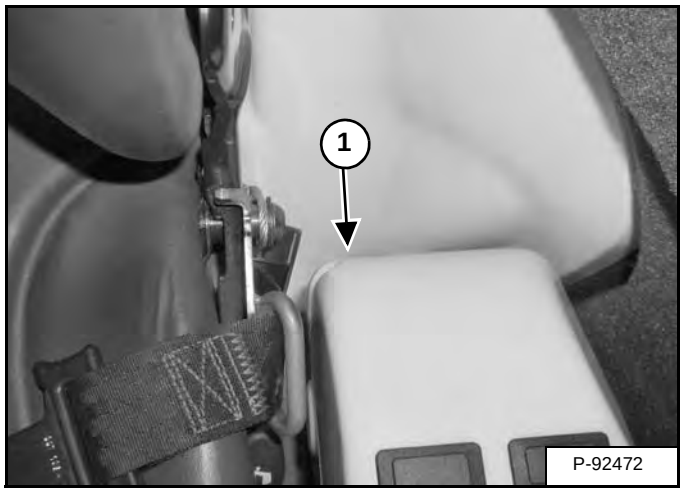
Upper Console Cover Removal And Installation

Figure 40-60-2



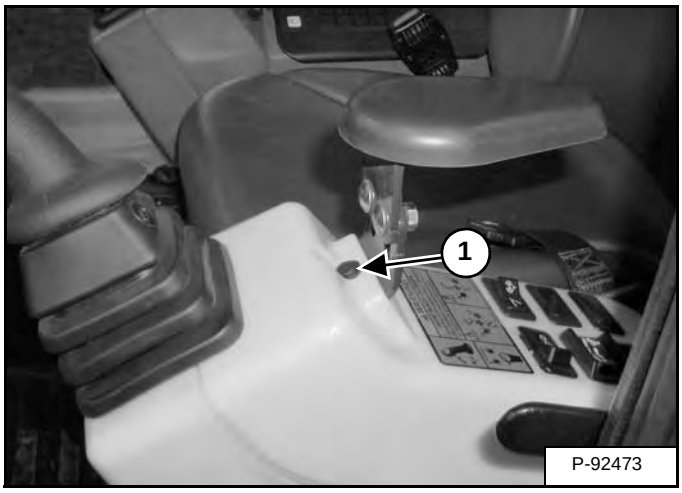
Remove the screw (Item 1) **[Figure 40-60-2]** and lower the console.

Figure 40-60-3



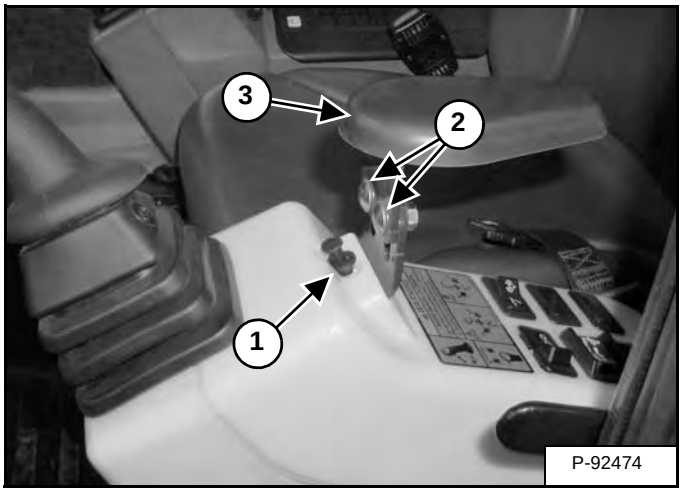
Remove the screw (Item 1) **[Figure 40-60-3]** from the rear of the cover.

Figure 40-60-4



Pull up on the center of the plastic fastener (Item 1) **[Figure 40-60-4]**.

Figure 40-60-5

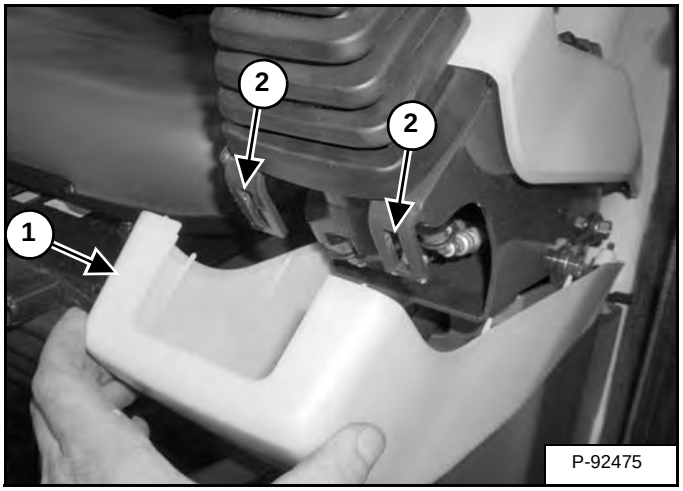


Remove the fastener assembly (Item 1). Remove the bolts (Item 2) and nuts. Remove the arm rest (Item 3) **[Figure 40-60-5]**.

Dealer Copy -- Not for Resale

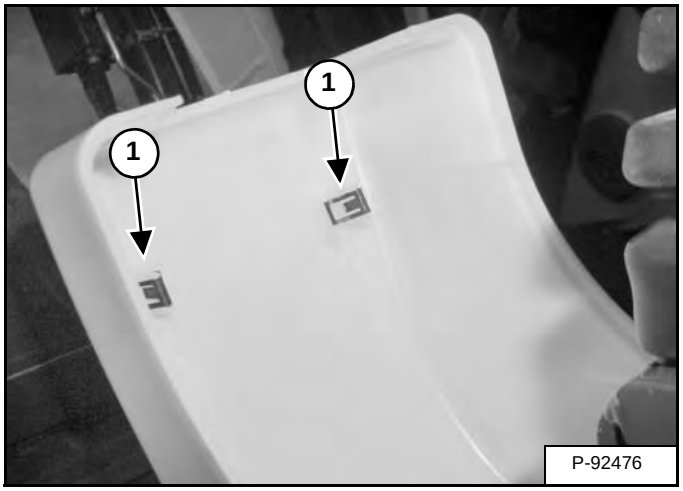
Upper Console Cover Removal And Installation (Cont'd)

Figure 40-60-6



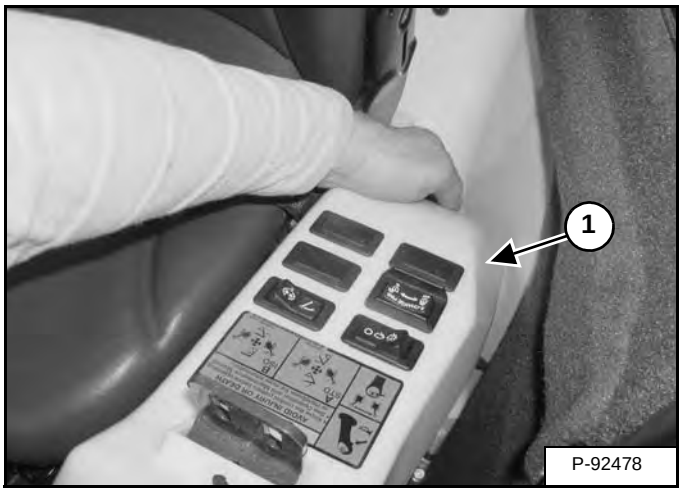
Pull down on the front of the bottom cover (Item 1) **[Figure 40-60-6]**.

Figure 40-60-7



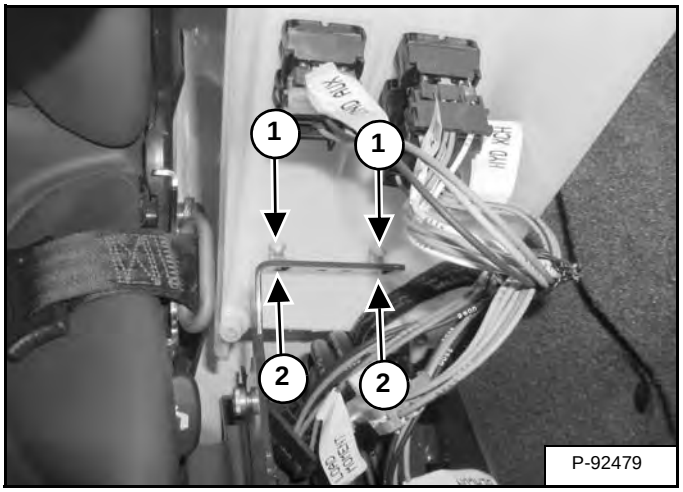
Installation: Push up on the bottom cover until the lock tabs (Item 1) **[Figure 40-60-7]** engage the slots (Item 2) **[Figure 40-60-6]**.

Figure 40-60-8



Pull up on the rear of the top cover (Item 1) **[Figure 40-60-8]**.

Figure 40-60-9

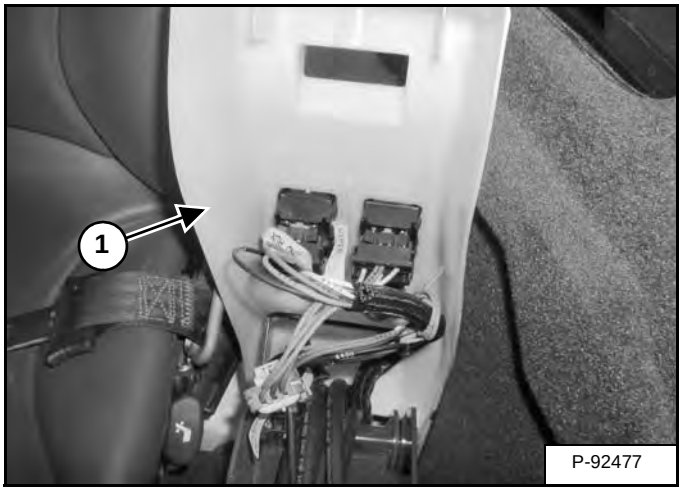


Installation: Push down on the top cover until the lock tabs (Item 1) engage the slots (Item 2) **[Figure 40-60-9]**.

Dealer Copy -- Not for Resale

Upper Console Cover Removal And Installation (Cont'd)

Figure 40-60-10



Disconnect the wire harness from the switches and remove the top cover (Item 1) **[Figure 40-60-10]**.

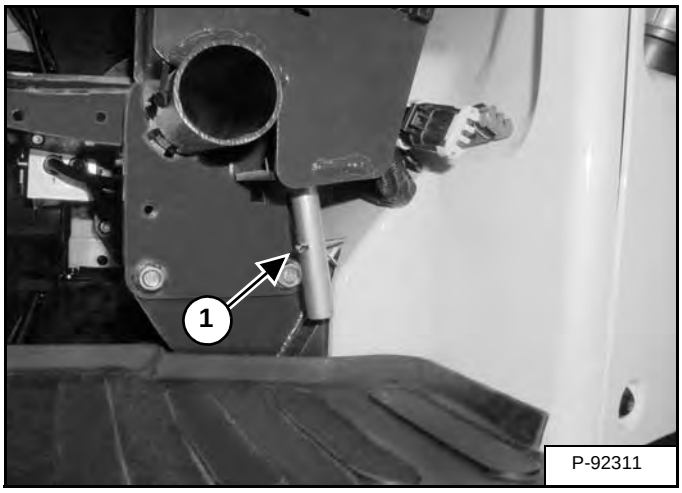
Dealer Copy -- Not for Resale

Compression Spring Removal And Installation

Remove the lower console cover. (See Lower Console Cover Removal And Installation on Page 40-60-1.)

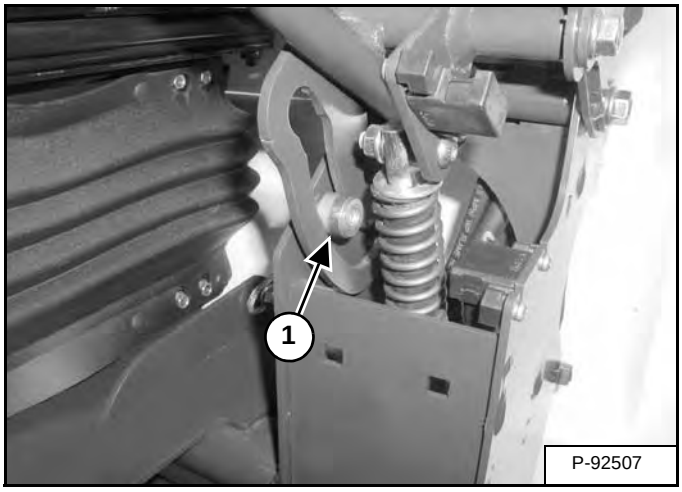
Lower the console.

Figure 40-60-11



Install a pin (Item 1) **[Figure 40-60-11]** in the bottom of the compression spring rod.

Figure 40-60-12

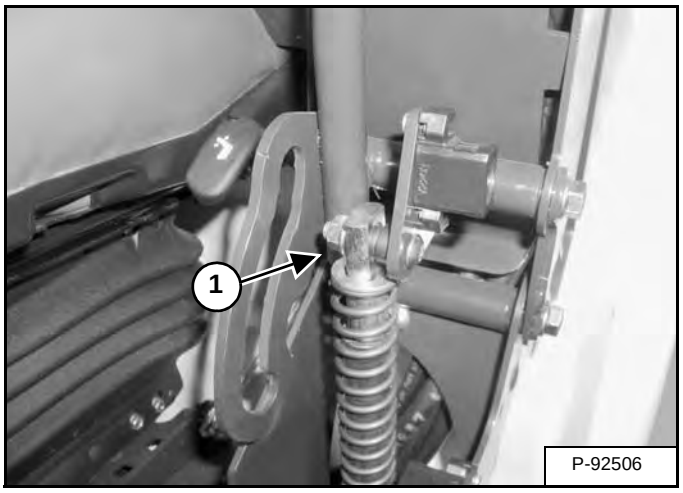


Support the console in the raised position. Remove the bolt and roller (Item 1) **[Figure 40-60-12]**.

Lower the console and remove the pin from the rod.

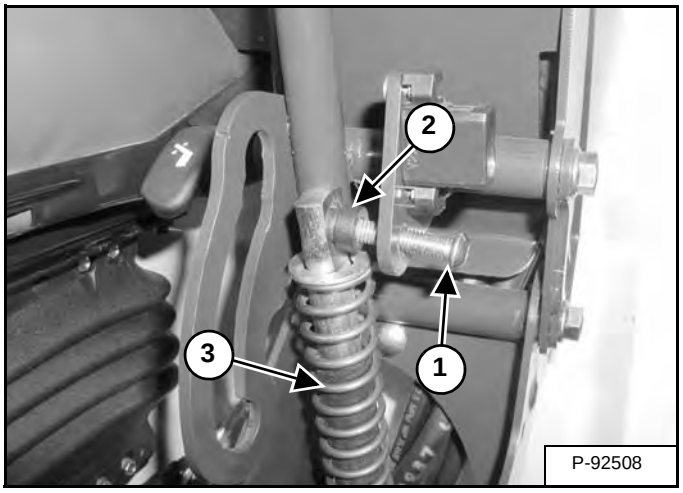
Raise and support the console.

Figure 40-60-13



Remove the nut (Item 1) **[Figure 40-60-13]**.

Figure 40-60-14

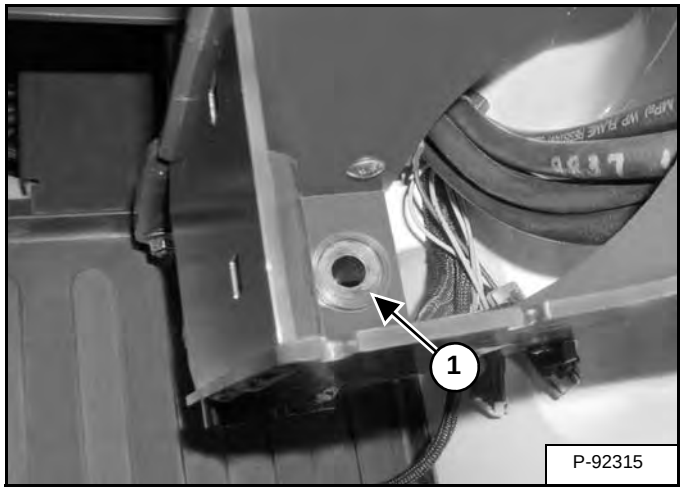


Remove the bolt (Item 1) and bushing (Item 2). Remove the spring assembly (Item 3) **[Figure 40-60-14]** from the console.

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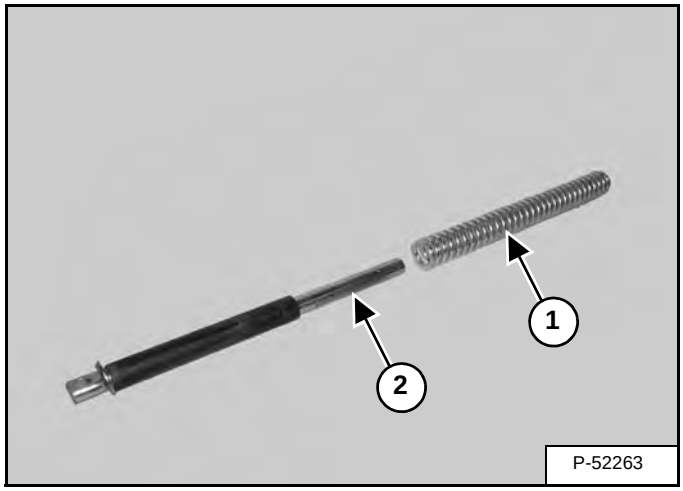
Compression Spring Removal And Installation (Cont'd)

Figure 40-60-15



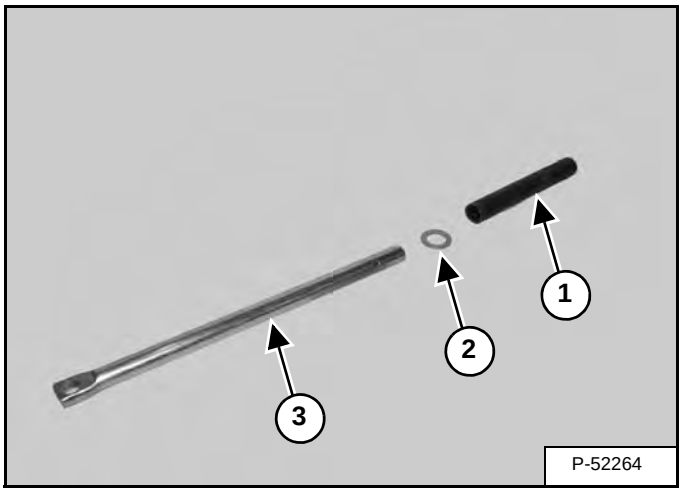
Remove the bushing (Item 1) **[Figure 40-60-15]** from the bottom of the console.

Figure 40-60-16



Remove the spring (Item 1) from the shaft (Item 2) **[Figure 40-60-16]**.

Figure 40-60-17



Remove the sleeve (Item 1) and washer (Item 2) from the shaft (Item 3) **[Figure 40-60-17]**.

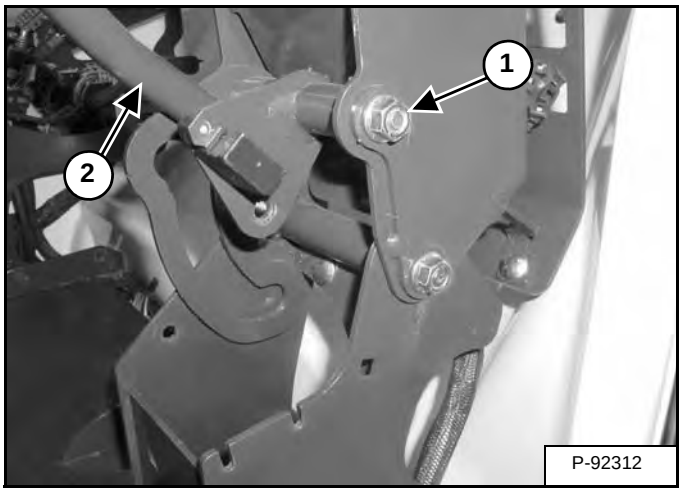
Dealer Copy -- Not for Resale

Lock Lever Removal And Installation

Remove the lower console cover. (See Console Removal And Installation on Page 40-60-7.)

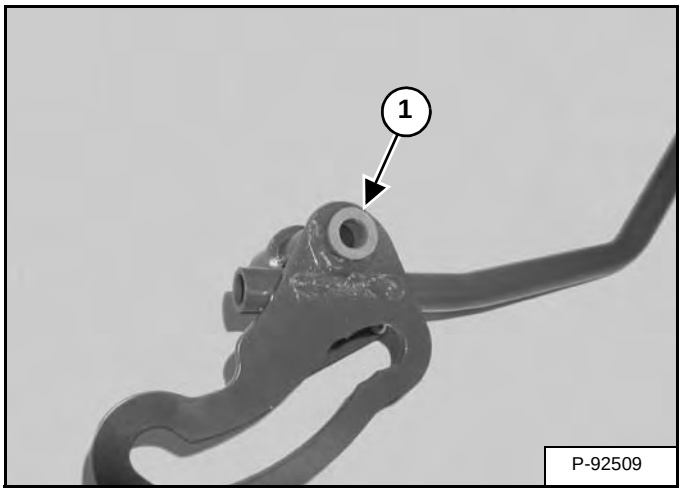
Remove the compression spring assembly from the console. (See Compression Spring Removal And Installation on Page 40-60-5.)

Figure 40-60-18



Remove the nut (Item 1) and bolt. Remove the lock lever (Item 2) **[Figure 40-60-18]**.

Figure 40-60-19



Remove the bushing (Item 1) **[Figure 40-60-19]** from both sides of the lever.

Console Removal And Installation

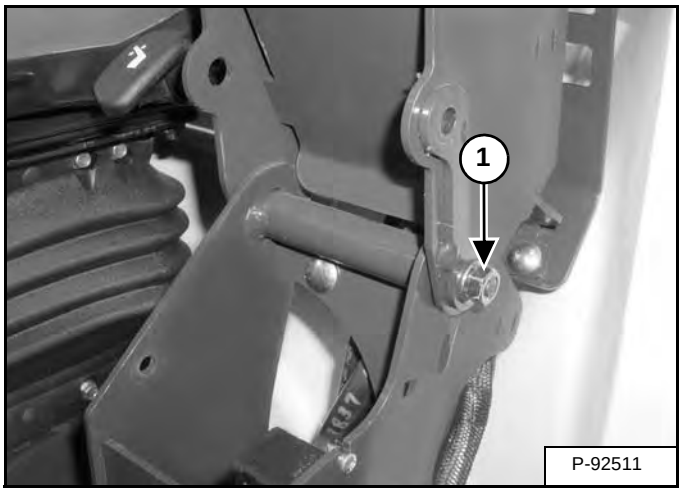
Remove the upper console cover. (See Upper Console Cover Removal And Installation on Page 40-60-2.)

Remove the lower console cover. (See Lower Console Cover Removal And Installation on Page 40-60-1.)

Remove the left control lever (Joystick). (See Joystick Assembly Removal And Installation on Page 20-120-4.)

Remove the lock lever. (See Lock Lever Removal And Installation on Page 40-60-7.)

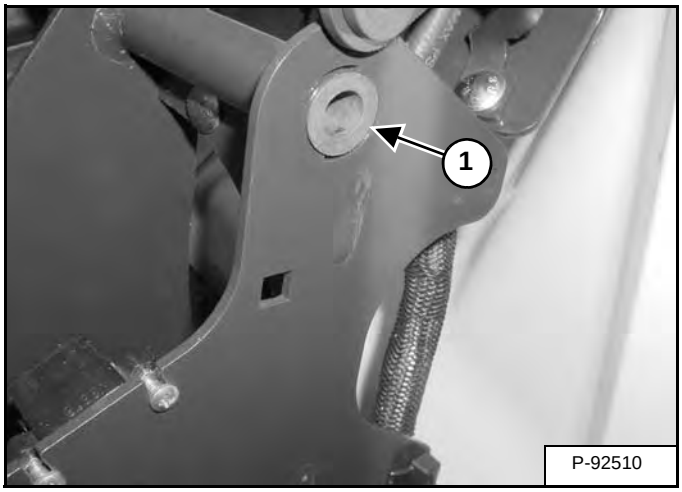
Figure 40-60-20



Remove the nut (Item 1) **[Figure 40-60-20]** and bolt.

Remove the console.

Figure 40-60-21



Remove the bushings (Item 1) **[Figure 40-60-21]**.

Dealer Copy -- Not for Resale

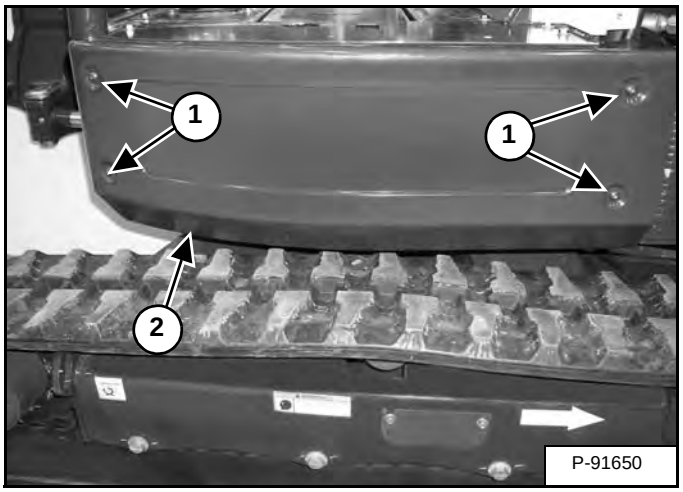


Dealer Copy -- Not for Resale

LEFT UPPERSTRUCTURE COVER

Removal And Installation

Figure 40-70-1



Remove the bolts (Item 1) and remove the cover (Item 2) **[Figure 40-70-1]**.

Dealer Copy -- Not for Resale

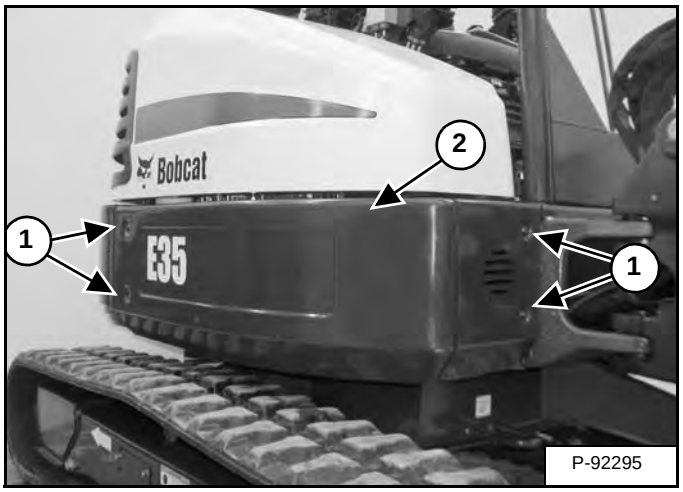


Dealer Copy -- Not for Resale

RIGHT UPPERSTRUCTURE COVER

Removal And Installation

Figure 40-80-1



Remove the bolts (Item 1). Remove the cover (Item 2) **[Figure 40-80-1]**.

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

COUNTERWEIGHT

Removal And Installation

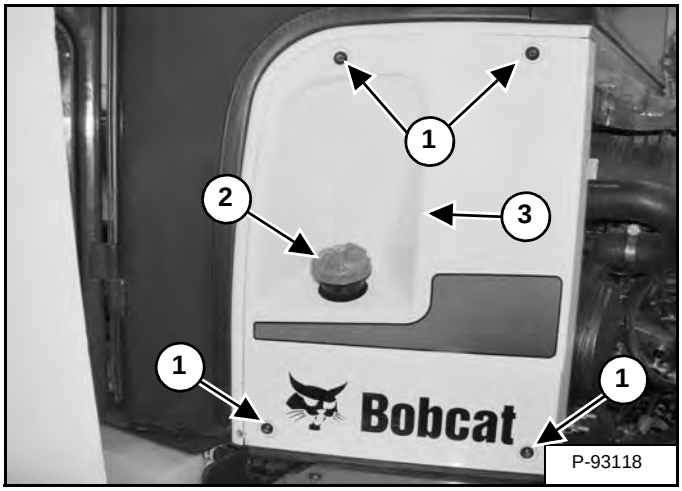
Remove the left upper structure cover. (See Removal And Installation on Page 40-70-1.)

Remove the right upper structure cover. (See Removal And Installation on Page 40-80-1.)

Remove the tailgate. (See Removal And Installation on Page 40-190-1.)

Remove the long arm counterweight (if equipped). (See Long Arm Counterweight Removal And Installation on Page 40-90-4.)

Figure 40-90-1



Remove the four bolts (Item 1), fuel cap (Item 2) and side cover (Item 3) **[Figure 40-90-1]**.

Reinstall the fuel cap (Item 2) **[Figure 40-90-1]**.

NOTE: Reinstall the fuel cap to prevent any contamination from entering the fuel tank.

Figure 40-90-2

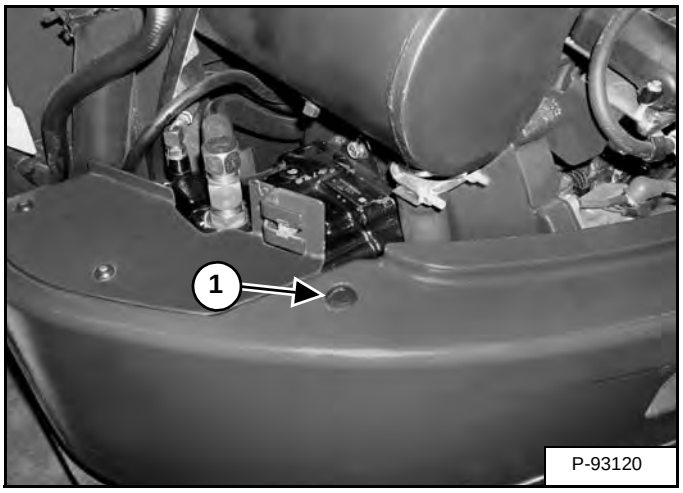
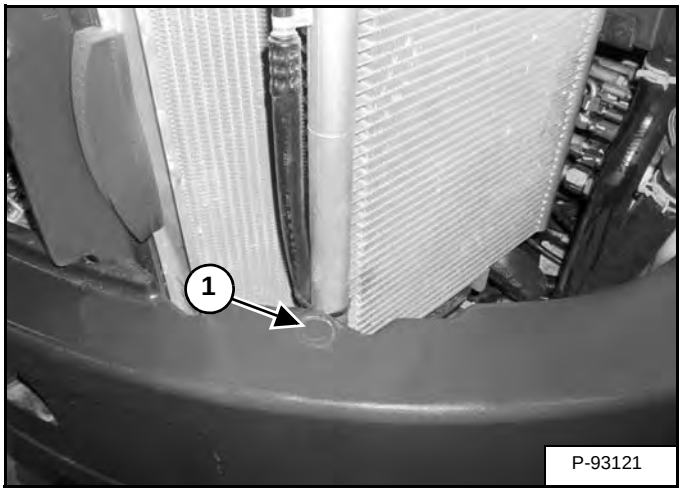


Figure 40-90-3



Remove the plugs (Item 1) **[Figure 40-90-2]** and **[Figure 40-90-3]**.

Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

Figure 40-90-4

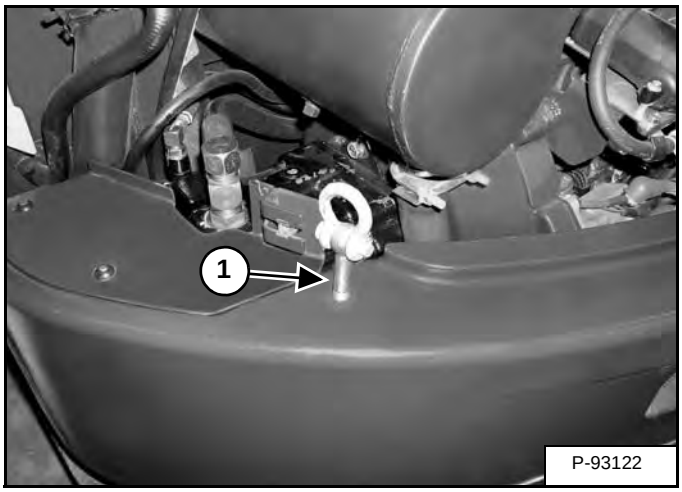
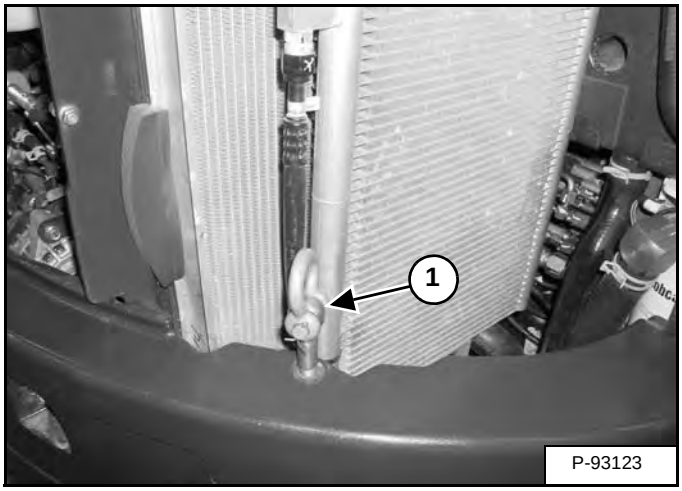


Figure 40-90-5



Install lifting brackets (Item 1) **[Figure 40-90-4]** and **[Figure 40-90-5]**.

Figure 40-90-6

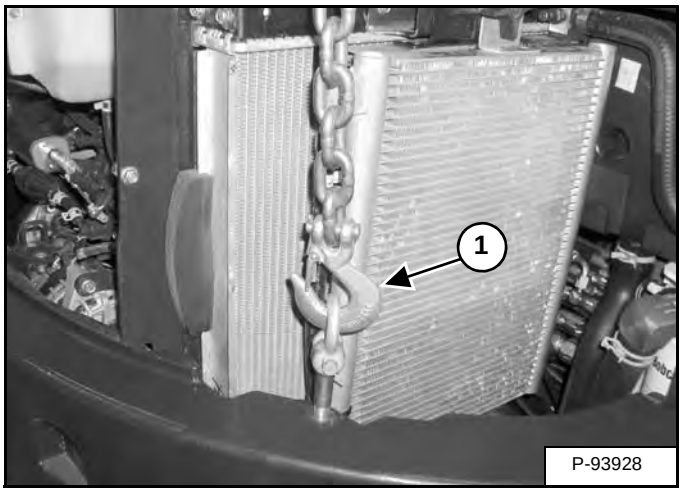
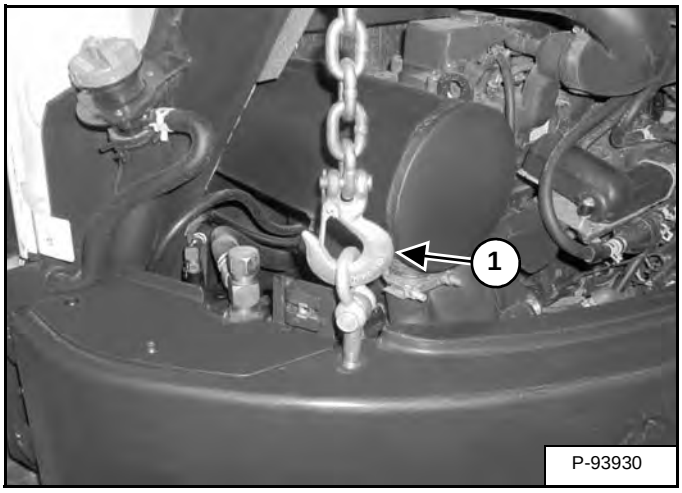


Figure 40-90-7



Attach a chain (Item 1) **[Figure 40-90-6]** and **[Figure 40-90-7]** and hoist to the lifting brackets.

Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

Figure 40-90-8

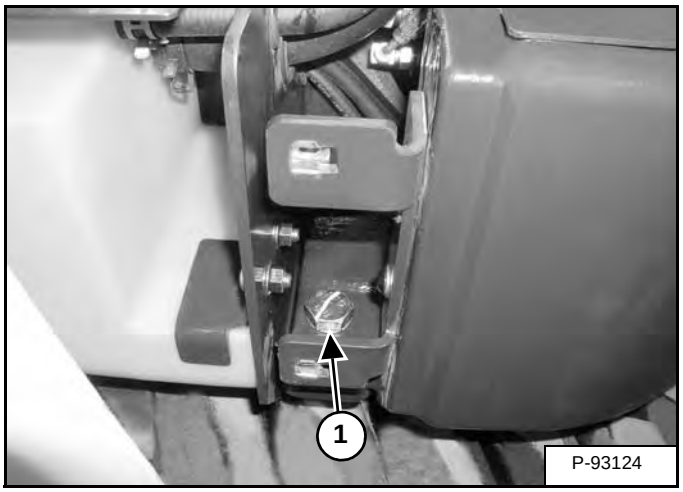


Figure 40-90-9

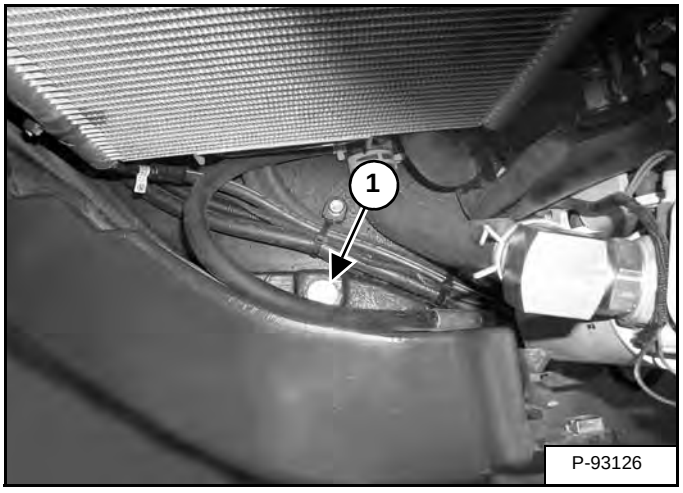
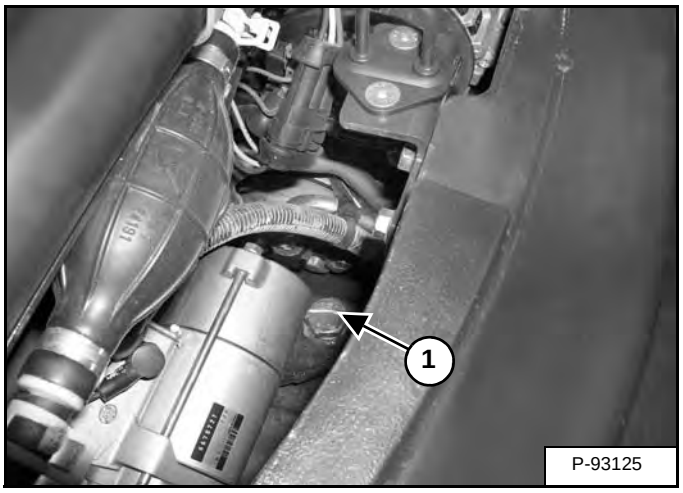


Figure 40-90-10



Remove the bolts (Item 1) **[Figure 40-90-8]**, **[Figure 40-90-9]** and **[Figure 40-90-10]**.

Installation: Tighten the bolts to 370 - 410 N•m (275 - 300 ft-lb) torque.

Remove the counterweight.

Dealer Copy -- Not for Resale

Long Arm Counterweight Removal And Installation

Remove the tailgate. (See Removal And Installation on Page 40-190-1.)

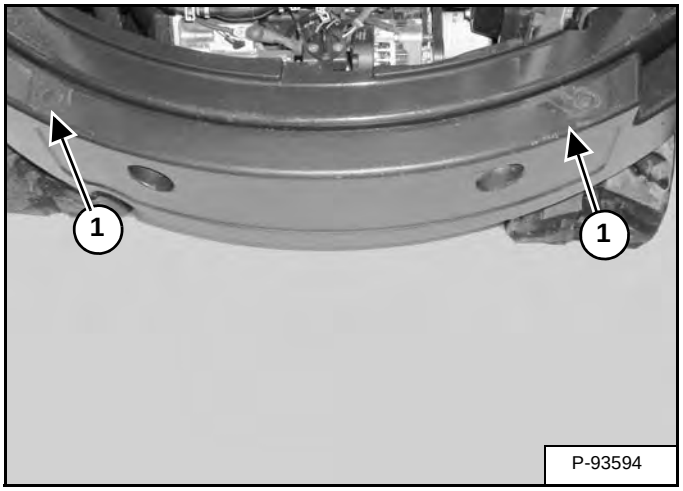
⚠ WARNING

AVOID INJURY OR DEATH

Never get under the counterweights during the installation or removal procedure.

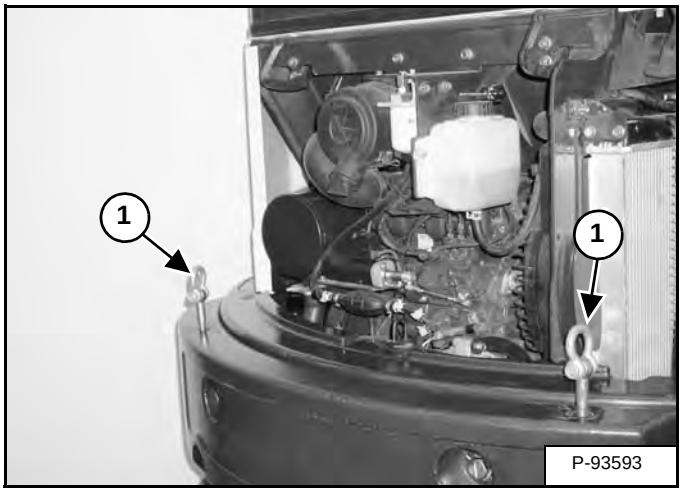
W-2383-1000

Figure 40-90-11



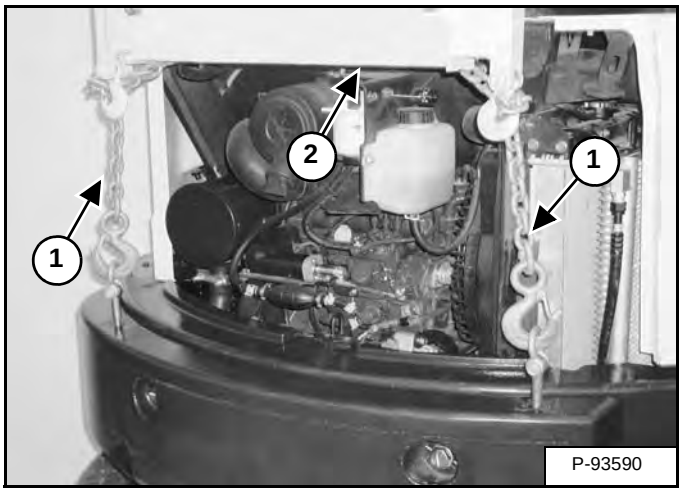
Remove the plugs (Item 1) **[Figure 40-90-1]**.

Figure 40-90-12



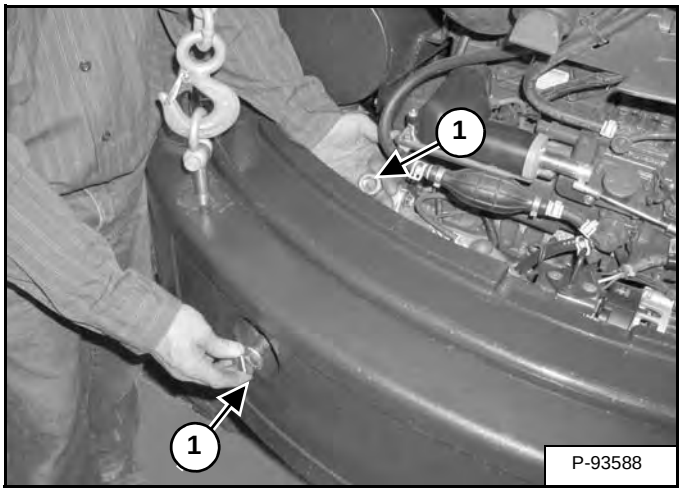
Install lifting brackets (Item 1) **[Figure 40-90-2]**.

Figure 40-90-13



Attach a chain (Item 1) and hoist (Item 2) **[Figure 40-90-3]** to the lifting brackets.

Figure 40-90-14



Remove the bolts (Item 1) **[Figure 40-90-4]**.

Installation: Tighten the bolts to 370 - 410 N•m (275 - 300 ft-lb) torque.

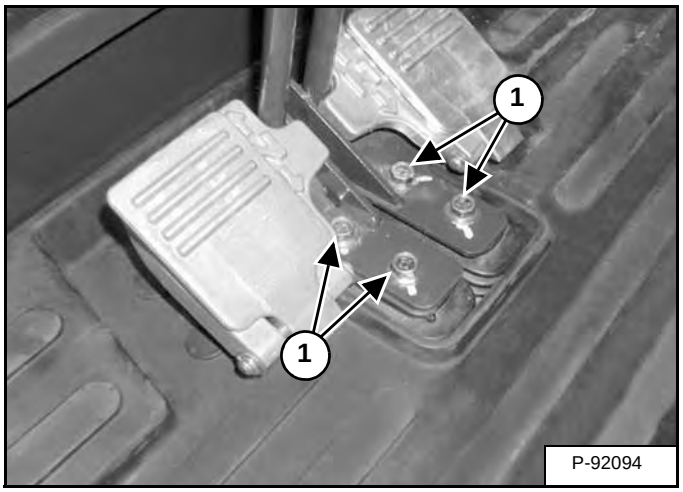
Remove the counterweight.

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TRAVEL LEVERS AND PEDALS

Removal And Installation

Figure 40-100-1

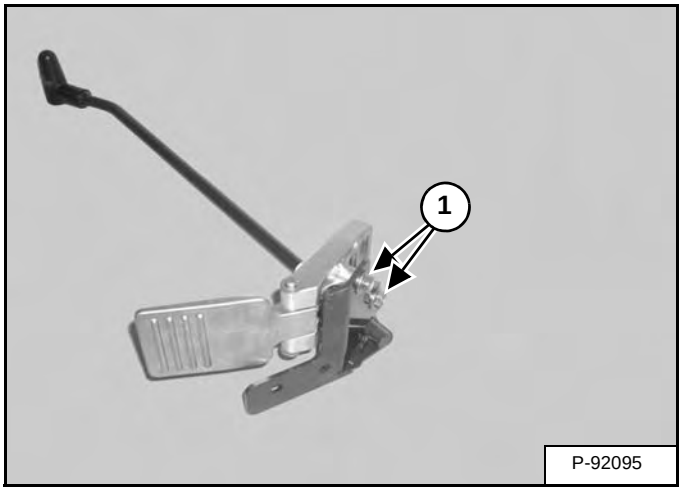


Remove the bolts (Item 1) **[Figure 40-100-1]**.

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

Disassembly And Assembly

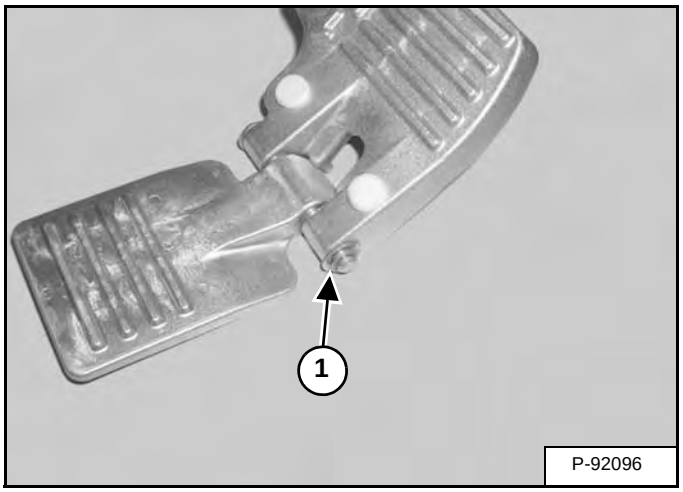
Figure 40-100-2



Remove the bolts (Item 1) **[Figure 40-100-2]**.

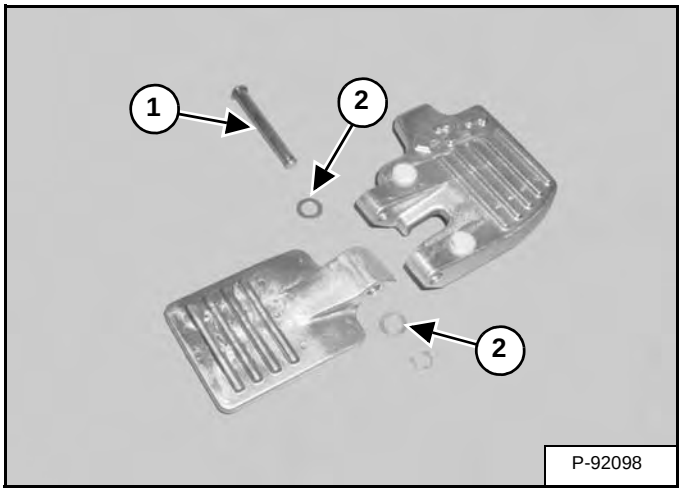
Installation: Tighten the bolts to 43 - 47 N•m (32 - 35 ft-lb) torque.

Figure 40-100-3



Remove the clip (Item 1) **[Figure 40-100-3]**.

Figure 40-100-4



Remove the pin (Item 1) and washers (Item 2) **[Figure 40-100-4]**. Separate the foot pedal.

Dealer Copy -- Not for Resale

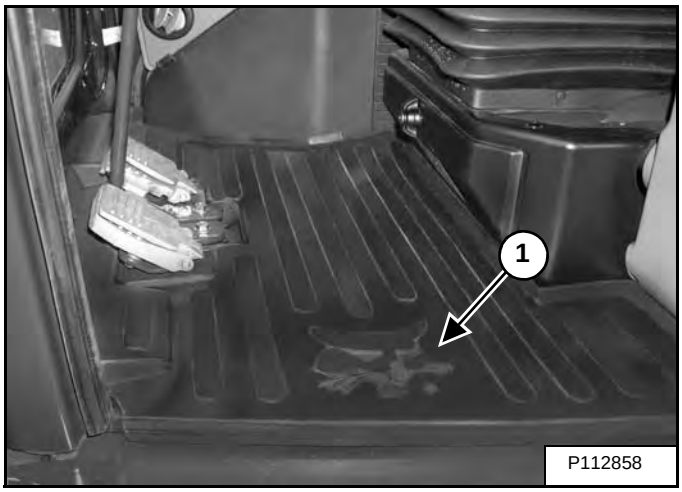


Dealer Copy -- Not for Resale

FLOOR MAT

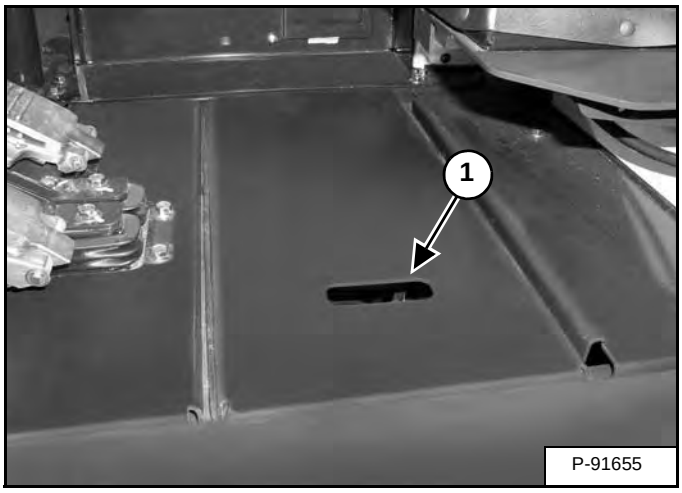
Removal And Installation

Figure 40-110-1



Lift up on and remove the floor mat (Item 1) **[Figure 40-110-1]**.

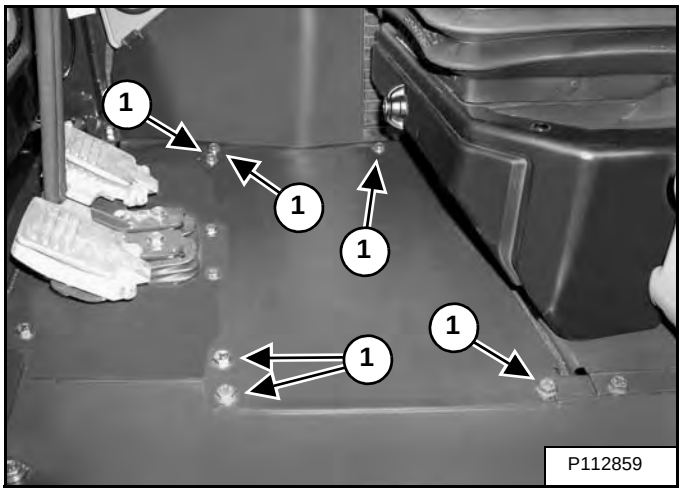
Figure 40-110-2



Early Models

Lift up on and remove the floor plate (Item 1) **[Figure 40-110-2]**.

Figure 40-110-3



Later Models

Remove the bolts (Item 1) **[Figure 40-110-3]** and remove the floor plate.

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

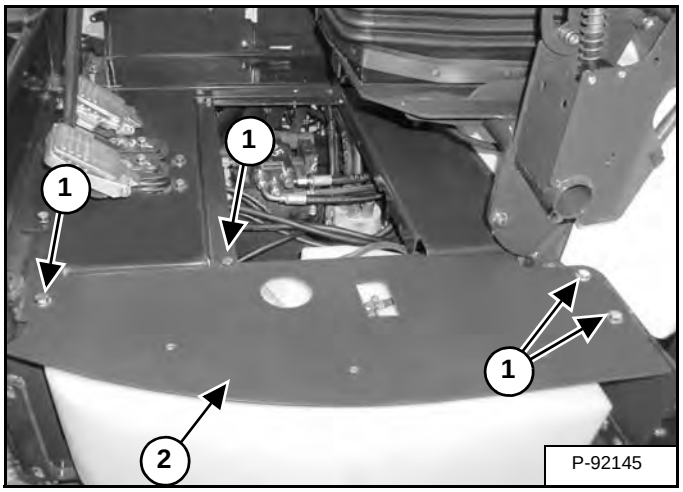
FUEL TANK

Removal And Installation (Canopy Equipped Excavator)

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

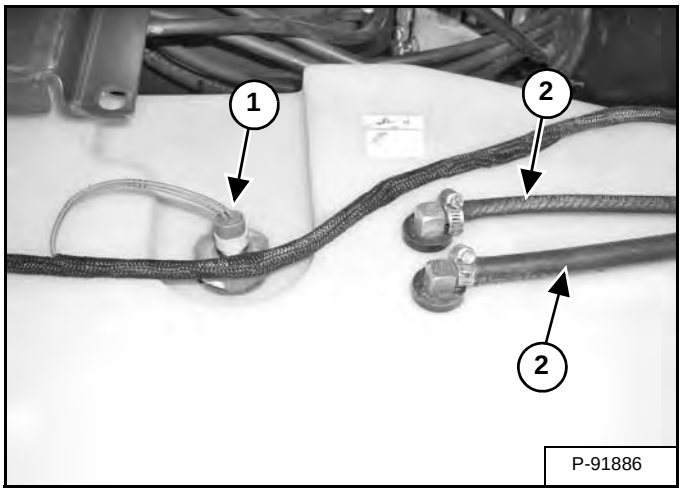
Remove the left upperstructure cover. (See Removal And Installation on Page 40-70-1.)

Figure 40-120-1



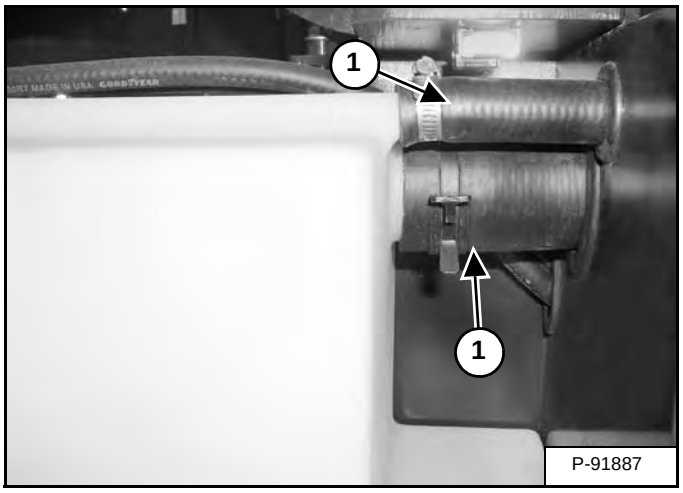
Remove the bolts (Item 1) and plate (Item 2) **[Figure 40-120-1]**.

Figure 40-120-2



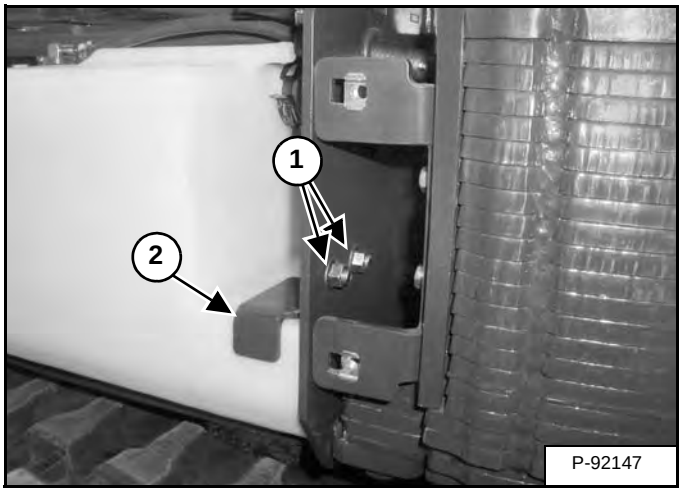
Disconnect the wire harness (Item 1). Remove the hoses (Item 2) **[Figure 40-120-2]**.

Figure 40-120-3



Remove the two hoses (Item 1) **[Figure 40-120-3]**.

Figure 40-120-4



Remove the two nuts (Item 1) and bracket (Item 2) **[Figure 40-120-4]**.

Remove the tank.

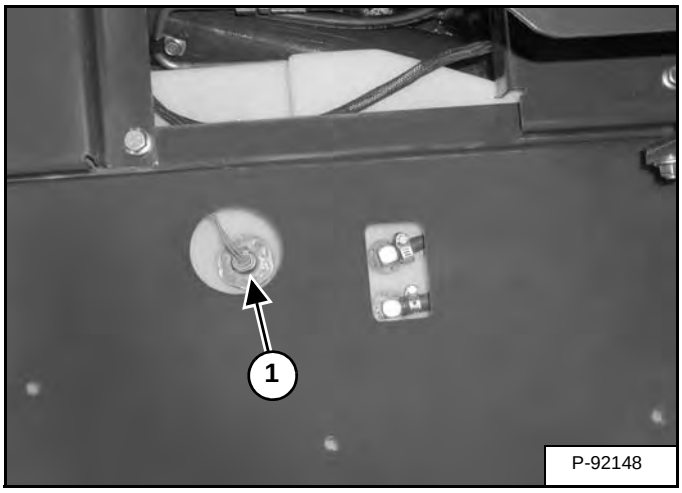
Dealer Copy -- Not for Resale

Removal And Installation (Cab Equipped Excavator)

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

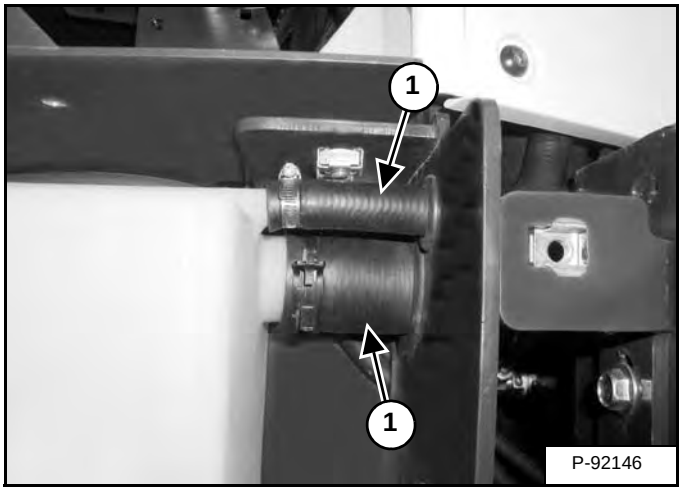
Remove the left upperstructure cover. (See Removal And Installation on Page 40-70-1.)

Figure 40-120-5



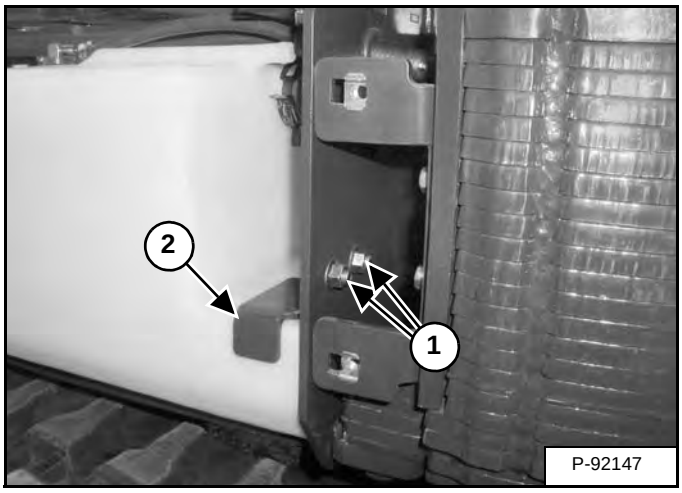
Disconnect the wire harness (Item 1) **[Figure 40-120-5]**.

Figure 40-120-6



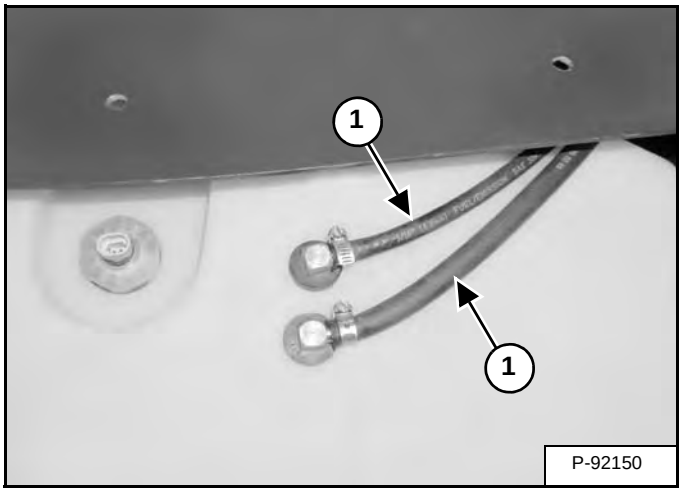
Remove the two hoses (Item 1) **[Figure 40-120-6]**.

Figure 40-120-7



Remove the two nuts (Item 1) and bracket (Item 2) **[Figure 40-120-7]**.

Figure 40-120-8

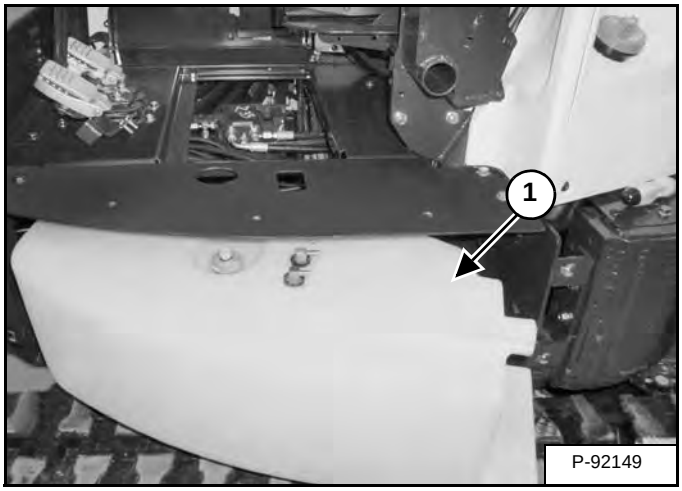


Slide the tank out of the side of the excavator and remove the two hoses (Item 1) **[Figure 40-120-8]**.

Dealer Copy -- Not for Resale

Removal And Installation (Cab Equipped Excavator) (Cont'd)

Figure 40-120-9



Remove the tank (Item 1) **[Figure 40-120-9]**.

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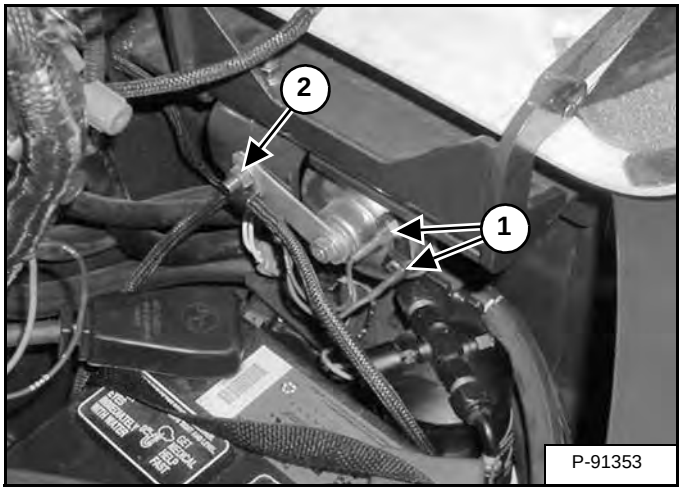
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HORN

Removal And Installation

Open the right side cover.

Figure 40-130-1



Disconnect the wire harness (Item 1) **[Figure 40-130-1]**.

Remove the nut (Item 2) **[Figure 40-130-1]** and remove the horn.

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Dealer Copy -- Not for Resale

SWING FRAME

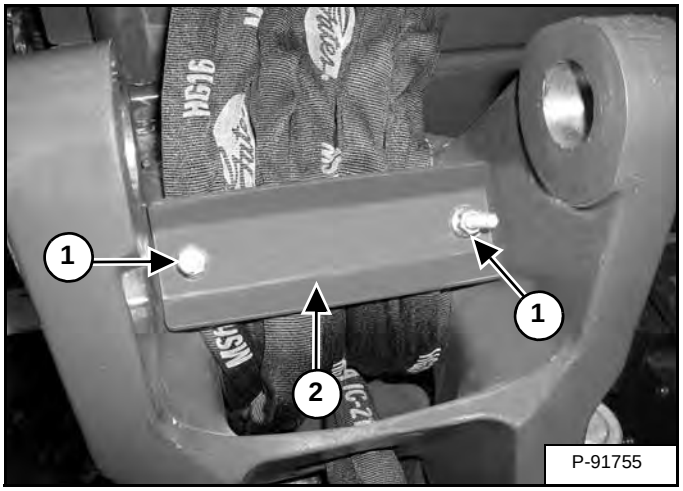
Removal And Installation

Rotate the upperstructure so the blade is to the rear of the excavator.

Remove the arm. (See Removal And Installation on Page 40-160-1.)

Remove the boom. (See Removal And Installation on Page 40-150-1.)

Figure 40-140-1

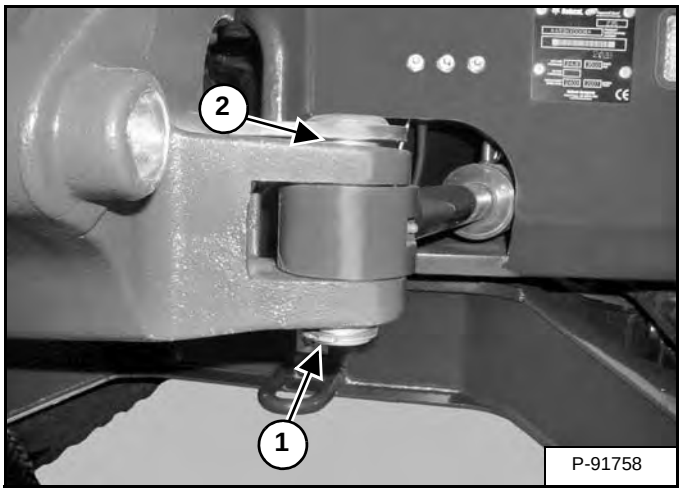


Remove the nuts (Item 1) and the clamp (Item 2) **[Figure 40-140-1]**.

NOTE: Before the hoses are removed from the clamped position, the hoses must be measured for correct clamped length and position. (See Boom Swing Frame Hose Routing on Page 40-140-5.)

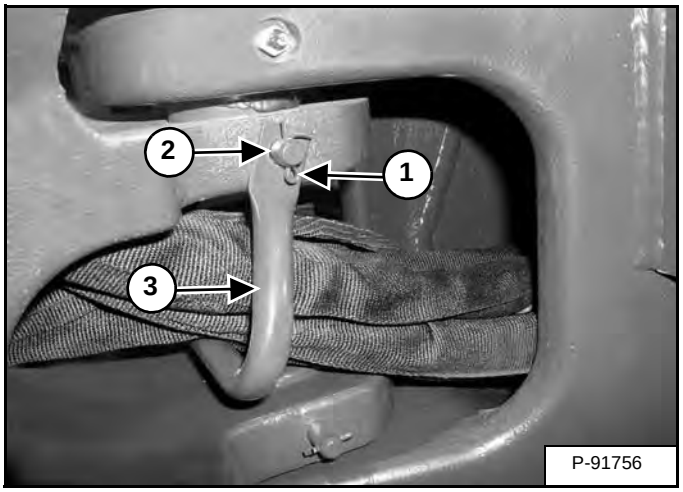
NOTE: Later model excavators are not equipped with the clamp (Item 2) [Figure 40-140-1].

Figure 40-140-2



Remove the snap ring (Item 1), washer, and pin (Item 2) **[Figure 40-140-2]** from the rod end of the swing cylinder.

Figure 40-140-3

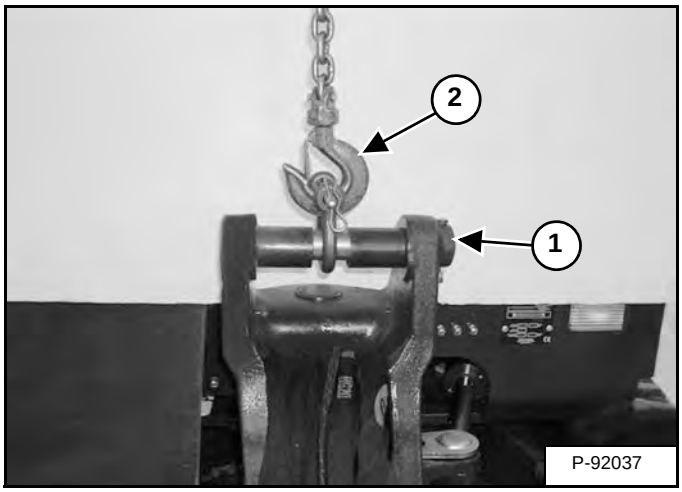


Remove the cotter pin (Item 1), retaining pin (Item 2) and hose bracket (Item 3) **[Figure 40-140-3]**.

Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

Figure 40-140-4



Install the boom pin (Item 1) using spacers to position a lifting clevis (Item 2) **[Figure 40-140-4]** on the center of the boom pin.

NOTE: The spacers will prevent the clevis from sliding on the boom pin causing the swing frame to tip from side to side.

IMPORTANT

Do Not use a porta-power to press out the swing frame pivot pins without the lower pin being supported. Excess pressure can cause the swing frame casting to crack.

I-2092-1204

Support the bottom pin with a jack.

Figure 40-140-5

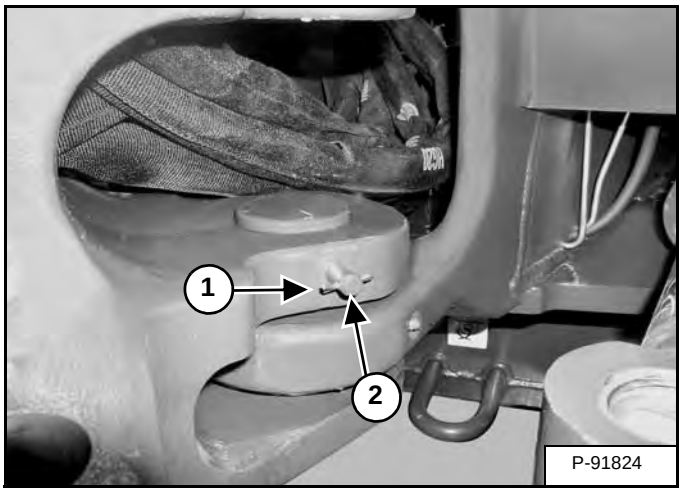


Install a porta-power between the top and bottom pins and press the top pin out **[Figure 40-140-5]**.

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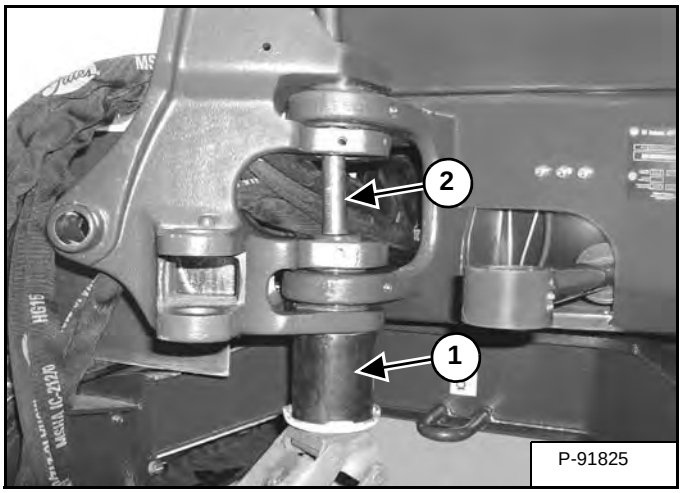
Removal And Installation (Cont'd)

Figure 40-140-6



Remove the cotter pin (Item 1) and retaining pin (Item 2) **[Figure 40-140-6]**.

Figure 40-140-7

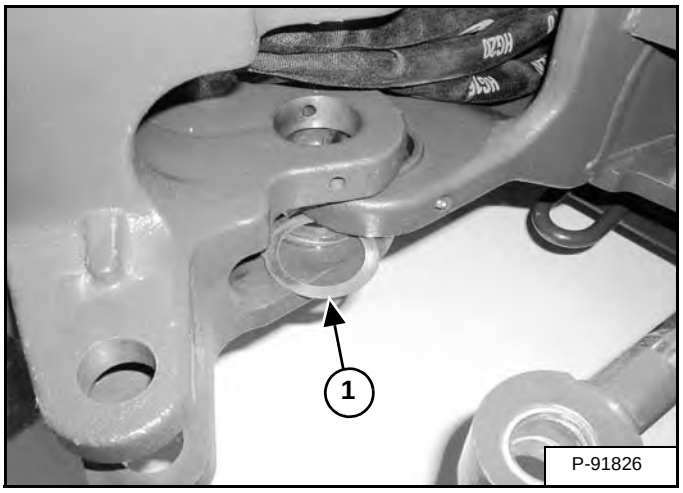


Install a spacer tube (Item 1) **[Figure 40-140-7]** and jack under the swing frame to support the casting. The spacer tube must be large enough to allow the pin to be driven in the center of the spacer tube for pin removal.

Use a large punch (Item 2) **[Figure 40-140-7]** and drive the bottom swing frame pin out.

NOTE: Do not use a porta-power to press out the bottom pin because the top casting cannot be supported and possible damage to the casting could occur.

Figure 40-140-8

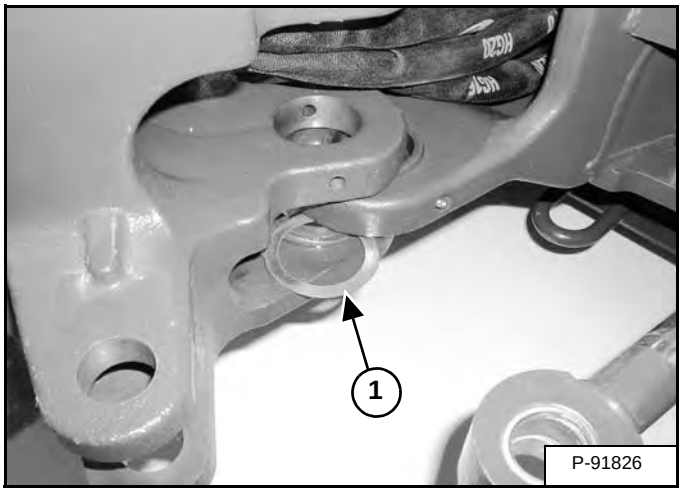


Remove the bottom spacer (Item 1) **[Figure 40-140-8]** from the swing frame.

Remove the swing frame.

Inspect the bushings for damage. Replace damaged bushings as necessary. (See Bushing Removal on Page 40-140-6.)

Figure 40-140-9

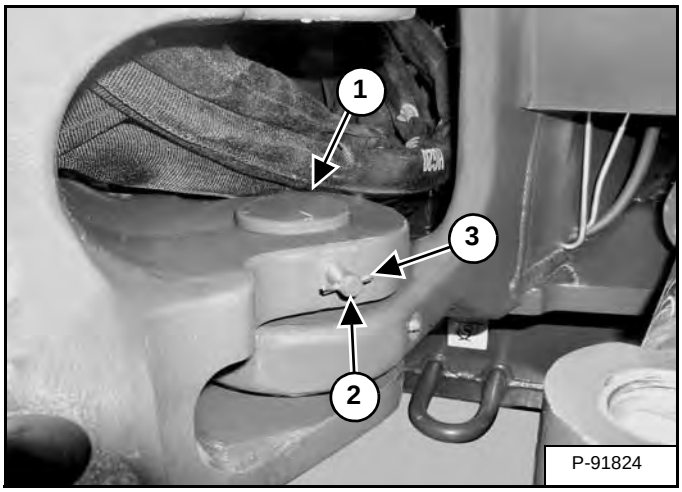


Installation: Install the bottom spacer (Item 1) **[Figure 40-140-9]** on the swing frame. Install the swing frame.

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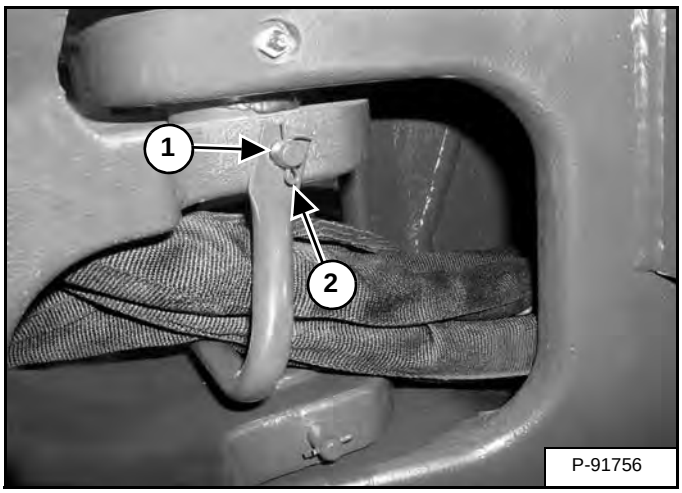
Removal And Installation (Cont'd)

Figure 40-140-10



Installation: Align the boom swing frame and install the lower pivot pin (Item 1). Install the retaining pin (Item 2) and cotter pin (Item 3) **[Figure 40-140-10]**. Lift up on the boom swing frame.

Figure 40-140-11

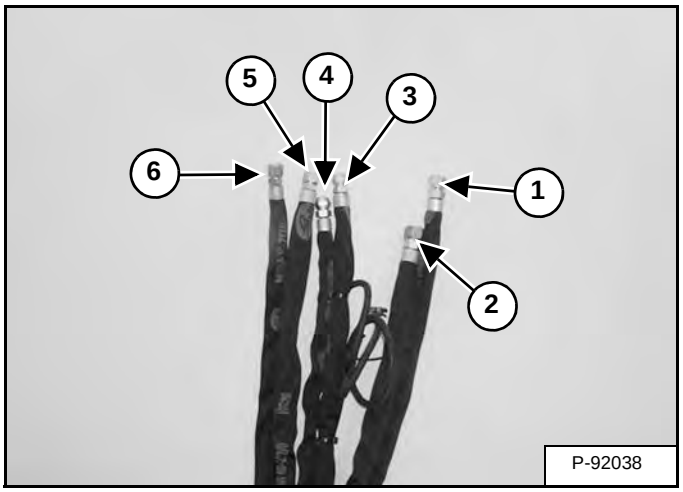


Installation: Install the top pivot pin, retaining pin (Item 1) and cotter pin (Item 2) **[Figure 40-140-11]**.

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Boom Swing Frame Hose Routing

Figure 40-140-12



Route the hoses through the swing frame as follows **[Figure 40-140-12]**:

1. Female Quick Coupler
2. Male Quick Coupler
3. Arm Rod End Hose
4. Arm Base End Hose
5. Bucket Rod End Hose
6. Bucket Base End Hose

Figure 40-140-13



Measure the length of the hoses from the top of the clamp to the end of each hose before removing the hose clamp **[Figure 40-140-13]**.

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Bushing Removal

IMPORTANT

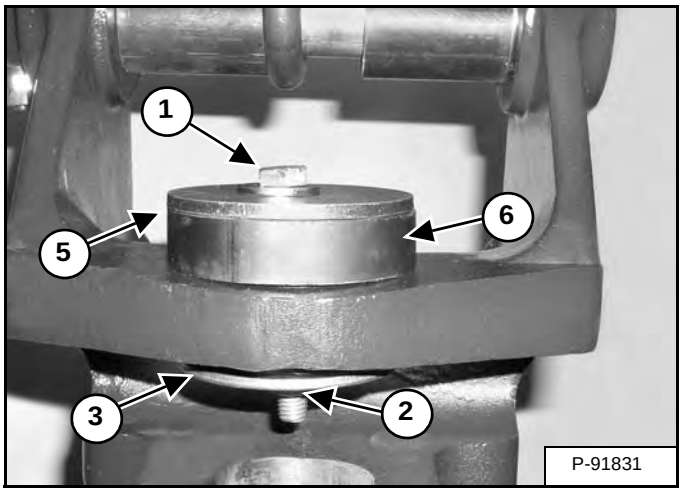
Do Not point (hammer) on the boom swing bracket. Excess pressure can cause the casting to crack.

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The following parts will be needed for removal and installation of the swing frame bushings:

1. Bolt - 19 x 153 mm or (3/4 x 6 in) long.
2. Nut - 19 mm or (3/4 in).
3. Washer - 22 mm I.D. x 79 mm O.D. x 10 mm thick or (7/8 I.D. x 3-1/8 O.D. x 3/8 in thick).
4. Washer - 22 mm I.D. x 89 mm O.D. x 10 mm thick or (7/8 I.D. x 3-1/2 O.D. x 3/8 in thick).
5. Washer - 22 mm I.D. 114 mm O.D. x 13 mm thick or (7/8 I.D. x 4-1/2 O.D. x 1/2 in thick).
6. Spacer - 89 mm I.D. x 108 mm O.D. x 38 mm thick or (3-1/2 I.D. x 4-1/4 O.D. x 1-1/2 in thick).

Figure 40-140-14



Install the spacer (Item 6) and washer (Item 5) **[Figure 40-140-14]** over the flanged end of the bushing.

The spacer (Item 6) **[Figure 40-140-14]** must be centered over the bushing to avoid contact between the bushing and the spacer during removal.

Install the washer (Item 3) **[Figure 40-140-14]** onto the opposite end of the bushing. This washer must be centered on the bushing and must not contact the casting.

Install the bolt (Item 1) and the nut (Item 2) **[Figure 40-140-14]** through the washers and the spacer.

Tighten the bolt and nut to remove the bushing from the casting.

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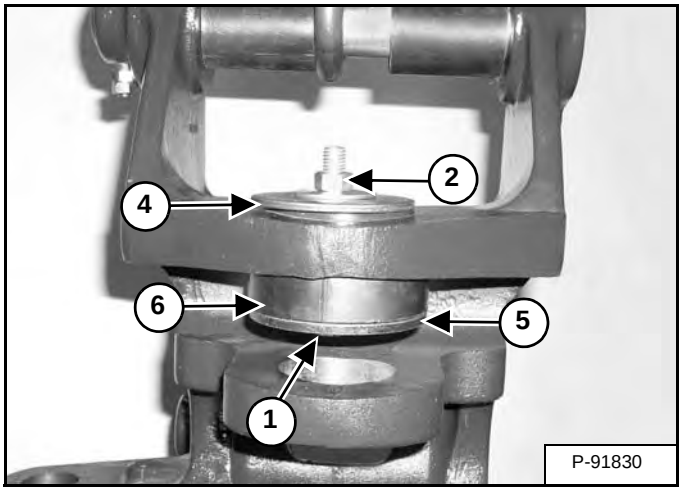
Bushing Installation

Apply a film of grease to the outer diameter of the bushing and to the inner diameter of the casting.

Center the bushing on the casting hole.

NOTE: Make sure that the bushing is centered into the casting hole and that it starts in the hole evenly and square.

Figure 40-140-15



Put the washer (Item 4) **[Figure 40-140-15]** over the flanged end of the bushing.

Put the spacer (Item 6) and the washer (Item 5) **[Figure 40-140-15]** over the bushing hole casting. Center the spacer and the washer over the bushing hole.

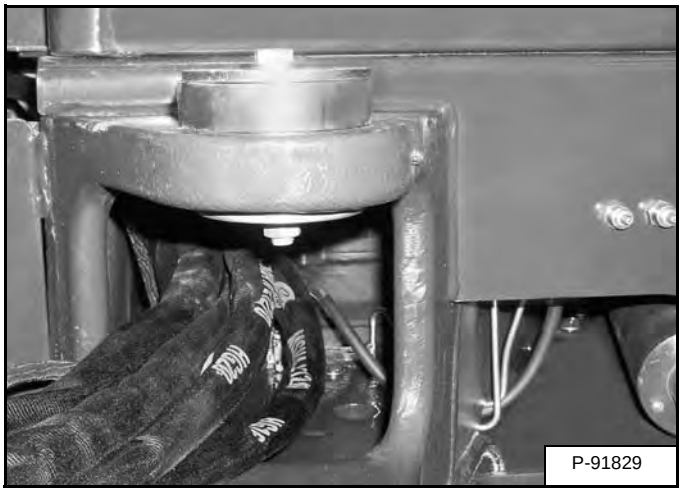
Install the bolt (Item 1) through the washers, the spacer and the bushing. Install the nut (Item 2) **[Figure 40-140-15]**.

Tighten the bolt and nut until the bushing is seated in the casting.

Figure 40-140-16



Figure 40-140-17



The same procedure is used to remove and install the bushings in the frame castings **[Figure 40-140-16]** and **[Figure 40-140-17]**.

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Dealer Copy -- Not for Resale

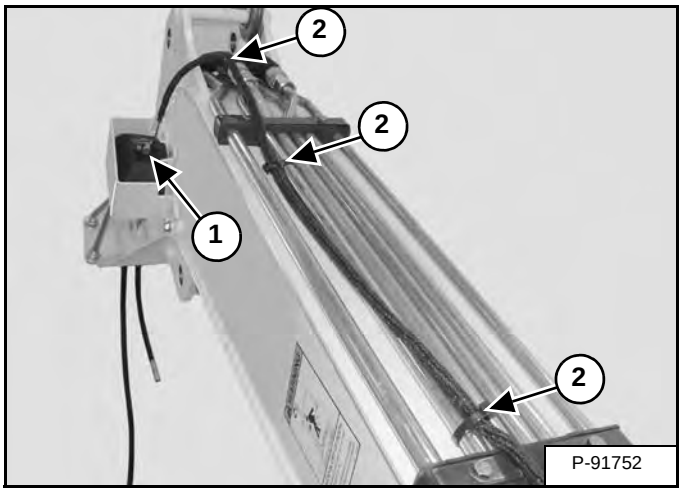
BOOM

Removal And Installation

Remove the arm. (See Removal And Installation on Page 40-160-1.)

Remove the boom cylinder. (See Removal And Installation on Page 20-20-3.)

Figure 40-150-1



Disconnect the wire harness (Item 1) **[Figure 40-150-1]**.

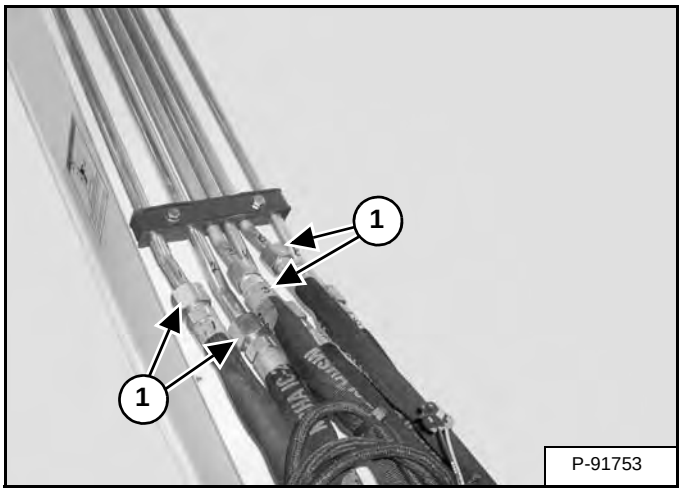
Cut and remove the cable ties (Item 2) **[Figure 40-150-1]**.

IMPORTANT

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

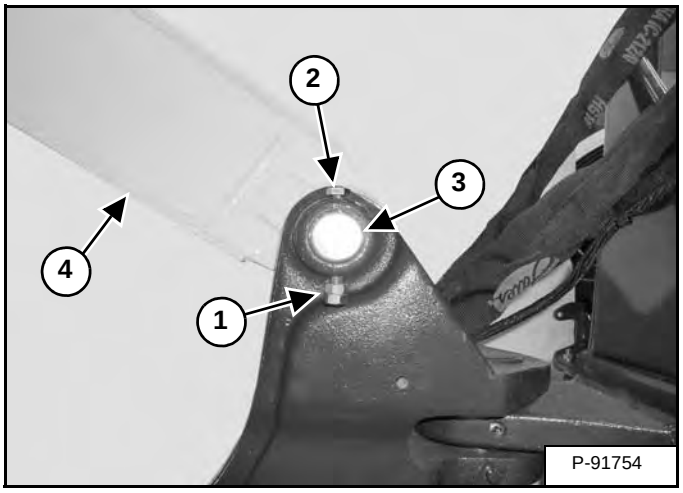
I-2003-0888

Figure 40-150-2



Mark and remove the hoses (Item 1) **[Figure 40-150-2]**.

Figure 40-150-3



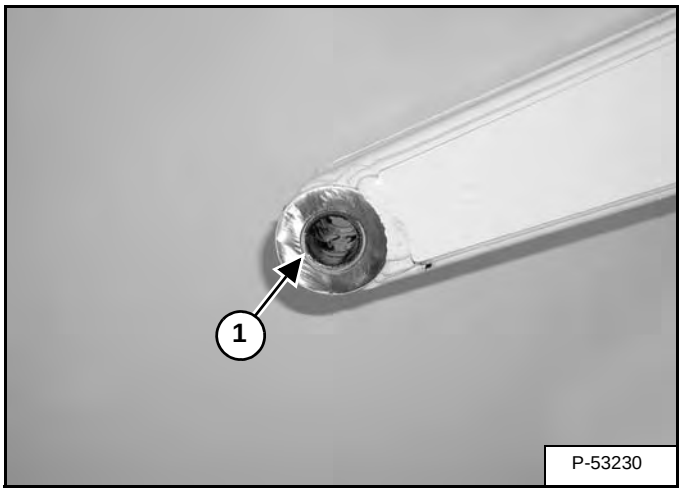
Remove the nuts (Item 1), bolt (Item 2) and pin (Item 3) **[Figure 40-150-3]**.

Remove the boom (Item 4) **[Figure 40-150-3]**.

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Removal And Installation (Cont'd)

Figure 40-150-4

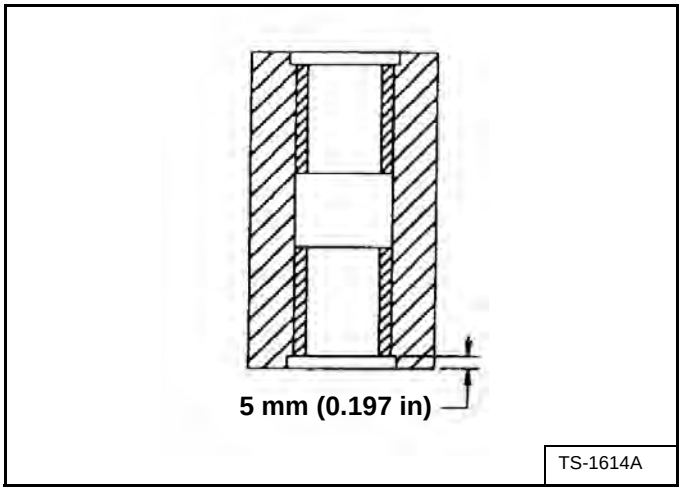


Remove the seals (Item 1) **[Figure 40-150-4]** from both sides of the boom.

Remove the bushings from both sides of the boom.

Install the new bushings in the boom.

Figure 40-150-5



Install the bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-150-5]** on both sides of the boom.

Install new seals on both sides of the boom.

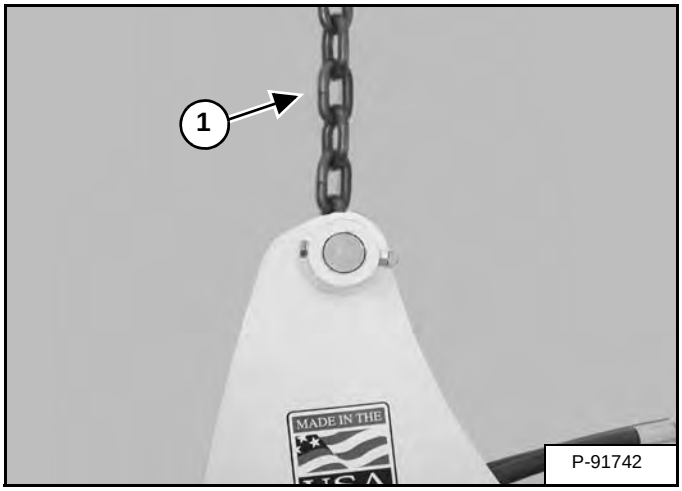
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ARM (STANDARD AND LONG)

Removal And Installation

Remove the arm cylinder. (See Removal And Installation on Page 20-22-3.)

Figure 40-160-1



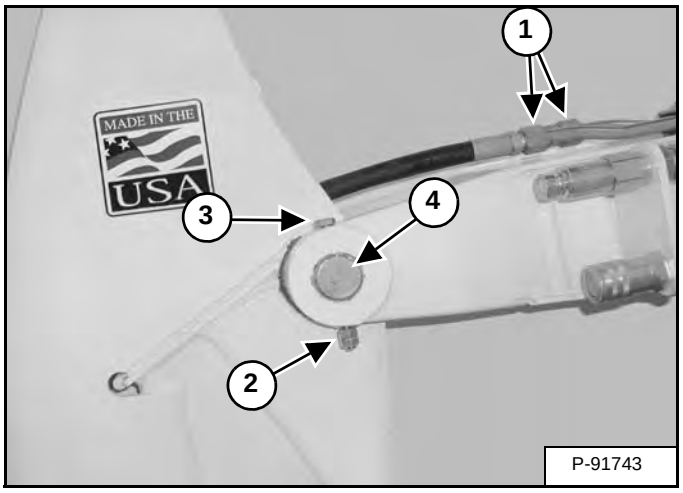
Support the arm with a chain hoist (Item 1) **[Figure 40-160-1]**.

IMPORTANT

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

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Figure 40-160-2



Remove the hydraulic hoses (Item 1) **[Figure 40-160-2]**.

Remove the nuts (Item 2) and bolt (Item 3) **[Figure 40-160-2]**.

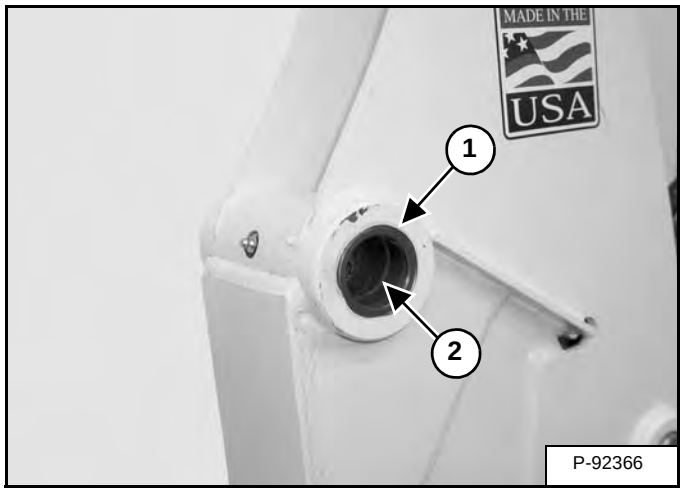
Remove the pin (Item 4) **[Figure 40-160-2]**.

Remove the arm from the boom.

Dealer Copy -- Not for Resale

Arm To Boom Bushing Removal And Installation

Figure 40-160-3

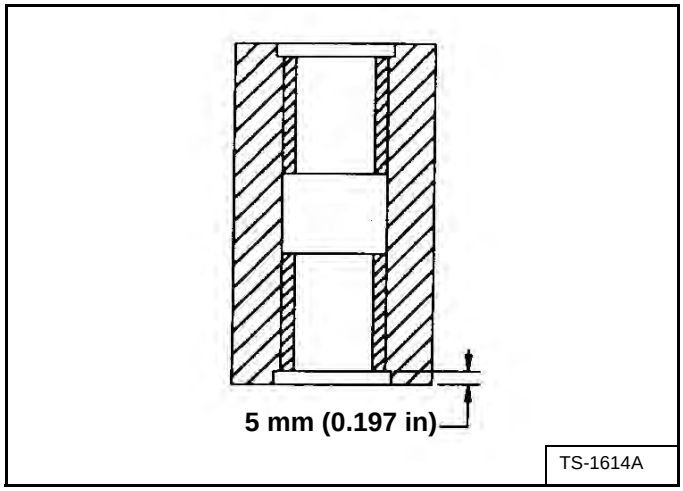


Remove the seals (Item 1) **[Figure 40-160-3]** from both sides of the arm.

Remove the bushings (Item 2) **[Figure 40-160-3]** from both sides of the arm.

Install the new bushings in the arm.

Figure 40-160-4



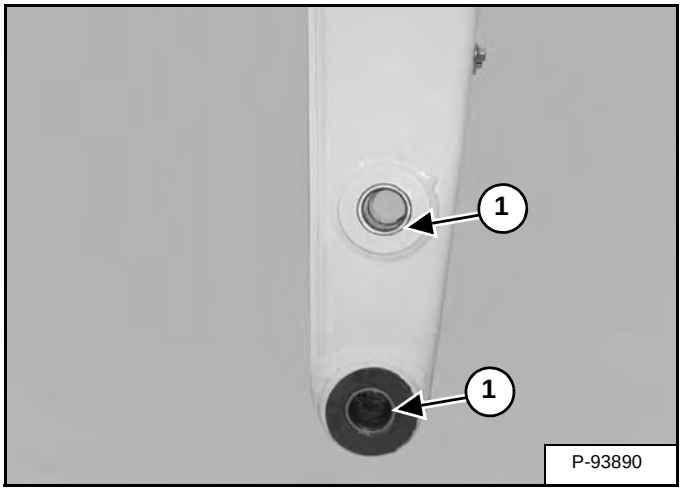
Install the bushings until they are seated 5 mm (0.197 in.) in the pin boss **[Figure 40-160-4]** (both sides).

Install new seals on both sides of the arm.

Dealer Copy -- Not for Resale

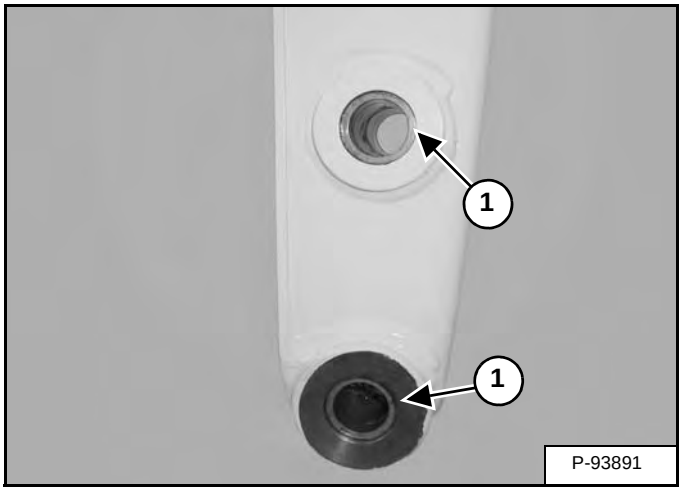
Arm To Bucket And Bucket Link Bushing Removal And Installation

Figure 40-160-5



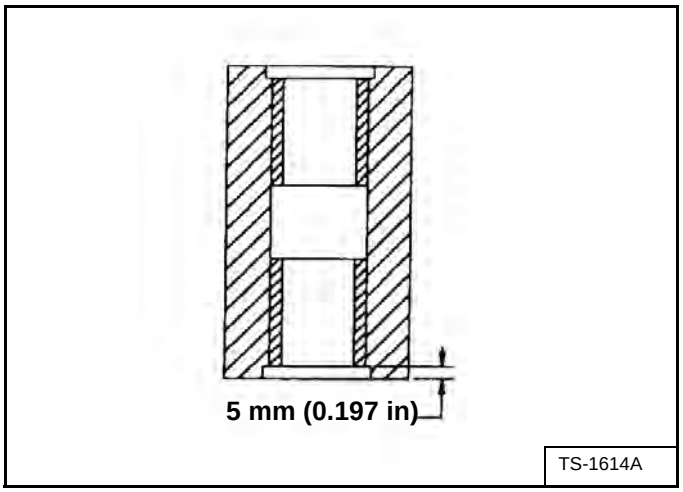
Remove the seals (Item 1) **[Figure 40-160-5]** from both sides of the arm.

Figure 40-160-6



Remove the bushings (Item 1) **[Figure 40-160-6]** from both sides of the arm.

Figure 40-160-7



Install the bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-160-7]** (both sides).

Install new seals on both sides of the arm.

Dealer Copy -- Not for Resale



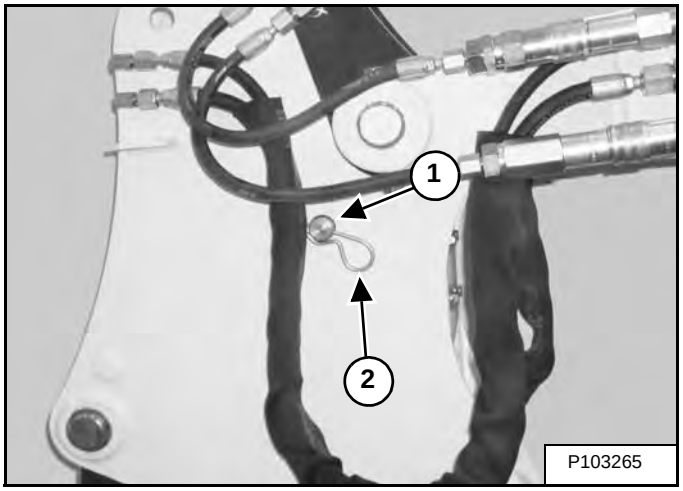
Dealer Copy -- Not for Resale

ARM (EXTENDABLE)

Removal And Installation

Remove the bucket or attachment. (See the Operation and Maintenance Manual for the correct procedure.)

Figure 40-161-1



Fully retract the arm and install the pin (Item 1). Install the retainer (Item 2) **[Figure 40-161-1]** on both sides of the pin.

WARNING

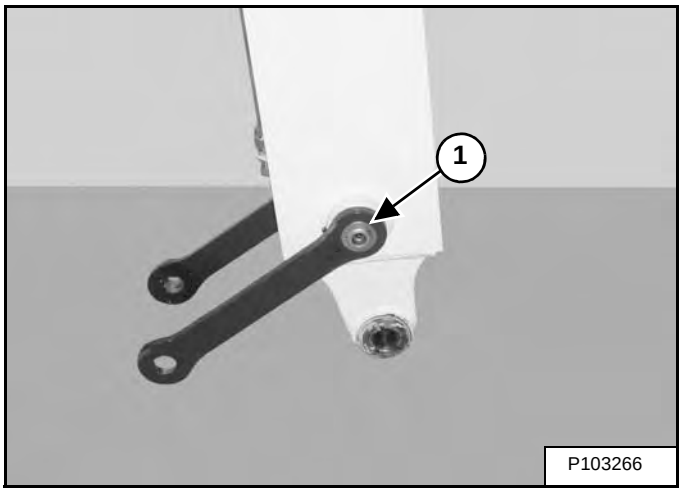
Keep all bystanders 6 m (20 ft) away from equipment when operating. Contact with moving parts, a trench cave-in or flying objects can cause injury or death.

W-2119-0910

Remove the X-Change. (See Removal And Installation on Page 40-200-1.) or (See Removal And Installation on Page 40-201-1.)

Remove the bucket cylinder. (See Removal And Installation on Page 20-24-3.).

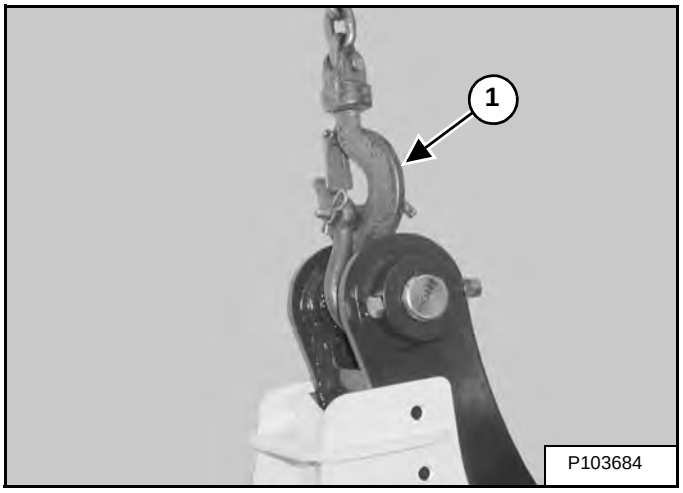
Figure 40-161-2



NOTE: Do Not remove the bucket link pin (Item 1) [Figure 40-161-2] at this time. The pin is also the extendable cylinder rod end pin.

Remove the arm cylinder. (See Removal And Installation on Page 20-22-3.)

Figure 40-161-3



Support the arm with a chain hoist (Item 1) **[Figure 40-161-3]**.

IMPORTANT

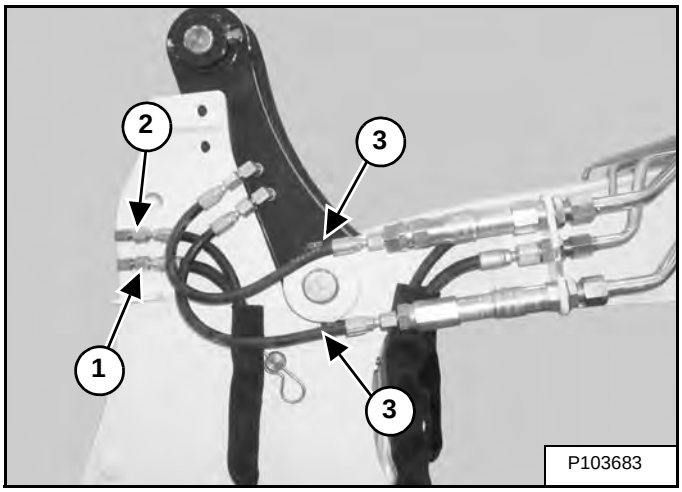
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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Removal And Installation (Cont'd)

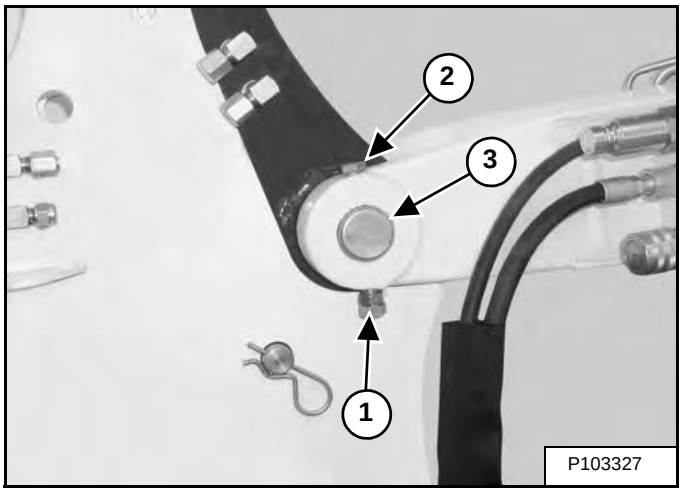
Figure 40-161-4



Remove the bucket cylinder hoses (Item 1) from both sides of the arm. Remove the X-Change hoses (If equipped) (Item 2) **[Figure 40-161-4]** from both sides of the arm.

Disconnect the hoses (Item 3) **[Figure 40-161-4]** from the quick couplers. Remove the hoses from the bulkhead fittings.

Figure 40-161-5

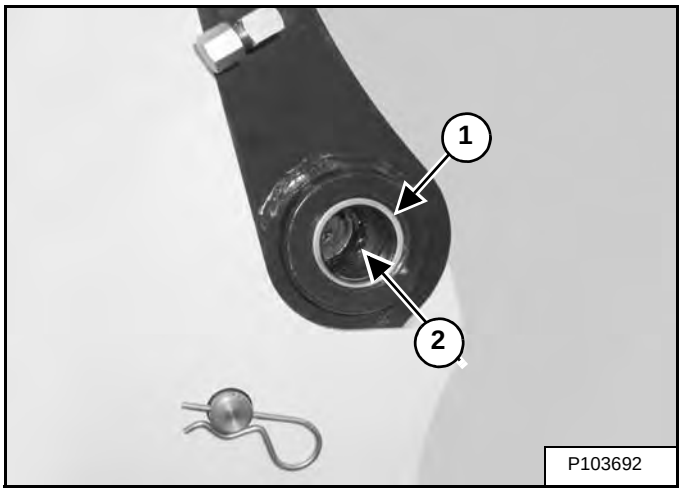


Remove the nuts (Item 1) and bolt (Item 2) **[Figure 40-161-5]**.

Remove the pin (Item 3) **[Figure 40-161-5]** and remove the arm from the boom.

Arm To Boom Bushing Removal And Installation

Figure 40-161-6

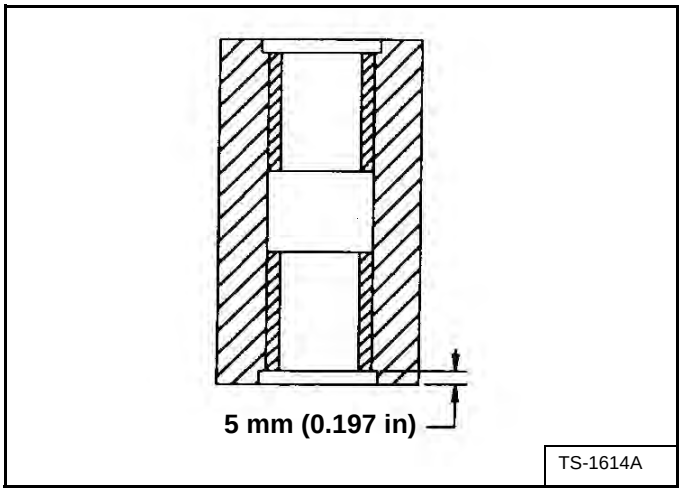


Remove the seals (Item 1) **[Figure 40-161-6]** from both sides of the arm.

Remove the bushings (Item 2) **[Figure 40-161-6]** from both sides of the arm.

Install the new bushings in the arm.

Figure 40-161-7



Install the bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-161-7]** (both sides).

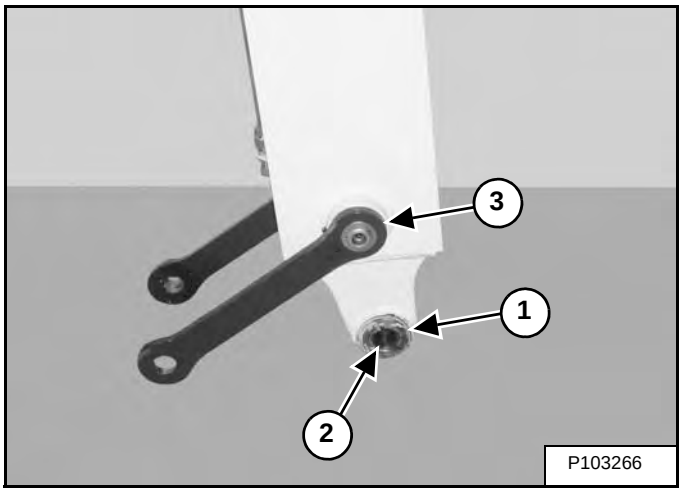
Install new seals on both sides of the arm.

NOTE: The metal side of the seals must face outward.

Dealer Copy -- Not for Resale

Arm To Bucket Bushing Removal And Installation

Figure 40-161-8

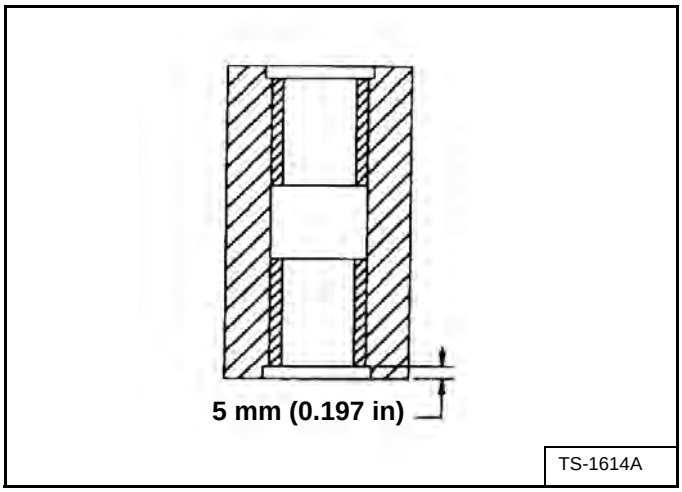


Remove the seals (Item 1) **[Figure 40-161-8]** from both sides of the arm.

Remove the bushings (Item 2) **[Figure 40-161-8]** from both sides of the arm.

NOTE: The seals and bushings can not be removed from the bucket link pivot pin (Item 3) [Figure 40-161-8] until the arm has been disassembled.

Figure 40-161-9



Install the bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-161-9]** (both sides).

Install new seals on both sides of the arm.

NOTE: The metal side of the seals must face outward.

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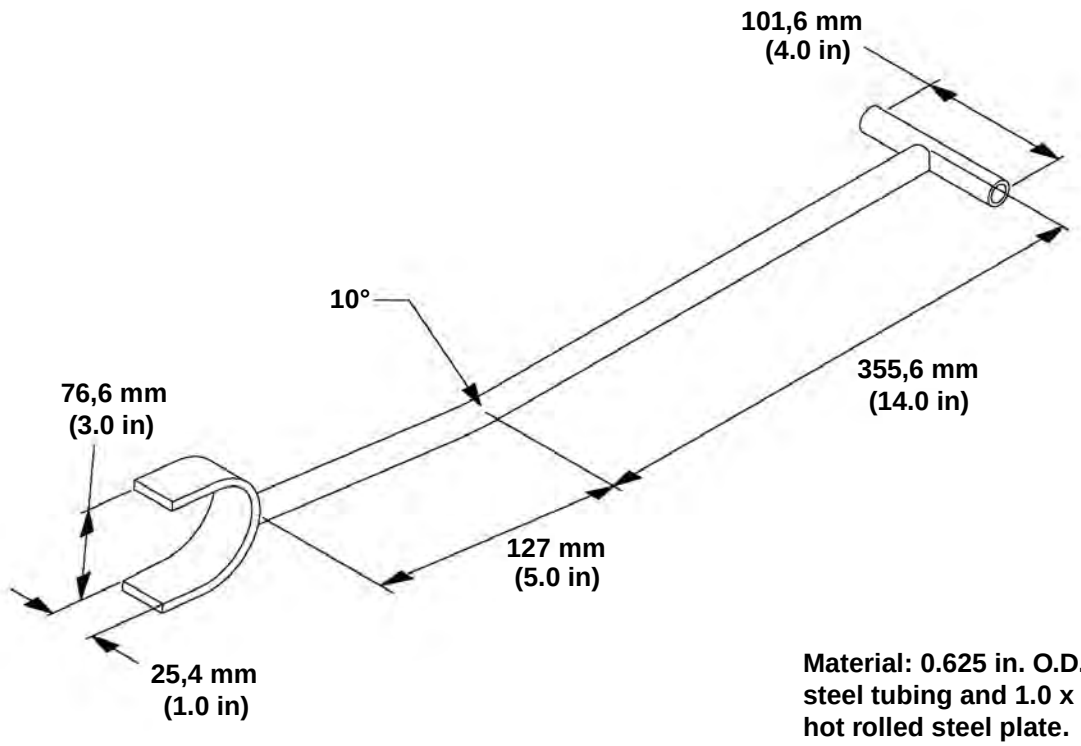
ARM (EXTENDABLE) (CONT'D)

Disassembly And Assembly

Build the service tool to assist in aligning the rod end of the cylinder between the left and right rod end pin boss.

Use the dimensions shown **[Figure 40-161-10]** to build the service tool.

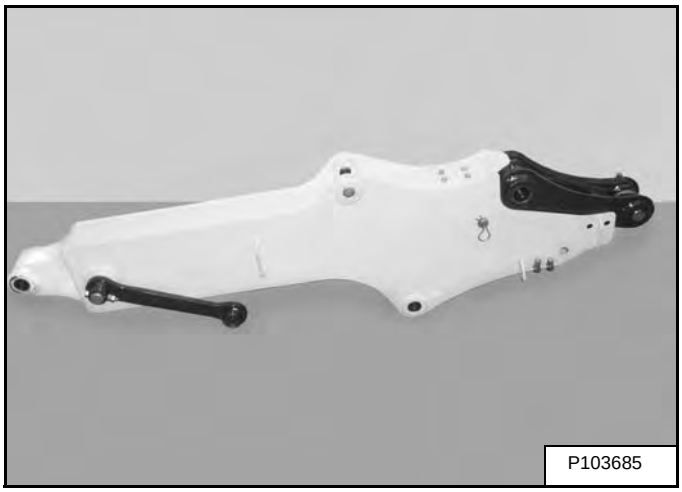
Figure 40-161-10



Dealer Copy -- Not for Resale

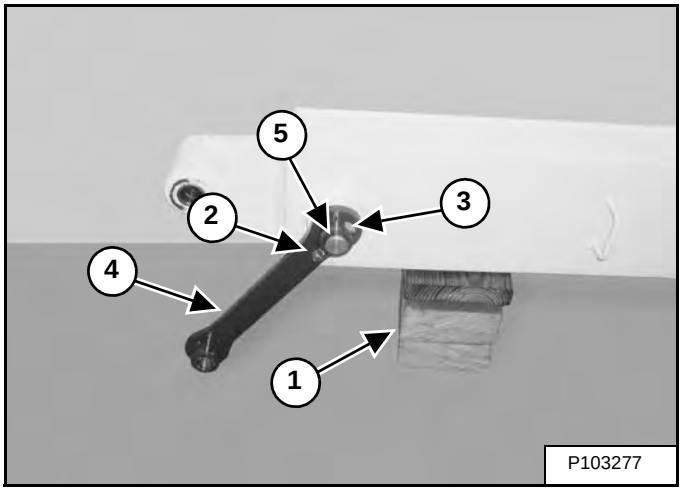
Disassembly And Assembly (Cont'd)

Figure 40-161-11



Position the arm on the ground as shown **[Figure 40-161-11]**.

Figure 40-161-12

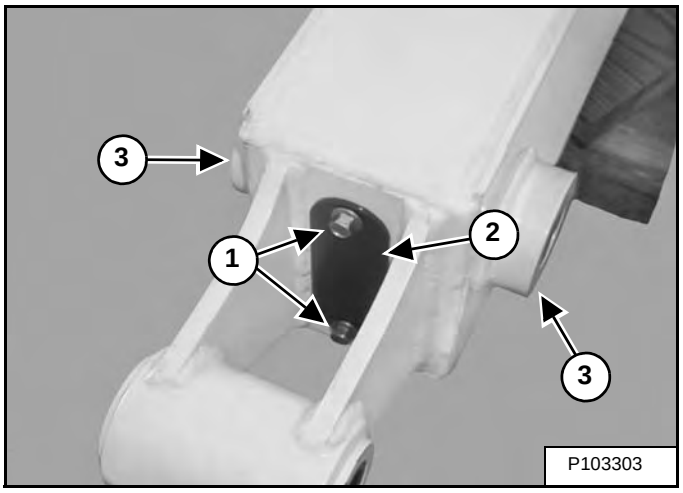


Install blocks (Item 1) **[Figure 40-161-12]** under the bucket end of the arm until the arm is level.

Remove the nuts (Item 2), bolt (Item 3) and link (Item 4) **[Figure 40-161-12]**.

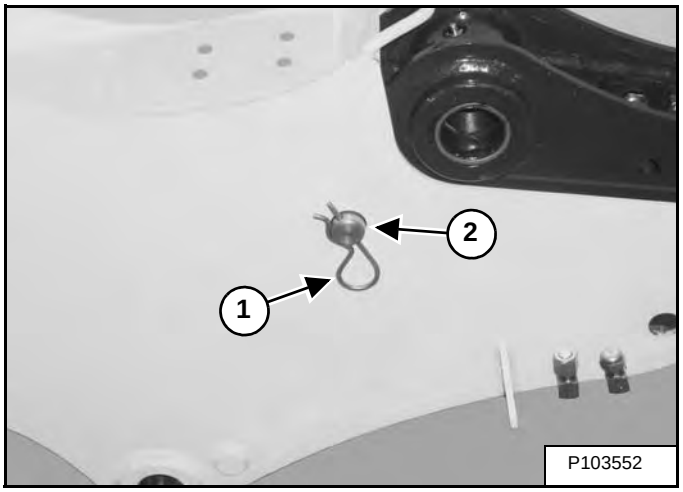
Remove the pin (Item 5) **[Figure 40-161-12]**.

Figure 40-161-13



Installation: Remove the bolts (Item 1) and cover (Item 2) to gain access to the extendable arm cylinder rod end. Use the tool **[Figure 40-161-10 on Page 4]** to align the rod end pin boss of the cylinder between the left and right pin boss (Item 3) **[Figure 40-161-13]** of the outer arm.

Figure 40-161-14

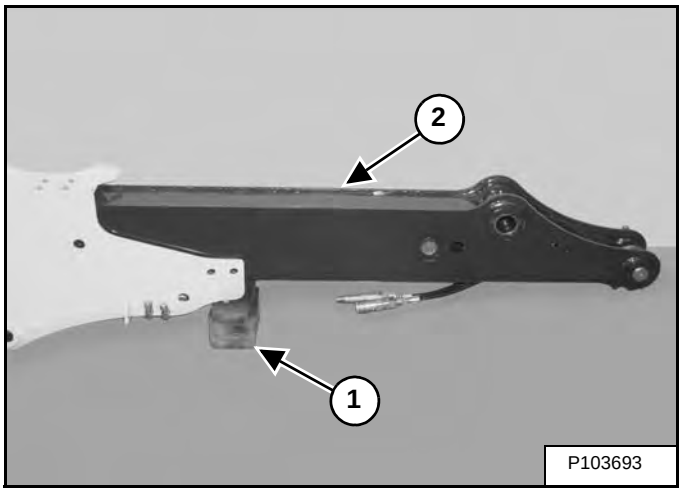


Remove the retainer (Item 1) and pin (Item 2) **[Figure 40-161-14]**.

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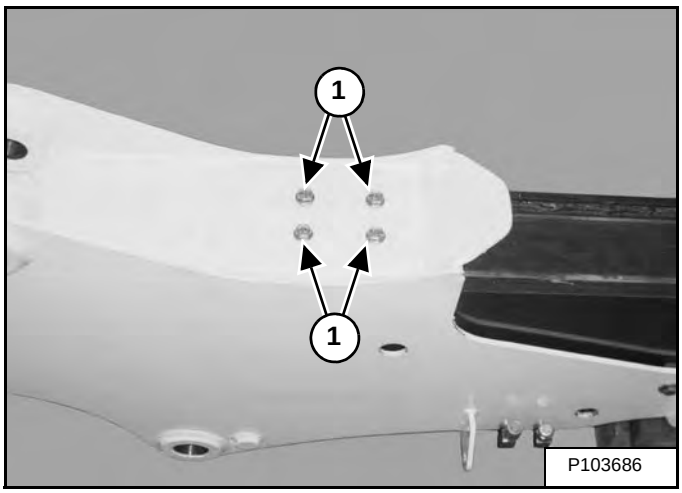
Disassembly And Assembly (Cont'd)

Figure 40-161-15



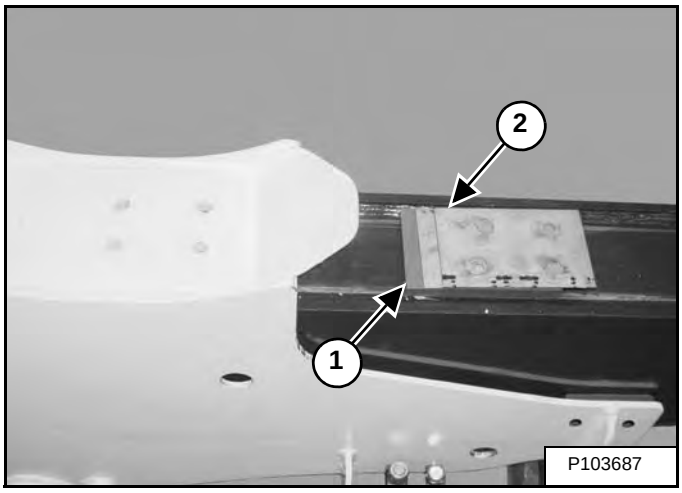
Install blocks (Item 1) under the arm. Slide the inner arm (Item 2) **[Figure 40-161-15]** out of the outer arm until the wear pads on the inner arm contact the wear pads on the outer arm.

Figure 40-161-16



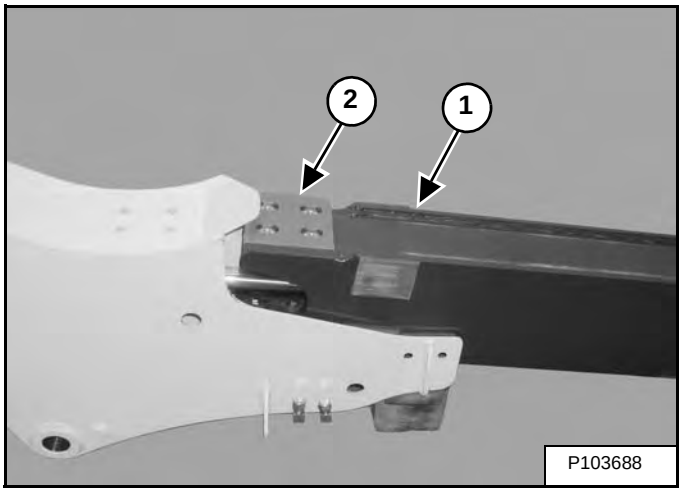
Remove the bolts (Item 1) **[Figure 40-161-17]** and washers.

Figure 40-161-17



Remove the wear pad (Item 1) and shims (Item 2) **[Figure 40-161-17]**.

Figure 40-161-18

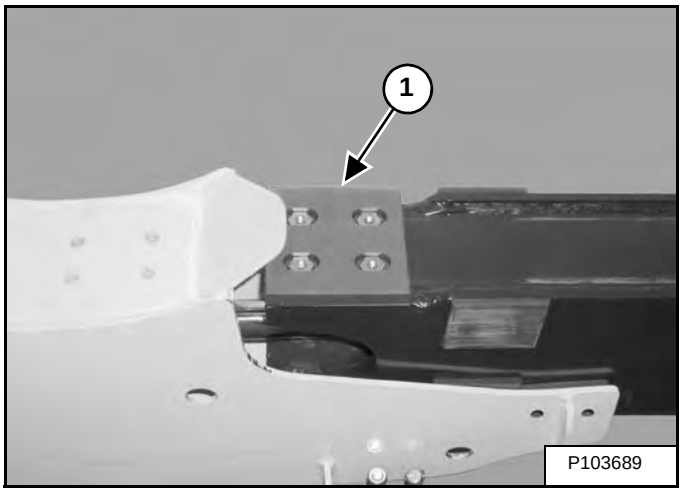


Slide the inner arm (Item 1) out until the wear pad (Item 2) **[Figure 40-161-18]** is exposed.

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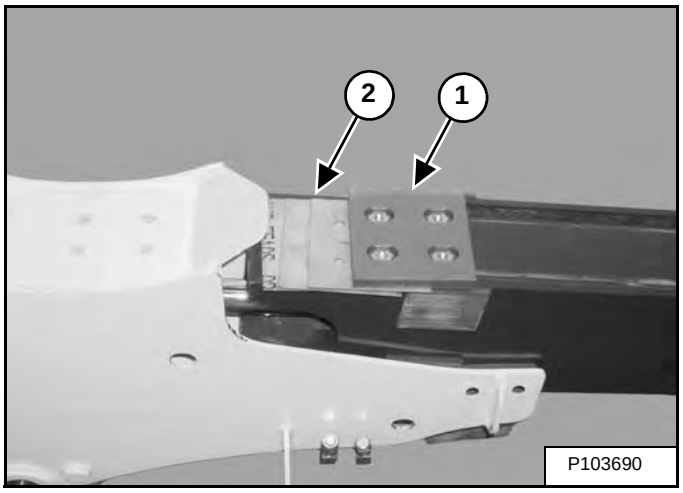
Disassembly And Assembly (Cont'd)

Figure 40-161-19



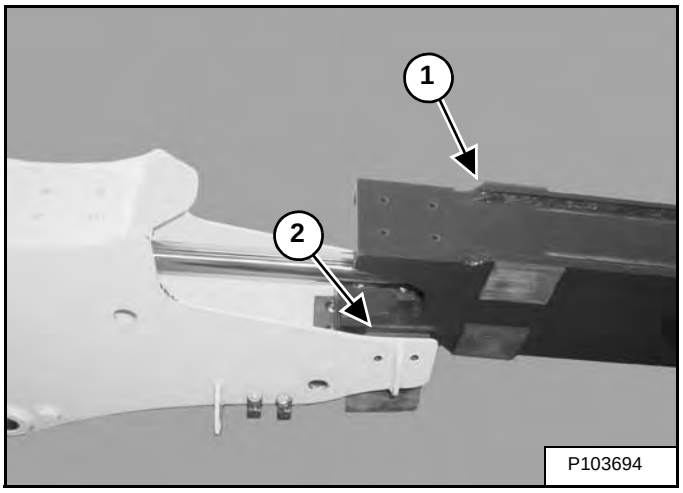
Remove the bolts from the wear pad (Item 1) **[Figure 40-161-19]**.

Figure 40-161-20



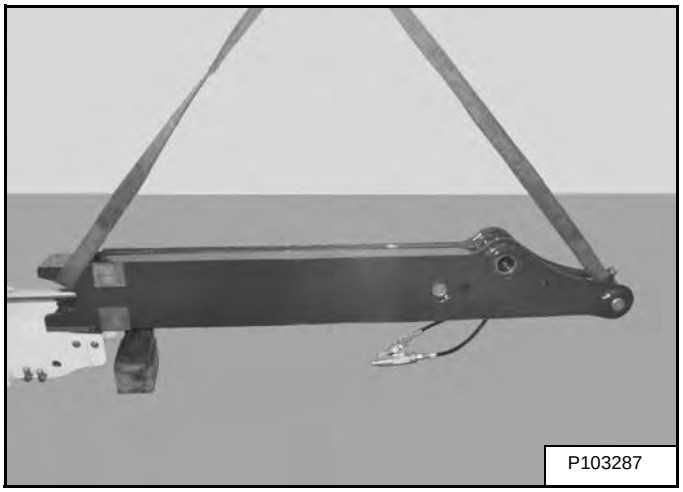
Remove the wear pad (Item 1) and shims (Item 2) **[Figure 40-161-20]**.

Figure 40-161-21



Raise the end of the inner arm and slide the arm (Item 1) out past the side wear pads (Item 2) **[Figure 40-161-21]**.

Figure 40-161-22

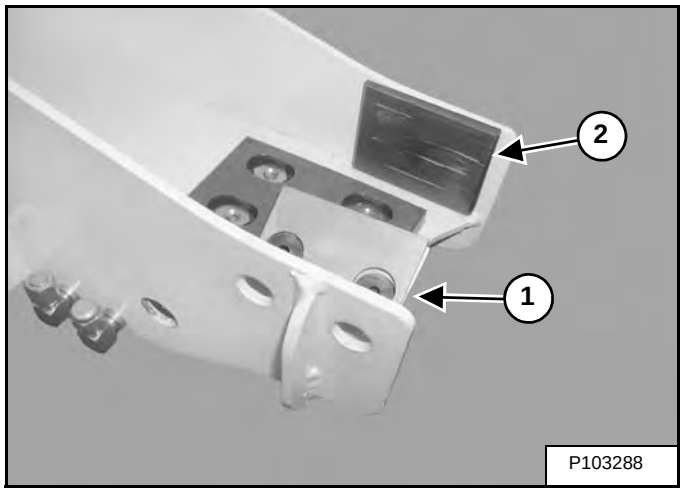


Install a hoist on the inner arm and remove the arm **[Figure 40-161-22]**

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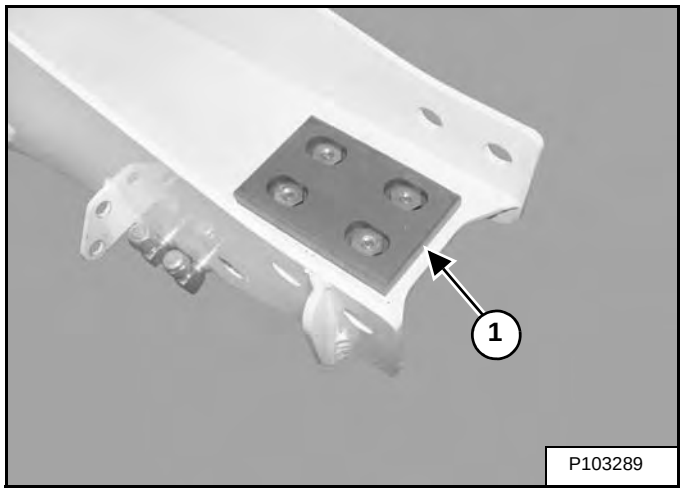
Disassembly And Assembly (Cont'd)

Figure 40-161-23



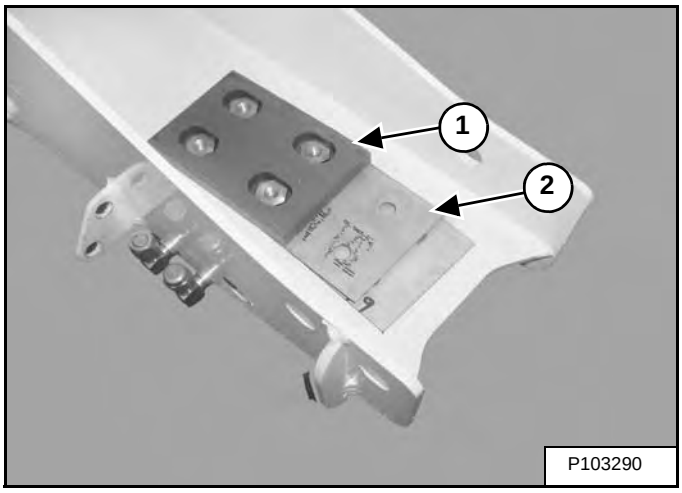
Remove the wear pad and shims (Item 1). Repeat the procedure for the opposite wear pad (Item 2) **[Figure 40-161-23]**.

Figure 40-161-24



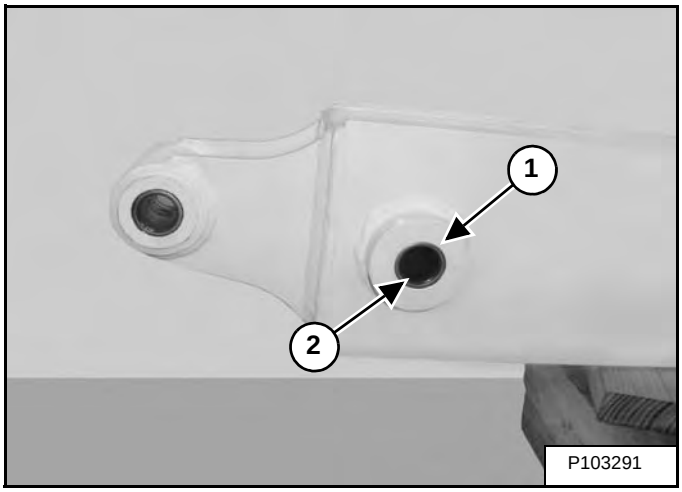
Remove the bolts from the wear pad (Item 1) **[Figure 40-161-24]**.

Figure 40-161-25



Remove the wear pad (Item 1) and shims (Item 2) **[Figure 40-161-25]**.

Figure 40-161-26



Remove the seals (Item 1) **[Figure 40-161-26]** from both sides of the arm.

Remove the bushings (Item 2) **[Figure 40-161-26]** from both sides of the arm.

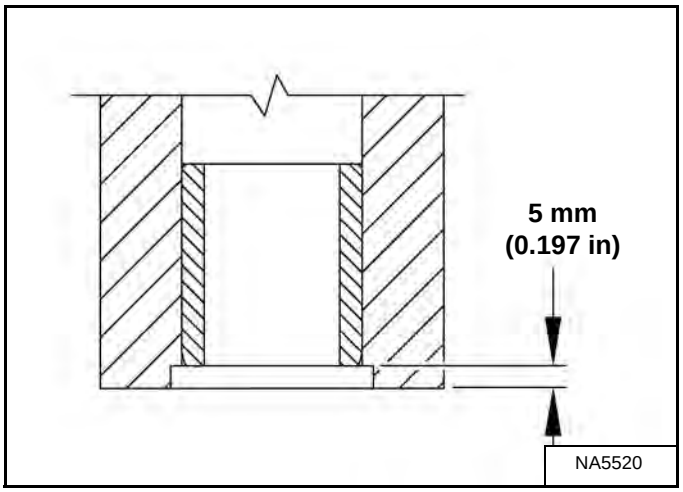
Install the new bushings in the arm.

NOTE: When installing the bushings, place a steel block between the left and right bushing boss to prevent damage to the outer arm.

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Disassembly And Assembly (Cont'd)

Figure 40-161-27

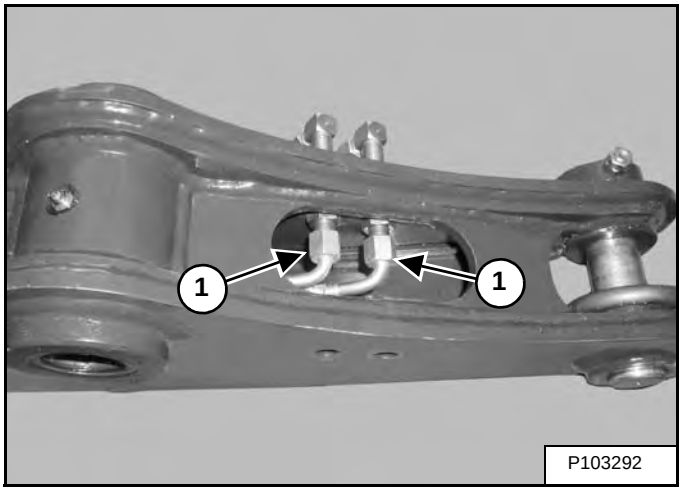


Install the bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-161-27]**.

Install new seals on both sides of the arm.

NOTE: The metal side of the seals must face outward.

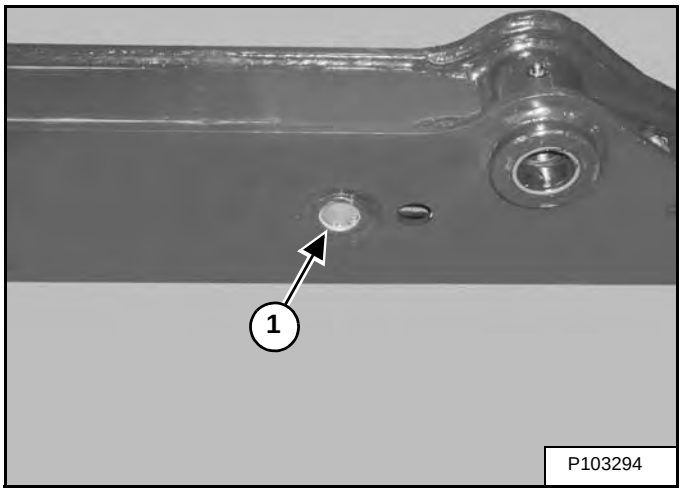
Figure 40-161-28



Remove the hoses (Item 1) **[Figure 40-161-28]** from the bulkhead fittings.

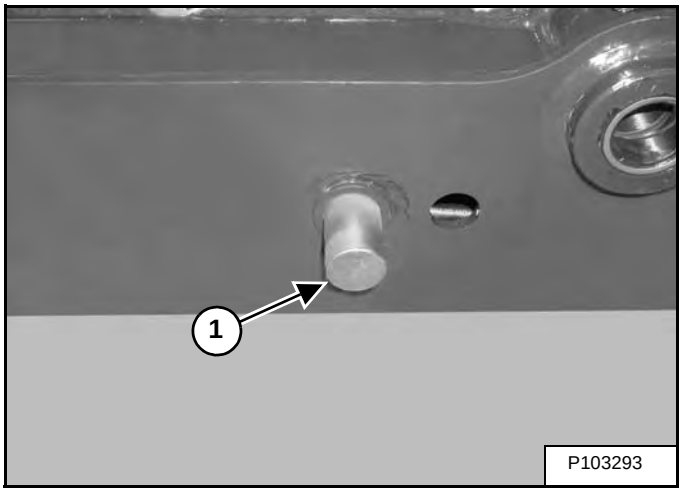
NOTE: The hoses will be removed with the cylinder.

Figure 40-161-29



Remove the snap ring (Item 1) **[Figure 40-161-29]**.

Figure 40-161-30

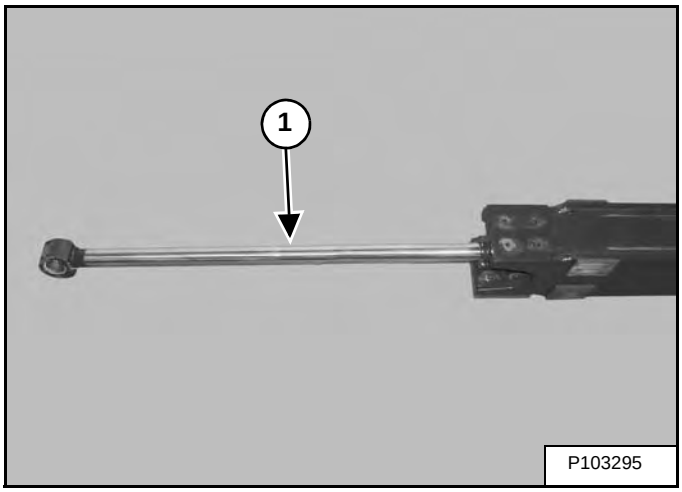


Remove the cylinder base end pin (Item 1) **[Figure 40-161-30]**.

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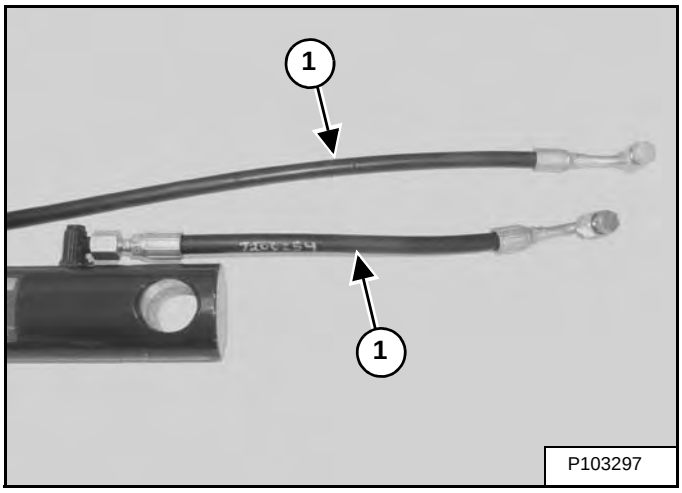
Disassembly And Assembly (Cont'd)

Figure 40-161-31



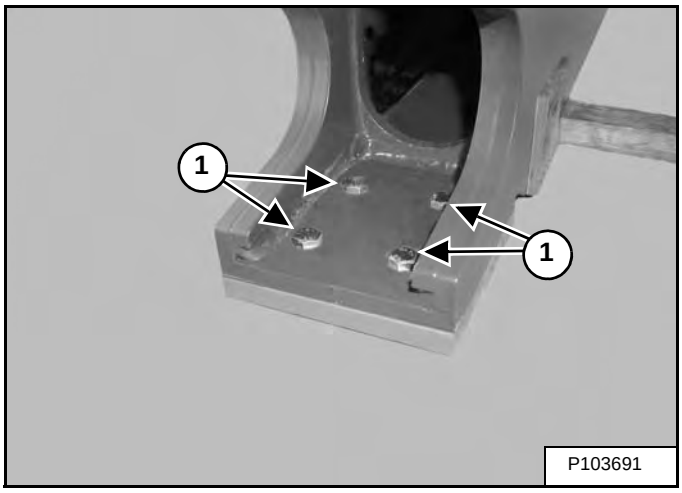
Remove the cylinder (Item 1) **[Figure 40-161-31]**.

Figure 40-161-32



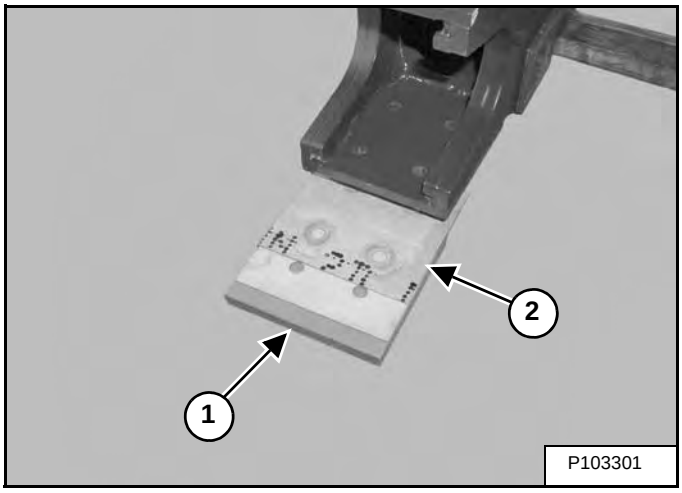
NOTE: Install the hoses (Item 1) [Figure 40-161-32] as shown to align the hoses with the bulkhead fittings on the inner arm assembly. Hose orientation can not be changed after the cylinder is installed. Install the cylinder with the hoses facing up, towards the bucket cylinder.

Figure 40-161-33



Remove the bolts (Item 1) **[Figure 40-161-33]**.

Figure 40-161-34

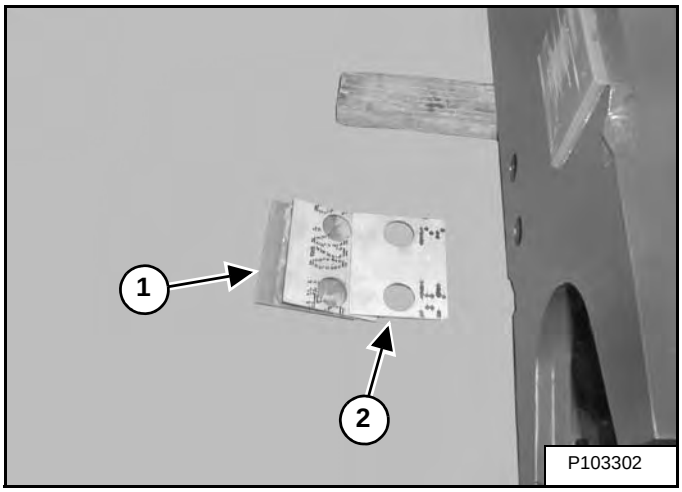


Remove the wear pad (Item 1) and shims (Item 2) **[Figure 40-161-34]**.

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Disassembly And Assembly (Cont'd)

Figure 40-161-35



Remove the wear pad (Item 1) and shims (Item 2) **[Figure 40-161-35]**.

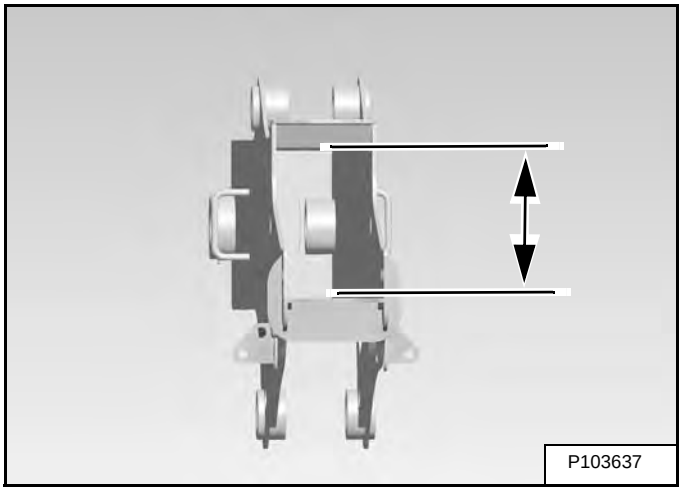
Repeat the procedure for the opposite wear pad.

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Shimming Procedure

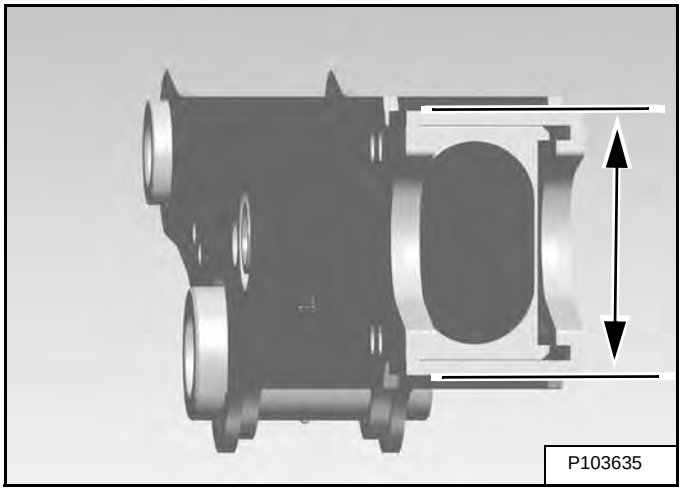
To determine the correct number and thickness of the shims needed, the inside of the outer arm and the outside of the inner arm will need to be measured.

Figure 40-161-36



Measure and record the inside dimension of the outer arm as shown **[Figure 40-161-36]**.

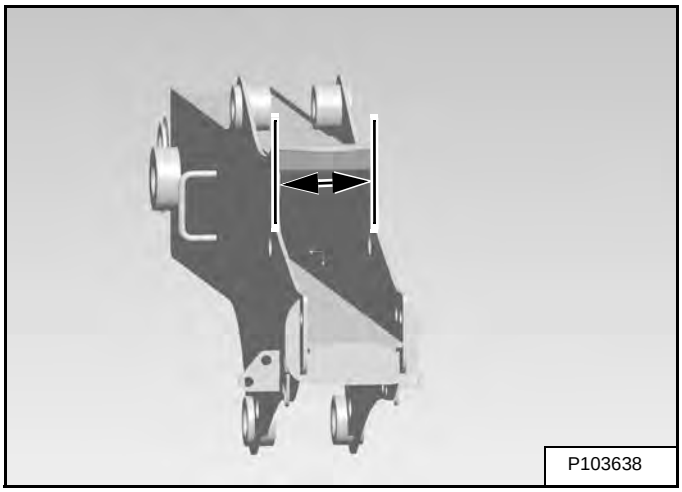
Figure 40-161-37



Measure and record the outside dimension of the inner arm as shown **[Figure 40-161-37]**.

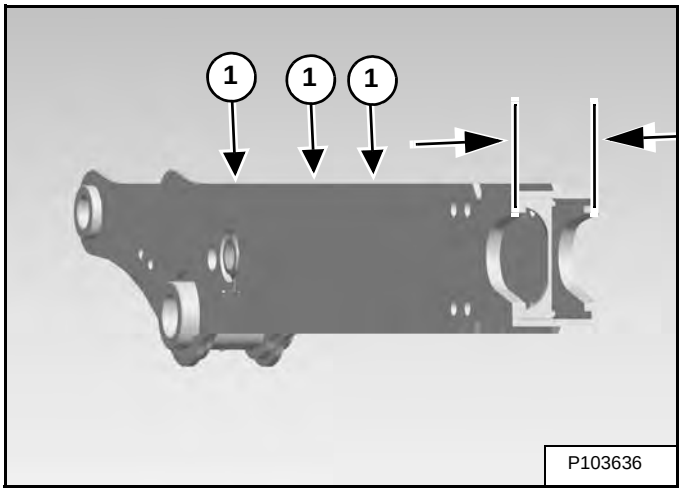
Subtract the smaller number from the larger number and record the difference.

Figure 40-161-38



Measure and record the inside dimension of the outer arm as shown **[Figure 40-161-38]**.

Figure 40-161-39



Measure and record the outside dimension of the inner arm as shown **[Figure 40-161-39]**.

Take the measurement in three different locations (Item 1) **[Figure 40-161-39]** along the length of the arm. Find the average dimension.

Subtract the average (smaller) dimension from the larger dimension and record the difference.

Install the correct number and thickness of shims under the wear pads to center the inner arm inside of the outer arm and obtain 0,0 - 0,5 mm (0.0 - 0.02 in) clearance between the wear pads and inner / outer arm assemblies.

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BUCKET

Bucket Teeth Removal And Installation

WARNING

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

- **Pressurized fluids and springs or other stored energy components.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

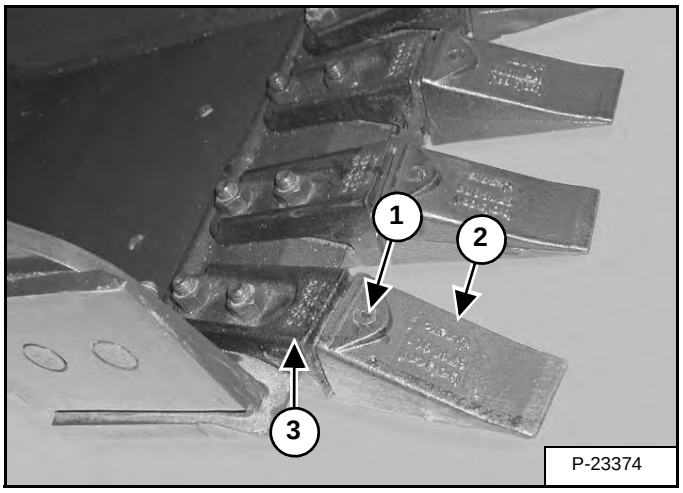
W-2505-0604

Position the bucket so the bucket teeth are at a 30° angle up from the ground for accessibility to the teeth.

Lower the boom until the bucket is fully on the ground.

Stop the engine and exit the excavator.

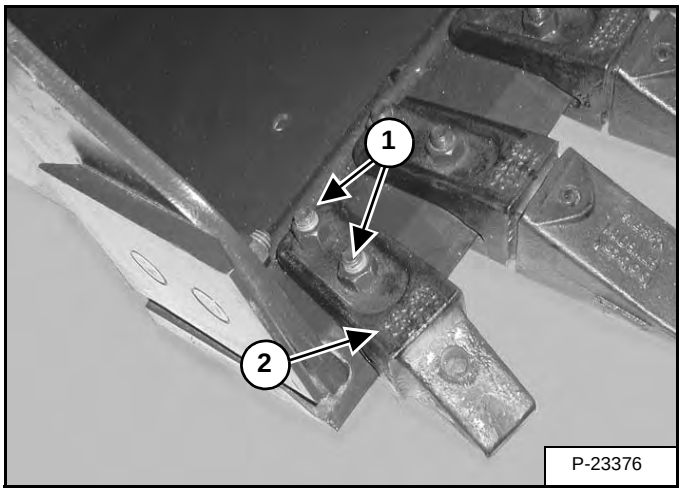
Figure 40-170-1



Remove the retaining pin (Item 1) from the tooth point (Item 2) **[Figure 40-170-1]**.

Remove the tooth point (Item 2) from the shank (Item 3) **[Figure 40-170-1]**.

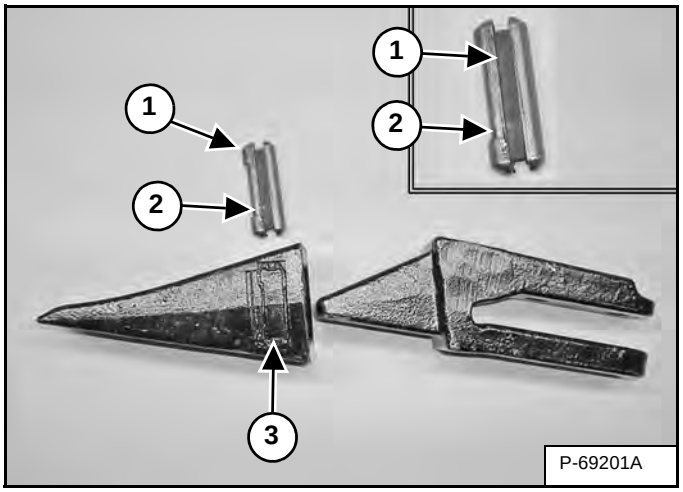
Figure 40-170-2



Remove the two nuts (Item 1) and bolts from the tooth shank (Item 2) **[Figure 40-170-2]**. Remove the tooth shank.

Installation: Tighten the nuts to 125 - 135 N•m (90 - 100 ft-lb) torque.

Figure 40-170-3



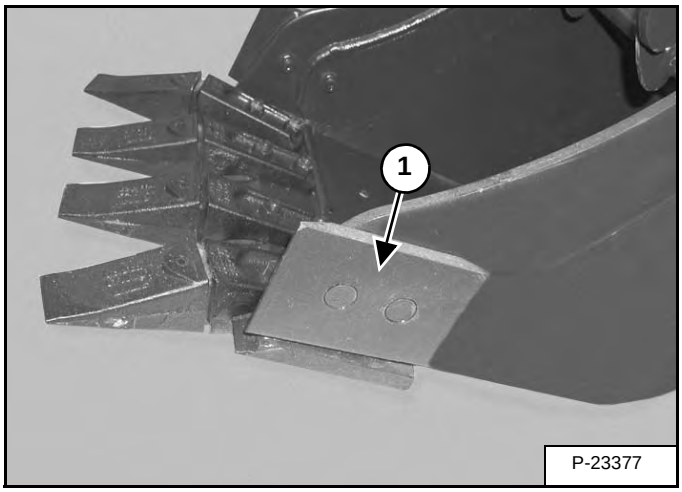
The retaining pin (Item 1) must be installed as shown [notch (Item 2) to the front] for proper fit and tooth retention. The side of the tooth point (Item 3) **[Figure 40-170-3]** also shows the correct orientation of the retaining pin.

Installation: Position the new tooth point on the shank and install a new retaining pin. Install the retaining pin until it is flush with the top of the point.

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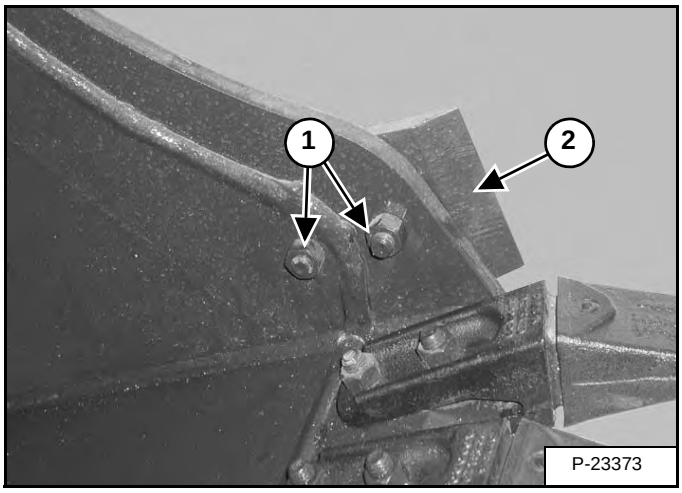
Bucket Side Cutting Edge Removal And Installation

Figure 40-170-4



The bucket side cutting edges (Item 1) **[Figure 40-170-4]** are reversible.

Figure 40-170-5



Remove the two bolts and nuts (Item 1) **[Figure 40-170-5]**.

Installation: Tighten the nuts to 125 - 135 N•m (90 - 100 ft-lb) torque.

Remove the cutting edge (Item 2) **[Figure 40-170-5]**.

Dealer Copy -- Not for Resale

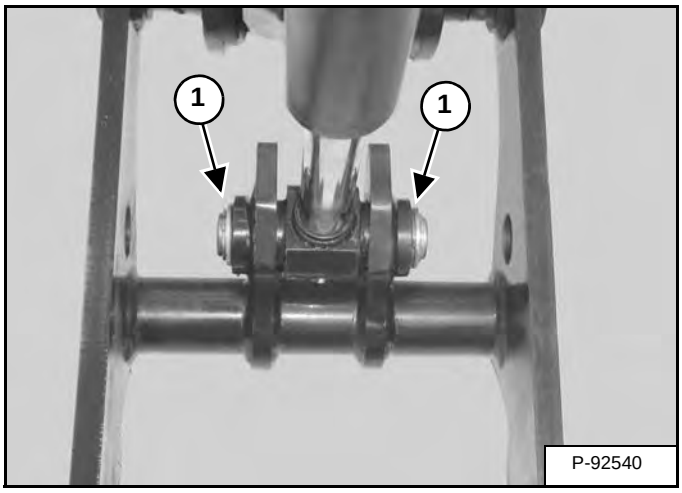
CLAMP

Removal And Installation

Remove the bucket. (See Operation & Maintenance Manual for correct removal procedure.)

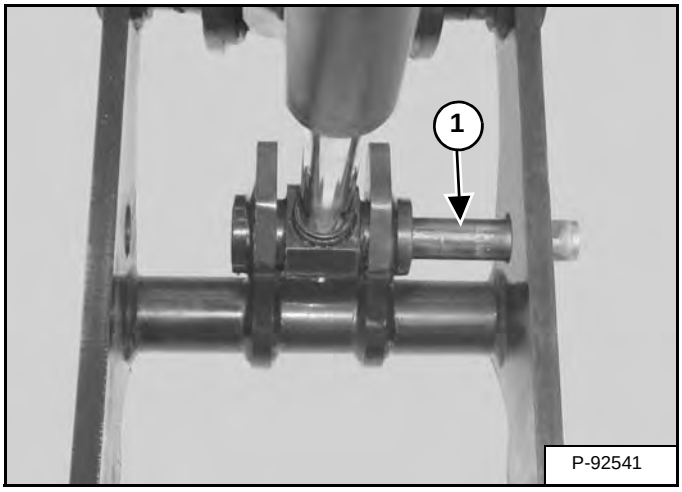
Lower the clamp to the ground.

Figure 40-180-1



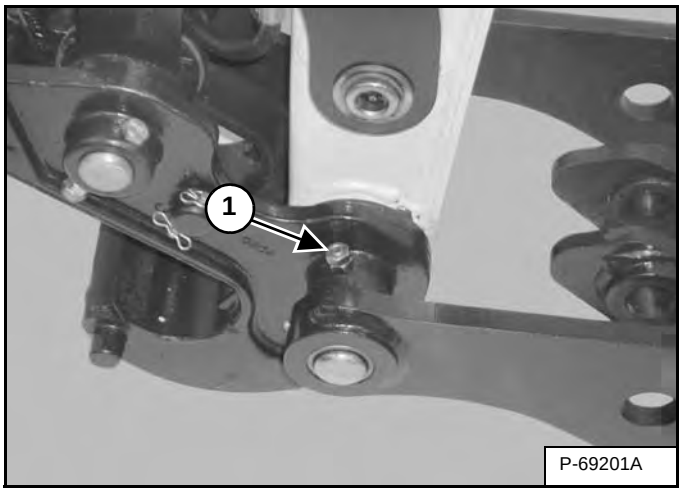
Remove the snap ring (Item 1) **[Figure 40-180-1]** and washers from the rod end of the clamp cylinder.

Figure 40-180-2



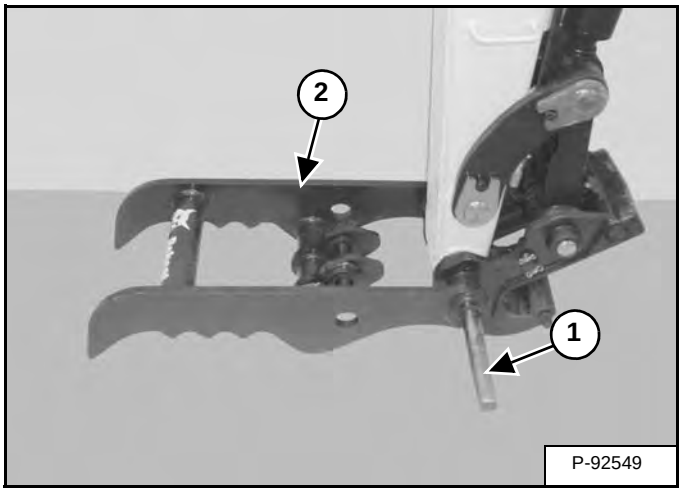
Remove the pin (Item 1) **[Figure 40-180-2]**.

Figure 40-180-3



Remove the nuts and bolt (Item 1) **[Figure 40-180-3]**.

Figure 40-180-4



Remove the pin (Item 1) and clamp (Item 2) **[Figure 40-180-4]**.

Dealer Copy -- Not for Resale

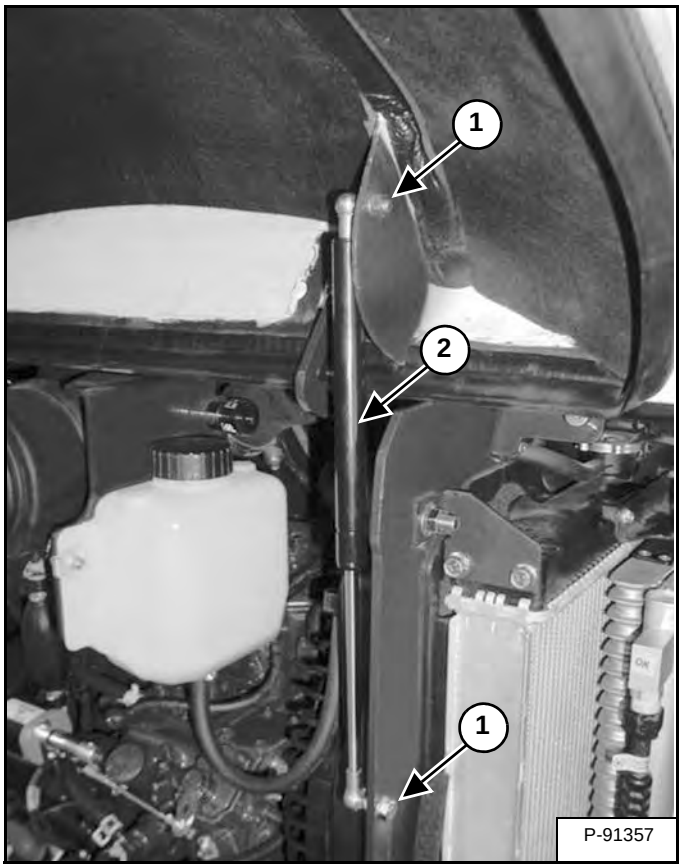


Dealer Copy -- Not for Resale

TAILGATE

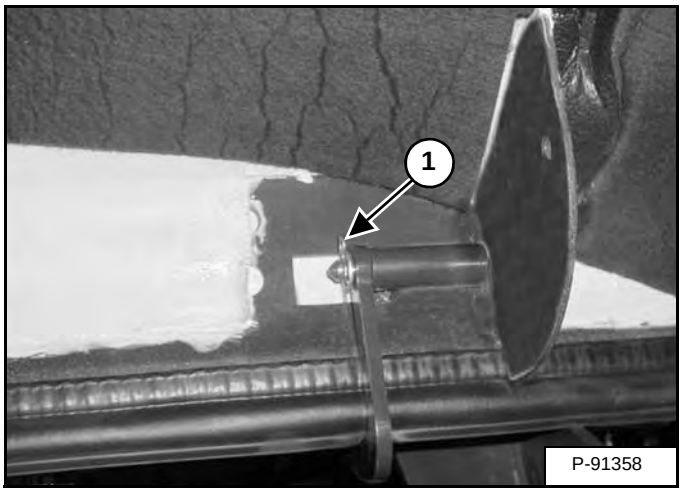
Removal And Installation

Figure 40-190-1



Support the tailgate and remove the nuts (Item 1). Remove the gas strut (Item 2) **[Figure 40-190-1]**.

Figure 40-190-2



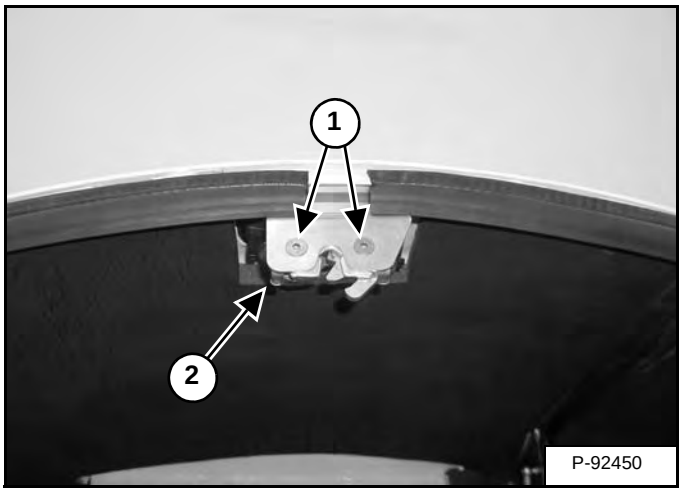
Remove the clip (Item 1) **[Figure 40-190-2]** and washer from both hinges.

Remove the tailgate.

Dealer Copy -- Not for Resale

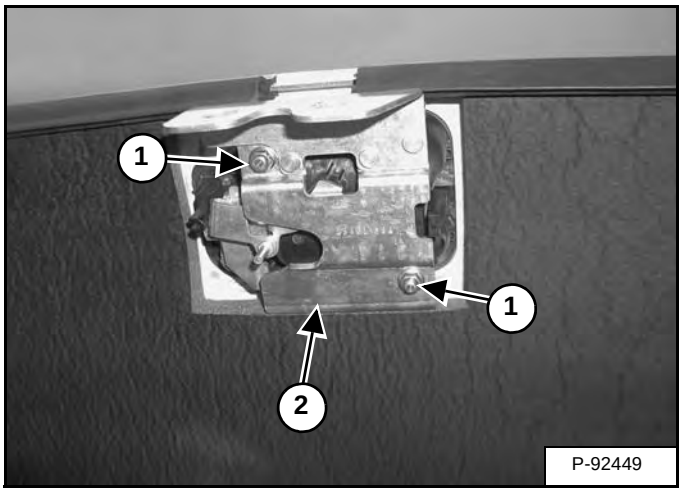
Latch Removal And Installation

Figure 40-190-3



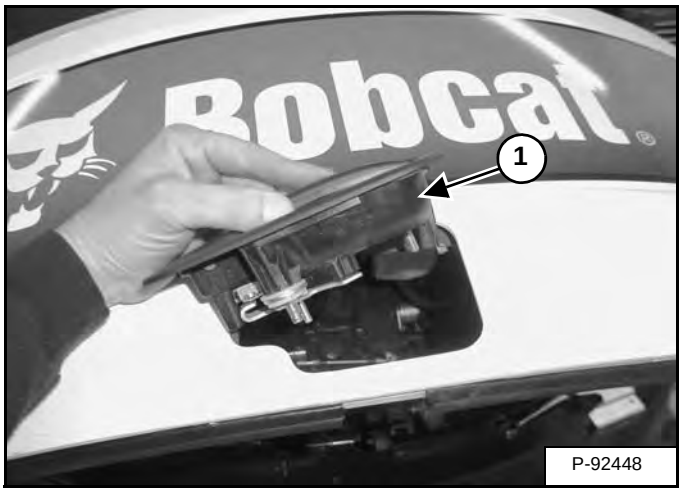
Remove the bolts (Item 1) and the latch (Item 2) **[Figure 40-190-3]**.

Figure 40-190-4



Remove the nuts (Item 1) and bracket (Item 2) **[Figure 40-190-4]**.

Figure 40-190-5



Remove the handle (Item 1) **[Figure 40-190-5]**.

Dealer Copy -- Not for Resale

X-CHANGE

Removal And Installation

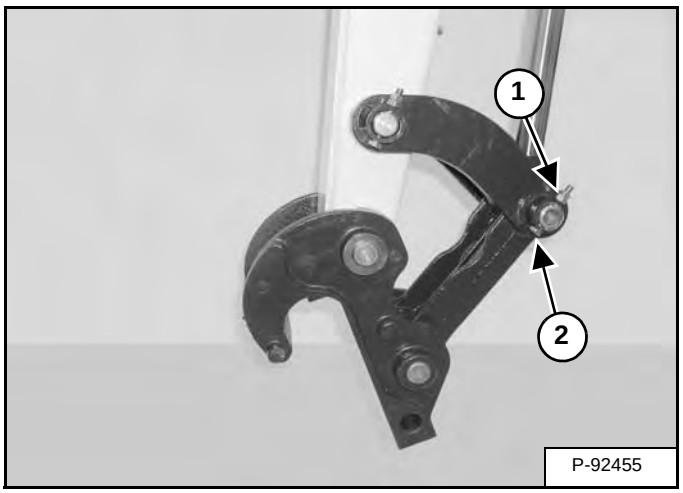
Remove the bucket. (See Operation & Maintenance Manual for correct removal procedure.

Figure 40-200-1



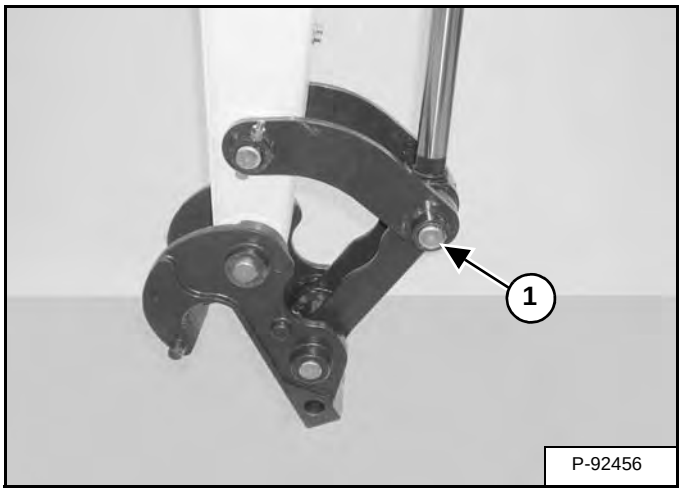
Support the boom with a hoist **[Figure 40-200-1]**.

Figure 40-200-2



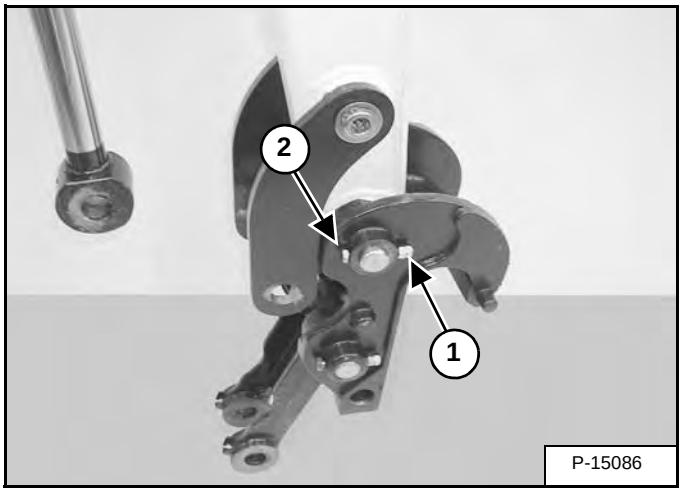
Remove the nuts (Item 1) and bolt (Item 2) **[Figure 40-200-2]**.

Figure 40-200-3



Remove the pin (Item 1) **[Figure 40-200-3]**.

Figure 40-200-4

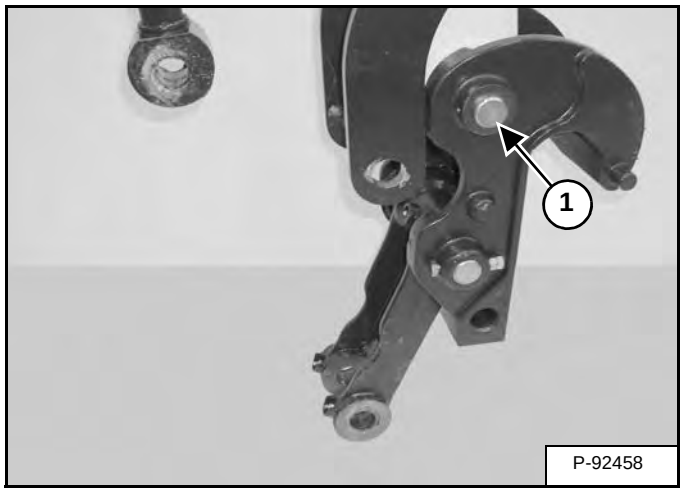


Remove the nuts (Item 1) and bolt (Item 2) **[Figure 40-200-4]**.

Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

Figure 40-200-5



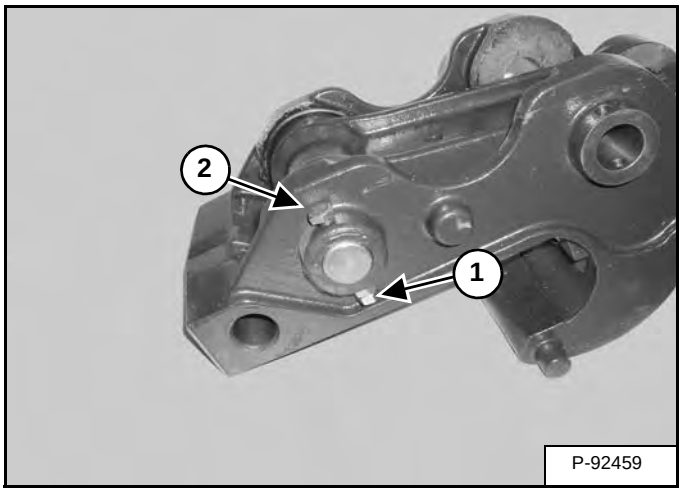
Remove the pin (Item 1) **[Figure 40-200-5]** and remove the X-Change™ from the arm.

Dealer Copy -- Not for Resale

X-CHANGE (CONT'D)

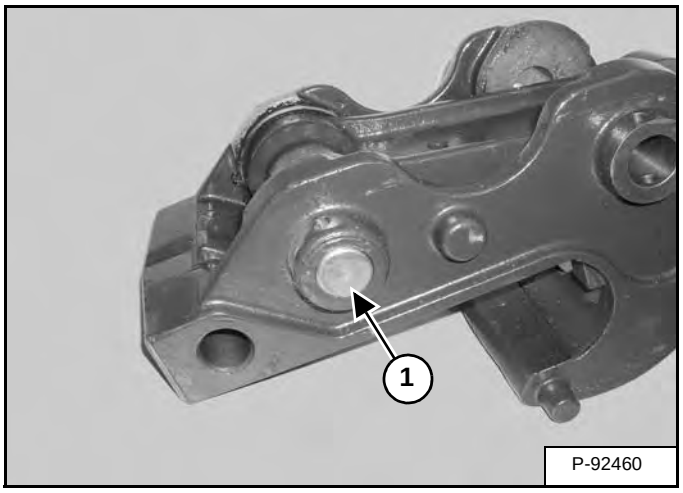
Disassembly

Figure 40-200-6



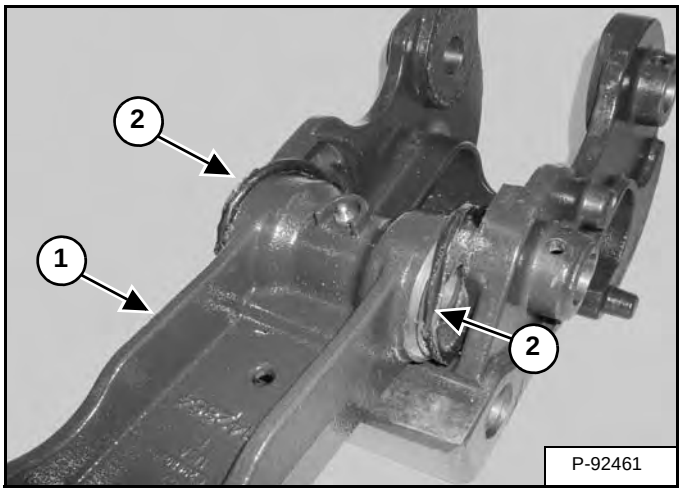
Remove the nuts (Item 1) and bolt (Item 2) **[Figure 40-200-6]**.

Figure 40-200-7



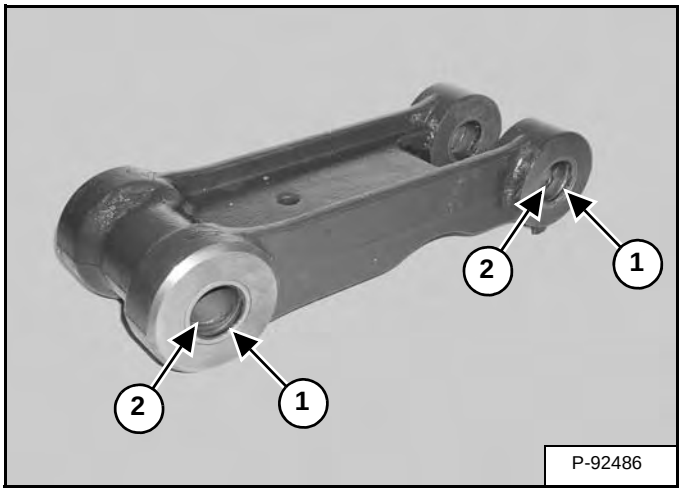
Remove the pin (Item 1) **[Figure 40-200-7]**.

Figure 40-200-8



Remove the link (Item 1) and O-rings (Item 2) **[Figure 40-200-8]**.

Figure 40-200-9

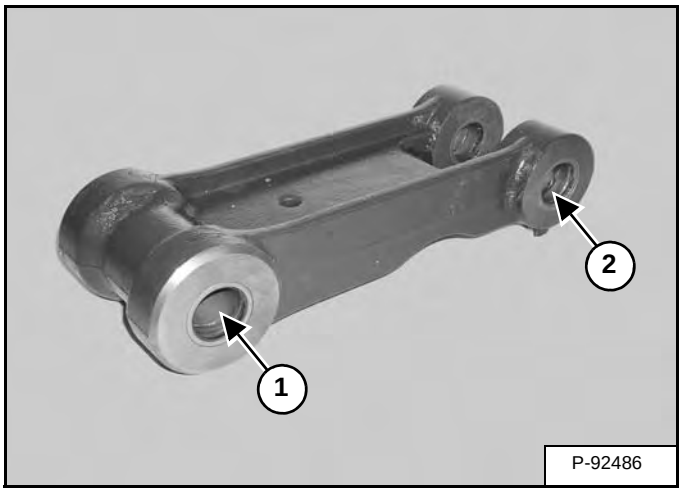


Remove the seals (Item 1) and bushings (Item 2) **[Figure 40-200-9]** (both sides).

Dealer Copy -- Not for Resale

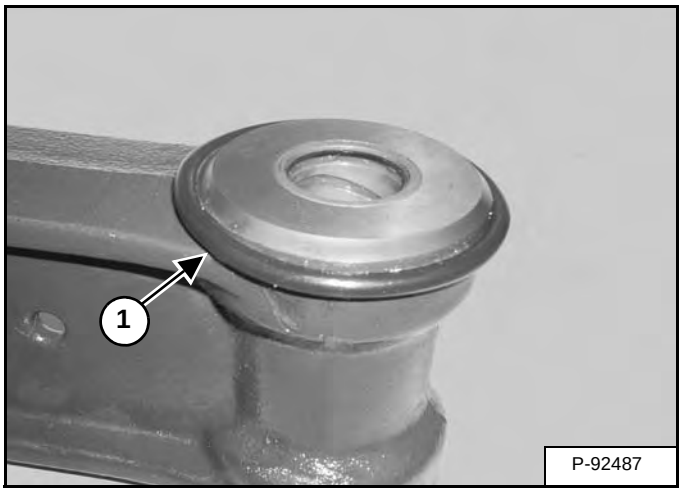
Assembly

Figure 40-200-10



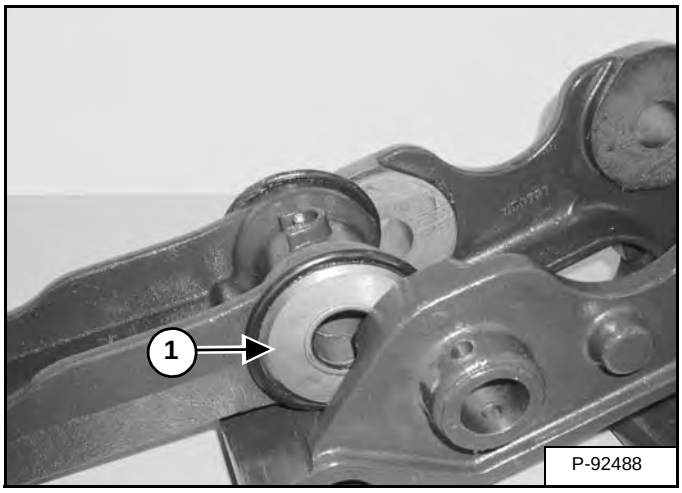
Install the bushings (Item 1) and seals (Item 2) **[Figure 40-200-10]** (both sides).

Figure 40-200-11



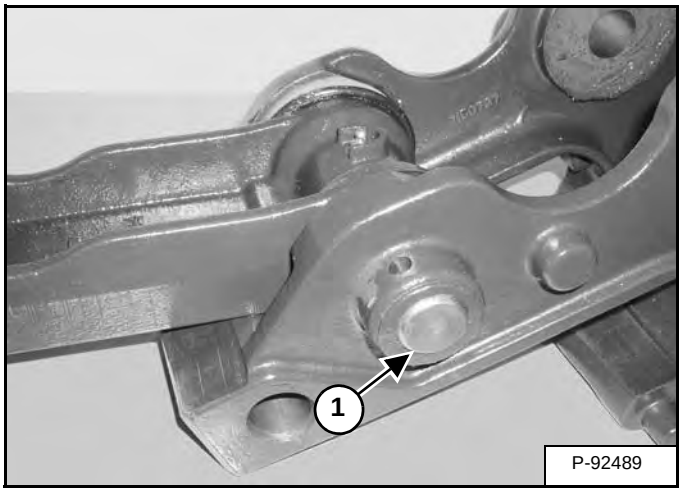
Install the O-ring (Item 1) **[Figure 40-200-11]** (both sides). Use grease to hold the O-rings in place.

Figure 40-200-12



Install the link (Item 1) **[Figure 40-200-12]**.

Figure 40-200-13

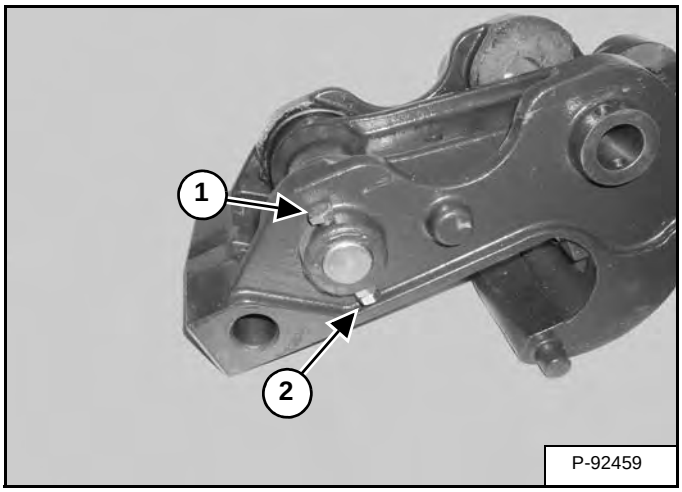


Install the pin (Item 1) **[Figure 40-200-13]**.

Dealer Copy -- Not for Resale

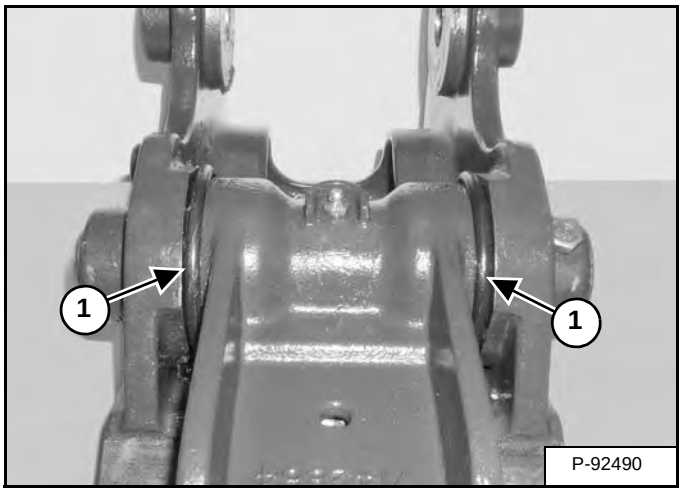
Assembly (Cont'd)

Figure 40-200-14



Install the bolt (Item 1) and nuts (Item 2) **[Figure 40-200-14]**.

Figure 40-200-15



Roll the two seals (Item 1) **[Figure 40-200-15]** into the groove between the link and the attachment.

Dealer Copy -- Not for Resale



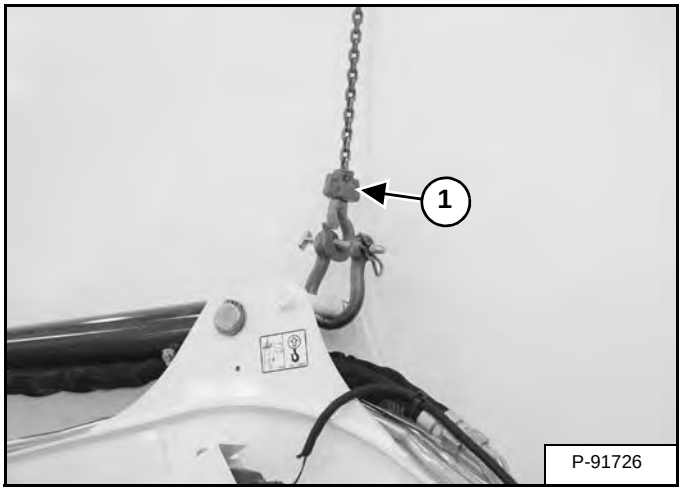
Dealer Copy -- Not for Resale

X-CHANGE (HYDRAULIC)

Removal And Installation

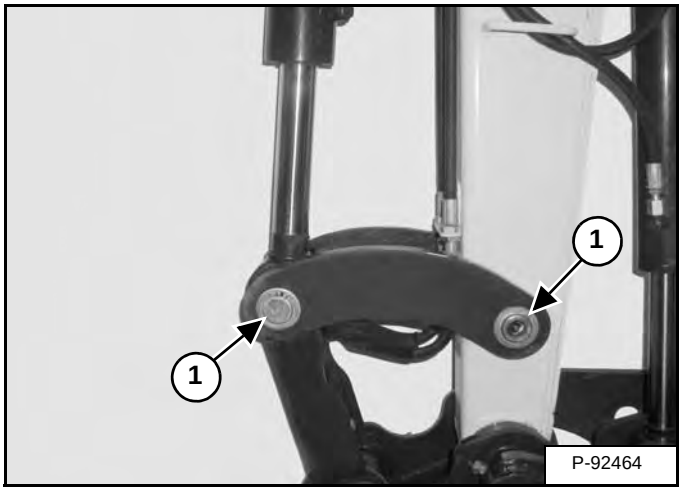
Remove the bucket. (See Operation & Maintenance Manual for the correct removal procedure.)

Figure 40-201-1



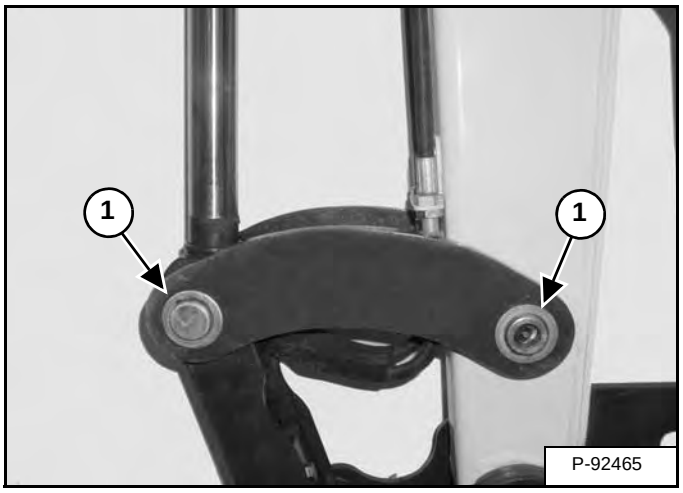
Support the boom with a hoist (Item 1) **[Figure 40-201-1]** and release the pressure on the boom cylinder.

Figure 40-201-2



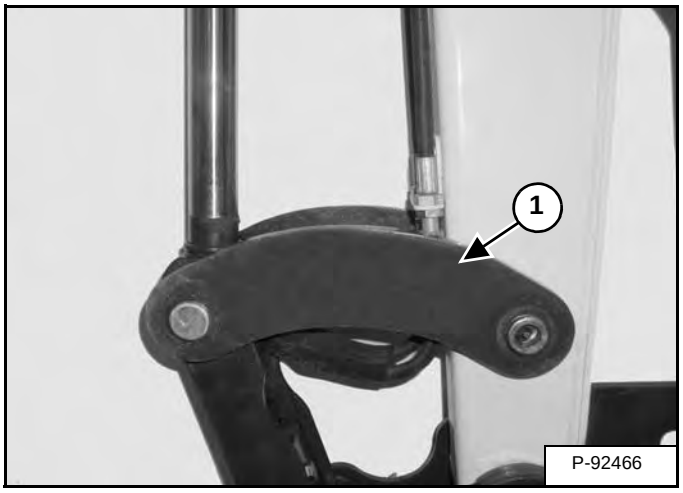
Remove the snap rings (Item 1) **[Figure 40-201-2]**.

Figure 40-201-3



Remove the washers (Item 1) **[Figure 40-201-3]**.

Figure 40-201-4

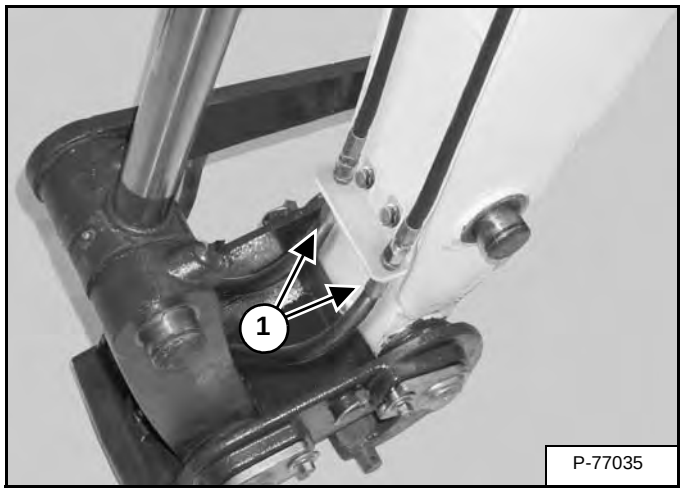


Remove the plate (Item 1) **[Figure 40-201-4]**.

Dealer Copy -- Not for Resale

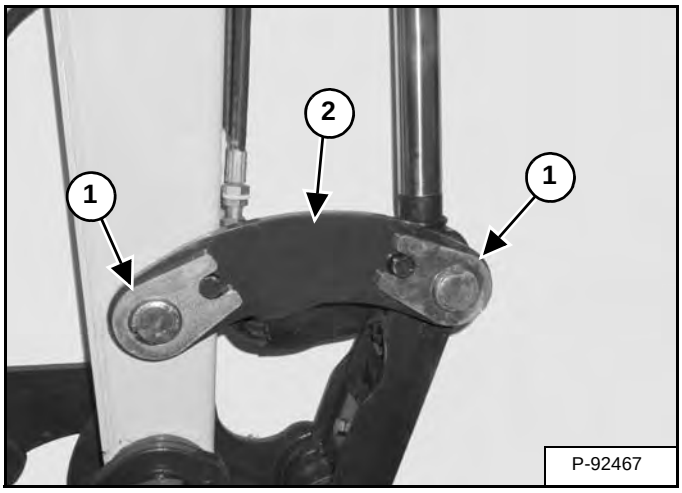
Removal And Installation (Cont'd)

Figure 40-201-5



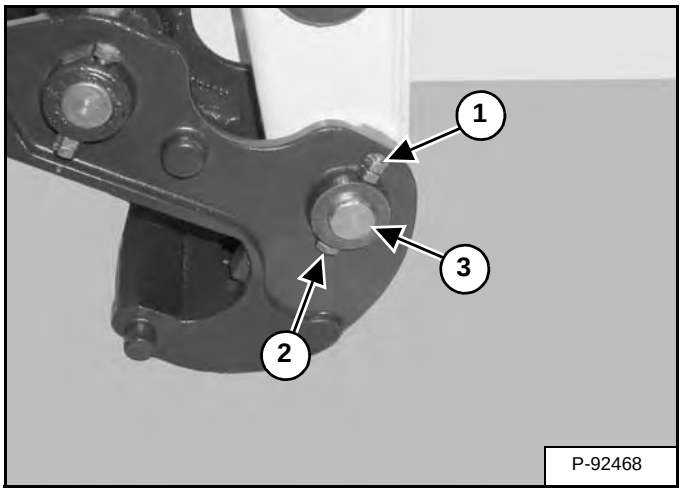
Remove the two hydraulic hoses (Item 1) **[Figure 40-201-5]** from the tubelines.

Figure 40-201-6



Remove the two pins (Item 1) and link (Item 2) **[Figure 40-201-6]**.

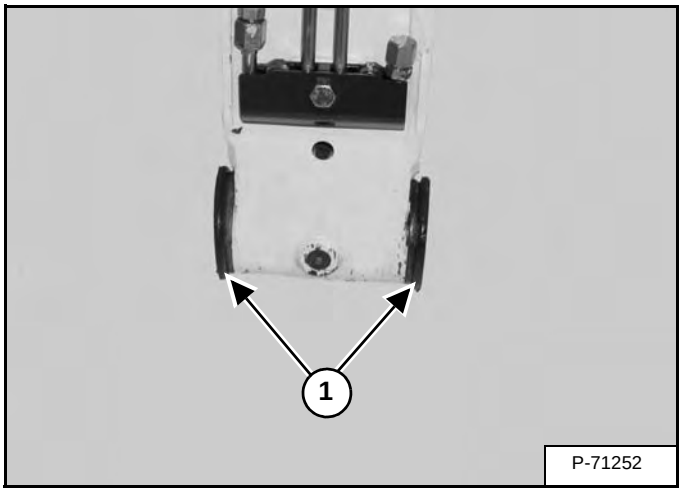
Figure 40-201-7



Remove the two nuts (Item 1) and bolt (Item 2). Remove the pin (Item 3) **[Figure 40-201-7]**.

Remove the hydraulic X-Change.

Figure 40-201-8

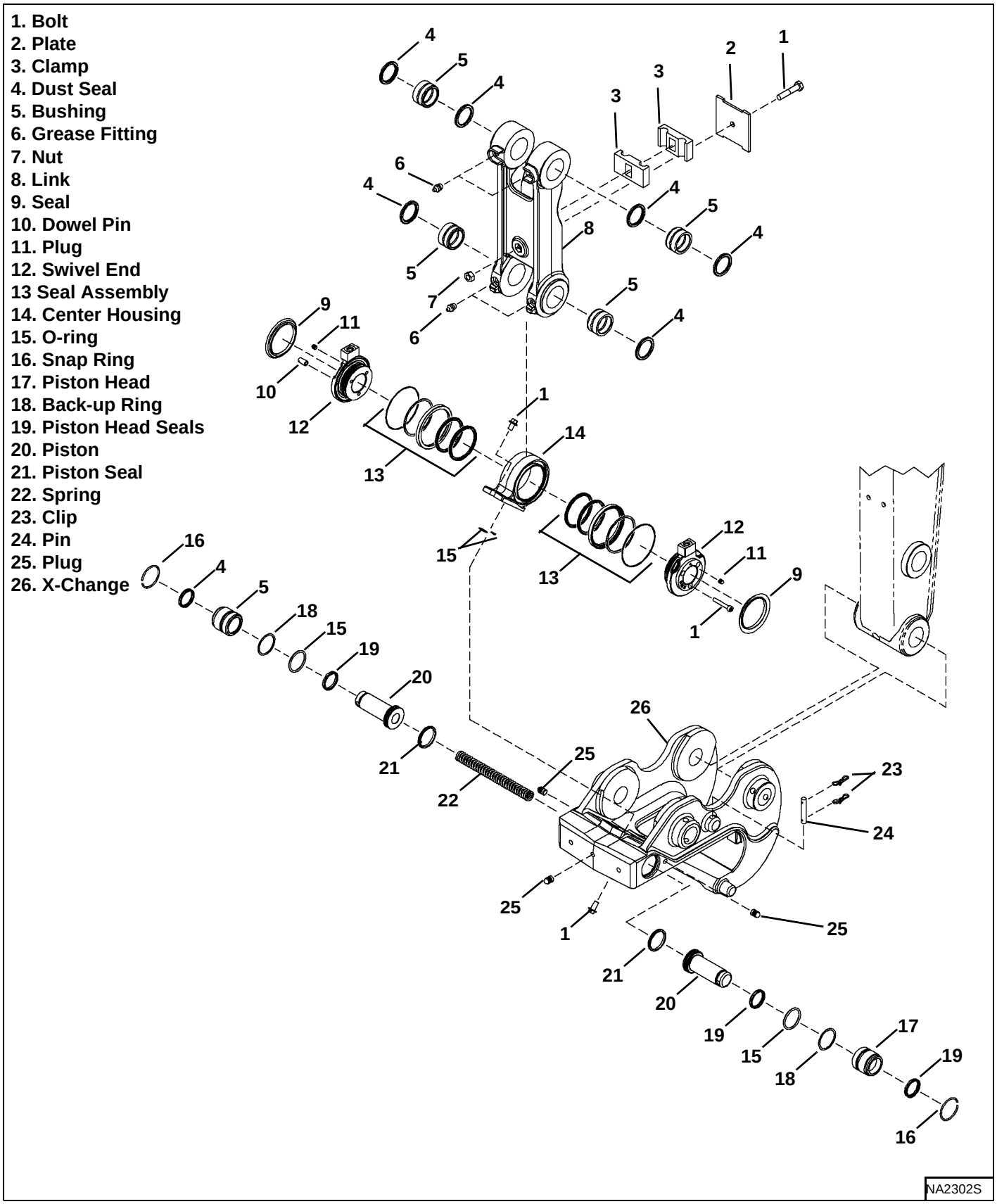


Remove the O-rings (Item 1) **[Figure 40-201-8]** from the arm.

Dealer Copy -- Not for Resale

Parts Identification

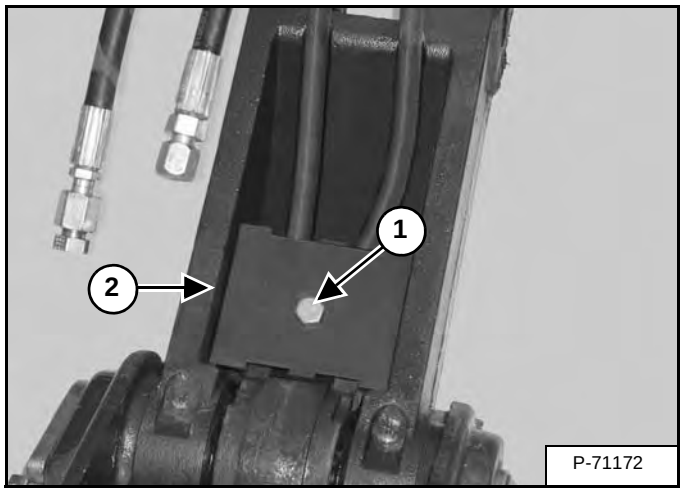
1. Bolt
2. Plate
3. Clamp
4. Dust Seal
5. Bushing
6. Grease Fitting
7. Nut
8. Link
9. Seal
10. Dowel Pin
11. Plug
12. Swivel End
13 Seal Assembly
14. Center Housing
15. O-ring
16. Snap Ring
17. Piston Head
18. Back-up Ring
19. Piston Head Seals
20. Piston
21. Piston Seal
22. Spring
23. Clip
24. Pin
25. Plug
26. X-Change



Dealer Copy -- Not for Resale

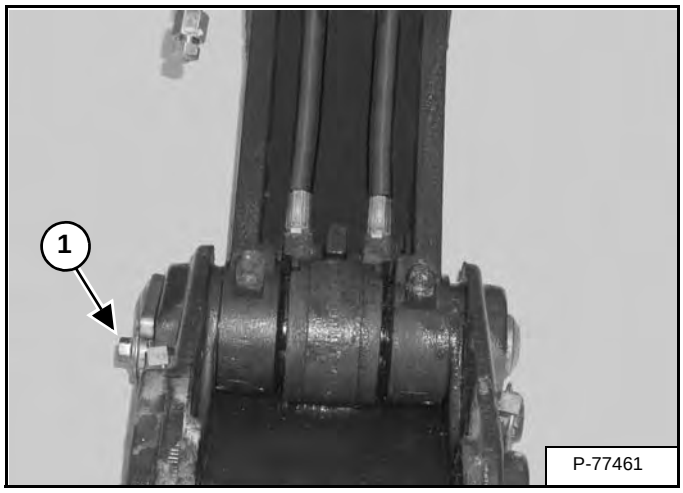
Disassembly

Figure 40-201-9



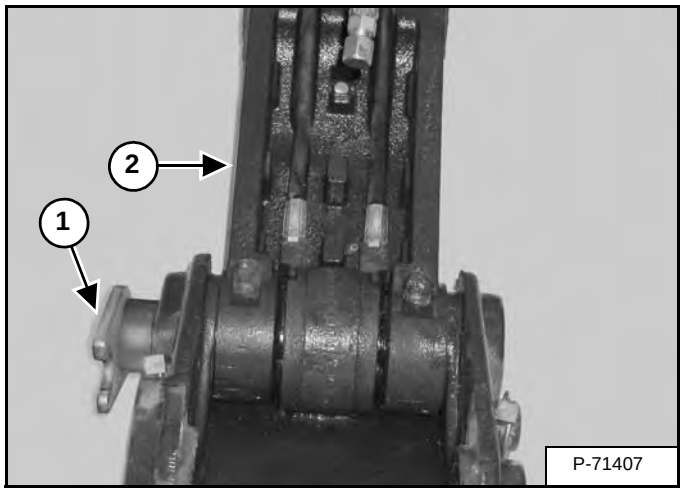
Remove the bolt (Item 1) and nut. Remove the cover (Item 2) **[Figure 40-201-9]**.

Figure 40-201-10



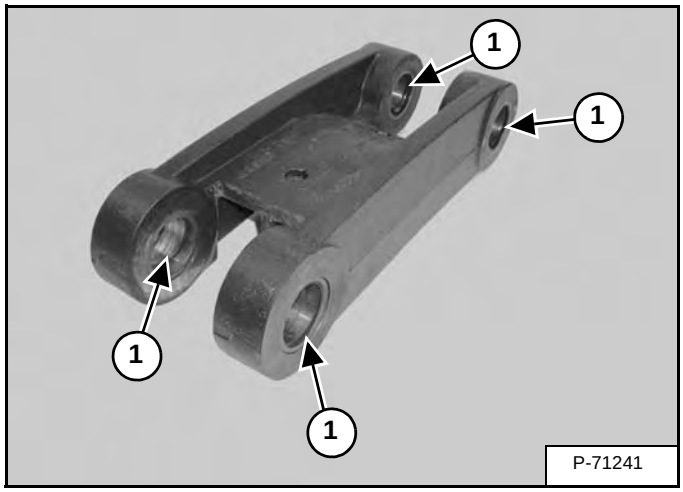
Remove the bolt (Item 1) **[Figure 40-201-10]**, washer and spacer.

Figure 40-201-11



Remove the pin (Item 1) and the bucket link (Item 2) **[Figure 40-201-11]**.

Figure 40-201-12

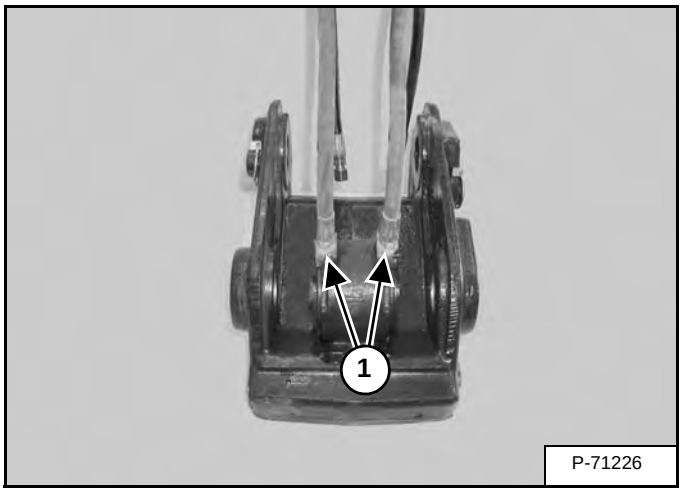


Remove the dust seals and bushings (Item 1) **[Figure 40-201-12]** from the bucket link.

Dealer Copy -- Not for Resale

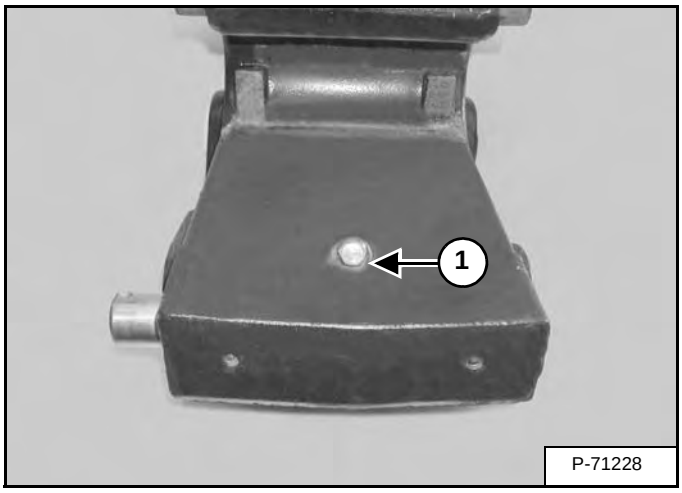
Disassembly (Cont'd)

Figure 40-201-13



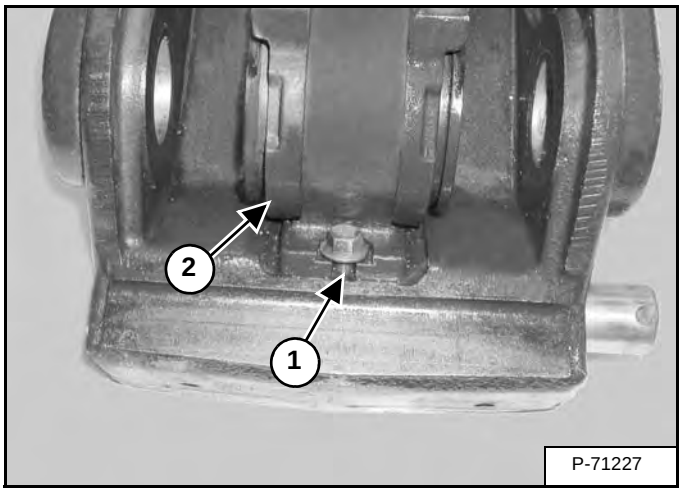
Remove the two hydraulic hoses (Item 1) **[Figure 40-201-13]** from the swivel ends.

Figure 40-201-14



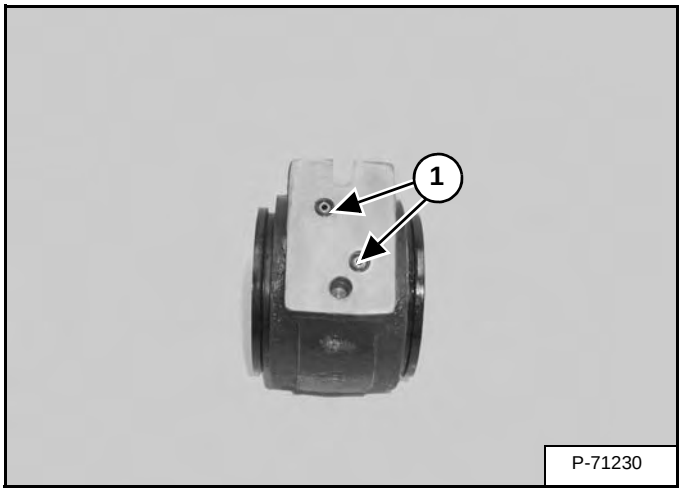
Remove the bolt (Item 1) **[Figure 40-201-14]**.

Figure 40-201-15



Remove the bolt (Item 1), nut, and the swivel assembly (Item 2) **[Figure 40-201-15]**.

Figure 40-201-16

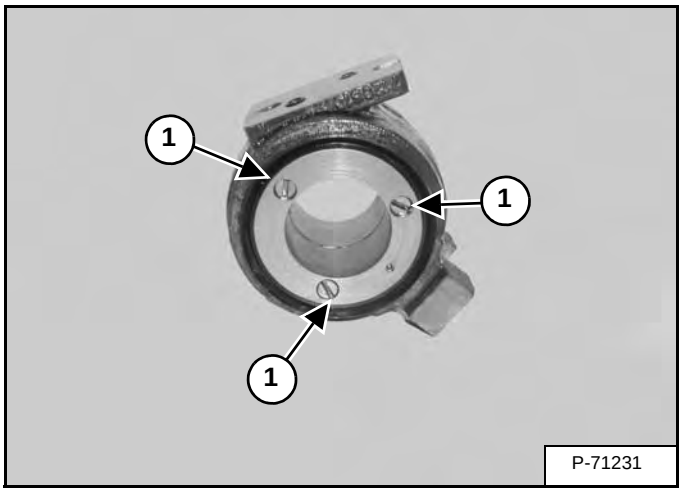


Remove the O-rings (Item 1) **[Figure 40-201-16]** from the swivel assembly.

Dealer Copy -- Not for Resale

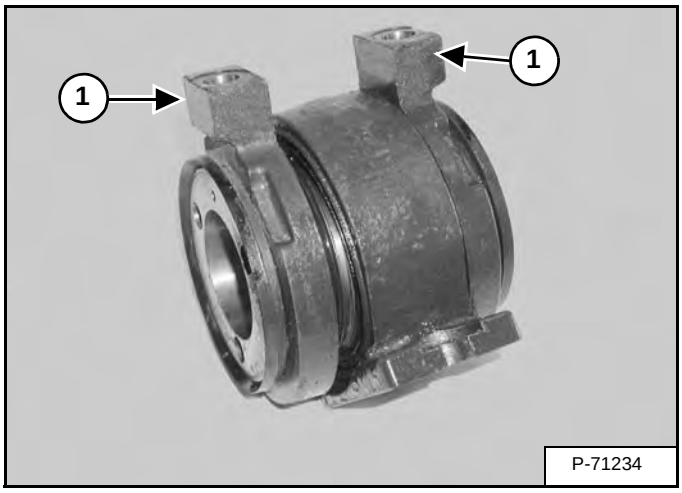
Disassembly (Cont'd)

Figure 40-201-17



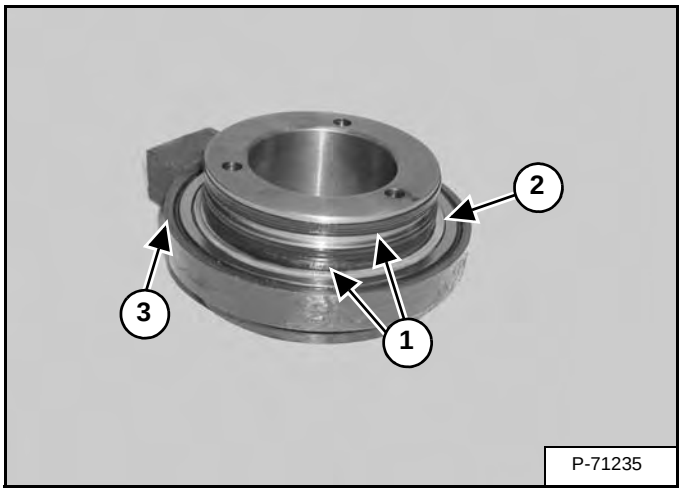
Remove the screws (Item 1) **[Figure 40-201-17]** and nuts from the swivel assembly.

Figure 40-201-18



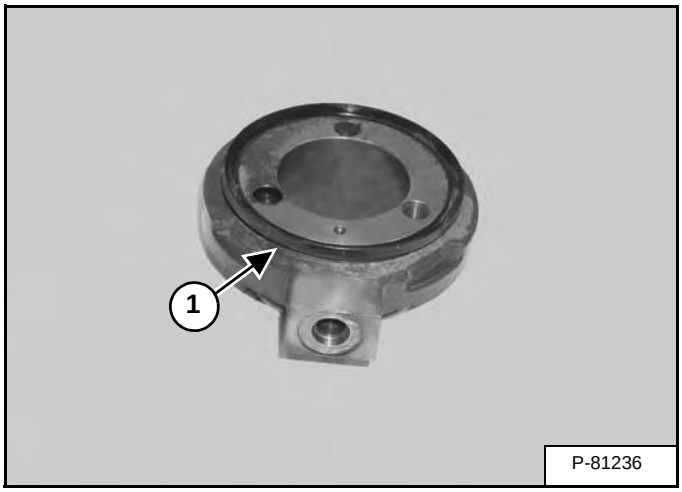
Remove the two swivel ends (Item 1) **[Figure 40-201-18]**.

Figure 40-201-19



Remove the seals (Item 1), wear ring (Item 2) and the O-ring (Item 3) **[Figure 40-201-19]** from the swivel end.

Figure 40-201-20

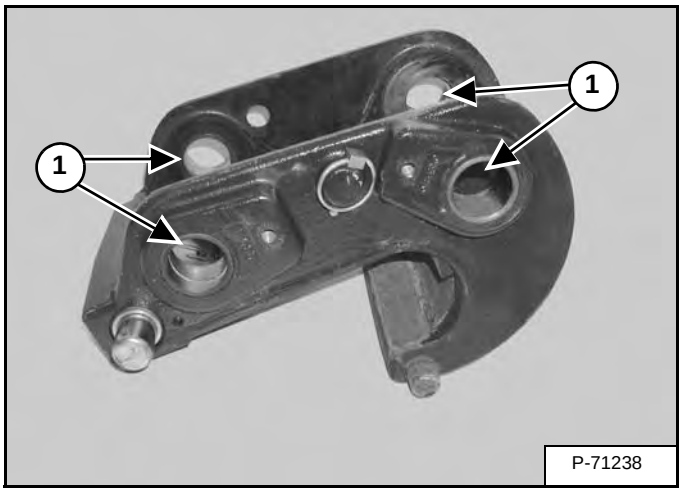


Remove the dust seal (Item 1) **[Figure 40-201-20]** (both swivel ends.)

Dealer Copy -- Not for Resale

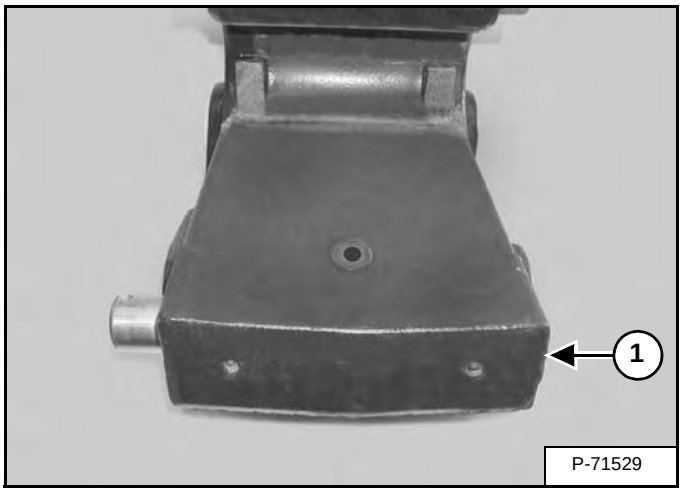
Disassembly (Cont'd)

Figure 40-201-21



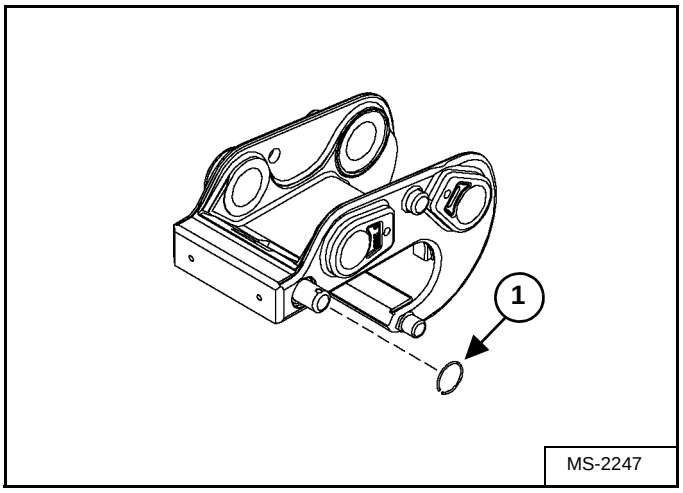
Remove the four bushings (Item 1) **[Figure 40-201-21]**.

Figure 40-201-22



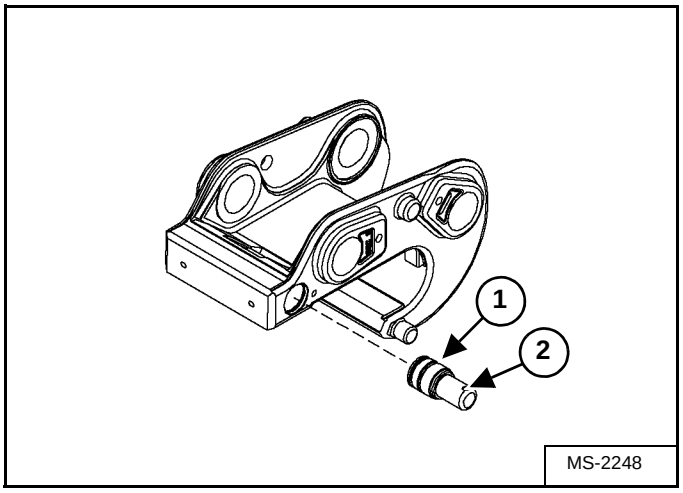
Apply inward pressure on the piston (Item 1) **[Figure 40-201-22]**.

Figure 40-201-23



Remove the retaining ring (Item 1) **[Figure 40-201-23]**.

Figure 40-201-24



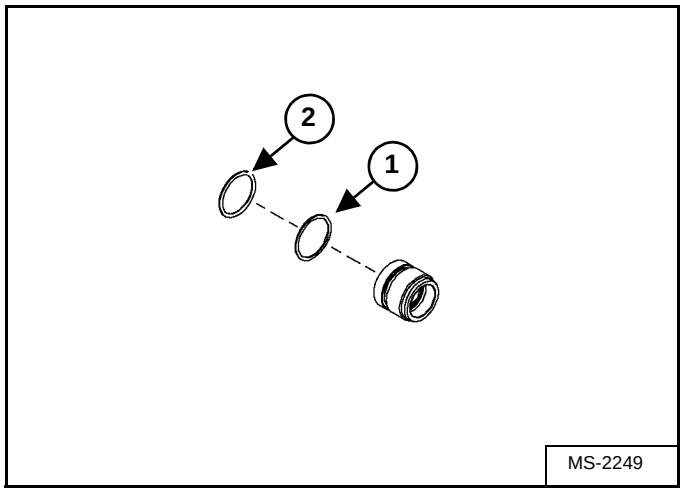
Remove the piston head (Item 1) and the piston (Item 2) **[Figure 40-201-24]**.

Repeat **[Figure 40-201-22]** through **[Figure 40-201-24]** to remove the piston head and piston from the opposite side of the X-change.

Dealer Copy -- Not for Resale

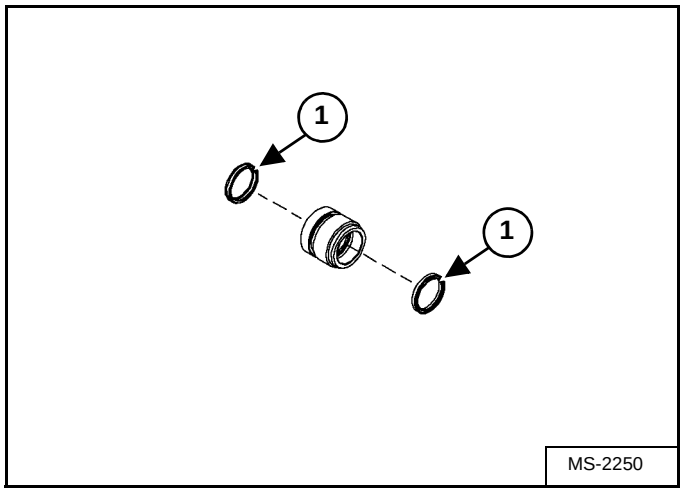
Disassembly (Cont'd)

Figure 40-201-25



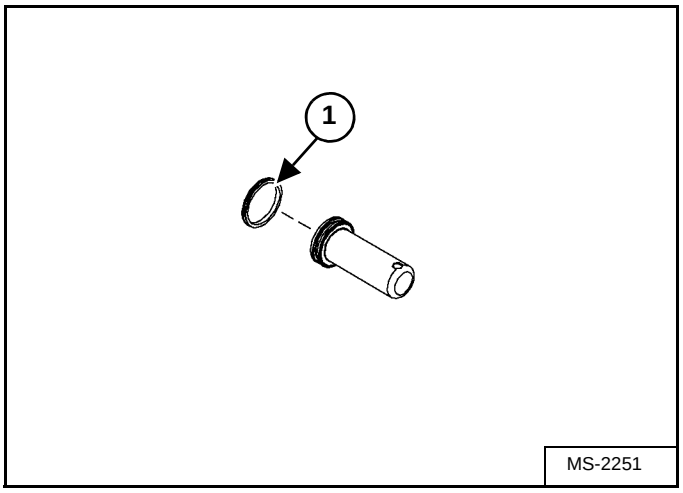
Remove the back-up ring (Item 1) and the O-ring (Item 2) **[Figure 40-201-25]** from the piston head.

Figure 40-201-26



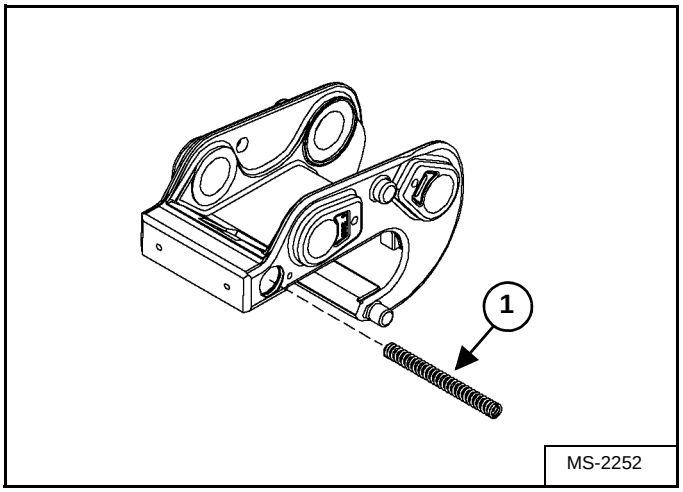
Remove the two pin seals (Item 1) **[Figure 40-201-26]** from inside the piston head.

Figure 40-201-27



Remove the piston seal (Item 1) **[Figure 40-201-27]** from the piston.

Figure 40-201-28



Remove the compression spring (Item 1) **[Figure 40-201-28]**.

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Assembly

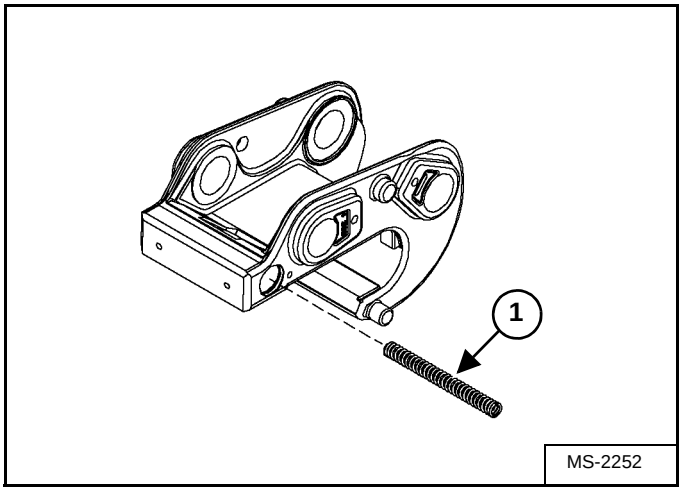
Clean all parts in solvent and dry with compressed air.

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

Always install new O-rings and seals.

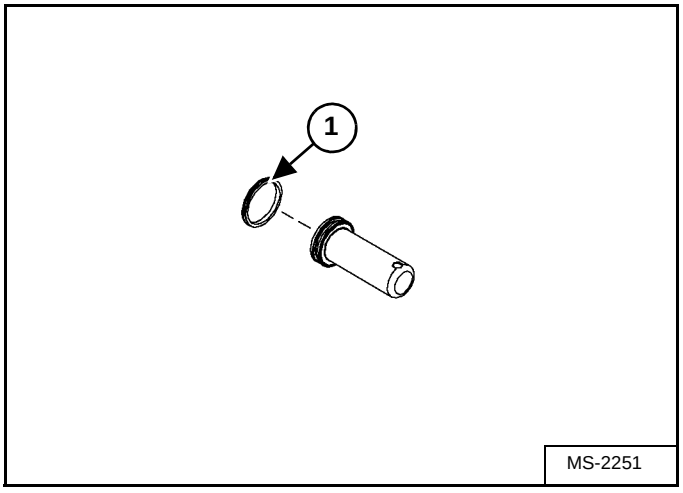
Lubricate all O-rings and seals with hydraulic oil during installation.

Figure 40-201-29



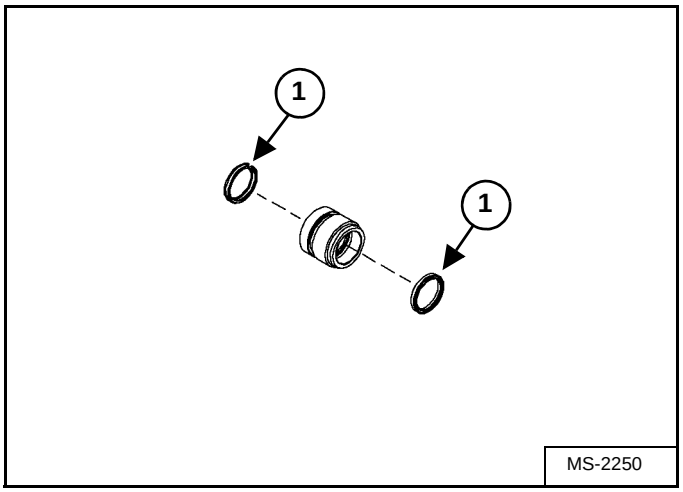
Install the compression spring (Item 1) **[Figure 40-201-29]**.

Figure 40-201-30



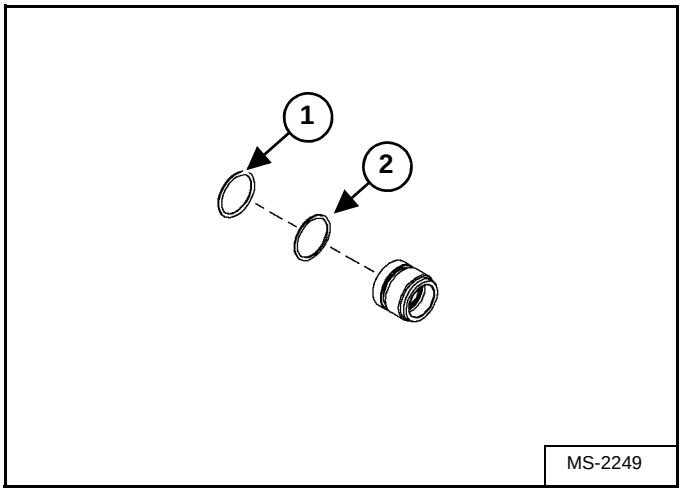
Install the piston seal (Item 1) **[Figure 40-201-30]** on the piston.

Figure 40-201-31



Install the two pin seals (Item 1) **[Figure 40-201-31]** on the inside of the piston head.

Figure 40-201-32

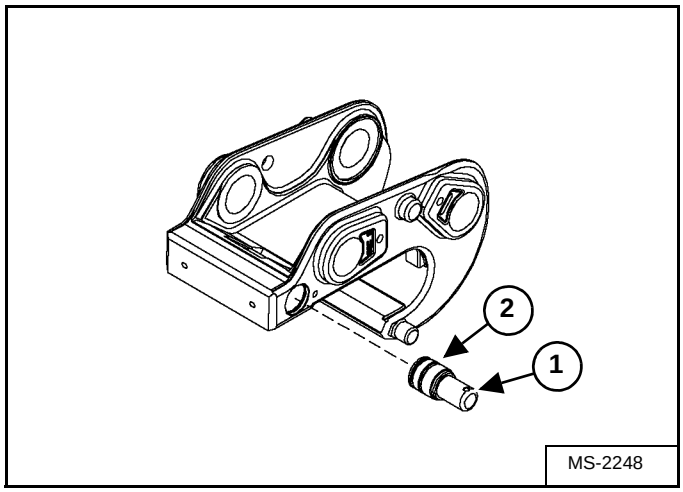


Install the O-ring (Item 1) and back-up ring (Item 2) **[Figure 40-201-32]** on the piston head.

Dealer Copy -- Not for Resale

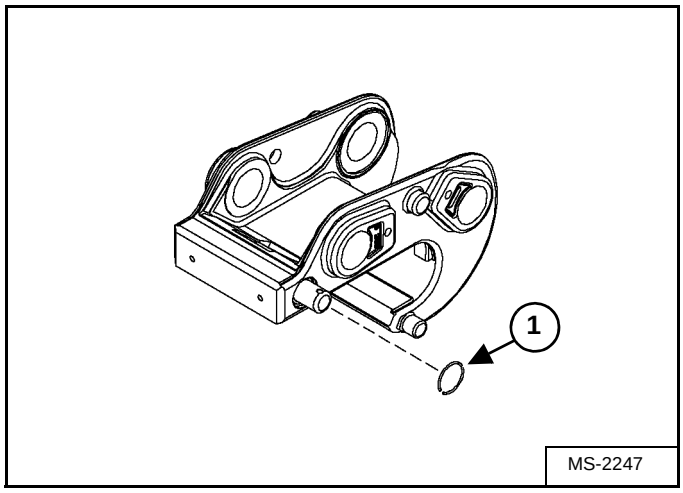
Assembly (Cont'd)

Figure 40-201-33



Install the piston (Item 1) and the piston head (Item 2) **[Figure 40-201-33]**.

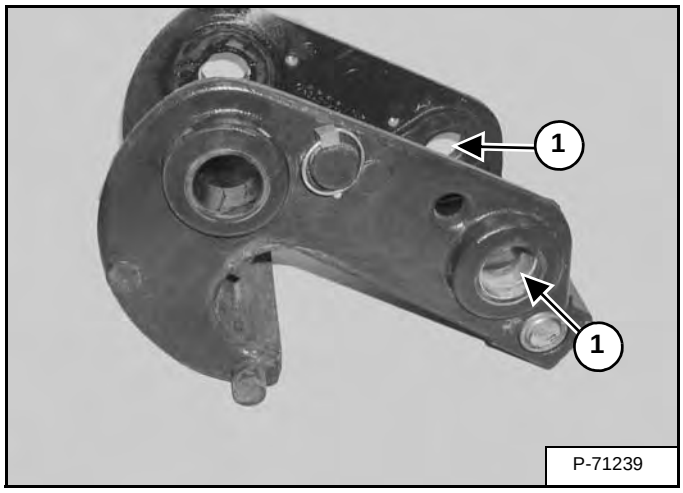
Figure 40-201-34



Apply inward pressure on the piston and install the retaining ring (Item 1) **[Figure 40-201-34]**.

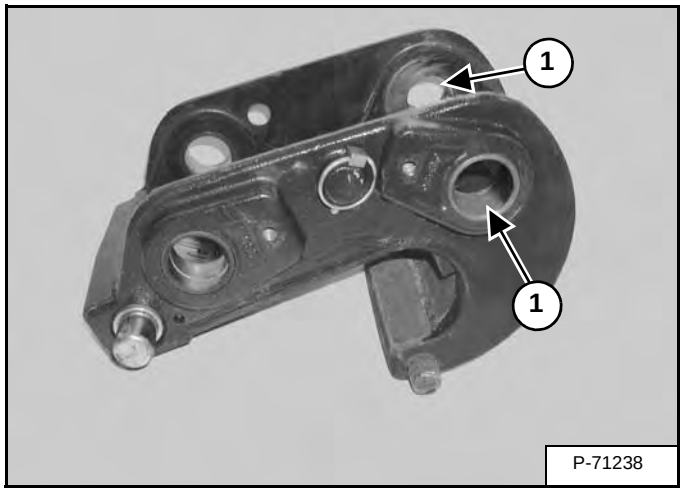
Repeat **[Figure 40-201-30 on Page 9]** through **[Figure 40-201-34]** to remove the piston head and piston from the opposite side of the X-change.

Figure 40-201-35



Install the bushings (Item 1) **[Figure 40-201-35]**.

Figure 40-201-36

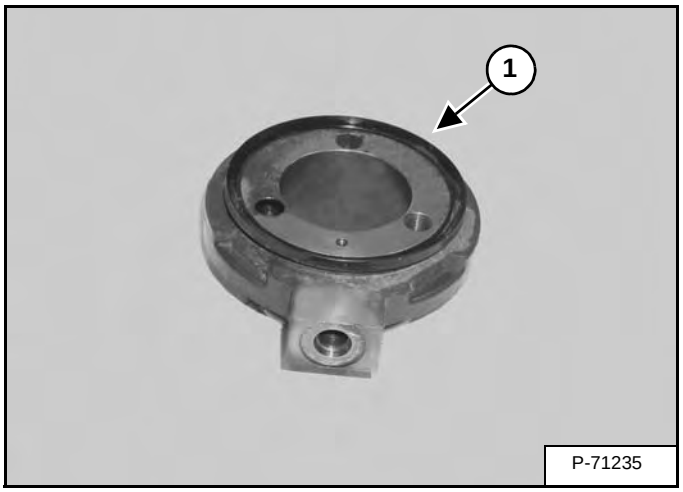


Install the bushings (Item 1) **[Figure 40-201-36]**.

Dealer Copy -- Not for Resale

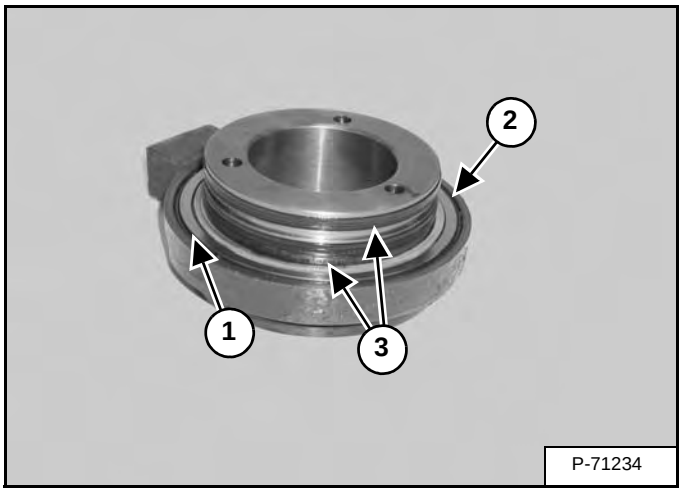
Assembly (Cont'd)

Figure 40-201-37



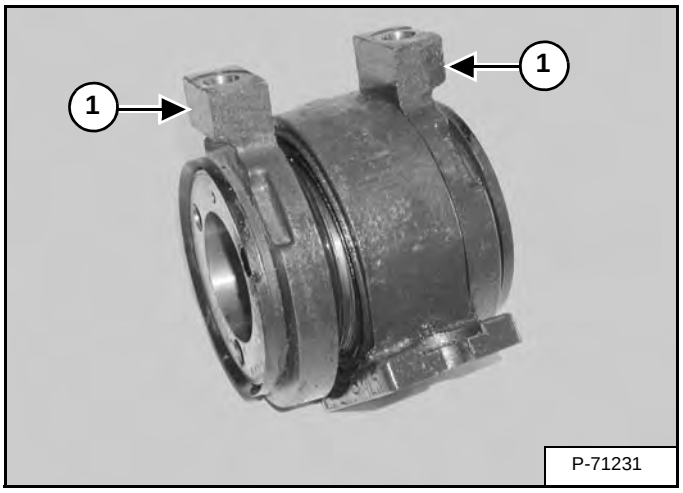
Install the dust seal (Item 1) **[Figure 40-201-37]** on the swivel.

Figure 40-201-38



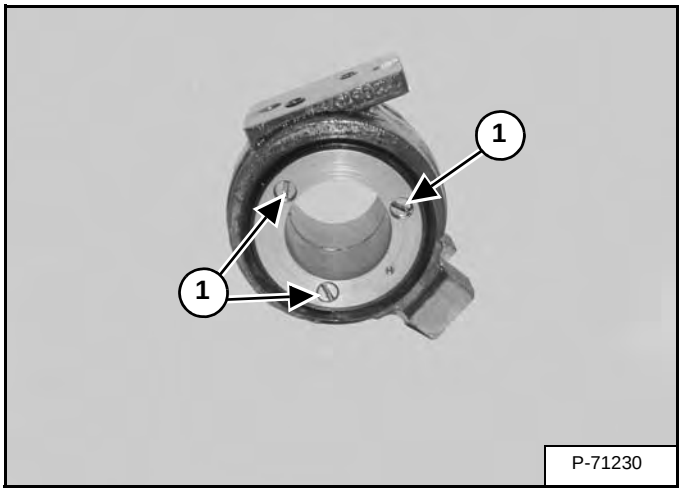
Install the O-ring (Item 1) wear ring (Item 2) and seals (Item 3) **[Figure 40-201-38]**.

Figure 40-201-39



Install the swivel ends (Item 1) **[Figure 40-201-39]** onto the base.

Figure 40-201-40

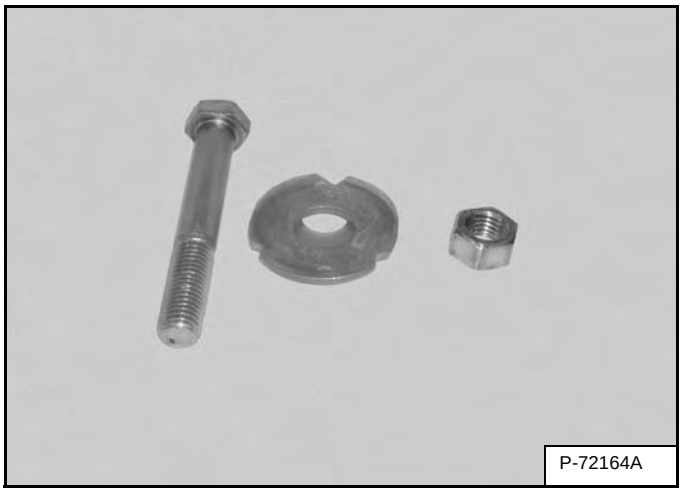


Install the screws (Item 1) **[Figure 40-201-40]** and nuts in the swivel assembly. Do not tighten at this time.

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Assembly (Cont'd)

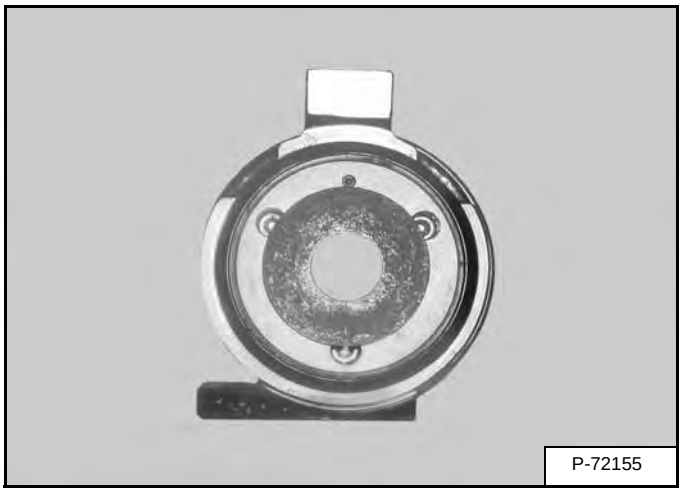
Figure 40-201-41



It is necessary to fabricate a preload tool to get the proper torque on the swivel assembly screws. The tool consists of a 15,9 x 127 mm (5/8 x 5 in) course thread bolt, two 15,9 x 50,8 mm (5/8 x 2 in) flat washers and a 5/8 course thread nut **[Figure 40-201-41]**.

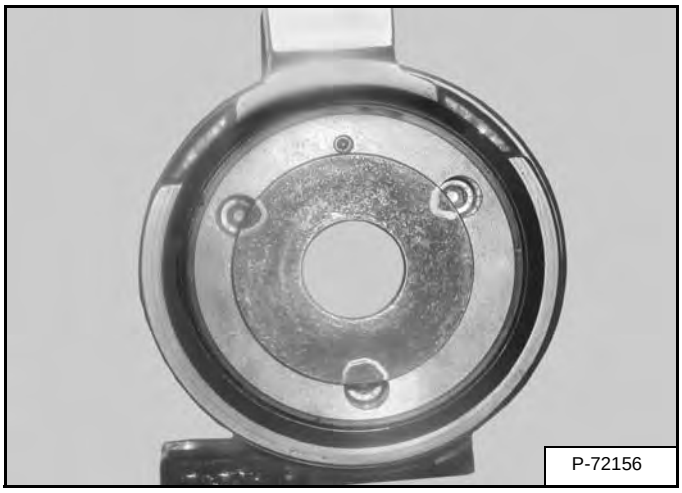
NOTE: This procedure must be followed to ensure the swivel assembly screws are tightened to the proper torque value.

Figure 40-201-42



Center a 50,8 mm (2 in) flat washer on one side of the swivel assembly **[Figure 40-201-42]**.

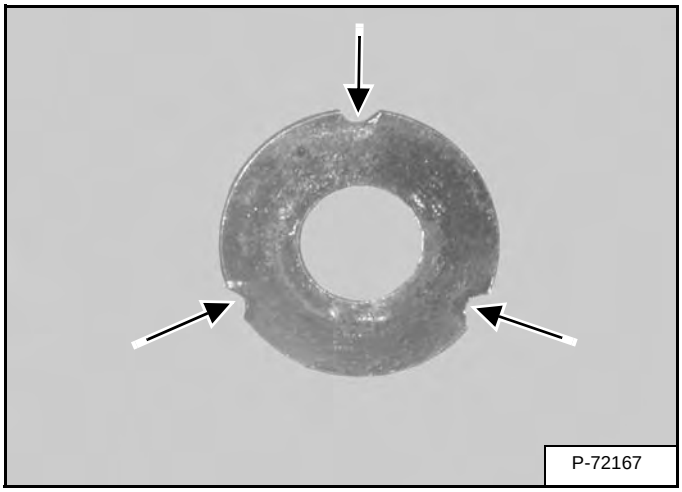
Figure 40-201-43



Using a marker, mark the three screw holes on the washer **[Figure 40-201-43]**.

Repeat for the opposite side.

Figure 40-201-44



Using a grinder, remove material identified in the previous step **[Figure 40-201-44]**.

WARNING

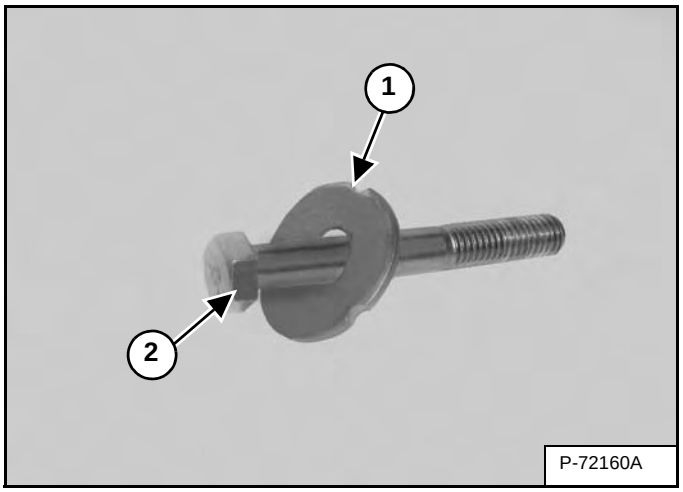
Eye and body protection is required when welding or grinding. Wear approved goggles, helmet and clothing. Failure to wear eye and body protection can result in serious injury.

W-2009-1285

Dealer Copy -- Not for Resale

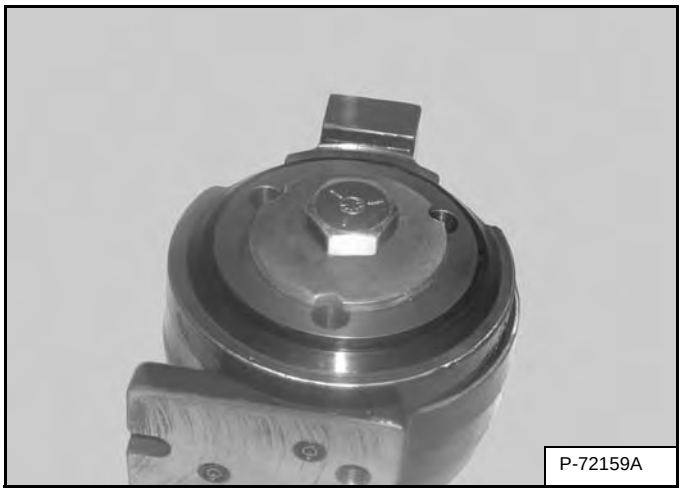
Assembly (Cont'd)

Figure 40-201-45



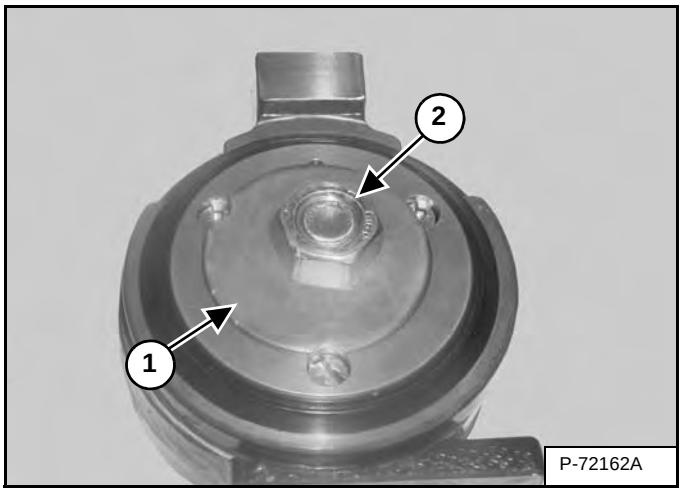
Install a 50,8 mm (2 in) flat washer (Item 1) onto the bolt (Item 2) **[Figure 40-201-45]**.

Figure 40-201-46



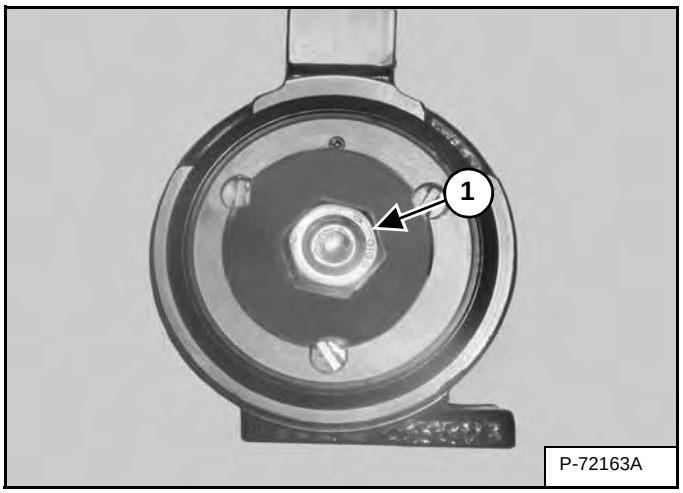
Insert the bolt through the center of the swivel assembly aligning the notches in the flat washer with the screw holes **[Figure 40-201-46]**.

Figure 40-201-47



Turn the swivel assembly over and install the remaining 50,8 mm (2 in) flat washer (Item 1) and nut (Item 2) **[Figure 40-201-47]**.

Figure 40-201-48



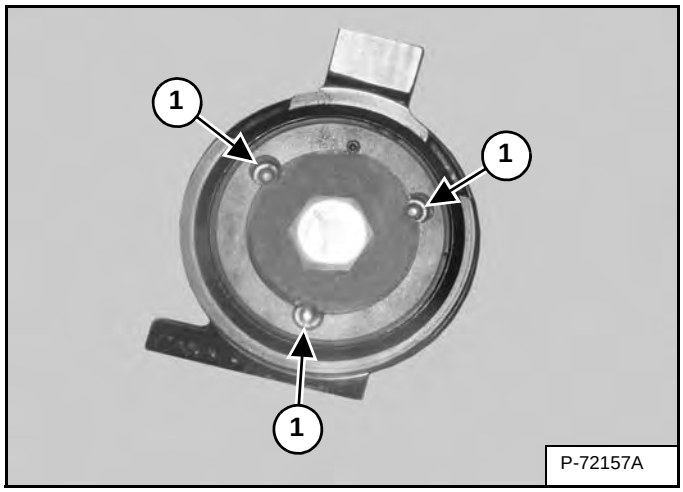
NOTE: The notches in both washers must be aligned with the screw holes on the swivel assembly [Figure 40-201-48].

Tighten the preload tool nut (Item 1) **[Figure 40-201-48]** to 112,5 N•m (83 ft-lb) torque.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

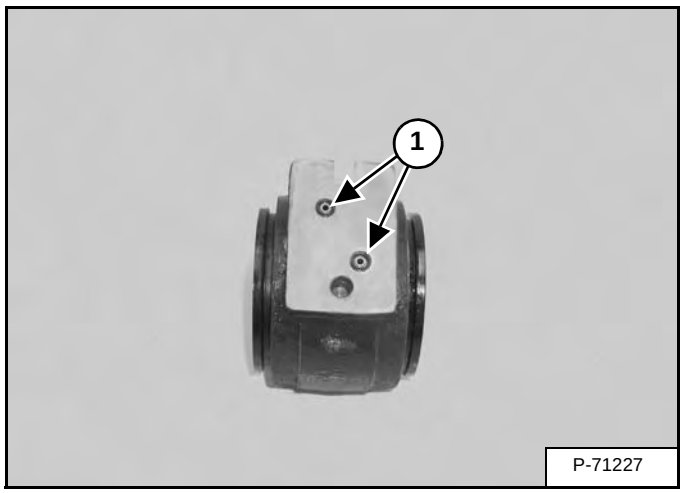
Figure 40-201-49



Tighten the swivel assembly screws (Item 1) **[Figure 40-201-49]** to 14,2 - 15,8 N•m (10.4 - 11.6 ft-lb) torque.

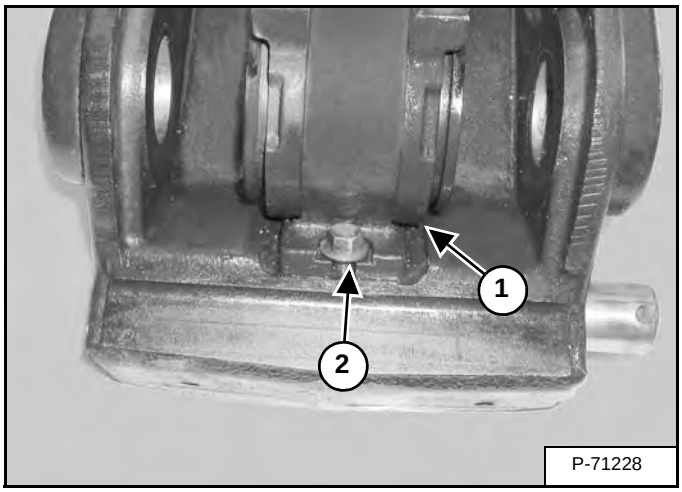
Remove the preload tool.

Figure 40-201-50



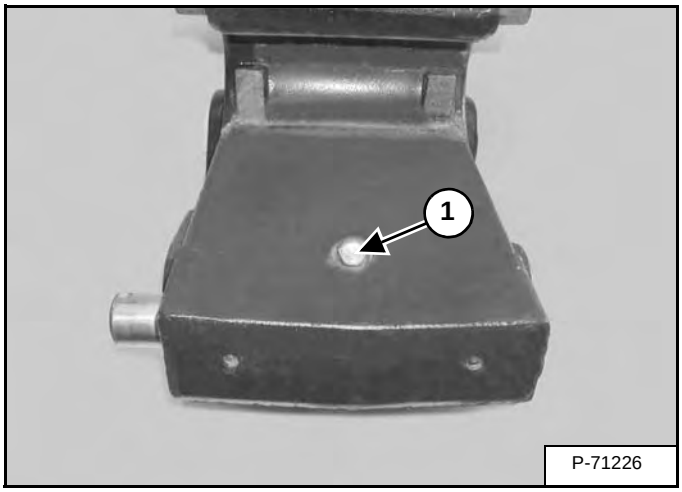
Install the two O-rings (Item 1) **[Figure 40-201-50]** into the swivel assembly.

Figure 40-201-51



Install the swivel assembly (Item 1) using the bolt (Item 2) **[Figure 40-201-51]**.

Figure 40-201-52

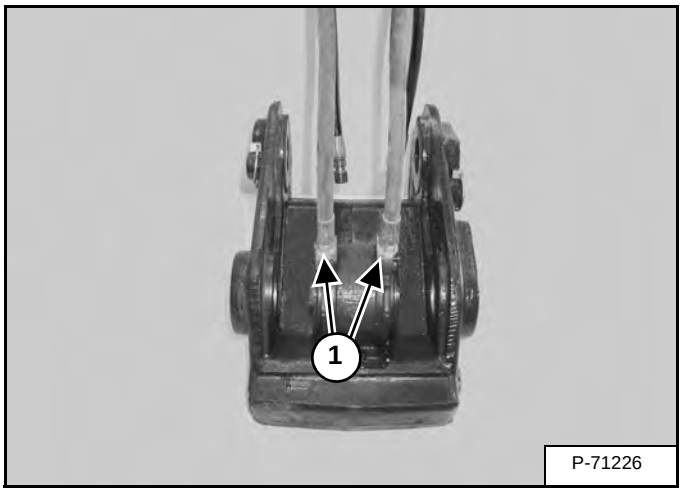


Install the bolt (Item 1) **[Figure 40-201-52]** and nut.

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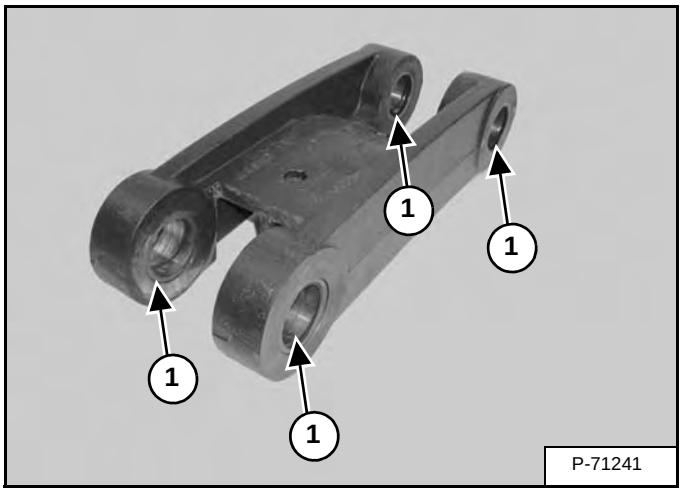
Assembly (Cont'd)

Figure 40-201-53



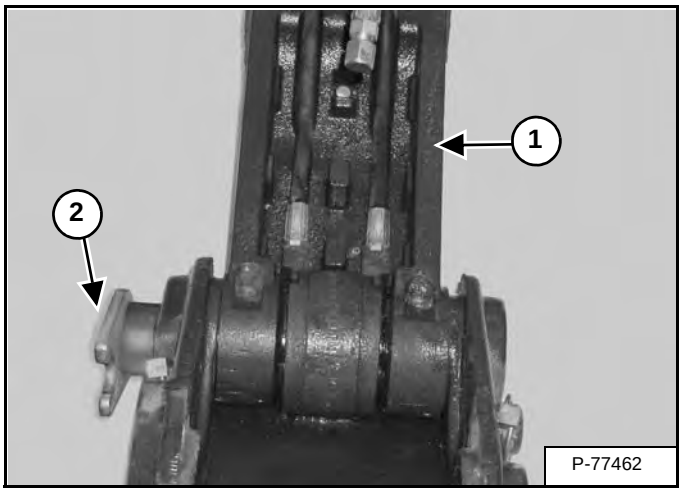
Install the hydraulic hoses (Item 1) **[Figure 40-201-53]** onto the swivel ends.

Figure 40-201-54



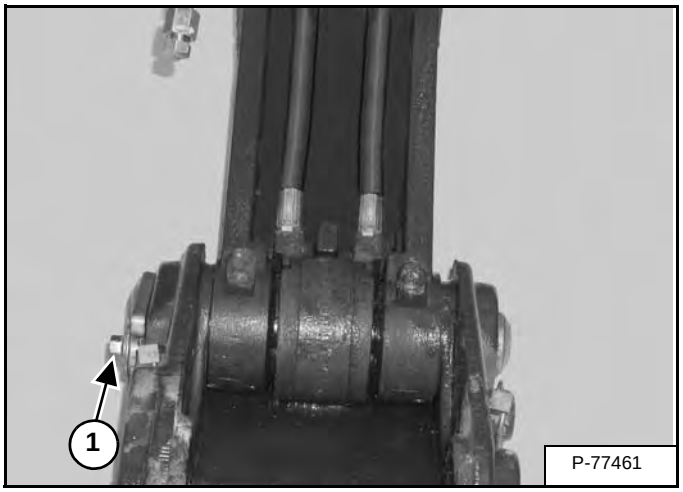
Install the bushings (Item 1) **[Figure 40-201-54]** and dust seals into the bucket link.

Figure 40-201-55



Install the bucket link (Item 1) and pin (Item 2) **[Figure 40-201-55]**.

Figure 40-201-56

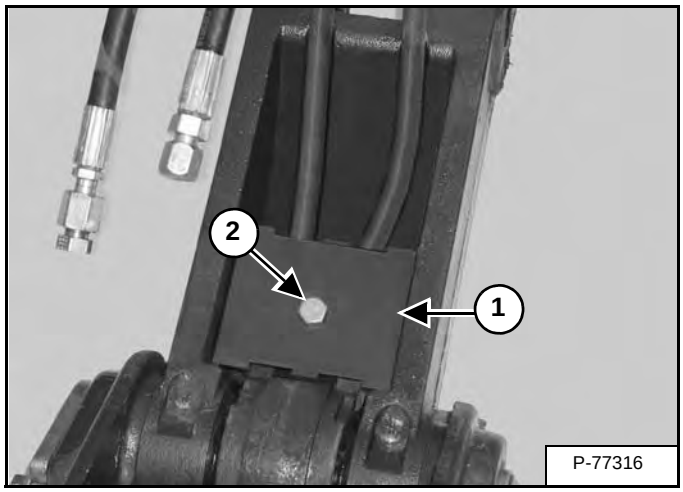


Install the spacer, flat washer and bolt (Item 1) **[Figure 40-201-56]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 40-201-57



Install the foam block and cover (Item 1) using the bolt (Item 2) **[Figure 40-201-57]** and nut.

Dealer Copy -- Not for Resale

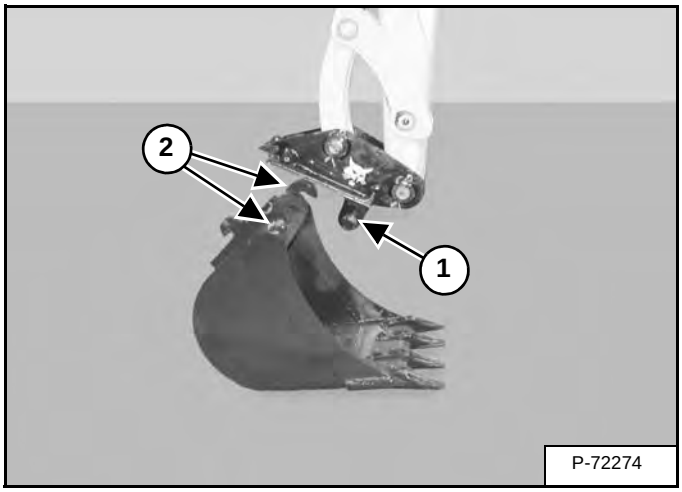
QUICK COUPLER (KLAC™ SYSTEM)

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 40-210-1



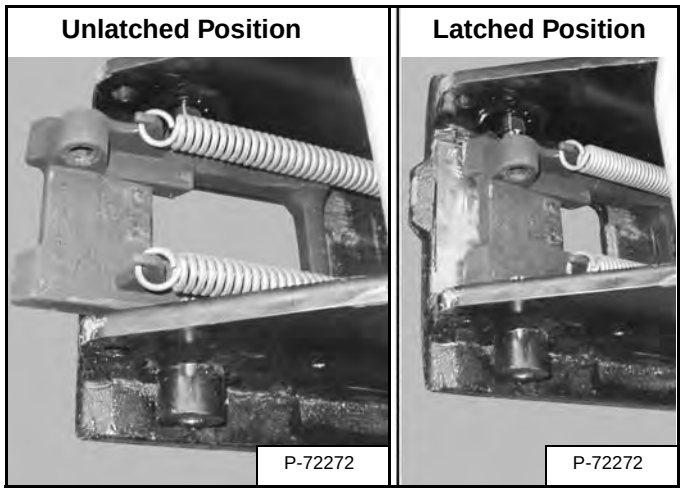
Inspect the quick coupler for wear or damage. Inspect the quick locking shaft (Item 1) and the hooks (Item 2) **[Figure 40-210-1]** (on the attachment) for wear or damage.

Repair or replace damaged parts.

Dealer Copy -- Not for Resale

Removal And Installation

Figure 40-210-2



Remove the attachment.

The quick coupler must be in the latched position **[Figure 40-210-2]** 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 40-210-3]** for additional information.

If the latch is in the latched position, proceed to **[Figure 40-210-4]**.

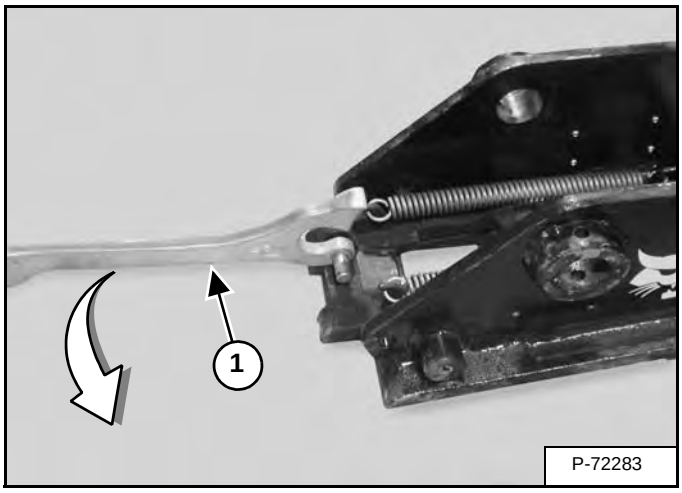
⚠ WARNING

AVOID INJURY

Keep fingers and hands out of pinch points when latching and unlatching the attachment quick coupler.

W-2541-1106

Figure 40-210-3



Install the tool (Item 1) **[Figure 40-210-3]** in the quick coupler as shown. Push down on the tool until the latch snaps closed.

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Removal And Installation (Cont'd)

WARNING

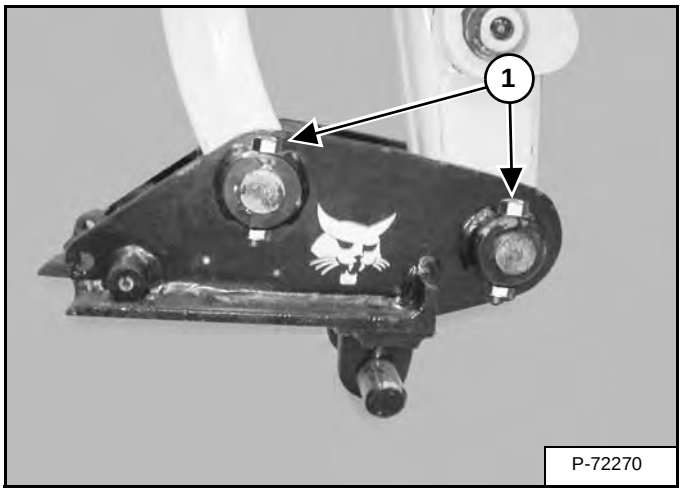
AVOID INJURY OR DEATH

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

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

W-2019-0907

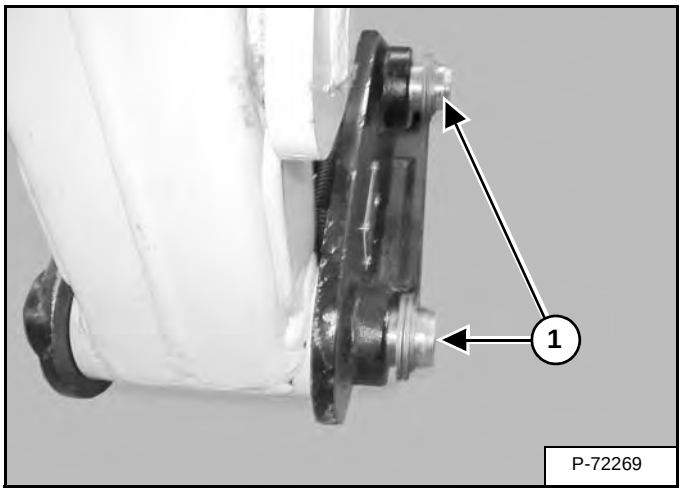
Figure 40-210-4



Remove the bolts (Item 1) **[Figure 40-210-4]** and nuts.

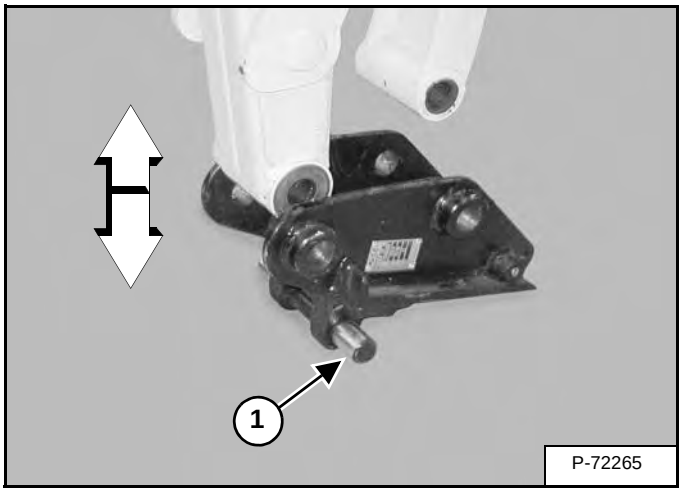
Installation: Align the holes of the connecting pins with the holes in the coupler. Install the two bolts (Item 1) **[Figure 40-210-4]** and nuts. Tighten the nuts securely against the couple.

Figure 40-210-5



Remove pins (Item 1) **[Figure 40-210-5]**.

Figure 40-210-6



Raise the arm and bucket link until the coupler is free **[Figure 40-210-6]**.

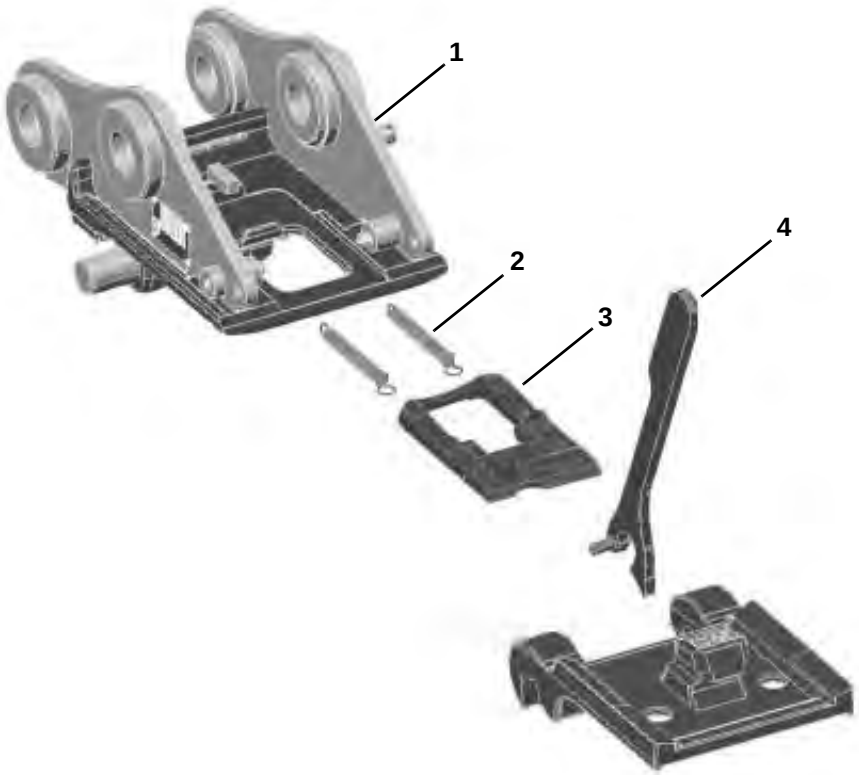
Installation: Align the arm and bucket link with the coupler **[Figure 40-210-6]**. Lower the arm and bucket link into the coupler.

NOTE: Place the coupler on the ground with the mounting pin (Item 1) [Figure 40-210-6] facing towards the excavator.

Dealer Copy -- Not for Resale

Parts Identification

1. Coupler Body
2. Spring
3. Locking Plate
4. Tool



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Disassembly

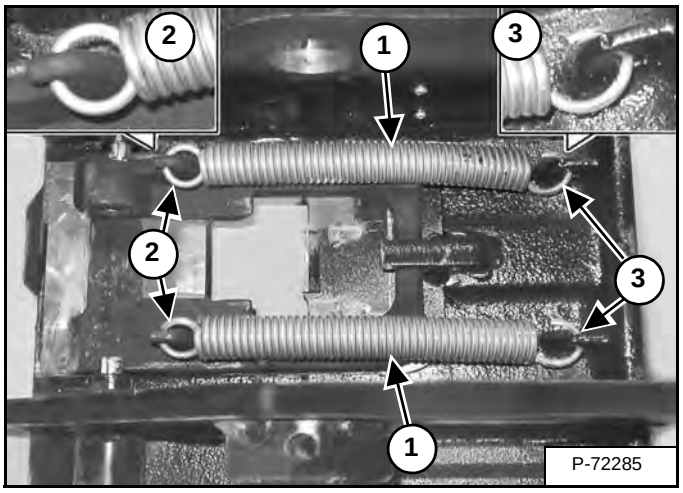
⚠ WARNING

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

- **Pressurized fluids and springs or other stored energy components.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

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Figure 40-210-7



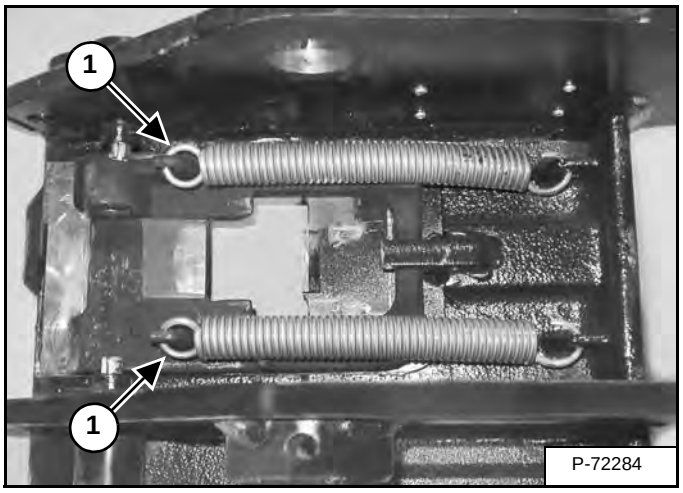
The two springs (Item 1) **[Figure 40-210-7]** have different style of end hooks.

The spring hook (Item 2) **[Figure 40-210-7]** are full circle hooks.

The spring hook (Item 3) **[Figure 40-210-7]** are partial circle hooks.

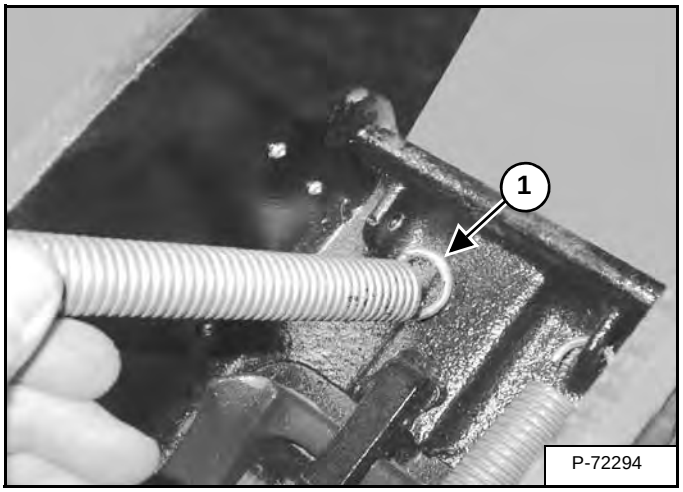
The spring ends must be positioned as shown when assembled.

Figure 40-210-8



Remove the spring end hook (Item 1) **[Figure 40-210-8]** from the quick coupler.

Figure 40-210-9

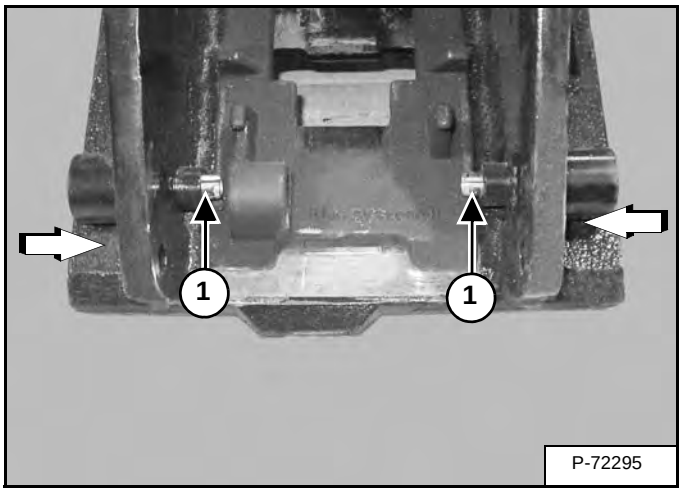


Remove the opposite end of the two springs (Item 1) **[Figure 40-210-9]**.

Dealer Copy -- Not for Resale

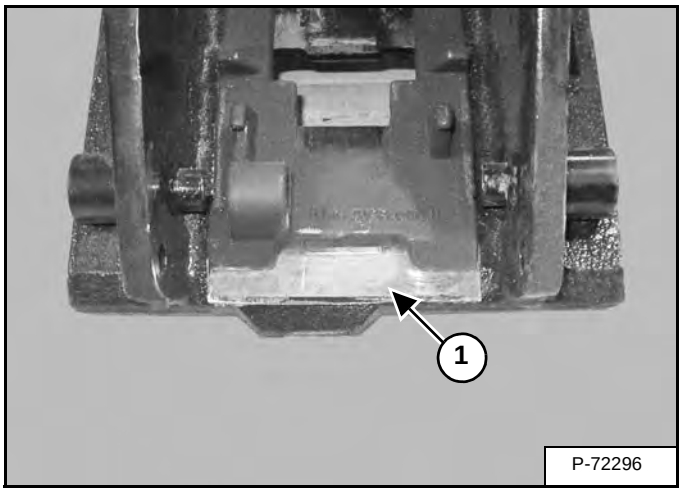
Disassembly (Cont'd)

Figure 40-210-10



Remove the two roll pins (Item 1) **[Figure 40-210-10]**. Drive the roll pins inwards to remove.

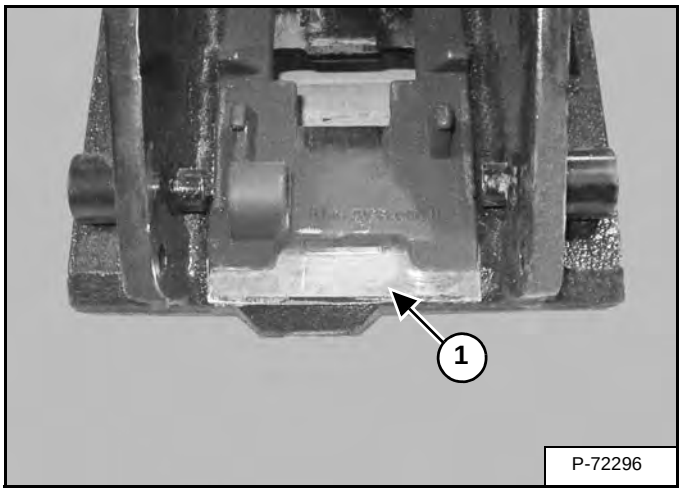
Figure 40-210-11



Remove the latch (Item 1) **[Figure 40-210-11]**.

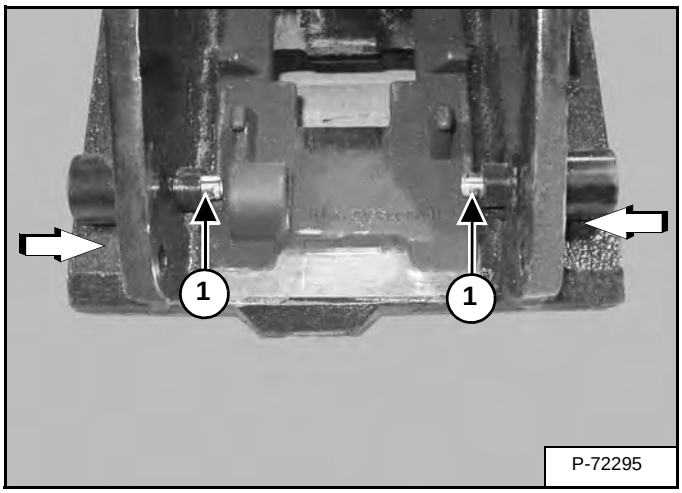
Assembly

Figure 40-210-12



Install the latch (Item 1) **[Figure 40-210-12]**.

Figure 40-210-13

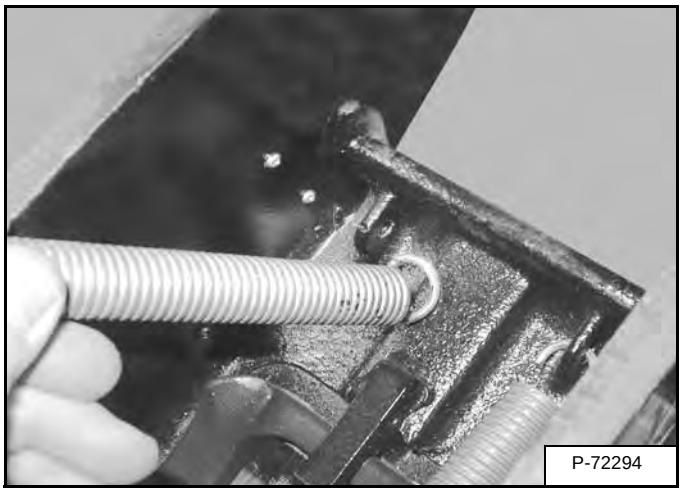


Install the two roll pins (Item 1) **[Figure 40-210-13]**. Drive the roll pins inwards until the roll pins are flush with the outside edge of the quick coupler.

Dealer Copy -- Not for Resale

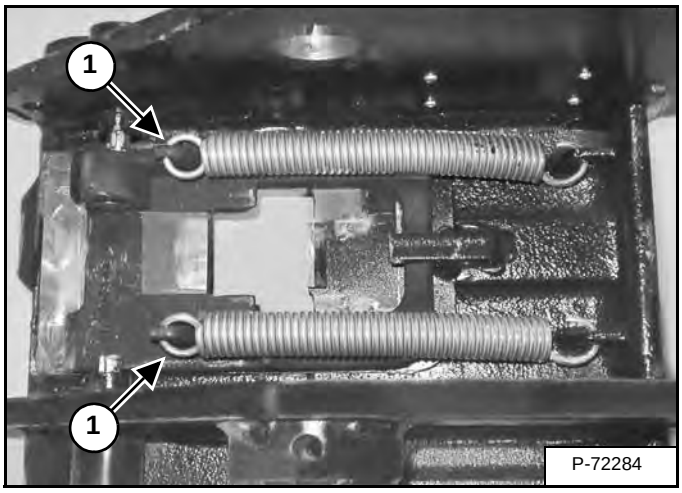
Assembly (Cont'd)

Figure 40-210-14



Install the partial circle hook end of the spring **[Figure 40-210-14]**.

Figure 40-210-15



Install the full circle end of the spring hook (Item 1) **[Figure 40-210-15]** on the quick coupler.

Do not lubricate the quick coupler. Lubrication will cause dirt to collect and interfere with proper movement of the quick coupler.

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Dealer Copy -- Not for Resale

QUICK COUPLER (LEHNHOFF® SYSTEM)

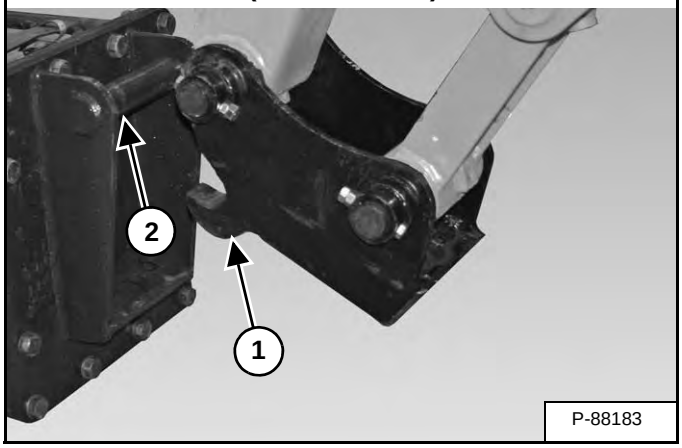
Troubleshooting

PROBLEM	CAUSE	CORRECTION
Coupler does not seat properly on the attachment mounting frame.	Mud, dirt, stones or debris are lodged between the coupler and the attachment mounting frame.	Remove mud, dirt, stones and debris from between the coupler and the attachment mounting frame.
	Worn locking mechanism.	Repair or replace worn pins and locking mechanisms.
	Attachment mounting frame damaged.	Repair or replace the attachment mounting frame.

Daily Inspection

Figure 40-211-1

(MS03 & MS08)



Inspect the quick coupler for wear or damage. Inspect the the hooks (Item 1) and coupler locking shaft (Item 2) **[Figure 40-211-1]** (on the attachment) for wear or damage.

Repair or replace damaged parts.

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Removal (MS03 And MS08)

⚠ WARNING

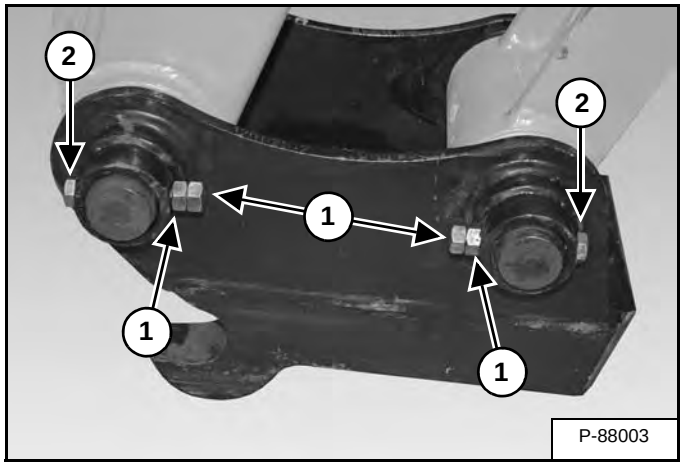
AVOID INJURY OR DEATH

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.**

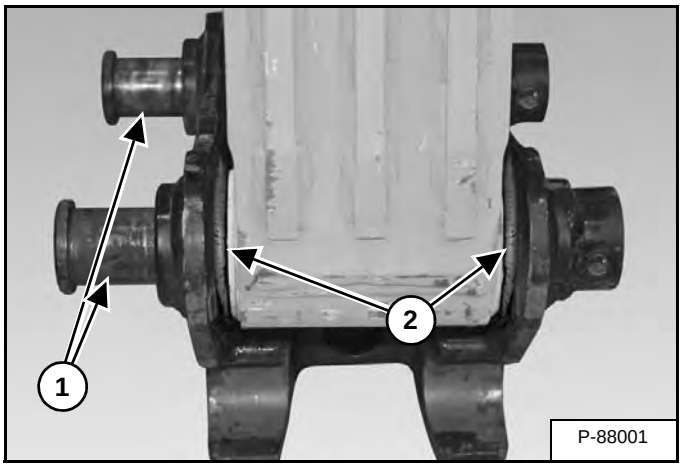
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Figure 40-211-2



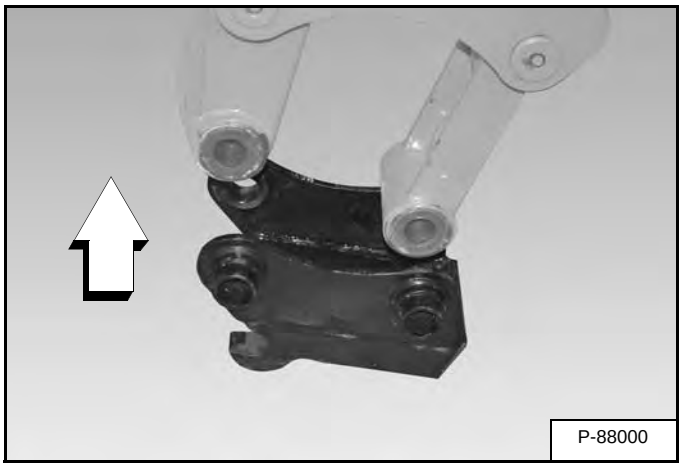
Remove the four nuts (Items 1). Remove the two bolts (Item 2) **[Figure 40-211-2]**.

Figure 40-211-3



Remove the two connecting pins (Item 1) and O-rings (Item 2) **[Figure 40-211-3]**.

Figure 40-211-4

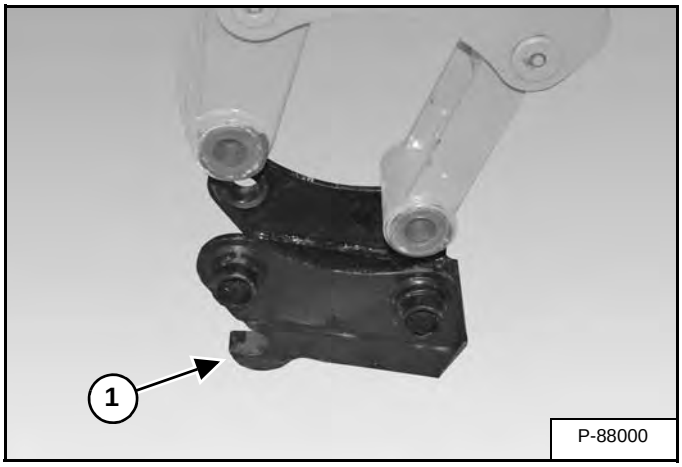


Raise the arm and bucket link until the quick coupler is free **[Figure 40-211-4]**.

Dealer Copy -- Not for Resale

Installation (MS03 And MS08)

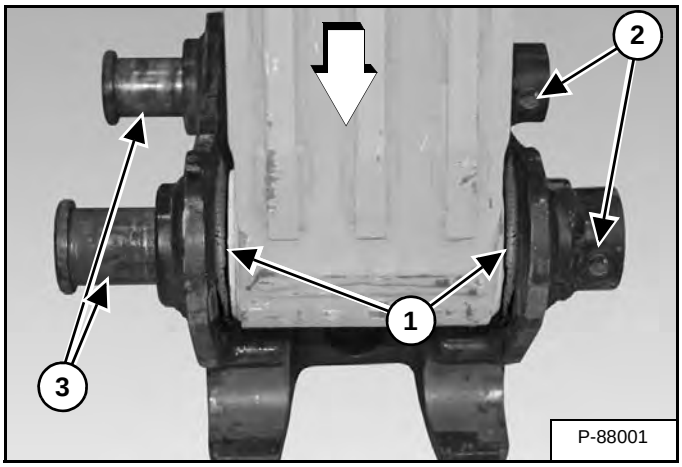
Figure 40-211-5



Place the coupler on the ground with the hooks (Item 1) **[Figure 40-211-5]** facing towards the excavator.

Align the arm and bucket link with the coupler **[Figure 40-211-5]**.

Figure 40-211-6



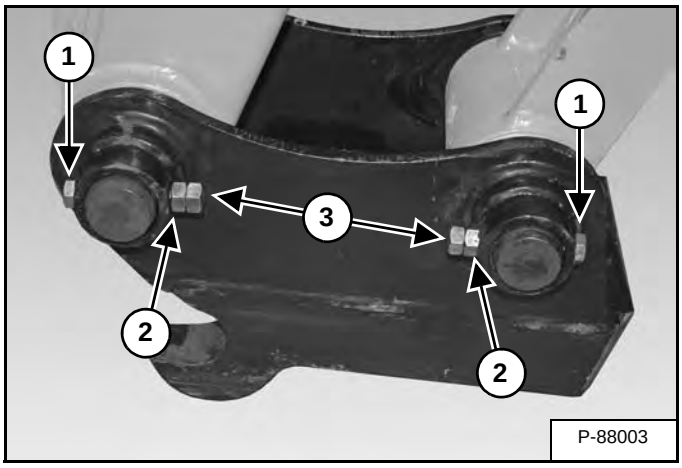
Install the O-rings (Item 1) **[Figure 40-211-6]** between the coupler pivot point and the arm and bucket link when lowering into position.

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 40-211-6]** in the coupler.

Install the two pins (Item 3) **[Figure 40-211-6]** through the coupler, arm and bucket link.

Figure 40-211-7



Install the two bolts (Item 1) **[Figure 40-211-7]**.

Install nuts (Item 2) **[Figure 40-211-7]** just until contact is made with the coupler.

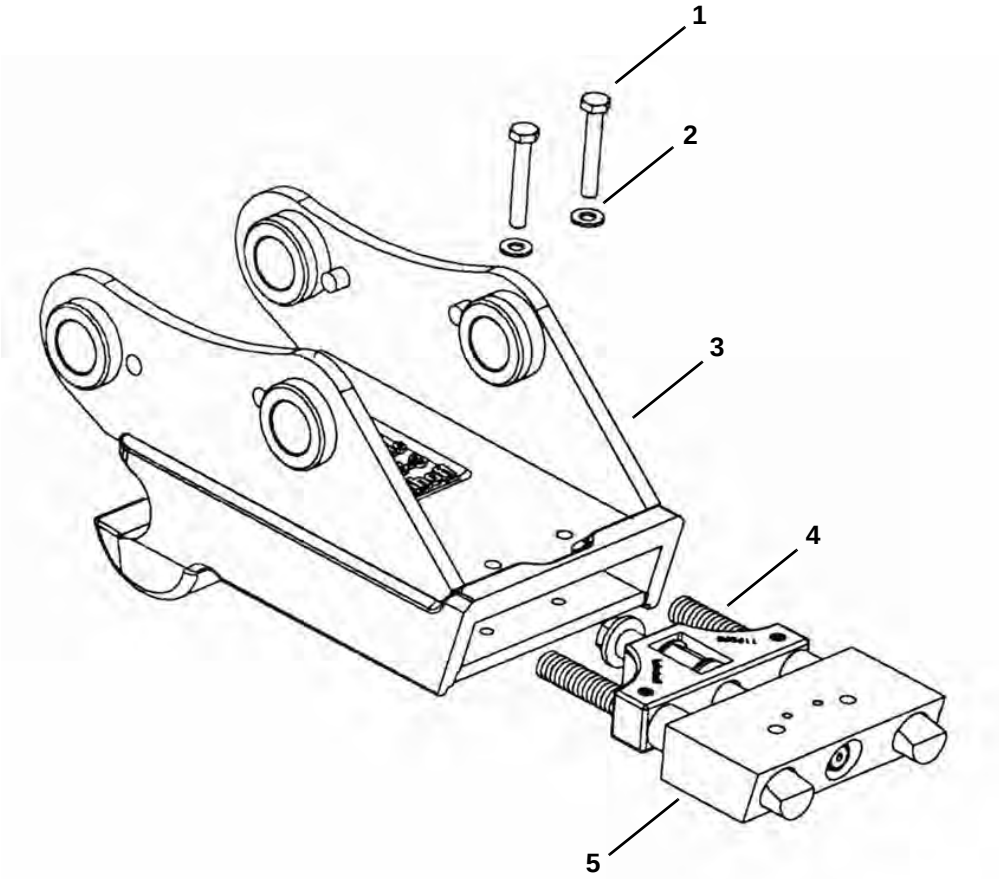
NOTE: Do Not tighten nuts (Item 2) [Figure 40-211-7] against the coupler. The retaining bolt must rotate freely.

Install and tighten nuts (Item 3) securely against the two nuts (Item 2) **[Figure 40-211-7]**. 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

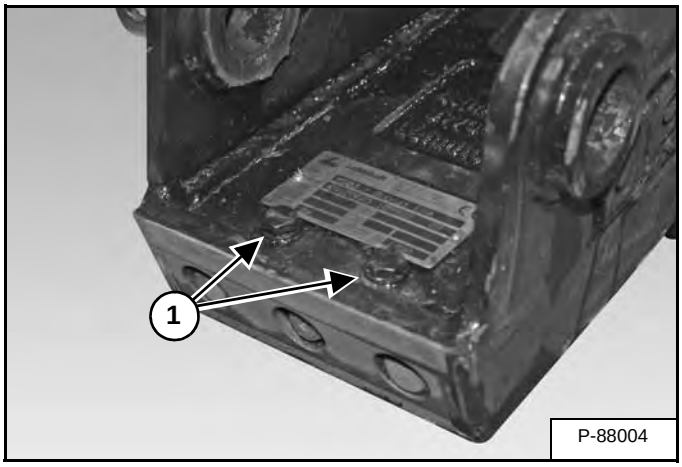


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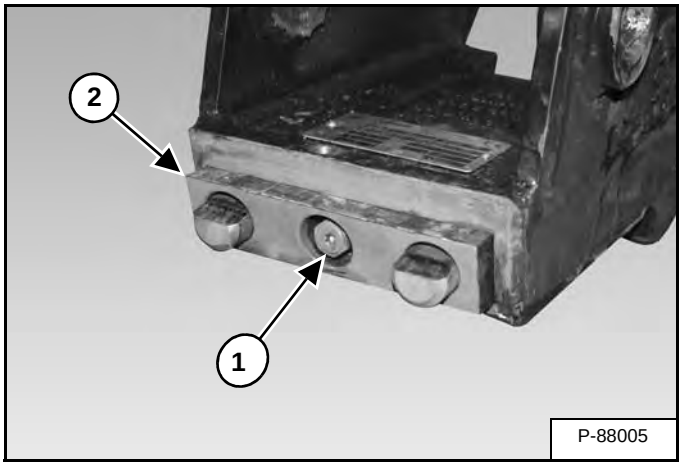
Disassembly And Assembly (MS03)

Figure 40-211-8



Remove the two bolts (Item 1) **[Figure 40-211-8]** and lock washers.

Figure 40-211-9

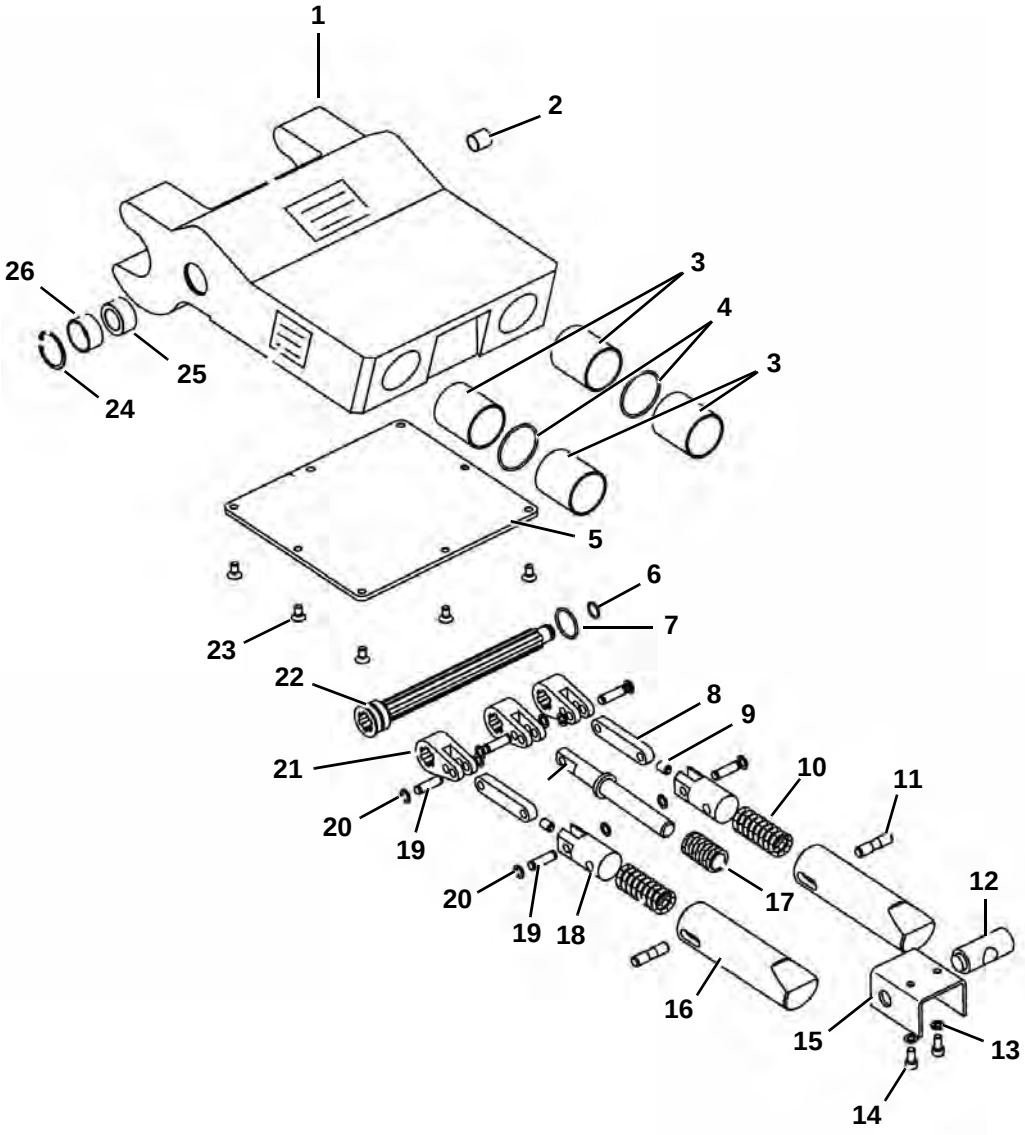


Turn the threaded spindle (Item 1) counterclockwise until the locking mechanism (Item 2) **[Figure 40-211-9]** is free from the housing.

Dealer Copy -- Not for Resale

Parts Identification (MS08)

1. Housing
2. Bushing
3. Bushing
4. O-ring
5. Cover
6. O-ring
7. O-ring
8. Reversing Lever
9. Threaded Pin
10. Pressure Spring
11. Pin
12. Pivoting Journal
13. Spring Washer
14. Bolt
15. Bearing Block
16. Locking Pin
17. Pressure Spring
18. Thrust Journal
19. Pin
20. O-ring
21. Driving Fork
22. Control Shaft
23. Bolt
24. Snap Ring
25. Bushing
26. Bushing



P-88115

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Disassembly (MS08)

⚠ WARNING

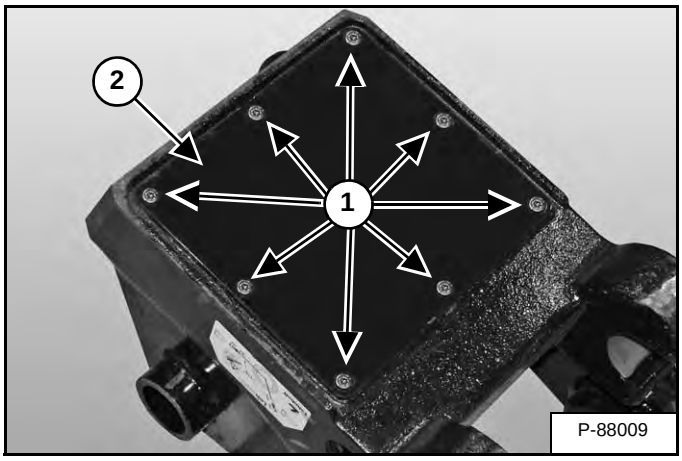
AVOID INJURY OR DEATH

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

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

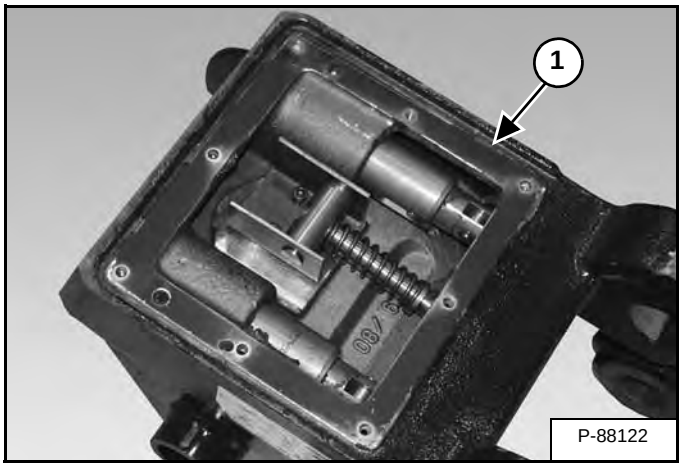
W-2019-0907

Figure 40-211-10



Remove the eight bolts (Item 1) and cover (Item 2) **[Figure 40-211-10]**.

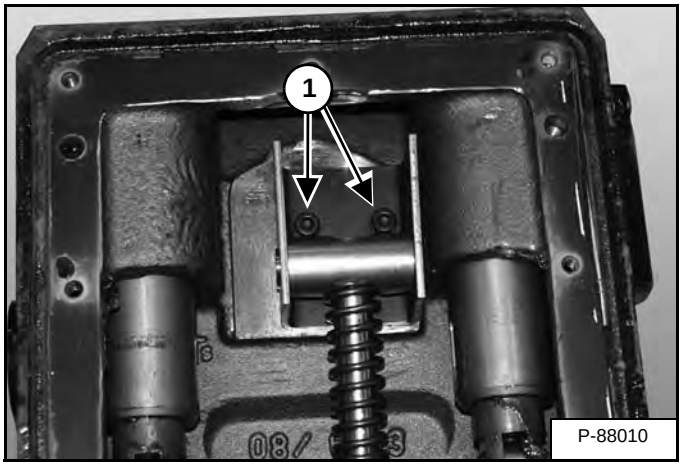
Figure 40-211-11



Remove all sealant (Item 1) **[Figure 40-211-11]** from the housing and cover.

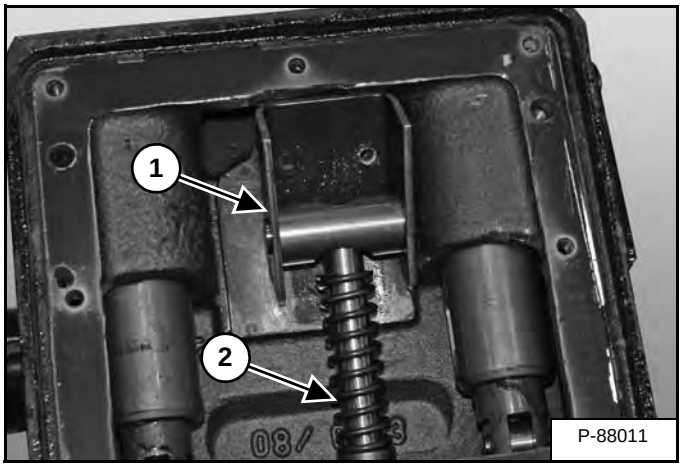
NOTE: Do not scratch the mounting surface while removing sealant.

Figure 40-211-12



Remove the two bolts (Item 1) **[Figure 40-211-12]**.

Figure 40-211-13

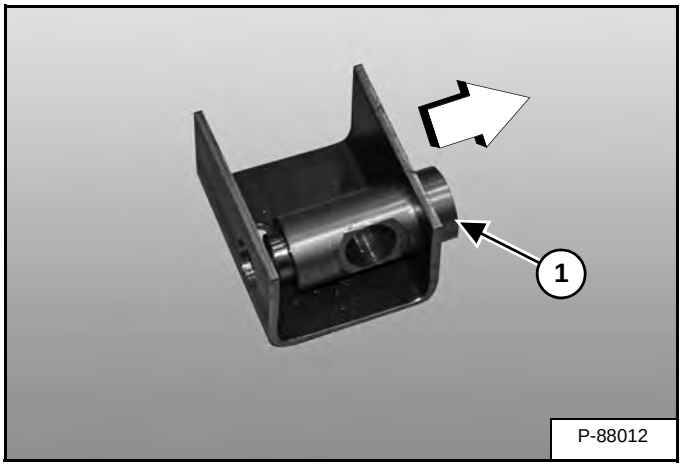


Tilt the bearing block and pivoting journal (Item 1) up and remove from the spring guide (Item 2) **[Figure 40-211-13]**.

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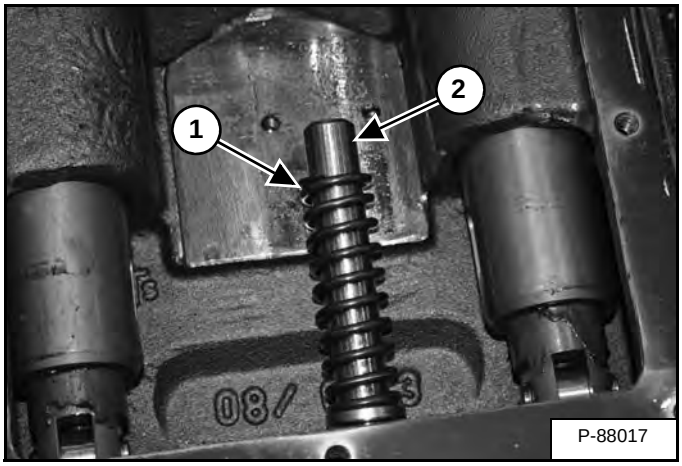
Disassembly (MS08) (Cont'd)

Figure 40-211-14



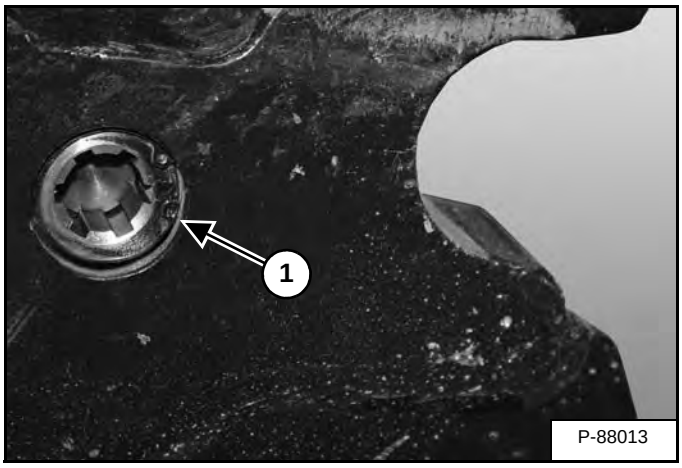
Remove the pivoting journal (Item 1) **[Figure 40-211-14]** from the bearing block.

Figure 40-211-15



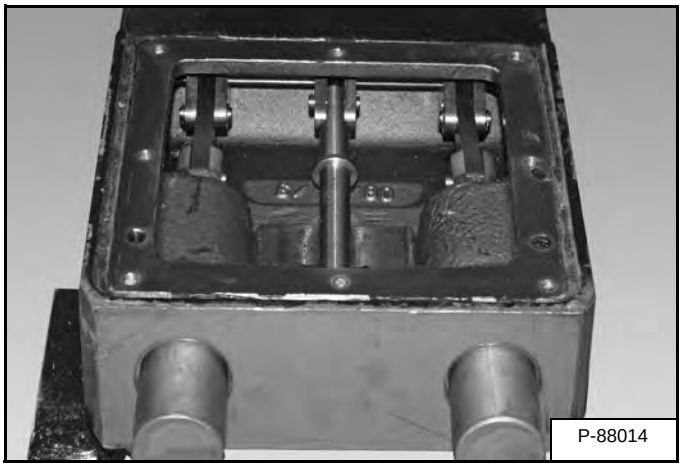
Remove the pressure spring (Item 1) from the spring guide (Item 2) **[Figure 40-211-15]**.

Figure 40-211-16



Remove the snap ring (Item 1) **[Figure 40-211-16]**.

Figure 40-211-17

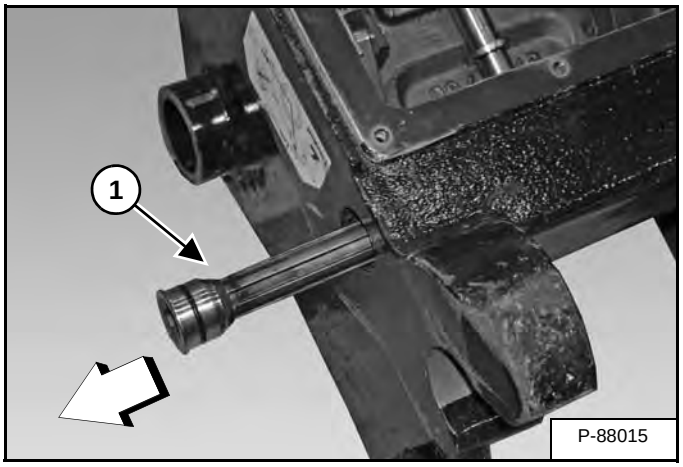


NOTE: Before removing the control shaft, note the position of each of the components so that when the coupler is reassembled all components are positioned correctly on the control shaft [Figure 40-211-17].

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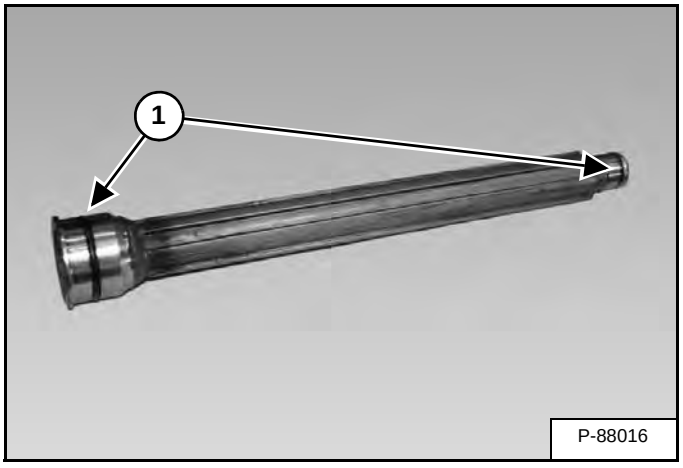
Disassembly (MS08) (Cont'd)

Figure 40-211-18



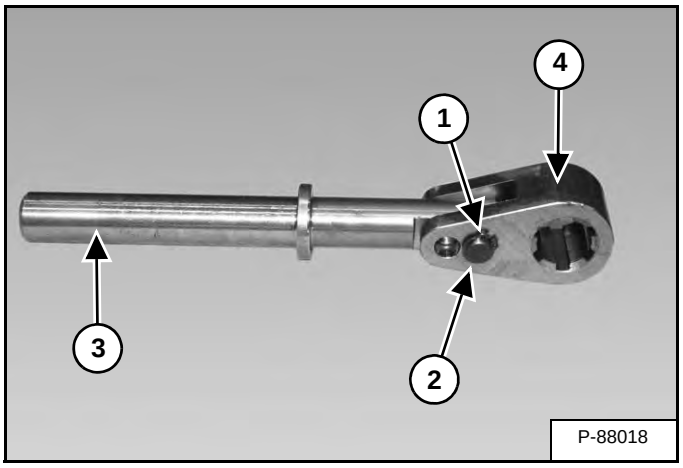
Remove the control shaft (Item 1) **[Figure 40-211-18]**.

Figure 40-211-19



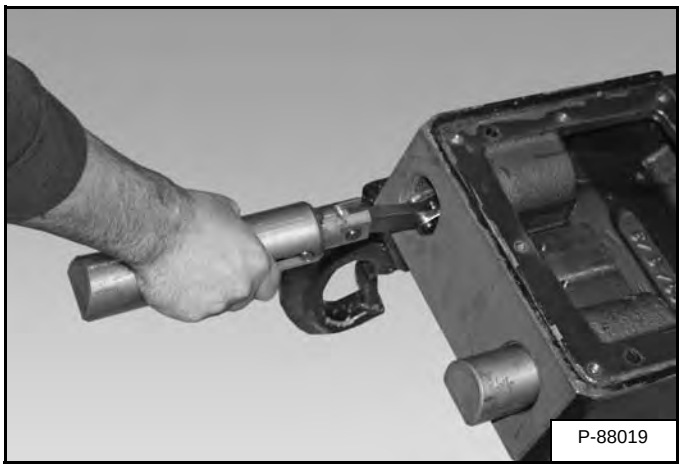
Remove O-rings (Item 1) **[Figure 40-211-19]**.

Figure 40-211-20



Remove the snap ring (Item 1) and pin (Item 2). Remove the spring guide (Item 3) from the driving fork (Item 4) **[Figure 40-211-20]**.

Figure 40-211-21

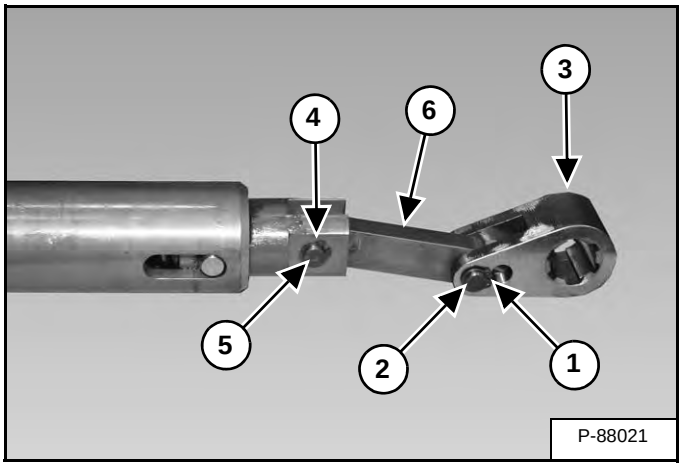


Remove the locking pin assemblies **[Figure 40-211-21]**.

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Disassembly (MS08) (Cont'd)

Figure 40-211-22

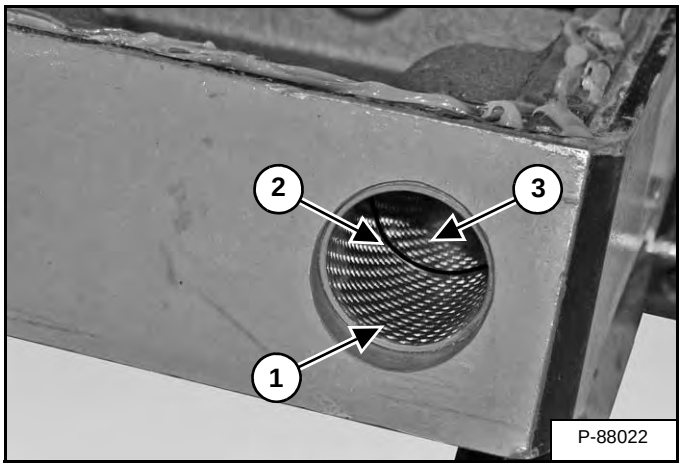


Remove the snap ring (Item 1) and pin (Item 2). Remove the driving fork (Item 3) **[Figure 40-211-22]**.

Remove the snap ring (Item 4) and pin (Item 5). Remove the reversing lever (Item 6) **[Figure 40-211-22]**.

Repeat the procedure for the other locking pin.

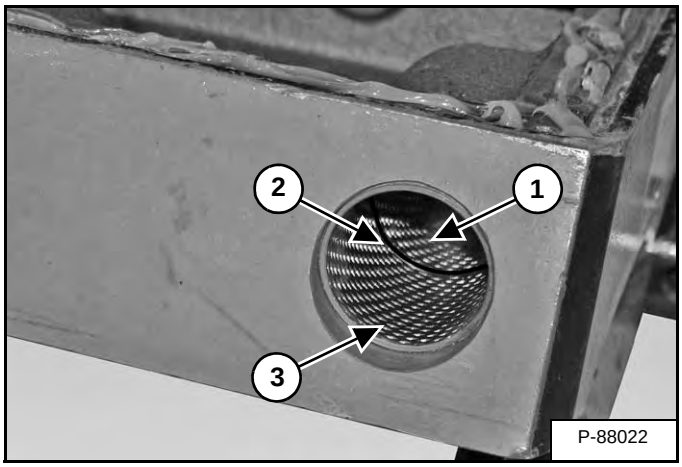
Figure 40-211-23



Remove the bushing (Item 1), O-ring (Item 2) and bushing (Item 3) **[Figure 40-211-23]** from both locking pin bores.

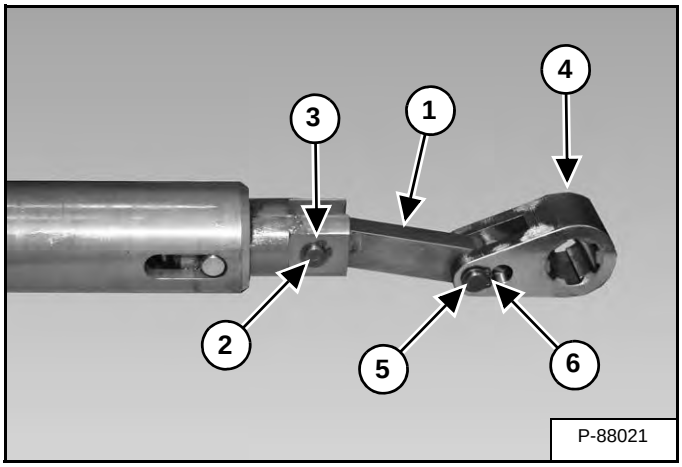
Assembly (MS08)

Figure 40-211-24



Install bushing (Item 1), O-ring (Item 2) and bushing (Item 3) **[Figure 40-211-24]** in both locking pin bores.

Figure 40-211-25



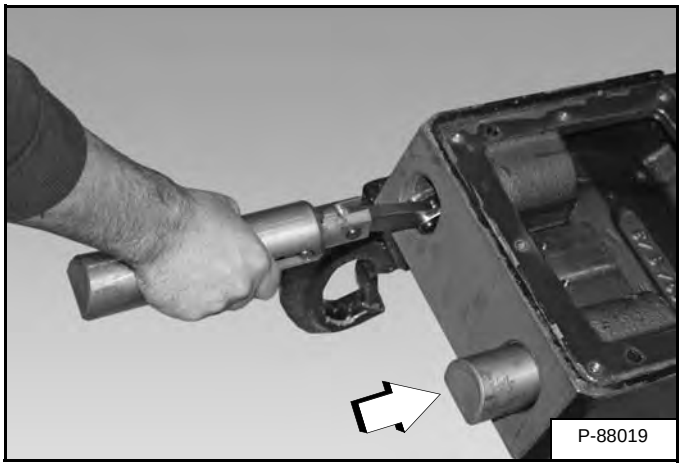
Install reversing lever (Item 1), pin (Item 2) and snap ring (Item 3) **[Figure 40-211-25]** on the locking pin.

Install the driving fork (Item 4), pin (Item 5) and snap ring (Item 6) **[Figure 40-211-25]** on the reversing lever. Repeat the procedure for the other locking pin.

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Assembly (MS08) (Cont'd)

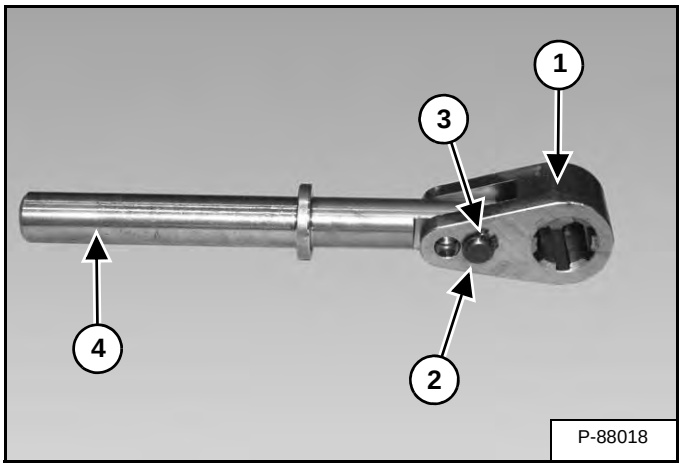
Figure 40-211-26



Install the locking pin assemblies **[Figure 40-211-26]**.

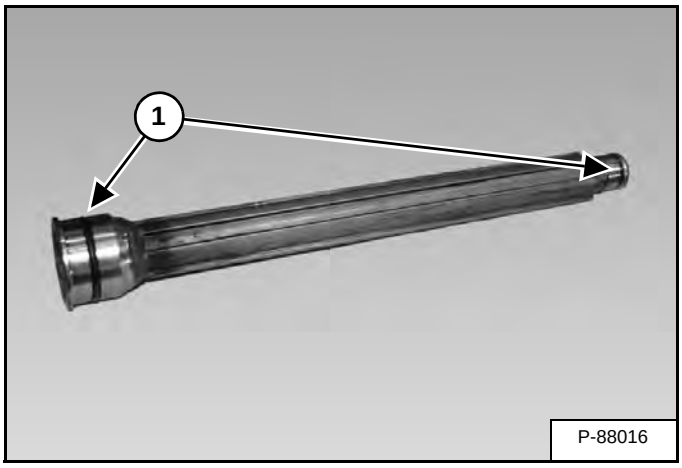
NOTE: Position the locking levers with the flat side down and away from the cover.

Figure 40-211-27



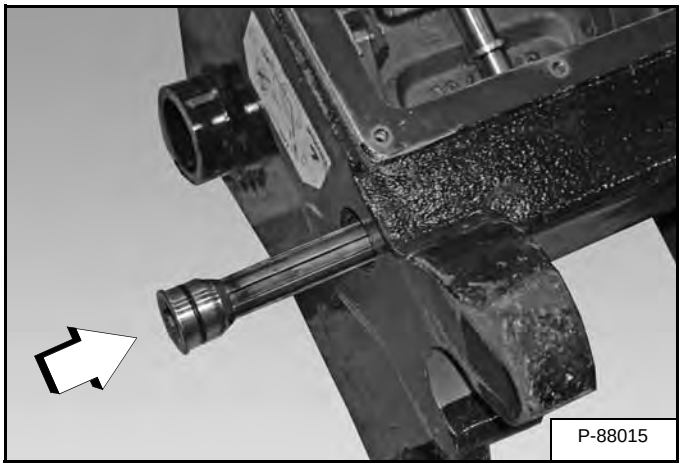
Install the driving fork (Item 1), pin (Item 2) and snap ring (Item 3) on the spring guide (Item 4) **[Figure 40-211-27]**.

Figure 40-211-28



Install the O-rings (Item 1) **[Figure 40-211-28]**.

Figure 40-211-29

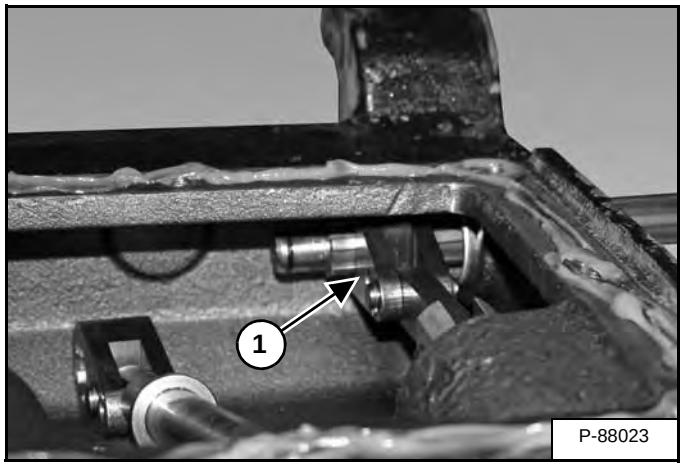


Install the control shaft **[Figure 40-211-29]**.

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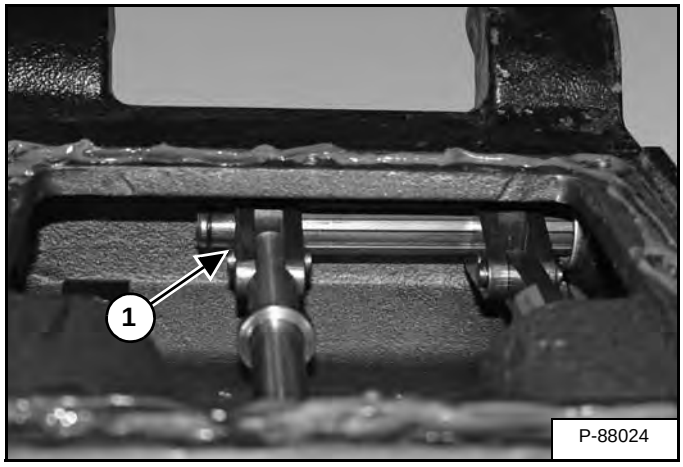
Assembly (MS08) (Cont'd)

Figure 40-211-30



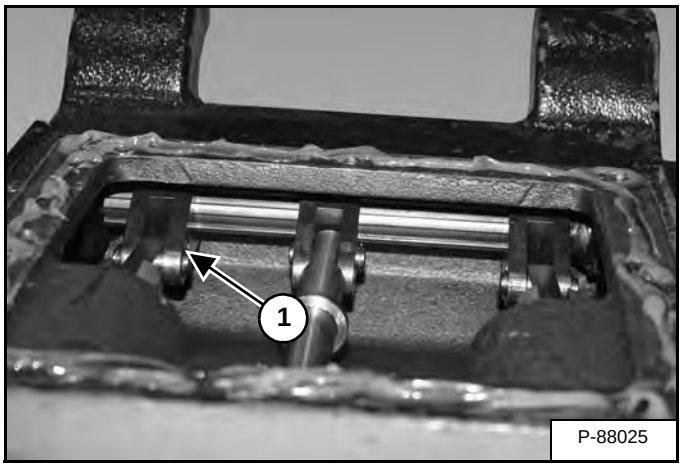
Install the control shaft through the first locking lever driving fork (Item 1) **[Figure 40-211-30]**.

Figure 40-211-31



Install the control shaft through the spring guide driving fork (Item 1) **[Figure 40-211-31]**.

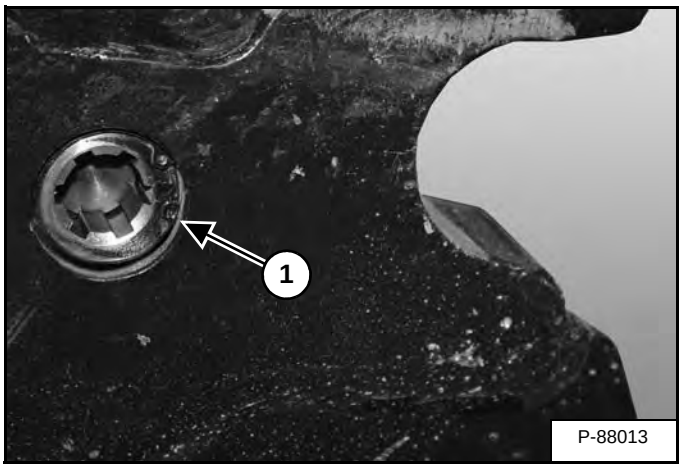
Figure 40-211-32



Install the control shaft through the second locking lever driving fork (Item 1) **[Figure 40-211-32]**.

NOTE: Check proper alignment of all three driving forks on the control shaft. If not aligned properly, repeat the procedure.

Figure 40-211-33

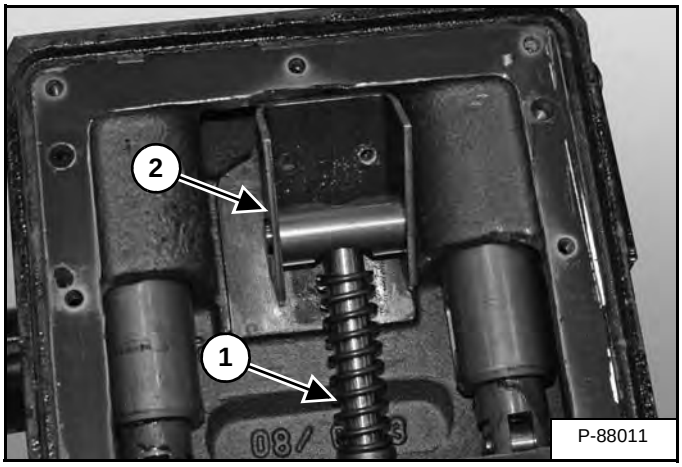


Install the snap ring (Item 1) **[Figure 40-211-33]**.

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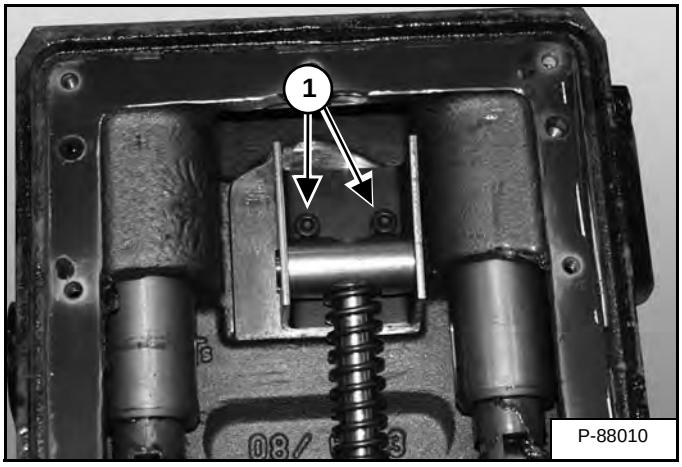
Assembly (MS08) (Cont'd)

Figure 40-211-34



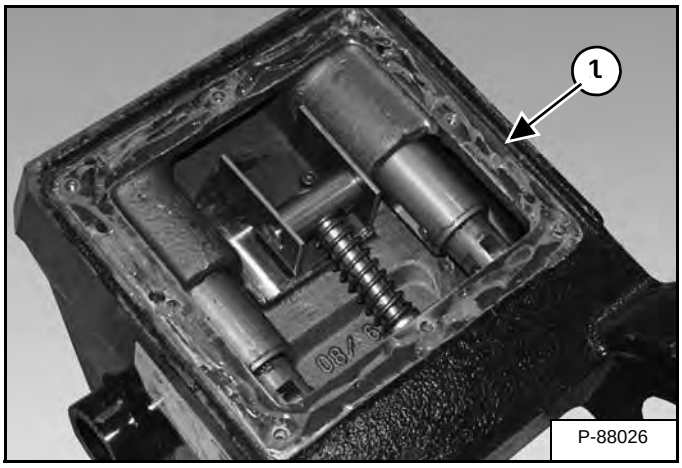
Install pressure spring (Item 1) on the spring guide. Tilt the bearing block and pivoting journal (Item 2) **[Figure 40-211-34]** down and install on the spring guide.

Figure 40-211-35



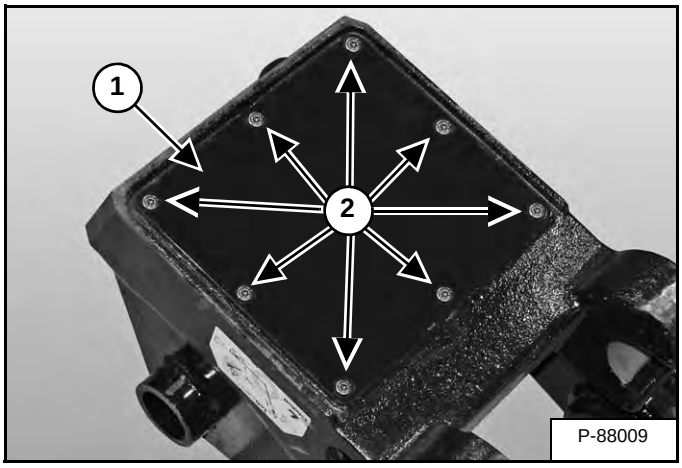
Install the two bolts (Item 1) **[Figure 40-211-35]**.

Figure 40-211-36



Apply a bead of sealant around the cover mounting surface (Item 1) **[Figure 40-211-36]**.

Figure 40-211-37



Install the cover (Item 1) **[Figure 40-211-37]**.

Apply Loctite® 242 on the eight bolts.

Install the eight bolts (Item 2) **[Figure 40-211-37]**.

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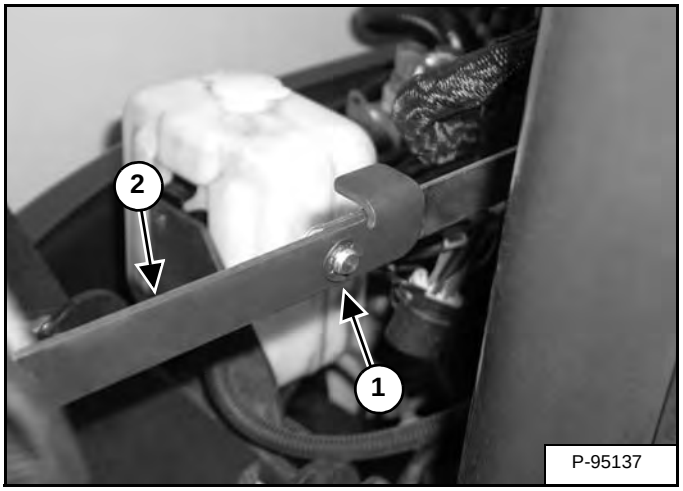
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RIGHT SIDE COVER

Removal And Installation

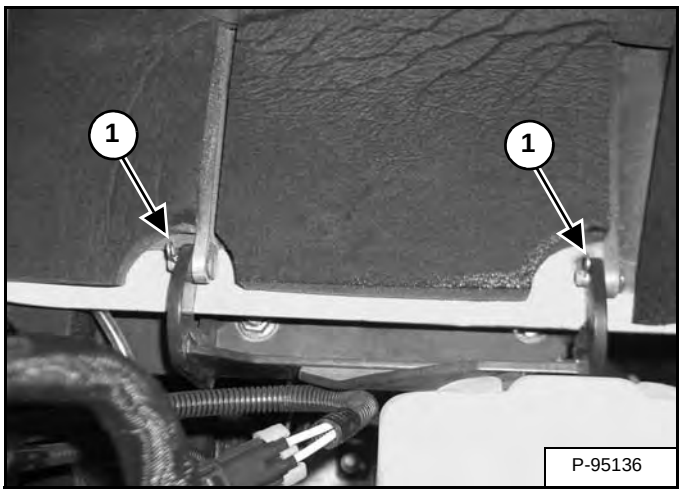
Open the right side cover.

Figure 40-220-1



Remove the clip (Item 1). Support the cover and separate the support (Item 2) **[Figure 40-220-1]**.

Figure 40-220-2



Support the cover and remove the two clips (Item 1) **[Figure 40-220-2]**.

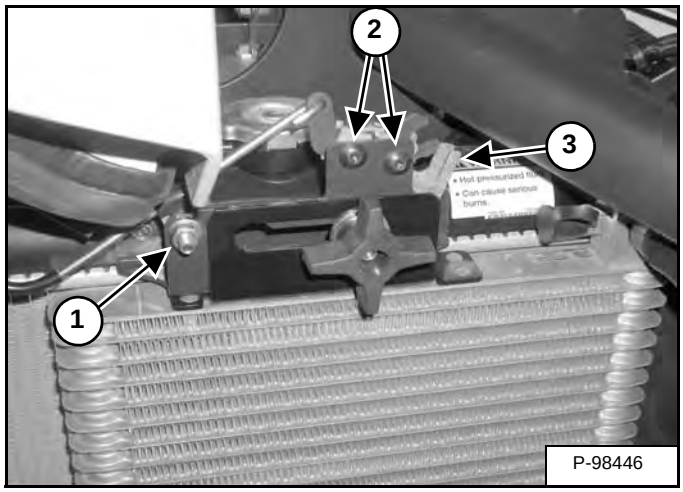
Slide the cover to the right and remove the cover from the excavator.

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RIGHT SIDE COVER (CONT'D)

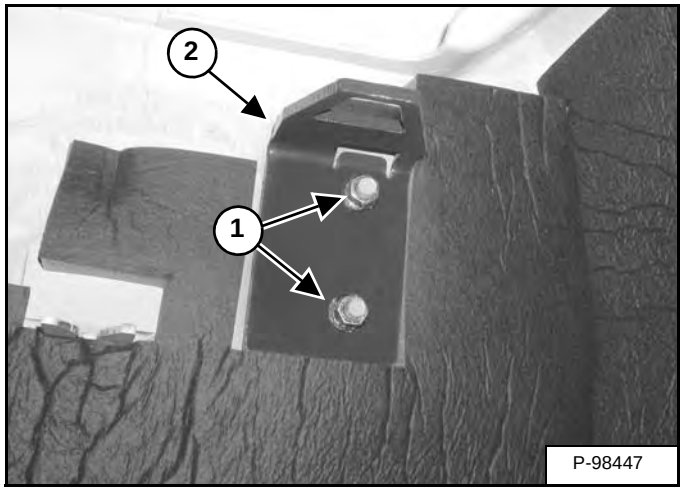
Latch Removal And Installation

Figure 40-220-3



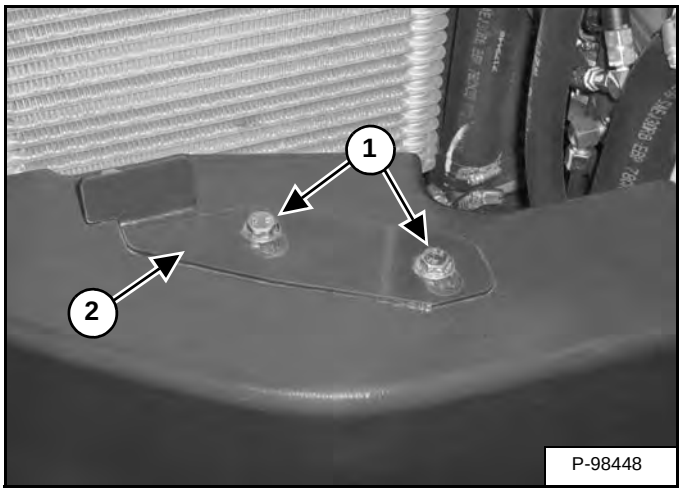
Remove the nut, bolt and clamp (Item 1). Remove the bolts and nuts (Item 2) and remove the latch (Item 3) **[Figure 40-220-3]**.

Figure 40-220-4



Remove the two nuts (Item 1) and remove the striker bracket (Item 2) **[Figure 40-220-4]**.

Figure 40-220-5

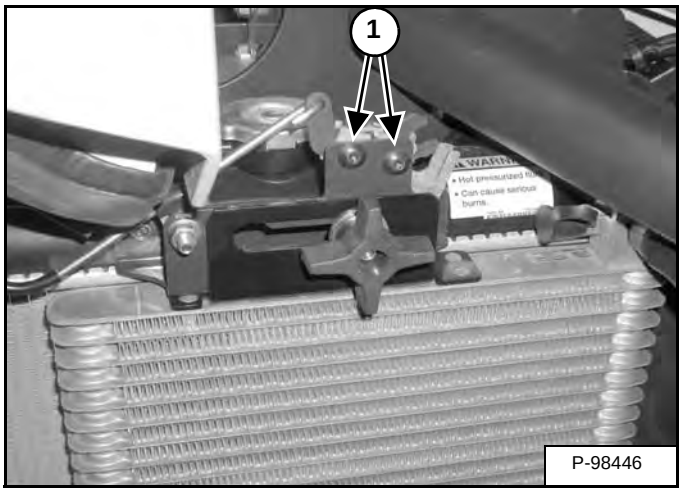


Remove the two bolts (Item 1) and remove the alignment bracket (Item 2) **[Figure 40-220-5]**.

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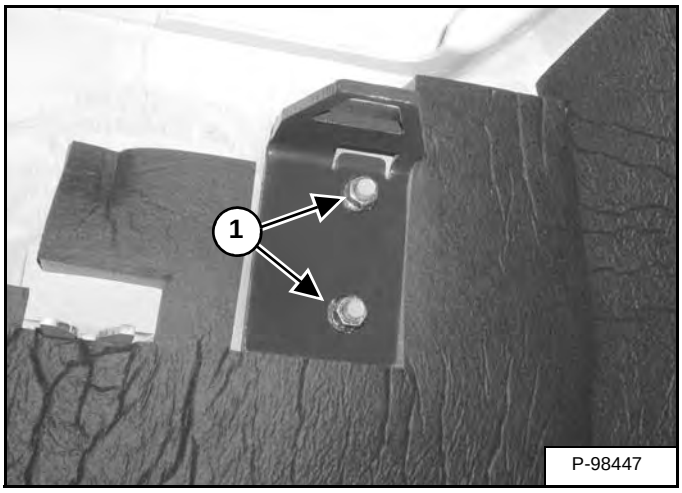
Latch Adjustment

Figure 40-220-6



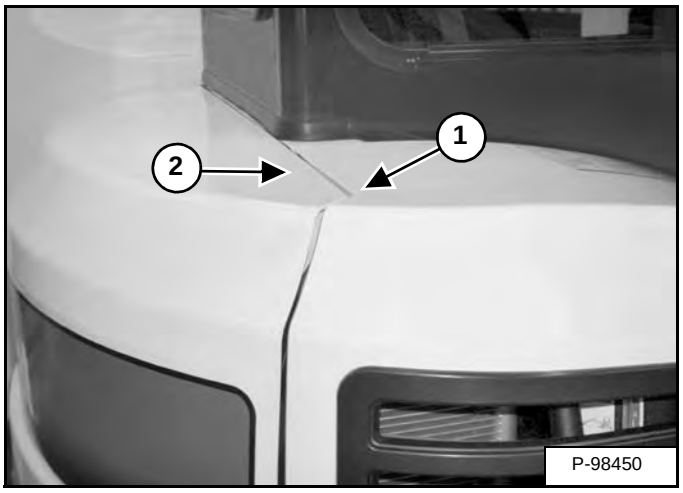
Loosen the two nuts and two bolts (Item 1) **[Figure 40-220-6]** and adjust the latch.

Figure 40-220-7



Loosen the two nuts (Item 1) **[Figure 40-220-6]** and adjust the striker bracket.

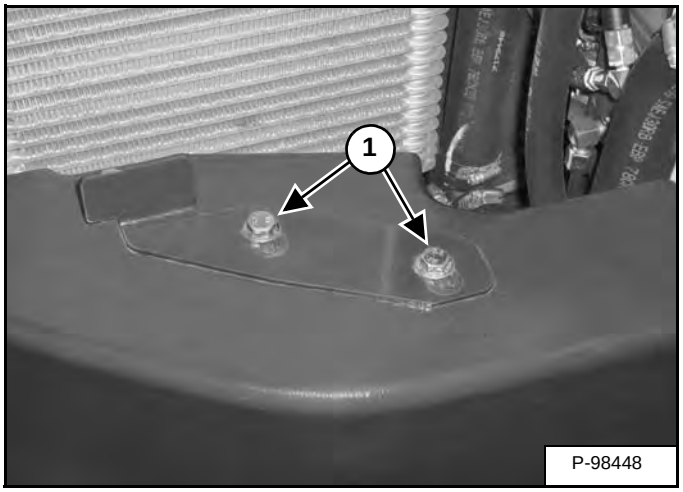
Figure 40-220-8



Adjust the latch and striker until the top edge of the right side cover (Item 1) is even with the top edge of the tailgate (Item 2) **[Figure 40-220-6]**.

Tighten the bolts and nuts.

Figure 40-220-9

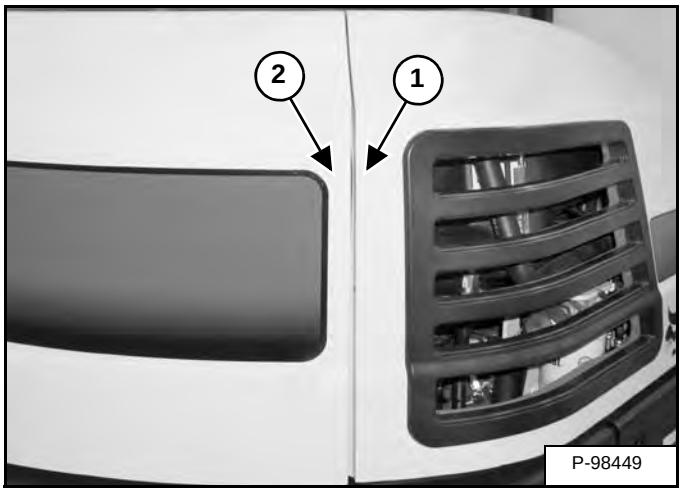


Loosen the two bolts (Item 1) **[Figure 40-220-6]** and adjust the alignment bracket.

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Latch Adjustment (Cont'd)

Figure 40-220-10



Adjust the alignment bracket until the rear edge of the cover (Item 1) is even with the rear edge of the tailgate (Item 2) **[Figure 40-220-6]**. Tighten the bolts.

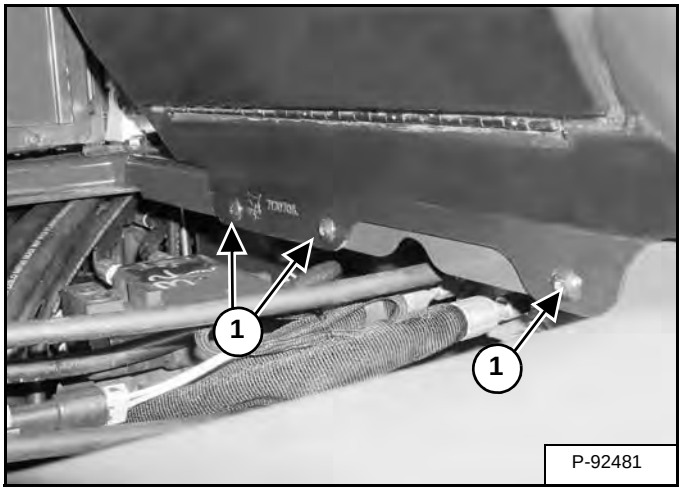
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TOOL BOX

Removal And Installation

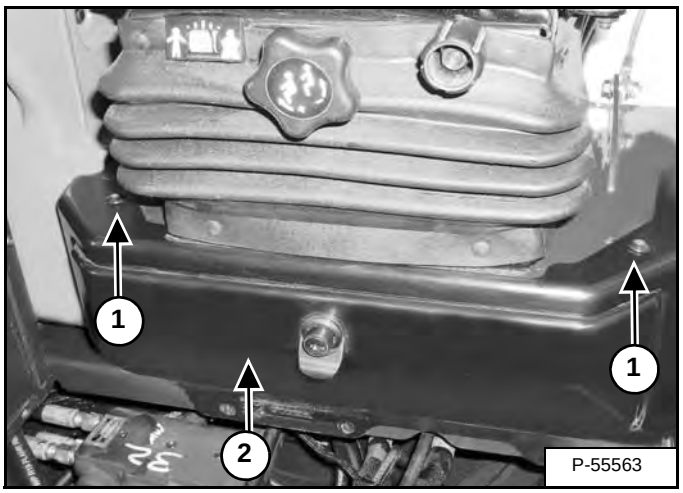
Remove the floor mat and floor panel. (See Removal And Installation on Page 40-110-1.)

Figure 40-230-1



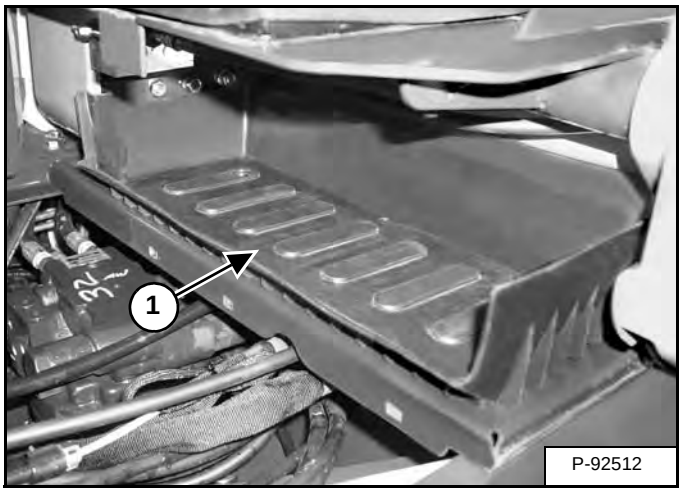
Remove the three screws (Item 1) **[Figure 40-230-1]**.

Figure 40-230-2



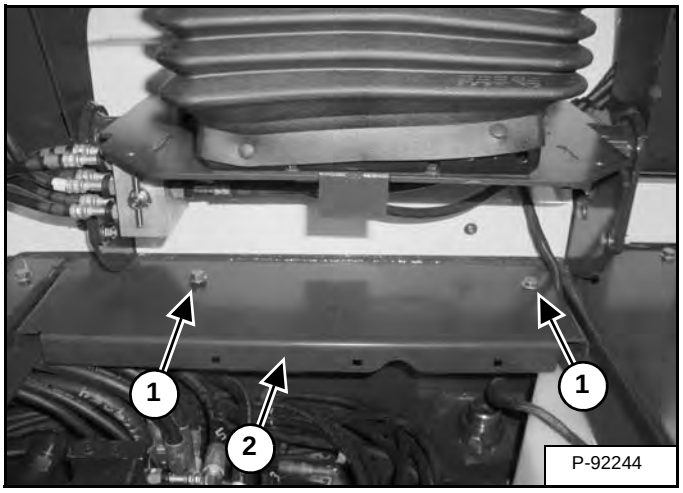
Remove the screws (Item 1) and tool box cover (Item 2) **[Figure 40-230-2]**.

Figure 40-230-3



Remove the rubber liner (Item 1) **[Figure 40-230-3]**.

Figure 40-230-4



Remove the two bolts (Item 1) and floor plate (Item 2) **[Figure 40-230-4]**.

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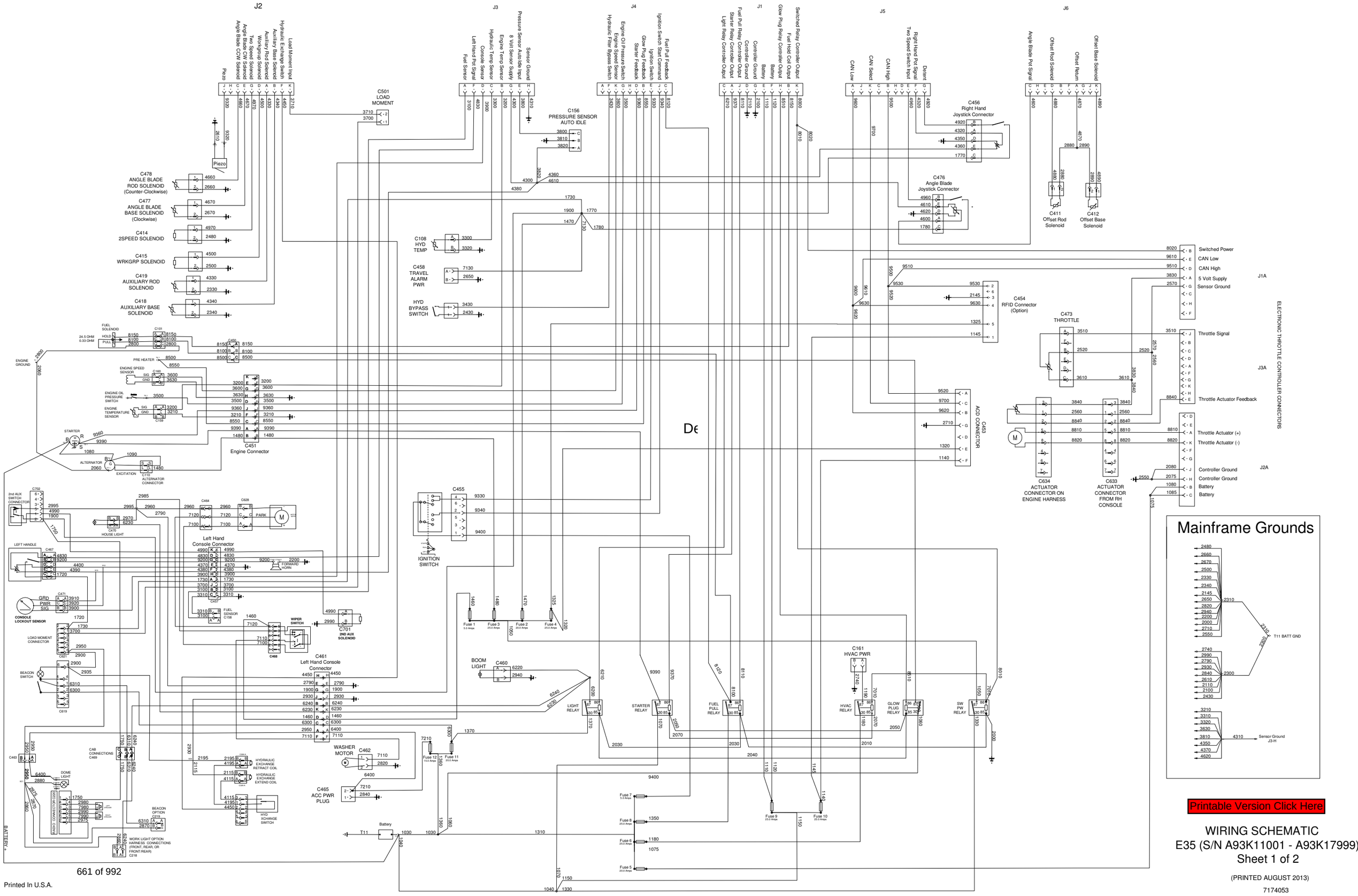
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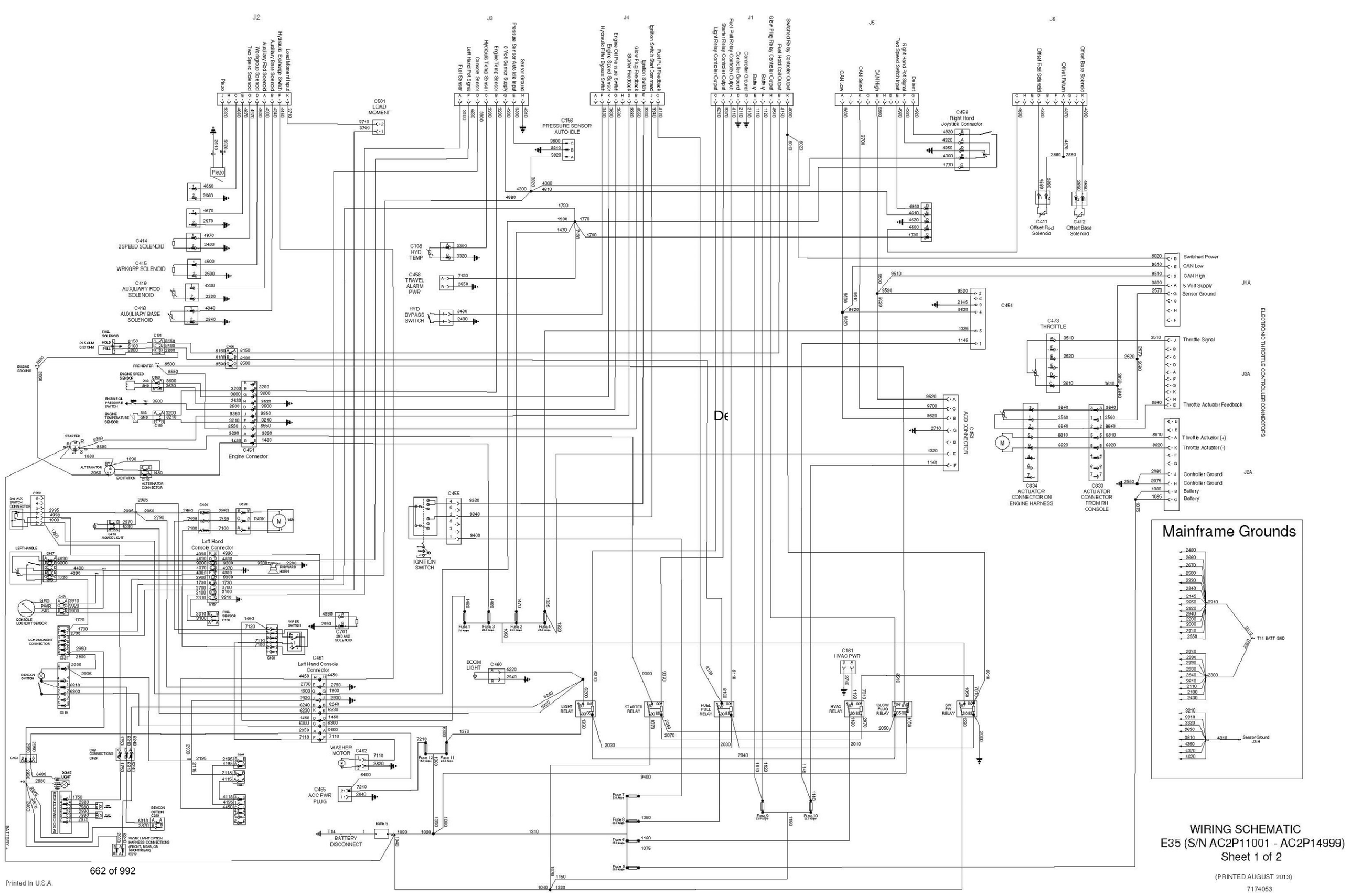
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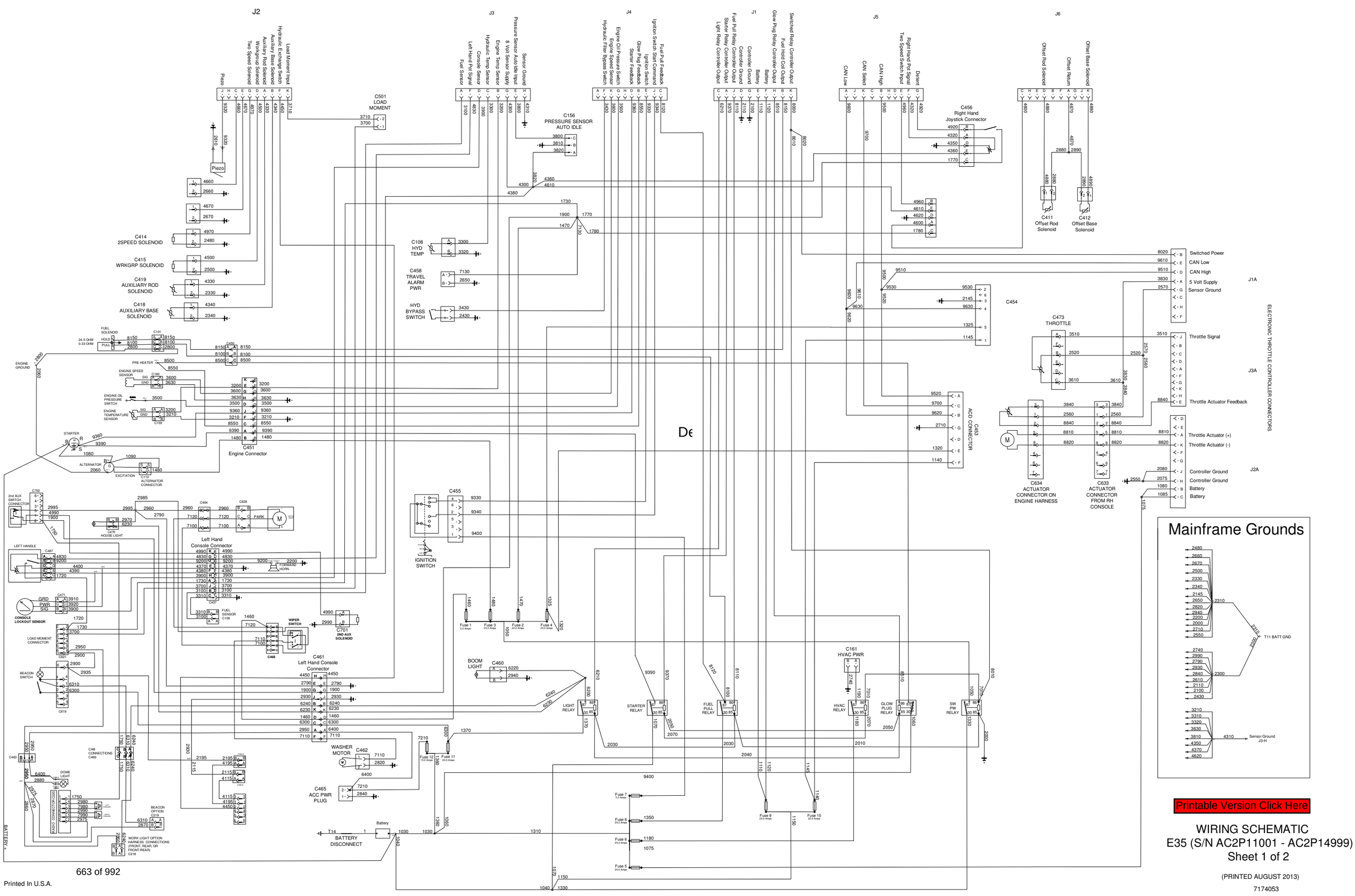


WIRING SCHEMATIC
E35 (S/N AC2P11001 - AC2P14999)
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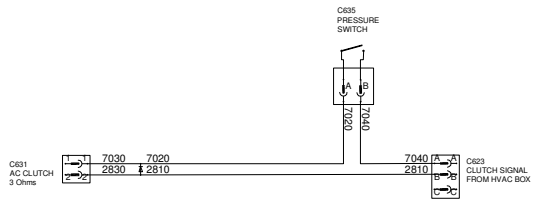
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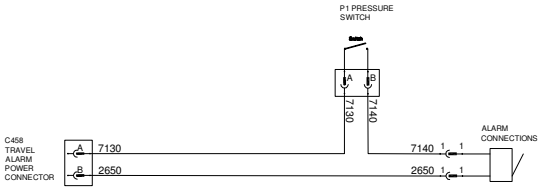
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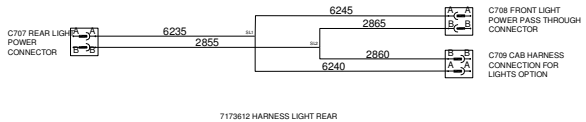
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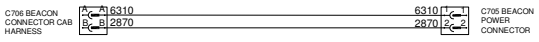
7168895 HARNESS AC CLUTCH



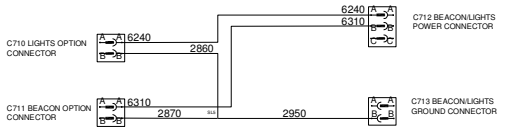
7173059 HARNESS MOTION ALARM



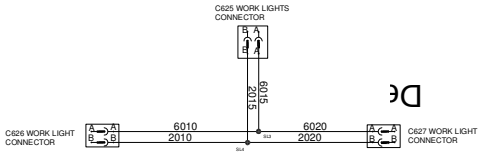
7173612 HARNESS LIGHT REAR



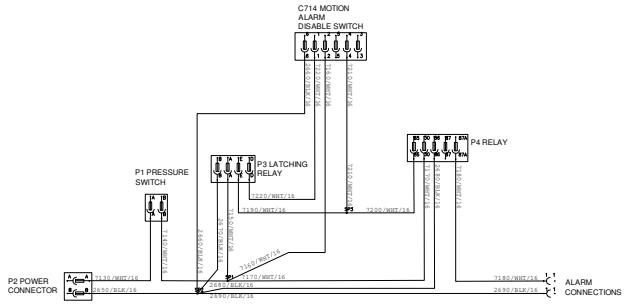
7172972 HARNESS BEACON/STROBE



7172977 HARNESS CANOPY L/B



7104649 HARNESS LIGHT



7180310 HARNESS MOTION ALARM

WIRING SCHEMATIC
E35 (S/N AC2P11001 - AC2P14999)
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7174053

HARNESS
R.H CONSOLE = 7210416
L.H. CONSOLE = 7217716
ENGINE (E32 - E35) = 7147399
ENGINE (E42 - E65) = 7175747
CAB = 7225809

7217775 HARNESS JUMPER M (MEDIUM FRAME MACHINES)

7217775 HARNESS JUMPER L (LARGE FRAME MACHINES)

7234118 HARNESS TRAVEL (LARGE FRAME MACHINES)

CAN 1
CONNECTIONS

PRESSURE SENSOR AUTO IDLE C156

FUEL SENSOR C158

2nd AUX SWITCH C702

LEFT HANDLE C467

BOOM LIGHT C480

LOAD MOMENT C501

FORWARD HORN

2ND AUX SOLENOID C701

TRAVEL ALARM PWR C408

HYD TEMP C105

HYD BYPASS SWITCH

CONSOLE LOCKOUT SENSOR C471

LOAD MOMENT CONNECTOR C621

BEACON SWITCH CONNECTOR C619

BEACON SWITCH

HTU XCHANGE SWITCH

HYDRAULIC EXCHANGE EXTEND COIL

HYDRAULIC EXCHANGE RETRACT COIL

WIPER SWITCH C456

ACC PWR PLUG C485

WASHER M/UTCH C462

DOME LIGHT C463

CAB CONNECTIONS C469

BEACON OPTION C219

WORK LIGHT OPTION HARNESS CONNECTIONS (FRONT, REAR, OR FRONT/REAR) C218

ENGINE GROUND

ALTERNATOR FRAME GROUND

FUEL SOLENOID C101

PRE HEATER

ENGINE SPEED SENSOR C160

ENGINE OIL PRESSURE SWITCH

ENGINE TEMPERATURE SENSOR C159

STARTER (S) TERM

ALTERNATOR EXCITATION

ALTERNATOR CONNECTOR C110

C450

C451

HVAC PWR C161

BATT GND RH CONS

BATT PWR RH CONS

Battery

MAIN RELAY

SW PWR RELAY

STARTER RELAY

FUEL PULL RELAY

LIGHT RELAY

GLOW PLUG RELAY

SEE CAN SPLICE PINS Y AND 4

SEE CAN SPLICE PINS 2 AND 4 C454

C812 CAN OPTION CONN

C811 DISPLAY CONN

SEE CAN SPLICE PINS 3 AND 2

RH JOYSTICK

2SPEED

ANGLE BLADE PADDLE

ANGLE BLADE SOLENOID CCW C478

ANGLE BLADE SOLENOID CW C477

2SPEED SOLENOID C414

WORKCRP SOLENOID C415

AUX ROD SOLENOID C419

OFFSET A C411

OFFSET B C412

AUX BASE SOLENOID C418

TRAVEL SWITCH C479

IGNITION SWITCH C455

ACD CONNECTOR C453

SEE CAN SPLICE

C473 THROTTLE

5 Volt Supply
Switched Power

SEE CAN SPLICE PINS D AND E

CAN Low
CAN High
Sensor Ground

J1AA

DISPLAY CAP

Throttle Actuator Feedback

Throttle Signal

J3A

Battery
Battery

Controller Ground
Controller Ground
Throttle Actuator (+)
Throttle Actuator (–)

J2AA

ACTUATOR CONNECTOR FROM RH CONSOLE C633

ACTUATOR CONNECTOR ON ENGINE HARNESS C634

ELECTRONIC THROTTLE CONTROLLER CONNECTORS

OPTION CONTROLLER

PRIMARY CONTROLLER

AI CONTROLLER

RFID CONTROLLER

CAN OPTIONS

ACD CONNECTOR 120 ohm resistor in cap

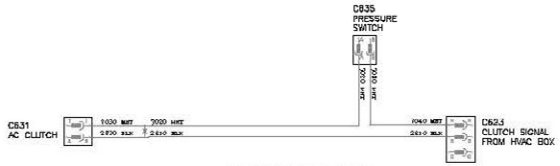
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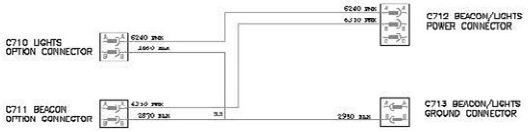
WIRING SCHEMATIC
E35 (S/N A93K18000 AND ABOVE)
(S/N AC2P15000 AND ABOVE)
Sheet 1 of 2

(PRINTED AUGUST 2013)
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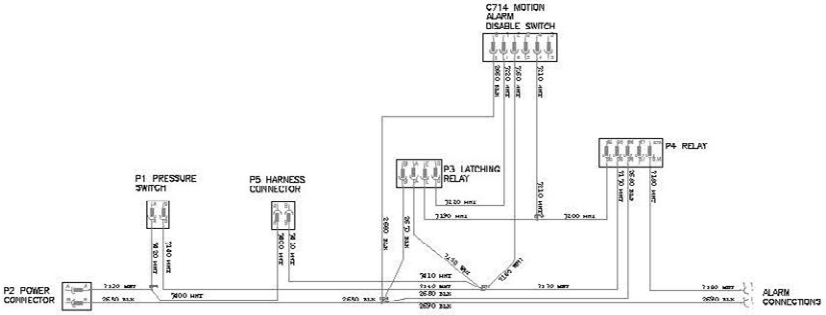
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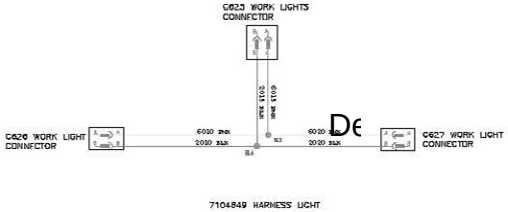
7168895 HARNESS AC CLUTCH



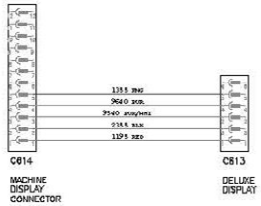
7172977 HARNESS CANOPY L/B



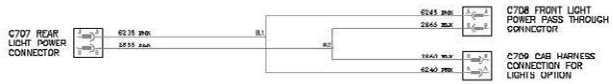
7205868 HARNESS MOTION ALARM



7104849 HARNESS LIGHT



7234121 HARNESS DELUXE



7173612 HARNESS LIGHT REAR



7172872 HARNESS BEACON/STROBE

WIRING SCHEMATIC
E35 (S/N A93K18000 AND ABOVE)
(S/N AC2P15000 AND ABOVE)
Sheet 2 of 2

(PRINTED AUGUST 2013)
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ELECTRICAL SYSTEM INFORMATION

Troubleshooting Chart

The following troubleshooting chart is provided for assistance in locating and correcting problems which are most common. Many of the recommended procedures must be done by authorized Bobcat service personnel only.

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2003-0807

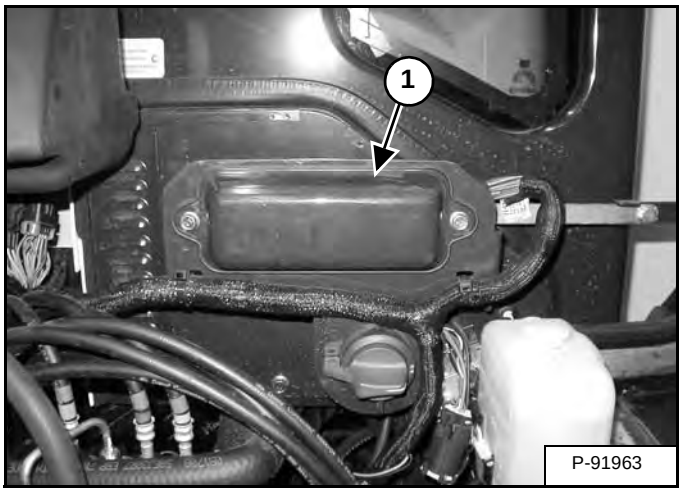
PROBLEM	CAUSE
Battery will not take charge.	1, 2, 3, 4, 5
Alternator will not charge.	1, 2, 5
Starter will not turn engine.	2, 3, 4, 6, 7, 8, 9

KEY TO CORRECT THE CAUSE
1. Alternator belt is loose or damaged.
2. Battery connections are dirty or loose.
3. Battery is damaged.
4. The ground connection is not making a good contact.
5. The alternator is damaged.
6. The engine is locked.
7. The starter is damaged.
8. The wiring or the solenoid is damaged.
9. Check the fuses.

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Description

Figure 50-10-1



The excavator has a 12 volt, negative ground electrical system. The electrical system is protected by fuses located under the right side cover of the excavator (Item 1) **[Figure 50-10-1]**. The fuses will protect the electrical system when there is an electrical overload. The reason for the overload must be found and corrected before starting the engine again.

The battery cables must be clean and tight. Check the electrolyte level in the battery. Add distilled water as needed. Remove acid or corrosion from the battery and cables with a sodium bicarbonate and water solution.

Put Battery Saver P/N 6664458 or grease on the battery terminals and cable ends to prevent corrosion.

⚠ WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

Fuse And Relay Location / Identification

A decal is inside the fuse cover to show location and amp ratings.

Remove the cover to check or replace the fuses and relays.

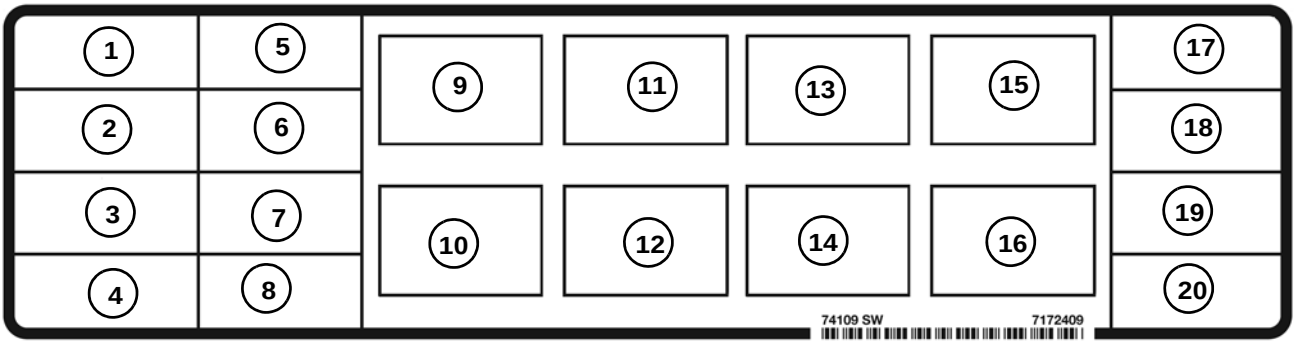
The location and sizes are shown in **[Figure 50-10-2 on Page 50-10-3]**.

Always replace fuses using the same type and capacity.

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Fuse And Relay Location / Identification (Cont'd)

Figure 50-10-2



The location and sizes are shown in the table below and on the decal **[Figure 50-10-2]**. Relays are identified by the letter "R" in the AMP column.

REF	ICON	DESCRIPTION	AMP	REF	ICON	DESCRIPTION	AMP	REF	ICON	DESCRIPTION	AMP
1		CONTROLLER	20	**9**		Switched Power	R	**17**		Controller	25
2		HVAC	25	**10**		Fuel Shutoff	R	**18**		ACD	25
3		Start Key	5	**11**		HVAC	R	**19**		LIGHTS	20
4		Fuel Pull	25	**12**		Lights	R	**20**		Power Port	15
5		Wiper / Washer	10	**13**		NOT USED	R				
6		Switched Power	20	**14**		Glow Plugs	R				
7		Alternator Excite / Heater	25	**15**		NOT USED	R				
8		ACD	25	**16**		Starter	R				

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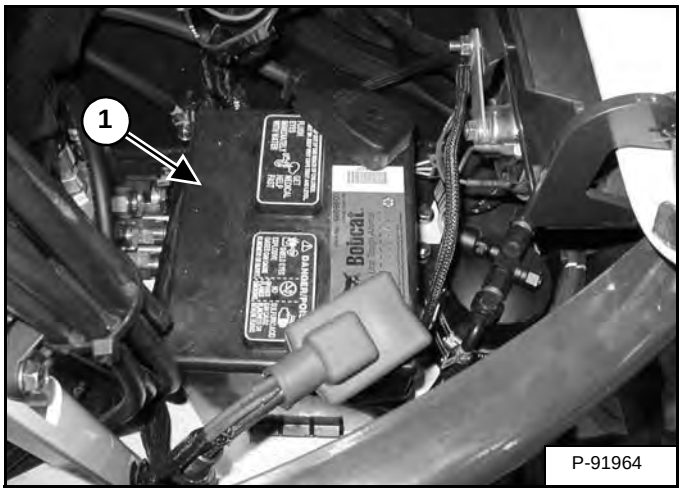


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BATTERY

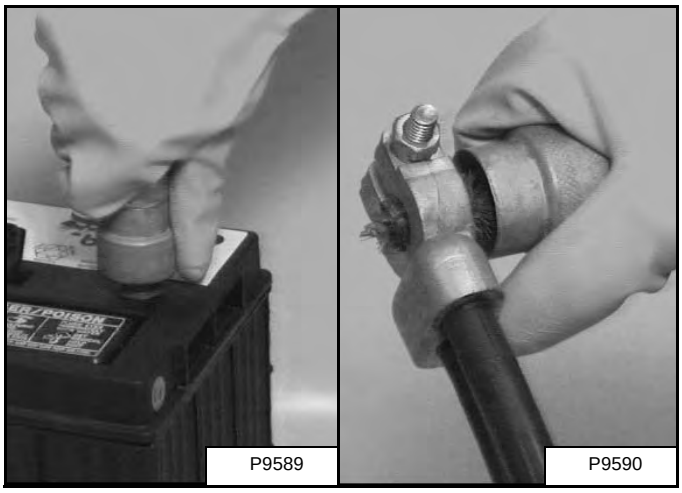
Servicing

Figure 50-20-1



The battery (Item 1) **[Figure 50-20-1]** is located in the front of the right side upperstructure.

Figure 50-20-2



The battery cables must be clean and tight **[Figure 50-20-2]**. Remove acid or corrosion from the battery and cables using a sodium bicarbonate and water solution. Cover the battery terminals and cable ends with battery saver grease to prevent corrosion.

Check for broken or loose connections.

If the battery cables are removed for any reason, disconnect the negative (-) cable first. When installing the battery cables, make the last connection the negative (-) cable to the battery.

The original equipment battery is maintenance free. If a replacement battery is installed, check the electrolyte level in the battery.

If the electrolyte level is lower than 13 mm (0.50 in) above the plates, add distilled water only.

⚠ WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

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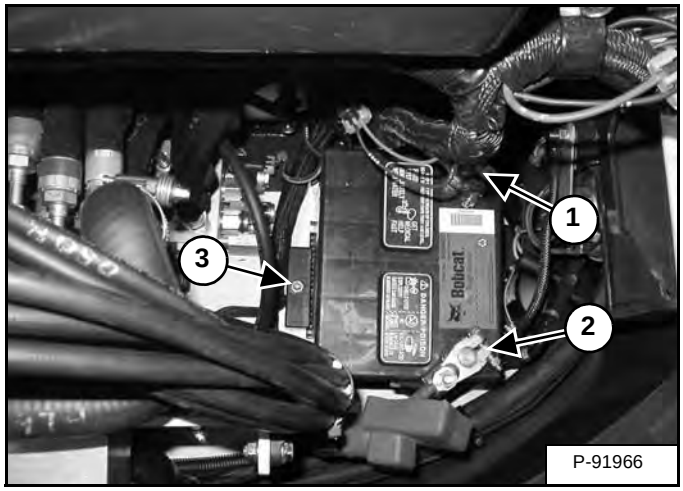
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BATTERY (CONT'D)

Removal And Installation

Open the right side cover.

Figure 50-20-3



Disconnect the negative (-) cable (Item 1) **[Figure 50-20-3]** first.

Disconnect the positive (+) cable (Item 2) **[Figure 50-20-3]**.

Remove the bolt (Item 3) **[Figure 50-20-3]** and remove the hold down clamp.

Remove the battery.

Always clean the terminals and the cable ends, even when installing a new battery.

Install the battery. Install the hold down clamp and tighten the bolts.

Connect the battery cables. Connect the negative (-) cable (Item 1) **[Figure 50-20-3]** last to prevent sparks.

WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

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Using A Booster Battery (Jump Starting)

IMPORTANT

If jump starting the excavator from a second machine:

When jump starting the excavator from a battery installed in a second machine, make sure the engine is NOT running while using the glow plugs. High voltage spikes from a running machine can burn out the glow plugs.

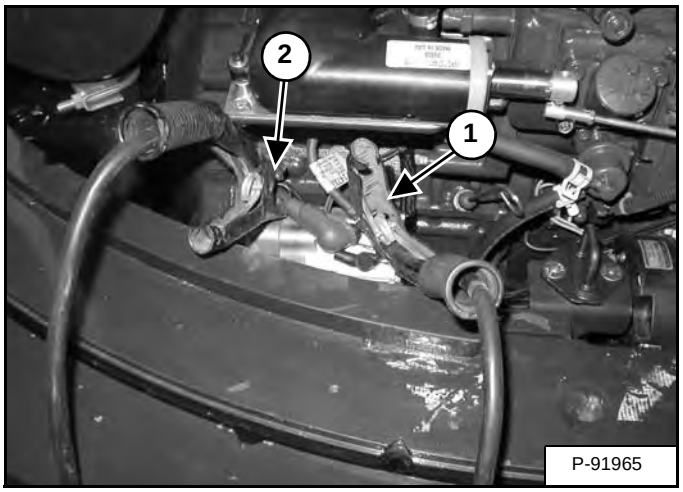
I-2060-0906

If it is necessary to use a booster battery to start the engine, BE CAREFUL! There must be one person in the operator's seat and one person to connect and disconnect the battery cables.

Be sure the key switch is OFF. The booster battery must be 12 volt.

Open the tailgate. (See TAILGATE on Page 10-50-1.)

Figure 50-20-4



Connect one end of the first cable to the positive (+) terminal of the booster battery. Connect the other end of the same cable to the positive (+) terminal (Item 1) **[Figure 50-20-4]** of the excavator starter.

Connect one end of the second cable to the negative (-) terminal of the booster battery. Connect the other end of the same cable to the starter mount bolt (Item 2) **[Figure 50-20-4]**.

Start the engine. After the engine has started, remove the ground (-) cable first (Item 2) **[Figure 50-20-4]**.

Disconnect the cable from the excavator starter (Item 1) **[Figure 50-20-4]**.

IMPORTANT

Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the excavator. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

I-2223-0903

⚠ WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

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ALTERNATOR

Belt Adjustment

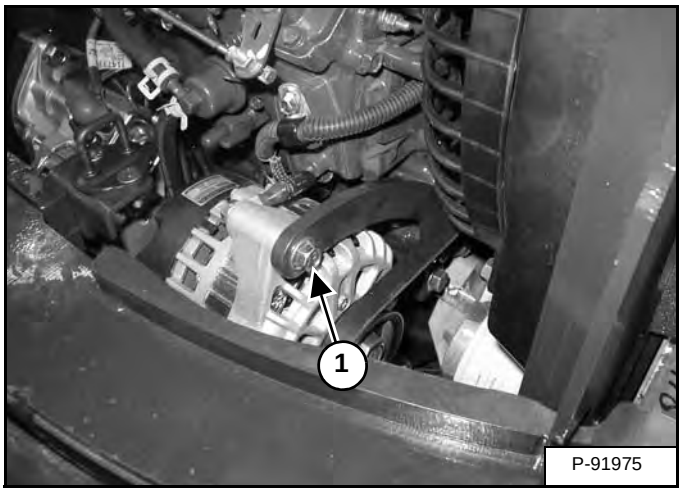
The alternator belt is a special maintenance free type that is pre-tensioned over the pulleys. This belt eliminates the need for a tensioning device and does not require periodic adjustment. Contact your Bobcat dealer for replacement parts.

Belt Replacement

Removal

Stop the engine and open the tailgate. (See Opening And Closing on Page 10-50-1.)

Figure 50-30-1



Loosen the bolt (Item 1) **[Figure 50-30-1]** and the lower alternator mounting bolt and nut (not shown).

Use a pry bar to take the pressure off of the bolt (Item 1) **[Figure 50-30-1]** and remove the top bolt.

Remove and replace the alternator belt.

Installation

Use the pry bar to position the alternator and install the bolt (Item 1) **[Figure 50-30-1]**.

Tighten the top and bottom alternator mounting bolts.

Close the tailgate.

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Charging System Inspection

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 engine accessory drive belt. If belt is worn or deteriorated replace the belt. (See Belt Replacement on Page 50-30-1.)

Inspect the alternator wiring harness and connectors at alternator. Harness and connectors must be clean and tight.

Check the fuse for the alternator in the fuse panel. If the fuse is burned, find the cause and repair / replace. If the fuse is in doubt, remove and check the fuse 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.

⚠ 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.

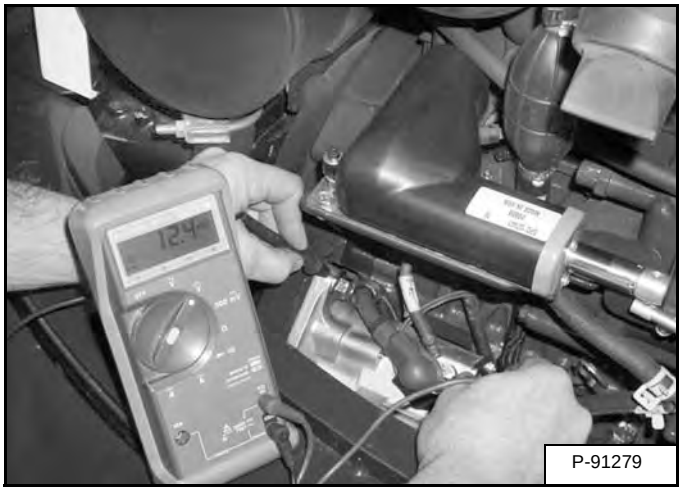
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Alternator Voltage Testing

Open the tailgate.

Figure 50-30-2



Start the engine and run at low idle. With a voltmeter, check the voltage between the B+ terminal and ground at the starter **[Figure 50-30-2]**.

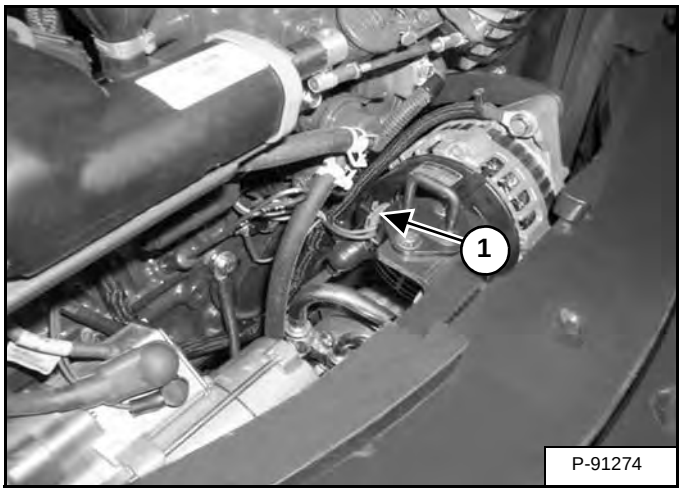
The voltage must be higher than 13.5 volts but lower than 14.7 volts at 21°C (70°F) (Alternator Temperature).

If the voltage is higher than 14.7 volts, proceed to the high voltage test.

If the voltage is lower than 13.5 volts, run the engine at high idle and recheck voltage. If voltage is still below 13.5 volts, proceed to the low voltage test.

Low Voltage Testing

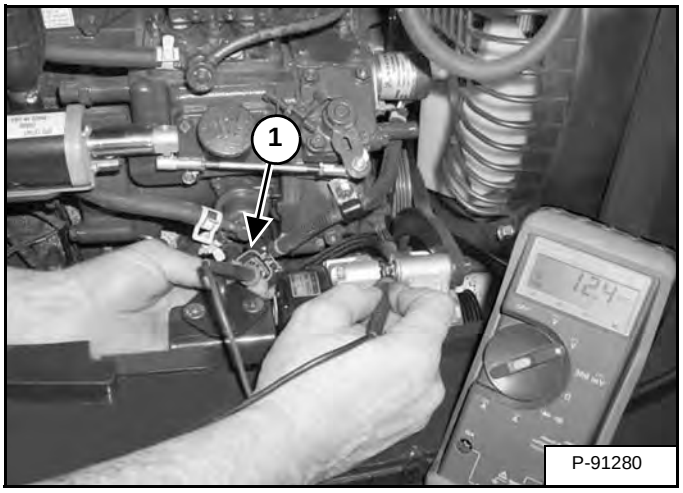
Figure 50-30-3



Turn engine OFF and remove the L & S terminal connector (Item 1) **[Figure 50-30-3]** from the alternator.

Turn the key to the ON position.

Figure 50-30-4

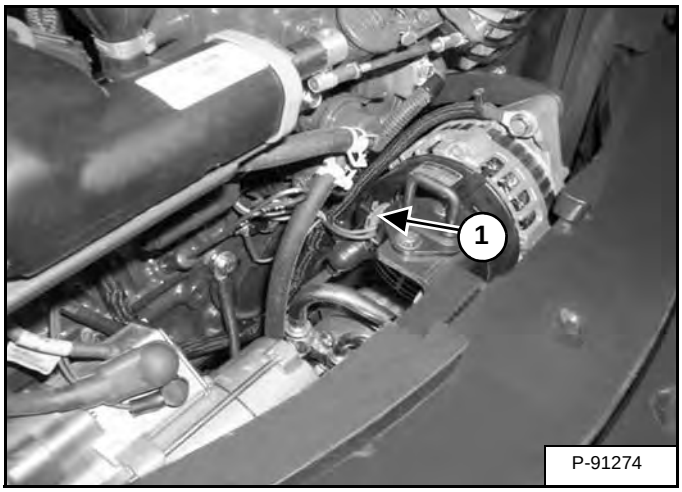


Check the voltage across the "L" terminal (Item 1) **[Figure 50-30-4]**. The voltage should be what the battery voltage is. If not, check the wire harness, relay, and fuses. If the wire harness, relay, and fuses are ok, remove the alternator for replacement or repair.

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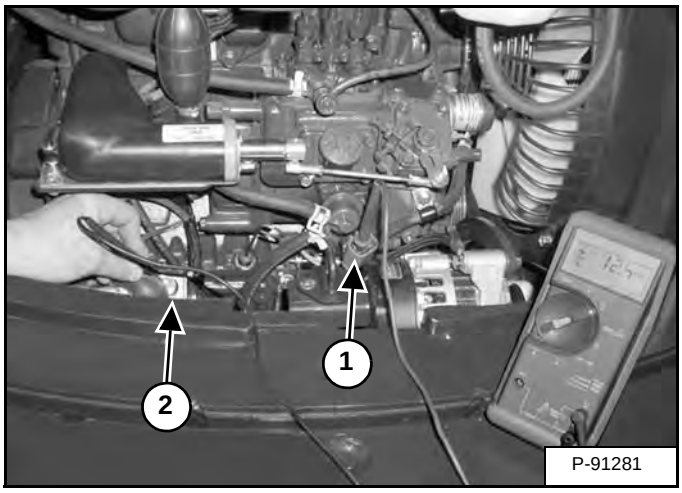
High Voltage Testing

Figure 50-30-5



Turn the engine OFF and remove the L & S Terminal connector (Item 1) **[Figure 50-30-5]** from the alternator.

Figure 50-30-6



Check the continuity between the "S" terminal (Item 1) and the positive (+) terminal on the battery or starter terminal (Item 2) **[Figure 50-30-6]**. There should be continuity. If there is no continuity, replace the wire harness.

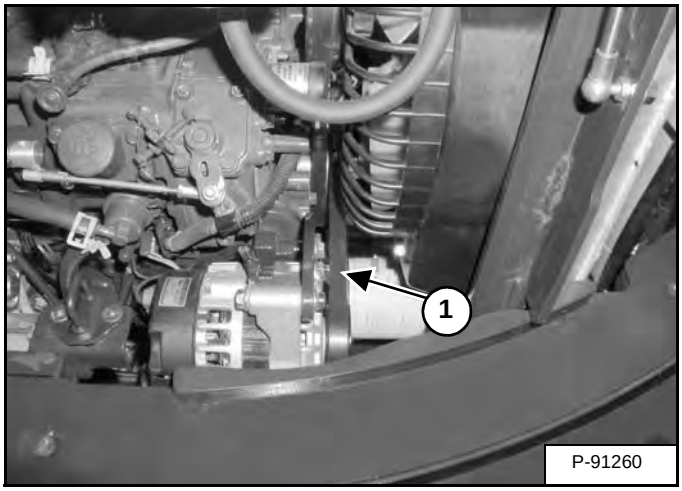
If the voltage is still above 14.7 volts at 21°C (70°F) (alternator temperature), then remove the alternator for replacement or repair.

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Removal And Installation

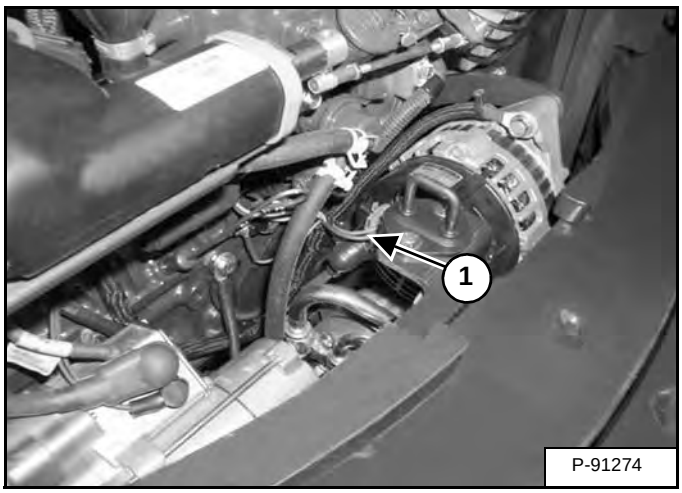
Open the tailgate.

Figure 50-30-7



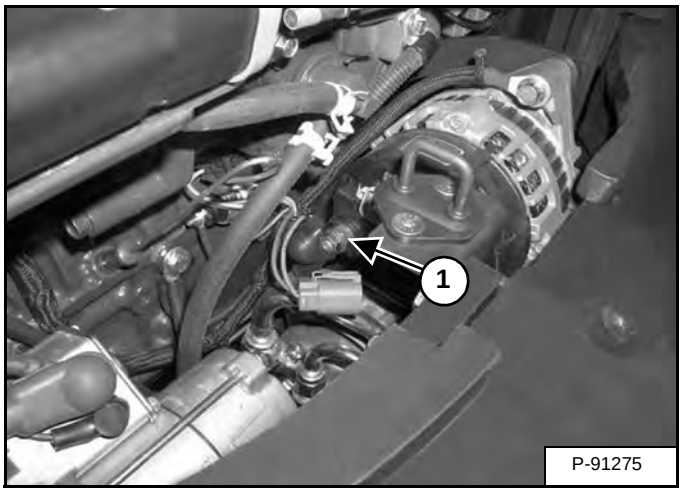
Remove the belt (Item 1) **[Figure 50-30-7]** from the engine. (See Belt Replacement on Page 50-30-1.)

Figure 50-30-8



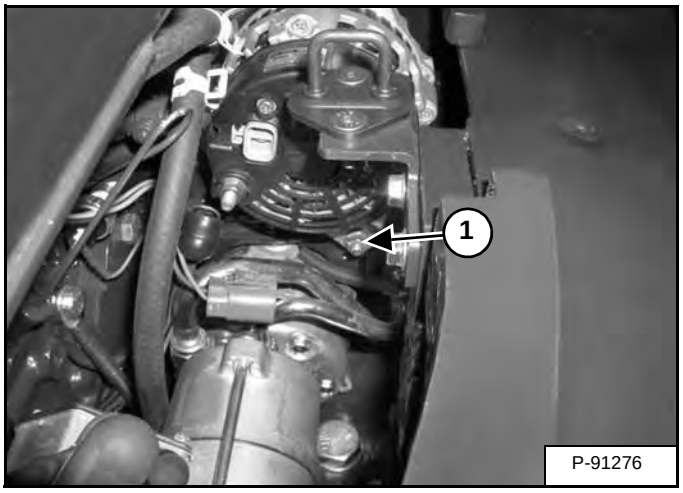
Disconnect the wire harness (Item 1) **[Figure 50-30-8]** from the alternator.

Figure 50-30-9



Remove the nut (Item 1) **[Figure 50-30-9]** and wire.

Figure 50-30-10

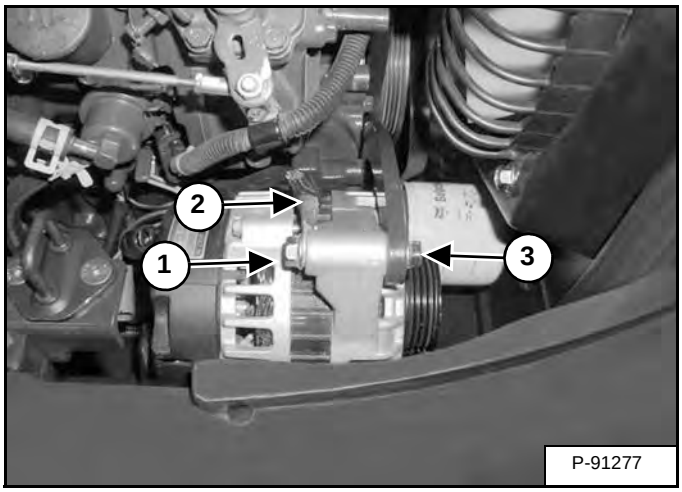


Remove the nut (Item 1) **[Figure 50-30-10]** and bolt.

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Removal And Installation (Cont'd)

Figure 50-30-11



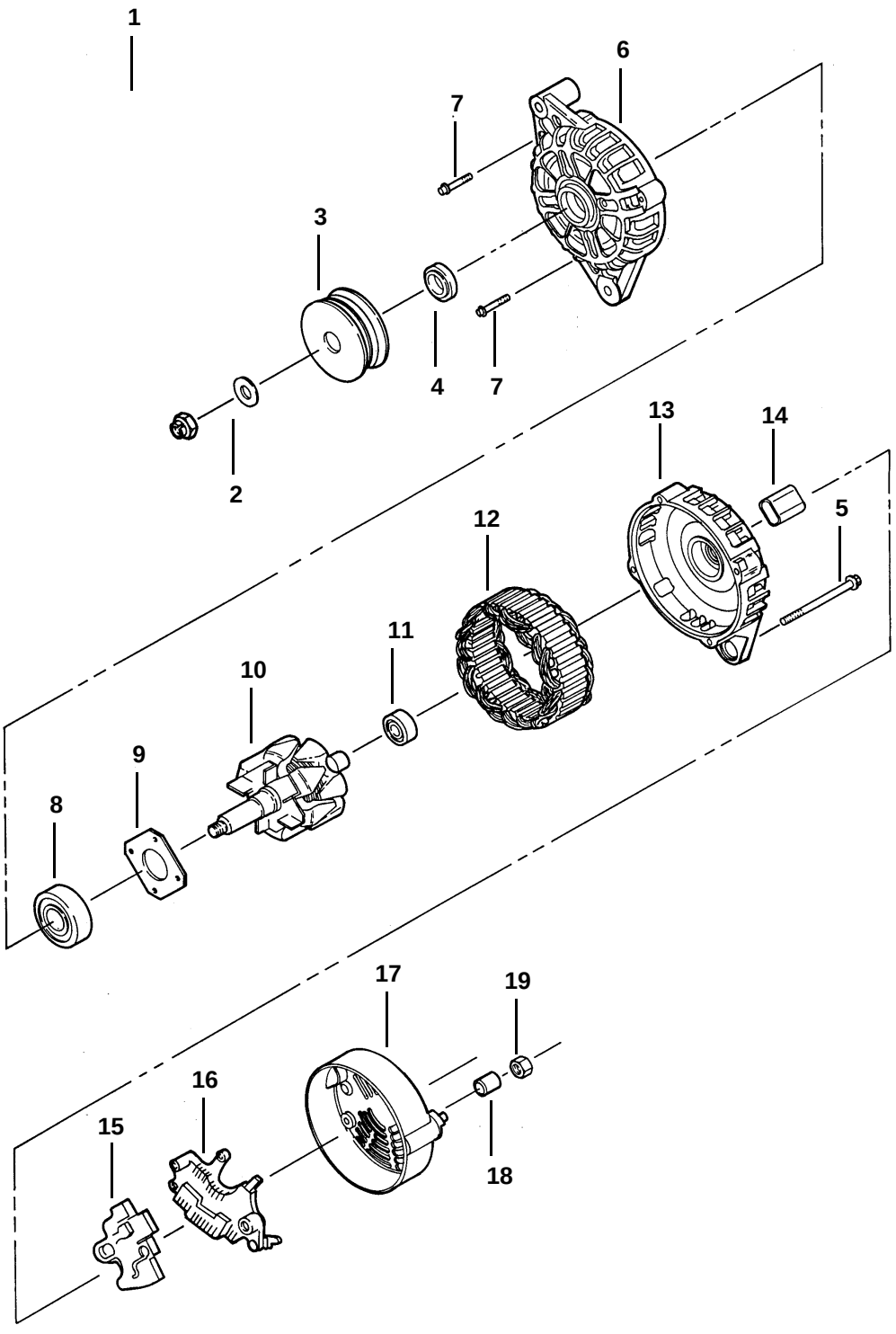
Remove the bolt (Item 1) and ground wire (Item 2) **[Figure 50-30-11]**.

Remove the bolt (Item 3) **[Figure 50-30-11]** and remove the alternator.

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Parts Identification

1. Alternator
2. Nut
3. Pulley
4. Spacer
5. Bolt
6. Case Half
7. Bolt
8. Bearing
9. Retainer
10. Rotor
11. Bearing
12. Stator
13. Case Half
14. Sleeve
15. Regulator
16. Rectifier
17. Cover
18. Spacer
19. Nut



C-3529

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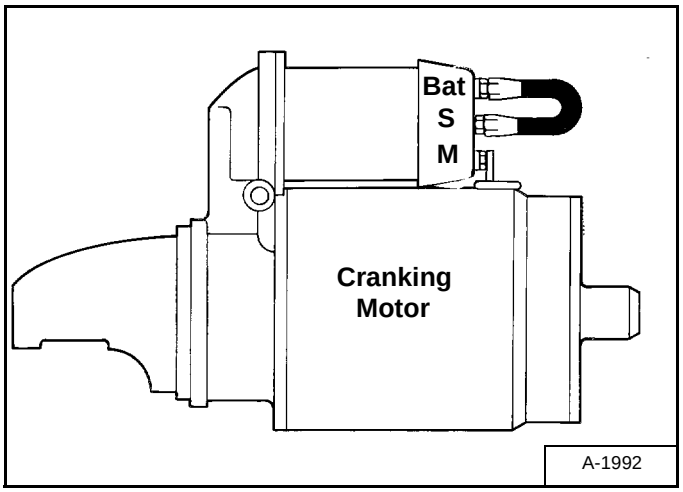


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STARTER

Testing

Figure 50-40-1



The key switch must be in the OFF position.

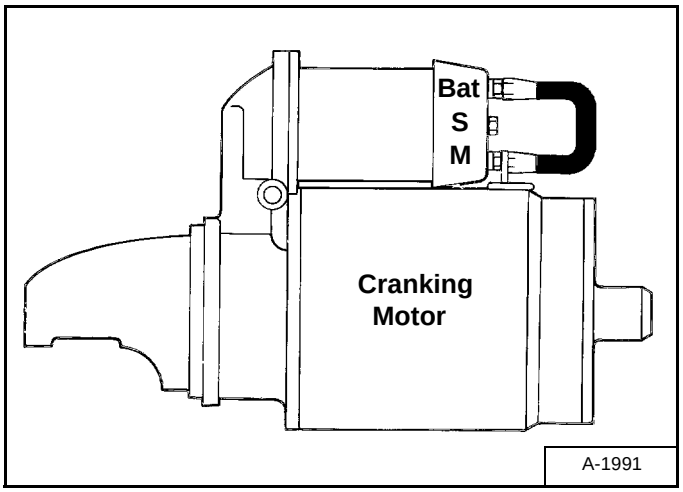
The battery must be at full charge.

The cable connections on the battery must be clean and tight.

Connect a jumper wire between S terminal and BAT terminal **[Figure 50-40-1]**.

If the starter turns but does not turn the engine, the starter drive has a defect.

Figure 50-40-2



Connect a jumper wire (of at least 4 gauge in size) between the M terminal and the BAT terminal **[Figure 50-40-2]**.

If the starter turns, the defect is in the solenoid.

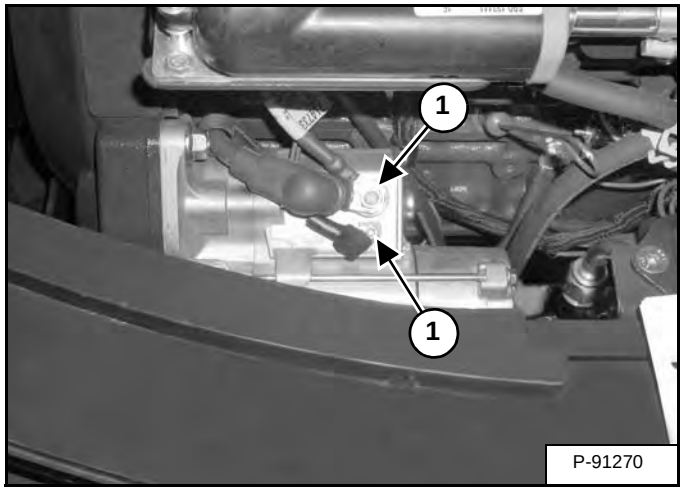
If the starter does not turn, the starter is defective.

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Removal And Installation

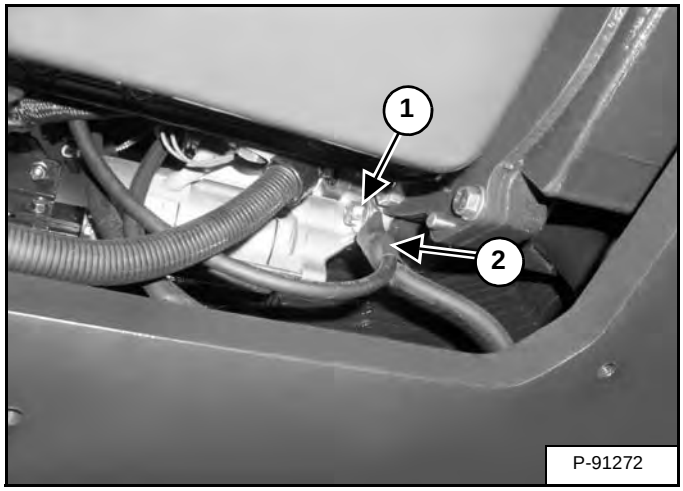
Disconnect the negative (-) cable from the battery. (See Removal And Installation on Page 50-20-2.)

Figure 50-40-3



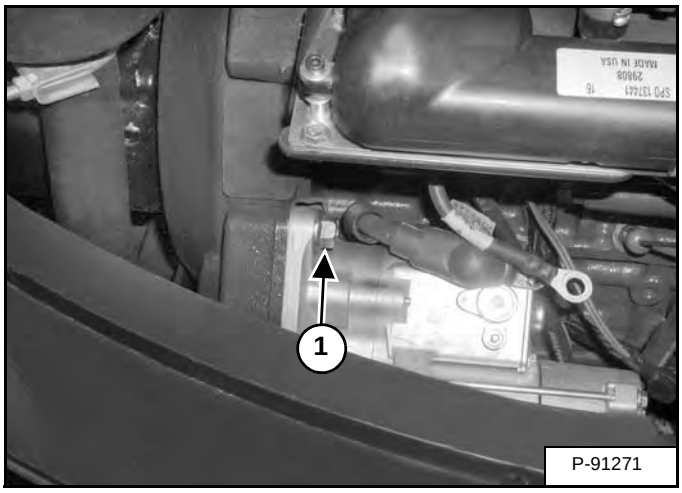
Disconnect the wires (Item 1) **[Figure 50-40-3]** from the starter.

Figure 50-40-4



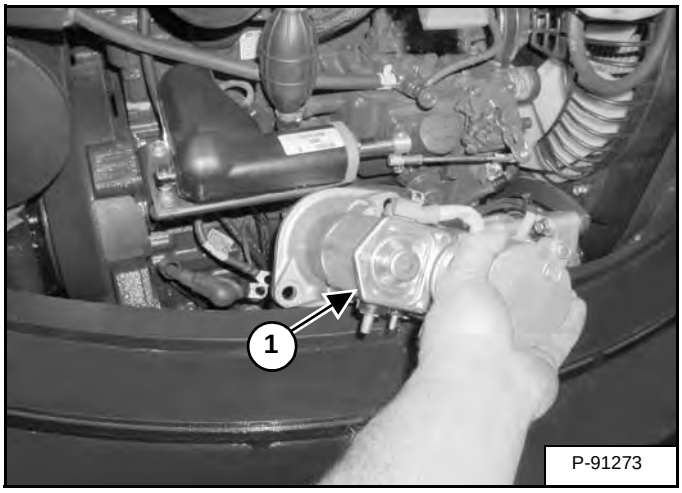
Remove the bottom bolt (Item 1) and ground cable (Item 2) **[Figure 50-40-4]**.

Figure 50-40-5



Remove the top bolt (Item 1) **[Figure 50-40-5]**.

Figure 50-40-6

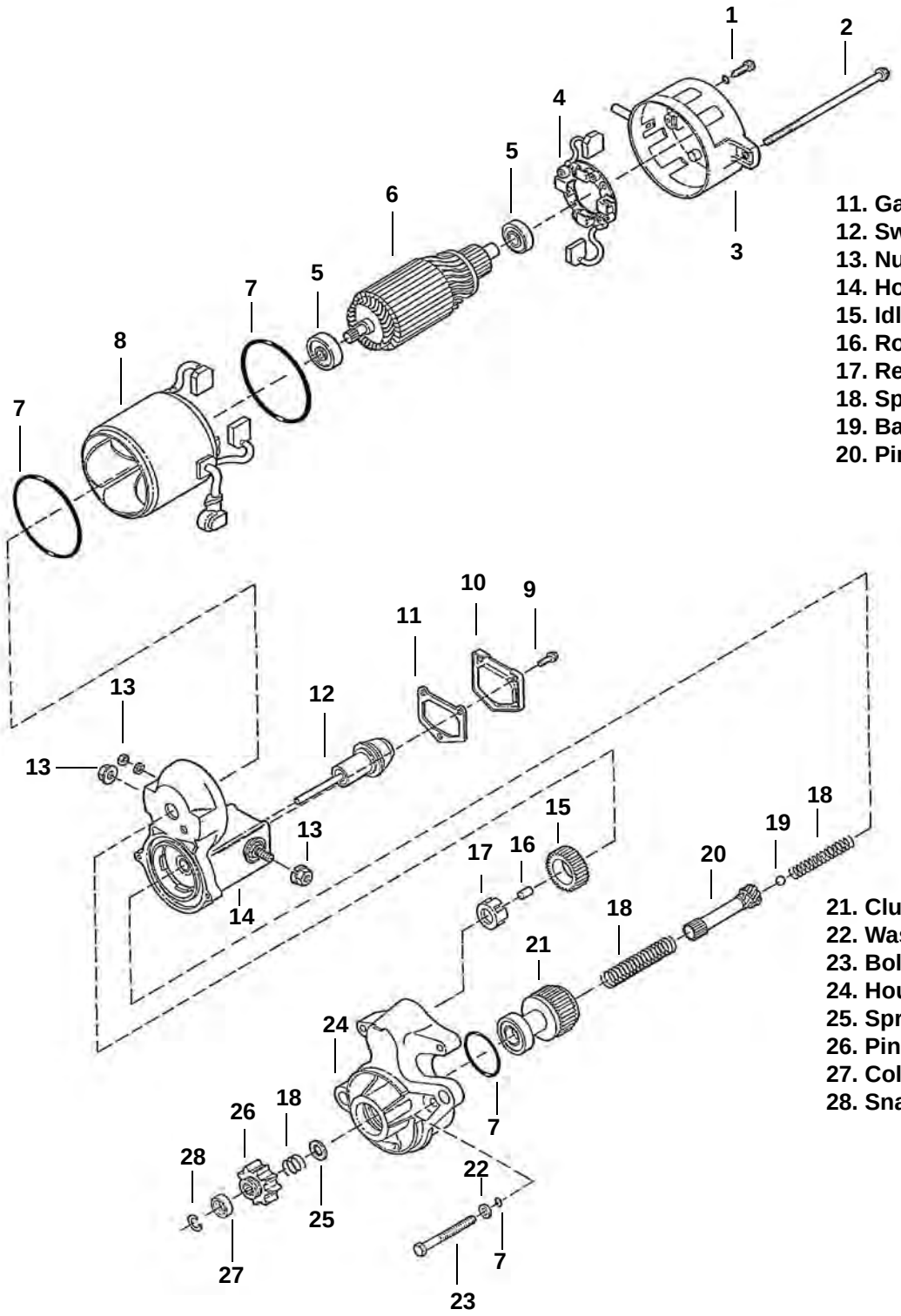


Remove the starter (Item 1) **[Figure 50-40-6]**.

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Parts Identification

1. Screw
2. Bolt
3. Brush Cover
4. Brush Holder
5. Bearing
6. Armature
7. O-ring
8. Frame
9. Bolt
10. Cover
11. Gasket
12. Switch
13. Nut
14. Housing
15. Idler Gear
16. Roller
17. Retainer
18. Spring
19. Ball
20. Pinion Shaft
21. Clutch
22. Washer
23. Bolt
24. Housing
25. Spring Seat
26. Pinion Gear
27. Collar
28. Snap Ring



D-2396

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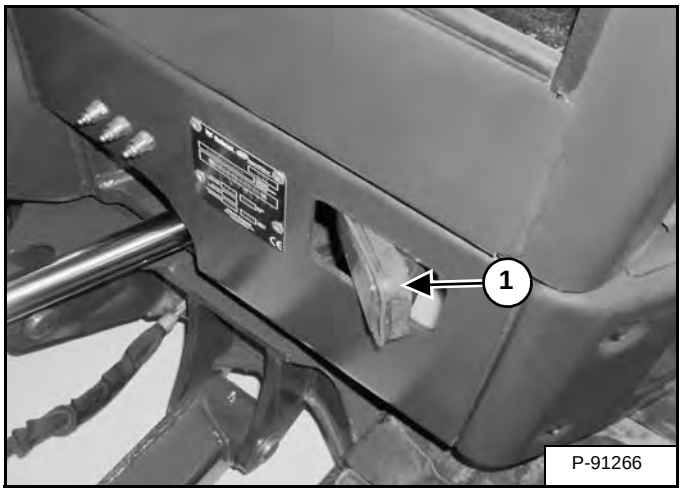


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LIGHTS

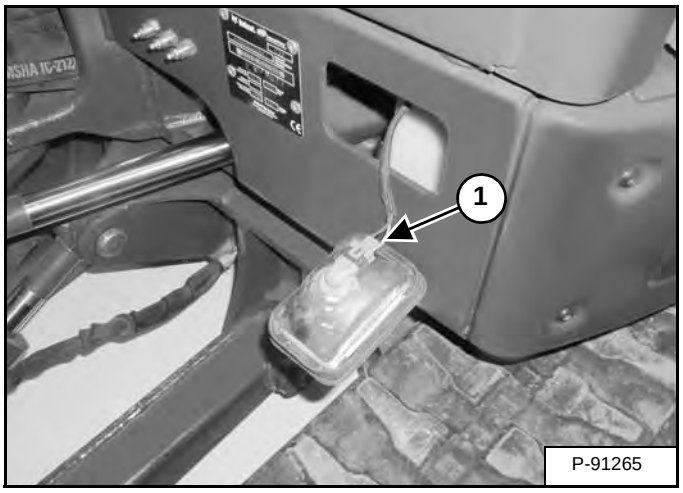
Removal And Installation

Figure 50-50-1



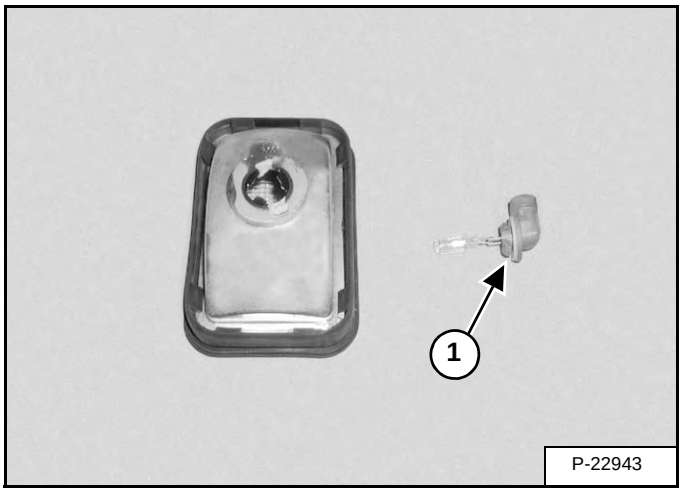
To remove the upperstructure light, pivot the light (Item 1) **[Figure 50-50-1]** back inside the frame.

Figure 50-50-2



Disconnect the wire harness (Item 1) **[Figure 50-50-2]**.

Figure 50-50-3

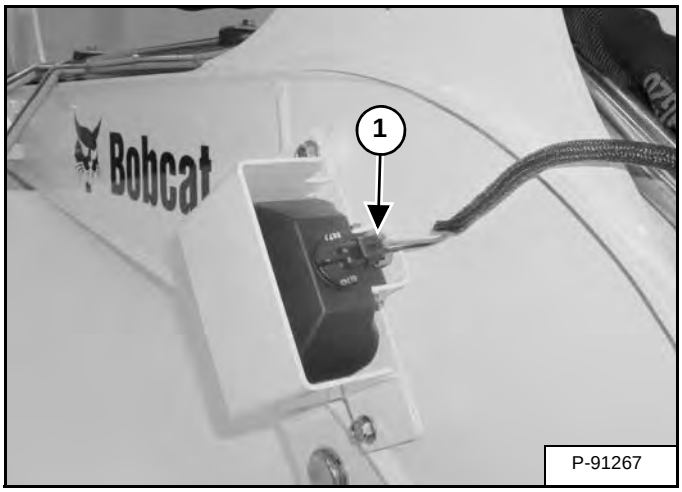


Remove the light bulb assembly (Item 1) **[Figure 50-50-3]** from the lens.

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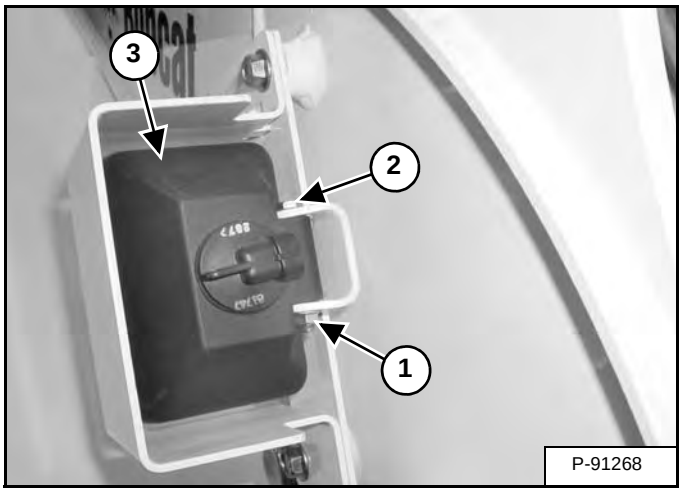
Boom Light Removal And Installation

Figure 50-50-4



Disconnect the wire harness (Item 1) **[Figure 50-50-4]**.

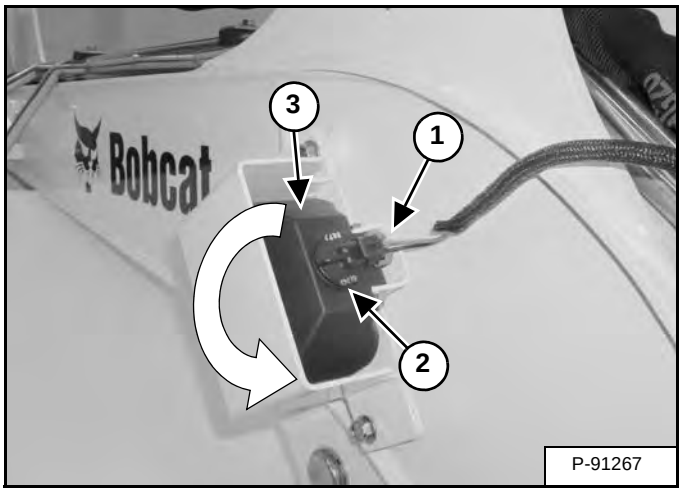
Figure 50-50-5



Remove the nut (Item 1) and bolt (Item 2). Remove the boom light (Item 3) **[Figure 50-50-5]** from the boom light guard.

Boom Light Bulb Replacement

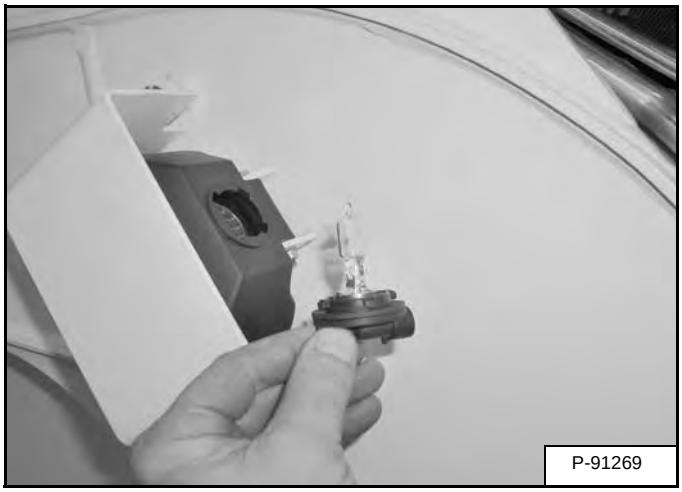
Figure 50-50-6



Disconnect the wire harness (Item 1) **[Figure 50-50-6]**.

Rotate light bulb assembly (Item 2) counterclockwise and pull straight out from the boom light (Item 3) **[Figure 50-50-6]**.

Figure 50-50-7



NOTE: Do not touch glass of halogen bulb with your fingers or allow bulb to come in contact with oils. If contaminated, the bulb should be cleaned with mild alcohol and a clean cloth [Figure 50-50-7].

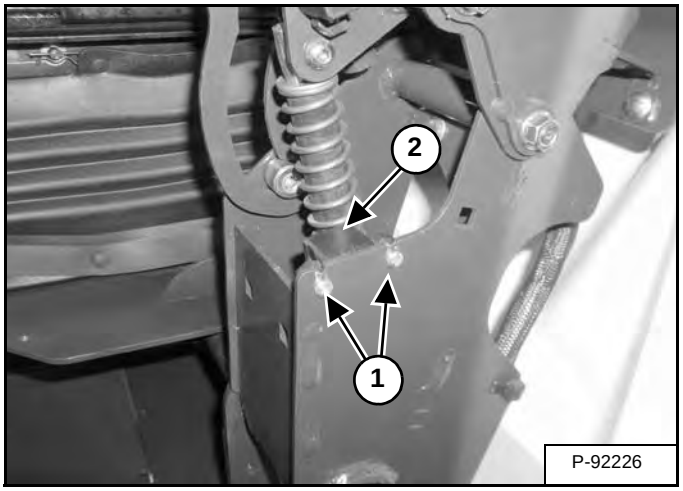
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MAGNETIC LOCKOUT SENSOR

Removal And Installation

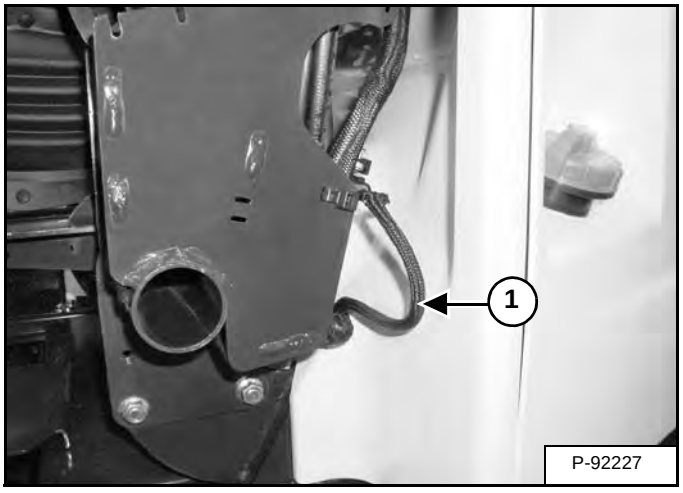
Remove the lower console cover. (See Lower Console Cover Removal And Installation on Page 40-60-1.)

Figure 50-60-1



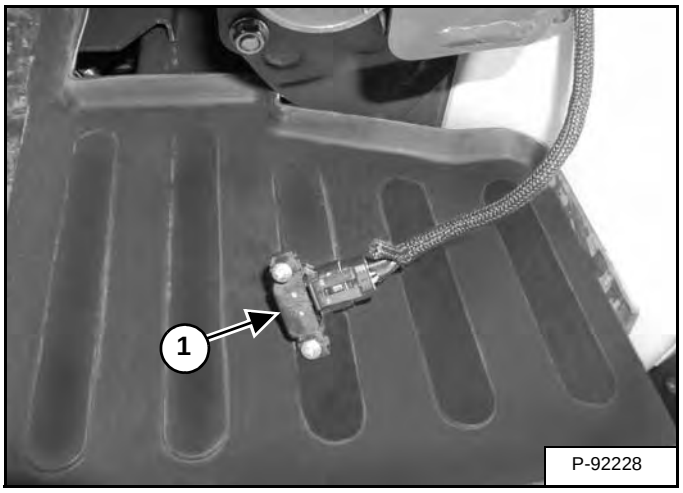
Loosen the screws (Item 1) and remove the switch (Item 2) **[Figure 50-60-1]**.

Figure 50-60-2



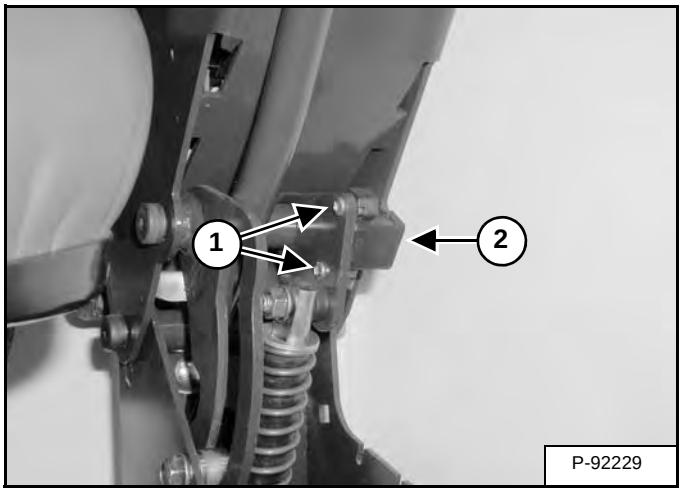
Route the switch and wire harness (Item 1) **[Figure 50-60-2]** out the back of the console.

Figure 50-60-3



Remove the switch (Item 1) **[Figure 50-60-3]** from the wire harness.

Figure 50-60-4



Loosen the screws (Item 1) and remove the magnet (Item 2) **[Figure 50-60-4]**.

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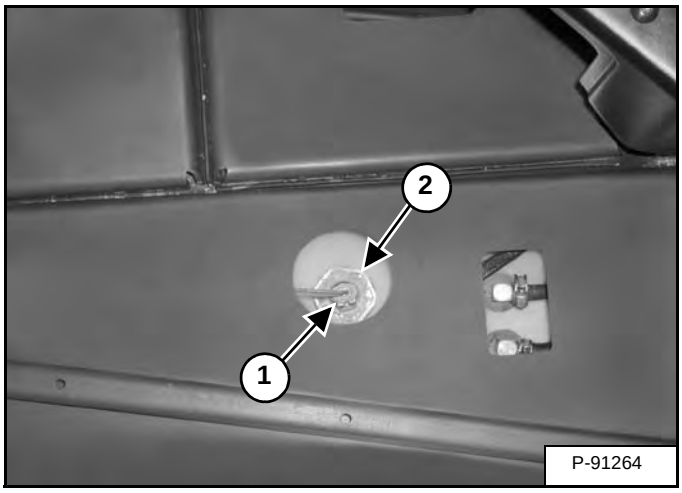
FUEL LEVEL SENDER

Removal And Installation

Remove the negative battery cable. (See Removal And Installation on Page 50-20-2.)

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

Figure 50-70-1



Disconnect the harness connector (Item 1) **[Figure 50-70-1]** from the fuel sender.

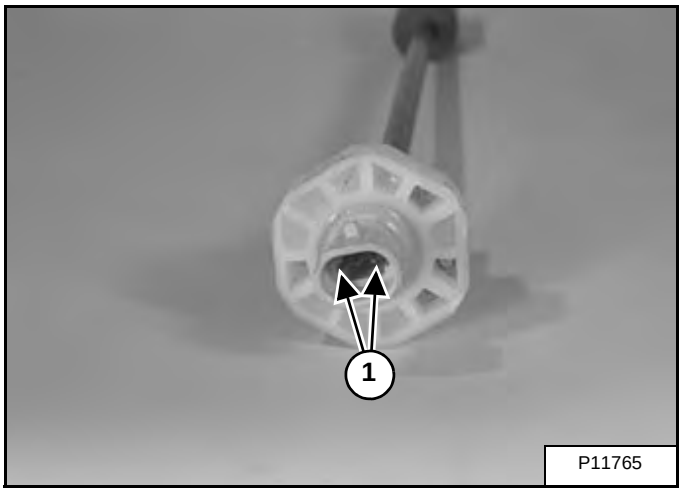
Remove the fuel sender (Item 2) **[Figure 50-70-1]**. The sender threads into the tank, use a wrench to remove the sender.

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FUEL LEVEL SENDER (CONT'D)

Testing

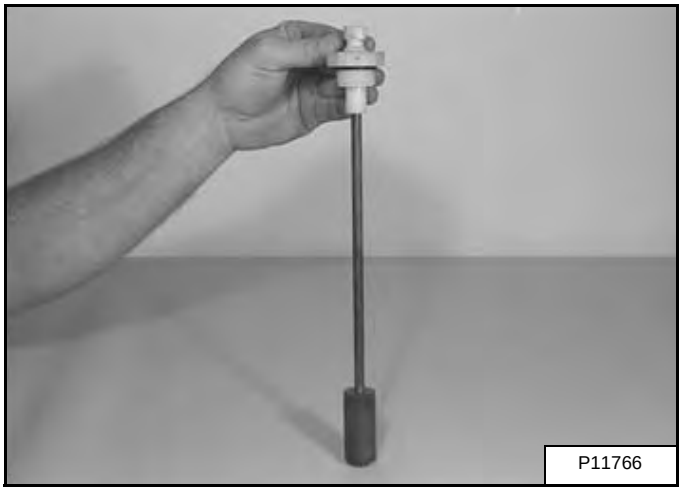
Figure 50-70-2



Use an ohmmeter to check the resistance of the fuel sender.

Insert one of the ohm tester leads into each of the fuel sender electrical connectors (Item 1) **[Figure 50-70-2]** in the end of the fuel sender.

Figure 50-70-3

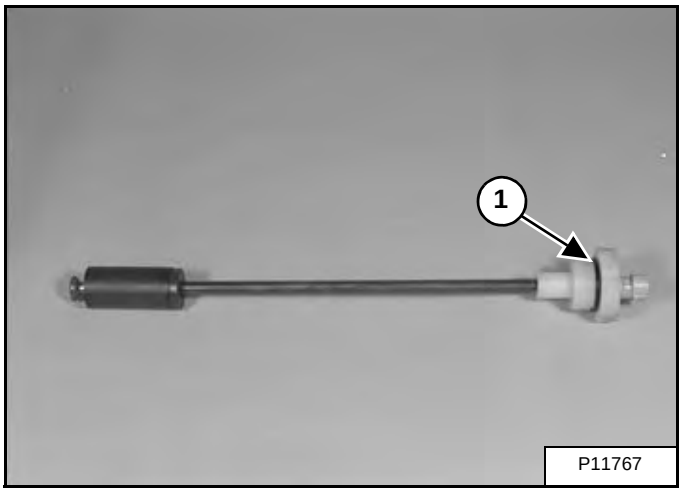


With the fuel sender in the position shown **[Figure 50-70-3]**, read the ohms in the empty position. Slide the float upwards and the ohm reading will decrease. See resistance chart below.

The resistance should read as follows:

FULL: 30 ohm
HALF: 150 ohm
EMPTY: 270 ohm

Figure 50-70-4



Inspect the O-ring (Item 1) **[Figure 50-70-4]** and replace as needed.

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DIAGNOSTICS SERVICE CODES (S/N A93K11001 - A93K17999 AND AC2P11001 - AC2P14999)

Number Codes List

CODE		CODE	
C0216	Hydraulic charge filter not connected	C1602	Auto idle pull solenoid error ON
C0217	Hydraulic charge filter plugged	C1603	Auto idle pull solenoid error OFF
C0309	Battery voltage low	C2002	Two speed solenoid error ON
C0310	Battery voltage high	C2003	Two speed solenoid error OFF
C0311	Battery voltage extremely high		
C0314	Battery voltage extremely low	C2102	Glow plugs error ON
C0315	Battery voltage shutdown level	C2103	Glow plugs error OFF
C0322	Battery voltage out of range low		
		C2202	Starter error ON
C0414	Oil pressure extremely low	C2203	Starter error OFF
C0415	Oil pressure shutdown level		
		C2305	Offset base solenoid short to battery
C0610	Engine speed high	C2306	Offset base solenoid short to ground
C0611	Engine speed extremely high	C2307	Offset base solenoid open circuit
C0613	Engine speed no signal		
C0615	Engine speed shutdown level	C2405	Offset rod solenoid short to battery
C0618	Engine speed out of range high	C2406	Offset rod solenoid short to ground
		C2407	Offset rod solenoid open circuit
C0710	Hydraulic oil temperature high		
C0711	Hydraulic oil temperature extremely high	C2505	Offset return short to battery
C0715	Hydraulic oil temperature shutdown level	C2506	Offset return short to ground
C0721	Hydraulic oil temperature out of range high	C2507	Offset return open circuit
C0722	Hydraulic oil temperature out of range low		
		C2605	Auxiliary base solenoid short to battery
C0810	Engine coolant temperature high	C2606	Auxiliary base solenoid short to ground
C0811	Engine coolant temperature extremely high	C2607	Auxiliary base solenoid open circuit
C0815	Engine coolant temperature shutdown level		
C0821	Engine coolant temperature out of range high	C2705	Auxiliary rod solenoid short to battery
C0822	Engine coolant temperature out of range low	C2706	Auxiliary rod solenoid short to ground
		C2707	Auxiliary rod solenoid open circuit
C0921	Fuel level out of range high		
C0922	Fuel level out of range low	C2802	Hydraulic exchange error ON
		C2803	Hydraulic exchange error OFF
C1221	Front auxiliary control out of range high		
C1222	Front auxiliary control out of range low	C3028	Controller memory failure (Log only)
C1223	Front auxiliary control not in neutral		
		C3128	Interrupted power failure (Log only)
C1305	Fuel shut-off hold solenoid short to battery		
C1306	Fuel shut-off hold solenoid short to ground	C3323	Main controller not programmed
C1307	Fuel shut-off hold solenoid open circuit		
		C3397	Main controller programmed (Log only)
C1402	Fuel shut-off hold solenoid short error on		
C1403	Fuel shut-off hold solenoid short error off		
C1505	Auto idle hold solenoid short to battery		
C1506	Auto idle hold solenoid short to ground		
C1507	Auto idle hold solenoid open circuit		

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Number Codes List (Cont'd)

CODE		CODE	
C4021	Angle blade control out of range high	E0105	Throttle actuator short to battery
C4022	Angle blade control out of range low	E0106	Throttle actuator short to ground
C4023	Angle blade control not in neutral	E0107	Throttle actuator open circuit
C4105	Angle blade base solenoid short to battery	E01233	Throttle actuator not calibrated
C4106	Angle blade base solenoid short to ground		
C4107	Angle blade base solenoid open circuit	E0321	5 volt supply out of range high
		E0322	5 volt supply out of range low
C4205	Angle blade rod solenoid short to battery		
C4206	Angle blade rod solenoid short to ground	E0421	Throttle sensor out of range high
C4207	Angle blade rod solenoid open circuit	E0422	Throttle sensor out of range low
C4321	Load sense pressure out of range high	E0421	Throttle actuator feedback out of range high
C4322	Load sense pressure out of range low	E0422	Throttle actuator feedback out of range low
C4416	Auxiliary controller not connected (Tilt rotator option only)		
C4516	Throttle controller not connected		
C6021	Offset controller out of range high		
C6022	Offset controller out of range low		
C6023	Offset controller not in neutral		
C6204	Load moment in error		
C6305	Console sensor short to battery		
C6306	Console sensor short to ground		
C6405	Switched power relay short to battery		
C6406	Switched power relay short to ground		
C6407	Switched power relay open circuit		
C6505	Work group lockout short to battery		
C6506	Work group lockout short to ground		
C6507	Work group lockout open circuit		

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DIAGNOSTICS SERVICE CODES (S/N A93K18000 & ABOVE AND AC2P15000 & ABOVE)

Number Codes List

CODE		CODE	
E0105	Throttle actuator short to battery	L0102	Lights Button Error On
E0106	Throttle actuator short to ground	L0202	High Flow Button Error On
E0107	Throttle actuator open circuit	L0302	Auxiliary Button Error On
		L0402	Information Button Error On
E0123	Throttle actuator not calibrated		
		L7404	Gateway Controller No Communication
E0321	5 volt supply out of range high		
E0322	5 volt supply out of range low	L7672	Left Hand Panel Programming Error
E0421	Throttle sensor out of range high		
E0422	Throttle sensor out of range low	M0216	Hydraulic Filter Not Connected
		M0217	Hydraulic Filter Plugged
E0521	Throttle actuator feedback out of range high		
E0522	Throttle actuator feedback out of range low	M0309	Battery Voltage Low
		M0310	Battery Voltage High
E3128	Interrupted power failure log only	M0311	Battery Voltage Extremely High
		M0314	Battery Voltage Extremely Low
E3297	Controller programmed log only	M0322	Battery Voltage Out of Range Low
		M0414	Engine Oil Pressure Extremely Low
		M0415	Engine Oil Pressure Shutdown
H2521	Angle Blade Control Switch Out of Range High		
H2522	Angle Blade Control Switch Out of Range Low		
H2524	Angle Blade Control Switch Out of Neutral	M0610	Engine Speed High
		M0611	Engine Speed Extremely High
H2605	Angle Blade Base Solenoid Short to Battery	M0613	Engine Speed No Signal
H2606	Angle Blade base Solenoid Short to Ground	M0615	Engine Speed Shutdown
H2607	Angle Blade Base Solenoid Open Circuit	M0618	Engine Speed Out of Range
H2632	Angle Blade Base Solenoid Overcurrent		
H2705	Angle Blade Rod Solenoid Short to Battery	M0710	Hydraulic Oil Temperature High
H2706	Angle Blade Rod Solenoid Short to Ground	M0711	Hydraulic Oil Temperature Extremely High
H2707	Angle Blade Rod Solenoid Open Circuit	M0715	Hydraulic Oil Temperature Shutdown
H2732	Angle Blade Rod Solenoid Overcurrent	M0721	Hydraulic Oil Temperature Out of Range High
		M0722	Hydraulic Oil Temperature Out of Range Low
H3128	Interrupted Power Failure		
		M0810	Engine Coolant Temperature High
H4423	Secondary Controller Not Programmed	M0811	Engine Coolant Temperature Extremely High
H4497	Secondary Controller Programmed	M0815	Engine Coolant Temperature Shutdown
		M0821	Engine Coolant Temperature Out of Range High
H4621	5V Sensor Supply Out of Range High	M0822	Engine Coolant Temperature Out of Range Low
H4622	5V Sensor Supply Out of Range Low	M0216	Hydraulic Filter Not Connected
H7404	Main Controller No Communication		
H7604	Display No Communication		

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Number Codes List (Cont'd)

CODE		CODE	
M0909	Fuel Level Low	M2721	Throttle Sensor Out of Range High
M0921	Fuel Level Out of Range High	M2722	Throttle Sensor Out of Range Low
M0922	Fuel Level Out of Range Low		
		M3128	Interrupted Power Failure
M1121	Console Sensor Out of Range High		
M1122	Console Sensor Out of Range Low	M3204	Throttle Controller No Communication
M1128	Console Sensor Failure		
		M3304	Deluxe Panel No Communication
M1305	Fuel Hold Solenoid Short to Battery		
M1306	Fuel Hold Solenoid Short to Ground	M3404	RFID Key Controller No Communication
M1307	Fuel Hold Solenoid Open Circuit		
		M3702	Hyd Exchange Output Error On
M1402	Fuel Pull Output Error On	M3703	Hyd Exchange Output Error Off
M1403	Fuel Pull Output Error Off		
M1407	Fuel Pull Output Open Circuit		
M1428	Fuel Pull Output Failure		
		M4109	Alternator Low
M1705	Hydraulics Enable Solenoid Short to Battery	M4110	Alternator High
M1706	Hydraulics Enable Solenoid Short to Ground		
M1707	Hydraulics Enable Solenoid Open Circuit	M4304	Keyless Start Panel No Communication
M1732	Hydraulics Enable Solenoid Overcurrent		
		M4404	Secondary Controller No Communication
M2005	Two Speed Solenoid Short to Battery		
M2006	Two Speed Solenoid Short to Ground	M4621	5V Sensor Supply Out of Range High
M2007	Two Speed Solenoid Open Circuit	M4622	5V Sensor Supply Out of Range Low
M2102	Glow Plug Output Error On	M4721	8V Sensor Supply Out of Range High
M2103	Glow Plug Output Error Off	M4722	8V Sensor Supply Out of Range Low
M2107	Glow Plug Output Open Circuit		
M2128	Glow Plug Output Failure	M5002	Light Output Error On
		M5003	Light Output Error Off
M2202	Starter Output Error On		
M2203	Starter Output Error Off	M5205	Offset Base Solenoid Short to Battery
M2207	Starter Output Open Circuit	M5206	Offset Base Solenoid Short to Ground
M2228	Starter Output Failure	M5207	Offset Base Solenoid Open Circuit
		M5232	Offset Base Solenoid Overcurrent
M2302	Starter Relay Error On		
M2303	Starter Relay Error Off	M5305	Offset Rod Solenoid Error On
		M5306	Offset Rod Solenoid Short to Ground
M2402	Fuel Pull Relay Error On	M5307	Offset Rod Solenoid Open Circuit
M2403	Fuel Pull Relay Error Off	M5332	Offset Rod Solenoid Overcurrent
M2521	Load Sense Sensor Out of Range High	M5421	Offset Control Switch Out of Range High
M2522	Load Sense Sensor Out of Range Low	M5422	Offset Control Switch Out of Range Low
		M5424	Offset Control Switch Out of Neutral
M2602	Glow Plug Relay Error On		
M2603	Glow Plug Relay Error Off		

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Number Codes List (Cont'd)

CODE		CODE	
M5505	Auxiliary Base Solenoid Short to Battery	M7423	Main Controller Not Programmed
M5506	Auxiliary Base Solenoid Short to Ground	M7497	Main Controller Software Updated
M5507	Auxiliary Base Solenoid Open Circuit		
M5532	Auxiliary Base Solenoid Overcurrent	M7604	Standard Display Panel No Communication
M5605	Auxiliary Rod Solenoid Short to Battery	M7748	Key Switch Multiple
M5606	Auxiliary Rod Solenoid Short to Ground		
M5607	Auxiliary Rod Solenoid Open Circuit	M7839	Hourmeter Changed
M5632	Auxiliary Rod Solenoid Overcurrent		
M5721	Auxiliary Control Switch Out of Range High		
M5722	Auxiliary Control Switch Out of Range Low		
M5724	Auxiliary Control Switch Out of Neutral		
M6204	Load Moment Sensor In Error	R7404	No Communication To Main Controller
M6402	Switched Power Relay Error On		
M6403	Switched Power Relay Error Off		
M6702	HVAC Output Error On		
M6703	HVAC Output Error Off		
M6905	Hydraulic Throttle Solenoid Short to Battery		
M6906	Hydraulic Throttle Solenoid Short to Battery		
M6907	Hydraulic Throttle Solenoid Open Circuit		
M6923	Hydraulic Throttle Solenoid Not Calibrated		
M6932	Hydraulic Throttle Solenoid Overcurrent		
M7002	Switched Power Output Error On		
M7003	Switched Power Output Error Off		
M7007	Switched Power Output Open Circuit		
M7028	Switched Power Output Failure		

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DELUXE INSTRUMENT PANEL SETUP (S/N A93K11001 - A93K17999 AND AC2P11001 - AC2P14999)

Passwords

All new machines with keyless option arrive at the Bobcat Dealerships with the panel in locked mode. This means that a password must be used to start the engine.

For security purposes, your dealer may change the password and also set it in the locked mode. Your dealer will provide you with the password.

Master Password:

A permanent, randomly selected password is set at the factory which cannot be changed. This password is used for service by the Bobcat dealer if the Owner Password is not known; or to change the Owner Password.

Owner Password:

There is only one Owner Password (**CodE 0**). It must be used to change the owner or operator passwords. See below for changing the Owner Password.

Operator Password:

There can be up to three operator Passwords (**CodE 1, CodE 2, CodE 3**). See below for changing the Operator Password.

Password Entry (For Starting And Operating The Machine)

Press ENTER CODE button (Item 1). The panel will become lighted and there will be two short beeps. **CodE** will appear on the data display screen (Item 2) **[Figure 50-90-1]**.

NOTE: After you press ENTER CODE you have 40 seconds to use the keypad (Item 3) [Figure 50-90-1] to enter the password. (If more than 40 seconds is used, the process will abort and you will need to start over.

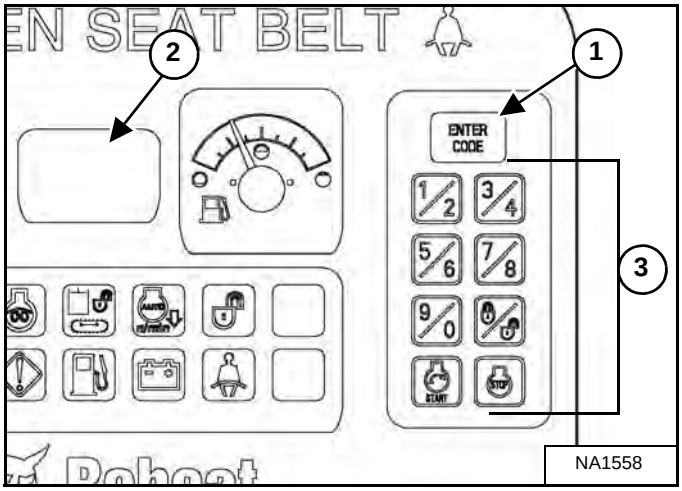
Enter the password. For each digit that you enter, a dash will appear on the data display screen. If the password was entered correctly, there will be one long beep.

NOTE: If the password was incorrect there will be three short beeps and *Error* will appear on the data display screen. Press the ENTER CODE button again and start over. After three failed attempts, you must wait three minutes to try again.

You are now ready to start and operate the machine.

If you will be changing the operator password, do not start the engine. (See Changing The Operator Password on Page 50-90-1.)

Figure 50-90-1



Changing The Operator Password

Perform Password Entry at left, but do not start the engine.

Press and hold the ENTER CODE button (Item 1) for three seconds. CodE 1 will appear on the data display screen (Item 2) **[Figure 50-90-1]**.

Press the ENTER CODE button until the desired Code (**CodE 0, CodE 1, CodE 2, CodE 3**) appears. CodE 0 is Owner Password, the other codes are Operator passwords.You now have 40 seconds to use the keypad (Item 3) **[Figure 50-90-1]** to enter each digit of a new four digit password.

Enter the new four digit password. After the fourth digit is entered, there will be two short beeps and **rPEAt** will appear.

Re-enter the new four digit password to verify. If the new passwords match, there will be two short beeps, **Code** will appear for 1 second and then the data display screen will return to HOURMETER function.

NOTE: If the new passwords do not match, there will be one long beep and Error will appear for 1 second and then the data display screen will return to HOURMETER function.

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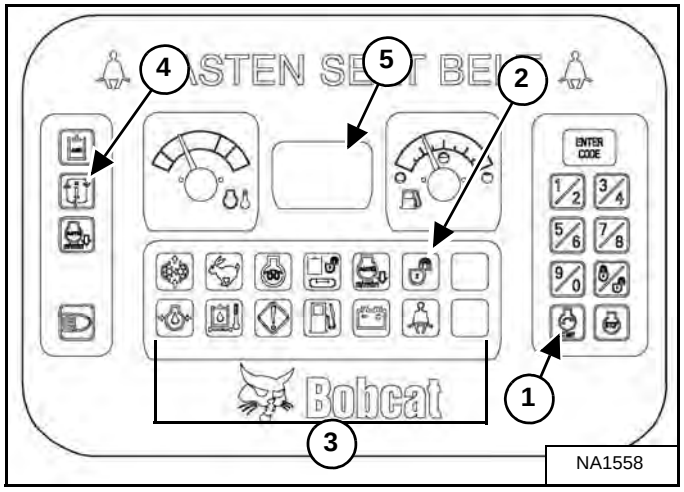
DELUXE INSTRUMENT PANEL SETUP (S/N A93K11001 - A93K17999 AND AC2P11001 - AC2P14999) (CONT'D)

Password Lockout Feature

This allows the operator to Unlock the password feature so that a password does not need to be used every time you start the engine.

Perform Password Entry (See Password Entry (For Starting And Operating The Machine) on Page 50-90-1.) (the engine can be started or stopped). The password entry can be performed with the engine off or with the engine running.

Figure 50-90-2



Press the Lock / Unlock button (Item 1). The data display screen (Item 5) **[Figure 50-90-2]** will continuously alternate from **UnLoc** to **CodE** for 1 second periods.

Perform Password Entry again.

UnLoc will appear in the data display screen (Item 5), the Unlocked Icon (Item 2) will appear in the Icon Display Area (Item 3) **[Figure 50-90-2]** and there will be two short beeps.

To start an Unlocked system, press the ENTER CODE button and press the START button.

When you stop the engine with the system unlocked, you will hear one long beep every 3 seconds for 15 seconds.

To lock the system again, press the Lock / Unlock button (Item 1) **[Figure 50-90-2]** and enter the password during the 15 second period.

Job Clock

The JOB CLOCK can be set to record accumulated hours for a particular job.

Press and release the information button (Item 4) until JOB light is ON at the top, center of the data display screen (Item 5) **[Figure 50-90-2]**.

While the JOB light is ON, press and hold the information button (Item 4) **[Figure 50-90-2]** until the data display screen returns to zero.

This process will clear the accumulated hours and will begin recording JOB CLOCK time again. (This does not affect the HOURMETER which continues to record the total operating hours of the excavator.)

Pressing the information button (Item 1) **[Figure 50-90-2]** again or pressing the START button will return the data display screen to HOURMETER function.

RPM

The data display screen (Item 5) **[Figure 50-90-2]** can be set to display engine rpm.

With the engine running, press and release the information button (Item 4) until rpm light is ON at the top, center of the data display screen (Item 5) **[Figure 50-90-2]**.

Engine rpm is now displayed in the data display screen.

Press the information button (Item 4) **[Figure 50-90-2]** again the return to HOURMETER function.

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CONTROL PANEL SETUP (S/N A93K18000 & ABOVE AND AC2P15000 & ABOVE)

Panel Setup (Deluxe Instrument Panel)

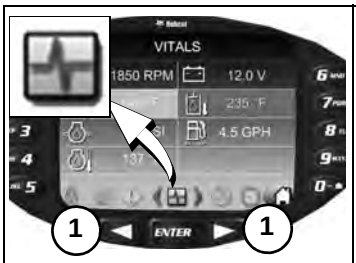
Icon Identification

Figure 50-91-1



ICON	DESCRIPTION
Mon, 17 Mar 3:45 PM	DATE / TIME
MINNY 234.5	USER / USER HOURS
Machine 353.5	MACHINE HOURS (HOURMETER)
	ACTIVE WARNINGS screen icon
	VITALS screen icon
	SERVICE screen icon
	AUTO IDLE Status icon
	ATTACHMENTS screen icon
	MACHINE SETTINGS screen icon
	DISPLAY screen icon
	HOME icon (Return to MAIN screen)
	LEFT SCROLL button RIGHT SCROLL button
ENTER	ENTER button

Vitals

	Press a scroll button (Item 1) repeatedly until the Vitals screen icon (Inset) is highlighted.
	Displays select system operating levels.
You can monitor real-time displays of: **Engine Speed (RPM)** **Engine Coolant Temperature** **System Voltage** **Hydraulic Fluid Temperature**	

The Deluxe Instrument Panel is easy to use. Continue to set your own preferences for operating / monitoring your Bobcat excavator.

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CONTROL PANEL SETUP (S/N A93K18000 & ABOVE AND AC2P15000 & ABOVE) (CONT'D)

Panel Setup (Deluxe Instrument Panel) (Cont'd)

Date And Time

	Press a scroll button (Item 1) repeatedly until the Display screen icon (Inset) is highlighted.
	Select **[1. CLOCKS]**.
	Select **[1. TIME]**.
	Use the keypad to enter time. Select AM / PM / 24hr. Press **[ENTER]** to continue.
	Select **[2. DATE]**.
	Use the keypad to enter date. Press **[ENTER]** to continue.

Languages

	Press a scroll button (Item 1) repeatedly until the Display screen icon (Inset) is highlighted.
	Select **[2. LANGUAGES]**.
	Select the desired language.

English / Metric Display

	Press a scroll button (Item 1) repeatedly until the Display screen icon (Inset) is highlighted.
	Select **[4. DISPLAY SETTINGS]**. Press **[1]** to cycle between ENGLISH and METRIC.

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CONTROL PANEL SETUP (S/N A93K18000 & ABOVE AND AC2P15000 & ABOVE) (CONT'D)

Panel Setup (Deluxe Instrument Panel) (Cont'd)

Auto Idle Time Delay

	Press a scroll button (Item 1) repeatedly until the Security screen icon (Inset) is highlighted.
	Select **[3. MACHINE PERFORMANCE]**.
	Select **[1. AUTO IDLE DELAY TIME]**.
	Use the keypad to enter the desired delay time between 4 and 250 seconds. Press **[ENTER]** to save and continue. Press left scroll button to exit without saving.

Job Clock Reset

	Press a scroll button (Item 1) repeatedly until the Security screen icon (Inset) is highlighted.
	Select **[1. PASSWORDS / LOCKOUTS]**.
	Enter owner password and press **[ENTER]**.
	Select **[1. USER SETTINGS]**.
	Select user.
	Press **[9]** to reset job statistics. Press left scroll button or **[0]** to exit without saving.

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CONTROL PANEL SETUP (S/N A93K18000 & ABOVE AND AC2P15000 & ABOVE) (CONT'D)

Panel Setup (Deluxe Instrument Panel) (Cont'd)

Alarm Clock Reset

	Press a scroll button (Item 1) repeatedly until the Display screen icon (Inset) is highlighted.
	Select **[3. ALARM CLOCK]**.
	Select **[1. OFF ONCE]**, Select **[2. ON Daily]** or Select **[3. ON WEEKLY]**.
	Select **[1. OFF / ON]**, Select **[2. TIME]** or Select **[3. DAILY]**.
	Use key pad numbers to set time. Select **[7. AM]**, Select **[8. PM]** or Select **[9. 24 hr clock]**. Select **[ENTER]** to save. Press left scroll to back space numbers.
	Press **[4]** to set alarm to sleep. (When pressed, display will return to main screen.) Press **[9]** to shut off alarm. Alarm will still be active for the next day alarm setting. (When pressed, display will return to main screen.)

ECO MODE

	Press a scroll button (Item 1) repeatedly until the Security screen icon (Inset) is highlighted.
	Select **[3. MACHINE PERFORMANCE]**.
	Select **[2. ECO MODE]**. ECO Mode will set the maximum engine rpm to be at 85% of the high idle setting. Example: If the machine maximum engine speed is 2450 rpm, when ECO Mode is enabled, the maximum engine speed will be approximately 2080 rpm.

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CONTROL PANEL SETUP (S/N A93K18000 & ABOVE AND AC2P15000 & ABOVE) (CONT'D)

Panel Setup (Deluxe Instrument Panel) (Cont'd)

Machine History - Log In Information

	Press a scroll button (Item 1) repeatedly until the Security screen icon (Inset) is highlighted.
	**MACHINE SETTINGS** is visible on screen. Select **[2. MACHINE HISTORY]**.
	Select **[1. LOG-IN INFORMATION]**.
	View User Log hours and last time / dated used. Individual information can be viewed and reset back to zero. Select user **[KEY PAD 1 - 9]** to access individual user.

Machine History - User Job Statistics

	Press a scroll button (Item 1) repeatedly until the Security screen icon (Inset) is highlighted.
	**MACHINE SETTINGS** is visible on screen. Select **[2. MACHINE HISTORY]**.
	Select **[2. USER JOB STATISTICS]**.
	View Job Statistics (Job Hours / Idle Time . Information can be viewed and reset back to zero.

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CONTROL PANEL SETUP (S/N A93K18000 & ABOVE AND AC2P15000 & ABOVE) (CONT'D)

Panel Setup (Deluxe Instrument Panel) (Cont'd)

Machine History - Overall Job Statistics

	Press a scroll button (Item 1) repeatedly until the Security screen icon (Inset) is highlighted.
	**MACHINE SETTINGS** is visible on screen. Select **[2. MACHINE HISTORY]**.
	Select **[3. OVERALL JOB STATISTICS]**.

Attachments

	Press a scroll button (Item 1) repeatedly until the Attachment screen icon (Inset) is highlighted.
	**ATTACHMENTS** is visible on screen. Press **[ENTER]**.
	Press **[4]** or **[9]** repeatedly until the desired Attachment is visible in the display screen.
	Information about the attachment, recommended auxiliary hydraulic flow and Tips about attachment operation will be displayed.

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CONTROL PANEL SETUP (S/N A93K18000 & ABOVE AND AC2P15000 & ABOVE) (CONT'D)

Password Setup (Keyless Start Panel)

Password Description

Master Password:

A permanent, randomly selected password set at the factory that cannot be changed. This password is used for service by the Bobcat dealer if the owner password is not known or to change the owner password.

Owner Password:

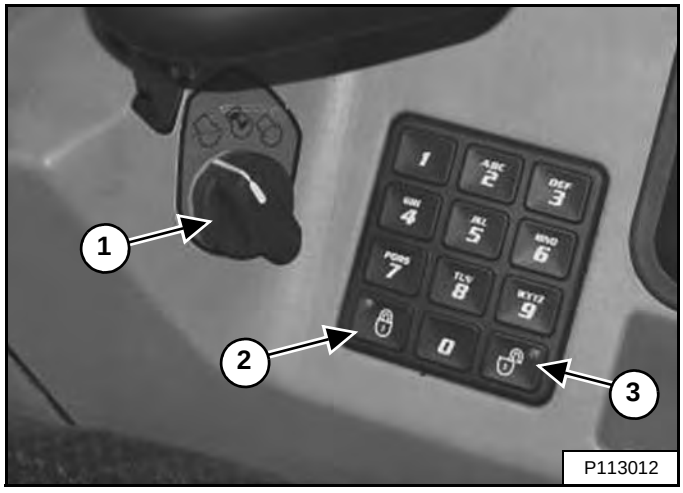
Allows for full use of the excavator. Must be used to change the owner password.

Changing The Owner Password

Turn the start switch (Item 1) **[Figure 50-91-2]** to the ON position to turn on the excavators electrical system.

Enter the five digit owner password using the number keys (1 through 0) if locked.

Figure 50-91-2



Press and hold the lock (Item 2) and unlock (Item 3) **[Figure 50-91-2]** keys for 2 seconds.

The lock key red light will flash and the instrument panel display screen will show **[ENTER]**.

Enter a new five digit owner password using the number keys (1 through 0). An asterisk will show in the left panel display screen for each key press.

The instrument panel display screen will show **[AGAIN]**.

Enter the new five digit owner password again.

The lock key red light will become solid.

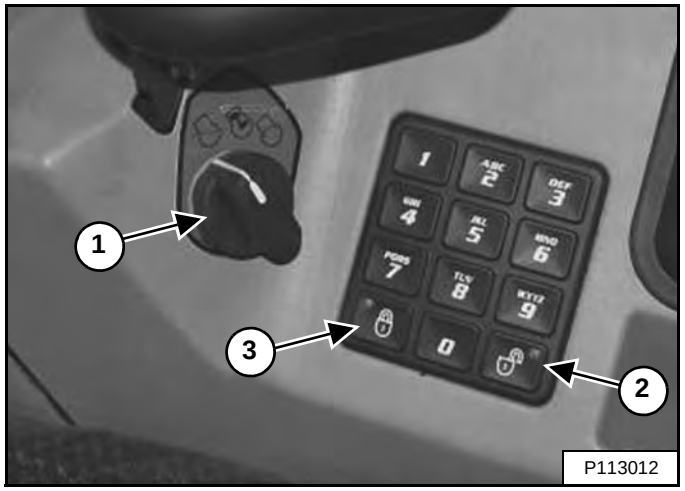
Password Lockout Feature

This feature allows the owner to unlock the password feature so that a password does not need to be used every time the engine is started.

Turn the start switch (Item 1) **[Figure 50-91-3]** to the ON position to turn on the excavators electrical system.

Enter the five digit owner password using the number keys (1 through 0).

Figure 50-91-3



Press the unlock key (Item 2) **[Figure 50-91-3]**.

The left panel display screen will show **[CODE]**.

Enter the five digit owner password using the number keys (1 through 0). The unlock key green light will flash, then become solid.

The excavator can now be started without using a password.

NOTE: Use the following procedure to reset the machine lock so that the excavator requires a password to start the engine.

Turn the key switch to the ON position to turn on the excavators electrical system.

Press the lock key (Item 3) **[Figure 50-91-3]**.

The lock key red light will flash and the left panel display screen will show **[CODE]**.

Enter the five digit owner password using the number keys (1 through 0). The unlock key green light will flash, then the lock key red light will become solid.

You must now enter the password every time to start the excavator.

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Password Setup (Deluxe Instrument Panel)

Password Setup is available on machines with a Deluxe Instrument Panel.

Password Description

All new machines with a Deluxe Instrument Panel arrive at Bobcat dealerships with the keypad in locked mode. Locked mode means that a password must be used to start the engine.

For security purposes, your dealer may change the password and set the keypad in the locked mode. Your dealer will provide you with the password.

Master Password:

A permanent, randomly selected password set at the factory that cannot be changed. This password is used for service by the Bobcat dealer if the owner password is not known or to change the owner password.

Owner Password:

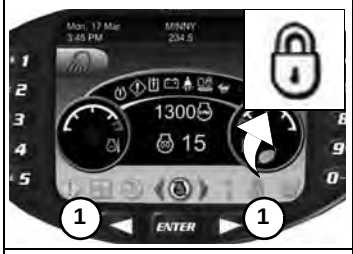
Allows for full use of the excavator and to set up the Deluxe Instrument Panel. There is only one owner password. The owner password must be used to change the owner or user passwords. Owner should change the password as soon as possible for security of the excavator.

User Password:

Allows starting and operating the excavator; cannot change password or any of the other setup features.

For the procedures to change passwords: (See Changing The Owner Password on Page 50-91-7.) and (See Changing The User Passwords on Page 50-91-9.)

Changing The Owner Password

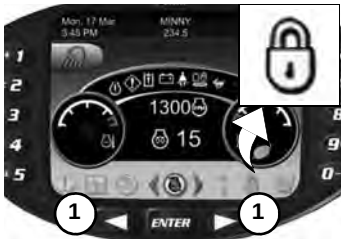
	Press a scroll button (Item 1) repeatedly until the Security screen icon (Inset) is highlighted.
	Select **[1. PASSWORDS / LOCKOUTS]**.
	Enter owner password and press **[ENTER]**.
	Select **[1. USER SETTINGS]**.
	Select **[1. OWNER]**.
	Select **[2. CHANGE PASSWORD]**.
	Enter new owner password and press **[ENTER]**. You will be prompted to reenter the new owner password.

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CONTROL PANEL SETUP (S/N A93K18000 & ABOVE AND AC2P15000 & ABOVE) (CONT'D)

Password Setup (Deluxe Instrument Panel) (Cont'd)

Changing The User Passwords

	Press a scroll button (Item 1) repeatedly until the Security screen icon (Inset) is highlighted.
	Select **[1. PASSWORDS / LOCKOUTS]**.
	Enter owner password and press **[ENTER]**.
	Select **[1. USER SETTINGS]**.
	Select user.
	Select **[2. CHANGE PASSWORD]**.
	Enter new user password and press **[ENTER]**.

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CONTROL PANEL SETUP (S/N A93K18000 & ABOVE AND AC2P15000 & ABOVE) (CONT'D)

Password Setup (Deluxe Instrument Panel) (Cont'd)

Password Lockout Feature

This feature allows the owner to unlock the password feature so that a password does not need to be used every time the engine is started.

	Press a scroll button (Item 1) repeatedly until the Security screen icon (Inset) is highlighted.
	Select **[1. PASSWORDS / LOCKOUTS]**.
	Enter owner password and press **[ENTER]**.
	Select **[2. MACHINE LOCK]**.

NOTE: The procedure above can be followed to reset the machine lock so that the machine requires a password to start the engine.

NOTE: When the password is in UNLOCKED, no password is needed. The start switch is used to start the machine.

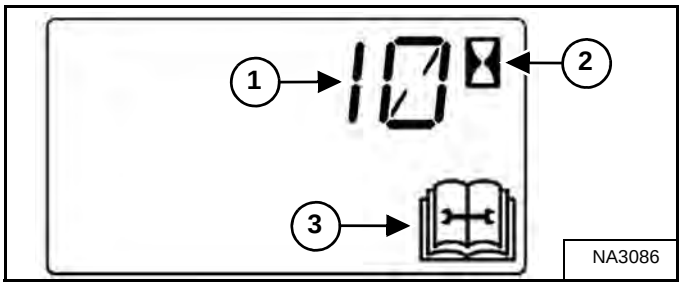
Maintenance Clock

Description

The Maintenance Clock alerts the operator when the next service interval is due. *EXAMPLE:* The maintenance clock can be set to a 500 hour interval as a reminder for the next 500 hour planned maintenance.

Standard Instrument Panel

Figure 50-91-4



During machine operation, a 2 beep alarm will sound when there are less than 10 hours until the next planned maintenance.

The remaining hours before maintenance is required (Item 1) will appear in the data display for 5 seconds while the service icon (Item 3) and the hourmeter icon (Item 2) **[Figure 50-91-4]** flash.

NOTE: The display will show negative numbers after counting down to zero.

The display will revert to the previous display and will appear for 5 seconds every time the machine is started until the maintenance clock is reset.

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CONTROL PANEL SETUP (S/N A93K18000 & ABOVE AND AC2P15000 & ABOVE) (CONT'D)

Maintenance Clock (Cont'd)

Setup

See your Bobcat dealer about installation of this feature.

Reset

Figure 50-91-5

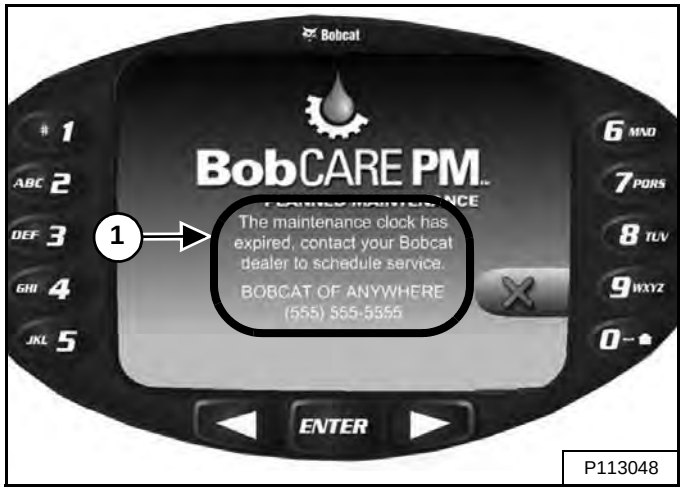


Press the Information button (Item 2) **[Figure 50-91-5]** until the display screen shows the maintenance clock.

Press and hold the Information button (Item 2) for 7 seconds until [RESET] (Item 1) **[Figure 50-91-5]** appears in the display screen.

Deluxe Instrument Panel

Figure 50-91-6



The Deluxe Instrument Panel (if equipped) will display a message (Item 1) **[Figure 50-91-6]** alerting the operator to service the machine.

This message will remain for 10 seconds and will appear for 10 seconds every time the machine is started until the maintenance clock is reset.

Figure 50-91-7



The Deluxe Instrument Panel (if equipped) will display a bar (Item 1) **[Figure 50-91-7]** showing the time remaining until next service. This bar will turn red when service is past due. NEXT MAINTENANCE DUE will change to MAINTENANCE PAST DUE and display the number of hours past due.

Keys **[4]** and **[9]** can be used to adjust the service interval when the owner is logged in **[Figure 50-91-7]**.

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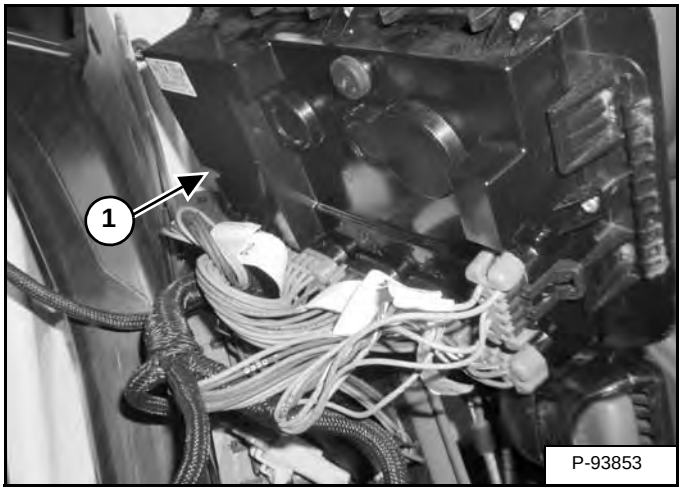
Dealer Copy -- Not for Resale

INSTRUMENT PANEL / CONTROLLER (S/N A93K11001 - A93K17999 AND AC2P11001 - AC2P14999)

Removal And Installation

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

Figure 50-100-1



Mark and disconnect the wire harness from the controller (Item 1) **[Figure 50-100-1]**.

Remove the controller.

Dealer Copy -- Not for Resale

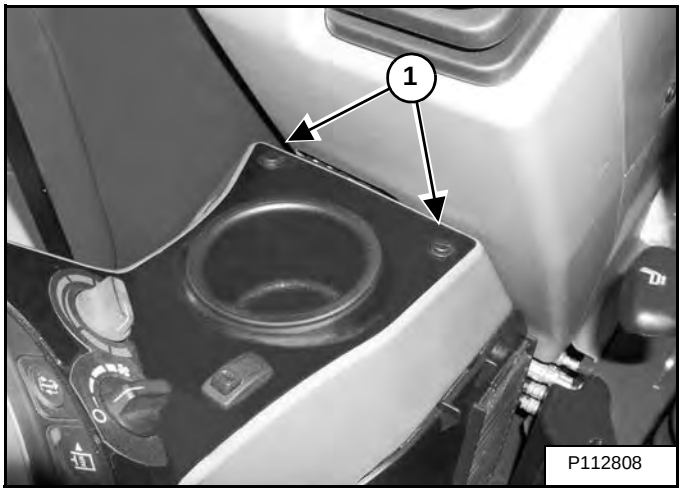


Dealer Copy -- Not for Resale

INSTRUMENT PANEL (S/N A93K18000 & ABOVE AND AC2P15000 & ABOVE)

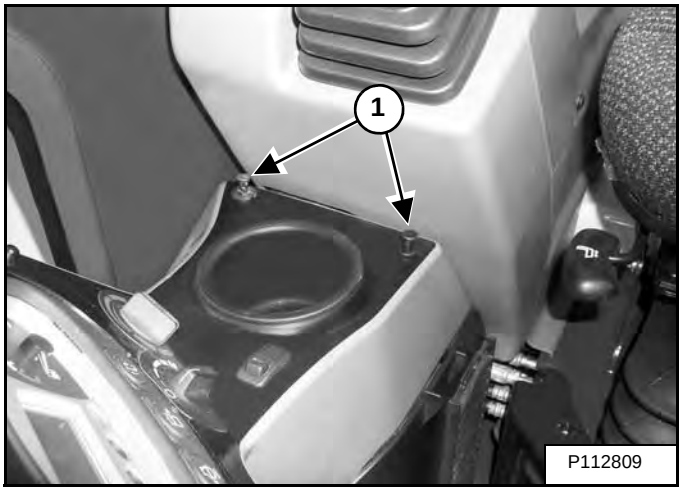
Removal And Installation

Figure 50-101-2



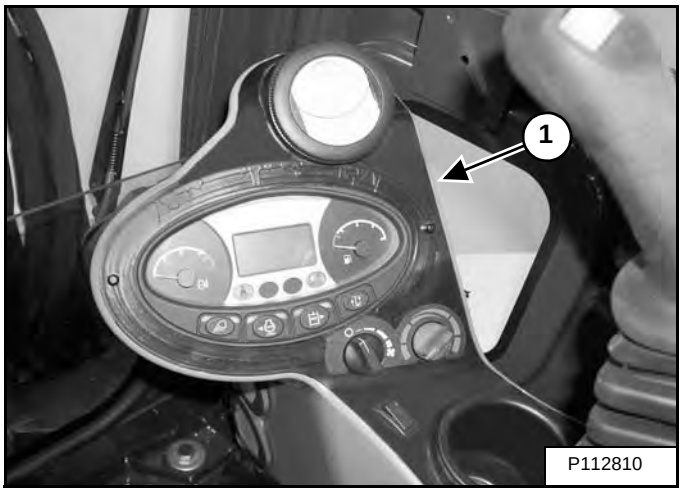
Pull up on the center pin (Item 1) **[Figure 50-101-2]**.

Figure 50-101-3



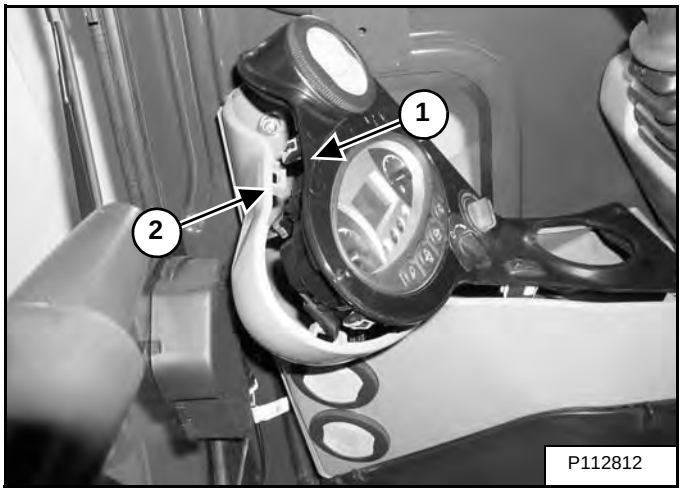
Remove the pin assembly (Item 1) **[Figure 50-101-3]**.

Figure 50-101-4



Pull up on the instrument panel (Item 1) **[Figure 50-101-4]**.

Figure 50-101-5

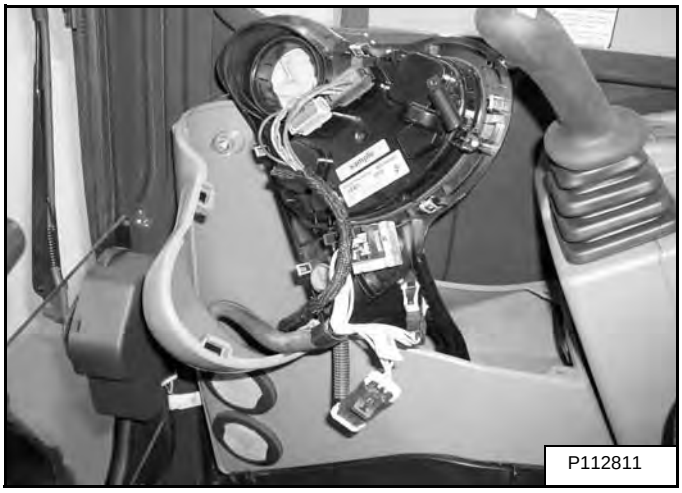


Installation: Install the tabs (Item 1) into the cover (Item 2) **[Figure 50-101-5]**.

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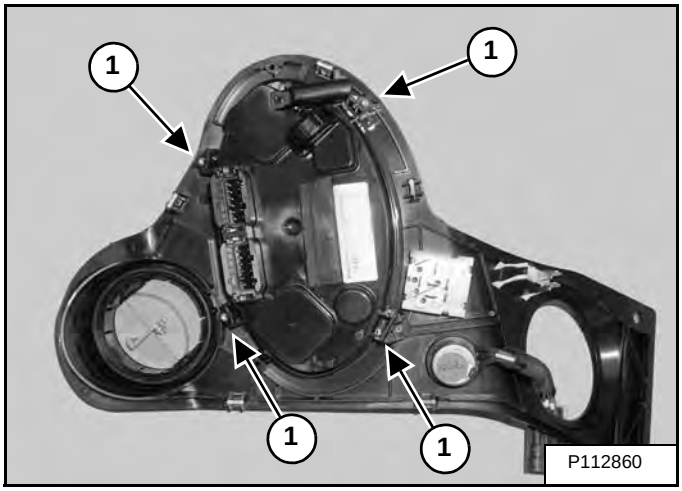
Removal And Installation (Cont'd)

Figure 50-101-6



Disconnect the wire harness from the instrument panel **[Figure 50-101-6]**.

Figure 50-101-7



Remove the screws (Item 1) **[Figure 50-101-7]** and remove the instrument panel.

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CONTROLLER (S/N A93K18000 & ABOVE AND AC2P15000 & ABOVE) (GATEWAY AND AUXILIARY)

Description

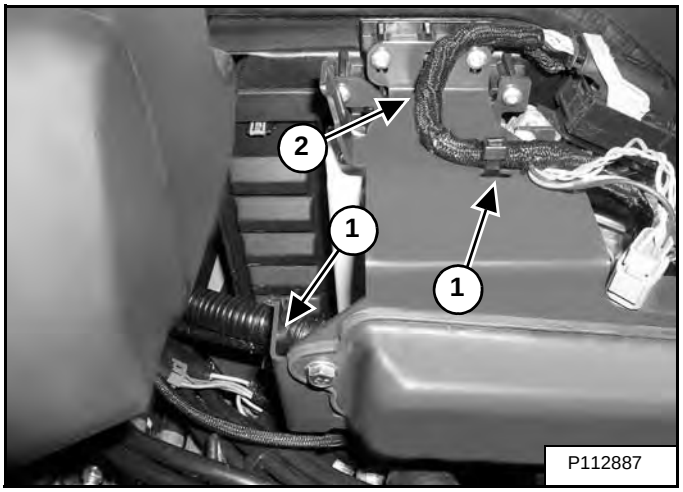
The gateway controller is the main controller. It provides information to all other controllers.

The gateway and auxiliary controllers are located under the right side cover.

Gateway Controller Removal and Installation

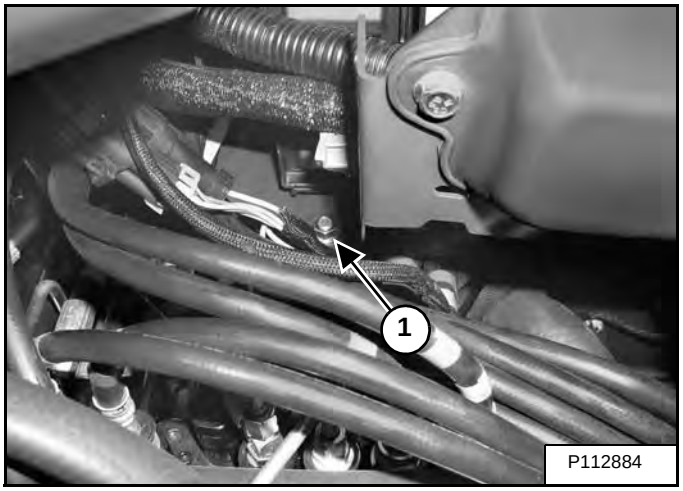
Open the right side cover.

Figure 50-102-1



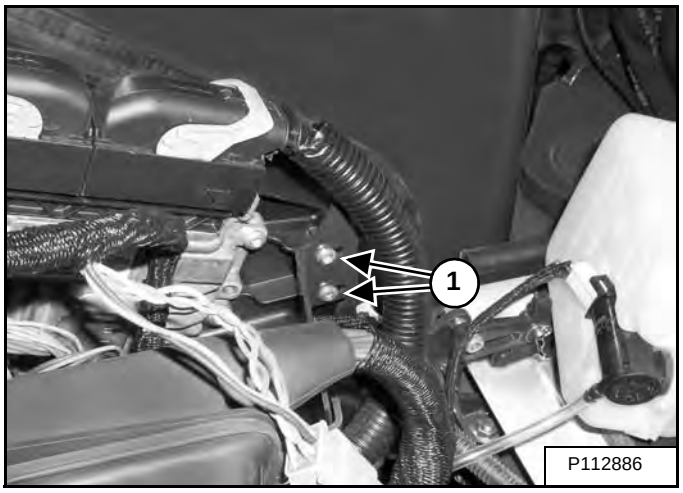
Cut and remove the cable ties (Item 1). Reposition the wire harness (Item 2) **[Figure 50-102-1]**.

Figure 50-102-2



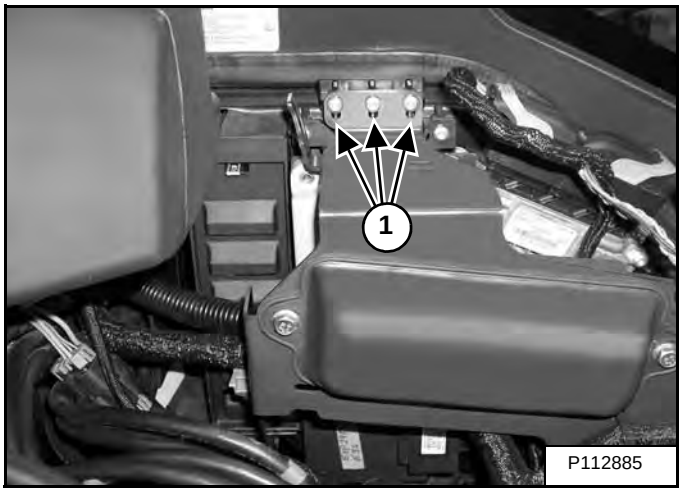
Remove the nut (Item 1) **[Figure 50-102-2]**.

Figure 50-102-3



Remove the screws (Item 1) **[Figure 50-102-3]**.

Figure 50-102-4

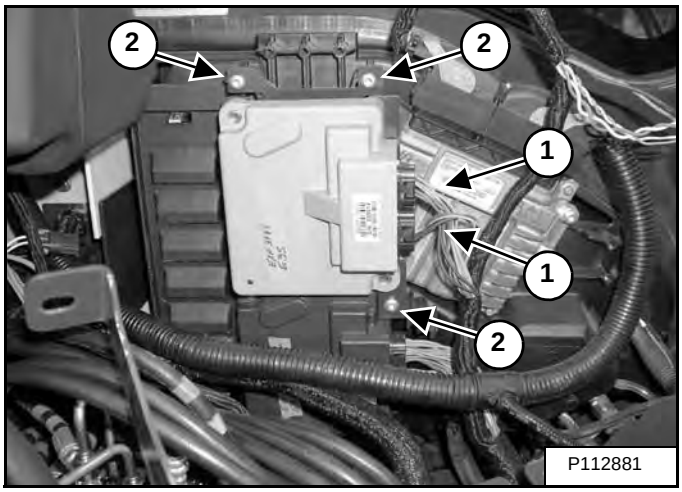


Remove the screws (Item 1) **[Figure 50-102-4]**. Reposition the fuse panel.

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Gateway Controller Removal and Installation (Cont'd)

Figure 50-102-5

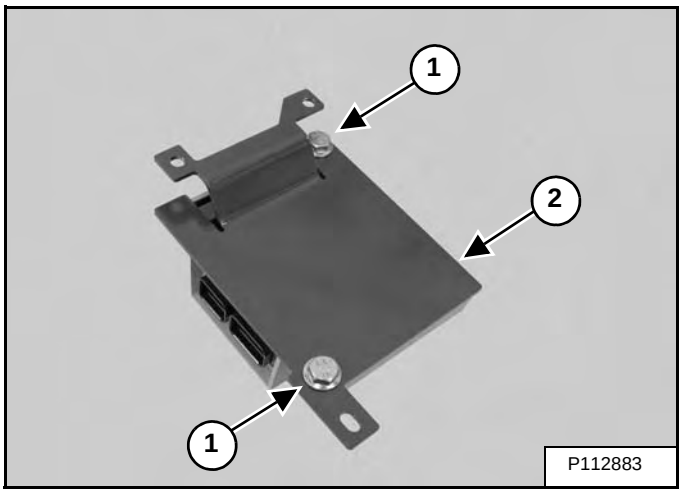


Disconnect the wire harness (Item 1) and remove the screws (Item 2) **[Figure 50-102-5]**.

NOTE: The wire harness connectors are keyed and will only plug in one way.

Remove the gateway controller from the excavator.

Figure 50-102-6

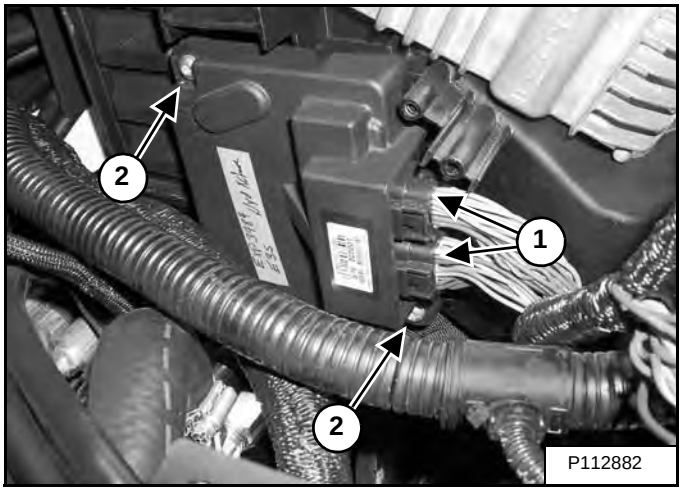


Remove the bolts (Item 1) and bracket (Item 2) **[Figure 50-102-6]**.

Auxiliary Controller Removal And Installation

Remove the gateway controller (See Gateway Controller Removal and Installation on Page 50-102-1.)

Figure 50-102-7



Disconnect the wire harness (Item 1). Remove the bolts (Item 2) **[Figure 50-102-7]** and remove the auxiliary controller from the excavator.

NOTE: The wire harness connectors are keyed and will only plug in one way.

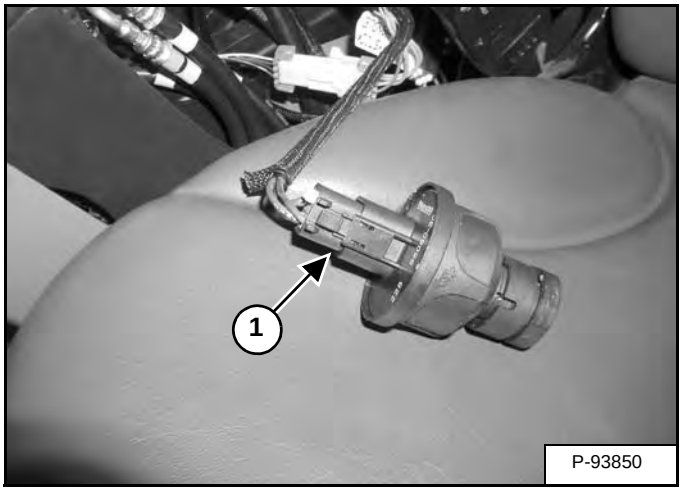
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KEY SWITCH

Removal And Installation

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

Figure 50-110-1



Disconnect the wire harness (Item 1) **[Figure 50-110-1]** from the switch. Remove the switch.

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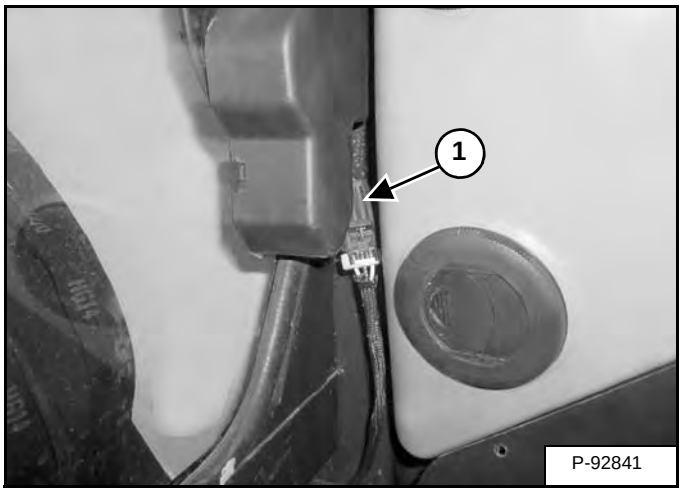


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WIPER MOTOR

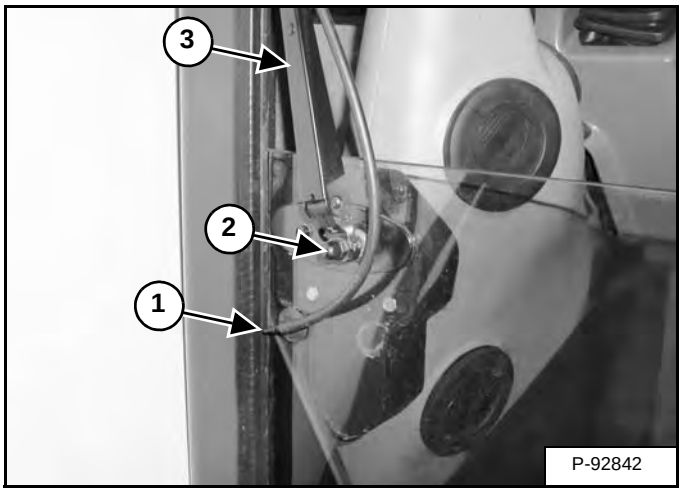
Removal And Installation

Figure 50-120-1



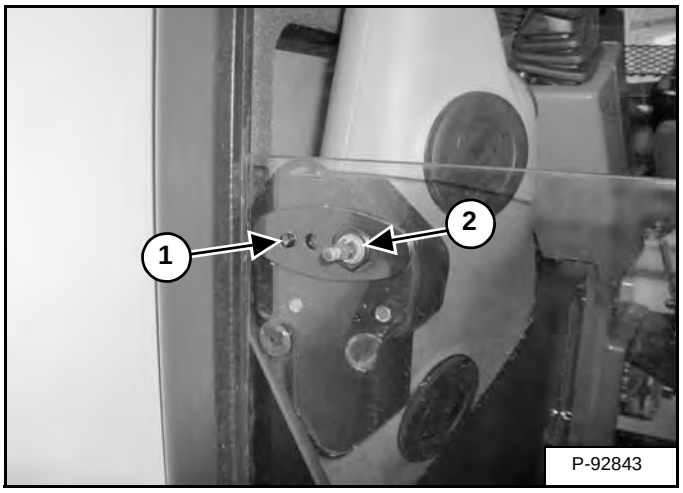
Disconnect the wire harness (Item 1) **[Figure 50-120-1]**.

Figure 50-120-2



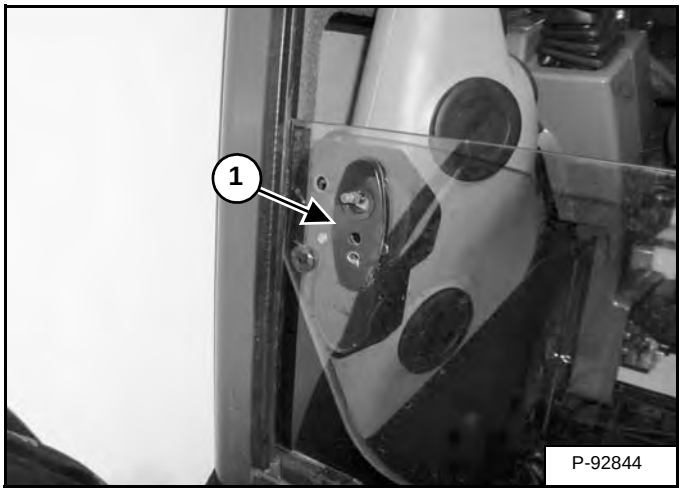
Disconnect the washer hose (Item 1). Remove the nut (Item 2) and wiper arm (Item 3) **[Figure 50-120-2]**.

Figure 50-120-3



Remove the screw (Item 1). Remove the nut (Item 2) **[Figure 50-120-3]**.

Figure 50-120-4

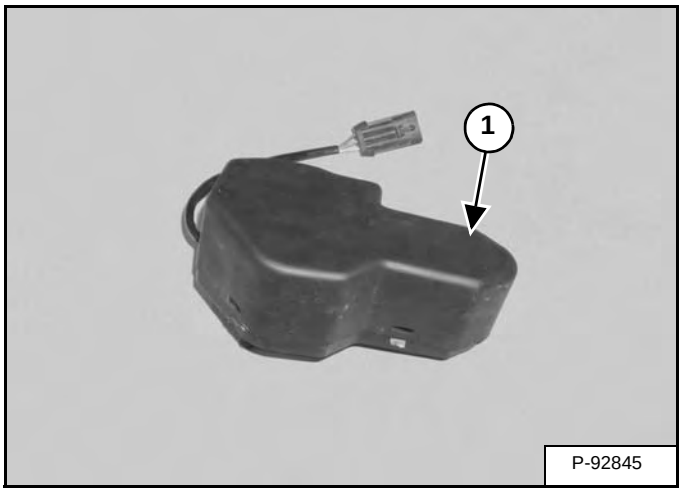


Remove the plate (Item 1) **[Figure 50-120-4]** and gasket.

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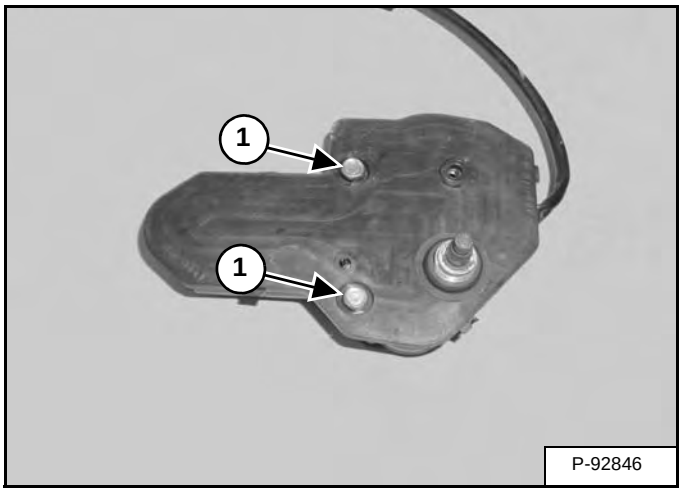
Removal And Installation (Cont'd)

Figure 50-120-5



Pry up on and remove the cover (Item 1) **[Figure 50-120-5]**.

Figure 50-120-6



Remove the bolts (Item 1) **[Figure 50-120-6]** and remove the wiper motor from the plate.

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MOTION ALARM SYSTEM

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 back-up alarm will sound.

Inspecting

Figure 50-130-1

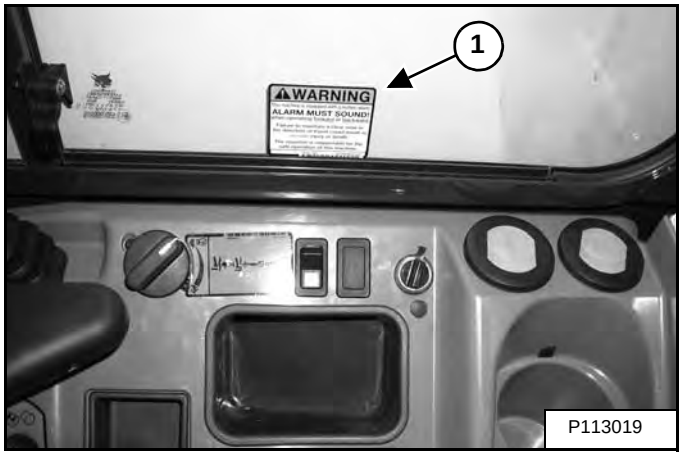
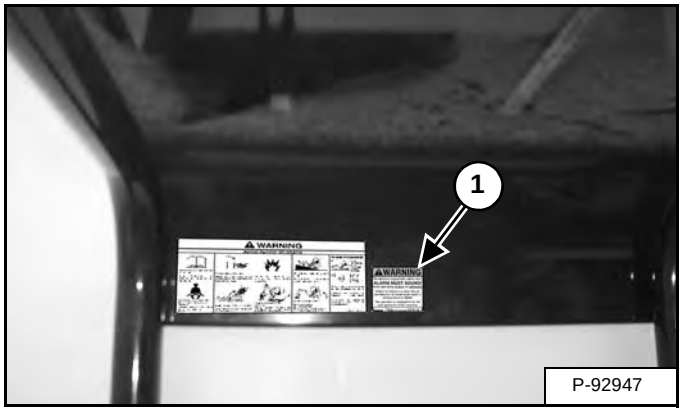


Figure 50-130-2



Inspect for damaged or missing motion alarm decal (Item 1) **[Figure 50-130-1]** (cab machine) or (Item 1) **[Figure 50-130-2]** (canopy machine). Replace if required.

NOTE: The excavator will need to be moved slightly in both the forward and reverse direction to test the motion alarm. Keep all bystanders away from machine during test.

WARNING

AVOID INJURY OR DEATH

When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W-2050-0807

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

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

Figure 50-130-3



Slightly move both travel control levers in the forward direction (until the machine is slowly moving forward) and then press the motion alarm cancel switch (Item 1) **[Figure 50-130-3]**. The motion alarm will shut off. With the machine still moving forward, move one of the levers to the neutral position, the motion alarm must sound.

Slightly move both travel control levers in the reverse direction (until the machine is slowly moving backward) and then press the motion alarm cancel switch (Item 1) **[Figure 50-130-3]** (the switch icon will be illuminated when the motion alarm is deactivated). The motion alarm will shut off. With the machine still moving backward, move one of the levers to the neutral position, the motion alarm must sound.

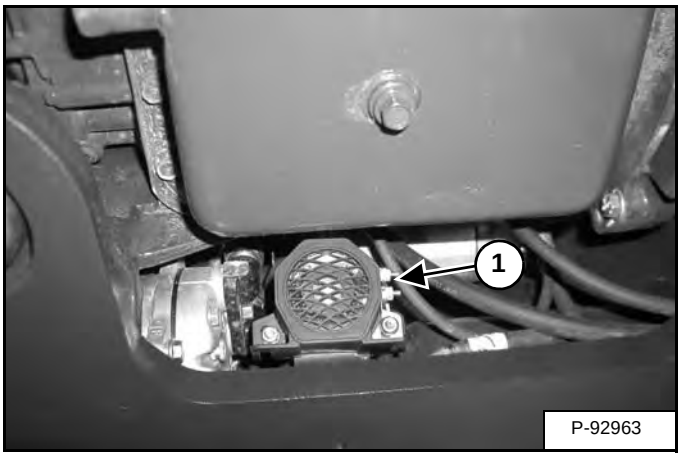
Return both levers to neutral and turn excavator key to OFF position. Exit the excavator.

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Inspecting (Cont'd)

The motion alarm is mounted to the bottom rear of the excavator. (To the front of the engine oil pan.)

Figure 50-130-4

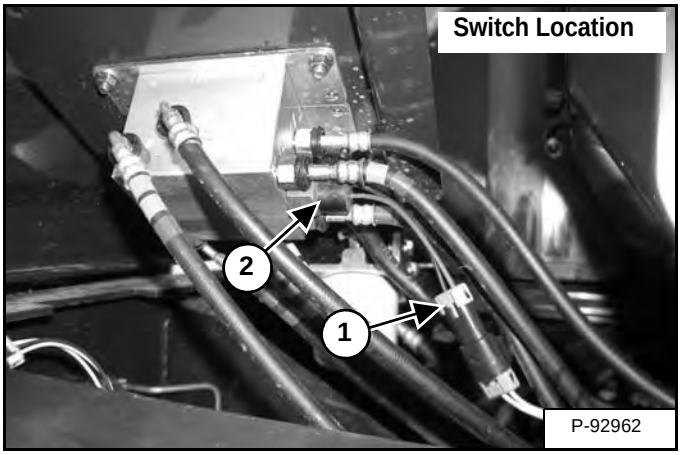


Inspect the motion alarm electrical connections and wire harness (Item 1) **[Figure 50-130-4]**, wire harness (Item 1) **[Figure 50-130-5]** and motion alarm switch (Item 2) **[Figure 50-130-5]** for tightness and damage. Repair or replace any damaged components.

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

Adjusting Switch Position

Figure 50-130-5



The motion alarm switch (Item 2) **[Figure 50-130-5]** is located in the travel control valve located under the floor plate. Remove the floor mat and the floor plate to access the switch.

The switch (Item 2) **[Figure 50-130-5]** is non-adjustable. It must be fully installed into the travel control valve housings and tightened. Tighten the switch to 18 - 20 N•m (13 - 15 ft-lb).

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

⚠ WARNING

This machine is equipped with a motion alarm.
ALARM MUST SOUND!
when operating forward or backward.

Failure to maintain a clear view in the direction of travel could result in serious injury or death.

The operator is responsible for the safe operation of this machine.

W-2786-0309

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SERVICE PC (LAPTOP COMPUTER)

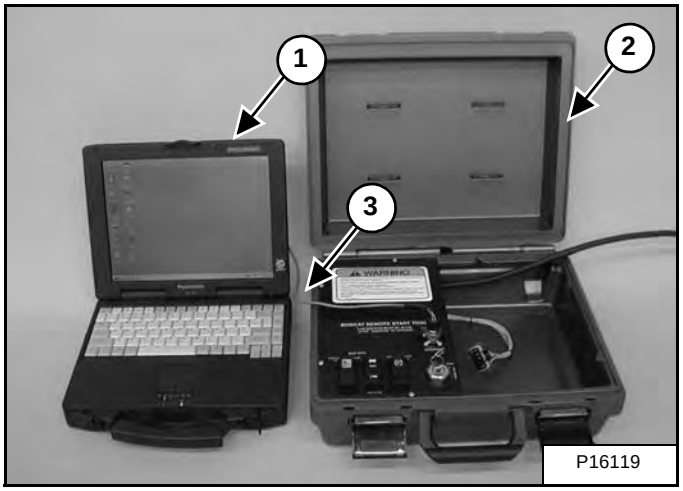
Connecting The Remote Start Tool

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

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

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

Figure 50-140-1



When the Service PC (Item 1) and the remote start tool (Item 2) **[Figure 50-140-1]**, are connected to the excavator, the Service PC is used to monitor, conduct diagnostic and load software.

Connect the Service Tool Harness Communicator (MEL1566) (Item 3) **[Figure 50-140-1]** to the designated serial port on the Service PC.

NOTE: The recommended serial cable length should not exceed 4,6 m (15 ft). A serial cable longer than 4,6 m (15 ft) will create a degraded signal causing communication errors.

Connect the other end to the connector on the remote start tool.

Connect the remote start tool to the excavator. (See Remote Start Tool - MEL1563 on Page 10-220-1.)

NOTE: Refer to BobcatNET for PC requirements and the latest Service Analyzer software.

Connecting Remote Start Tool (Service Tool)

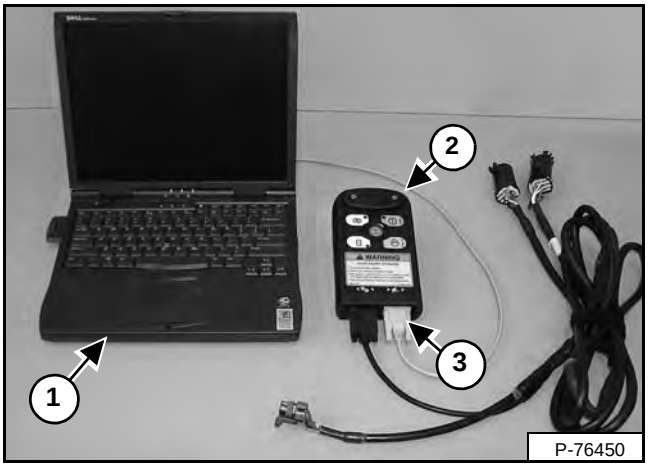
The tools listed will be needed to do the following procedure:

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
6689745 - BOSS® Service Tool Harness

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

Figure 50-140-2



When the Service PC (Item 1) and the Remote Start Tool (Service Tool) (Item 2) **[Figure 50-140-2]**, are connected to the excavator, the Service PC is used to monitor, conduct diagnostics, and load software.

Connect the Remote Start Tool (Service Tool) Computer Service Tool Harness (Item 3) **[Figure 50-140-2]** to the designated serial port on the Service PC.

NOTE: The recommended serial cable length should not exceed 4,6 m (15 ft). A serial cable longer than 4,6 m (15 ft) will create a degraded signal causing communication errors.

Connect the other end to the connector on the Remote Start Tool (Service Tool).

Connect the Remote Start Tool (Service Tool) to the excavator. (See Remote Start Tool - MEL1563 on Page 10-220-1.)

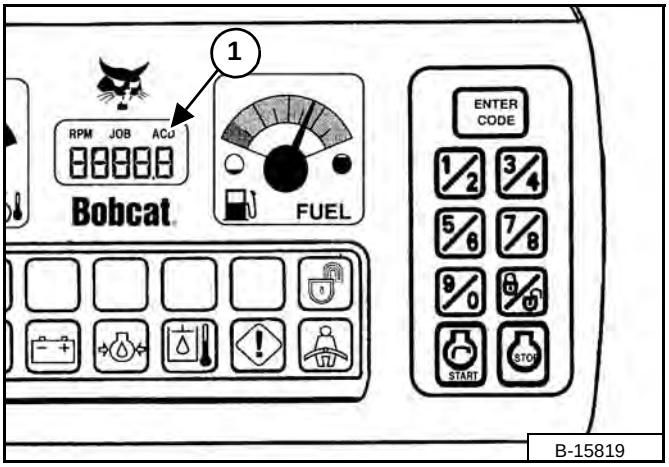
NOTE: Refer to BobcatNET for PC requirements and the latest Service Analyzer software.

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Operation

Turn the excavator start key to the run position, or push the ENTER CODE button on the deluxe instrument panel.

Figure 50-140-3



[Figure 50-140-3] If a new controller is locked, CODe will show in the readout (Item 1) of the deluxe controller. Press 1111 to unlock the controller. This is the default password of all new controllers.

Figure 50-140-4



Follow the directions as outlined on the service PC **[Figure 50-140-4]**.

After successfully updating the new controller, change the password. (See Passwords on Page 50-90-1.)

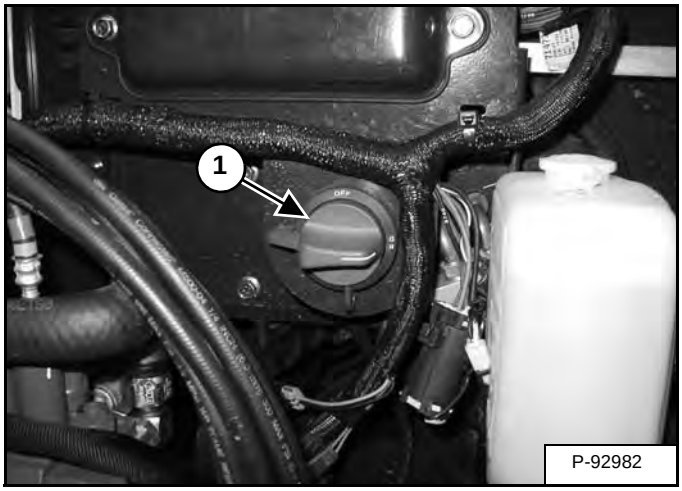
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SHUT-OFF SWITCH

Description

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

Figure 50-150-1



The shut-off switch (Item 1) **[Figure 50-150-1]** is located under the right side cover below the fuse panel.

Rotate the switch (Item 1) counter clockwise to turn the switch to the OFF position, clockwise to turn to the ON position.

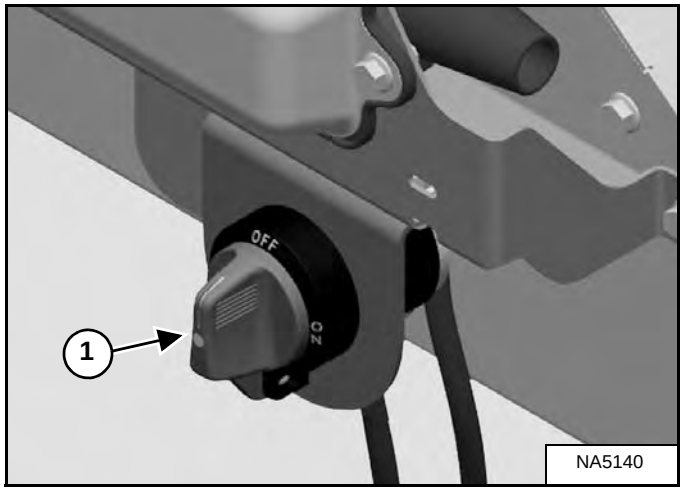
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SHUT-OFF SWITCH (CONT'D)

Removal And Installation

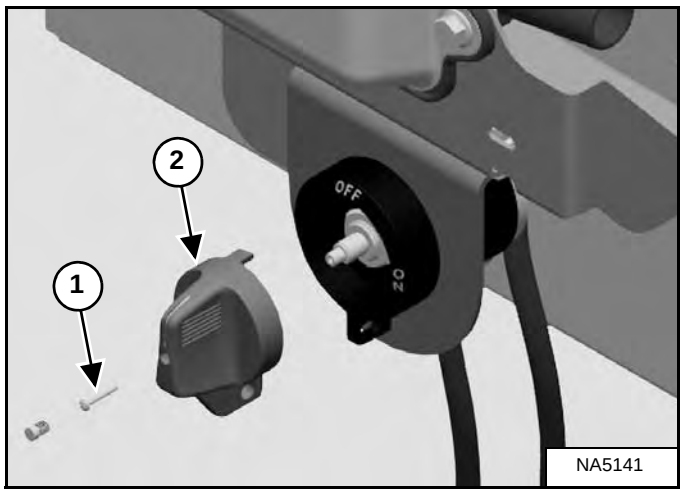
Disconnect the negative (-) cable from the battery. (See Removal And Installation on Page 50-20-2.)

Figure 50-150-2



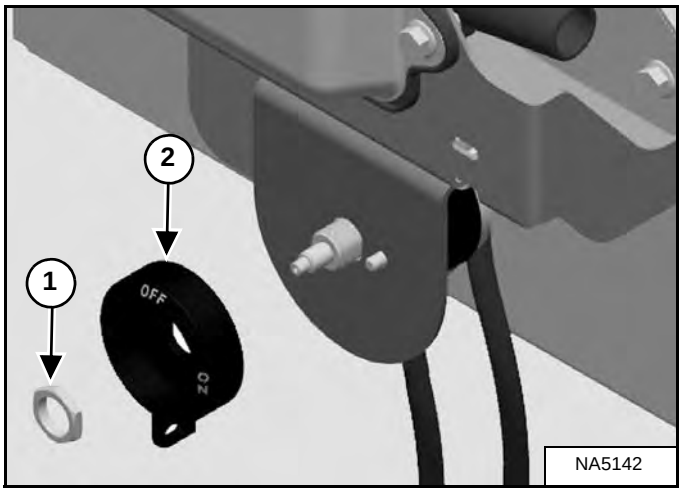
Remove the plug (Item 1) **[Figure 50-150-2]**.

Figure 50-150-3



Remove the screw (Item 1) and knob (Item 2) **[Figure 50-150-3]**.

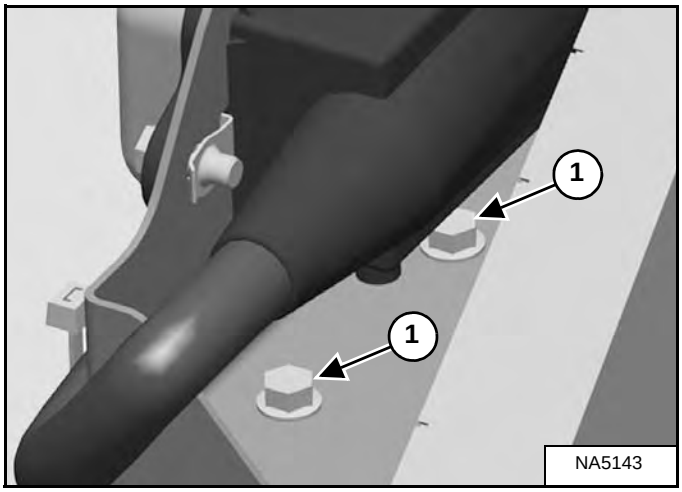
Figure 50-150-4



Remove the nut (Item 1) and bezel (Item 2) **[Figure 50-150-4]**.

Installation: Tighten the nut to 24 N•m (18 ft-lb) torque.

Figure 50-150-5

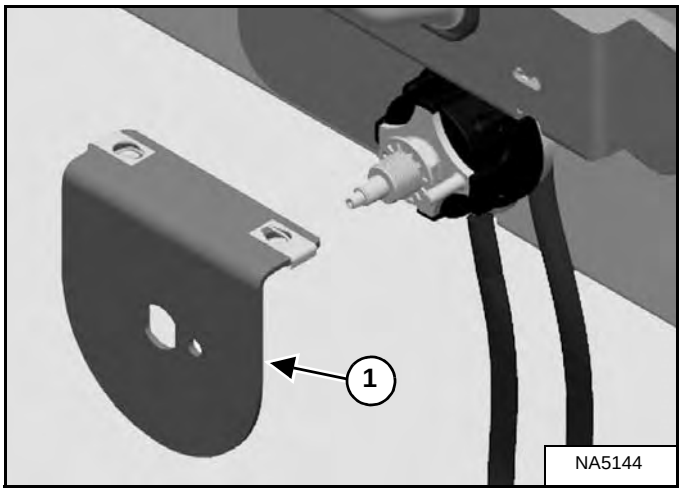


Remove the two bolts (Item 1) **[Figure 50-150-5]**.

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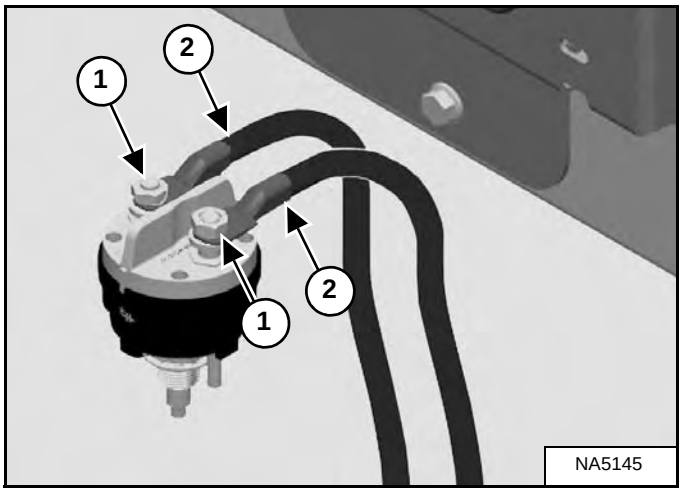
Removal And Installation (Cont'd)

Figure 50-150-6



Remove the bracket (Item 1) **[Figure 50-150-6]**.

Figure 50-150-7



Tilt the switch down. Remove the nut (Item 1) and washer from both switch terminals. Remove the cables (Item 2) **[Figure 50-150-7]** from the switch.

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ENGINE SERVICE

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ENGINE INFORMATION

Description

The E35 has a Kubota direct injected V1803-DI diesel engine with a displacement of 1,8 L (111.4 in^3). The engine is rated at an SAE Gross 23,1 kW (31 hp) and has a closed breather system.

The engine has 3 cylinders and the rotation is counter-clockwise (viewed from the flywheel side). It is equipped with glow plugs for assisting in cold start. 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 in a radiator. Coolant flow is controlled by a thermostat. The cooling fan is belt driven.

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Specifications

Fuel Injection Nozzles

Opening Pressure	18630 - 20105 kPa (186 - 201 bar) (2702 - 2916 psi)
Fuel Tightness Nozzle Seat	Dry Nozzle at 16672 kPa (166,8 bar) (2418 psi)

Fuel Injection Pump

Fuel Tightness Plunger	10 sec: initial pressure 12755 kPa (127,5 bar) (1850 psi)
Allowable Limit	5 seconds
Injection Timing	5.0° degrees B.T.D.C.
High Idle	2650 rpm
Low Idle Speed S/N A93K11001 - A93K11274 S/N AC2P11001 - AC2P11124	1125 ± 75 rpm
Low Idle Speed S/N A93K11275 & Above S/N AC2P11125 & Above	975 ± 75 rpm

Cylinder Head

Cylinder Head Surface Distortion	0,05 mm (0.002 in) 500 mm (9.70 in) Maximum
Top Clearance (Piston to Head)	0,60 - 0,70 mm (0.0236 - 0.0276 in)
Compression	2944 - 3234 kPa (30 - 33 bar) (427 - 469 psi) @ 290 rpm
Allowable Limit	23,5 kPa (24 bar) (341 psi) @ 290 rpm
Allowable Difference Between Cylinders	10% or less

Valves

Valve Seat Width (Intake And Exhaust)	2,12 mm (0.0835 in)
O.D. of Valve Stems	7,96 - 7,98 mm (0.3134 - 0.3140 in)
I.D. of Valve Guides	8,015 - 8,03 mm (0.3156 - 0.3161 in)
Clearance Between Valve Stem And Guide	0,04 - 0,07 mm (0.0016 - 0.0028 in)
Allowable Limit	0,1 mm (0.0039 in)
Valve Clearance (Cold)	0,18 - 0,22 mm (0.007 - 0.0087 in)
Valve Recessing	0,65 - 0,85 mm (0.026 - 0.033 in)
Valve Seat Angle (Int.)	60 degrees
Valve Seat Angle (Exh.)	45 degrees

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Specifications (Cont'd)

Valve Springs

Free Length	41,7 - 42,2 mm (1.642 - 1.661 in)
Allowable Limit	41,2 mm (1.622 in)
Fitted Length	35,0 mm (1.378 in)
Compress To Fitted Length	117,6 N (26.4 lb)
Allowable Limit	100,0 N (22.5 lb)
Inclination Allowable Limit	1,0 mm (0.039 in)

Valve Timing

Intake Valve (Open)	9 degrees B.T.D.C.
(Close)	45 degrees A.B.D.C.
Exhaust Valve (Open)	50 degrees B.B.D.C.
(Close)	12 degrees A.T.D.C.

Rocker Arms

O.D. Of Rocker Arm Shaft	13,97 - 13,98 mm (0.5501 - 0.5506 in)
I.D. Of Rocker Arm	14,0 - 14,02 mm (0.5512 - 0.5519 in)
Clearance Between Rocker Arm And Shaft	0,02 - 0,05 mm (0.0006 - 0.0018 in)
Allowable Limit	0,1 mm (0.004 in)

Camshaft

Journal O.D.	39,93 - 39,95 mm (1.572 - 1.573 in)
Cylinder Block Bore I.D.	40,0 - 40,025 mm (1.575 - 1.576 in)
Oil Clearance	0,05 - 0,091 mm (0.002 - 0.0036 in)
Allowable Limit	0,15 mm (0.006 in)
Alignment Allowable Limit	0,01 mm (0.0004 in)
Cam Lobe Height	33,9 mm (1.335 in)
Allowable Limit	33,85 mm (1.333 in)
End Clearance	0,07 - 0,22 mm (0.0028 - 0.0087 in)
Allowable Limit	0,3 mm (0.012 in)

Tappet

Clearance Between Tappet And Guide	0,02 - 0,062 mm (0.0008 - 0.0024 in)
Allowable Limit	0,07 mm (0.003 in)
Tappet O.D.	23,96 - 23,98 mm (0.943 - 0.944 in)
Tappet Guide I.D.	24,0 - 24,021 mm (0.945 - 0.946 in)

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Specifications (Cont'd)

Pushrod

Alignment	0,25 mm (0.0098 in)

Cylinders

Cylinder Bore I.D. (Standard)	87,00 - 87,02 mm (3.425 - 3.426 in)
Allowable Limit (Standard)	+0,15 mm (+0.006 in)
Cylinder Bore I.D. (Oversize)	87,25 - 87,27 mm (3.435 - 3.436 in)
Allowable Limit (Oversize)	+0,15 mm (+0.006 in)

Piston Rings

Ring Gap (Top)	0,20 - 0,35 mm (0.008 - 0.0138 in)
Ring Gap (2nd Ring)	0,30 - 0,45 mm (0.012 - 0.017 in)
Ring Gap (Oil Ring)	0,20 - 0,40 mm (0.0079 - 0.015 in)
Allowable Limit (All Rings)	1,25 mm (0.05 in)
Side Clearance of Top Ring to Ring Groove	0,05 - 0,09 mm (0.002 - 0.0035 in)
2nd Ring	0,078 - 0,110 mm (0.00307 - 0.00433 in)
Allowable Limit (To and 2nd Ring)	0,20 mm (0.0079 in)
Oil Ring	0,03 - 0,07 mm (0.0012 - 0.0027 in)
Allowable Limit	0,15 mm (0.0059 in)

Pistons

Piston Pin Bore	25,0 - 25,013 mm (0.984 - 0.985 in)
Allowable Limit	25,05 mm (0.986 in)

Connecting Rods

Piston Pin O.D.	25,0 - 25,011 mm (0.984 - 0.985 in)
Small End Bushing I.D.	25,025 - 25,04 mm (0.985 - 0.986 in)
Clearance Between Piston Pin And Small End Bushing	0,014 - 0,036 mm (0.0056 - 0.0014 in)
Allowable Limit	0,15 mm (0.0059 in)
Connecting Rod Alignment Allowable Limit	0,05 mm (0.002 in)

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Specifications (Cont'd)

Oil Pump

Oil Pressure at Rated RPM	296 - 441 kPa (2,94 - 4,4 bar) (43 - 64 psi)
Allowable Limit	248 kPa (2,5 bar) (36 psi)
Idle Speed Allowable Limit	48 kPa (0,48 bar) (7 psi)
Clearance Between Inner Rotor And Outer Rotor	0,03 - 0,14 mm (0.0012 - 0.0055 in)
Allowable Limit	0,2 mm (0.008 in)
Clearance Between Outer Rotor And Pump Body	0,11 - 0,19 mm (0.0043 - 0.0075 in)
Allowable Limit	0,25 mm (0.0098 in)
End Clearance Between Inner Rotor And Cover	0,105 - 0,15 mm (0.0041 - 0.0059 in)
Allowable Limit	0,2 mm (0.008 in)

Crankshaft

Crankshaft Alignment Allowable Limit	0,02 mm (0.0008 in)
Oil Clearance Between Journal And Bearing #1	0,04 - 0,118 mm (0.0016 - 0.0047 in)
Allowable Limit	0,2 mm (0.008 in)
Journal O.D. #1	59,921 - 59,940 mm (2.3591 - 2.3598 in)
Bearing I.D. #1	59,980 - 60,039 mm (2.3614 - 2.3637 in)
Oil Clearance Between Journal And Bearing #2	0,04 - 0,104 mm (0.0016 - 0.0041 in)
Allowable Limit	0,2 mm (0.008 in)
Journal O.D. #2	59,921 - 59,940 mm (2.3591 - 2.3598 in)
Bearing I.D. #2	59,980 - 60,025 mm (2.3614 - 2.3632 in)
Oil Clearance Between Crank Pin And Bearing	0,025 - 0,087 mm (0.001 - 0.0034 in)
Allowable Limit	0,2 mm (0.008 in)
Crank Pin O.D.	46,96 - 46,98 mm (1.8488 -1.8494 in)
Crank Pin Bearing I.D.	47,0 - 47,05 mm (1.850 - 1.852 in)
Crankshaft Side Clearance	0,15 - 0,31 mm (0.006 - 0.012 in)
Allowable Limit	0,5 mm (0.020 in)

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Specifications (Cont'd)

Timing Gear

Timing Gear Backlash	
Crank Gear - Idle Gear	0,042 - 0,112 mm (0.0016 - 0.0044 in)
Idle Gear - Cam Gear	0,042 - 0,115 mm (0.0016 - 0.0045 in)
Idle Gear - Injection Pump Gear	0,042 - 0,115 mm (0.0016 - 0.0045 in)
Crank Gear - Oil Pump Gear	0,042 - 0,109 mm (0.0016 - 0.0043 in)
Allowable Limit	0,15 mm (0.006 in)
Idle Gear Shaft O.D.	37,959 - 37,975 mm (1.494 - 1.495 in)
Idle Gear Bushing I.D.	38,000 - 38,025 mm (1.496 - 1.497 in)
Clearance Between Idle Gear Shaft And Idle Gear Bushing	0,025 - 0,066 mm (0.001 - 0.0026 in)
Allowable Limit	0,10 mm (0.004 in)
Idler Gear Side Clearance	0,12 - 0,48 mm (0.005 - 0.019 in)
Allowable Limit	0,9 mm (0.04 in)

Thermostat

Valve Opening Temperature	81 - 84°C (177 - 182°F)
Valve Fully Open	95°C (203°F)

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Specifications (Cont'd)

Engine Bolt Torque

	N•m	ft-lb
Camshaft Retainer Plate Bolts	24 - 28	17 - 20
* Connecting Rod Bolts	44 - 49	33 - 36
* Crankshaft Nut	138 - 156	102 - 115
* Cylinder Head Bolts	93 - 98	69 - 72
* Flywheel Bolts	98 - 108	72 - 80
Fuel Injection Tubeline Fittings	15 - 24	11 - 18
Glow Plugs	20 - 24	15 - 18
* Idler Gear Shaft Bolt	23 - 28	17 - 20
Injection Nozzle Clamp	26 - 29	19 - 22
* Main Bearing Bolts	69 - 74	51 - 54
* Main Bearing Case Bolts	46 - 51	34 - 38
Oil Switch	15 - 20	11 - 15
Rear Bearing Case Cover Bolts	24 - 28	17 - 20

* Lightly Oiled Threads

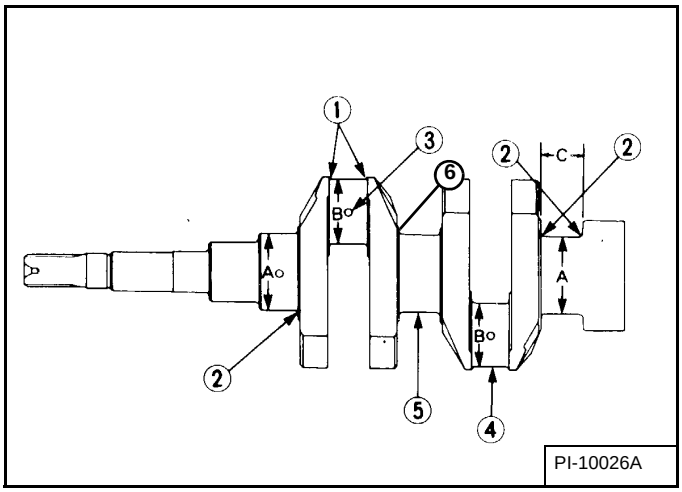
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Crankshaft Re-Grind Data

If the standard size bearing cannot be used due to excessive wear of the crankpin and crank journal use undersize or oversize bearings.

For undersize or oversize bearing use, follow the precautions noted below.

Figure 60-10-1



Grind the crankpin and journal with a wheel which has specified round corner and width without shoulder **[Figure 60-10-1]**.

1. 3,3 - 3,7 mm (0.1299 - 0.14 in) radius.
2. 2,8 - 3,2 mm (0.1102 - 0.1260 in) radius.
3. Chamfer the oil hole circumference to 1,0 - 1,5 mm (0.04 - 0.06 in) radius with an oil stone.
4. The crankpin must be fine finished to higher than (0,4S).
5. The crank journal must be fine-finished to higher than (0,4S).
6. The crank journal side surface must be fine-finished to higher than (0,4S).

SIZE	NAME OF BEARING	BEARING MARK	CRANKSHAFT PROCESSING DIM.	
0,2 mm (-0.008 in)	Crankshaft Bearing 1 0,2 mm minus (0.008" minus)	020 US	A	59,721 - 59,740 mm (2.3513 - 2.3519 in)
0,2 mm (-0.008 in)	Crankshaft Bearing 2 0,2 mm minus (0.008" minus)	020 US		
0,4 mm (-0.016 in)	Crankshaft Bearing 1 0,4 mm minus (0.016" minus)	040 US	A	59,521 - 59,540 mm (2.3434 - 2.3444 in)
0,4 mm (-0.016 in)	Crankshaft Bearing 2 0,4 mm minus (0.016" minus)	040 US		
0,2 mm (-0.008 in)	Crank Pin Bearing 0,2 mm minus (0.008" minus)	020 US	B	46,759 - 46,775 mm (1.8409 - 1.8415 in)
0,4 mm (-0.016 in)	Crank Pin Bearing 0,4 mm minus (0.016" minus)	040 US	B	46,559 - 46,575 mm (1.8330 - 1.8337 in)
+0,2 mm (+0.008 in)	Thrust Bearing 1 0,2 mm plus (0.008 in plus)	020 OS	C	26,20 - 26,25 mm (1.0315 - 1.0335 in)
	Thrust Bearing 2 0,2 mm plus (0.008 in plus)			
+0,4 mm (+0.016 in)	Thrust Bearing 1 0,4 mm plus (0.016 in plus)	040 OS	C	26,4 - 26,45 mm (1.0394 - 1.0413 in)
	Thrust Bearing 2 0,4 mm plus (0.016 in plus)			

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Torque For Kubota Metric Bolts

Nominal Diameter	Grade	Standard Screw and Bolt ⬡ 4			Special Screw and Bolt ⬡ 7		
	Unit	N•m	kfg m	ft-lb	N•m	kgf m	ft-lb
M6		7,9 - 9,3	0.80 - 0.95	5.8 - 6.9	9,8 - 11,3	1.00 - 1.15	7.23 - 8.32
M8		17,7 - 20,6	1.8 - 2.1	13.0 - 15.2	23,5 - 27,5	2.4 - 2.8	17.4 - 20.3
M10		39,2 - 45,1	4.0 - 4.6	28.9 - 33.3	48,1 - 55,9	4.9 - 5.7	35.4 - 41.2
M12		62,8 - 72,6	6.4 - 7.4	46.3 - 53.5	77,5 - 90,2	7.9 - 9.2	57.1 - 66.5

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Troubleshooting

The following troubleshooting chart is provided for assistance in locating and correcting problems which are most common. Many of the recommended procedures must be done by authorized Bobcat Service personnel only.

PROBLEM	CAUSE
Slow cranking speed	1, 2, 3, 4
Engine will not start	2, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 19, 27, 28, 29
Difficult to start	5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 25, 27, 28, 29
No power from engine	8, 9, 10, 11, 12, 13, 15, 16, 17, 21, 22, 24, 25, 26, 28, 29
Engine is mis-firing	8, 9, 11, 12, 13, 15, 16, 17, 21, 22, 24, 25, 26, 28
Too much fuel consumption	10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29
Black exhaust	10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29
Blue / white exhaust	4, 10, 15, 16, 17, 21, 23, 27, 29, 30, 50
Low oil pressure	4, 31, 32, 33, 34, 35, 37, 38, 39, 52
Engine knocking	13, 15, 16, 19, 22, 24, 25, 27, 29, 31, 40, 41, 53
Engine running rough	7, 8, 9, 10, 11, 12, 13, 17, 18, 22, 24, 25, 26, 29, 40, 53
Vibration	12, 13, 17, 21, 22, 25, 26, 29, 40, 42, 43
High oil pressure	4, 33, 36
Overheating	10, 12, 13, 15, 16, 20, 21, 40, 44, 45, 46, 47, 48, 51
Too much crankcase pressure	22, 27, 29, 30, 40, 49
Poor compression	10, 16, 21, 24, 25, 27, 28, 29, 30, 41, 53
Start and stop	9, 10, 11

KEY TO CORRECT THE CAUSE	
1. Battery capacity low	28. Worn valves and seat
2. Bad electrical connections	29. Broken or worn piston rings
3. Faulty starter motor	30. Worn valve stems or guides
4. Incorrect grade of oil	31. Worn or damaged bearings
5. Low cranking speed	32. Not enough oil in the oil pan
6. Fuel tank empty	33. Switch is defective
7. Faulty stop control operation	34. Oil pump worn
8. Plugged fuel line	35. Relief valve is stuck open
9. Plugged fuel filter	36. Relief valve is stuck closed
10. Restriction in the air cleaner	37. Broken relief valve spring
11. Air in the fuel system	38. Faulty suction pipe
12. Faulty fuel injection pump	39. Plugged oil filter
13. Faulty fuel injectors	40. Piston seizure
14. Broken injection pump drive	41. Incorrect piston height
15. Incorrect injection pump timing	42. Faulty engine mounting
16. Incorrect valve timing	43. Incorrect alignment of flywheel
17. Poor compression	44. Faulty thermostat
18. Plugged fuel tank vent	45. Restriction in water jacket
19. Incorrect grade of fuel	46. Loose alternator belt
20. Exhaust pipe restriction	47. Plugged radiator
21. Cylinder head gasket leaking	48. Plugged breather pipe
22. Over heating	49. Plugged breather pipe
23. Cold running	50. Damaged valve stem oil deflectors
24. Incorrect tappet adjustment	51. Coolant level too low
25. Sticking valves	52. Plugged oil pump pipe strainer
26. Incorrect high pressure fuel lines	53. Broken valve spring
27. Worn cylinder bores	

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Engine Removal And Installation

Disconnect the negative (-) cable on the battery. (See Removal And Installation on Page 50-20-2.)

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-130-5.)

Drain the radiator. (See Removing And Replacing Coolant on Page 10-100-3.)

Remove the muffler. (See Removal And Installation on Page 60-30-1.)

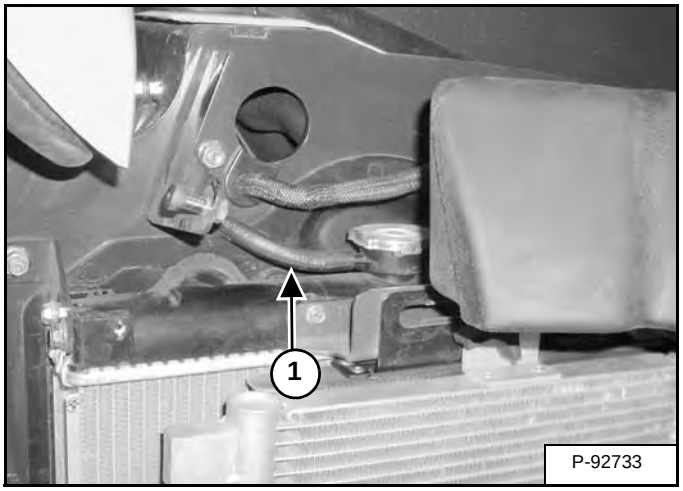
Remove the air cleaner. (See Removal And Installation on Page 60-40-1.)

Remove the tailgate. (See Removal And Installation on Page 40-190-1.)

Remove the starter. (See Removal And Installation on Page 50-40-2.)

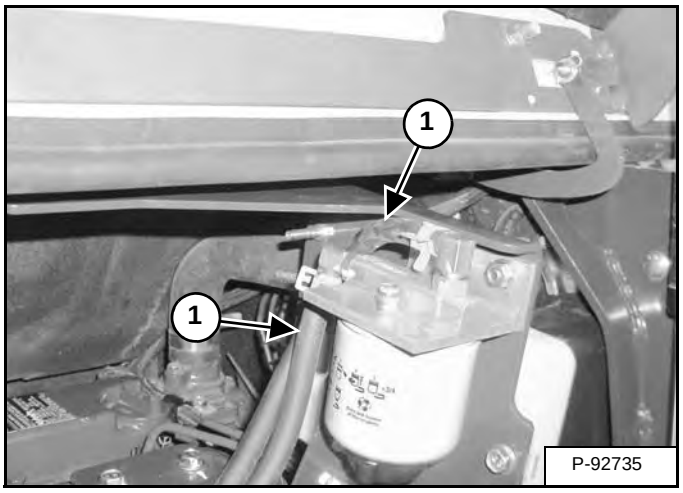
Remove the hydraulic pump. (See Removal And Installation on Page 20-50-11.)

Figure 60-10-2



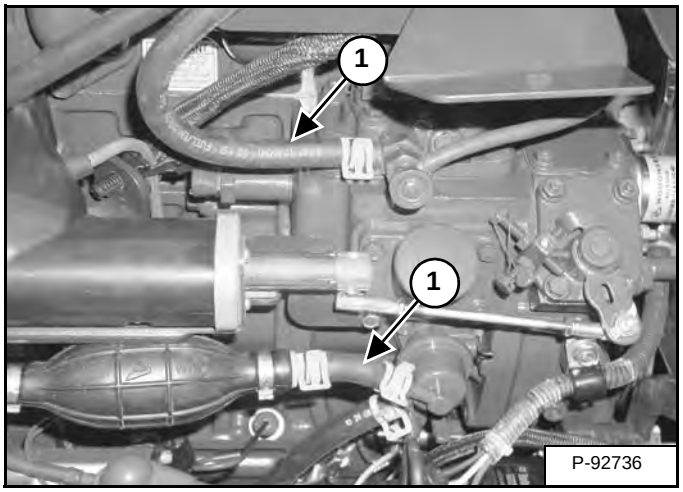
Remove the radiator overflow hose (Item 1) **[Figure 60-10-2]**.

Figure 60-10-3



Remove the fuel lines (Item 1) **[Figure 60-10-3]** from the filter.

Figure 60-10-4

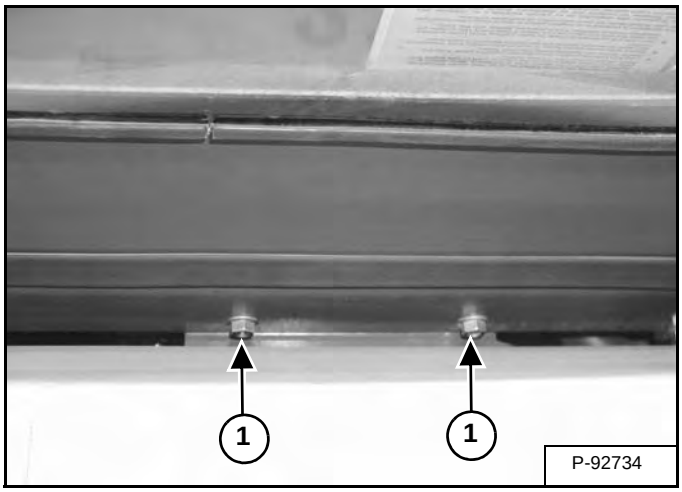


Remove the fuel lines (Item 1) **[Figure 60-10-4]** from the fuel pump and fuel injection pump.

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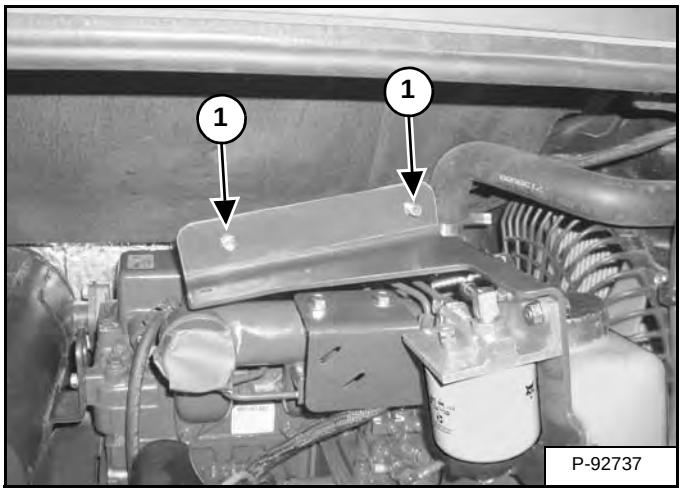
Engine Removal And Installation (Cont'd)

Figure 60-10-5



Remove the nuts (Item 1) **[Figure 60-10-5]**.

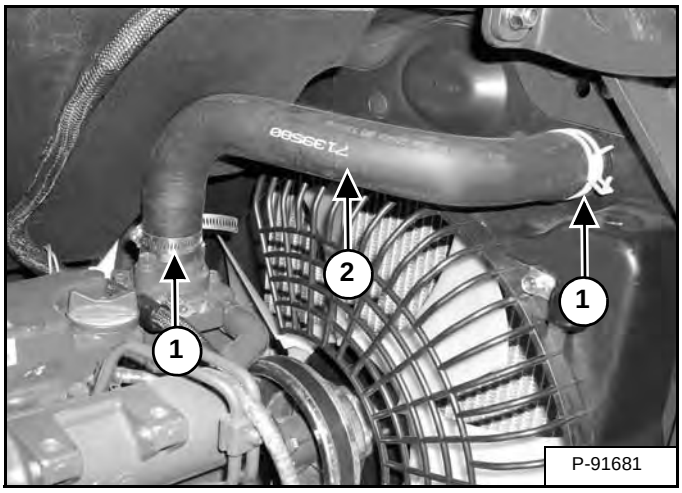
Figure 60-10-6



Lower the bracket and remove the bolts (Item 1) **[Figure 60-10-6]**.

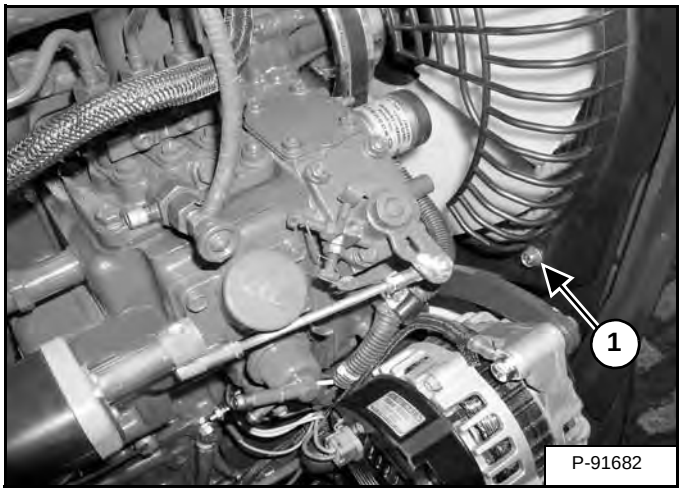
Remove the bracket.

Figure 60-10-7



Loosen the two clamps (Item 1) and remove the hose (Item 2) **[Figure 60-10-7]**.

Figure 60-10-8

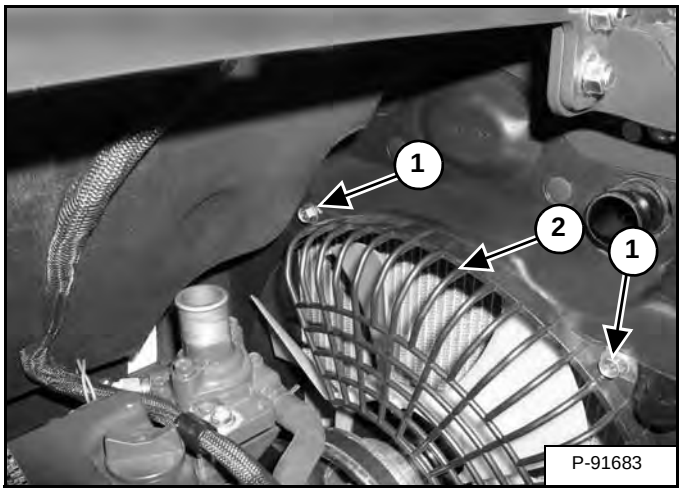


Remove the bolt (Item 1) **[Figure 60-10-8]**.

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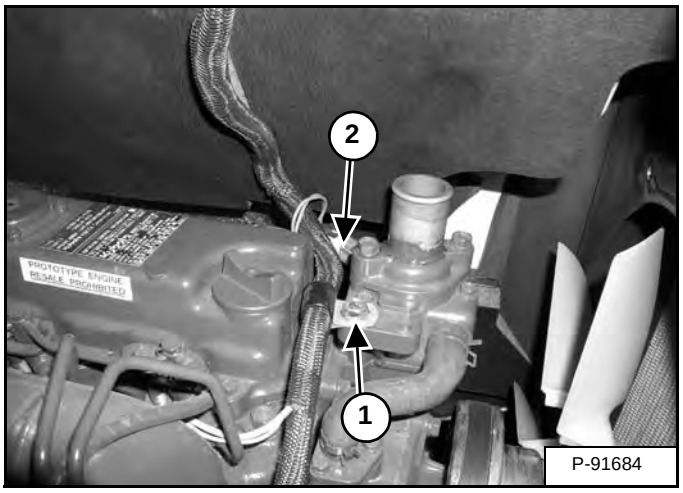
Engine Removal And Installation (Cont'd)

Figure 60-10-9



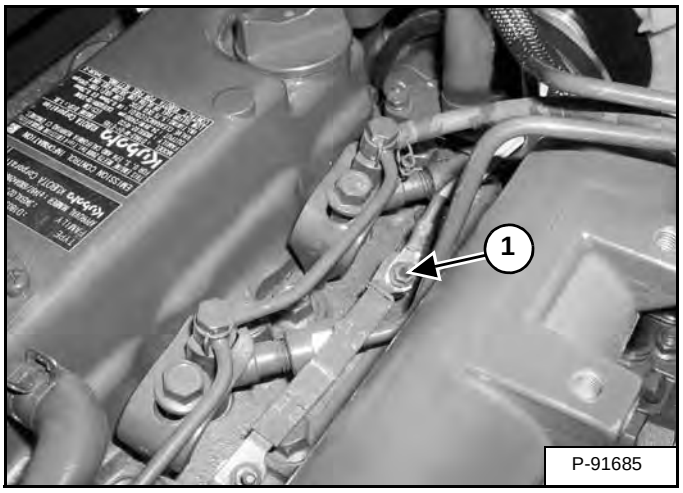
Remove the two bolts (Item 1) and fan guard (Item 2) **[Figure 60-10-9]**.

Figure 60-10-10



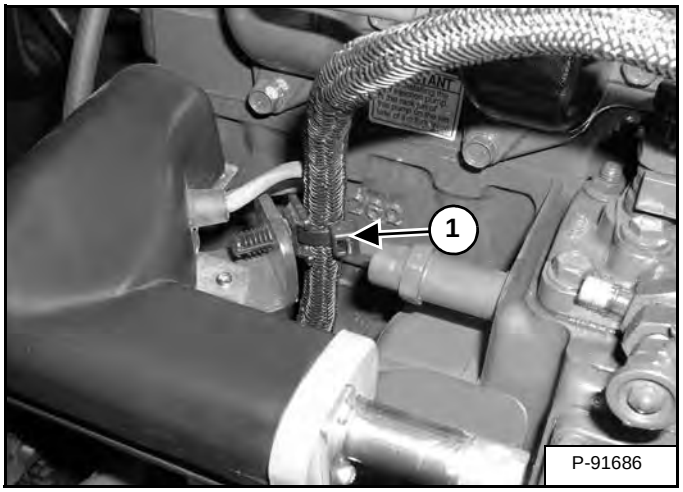
Remove the bolt (Item 1) and disconnect the wire harness (Item 2) **[Figure 60-10-10]** from the coolant temperature sensor.

Figure 60-10-11



Remove the wire (Item 1) **[Figure 60-10-11]** from the glow plugs.

Figure 60-10-12

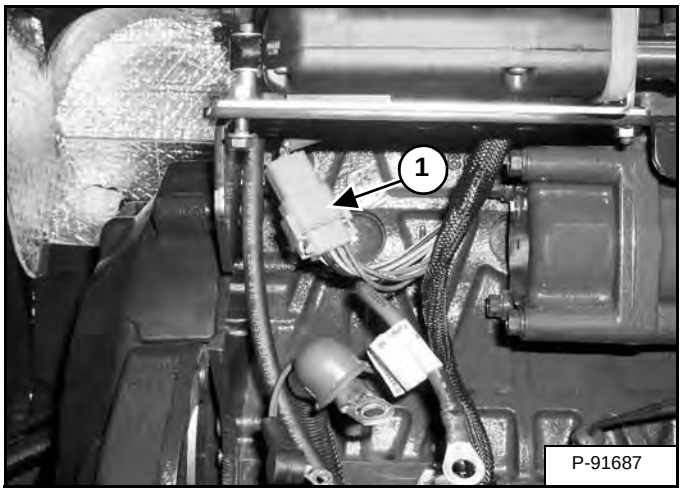


Remove the tie strap (Item 1) **[Figure 60-10-12]**.

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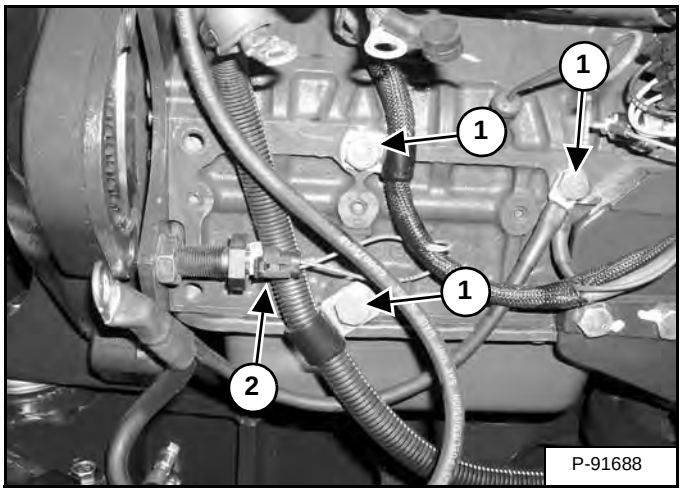
Engine Removal And Installation (Cont'd)

Figure 60-10-13



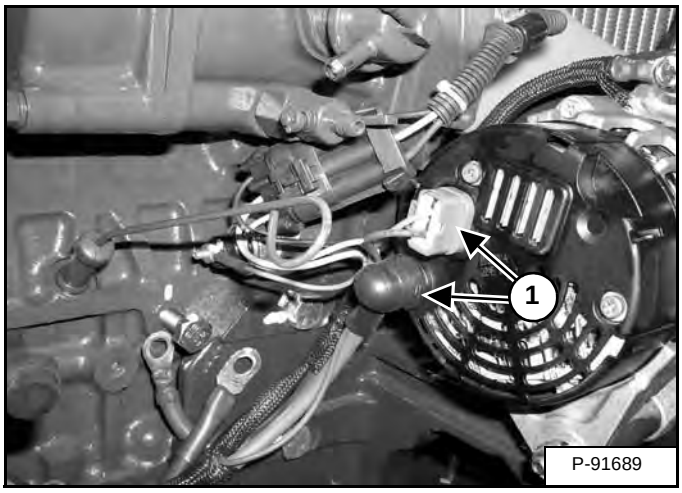
[Figure 60-10-13] Disconnect the harness (Item 1) from the engine speed control actuator.

Figure 60-10-14



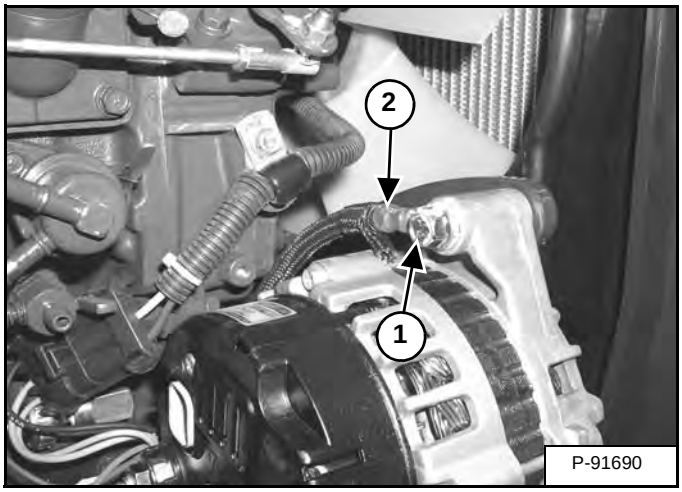
Remove the three bolts (Item 1). Remove the harness (Item 2) **[Figure 60-10-14]** from the engine speed sensor.

Figure 60-10-15



Remove the wires (Item 1) **[Figure 60-10-15]** from the alternator.

Figure 60-10-16

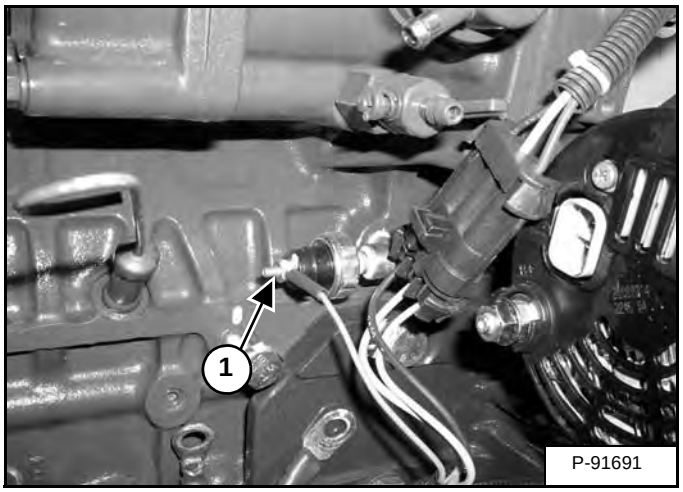


Remove the bolt (Item 1) and ground cable (Item 2) **[Figure 60-10-16]**.

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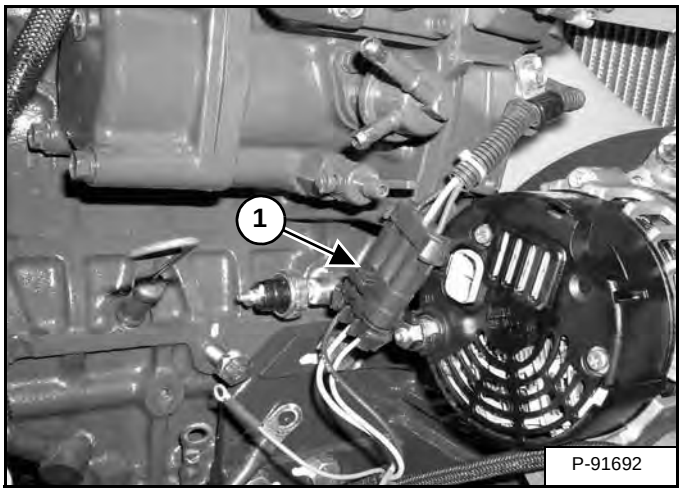
Engine Removal And Installation (Cont'd)

Figure 60-10-17



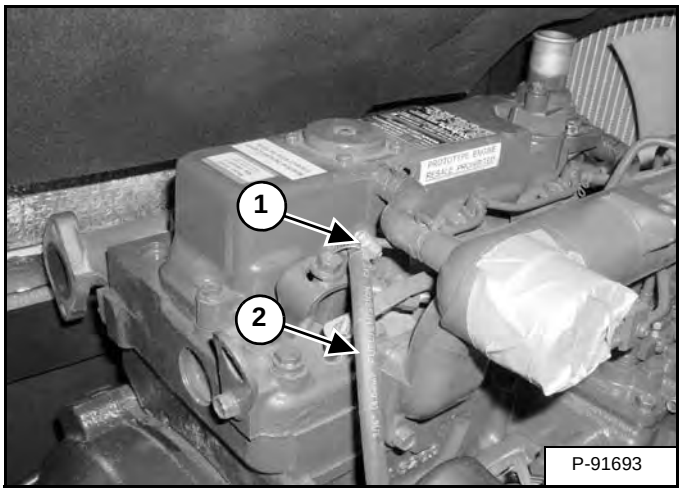
Remove the wire (Item 1) **[Figure 60-10-17]** from the oil pressure sensor.

Figure 60-10-18



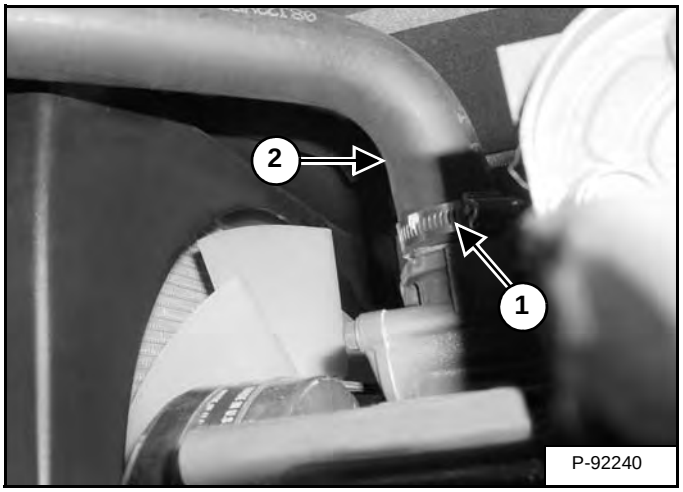
Disconnect the harness (Item 1) **[Figure 60-10-18]** from the fuel shut off solenoid.

Figure 60-10-19



Loosen the clamp (Item 1) and remove the fuel return line (Item 2) **[Figure 60-10-19]**.

Figure 60-10-20

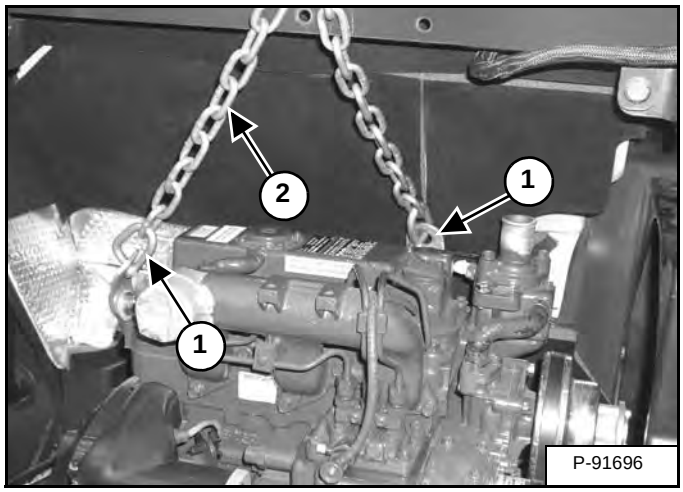


Loosen the clamp (Item 1) and remove the lower radiator hose (Item 2) **[Figure 60-10-20]**.

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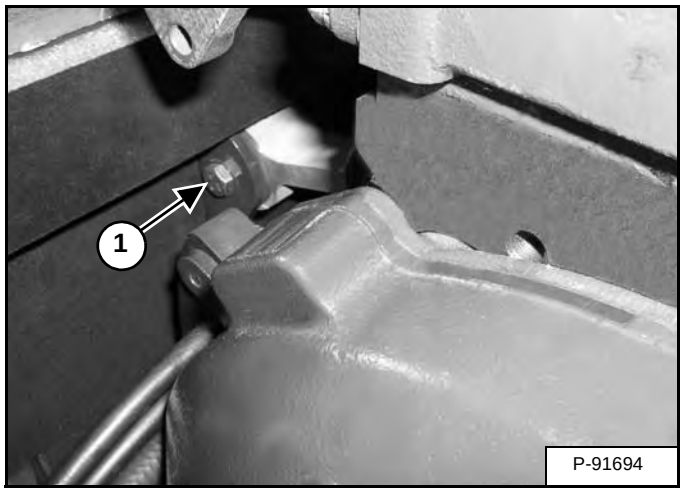
Engine Removal And Installation (Cont'd)

Figure 60-10-21



Attach lifting brackets (Item 1) and chain (Item 2) **[Figure 60-10-21]** to a hoist.

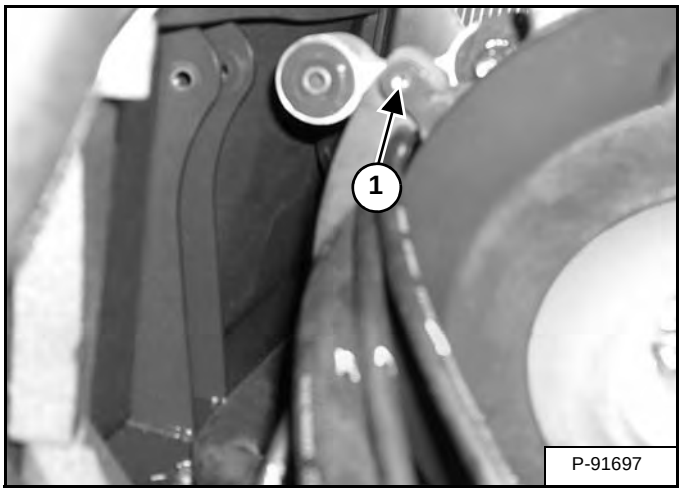
Figure 60-10-22



Remove the bolt (Item 1) **[Figure 60-10-22]** from the front motor mount.

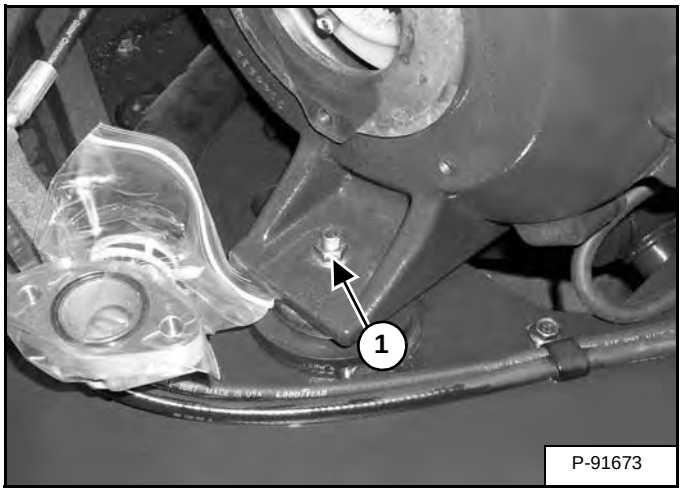
Installation: Tighten the bolt to 105 - 115 N•m (78 - 85 ft-lb) torque.

Figure 60-10-23



Remove the bolts (Item 1) **[Figure 60-10-23]** from the hose guide.

Figure 60-10-24



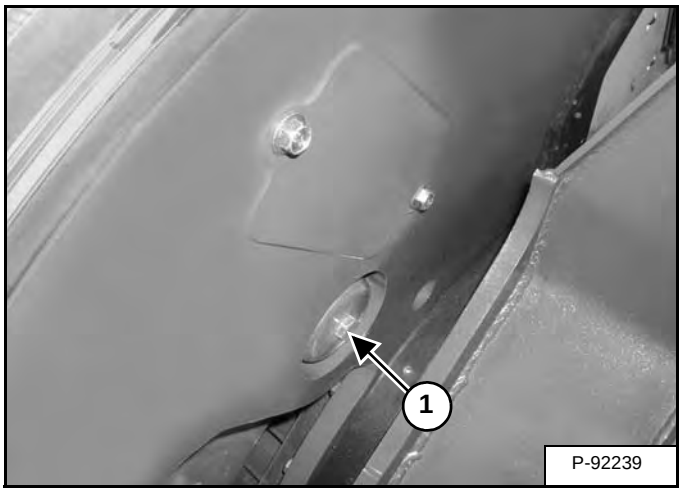
Remove the bolt (Item 1) **[Figure 60-10-24]** from the left motor mount.

Installation: Tighten the bolt to 105 - 115 N•m (78 - 85 ft-lb) torque.

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Engine Removal And Installation (Cont'd)

Figure 60-10-25



Remove the bolt (Item 1) **[Figure 60-10-25]** from the right motor mount.

Installation: Tighten the bolt to 105 - 115 N•m (78 - 85 ft-lb) torque.

Remove the engine.

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Compression - Checking

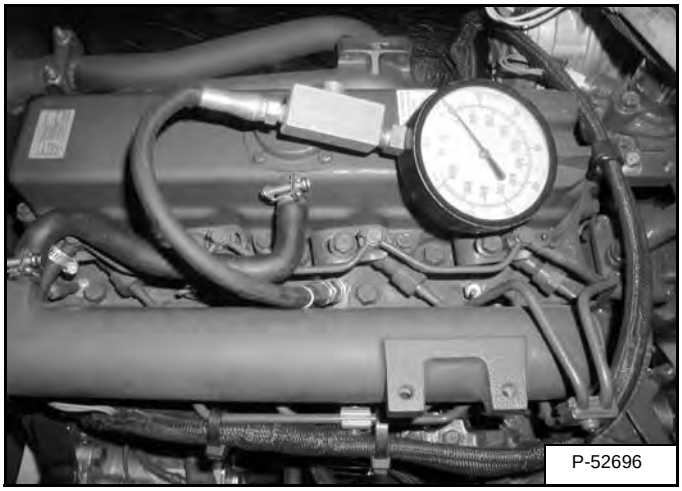
The tools listed will be needed to do the following procedure:

MEL10630 - Engine Compression Kit
MEL1631 - Compression Adapter

The engine must be at operating temperature.

Remove the glow plugs. (See Glow Plugs Removal And Installation on Page 60-80-2.)

Figure 60-10-26



Install the correct compression adapter into the cylinder head **[Figure 60-10-26]**.

Connect the compression gauge **[Figure 60-10-26]**.

Make sure the speed control lever is at low engine idle.

Disconnect the fuel stop solenoid.

Crank the engine with the starter at 200 - 300 rpm.

Compression Pressure	2944 - 3234 kPa (29 - 32 bar) (427 - 469 psi)
Allowable Limit (minimum)	2351 kPa (24 bar) (341 psi)

The compression must be no lower than the allowable limit, with no more than 10% variance among cylinders.

Connect the fuel stop solenoid.

Install the glow plugs.

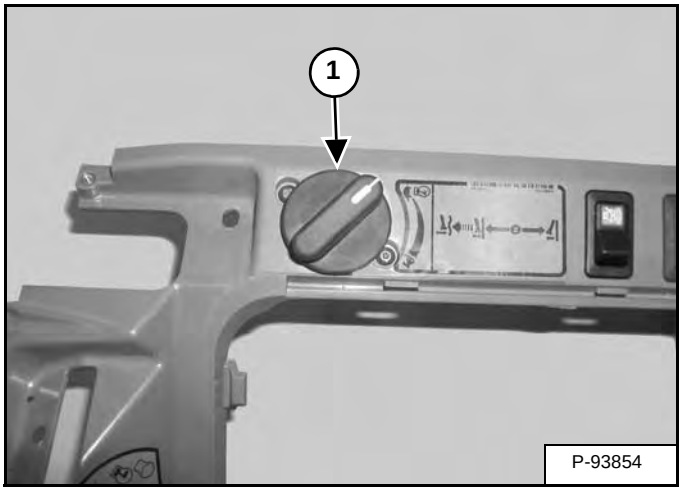
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ENGINE SPEED CONTROL

Removal And Installation

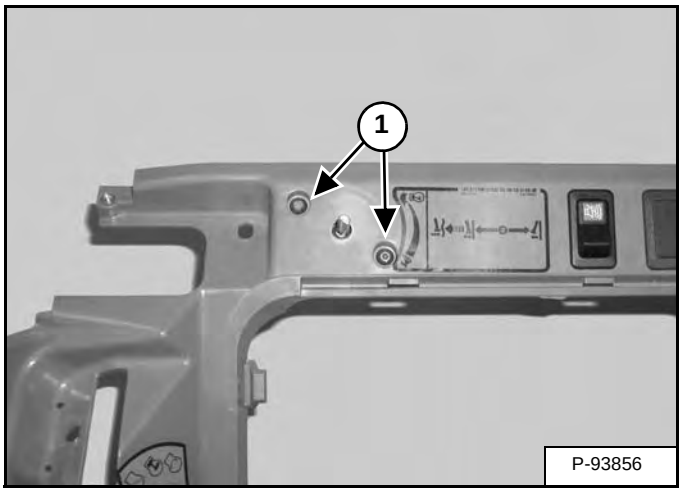
Remove the console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 60-20-1



Pull up on and remove the engine speed control knob (Item 1) **[Figure 60-20-1]**.

Figure 60-20-2



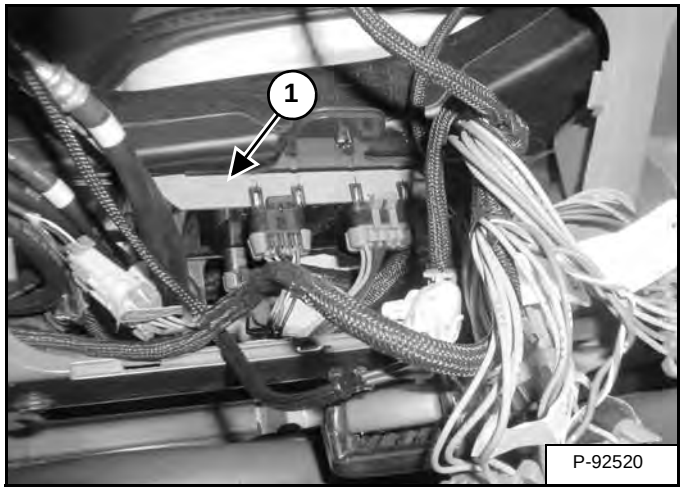
Remove the screws (Item 1) **[Figure 60-20-2]** and remove the speed control switch.

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Auto Idle Controller Removal And Installation

Remove the instrument panel / controller. (See Removal And Installation on Page 50-100-1.)

Figure 60-20-3



Disconnect the wire harness from the control (Item 1) **[Figure 60-20-3]**.

Figure 60-20-4

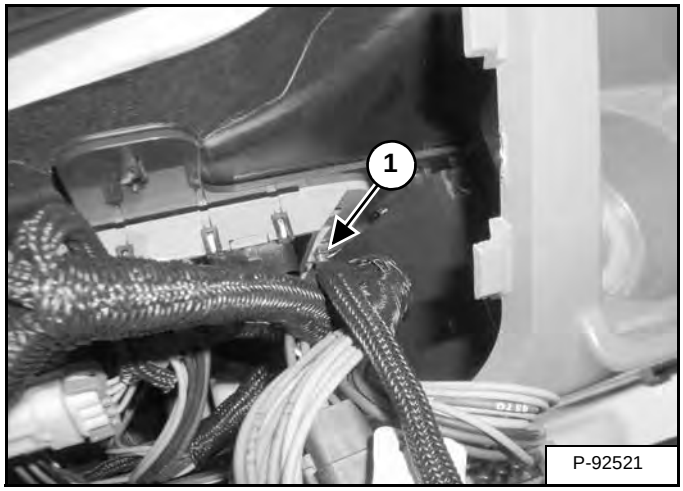
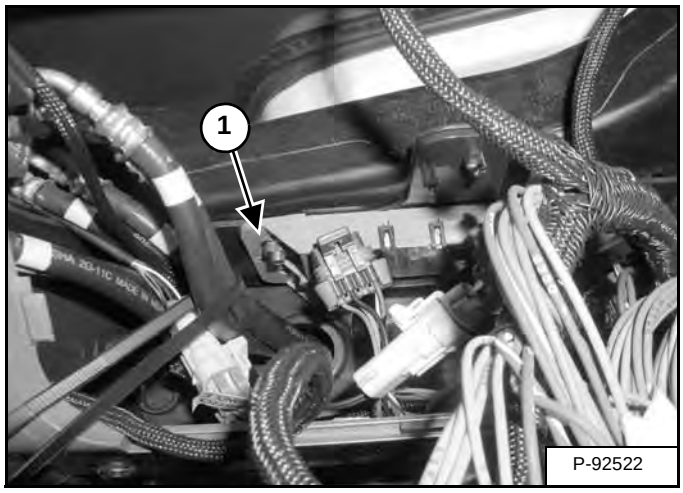


Figure 60-20-5



Remove the nuts (Item 1) **[Figure 60-20-4]** and **[Figure 60-20-5]**.

Remove the controller.

After installing the controller, the engine speed control system must be calibrated. (See Calibration on Page 60-20-3.)

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Calibration

Figure 60-20-6

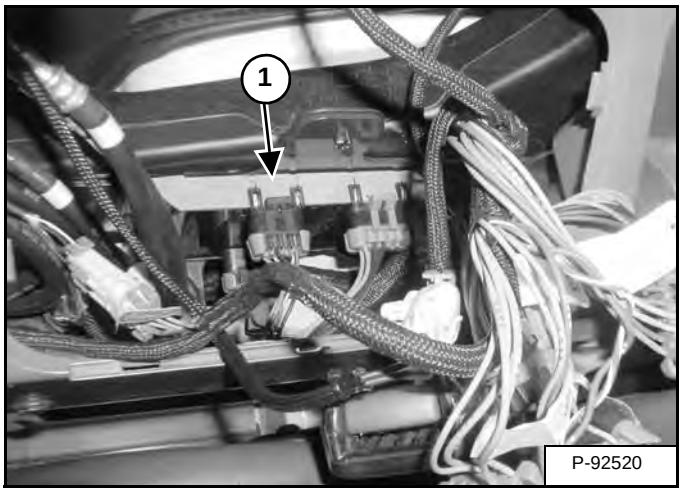
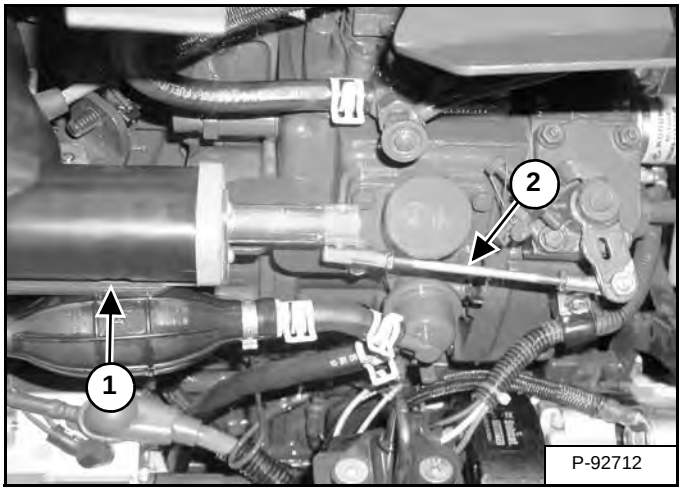
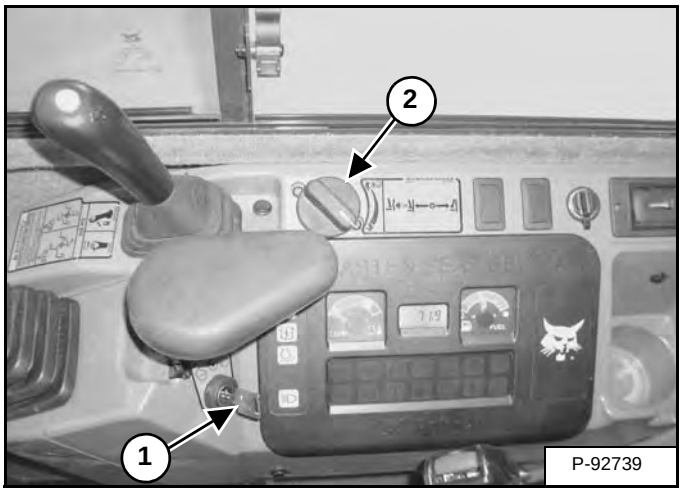


Figure 60-20-7



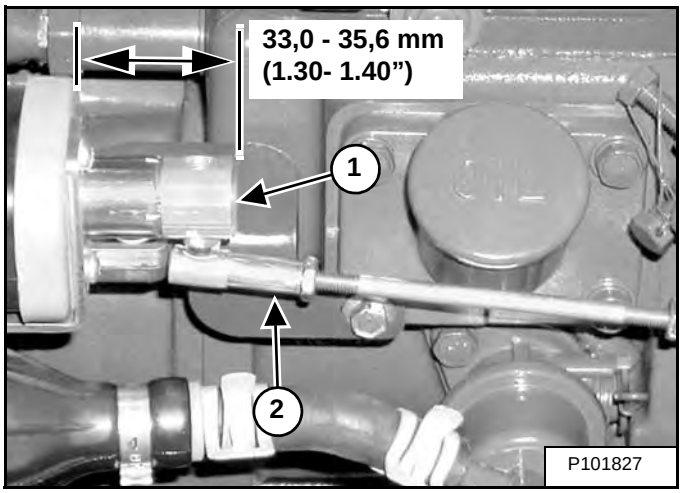
The engine speed control components must be calibrated any time the controller (Item 1) **[Figure 60-20-6]** and or the actuator (Item 1) **[Figure 60-20-7]** has been replaced or if the linkage (Item 2) **[Figure 60-20-7]** has been adjusted.

Figure 60-20-8



With the engine off, turn the key (Item 1) to the ON position. Rotate the engine speed control dial (Item 2) **[Figure 60-20-8]** to the high speed position.

Figure 60-20-9



Leave the engine speed control dial at the high speed position and turn the key to the STOP position.

Measure from the face of the seal to the end of the actuator plunger. The plunger (Item 1) **[Figure 60-20-9]** must be between 33,0 - 35,6 mm (1.30 - 1.40 in).

If the actuator plunger needs to be adjusted, push down and disconnect the linkage (Item 2) **[Figure 60-20-9]**.

Manually pull or push the actuator plunger (Item 1) **[Figure 60-20-9]** to a point between 33,0 - 35,6 mm (1.30 - 1.40 in). This is the actuator starting point for the calibration procedure.

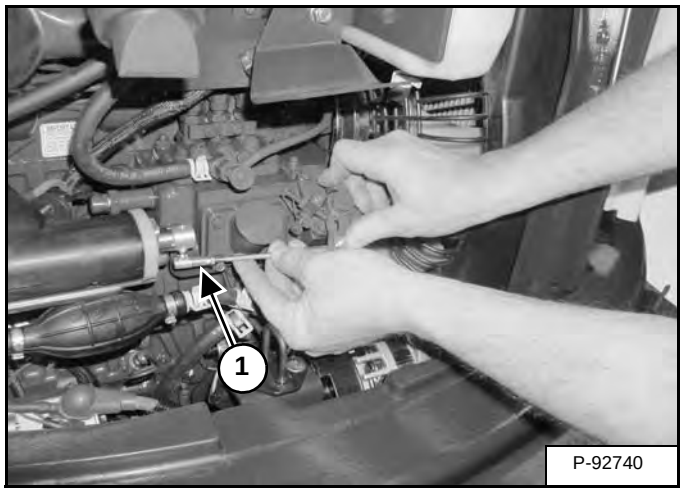
If the actuator is less than specified a E0522 error code, out of range low, will be generated. If the actuator is greater than specified, a E0521 error code, out of range high, will be generated.

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ENGINE SPEED CONTROL (CONT'D)

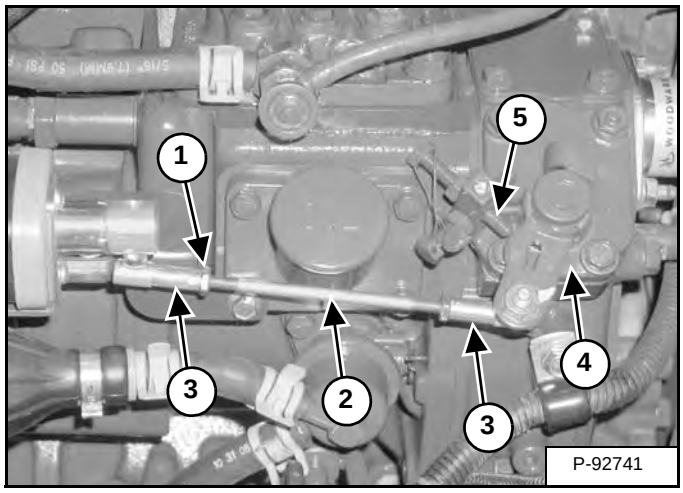
Calibration (Cont'd)

Figure 60-20-10



Connect the linkage (Item 1) **[Figure 60-20-10]** to the actuator.

Figure 60-20-11



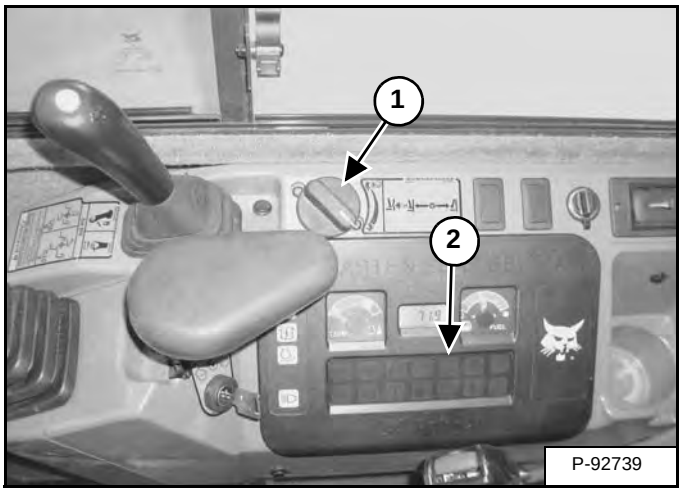
Loosen the nuts (Item 1). Push down and disconnect the linkage (Item 2). Turn the ball joints (Item 3) a small amount and reconnect the linkage. Repeat the procedure until the lever (Item 4) fully contacts the stop (Item 5) **[Figure 60-20-11]**.

Tighten the nuts (Item 1) **[Figure 60-20-11]**.

The following procedure must be completed within 7.5 seconds;

With the engine off and the engine speed control dial at the high speed position, turn the key to the ON position.

Figure 60-20-12



Turn the engine speed control dial (Item 1) **[Figure 60-20-12]** from the high speed position to the low speed position four times:

High Speed
Low Speed
High Speed
Low Speed
High Speed
Low Speed
High Speed
Low Speed

NOTE: The auto idle icon (Item 2) [Figure 60-20-12] will flash while the calibration procedure is in process.

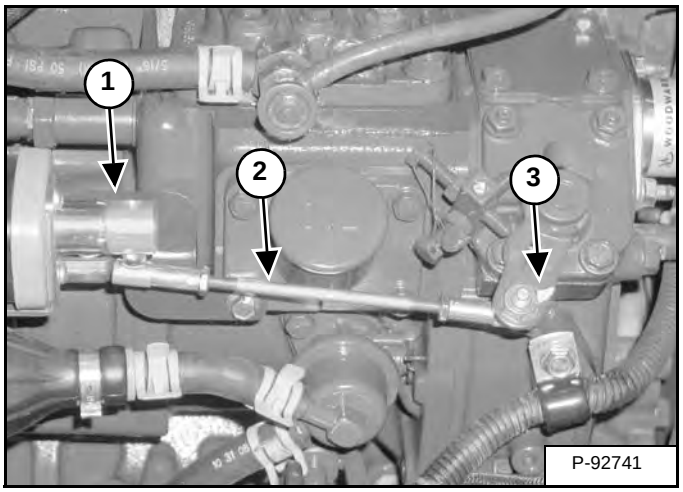
NOTE: The calibration procedure may start after the third rotation of the speed control dial.

When the calibration procedure is complete, the operator warning alarm will sound twice. Turn the key to the STOP position.

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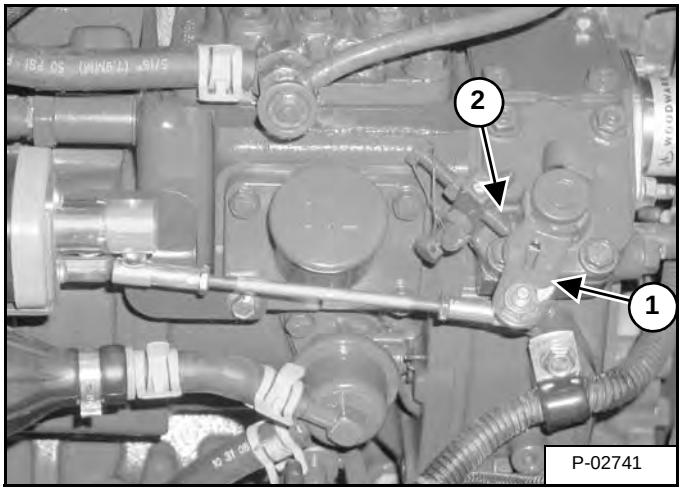
Calibration (Cont'd)

Figure 60-20-13



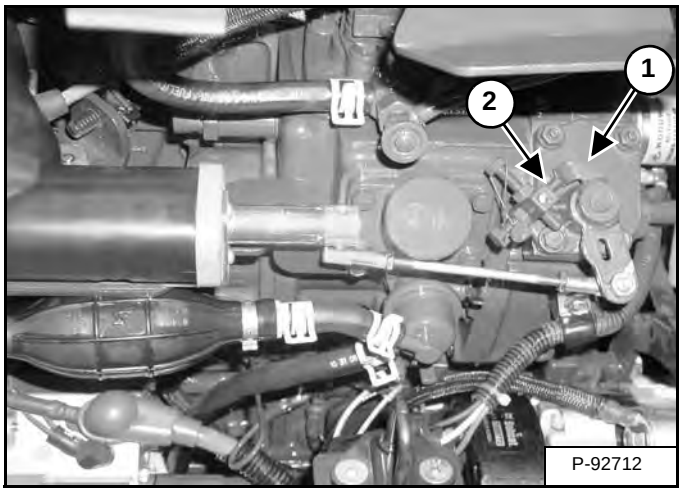
NOTE: The actuator plunger (Item 1), linkage (Item 2) and lever (Item 3) [Figure 60-20-13] will move several times during the calibration procedure. Keep all personnel, tools and shop towels away from all moving components while performing the calibration procedure

Figure 60-20-14



After the calibration procedure has been completed, with the engine off, turn the key to the ON position. Turn the engine speed control to the high speed position. The engine speed control lever (Item 1) must contact the stop (Item 2) **[Figure 60-20-14]**.

Figure 60-20-15



Turn the engine speed control to the low speed position. The engine speed control lever (Item 1) must contact the stop (Item 2) **[Figure 60-20-15]**.

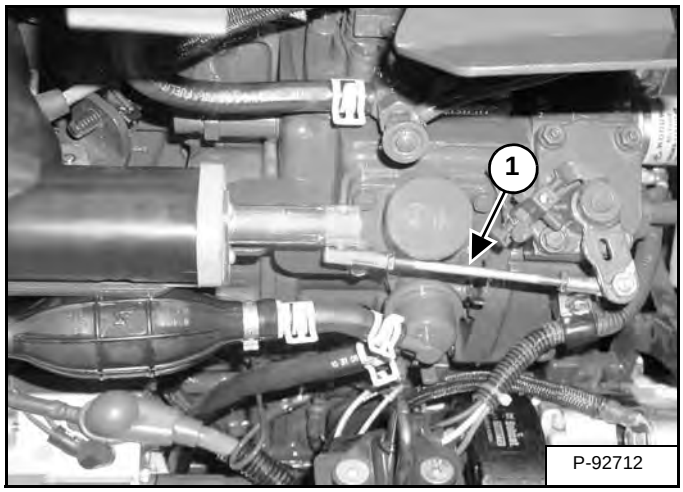
If the control lever does not contact both stops, repeat the calibration procedure.

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ENGINE SPEED CONTROL (CONT'D)

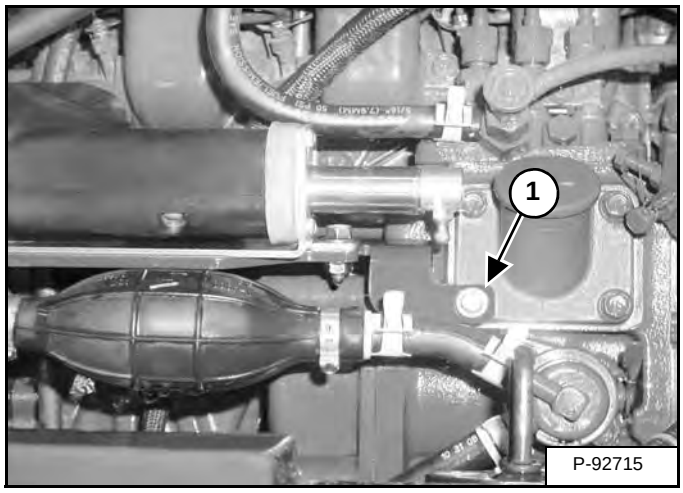
Actuator Removal And Installation

Figure 60-20-16



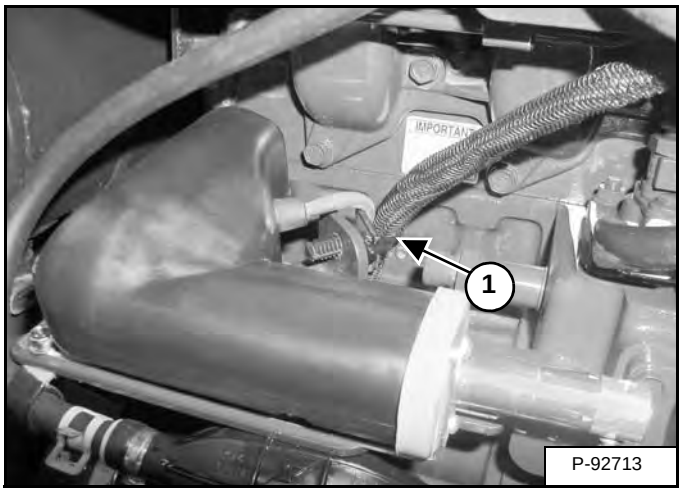
Pry down on the linkage (Item 1) **[Figure 60-20-16]** and remove the linkage from the actuator.

Figure 60-20-17



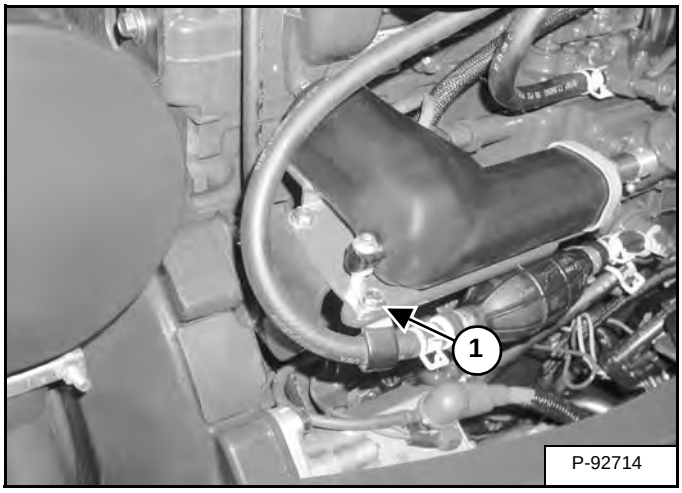
Remove the bolt (Item 1) **[Figure 60-20-17]**.

Figure 60-20-18



Cut and remove the cable tie (Item 1) **[Figure 60-20-18]**.

Figure 60-20-19

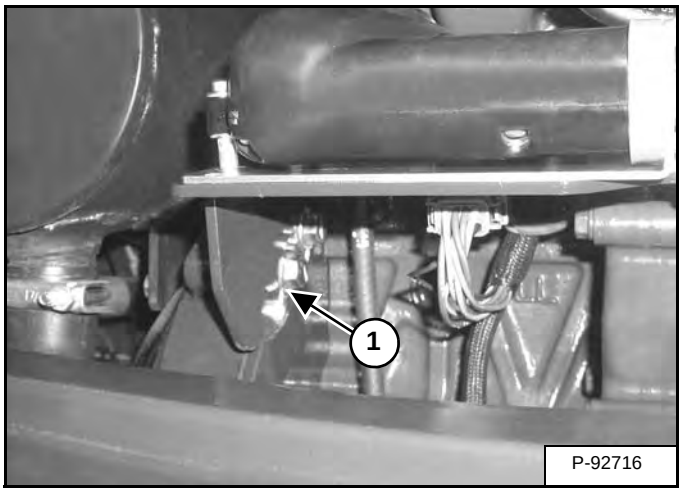


Remove the bolt (Item 1) **[Figure 60-20-19]** and reposition the fuel line.

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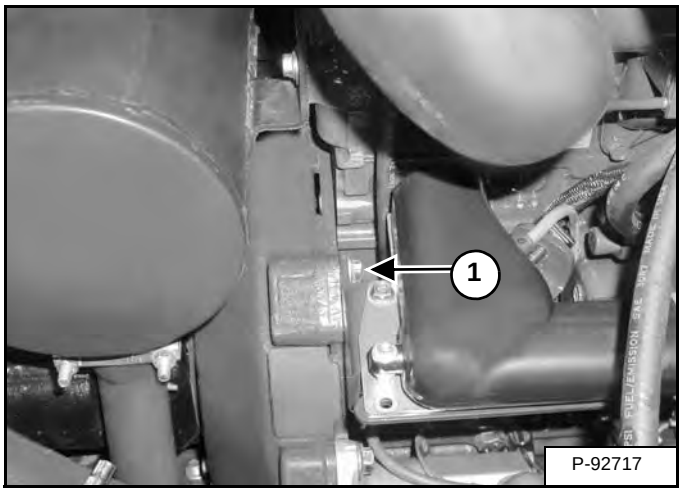
Actuator Removal And Installation (Cont'd)

Figure 60-20-20



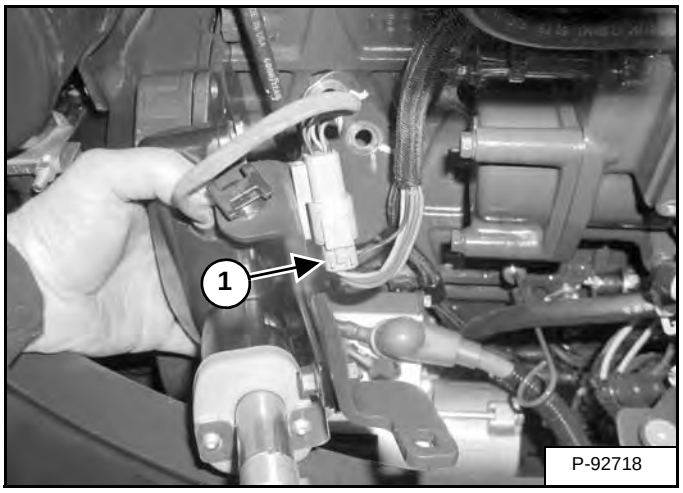
Remove the bolt (Item 1) **[Figure 60-20-20]**.

Figure 60-20-21



Remove the bolt (Item 1) **[Figure 60-20-21]**.

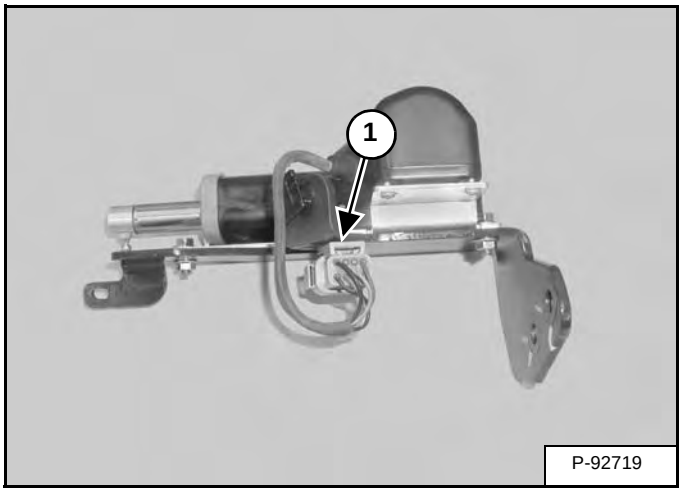
Figure 60-20-22



Tip the actuator / mount assembly over and disconnect the wire harness (Item 1) **[Figure 60-20-22]**.

Remove the actuator / mount assembly from the excavator.

Figure 60-20-23

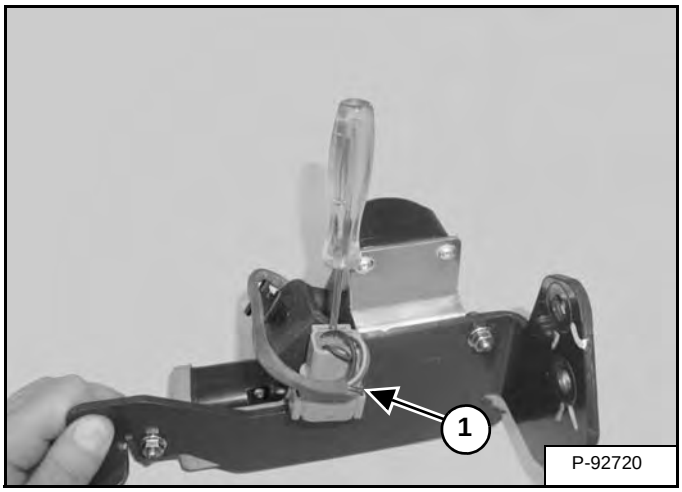


Install a flat bladed screw driver in the slot (Item 1) **[Figure 60-20-23]** of the wire harness connector.

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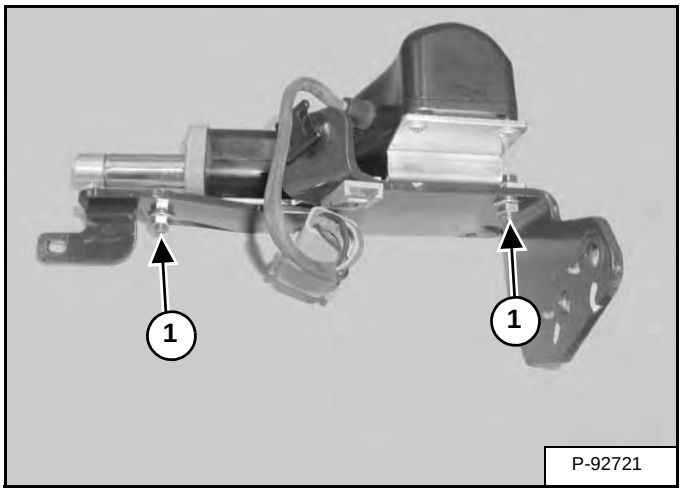
Actuator Removal And Installation (Cont'd)

Figure 60-20-24



Push down on the screw driver to remove the connector (Item 1) **[Figure 60-20-24]** from the mount.

Figure 60-20-25



Remove the two bolts and nuts (Item 1) **[Figure 60-20-25]**. Remove the actuator from the mount.

After installing the actuator, the engine speed control system must be calibrated. (See Calibration on Page 60-20-3.)

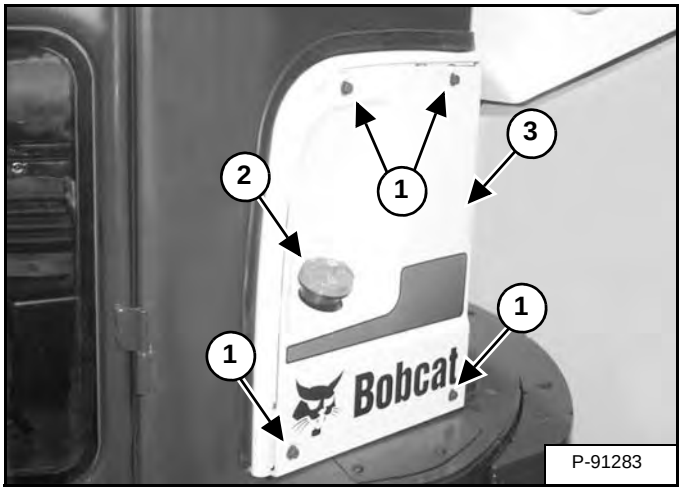
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MUFFLER

Removal And Installation

Open the tailgate.

Figure 60-30-1

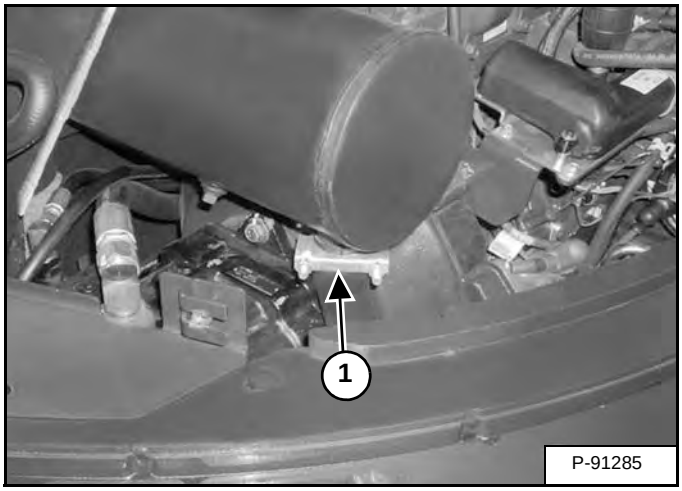


Remove the four bolts (Item 1), fuel cap (Item 2) and side cover (Item 3) **[Figure 60-30-1]**.

Reinstall the fuel cap (Item 2) **[Figure 60-30-1]**.

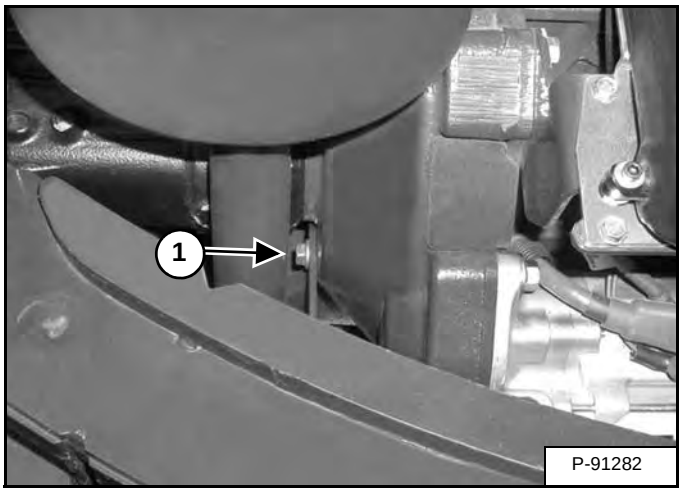
NOTE: Reinstall the fuel cap to prevent any contamination from entering the fuel tank.

Figure 60-30-2



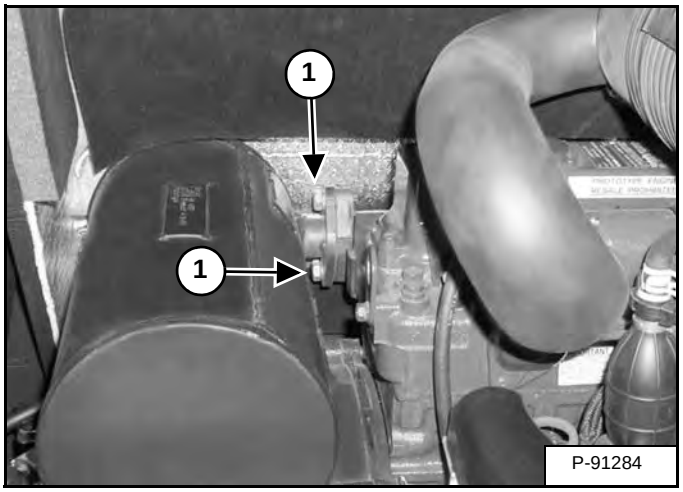
Remove the clamp (Item 1) **[Figure 60-30-2]**.

Figure 60-30-3



Remove the bolt (Item 1) **[Figure 60-30-4]** and remove the tail pipe.

Figure 60-30-4



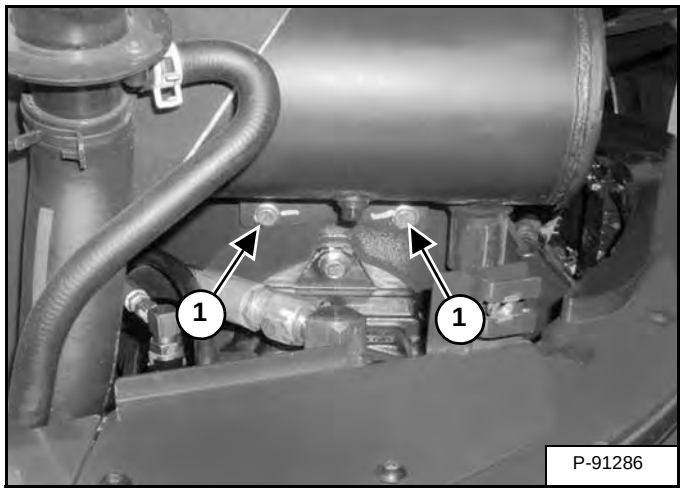
Remove the two bolts (Item 1) **[Figure 60-30-4]** and washers.

Installation: Tighten the bolts to 54 - 61 N•m (40 - 45 ft-lb) torque.

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Removal And Installation (Cont'd)

Figure 60-30-5



Remove the two bolts (Item 1) **[Figure 60-30-5]**.

Remove the muffler.

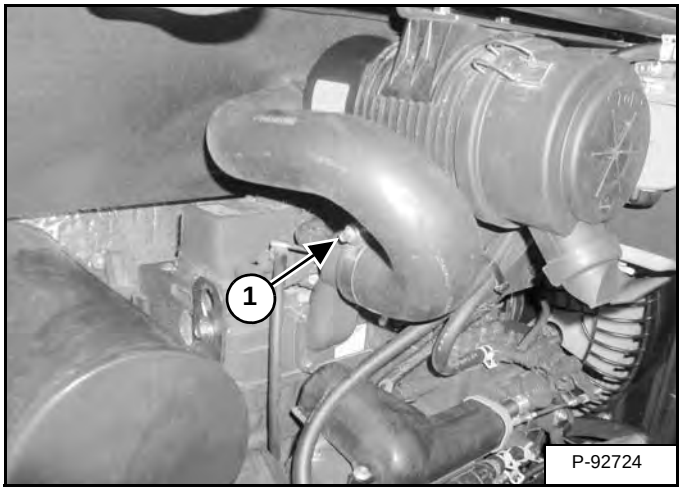
Dealer Copy -- Not for Resale

AIR CLEANER

Removal And Installation

Open the tailgate.

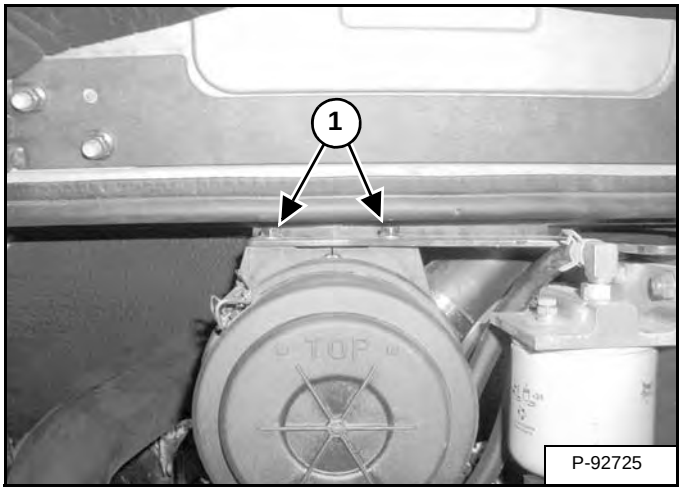
Figure 60-40-1



Loosen the clamp (Item 1) **[Figure 60-40-1]** and remove the hose from the intake manifold.

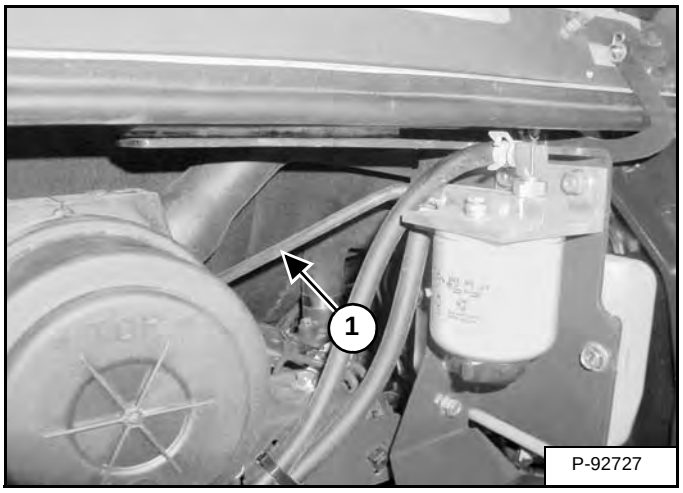
NOTE: Plug the intake manifold to prevent any contamination from entering the engine.

Figure 60-40-2



Remove the bolts (Item 1) **[Figure 60-40-2]** from the air cleaner.

Figure 60-40-3



Lower the air cleaner assembly and remove the air filter indicator hose (Item 1) **[Figure 60-40-3]**.

Remove the air cleaner assembly from the excavator.

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Dealer Copy -- Not for Resale

ENGINE COOLING SYSTEM

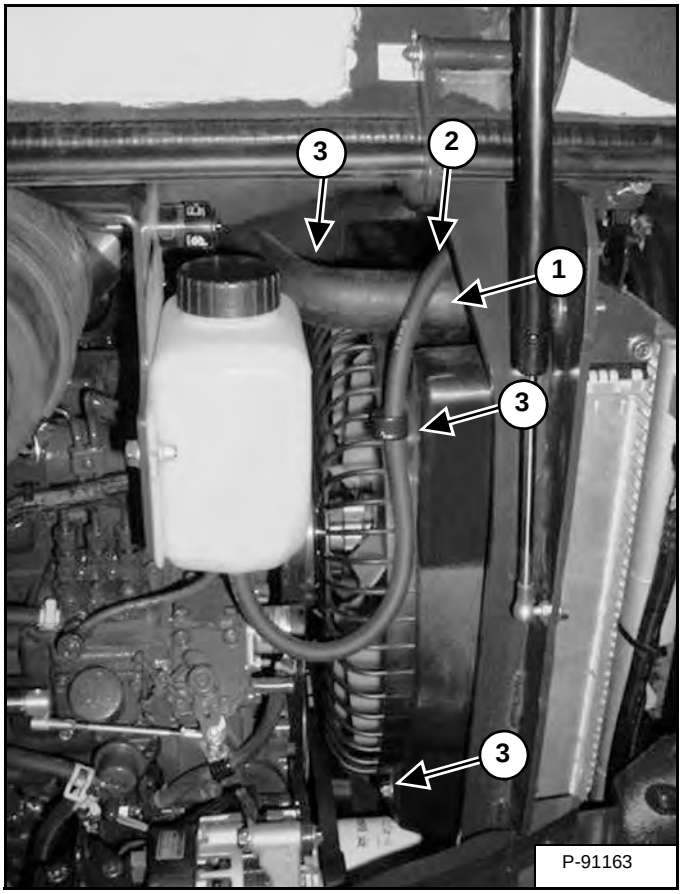
Radiator Removal And Installation

Remove the hydraulic reservoir. (See Removal And Installation on Page 20-140-1.)

Remove the oil cooler. (See Removal And Installation on Page 20-150-1.)

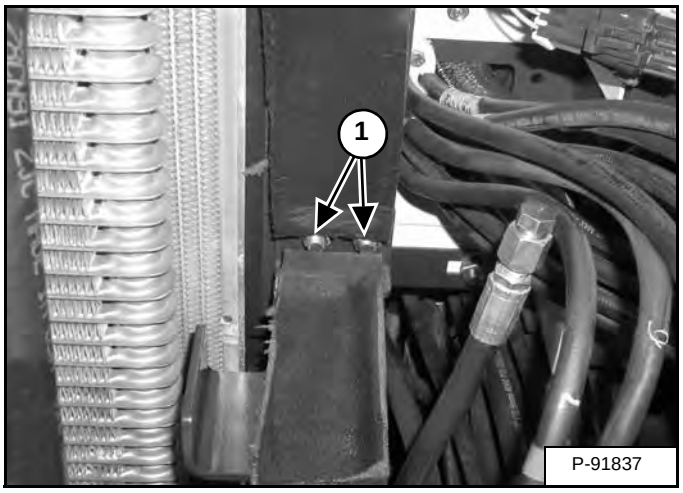
Drain the coolant. (See Removing And Replacing Coolant on Page 10-100-3.)

Figure 60-50-1



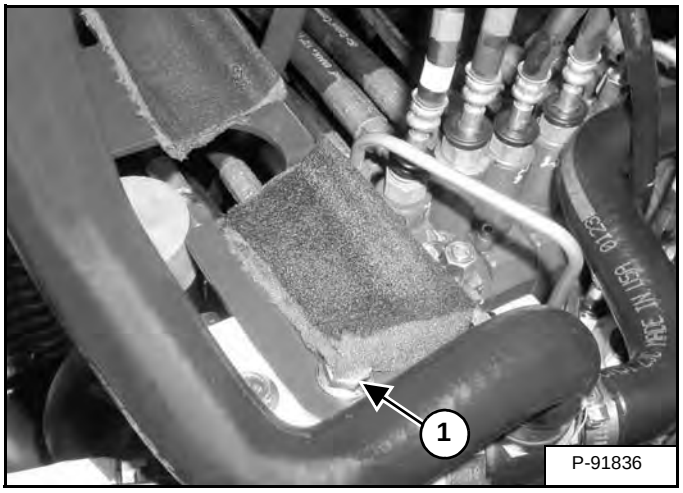
Remove the top hose (Item 1) and overflow hose (Item 2). Remove the three bolts (Item 3) **[Figure 60-50-1]** and remove the fan guard.

Figure 60-50-2



Remove the nuts (Item 1) **[Figure 60-50-2]**.

Figure 60-50-3

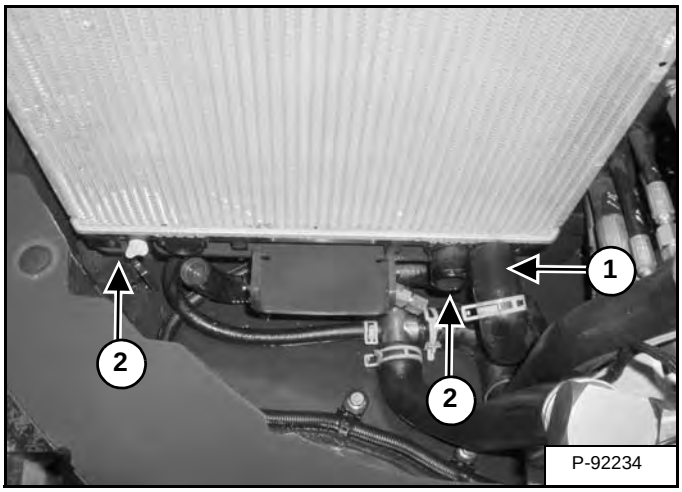


Remove the bolt (Item 1) **[Figure 60-50-3]** and remove the bracket.

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Radiator Removal And Installation (Cont'd)

Figure 60-50-4



Remove the lower hose (Item 1). Remove the nuts (Item 2) **[Figure 60-50-4]** from the bottom of the radiator.

Figure 60-50-5

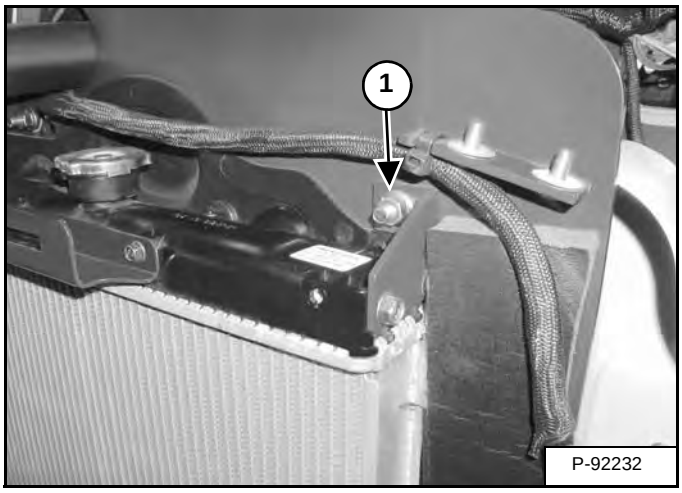
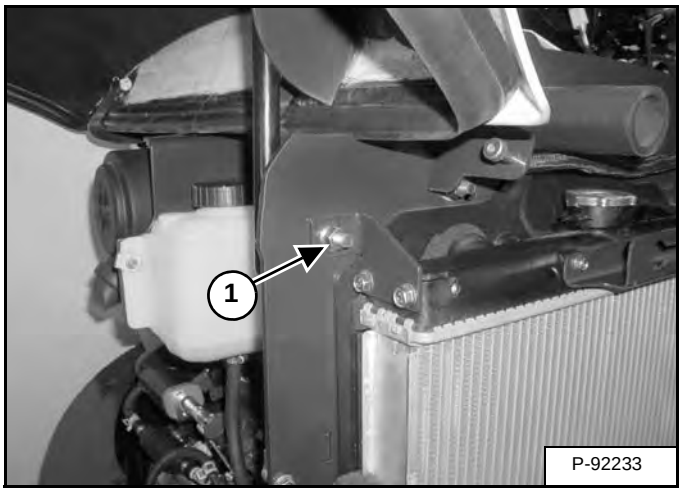


Figure 60-50-6



Remove the nuts (Item 1) **[Figure 60-50-5]** and **[Figure 60-50-6]** from the top of the radiator.

Remove the radiator.

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Radiator Removal And Installation (Cont'd)

Figure 60-50-7

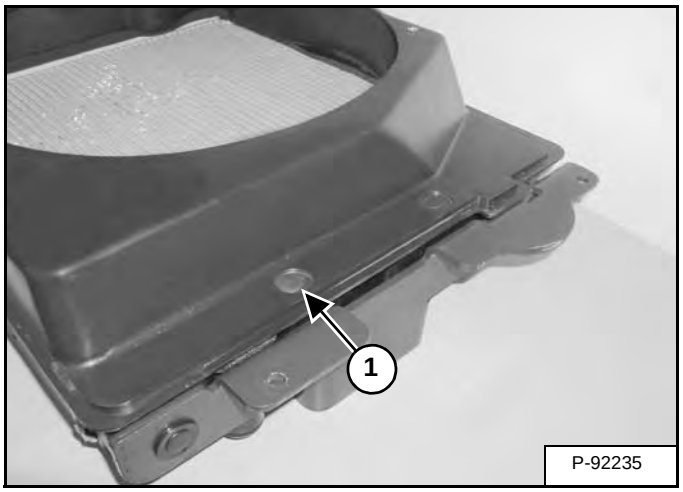
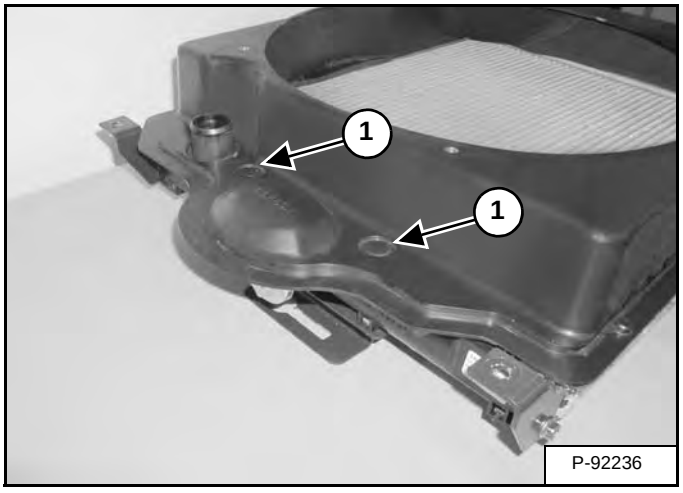


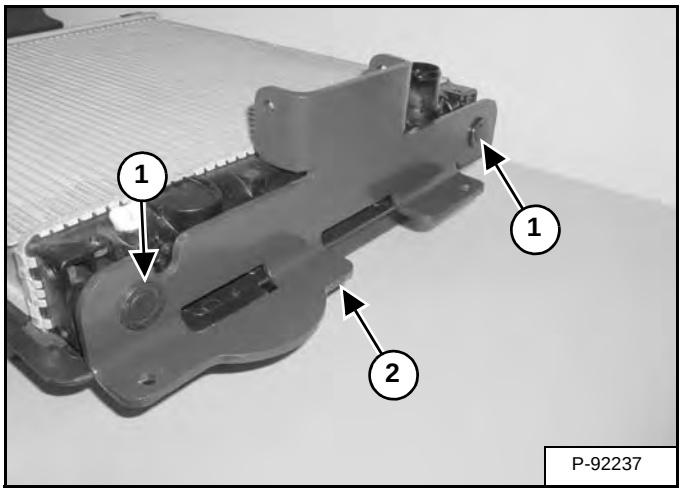
Figure 60-50-8



Remove the fasteners (Item 1) **[Figure 60-50-7]** and **[Figure 60-50-8]**.

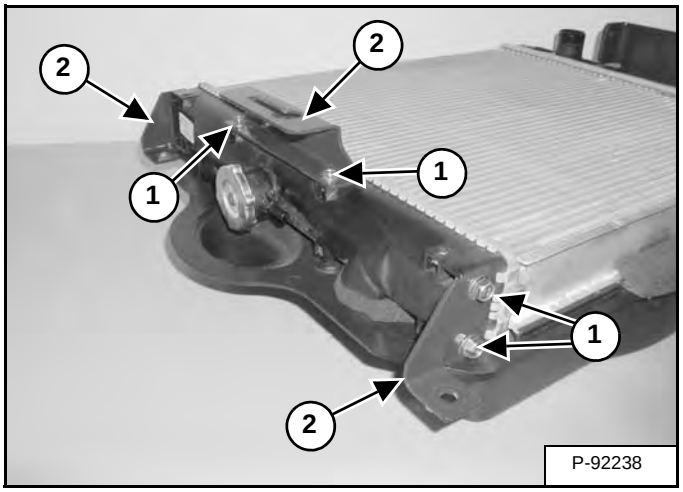
Remove the shroud.

Figure 60-50-9



Remove the fasteners (Item 1). Remove the bottom bracket (Item 2) **[Figure 60-50-9]**.

Figure 60-50-10

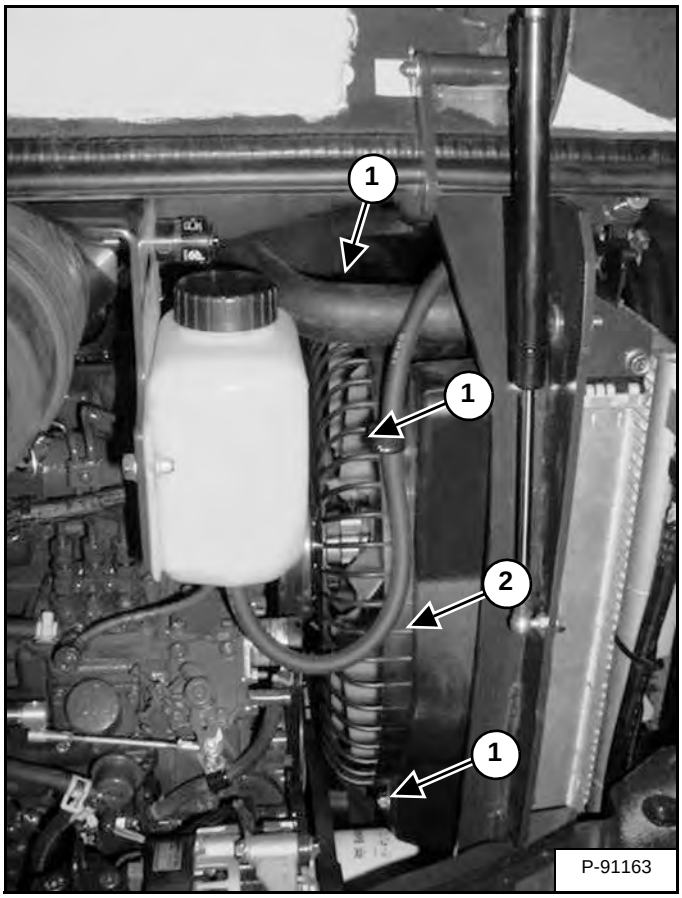


Remove the bolts (Item 1) and remove the top brackets (Item 2) **[Figure 60-50-10]**.

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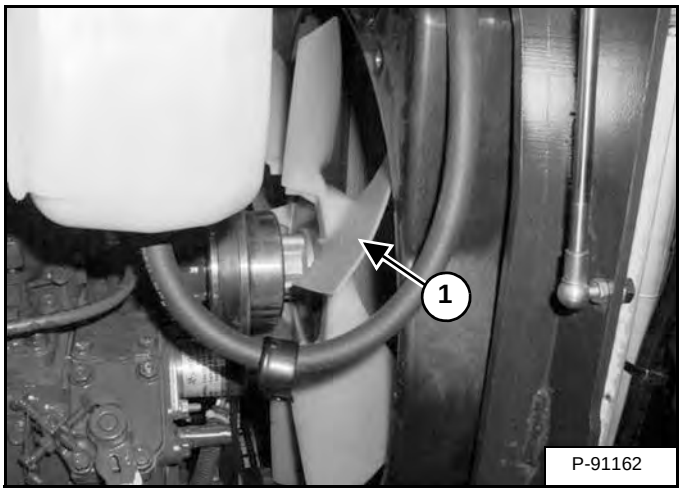
Fan Removal And Installation

Figure 60-50-11



Remove the three bolts (Item 1) and fan guard (Item 2) **[Figure 60-50-11]**.

Figure 60-50-12



Remove the four bolts and fan (Item 1) **[Figure 60-50-12]**.

Installation: Install new bolts with pre-applied thread adhesive. Tighten the bolts to 16,3 - 20,3 N•m (12 - 15 ft-lb) torque.

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Water Pump Removal And Installation

Drain the cooling system.

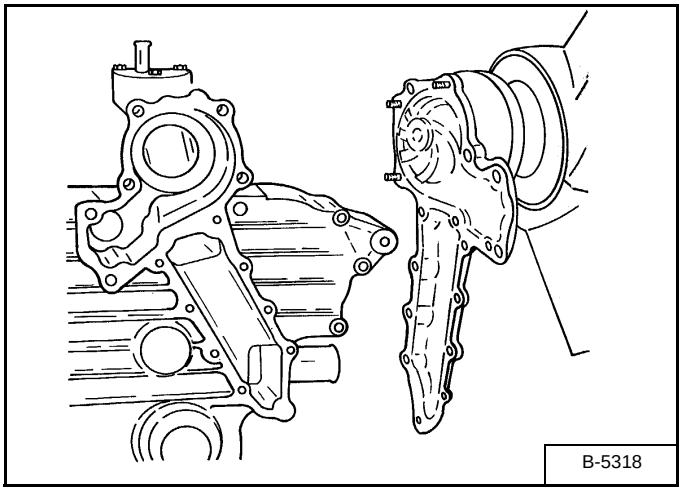
Remove the radiator. (See Radiator Removal And Installation on Page 60-50-1.)

Remove the alternator belt.

Remove the fan.

Remove the water pump bolts.

Figure 60-50-13



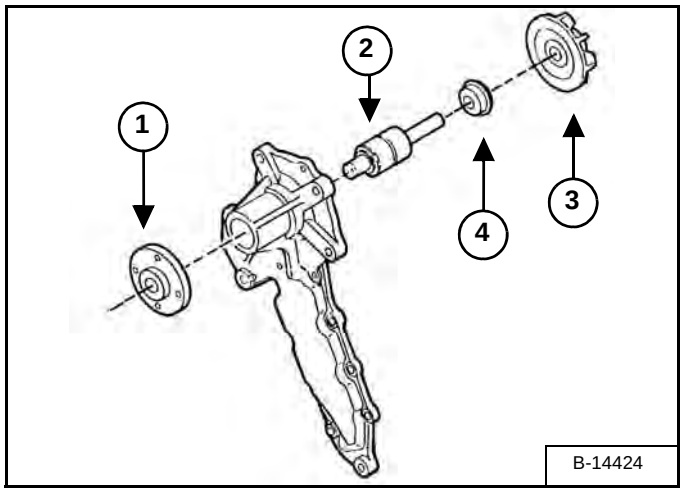
Remove the water pump **[Figure 60-50-13]**.

Installation: Always use a new gasket when installing the water pump.

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Water Pump Disassembly And Assembly

Figure 60-50-14



Remove the flange (Item 1) **[Figure 60-50-14]**.

Press the shaft (Item 2) and impeller (Item 3) **[Figure 60-50-14]** out the impeller side of the water pump.

Remove the impeller (Item 3) **[Figure 60-50-14]** from the shaft.

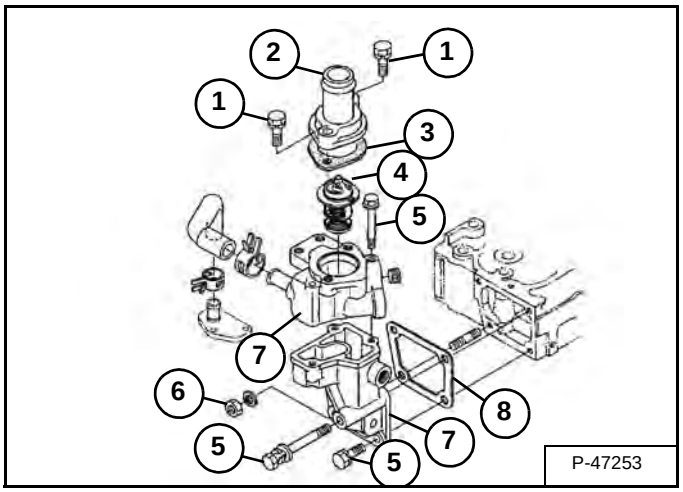
Remove the seal (Item 4) **[Figure 60-50-14]**.

Install a new seal (Item 4) **[Figure 60-50-14]** when assembling the water pump.

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Thermostat Housing Removal And Installation

Figure 60-50-15



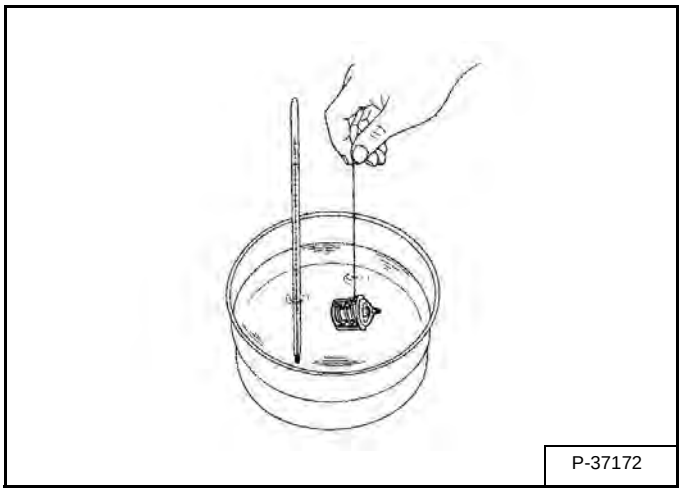
Remove the bolts (Item 1), housing (Item 2), gasket (Item 3) and thermostat (Item 4) **[Figure 60-50-15]**.

Remove bolts (Item 5), nut (Item 6), top and bottom housing (Item 7), and gasket (Item 8) from the cylinder head **[Figure 60-50-15]**.

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Thermostat - Checking

Figure 60-50-16



Push down the thermostat valve and insert a string between the valve and the valve seat.

Place the thermostat and a thermometer in a container with water and gradually heat the water **[Figure 60-50-16]**.

Hold the string to suspend the thermostat in the water. When the water temperature rises, the thermostat valve will open, allowing it to fall down from the string.

Continue heating the water and read the temperature when the valve has risen by about 8 mm (0.315 in.).

If the measurement is not acceptable, replace the thermostat.

Thermostat's valve opening temperature	Factory spec.	74,5 - 78,5°C 166.1 - 173°F
Temperature at which thermostat completely opens	Factory spec.	90°C 194°F

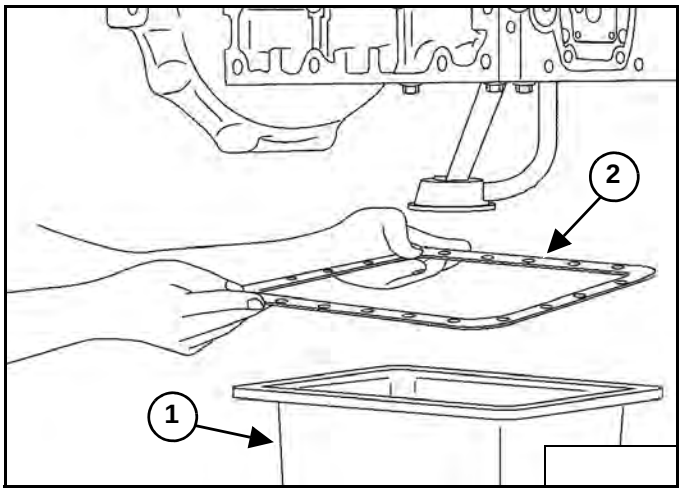
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Oil Pan Removal And Installation

Remove the engine assembly from the excavator. (See Engine Removal And Installation on Page 60-10-11.)

The engine will have to be on an engine stand or suspended in the air safely to remove the oil pan.

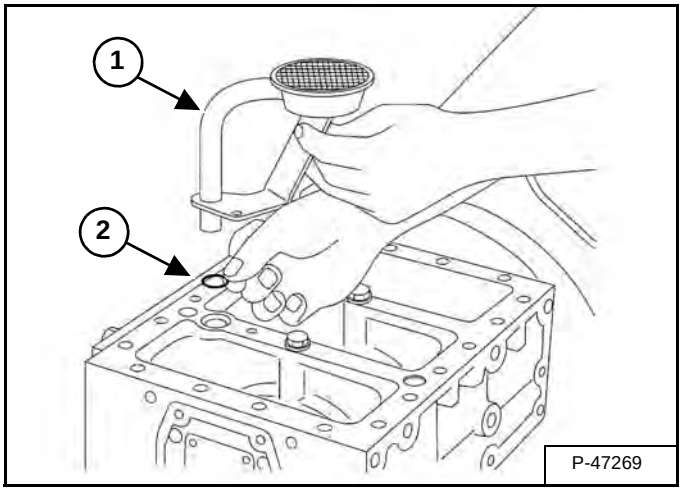
Figure 60-60-1



Remove the oil bolts securing the oil pan (Item 1) **[Figure 60-60-1]**. Slightly tapping on the oil pan with a soft mallet will break lose the oil pan from the engine block.

Installation: Use a liquid gasket adhesive to the oil side of the oil pan gasket (Item 2) **[Figure 60-60-1]**. Tighten the oil pan bolts to 39 - 75 N•m (29 - 33 ft-lb) torque.

Figure 60-60-2



Remove the oil pump strainer (Item 1) and O-ring (Item 2) **[Figure 60-60-2]** by tapping the edge of the strainer with a soft faced hammer.

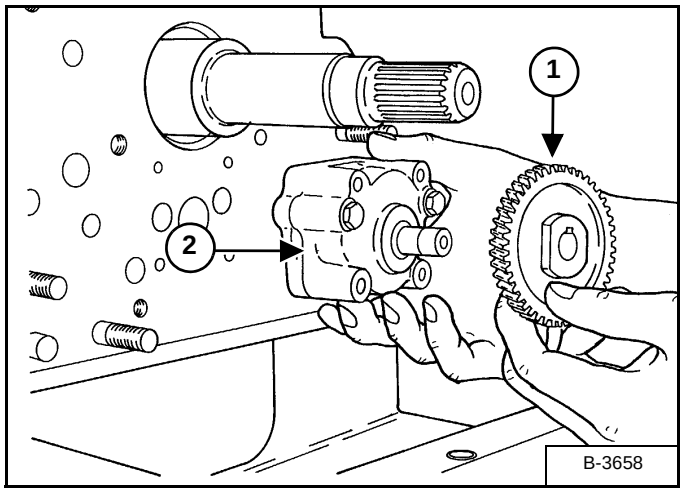
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Oil Pump Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-100-1.)

Remove the crankshaft gear.

Figure 60-60-3



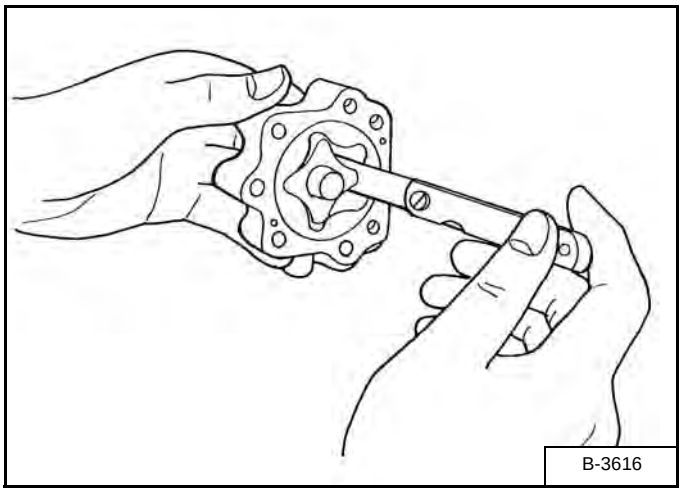
Remove the nut from the oil pump shaft. Use a puller to remove the oil pump gear (Item 1) **[Figure 60-60-3]**.

Remove the oil pump mounting bolts. Remove the oil pump (Item 2) **[Figure 60-60-3]**.

Installation: Tighten the oil pump mounting bolts to 6,9 - 8,1 N•m (60 - 72 in-lb) torque.

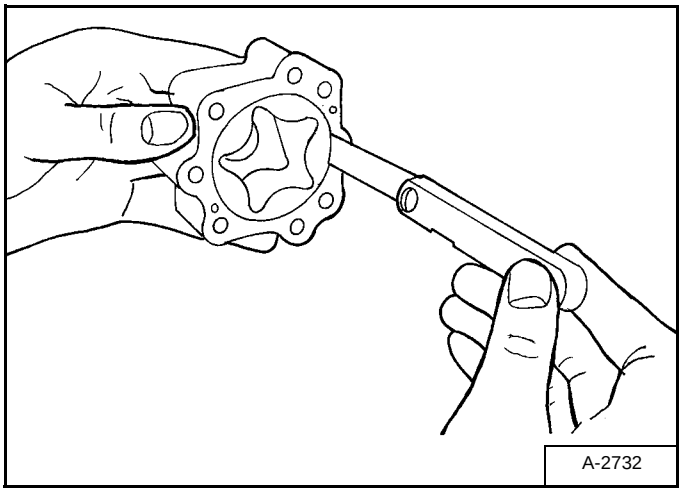
Oil Pump Inspection

Figure 60-60-4



Measure the clearance between the lobes of the inner rotor and outer rotor **[Figure 60-60-4]**.

Figure 60-60-5



Measure the clearance between the outer rotor and pump body **[Figure 60-60-5]**.

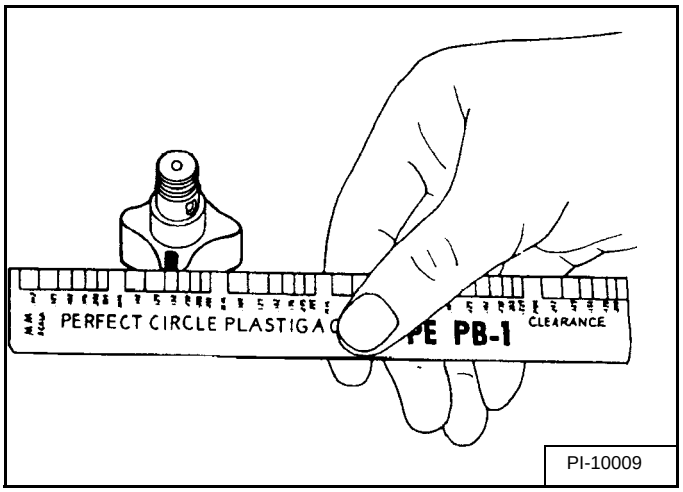
If the clearance exceeds the allowable limit, replace the oil pump.

Clearance Between Inner & Outer Rotor	0,03 - 0,14 mm (0.0012 - 0.0055 in)
Allowable Limit	0,2 mm (0.008 in)
Clearance Between Outer Rotor & Body	0,11 - 0,19 mm (0.0043 - 0.0075 in)
Allowable Limit	0,25 mm (0.0098 in)

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Oil Pump Inspection (Cont'd)

Figure 60-60-6



Put a piece of press gauge on the rotor face **[Figure 60-60-6]**.

Install the cover and tighten the bolts.

Remove the cover carefully. Measure the width of the press gauge **[Figure 60-60-6]**.

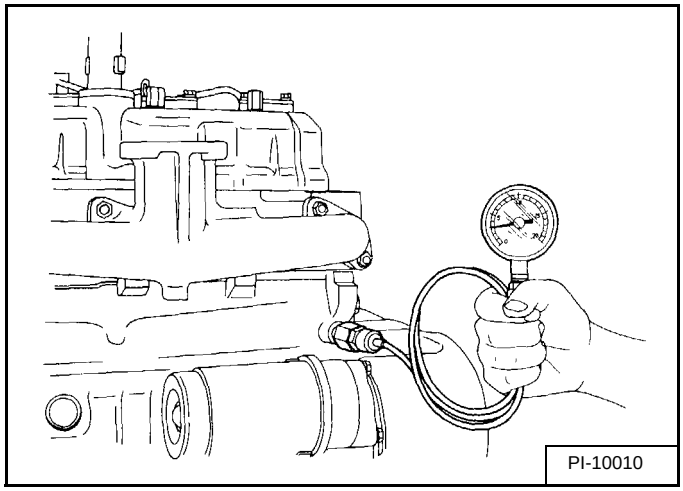
If the clearance exceeds the allowable limit replace the oil pump.

End Clearance	0,104 - 0,15 mm (0.0041 - 0.0059 in)
Allowable Limit	0,20 mm (0.008 in)

Engine Oil Pressure - Testing

Remove the oil pressure sender.

Figure 60-60-7



Install a pressure gauge **[Figure 60-60-7]**.

Start the engine and run until it is at operating temperature.

If the oil pressure is less than the allowable limit, check the following items:

* Engine Oil Level Low
* Oil Pump Defective
* Oil Galley Plugged
* Oil Strainer Plugged
* Excessive Clearance at the Rod And Main Bearings
* Oil Pump Relief Valve Stuck

At Idle Speed Allowable Limit	48 kPa (0,48 bar) (7 psi)
At Rated Speed	289 - 441 kPa (2,94 - 4,4 bar) (42 - 64 psi)
Allowable Limit	248 kPa (2,5 bar) (36 psi)

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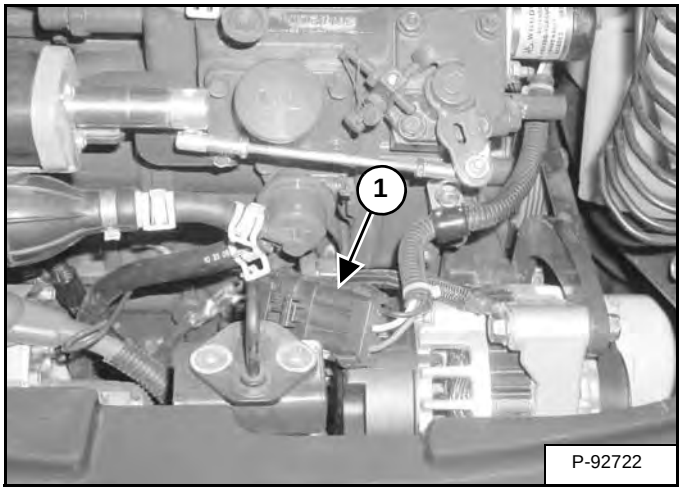


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Fuel Shutoff Solenoid - Checking

Stop the engine and open the tailgate.

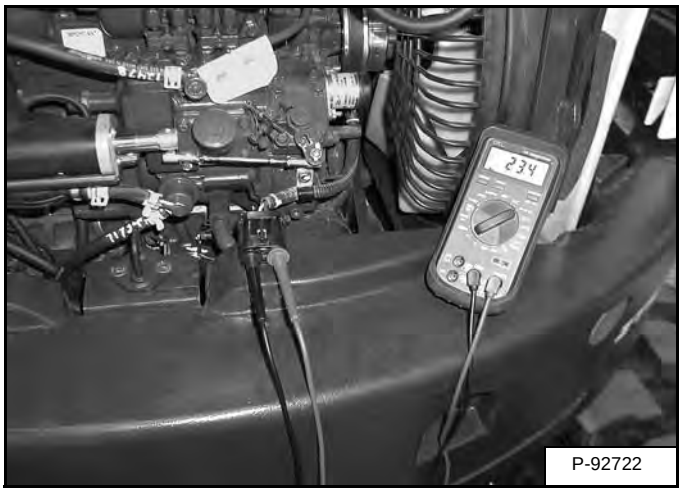
Figure 60-70-1



Disconnect the fuel shut off solenoid wire harness (Item 1) **[Figure 60-70-1]**.

Use an ohmmeter to check the fuel shut off solenoid.

Figure 60-70-2

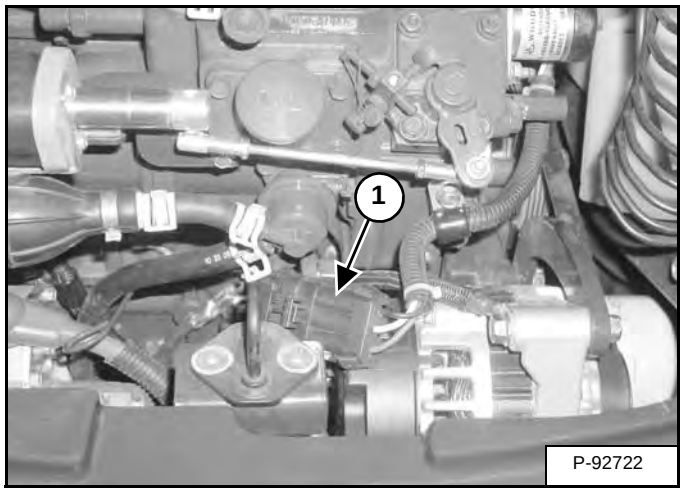


The reading between terminals A - B and A - C should be approximately 23.7 ohm. The reading between terminals B - C should be approximately 0.3 ohm **[Figure 60-70-2]**.

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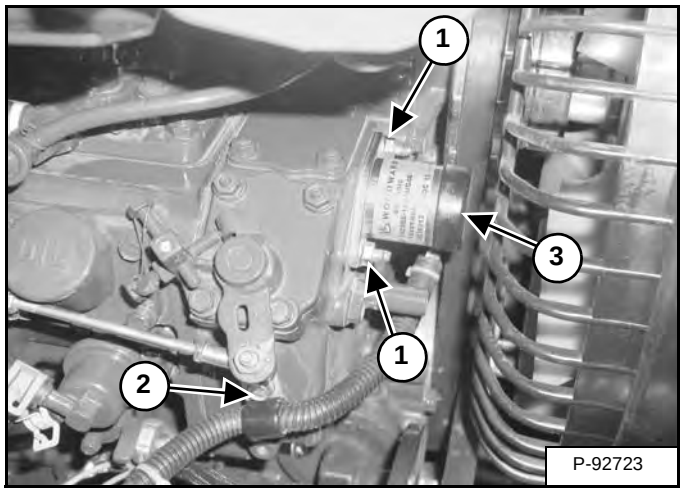
Fuel Shut-off Solenoid Removal And Installation

Figure 60-70-3



Disconnect the wire harness (Item 1) **[Figure 60-70-3]**.

Figure 60-70-4

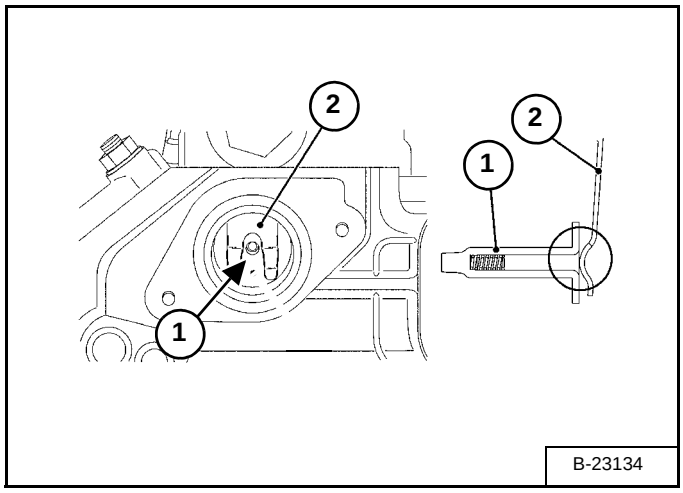


Remove the nuts (Item 1) **[Figure 60-70-4]**.

Remove the bolt (Item 2) **[Figure 60-70-4]**.

Remove the solenoid (Item 3) **[Figure 60-70-4]**.

Figure 60-70-5



Installation: The guide (Item 1) on the fuel shut-off solenoid must contact the boost lever (Item 2) **[Figure 60-70-5]**.

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Fuel Injection Pump - Checking

The injection pump contains parts which have a very close tolerance and its operation has a direct effect on the performance of the engine.

⚠ WARNING

AVOID INJURY OR DEATH

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

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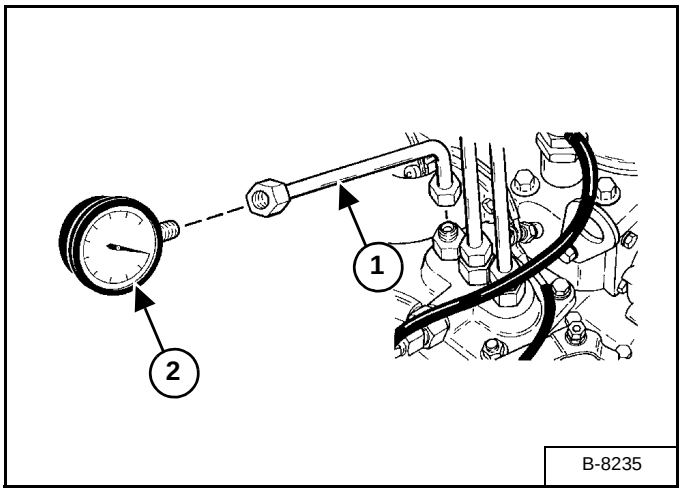
The tools listed will be needed to do the following procedure:

MEL1237 - Adapter Fuel Line
MEL1173-1 Pressure Gauge

To check the discharge pressure at the fuel injection pump, use the following procedure:

Disconnect a high pressure fuel line from the injection pump. Loosen the other end of the same fuel line so it can be turned away from the fitting.

Figure 60-70-6



Connect the adapter fuel line (Item 1) to the fitting and connect the pressure gauge (Item 2) **[Figure 60-70-6]**.

Move the speed control lever to the high engine idle position.

Turn the flywheel to increase the pressure. If the pressure can not reach the allowable limit, replace the injection pump assembly.

Fuel Tightness of Pump Element Allowable Limit	18630 kPa (186 bar) (2702 psi)

With the speed control lever at the low engine idle position, turn the flywheel until the pressure is at 18630 - 20105 kPa (186 - 201 bar) (2702 - 2916 psi).

Turn the flywheel back approximately one-half turn. Keep the flywheel at this position, and measure the time it takes the pressure to decrease from 12755 kPa (127,5 bar) (1850 psi).

Fuel Tightness of Delivery Valve Allowable Limit	5 Seconds

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Fuel Injection Pump Removal And Installation

IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

I-2029-0289

IMPORTANT

Do not attempt to maintain or adjust unless you are trained and have the correct equipment.

I-2028-0289

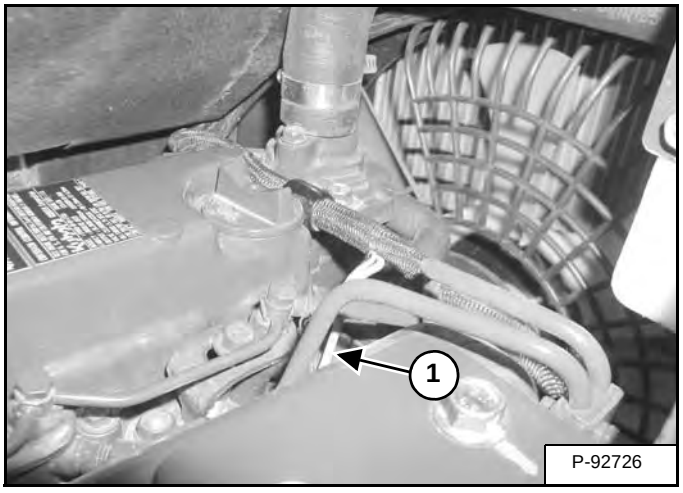
Remove the air cleaner. (See Removal And Installation on Page 60-40-1.)

Remove the fuel shut-off solenoid. (See Fuel Shut-off Solenoid Removal And Installation on Page 60-70-2.)

Disconnect the negative (-) cable from the battery.

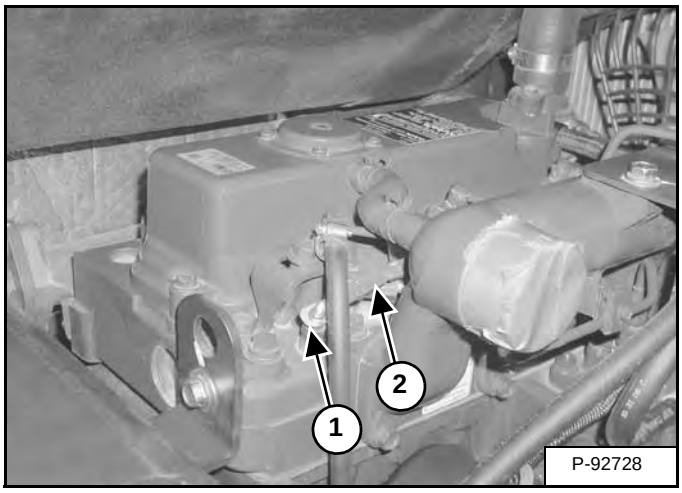
Clean around the injection pump.

Figure 60-70-7



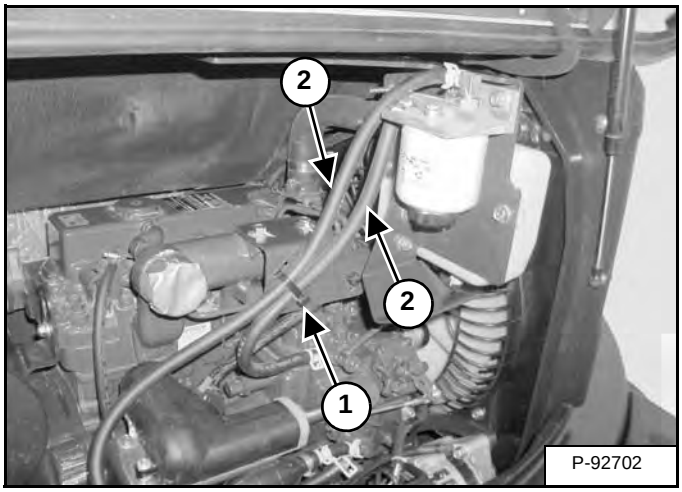
Remove the nut and wire harness (Item 1) **[Figure 60-70-7]** from the right glow plug.

Figure 60-70-8



Remove the nuts (Item 1) from the two remaining glow plugs. Remove the strap (Item 2) **[Figure 60-70-8]** from the glow plugs.

Figure 60-70-9

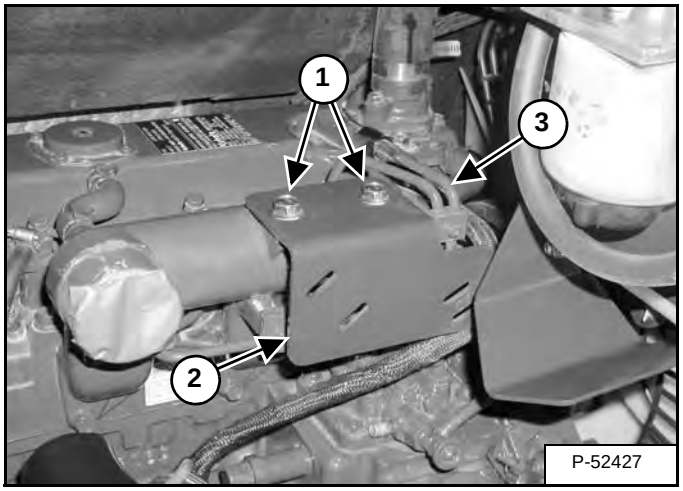


Cut and remove the tie strap (Item 1). Remove the fuel lines (Item 2) **[Figure 60-70-9]**.

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Fuel Injection Pump Removal And Installation (Cont'd)

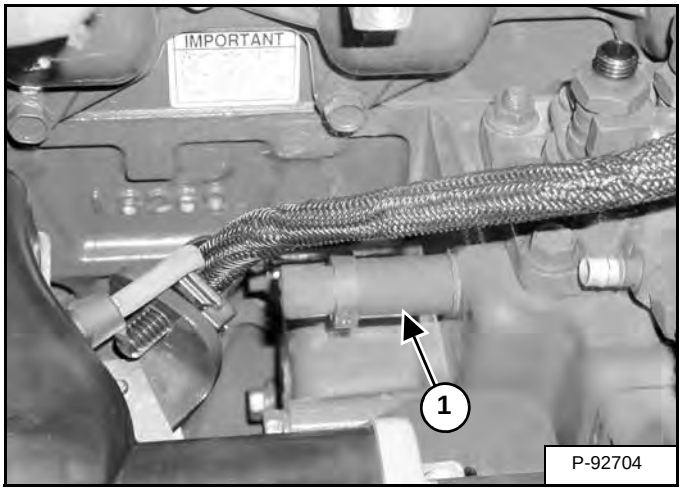
Figure 60-70-10



Remove the bolts (Item 1) and bracket (Item 2) **[Figure 60-70-10]**.

Disconnect the high pressure fuel lines (Item 3) **[Figure 60-70-10]** from the fuel injectors and fuel injection pump.

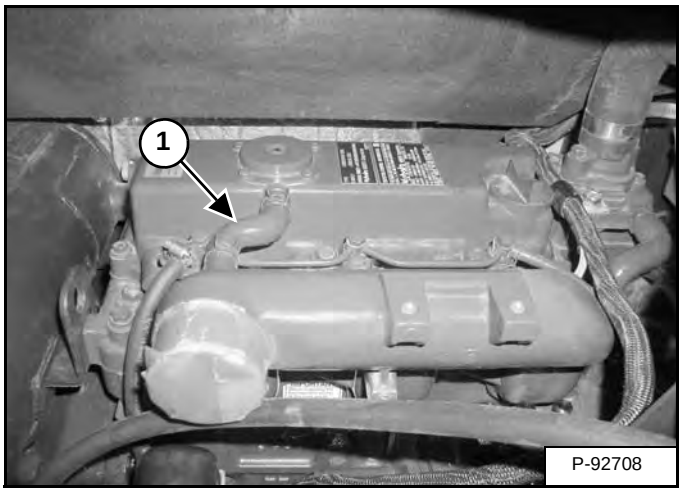
Figure 60-70-11



Remove the high idle body (Item 1) **[Figure 60-70-11]**.

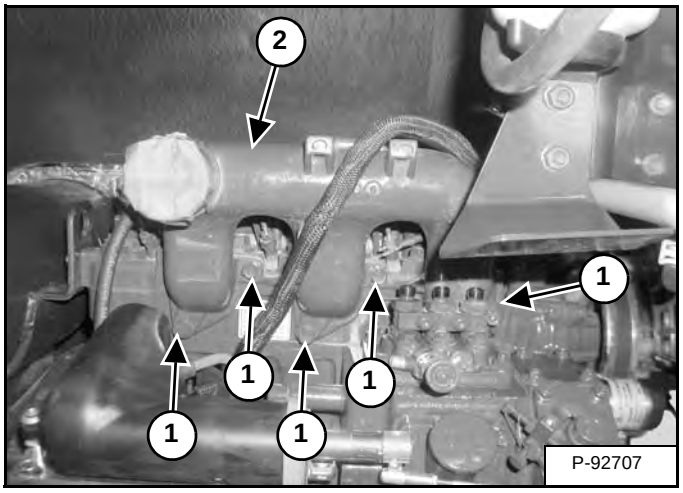
Installation: Tighten the high idle body to 44 - 49 N•m (33 - 36 ft-lb) torque.

Figure 60-70-12



Remove the hose (Item 1) **[Figure 60-70-12]**.

Figure 60-70-13

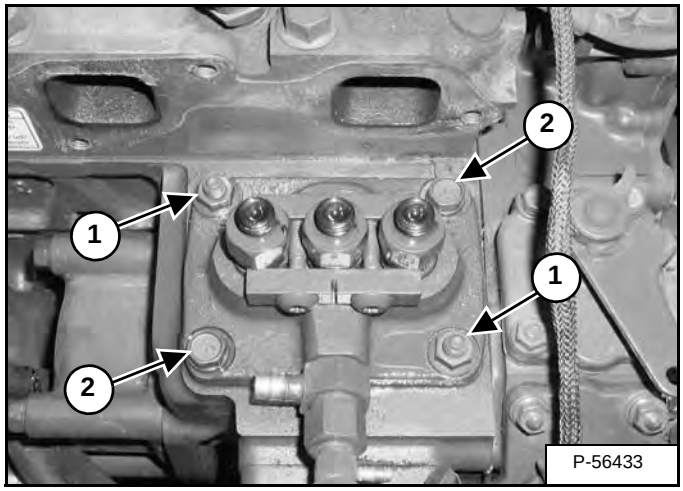


Remove the bolts (Item 1) and remove the intake manifold (Item 2) **[Figure 60-70-13]**.

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Fuel Injection Pump Removal And Installation (Cont'd)

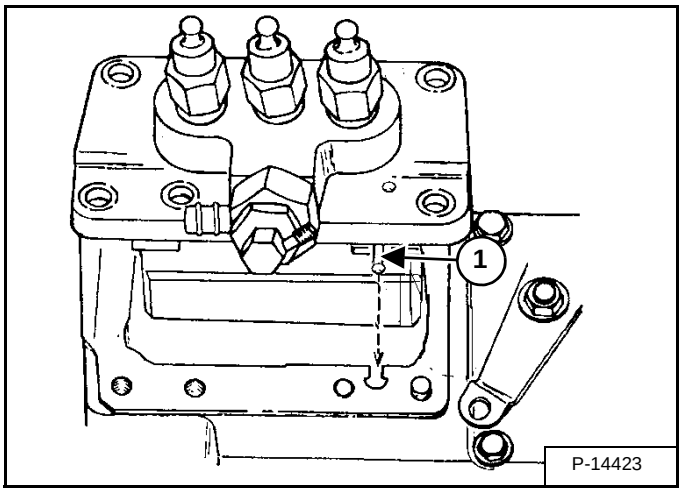
Figure 60-70-14



Remove the nuts (Item 1) and bolts (Item 2) **[Figure 60-70-14]**.

Remove the injection pump.

Figure 60-70-15



Installation: When the injection pump is installed, the rack pin (Item 1) **[Figure 60-70-15]** must be aligned with the slot in the engine block and positioned on the left side of the fork lever.

If the rack pin is not installed correctly engine damage can result.

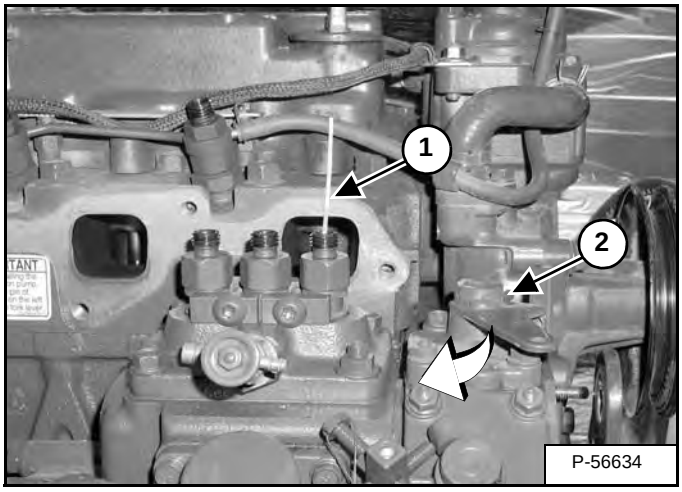
NOTE: Make sure the same number of shims with the same thickness are installed under the injection pump. The shims are used for engine timing.

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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 engine block.

Figure 60-70-16



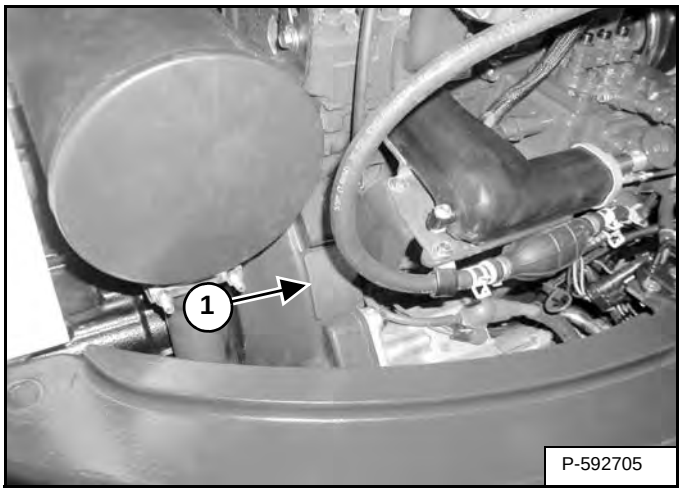
Turn the fuel supply lever to the ON position. Install a short plastic tube (Item 1) **[Figure 60-70-16]** in the fitting of the number one cylinder port. Point the tube up (vertical).

Turn the engine counterclockwise until fuel flows out of the injection pumps number 1 cylinder nozzle. (Install a tool on the crankshaft at the front of the engine to turn the engine.)

NOTE: The fuel must flow out of the nozzle for one firing cycle before timing can be attempted.

Pull the stop lever (Item 2) **[Figure 60-70-16]** 5,9 - 7,7 mm (0.232 - 0.302 in) from the free position toward the stop position.

Figure 60-70-17



Remove the rubber plug (Item 1) **[Figure 60-70-17]**.

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Fuel Injection Pump - Timing (Cont'd)

Figure 60-70-18

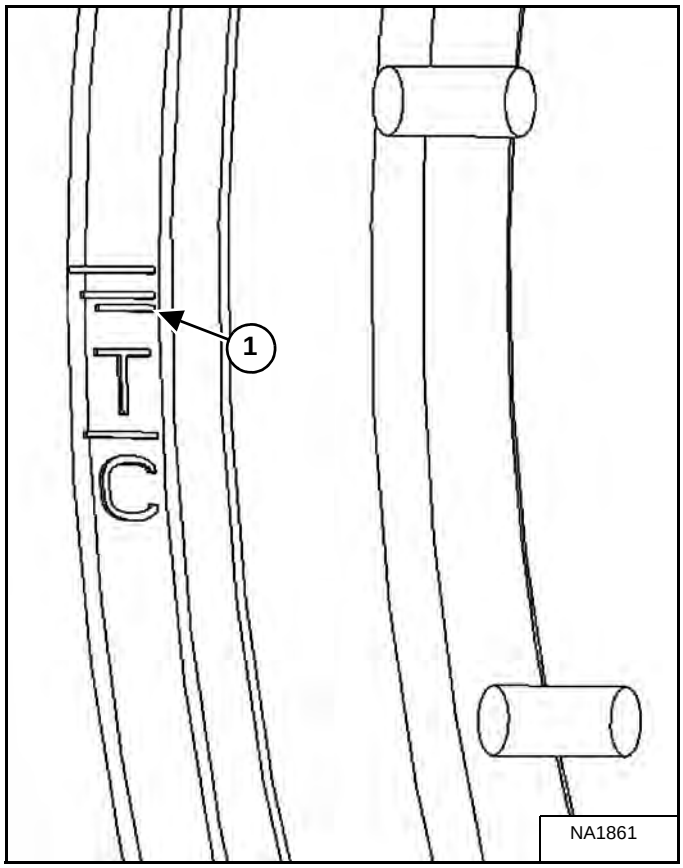
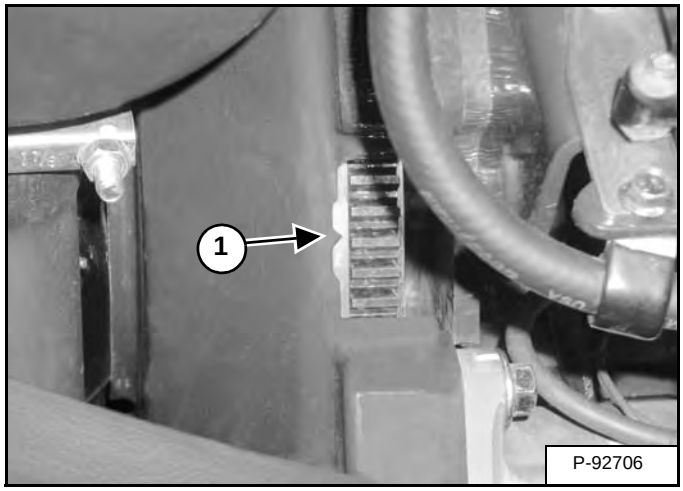
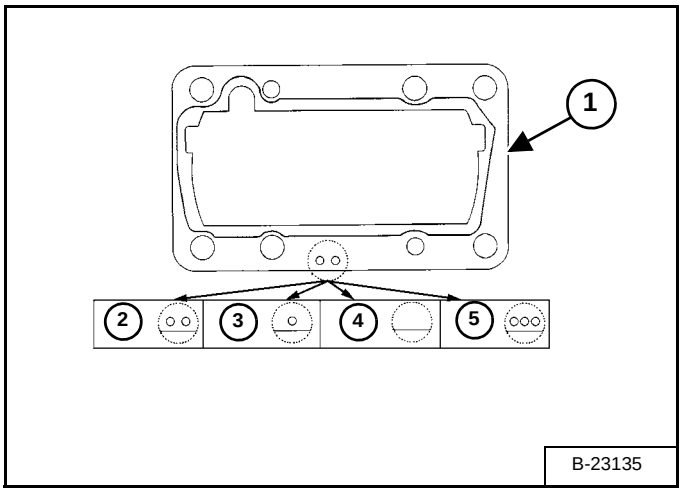


Figure 60-70-19



Continue to turn the engine slowly (for approximately one and three-quarter turns after fuel stops flowing from the injection pump nozzle), until the timing mark on the side of the flywheel (Item1) **[Figure 60-70-18]** is at the edge of the timing hole (Item 1) **[Figure 60-70-19]** in the flywheel housing.

Figure 60-70-20



The correct engine timing is 5.0° B.T.D.C. Add or subtract shims (Item 1) **[Figure 60-70-20]** to time the engine to 5.0° B.T.D.C. The engine is correctly timed when the correct mark on the flywheel is aligned with the notch in the timing hole.

NOTE: Shims (Item 1) are available in four thicknesses, shims with the two holes (Item 2) are 0,20 mm thick, shims with one hole (Item 3) are 0,25 mm thick, shims with no holes (Item 4) are 0,30 thick and shims with three holes (Item 5) [Figure 60-70-20] are 0,35 mm thick.

NOTE: Increasing the thickness of the shim pack by 0,050 mm retards the injection timing by 0.500×. Decreasing the shim pack by 0,050 mm advances the timing by 0,500.

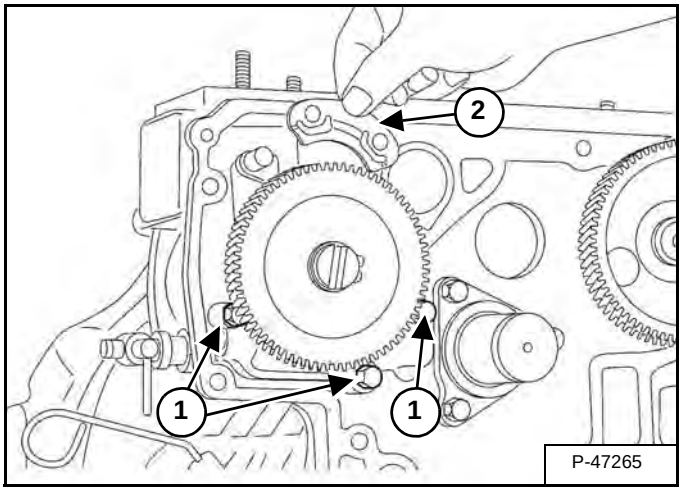
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Fuel Camshaft Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-100-1.)

Remove the idle gear. (See Idle Gear And Camshaft Removal And Installation on Page 60-100-5.)

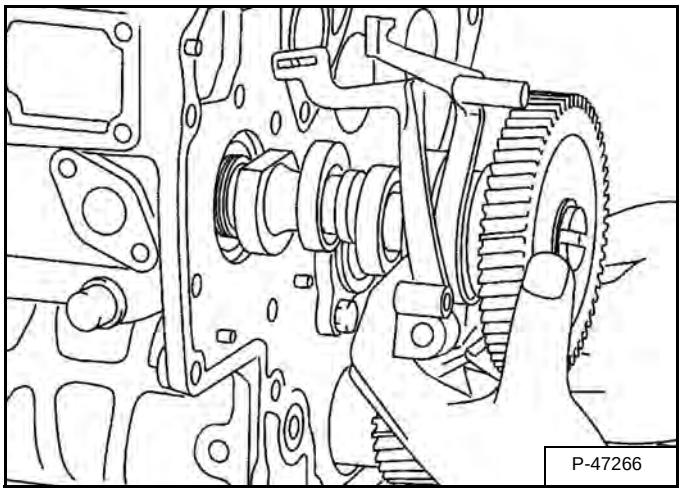
Figure 60-70-21



Remove the three bolts (Item 1) **[Figure 60-70-21]**.

Remove the two bolts and fuel camshaft retainer plate (Item 2) **[Figure 60-70-21]**.

Figure 60-70-22



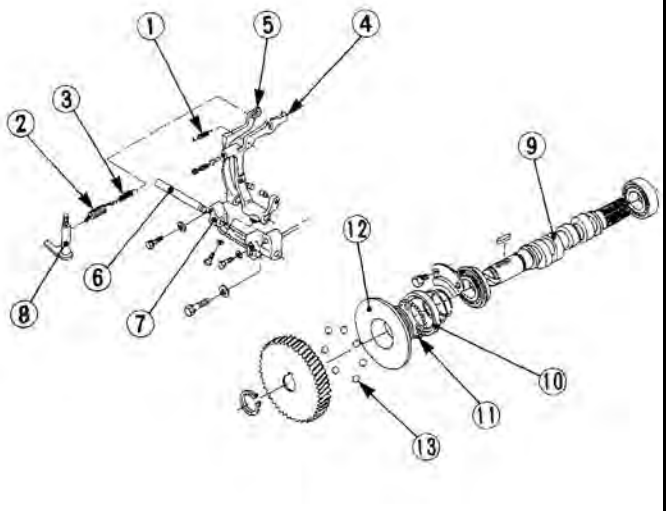
Remove the fuel camshaft and fork lever assembly at the same time **[Figure 60-70-22]**.

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Fuel Camshaft Governor

The governor serves to keep the engine speed constant by automatically adjusting the amount of fuel supplied to the engine according to changes in the load.

Figure 60-70-23



1. Start Spring
2. Governor Spring
3. Governor Spring
4. Fork Lever
5. Fork Lever
6. Fork Lever Shaft
7. Fork Lever Holder
8. Governor Lever
9. Fuel Camshaft
10. Governor Ball Case
11. Steel Balls
12. Governor Sleeve
13. Steel Ball

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Disassemble and assemble the governor and fuel camshaft as shown in figure **[Figure 60-70-23]**.

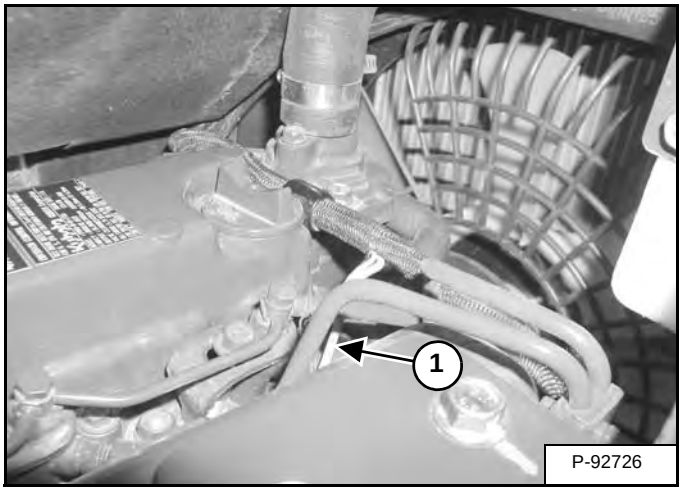
Check all the parts for wear or damage and replace as needed.

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Fuel Injector Removal And Installation

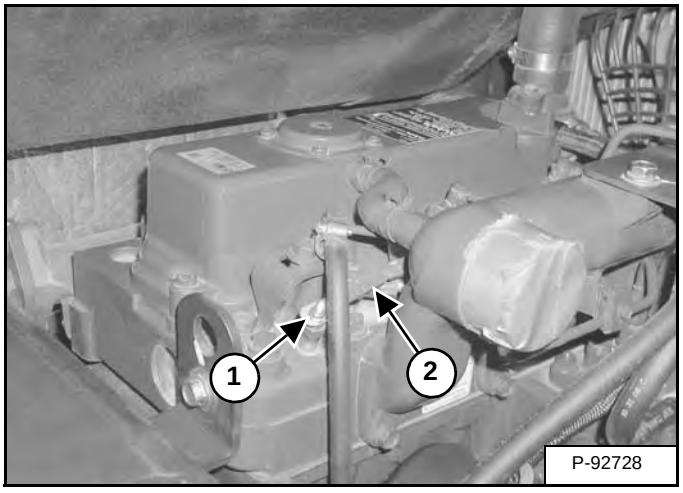
Remove the air cleaner. (See Removal And Installation on Page 60-40-1.)

Figure 60-70-24



Remove the nut and wire harness (Item 1) **[Figure 60-70-24]**.

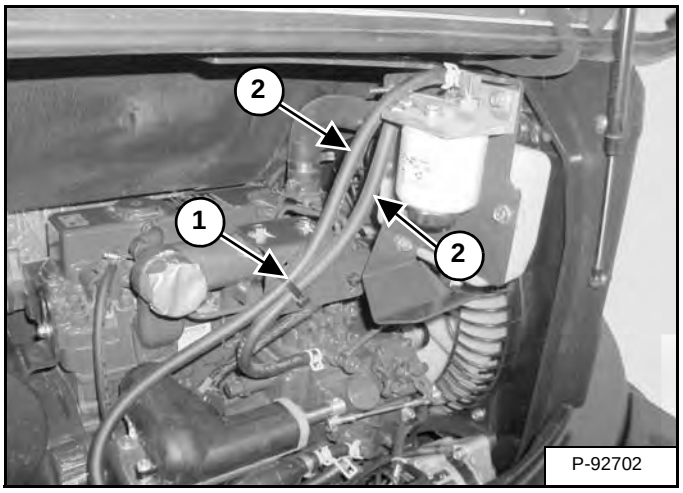
Figure 60-70-25



Remove the nuts (Item 1) **[Figure 60-70-25]** from the two remaining glow plugs.

Remove the connecting strap (Item 2) **[Figure 60-70-25]** from the glow plugs.

Figure 60-70-26



Cut and remove the cable tie (Item 1). Remove the fuel lines (Item 2) **[Figure 60-70-26]**.

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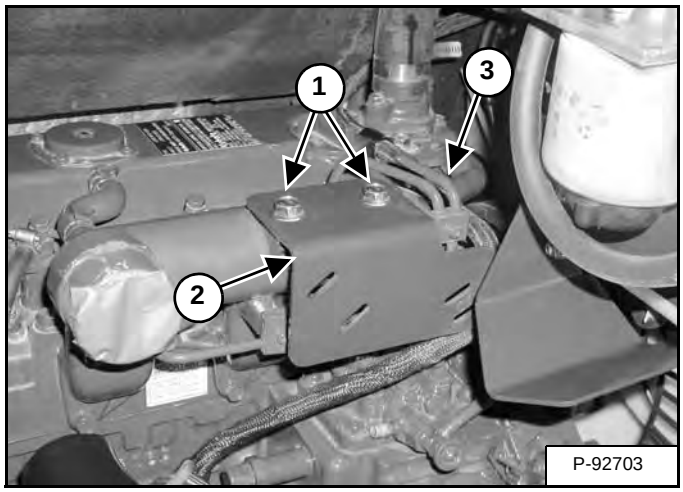
Fuel Injector Removal And Installation (Cont'd)

IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

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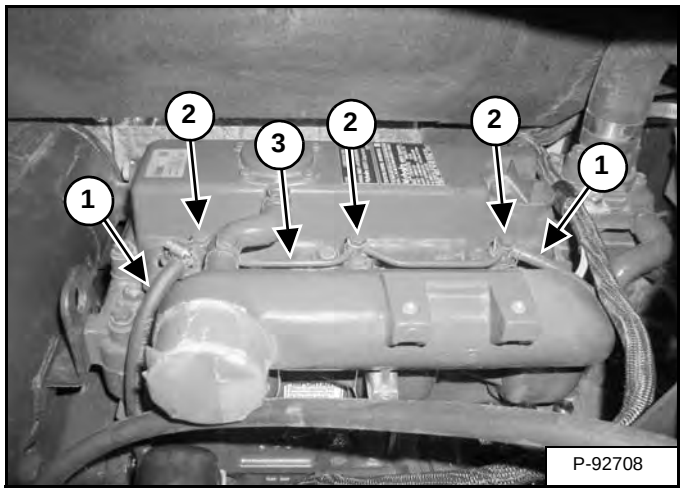
Figure 60-70-27



Remove the bolts (Item 1) and bracket (Item 2) **[Figure 60-70-27]**.

Remove the fuel lines (Item 3) **[Figure 60-70-27]**.

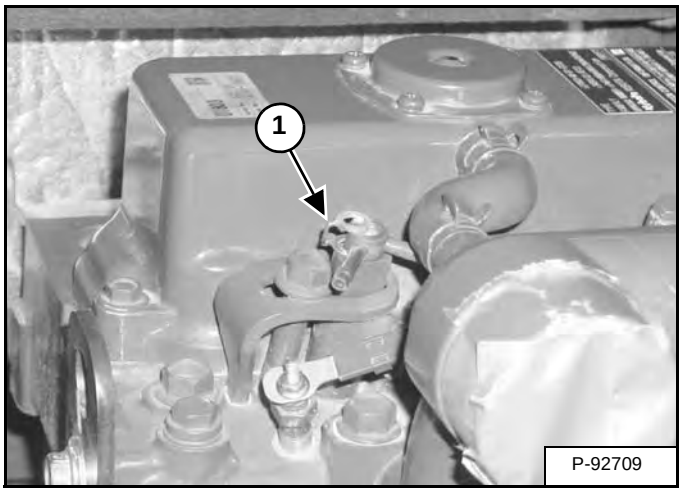
Figure 60-70-28



Remove the fuel line (Item 1) and bolts (Item 2) **[Figure 60-70-28]**.

Remove the tube line (Item 3) **[Figure 60-70-28]**.

Figure 60-70-29

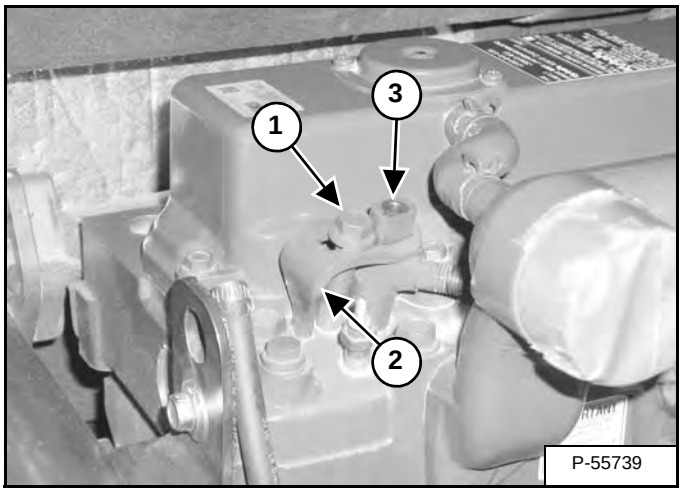


Installation: Always install new gaskets (Item 1) **[Figure 60-70-29]** when reinstalling the tubeline and bolts.

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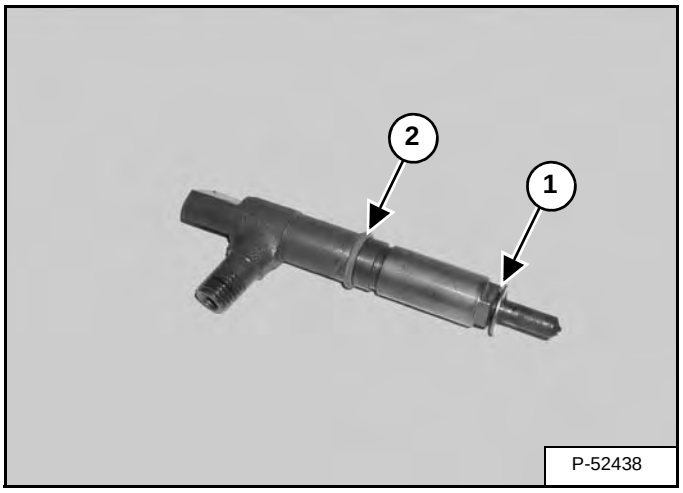
Fuel Injector Removal And Installation (Cont'd)

Figure 60-70-30



Remove the bolts (Item 1) and clamps (Item 2). Remove the injector nozzles (Item 3) **[Figure 60-70-30]**.

Figure 60-70-31



NOTE: Replace the copper washer (Item 1) and O-ring (Item 2) [Figure 60-70-31] anytime new or used fuel injectors are installed.

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Fuel Injector Nozzle Pressure - Checking

⚠ 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.

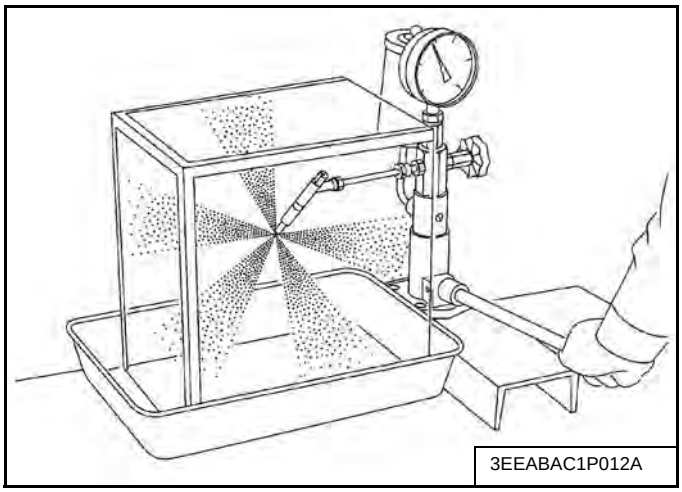
When temperatures are below -30°C (-20°F), the hydrostatic oil must be heated or kept warm. The hydrostatic system will not get enough oil at low temperatures. Park the machine in an area where the temperature will be above -18°C (0°F) if possible.

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The tools listed will be needed to do the following procedure:

MEL4200 - Injector Nozzle Tester
MEL4201 - Injector Nozzle Tester Adapter Set

Figure 60-70-32



Connect the nozzle to the tester with the nozzle down **[Figure 60-70-32]**.

Operate the hand lever at a slow rate and record the opening pressure. If the pressure is not correct, replace the fuel injection nozzle.

Fuel Injection Pressure	1282 - 1386 kPa (186 - 201 bar) (2702 - 2916 psi)

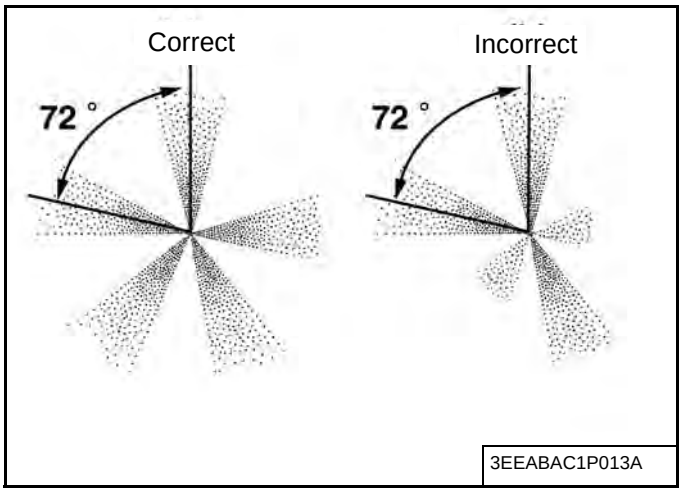
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Nozzle Spray Condition

The tool listed will be needed to do the following procedure:

OEM1064 - Injector Nozzle Tester

Figure 60-70-33



Set the injection nozzle to a nozzle tester, and check the nozzle spraying condition **[Figure 60-70-33]**.

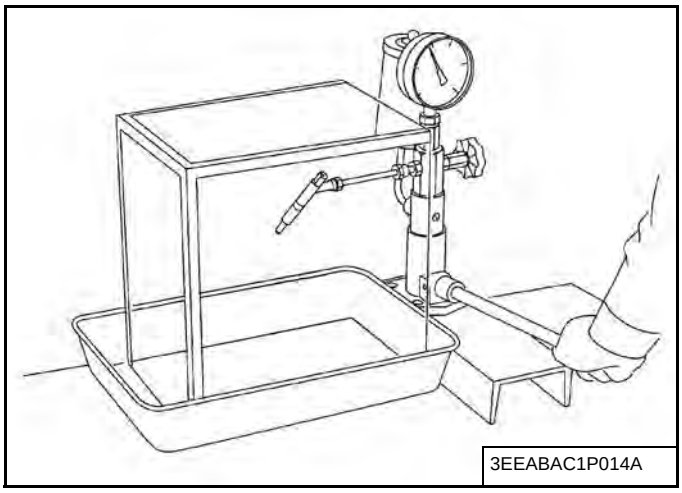
If the spraying condition is defective, replace the injection nozzle assembly.

Valve Seat Tightness

The tool listed will be needed to do the following procedure:

OEM1064 - Injector Nozzle Tester

Figure 60-70-34



Connect the injection nozzle to a nozzle tester **[Figure 60-70-34]**.

Raise the fuel pressure, and keep at 16671 kPa (166,7 bar) (2418 psi) for 10 seconds.

If any fuel leak is found, replace the injection nozzle assembly.

Valve seat tightness	Factory spec	No fuel leak at 16671 kPa (166,7 bar) (2418 psi)

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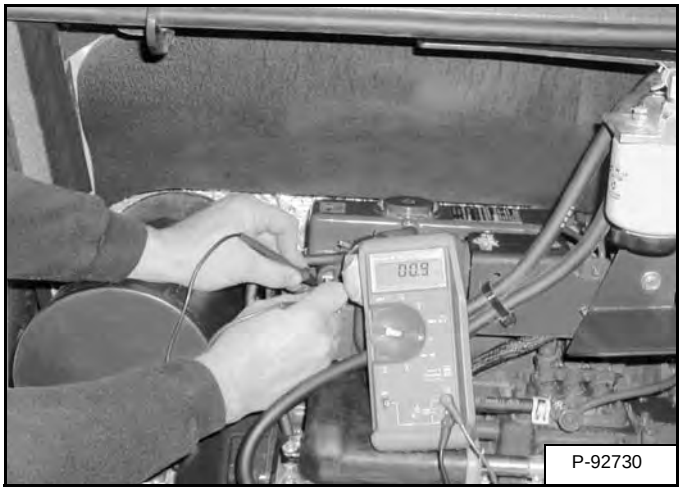


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Glow Plugs - Testing

Disconnect the glow plug wire harness and connecting strap.

Figure 60-80-1



Use an ohmmeter to check the glow plugs **[Figure 60-80-1]**.

Touch one probe to the end of the glow plug and the other probe to the body of the glow plug.

The reading should be approximately 0.9 ohm. If the resistance is infinite, the coil of the glow plug is broken. If the resistance is 0 the glow plug is short circuited.

Repeat the procedure for each glow plug.

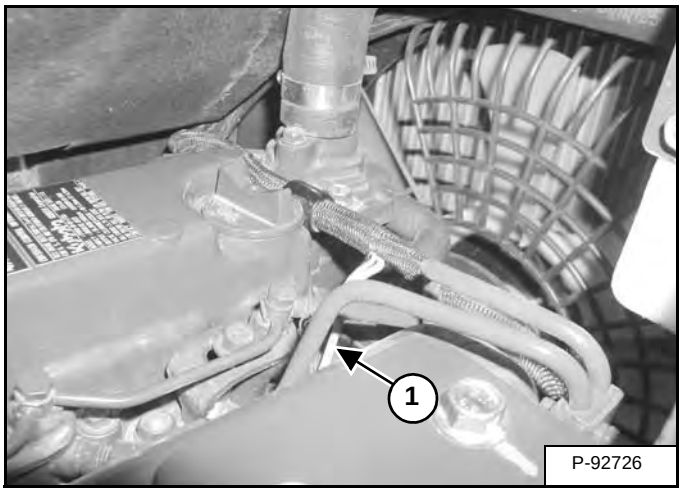
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Glow Plugs Removal And Installation

Remove the air cleaner. (See Removal And Installation on Page 60-40-1.)

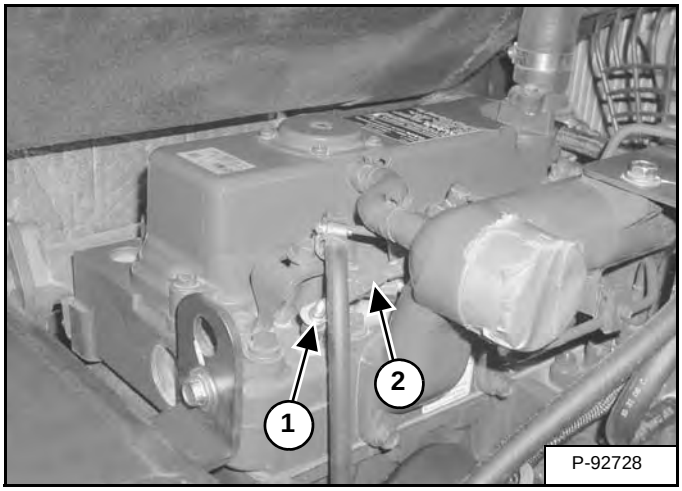
Disconnect the negative (-) cable from the battery.

Figure 60-80-2



Remove the nut and wire harness (Item 1) **[Figure 60-80-2]**.

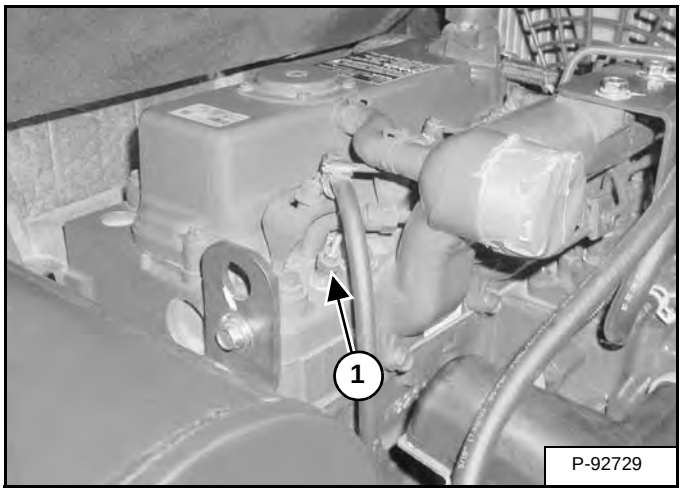
Figure 60-80-3



Remove the nuts (Item 1) **[Figure 60-80-3]** from the two remaining glow plugs.

Remove the connecting strap (Item 2) **[Figure 60-80-3]** from the glow plugs.

Figure 60-80-4



Remove the three glow plugs (Item 1) **[Figure 60-80-4]**.

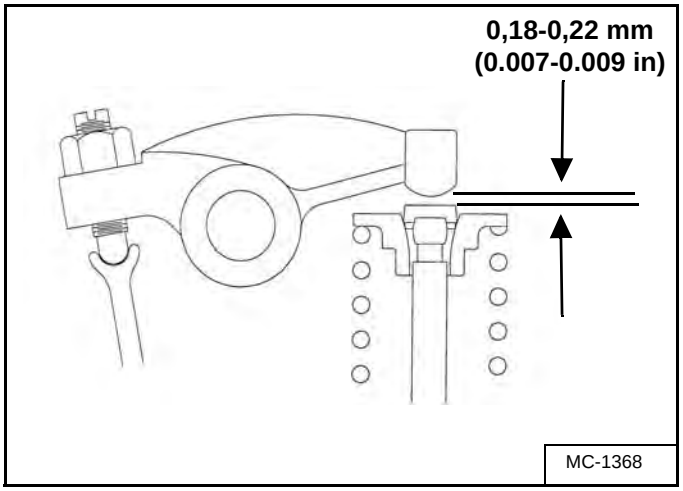
Installation: Tighten the glow plugs to 15 - 20 N•m (11 - 15 ft-lb) torque.

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Valve Clearance Adjustment

Adjust the valve clearance with the engine stopped and cold.

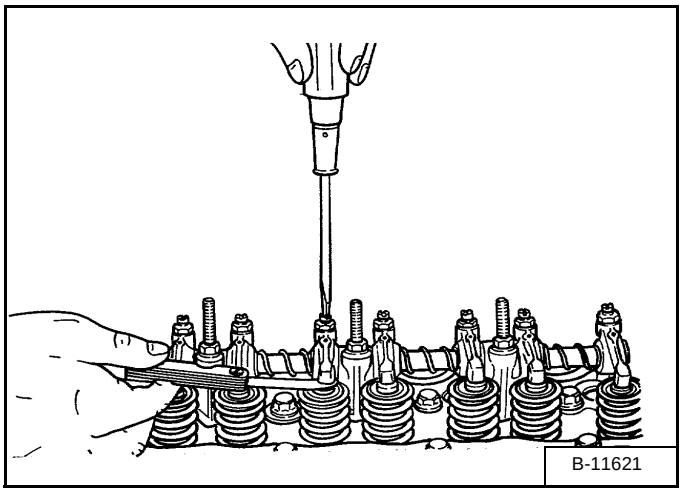
Figure 60-80-5



The correct valve clearance is 0,18 - 0,22 mm (0.007 - 0.0087 in) **[Figure 60-80-5]**.

Make sure the piston is at T.D.C. when making the adjustment for the valves of the particular cylinder.

Figure 60-80-6

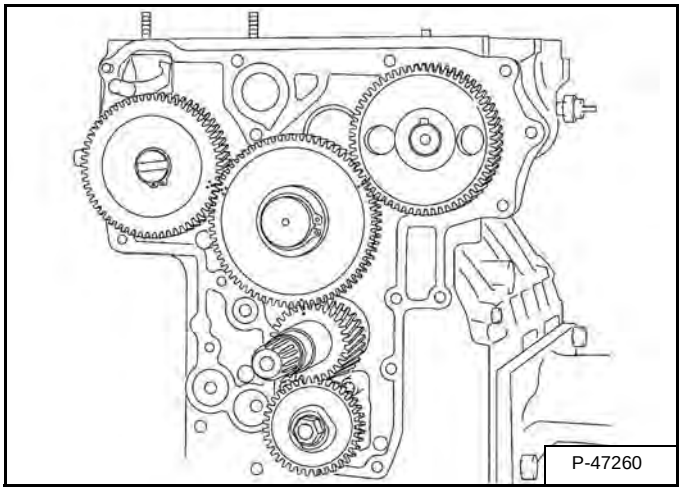


Put the correct size feeler gauge between the rocker arm and valve stem. Turn the adjustment bolt until the clearance is correct **[Figure 60-80-6]**.

Valve Timing - Checking

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-100-1.)

Figure 60-80-7

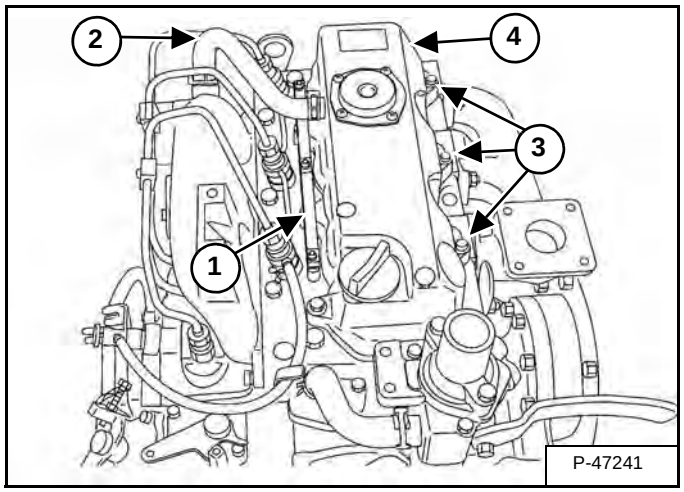


Make sure the timing marks are in correct alignment when installing the timing gears **[Figure 60-80-7]**.

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Cylinder Head Removal And Installation

Figure 60-80-8

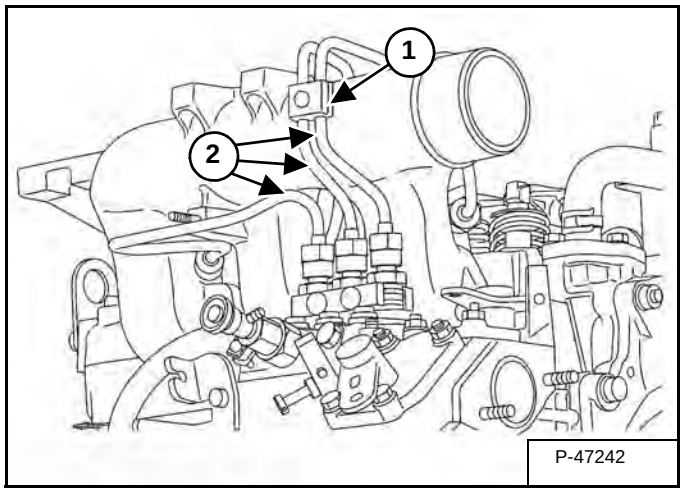


Remove the glow plug lead (Item 1), breather hose (Item 2), and valve cover bolts (Item 3) **[Figure 60-80-8]**.

Remove the valve cover (Item 4) **[Figure 60-80-8]** and gasket.

Installation: Tighten the valve cover bolts to 7 - 11 N•m (5 - 8 ft-lb).

Figure 60-80-9

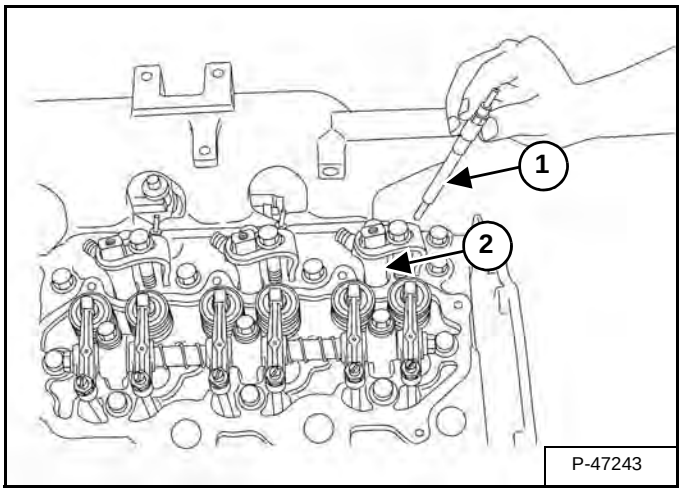


Loosen the bolts on the clamps (Item 1) and remove the injection tubes (Item 2) **[Figure 60-80-9]**.

Tighten the injection tube nuts to 15 - 24 N•m (11 - 18 ft-lb) torque.

Remove the overflow tube assembly.

Figure 60-80-10

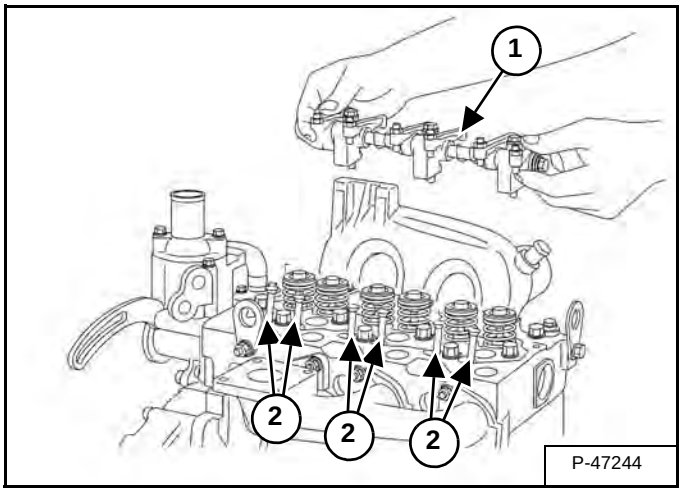


Remove the glow plugs (Item 1) and fuel injector holder assemblies (Item 2) **[Figure 60-80-10]**.

Installation: Tighten the glow plugs to 20 - 24 N•m (15 - 18 ft-lb) torque.

Tighten the injector holders to 26 - 29 N•m (19 - 22 ft-lb) torque.

Figure 60-80-11



Remove the rocker arm bolts and remove the rocker arm assembly (Item 1) **[Figure 60-80-11]**.

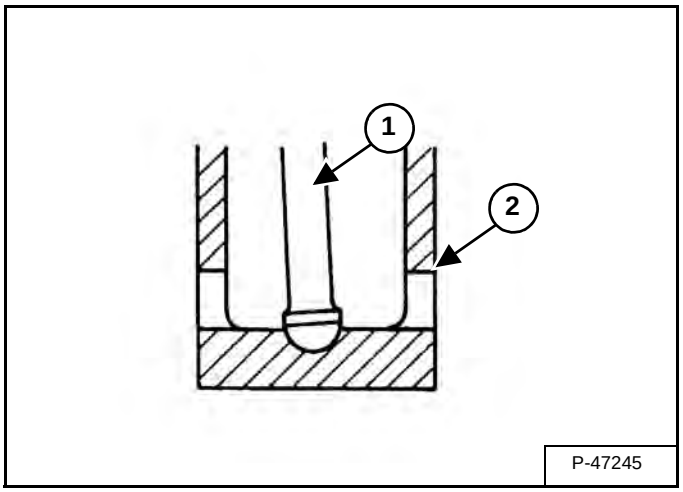
Installation: Tighten the bolts to 24 - 27 N•m (18 - 20 ft-lb) torque.

Remove the pushrods (Item 2) **[Figure 60-80-11]**.

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Cylinder Head Removal And Installation (Cont'd)

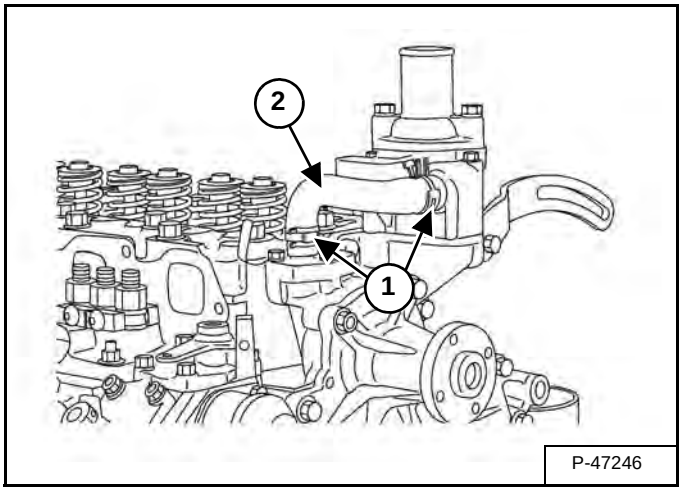
Figure 60-80-12



Installation: The push rod (Item 1) must be seated in the tappet (Item 2) **[Figure 60-80-12]** correctly or the push rods will be damaged.

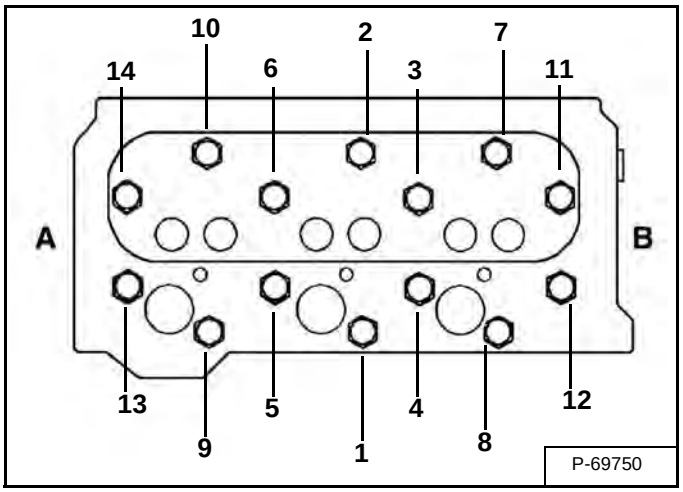
After installing the rocker arm assembly and push rods, the valve lash must be adjusted. (See Valve Clearance Adjustment on Page 60-80-3.)

Figure 60-80-13



Remove the clamps (Item 1) and remove the hose (Item 2) **[Figure 60-80-13]**.

Figure 60-80-14



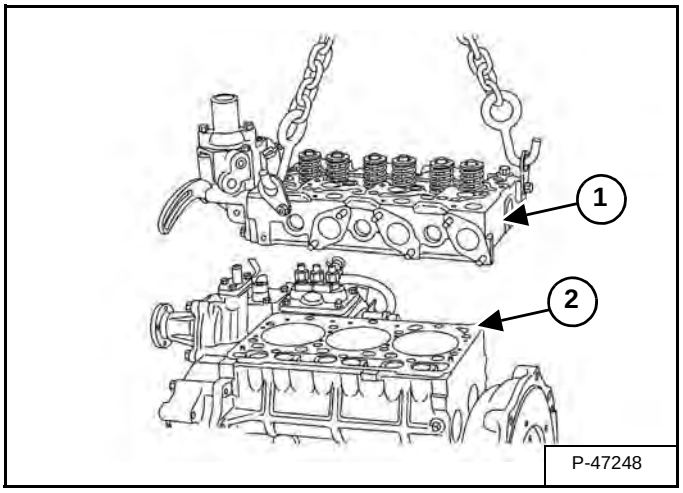
Remove the cylinder head bolts in order of #14 to #1 **[Figure 60-80-14]**.

NOTE: (A) is the gearcase side, (B) is the flywheel side.

Installation: Put oil on the bolt threads. Tighten the bolts in the correct sequence in order of #1 to #14 to 93 - 98 N•m (69 - 72 ft-lb) torque.

NOTE: Re-tighten the cylinder head bolts in the correct sequence after the engine has been run for 30 minutes.

Figure 60-80-15

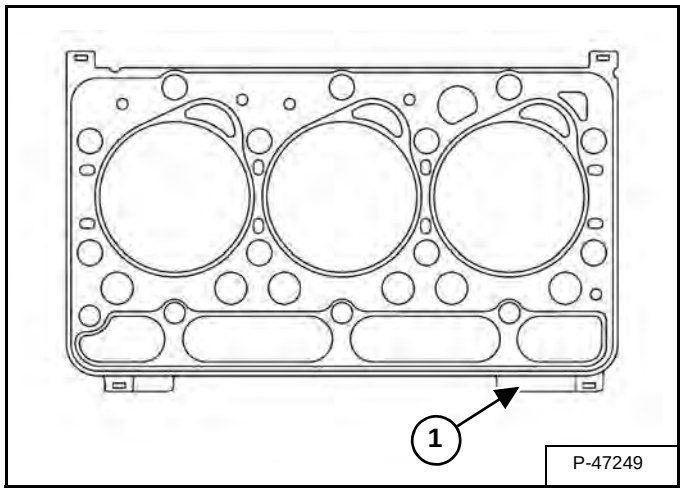


Remove the cylinder head (Item 1) and gasket (Item 2) **[Figure 60-80-15]**.

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Cylinder Head Removal And Installation (Cont'd)

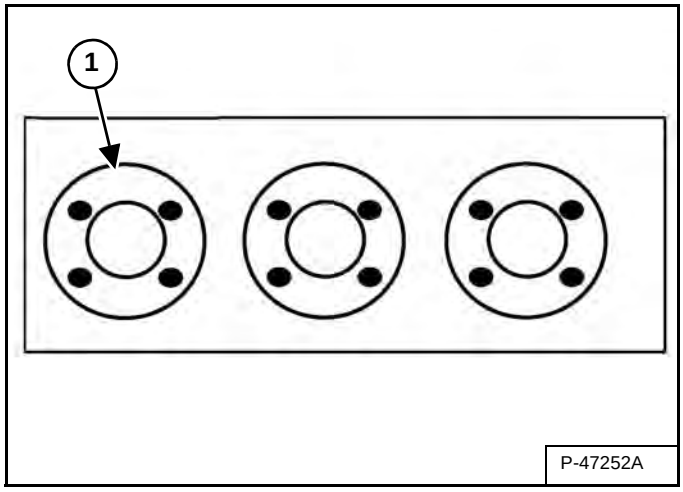
Figure 60-80-16



When replacing just the gasket, use a new gasket that has the same mark (Item 1) **[Figure 60-80-16]** as the original gasket.

When replacing the gasket after an engine rebuild, the piston protrusion must be measured. (See Cylinder Head Top Clearance on Page 60-80-8.)

Figure 60-80-17



Measure and record the protrusion of each piston in the four places shown (Item 1) **[Figure 60-80-17]**. Find the average of each piston, then find the combined average of the three pistons.

Figure 60-80-18

Gasket Size (Number)	Piston Protrusion
15	0,475 - 0,525 mm 0.0187 - 0.0207 in
20	0,525 - 0,575 mm 0.0207 - 0.0226 in
25	0,575 - 0,625 mm 0.0226 - 0.0246 in
30	0,625 - 0,675 mm 0.0246 - 0.0266 in
35	0,675 - 0,725 mm 0.0266 - 0.0285 in

Select the correct gasket size (thickness) from the chart **[Figure 60-80-18]**.

Find the measurement of the highest piston protrusion and the lowest piston protrusion (recorded earlier) for each piston.

If the highest measurement exceeds the piston protrusion of the selected gasket, use the gasket which is one size larger. If the measurement exceeds gasket size 35, the engine must be disassembled, clearances checked, and reassembled.

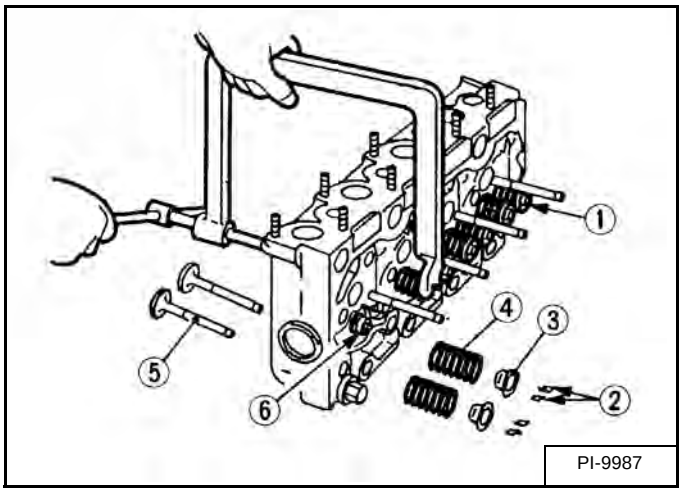
If the measurement is two sizes smaller than the selected gasket or smaller than gasket size 15, the engine must be disassembled, clearances checked, and reassembled.

After the gasket and cylinder head have been installed, turn the crankshaft by hand to be sure there is no interference between the piston, cylinder, and valves.

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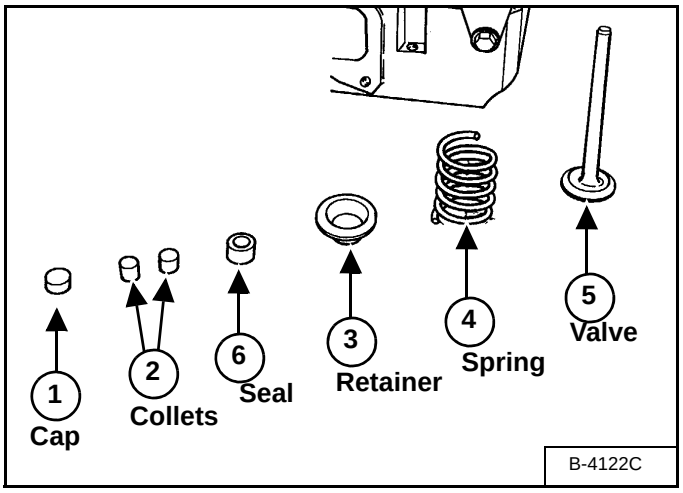
Cylinder Head Disassembly And Assembly

Figure 60-80-19



Use a valve spring compressor to compress the valve springs **[Figure 60-80-19]**.

Figure 60-80-20



Remove the valve cap (Item 1) and valve spring collet (Item 2) **[Figure 60-80-19]** and **[Figure 60-80-20]**.

Remove the valve spring retainer (Item 3) and the spring (Item 4) **[Figure 60-80-19]** and **[Figure 60-80-20]**.

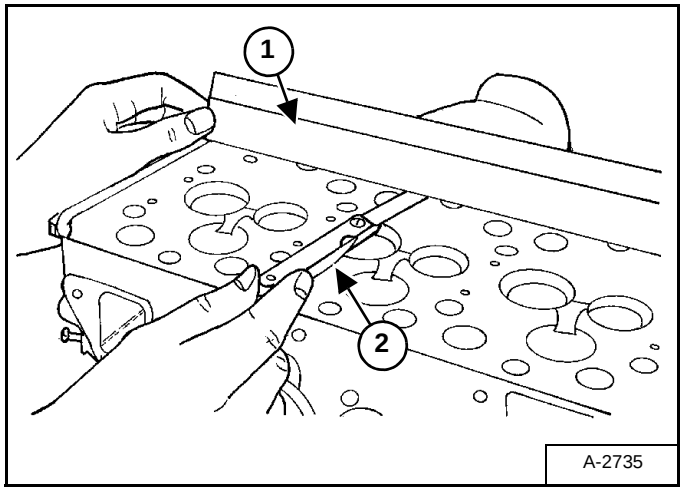
Remove the seal (Item 6) and the valve (Item 5) **[Figure 60-80-19]** and **[Figure 60-80-20]**.

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Cylinder Head - Servicing

Clean the surface of the cylinder head.

Figure 60-80-21

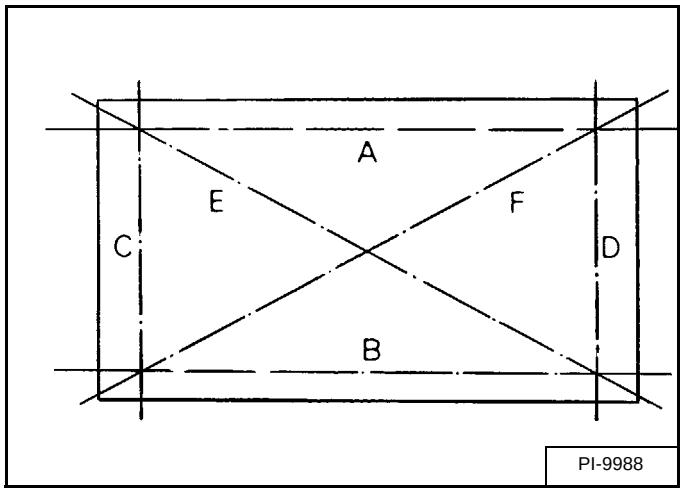


Put a straight edge (Item 1) **[Figure 60-80-21]** on the cylinder head.

NOTE: Do not put the straight edge across combustion chambers.

Put a feeler gauge (Item 2) **[Figure 60-80-21]** between the straight edge and the surface of the cylinder head.

Figure 60-80-22

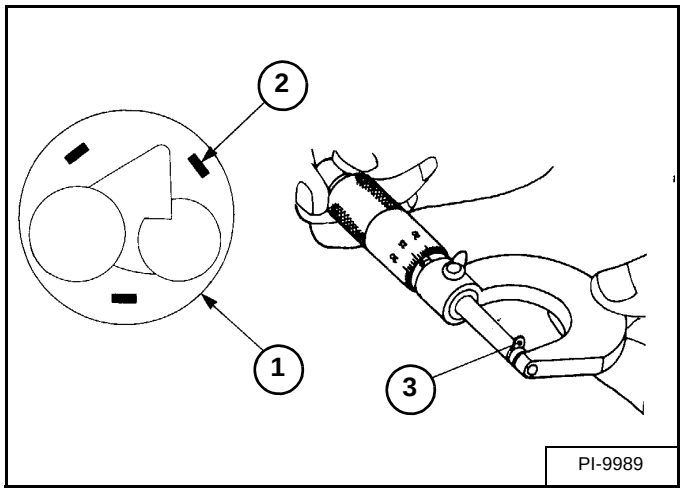


Put the straight edge on the cylinder head's four sides and two diagonal as shown in figure **[Figure 60-80-22]**.

The maximum distortion of the head surface is ± 0,05 mm (± 0.002 in). If the measurement exceeds the specification, replace the cylinder head.

Cylinder Head Top Clearance

Figure 60-80-23



Install the cylinder head gasket. Put the piston (Item 1) **[Figure 60-80-23]** being checked at T.D.C.

Put three pieces of 1,5 mm (0.06 in) diameter solder (Item 2) **[Figure 60-80-23]** on the top of the piston. Use grease to hold them in position.

NOTE: Put the solder in position so they do not touch the valves.

Turn the piston to bottom dead center.

Install the cylinder head and tighten to the correct torque in the correct sequence. (See Cylinder Head Removal And Installation on Page 60-80-4.)

Turn the crankshaft until the piston exceeds T.D.C. Remove the cylinder head.

Remove the solder (Item 3) **[Figure 60-80-23]** and measure it.

If the measurement exceeds the specifications, check the oil clearance of the crank pin journal or the piston pin.

Top Clearance	0,60 - 0,70 mm (0.024 - 0.027 in)

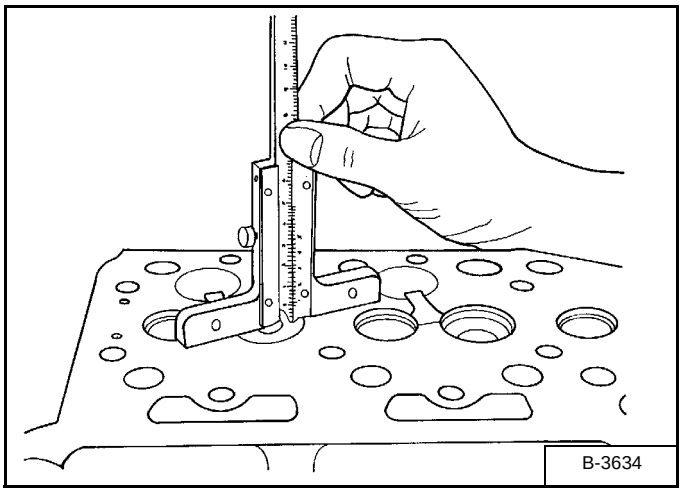
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Valve Guide - Checking

Remove the valve and spring from the cylinder head. (See Cylinder Head Disassembly And Assembly on Page 60-80-7.)

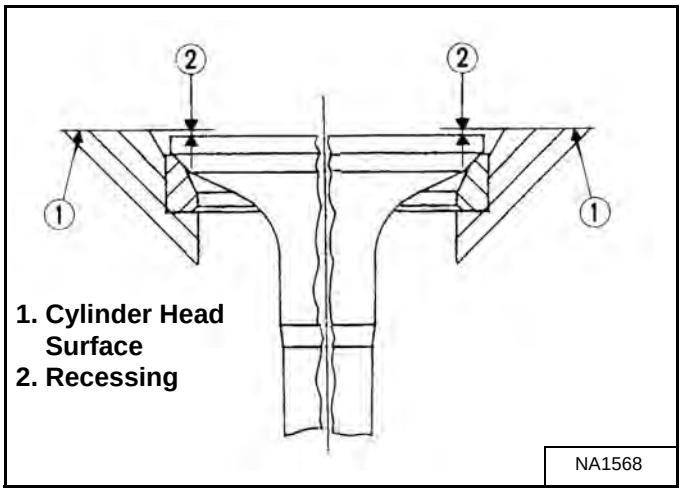
Clean the valve seat and combustion chamber.

Figure 60-80-24



Install the valve into the guide. Measure the valve recessing with a depth gauge **[Figure 60-80-24]**.

Figure 60-80-25

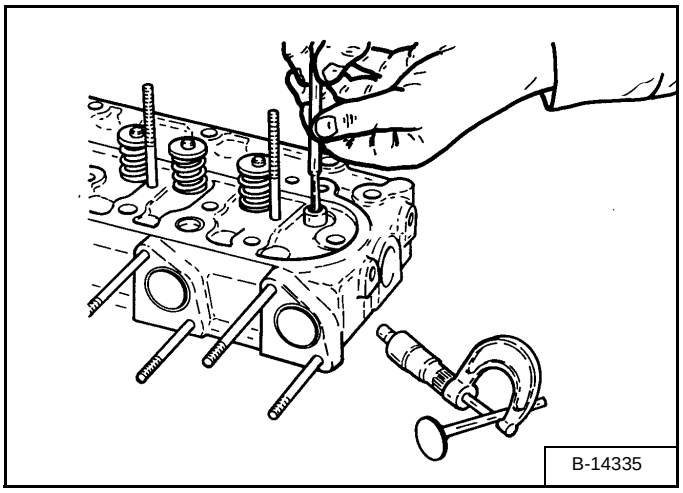


If the measurement exceeds the limit, replace the valve or cylinder head **[Figure 60-80-25]**.

Recessing	0,65 - 0,85 mm (0.026 - 0.033 in)

Remove the carbon from the valve guide.

Figure 60-80-26



Measure the valve stem O.D. **[Figure 60-80-26]**.

Measure the valve guide I.D. **[Figure 60-80-26]**.

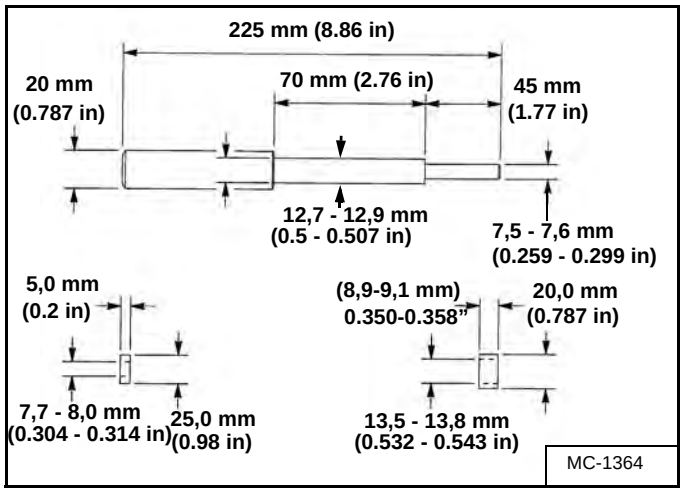
Calculate the clearance. If the clearance exceeds the allowable limit, replace the valve and / or valve guide.

Valve Guide I.D.	8,015 - 8,03 mm (0.3156 - 0.3161 in)
Valve Stem O.D.	7,96 - 7,98 mm (0.3134 - 0.3140 in)
Clearance Between Valve Stem and Guide	0,04 - 0,07 mm (0.0016 - 0.0028 in)
Allowable Limit	0,1 mm (0.0039 in)

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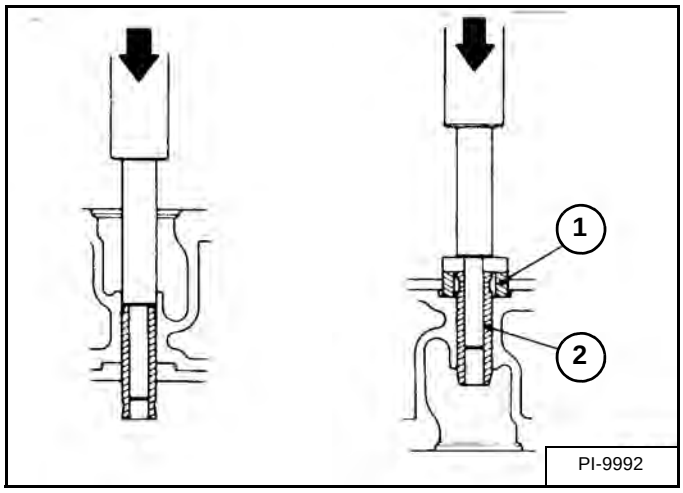
Valve Guide Removal And Installation

Figure 60-80-27



To remove and replace the valve guide, make the driver tool as shown in **[Figure 60-80-27]**.

Figure 60-80-28



Press the used valve guide out of the cylinder head using the special driver tool **[Figure 60-80-28]**.

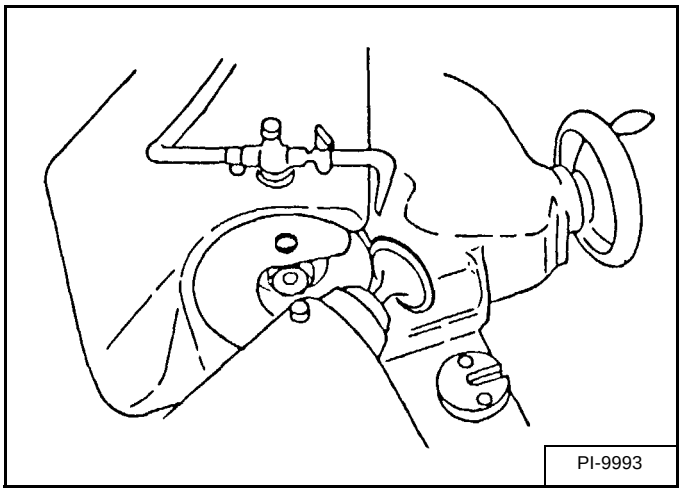
Put oil on the outside diameter of the new valve guide. Press the new valve guide into the cylinder head from the top side. Use the special driver tools (Items 1 and 2) **[Figure 60-80-28]**, press the new guide until the tool contacts the cylinder head.

Ream the valve guide to the correct specifications.

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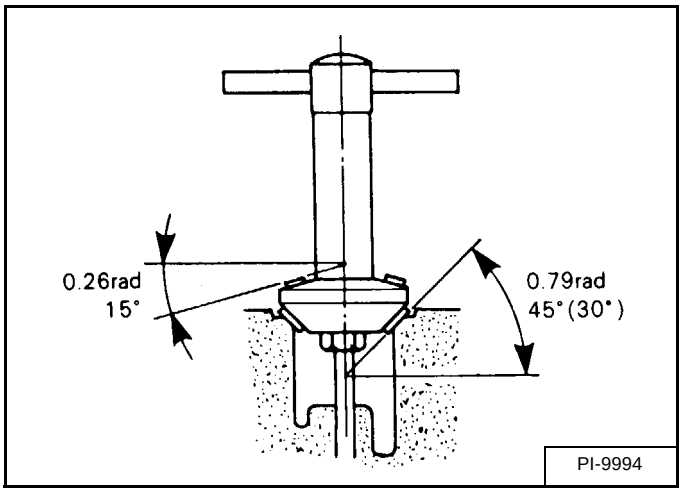
Reconditioning The Valve And Valve Seat

Figure 60-80-29



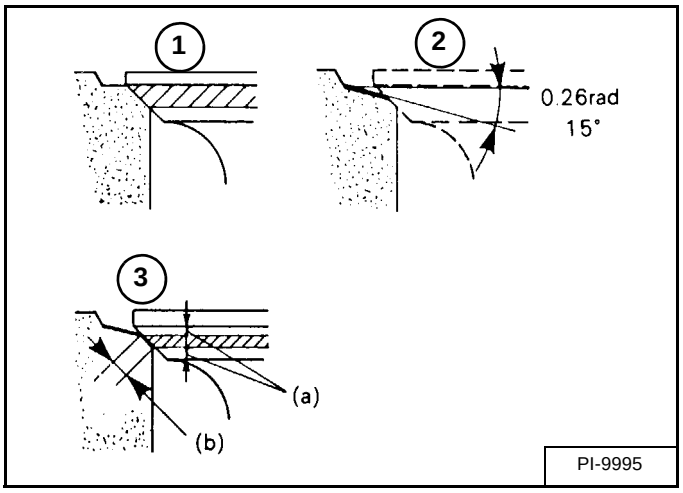
Grind the valve face to the correct angle using a valve refacer **[Figure 60-80-29]**.

Figure 60-80-30



Grind the valve seat surface in the cylinder head to the correct angle **[Figure 60-80-30]**.

Figure 60-80-31



Check the seat surface and valve face (Item 1) **[Figure 60-80-31]**.

If the seat surface is too wide, use a 15° cutter on the exhaust or 30° cutter on the intake (Item 2) to get the correct width (Item 3) **[Figure 60-80-31]**.

Valve Seat Width

Intake	2,12 mm (0.0835 in)
Exhaust	2,12 mm (0.0835 in)

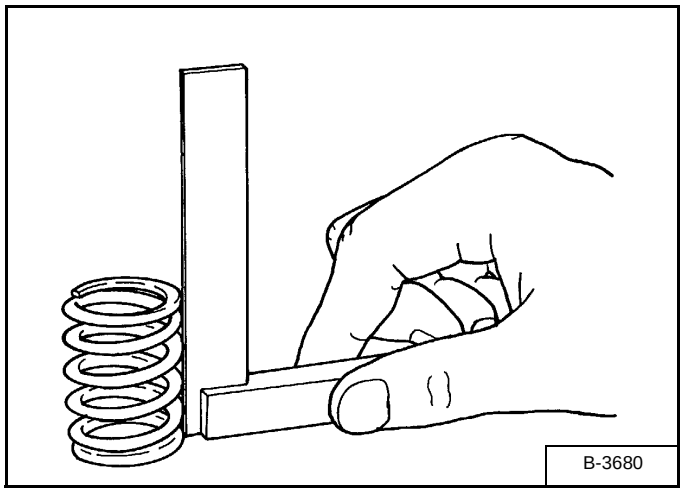
Valve Seat And Face Angle

Intake	60°
Exhaust	45°

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Valve Spring

Figure 60-80-32



Measure the length of the valve spring. If the measurement is less than the allowable limit, replace the spring **[Figure 60-80-32]**.

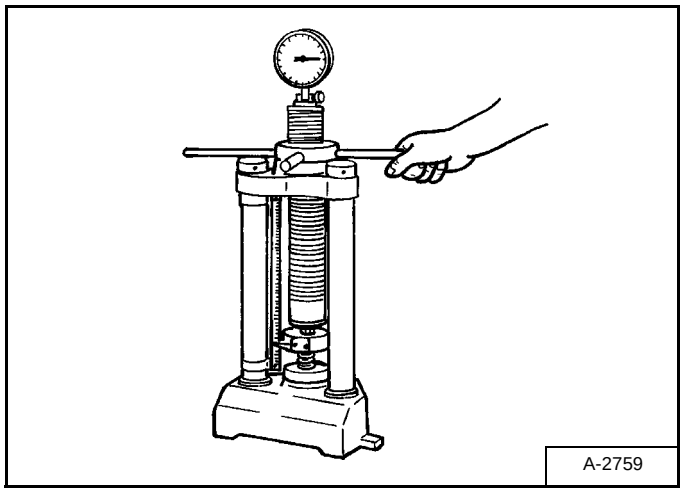
Free Length	41,7 - 42,2 mm (1.642 - 1.661 in)
Allowable Limit	41,2 mm (1.622 in)

Put the spring on a flat surface, place a square on the side of the spring **[Figure 60-80-32]**.

Rotate the spring and measure the maximum tilt. If the measurement exceeds the allowable limit, replace the spring.

Tilt	1,0 mm (0.039 in)

Figure 60-80-33



Put the spring on a tester and compress to specified length **[Figure 60-80-33]**.

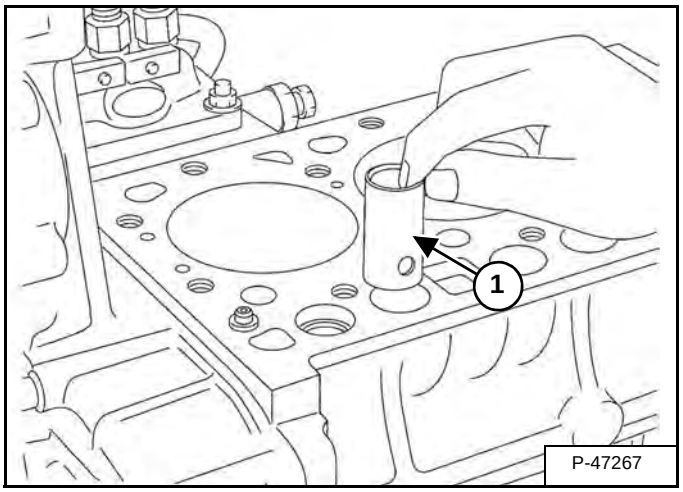
Read the compressed load on the gauge. If the measurement exceeds the allowable limit, replace the spring.

Setting Length	35,0 mm (1.378 in)
Setting Load	117,6 N (26.4 lb)
Allowable Limit	100,0 N (22.5 lb)

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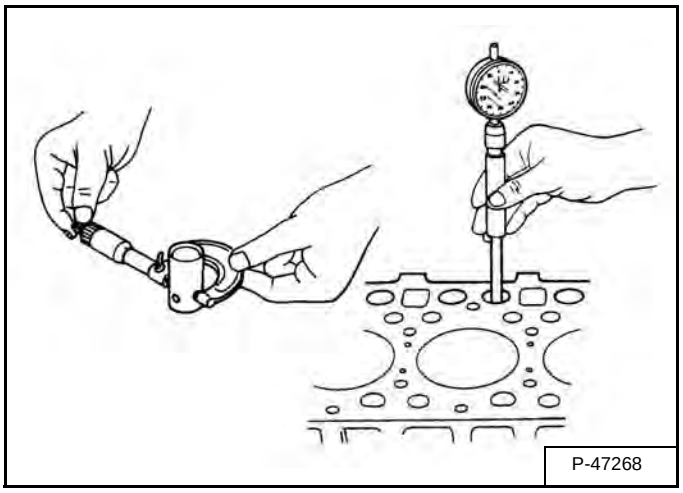
Valve Tappets

Figure 60-80-34



Remove the valve tappets (Item 1) **[Figure 60-80-34]**.

Figure 60-80-35



Measure the O.D. of the tappet **[Figure 60-80-35]**.

Measure the ID of the tappet bore **[Figure 60-80-35]**.

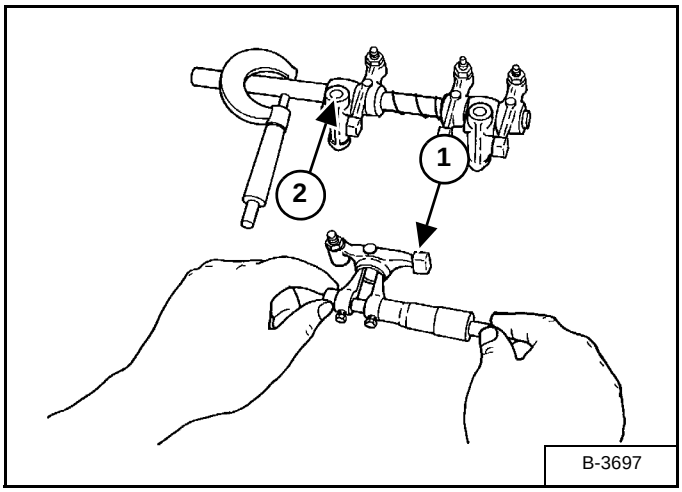
If the clearance exceeds the allowable limit, replace the tappets.

Tappet OD	23,96 - 23,98 mm (0.943 - 0.944 in)
Tappet Bore ID	24,0 - 24,021 mm (0.945 - 0.946 in)
Clearance Between Tappet and Tappet Bore	0,02 - 0,062 mm (0.0008 - 0.0024 in)
Allowable Limit	0,07 mm (0.0028 in)

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Rocker Arm And Shaft - Checking

Figure 60-80-36



Measure the rocker arm I.D. (Item 1) **[Figure 60-80-36]** with an inside micrometer.

Measure the rocker arm shaft O.D. (Item 2) **[Figure 60-80-36]** with an outside micrometer.

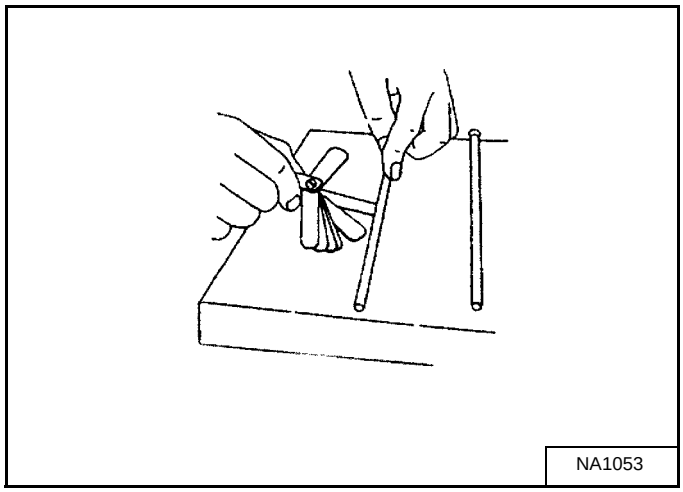
If the clearance exceeds the allowable limit, replace the bushing.

If the clearance still exceeds the allowable limit after the bushing is replace, replace the rocker arm shaft.

Oil Clearance Between Rocker Arm & Shaft	0,02 - 0,05 mm (0.0006 - 0.0017 in)
Allowable Limit	0,1 mm (0.004 in)
Rocker Arm Shaft O.D.	13,97 - 13,98 mm (0.5501 - 0.5506 in)
Rocker Arm I.D.	14,0 - 14,02 mm (0.5512 - 0.5519 in)

Push Rod Alignment - Checking

Figure 60-80-37



Place the push rod on an inspection block. Use a feeler gauge **[Figure 60-80-37]** to measure the gap.

Push Rod Alignment Allowable Limit	0,25 mm (0.0098 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 60-80-4.)

Remove the top edge from the cylinder bore with a ridge reamer.

Remove the oil pan.

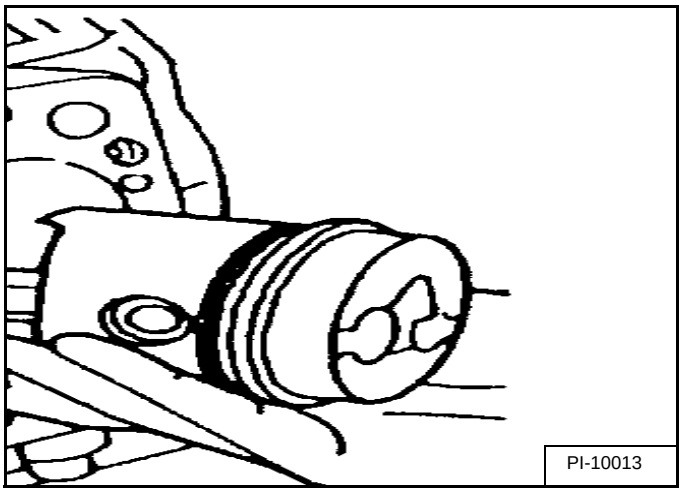
Turn the flywheel and put a pair of connecting rods at bottom dead center.

Remove the connecting rod bolts.

Installation: Tighten the connecting rod bolts to 44 - 49 N•m (33 - 36 ft-lb) torque.

Remove the rod cap and bearing.

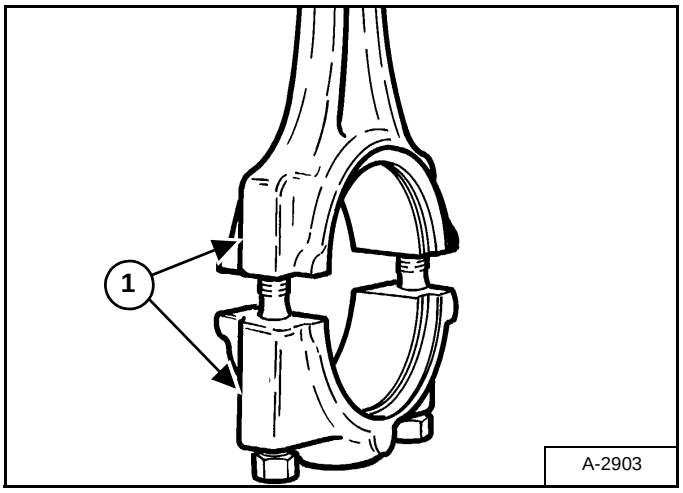
Figure 60-90-1



Use a hammer handle and push the piston / connecting rod assembly out of the cylinder bore **[Figure 60-90-1]**.

NOTE: Make sure the pistons are marked so they will be returned to the same cylinder bore.

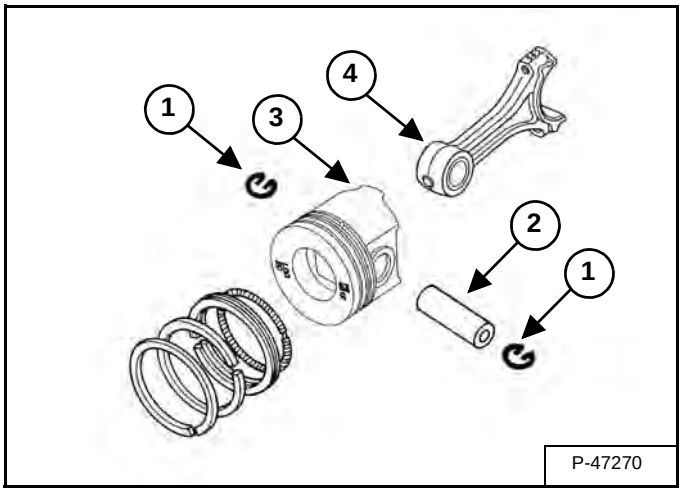
Figure 60-90-2



Installation: Make sure the marks on the connecting rod and bearing are aligned when installing the bearing cap (Item 1) **[Figure 60-90-2]**.

Repeat the procedure to remove the other piston / connecting rod assemblies from the engine block.

Figure 60-90-3



Remove the piston rings **[Figure 60-90-3]**.

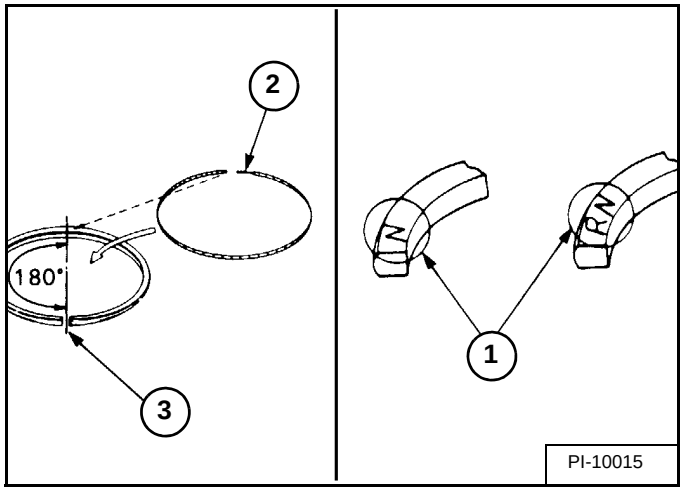
Remove the snap ring (Item 1) and piston pin (Item 2) **[Figure 60-90-3]**.

Separate the piston (Item 3) from the connecting rod (Item 4) **[Figure 60-90-3]**.

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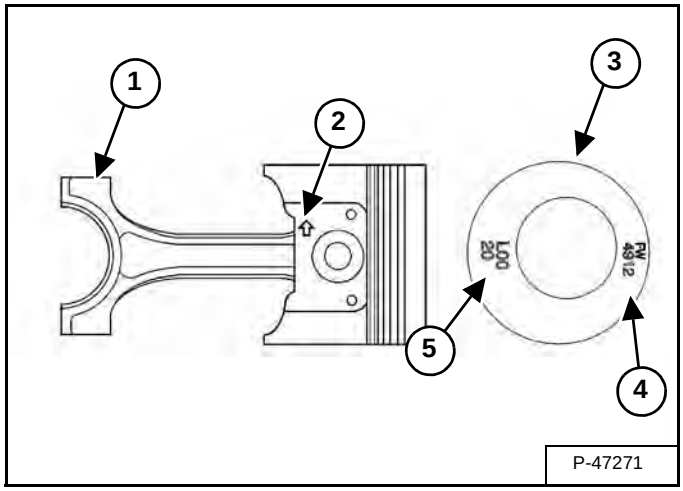
Piston And Connecting Rod Removal And Installation (Cont'd)

Figure 60-90-4



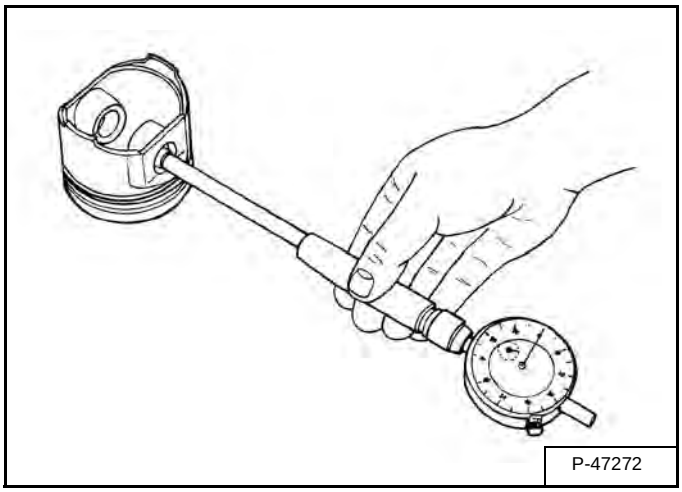
Installation: When installing new rings, assemble the ring so the mark (Item 1) near the gap faces the top of the piston. When installing the oil ring, place the expander joint (Item 2) on the opposite side of the oil ring gap (Item 3) **[Figure 60-90-4]**.

Figure 60-90-5



Installation: When reassembling, align the marks (Item 1) on the connecting rod and piston (Item 2). Heat the piston in clean engine oil to 80°C (176°F) and tap the piston pin into position. Place the piston rings so that there are gaps every 120° (Items 3, 4 and 5) **[Figure 60-90-5]** with no gap facing the piston pin in the cylinder.

Figure 60-90-6



Measure the I.D. of the piston pin bore in both horizontal and vertical directions **[Figure 60-90-6]**.

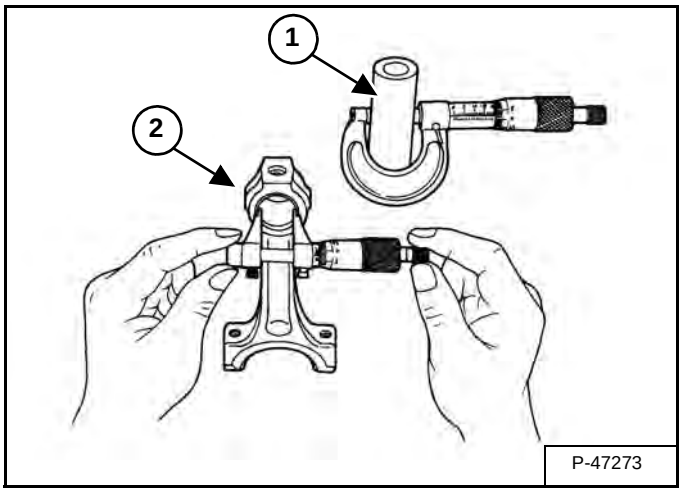
If the measurement exceeds the allowable limit, replace the piston.

Piston Bore I.D.	25,0 - 25,013 mm (0.984 - 0.985 in)
Allowable Limit	25,05 mm (0.986 in)

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Piston And Connecting Rod - Servicing

Figure 60-90-7



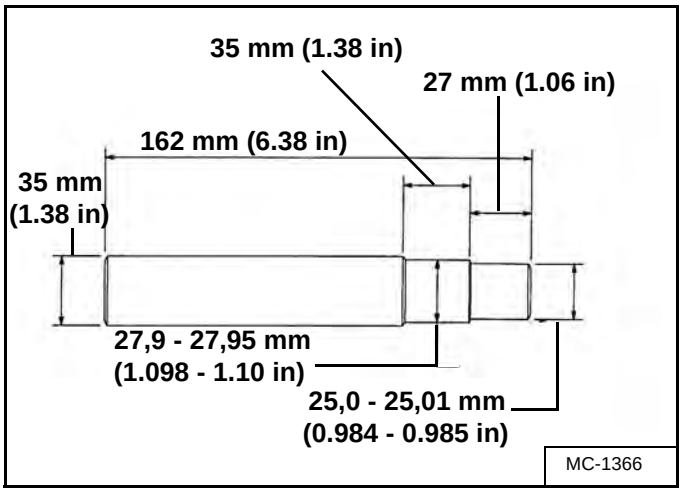
Measure the O.D. of the piston pin (Item 1) **[Figure 60-90-7]**.

Measure the I.D. of the connecting rod small end (Item 2) **[Figure 60-90-7]**.

Calculate the oil clearance. If the clearance exceeds the allowable limit, replace the bushing. If it still exceeds the specifications, replace the piston pin.

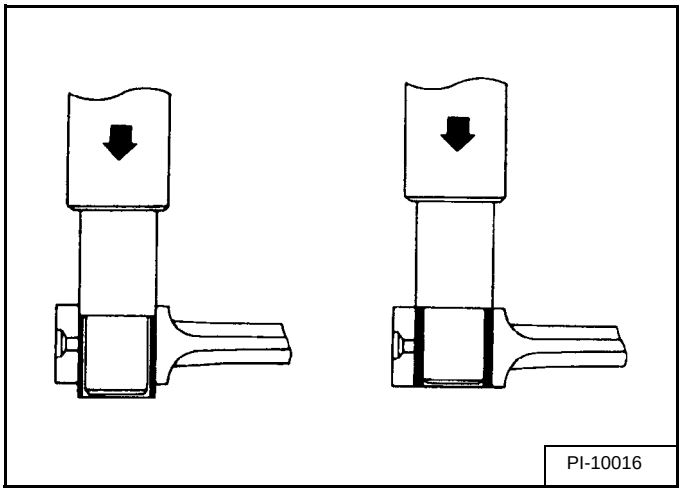
Piston Pin O.D.	25,0 - 25,011 mm (0.984 - 0.985 in)
Bushing I.D.	25,025 - 25,04 mm (0.985 - 0.986 in)
Oil Clearance Between Piston Pin & Bushing	0,014 - 0,038 mm (0.0006 - 0.0015 in)
Allowable Limit	0,15 mm (0.006 in)

Figure 60-90-8



To replace the connecting rod small end bushing, make a driver tool as shown in figure **[Figure 60-90-8]**.

Figure 60-90-9



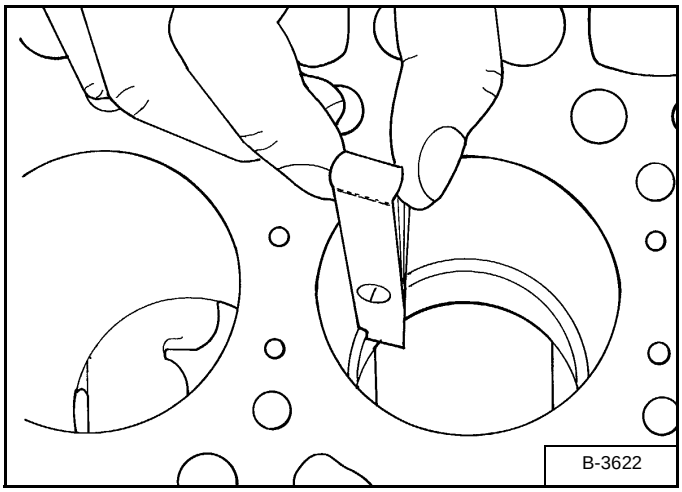
Use a press and special driver tool to remove the small end bushing **[Figure 60-90-9]**.

Installation: Clean the small end bushing and bore. Put oil on the bushing and press into the connecting rod until it is flush **[Figure 60-90-9]**.

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Piston And Connecting Rod - Servicing (Cont'd)

Figure 60-90-10

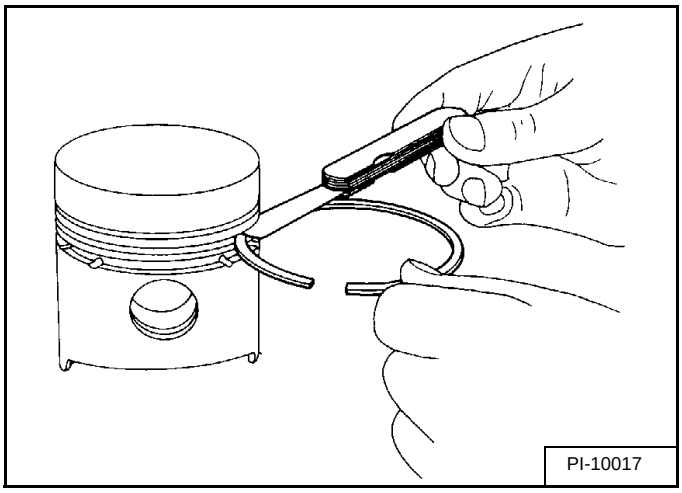


Install a piston ring into the lower part of the cylinder bore. Measure the ring gap with a feeler gauge **[Figure 60-90-10]**.

If the gap exceeds the allowable limit, replace the ring.

Top Ring Gap	0,2 - 0,35 mm (0.008 - 0.0138 in)
Second Ring Gap	0,3 - 0,45 mm (0.012 - 0.017 in)
Oil Ring Gap	0,2 - 0,4 mm (0.008 - 0.015 in)
Allowable Limit	1,25 mm (0.05 in)

Figure 60-90-11



Remove the carbon from the ring grooves. Measure the clearance between the ring and groove with a feeler gauge **[Figure 60-90-11]**.

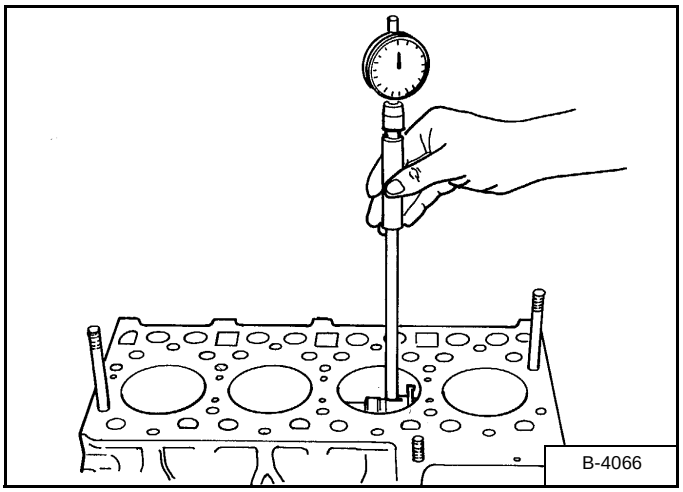
If the clearance exceeds the allowable limit, replace the ring. If the clearance still exceeds the allowable limit, replace the piston.

Top Ring Gap	0,05 - 0,09 mm (0.002 - 0.0035 in)
Second Ring Gap	0,078 - 0,110 mm (0.00307 - 0.00433 in)
Allowable Limit	0,20 mm (0.0079 in)
Oil Ring	1,03 - 0,07 mm (0.0012 - 0.0027 in)
Allowable Limit	0,15 mm (0.0059 in)

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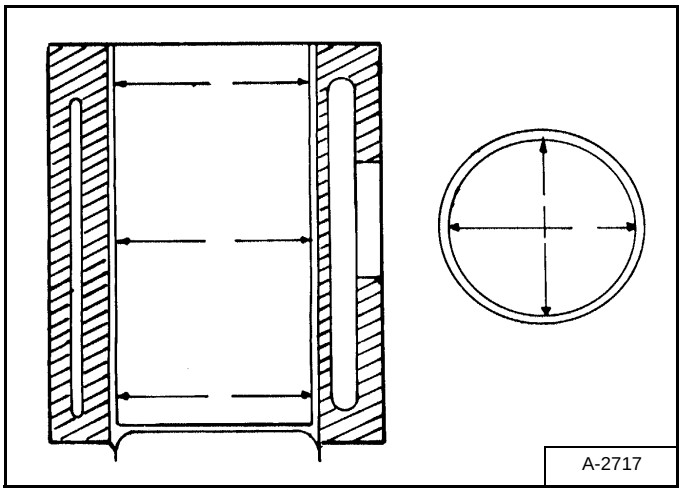
Cylinder Bore - Checking

Figure 60-90-12



Use a gauge to check the inside measurement of the cylinder bore **[Figure 60-90-12]**.

Figure 60-90-13



Measure the six points as shown in **[Figure 60-90-13]** to find the maximum wear.

The specifications are 87,0 - 87,02 mm (3.425 - 3.426 in). The wear limit is +0,15 mm (+0.006 in).

If the cylinder bore is not within specifications, re-bore the cylinder for oversize piston.

Dealer Copy -- Not for Resale

Connecting Rod Alignment

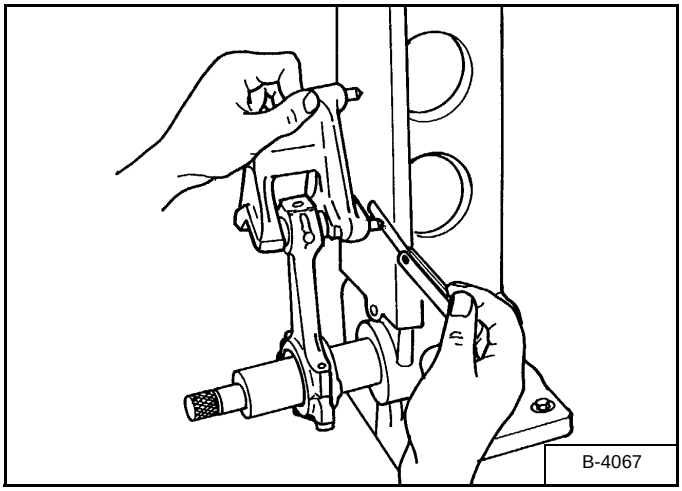
NOTE: The small end bushing is the basis of this check, check the bushing for wear before doing this check.

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 60-90-14



If the gauge does not fit squarely against the face plate, measure the space between the gauge and face plate **[Figure 60-90-14]**.

If the measurement exceeds the allowable limit, replace the connecting rod.

Rod Alignment	0,05 mm (0.002 in)

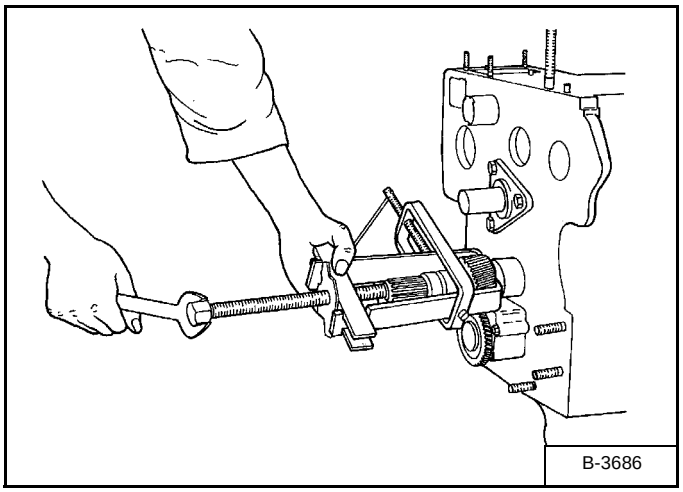
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Crankshaft Gear Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-100-1.)

Remove the idle gear. (See Idle Gear And Camshaft Removal And Installation on Page 60-100-5.)

Figure 60-90-15



Remove the crankshaft gear with a puller **[Figure 60-90-15]**.

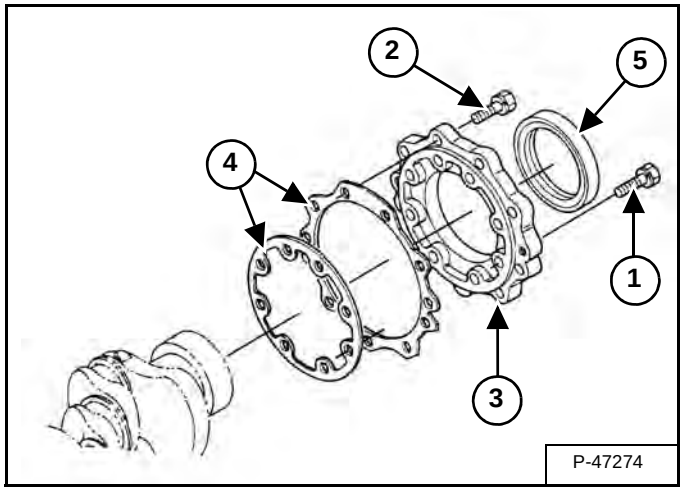
Remove the crankshaft key.

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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 60-90-1.)

Figure 60-90-16



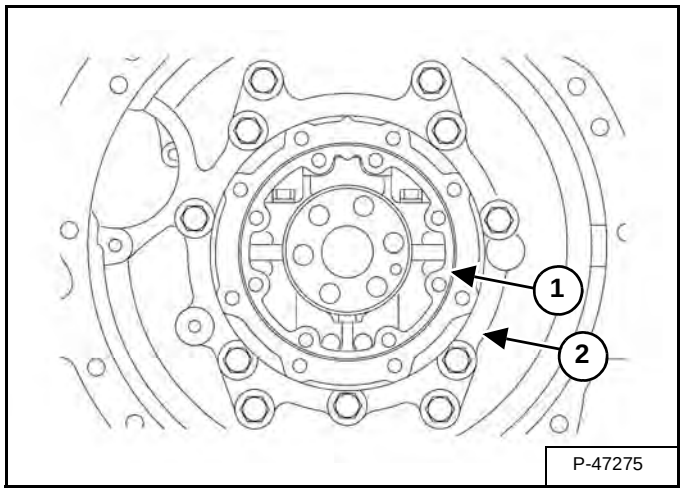
Mark and remove the inside screws (Item 1) first, then remove the outside screws (Item 2) **[Figure 60-90-16]**.

NOTE: The inside bolts are different length than the outside bolts.

Install two screws in the bearing case cover and remove the cover (Item 3) **[Figure 60-90-16]**.

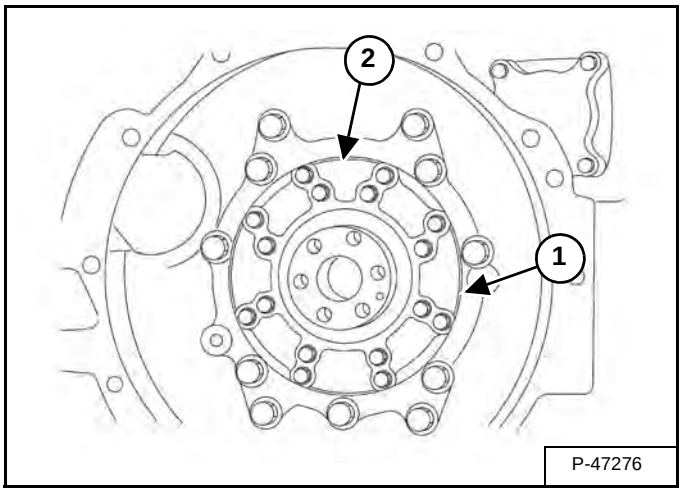
Remove the two gaskets (Item 4) and oil seal (Item 5) **[Figure 60-90-16]** from the cover.

Figure 60-90-17



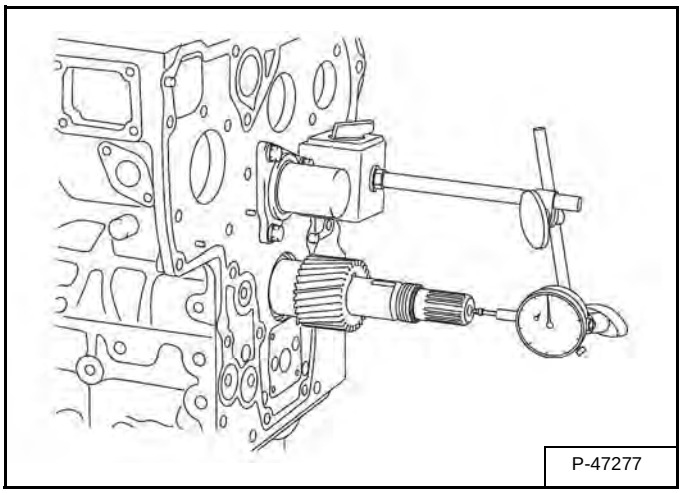
Installation: Install the gaskets (Item 1) and (Item 2) **[Figure 60-90-17]** as shown.

Figure 60-90-18



Install the bearing case cover (Item 1) with the casting mark (Item 2) **[Figure 60-90-18]** in the upward position. Tighten the bolts to 24 - 27 N•m (18 - 20 ft-lb) torque.

Figure 60-90-19



Before removing the crankshaft / main bearings, check the end play. Install a dial indicator. Move the crankshaft **[Figure 60-90-19]** to the flywheel side, zero the dial indicator. Measure the end play by pulling the crankshaft toward the gear case side.

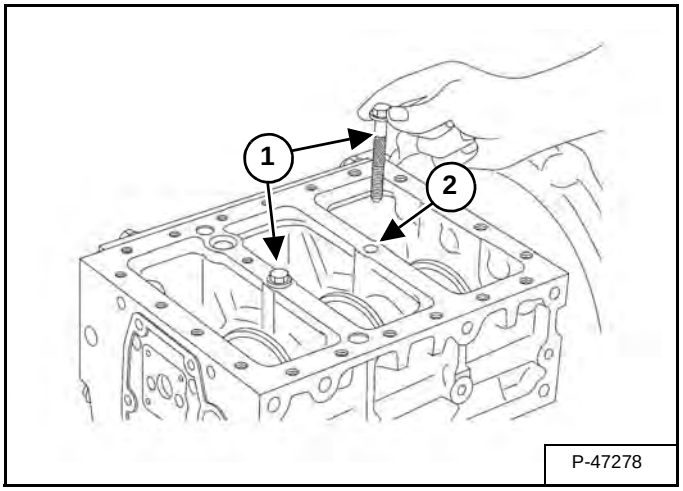
If the measurement exceeds the allowable limit, replace the thrust washers **[Figure 60-90-19]**.

End Play	0,15 - 0,31 mm (0.006 - 0.012 in)
Allowable Limit	0,5 mm (0.020 in)

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Crankshaft And Bearings Removal And Installation (Cont'd)

Figure 60-90-20

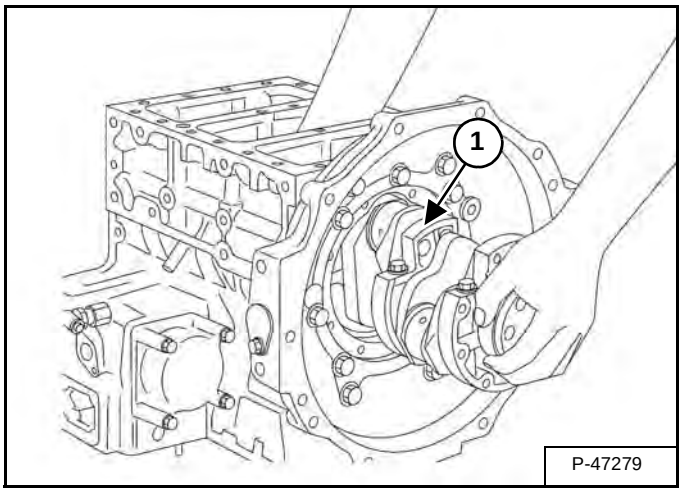


Remove the main bearing bolt (Item 1) **[Figure 60-90-20]**.

Turn the crankshaft so the crank pin of the #3 cylinder is at BDC. Start to remove the crankshaft until the crankpin of the #2 cylinder is in the #3 cylinder bore. Rotate the crankshaft 120° counter clockwise so the #2 crank pin is at BDC. Repeat the above procedure when the #1 crank pin is in the #3 cylinder.

Installation: Align the bearing case hole with the hole in the block (Item 2) **[Figure 60-90-20]**. Put oil on the bolt threads and tighten to 69 - 74 N•m (51 - 54 ft-lb) torque.

Figure 60-90-21

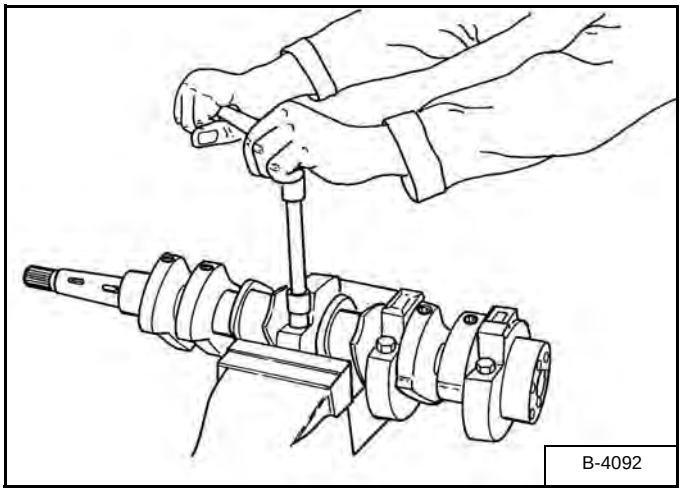


Remove the crankshaft / main bearing assembly from the engine block **[Figure 60-90-21]**.

NOTE: Turn the crankshaft as needed to allow the crank pin journals to pass through the cut out (Item 1) [Figure 60-90-21] of the engine block.

Mark the bearing case halves for correct installation.

Figure 60-90-22



Remove the two bearing case bolts **[Figure 60-90-22]**.

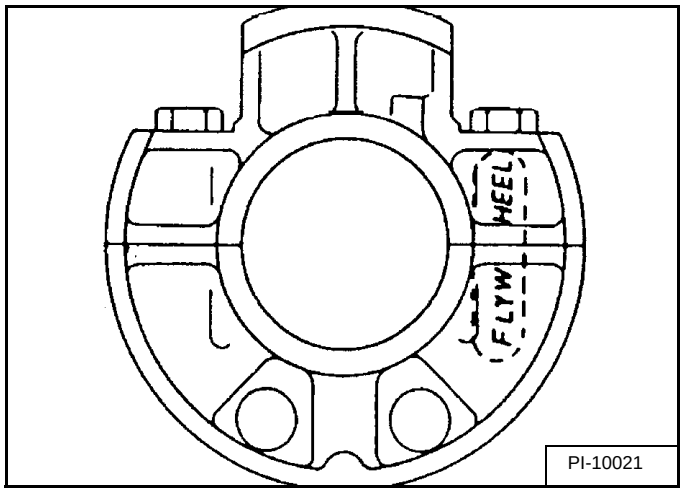
Remove the bearing case and bearing.

Installation: Tighten the bearing case bolts to 46 - 51 N•m (34 - 38 ft-lb) torque.

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Crankshaft And Bearings Removal And Installation (Cont'd)

Figure 60-90-23

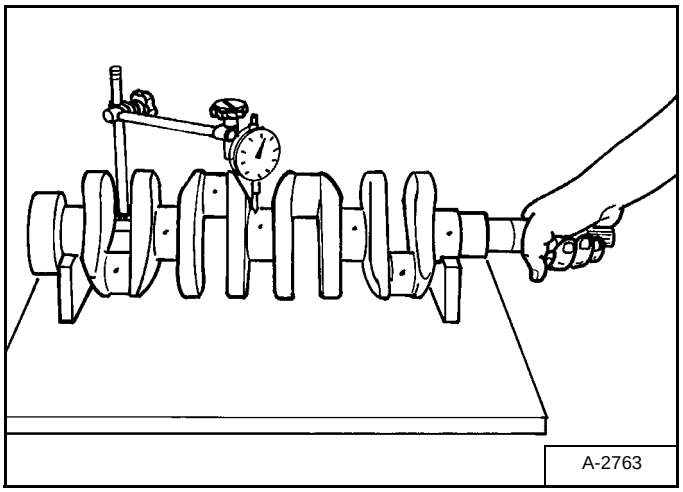


Installation: When installing the main bearing case assemblies, face the mark FLYWHEEL to the flywheel side of the engine block **[Figure 60-90-23]**. The thrust washers oil grooves must face outward.

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Crankshaft And Bearings - Servicing

Figure 60-90-24



Put the crankshaft on V-blocks. Install a dial indicator on the center journal **[Figure 60-90-24]**.

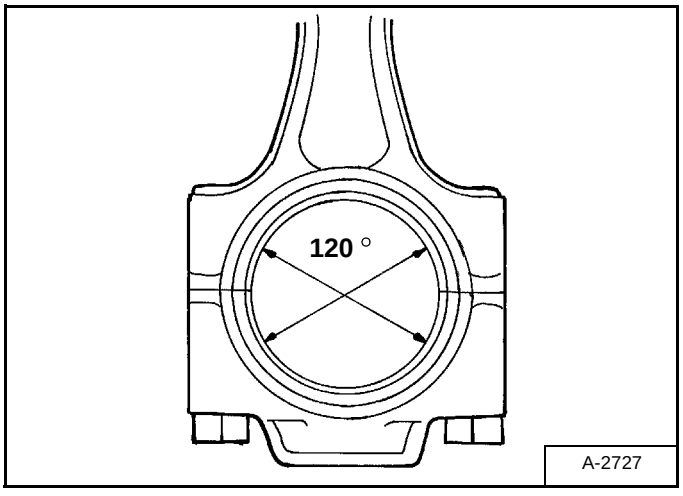
Turn the crankshaft at a slow rate to obtain the misalignment (one half of the alignment measurement).

If the misalignment exceeds the allowable limit, replace the crankshaft.

Alignment	0,02 mm (0.0008 in)

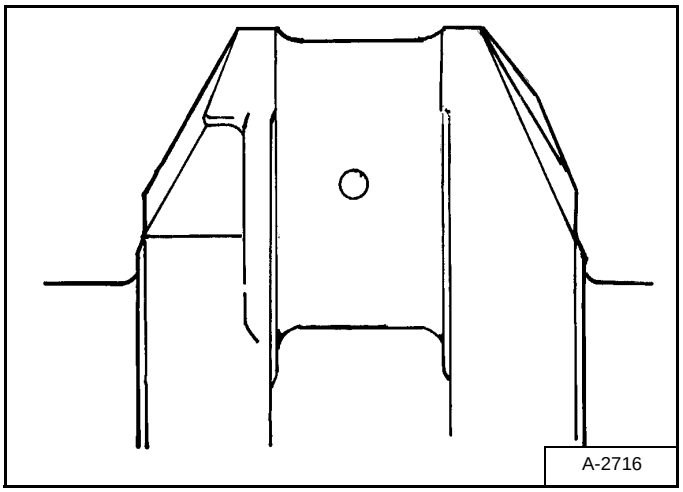
Tighten the connecting rod bolts to 44 - 49 N•m (33 - 36 ft-lb) torque.

Figure 60-90-25



Measure the crankpin bearing I.D. **[Figure 60-90-25]**.

Figure 60-90-26



Measure the crankpin O.D. **[Figure 60-90-26]**.

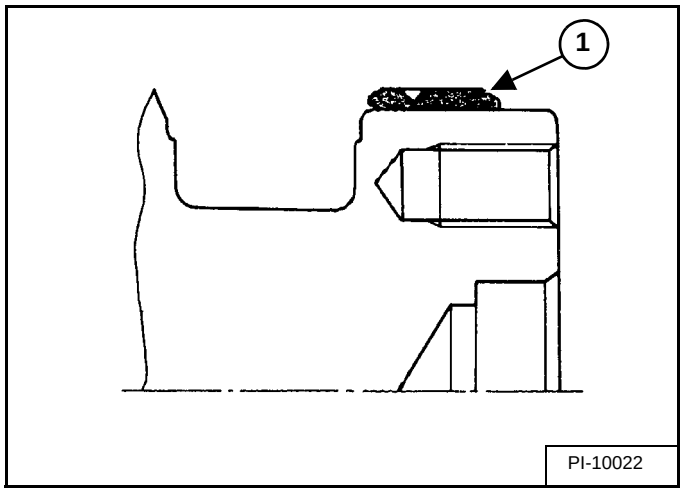
Calculate the oil clearance.

Crankpin Bearing I.D.	47,0 - 47,05 mm (1.850 - 1.852 in)
Crankpin O.D.	49,96 - 46,98 mm (1.8488 - 1.8494 in)
Oil Clearance	0,025 - 0,087 mm (0.001 - 0.0034 in)
Allowable Limit	0,2 mm (0.008 in)

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Crankshaft And Bearings - Servicing (Cont'd)

Figure 60-90-27



Check the wear on the crankshaft sleeve (Item 1) **[Figure 60-90-27]**.

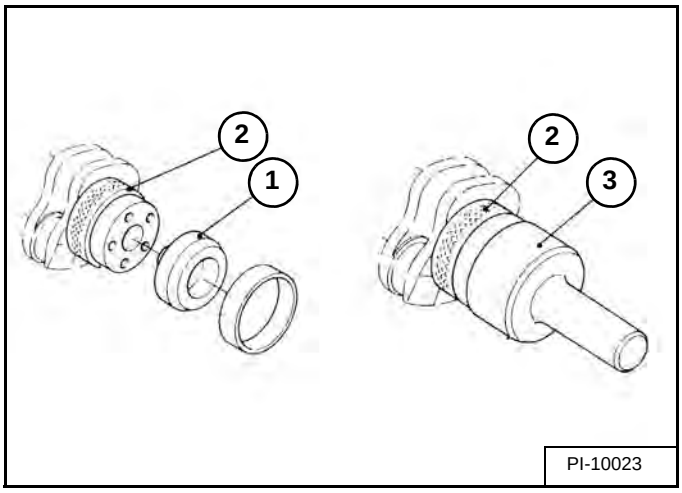
If the wear exceeds the allowable limit or the seal leaks oil, replace the sleeve.

Wear of Sleeve	0,1 mm (0.0004 in)

The special tool set will be needed to replace the crankshaft sleeve.

Remove the sleeve.

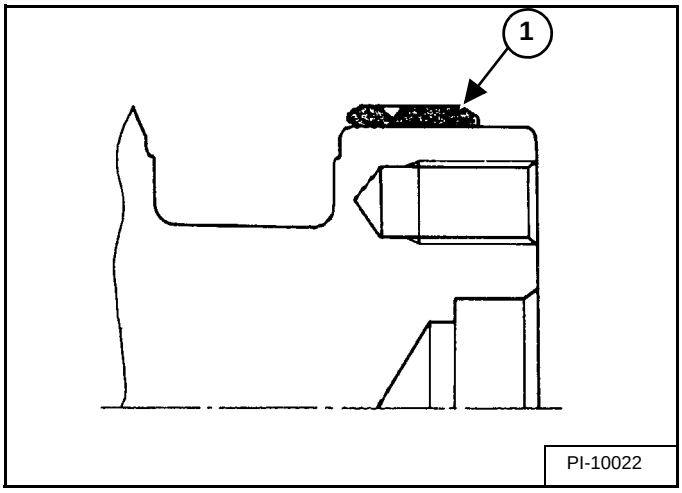
Figure 60-90-28



Install the sleeve guide (Item 1) and stop (Item 2) **[Figure 60-90-28]**.

Heat the sleeve to approximately 150 - 200°C (302 - 392°F). Install the sleeve on the crankshaft using the special driver tool (Item 3) **[Figure 60-90-28]**.

Figure 60-90-29

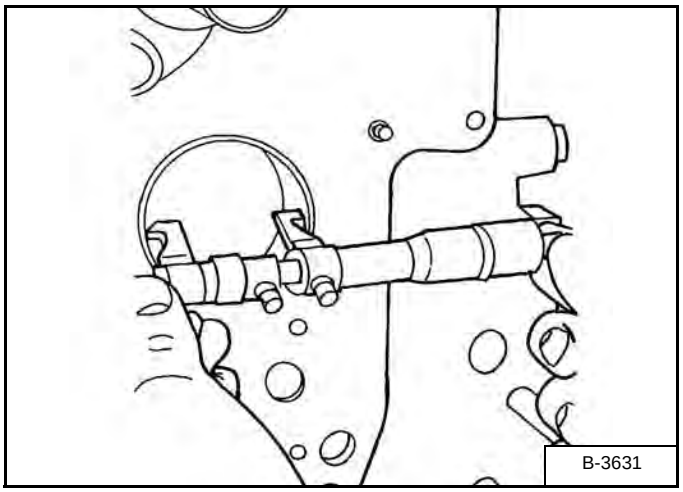


NOTE: The sleeve is installed with the larger chamfered surface to the front of the crankshaft (Item 1) [Figure 60-90-29].

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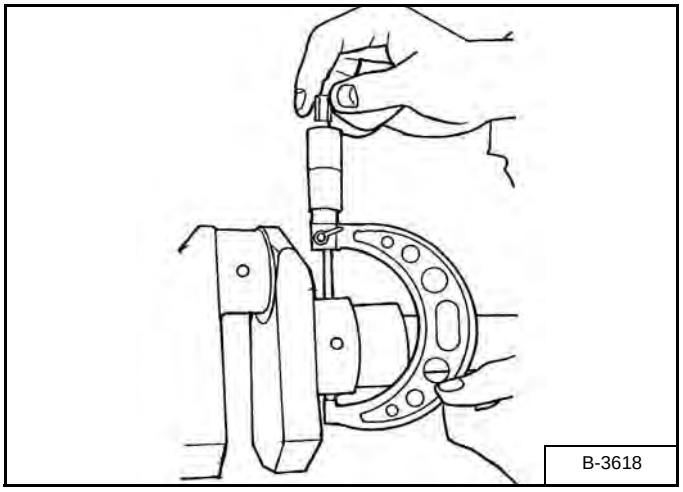
Crankshaft And Bearings - Servicing (Cont'd)

Figure 60-90-30



Measure the I.D. of the No. 1 crankshaft bearing **[Figure 60-90-30]**.

Figure 60-90-31



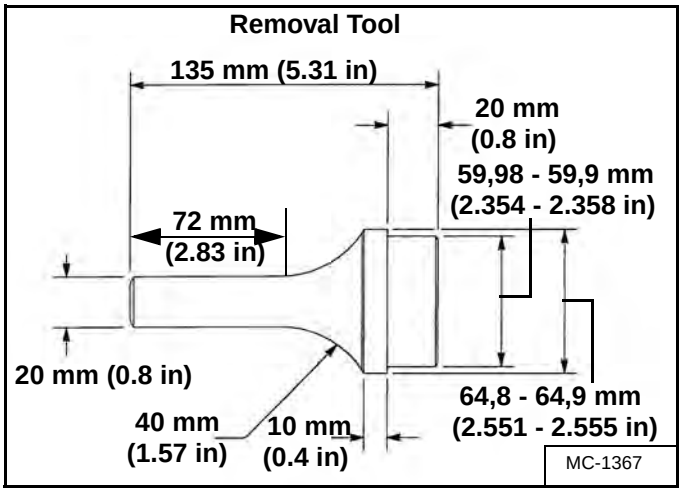
Measure the O.D. of the crankshaft journal **[Figure 60-90-31]**.

Calculate the oil clearance.

If the clearance exceeds the allowable limit, replace the crankshaft bearing.

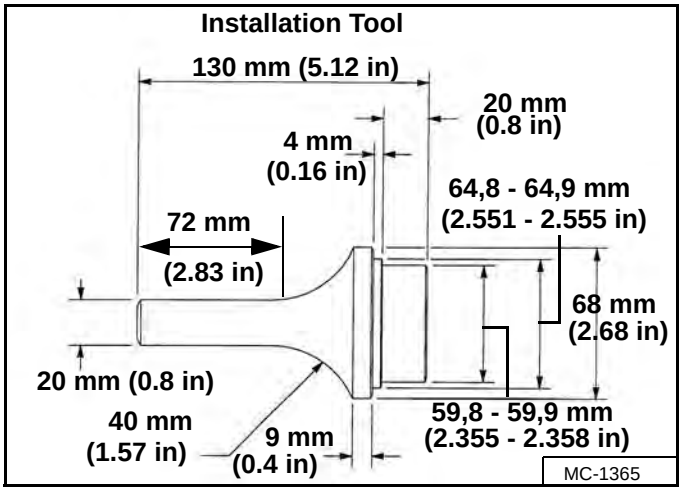
Bearing I.D.	59,98 - 60,039 mm (2.3615 - 2.3631 in)
Crankshaft Journal O.D.	59,921 - 59,94 mm (2.3591 - 2.3598 in)
Oil Clearance	0,04 - 0,118 mm (0.0016 - 0.0046 in)
Allowable Limit	0,20 mm (0.0079 in)

Figure 60-90-32



To remove the front bearing make the tool as shown in **[Figure 60-90-32]**.

Figure 60-90-33

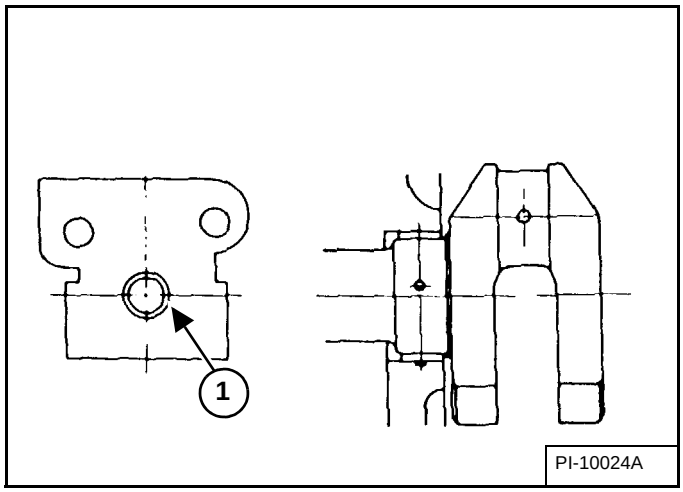


To install the front bearing make the tool as shown in **[Figure 60-90-33]**.

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Crankshaft And Bearings - Servicing (Cont'd)

Figure 60-90-34



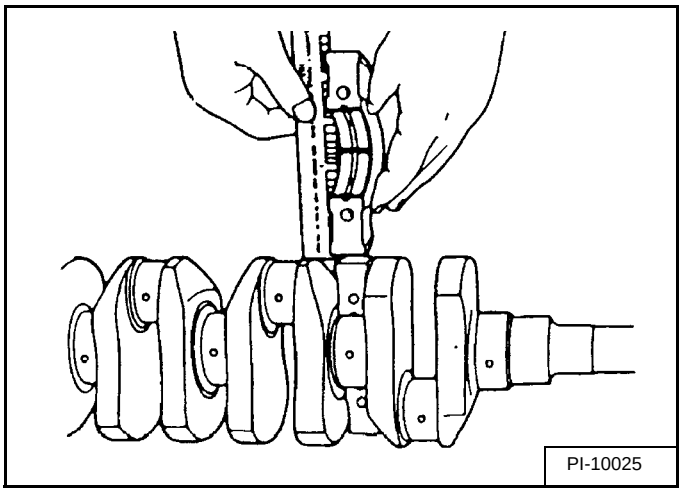
Remove the front bearing with the special removal tool **[Figure 60-90-34]**.

Installation: Clean the new bearing and bore, apply oil to the bearing and bore. Install the new bearing with the seam (Item 1) **[Figure 60-90-34]** towards the exhaust manifold side, using the installation driver tool.

Clean the crankshaft journal and bearing. Put a strip of press gauge on the center journal. Install the main bearing case halves and tighten the bolts. Remove the bearing case halves.

NOTE: DO NOT turn the crankshaft with the press gauge installed. Incorrect measurements will be obtained.

Figure 60-90-35



Measure the flattened press gauge **[Figure 60-90-35]**.

If the clearance exceeds the allowable limit, replace the crankshaft bearing.

Crankshaft Journal O.D.	59,921 - 59,94 mm (2.3591 - 2.3598 in)
Bearing I.D.	59,98 - 60,039 mm (2.3614 - 2.3637 in)
Oil Clearance	0,04 - 0,118 mm (0.00158 - 0.00464 in)
Allowable Limit	0,2 mm (0.008 in)

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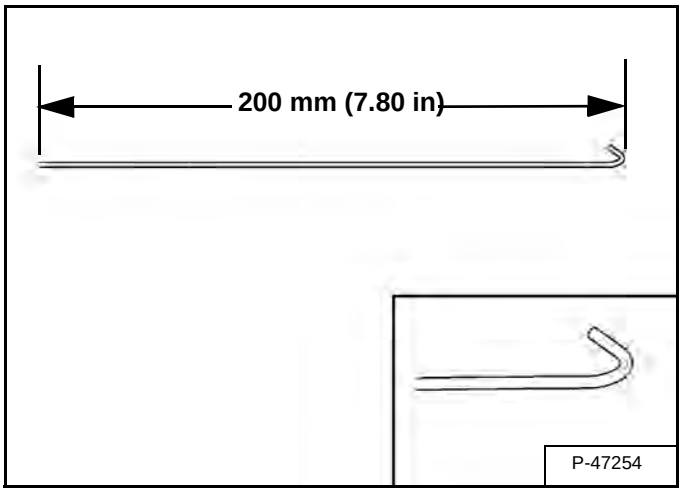
CAMSHAFT AND TIMING GEARS

Timing Gearcase Cover Removal And Installation

Remove the fuel injection pump. (See Fuel Injection Pump Removal And Installation on Page 60-50-4.)

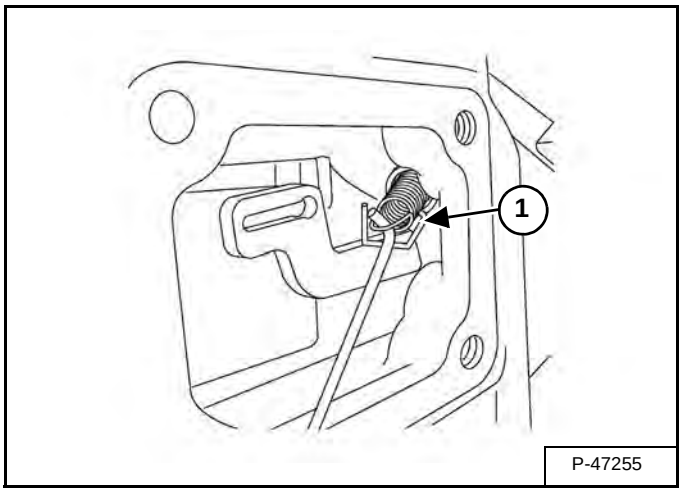
Remove the cylinder head, rocker arms and push rods. (See Cylinder Head Removal And Installation on Page 60-80-4.)

Figure 60-100-1



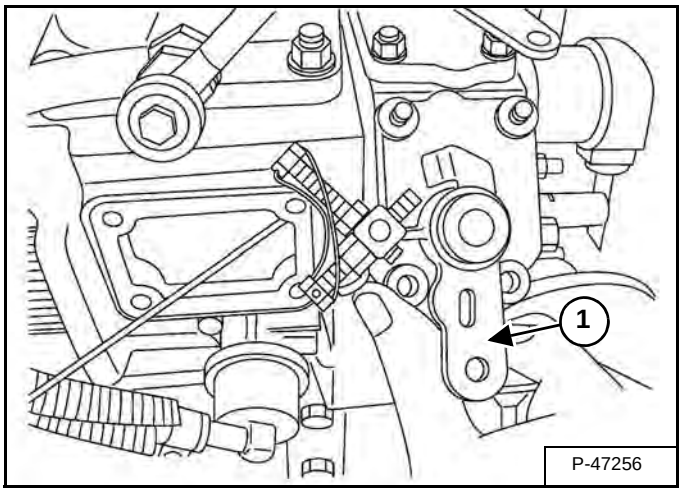
Bend a hook on the end of a 200 mm (7.80 in) long, 1,2 mm (0.050 in) diameter hard wire **[Figure 60-100-1]**.

Figure 60-100-2



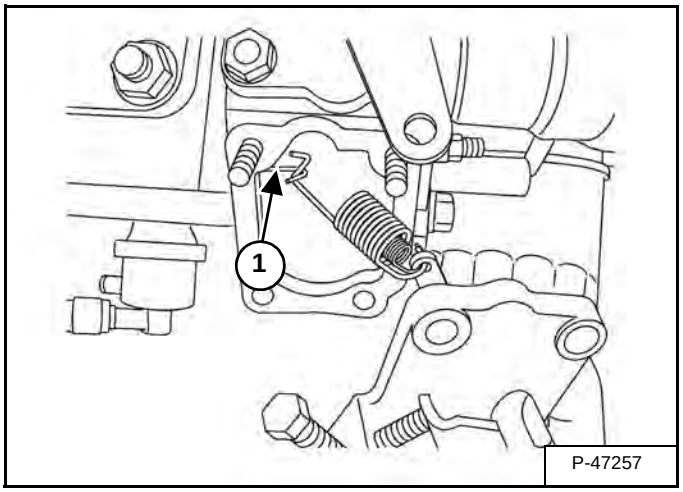
Disconnect the two governor springs (Item 1) **[Figure 60-100-2]**.

Figure 60-100-3



Remove the speed control plate (Item 1) **[Figure 60-100-3]**.

Figure 60-100-4



Remove the wire (Item 1) **[Figure 60-100-4]** from the springs.

Installation: Do not drop the governor springs into the gear case.

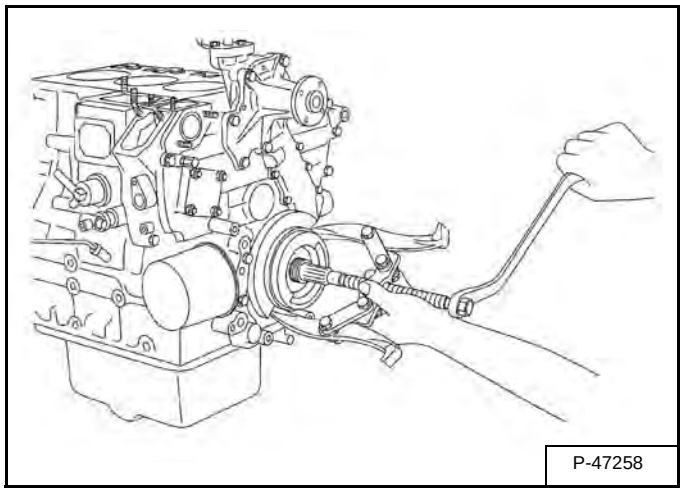
Remove the crankshaft pulley nut.

Installation: Tighten the nut to 138 - 156 N•m (102 - 115 ft-lb) torque.

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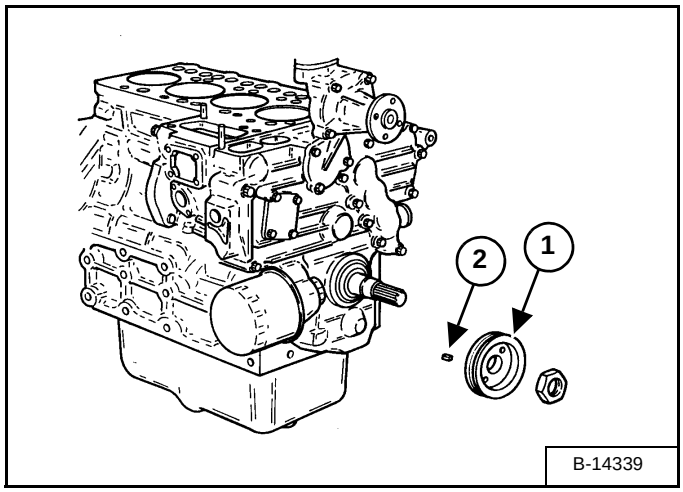
Timing Gearcase Cover Removal And Installation (Cont'd)

Figure 60-100-5



Use a puller and remove the crankshaft pulley **[Figure 60-100-5]**.

Figure 60-100-6

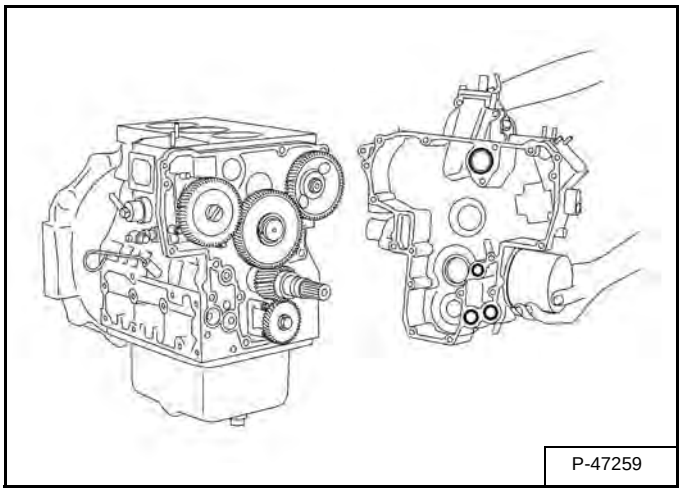


Remove the crankshaft pulley (Item 1) and key (Item 2) **[Figure 60-100-6]**.

Remove the bolts from the timing gearcase cover.

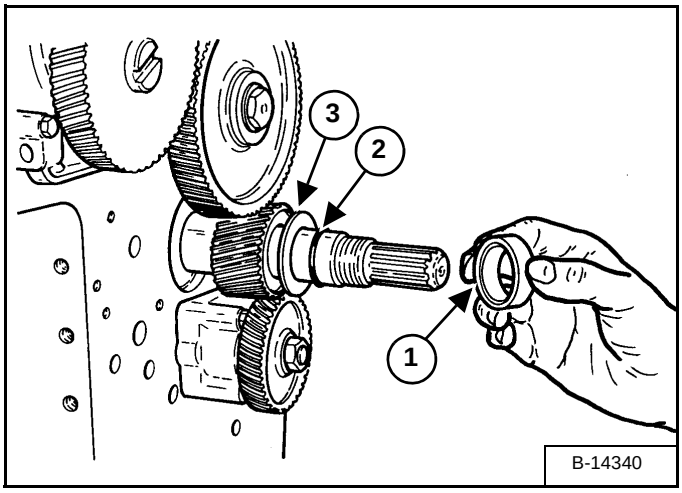
Installation: Tighten the bolts to 18 - 20 N•m (13 - 15 ft-lb) torque.

Figure 60-100-7



Remove the timing gearcase cover **[Figure 60-100-7]**.

Figure 60-100-8

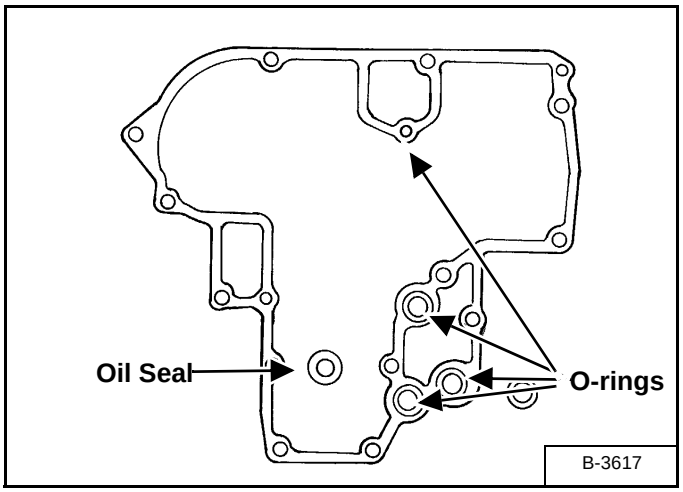


Remove the crankshaft collar (Item 1), O-ring (Item 2) and oil slinger (Item 3) **[Figure 60-100-8]**.

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Timing Gearcase Cover Removal And Installation (Cont'd)

Figure 60-100-9



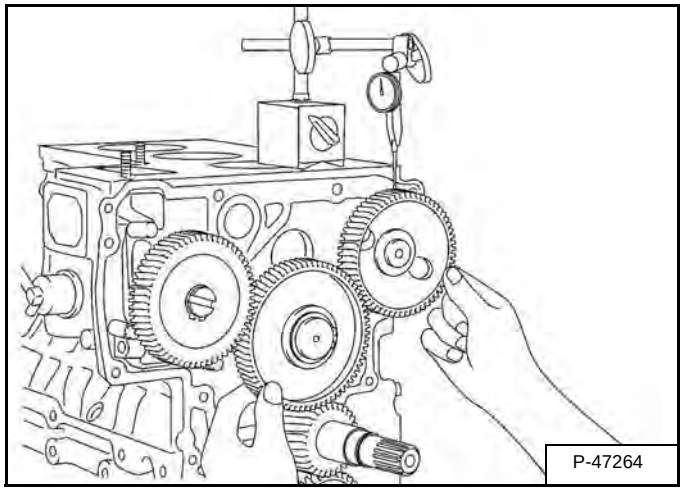
Installation: Install new O-rings and oil seal into the timing gearcase cover **[Figure 60-100-9]**.

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Timing Gears Backlash - Checking

When the gears are installed, check the backlash of the gears.

Figure 60-100-10



Install a dial indicator **[Figure 60-100-10]**.

Hold one gear while turning the other gear **[Figure 60-100-10]**.

If the backlash exceeds the allowable limit, check the oil clearance of the shaft and gear. If the oil clearance is correct, replace the gear.

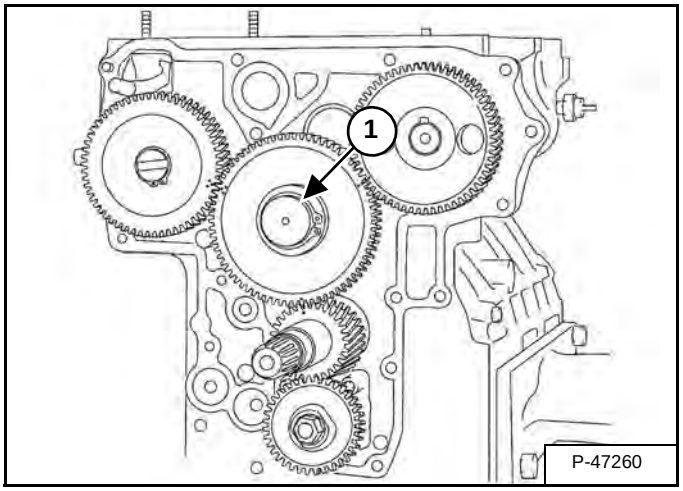
Crank Gear & Idle Gear	0,042 - 0,112 mm (0.0016 - 0.0044 in)
Allowable Limit	0,15 mm (0.006 in)
Cam Gear & Idle Gear	0,042 - 0,115 mm (0.0016 - 0.0045 in)
Allowable Limit	0,15 mm (0.006 in)
Injection Pump Gear & Idle Gear	0,042 - 0,115 mm (0.0016 - 0.0045 in)
Allowable Limit	0,15 mm (0.006 in)
Oil Pump Gear & Crankgear	0,042 - 0,109 mm (0.0016 - 0.0043 in)
Allowable Limit	0,15 mm (0.006 in)

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Idle Gear And Camshaft Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-100-1.)

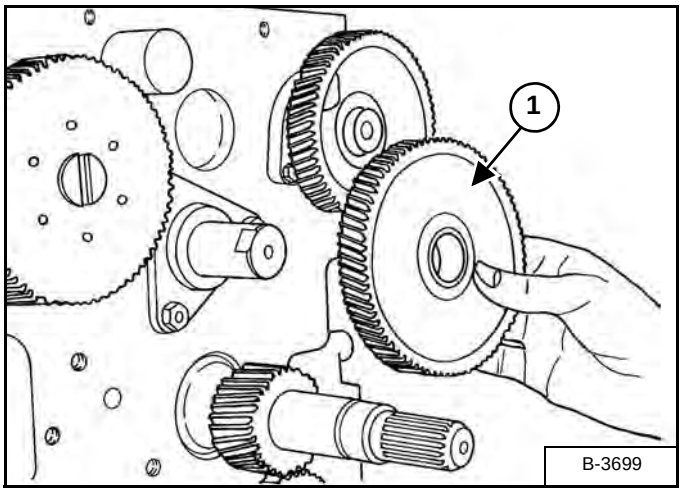
Figure 60-100-11



Remove the snap ring (Item 1) **[Figure 60-100-11]** and collar from the idle gear shaft.

Installation: Make sure the timing marks are in correct alignment when installing the timing gears **[Figure 60-100-11]**.

Figure 60-100-12

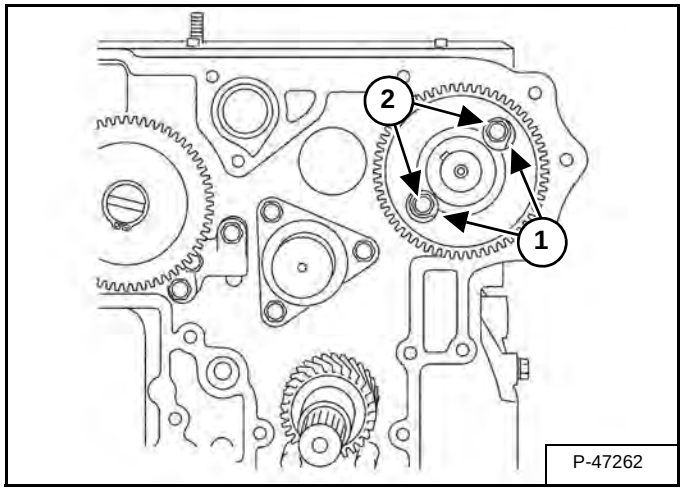


Remove the idle gear (Item 1) **[Figure 60-100-12]**.

Installation: Check the idle gear end play. If the clearance exceeds the allowable limit, replace the gear collar.

Idle Gear End Play	0,12 - 0,48 mm (0.005 - 0.019 in)
Allowable Limit	0,9 mm (0.035 in)

Figure 60-100-13



Align the holes (Item 1) on the camshaft gear with the camshaft retainer plate bolts (Item 2) **[Figure 60-100-13]**. Remove the bolts.

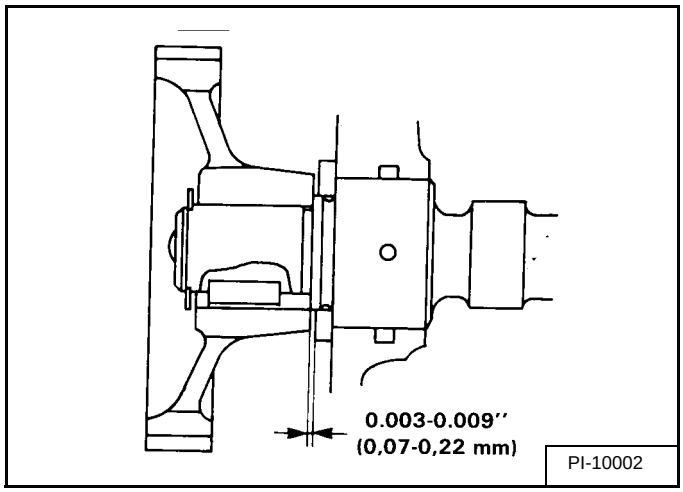
Installation: Tighten the camshaft retainer bolts to 24 - 28 N•m (17 - 20 ft-lb) torque.

Remove the camshaft from the engine block.

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Idle Gear And Camshaft Removal And Installation (Cont'd)

Figure 60-100-14



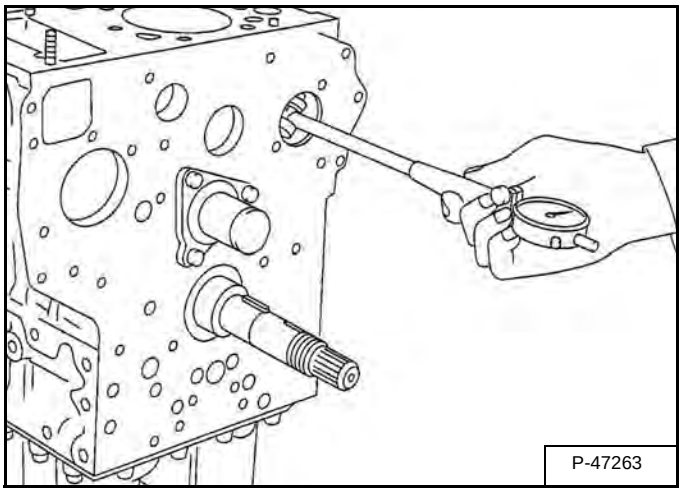
Installation: Check the camshaft end play. If clearance exceeds the allowable limit, replace the camshaft retainer plate **[Figure 60-100-14]**.

Camshaft End Play	0,07 - 0,22 mm (0.0028 - 0.0087 in)
Allowable Limit	0,3 mm (0.012 in)

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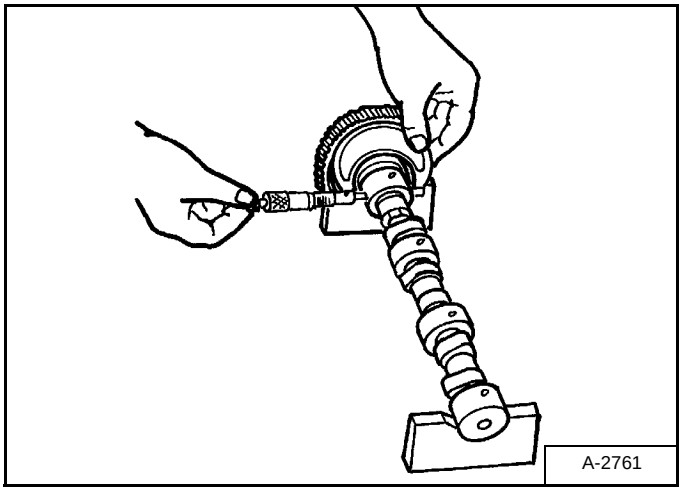
Camshaft - Servicing

Figure 60-100-15



Measure the cylinder block bore in the engine block **[Figure 60-100-15]**.

Figure 60-100-16

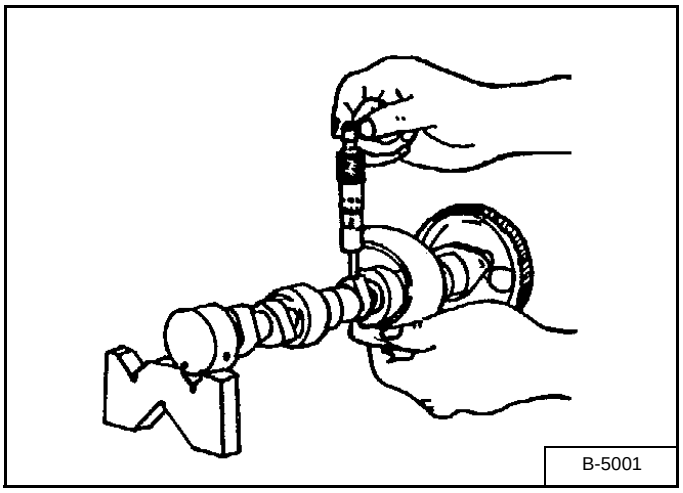


Measure the camshaft journal **[Figure 60-100-16]**.

Calculate the oil clearance. If the clearance exceeds the allowable limit, replace the camshaft.

Cylinder Block Bore I.D.	40,0 - 40,025 mm (1.575 - 1.576 in)
Journal O.D.	39,93 - 39,95 mm (1.572 - 1.573 in)
Oil Clearance of Camshaft Journal	0,05 - 0,091 mm (0.002 - 0.0036 in)
Allowable Limit	0,15 mm (0.006 in)

Figure 60-100-17

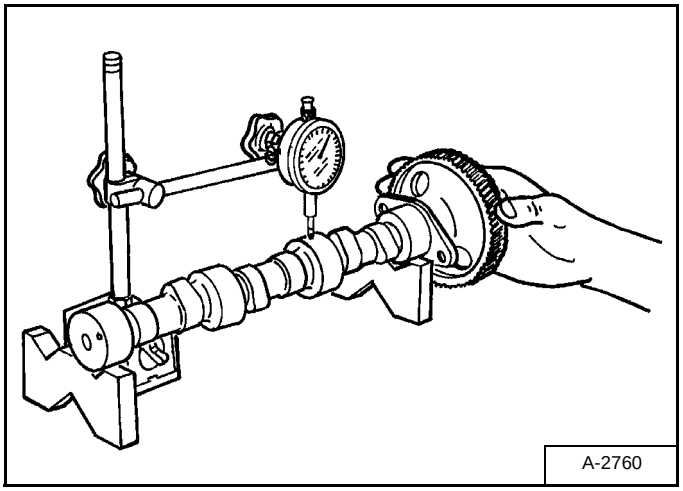


Measure the cam lobes at their highest point **[Figure 60-100-17]**.

If the measurement is less than the allowable limit, replace the camshaft.

Cam Lobe Height	33,9 mm (1.335 in)
Allowable Limit	33,85 mm (1.333 in)

Figure 60-100-18



Put the camshaft in V-blocks. Install a dial indicator **[Figure 60-100-18]**.

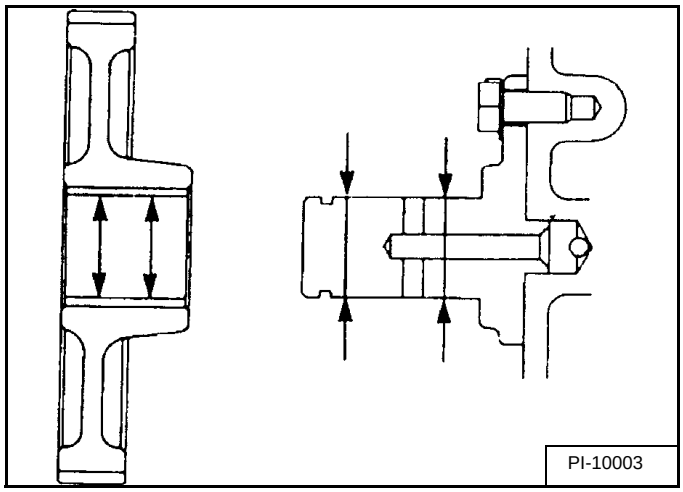
Turn the camshaft at a slow rate. If the misalignment exceeds the allowable limit, replace the camshaft.

Camshaft Alignment Allowable Limit	0,01 mm (0.0004 in)

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Idle Gear And Shaft - Servicing

Figure 60-100-19



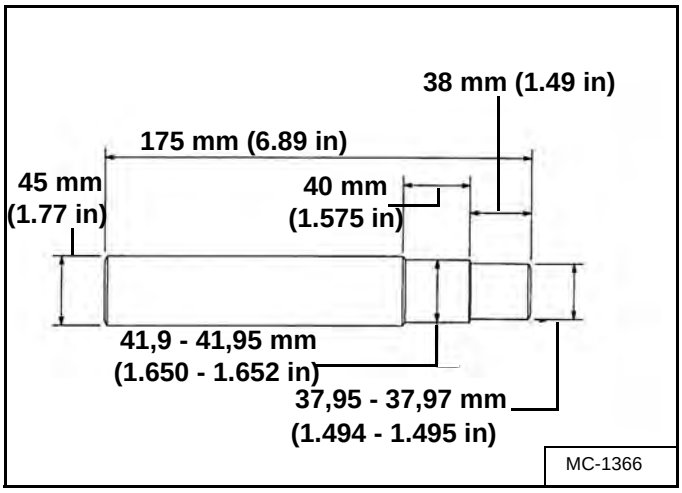
Measure the O.D. of the idle gear shaft **[Figure 60-100-19]**.

Measure the I.D. of the idle gear bushing **[Figure 60-100-19]**.

If the clearance exceeds the allowable limit, replace the bushing.

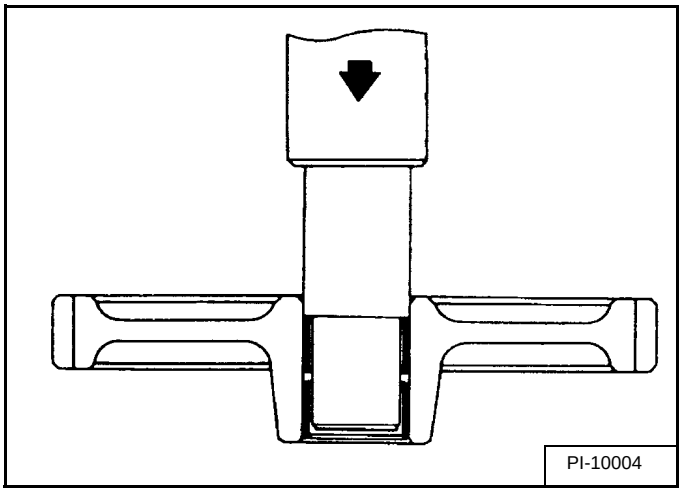
Idle Gear Shaft O.D.	37,96 - 37,98 mm (1.494 - 1.495 in)
Idle Gear Bushing I.D.	38,0 - 38,03 mm (1.496 - 1.497 in)
Clearance Between Idle Shaft & Gear Bushing	0,025 - 0,066 mm (0.001 - 0.0026 in)
Allowable Limit	0,1 mm (0.004 in)

Figure 60-100-20



To replace the idle gear bushing, make a driver tool as shown in figure **[Figure 60-100-20]**.

Figure 60-100-21



Use a press and special driver tool to remove the old bushing and install the new bushing **[Figure 60-100-21]**.

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Hydraulic Pump Coupler Removal And Installation

Open the tailgate.

Remove the counterweight. (See Removal And Installation on Page 40-90-1.)

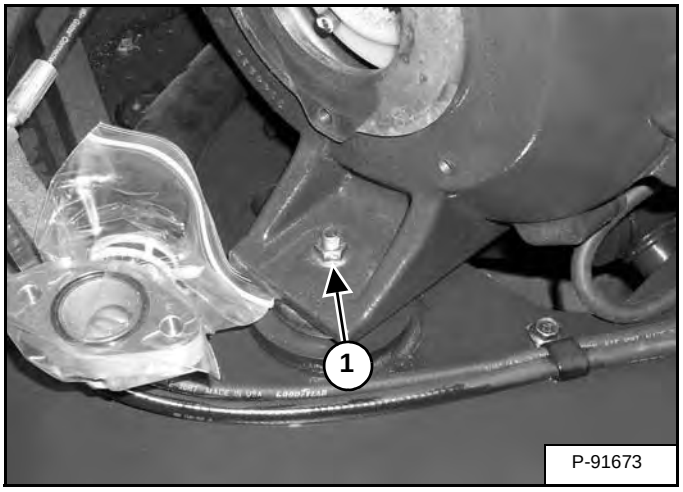
Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-130-5.)

Remove the muffler. (See Removal And Installation on Page 60-30-1.)

Remove the hydraulic pump. (See Removal And Installation on Page 20-50-11.)

Remove the starter. (See Removal And Installation on Page 50-40-2.)

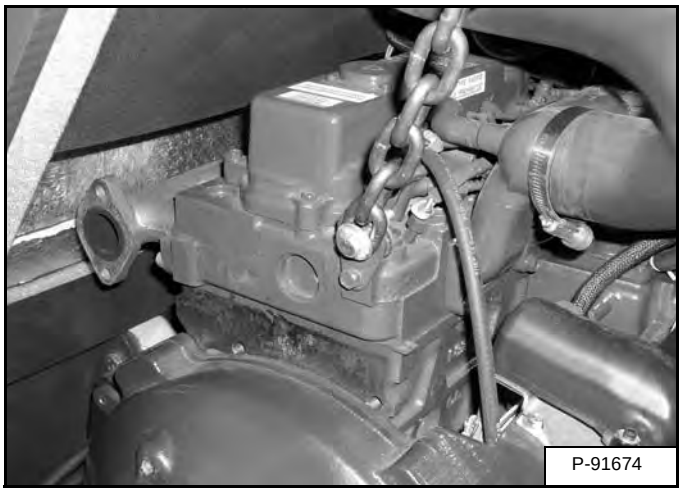
Figure 60-110-1



Remove the nut (Item 1) **[Figure 60-110-1]** and bolt from the engine mount.

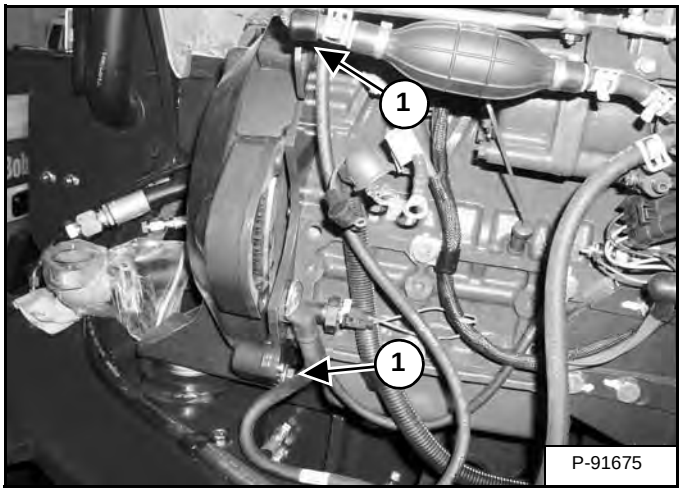
Installation: Tighten the bolt to 105 - 115 N•m (78 - 85 ft-lb) torque.

Figure 60-110-2



Slightly raise the flywheel end of the engine, and place a support under the oil pan **[Figure 60-110-2]**.

Figure 60-110-3

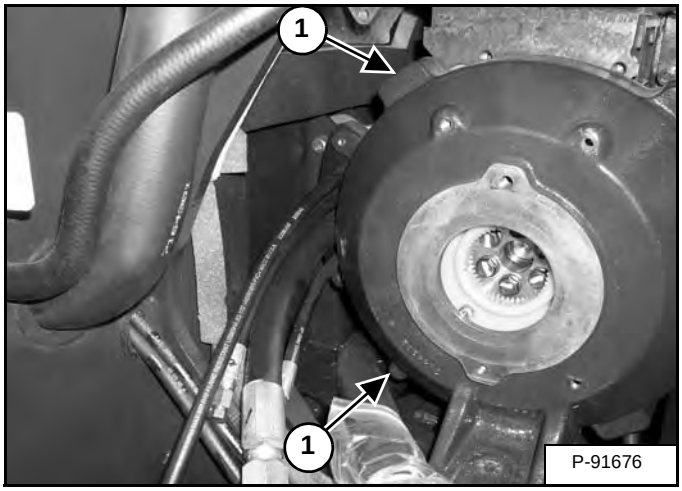


Remove the three flywheel housing bolts (Item 1) **[Figure 60-110-3]**.

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Hydraulic Pump Coupler Removal And Installation (Cont'd)

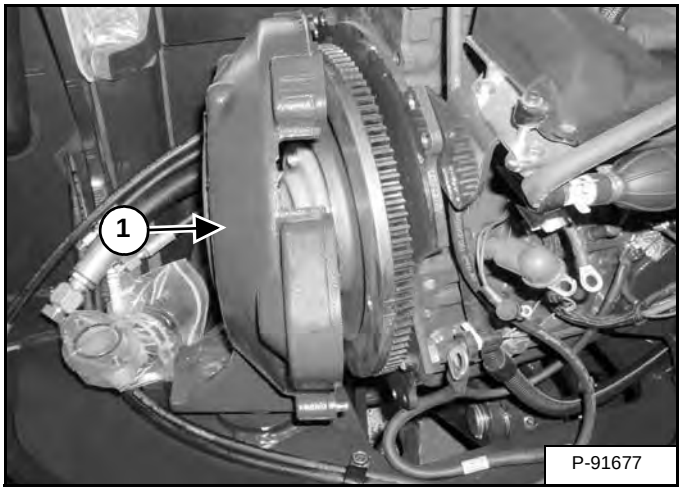
Figure 60-110-4



Remove the two flywheel housing bolts (Item 1) **[Figure 60-110-4]** from the front side of the engine.

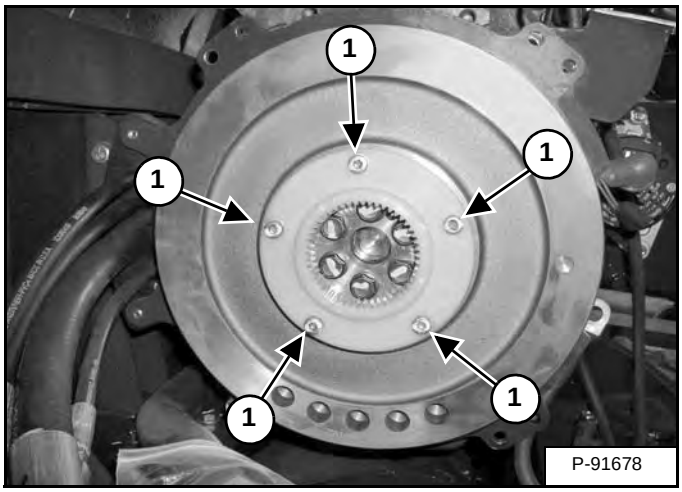
Installation: Position the housing over the alignment pins and tighten the bolts to 43 - 47 N•m (32 - 35 ft-lb) torque.

Figure 60-110-5



Remove the flywheel housing (Item 1) **[Figure 60-110-5]** from the engine.

Figure 60-110-6



Remove the bolts (Item 1) **[Figure 60-110-6]** from the hydraulic pump coupler.

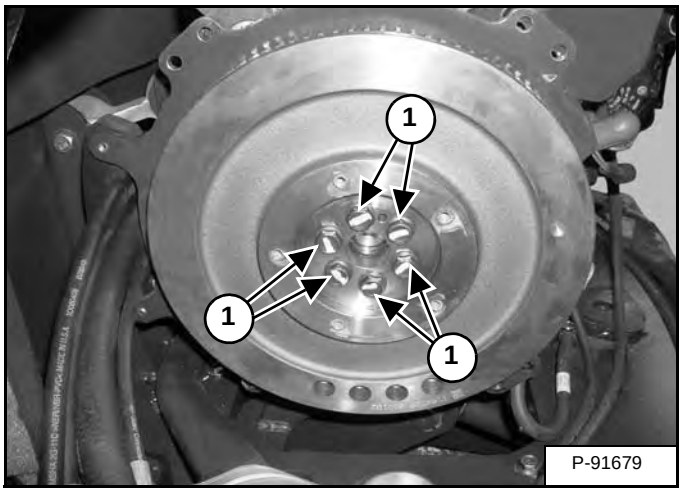
Installation: Apply Loctite® 242 to the bolts. Tighten the bolts to 35 - 39 N•m (25 - 28 ft-lb) torque.

Remove the hydraulic pump coupler.

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Flywheel Removal And Installation

Figure 60-110-7



Remove the six bolts (Item 1) **[Figure 60-110-7]** from the flywheel.

Installation: Apply Loctite 242™ to the bolts. Tighten the bolts to 113 - 122 N•m (83 - 90 ft-lb) torque.

Remove the flywheel.

Flywheel Ring Gear

WARNING

AVOID INJURY OR DEATH

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

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

W-2019-0907

The ring gear on the flywheel is an interference fit. Heat the ring gear enough to expand it and hit it with a hammer evenly to remove it.

Clean the outer surface of the flywheel to give a smooth fit.

Clean the new ring gear and heat it to a temperature of 232 - 260°C (450 - 500°F).

Fit the ring gear over the flywheel. Make sure the gear is seated correctly.

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HEATING, VENTILATION AND AIR CONDITIONING (HVAC)
S/N A93K11001 - A93K17999 AND AC2P11001 - AC2P14999

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Removal And Installation 70-150-1

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AIR CONDITIONING SYSTEM FLOW

Description

In an air conditioning system the refrigerant is circulated under pressure through five major components in a closed circuit. At these five points in the system the refrigerant goes through pressure and temperature changes.

The compressor (Item 1) Page 70-10-3 takes in heated, low pressure refrigerant gas through the suction valve (low pressure side) and as the name indicates, pressurizes the heated refrigerant and forces it through the discharge valve (high pressure side) on the condenser (Item 2) Page 70-10-3.

Ambient air passing through the condenser removes the heat from refrigerant resulting in physical state change in the refrigerant from a gas to a liquid.

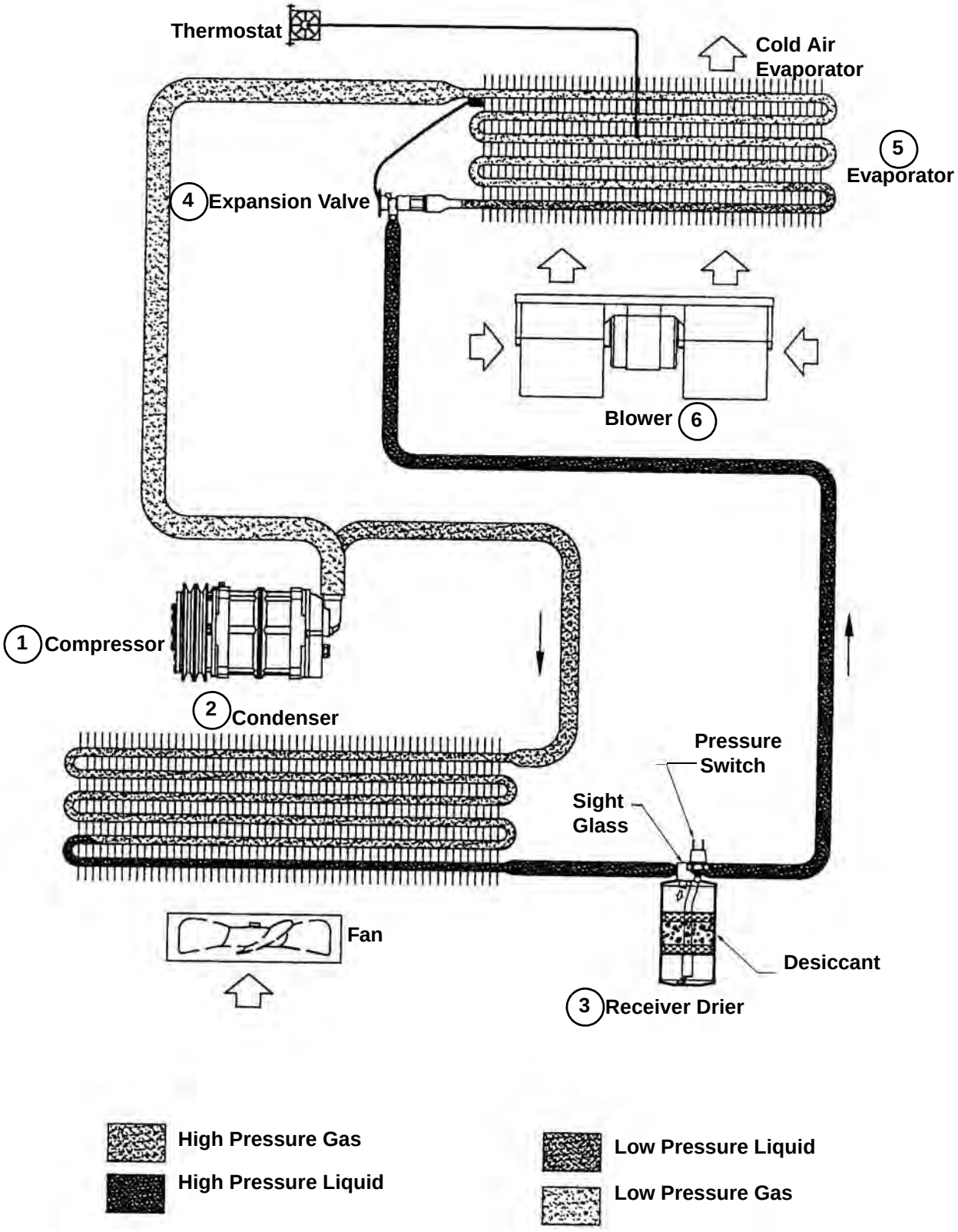
The liquid refrigerant moves on to the receiver / drier (Item 3) Page 70-10-3 where impurities such as moisture and dirt are filtered out. The receiver / drier also serves as the storage tank for the liquid refrigerant. The liquid refrigerant (still under high pressure) flows to the expansion valve (Item 4) Page Page 70-10-3.

The expansion valve meters the amount of refrigerant into the evaporator coil (Item 5) Page 70-10-3. As the refrigerant passes through the expansion valve, it again changes its physical state. It becomes a low temperature, low-pressure liquid and saturated vapor. The low pressure liquid immediately starts to boil and vaporize as it enters the evaporator. The hot humid air of the machine's cab is drawn through or blown into the evaporator by the evaporator fan (Item 6) Page 70-10-3. Since the refrigerant is colder than the air, it absorbs the heat from the air and produces cooled air, which is pushed into the cab by the fan. The moisture in the air condenses on the evaporator coil and drips into the drain pan, which directs the water out of the cab.

The refrigerant cycle is completed when the heated low pressure gas is again drawn into the compressor.

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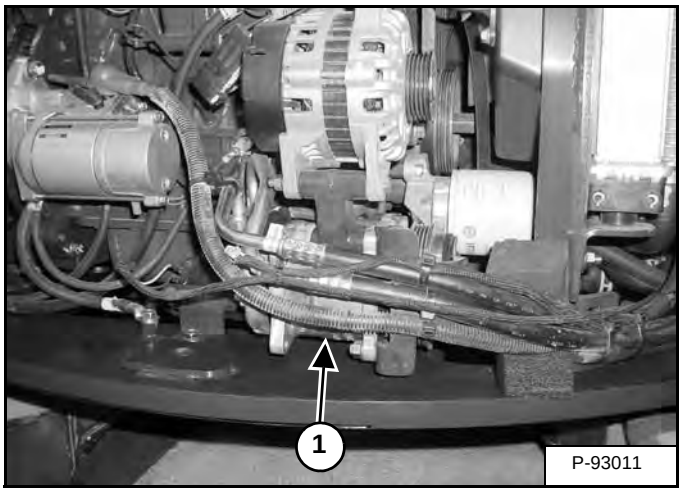
Chart



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Components

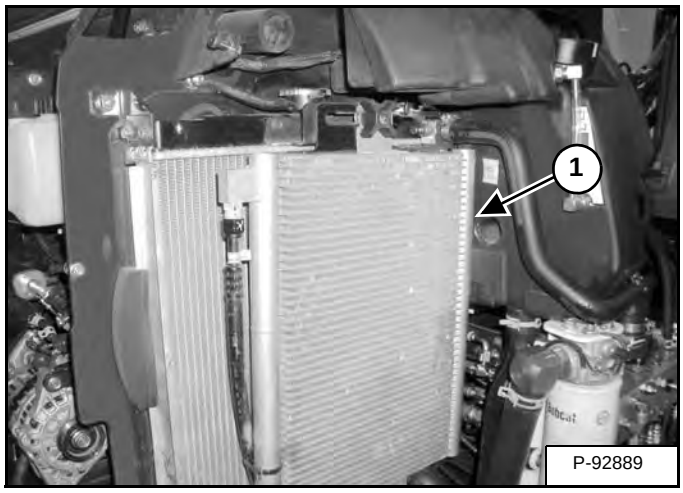
Figure 70-10-1



Compressor: The compressor (Item 1) **[Figure 70-10-1]** is the pump that circulates the refrigerant throughout the system. It raises the pressure of the refrigerant for heat transfer through the condenser and evaporator.

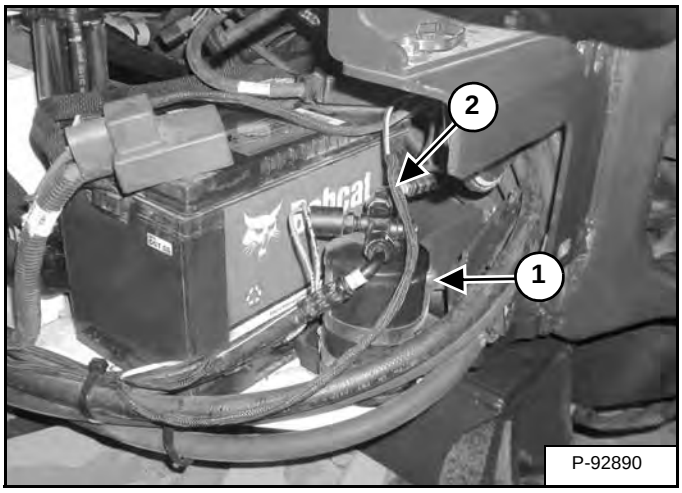
NOTE: The A/C system (Compressor) is recommended to be turned on for at least 5 minutes weekly throughout the year to lubricate the internal components.

Figure 70-10-2



Condenser: The condenser (Item 1) **[Figure 70-10-2]** is the unit that receives the high pressure, high temperature refrigerant vapor from the compressor and condenses it into a high temperature liquid.

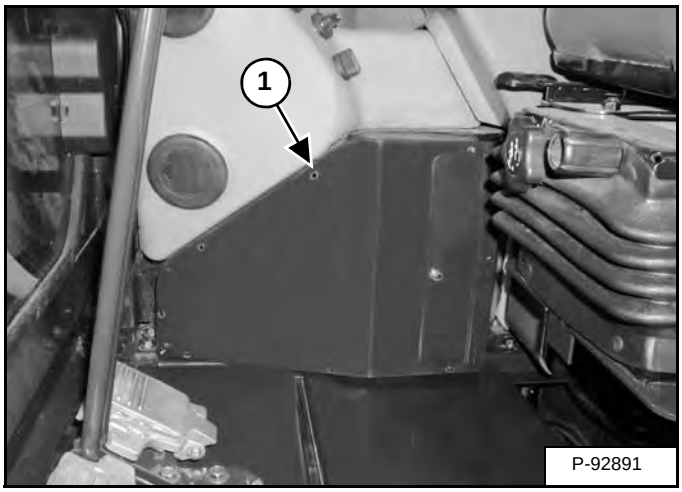
Figure 70-10-3



Receiver / Drier: The receiver / drier (Item 1) **[Figure 70-10-3]** is the unit that receives the liquid refrigerant from the condenser and removes moisture and foreign matter from the system. It also serves as a storage tank for the extra liquid refrigerant until it is needed by the evaporator.

Pressure Relief Valve: The pressure relief valve (Item 2) **[Figure 70-10-3]** is located on the receiver / drier assembly. This small brass valve is a safety feature that is designed to open and release the A/C charge if the pressure reaches 3344 - 3792 kPa (33,4 - 38 bar) (485 - 550 psi).

Figure 70-10-4

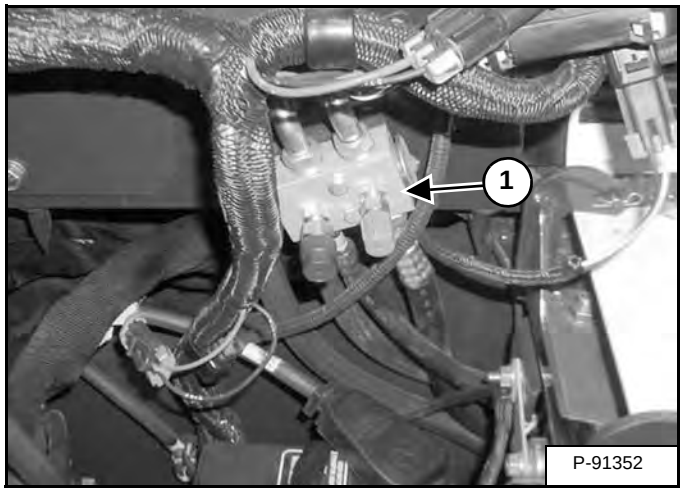


Evaporator / Heater Unit: The evaporator / heater unit (Item 1) **[Figure 70-10-4]** is located in the excavator cab. The unit delivers cold air for the A/C and warm air for heat into the cab. The unit contains the blower, heater coil, evaporator coil, and thermostat.

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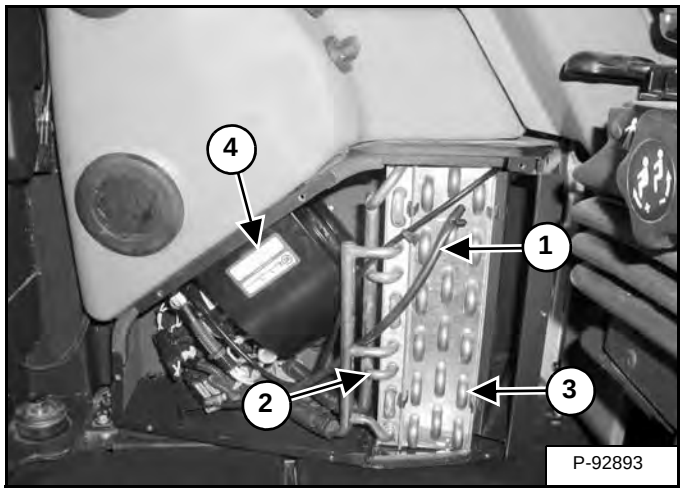
Components (Cont'd)

Figure 70-10-5



Expansion Valve: The expansion valve (Item 1) **[Figure 70-10-5]** controls the amount of refrigerant entering the evaporator coil.

Figure 70-10-6



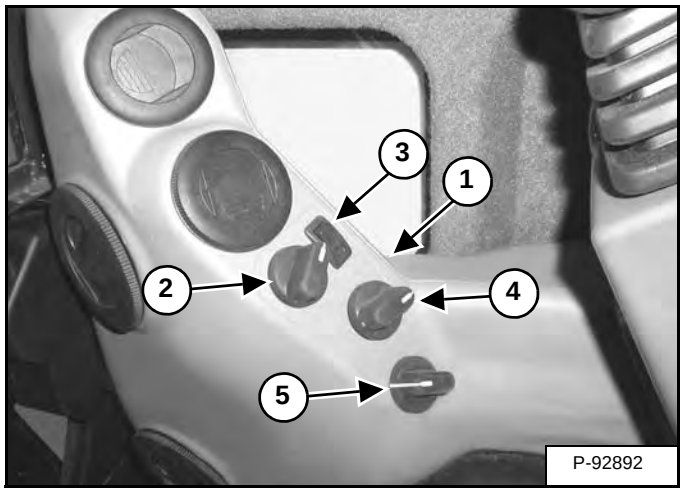
Thermostat: The thermostat (Item 1) **[Figure 70-10-6]** controls the temperature of the evaporator coil.

Heater Coil: The heater coil (Item 2) **[Figure 70-10-6]** supplies the warm air into the cab by passing air through the coil.

Evaporator Coil: The evaporator coil (Item 3) **[Figure 70-10-6]** cools and dehumidifies the air before it enters the cab.

Heater / Evaporator Blower: The blower (Item 4) **[Figure 70-10-6]** is used to push air through the heater and evaporator coils and into the cab.

Figure 70-10-7



Control Panel: The panel (Item 1) **[Figure 70-10-7]** has four separate components.

Fan Switch: This is a four position rotary switch (Item 2) **[Figure 70-10-7]**. When the fan switch is in the off position the A/C will not engage, but the heat valve will operate, as it is controlled by the ignition power.

A/C Switch: The rocker switch (Item 3) **[Figure 70-10-7]** will be illuminated when the A/C is engaged.

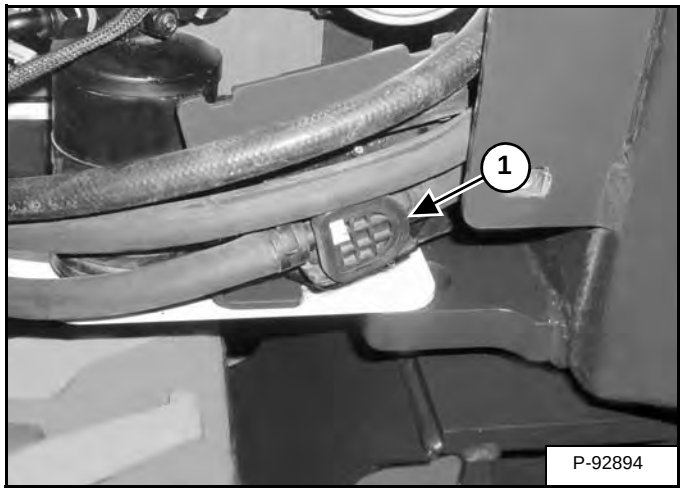
Potentiometer: The potentiometer (Item 4) **[Figure 70-10-7]** controls the Heat Valve from fully Off to fully On. This can be used in conjunction with the A/C for defrost of the windows and temperature control.

Fresh Air Control: The fresh air control (Item 5) **[Figure 70-10-7]** opens a ventilation door and allows fresh air to be drawn in to the cab.

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Components (Cont'd)

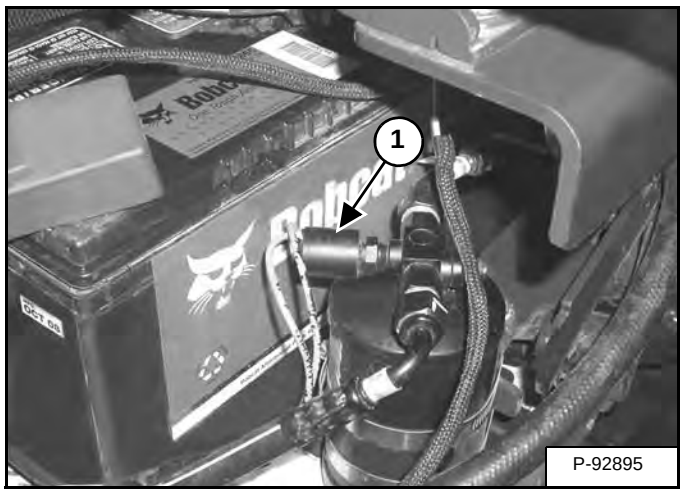
Figure 70-10-8



Heater Valve: The heater valve (Item 1) **[Figure 70-10-8]** is used to control the amount of engine coolant that flows to the heater coil.

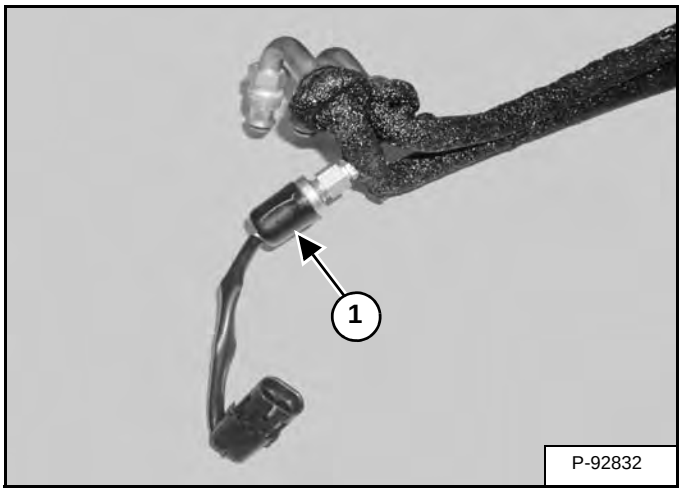
The heater valve is located in front of the battery.

Figure 70-10-9



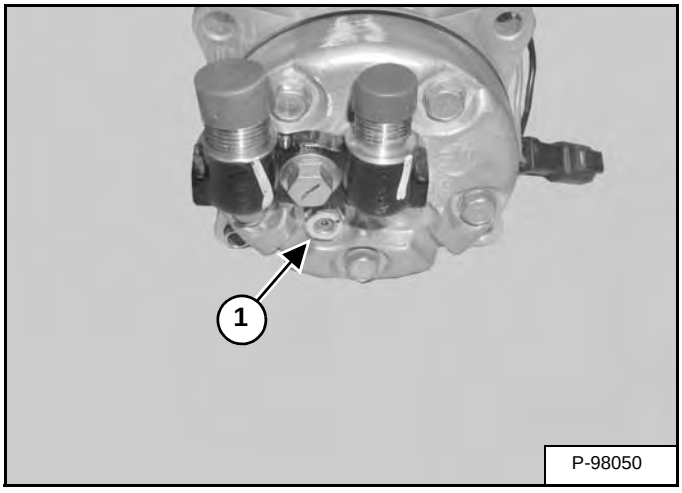
High Pressure Switch: The high pressure switch (Item 1) **[Figure 70-10-9]** will disengage the compressor clutch at high pressure readings over 2689 - 2827 kPa (26,9 - 28,3 bar) (390 - 410 psi) on the high side. The clutch will engage when the pressure is at 2103 - 2379 kPa (21 - 23,8 bar) (305 - 345 psi).

Figure 70-10-10



Low Pressure Switch: The low pressure switch (Item 1) **[Figure 70-10-10]** will disengage the compressor clutch at low pressure readings below 34 - 76 kPa (0,34 - 0,76 bar) (5 - 11 psi) on the low side. The clutch will engage when the pressure is at 117 - 186 kPa (1,2 - 1,9 bar) (17 - 27 psi).

Figure 70-10-11



Compressor Relief Valve: The relief valve (Item 1) **[Figure 70-10-11]** is set at 3502 - 4102 kPa (35 - 41 bar) (508 - 595 psi).

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Safety Equipment

In servicing A/C and heater systems you will be exposed to high pressures, temperatures and several chemical hazards. Moving belts and pulleys are normal shop hazards.

Figure 70-10-12


P-16398

In addition to exercising caution in your work, **DO WEAR SAFETY GLASSES OR A FACE SHIELD [Figure 70-10-12]** when you are using R-134a or a leak detector, adjusting service valves or the manifold gage set connectors. Safety glasses or a transparent face shield are practical safety items and one or the other is absolutely required.

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

W-2371-0611

Figure 70-10-13


P-16399

R-134a inside a canister or in an A/C system is a liquid under pressure. When it escapes or releases into the air, **ITS TEMPERATURE DROPS TO -5.7°C (21.6°F) "INSTANTLY".**

If it spills on your skin or in your eyes you should flood the area with cool water and **SEEK MEDICAL ATTENTION FAST!** It is a good idea to wear gloves **[Figure 70-10-13]** to prevent frost bite if you should get refrigerant on your hands.

⚠ WARNING

HFC R-134a refrigerant can be dangerous if not properly handled. Liquid R-134a may cause blindness if it contacts the eyes and may cause serious frostbite if it contacts the skin.

- **Gaseous R-134a becomes lethal (phosgene) gas when it contacts open flame or very hot substances.**
- **NEVER SMOKE when there is the possibility of even small amounts of R-134a in the air.**

Any servicing work that involves release or addition of R-134a to the system must be done by a competent refrigeration dealer who has the proper equipment, knowledge, and experience to service refrigeration equipment.

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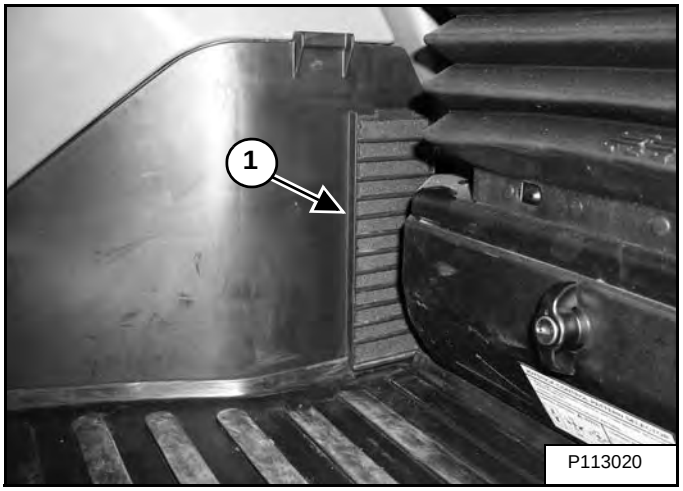
Cab Filters

The recirculation filter and fresh air filter must be cleaned regularly. (See Cleaning And Maintenance on Page 10-90-1.)

The recirculation filter is located to the right of the operator seat and the fresh air filter is located under the right side cover.

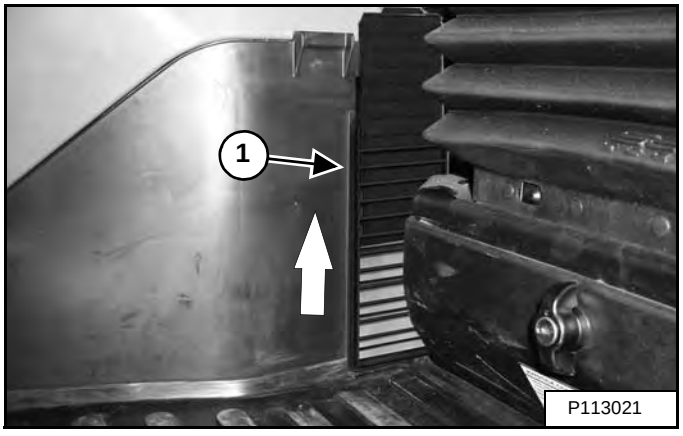
Recirculation Filter

Figure 70-20-1



The recirculation filter (Item 1) **[Figure 70-20-1]** is located to the right of the operator's seat.

Figure 70-20-2



Pull up on the filter (Item 1) **[Figure 70-20-2]** until removed from the housing.

Shake the filter or use low pressure air to clean the filter. Replace the filter when very dirty or if damaged.

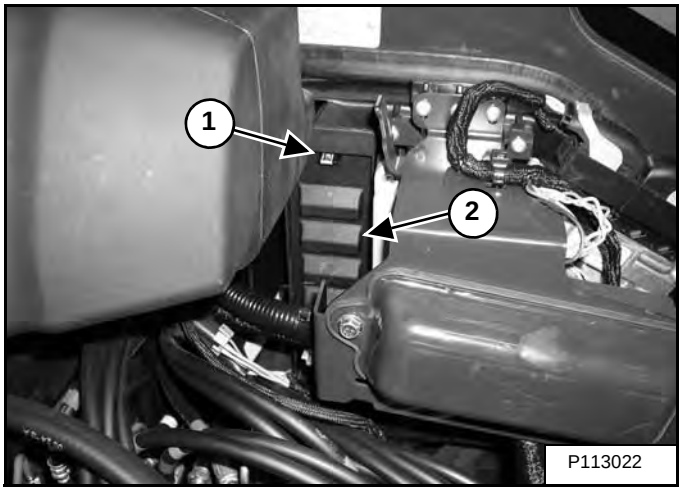
Installation: Position the bottom of the filter (Item 1) **[Figure 70-20-2]** into the housing and slowly push the filter down fully.

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Cab Filters (Cont'd)

Fresh Air Filter

Figure 70-20-3

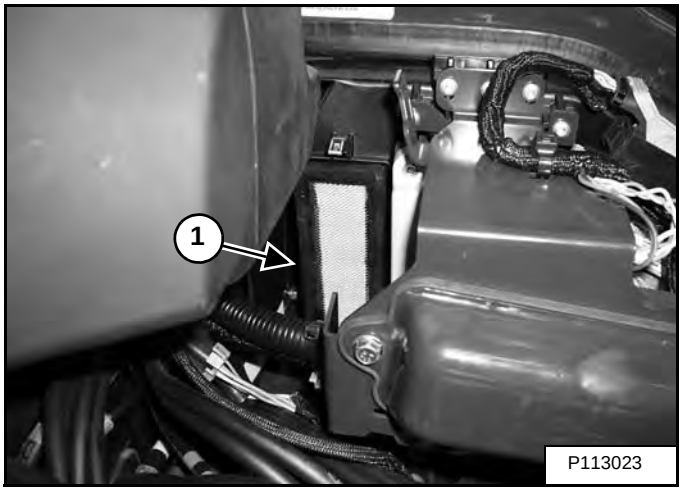


The fresh air filter is located under the right side cover.

Open the right side cover. (See RIGHT SIDE COVER on Page 40-220-1.)

Pull out on the tab (Item 1) and remove the cover (Item 2) **[Figure 70-20-3]**.

Figure 70-20-4



Pull the filter (Item 1) **[Figure 70-20-4]** out of the housing.

Shake the filter or use low pressure air to clean the filter. Do not use solvents. Replace the filter when very dirty or damaged.

Installation: Position the filter (Item 1) **[Figure 70-20-2]** into the housing and slowly push the filter in fully.

Place the bottom tabs of the filter cover (Item 2) into the frame and push the top in until the tab (Item 1) **[Figure 70-20-3]** locks to the frame.

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Fan Belt Adjustment

The fan belt is a special maintenance free type that is pretensioned over the pulleys. This belt eliminates the need for a tensioning device and does not require periodic adjustment. Contact your Bobcat dealer for replacement parts.

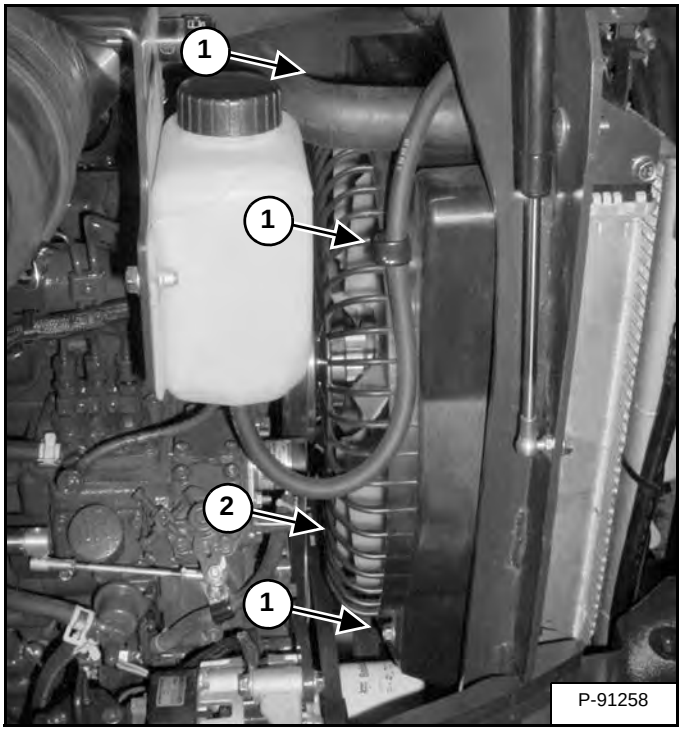
Fan Belt Replacement

Removal

Stop the engine and open the tailgate. (See Opening And Closing on Page 10-50-1.)

Remove the alternator belt. (See Belt Replacement on Page 50-30-1.)

Figure 70-20-5



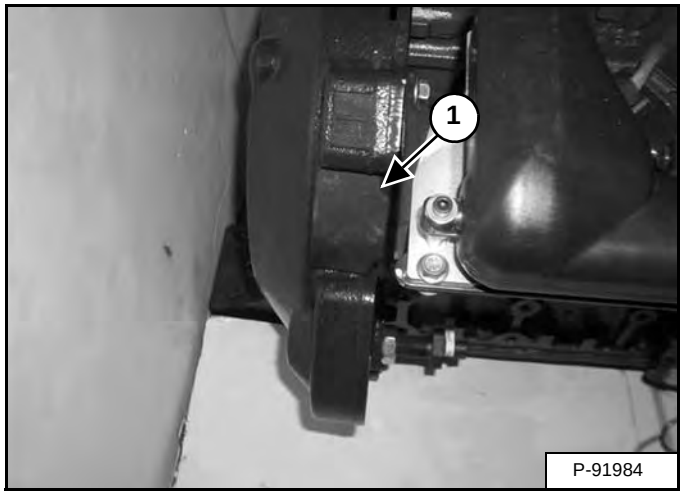
Remove the three bolts (Item 1) and the fan guard (Item 2) **[Figure 70-20-5]** for clearance for belt removal.

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Fan Belt Replacement (Cont'd)

Removal (Cont'd)

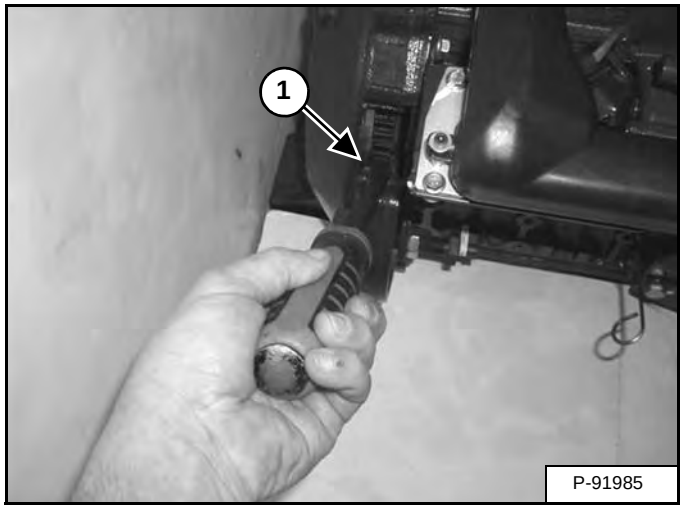
Figure 70-20-6



NOTE: The engine is removed from the machine for photo clarity only. This procedure can be performed with engine installed in machine.

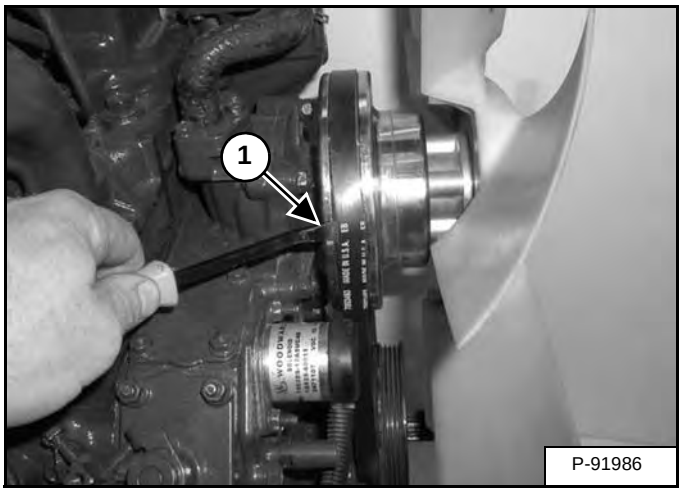
The engine will need to be rotated by hand to remove the belt. To access the flywheel, remove the plug (Item 1) **[Figure 70-20-6]** from the flywheel housing.

Figure 70-20-7



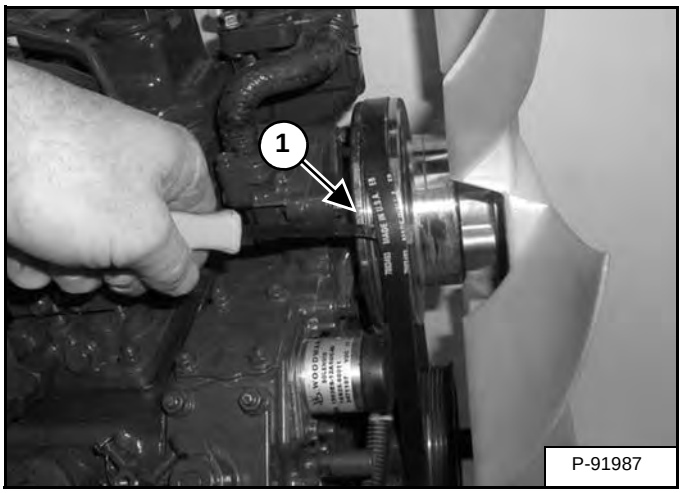
Install a pry bar (Item 1) **[Figure 70-20-7]** to the flywheel teeth.

Figure 70-20-8



Install a second pry bar (Item 1) **[Figure 70-20-8]** or flat blade screw driver between the belt and the water pump pulley.

Figure 70-20-9



Using the pry bar (Item 1) **[Figure 70-20-7]** to rotate the engine, start to push the belt off of the pulley using the second pry bar (Item 1) **[Figure 70-20-9]**.

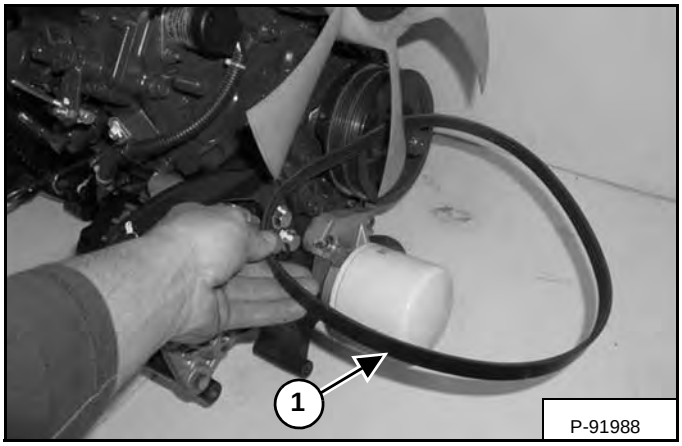
Continue to manually rotate the engine until the belt is off the pulley.

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Fan Belt Replacement (Cont'd)

Removal (Cont'd)

Figure 70-20-10



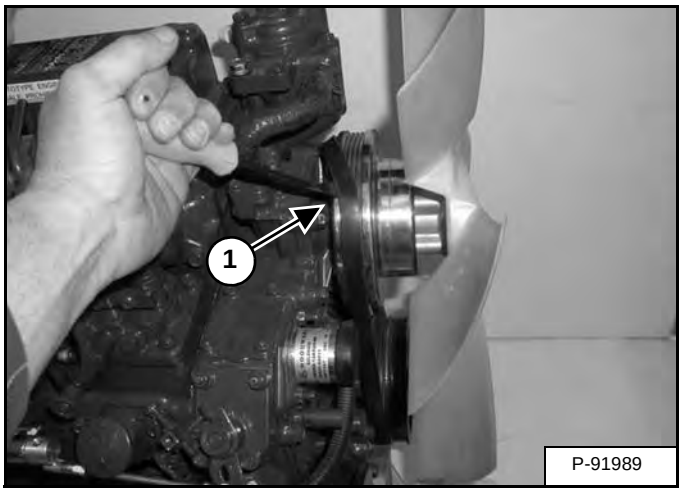
NOTE: Fan blades may be sharp, use care when removing the belt over the fan blades.

The belt (Item 1) **[Figure 70-20-10]** will need to be worked over the fan blades until it can be removed.

Installation

Install the new fan belt.

Figure 70-20-11



Position the belt over the water pump pulley and next to the engine block and align the lower part of the belt to the crankshaft pulley.

Using the pry bar (Item 1) **[Figure 70-20-7]** to rotate the engine and push the belt on the pulley using the second pry bar (Item 1) **[Figure 70-20-11]**.

Install the flywheel plug (Item 1) **[Figure 70-20-6]**.

Install the alternator belt. (See Belt Replacement on Page 50-30-1.)

Install the fan guard (Item 1) **[Figure 70-20-5]**.

Close the tailgate.

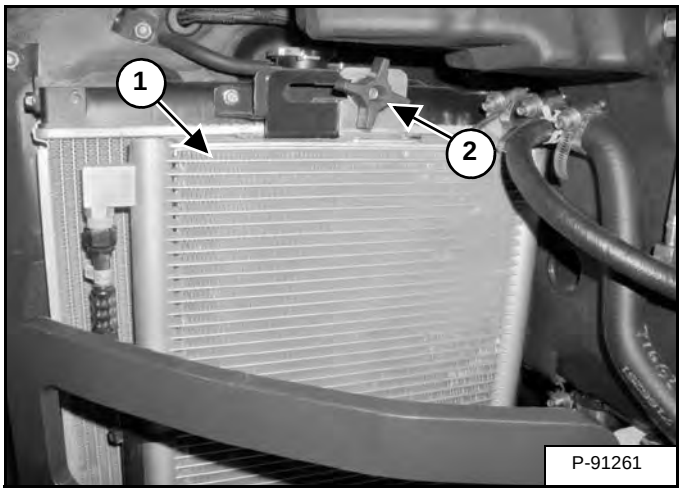
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Condenser

Open the tailgate. (See Opening And Closing on Page 10-50-1.)

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

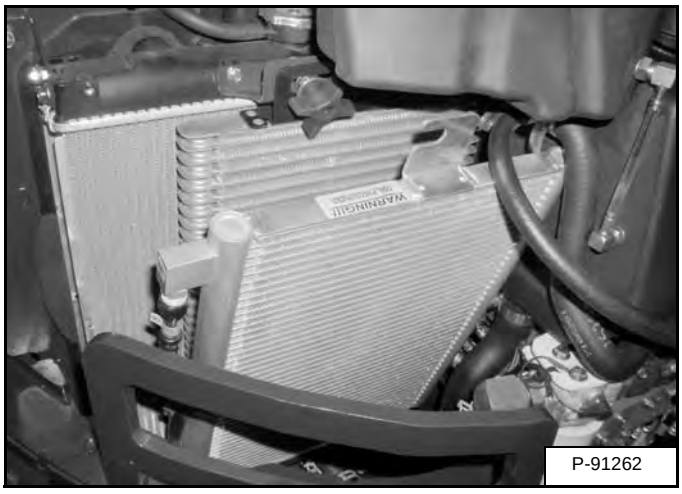
Figure 70-20-12



Check the condenser (Item 1) **[Figure 70-20-12]** for mud or dirt.

Loosen the handle (Item 2) **[Figure 70-20-12]**.

Figure 70-20-13



Tilt the condenser forward **[Figure 70-20-13]**.

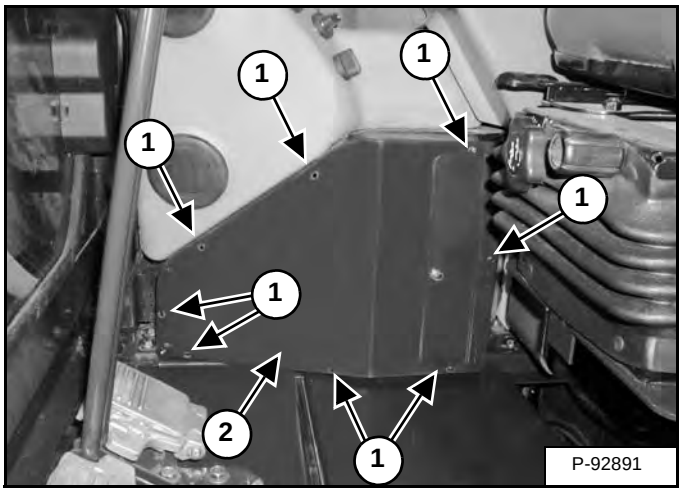
The condenser can be cleaned with low water or air pressure.

Air Conditioning Lubrication

Run the air conditioning for about five minutes every week to lubricate the internal components.

Evaporator / Heater Coil

Figure 70-20-14

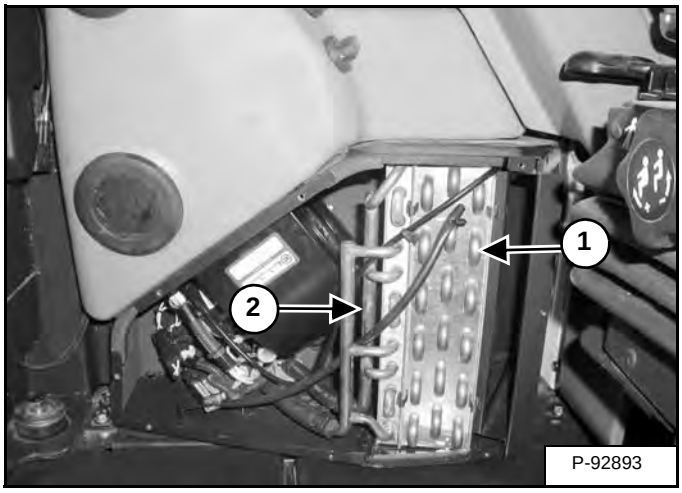


Remove the bolts (Item 1) **[Figure 70-20-14]**.

Remove the cover.

Remove the fresh air filter from the unit. (See Replacing The Filter Elements on Page 10-80-1.).

Figure 70-20-15



Clean the evaporator coil (Item 1) and heater coil (Item 2) **[Figure 70-20-15]** with low pressure air or water.

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Air Conditioning Service Chart

Service Company Name / Phone Number:			
Date:			
Machine Model:			Machine Dealer:
Machine Serial Number:			Customer:
Machine Hours:			
Pre Service Conditions	15 Minutes	30 Minutes	Notes
Ambient Temperature:			
Louver Temperature:			
Cab Temperature At Head Position:			
Temperature Into Condenser:			
High Side Pressure:			
Low Side Pressure:			
Ambient Humidity:			
Observations:			
Explain services required:			
Post Service Conditions	15 Minutes	30 Minutes	Notes
Ambient Temperature:			
Louver Temperature:			
Cab Temperature At Head Position:			
Temperature Into Condenser:			
High Side Pressure:			
Low Side Pressure:			
Ambient Humidity:			
Observations:			

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TROUBLESHOOTING

Blower Motor Does Not Operate

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. Blown Fuse	Inspect the fuse / wiring	Replace fuse / repair wiring
2. Broken wiring or bad connection	Check the fan motor ground and connectors	Repair the wiring or connector
3. Fan Motor Malfunction	Check the lead wires from the motor with a circuit tester	Replace motor
4. Resistor Malfunction	Check resistor using a circuit tester	Replace resistor
5. Fan motor switch malfunction	Check power into and out of the fan switch	Replace fan switch

Blower Motor Operates Normally, But Air Flow Is Insufficient

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. Evaporator inlet obstruction	Check evaporator for plugging	Remove the obstruction and clean evaporator fins with air or water
2. Air leak	Check to make sure air hoses are properly hooked to Louvers and air ducts	Repair or adjust
3. Defective thermo switch (frozen evaporator)	Check thermostat using a circuit tester	Replace thermostat
4. Plugged cab filters	Check cab recirculation and fresh air filters	Clean or replace filters

Insufficient Cooling Although Air Flow And Compressor Operation Are Normal

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. System low on refrigerant	The high side pressure will be low and bubbles may be present in sight glass on receiver / drier	Repair any leaks and recharge the refrigerant to the correct level
2. Excessive Refrigerant	The high pressure side will be high	Use refrigerant recovery equipment to capture excess refrigerant. Charge to the correct refrigerant level

The Compressor Operates Improperly Or Not At All

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. Loose drive belt	The belt is vibrating or oscillating	Replace Belt
2. Internal compressor malfunction	The compressor is locked up and the belt slips	Replace compressor
	Magnetic Clutch Related	
3. Low battery voltage	Clutch slips	Recharge the battery
4. Faulty coil	Clutch slips	Replace the magnetic clutch
5. Oil on the clutch surface	Clutch slips	Replace or clean the clutch surface
6. Open coil	Clutch does not engage and there is not reading when a circuit tester is connected between the coil and terminals	Replace clutch
7. Broken wiring or poor ground	Clutch will not engage. Inspect the ground and connections.	Repair
8. Wiring harness components	Test the conductance of the pressure switch, thermostat, relay, etc.	Check operation

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TROUBLESHOOTING (CONT'D)

Gauge Pressure Related Troubleshooting

Normal compressor suction (low side) and discharge (high side) pressure at ambient temperatures of 30 - 38°C (86 - 96°F) and compressor speed of approximately 2000 rpm are:

High pressure side pressure: 1448 - 1827 kPa (14,5 - 18,3 bar) (210 - 265 psi)

Low pressure side pressure: 103 - 228 kPa (1,0 - 2,3 bar) (15 - 33 psi)

As a rule of thumb the high side pressure will be around eight times greater then the low side pressure.

POSSIBLE CAUSE	INSPECTION	SOLUTION
Low Pressure Side Too High	The Low pressure side pressure normally becomes too high when the high pressure side pressure is too high. As this is explained below, the following inspection is only used when the low pressure side is too high.	
1. Expansion valve opens too far	Frost is present on the suction hose	Replace the expansion valve
2. Defective compressor	The high and low pressure side gauge pressures equalize when the magnetic clutch is disengaged	Replace compressor
Low Pressure Side Too Low		
1. Low refrigerant charge	The high side pressure will be low and bubbles may be present in sight glass on receiver / drier	Repair any leaks and recharge the refrigerant to the correct level
2. Clogged or closed expansion valve	The expansion valve's inlet side is frosted. Moisture or other contaminants can be the cause.	Clean or replace the expansion valve
3. Restriction between drier and expansion valve	Frost on the line between drier and expansion valve. A negative low pressure reading may be shown.	Flush system or replace hose
4. Thermostat malfunction	the evaporator is frozen	Adjust thermostat's temperature setting or probe placement or replace thermostat
5. Restriction in receiver dryer	Excessive frost on receiver dryer	Replace receiver dryer
High Pressure Side Too High		
1. Poor condenser performance	Dirty or clogged condenser fins. Condenser fans not operating.	Clean fins and / or repair the fan
2. Excessive refrigerant	The high pressure side pressure will be high	Use refrigerant recovery equipment to capture excess refrigerant. Charge to the correct refrigerant level.
3. Excessive oil charge	The high pressure side will be high	Evacuate system. Remove oil from condenser and compressor. Measure oil from compressor and add correct oil charge back into compressor. Flush system with nitrogen. Replace drier.
4. Air in system	Pressure is high on both high and low sides	Evacuate and recharge with refrigerant
5. Restriction in drier, condenser, or high pressure line	High pressure side will be high and low pressure side will be low	Evacuate and flush system replacing defective parts
High Pressure Side Too Low		
1. Low refrigerant charge	The high side pressure will be low and bubbles may be present in sight glass jon receiver / drier	Repair any leaks and recharge the refrigerant to the correct level.
System Pressure Equals		
1. Clutch not operating	See magnetic clutch related topics above	
2. Compressor not pumping	Equal high and low pressures	Replace compressor

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Temperature / Pressure Chart

NORMAL EVAPORATOR RANGE		NORMAL CONDENSER RANGE	
TEMP C (F)	kPag (barg) (psig)	TEMP C (F)	kPag (barg) (psig)
-9 (16)	108 (1,08) (15.69)	34 (93)	760 (7,60) (110.20)
-8 (18)	118 (1,18) (17.04)	34 (94)	773 (7,73) (112.10)
-7 (20)	127 (1,27) (18.43)	35 (95)	787 (7,87) (114.10)
-6 (22)	137 (1,37) (19.87)	38 (100)	857 (8,57) (124.30)
-4 (24)	147 (1,47) (21.35)	39 (102)	886 (8,86) (128.50)
-3 (26)	158 (1,58) (22.88)	40 (104)	916 (9,16) (132.90)
-2 (28)	169 (1,69) (24.47)	41 (106)	947 (9,47) (137.30)
-1 (30)	179 (1,79) (26.10)	42 (108)	978 (9,78) (141.90)
0 (32)	192 (1,92) (27.79)	43 (110)	1010 (10,10) (146.50)
1 (34)	204 (2,04) (29.52)	44 (112)	1043 (10,43) (151.30)
2 (36)	216 (2,16) (31.32)	46 (114)	1076 (10,76) (156.10)
3 (38)	229 (2,29) (33.17)	47 (116)	1111 (11,11) (161.10)
4 (40)	242 (2,42) (35.07)	48 (118)	1145 (11,45) (166.10)
6 (42)	255 (2,55) (37.03)	49 (120)	1181 (11,81) (171.30)
7 (44)	269 (2,69) (39.05)	50 (122)	1218 (12,18) (176.60)
7 (45)	276 (2,76) (40.09)	51 (124)	1255 (12,55) (182.00)
10 (50)	314 (3,14) (45.48)	52 (126)	1293 (12,93) (187.50)
13 (55)	353 (3,53) (51.27)	53 (128)	1331 (13,31) (193.10)
16 (60)	396 (3,96) (57.47)	54 (130)	1371 (13,71) (198.90)
18 (65)	442 (4,42) (64.10)	57 (135)	1473 (14,73) (213.70)
21 (70)	491 (4,91) (71.19)	60 (140)	1582 (15,82) (229.40)
24 (75)	543 (5,43) (78.75)	63 (145)	1695 (16,95) (245.80)
27 (80)	598 (5,98) (86.80)	66 (150)	1813 (18,13) (263.00)
29 (85)	658 (6,58) (95.40)	68 (155)	1938 (19,38) (281.10)
32 (90)	720 (7,20) (104.40)	71 (160)	2069 (20,69) (300.10)
33 (91)	733 (7,33) (106.30)	74 (165)	2207 (22,07) (320.10)
33 (92)	746 (7,46) (108.20)	77 (170)	2350 (23,50) (340.80)

Evaporator

Pressures represent gas temperatures inside the coil, not the coil surface. For an estimate of the temperature of the air coming off the coil add -12.5 ± -0.5°C (9 ± 1°F) to the temperature on the chart.

Condenser

Temperatures are not ambient temperatures but condensing temperatures. Add 4°C (40°F) to the ambient temperature to get the condensing temperature and then refer to the pressure chart to see appropriate pressure for ambient temperature.

Example: Ambient Temperature = 32°C (90°F)

32°C (90°F)
+ 4°C (40°F)
54°C (130°F) condenser temperature = 1379 kPa (14 bar) (200 psig)

Conditions and pressures will vary from system to system.

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Poor A/C Performance

Start the excavator. Engage the A/C system with the blower fan on high. Run the excavator at full RPM for approximately 15 minutes, with the cab door closed.

Figure 70-30-1

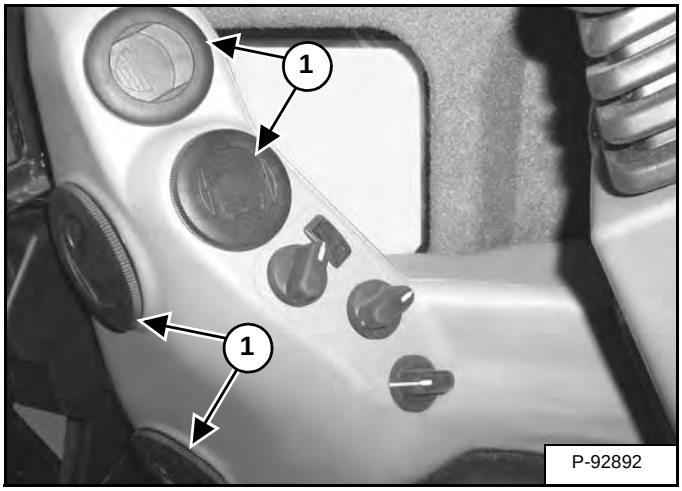
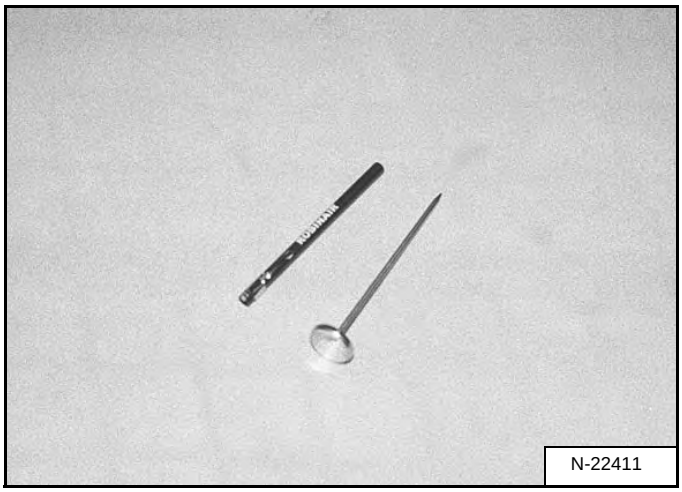


Figure 70-30-2



Check the temperature at the louvers (Item 1) **[Figure 70-30-1]** with a thermometer **[Figure 70-30-2]**.

The louver temperature should be between 2,2 - 11,6°C (36 - 53°F). depending on the amount of humidity in the air.

If louver temperature is too high see the System Troubleshooting Chart. (See Gauge Pressure Related Troubleshooting on Page 70-30-2.)

Check the blower fan for proper operation, and replace if necessary. (See Removal And Installation on Page 70-130-1.)

Check the air conditioning compressor belt for wear or damage. (See Fan Belt Replacement on Page 70-20-3.)

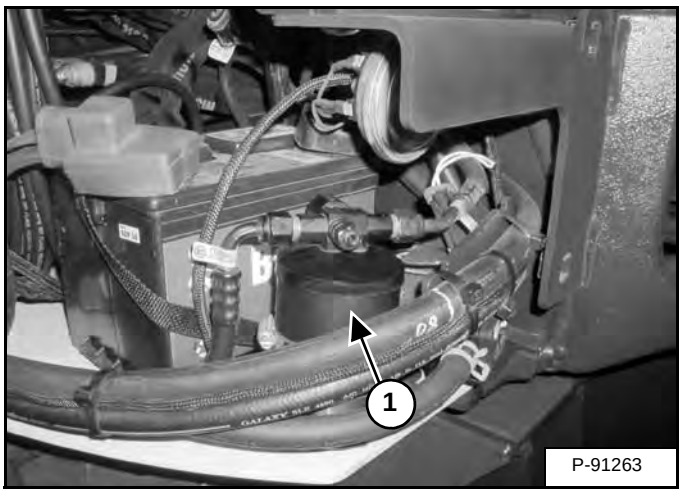
Check the A/C evaporator coil for dirt or mud, and clean if necessary. (See Evaporator / Heater Coil on Page 70-20-6.)

Inspect the sight glass located on the receiver / drier for air bubbles. (See Gauge Pressure Related Troubleshooting on Page 70-30-2.)

Check the engine coolant to see if it is bypassing the heater valve.

HVAC Repair And Leaks

Figure 70-30-3



Whenever the A/C system is opened to the atmosphere or there has been a leak in the system, the receiver / dryer (Item 1) **[Figure 70-30-2]** must be changed.

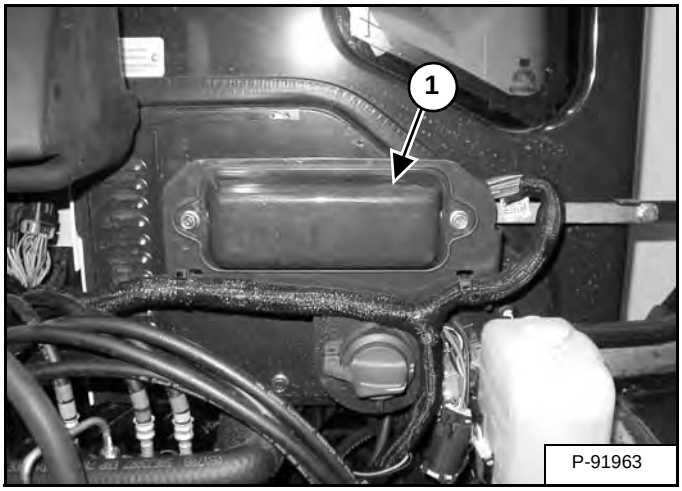
Never leave hose fittings, compressor fittings or components uncapped while working on the A/C system.

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Electrical System

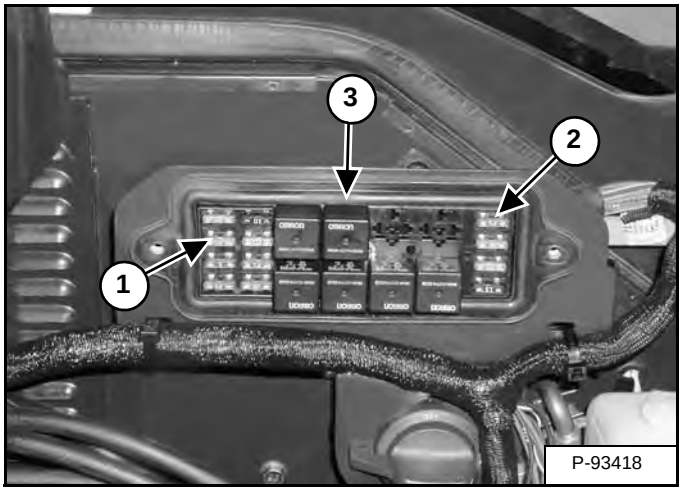
If the excavator A/C system shows no blower motor function, no A/C switch light and no A/C compressor function, do the following check:

Figure 70-30-4



Remove the two bolts and fuse / relay cover (Item 1) **[Figure 70-30-4]**.

Figure 70-30-5

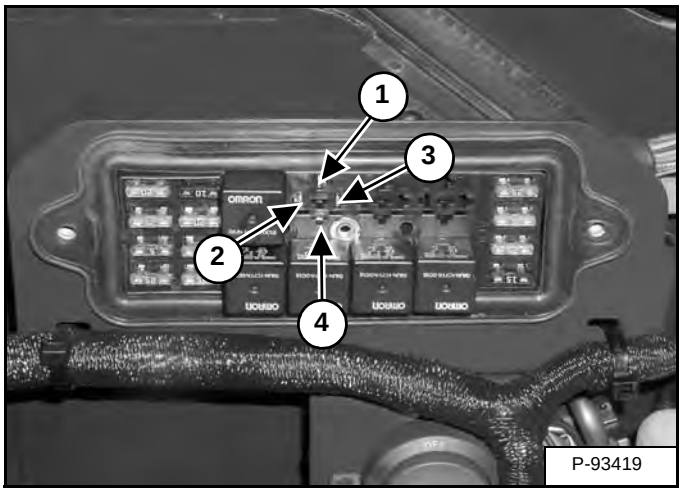


Check the HVAC fuse (Item 1) and controller fuse (Item 2) **[Figure 70-30-5]**.

Replace the fuse if burned out. If the fuses are good, remove the relay (Item 3) **[Figure 70-30-5]**.

Using a multimeter, check the voltage at the following relay terminals:

Figure 70-30-6



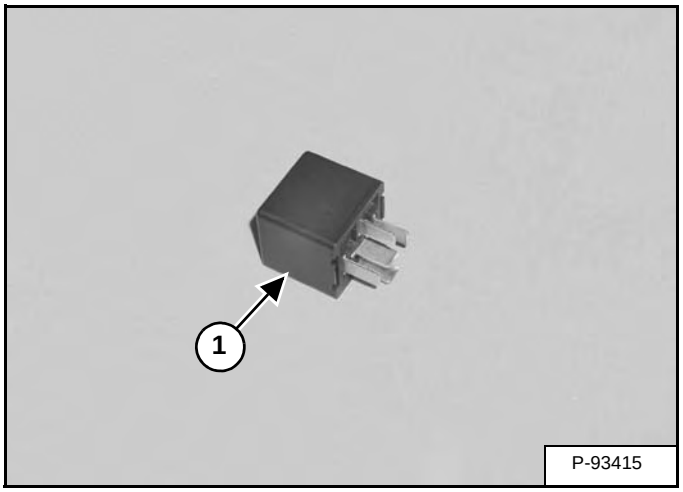
Voltage at pin 30 (Item 1) **[Figure 70-30-6]** is 12 volts at all times.

Voltage at pin 86 (Item 2) **[Figure 70-30-6]** is 12 volts when the start key is in the on position.

Pin 85 (Item 3) **[Figure 70-30-6]** is ground. Check for continuity to the ground.

With the key in the ON position, A/C switch ON, turn the fan switch ON pin 87 (Item 4) **[Figure 70-30-6]** is ground. Turn the fan switch OFF, and there is no continuity.

Figure 70-30-7



If the voltages and continuity checks are OK but the problem still persists, replace the A/C relay (Item 1) **[Figure 70-30-7]**.

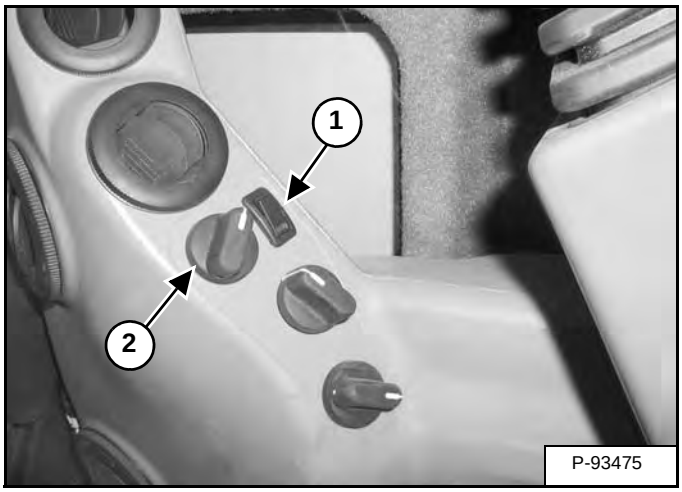
Check to see if the compressor clutch is engaging.

With a person in the operator seat and the cab door open, turn the key switch to RUN (Standard panel) OR press the RUN / ENTER Button (Deluxe Panel), without starting the excavator.

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Electrical System (Cont'd)

Figure 70-30-8

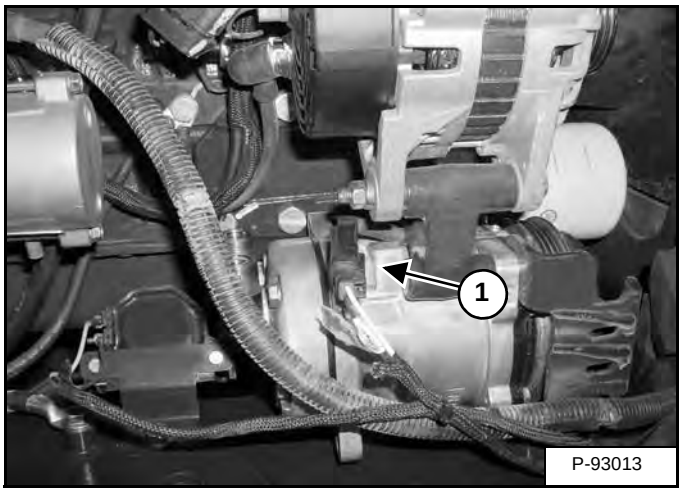


Push the A/C switch (Item 1) to the ON position. Turn the blower fan switch (Item 2) **[Figure 70-30-8]** to the first ON position.

The compressor clutch should make a click sound, which indicates the clutch is engaging.

NOTE: There is a time delay of 5 - 10 seconds until the clutch will engage.

Figure 70-30-9



Disconnect the wire harness (Item 1) **[Figure 70-30-9]**.

NOTE: The counterweight is removed for photo clarity.

With a multimeter, check the resistance to the compressor clutch.

If there is no resistance value, replace the compressor. (See Removal And Installation on Page 70-50-1.)

With a multimeter, check the voltage to the compressor clutch at the wire harness.

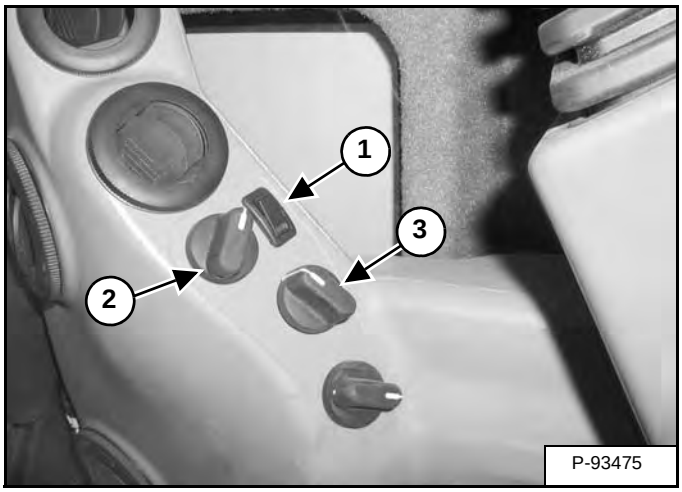
If the voltage reading is approximately 12 volts, the system is operating correctly.

If there is no power at the clutch, reconnect the wiring harness to the compressor clutch.

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Engine Coolant Bypassing The Heater Valve

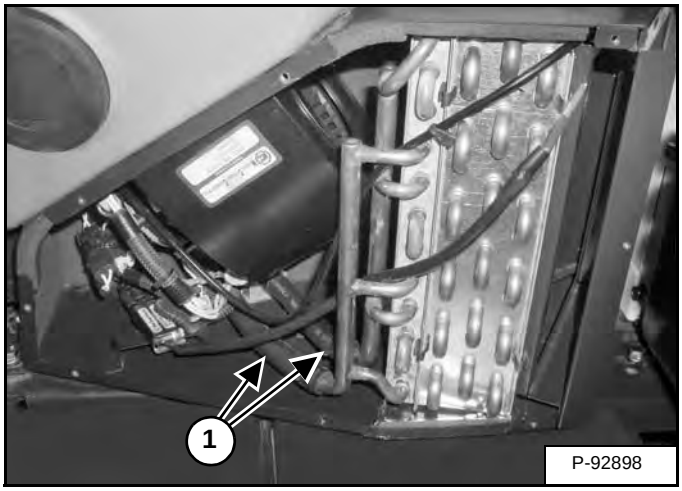
Figure 70-30-10



Push the A/C switch (Item 1) to the OFF position. Turn the fan switch (Item 2) to the High Speed position. Turn the temperature control (Item 3) **[Figure 70-30-10]** to the High A/C position, with the key switch OFF.

Start the excavator and run at high idle, for ten minutes.

Figure 70-30-11



Check the temperature of the heater hoses (Item 1) **[Figure 70-30-11]**.

If the hoses are hot, the heater valve is leaking internally and needs to be replaced.

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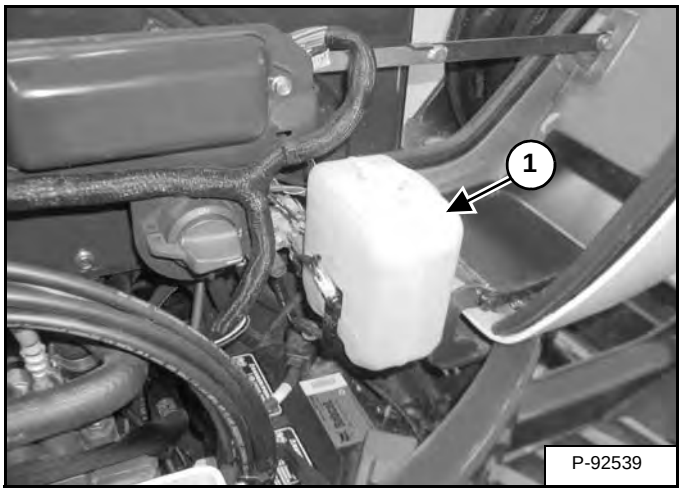


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SYSTEM CHARGING AND RECLAMATION

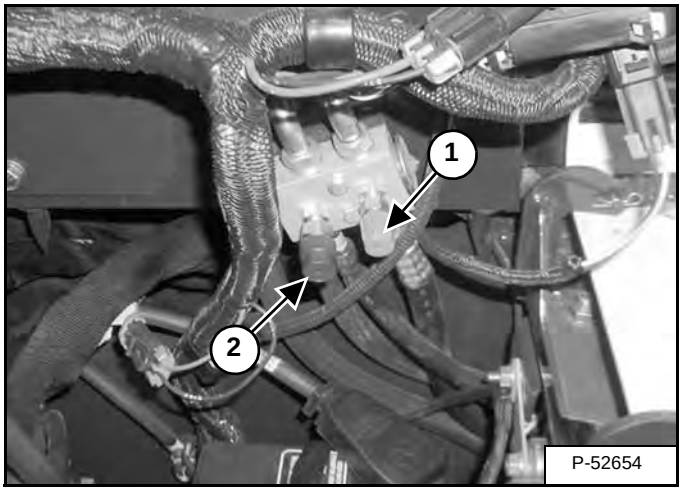
Refrigerant Identification

Figure 70-40-1



Pull up on and reposition the washer reservoir (Item 1) **[Figure 70-40-1]**.

Figure 70-40-2



Locate the low pressure port (Item 1) and high pressure port (Item 2) **[Figure 70-40-2]**.

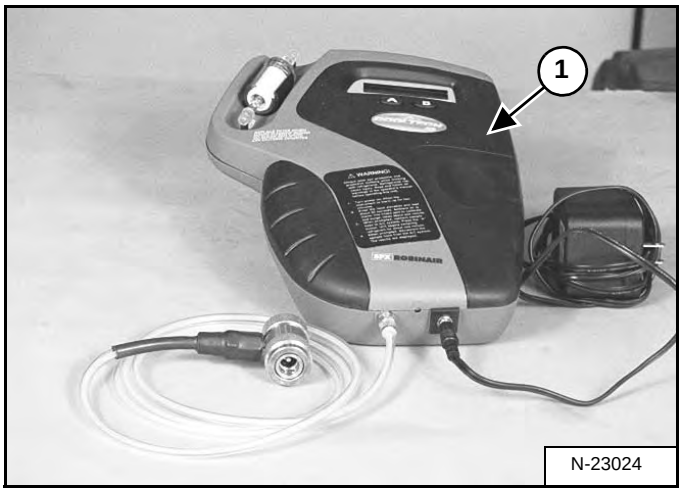
⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

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NOTE: This procedure is run with the excavator engine OFF, and the A/C switch in the OFF position.

Figure 70-40-3



NOTE: Before reclaiming a refrigeration system, it is recommended to identify the type of refrigerant that is in the A/C system and if it is pure enough to use. The tool MEL1592, Refrigerant Identifier (Item 1) [Figure 70-40-3] will determine the kind of refrigerant and any possible harmful or dangerous substances that may be present in the system. Thus preventing mixing of dangerous material with your reclaimed R-134a in your reclaimer, and further contamination to other A/C systems that are reclaimed and charged from your MEL1581 Recovery / Recycling / Recharging Machine.

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Refrigerant Identification (Cont'd)

Figure 70-40-4



Remove the protective cap and connect the Refrigerant Identifier to the low pressure hose (Item 1) **[Figure 70-40-4]**.

Connect the refrigerant identifier to a power source.

Follow the steps displayed on the refrigerant identifier screen.

Allow two minutes for the refrigerant identifier to display the type of refrigerant and air content. An alarm will sound if potentially flammable hydrocarbons are present and will also indicate on the visual display.

Disconnect the refrigerant identifier from the excavator A/C.

If the refrigerant is dangerous or flammable, it must be evacuated from the A/C system into a separate container and properly and safely disposed of.

If R-134a is found, evacuate the system.

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Reclamation And Charging With Recovery / Charging Unit

⚠ WARNING

HFC R-134a refrigerant can be dangerous if not properly handled. Liquid R-134a may cause blindness if it contacts the eyes and may cause serious frostbite if it contacts the skin.

- **Gaseous R-134a becomes lethal (phosgene) gas when it contacts open flame or very hot substances.**
- **NEVER SMOKE when there is the possibility of even small amounts of R-134a in the air.**

Any servicing work that involves release or addition of R-134a to the system must be done by a competent refrigeration dealer who has the proper equipment, knowledge, and experience to service refrigeration equipment.

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Figure 70-40-5

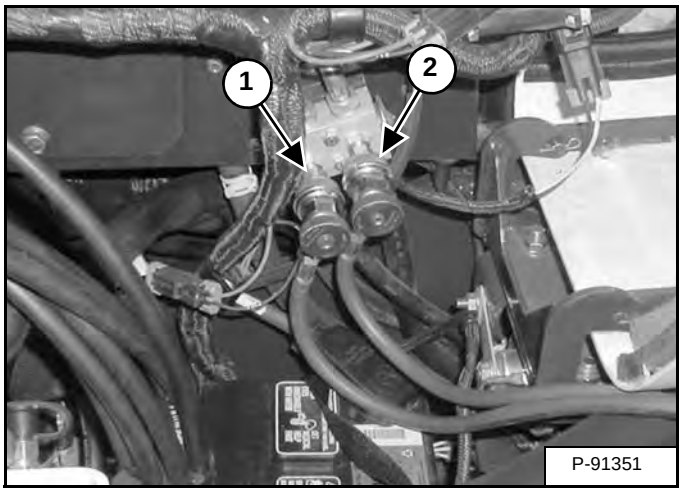


Use an approved recover / charging unit **[Figure 70-40-5]** to evacuate the system.

Connect the reclaimer to the excavator A/C charge ports.

IMPORTANT: Only A/C trained technicians should perform the reclaiming and recharging procedure.

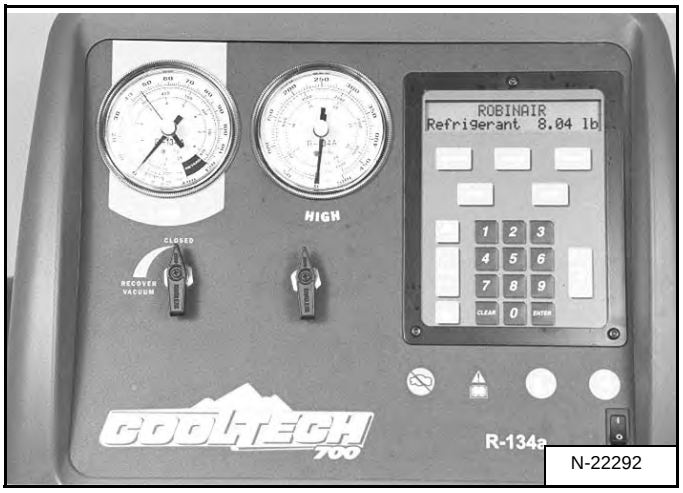
Figure 70-40-6



Connect the Red hose (Item 1) **[Figure 70-40-6]** to the high pressure port and open the valve.

Connect the Blue hose (Item 2) **[Figure 70-40-6]** to the low pressure port and open the valve.

Figure 70-40-7



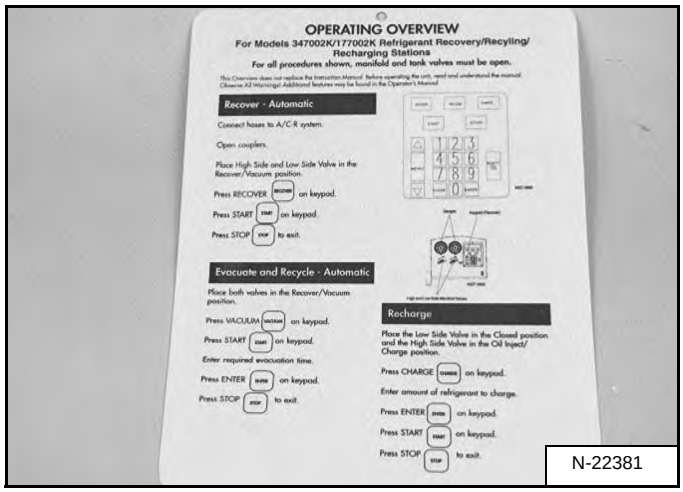
Turn the reclaimer unit to the ON position and follow the on screen instructions **[Figure 70-40-7]**.

NOTE: For the correct quantity of refrigerant (See Capacities on Page SPECS-10-9)

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Reclamation And Charging With Recovery / Charging Unit (Cont'd)

Figure 70-40-8



NOTE: The reclaimer unit has a complete step by step set of instructions [Figure 70-40-8] to follow for reclamation and recharging of the A/C system. A trained technician should follow these instructions as they may vary slightly depending on the model and brand of reclaimer used.

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COMPRESSOR

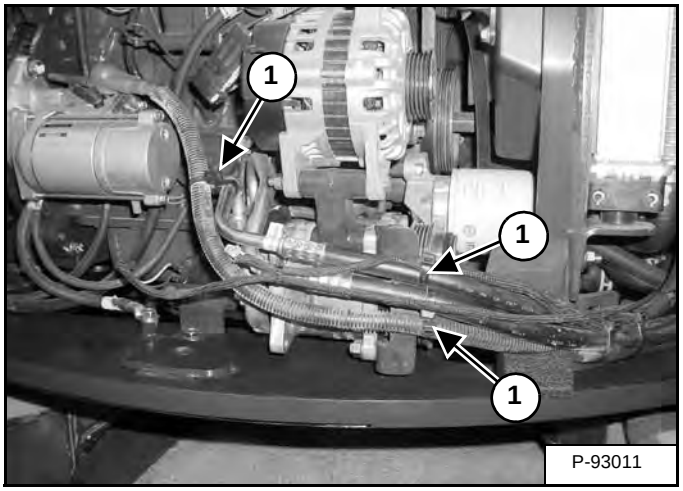
Removal And Installation

Remove the counterweight. (See Removal And Installation on Page 40-90-1.)

Remove the alternator belt. (See Belt Replacement on Page 50-30-1.)

Evacuate the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 70-40-3.)

Figure 70-50-1



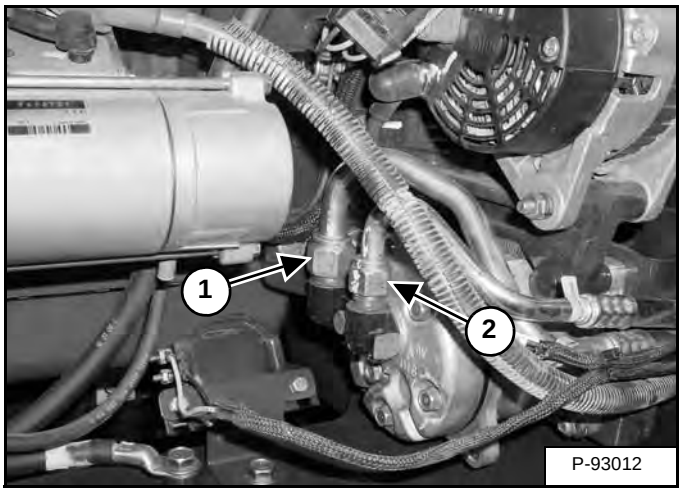
Cut and remove the cable ties (Item 1) **[Figure 70-50-1]**.

WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

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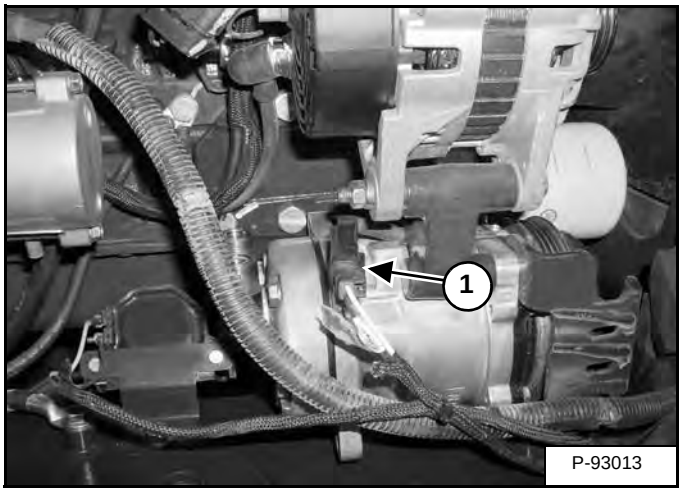
Figure 70-50-2



Remove the hoses (Item 1 and 2) **[Figure 70-50-2]**.

Installation: Tighten the compressor hose (Item 1) to 28 - 36 N•m (21 - 27 ft-lb) torque. Tighten the compressor hose (Item 2) **[Figure 70-50-2]** to 20 - 27 N•m (15 - 20 ft-lb) torque.

Figure 70-50-3

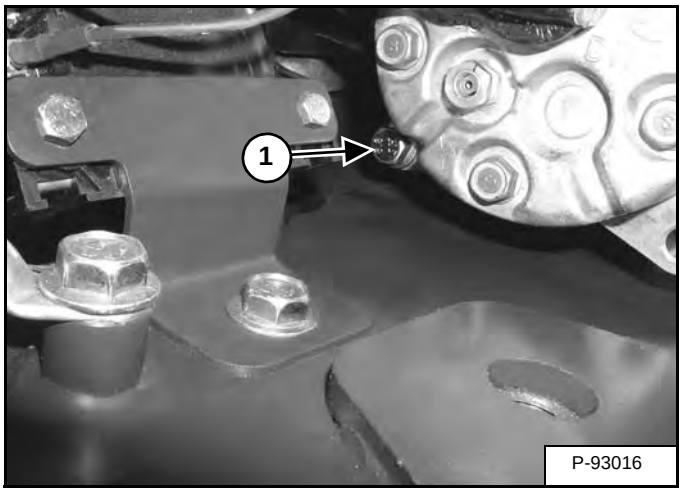


Disconnect the wire harness (Item 1) **[Figure 70-50-3]**.

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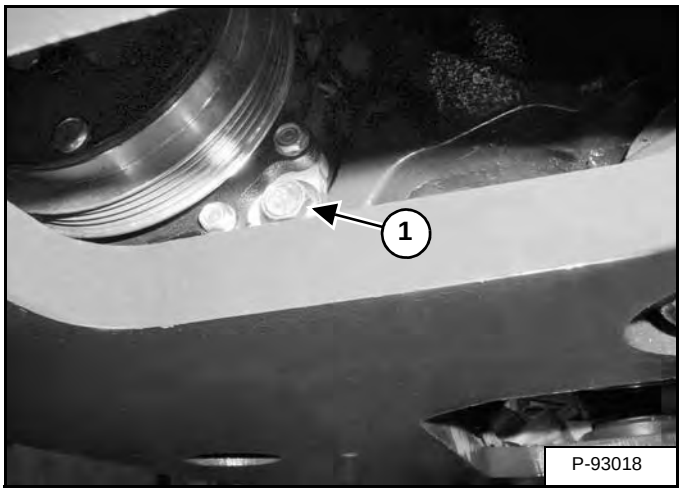
Removal And Installation (Cont'd)

Figure 70-50-4



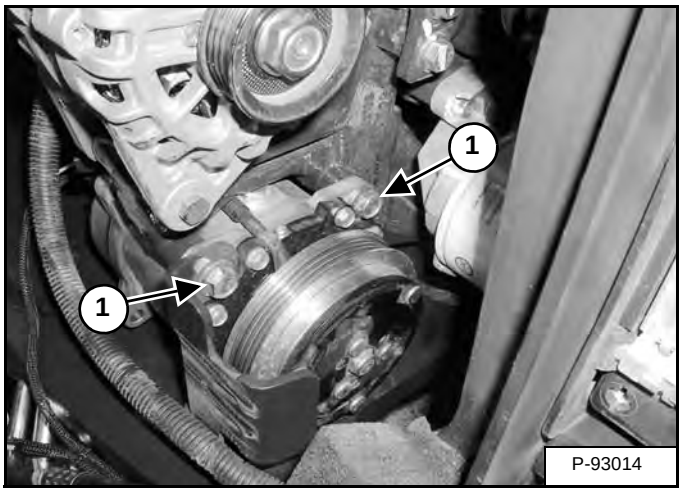
Remove the bolt (Item 1) **[Figure 70-50-4]**.

Figure 70-50-5



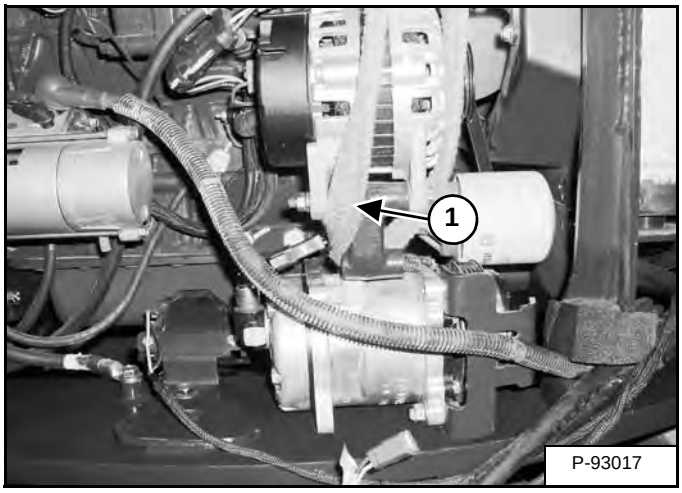
Remove the bolt (Item 1) **[Figure 70-50-5]**.

Figure 70-50-6



Remove the bolts (Item 1) **[Figure 70-50-6]**.

Figure 70-50-7

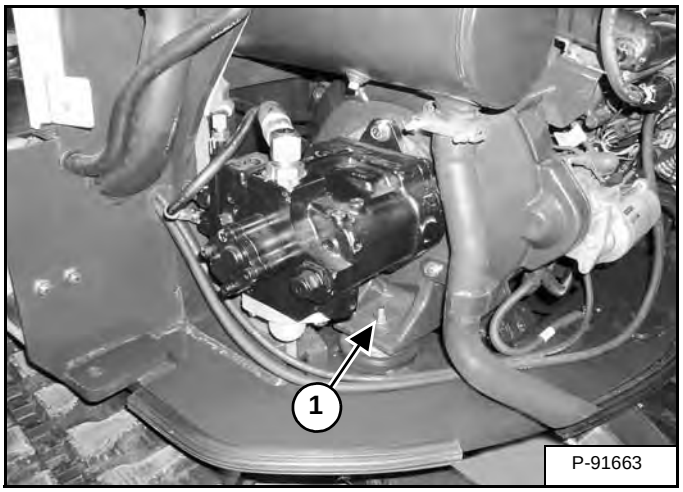


Install a lifting strap (Item 1) **[Figure 70-50-7]** on the alternator / compressor bracket.

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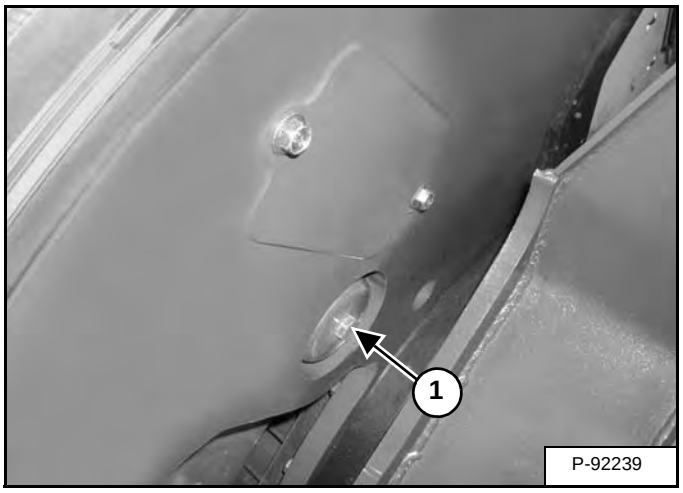
Removal And Installation (Cont'd)

Figure 70-50-8



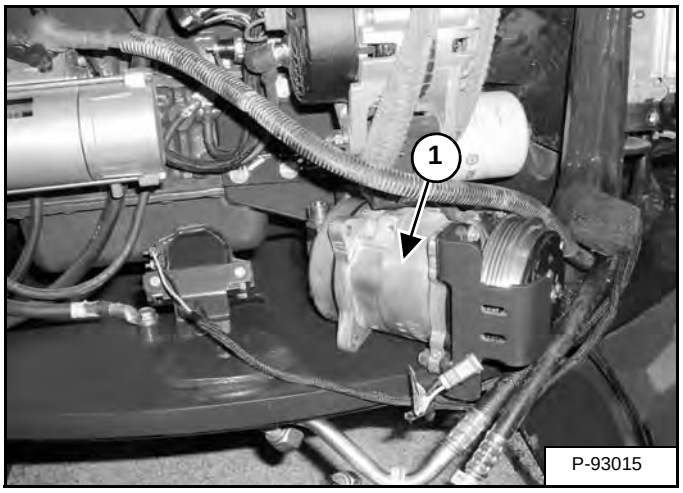
Loosen the left engine mount bolt (Item 1) **[Figure 70-50-8]**.

Figure 70-50-9



Loosen the right engine mount bolt (Item 1) **[Figure 70-50-9]**.

Figure 70-50-10



Raise the engine and remove the compressor (Item 1) **[Figure 70-50-10]**.

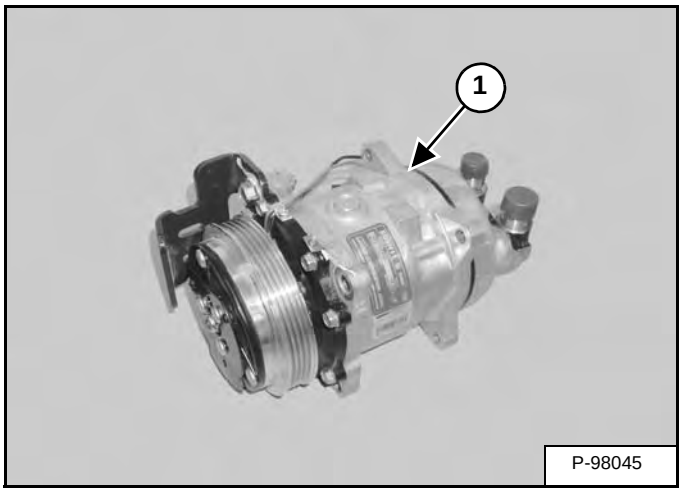
The compressor is not serviceable and must be replaced as an assembly.

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COMPRESSOR (CONT'D)

Oil

Figure 70-50-11



The compressor (Item 1) **[Figure 70-50-11]** is factory filled with **150-170 cc's** of PAG 100 refrigerant oil (Polyalkelene Glycol).

It is not necessary to frequently check or change the compressor oil.

It is necessary to check, replenish or replace the compressor oil in the following cases:

1. When the evaporator, condenser or receiver-drier is replaced.

2. When refrigerant has leaked from the system.

3. When refrigerant is suddenly released from the cooling cycle.

4. When any oil related problems occur in the cooling cycle.

When one of the components (the evaporator, condenser or receiver-drier) is replaced, **one ounce** (30 cc) of PAG oil should be added for each component replaced.

If the A/C compressor is changed, no oil should be added to the system, the compressor comes factory filled with oil.

NOTE: Only PAG 100 oil should be used. Never mix R-12 and R-134a Oils.

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COMPRESSOR (CONT'D)

Oil Check

The compressor oil should be checked as follows when oil is being added to an in service excavator.

There is a close affinity between oil and refrigerant. During normal operation, part of the oil circulates with the refrigerant in the system. When checking the amount of oil in the system or replacing any system component, the compressor must be run in advance to insure return of oil to the compressor.

If the amount of refrigerant in the system has decreased, charge the system. (See Reclamation And Charging With Recovery / Charging Unit on Page 70-40-3.)

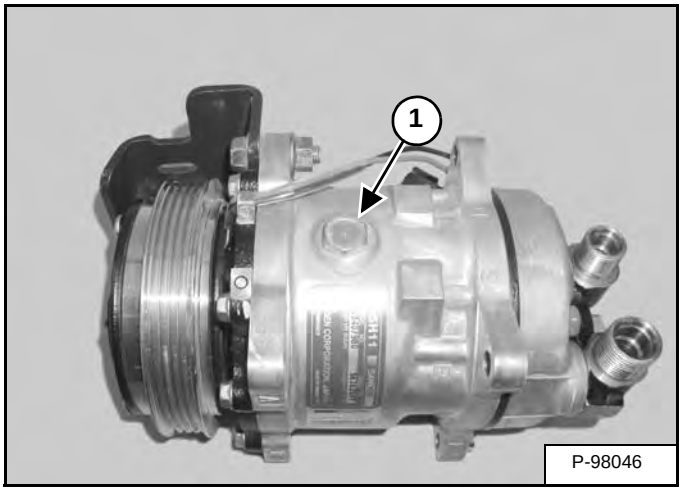
Open the cab door and windows.

Run the blower at maximum speed.

Run the compressor for at least 20 minutes at 800 - 1200 rpm.

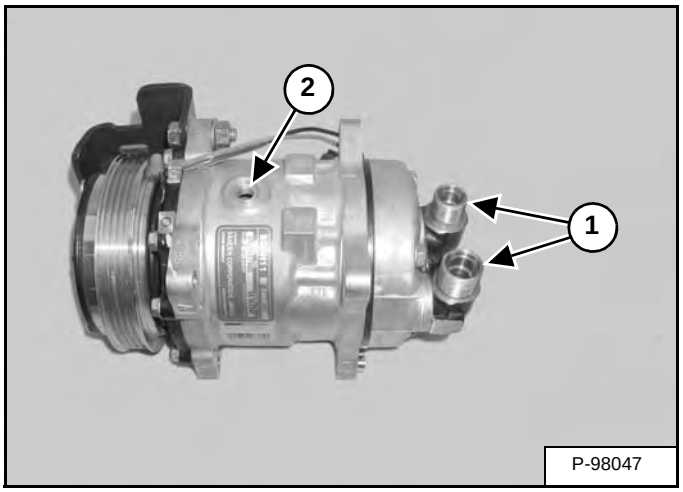
Remove the compressor from the excavator. (See Removal And Installation on Page 70-50-1.)

Figure 70-50-12



Remove the drain plug (Item 1) **[Figure 70-50-12]**.

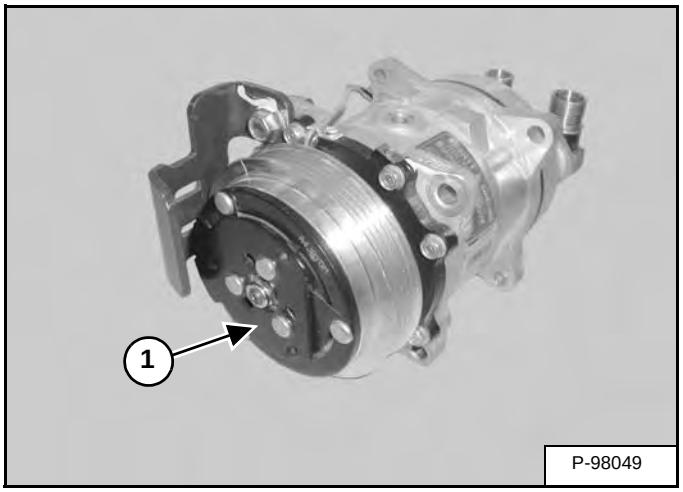
Figure 70-50-13



Drain the oil through the connectors (Item 1) and the oil drain hole (Item 2) **[Figure 70-50-13]**.

Installation: Tighten the oil drain plug to 13 - 15 N•m (9.4 - 10.8 ft-lb) torque.

Figure 70-50-14



NOTE: After draining the oil through the drain hole and the connectors, extract the remaining oil through the discharge-side connector by rotating the drive pulley (Item 1) [Figure 70-50-14] several times by hand.

Measure the drained oil in a measuring cylinder.

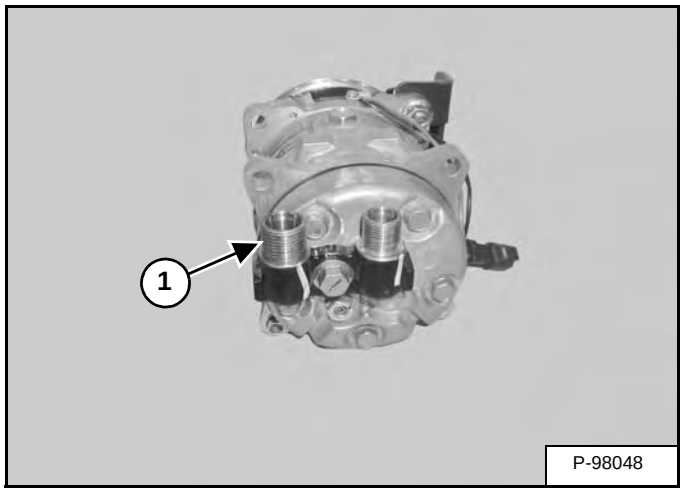
Check the oil for contamination, dirt, metal shavings, or varnish color, discard the oil if contaminated.

NOTE: If metal shavings are found in the compressor oil, replace the complete compressor assembly.

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Oil Check (Cont'd)

Figure 70-50-15



Add new compressor oil through the suction side connector (Item 1) **[Figure 70-50-15]**.

Installation: Add 150 - 170 cc's of PAG 100 oil.

NOTE: The suction port on the compressor is marked with an S and is the larger port on the compressor.

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CONDENSER

Removal And Installation

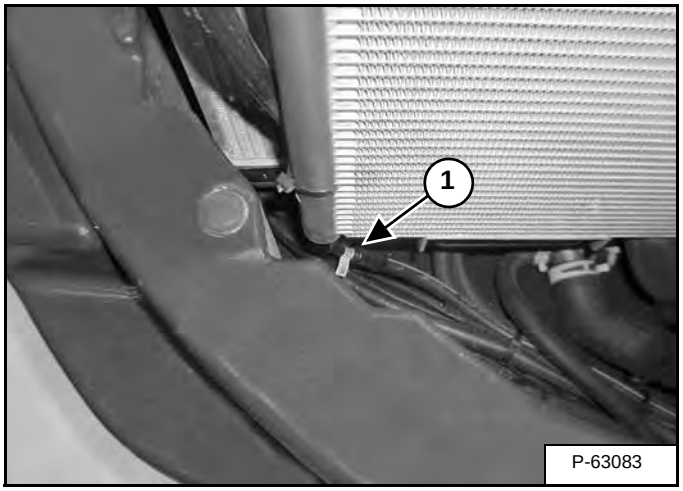
Open the tailgate.

Evacuate the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 70-40-3.)

Open the right side cover.

Mark the A/C hoses for proper installation.

Figure 70-60-1



Remove the hose (Item 1) **[Figure 70-60-1]** from the condenser.

Cap the hose and plug the fitting on the condenser.

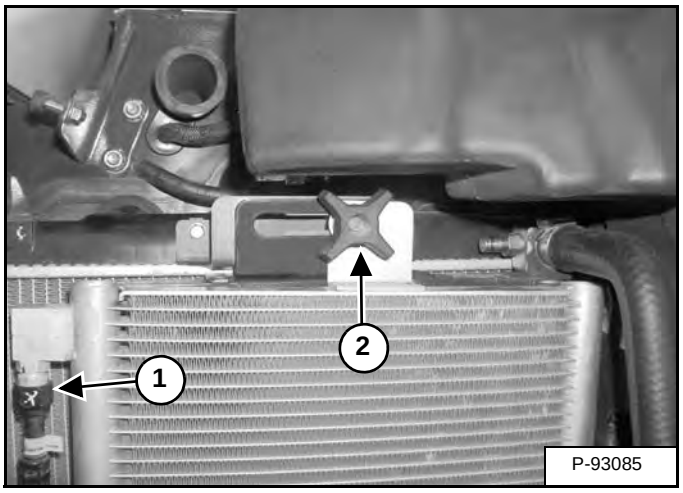
Installation: Tighten the hose (Item 1) **[Figure 70-60-1]** to 15 - 17 N•m (11 - 13 ft-lb) torque.

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

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Figure 70-60-2



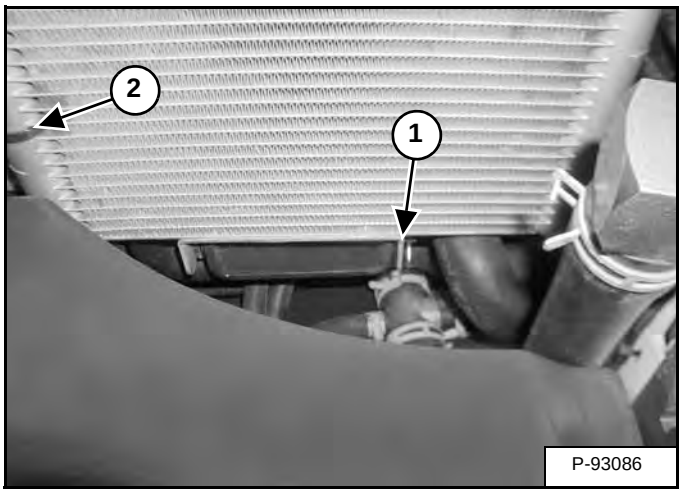
Remove the hose (Item 1) **[Figure 70-60-2]** from the condenser.

Cap the hose and plug the fitting on the condenser.

Installation: Tighten the hose (Item 1) **[Figure 70-60-2]** to 20 - 27 N•m (15 - 20 ft-lb) torque.

Loosen the clamp (Item 2) **[Figure 70-60-2]**.

Figure 70-60-3



Remove the tie-strap (Item 1) **[Figure 70-60-3]**.

Remove the clips (Item 2) **[Figure 70-60-3]** and remove the rod.

Remove the condenser from the excavator.

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RECEIVER / DRIER

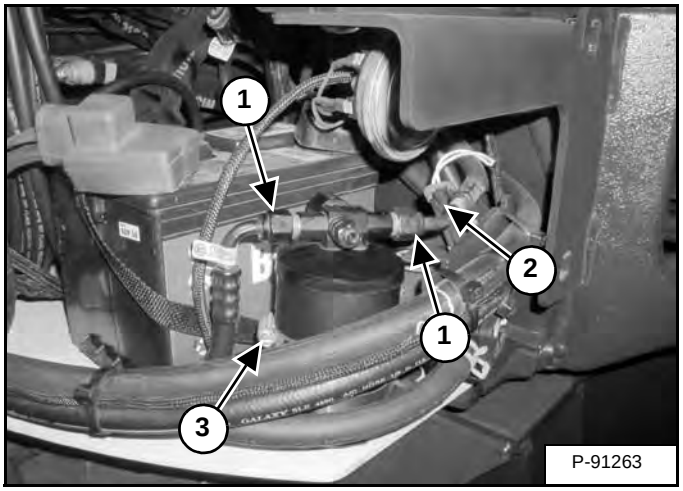
Receiver / Drier Removal And Installation

Evacuate the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 70-40-3.)

Open the right side cover.

Remove the right upperstructure cover. (See Removal And Installation on Page 40-80-1.)

Figure 70-70-1



Mark the hoses (Item 1) **[Figure 70-70-1]** for proper installation.

Both fittings on the drier are the same size, so the hoses can be hooked up incorrectly.

Note the flow direction on the drier for proper installation.

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

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Remove the A/C hoses (Item 1) **[Figure 70-70-1]** from the receiver / drier.

Cap and plug the hoses and the receiver / drier fittings with the proper A/C caps and plugs.

Installation: Tighten the hoses (Item 1) **[Figure 70-70-1]** to 15 - 17 N•m (11 - 13 ft-lb) torque.

Disconnect the wire harness (Item 2) **[Figure 70-70-1]**.

Loosen the hose clamps (Item 3) **[Figure 70-70-1]** that hold the receiver / drier to the mount.

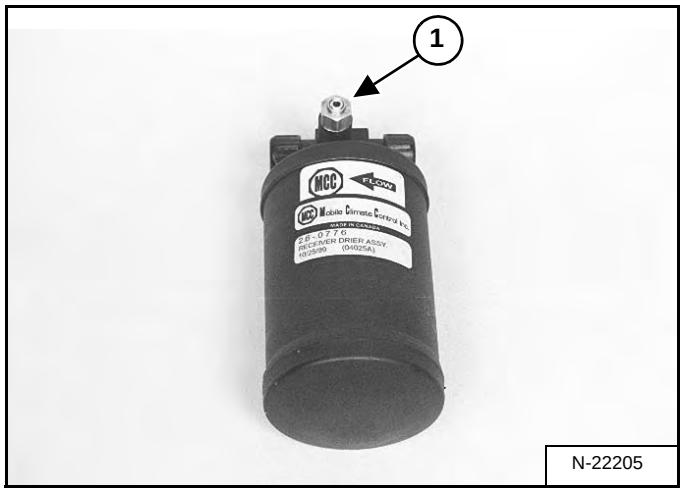
Remove the receiver / drier from the excavator.

NOTE: When replacing a receiver / drier in an A/C system 30 cc (1 U.S. fl oz) of PAG 100 oil must be added to the system when recharging.

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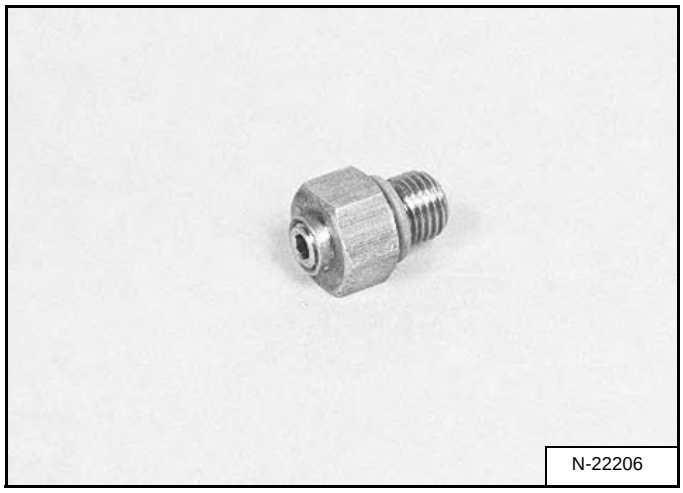
Pressure Relief Valve Removal And Installation

Figure 70-70-2



The pressure relief valve (Item 1) **[Figure 70-70-2]** is located on the receiver / drier assembly.

Figure 70-70-3



The pressure relief valve is designed to open and release the A/C charge if the pressure reaches 3344 - 3792 kPa (33,4 - 37,9 bar) (485 - 550 psi) **[Figure 70-70-3]**.

This will cause the A/C system to shutdown, saving the compressor.

The pressure relief valve is a secondary protection device in the A/C system, with the Pressure Switch shutting down the system at 2647 kPa (26,5 bar) (384 psi).

NOTE: If a pressure relief valve is found open, check the A/C system for problems. Replace the complete receiver / drier unit.

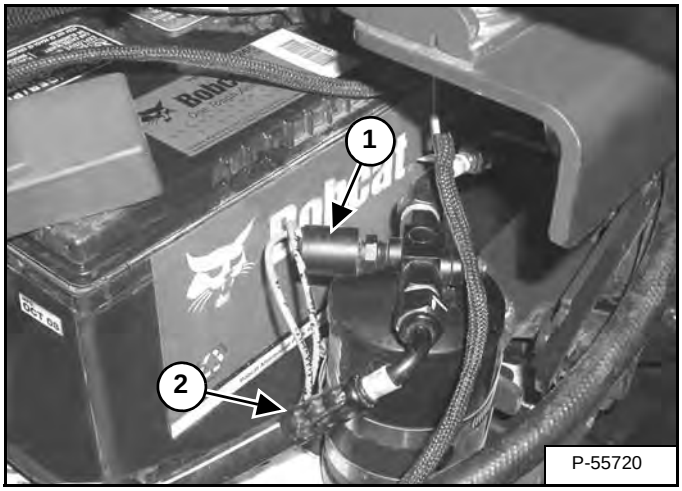
Pressure Switch Removal And Installation

Open the right side cover.

Evacuate the A/C System. (See Reclamation And Charging With Recovery / Charging Unit on Page 70-40-3.)

Remove the right upperstructure cover. (See Removal And Installation on Page 40-80-1.)

Figure 70-70-4



Locate the pressure switch (Item 1) **[Figure 70-70-4]**.

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

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Disconnect the wire harness (Item 2) **[Figure 70-70-4]** from the pressure switch wire harness.

Remove the pressure switch from the excavator.

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EVAPORATOR / HEATER UNIT

Removal And Installation

Remove the cab. (See Removal And Installation on Page 40-30-1.)

Discharge the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 70-40-3.)

Remove the engine coolant. (See Removing And Replacing Coolant on Page 10-100-3.)

Remove the right upper structure cover. (See Removal And Installation on Page 40-80-1.)

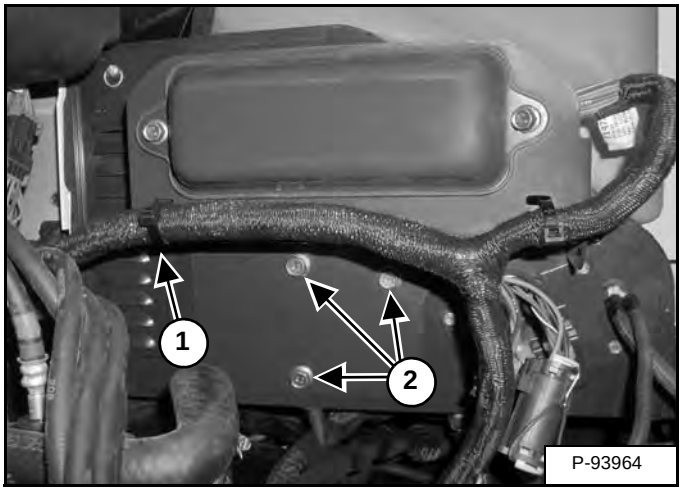
Remove the tool box. (See Removal And Installation on Page 40-230-1.)

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

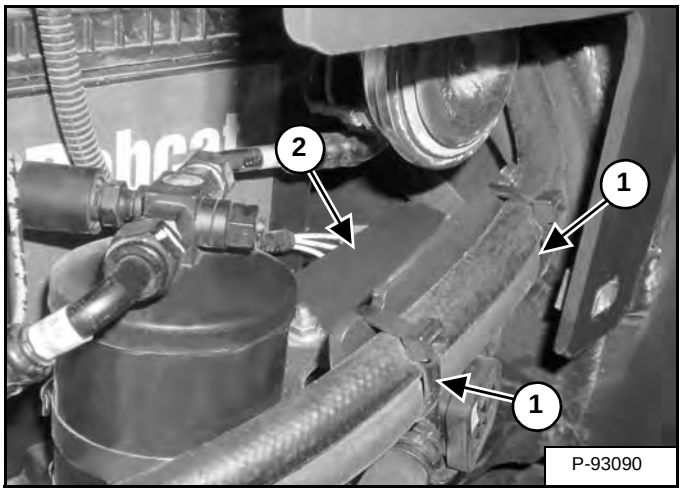
W-2371-0611

Figure 70-80-1



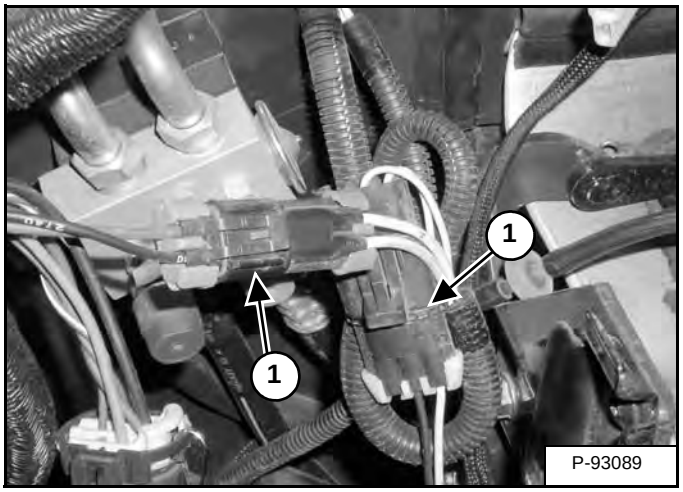
Cut and remove the cable ties (Item 1). Remove the three bolts (Item 2) **[Figure 70-80-1]** and reposition the fuse box.

Figure 70-80-2



Cut and remove the cable ties (Item 1). Disconnect the wire harness (Item 2) **[Figure 70-80-2]**.

Figure 70-80-3

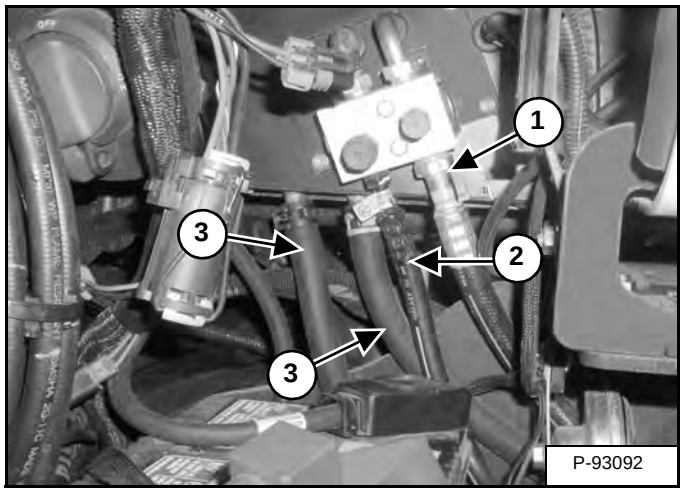


Disconnect the wire harnesses (Item 1) **[Figure 70-80-3]**.

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Removal And Installation (Cont'd)

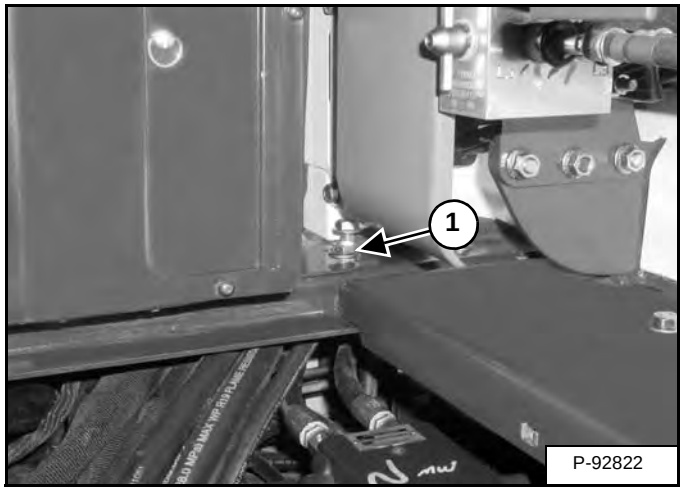
Figure 70-80-4



Remove the air conditioning hoses (Item 1 and 2). Remove the heater hoses (Item 3) **[Figure 70-80-4]**.

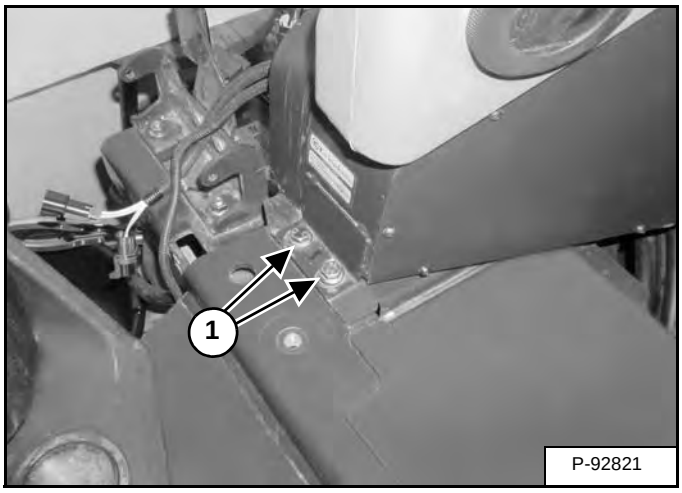
Installation: Tighten the hose (Item 1) to 28 - 36 N•m (21 - 27 ft-lb) torque. Tighten the hose (Item 2) **[Figure 70-80-4]** to 15 - 17 N•m (11 - 13 ft-lb) torque.

Figure 70-80-5



Remove the bolt (Item 1) **[Figure 70-80-5]**.

Figure 70-80-6



Remove the two bolts (Item 1) **[Figure 70-80-6]**.

Remove the evaporator / heater unit.

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THERMOSTAT

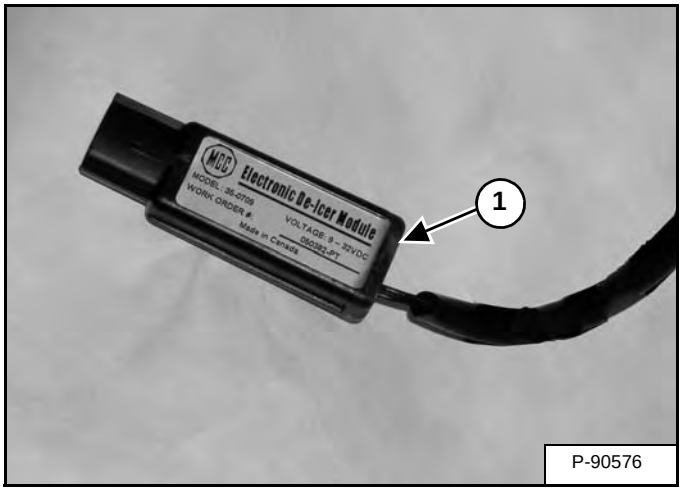
Description

The Electronic De-icing Thermostat (EDT) is a micro controller based module that measures evaporator coil temperature and cycles the compressor clutch to maintain a constant evaporator pressure. Onboard circuit protection and diagnostics are also built into the module.

NOTE: The EDT has a six second delay before start up to protect the compressor clutch.

The EDT will turn the clutch on when the evaporator coil temperature is above 2°C (35.6°F). If the EDT does not detect any malfunction, it will continue to operate and the status LED will be lit continuously. When the evaporator temperature is below -2°C (28.4°F), the EDT will turn off the clutch and status LED.

Figure 70-90-1



When the EDT detects an open or short from the temperature sensor, the status LED (Item 1) **[Figure 70-90-1]** will blink once per second and the output signal to the clutch will be turned off. The status LED will flash two times per second when EDT detects an open circuit (current draw less than 200 mA), short circuit or over current (current draw greater than 7A) from the clutch output. The status LED will flash three times per second when the compressor clutch is shorted to ground.

NOTE: The EDT will attempt to restart every 20 seconds until the fault is repaired.

The EDT has the following protection built in:

1. Over temperature
2. Over current from clutch output
3. Voltage (Above and below operational limits or reverse voltage)
4. Short circuit protection (Output shorted to ground)
5. Temperature sensor open and short detection

MALFUNCTION	DETECTION INTERVAL	STATUS LED
Temperature sensor	Continuous	1x per second
Temperature sensor open and short detection	At A/C start up	2x per second
Compressor clutch short to battery	Continuous	3x per second

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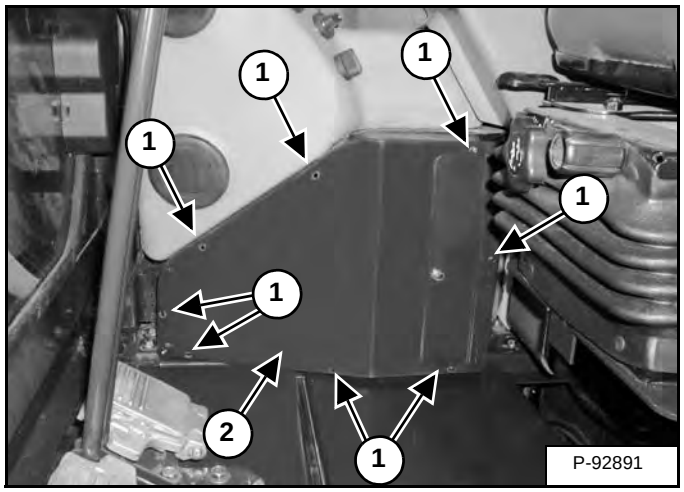
THERMOSTAT (CONT'D)

Removal And Installation

NOTE: The thermostat can be changed without evacuating the A/C system, or removing the evaporator / heater unit from the excavator.

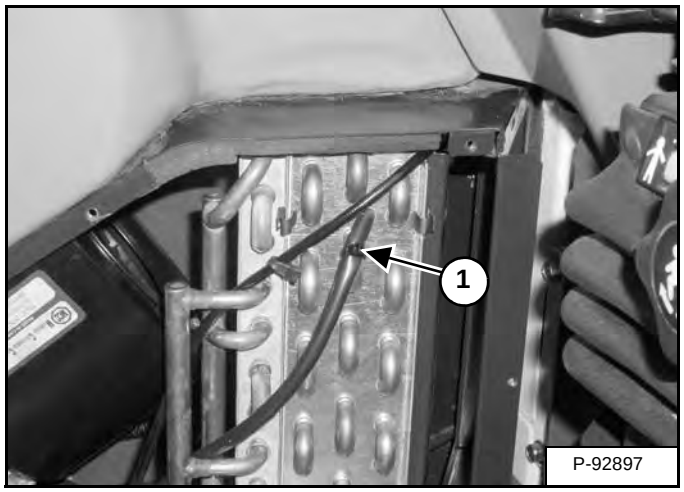
Remove the floor mat. (See Removal And Installation on Page 40-110-1.)

Figure 70-90-2



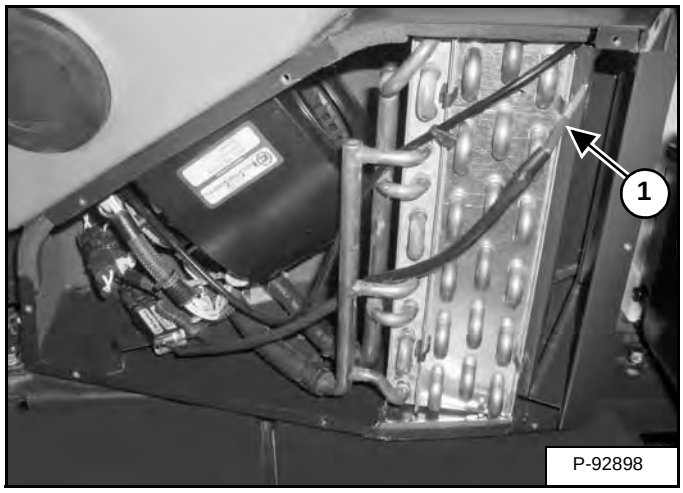
Remove the eight screws (Item 1) and cover (Item 2) **[Figure 70-90-2]**.

Figure 70-90-3



Cut and remove the cable tie (Item 1) **[Figure 70-90-3]**.

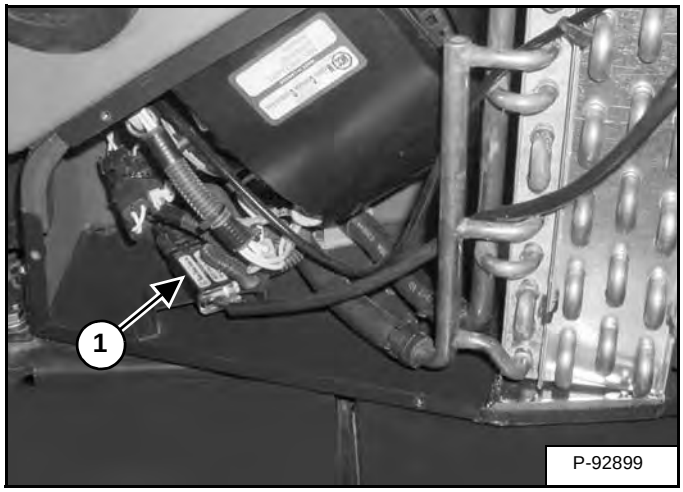
Figure 70-90-4



Remove the probe (Item 1) **[Figure 70-90-4]** from the coil.

NOTE: Mark the location of the probe before removal. Reinstall the probe in the same location. Moving the thermostat probe location in the evaporator coil will effect air conditioning performance.

Figure 70-90-5

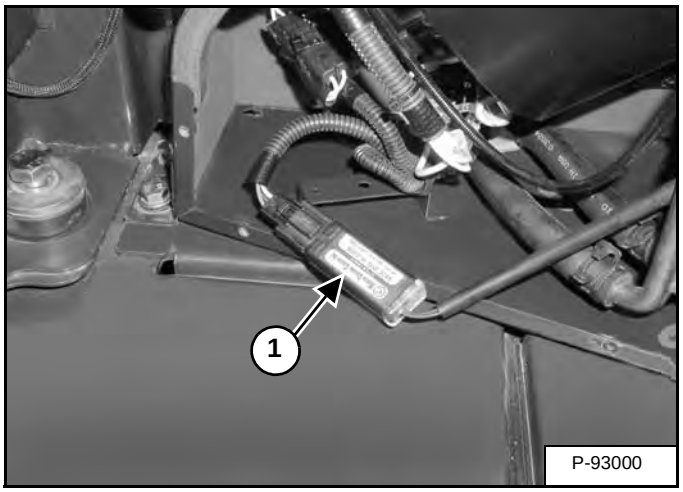


Remove the wire harness connector (Item 1) **[Figure 70-90-5]** from the mount.

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Removal And Installation (Cont'd)

Figure 70-90-6



Disconnect the wire harness (Item 1) **[Figure 70-90-6]**.

Remove the thermostat from the unit.

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EXPANSION VALVE

Removal And Installation

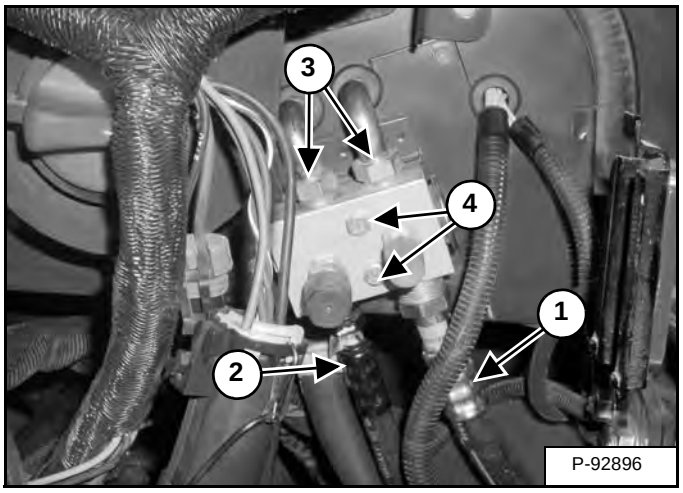
Evacuate the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 70-40-3.)

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

W-2371-0611

Figure 70-100-1



Remove the A/C hoses (Item 1 and 2) **[Figure 70-100-1]** from the expansion valve.

Remove the evaporator fittings (Item 3) **[Figure 70-100-1]** from the expansion valve.

Installation: Tighten the hose (Item 1) to 28 - 36 N•m (21 - 27 ft-lb) torque. Tighten the hose (Item 2) to 15 - 17 N•m (11 - 13 ft-lb) torque. Tighten the fittings (Item 3) **[Figure 70-100-1]** to 15 - 17 N•m (11 - 13 ft-lb) torque.

Remove the bolts (Item 4) **[Figure 70-100-1]**.

Remove the expansion valve from the excavator.

Cap and plug the evaporator tubelines and the expansion valve fittings with the proper A/C caps and plugs.

The expansion valve is not serviceable and must be replaced as an assembly.

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EVAPORATOR COIL

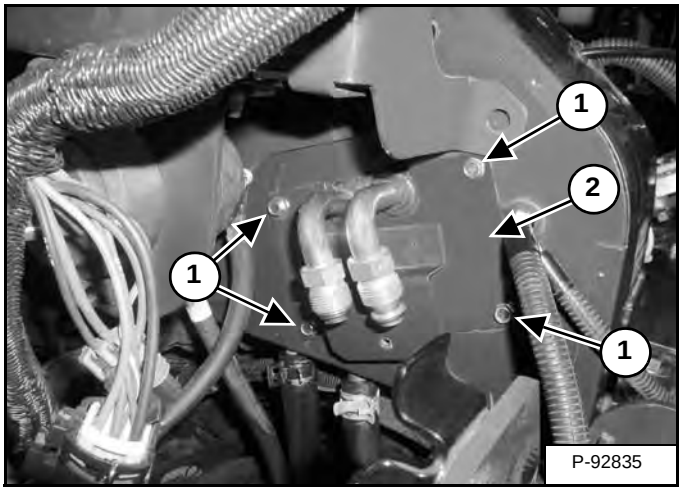
Removal And Installation

Remove the blower fan. (See Removal And Installation on Page 70-130-1.)

Remove the expansion valve. (See Removal And Installation on Page 70-100-1.)

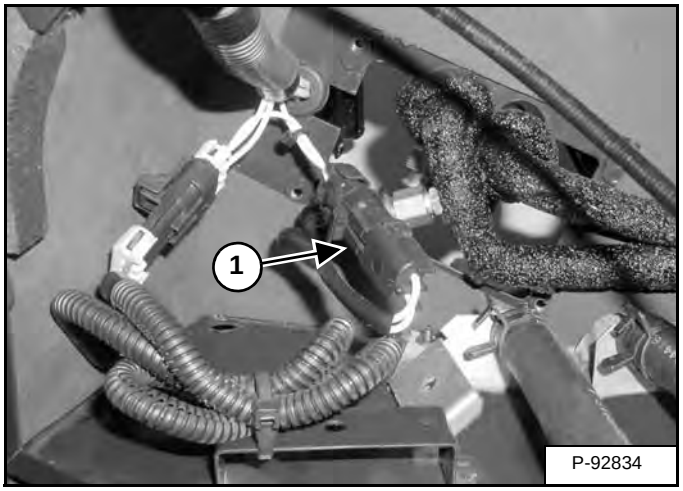
Remove the heater coil. (See Removal And Installation on Page 70-120-1.)

Figure 70-110-1



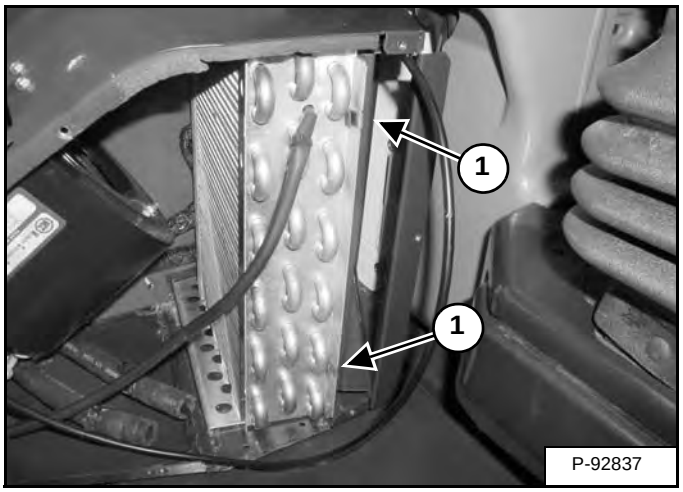
Remove the four bolts (Item 1) and cover (Item 2) **[Figure 70-110-1]**.

Figure 70-110-2



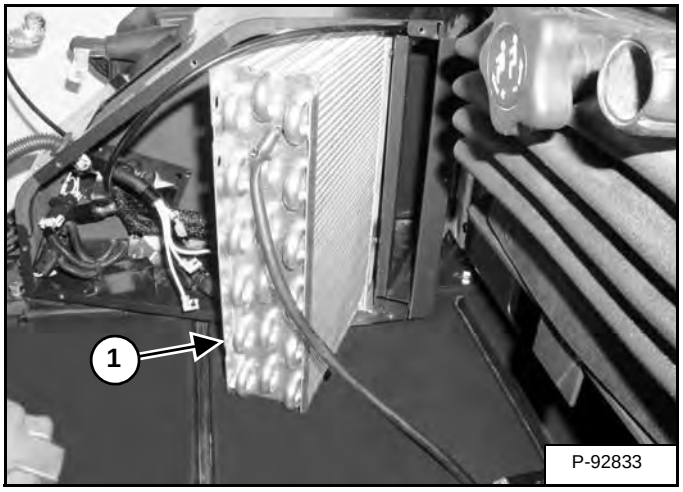
Disconnect the wire harness (Item 1) **[Figure 70-110-2]**.

Figure 70-110-3



Remove the clips (Item 1) **[Figure 70-110-3]**.

Figure 70-110-4

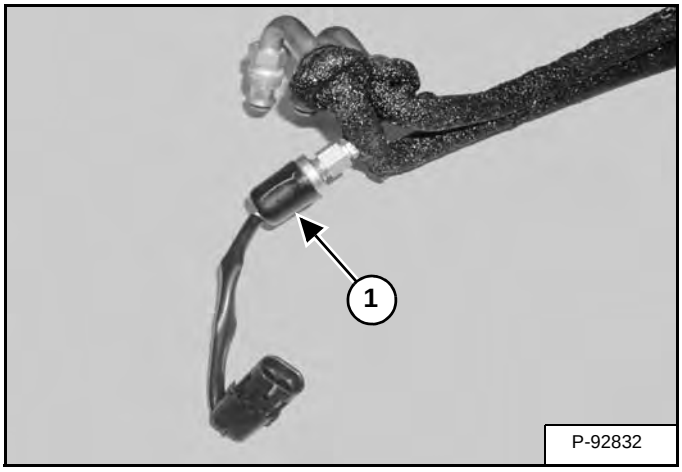


Remove the evaporator (Item 1) **[Figure 70-110-4]**.

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Removal And Installation (Cont'd)

Figure 70-110-5



Remove the sending unit (Item 1) **[Figure 70-110-5]** from the evaporator line.

Inspect the evaporator coil for leaks, and replace as needed.

Clean with low water or air pressure.

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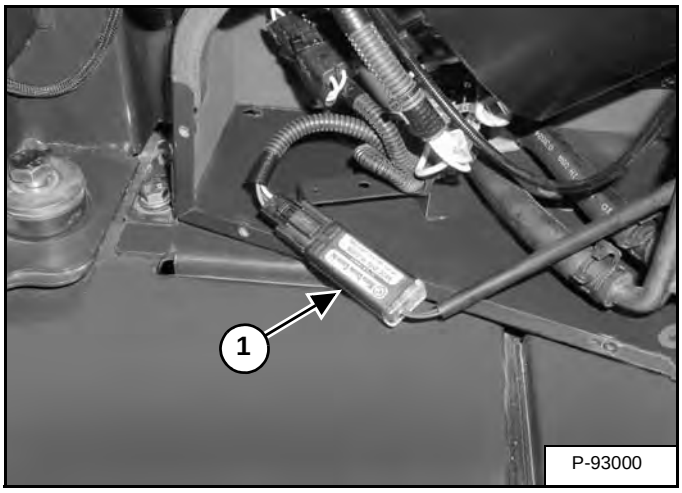
HEATER COIL

Removal And Installation

Remove the engine coolant. (See Removing And Replacing Coolant on Page 10-100-3.)

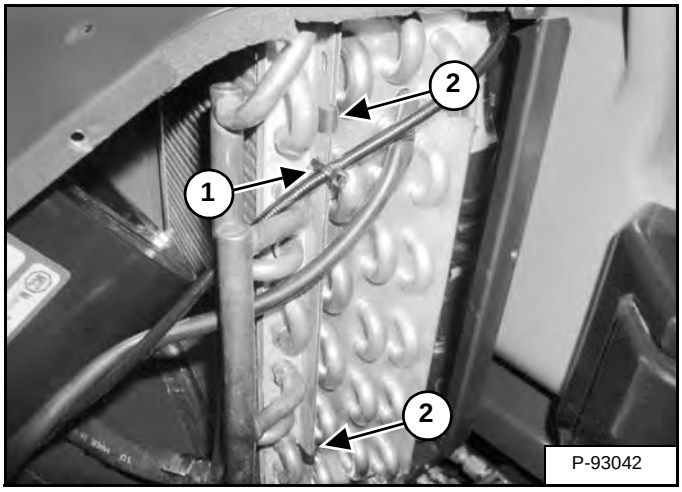
Remove the HVAC Duct. (See Removal And Installation on Page 70-150-1.)

Figure 70-120-1



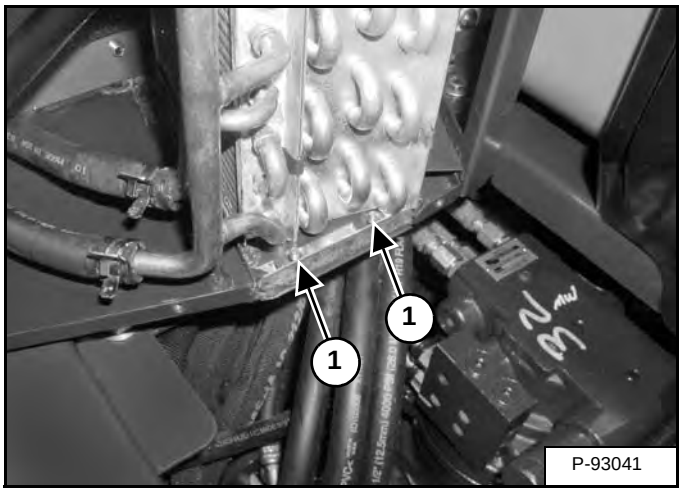
Disconnect the wire harness (Item 1) **[Figure 70-120-1]**.

Figure 70-120-2



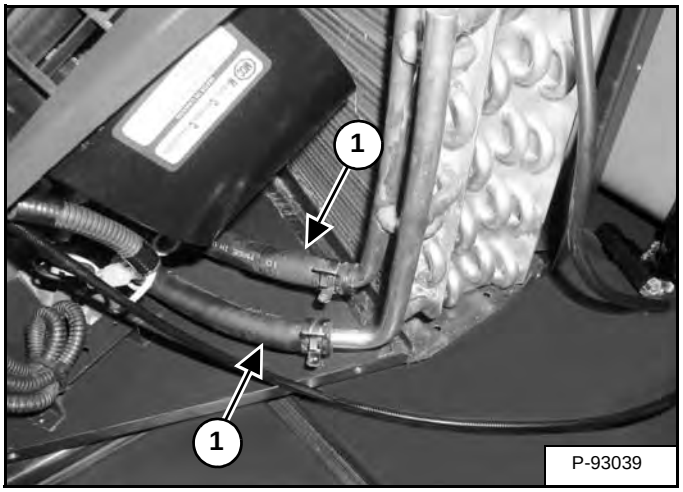
Cut and remove the cable tie (Item 1). Remove the clips (Item 2) **[Figure 70-120-2]**.

Figure 70-120-3



Remove the center floor panel. Remove the two screws and remove the bracket (Item 1) **[Figure 70-120-3]**.

Figure 70-120-4

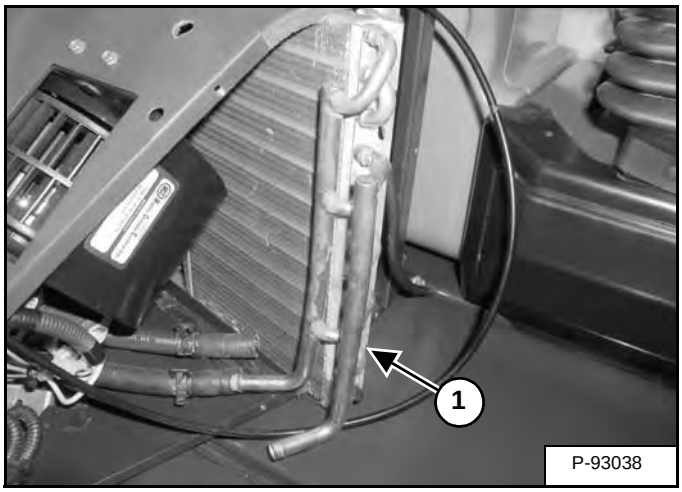


Disconnect the heater hoses (Item 1) **[Figure 70-120-4]**.

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Removal And Installation (Cont'd)

Figure 70-120-5



Remove the coil (Item 1) **[Figure 70-120-5]**.

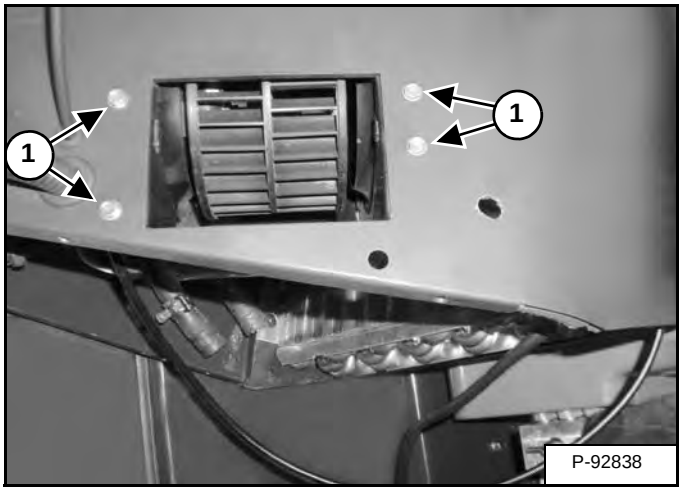
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BLOWER FAN

Removal And Installation

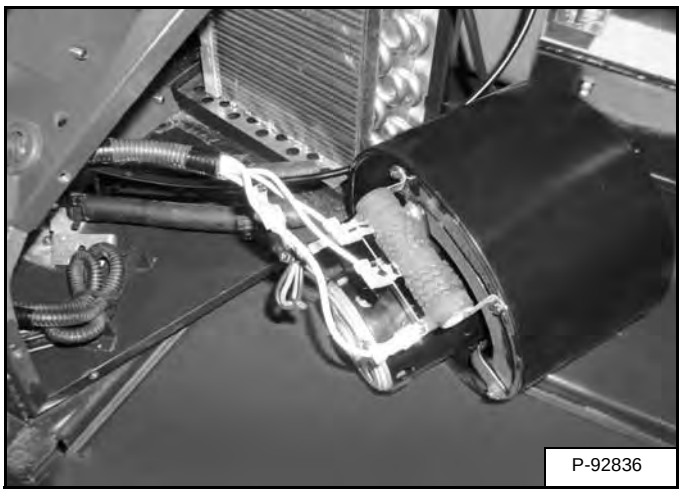
Remove the heater coil. (See Removal And Installation on Page 70-120-1.)

Figure 70-130-1



Remove the four bolts (Item 1) **[Figure 70-130-1]**.

Figure 70-130-2



Mark and remove the wire connectors from the motor **[Figure 70-130-2]**. Remove the motor.

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HEATER VALVE

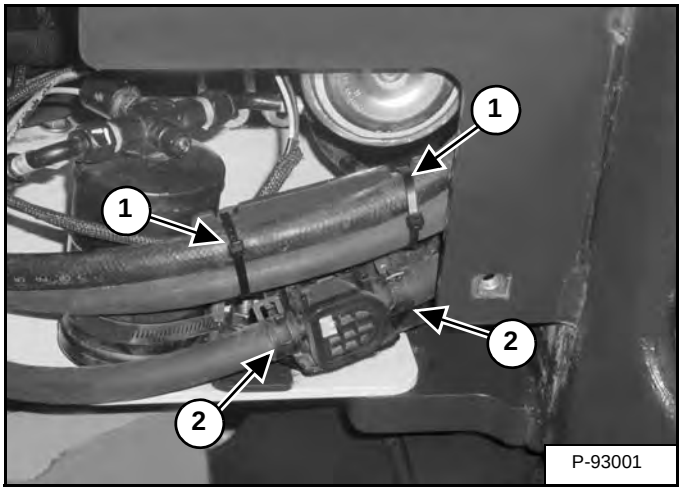
Removal And Installation

Drain the radiator. (See Removing And Replacing Coolant on Page 10-100-3.)

Remove the right upperstructure cover. (See Removal And Installation on Page 40-80-1.)

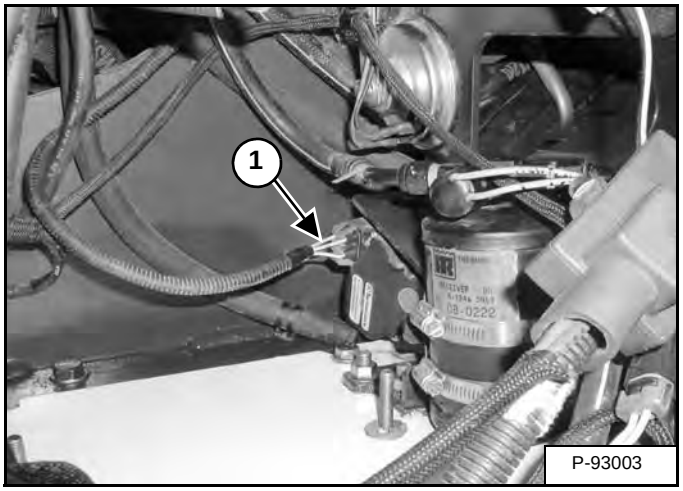
Remove the battery. (See Removal And Installation on Page 50-20-2.)

Figure 70-140-1



Cut and remove the cable ties (Item 1). Remove the hoses (Item 2) **[Figure 70-140-1]**.

Figure 70-140-2



Disconnect the wire harness (Item 1) **[Figure 70-140-2]**.

Figure 70-140-3

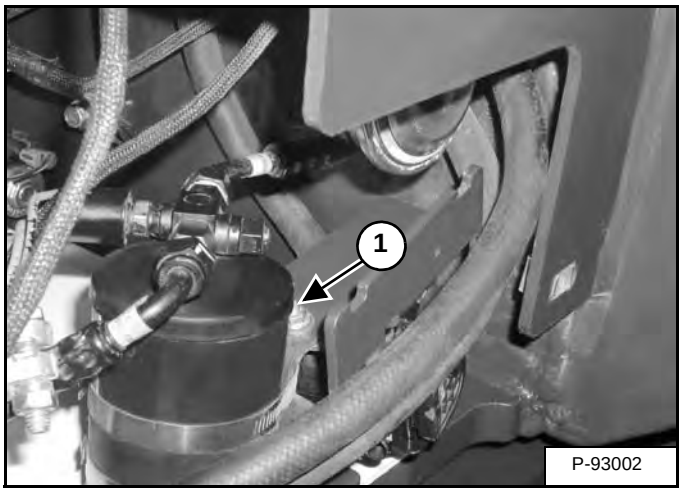
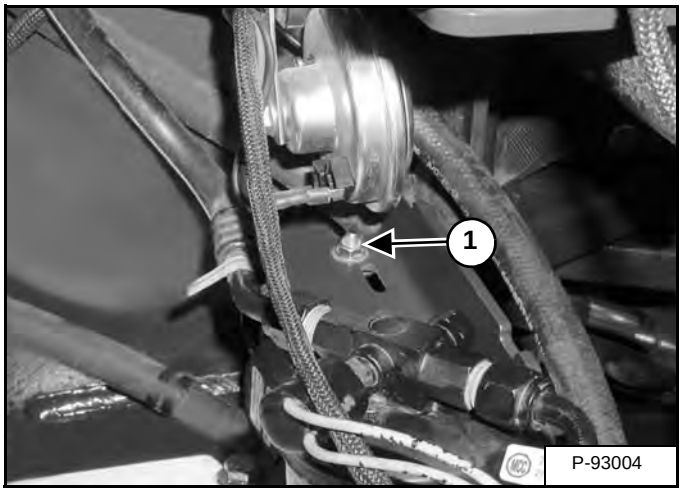


Figure 70-140-4

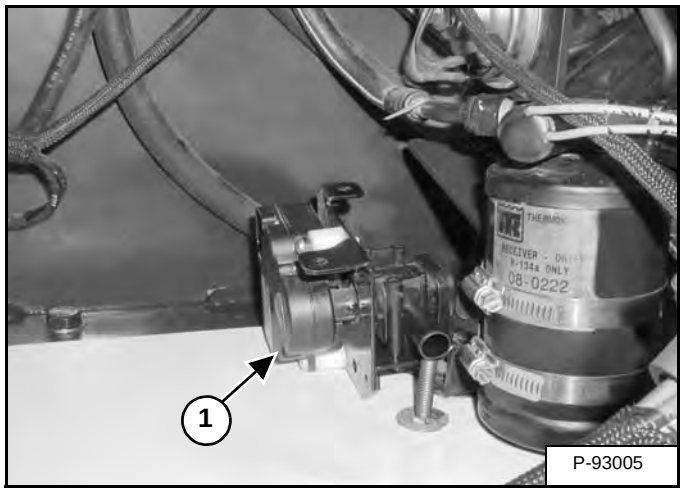


Remove the nuts (Item 1) **[Figure 70-140-3]** and **[Figure 70-140-4]**.

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Removal And Installation (Cont'd)

Figure 70-140-5



Remove the valve (Item 1) **[Figure 70-140-5]**.

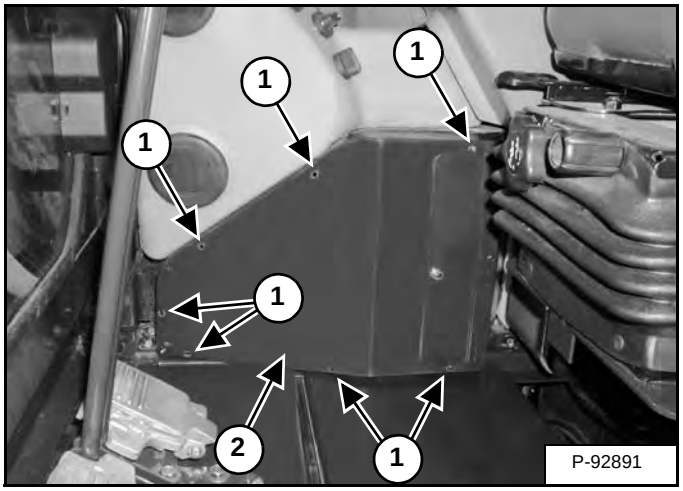
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HVAC DUCT

Removal And Installation

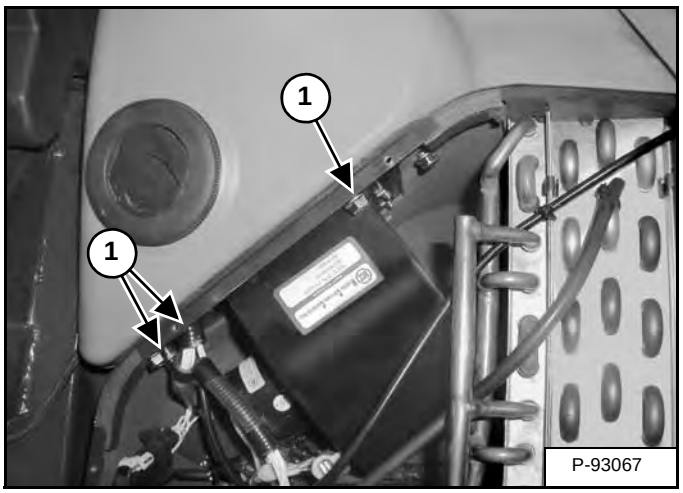
Remove the floor mat.

Figure 70-150-1



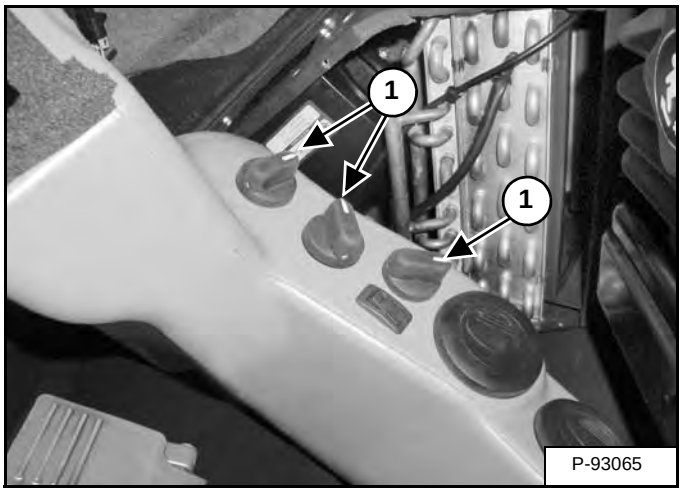
Remove the eight screws (Item 1) and cover (Item 2) **[Figure 70-150-1]**.

Figure 70-150-2



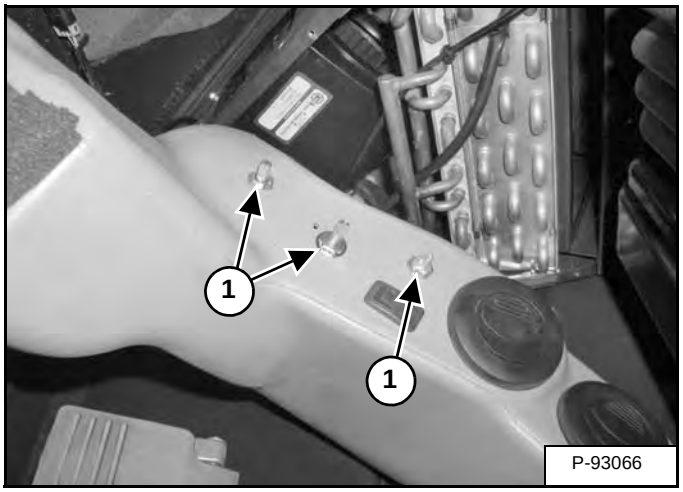
Remove the four bolts (Item 1) **[Figure 70-150-2]**.

Figure 70-150-3



Loosen the set screws (Item 1) **[Figure 70-150-3]** and remove the control knobs.

Figure 70-150-4

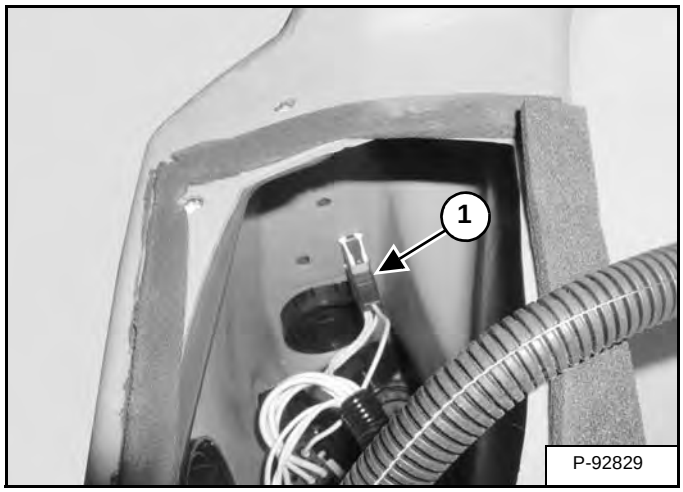


Remove the nuts (Item 1) **[Figure 70-150-4]** and push the controls into the duct.

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Removal And Installation (Cont'd)

Figure 70-150-5



Tilt the duct toward the center of the excavator. Disconnect the A/C switch wire harness (Item 1) **[Figure 70-150-5]**.

Remove the duct from the excavator.

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HEATING, VENTILATION AND AIR CONDITIONING
S/N A93K18000 & ABOVE AND AC2P15000 & ABOVE

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THERMOSTAT 71-90-1
Description 71-90-1
Removal And Installation 71-90-2

EXPANSION VALVE 71-100-1
Removal And Installation 71-100-1

EVAPORATOR COIL 71-110-1
Removal And Installation 71-110-1

HEATER COIL 71-120-1
Removal And Installation 71-120-1

BLOWER FAN 71-130-1
Removal And Installation 71-130-1

HEATER VALVE 71-140-1
Removal And Installation 71-140-1

HVAC DUCT 71-150-1
Removal And Installation 71-150-1

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AIR CONDITIONING SYSTEM FLOW

Description

In an air conditioning system the refrigerant is circulated under pressure through five major components in a closed circuit. At these five points in the system the refrigerant goes through pressure and temperature changes.

The compressor (Item 1) Page 71-10-4 takes in heated, low pressure refrigerant gas through the suction valve (low pressure side) and as the name indicates, pressurizes the heated refrigerant and forces it through the discharge valve (high pressure side) on the condenser (Item 2) Page 71-10-4.

Ambient air passing through the condenser removes the heat from refrigerant resulting in physical state change in the refrigerant from a gas to a liquid.

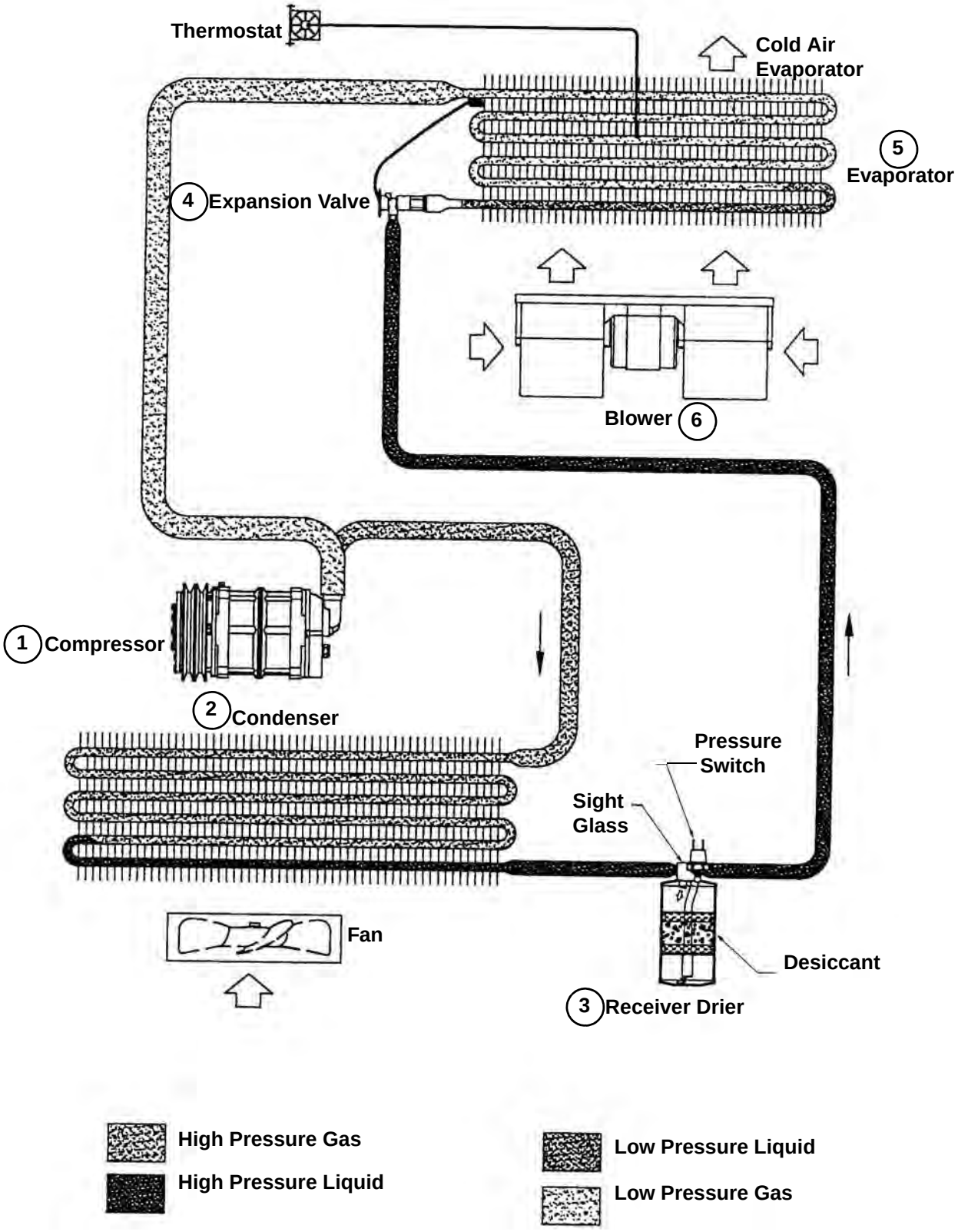
The liquid refrigerant moves on to the receiver / drier (Item 3) Page 71-10-4 where impurities such as moisture and dirt are filtered out. The receiver / drier also serves as the storage tank for the liquid refrigerant. The liquid refrigerant (still under high pressure) flows to the expansion valve (Item 4) Page Page 71-10-4.

The expansion valve meters the amount of refrigerant into the evaporator coil (Item 5) Page 71-10-4. As the refrigerant passes through the expansion valve, it again changes its physical state. It becomes a low temperature, low-pressure liquid and saturated vapor. The low pressure liquid immediately starts to boil and vaporize as it enters the evaporator. The hot humid air of the machine's cab is drawn through or blown into the evaporator by the evaporator fan (Item 6) Page 71-10-4. Since the refrigerant is colder than the air, it absorbs the heat from the air and produces cooled air, which is pushed into the cab by the fan. The moisture in the air condenses on the evaporator coil and drips into the drain pan, which directs the water out of the cab.

The refrigerant cycle is completed when the heated low pressure gas is again drawn into the compressor.

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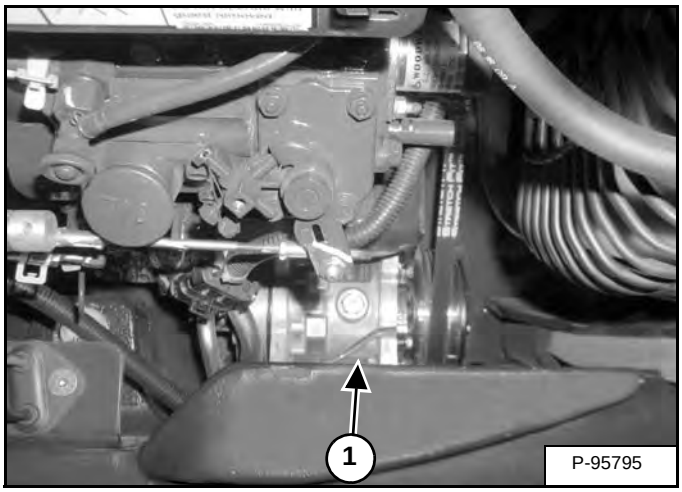
Chart



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Components

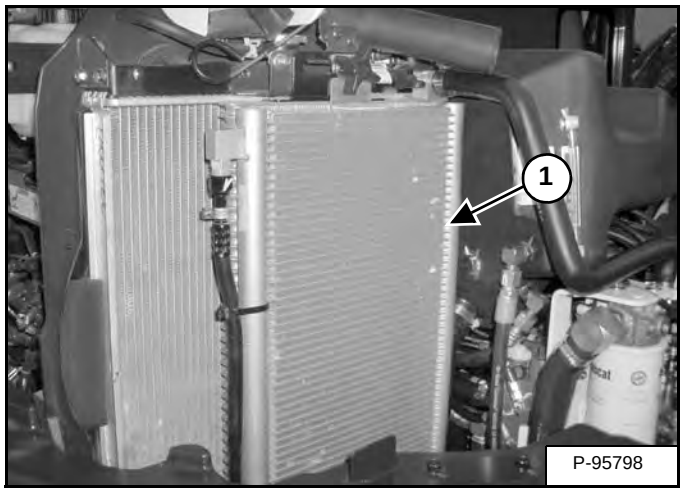
Figure 71-10-1



Compressor: The compressor (Item 1) **[Figure 71-10-1]** is the pump that circulates the refrigerant throughout the system. It raises the pressure of the refrigerant for heat transfer through the condenser and evaporator.

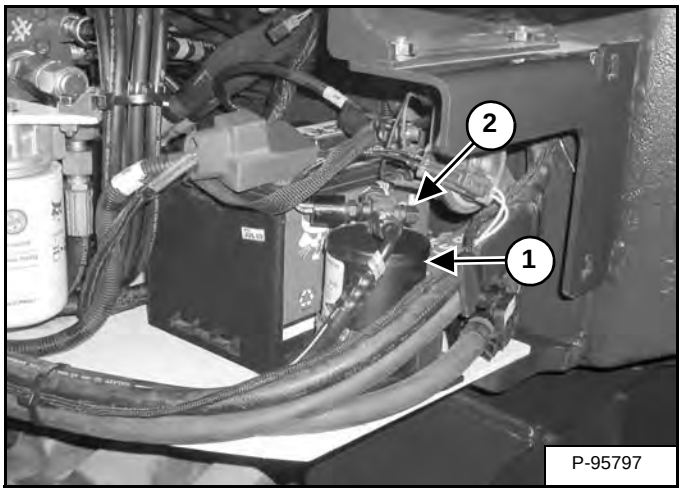
NOTE: The A/C system (Compressor) is recommended to be turned on for at least 5 minutes weekly throughout the year to lubricate the internal components.

Figure 71-10-2



Condenser: The condenser (Item 1) **[Figure 71-10-2]** is the unit that receives the high pressure, high temperature refrigerant vapor from the compressor and condenses it into a high temperature liquid.

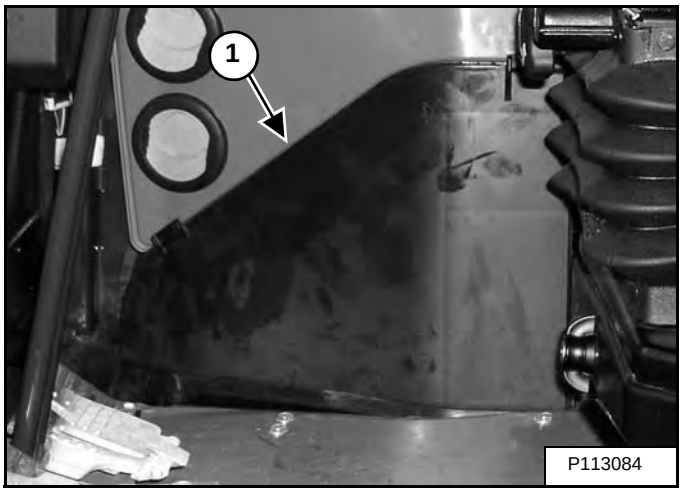
Figure 71-10-3



Receiver / Drier: The receiver / drier (Item 1) **[Figure 71-10-3]** is the unit that receives the liquid refrigerant from the condenser and removes moisture and foreign matter from the system. It also serves as a storage tank for the extra liquid refrigerant until it is needed by the evaporator.

Pressure Relief Valve: The pressure relief valve (Item 2) **[Figure 71-10-3]** is located on the receiver / drier assembly. This small brass valve is a safety feature that is designed to open and release the A/C charge if the pressure reaches 3344 - 3792 kPa (33,4 - 38 bar) (485 - 550 psi).

Figure 71-10-4

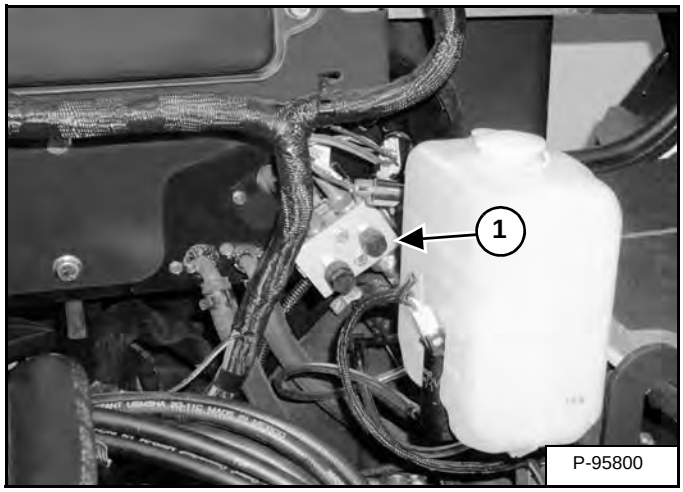


Evaporator / Heater Unit: The evaporator / heater unit (Item 1) **[Figure 71-10-4]** is located in the excavator cab. The unit delivers cold air for the A/C and warm air for heat into the cab. The unit contains the blower, heater coil, evaporator coil, and thermostat.

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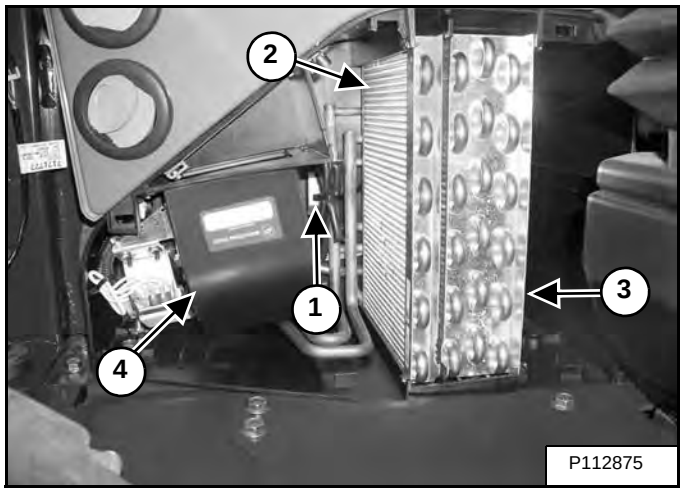
Components (Cont'd)

Figure 71-10-5



Expansion Valve: The expansion valve (Item 1) **[Figure 71-10-5]** controls the amount of refrigerant entering the evaporator coil.

Figure 71-10-6



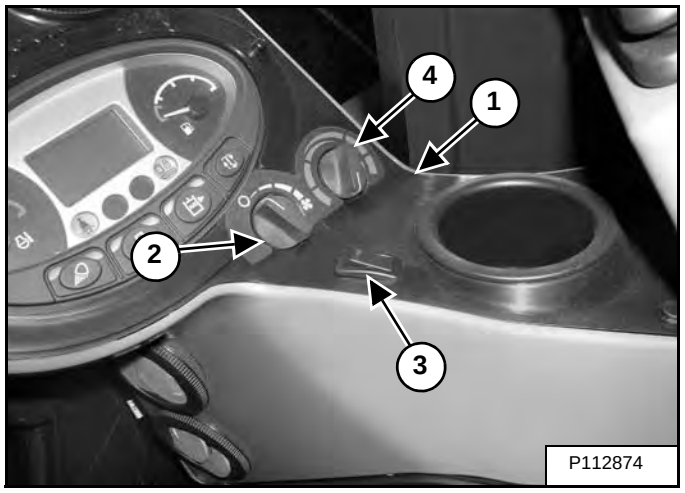
Thermostat: The thermostat (Item 1) **[Figure 71-10-6]** controls the temperature of the evaporator coil.

Heater Coil: The heater coil (Item 2) **[Figure 71-10-6]** supplies the warm air into the cab by passing air through the coil.

Evaporator Coil: The evaporator coil (Item 3) **[Figure 71-10-6]** cools and dehumidifies the air before it enters the cab.

Heater / Evaporator Blower: The blower (Item 4) **[Figure 71-10-6]** is used to push air through the heater and evaporator coils and into the cab.

Figure 71-10-7



Control Panel: The panel (Item 1) **[Figure 71-10-7]** has three separate components.

Fan Switch: This is a four position rotary switch (Item 2) **[Figure 71-10-7]**. When the fan switch is in the off position the A/C will not engage, but the heat valve will operate, as it is controlled by the ignition power.

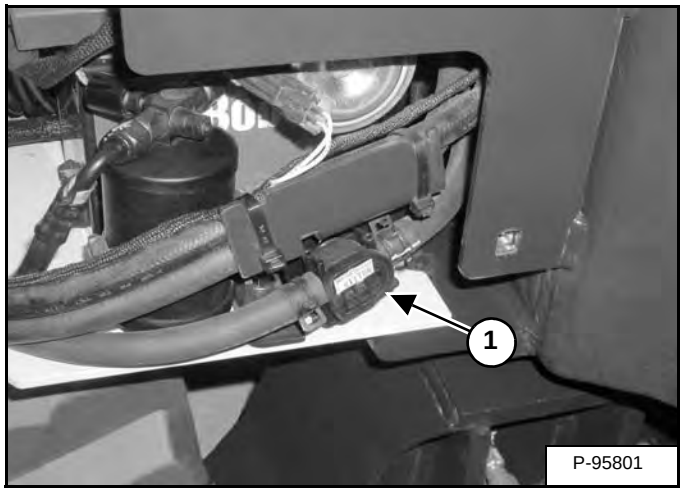
A/C Switch: The rocker switch (Item 3) **[Figure 71-10-7]** will be illuminated when the A/C is engaged.

Potentiometer: The potentiometer (Item 4) **[Figure 71-10-7]** controls the Heat Valve from fully Off to fully On. This can be used in conjunction with the A/C for defrost of the windows and temperature control.

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Components (Cont'd)

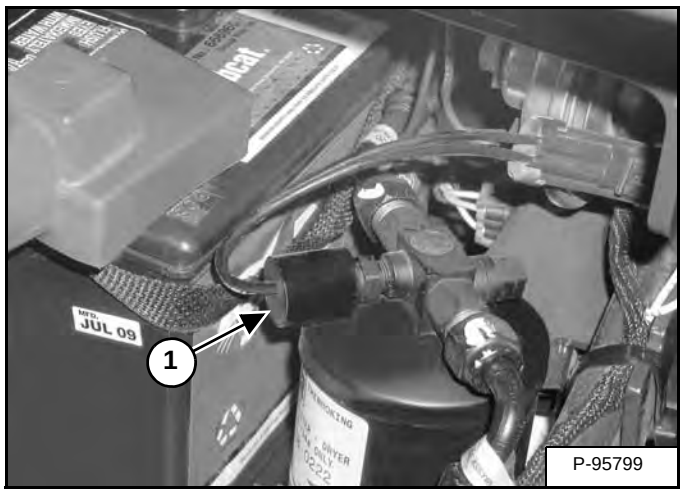
Figure 71-10-8



Heater Valve: The heater valve (Item 1) **[Figure 71-10-8]** is used to control the amount of engine coolant that flows to the heater coil.

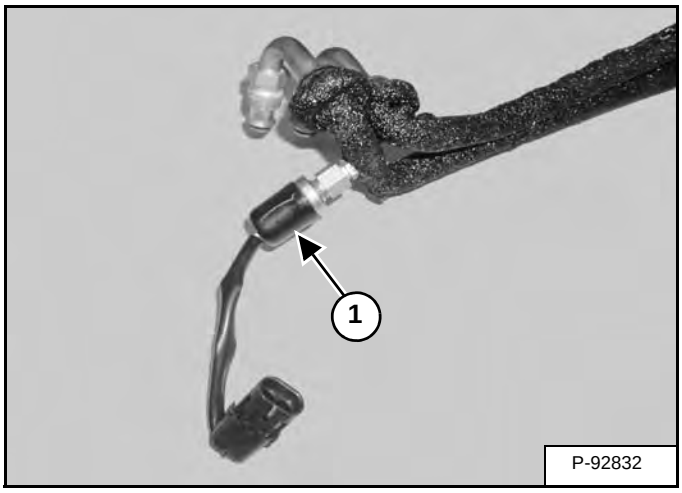
The heater valve is located in front of the battery.

Figure 71-10-9



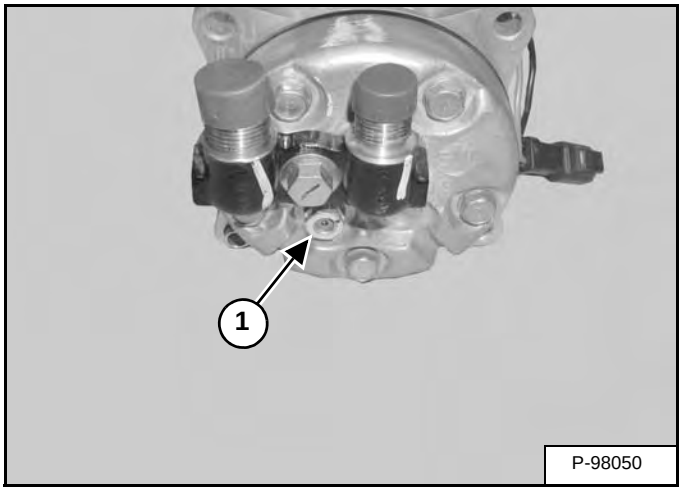
High Pressure Switch: The high pressure switch (Item 1) **[Figure 71-10-9]** will disengage the compressor clutch at high pressure readings over 2689 - 2827 kPa (26,9 - 28,3 bar) (390 - 410 psi) on the high side. The clutch will engage when the pressure is at 2103 - 2379 kPa (21 - 23,8 bar) (305 - 345 psi).

Figure 71-10-10



Low Pressure Switch: The low pressure switch (Item 1) **[Figure 71-10-10]** will disengage the compressor clutch at low pressure readings below 34 - 76 kPa (0,34 - 0,76 bar) (5 - 11 psi) on the low side. The clutch will engage when the pressure is at 117 - 186 kPa (1,2 - 1,9 bar) (17 - 27 psi).

Figure 71-10-11



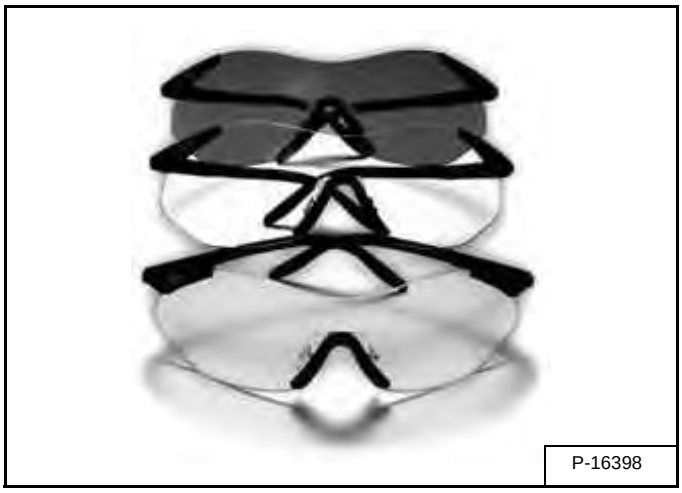
Compressor Relief Valve: The relief valve (Item 1) **[Figure 71-10-11]** is set at 3503 - 4102 kPa (35-41 bar) (508 - 595 psi).

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Safety Equipment

In servicing A/C and heater systems you will be exposed to high pressures, temperatures and several chemical hazards. Moving belts and pulleys are normal shop hazards.

Figure 71-10-12



In addition to exercising caution in your work, **DO WEAR SAFETY GLASSES OR A FACE SHIELD [Figure 71-10-12]** when you are using R-134a or a leak detector, adjusting service valves or the manifold gage set connectors. Safety glasses or a transparent face shield are practical safety items and one or the other is absolutely required.

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

W-2371-0611

Figure 71-10-13



R-134a inside a canister or in an A/C system is a liquid under pressure. When it escapes or releases into the air, **ITS TEMPERATURE DROPS TO -5,7°C (21.6°F) "INSTANTLY".**

If it spills on your skin or in your eyes you should flood the area with cool water and **SEEK MEDICAL ATTENTION FAST!** It is a good idea to wear gloves **[Figure 71-10-13]** to prevent frost bite if you should get refrigerant on your hands.

⚠ WARNING

HFC R-134a refrigerant can be dangerous if not properly handled. Liquid R-134a may cause blindness if it contacts the eyes and may cause serious frostbite if it contacts the skin.

- **Gaseous R-134a becomes lethal (phosgene) gas when it contacts open flame or very hot substances.**
- **NEVER SMOKE when there is the possibility of even small amounts of R-134a in the air.**

Any servicing work that involves release or addition of R-134a to the system must be done by a competent refrigeration dealer who has the proper equipment, knowledge, and experience to service refrigeration equipment.

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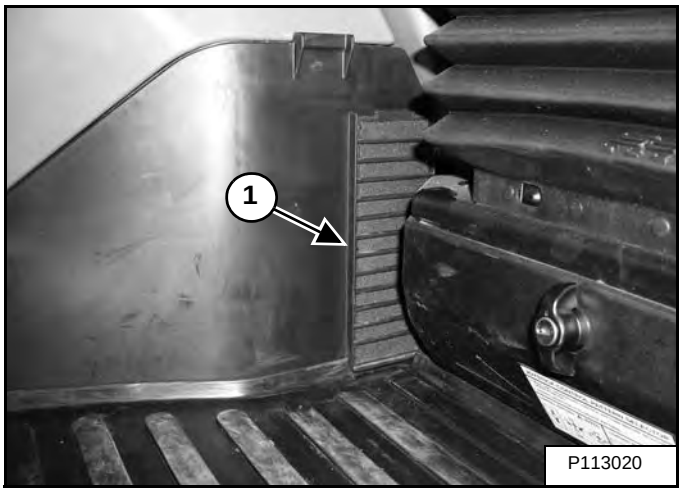
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Cab Filters

The recirculation filter and the fresh air filter must be cleaned regularly. (See SERVICE SCHEDULE on Page 10-70-1.)

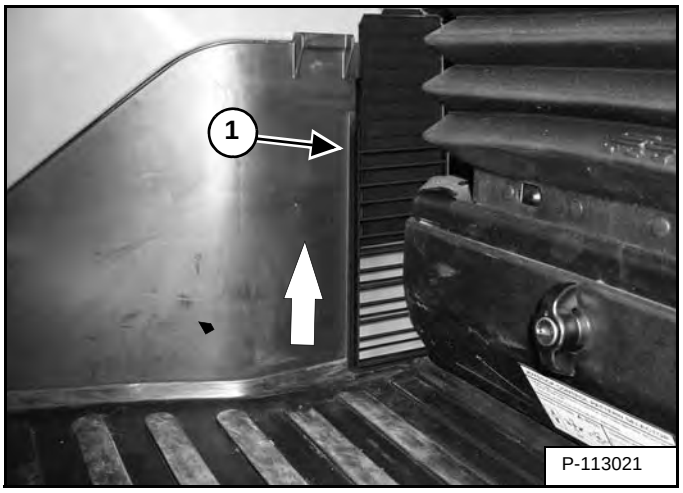
Recirculation Filter

Figure 71-20-1



The recirculation filter (Item 1) **[Figure 71-20-1]** is located to the right of the operator's seat.

Figure 71-20-2



Pull up on the filter (Item 1) **[Figure 71-20-2]** until removed from the housing.

Shake the filter or use low pressure air to clean the filter. Replace the filter when very dirty or if damaged.

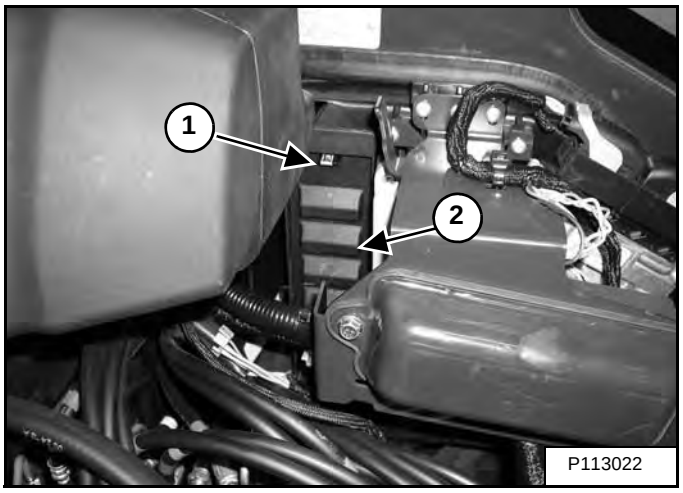
Installation: Position the bottom of the filter (Item 1) **[Figure 71-20-2]** into the housing and slowly push the filter down fully.

Fresh Air Filter

The fresh air filter is located under the right side cover.

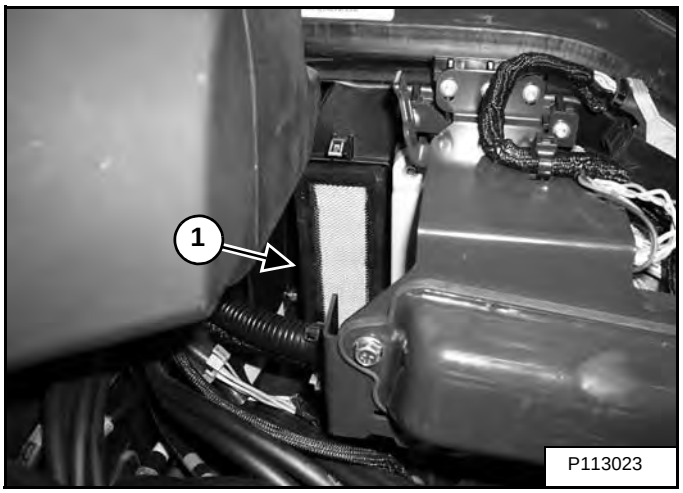
Open the right side cover. (See RIGHT SIDE COVER on Page 10-60-1.)

Figure 71-20-3



Pull out on the tab (Item 1) and remove the cover (Item 2) **[Figure 71-20-3]**.

Figure 71-20-4



Pull the filter (Item 1) **[Figure 71-20-4]** out of the housing.

Shake the filter or use pressure air to clean the filter. Do not use solvents. Replace the filter when very dirty or damaged.

Installation: Position the filter (Item 1) **[Figure 71-20-4]** into the housing and slowly push the filter in fully.

Place the bottom tabs of the filter cover (Item 2) into the frame and push the top in until the tab (Item 1) **[Figure 71-20-3]** locks to the frame.

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Air Conditioning Compressor Belt Adjustment

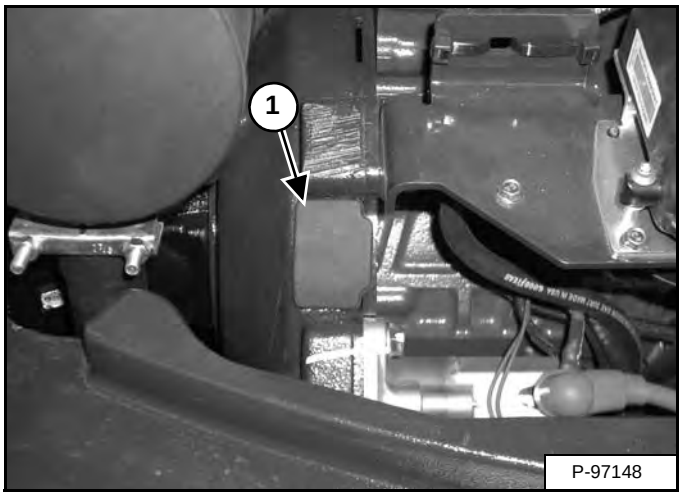
The belt is a special maintenance free type that is pretensioned over the pulleys. This belt eliminates the need for a tensioning device and does not require periodic adjustment. Contact your Bobcat dealer for replacement parts.

Air Conditioning Compressor Belt Replacement

Stop the engine and open the tailgate. (See TAILGATE on Page 10-50-1.)

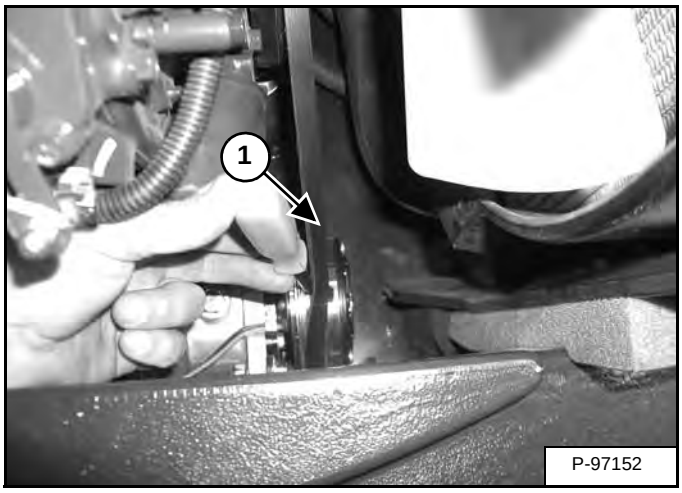
Removal

Figure 71-20-5



The engine will need to be rotated by hand to remove the belt. To access the flywheel, remove the plug (Item 1) **[Figure 71-20-5]** from the flywheel housing.

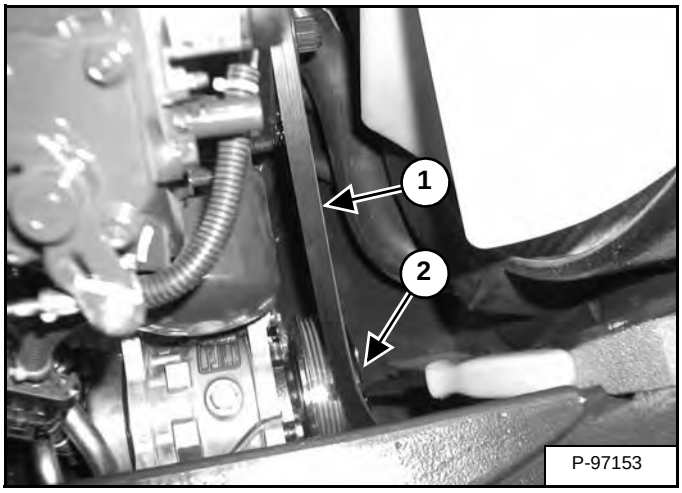
Figure 71-20-6



Use a pry bar (Item 1) **[Figure 71-20-6]** to push the belt off of the pulley. Using a pry bar on the flywheel, rotate the engine by hand to push the belt off the crankshaft pulley. Continue to rotate the flywheel until the belt is loose. Remove the belt.

Installation

Figure 71-20-7



Position the belt (Item 1) **[Figure 71-20-7]** over the crankshaft pulley and to the compressor pulley.

Use a pry bar (Item 2) **[Figure 71-20-7]** to position the belt on the pulley while using the second pry bar at the flywheel to rotate the engine by hand.

Continue to rotate the engine by hand until the belt is fully on the pulleys.

Reinstall the rubber plug (Item 1) **[Figure 71-20-5]**.

Close the tailgate.

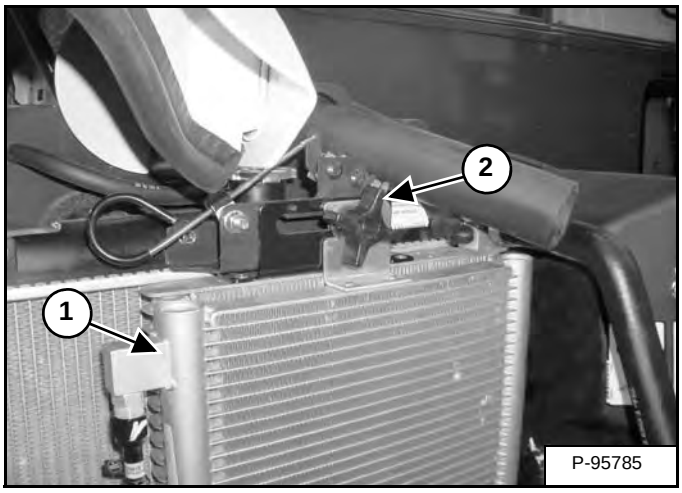
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Condenser

Open the tailgate. (See Opening And Closing on Page 10-50-1.)

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

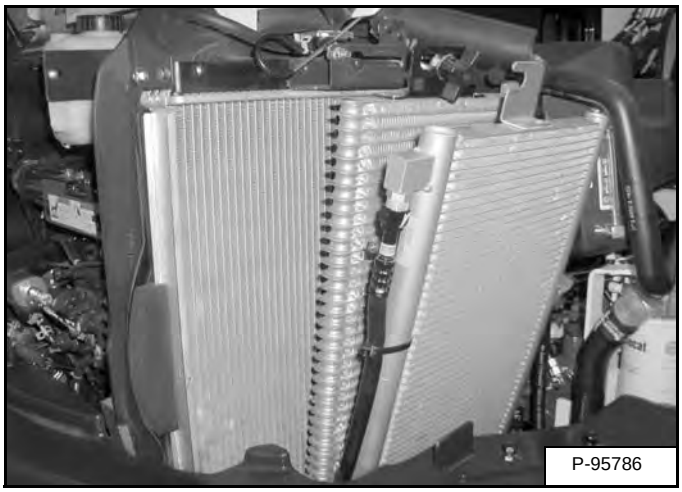
Figure 71-20-8



Check the condenser (Item 1) **[Figure 71-20-8]** for mud or dirt.

Loosen the handle (Item 2) **[Figure 71-20-8]**.

Figure 71-20-9



Tilt the condenser forward **[Figure 71-20-9]**.

The condenser can be cleaned with low water or air pressure.

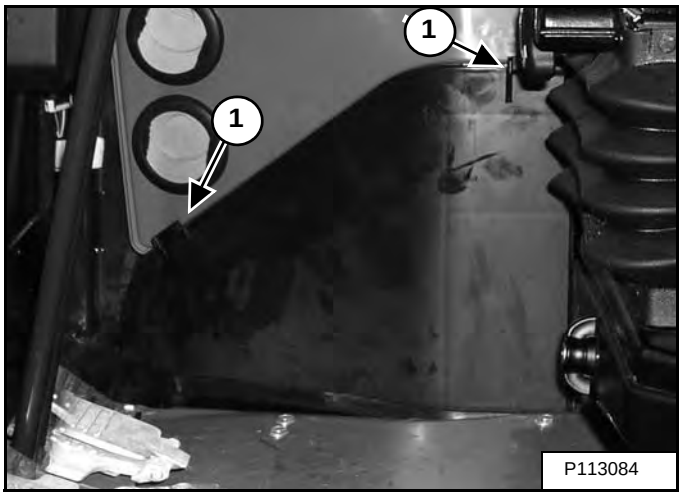
Air Conditioning Lubrication

Run the air conditioning for about five minutes every week to lubricate the internal components.

Evaporator / Heater Coil

Remove the floor mat.

Figure 71-20-10



Remove the floor mat.

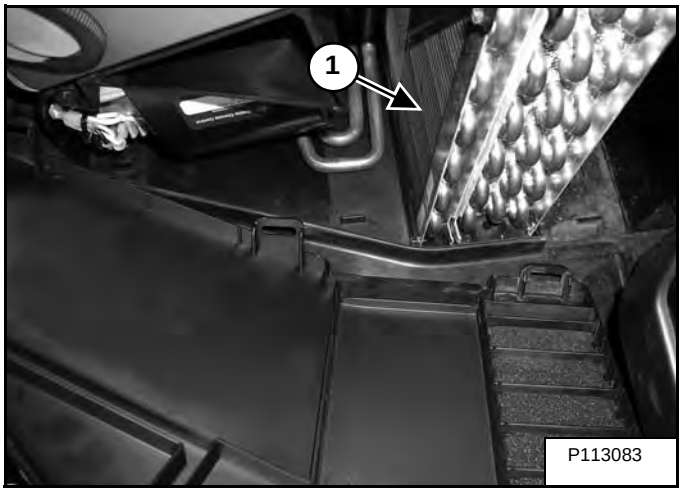
Pull back on the two latches (Item 1) **[Figure 71-20-10]** and remove the HVAC side cover.

To allow water to drain from the HVAC housing during the cleaning process, it is recommended to rotate the upperstructure 90° to the right. Then using the blade, raise the front of the excavator to allow water to run out of the housing. Use jackstands to support the front of the upperstructure.

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Evaporator / Heater Coil (Cont'd)

Figure 71-20-11



Use a lower pressure air or a low pressure water stream to remove debris and to clean the coils (Item 1) **[Figure 71-20-11]**.

After the housing has been cleaned and flushed, remove the jackstands and raise the blade so the front of the excavator is flat on the ground. Stop the engine.

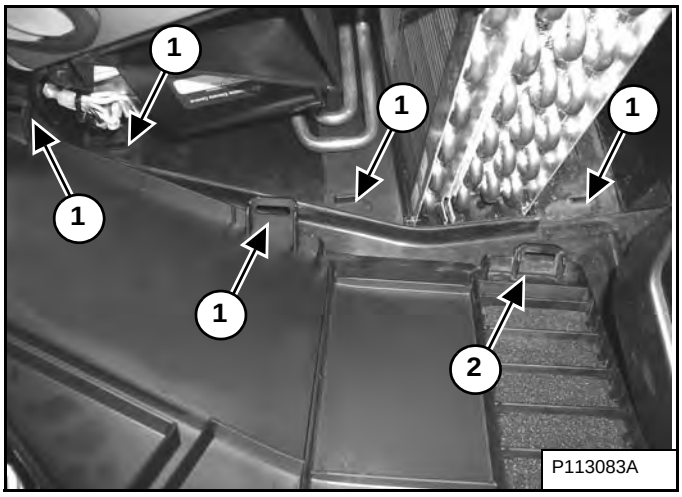
There are three rubber drain valves that allow condensation to drain from the housing during normal air conditioning usage. These drain valve can get clogged with dirt and should be cleaned at the same time the housing is cleaned.

Two of the drain valve can be accessed from the right side cover (the drain valves are located below the HVAC housing on the right side) and one of the valves is located below the left rear corner of the HVAC housing and will be accessed by removing the center floor plate.

Pinch the three rubber drain valves on the flat sides to open the valves and allow dirt and moisture to exit from the end of the valves.

Reinstall the center floor plate and close the right side cover.

Figure 71-20-12



NOTE: The floor mat needs to be removed to allow easier access for installing the HVAC side cover.

Three tabs (Item 1) are on the bottom of the HVAC housing that the side cover retainers (Item 2) **[Figure 71-20-12]** fit into.

Position the side cover on the tabs and starting with the front edge of the side cover, position it into the front of the HVAC housing. Press on the front of the cover to secure the front latch (Item 1) **[Figure 71-20-10]**. Then press in on the top edge of the side cover and work back to the rear of the cover and secure the rear latch.

Reinstall the floor mat.

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Air Conditioning Service Chart

Service Company Name / Phone Number:			
Date:			
Machine Model:			Machine Dealer:
Machine Serial Number:			Customer:
Machine Hours:			
Pre Service Conditions	15 Minutes	30 Minutes	Notes
Ambient Temperature:			
Louver Temperature:			
Cab Temperature At Head Position:			
Temperature Into Condenser:			
High Side Pressure:			
Low Side Pressure:			
Ambient Humidity:			
Observations:			
Explain services required:			
Post Service Conditions	15 Minutes	30 Minutes	Notes
Ambient Temperature:			
Louver Temperature:			
Cab Temperature At Head Position:			
Temperature Into Condenser:			
High Side Pressure:			
Low Side Pressure:			
Ambient Humidity:			
Observations:			

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TROUBLESHOOTING

Blower Motor Does Not Operate

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. Blown Fuse	Inspect the fuse / wiring	Replace fuse / repair wiring
2. Broken wiring or bad connection	Check the fan motor ground and connectors	Repair the wiring or connector
3. Fan Motor Malfunction	Check the lead wires from the motor with a circuit tester	Replace motor
4. Resistor Malfunction	Check resistor using a circuit tester	Replace resistor
5. Fan motor switch malfunction	Check power into and out of the fan switch	Replace fan switch

Blower Motor Operates Normally, But Air Flow Is Insufficient

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. Evaporator inlet obstruction	Check evaporator for plugging	Remove the obstruction and clean evaporator fins with air or water
2. Air leak	Check to make sure air hoses are properly hooked to Louvers and air ducts	Repair or adjust
3. Defective thermo switch (frozen evaporator)	Check thermostat using a circuit tester	Replace thermostat
4. Plugged cab filters	Check cab recirculation and fresh air filters	Clean or replace filters

Insufficient Cooling Although Air Flow And Compressor Operation Are Normal

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. System low on refrigerant	The high side pressure will be low and bubbles may be present in sight glass on receiver / drier	Repair any leaks and recharge the refrigerant to the correct level
2. Excessive Refrigerant	The high pressure side will be high	Use refrigerant recovery equipment to capture excess refrigerant. Charge to the correct refrigerant level

The Compressor Operates Improperly Or Not At All

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. Loose drive belt	The belt is vibrating or oscillating	Replace Belt
2. Internal compressor malfunction	The compressor is locked up and the belt slips	Replace compressor
	Magnetic Clutch Related	
3. Low battery voltage	Clutch slips	Recharge the battery
4. Faulty coil	Clutch slips	Replace the magnetic clutch
5. Oil on the clutch surface	Clutch slips	Replace or clean the clutch surface
6. Open coil	Clutch does not engage and there is not reading when a circuit tester is connected between the coil and terminals	Replace clutch
7. Broken wiring or poor ground	Clutch will not engage. Inspect the ground and connections.	Repair
8. Wiring harness components	Test the conductance of the pressure switch, thermostat, relay, etc.	Check operation

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TROUBLESHOOTING (CONT'D)

Gauge Pressure Related Troubleshooting

Normal compressor suction (low side) and discharge (high side) pressure at ambient temperatures of 30 - 38°C (86 - 96°F) and compressor speed of approximately 2000 rpm are:

High pressure side pressure: 1448 - 1827 kPa (14 - 18 bar) (210 - 265 psi)

Low pressure side pressure: 103 - 228 kPa (1 - 2 bar) (15 - 33 psi)

As a rule of thumb the high side pressure will be around eight times greater then the low side pressure.

POSSIBLE CAUSE	INSPECTION	SOLUTION
Low Pressure Side Too High	The Low pressure side pressure normally becomes too high when the high pressure side pressure is too high. As this is explained below, the following inspection is only used when the low pressure side is too high.	
1. Expansion valve opens too far	Frost is present on the suction hose	Replace the expansion valve
2. Defective compressor	The high and low pressure side gauge pressures equalize when the magnetic clutch is disengaged	Replace compressor
Low Pressure Side Too Low		
1. Low refrigerant charge	The high side pressure will be low and bubbles may be present in sight glass on receiver / drier	Repair any leaks and recharge the refrigerant to the correct level
2. Clogged or closed expansion valve	The expansion valve's inlet side is frosted. Moisture or other contaminants can be the cause.	Clean or replace the expansion valve
3. Restriction between drier and expansion valve	Frost on the line between drier and expansion valve. A negative low pressure reading may be shown.	Flush system or replace hose
4. Thermostat malfunction	the evaporator is frozen	Adjust thermostat's temperature setting or probe placement or replace thermostat
5. Restriction in receiver dryer	Excessive frost on receiver dryer	Replace receiver dryer
High Pressure Side Too High		
1. Poor condenser performance	Dirty or clogged condenser fins. Condenser fans not operating.	Clean fins and / or repair the fan
2. Excessive refrigerant	The high pressure side pressure will be high	Use refrigerant recovery equipment to capture excess refrigerant. Charge to the correct refrigerant level.
3. Excessive oil charge	The high pressure side will be high	Evacuate system. Remove oil from condenser and compressor. Measure oil from compressor and add correct oil charge back into compressor. Flush system with nitrogen. Replace drier.
4. Air in system	Pressure is high on both high and low sides	Evacuate and recharge with refrigerant
5. Restriction in drier, condenser, or high pressure line	High pressure side will be high and low pressure side will be low	Evacuate and flush system replacing defective parts
High Pressure Side Too Low		
1. Low refrigerant charge	The high side pressure will be low and bubbles may be present in sight glass jon receiver / drier	Repair any leaks and recharge the refrigerant to the correct level.
System Pressure Equals		
1. Clutch not operating	See magnetic clutch related topics above	
2. Compressor not pumping	Equal high and low pressures	Replace compressor

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Temperature / Pressure Chart

TEMP F	PSIG	TEMP F	PSIG
16	15.69	93	110.20
18	17.04	94	112.10
20	18.43	95	114.10
22	19.87	100	124.30
24	21.35	102	128.50
26	22.88	104	132.90
28	24.47	106	137.30
30	26.10	108	141.9
32	27.79	110	146.50
34	29.52	112	151.30
36	31.32	114	156.10
38	33.17	116	161.10
40	35.07	118	166.10
42	37.03	120	171.30
44	39.05	122	176.60
45	40.09	124	182.00
50	45.48	126	187.50
55	51.27	128	193.10
60	57.47	130	198.90
65	64.10	135	213.70
70	71.19	140	229.40
75	78.75	145	245.80
80	86.80	150	263.00
85	95.40	155	281.10
90	104.40	160	300.10
91	106.30	165	320.10
92	108.20	170	340.80

Evaporator

Pressures represent gas temperatures inside the coil, not the coil surface. For an estimate of the temperature of the air coming off the coil add -13 - -12°C (8 - 10°F) to the temperature on the chart.

Condenser

Temperatures are not ambient temperatures but condensing temperatures. Add 4°C (40°F) to the ambient temperature to get the condensing temperature and then refer to the pressure chart to see appropriate pressure for ambient temperature.

Example: Ambient Temperature = 90°F

90°F
+ 40°F
130°F condenser temperature = 200 psig

Conditions and pressures will vary from system to system.

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Poor A/C Performance

Start the excavator. Engage the A/C system with the blower fan on high. Run the excavator at full RPM for approximately 15 minutes, with the cab door closed.

Figure 71-30-1

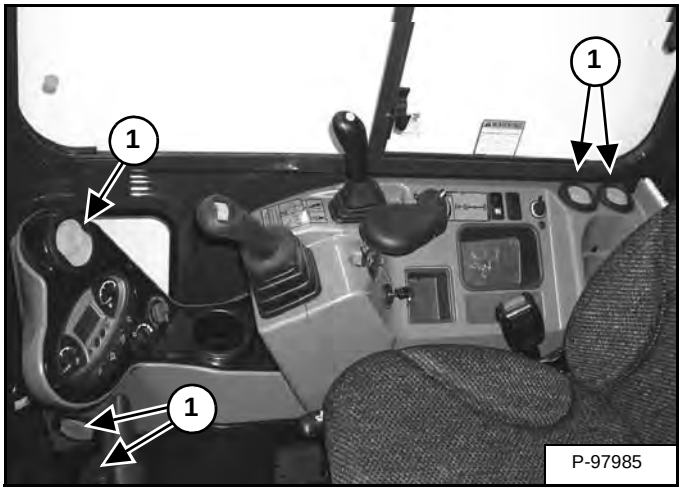
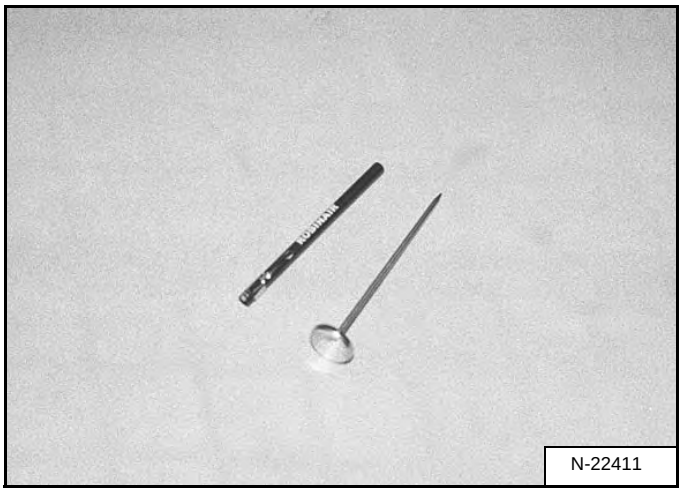


Figure 71-30-2



Check the temperature at the louvers (Item 1) **[Figure 71-30-1]** with a thermometer **[Figure 71-30-2]**.

The louver temperature should be between 2,2 - 11,6°C (36 - 53°F) depending on the amount of humidity in the air.

If louver temperature is too high see the System Troubleshooting Chart. (See Gauge Pressure Related Troubleshooting on Page 71-30-2.)

Check the blower fan for proper operation, and replace if necessary. (See Removal And Installation on Page 71-130-1.)

Check the air conditioning compressor belt for wear or damage. (See Air Conditioning Compressor Belt Replacement on Page 71-20-2.)

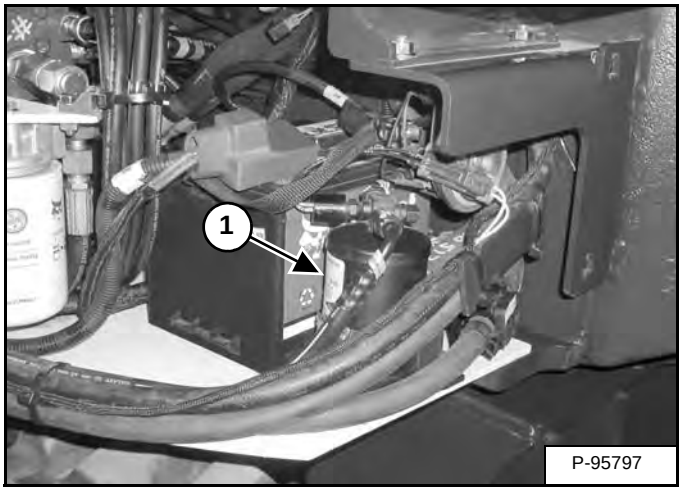
Check the A/C evaporator coil for dirt or mud, and clean if necessary. (See Evaporator / Heater Coil on Page 71-20-3.)

Inspect the sight glass located on the receiver / drier for air bubbles. (See Gauge Pressure Related Troubleshooting on Page 71-30-2.)

Check the engine coolant to see if it is bypassing the heater valve.

HVAC Repair And Leaks

Figure 71-30-3



Whenever the A/C system is opened to the atmosphere or there has been a leak in the system, the receiver / dryer (Item 1) **[Figure 71-30-2]** must be changed.

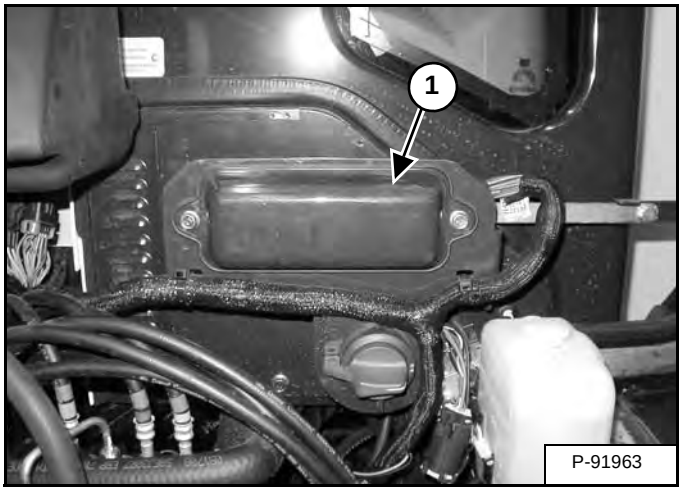
Never leave hose fittings, compressor fittings or components uncapped while working on the A/C system.

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Electrical System

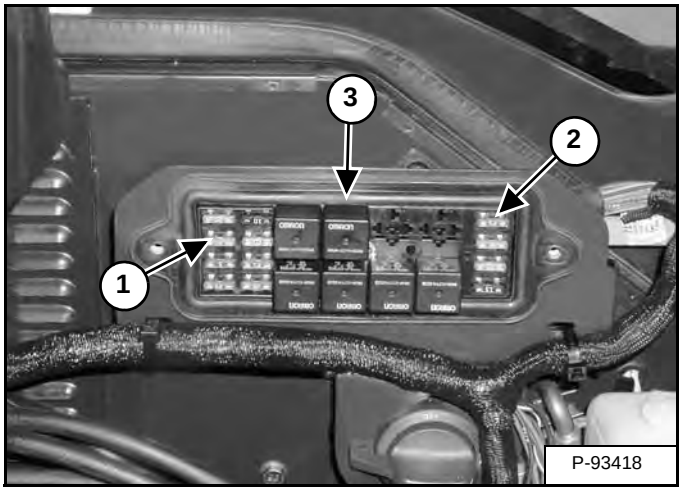
If the excavator A/C system shows no blower motor function, no A/C switch light and no A/C compressor function, do the following check:

Figure 71-30-4



Remove the two bolts and fuse / relay cover (Item 1) **[Figure 71-30-4]**.

Figure 71-30-5

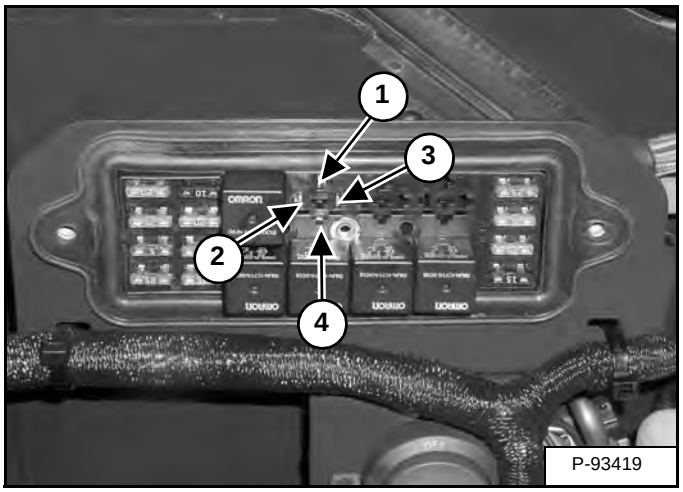


Check the HVAC fuse (Item 1) and controller fuse (Item 2) **[Figure 71-30-5]**.

Replace the fuse if burned out. If the fuses are good, remove the relay (Item 3) **[Figure 71-30-5]**.

Using a multimeter, check the voltage at the following relay terminals:

Figure 71-30-6



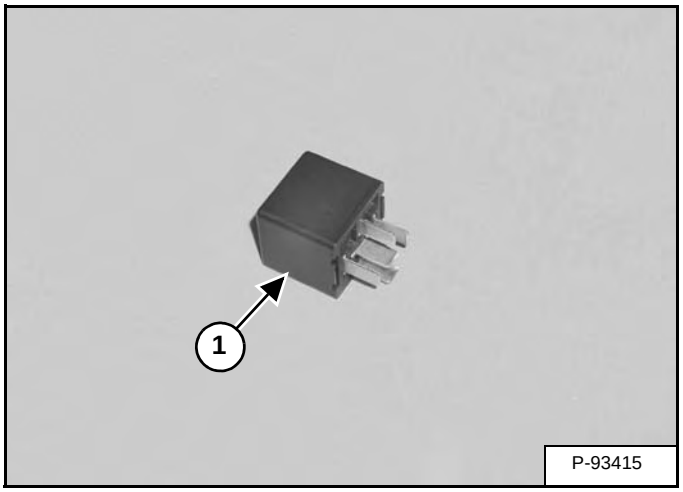
Voltage at pin 30 (Item 1) **[Figure 71-30-6]** is 12 volts at all times.

Voltage at pin 86 (Item 2) **[Figure 71-30-6]** is 12 volts when the start key is in the on position.

Pin 85 (Item 3) **[Figure 71-30-6]** is ground. Check for continuity to the ground.

With the key in the ON position, A/C switch ON, turn the fan switch ON pin 87 (Item 4) **[Figure 71-30-6]** is ground. Turn the fan switch OFF, and there is no continuity.

Figure 71-30-7



If the voltages and continuity checks are OK but the problem still persists, replace the A/C relay (Item 1) **[Figure 71-30-7]**.

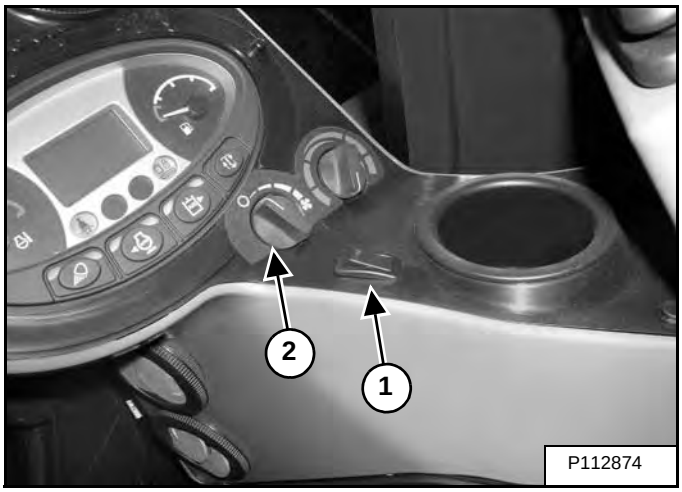
Check to see if the compressor clutch is engaging.

With a person in the operator seat and the cab door open, turn the key switch to RUN (Standard panel) OR press the RUN/ENTER Button (Deluxe Panel), without starting the excavator.

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Electrical System (Cont'd)

Figure 71-30-8

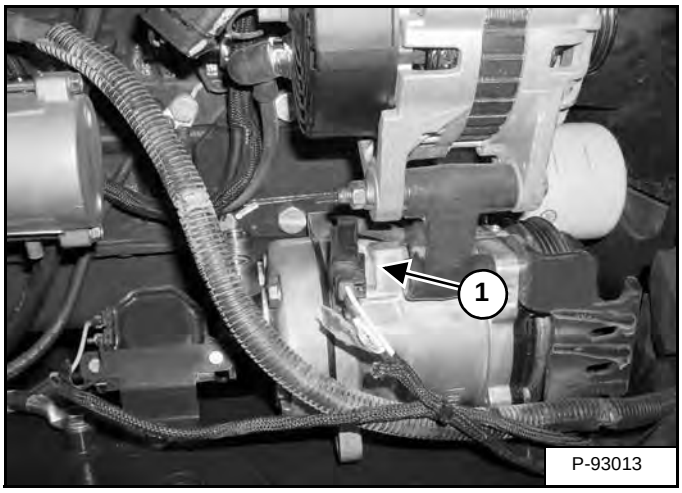


Push the A/C switch (Item 1) to the ON position. Turn the blower fan switch (Item 2) **[Figure 71-30-8]** to the first ON position.

The compressor clutch should make a click sound, which indicates the clutch is engaging.

NOTE: There is a time delay of 5 - 10 seconds until the clutch will engage.

Figure 71-30-9



Disconnect the wire harness (Item 1) **[Figure 71-30-9]**.

NOTE: The counterweight is removed for photo clarity.

With a multimeter, check the resistance to the compressor clutch.

If there is no resistance value, replace the compressor. (See Removal And Installation on page 70-140- 1.)

With a multimeter, check the voltage to the compressor clutch at the wire harness.

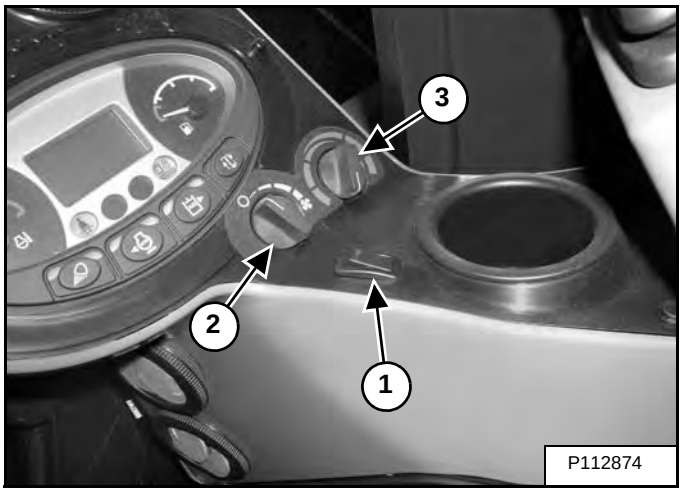
If the voltage reading is approximately 12 volts, the system is operating correctly.

If there is no power at the clutch, reconnect the wiring harness to the compressor clutch.

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Engine Coolant Bypassing The Heater Valve

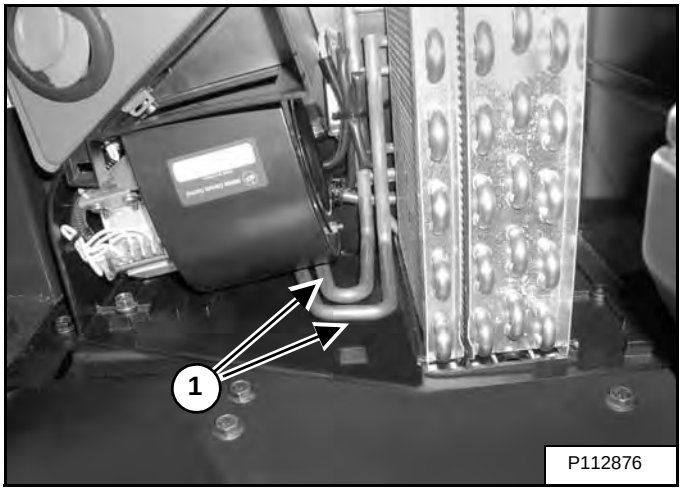
Figure 71-30-10



Push the A/C switch (Item 1) to the OFF position. Turn the fan switch (Item 2) to the High Speed position. Turn the temperature control (Item 3) **[Figure 71-30-10]** to the High A/C position, with the key switch OFF.

Start the excavator and run at high idle, for ten minutes.

Figure 71-30-11



Check the temperature of the heater coil tubelines (Item 1) **[Figure 71-30-11]**.

If the hoses are hot, the heater valve is leaking internally and needs to be replaced.

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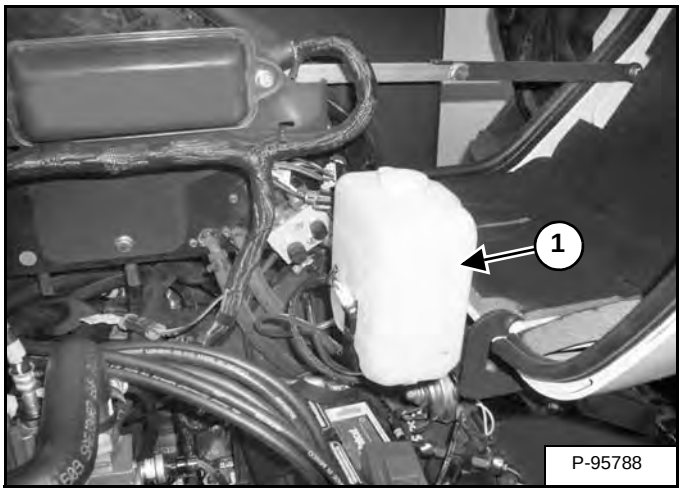


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SYSTEM CHARGING AND RECLAMATION

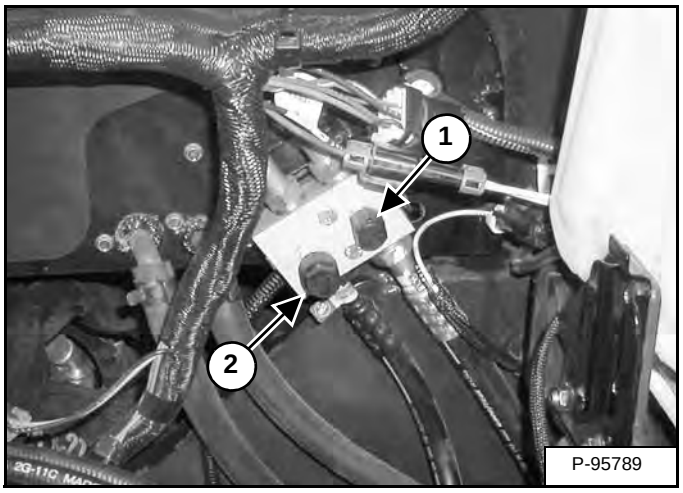
Refrigerant Identification

Figure 71-40-1



Pull up on and reposition the washer reservoir (Item 1) **[Figure 71-40-1]**.

Figure 71-40-2



Locate the low pressure port (Item 1) and high pressure port (Item 2) **[Figure 71-40-2]**.

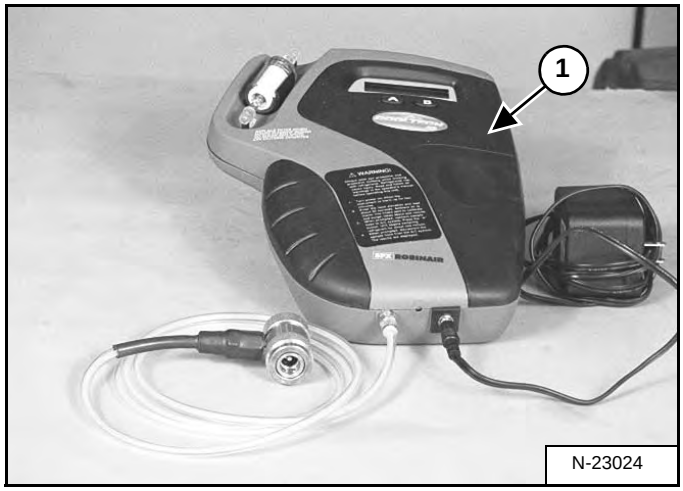
⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

W-2371-0611

NOTE: This procedure is run with the excavator engine OFF, and the A/C switch in the OFF position.

Figure 71-40-3



NOTE: Before reclaiming a refrigeration system, it is recommended to identify the type of refrigerant that is in the A/C system and if it is pure enough to use. The tool MEL1592, Refrigerant Identifier (Item 1) [Figure 71-40-3] will determine the kind of refrigerant and any possible harmful or dangerous substances that may be present in the system. Thus preventing mixing of dangerous material with your reclaimed R-134a in your reclaimer, and further contamination to other A/C systems that are reclaimed and charged from your MEL1581 Recovery / Recycling / Recharging Machine.

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Refrigerant Identification (Cont'd)

Figure 71-40-4



Remove the protective cap and connect the Refrigerant Identifier to the low pressure hose (Item 1) **[Figure 71-40-4]**.

Connect the refrigerant identifier to a power source.

Follow the steps displayed on the refrigerant identifier screen.

Allow two minutes for the refrigerant identifier to display the type of refrigerant and air content. An alarm will sound if potentially flammable hydrocarbons are present and will also indicate on the visual display.

Disconnect the refrigerant identifier from the excavator A/C.

If the refrigerant is dangerous or flammable, it must be evacuated from the A/C system into a separate container and properly and safely disposed of.

If R-134a is found, evacuate the system.

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Reclamation And Charging With Recovery / Charging Unit

⚠ WARNING

HFC R-134a refrigerant can be dangerous if not properly handled. Liquid R-134a may cause blindness if it contacts the eyes and may cause serious frostbite if it contacts the skin.

- **Gaseous R-134a becomes lethal (phosgene) gas when it contacts open flame or very hot substances.**
- **NEVER SMOKE when there is the possibility of even small amounts of R-134a in the air.**

Any servicing work that involves release or addition of R-134a to the system must be done by a competent refrigeration dealer who has the proper equipment, knowledge, and experience to service refrigeration equipment.

W-2373-0611

Figure 71-40-5

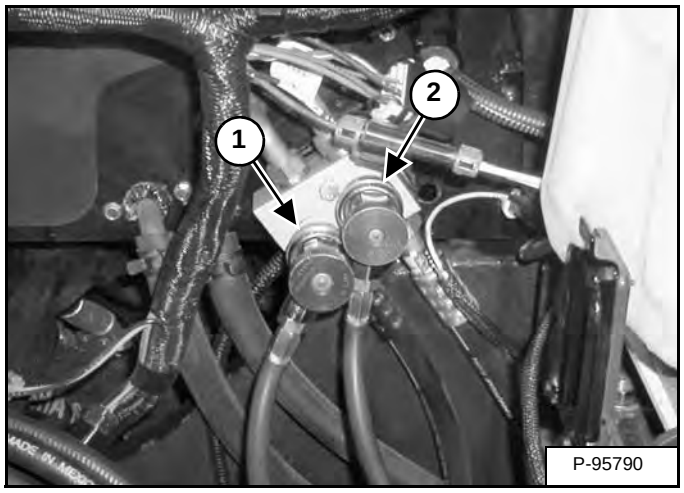


Use an approved recover / charging unit **[Figure 71-40-5]** to evacuate the system.

Connect the reclaimer to the excavator A/C charge ports.

IMPORTANT: Only A/C trained technicians should perform the reclaiming and recharging procedure.

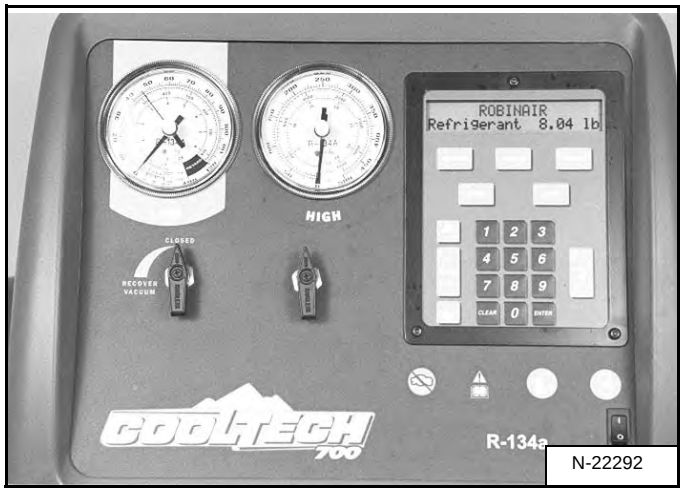
Figure 71-40-6



Connect the Red hose (Item 1) **[Figure 71-40-6]** to the high pressure port and open the valve.

Connect the Blue hose (Item 2) **[Figure 71-40-6]** to the low pressure port and open the valve.

Figure 71-40-7



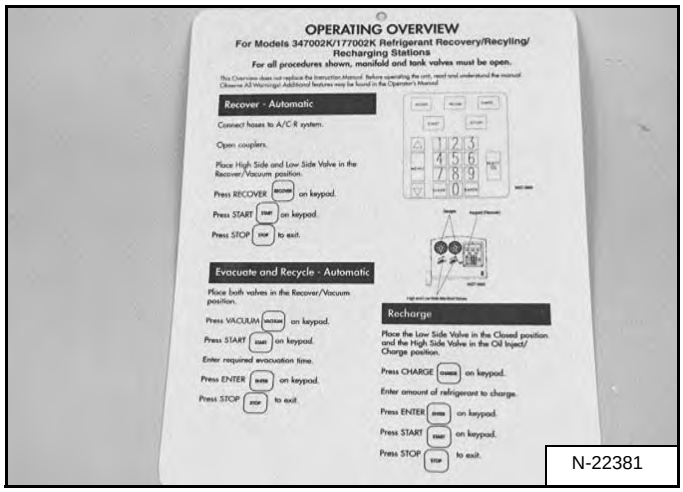
Turn the reclaimer unit to the ON position and follow the on screen instructions **[Figure 71-40-7]**.

NOTE: For correct quantity of refrigerant (See Capacities on Page SPEC-10-9.).

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Reclamation And Charging With Recovery / Charging Unit (Cont'd)

Figure 71-40-8



NOTE: The reclaimer unit has a complete step by step set of instructions [Figure 71-40-8] to follow for reclamation and recharging of the A/C system. A trained technician should follow these instructions as they may vary slightly depending on the model and brand of reclaimer used.

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COMPRESSOR

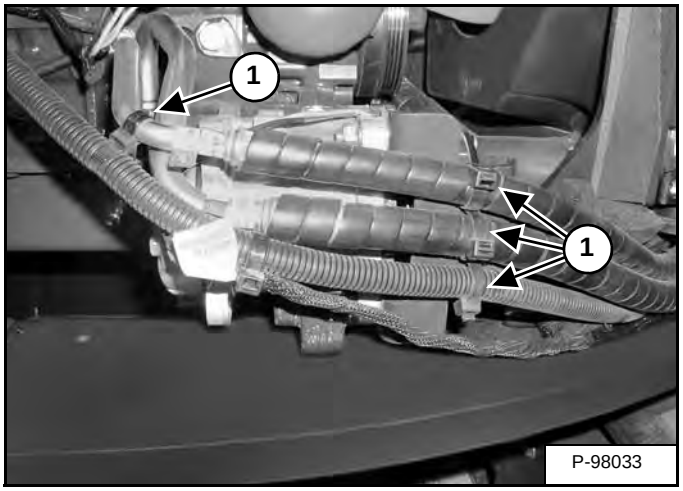
Removal And Installation

Remove the counterweight. (See Removal And Installation on Page 40-90-1.)

Remove the alternator belt. (See Belt Replacement on Page 50-30-1.)

Evacuate the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 71-40-3.)

Figure 71-50-1



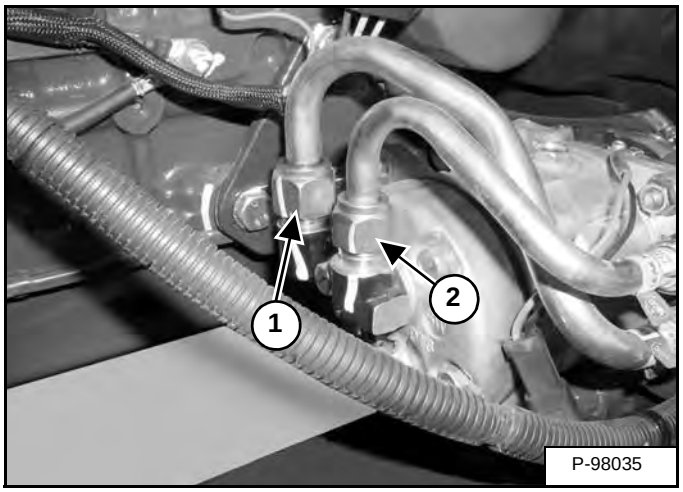
Cut and remove the cable ties (Item 1) **[Figure 71-50-1]**.

WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

W-2371-0611

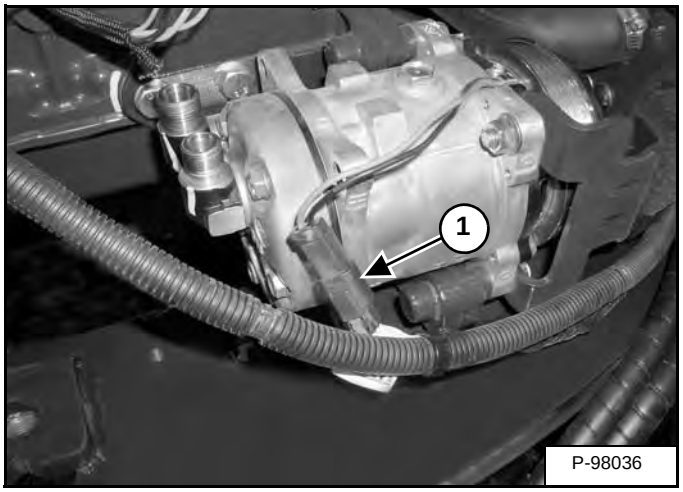
Figure 71-50-2



Remove the hose (Item 1) and (Item 2) **[Figure 71-50-2]**.

Installation: Tighten the hose (Item 1) to 28 - 37 N•m (21 - 27 ft-lb) torque. Tighten the hose (Item 2) **[Figure 71-50-2]** to 20 - 27 N•m (15 - 20 ft-lb) torque.

Figure 71-50-3

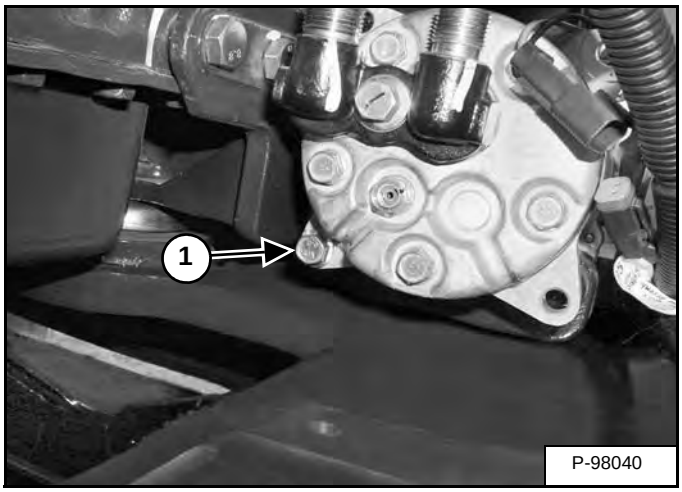


Disconnect the wire harness (Item 1) **[Figure 71-50-3]**.

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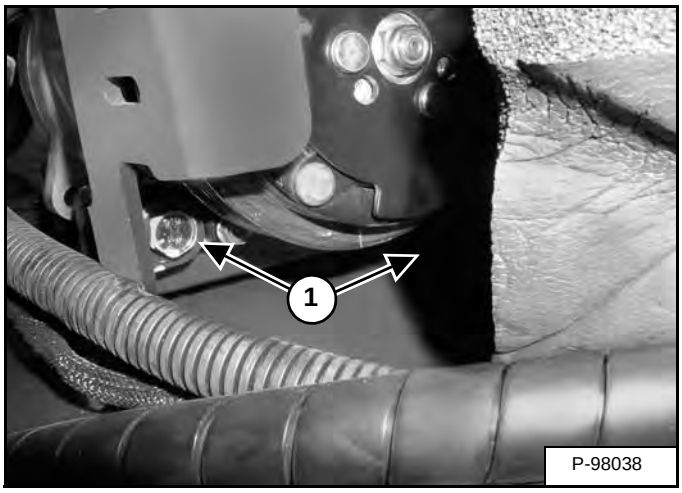
Removal And Installation (Cont'd)

Figure 71-50-4



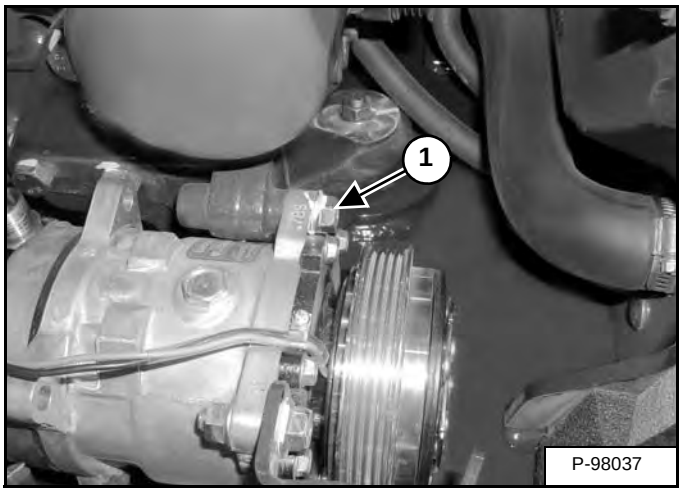
Remove the bolt (Item 1) **[Figure 71-50-4]**.

Figure 71-50-5



Remove the two bolts (Item 1) **[Figure 71-50-5]**.

Figure 71-50-6



Remove the bolt (Item 1) **[Figure 71-50-6]**.

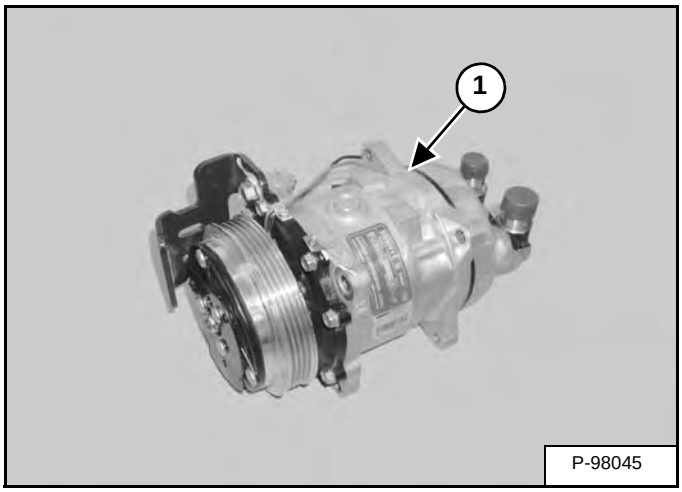
Remove the compressor.

The compressor is not serviceable and must be replaced as an assembly.

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Oil

Figure 71-50-7



The compressor (Item 1) **[Figure 71-50-7]** is factory filled with 150-170 cc's of PAG 100 refrigerant oil (Polyalkelene Glycol).

It is not necessary to frequently check or change the compressor oil.

It is necessary to check, replenish or replace the compressor oil in the following cases:

1. When the evaporator, condenser or receiver-drier is replaced.

2. When refrigerant has leaked from the system.

3. When refrigerant is suddenly released from the cooling cycle.

4. When any oil related problems occur in the cooling cycle.

When one of the components (the evaporator, condenser or receiver-drier) is replaced, 30 cc of PAG oil should be added for each component replaced.

If the A/C compressor is changed, no oil should be added to the system, the compressor comes factory filled with oil.

NOTE: Only PAG oil should be used. Never mix R-12 and R-134a Oils.

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COMPRESSOR (CONT'D)

Oil Check

The compressor oil should be checked as follows when oil is being added to an in service excavator.

There is a close affinity between oil and refrigerant. During normal operation, part of the oil circulates with the refrigerant in the system. When checking the amount of oil in the system or replacing any system component, the compressor must be run in advance to insure return of oil to the compressor.

If the amount of refrigerant in the system has decreased, charge the system. (See Reclamation And Charging With Recovery / Charging Unit on Page 71-40-3.)

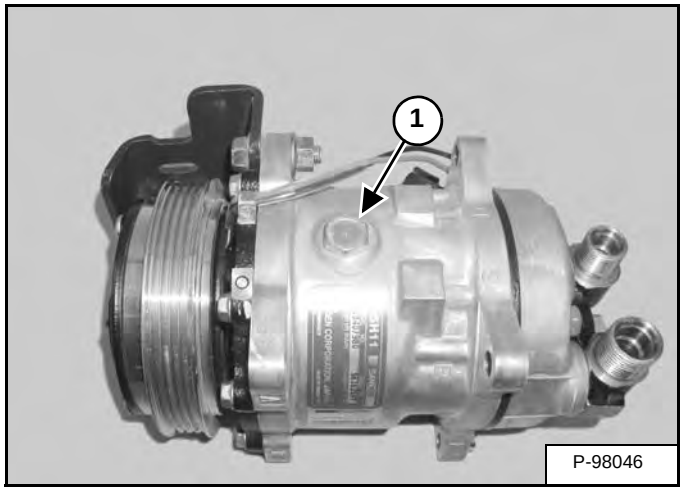
Open the cab door and windows.

Run the blower at maximum speed.

Run the compressor for at least 20 minutes at 800 - 1200 rpm.

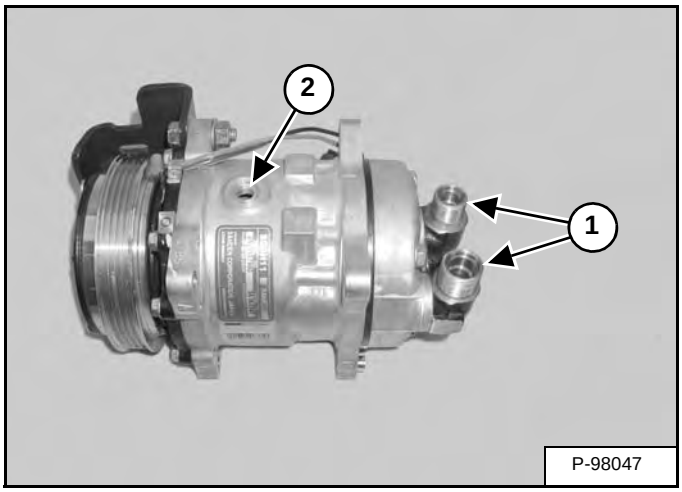
Remove the compressor from the excavator. (See Removal And Installation on Page 71-50-1.)

Figure 71-50-8



Remove the drain plug (Item 1) **[Figure 71-50-8]**.

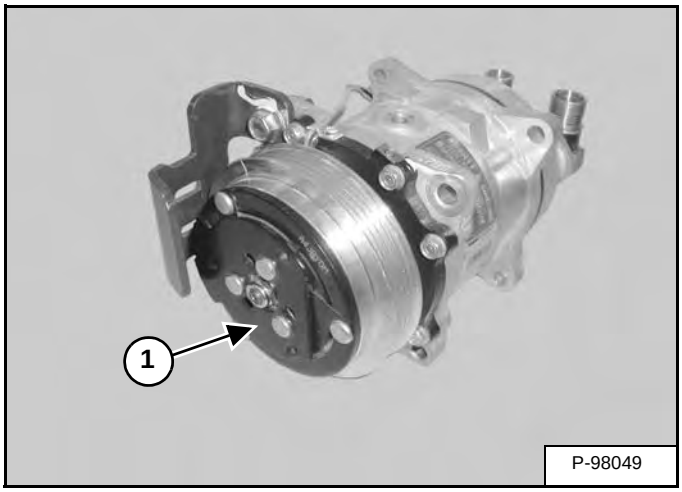
Figure 71-50-9



Drain the oil through the connectors (Item 1) and the oil drain hole (Item 2) **[Figure 71-50-9]**.

Installation: Tighten the oil drain plug to 13 - 15 N•m (9.4 - 10.8 ft-lb) torque.

Figure 71-50-10



NOTE: After draining the oil through the drain hole and the connectors, extract the remaining oil through the discharge-side connector by rotating the drive pulley (Item 1) [Figure 71-50-10] several times by hand.

Measure the drained oil in a measuring cylinder.

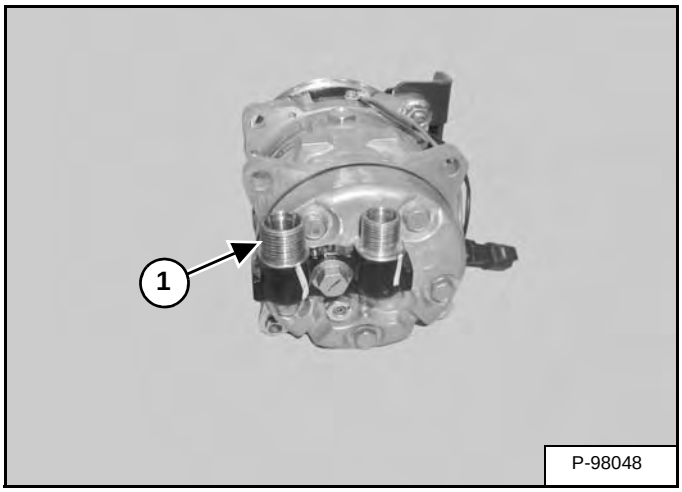
Check the oil for contamination, dirt, metal shavings, or varnish color, discard the oil if contaminated.

NOTE: If metal shavings are found in the compressor oil, replace the complete compressor assembly.

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Oil Check (Cont'd)

Figure 71-50-11



Add new compressor oil through the suction side connector (Item 1) **[Figure 71-50-11]**.

Installation: Add 150 - 170 cc's of PAG 100 oil.

NOTE: The suction port on the compressor is marked with an S and is the larger port on the compressor.

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CONDENSER

Removal And Installation

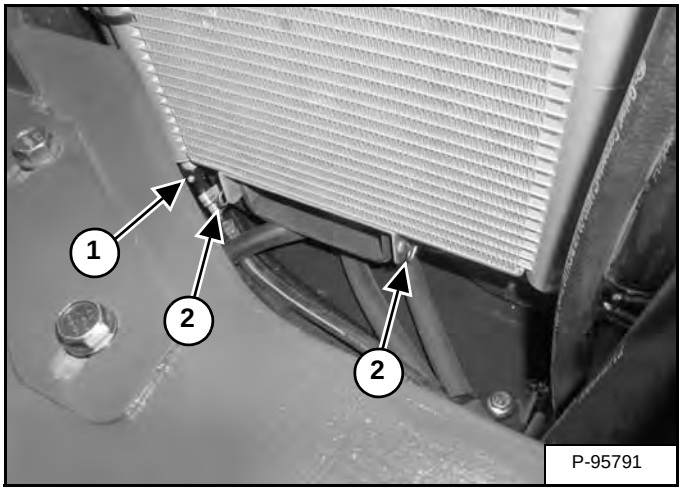
Open the tailgate.

Evacuate the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 71-40-3.)

Open the right side cover.

Mark the A/C hoses for proper installation.

Figure 71-60-1



Remove the hose (Item 1) **[Figure 71-60-1]** from the condenser.

Installation: Tighten the hose to 15 - 18 N•m (11 - 13 ft-lb) torque.

Cap the hose and plug the fitting on the condenser.

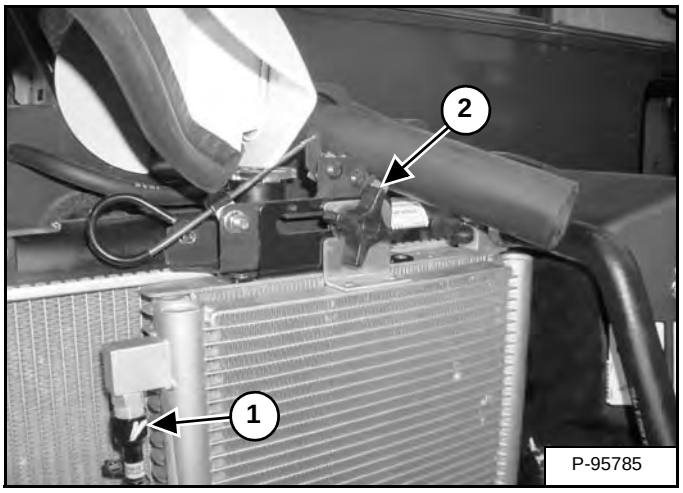
Remove the clips (Item 2) **[Figure 71-60-1]**.

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

W-2371-0611

Figure 71-60-2



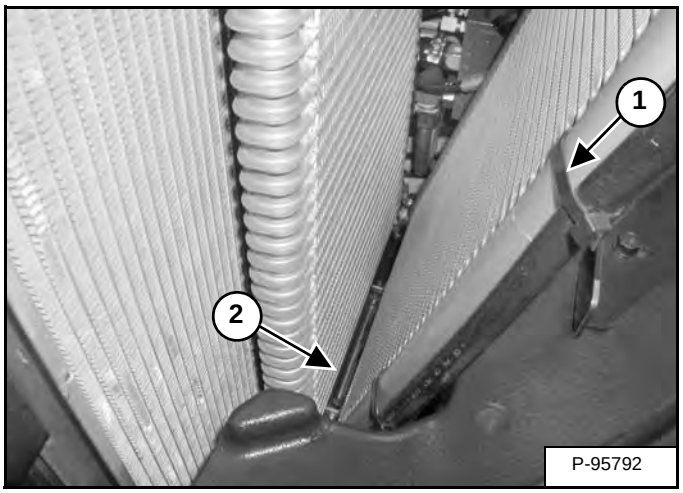
Remove the hose (Item 1) **[Figure 71-60-2]** from the condenser.

Installation: Tighten the hose to 20 - 27 N•m (15 - 20 ft-lb) torque.

Cap the hose and plug the fitting on the condenser.

Loosen the clamp (Item 2) **[Figure 71-60-2]**.

Figure 71-60-3



Remove the tie-strap (Item 1) **[Figure 71-60-3]**.

Remove the rod (Item 2) **[Figure 71-60-3]**.

Remove the condenser from the excavator.

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RECEIVER / DRIER

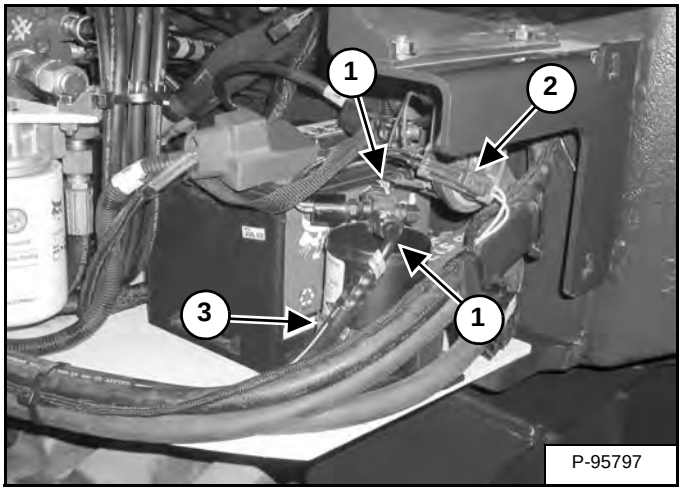
Receiver / Drier Removal And Installation

Evacuate the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 71-40-3.)

Open the right side cover.

Remove the right upperstructure cover. (See Removal And Installation on Page 40-80-1.)

Figure 71-70-1



Mark the hoses (Item 1) **[Figure 71-70-1]** for proper installation.

Installation: Tighten the hoses to 15 - 18 N•m (11 - 13 ft-lb) torque.

Both fittings on the drier are the same size, so the hoses can be hooked up incorrectly.

Note the flow direction on the drier for proper installation.

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

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Remove the A/C hoses (Item 1) **[Figure 71-70-1]** from the receiver / drier.

Cap and plug the hoses and the receiver / drier fittings with the proper A/C caps and plugs.

Disconnect the wire harness (Item 2) **[Figure 71-70-1]**.

Loosen the hose clamps (Item 3) **[Figure 71-70-1]** that hold the receiver / drier to the mount.

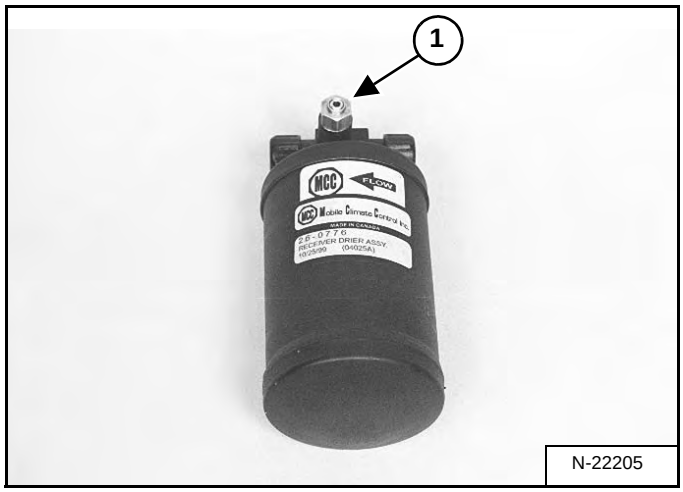
Remove the receiver / drier from the excavator.

NOTE: When replacing a receiver / drier in an A/C system 30 cc (1 US fl oz) of PAG 100 oil must be added to the system when recharging.

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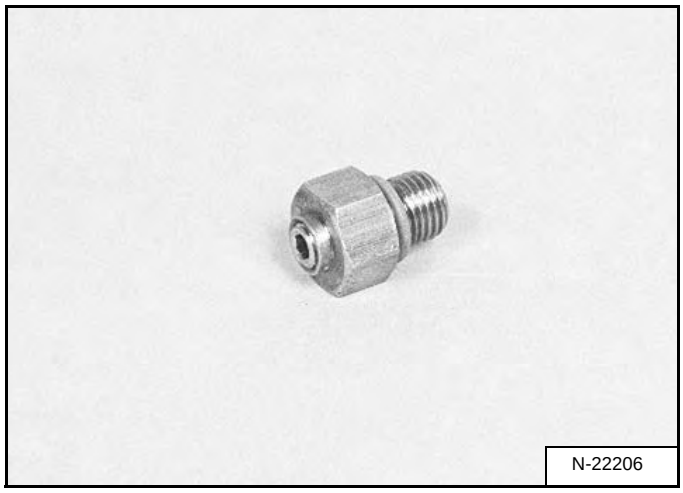
Pressure Relief Valve Removal And Installation

Figure 71-70-2



The pressure relief valve (Item 1) **[Figure 71-70-2]** is located on the receiver / drier assembly.

Figure 71-70-3



The pressure relief valve is designed to open and release the A/C charge if the pressure reaches 3344 - 3792 kPa (33,4 - 37,9 bar) (485 - 550 psi) **[Figure 71-70-3]**.

This will cause the A/C system to shutdown, saving the compressor.

The pressure relief valve is a secondary protection device in the A/C system, with the Pressure Switch shutting down the system at 2648 kPa (26,5 bar) (384 psi).

NOTE: If a pressure relief valve is found open, check the A/C system for problems. Replace the complete receiver / drier unit.

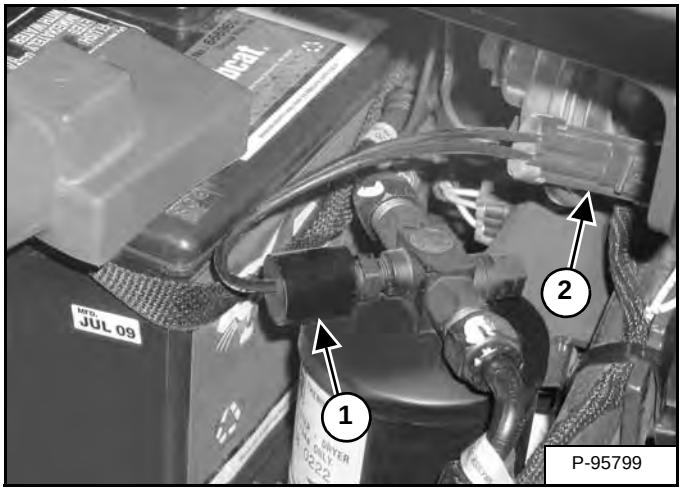
Pressure Switch Removal And Installation

Open the right side cover.

Evacuate the A/C System. (See Reclamation And Charging With Recovery / Charging Unit on Page 71-40-3.)

Remove the right upperstructure cover. (See Removal And Installation on Page 40-80-1.)

Figure 71-70-4



Locate the pressure switch (Item 1) **[Figure 71-70-4]**.

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

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Disconnect the wire harness (Item 2) **[Figure 71-70-4]** from the pressure switch wire harness.

Remove the pressure switch from the excavator.

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EVAPORATOR / HEATER UNIT

Removal And Installation

Remove the cab. (See Removal And Installation on Page 40-30-1.)

Discharge the A.C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 71-40-3.)

Remove the engine coolant. (See Removing And Replacing Coolant on Page 10-100-3.)

Remove the right upper structure cover. (See Removal And Installation on Page 40-80-1.)

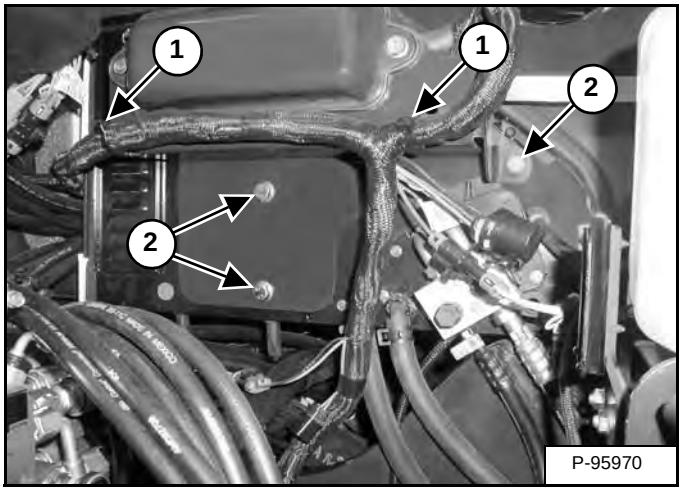
Remove the tool box. (See Removal And Installation on Page 40-220-1.)

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

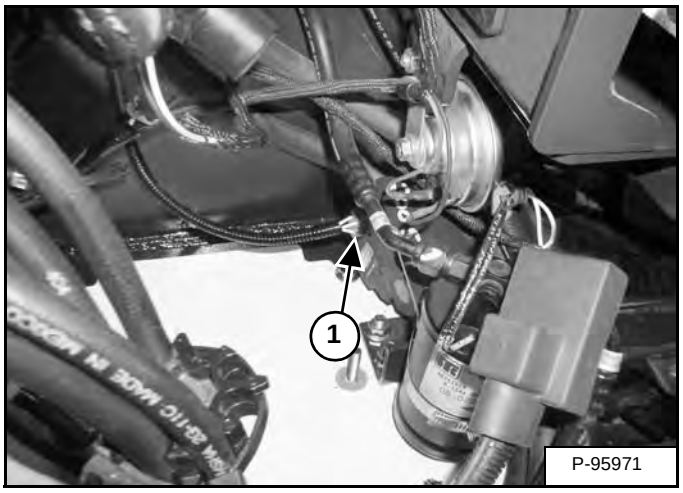
W-2371-0611

Figure 71-80-1



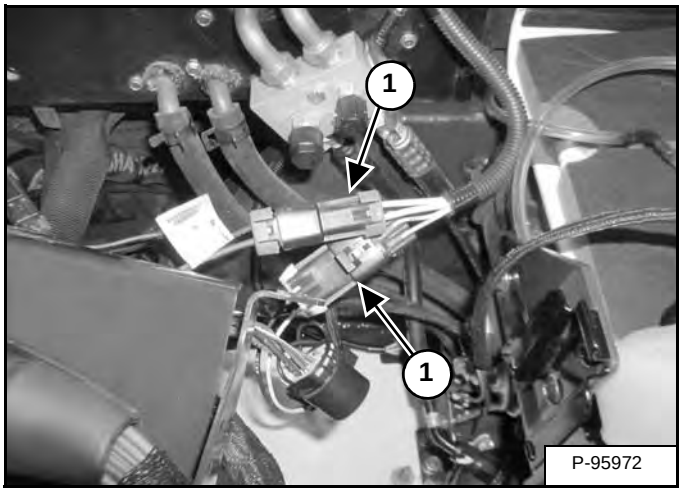
Cut and remove the cable ties (Item 1). Remove the three bolts (Item 2) **[Figure 71-80-1]** and reposition the fuse box.

Figure 71-80-2



Disconnect the wire harness (Item 1) **[Figure 71-80-2]**.

Figure 71-80-3

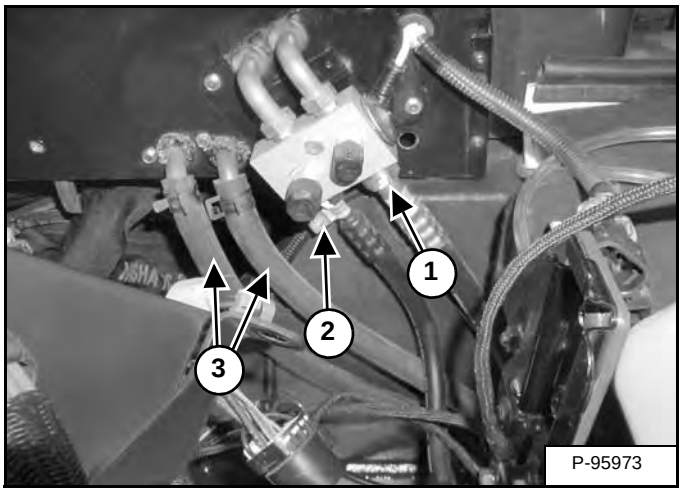


Disconnect the wire harnesses (Item 1) **[Figure 71-80-3]**.

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Removal And Installation (Cont'd)

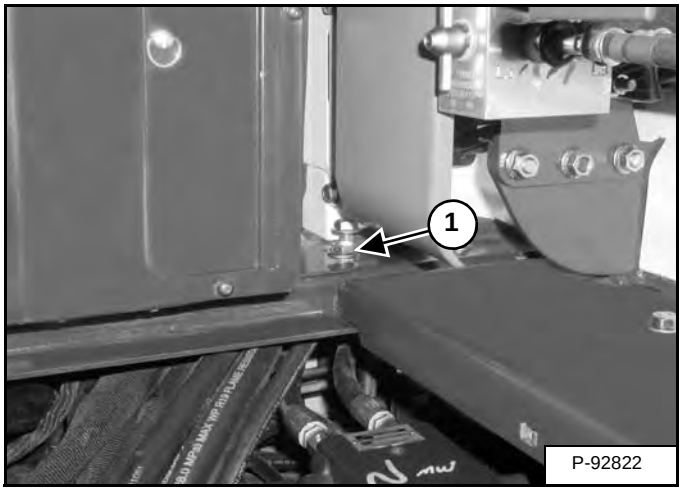
Figure 71-80-4



Remove the air conditioning hoses (Item 1) and (Item 2). Remove the heater hoses (Item 3) **[Figure 71-80-4]**.

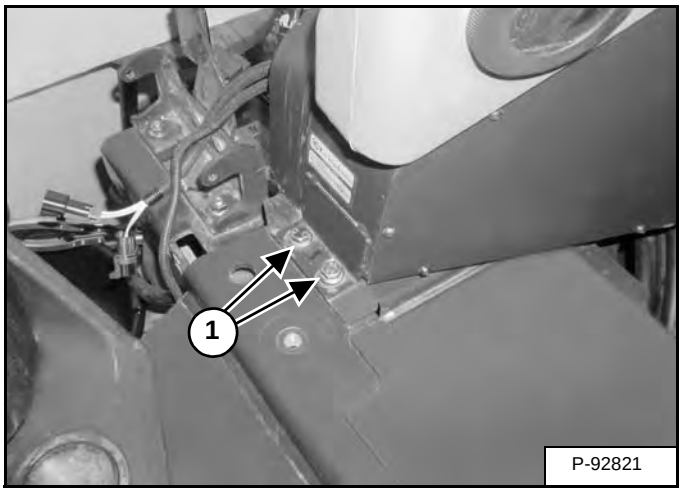
Installation: Tighten the hose (Item 1) to 28 - 37 N•m (21 - 27 ft-lb) torque. Tighten the hose (Item 2) **[Figure 71-80-4]** to 20 - 27 N•m (15 - 18 ft-lb) torque.

Figure 71-80-5



Remove the bolt (Item 1) **[Figure 71-80-5]**.

Figure 71-80-6



Remove the two bolts (Item 1) **[Figure 71-80-6]**.

Remove the evaporator / heater unit.

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THERMOSTAT

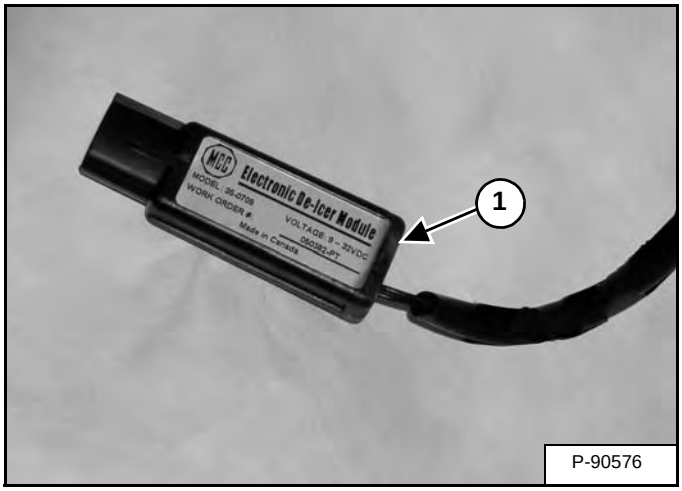
Description

The Electronic De-icing Thermostat (EDT) is a micro controller based module that measures evaporator coil temperature and cycles the compressor clutch to maintain a constant evaporator pressure. Onboard circuit protection and diagnostics are also built into the module.

NOTE: The EDT has a six second delay before start up to protect the compressor clutch.

The EDT will turn the clutch on when the evaporator coil temperature is above 2°C (35.6°F). If the EDT does not detect any malfunction, it will continue to operate and the status LED will be lit continuously. When the evaporator temperature is below -2°C (28.4°F), the EDT will turn off the clutch and status LED.

Figure 71-90-1



When the EDT detects an open or short from the temperature sensor, the status LED (Item 1) **[Figure 71-90-1]** will blink once per second and the output signal to the clutch will be turned off. The status LED will flash two times per second when EDT detects an open circuit (current draw less than 200 mA), short circuit or over current (current draw greater than 7A) from the clutch output. The status LED will flash three times per second when the compressor clutch is shorted to ground.

NOTE: The EDT will attempt to restart every 20 seconds until the fault is repaired.

The EDT has the following protection built in:

1. Over temperature
2. Over current from clutch output
3. Voltage (Above and below operational limits or reverse voltage)
4. Short circuit protection (Output shorted to ground)
5. Temperature sensor open and short detection

MALFUNCTION	DETECTION INTERVAL	STATUS LED
Temperature sensor	Continuous	1x per second
Temperature sensor open and short detection	At A/C start up	2x per second
Compressor clutch short to battery	Continuous	3x per second

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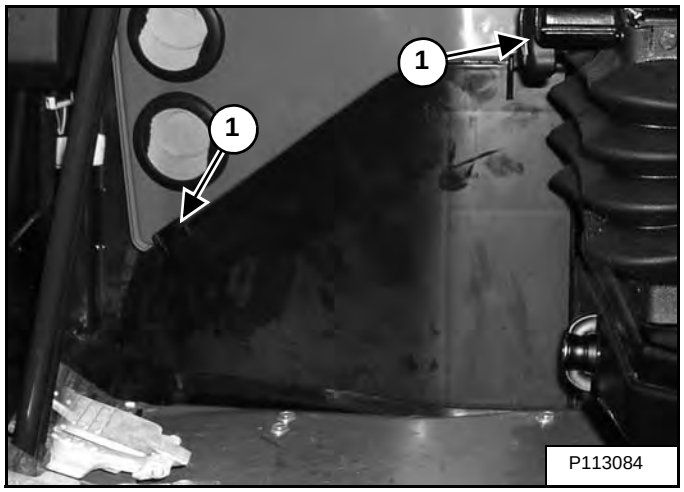
THERMOSTAT (CONT'D)

Removal And Installation

NOTE: The thermostat can be changed without evacuating the A/C system, or removing the evaporator / heater unit from the excavator.

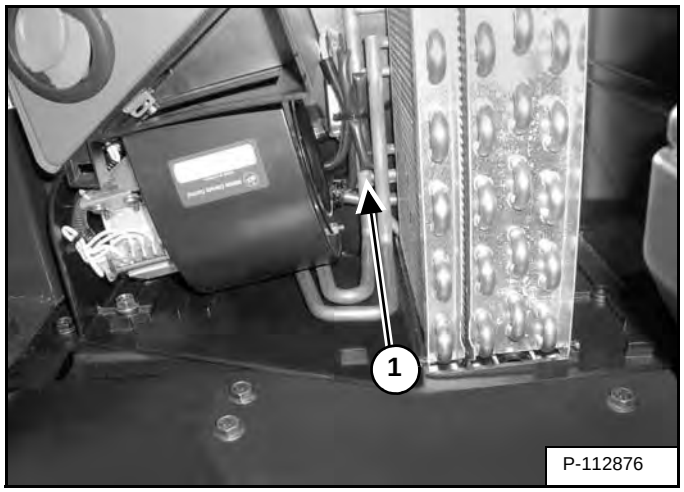
Remove the floor mat (See Removal And Installation on Page 40-110-1.)

Figure 71-90-2



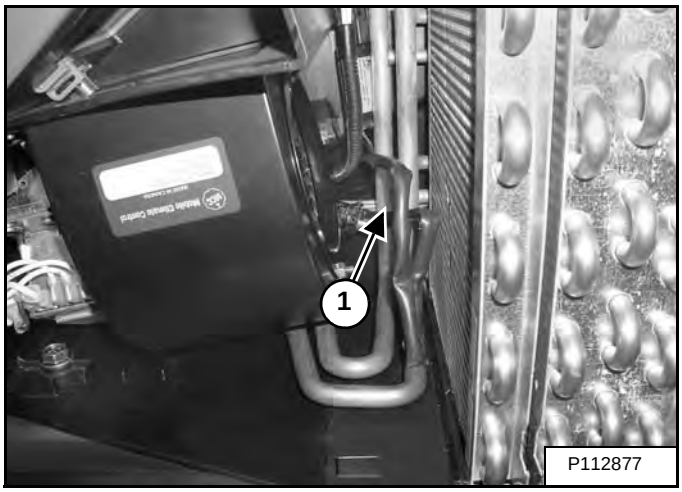
Pull back on the two latches (Item 1) **[Figure 71-90-2]** and remove the HVAC side cover.

Figure 71-90-3



Cut and remove the cable tie (Item 1) **[Figure 71-90-3]**.

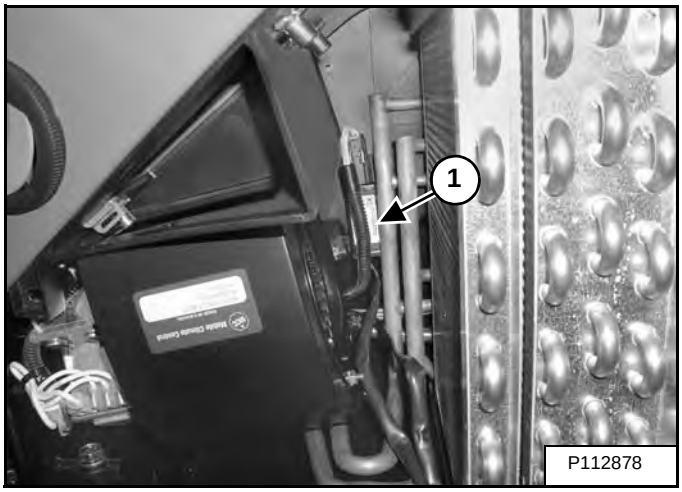
Figure 71-90-4



Remove the probe (Item 1) **[Figure 71-90-4]** from under the AC tape on the coil tubeline.

NOTE: Reinstall the probe in the same location. Moving the thermostat probe location will effect air conditioning performance.

Figure 71-90-5

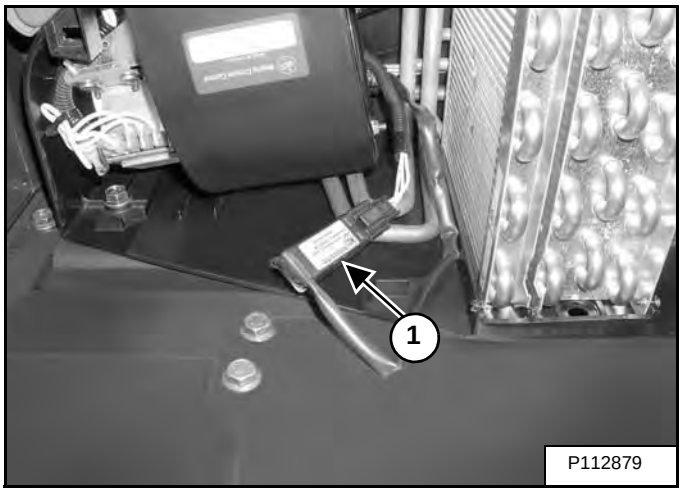


Remove the wire harness connector (Item 1) **[Figure 71-90-5]** from the mount.

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Removal And Installation (Cont'd)

Figure 71-90-6



Disconnect the wire harness (Item 1) **[Figure 71-90-6]**.

Remove the thermostat from the unit.

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Dealer Copy -- Not for Resale

EXPANSION VALVE

Removal And Installation

Evacuate the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 71-40-3.)

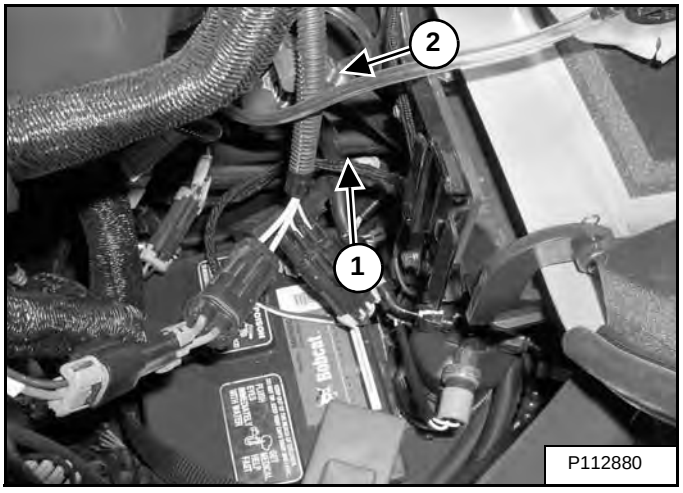
Remove the blower fan. (See Removal And Installation on Page 71-100-1.)

WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

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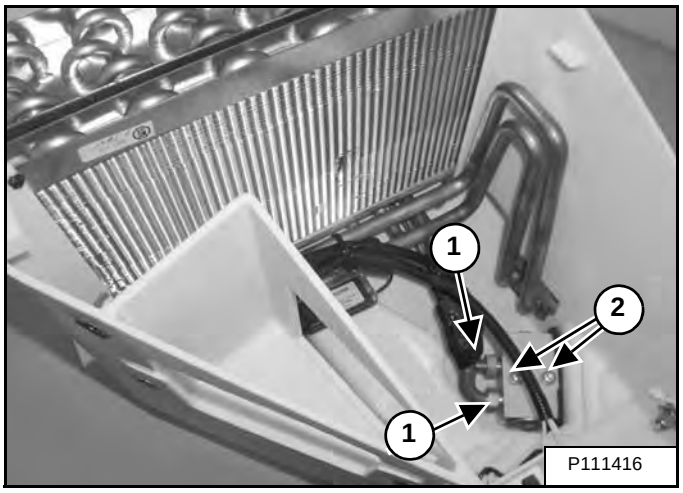
Figure 71-100-1



Remove the A/C hose (Item 1) and (Item 2) **[Figure 71-100-1]** from the expansion valve.

Installation: Tighten the hose (Item 1) to 15 - 18 N•m (11 - 13 ft-lb) torque. Tighten the hose (Item 2) **[Figure 71-100-1]** to 28 - 37 N•m (21 - 27 ft-lb) torque.

Figure 71-100-2



Remove the evaporator fittings (Item 1) **[Figure 71-100-2]** from the expansion valve.

Installation: Tighten the evaporator fittings to 29,8 N•m (22 ft-lb) torque.

Remove the bolts (Item 2) **[Figure 71-100-2]**.

Remove the expansion valve from the excavator.

Cap and plug the evaporator tubelines and the expansion valve fittings with the proper A/C caps and plugs.

The expansion valve is not serviceable and must be replaced as an assembly.

NOTE: The HVAC box is shown removed from the excavator for photo clarity.

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EVAPORATOR COIL

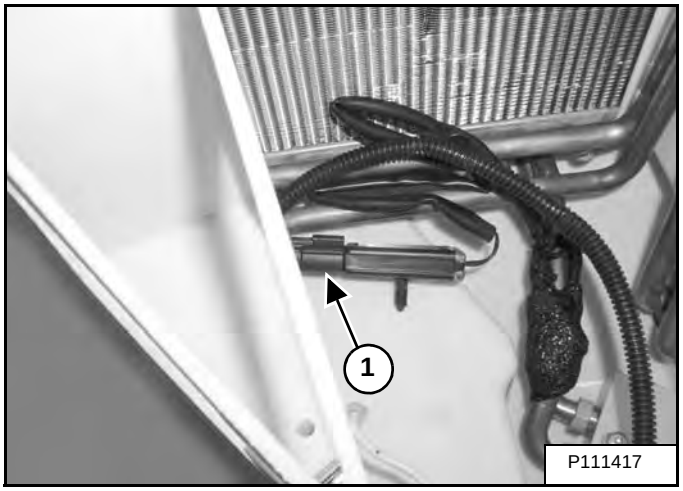
Removal And Installation

Remove the blower fan. (See Removal And Installation on Page 71-130-1.)

Remove the expansion valve. (See Removal And Installation on Page 71-100-1.)

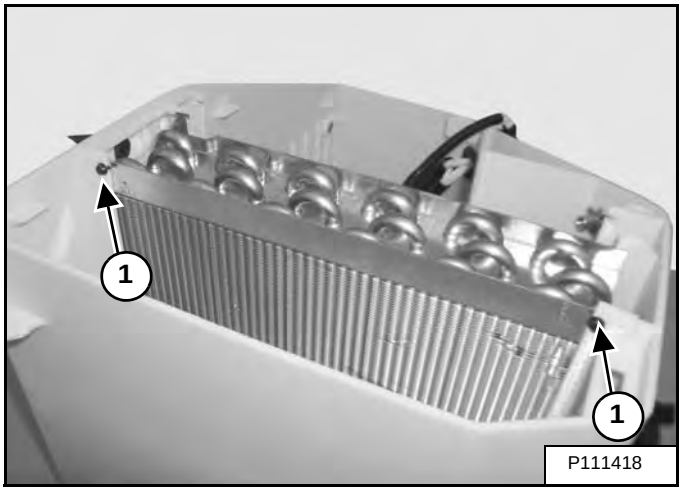
Remove the heater coil. (See Removal And Installation on Page 71-120-1.)

Figure 71-110-1



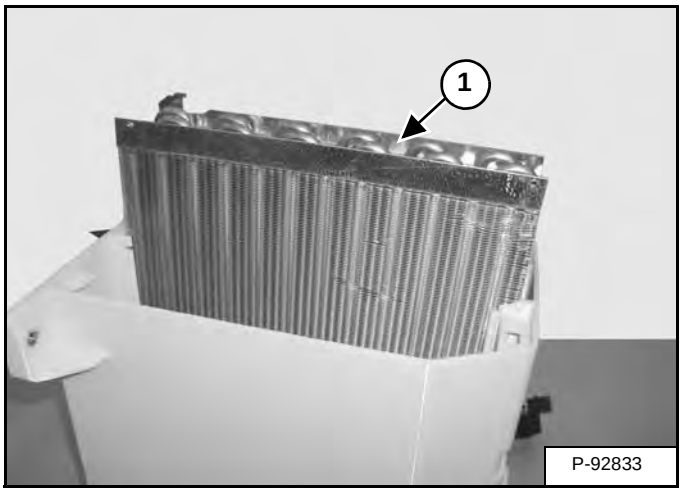
Disconnect the wire harness (Item 1) **[Figure 71-110-1]**.

Figure 71-110-2



Remove the screws (Item 1) **[Figure 71-110-2]**.

Figure 71-110-3



Remove the evaporator (Item 1) **[Figure 71-110-3]**.

Inspect the evaporator coil for leaks, and replace as needed.

Clean with low water or air pressure.

NOTE: The HVAC box is shown removed for photo clarity.

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Dealer Copy -- Not for Resale

HEATER COIL

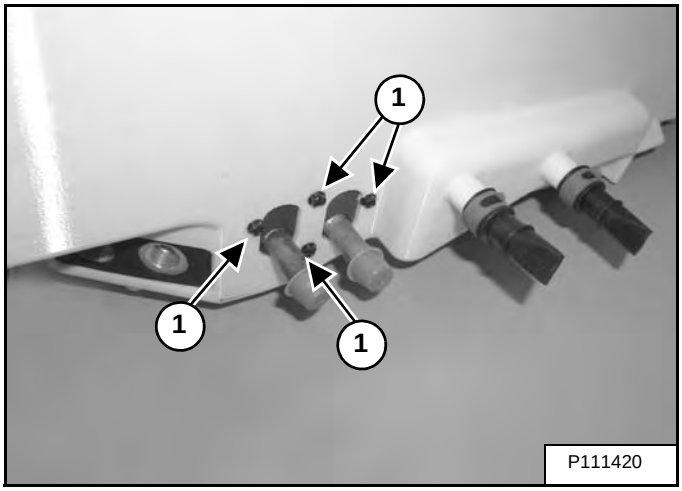
Removal And Installation

Remove the engine coolant. (See Removal And Installation on Page 71-90-2.)

Remove the HVAC Duct. (See Removal And Installation on Page 71-150-1.)

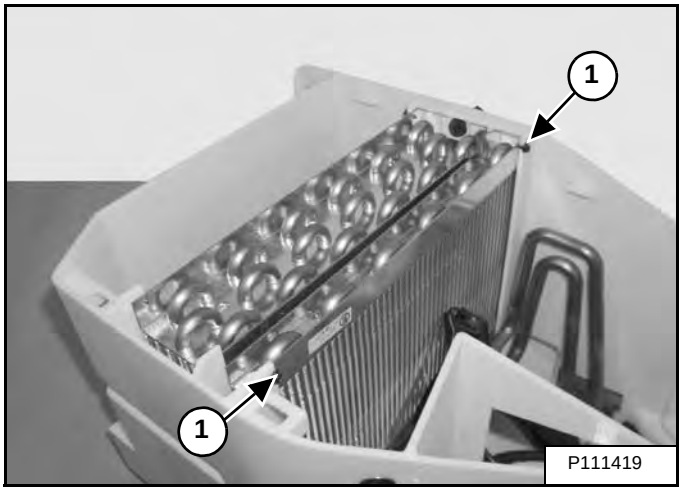
Remove the blower fan. (See Removal And Installation on Page 71-120-1.)

Figure 71-120-1



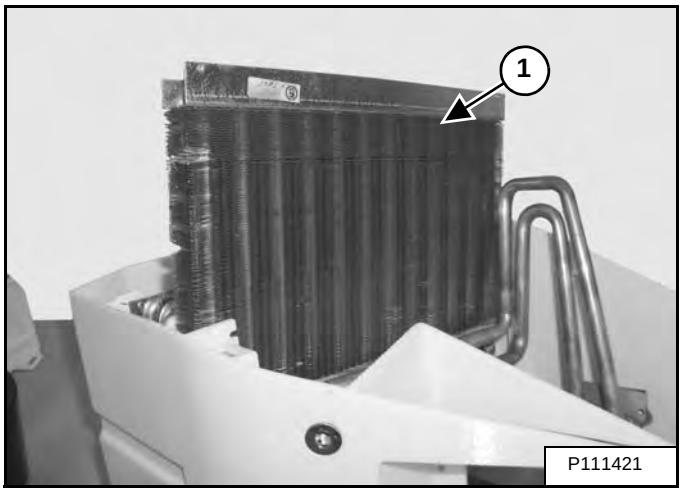
Remove the heater hoses. Remove the four screws (Item 1) **[Figure 71-120-1]** from the bottom of the HVAC box.

Figure 71-120-2



Remove the two screws (Item 1) **[Figure 71-120-2]**.

Figure 71-120-3



Remove the coil (Item 1) **[Figure 71-120-3]**.

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Dealer Copy -- Not for Resale

BLOWER FAN

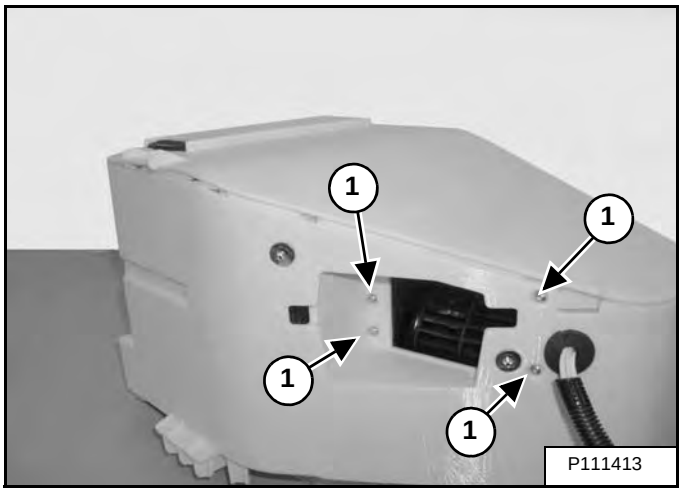
Removal And Installation

Figure 71-130-1



Mark and remove the wire connectors from the motor **[Figure 71-130-1]**.

Figure 71-130-2



Remove the two bolts (Item 1) **[Figure 71-130-2]**.

Remove the motor.

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Dealer Copy -- Not for Resale

HEATER VALVE

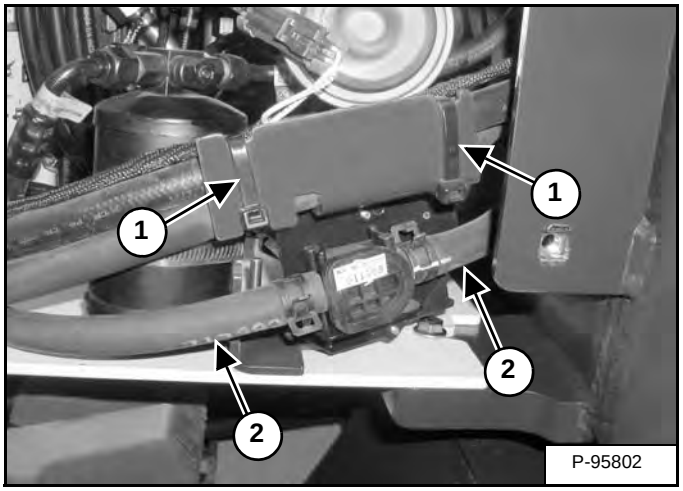
Removal And Installation

Drain the radiator. (See Removing And Replacing Coolant on Page 10-100-3.)

Remove the right upperstructure cover. (See Removal And Installation on Page 40-80-1.)

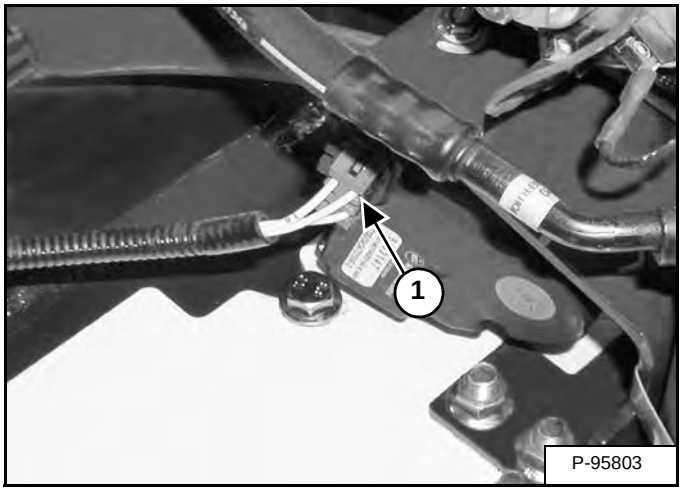
Remove the battery. (See Removal And Installation on Page 50-20-2.)

Figure 71-140-1



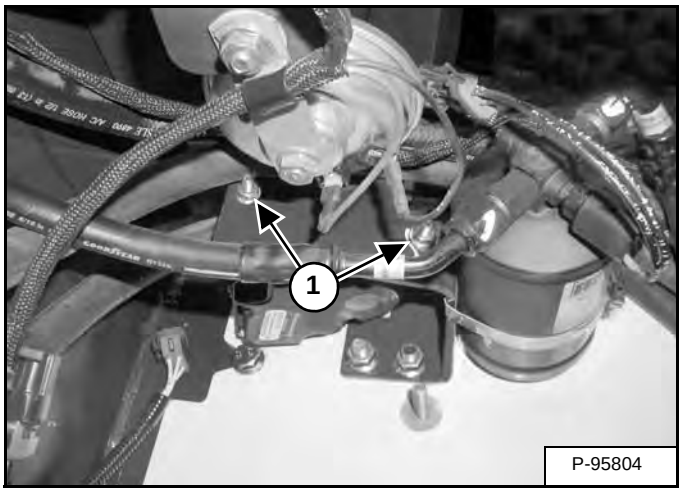
Cut and remove the cable ties (Item 1). Remove the hoses (Item 2) **[Figure 71-140-1]**.

Figure 71-140-2



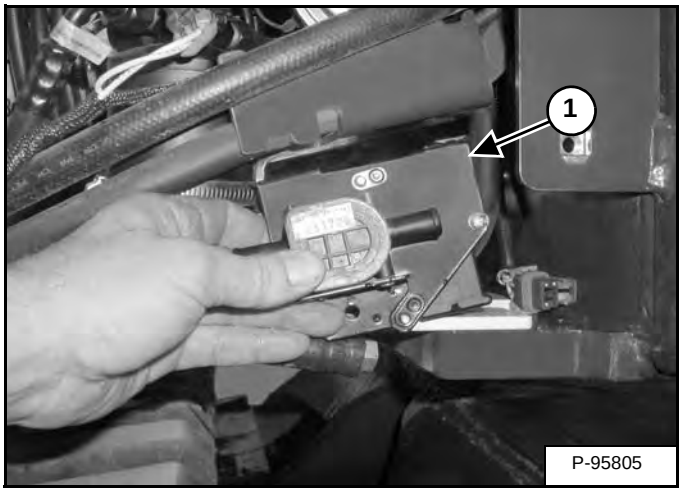
Disconnect the wire harness (Item 1) **[Figure 71-140-2]**.

Figure 71-140-3



Remove the nuts (Item 1) **[Figure 71-140-3]**.

Figure 71-140-4



Remove the valve (Item 1) **[Figure 71-140-4]**.

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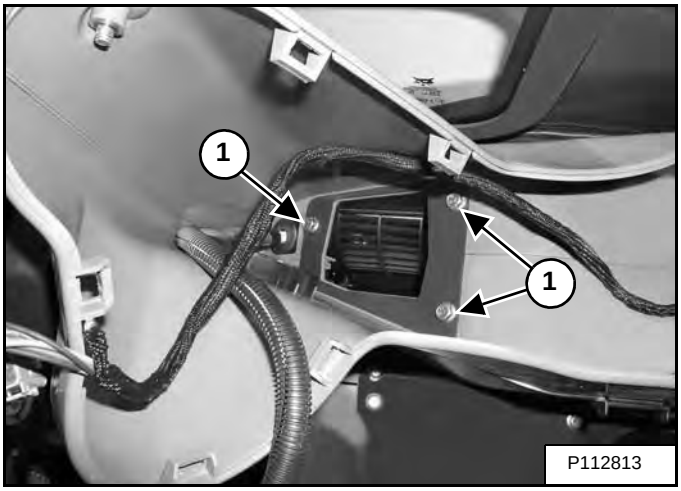
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HVAC DUCT

Removal And Installation

Remove the instrument panel. (See Removal And Installation on Page 71-150-1.)

Figure 71-150-1



Remove the bolts (Item 1) **[Figure 71-150-1]**. Remove the plate and duct.

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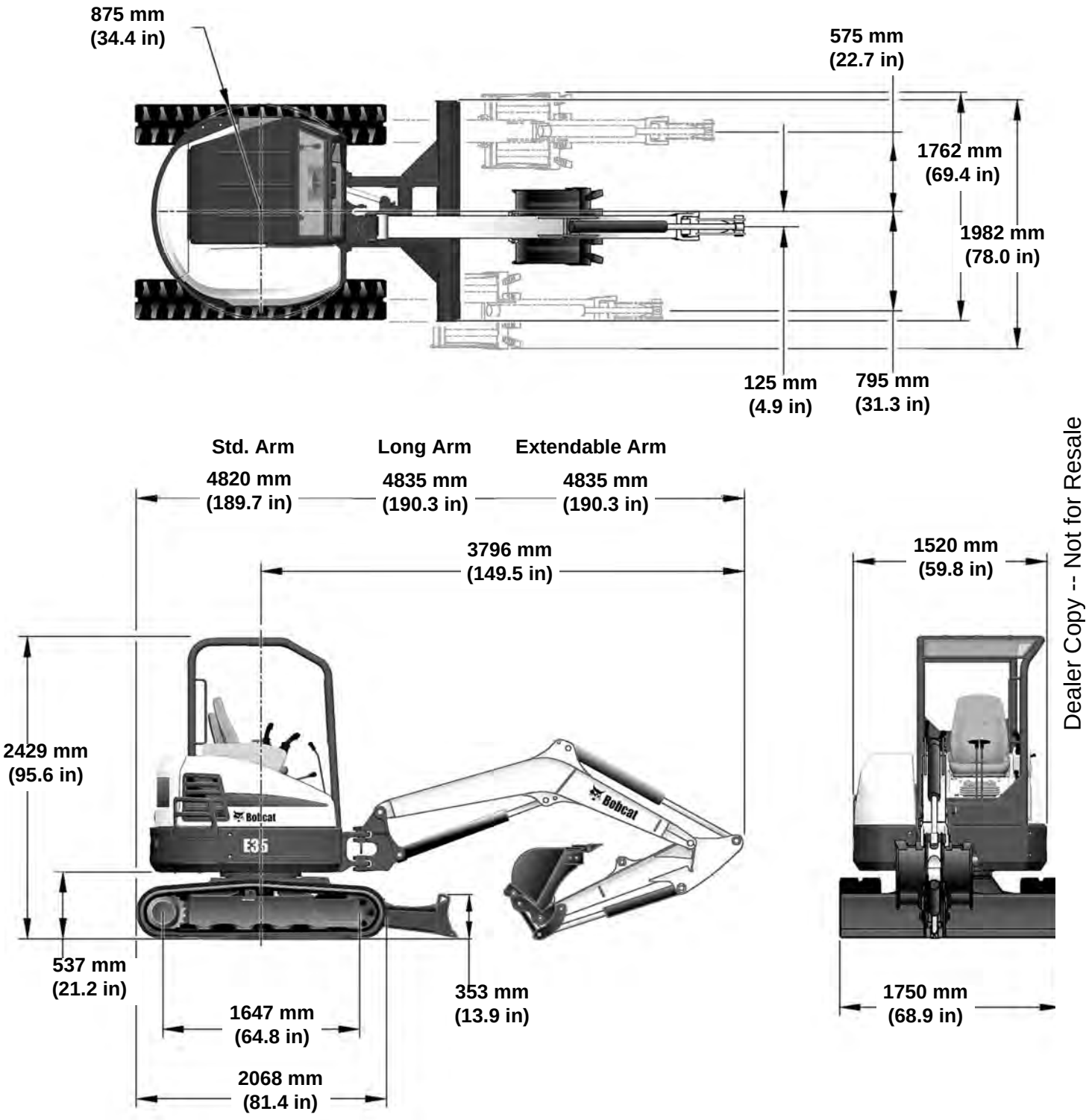


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EXCAVATOR SPECIFICATIONS

E35 Excavator Machine Dimensions

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



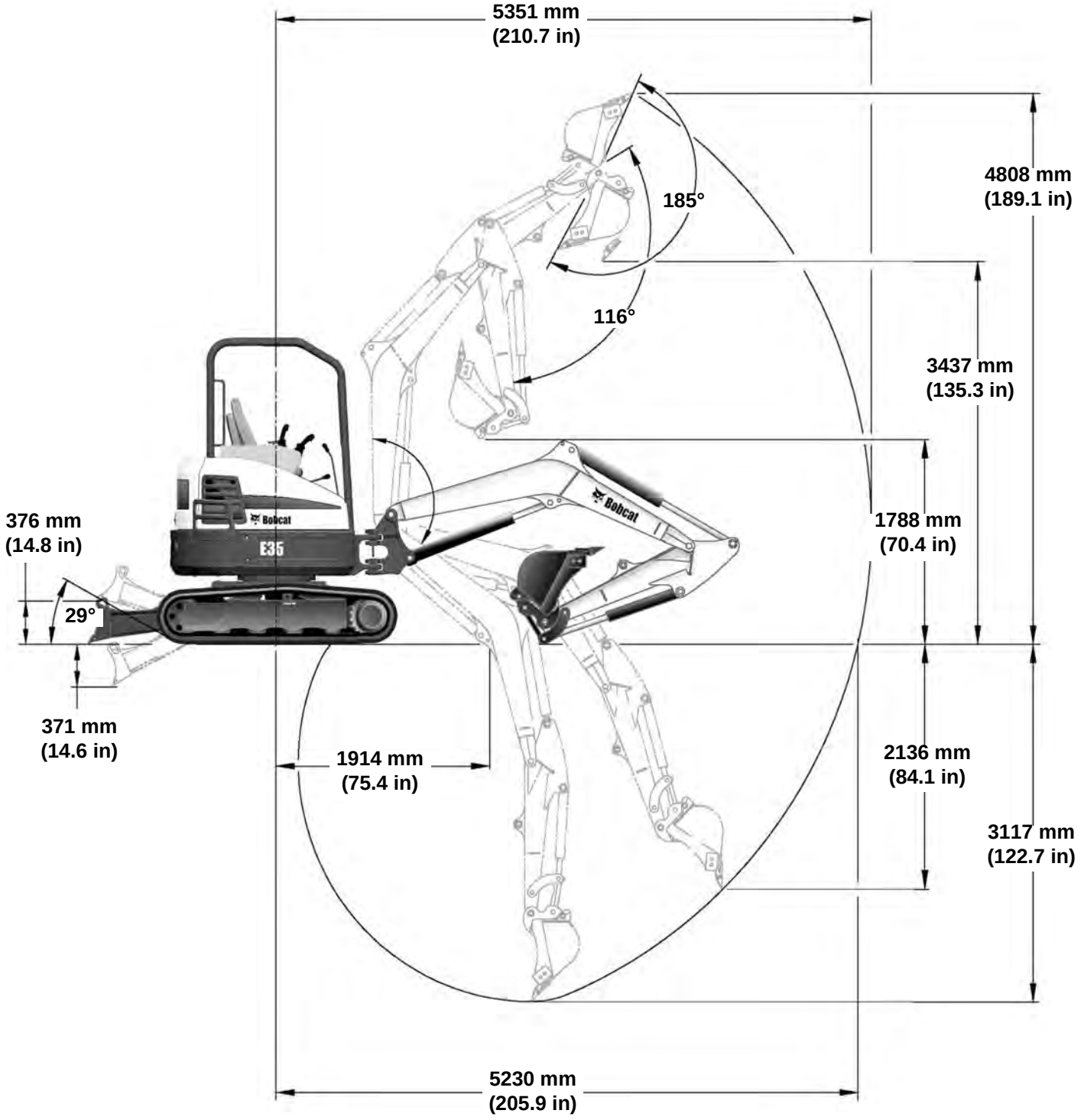
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EXCAVATOR SPECIFICATIONS (CONT'D)

E35 Excavator Machine Dimensions - Standard Arm

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.

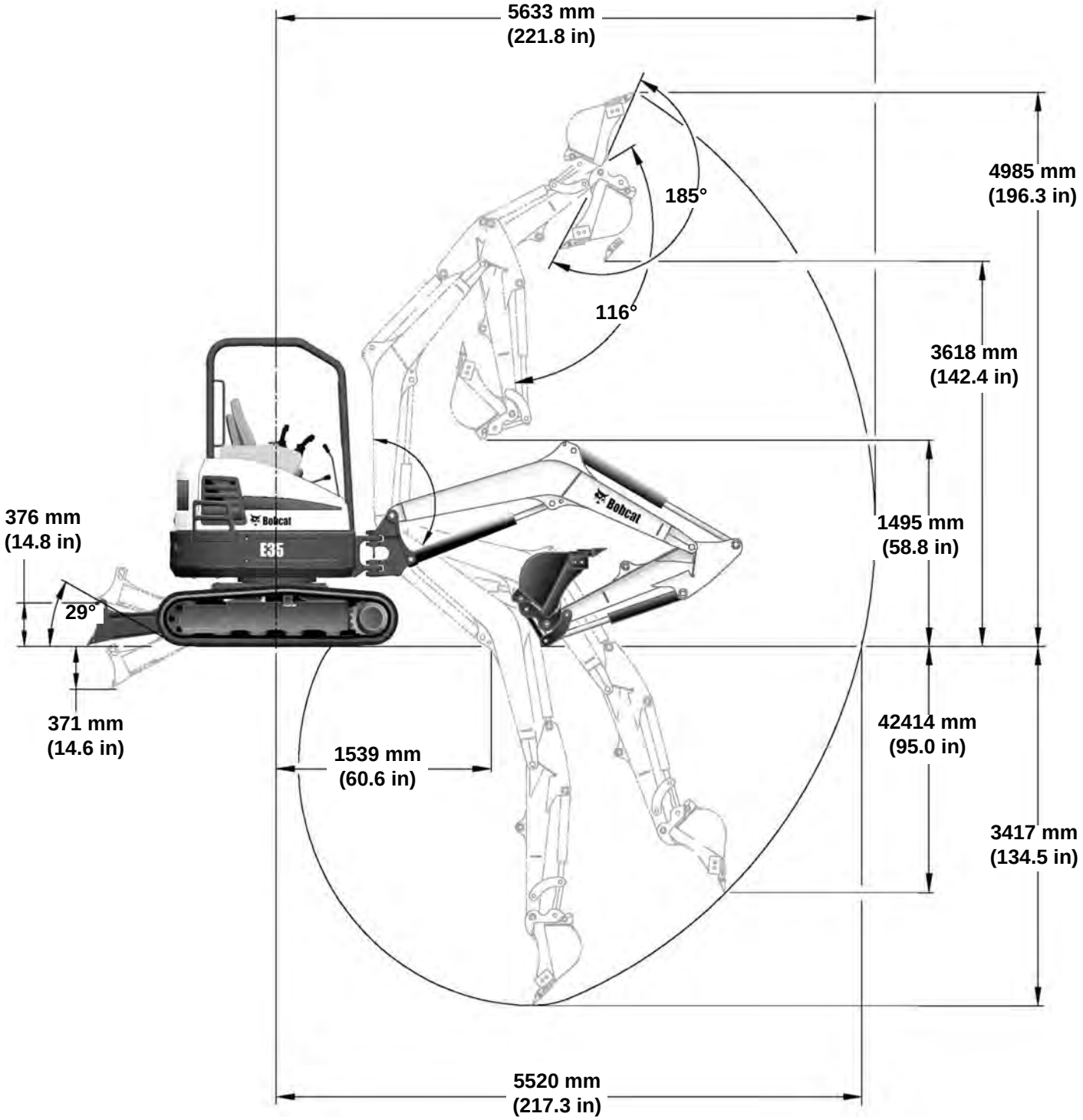


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E35 Excavator Machine Dimensions - Long Arm

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.

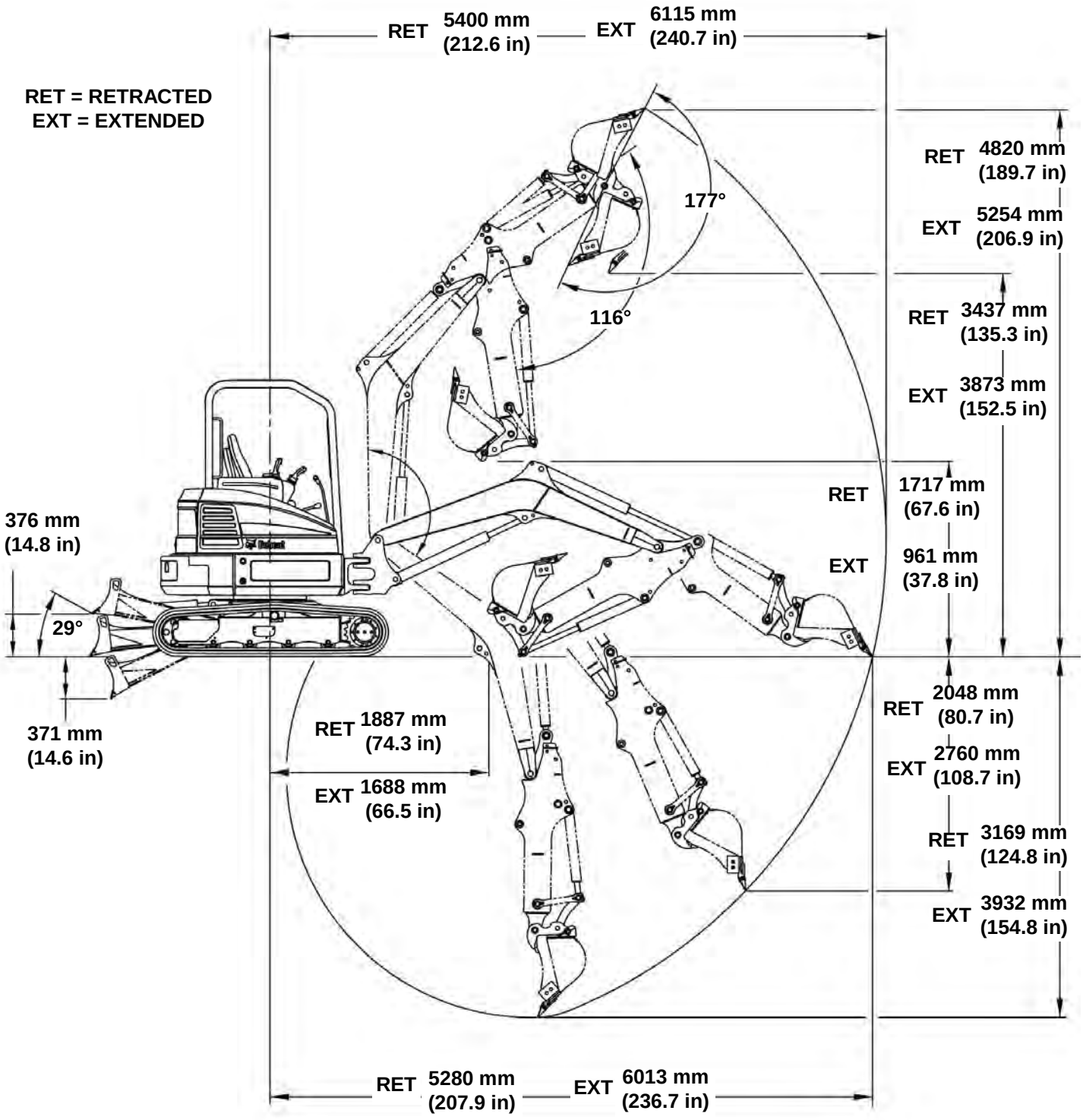


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E35 Excavator Machine Dimensions - Extendable Arm

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.

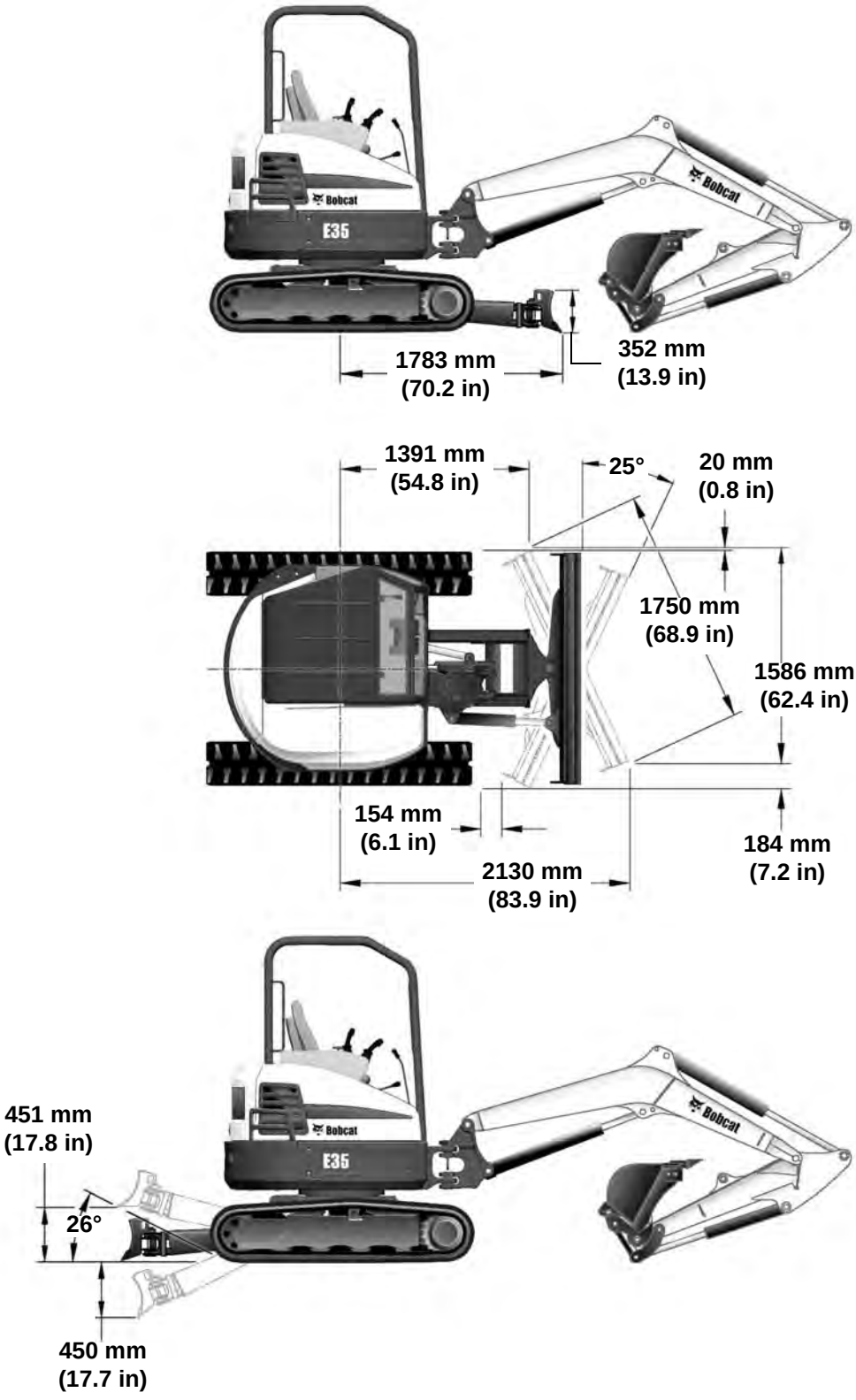


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E35 Excavator Machine Dimensions - Angle Blade

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



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Performance

E35	
operating weight (canopy w / rubber tracks, and 609 mm (24 in) bucket)	3258 kg (7468 lb)
If equipped with the following, add:	Steel tracks, add 92 kg (212 lb); Cab w/Heater, add 121 kg (267 lb); Cab w/HVAC, add 140 kg (309 lb); Long Arm (with additional counterweight), add 306 kg (675 lb); Additional Counterweight 295 kg (650 lb); Angle Blade, add 114 kg (212 lb) Extendable Arm, add 411 kg (906 lb)
Travel Speed (Low / High)	4.7 km/h / 2.6 km/h (1.6 mph / 2.9 mph)
Digging Force (per ISO 6015)	
With Standard Arm	Arm - 20413 N (4589 lbf) Bucket 30995 N (6968 lbf)
With Long Arm	Arm - 17734 N (3986 lbf) Bucket 30995 N (6968 lbf)
With Extendable Arm	Arm (Retracted)- 19921 N (4478 lbf) Arm (Extended)- 14472 N (3254 lbf) Bucket 30995 N (6968 lbf)

Controls

Steering	Two hand levers (optional foot pedals)
Hydraulics	Two hand operated levers (joysticks) control boom, bucket, arm and upperstructure slew
Blade	Hand lever
Angle Blade (If Equipped)	Switch on blade lever
Two Speed	Switch on blade lever
Boom Switch	Electric switch in left joystick
Auxiliary Hydraulics	Electric switch in right joystick
Auxiliary Pressure Release	Electric switch in right joystick
Engine	Engine speed control dial with auto idle feature, key type start switch
Starting Aid	Glow Plugs - activated by key switch
Brakes Travel Service & Parking Swing Service Holding	 Hydraulic lock in motor circuit Hydraulic lock on motor Spring applied - hydraulic release

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Engine

Make / Model	Kubota D1803-M-DI-E3B-BC-3
Fuel / Cooling	Diesel / Liquid
Horsepower (SAE Net) @ 2400 rpm	23,1 kW (31.0 hp)
Torque @ 1400 rpm (SAE Net)	
Number Of Cylinders	3
Displacement	1,862 L (111.4 ci)
Bore / Stroke	87 x 102,4 mm (3.43 x 4.03 in)
Lubrication	Pressure System with Filter
Crankcase Ventilation	Closed Breathing
Air Cleaner	Dry replaceable paper dual cartridge
Ignition	Diesel-Compression
Low Idle Speed (S/N A93K11001 - A93K11274)	1125 rpm +/- 75 rpm
Low Idle Speed (S/N A93K11275 And Above)	975 rpm +/- 75 rpm
High Idle Speed	2650 rpm
Engine Coolant	Propylene Glycol / water mixture (53% PG / 47% water)

Hydraulic System

Pump Type	Engine driven, single outlet, variable displacement, load sensing, torque limited, piston pump
Pump Capacity Piston Pump Gear Pump - Pilot	 100,8 L/min (26.6 U.S. gpm) 9,6 L/min (2.5 U.S. gpm)
Auxiliary Flow (Aux3)	63,9 L/min (16.9 U.S. gpm)
Auxiliary Flow - 2nd Aux (Female coupler) (Male Coupler)	 20,3 L/min (5.4 U.S. gpm) 15,0 L/min (4.0 U.S. gpm)
Hydraulic Filter	Full flow replaceable, 3 micron synthetic media element
Control Valve	9 spool closed center individually compensated
Fluid Type	Bobcat Fluid, Hydraulic / Hydrostatic 6903117 - (2.5 U.S. gal) 6903118 - (5 U.S. gal) 6903119 - (55 U.S. gal)
System Relief Pressure Slew Circuit Boom, Boom Swing Bucket, Arm, Auxiliary Blade Joystick Control Pressure	 21600 kPa (216 bar) (2132 psi) 24500 kPa (245 bar) (3550 psi) 24500 kPa (245 bar) (3550 psi) 24500 kPa (245 bar) (3550 psi) 3000 kPa (30 bar) (435 psi)
Auxiliary Relief	20600 kPa (206 bar) (2987 psi)
Arm Port Relief, Base End And Rod End	27000 kPa (270 bar) (3916 psi)
Boom Port Relief, Base End And Rod End	29000 kPa (290 bar) (4206 psi)
Bucket Port Relief Base End And Rod End	27000 kPa (270 bar) (3916 psi)
Blade Port Relief Base End	27000 kPa (270 bar) (3916 psi)
Angle Blade (If Equipped) Port Relief Base End And Rod End	27000 kPa (270 bar) (3916 psi)
Main Hydraulic Filter Bypass	350 kPa (3,5 bar) (50 psi)
Case Drain	140 kPa (1,4 bar) (20 psi)

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Hydraulic Cylinders

Cylinder	Bore	Rod	Stroke
Boom (cushion up)	76,2 mm (3.00 in)	44,5 mm (1.75 in)	670 mm (26.38 in)
Arm (cushion retract / extend)	76,2 mm (3.00 in)	44,5 mm (1.75 in)	607 mm (23.90 in)
Bucket	69,9 mm (2.75 in)	44,5 mm (1.75 in)	466,3 mm (18.36 in)
Boom Swing	82,6 mm (3.25 in)	44,5 mm (1.75 in)	459,9 mm (18.11 in)
Blade	88,9 mm (3.50 in)	44,5 mm (1.75 in)	160 mm (6.30 in)
Extendable Arm (If Equipped) (cushion retract)	57,2 mm (2.20 in)	38,1 mm (1.50 in)	765,6 mm (30.14 in)

Hydraulic Cycle Times

Bucket Curl	2.7 Seconds
Bucket Dump	1.9 Seconds
Arm Retract	2.9 Seconds
Arm Extend	2.4 Seconds
Boom Raise	4.4 Seconds
Boom Lower	5.1 Seconds
Boom Swing Left	7.0 Seconds
Boom Swing Right	7.2 Seconds
Blade Raise	3.1 Seconds
Blade Lower	3.5 Seconds
Extendable Arm Retract	3.2 Seconds
Extendable Arm Extend	2.5 Seconds

Drive System

Final Drive	Each track is driven by hydrostatic axial piston motor
Type of Reduction	48.6:1 two stage planetary

Slew System

Slew Motor	Axil piston connected to a planetary drive
Slew Circle	Single row shear type ball bearing with internal gear
Slew Speed	8.6 rpm

Undercarriage

Crawler Track Design	Sealed track rollers with boxed section track roller frame, grease type track adjuster with shock absorbing recoil spring
Width of crawler	1520 mm (59.8 in)

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Electrical

Starting Aid	Glow Plugs
Alternator	12 volt, 90 Amp open frame w / internal regulator
Battery	12 volt - 530 CCA @ -18°C (0°F)
Starter	12 volt; gear reduction 2.0 kW (2.7 hp)
Lights	37.5 watt (2)
Instrumentation	**Gauges:** Engine Coolant Temperature, Fuel Level. **Warning lights:** Fuel Level, Seat Belt, Engine Coolant Temperature, Engine Malfunction, Hydraulic System Malfunction, General Warning. **Indicators:** Two-Speed, Engine Preheat. **Data Display:** Operating Hours, Engine rpm, Maintenance Clock Countdown, Battery Voltage, Service Codes, Engine Preheat. **Other:** Audible Alarm, Lights. **Optional Deluxe Instrumentation Panel:** *Additional displays for: Engine rpm, Coolant Temperature and Oil Pressure; System Voltage and Hydraulic Oil Temperature. *Additional Features Included: Keyless Start, Digital Clock, Job Clock, Password Lockout, Multi-language Display, Help Screens, Diagnostic Capability and Engine / Hydraulic Systems Shutdown Function.

Capacities

Fuel Tank	53,1 L (14 U.S. gal)
Hydraulic Reservoir Only (Center of Sight Glass)	Tank Cap. 8,3 L (2.2 U.S. gal)
Hydraulic System (with Reservoir)	39,7 L (10.5 U.S. gal)
Cooling System	8.0 L (2.1 U.S. gal)
Engine Oil and Filter	5,2 L (5.5 qt)
Final Drive (each)	0,5 L (0.55 qt)

Tracks

Type	Rubber	Steel
Width	320 mm (12.6 in)	300 mm (11.8 in)
Number Of Shoes	Single Assembly	43
Number of Track Rollers (per side)	4	4

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EXCAVATOR SPECIFICATIONS (CONT'D)

Ground Pressure

Rubber Tracks - Standard Arm	28,9 kPa (0,289 bar) (4.20 psi)
Long Arm	31,5 kPa (0,315 bar) (4.57 psi)
Extendable Arm	32,4 kPa (0,324 bar) (4.70 psi)
Steel Tracks - Standard Arm	31,7 kPa (0,317 bar) (4.60 psi)
Long Arm	34,5 kPa (0,345 bar) (5.01 psi)
Extendable Arm	35,5 kPa (0,355 bar) (5.14 psi)

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TORQUE SPECIFICATION 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)	2000 - 2200 (1475 - 1625)
	1.375	1630 - 1830 (1200 - 1350)	2720 - 2980 (2000 - 2200)
	1.500	2040 - 2240 (1500 - 1650)	3530 - 3870 (2600 - 2850)
	1.625	2720 - 2980 (2000 - 2800)	4680 - 5150 (3450 - 3800)
	1.750	3390 - 3730 (2500 - 2750)	5830 - 6500 (4300 - 4800)
	1.875	4270 - 4750 (3150 - 3500)	5830 - 6500 (5500 - 6100)
	2.000	5150 - 5700 (3800 - 4200)	8800 - 9800 (6500 - 7200)

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TORQUE SPECIFICATIONS FOR BOLTS (CONT'D)

Torque For General Metric Bolts

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 NOM. DIA	PROPERTY CLASS					
	8.8		10.9		12.9	
-	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
M4	3,5 - 2,5	2.5 - 2.0	4,2 - 3,8	3.1 - 2.8	5,3 - 4,7	3.9 - 3.5
M5	6,5 - 5,5	5.0 - 4.0	8,4 - 7,6	6.2 - 5.6	9,5 - 8,5	7.0 - 6.2
M6	10,5 - 9,5	7.5 - 7.0	13,7 - 12,3	10.1 - 9.1	15,8 - 14,2	11.6 - 10.4
M7	17 - 15	12.5 - 11.0	22 - 20	16.2 - 14.7	26,3 - 23,7	19.5 - 17.5
M8	26 - 24	19 - 18	32,6 - 29,4	24.0 - 21.7	39 - 35	28.5 - 25.5
M10	47 - 43	35 - 32	63 - 57	46.5 - 42.0	79 - 71	58.5 - 52.5
M12	85 - 75	60 - 55	115 - 105	85 - 78	137 - 123	110 - 91
M14	140 - 125	100 - 90	180 - 160	133 - 118	210 - 190	155 - 140
M16	210 - 190	155 - 140	285 - 255	210 - 188	330 - 300	245 - 225
M18	290 - 260	215 - 190	385 - 345	285 - 255	460 - 420	340 - 310
M20	410 - 370	300 - 275	550 - 490	405 - 360	650 - 590	490 - 440
M22	550 - 500	400 - 370	740 - 760	545 - 560	880 - 800	650 - 590
M24	700 - 640	520 - 470	950 - 850	700 - 625	1120 - 1000	830 - 730
M27	1030 - 930	760 - 680	1370 - 1230	1000 - 900	1630 - 1470	1200 - 1100
M30	1400 - 1260	1030 - 930	1900 - 1700	1400 - 1250	2200 - 2000	1600 - 1500
M33	1900 - 1720	1400 - 1270	2500 - 2300	1850 - 1700	3100 - 2700	2300 - 2000
M36	2450 - 2200	1800 - 1620	3200 - 2900	2400 - 2200	3900 - 3500	2900 - 2600

NOTE: Use the torque value for the part having the lesser property class when a fastener and nut are used together but have a different property class.

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HYDRAULIC CONNECTION SPECIFICATIONS

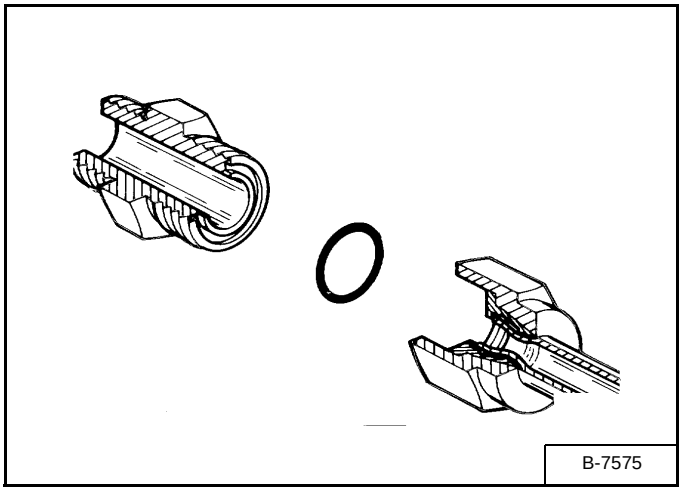
O-ring Face Seal Connection

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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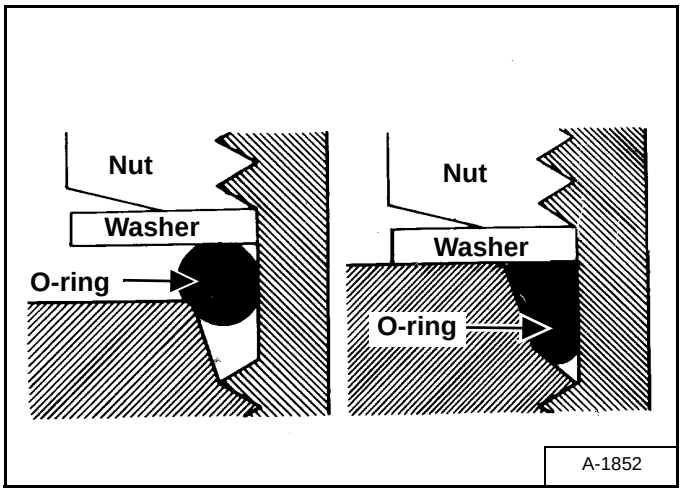
Figure SPEC-30-1



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-30-1]**.

Straight Thread O-ring Fitting

Figure SPEC-30-2



Lubricate the O-ring before installing the fitting. Loosen the nut and install the fitting. Tighten the nut until the washer is tight against the surface **[Figure SPEC-30-2]**.

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Tubelines And Hoses

Replace any tubelines that are bent or flattened. They will restrict flow, which will slow hydraulic action and cause heat.

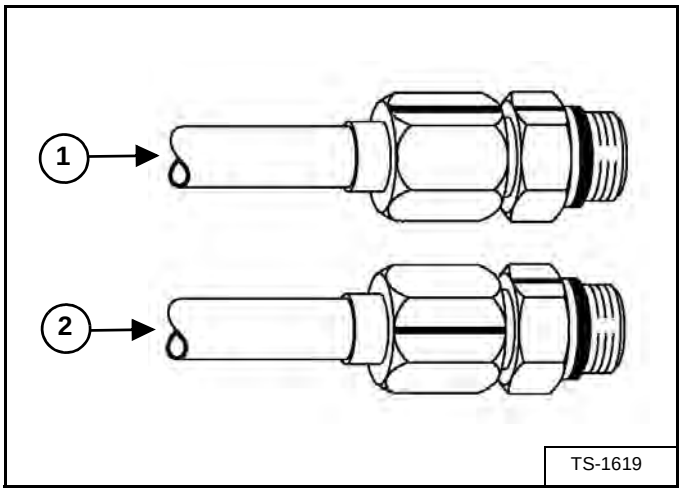
Replace hoses which show signs of wear, damage or weather cracked rubber.

Always use two wrenches when loosening and tightening hose or tubeline fittings.

Flare Fitting

Use the following procedure to tighten the flare fitting:

Figure SPEC-30-3



Tighten the nut until it makes contact with the seat. Make a mark across the flats of both the male and female parts of the connection (Item 1) **[Figure SPEC-30-3]**.

Use the chart below to find the correct tightness needed (Item 2) **[Figure SPEC-30-3]**. If the fitting leaks after tightening, disconnect it and inspect the seat area for damage.

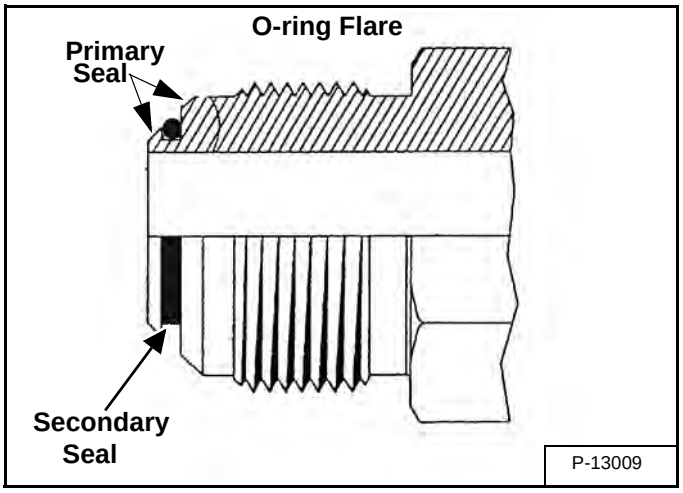
FLARE FITTING TIGHTENING TORQUE

Wrench Size	Tubeline Outside Diameter	Thread Size	TORQUE ft-lb (N•m)	NEW Rotate No. of Hex Flats	RE-ASSEMBLY Rotate No. of Hex Flats
5/8”	5/16”	1/2” - 20	23 (17)	2 - 1/2	1
11/16”	3/8”	9/1”6 - 18	30 (22)	2	1
7/8”	1/2”	3/4” - 16	54 (40)	2	1
1”	5/8”	7/8” - 14	81 (60)	1 - 1/2	1
1-1/4”	3/4”	1-1/16” - 12	114 (84)	1	3/4
1-3/8”	1”	1-5/16” - 12	160 (118)	3/4	3/4

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O-ring Flare Fitting

Figure SPEC-30-4

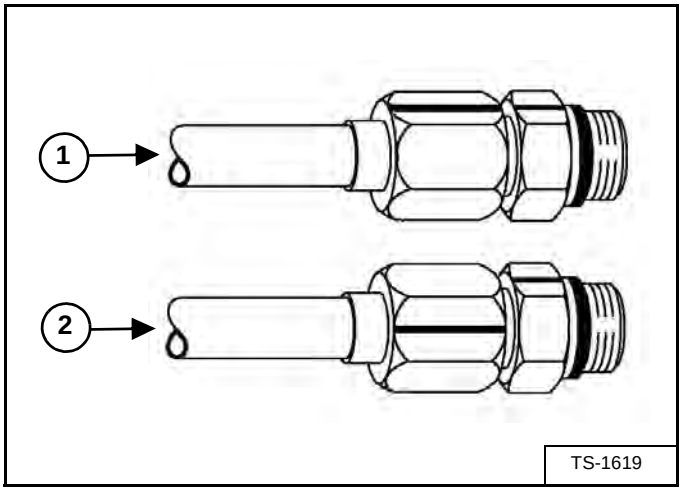


The flare is the primary seal, the O-ring is the secondary seal and helps absorb vibration and pressure pulses at the connection **[Figure SPEC-30-4]**.

If necessary, the O-ring-flare fitting can be used without an O-ring.

Use the following procedure to tighten the O-ring flare fitting.

Figure SPEC-30-5



Tighten the nut until it contacts with the seat. Make a mark across the flats of both the male and female parts of the connection (Item 1) **[Figure SPEC-30-5]**.

Use the chart below to find the correct tightness needed (Item 2) **[Figure SPEC-30-5]**. If the fitting leaks after tightening, disconnect it and inspect the seat area for damage.

O-RING FLARE FITTING TIGHTENING TORQUE

			*	**	***
Wrench Size	Tubeline Outside Diameter	Thread Size	TORQUE ft-lb (N•m)	NEW Rotate No. of Hex Flats	RE-ASSEMBLY Rotate No. of Hex Flats
5/8”	5/16”	1/2” - 20	23 (17)	2 - 1/2	1
11/16”	3/8”	9/16” - 18	30 (22)	2	1
7/8”	1/2”	3/4” - 16	54 (40)	2	1
1”	5/8”	7/8” - 14	81 (60)	1 - 1/2	1
1-1/4”	3/4”	1-1/16” - 12	114 (84)	1	3/4
1-3/8”	1”	1-5/16” - 12	160 (118)	3/4	3/4

*If a torque wrench is used to tighten a new fitting to a used hose / tubeline.

*If a torque wrench is used to tighten a used fitting to a new hose / tubeline.

*If a torque wrench is used to tighten a new fitting to a new hose / tubeline.

**If using the hex flat tightening method to tighten a new fitting to a new hose / tubleline.

**If using the hex flat tightening method to tighten a new fitting to a used hose / tubeline.

***If using the hex flat tightening method to tighten a used fitting to a new hose / tubeline.

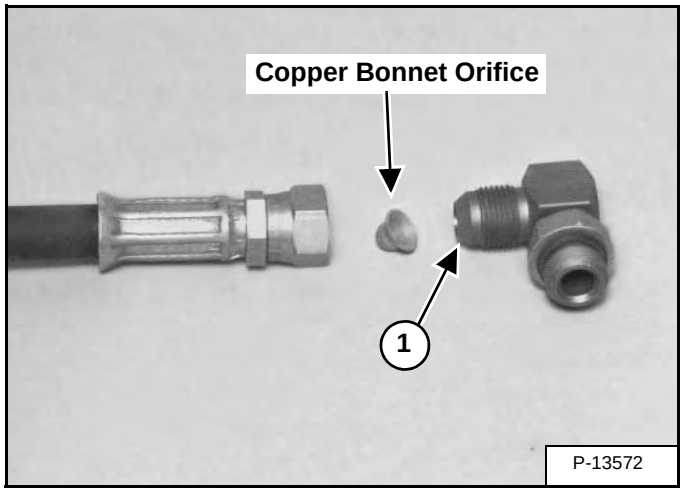
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O-ring Flare Fitting (Cont'd)

NOTE: O-ring flare fittings are not recommended in all applications. Use the standard flare fittings in these applications.

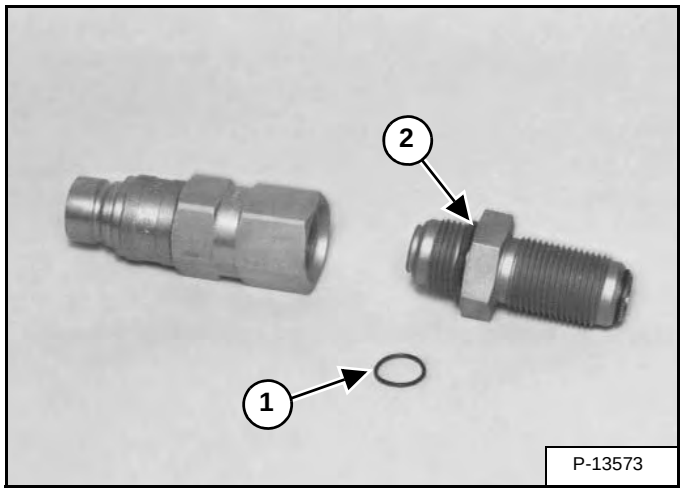
Do not use a O-ring flare fitting when a copper bonnet orifice is used. When tightened the connection at the bonnet may distort the flare face and prevent it from sealing.

Figure SPEC-30-6



Use a standard flare fitting (Item 1) **[Figure SPEC-30-6]** as shown.

Figure SPEC-30-7



When a O-ring flare fitting is used as a straight thread port adapter the O-ring flare face is not used to seal. The O-ring may come off the fitting and enter the system.

Always remove the O-ring (Item 1) **[Figure SPEC-30-7]** from the flare face as shown.

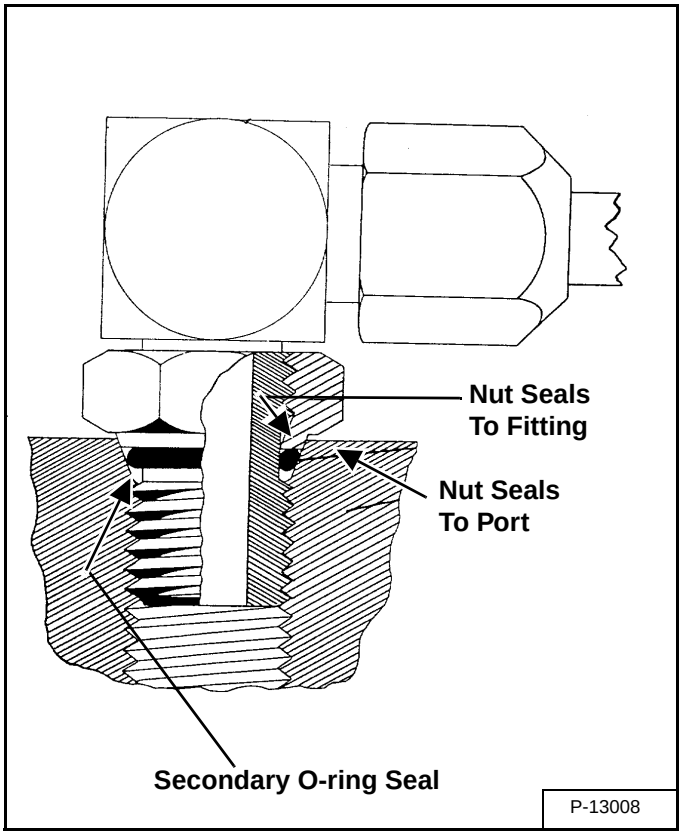
An O-ring (Item 2) **[Figure SPEC-30-7]** is added to the flat boss of the fitting to seal the connection in this application.

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HYDRAULIC CONNECTION SPECIFICATIONS (Cont'd)

Port Seal Fitting

Figure SPEC-30-8



The nut is the primary seal, the O-ring is the secondary seal and helps absorb vibration and pressure pulses at the connection **[Figure SPEC-30-8]**.

The hex portion of the nut does not contact the surface of the component when the nut is tight.

Use the following procedure to tighten the port seal fitting:

Port seal and nut, washer and O-ring (O-ring Boss) fittings use the same tightening torque valve chart.

If a torque wrench cannot be used, use the following method.

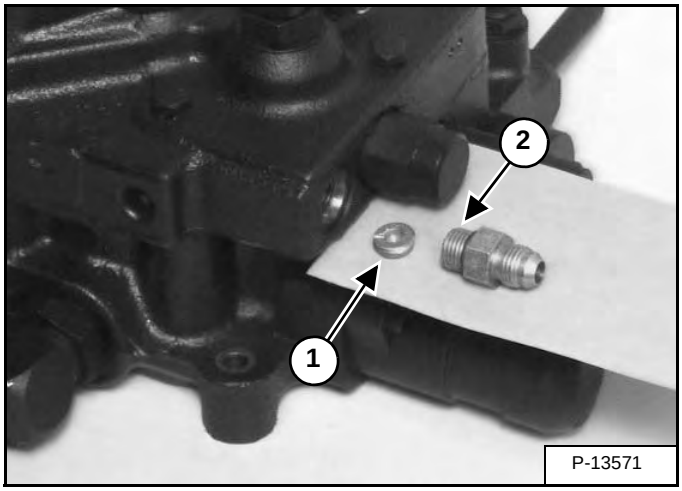
Tighten the nut until it just makes metal to metal contact, you can feel the resistance. Tighten the nut with a wrench no more than one hex flat maximum.

Do not over tighten the port seal fitting.

NOTE: If a torque wrench cannot be used, use the hex flat tightening method as an approximate guideline.

NOTE: Port seal fittings are not recommended in all applications. Use O-ring boss fittings in these applications.

Figure SPEC-30-9



Do not use port seal fittings when a thread in orifice (Item 1) **[Figure SPEC-30-9]** is used in the port. The orifice may interfere with the fitting and prevent it from sealing.

Use an O-ring boss fitting (Item 2) **[Figure SPEC-30-9]** as shown.

PORT SEAL AND O-RING BOSS TIGHTENING TORQUE

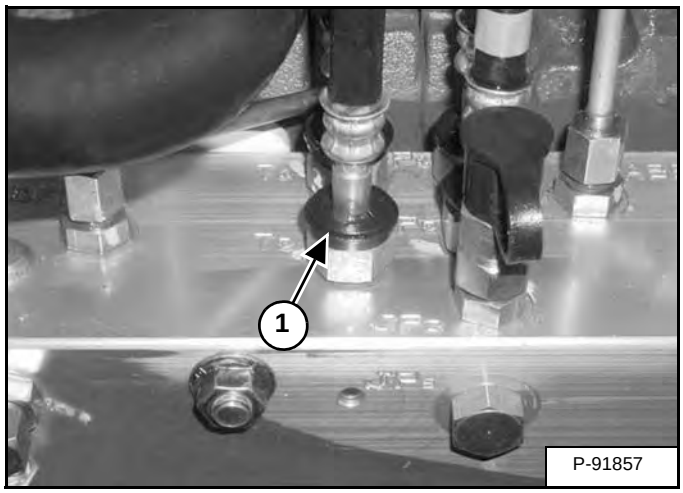
Fitting Nut Wrench Size	Thread Size	TORQUE ft-lb (N•m)
11/16”	9/16” - 18	30 (22)
15/16”	3/4” - 16	50 (40)
1-1/8”	7/8” - 14	81 (60)
1-1/4”	1 - 1/16” - 12	114 (84)
1-1/2”	1 - 5/16”	114 (84)

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Push To Connect Fittings

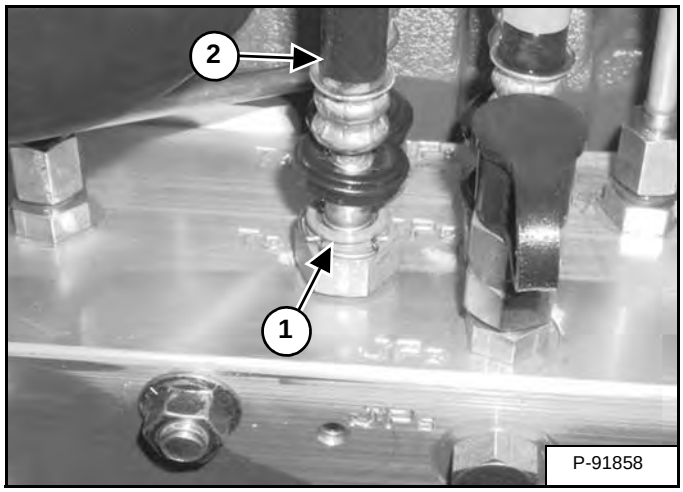
The push to connect fittings provide a leak free seal that also acts as a swivel fitting.

Figure SPEC-30-10



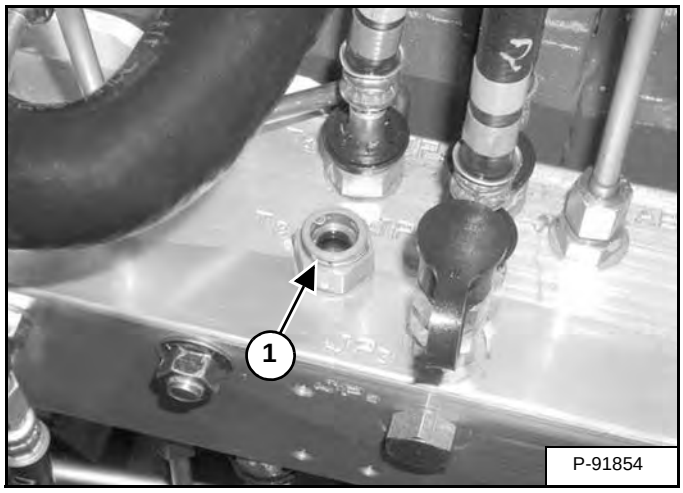
To disconnect the hose, pull up on the grommet (Item 1) **[Figure SPEC-30-10]**.

Figure SPEC-30-11



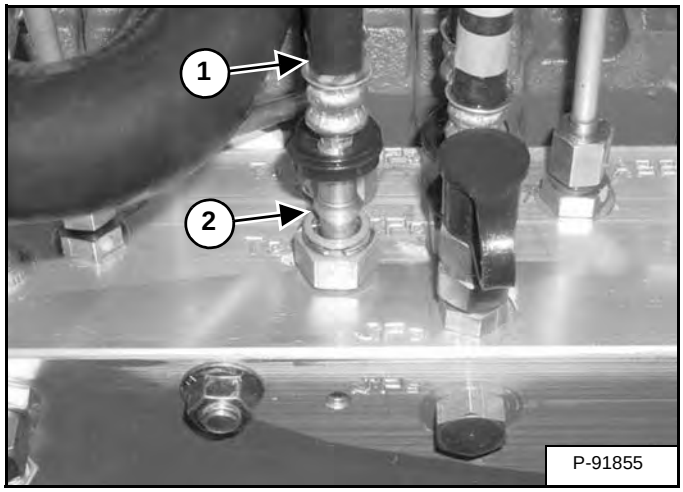
Use a O-ring pick to remove the retainer clip (Item 1). Pull up on the hose (Item 2) **[Figure SPEC-30-11]** and remove the hose from the fitting.

Figure SPEC-30-12



To install the hose, install the retainer clip (Item 1) **[Figure SPEC-30-12]** in the fitting.

Figure SPEC-30-13

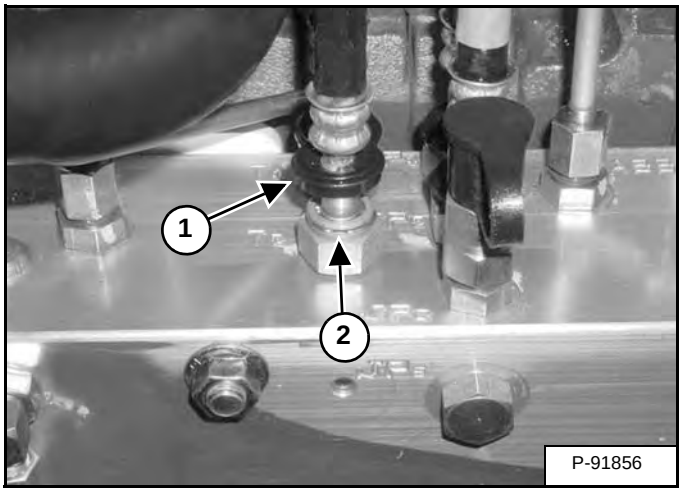


Install the hose (Item 1) in the fitting. Press down on the hose until the top of the hose flare is fully seated in the fitting and the retainer clip is over the top of the hose flare (Item 2) **[Figure SPEC-30-13]**.

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Push To Connect Fittings (Cont'd)

Figure SPEC-30-14



Push the grommet (Item 1) down and over the top of the fitting (Item 2) **[Figure SPEC-30-14]**.

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HYDRAULIC FLUID SPECIFICATIONS

Specifications

Use only Bobcat hydraulic fluid.

DO NOT use automatic transmission fluids in the excavator or permanent damage to the hydraulic system will result.

Bobcat hydraulic fluid is available in:

- 9.5 L (2.5 U.S. gal) qty 2 (P/N 6903117)
- 18.9 L (5 U.S. gal) (P/N 6903118
- 208 L (55 U.S. gal) (P/N 6903119)

WARNING

AVOID INJURY OR DEATH

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

W-2072-0807

When temperatures below -18°C (0°F) are common, the excavator must be kept in a warm building. Extra warm-up time must be used each time the excavator is started during cold temperature conditions. Cold fluid will not flow easily and it makes action of the hydraulic function slower. Loss of fluid flow to the hydraulic system (Indicated by hydraulic temp / pressure lights on) can cause system damage in less than 60 seconds.

WARNING

During cold weather (0°C [32°F] and below), do not operate machine until the engine has run for at least 5 minutes at less than half throttle. This warm-up period is necessary for foot pedal operation and safe stopping. Do not operate controls during warm-up period.

When temperatures are below -30°C (-20°F), the hydrostatic oil must be heated or kept warm. The hydrostatic system will not get enough oil at low temperatures. Park the machine in an area where the temperature will be above -18°C (0°F) if possible.

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CONVERSIONS

Decimal And Millimeter Equivalent Chart

FRACTIONS	DECIMALS	MM	FRACTIONS	DECIMALS	MM
1/64	0.015625	0.397	33/64	0.515625	13.097
1/32	0.03125	0.794	17/32	0.53125	13.494
3/64	0.046875	1.191	35/64	0.546875	13.891
1/16	0.0625	1.588	9/16	0.5625	14.288
5/64	0.078125	1.984	37/64	0.578125	14.684
3/32	0.09375	2.381	19/32	0.59375	15.081
7/64	0.109375	2.778	39/64	0.609375	15.478
1/8	0.1250	3.175	**5/8**	0.6250	15.875
9/64	0.140625	3.572	41/64	0.640625	16.272
5/32	0.15625	3.969	21/32	0.65625	16.669
11/64	0.171875	4.366	43/64	0.671875	17.066
3/16	0.1876	4.762	11/16	0.6875	17.462
13/64	0.203125	5.159	45/64	0.703125	17.859
7/32	0.21875	5.556	23/32	0.71875	18.256
15/64	0.234375	5.953	47/64	0.734375	18.653
1/4	0.2500	6.350	**3/4**	0.7500	19.050
17/64	0.265625	6.747	49/64	0.765625	19.447
9/32	0.28125	7.144	25/32	0.78125	19.844
19/64	0.296875	7.541	51/64	0.796875	20.241
5/16	0.3125	7.938	13/16	0.8125	20.638
21/64	0.328125	8.334	53/64	0.828125	21.034
11/32	0.34375	8.731	27/32	0.84375	21.431
23/64	0.359375	9.128	55/64	0.859375	21.828
3/8	0.3750	9.525	**7/8**	0.8750	22.225
25/64	0.390625	9.922	57/64	0.890625	22.622
13/32	0.40625	10.319	29/32	0.90625	23.019
27/64	0.421875	10.716	59/64	0.921875	23.416
7/16	0.4375	11.112	15/16	0.9375	23.812
29/64	0.453125	11.509	61/64	0.953125	24.209
15/32	0.46875	11.906	31/32	0.96875	24.606
31/64	0.484375	12.303	63/64	0.984375	25.003
1/2	0.5000	12.700	**1**	1.000	25.400

1 mm = 0.03937” **0.001 = 0.0254 mm**

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U.S. To Metric Conversion Chart

	TO CONVERT	INTO	MULTIPLY BY
LINEAR MEASUREMENT	Miles	Kilometers	1.609
	Yards	Meters	0.9144
	Feet	Meters	0.3048
	Feet	Centimeters	30.48
	Inches	Meters	0.0254
	Inches	Centimeters	2.54
	Inches	Millimeters	25.4
AREA	Square Miles	Square Kilometers	2.59
	Square Feet	Square Meters	0.0929
	Square Inches	Square Centimeters	6.452
	Acre	Hectare	0.4047
VOLUME	Cubic Yards	Cubic Meters	0.7646
	Cubic Feet	Cubic Meters	0.02832
	Cubic Inches	Cubic Centimeters	16.39
WEIGHT	Tons (Short)	Metric Tons	0.9078
	Pounds	Kilograms	0.4536
	Ounces (Avdp.)	Grams	28.3495
PRESSURE	Pounds/Sq. In.	Kilopascal	6.895
WORK	Foot–Pounds	Newton–Meter	1.356
LIQUID VOLUME	Quarts	Liters	0.9463
	Gallons	Liters	3.785
LIQUID FLOW	Gallons/Minute	Liters/Minute	3.785
TEMPERATURE	Fahrenheit	Celsius	1.Subtract 32° 2. Multiply by 5/9

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SERVICE TOOLS REQUIRED

The following is a list of service tools required for servicing excavators.

Remote Start Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1563	Remote Start Tool	E26 - E55	This tool has been replaced by the new remote start tool 7003031, see below. MEL1563 includes: MEL1565 and MEL1566.	
MEL1565	Service Tool Harness		Used with MEL1563 to connect remote start tool to machine	
MEL1566	Service Tool Harness Communicator		Used with MEL1563 to connect remote start tool to PC	
7217666 (Was 7003031) (Was 6689779)	Remote Start Tool Kit	E26 - E55	This tool replaced the original remote start tool kit MEL1563 and 7003031. Kit 7217666 includes: 7022042, 6689747, 6689746 and 6689745.	
7022042 (Was 7003030) (Was 6689778)	Remote Start Tool		This tool replaces remote start tool 6689778 and 7003030.	
6689747	Remote Start Tool Harness		Used with 7003030 to connect remote start tool to excavator.	
6689746	Remote Start Tool Harness		Used with 7003030 to connect Service PC to remote start tool.	

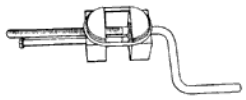
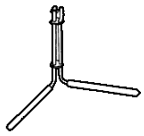
See BobcatNET for parts ordering information. (For Europe dealers, see the Bobcat Special Tools Catalogue for additional information and part numbers.)

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SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL10003	Hydraulic Tester (Flow Meter)	E26 - E80	Either hydraulic tester, MEL10003 or TWX-RFIK200-S-6 can be used for hydraulic testing.	
TWX-RFIK200-S-6 NEED MEL #	Hydraulic Tester (Flow Meter)			
MEL1074	O-Ring Seal Hook			
MEL1075	Adjustable Gland NUt Wrench		Includes MEL1075-1 and MEL1075-2	
MEL1075-1	Standard Pins		These are replaceable pins that insert into MEL1075-1 for disassembling various cylinders	No Image Available
MEL1075-2	Offset Pins		These are replaceable pins that insert into MEL1075-1 for disassembling various cylinders	No Image Available
MEL1396-1	Universal Seal Expander		MEL1396 includes: MEL1396-1 and MEL1396-2	
MEL1396-2	Piston Ring Comppressor			
MEL1033	Rod Seal Installation Tool			
MEL1418	Cylinder Hone = 2.00 in			
OEM6275	Cylinder Hone = 2.75 - 3.00 in			
OEM6270	Cylinder Hone = 3.00 - 3.50 in			
OEM6271	Cylinder Hone = 3.50 - 4.00 in			

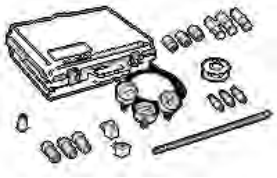
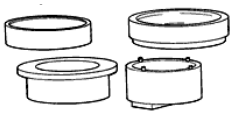
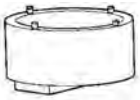
See BobcatNET for parts ordering information. (For Europe dealers, see the Bobcat Special Tools Catalogue for additional information and part numbers.)

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SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools (Cont'd)

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1355	Hydraulic Test Kit	E26 - E80	This test kit includes various gauges, adapters, couplers and hoses that are used when testing hydraulic functions. MEL1355 Includes: MEL1355-1 thru MEL1355-12	
MEL1355-2	1000 psi gauge			
MEL1355-3	5000 psi gauge			
MEL1355-12	Coupler			
MEL1412	Seal Installation Tool	E32, E35	Used for installing Travel Motor Seal	
MEL1413	Seal Installation Tool	E26	Used for installing Travel Motor Seal	
MEL1553	Travel Motor Tool Kit	E42 - E55	MEL1553 Includes: MEL1553-1 thru MEL1553-4	
MEL1553-1	Motor Seal Installation Tool		Included with MEL1553	
MEL1553-2	Motor Seal Installation Tool		Included with MEL1553	
MEL1553-3	Motor Seal Installation Tool		Included with MEL1553	
MEL1553-4	Motor Seal Installation Tool		Included with MEL1553	
MEL1560	Grease Spring Tool (Grease Release)	E26 - E55		
MEL1713	Hydraulic Test Kit	E60, E80	This test kit includes various adapters that are used when testing hydraulic functions. MEL1355 Includes: MEL1713-1 thru MEL1713-5	

See BobcatNET for parts ordering information. (For Europe dealers, see the Bobcat Special Tools Catalogue for additional information and part numbers.)

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SERVICE TOOLS REQUIRED (CONT'D)

Engine Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL10630	Engine Compression Test Kit	E26 - E55	Includes: MEL1352, MEL1433, MEL1489, MEL1546, MEL1551, MEL1594, MEL1594, MEL10630-1 - MEL10630-11 and MEL10630-14	
MEL1352	Compression Adapter	E26, E42 - E55	Used in glow plug port for testing compression - Included with MEL10630	
MEL1631	Compression Adapter	E32, E35	Used in glow plug port for testing compression, NOT included with MEL10630	
MEL1237	Fuel Line Adapter	E26 - E55	Adapter used to test delivery valve at the injection pump (Used with pressure gauge MEL1173-1)	
MEL1173-1	Pressure Gauge 10000 psi			
4200	Injector Nozzle Tester			

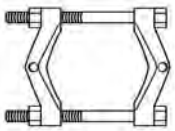
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SERVICE TOOLS REQUIRED (CONT'D)

HVAC Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1581	HVAC Recover, Recycling, Recharging Machine	E26 - E80		
MEL1592	HVAC Refrigerant Identification Tool			
MEL1595	AC Compressor Pulley Puller	E26 - E55		

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SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	☐
SERVICE MANAGER	X
SALES MANAGER	☐

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: **E35 - 1**
Date: **15 June 2009**
Product: **Bobcat Excavator**
Model: **E35**
Manual No: **6987276 (6-09)**

The following Sections are a revision to the above Service Manual.

COVER
ALPHABETICAL INDEX

10-01
10-111 ADDED

20-01
20-30
20-32
20-33
20-200
20-210 ADDED
20-220 ADDED
20-221 ADDED

70-80
70-230

SPEC-10

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SERVICE MANUAL REVISION

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Revision No: **E35 - 2**
Date: **15 November 2009**
Product: **Bobcat Excavator**
Model: **E35**
Manual No: **6987276 (11-09)**

The following Sections are a revision to the above Service Manual.

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Revision No: **E35 - 3**
Date: **15 June 2010**
Product: **Bobcat Excavator**
Model: **E35**
Manual No: **6987276 (6-10)**

E35 Service Manual (P/N 6987276) Dated 6-10 contains updated service information which replaces the previous E35 Service Manual (P/N 6987276) Dated 11-09.

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SERVICE MANUAL REVISION

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SALES MANAGER	☐

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Revision No: **E35 - 4**
Date: **15 February 2011**
Product: **Bobcat Excavator**
Model: **E35**
Manual No: **6987276 (2-11)**

E35 Service Manual (P/N 6987276) Dated 2-11 contains updated service information which replaces the previous E35 Service Manual (P/N 6987276) Dated 6-10.

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Revision No: **E35 - 5**
Date: **3 August 2012**
Product: **Bobcat Excavator**
Model: **E35**
Manual No: **6987276 (8-12)**

The following Sections are a revision to the above Service Manual.

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SALES MANAGER	☐

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Revision No: **E35 - 6**
Date: **5 September 2013**
Product: **Bobcat Excavator**
Model: **E35**
Manual No: **6987276 (9-13)**

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