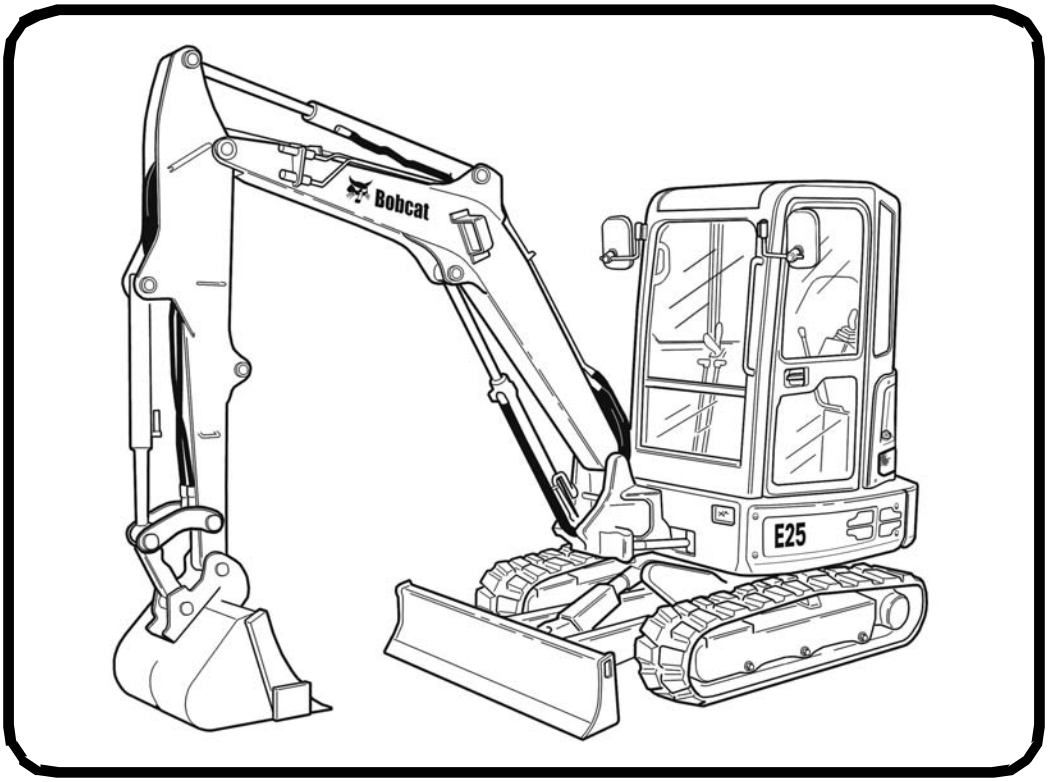
Bobcat®

Service Manual
E25 Compact Excavator

S/N AB8B11001 & Above



6989691enUS (05-18) (D)
Printed in USA
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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.

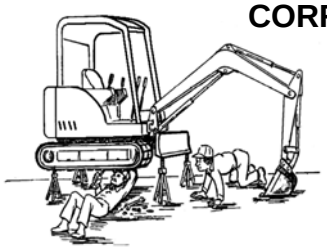
CORRECT



P-90216

Never service the Bobcat excavator without instructions.

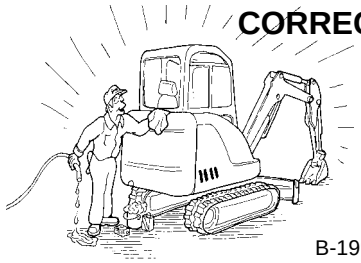
CORRECT



B-19964

Use the correct procedure to lift and support the excavator.

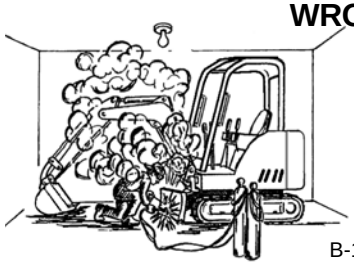
CORRECT



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

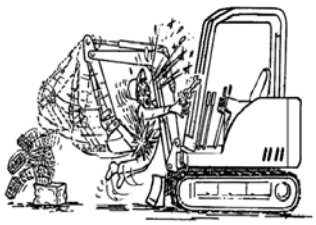


B-19960

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

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

WRONG

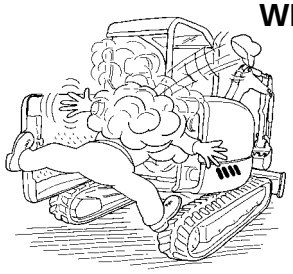


B-19966

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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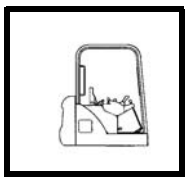

Bobcat®

FOREWORD

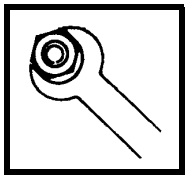
This manual is for the Bobcat excavator mechanic. It provides necessary servicing and adjustment procedures for the Bobcat excavator and its component parts and systems. Refer to the Operation & Maintenance Manual for operating instructions, starting procedure, daily checks, etc.

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

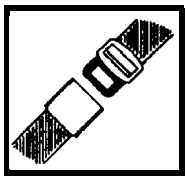
1. Check that the ROPS/TOPS/ FOPS is in good condition and is not modified.



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



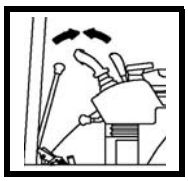
3. The seat belt must be correctly installed, functional and in good condition.



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



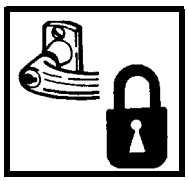
5. Travel levers, control levers and foot pedals must return to neutral. Check that the pedal locks are in working order.



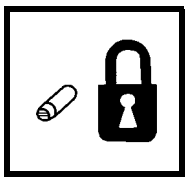
6. Check for correct function of the work lights.



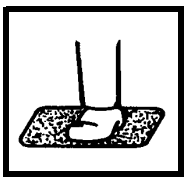
7. Enclosure door latches must open and close freely.



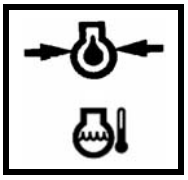
8. Attachment locking pins must function correctly and be in good condition.



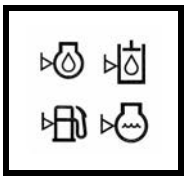
9. Safety treads must be in good condition.



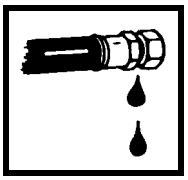
10. Check for correct function of indicator lamps.



11. Check all machine fluid levels.



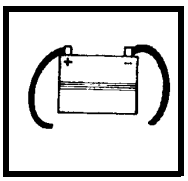
12. Inspect for fuel, oil or hydraulic fluid leaks.



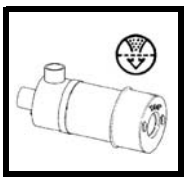
13. Lubricate the excavator.



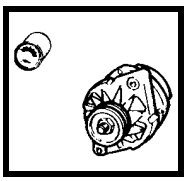
14. Check the condition of the battery and cables.



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

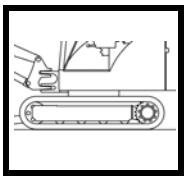


16. Check the electrical charging system.

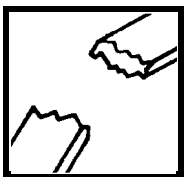


FW EXC-0617SM

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



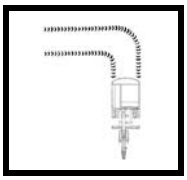
18. Inspect for loose or broken parts or connections.



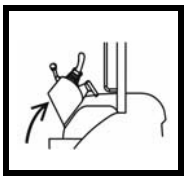
19. Check for any field modification not completed.



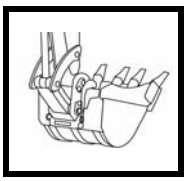
20. Operate the machine and check all functions.



21. Check the control console interlocks for correct function.



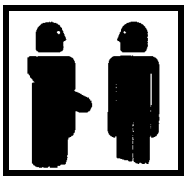
22. Inspect the X-Change™ for wear or damage. Repair or replace damaged parts.



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.

FW EXC-0617SM

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 deale in an English edition or one of many other languages See your Bobcat dealer for more information o translated versions.
- The AEM Safety Manual delivered with the machin gives general safety information.
- The Service Manual and Parts Manual are availabl from your dealer for use by mechanics to do shop type service and repair work.
- The Compact Excavator Operator Training Course i available through your local dealer or at **Bobcat.com/ training** or **Bobcat.com**. This course is intended to provide rules and practices of correct operation of the Bobcat excavator. The course is available in English and Spanish versions.
- Service Safety Training Courses are available from your Bobcat dealer or at **Bobcat.com/training** or **Bobcat.com**. They provide information for safe and correct service procedures.
- The Bobcat compact excavator Safety Video is available from your Bobcat dealer or at **Bobcat.com/ training** or **Bobcat.com**.

SI EXC-1016 SM

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



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

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



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

SI EXC1016 SM

FIRE PREVENTION



Maintenance

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

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

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

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

Operation

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

Electrical



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

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

Hydraulic System

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

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

Fueling



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

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

Starting

Do not use ether or starting fluids on any engine that ha glow plugs. These starting aids can cause explosion an 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).

SI EXC-1016 SM

FIRE PREVENTION (CONT'D)

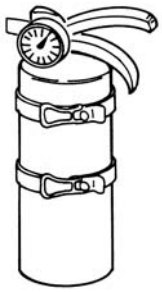
Welding And Grinding

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

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

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

Fire Extinguishers



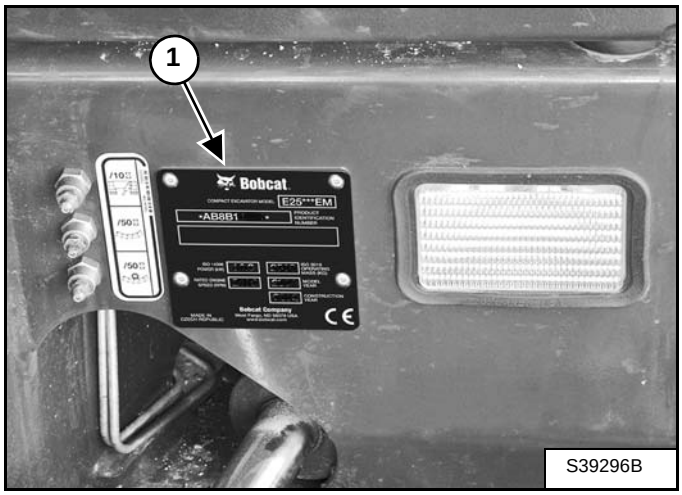
Know where fire extinguishers and first aid kits are located and how to use them. Inspect the fire extinguisher and service the fire extinguisher regularly. Obey the recommendations on the instructions plate.

SERIAL NUMBER LOCATIONS

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

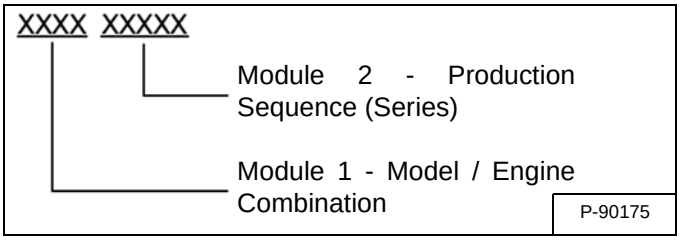
Excavator Serial Number

Figure 1



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

Figure 2



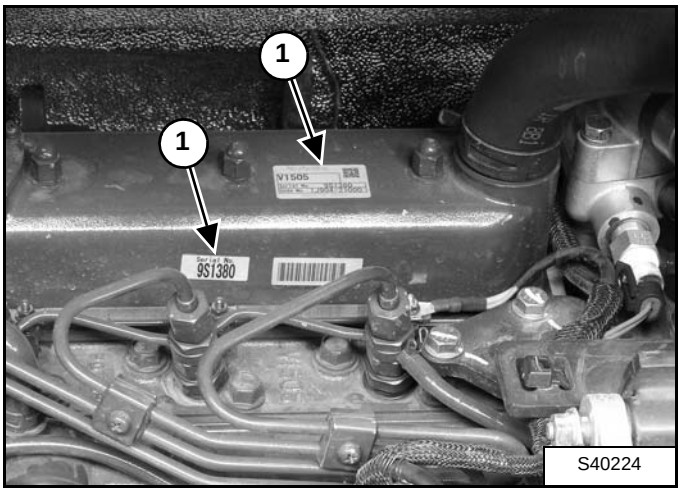
Explanation of excavator Serial Number **[Figure 2]**:

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

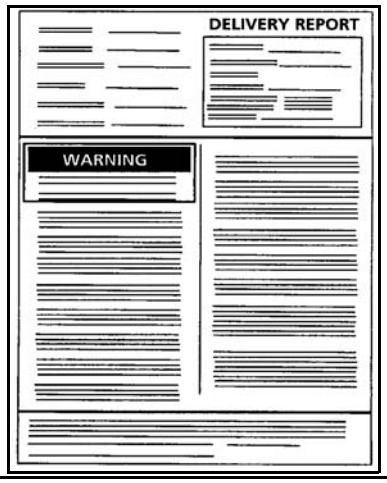
Figure 3



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

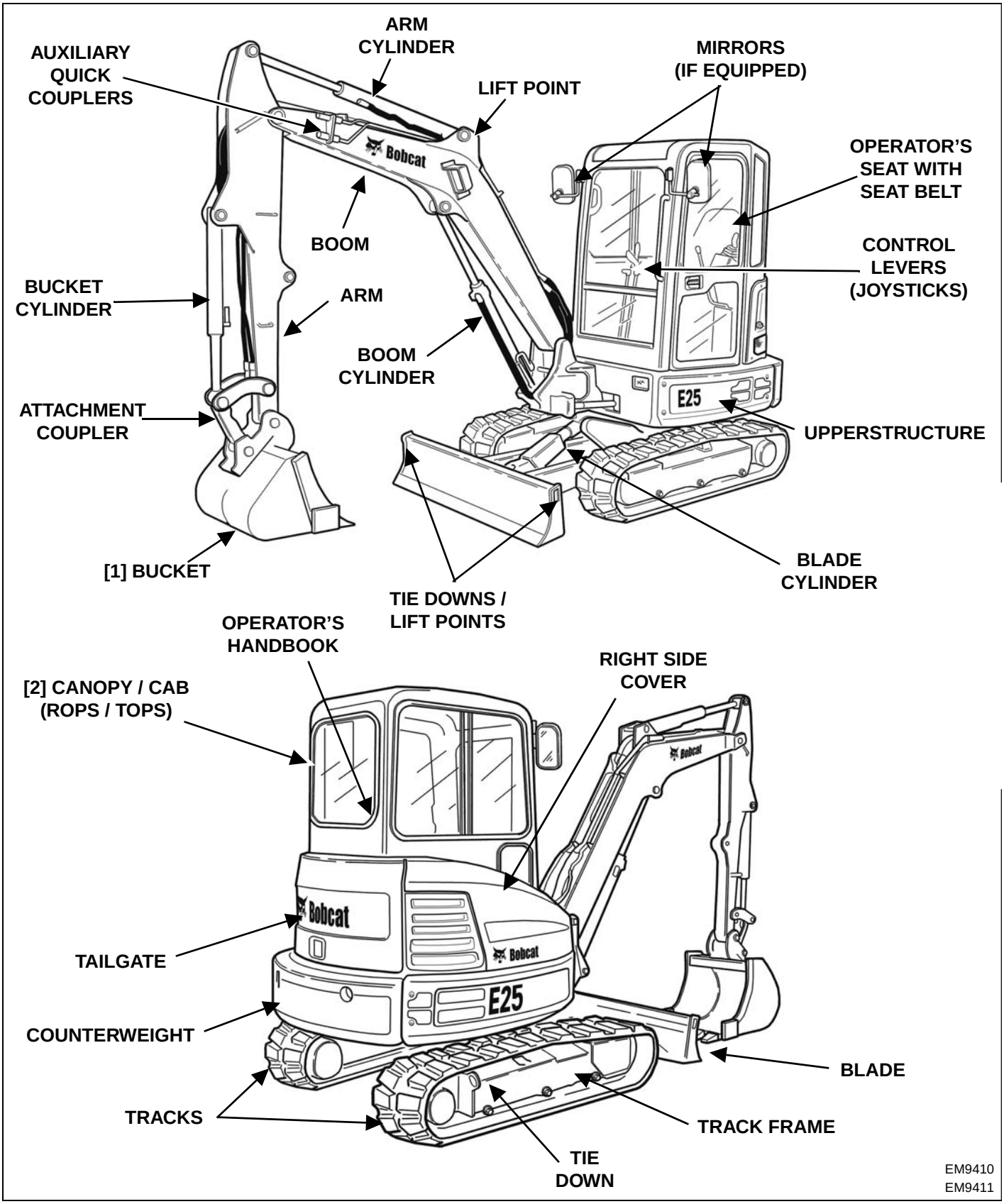
DELIVERY REPORT

Figure 4



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

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



[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.


Bobcat®

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

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Fastening 10-40-2

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Opening And Closing 10-50-1
Adjusting The Latch 10-50-1

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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

Raise the side of the machine (approximately 102 mm [4 in]) using the boom and arm.

Figure 10-10-1

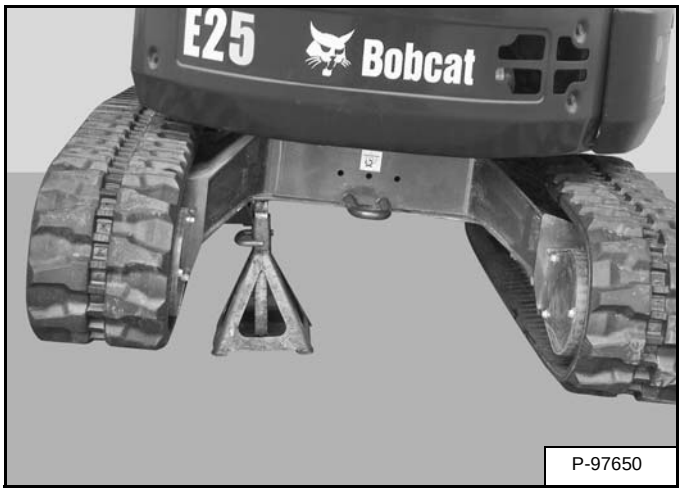
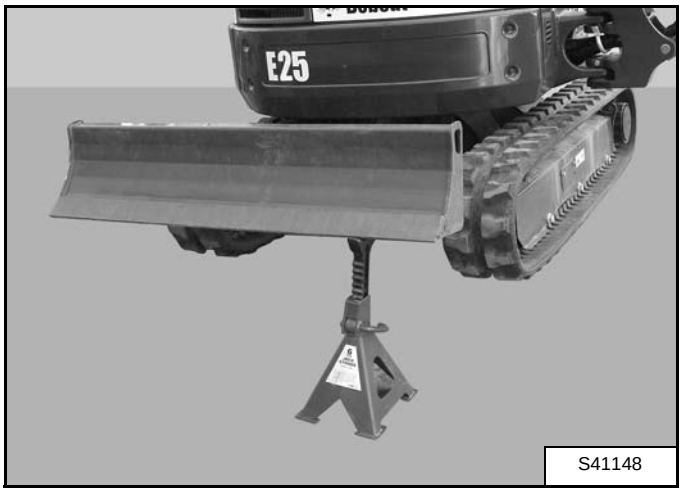


Figure 10-10-2



Raise the blade fully and install jackstands 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 jackstands.

Repeat the procedure for the other side.

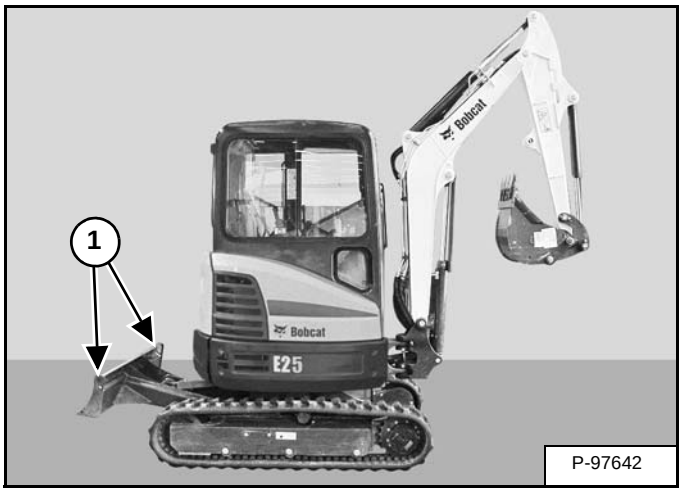
Stop the engine.


Bobcat®

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 fully.

Put all the control levers in neutral.

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2800-EN-0210

Figure 10-20-2

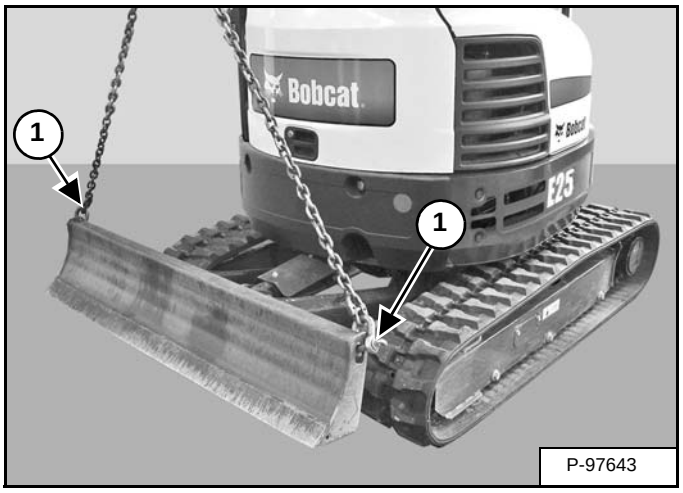
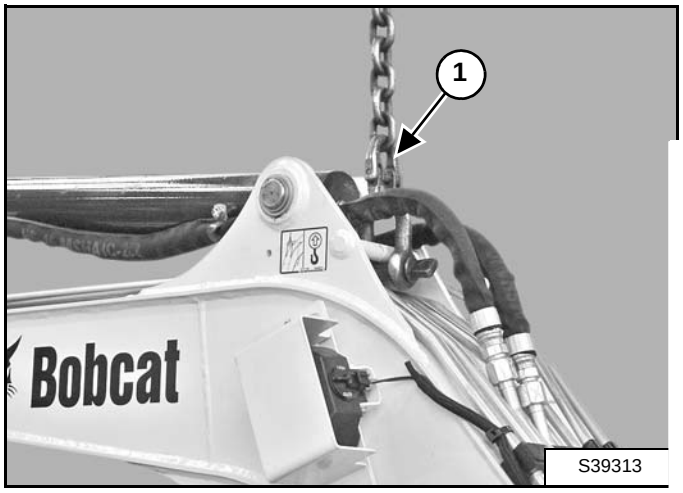


Figure 10-20-3



Fasten chains to the ends of the blade (Item 1) **[Figur 10-20-2]** and **[Figure 10-20-3]** 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 1) **[Figure 10-20-3]** from the rod to the lift fixture.


Bobcat®

OPERATOR CAB (ROPS / TOPS)

Description

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

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

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

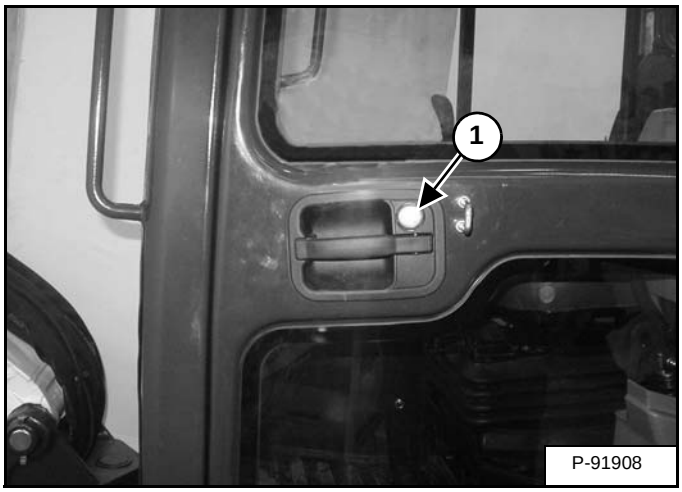
⚠ WARNING

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

W-2069-0200

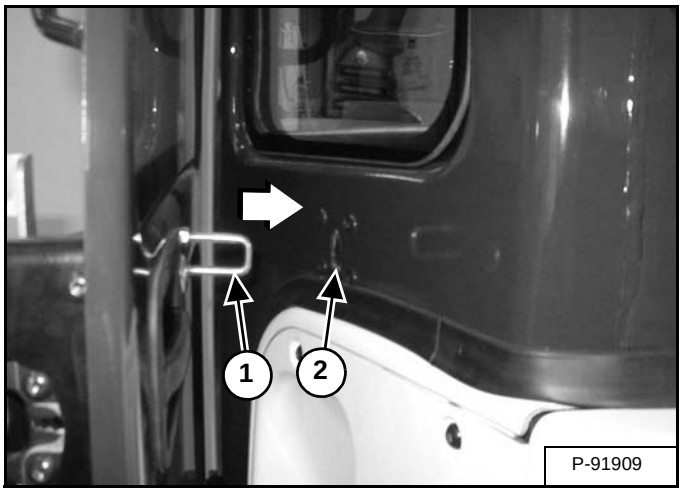
Cab Door

Figure 10-30-1



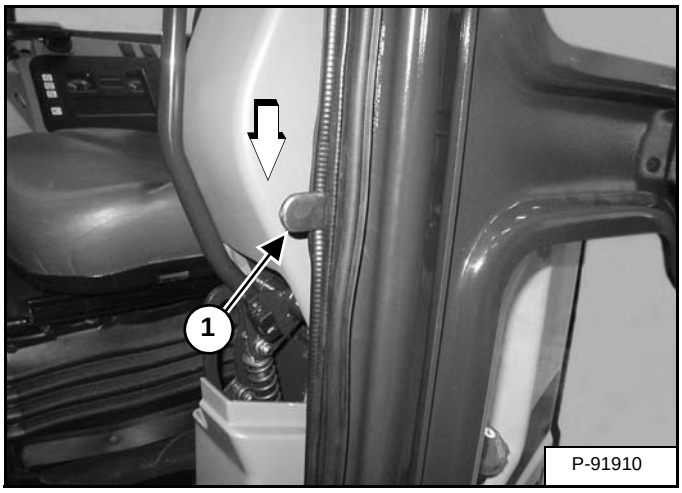
The cab door can be locked (Item 1) **[Figure 10-30-1]** with the same key as the starter switch.

Figure 10-30-2



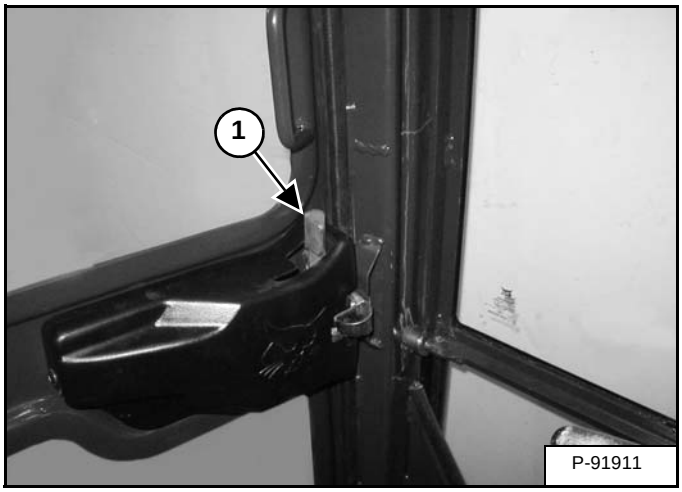
Push the door all the way open until the latch post (Item 1) engages in the latch (Item 2) **[Figure 10-30-2]** to hold the door in the open position.

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

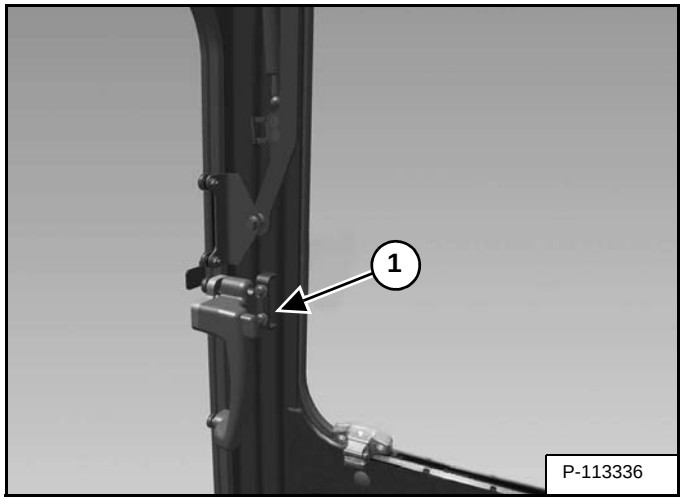


From inside the cab, open the door using handle (Item 1) **[Figure 10-30-4]**.

Front Window

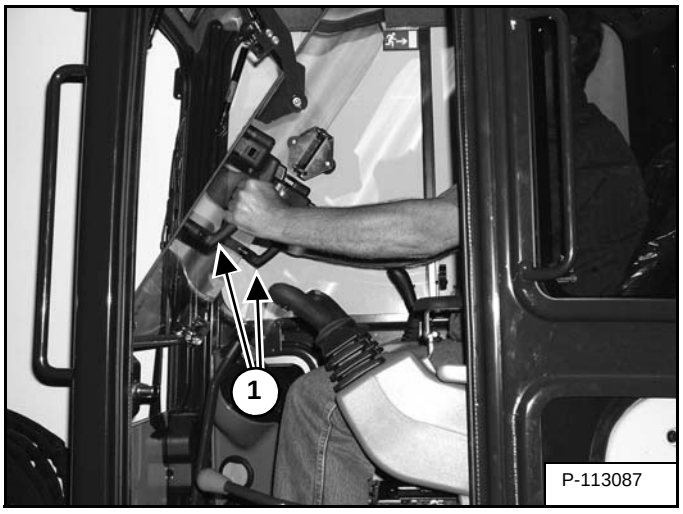
Opening The Front Window

Figure 10-30-5



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

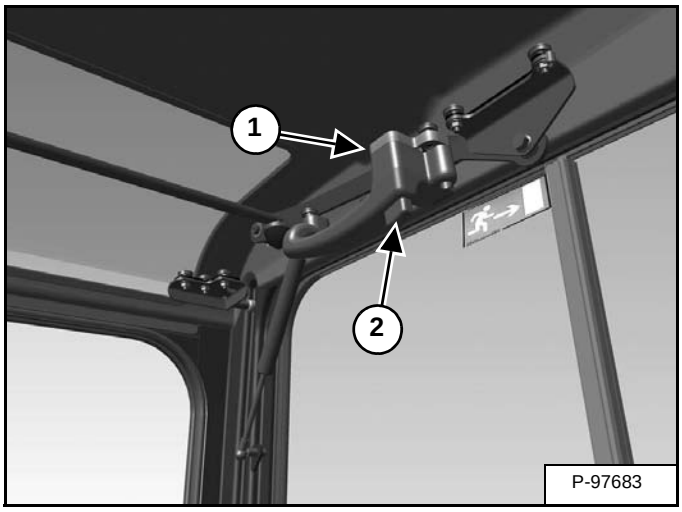
Figure 10-30-6



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 windo while pressing the window latch button (Item 2) **[Figur 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 int 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.

Front Wiper

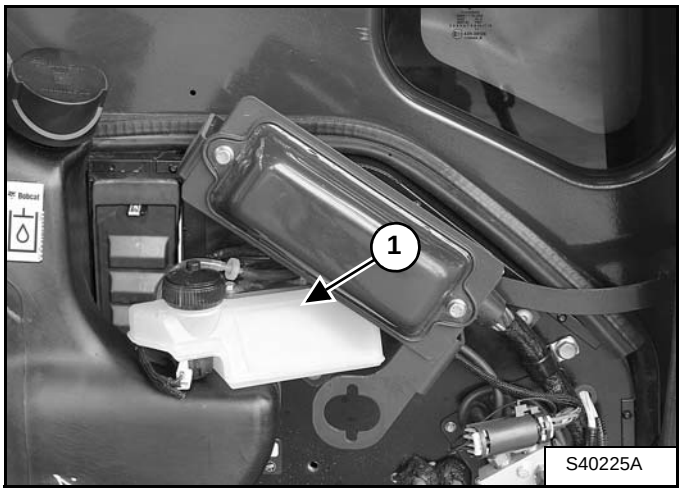
Figure 10-30-8



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

Window Washer Reservoir

Figure 10-30-9

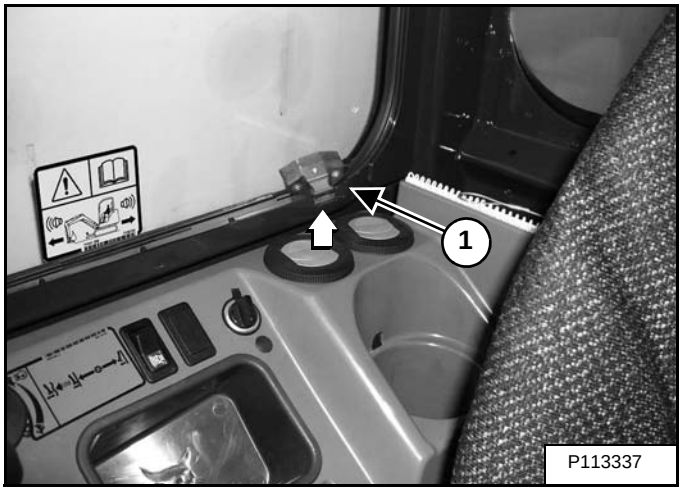


The window washer reservoir (Item 1) **[Figure 10-30-9]** is located under the right side cover.

Right Side Window

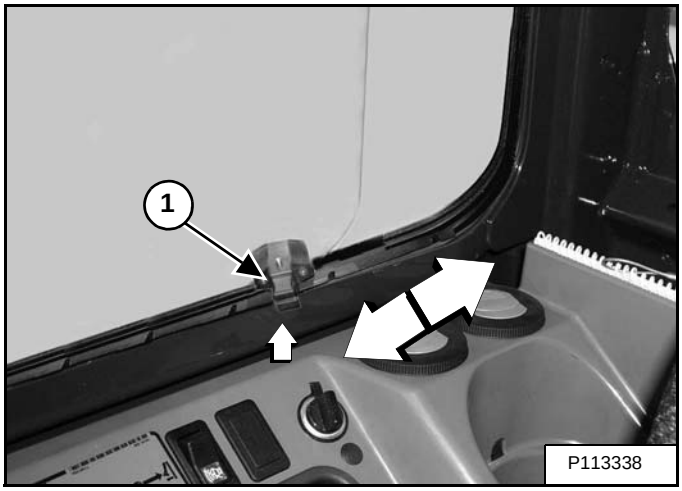
Opening The Right Rear Window

Figure 10-30-10



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

Figure 10-30-11



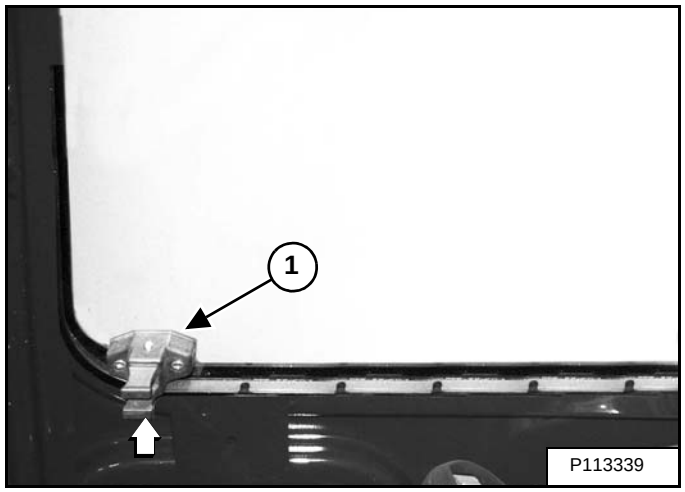
Pull the latch (Item 1) **[Figure 10-30-11]** forward to open the window until the desired stop. Release the bottom latch and snap the lock in place.

Closing The Right Rear Window

Pull up on the bottom latch (Item 1) **[Figure 10-30-10]** and push the latch back to close the window.

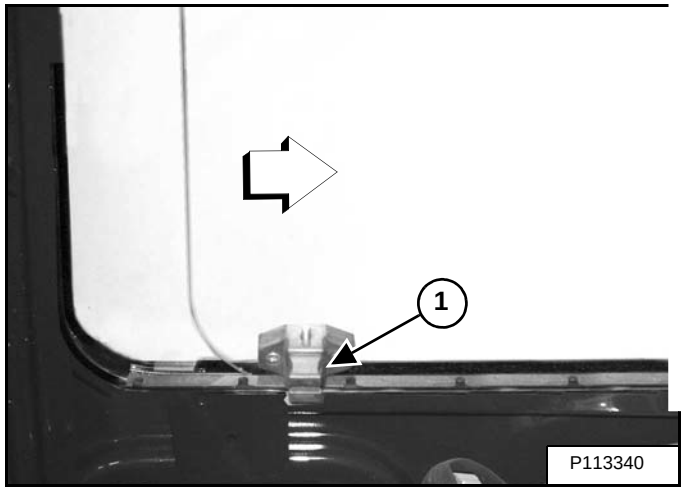
Opening The Right Front Window

Figure 10-30-12



Pull up on the bottom latch (Item 1) **[Figure 10-30-12]** located at the front of the front window.

Figure 10-30-13



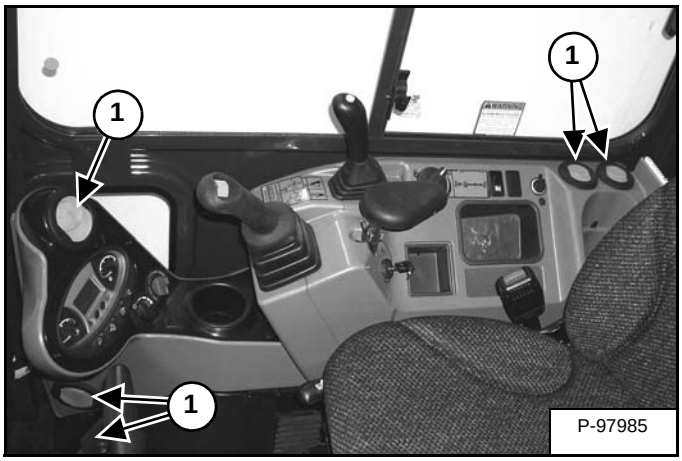
Pull the latch (Item 1) **[Figure 10-30-13]** backward to open the window until the desired stop. Release the bottom latch and snap the lock in place.

Closing The Right Front Window

Pull up on the bottom latch (Item 1) **[Figure 10-30-12]** and push the latch forward to close the window.

Heating And Ventilation Ducting

Figure 10-30-14



The louvers (Item 1) **[Figure 10-30-14]** can be positioned as needed to direct the air flow to various areas in the cab.

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.

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 transpor 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

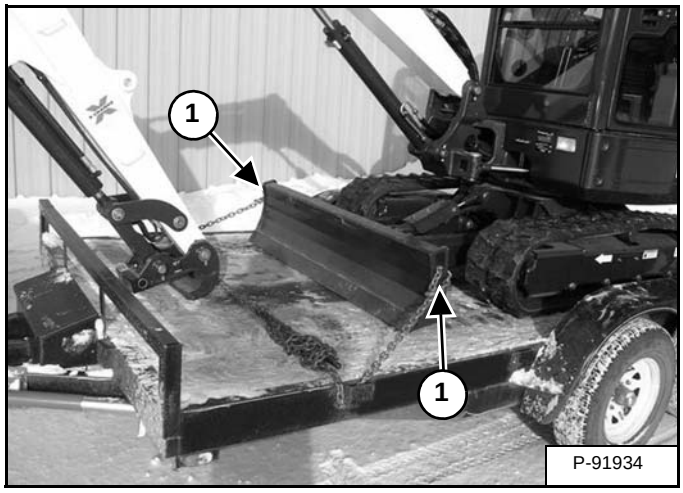
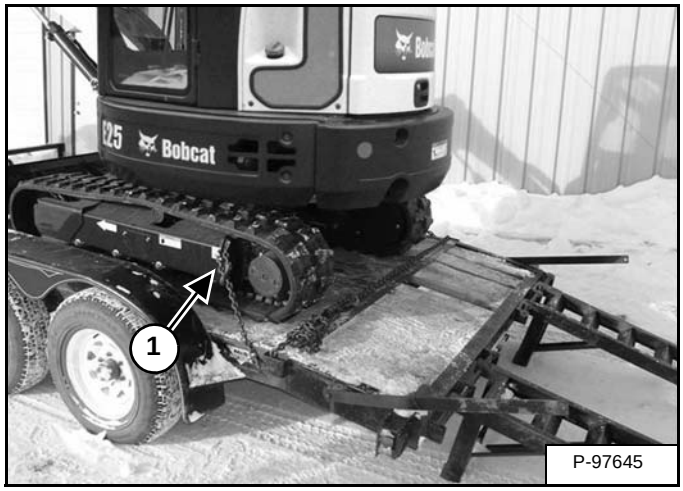


Figure 10-40-3



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.

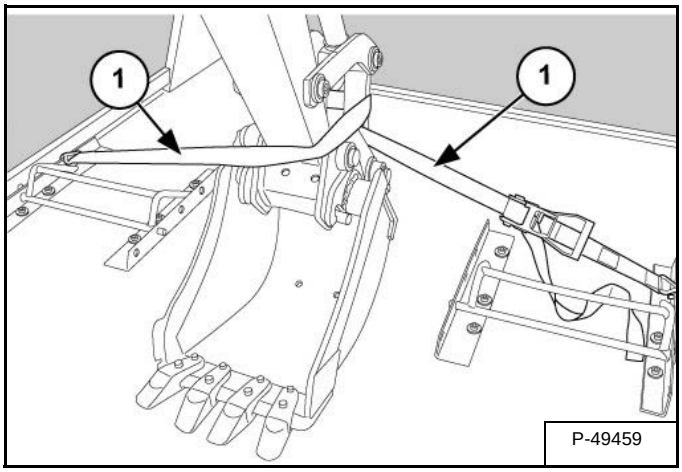
WARNING

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

Figure 10-40-4



When on the transport vehicle, loop the chains through the holes in the mounting frame.

Loop the chain (Item 1) **[Figure 10-40-4]** round the bucket link.

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.

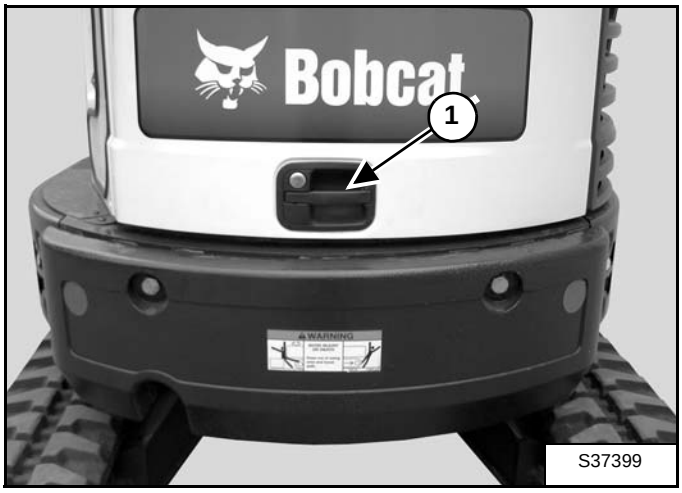
W-2012-0497

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



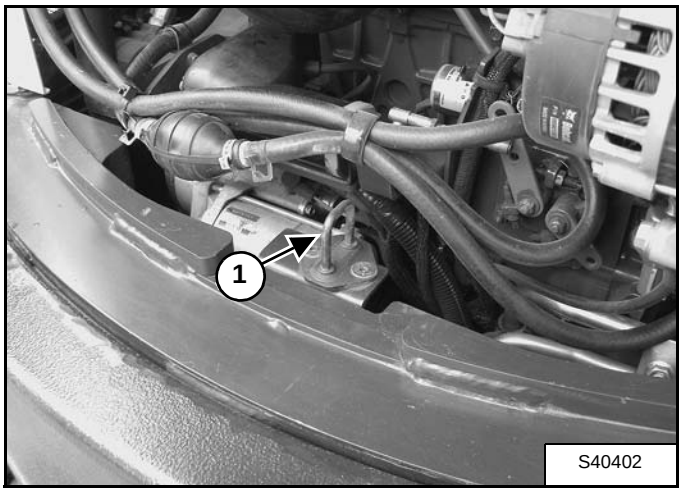
Pull the latch (Item 1) **[Figure 10-50-1]** and open the tailgate.

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.


Bobcat®

RIGHT SIDE COVER

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.

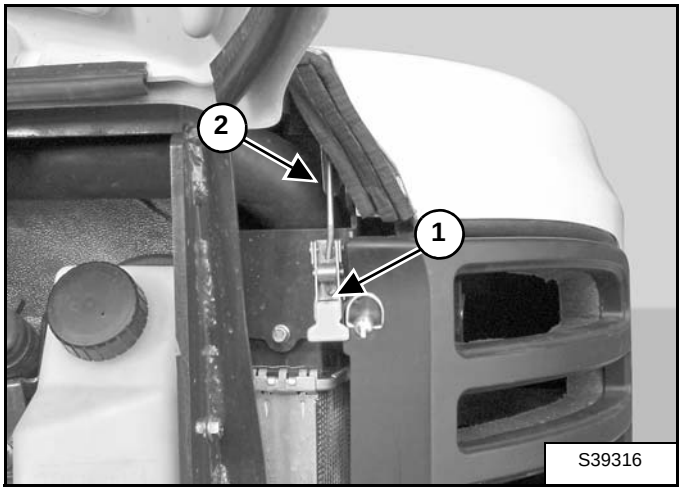
W-2012-0497

WARNING

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

W-2020-1285

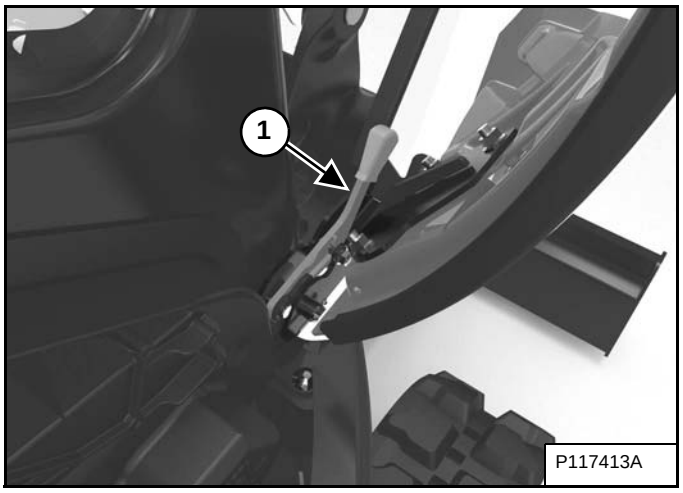
Figure 10-60-1



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

Pull up the lever (Item 1) and remove the latch (Item 2) **[Figure 10-60-1]** from the latch post.

Figure 10-60-2



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

To close the right side cover, lift up on the latch (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 2) an lever (Item 1) **[Figure 10-60-1]**.


Bobcat®

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 conditio of seat belt and mounting hardware. Clean or replace seat belt retractors as needed. Check the control consol lockout lever for proper operation. Clean dirt and debris from moving parts.
- **Motion Alarm and Horn** - Check for proper function (if equipped).
- **Operator Canopy / Cab** - Check the canopy / cab condition and mounting hardware.
- **Operator Cab and Heater Filters** - Clean filters.
- **Indicators and Lights** - Check for correct operation of all indicators and lights. (See the Operations And Safet Manual for the correct procedure.)
- **Safety Signs** - Check for damaged signs (decals). Replace any signs that are damaged. (See the Operations An Safety Manual for the correct procedure.)
- **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 (if equipped).
- **Attachment Coupler** - Check for damage or loose parts (if equipped). (See the Operations And Safety Manual for the correct procedure.)
- **Fuel Filter** - Drain water and sediment.

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.

Every 100 Hours

- **Drive Belts (Alternator)** - Check condition. Replace as needed. Service at first 50 hours, then as scheduled.

SERVICE SCHEDULE (CONT'D)

Maintenance Intervals (Cont'd)

Every 250 Hours Or Every 12 Months

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

Every 500 Hours Or Every 12 Months

- **Cooling System** - Clean debris from radiator, fuel cooler and hydraulic fluid cooler.
- **Hydraulic Filter, Case Drain Filter and Hydraulic Reservoir Breather Cap** - Replace the hydraulic filter, case drain filter and the reservoir breather cap. Service at first 50 hours, then as scheduled.
- **Drive Belts (Alternator)** - 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.

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

Every 24 Months

- **Coolant** - Replace the coolant.

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

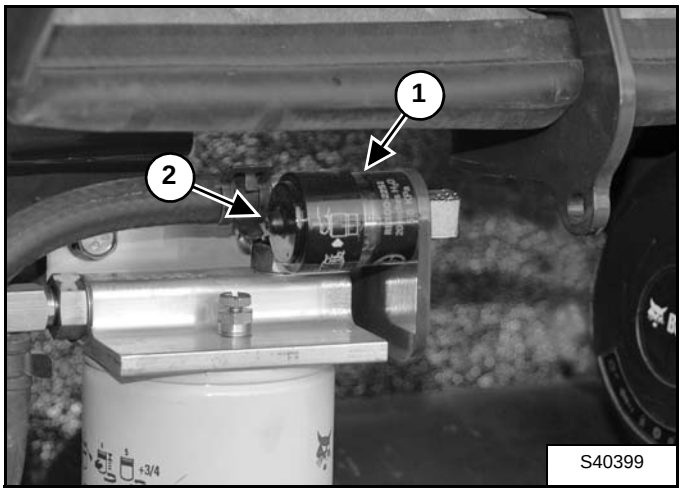
AIR CLEANER SERVICE

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 Opening And Closing on Page 10-50-1.)

Figure 10-80-1



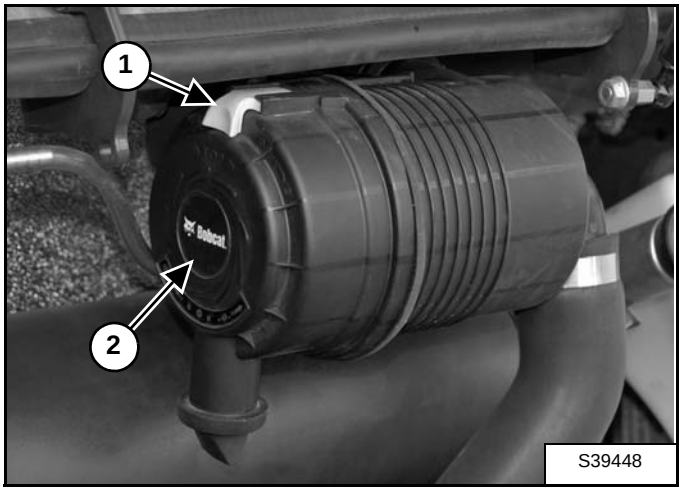
Check the condition indicator (Item 1) **[Figure 10-80-1]**. If the red ring shows in the condition indicator, the filter needs to be replaced.

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

Replacing The Filter Elements

Outer Filter

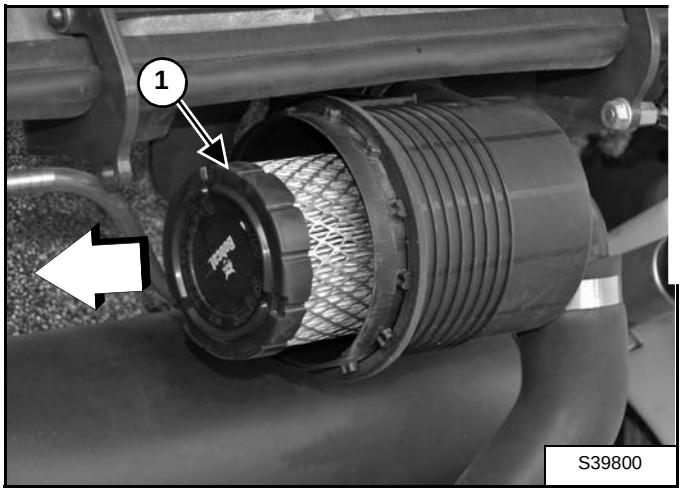
Figure 10-80-2



Open the latch (Item 1) **[Figure 10-80-2]**.

Remove and clean the dust cover (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.

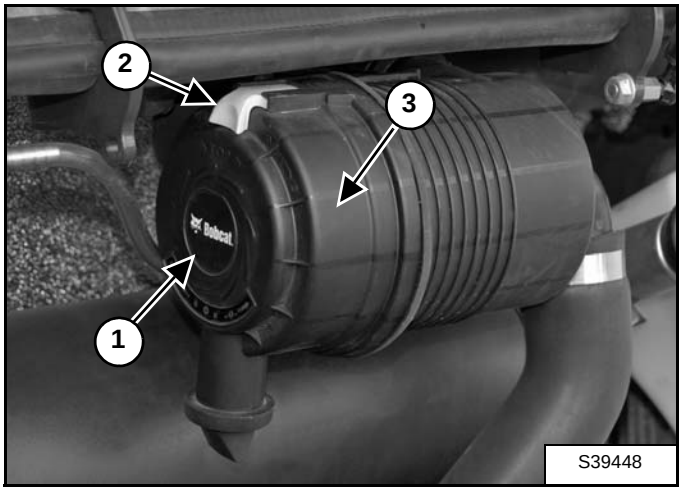
Clean the housing and the seal surface. DO NOT use compressed air.

Install a new filter.

Replacing The Filter Elements (Cont'd)

Outer Filter (Cont'd)

Figure 10-80-4



Install the dust cover (Item 3) **[Figure 10-80-4]** by turning cover clockwise.

Make sure the dust cap (Item 1) is installed and engage the latch (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.

Start the engine. Run at full rpm, then reduce engine speed. Stop the engine.

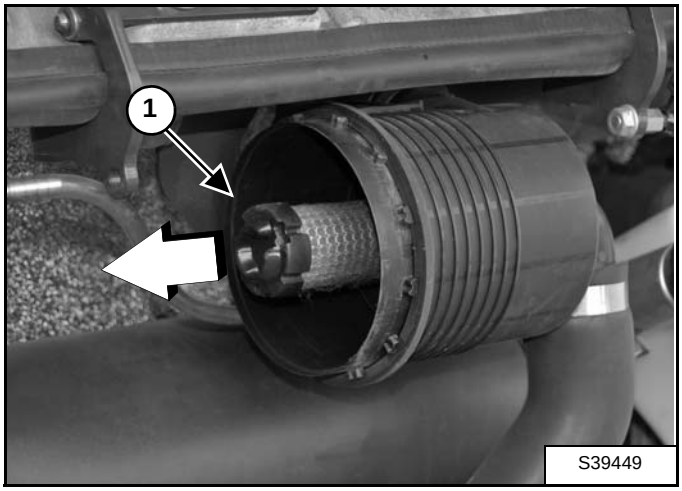
If the red ring (Item 1) **[Figure 10-80-1]** shows in the condition indicator, replace the inner filter.

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 condition indicator. Start the engine and run 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 cover, 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.

ENGINE COOLING SYSTEM

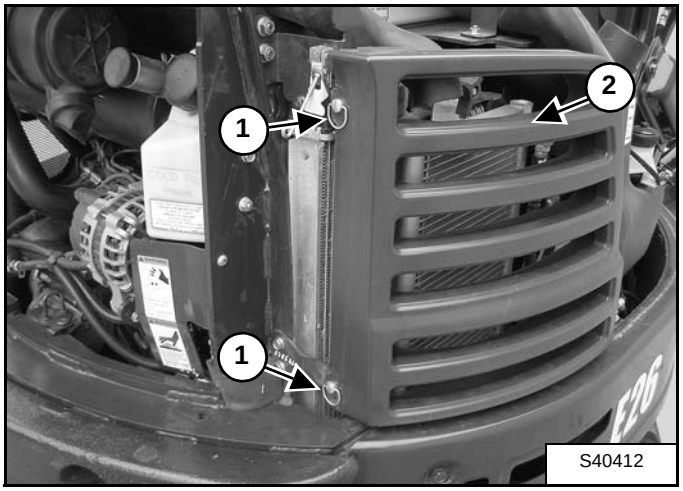
Check the cooling system every day to prevent over heating, loss of performance or engine damage. (See Maintenance Intervals on Page 10-70-1.)

Cleaning

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

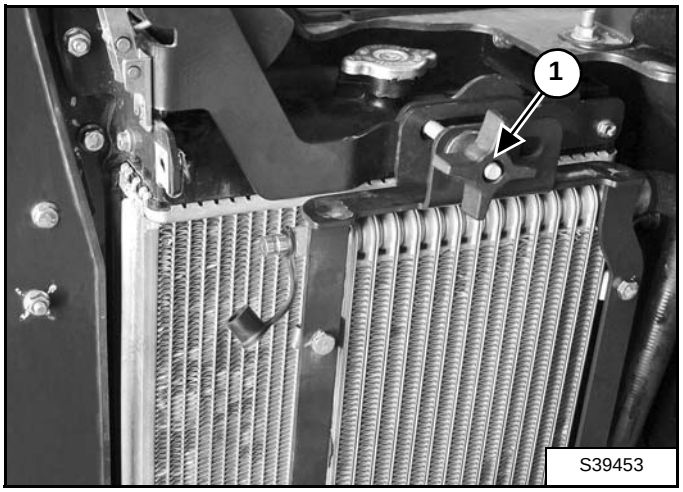
NOTE: Allow the cooling system and engine to cool before servicing or cleaning the cooling system.

Figure 10-90-1



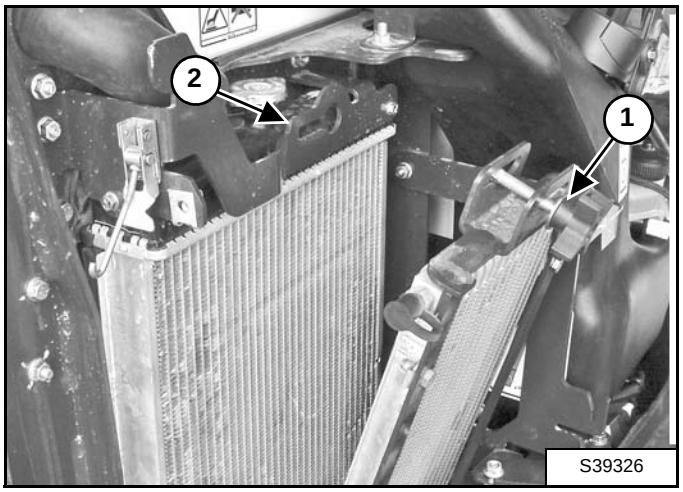
Turn the two quarter turn fasteners (Item 1) and remove the rear side cover (Item 2) **[Figure 10-90-1]**.

Figure 10-90-2



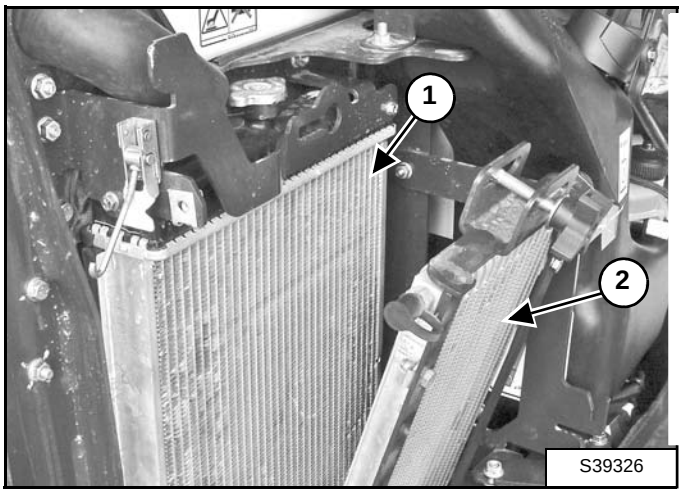
Loosen the knob (Item 1) **[Figure 10-90-2]**. Slide the knob toward the rear of the machine.

Figure 10-90-3



Slide the knob (Item 1) out of the radiator mounting bracket (Item 2) **[Figure 10-90-3]**. Be careful not to damage fins.

Figure 10-90-4



Use air pressure or water pressure to clean the radiator (Item 1) and oil cooler (Item 2) **[Figure 10-90-4]**. Be careful not to damage fins when cleaning.

Position the knob (Item 1) so it fits into the radiator mount (Item 2) **[Figure 10-90-3]**.

Slide the knob (Item 1) toward the rear of the machine until it is fully seated in the slots of the mounting brackets. Tighten the knob (Item 1) **[Figure 10-90-2]**. Be careful not to damage fins.

Reinstall the rear side cover (Item 2) and turn the quarter turn fasteners (Item 1) **[Figure 10-90-1]** to secure the rear side cover.

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

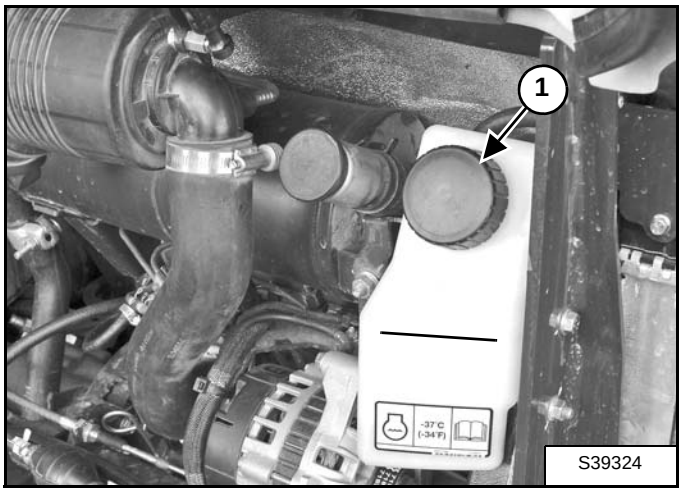
Wear safety glasses to prevent eye injury when any of the following conditions exist:

- **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 Opening And Closing on Page 10-50-1.)

Figure 10-90-5



Check the coolant level in the coolant recovery tank (Item 1) **[Figure 10-90-5]**.

The coolant level must be filled to the COLD FILL line marked on the coolant recovery tank.

NOTE: The cooling system is factory filled with propylene glycol (purple colour). 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

Removing And Replacing Coolant

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

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

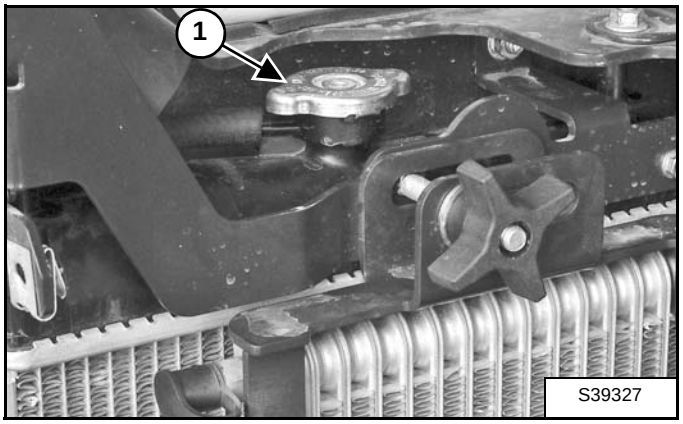
⚠ WARNING

AVOID BURNS

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

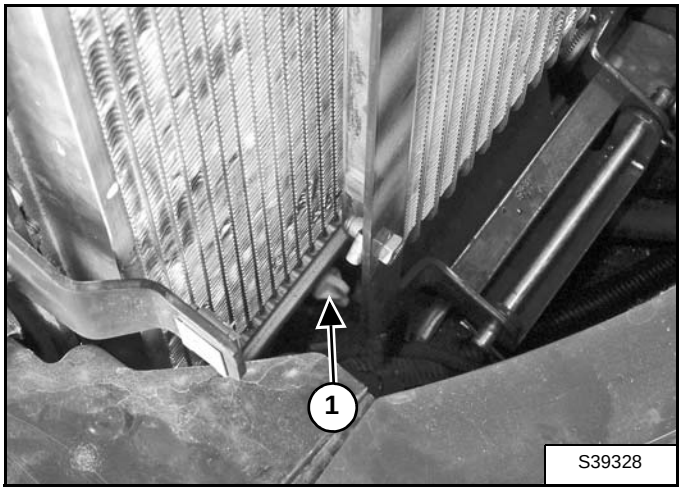
W-2070-1203

Figure 10-90-6



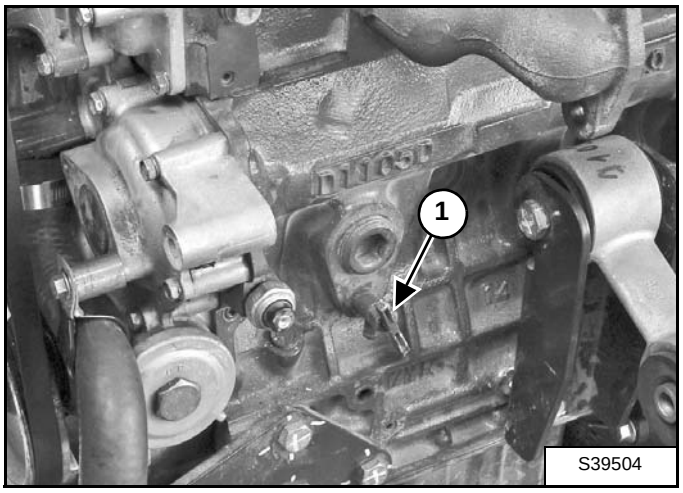
When the engine is cool, loosen and remove the coolant fill cap (Item 1) **[Figure 10-90-6]**.

Figure 10-90-7



Install a hose on the drain valve at the bottom of the radiator. Open the drain valve (Item 1) **[Figure 10-90-7]** and drain the coolant into a container.

Figure 10-90-8



Install a hose on the drain valve located at the back of the engine block. Open the drain valve (Item 1) **[Figure 10-90-8]** and drain the coolant into a container.

NOTE: Engine is removed for photo clarity.

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

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

Mix the coolant in a separate container. (See Capacitie on Page SPEC-10-12.)

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

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

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

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

Add premixed coolant until the level is correct. Install the coolant fill cap.

Run the engine until it is at operating temperature. Stop the engine. Check the coolant level when cool. Add coolant as needed. Install the coolant fill cap.

Add coolant to the recovery tank as needed.

Close the tailgate.


Bobcat®

FUEL SYSTEM

Fuel Specifications

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

The following is a suggested blending guideline which should prevent fuel gelling problems during cold temperatures:

TEMP. C° (F°)	NO. 2	NO. 1
Above -9° (+15°)	100%	0%
Down to -29°C (-20°)	50%	50%
Below -29°C (-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. B5 blended diesel fuel must meet ASTM D975 (US Standard) or EN590 (EU Standard) specifications.

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2063-0807

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2103-0508

Biodiesel Blend Fuel

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

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

Apply the following guidelines if biodiesel blend fuel i used:

- Ensure the fuel tank is as full as possible at all time 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 surface immediately.
- Drain all water from the fuel filter daily before operating the machine.
- Do not exceed engine oil change interval. Extended oil change intervals can cause engine damage.
- Before machine storage; drain the fuel tank, refill with 100% petroleum diesel fuel, add fuel stabilizer and run the engine for at least 30 minutes.

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

Filling The Fuel Tank

WARNING

AVOID INJURY OR DEATH

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

W-2063-0807

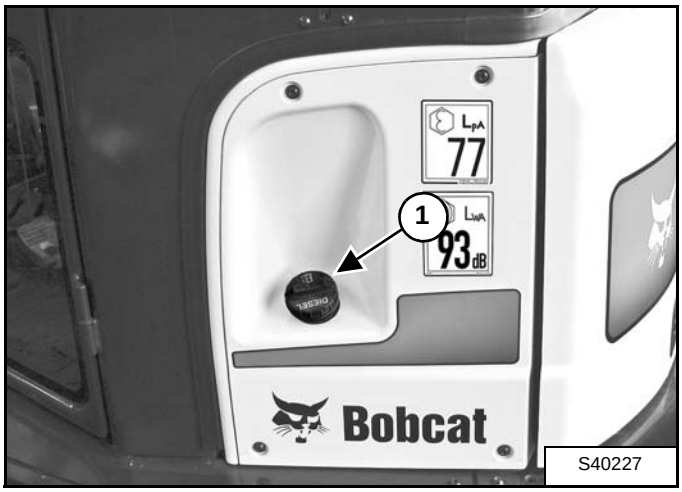
WARNING

AVOID INJURY OR DEATH

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

W-2103-0508

Figure 10-100-1



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

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

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.

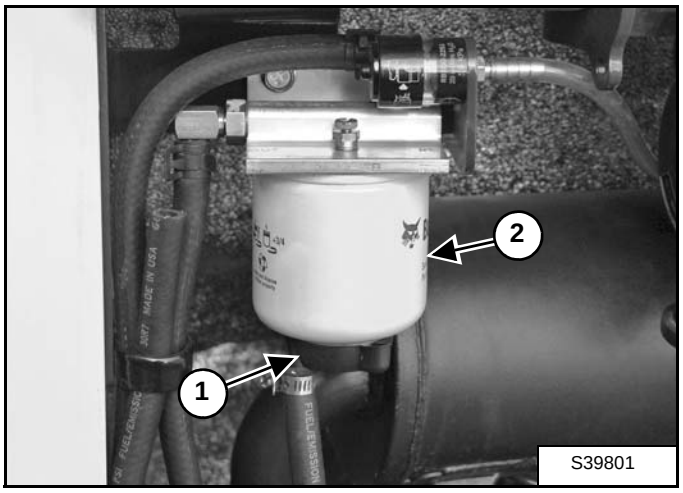
See the service schedule for the service interval when to remove water from or replace the fuel filter. (See Maintenance Intervals on Page 10-70-1.)

Fuel Filter

Removing Water

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

Figure 10-100-2



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

Clean up any spilled fuel.

Replacing Elements

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

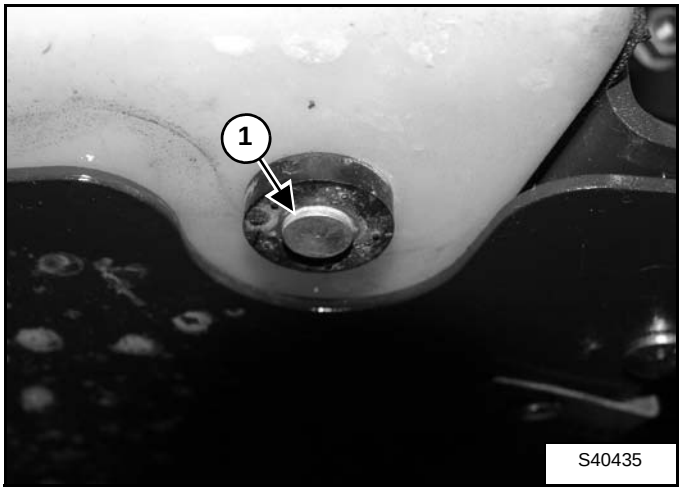
Clean the area around the filter housing. Put clean oil on the seal of the new filter. Install the fuel filter and hand tighten.

Remove the air from the fuel system. (See Removing Air From The Fuel System on Page 10-100-4.)

Draining The Fuel Tank

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

Figure 10-100-3



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

Drain the fuel into the container.

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

Reinstall the drain plug.

WARNING

AVOID INJURY OR DEATH

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

W-2072-EN-0909

Removing Air From The Fuel System

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

Figure 10-100-4

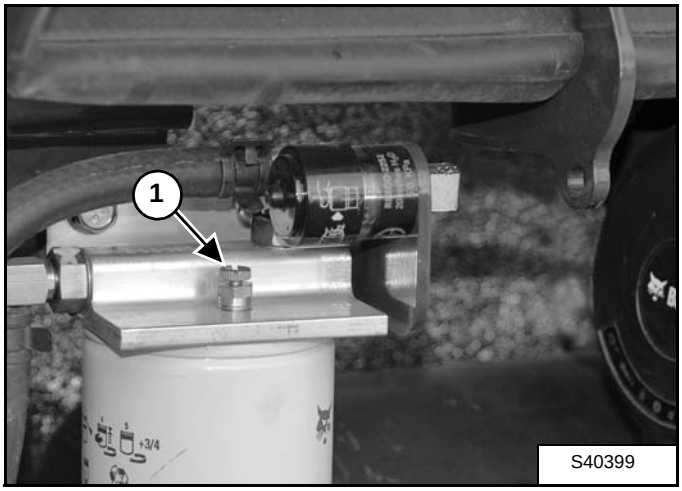
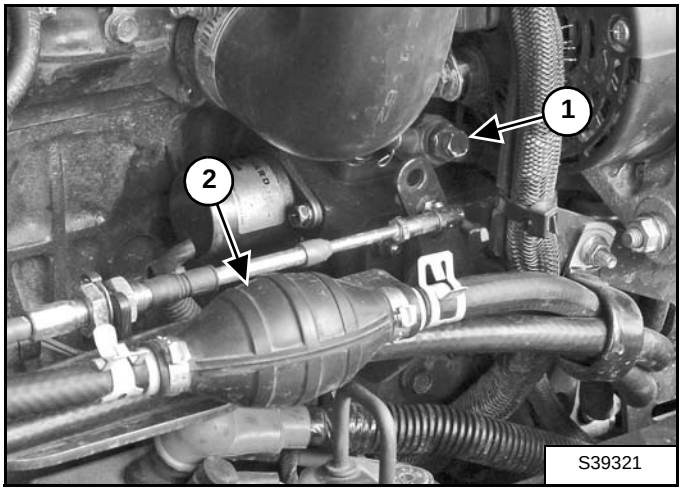


Figure 10-100-5



Open the fuel filter vent (Item 1) **[Figure 10-100-4]** and operate the hand pump (priming bulb) (Item 2) **[Figure 10-100-5]** until the fuel flows from the vent with no air bubbles.

Close the vent (Item 1) **[Figure 10-100-4]**.

Start the engine. It can be necessary to open the vent (Item 1) **[Figure 10-100-5]** (at the fuel injection pump) briefly until the engine runs smoothly.

⚠ WARNING

AVOID INJURY OR DEATH

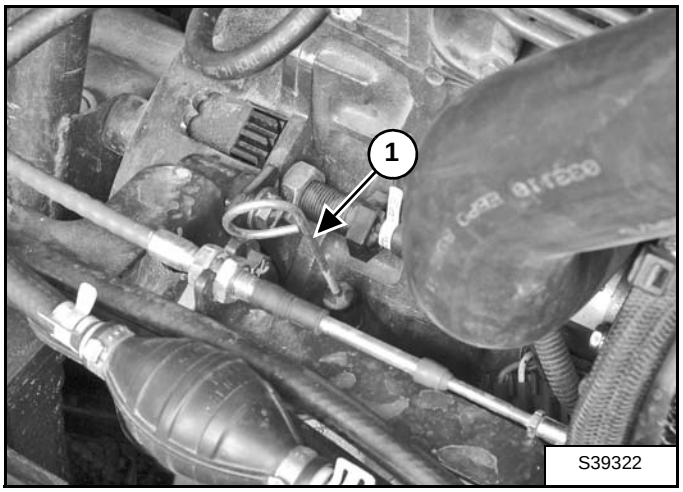
Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical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

W-2072-EN-0909

ENGINE LUBRICATION SYSTEM

Checking And Adding Engine Oil

Figure 10-110-1



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

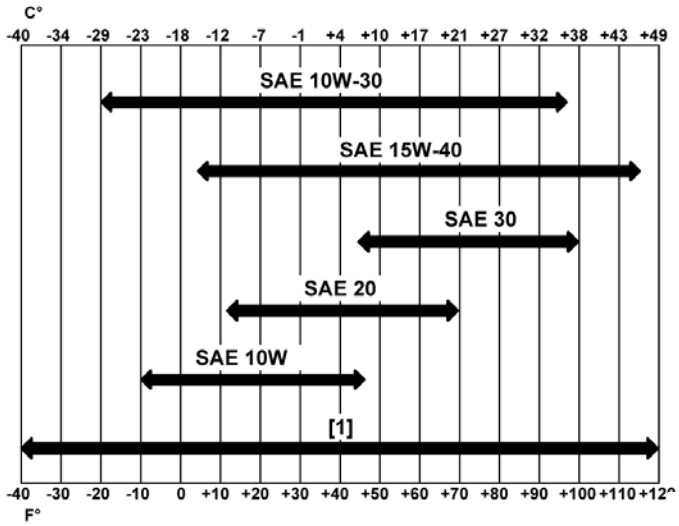
Keep the oil level between the marks on the dipstick.

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

Engine Oil Chart

Figure 10-110-2

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



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

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

Use good quality engine oil that meets API Servic Classification of CI-4 or better **[Figure 10-110-2]**.

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2103-0508

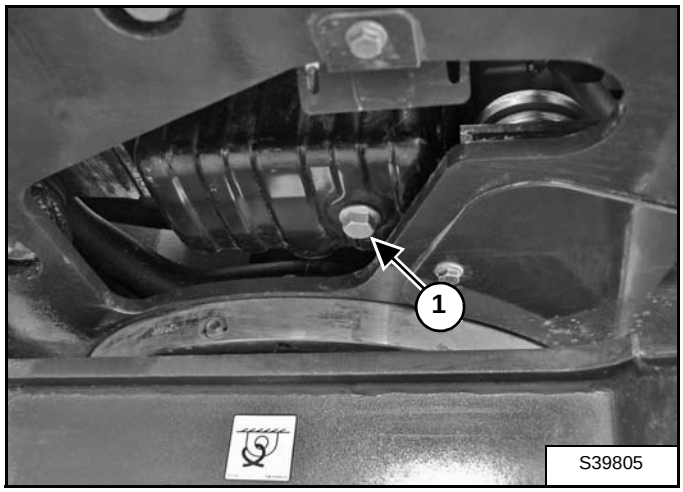
Removing And Replacing Oil And Filter

See the SERVICE SCHEDULE for the service interval for replacing the engine oil and filter. (See Maintenance Intervals 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.)

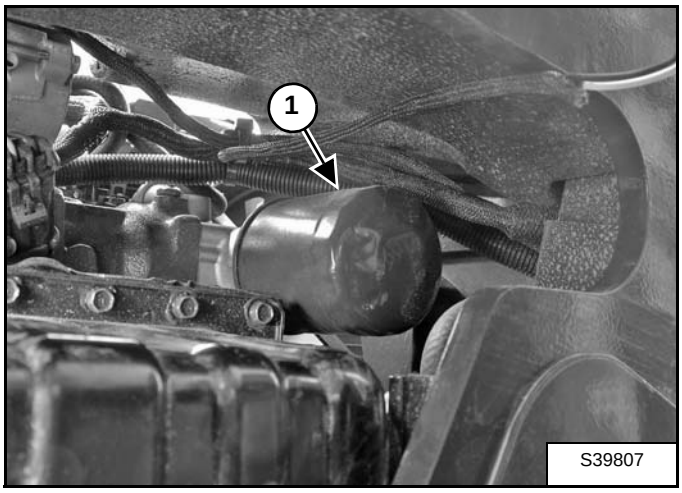
Figure 10-110-3



Place a container under the oil pan. Remove the drain plug (Item 1) **[Figure 10-110-3]** from the bottom of the engine oil pan.

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

Figure 10-110-4

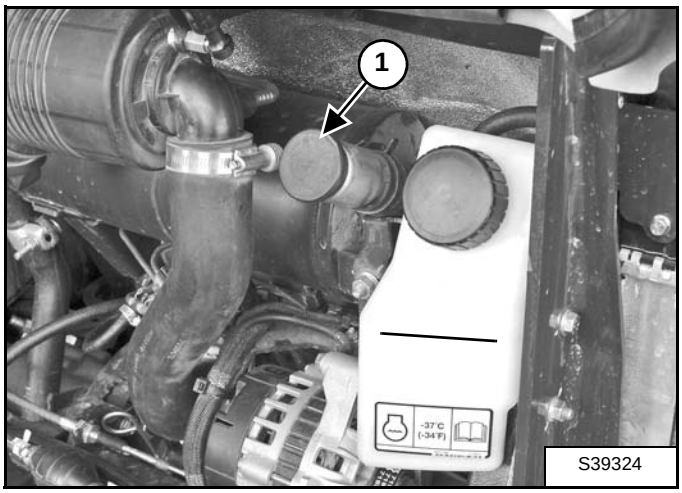


Remove the oil filter (Item 1) **[Figure 10-110-4]** and clean the filter housing surface.

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

Install and tighten the drain plug (Item 1) **[Figure 10-110-3]**.

Figure 10-110-5



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

Put oil in the engine. (See Checking And Adding Engine Oil on Page 10-110-1.)

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

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.

HYDRAULIC SYSTEM

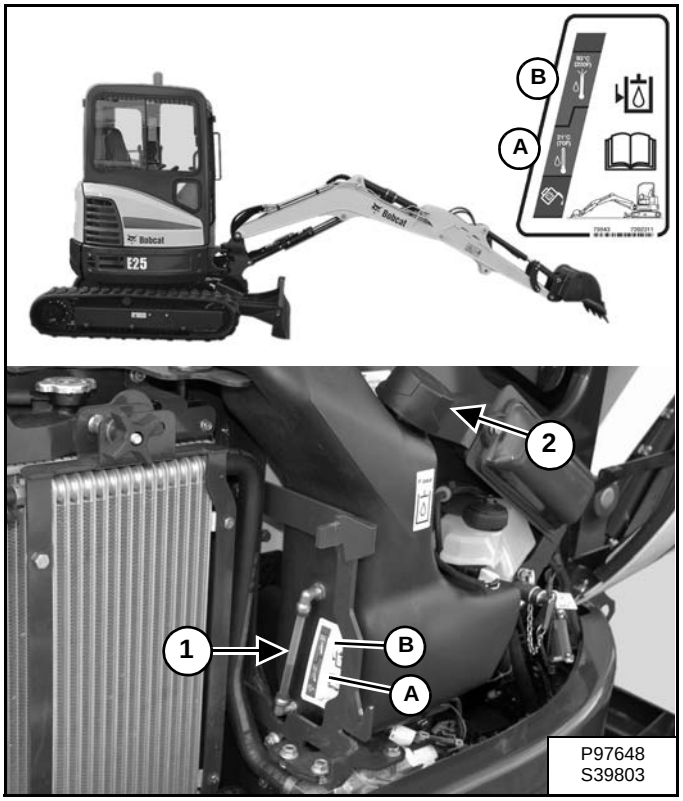
Checking And Adding Hydraulic Fluid

Put the machine on a flat level surface.

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

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

Figure 10-120-1



Park the machine in the position shown **[Figure 10-120-1]**. (The preferred method is to check the hydraulic fluid when it is cold.)

Check the hydraulic fluid level, it must be visible in the sight gauge (Item 1) **[Figure 10-120-1]**. The decal on the hydraulic tank shows the correct fill level.

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

Clean the surface around the reservoir cap and remove the cap from the reservoir (Item 2) **[Figure 10-120-1]**.

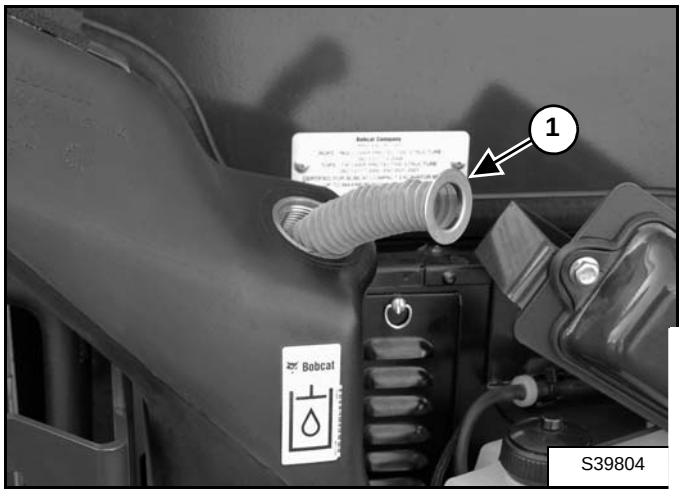
WARNING

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 10-120-2



Check the condition of the fill strainer screen (Item 1 **[Figure 10-120-2]**. 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 th sight gauge.

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

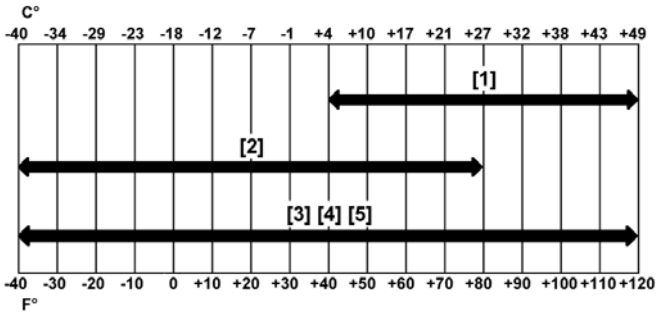
Install the cap.

Close the right side cover and tailgate.

Hydraulic / Hydrostatic Fluid Chart

Figure 10-120-3

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



TEMPERATURE RANGE ANTICIPATED DURING MACHINE USE

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

Install the oil fill cap.

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 chart for the correct service interval. (See Maintenance Intervals on Page 10-70-1.)

Figure 10-120-4



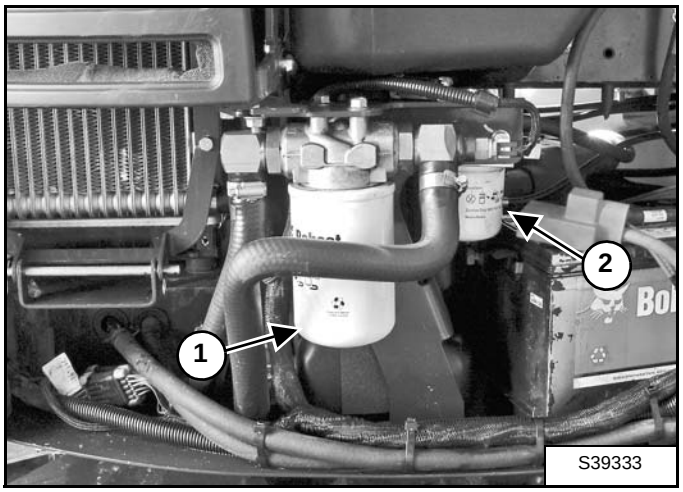
For easier access to change the hydraulic filter, remove the lower right side panel.

Remove the four bolts (Item 1) and the side panel (Item 2) **[Figure 10-120-4]**. Remove the side panel.

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

Removing And Replacing Hydraulic Filters (Cont'd)

Figure 10-120-5



Remove the hydraulic filter (Item 1) **[Figure 10-120-5]**.

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.

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 chart for the correct service interval. (See Maintenance Intervals on Page 10-70-1.)

Remove the case drain filter (Item 2) **[Figure 10-120-5]**.

Clean the housing where the filter gasket makes contact.

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

Reinstall the lower right side cover.

Close the right side cover.

Removing And Replacing Hydraulic Fluid

See the chart for the correct service interval. (See Maintenance Intervals on Page 10-70-1.)

⚠ WARNING

AVOID INJURY OR DEATH

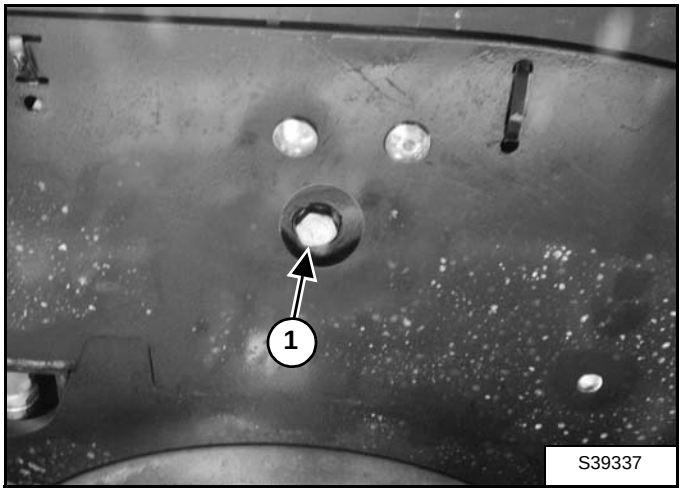
Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical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

W-2072-EN-0909

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

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

Figure 10-120-6



The hydraulic fluid drain plug (Item 1) **[Figure 10-120-6]** is located below right side of the upperstructure.

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

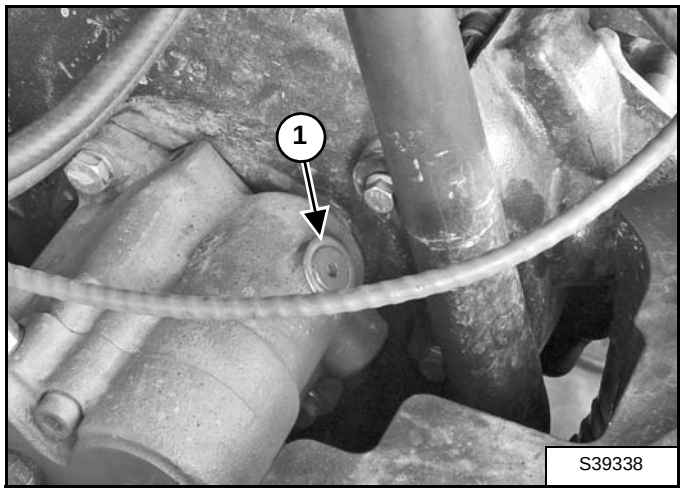
Drain the fluid into a container.

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

Install the plug (Item 1) **[Figure 10-120-6]**.

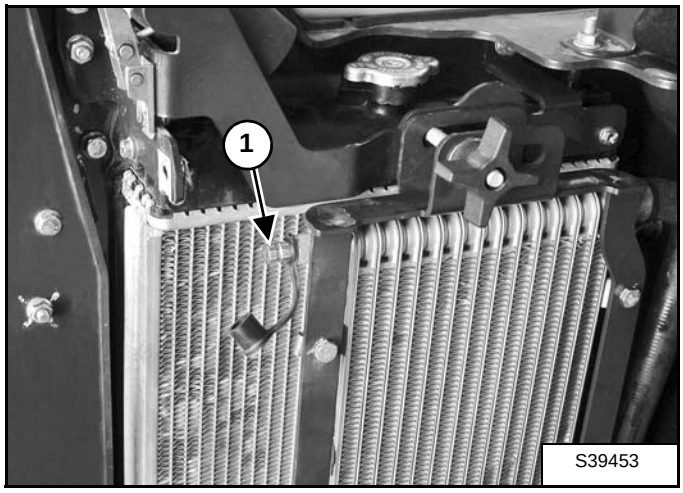
Add fluid to the reservoir. (See Checking And Adding Hydraulic Fluid on Page 10-120-1.)

Figure 10-120-7



With the engine OFF, loosen the plug (Item 1) **[Figure 10-120-7]** 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.**

Figure 10-120-8



There is also a port (Item 1) **[Figure 10-120-8]** on the hydraulic cooler for bleeding air. Install a diagnostic coupler and hose on this fitting 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.

LUBRICATION OF THE HYDRAULIC EXCAVATOR

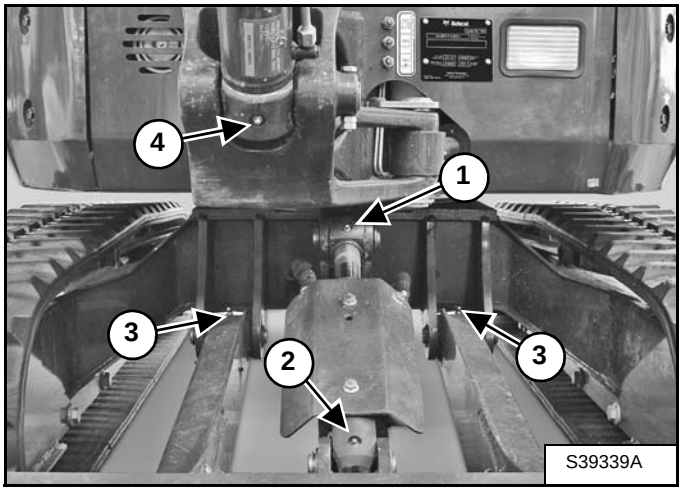
Lubrication Locations

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.

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

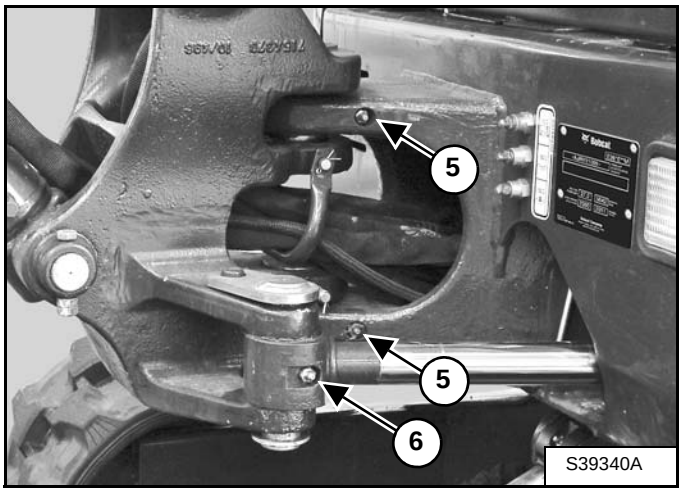
Figure 10-130-1



Ref Description (# of Fittings)

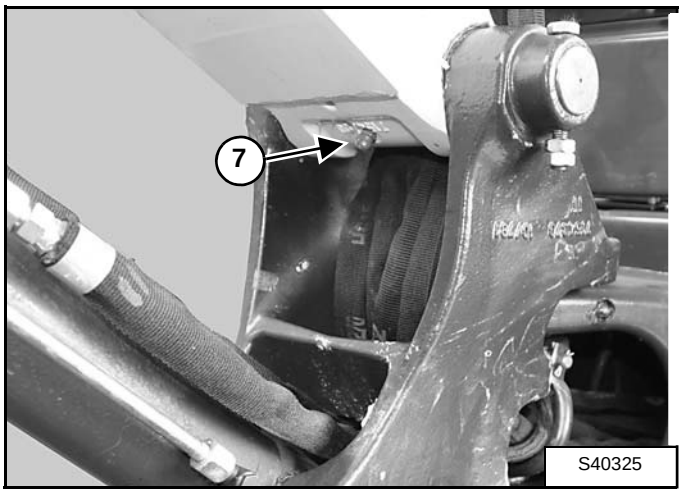
1. Blade Cylinder Rod End (1) **[Figure 10-130-1]**.
2. Blade Cylinder Base End (1) **[Figure 10-130-1]**.
3. Blade Pivots (2) **[Figure 10-130-1]**.
4. Boom Cylinder Base End (1) **[Figure 10-130-1]**.

Figure 10-130-2



5. Boom Swing Pivot (3) **[Figure 10-130-2]**.
6. Boom Swing Cylinder Rod End (1) **[Figure 10-130-2]**.

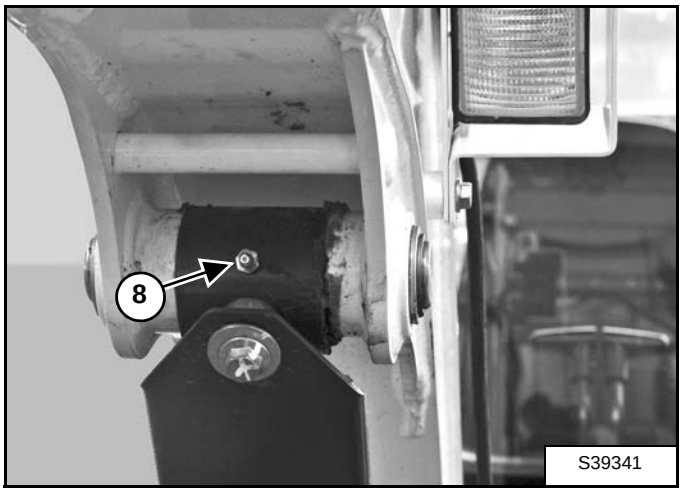
Figure 10-130-3



7. Boom Pivot (1) **[Figure 10-130-3]**.

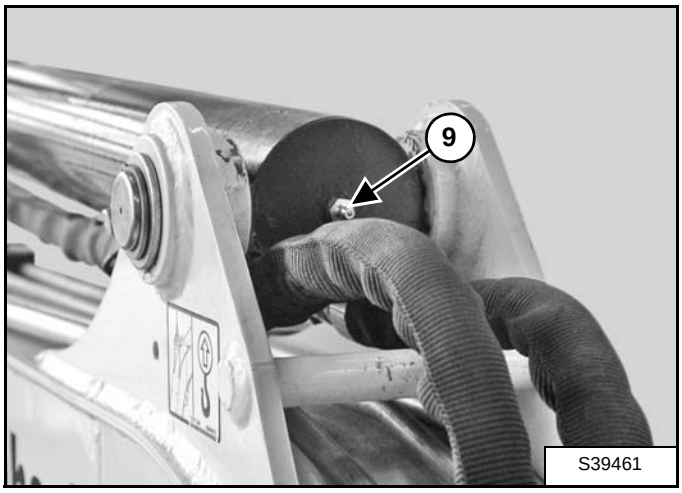
Lubrication Locations (Cont'd)

Figure 10-130-4



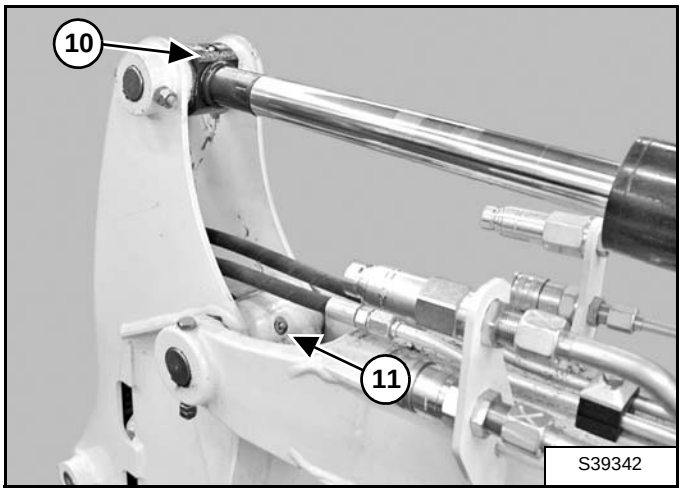
8. Boom Cylinder Rod End (1) **[Figure 10-130-4]**.

Figure 10-130-5



9. Arm Cylinder Base End (1) **[Figure 10-130-5]**.

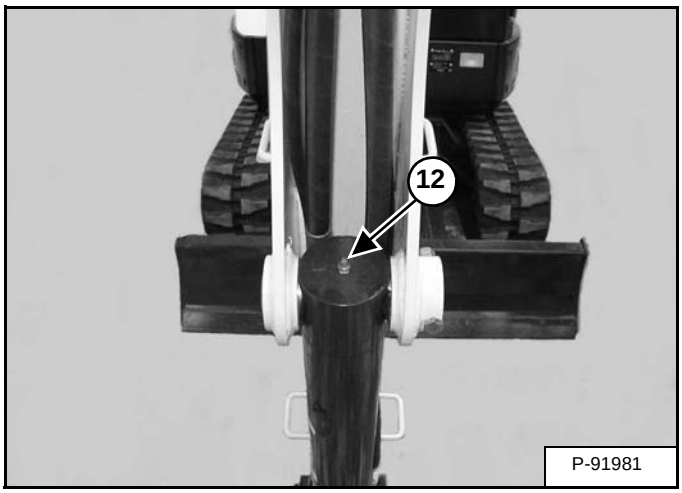
Figure 10-130-6



10. Arm Cylinder Rod End (1) **[Figure 10-130-6]**.

11. Arm Pivot (1) **[Figure 10-130-6]**.

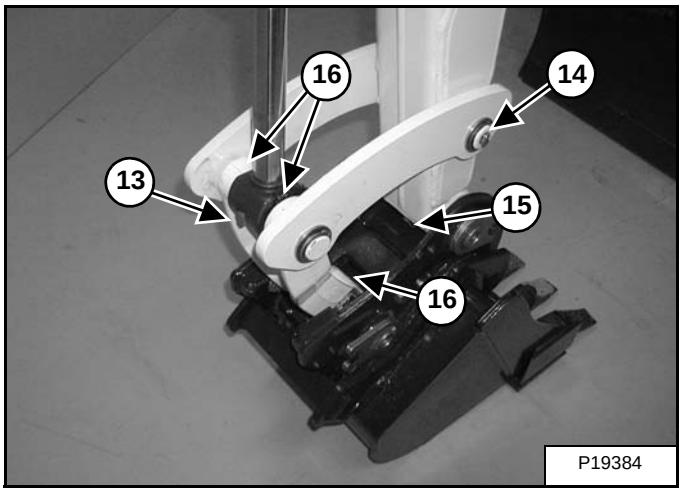
Figure 10-130-7



12. Bucket Cylinder Base End (1) **[Figure 10-130-7]**.

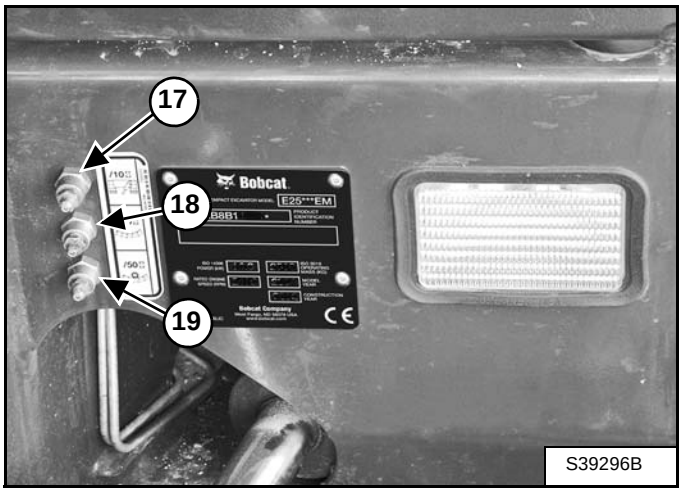
Lubrication Locations (Cont'd)

Figure 10-130-8



13. Bucket Cylinder Rod End (1) **[Figure 10-130-8]**.
14. Bucket Link Pin (1) **[Figure 10-130-8]**.
15. Bucket Pivot (1) **[Figure 10-130-8]**.
16. Bucket Link (3) **[Figure 10-130-8]**.

Figure 10-130-9



17. Boom Swing Cylinder Base (1) **[Figure 10-130-9]**.

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

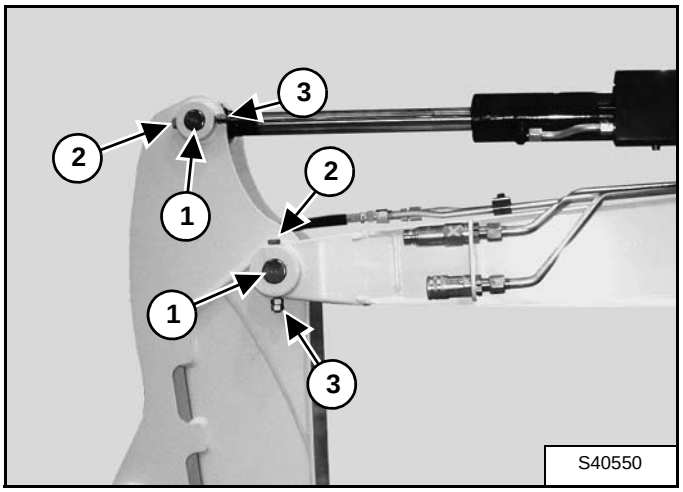
18. Swing Circle (1) **[Figure 10-130-9]**.
19. Swing Pinion (1) **[Figure 10-130-9]**. (Install three t four pumps of grease then rotate the upperstructur 90°. Install three to four pumps of grease and agai rotate the upperstructure 90°. Repeat this until th swing pinion has been greased at four positions.)


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PIVOT PINS

Inspection And Maintenance

Figure 10-140-1



The pivots and cylinders (Item 1) have a large pin held in position with a bolt (Item 2) and double nuts (Item 3) **[Figure 10-140-1]** securing the pin.

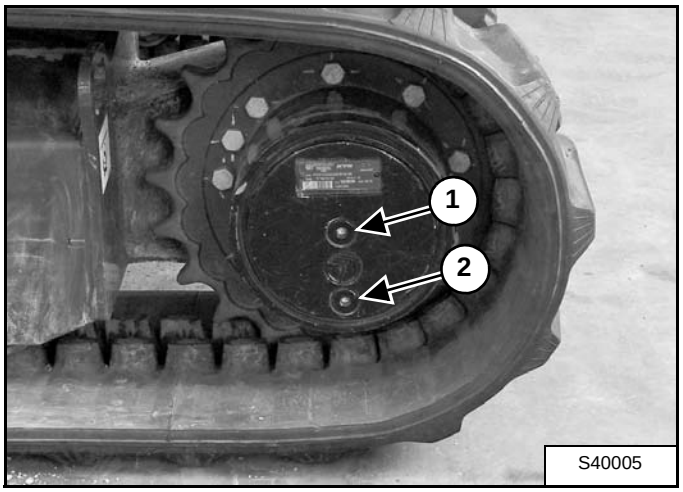
The the two nuts (Item 3) are used as jam nuts to hold the bolt (Item 2) without tightening the bolt (Item 2) to the pin boss. After the nuts (Item 3) are tightened together, the bolt (Item 2) **[Figure 10-140-1]** should be free to spin.


Bobcat®

TRAVEL MOTOR

Checking And Adding Oil

Figure 10-150-1



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

Remove the plug (Item 1) **[Figure 10-150-1]**. 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. (See Capacities on Page SPEC-10-12.)

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 (Items 1 and 2) **[Figure 10-150-1]** 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 10-150-1]**. Add lubricant through the center plug hole until the lube leve is at the bottom edge of the hole. (See Capacities o Page SPEC-10-12.)

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

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


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EMERGENCY EXIT

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

Right Rear Side Window

Figure 10-160-1



Exit through the window **[Figure 10-160-1]**.

Front Window

Figure 10-160-2



Open the front window and exit **[Figure 10-160-2]**.

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


Bobcat®

SEAT BELT

Inspection And Maintenance

WARNING

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

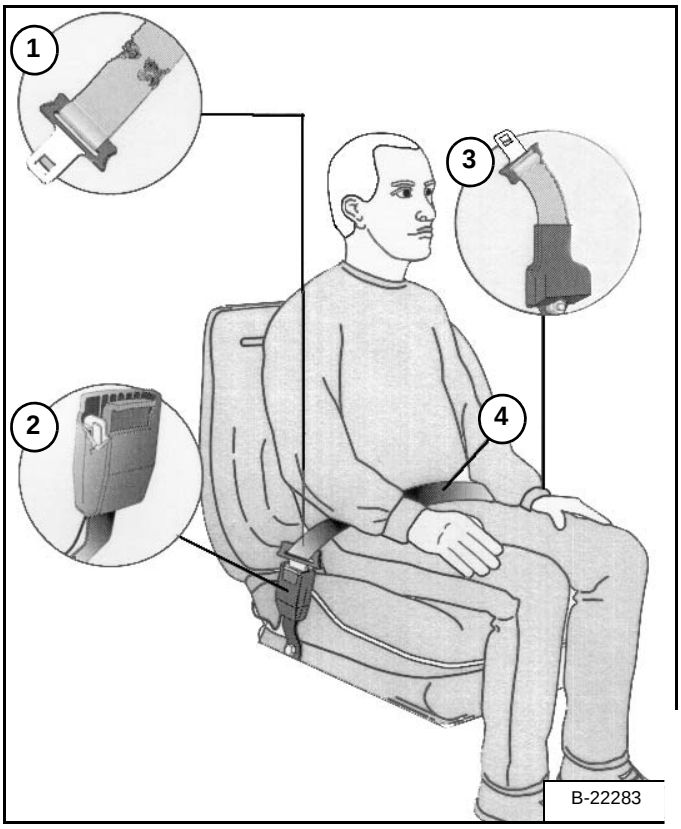
W-2466-0703

Check the seat belt daily for correct function.

Inspect the seat belt system thoroughly 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 10-170-1



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

1. Check the webbing. If the system is equipped with retractor, pull the webbing completely out and inspec 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.

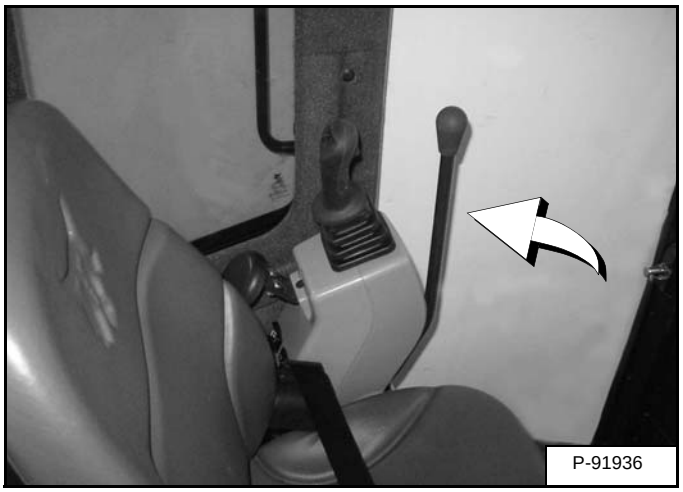
4. Check webbing in areas exposed to ultraviolet (UV) rays from the sun or extreme dust or dirt. If the original color of the webbing in these areas is extremely faded and / or the webbing is packed with dirt, the webbing strength may have deteriorated.


Bobcat®

CONTROL CONSOLE LOCKOUTS

Inspection And Maintenance

Figure 10-180-1



When the left console is raised **[Figure 10-180-1]**, 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 10-180-1]**.

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.


Bobcat®

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-10-9.)


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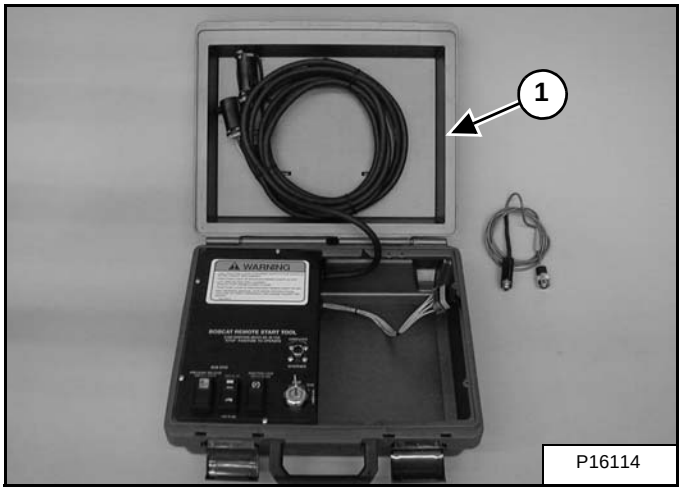
REMOTE START TOOL KIT - MEL1563

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 10-200-1

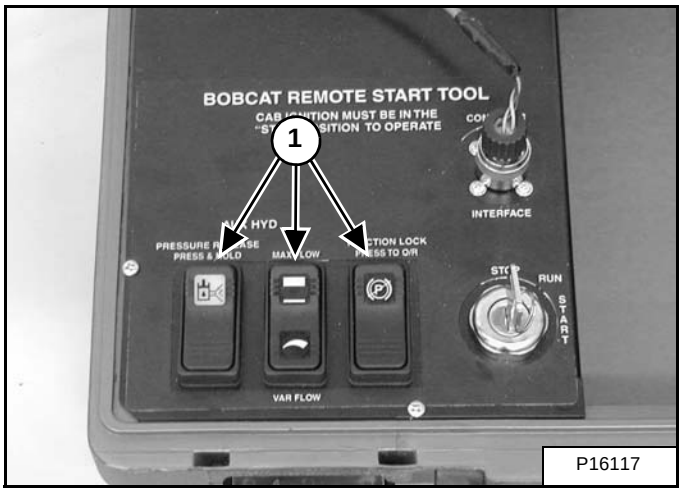


The Remote Start Tool (Item 1) **[Figure 10-200-1]** is used for excavators.

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.

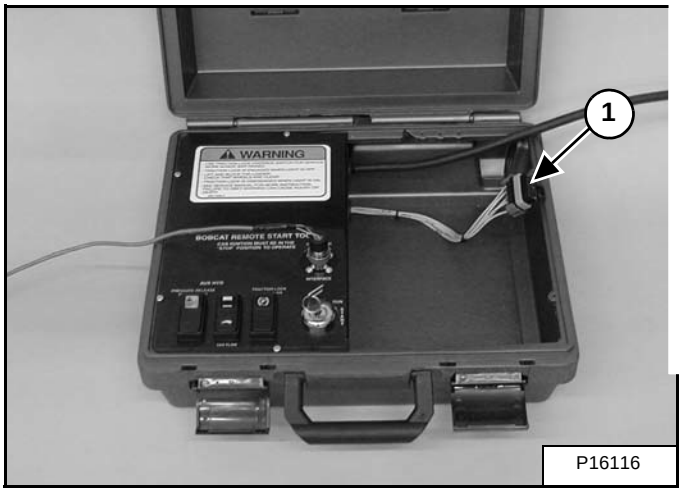
Figure 10-200-2



The three function buttons (Item 1) **[Figure 10-200-2]** are non-functional for excavators.

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

Figure 10-200-3

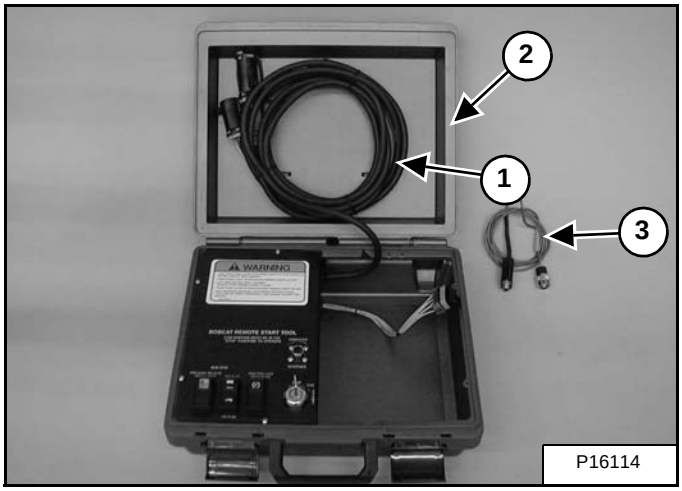


The 10-pin rectangular connector (Item 1) **[Figure 10-200-3]** is not used for an excavator application.

REMOTE START TOOL - MEL1563 (CONT'D)

Service Tool Harness Control - MEL1565

Figure 10-200-4



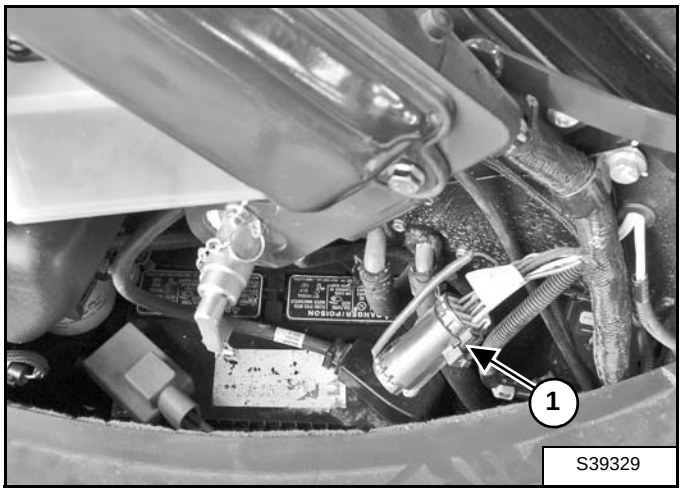
The Service Tool Harness Control (Item 1) is used to connect the Remote Start Tool (Item 2) **[Figure 10-200-4]** to the electrical system on the excavator.

The Service Tool Harness Communicator (Item 3) **[Figure 10-200-4]** is used to connect the Remote Start Tool to the Service PC.

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

Open the right side cover.

Figure 10-200-5



Remove the plug (Item 1) **[Figure 10-200-5]** from the excavator harness connector.

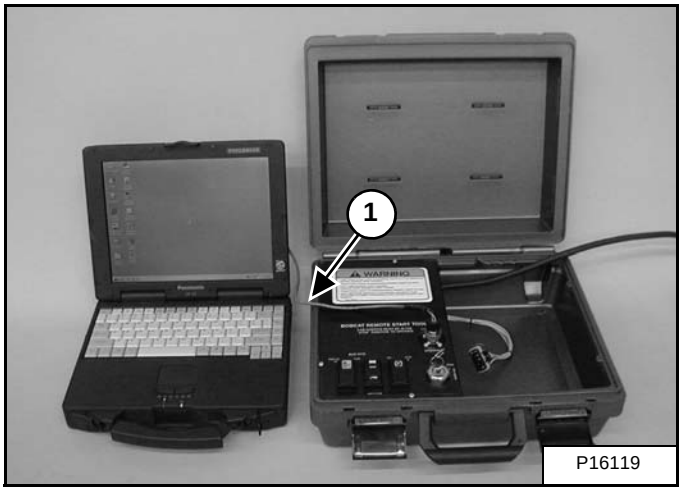
Connect the service tool harness control (MEL1565) to the excavator harness connector.

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

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 10-200-6



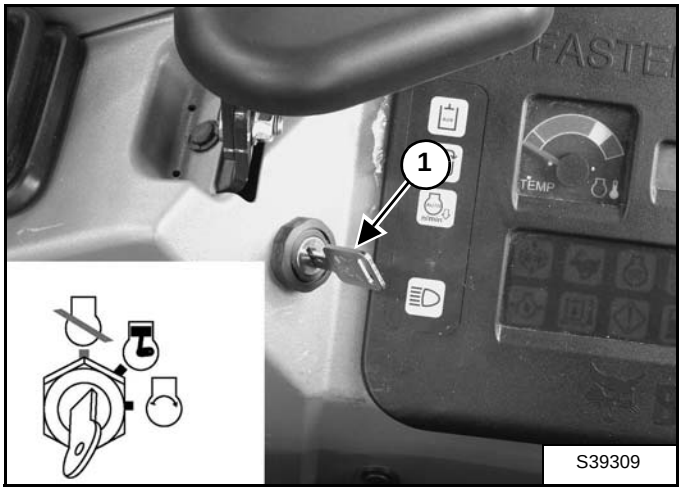
The Service Tool Harness Communicator (Item 1) **[Figure 10-200-6]** is required to connect the Service PC to the Remote Start Tool.

REMOTE START TOOL - MEL1563 (CONT'D)

Service Tool Harness Communicator - MEL1566 (Cont'd)

Key Switch

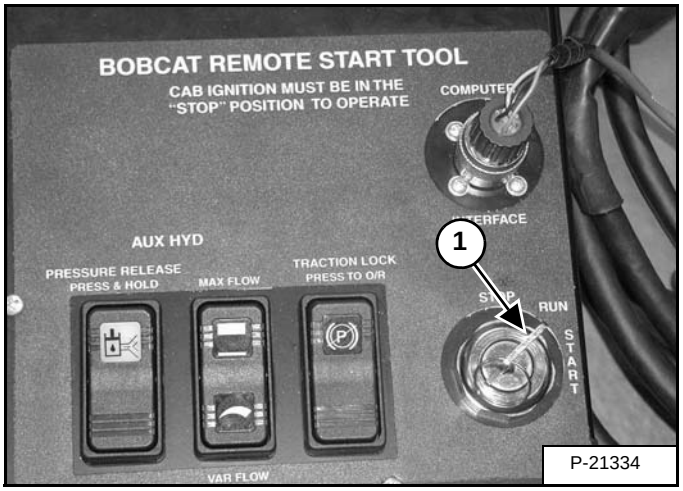
Figure 10-200-7



Turn the key switch (Item 1) **[Figure 10-200-7]** to the RUN position on the excavator.

NOTE: DO NOT start the excavator.

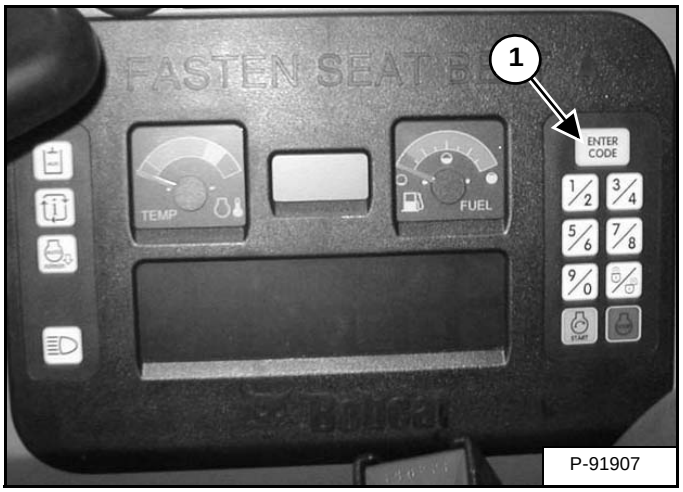
Figure 10-200-8



Turn the key switch (Item 1) **[Figure 10-200-8]** to the RUN position on the Remote Start Tool.

Keyless Start

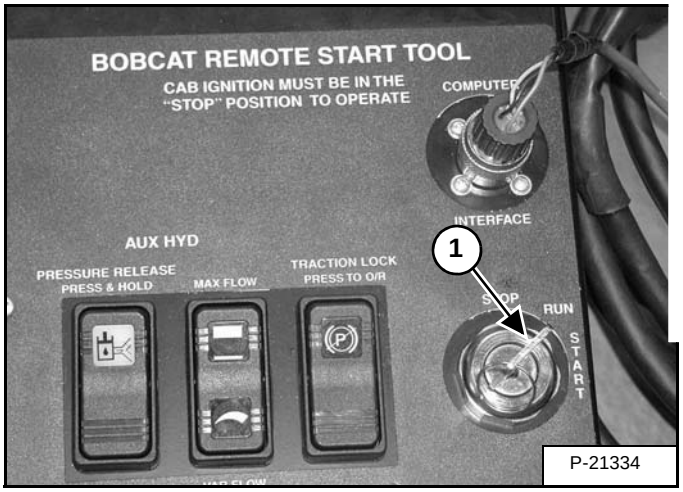
Figure 10-200-9



Press the ENTER CODE button (Item 1) **[Figure 10-200-9]** to turn power on.

NOTE: DO NOT start the excavator.

Figure 10-200-10



Turn the key switch (Item 1) **[Figure 10-200-10]** to the RUN position on the Remote Start Tool.


Bobcat®

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

Description

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

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

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

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

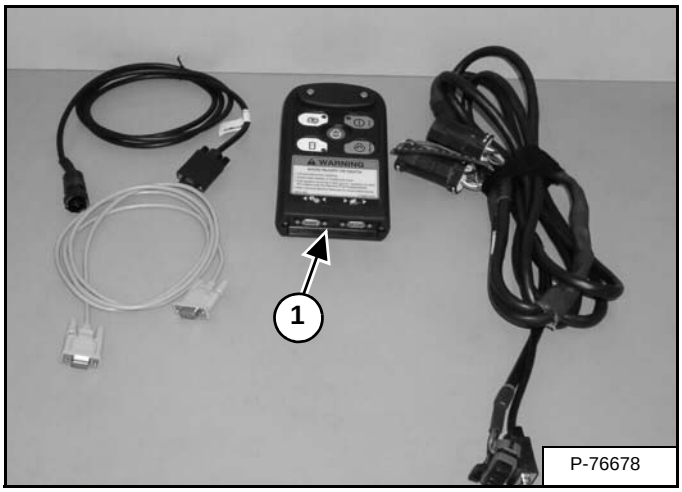
Remote Start Tool (Service Tool) - 6689778 / 7003030

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

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

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

Figure 10-201-1

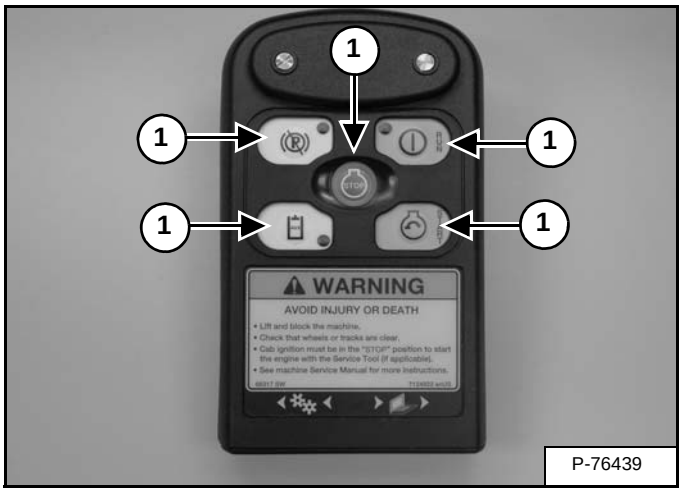


The Remote Start Tool (Item 1) **[Figure 10-201-1]** is used for excavators.

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 10-201-2



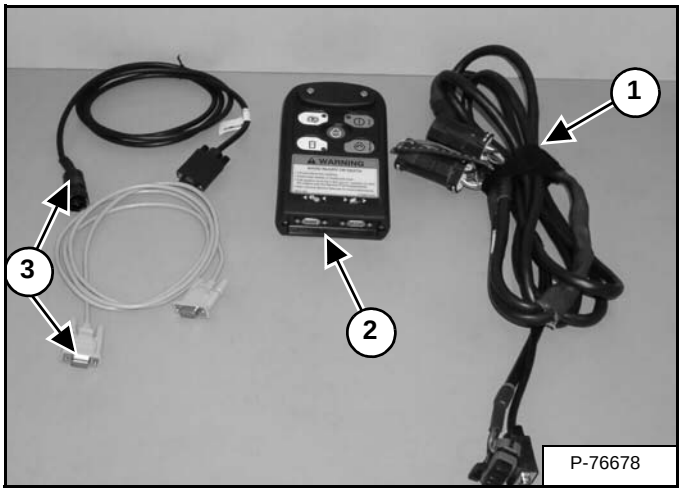
The five function buttons (Item 1) **[Figure 10-201-2]** are non-functional for excavators.

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

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

Excavator Service Tool Harness - 6689747

Figure 10-201-3



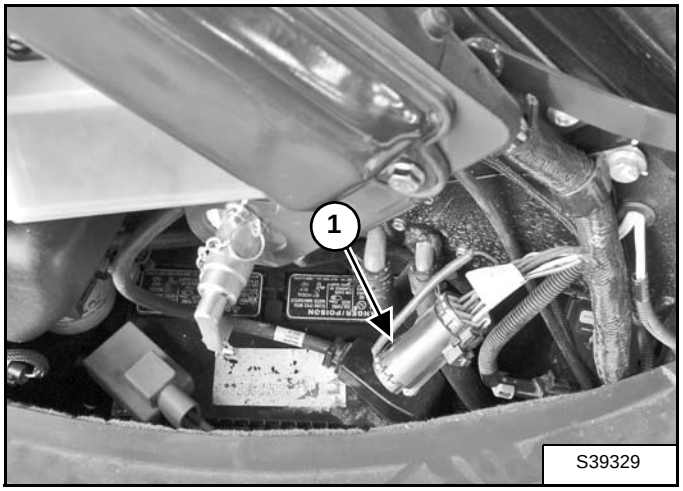
The service tool harness control (Item 1) **[Figure 10-201-3]** is used to connect the Remote Start Tool (Item 2) **[Figure 10-201-3]** to the electrical system on the excavator.

The service tool harness communicator (Item 3) **[Figure 10-201-3]** is used to connect the Remote Start Tool to the Service PC.

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

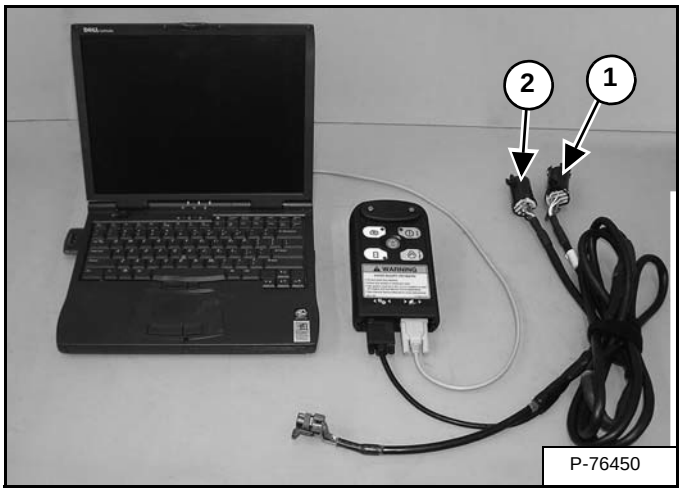
Open the right side cover.

Figure 10-201-4



Remove the plug (Item 1) **[Figure 10-201-4]** from the excavator harness connector.

Figure 10-201-5



NOTE: The Remote Start Tool (Service Tool) connection harness has two connectors (Item 1) and (Item 2). The main connector (Item 1) [Figure 10-201-5] is always used for connection to the excavator harness.

The second connector (Item 2) [Figure 10-201 5] is not used for E25 excavator applications This connector has a cap attached to it t prevent damage or corrosion when not in use

Connect the Remote Start Tool (Service Tool) connecto (Item 1) **[Figure 10-201-5]** to the excavator harnes connector.

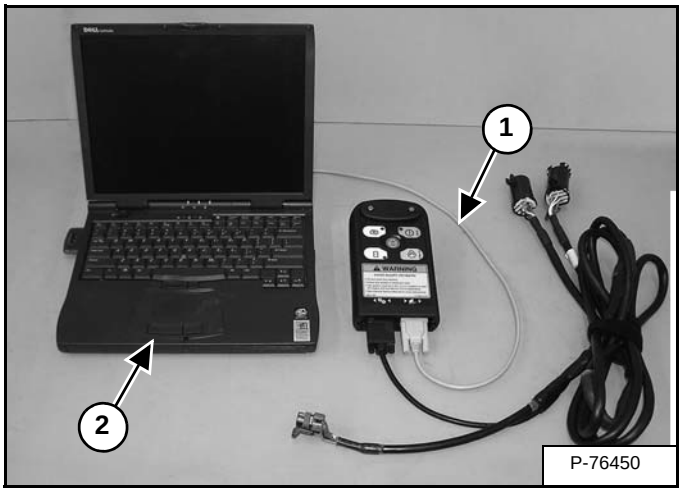
NOTE: The Key Switch or Keyless Instrument Pane must be in the run position or the Remot Start Tool (Service Tool) will not operate.

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

Computer Service Tool Harness - 6689746

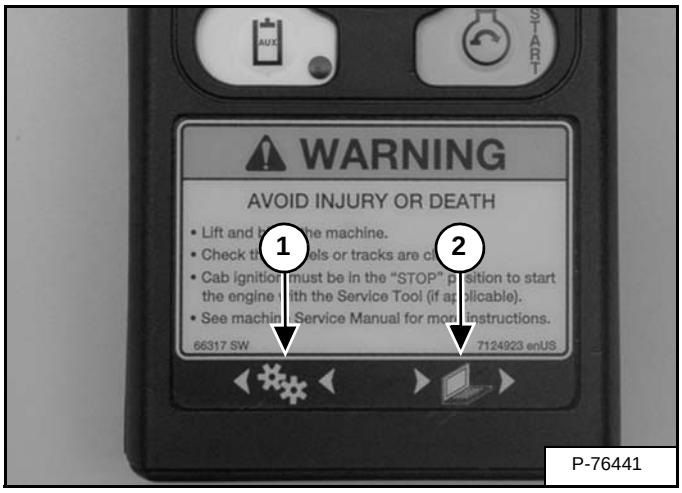
NOTE: To monitor, diagnose or load new software the Service PC must be connected to the Remote Start Tool.

Figure 10-201-6



The Computer Service Tool Harness (Item 1) **[Figure 10-201-6]** is required to connect Remote Start Tool (Service Tool) to the Service PC (Item 2) **[Figure 10-201-6]**.

Figure 10-201-7



The gear icon with the left facing arrows (Item 1) **[Figure 10-201-7]** will illuminate and blink when the excavator key switch 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 10-201-7]** will illuminate and blink when the Remote Start Tool (Service Tool) is transmitting data to and from the computer.

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E25 HYDRAULIC/HYDROSTATIC SCHEMATIC
S/N AB8B11001 AND ABOVE

(PRINTED APRIL 2014)
V-1547legend

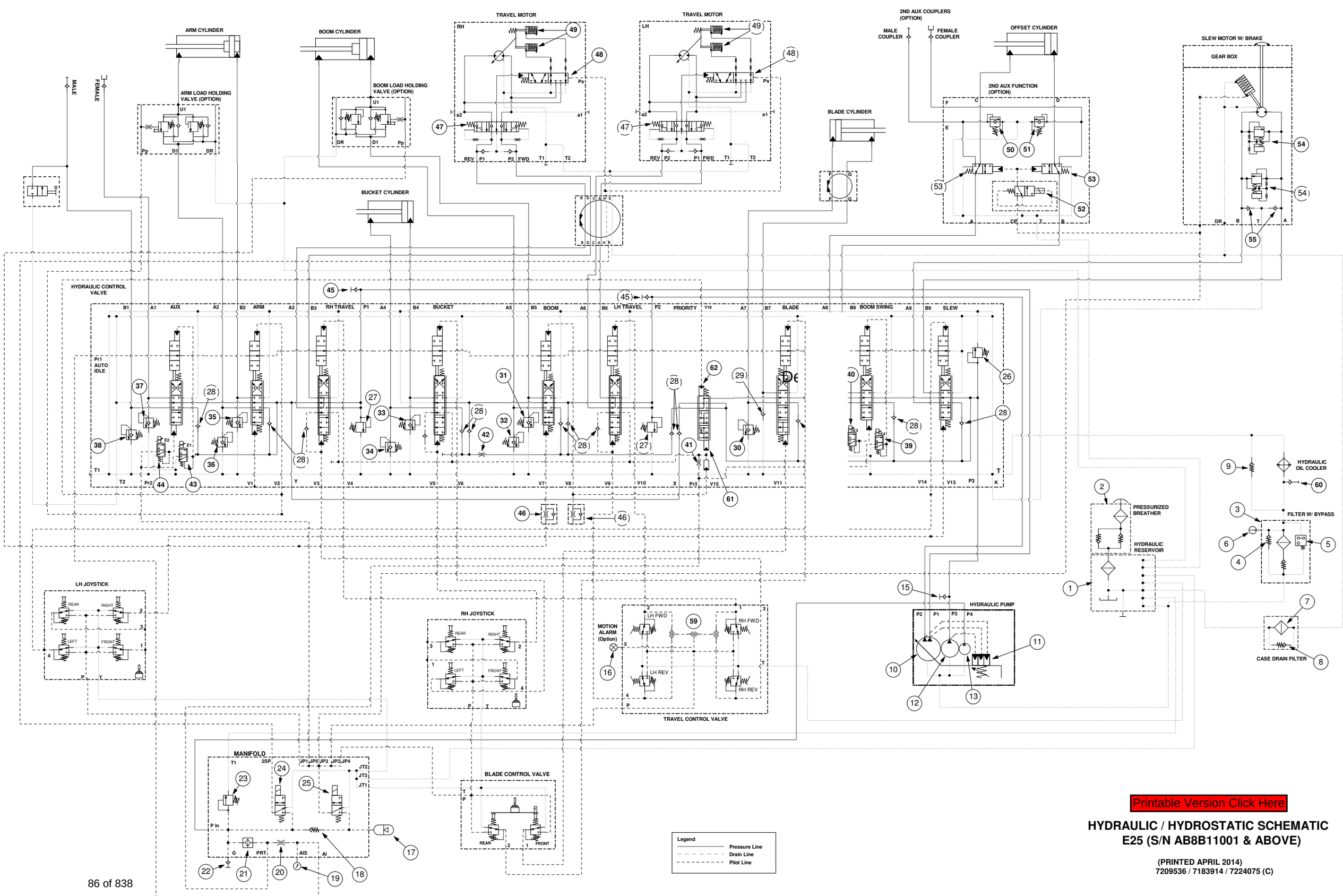
LEGEND

1. HYDRAULIC RESERVOIR: Pressurized with Fill Strainer
   Reservoir Capacity (at Site Gauge): 14.7 L (15.5 qt)
   System Capacity: 25 L (26.4 qt)
2. PRESSURIZED BREATHER/FILL CAP with FILTER:
   600 kPa (0.4 bar) (6 psi) – Outlet
   60 kPa (0.04 bar) (0.6 psi) - Inlet
3. HYDRAULIC FILTER ELEMENT 15 Micron
4. FILTER BY-PASS: 340 kPa (3.4 bar) (50 psi)
5. HYDRAULIC BY-PASS SWITCH
6. PRESSURE DIFFERENTIAL SWITCH
7. CASE DRAIN FILTER
8. FILTER BY-PASS: 120 – 160 kPa (1,2 – 1,6 bar) (18 - 23 psi)
9. OIL COOLER BY-PASS: 130 kPa (1,3 bar) (19 psi)
10. HYDRAULIC PISTON PUMP (2) . . . . . 28,8 Lpm (7.6 gpm) at High Engine RPM
11. TORQUE LIMITER
12. HYDRAULIC GEAR PUMP . . . . . 19,2 Lpm (5.1 gpm) at High Engine RPM
13. HYDRAULIC GEAR PUMP . . . . . 6,5 Lpm (1.7 gpm) at High Engine RPM
14. NOT USED FOR THIS MODEL
15. TEST PORT – Hydraulic Gear Pump P3
16. PRESSURE SWITCH – Motion Alarm (If Equipped)
17. ACCUMULATOR
18. CHECK VALVE - Accumulator
19. PRESSURE SENSOR – Auto Idle
20. ORIFICE: 0,4 mm (0.016 in)
21. FILTER – Manifold
22. TEST PORT – Pressure Reducing Valve
23. PRESSURE REDUCING VALVE: 3200 kPa (32 bar) (464 psi)
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - Two Speed
25. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Work Group Lock
26. RELIEF VALVE: 20600 kPa (206 bar) (2987 psi)
27. RELIEF VALVE: 24000 kPa (240 bar) (3480 psi)
28. CHECK VALVE
29. ANTI-CAVITATION VALVE
30. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Blade Cylinder): 27000 kPa (270 bar) (3915 psi)
31. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Boom Cylinder): 29000 kPa (290 bar) (4206 psi)
32. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Boom Cylinder): 29000 kPa (290 bar) (4206 psi)
33. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (BUCKET Cylinder): 26000 kPa (260 bar) (3770 psi)
34. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (BUCKET Cylinder): 26000 kPa (260 bar) (3770 psi)
35. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (ARM Cylinder): 29000 kPa (290 bar) (4206 psi)
36. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (ARM Cylinder): 29000 kPa (290 bar) (4206 psi)
37. PORT RELIEF VALVE - (With Anti-Cavitation Valve) - (Auxiliary Pressure Port: 18000 kPa (180 bar) (2610 psi)
38. PORT RELIEF VALVE - (With Anti-Cavitation Valve) - (Auxiliary Pressure Port: 18000 kPa (180 bar) (2610 psi)
39. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Boom Offset
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Boom Offset
41. ORIFICE: 0,4 mm (0.016 in)
42. ORIFICE: 1,5 mm (0.06 in)
43. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Auxiliary
44. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Auxiliary
45. TEST PORT (2) – Hydraulic Piston Pump
46. CHECK VALVE (2) - With 0,58 mm (0.023 in) Orifice
47. DRIVE MOTOR SHUTTLE – With 0,5 mm (0.019 in) restrictors
48. VALVE - Two Speed
49. PISTON - Two Speed
50. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Second Auxiliary) (Optional): 17926 kPa 179 bar (2600 psi)
51. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Second Auxiliary) (Optional): 17926 kPa 179 bar (2600 psi)
52. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - Second Auxiliary (Optional)
53. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - Second Auxiliary (2) (Optional)
54. CROSSPORT RELIEF VALVE (Ramp Pressure Increasing Type):
    Set @: 19100 kPa (191 bar) (2770 psi)
    Crack Pressure: 17200 kPa (172 bar) (2494 psi)
55. ANTI-CAVITATION VALVE (2)
56. NOT USED FOR THIS MODEL
57. NOT USED FOR THIS MODEL
58. NOT USED FOR THIS MODEL
59. SHUTTLE VALVE – Motion Alarm (If Equipped)
60. FACTORY FILL PORT
61. BOOM UP PRIORITY
62. ARM IN PRIORITY

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

V-1547legend (4-3-14)

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HYDRAULIC / HYDROSTATIC SCHEMATIC E25 (S/N AB8B11001 & ABOVE)

(PRINTED APRIL 2014)
7209536 / 7183914 / 7224075 (C)

PRINTED IN BELGIUM

Glossary Of Hydraulic / Hydrostatic Symbols

GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL DESCRIPTION

FLOW LINES and CONNECTIONS

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

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

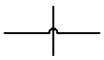
DRAIN CIRCUITS – Dotted Line – Drain Line (drain or bleed line – line conducting fluid from a component housing to the reservoir)

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

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



CONNECTED JUNCTION OF OIL LINES (Flow Line Connection)



OIL LINES CROSSING (NOT Connected)



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

SYMBOL DESCRIPTION

BASIC and MISCELLANEOUS SYMBOLS



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



VARIABLE ADJUSTMENT RESTRICTION – Regulated or Variable Restriction

TEMPERATURE CONTROL – (indication of temperature)



TEMPERATURE INDICATOR – (temperature measurement – thermometer)



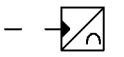
FILTER (strainer or screen) – For fluid conditioning



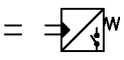
VENTED AND FILTERED RESERVOIR (reservoir open to atmosphere)



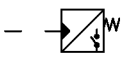
OIL COOLER (heat exchanger) – The arrows in the diamond indicate the extraction of heat (heat dissipation)



PRESSURE SENSOR – Varies electric signal with pressure



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



PRESSURE SWITCH – Switch activates when pressure reaches specified level



MUFFLER (silencer) – Reduces noise

MS-1892-1

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

Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

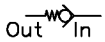
GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL DESCRIPTION

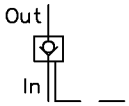
NON–RETURN VALVE, SHUTTLE VALVE: Valve which allows free flow in one direction only



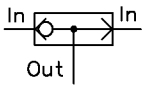
NON–RETURN VALVE (Check Valve) – Used as Replenishing Valve, Load Check Valve or Anticavitation Valve – Opens if the Inlet pressure is higher than the Outlet pressure. Often contains internal spring which has NO significant pressure value



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



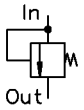
PILOT CONTROLLED NON–RETURN VALVE – It is possible to open the valve by pilot pressure



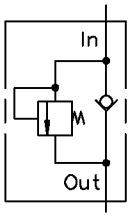
SHUTTLE VALVE – The Inlet port connected to the higher pressure is automatically connected to the Outlet port while the other Inlet port is closed

SYMBOL DESCRIPTION

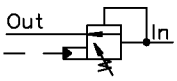
PRESSURE CONTROL VALVE: Valve ensuring the control of pressure



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



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

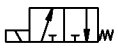


DUAL PRESSURE RELIEF VALVE – When the inlet pressure overcomes the opposing force of the spring, the valve opens permitting flow from the Outlet port. Pilot pressure provides a second pressure value.

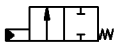
DIRECTIONAL CONTROL VALVE: Valve providing for the opening (fully or restricted) or the closing of one or more flow paths (represented by several squares)



TWO PORTS and CLOSED FLOW PATHS

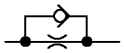


SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) – controlled by an electric solenoid (with return spring)

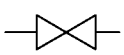


PILOT ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) – controlled by pressure (with return spring)

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



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



TOW VALVE – Normally in closed position

MS-1892-3

Troubleshooting The Hydraulic Circuit

PROBLEM	CAUSE	CORRECTION
No hydraulic operation at one or more circuits	Hydraulic fluid 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 fluid 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 fluid level low	Fill to correct level
	Non recommended hydraulic fluid	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 (e.g.: Enclosed structure)	
	Engine accessory drive belt loose	Replace Belt

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 relief valve
	Lever linkage incorrectly adjusted	Readjust
	Control console lockout switch	Readjust or replace
	Cylinder internal leakage excessive	Repair or replace
	Joystick manifold pressure relief 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 relief 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

Troubleshooting The Swing (Upperstructure Slew) Circuit

PROBLEM	CAUSE	CORRECTION
Slew not operating	Control console raised	Lower control console.
	Control console lock out switch incorrectly adjusted or defective	Readjust or replace
	Joystick manifold pressure relief 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 motor brake does not disengage	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

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


Bobcat®

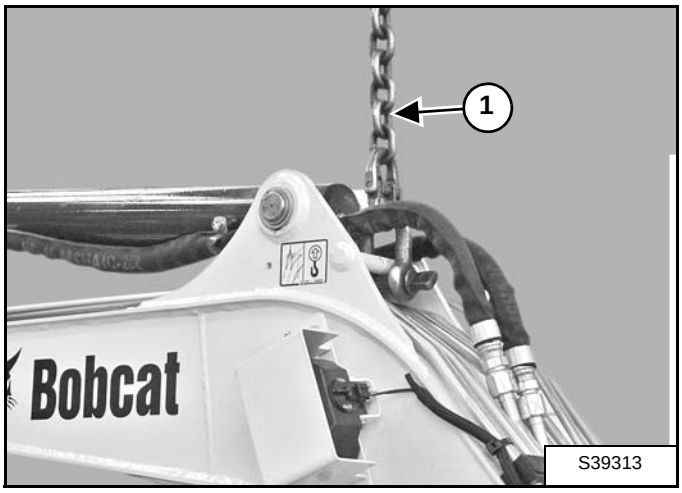
CYLINDER (BOOM)

Testing

Lower the work group to the earth.

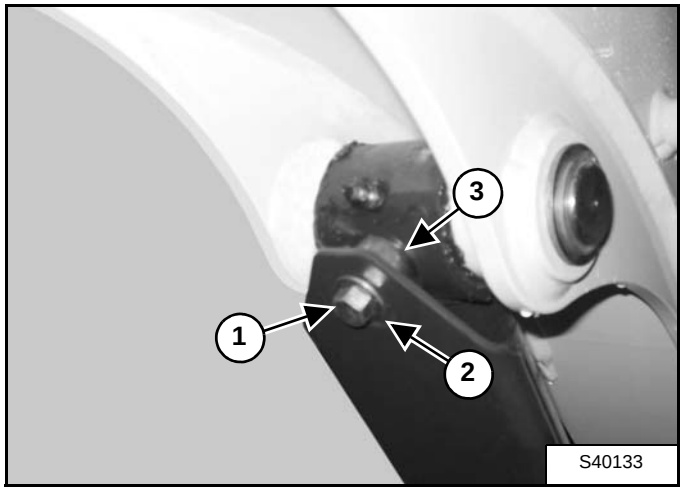
With the engine off, turn the key switch to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-20-1



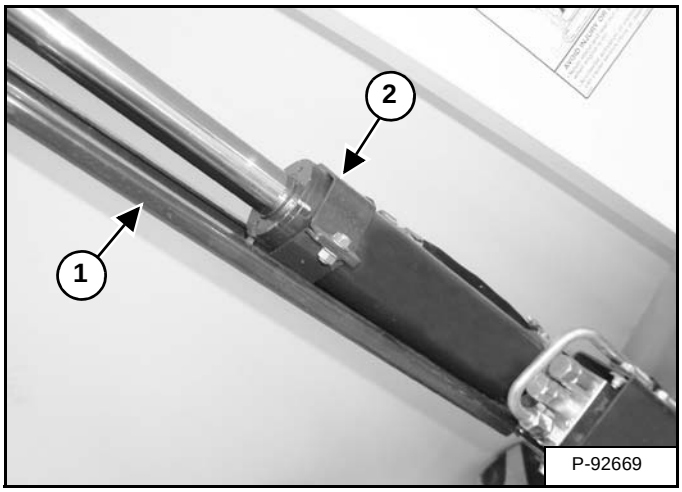
Support the boom with a chain hoist (Item 1) **[Figure 20-20-1]**.

Figure 20-20-2



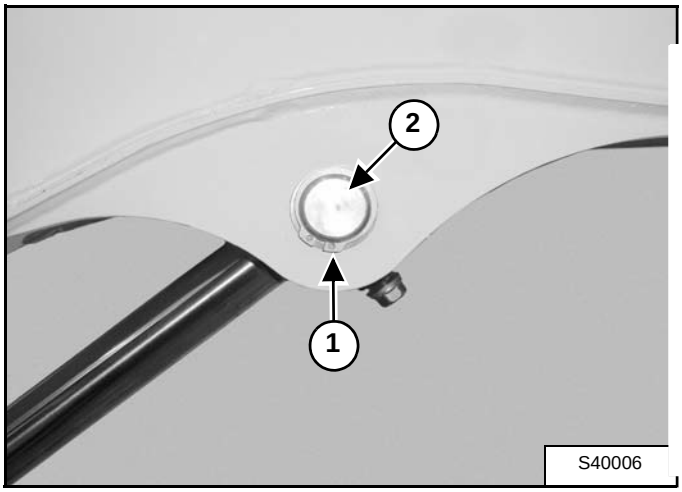
Remove the boom shield bolt (Item 1), washer (Item 2), spring washer and spacer (Item 3) **[Figure 20-20-2]**.

Figure 20-20-3



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

Figure 20-20-4



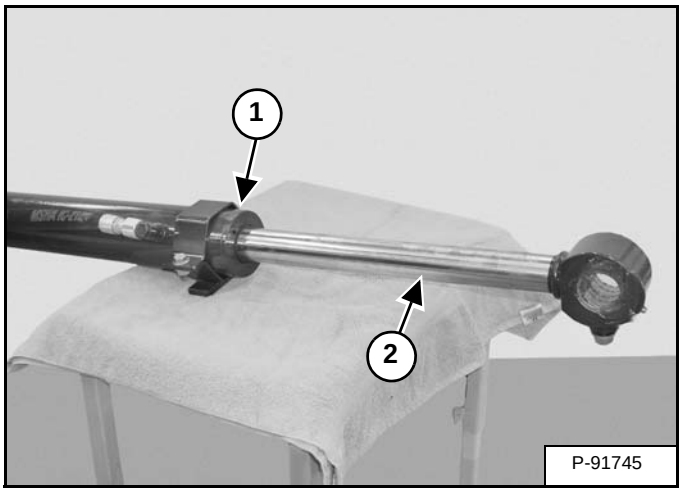
Remove the snap ring (Item 1) **[Figure 20-20-4]** and washer.

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

CYLINDER (BOOM) (CONT'D)

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]**.

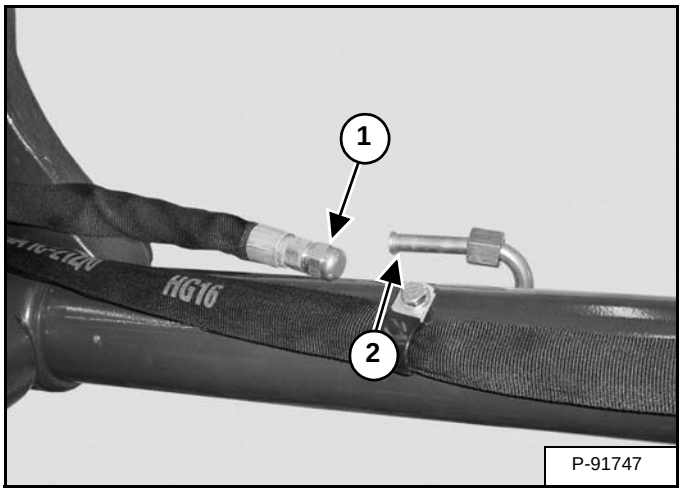
Stop the engine. Relieve hydraulic pressure.

⚠ 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 doctor familiar with this injury is not received immediately.

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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.

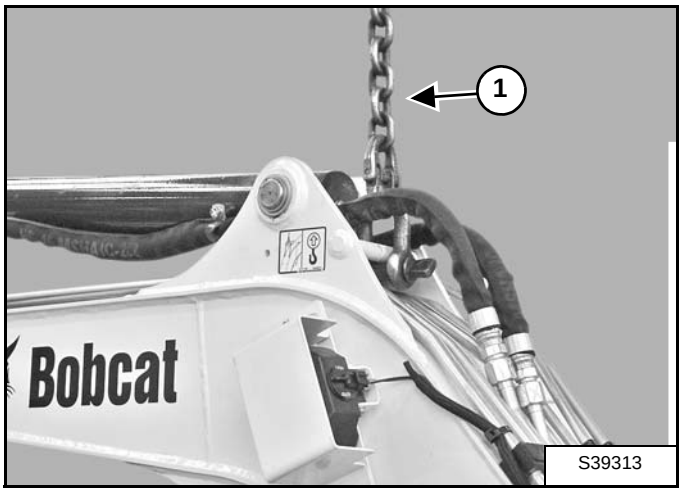
If there is any oil leakage from the base end fitting (Item 2) **[Figure 20-20-6]**, remove the cylinder for repair or replacement.

Removal And Installation

Lower the work group to the earth.

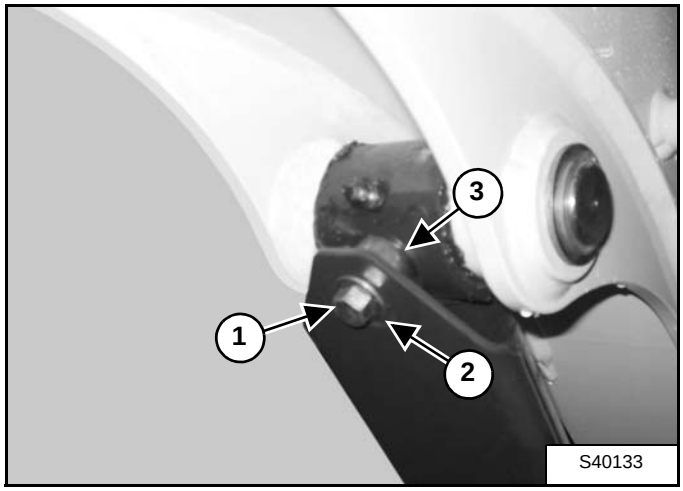
With the engine off, turn the key switch to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-20-7



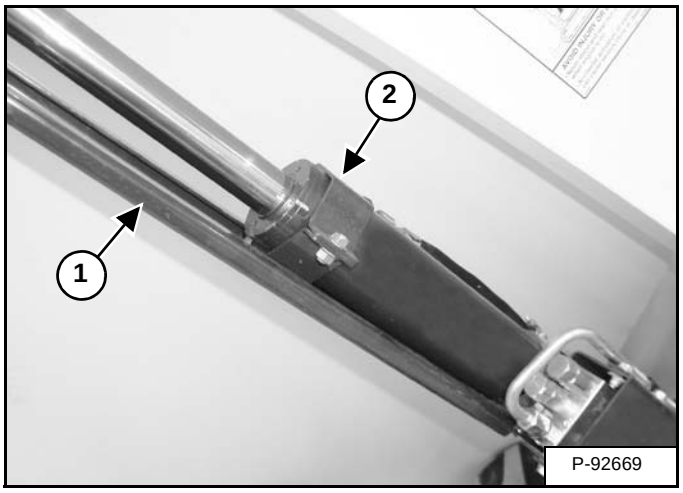
Support the boom with a chain hoist (Item 1) **[Figure 20-20-7]**.

Figure 20-20-8



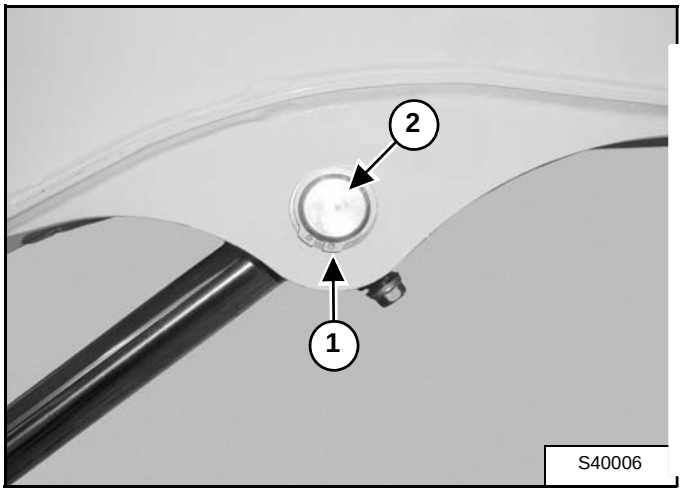
Remove the boom shield bolt (Item 1), washer (Item 2), spring washer and spacer (Item 3) **[Figure 20-20-8]**.

Figure 20-20-9



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

Figure 20-20-10

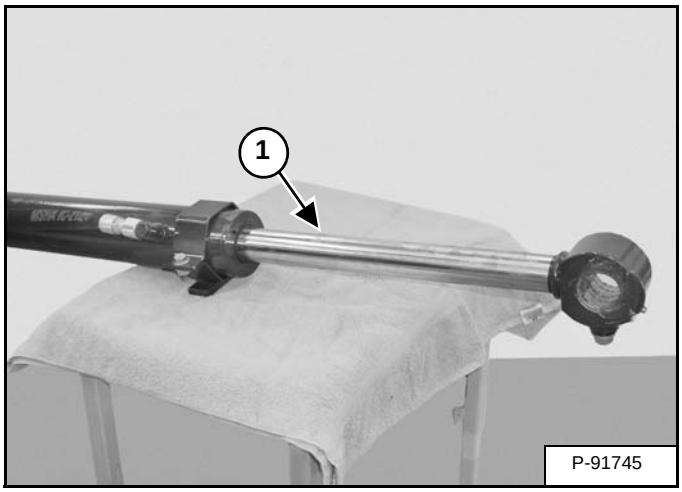


Remove the snap ring (Item 1) **[Figure 20-20-10]** and washer.

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

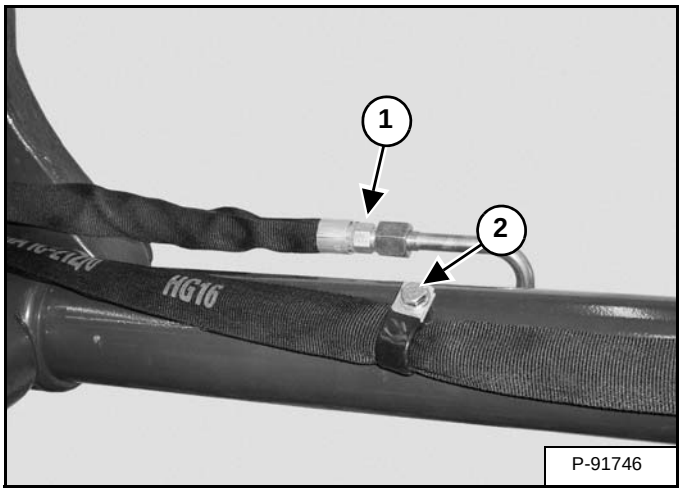
Removal And Installation (Cont'd)

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]**.

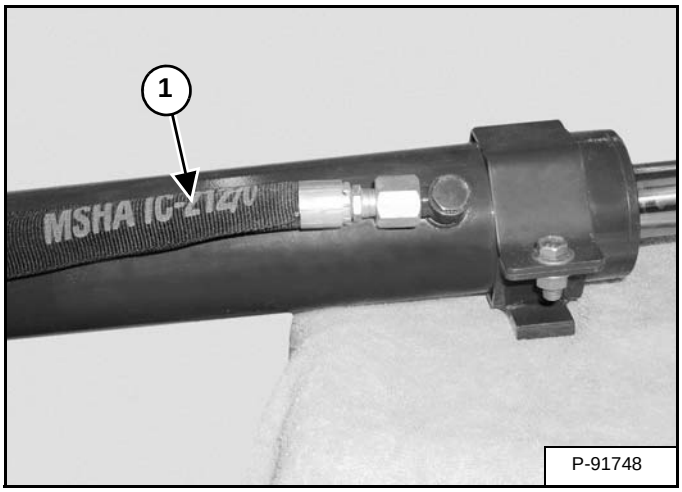
Remove the hose clamp bolt (Item 2) **[Figure 20-20-12]**.

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.

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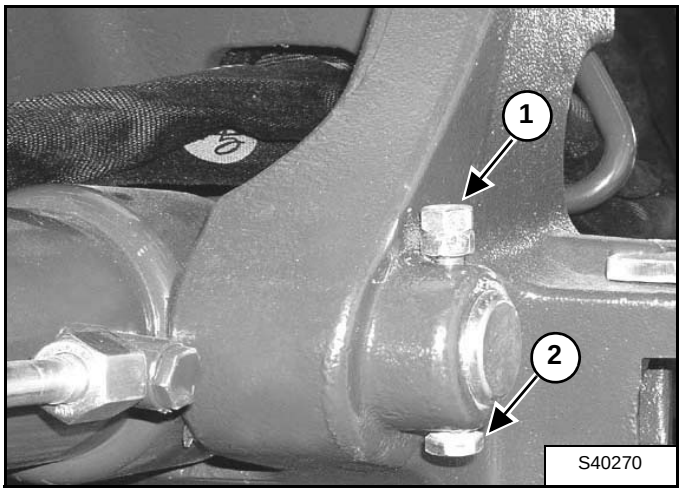
Figure 20-20-13



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

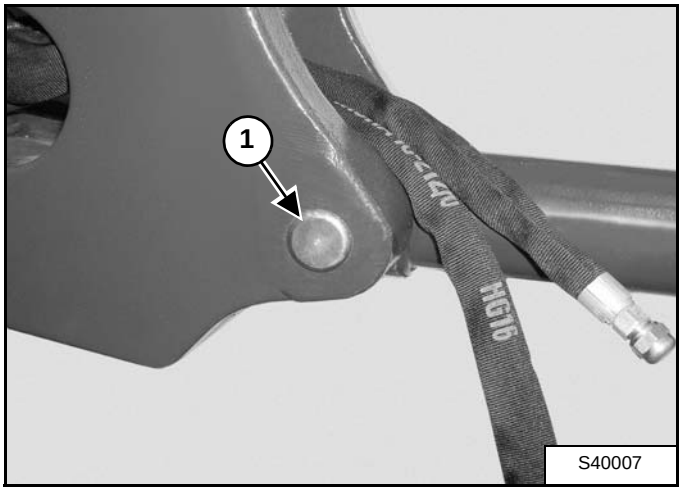
Removal And Installation (Cont'd)

Figure 20-20-14



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

Figure 20-20-15

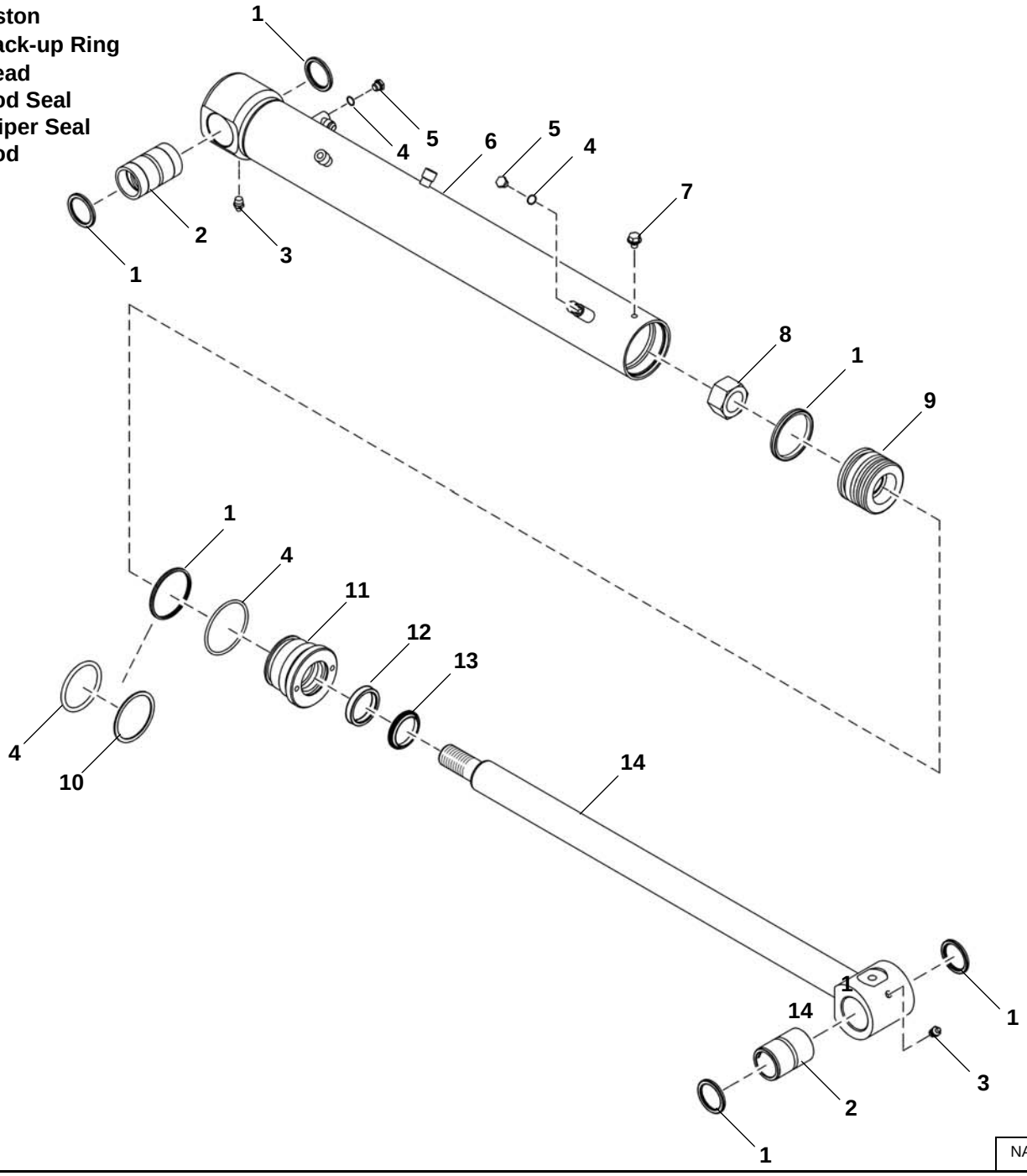


Remove the pin (Item 1) **[Figure 20-20-15]** from the base end of the cylinder.

Remove the cylinder.

Parts Identification

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



Disassembly

Clean the outside of the cylinder before disassembly.

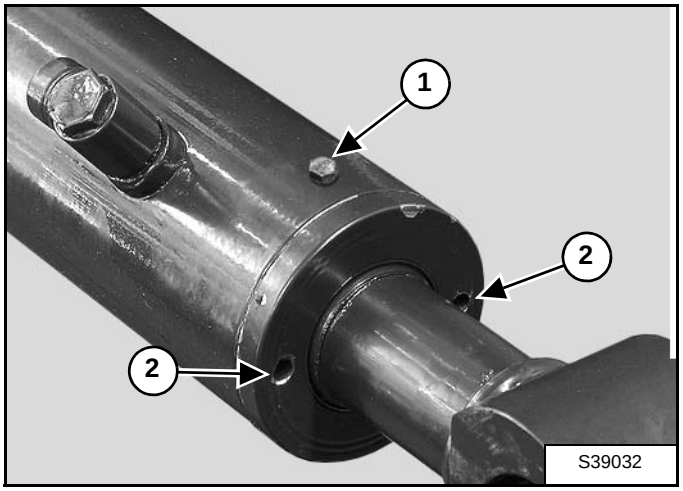
Use the following tools to disassemble the cylinder:

MEL1074 - O-ring Seal Hook
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - 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.

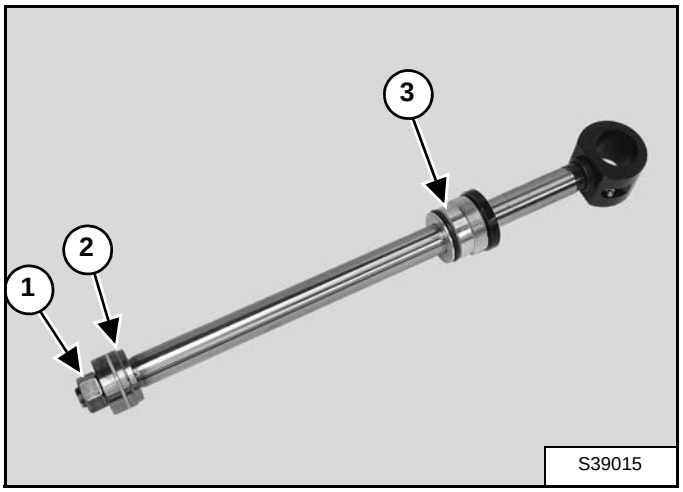
Figure 20-20-16



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

Insert the Adjustable Gland Nut Wrench into the holes (Item 2) **[Figure 20-20-16]** to loosen the head.

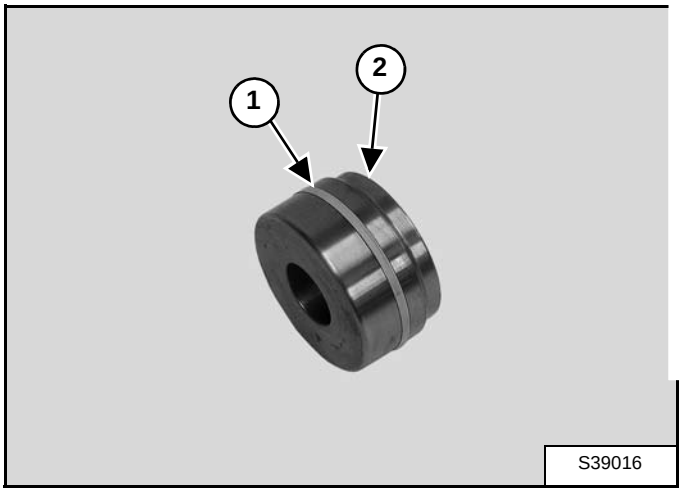
Figure 20-20-17



Remove the head and the rod assembly from the cylinder **[Figure 20-20-17]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-20-17]**.

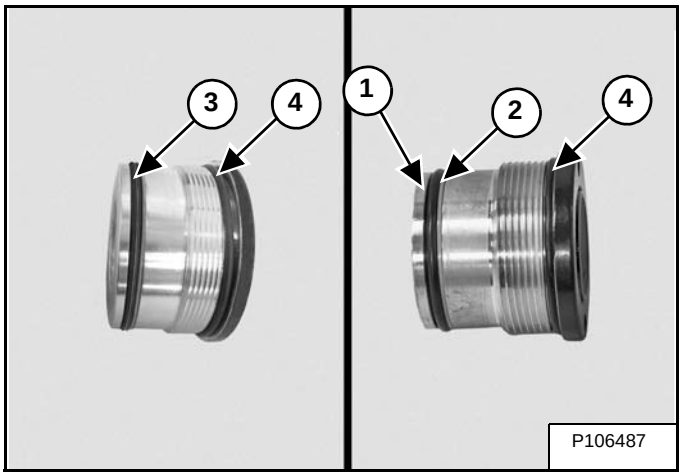
Figure 20-20-18



Remove the seal (Item 1) from the piston (Item 2) **[Figure 20-20-18]**.

Disassembly (Cont'd)

Figure 20-20-19

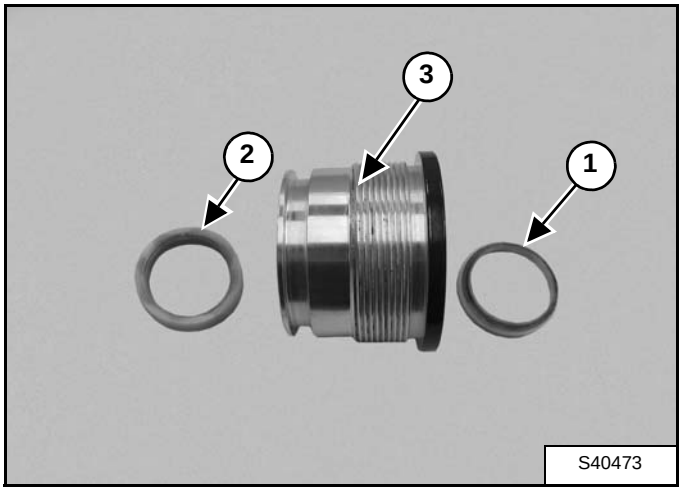


Remove the O-ring (Item 1) and the back-up ring (Item 2) or seal (Item 3) **[Figure 20-20-19]**.

NOTE: The seal kit may contain the O-ring / back-up ring or seal.

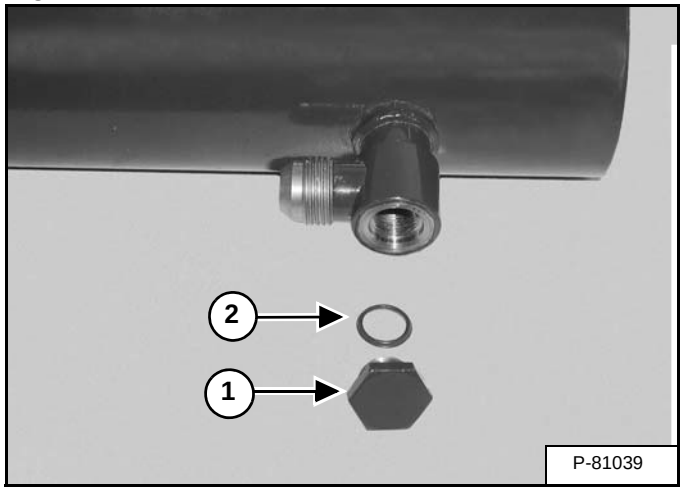
Remove the O-ring (Item 4) **[Figure 20-20-19]**.

Figure 20-20-20



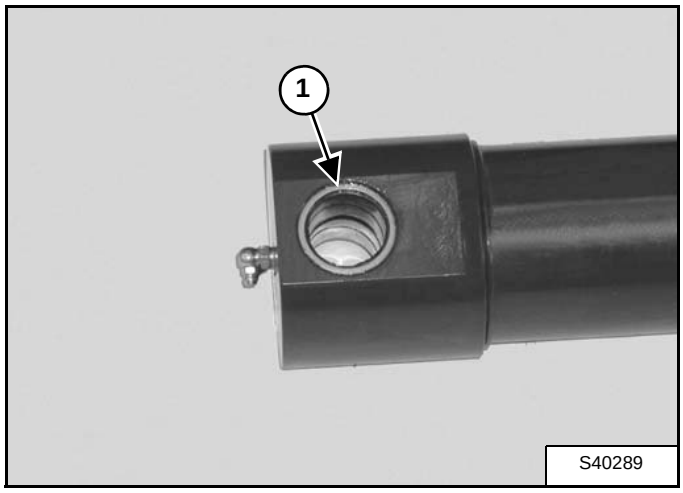
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-20-20]**.

Figure 20-20-21



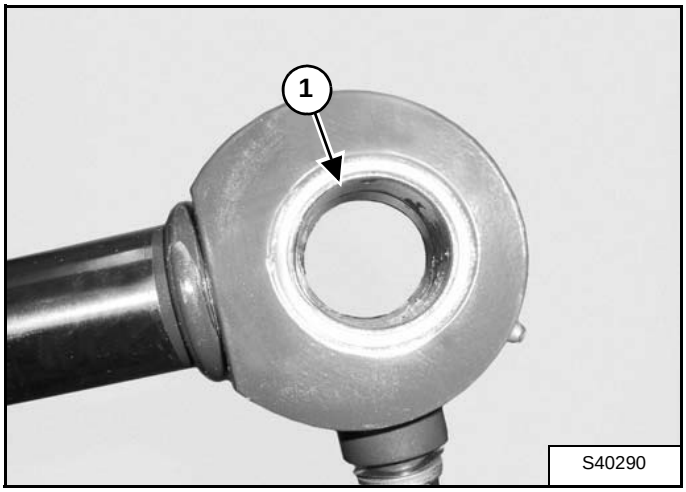
Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-20-21]**.

Figure 20-20-22



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

Figure 20-20-23



Remove the bushing (Item 1) **[Figure 20-20-23]** from the cylinder rod end.

Assembly

Clean all parts in solvent and dry with compressed air.

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

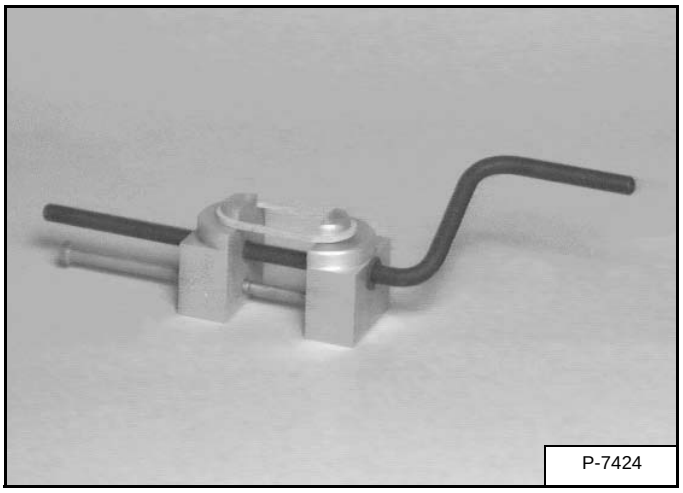
Always install new O-rings and seals during assembly.

Lubricate all O-rings and seals with hydraulic fluid 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 - Offset Pins

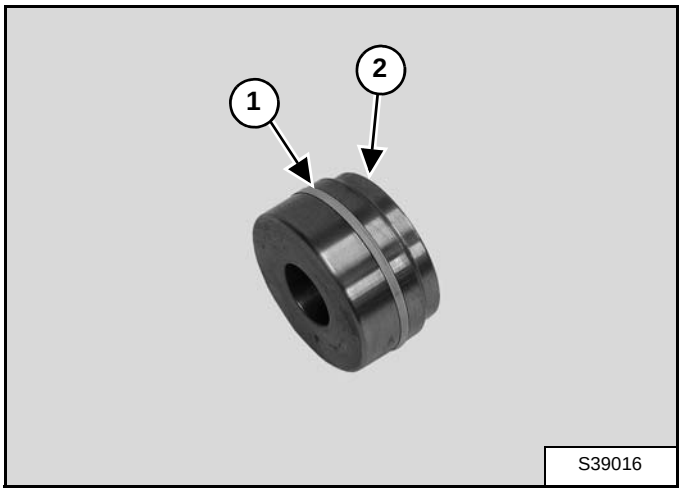
Figure 20-20-24



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

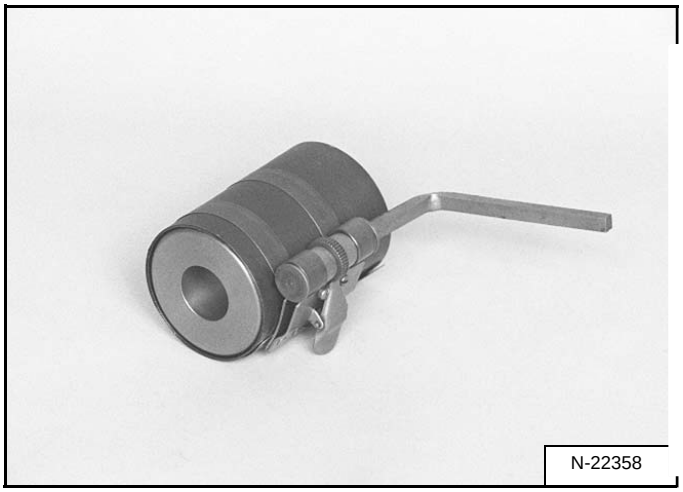
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-20-25



Install the seal (Item 1) on the piston (Item 2) **[Figure 20-20-25]**.

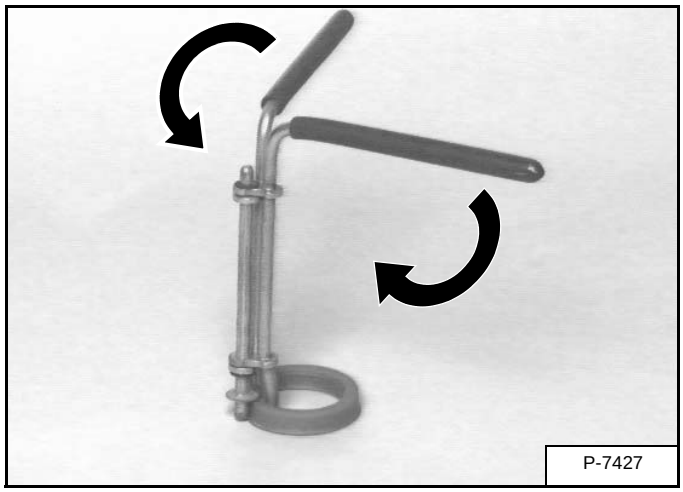
Figure 20-20-26



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for approximately 3 minutes **[Figure 20-20-26]**.

Assembly (Cont'd)

Figure 20-20-27

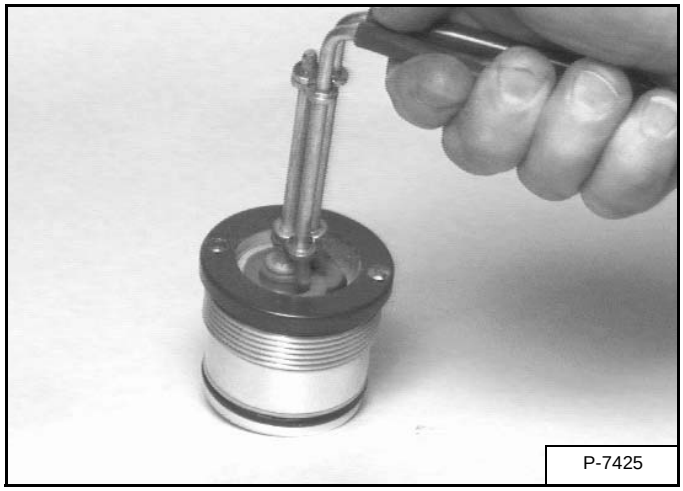


Install the rod seal on the rod seal tool **[Figure 20-20-27]**.

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

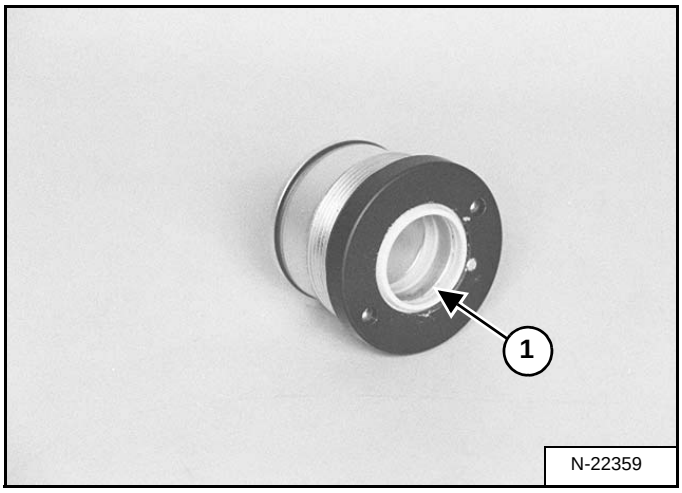
Rotate the handles to collapse the rod seal **[Figure 20-20-27]**.

Figure 20-20-28



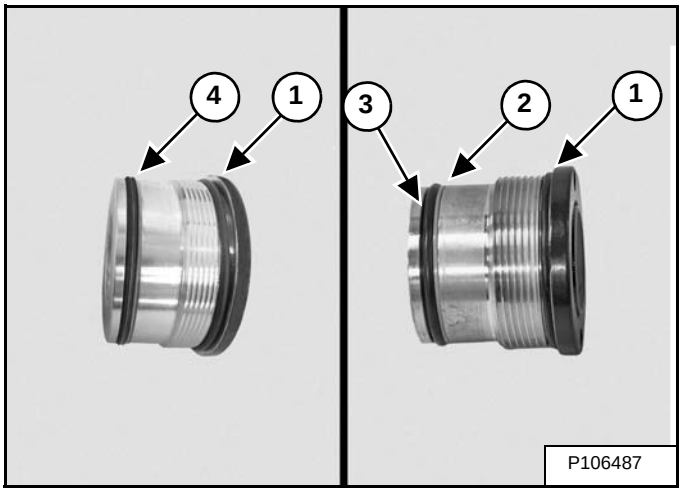
Install the rod seal in the head **[Figure 20-20-28]**.

Figure 20-20-29



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

Figure 20-20-30



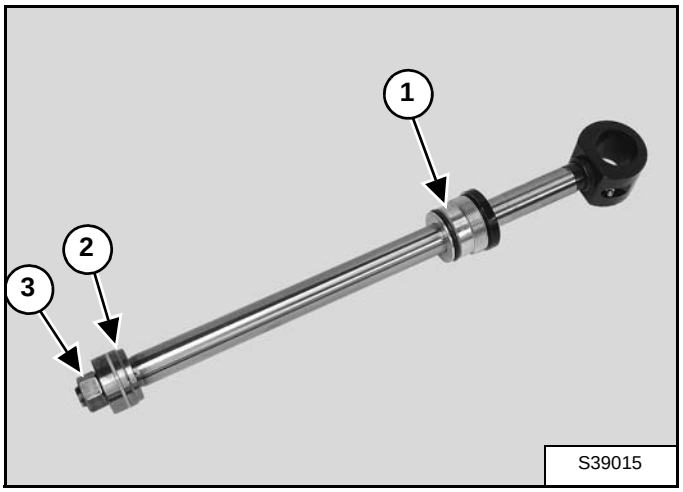
Install the O-ring (Item 1) **[Figure 20-20-30]**.

Install the back-up ring (Item 2) / O-ring (Item 3) or seal (Item 4) **[Figure 20-20-30]**.

NOTE: Use a ring compressor to compress the seal to the correct size. Leave the head in the compressor for approximately 3 minutes.

Assembly (Cont'd)

Figure 20-20-31



Install the head (Item 1) and the piston (Item 2) **[Figure 20-20-31]** on the rod.

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

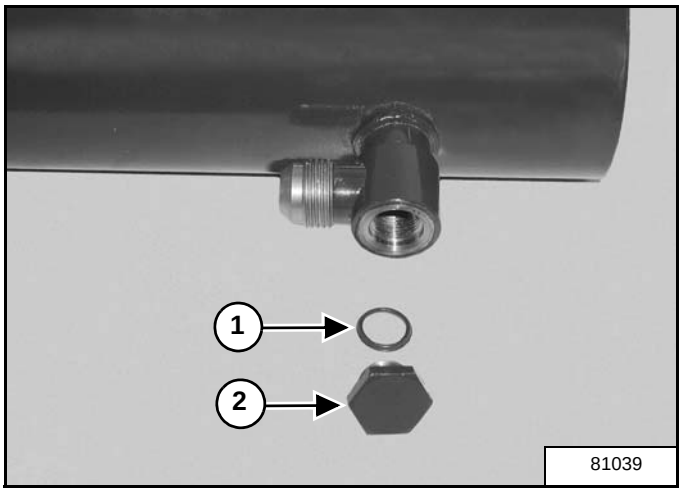
Provide an adequate support for the cylinder before tightening.

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

Install the nut (Item 3) **[Figure 20-20-31]**.

Tighten the nut to 1152,6 N•m (850 ft-lb) torque.

Figure 20-20-32

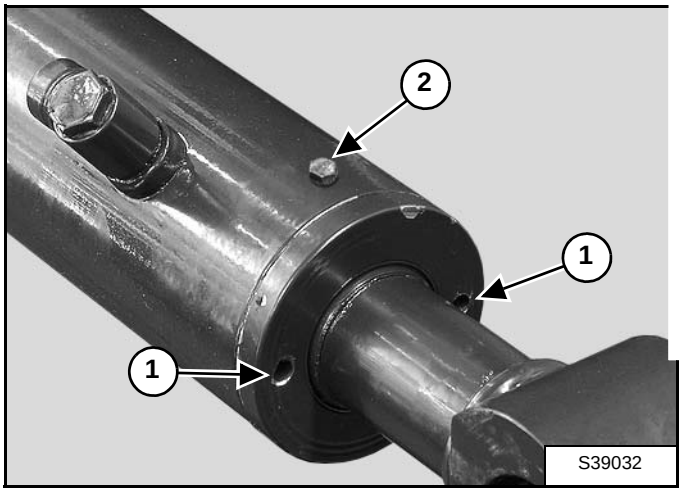


Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-20-32]**.

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

Put the base end of the cylinder in a vise.

Figure 20-20-33

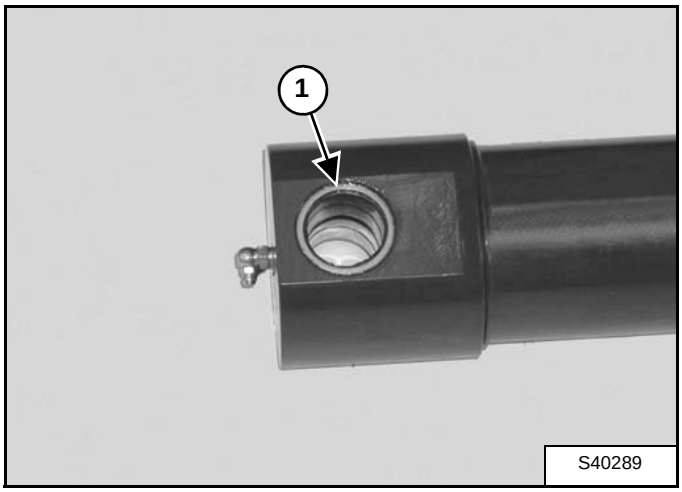


Insert the Adjustable Gland Nut Wrench into the holes (Item 1) **[Figure 20-20-33]**. Tighten the head to 373 N•m (275 ft-lb) torque.

Install the bolt (Item 2) **[Figure 20-20-33]** and tighten to 22 - 28 N•m (16 - 20 ft-lb) torque.

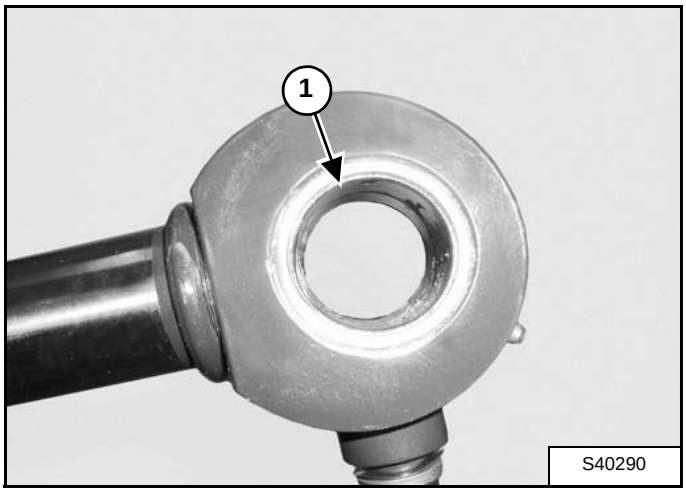
Assembly (Cont'd)

Figure 20-20-34



Install the bushing (Item 1) **[Figure 20-20-34]** in the cylinder base end. Make sure the bushing is aligned with the grease channel in the cylinder.

Figure 20-20-35



Install the bushing (Item 1) **[Figure 20-20-35]** in the cylinder rod end. Make sure the bushing is aligned with the grease channel in the cylinder.

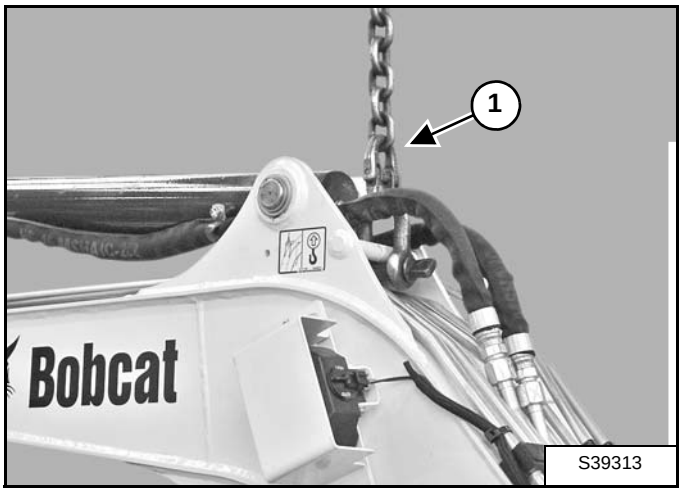
CYLINDER (ARM)

Testing

Lower the work group to the earth.

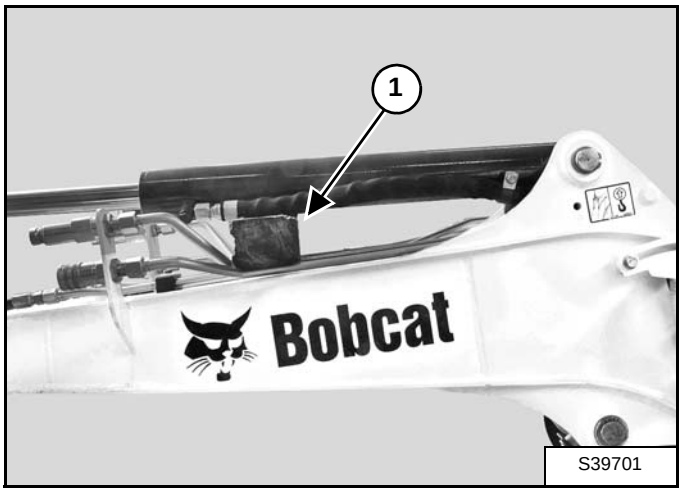
With the engine off, turn the key switch to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-21-1



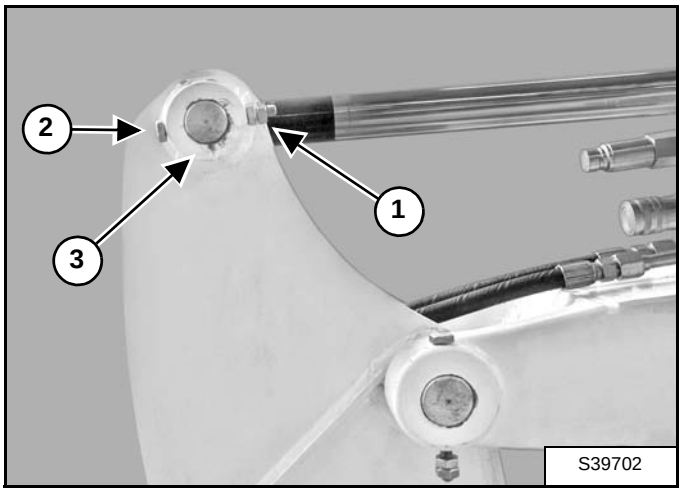
Support the boom with a chain hoist (Item 1) **[Figure 20-21-1]**.

Figure 20-21-2



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

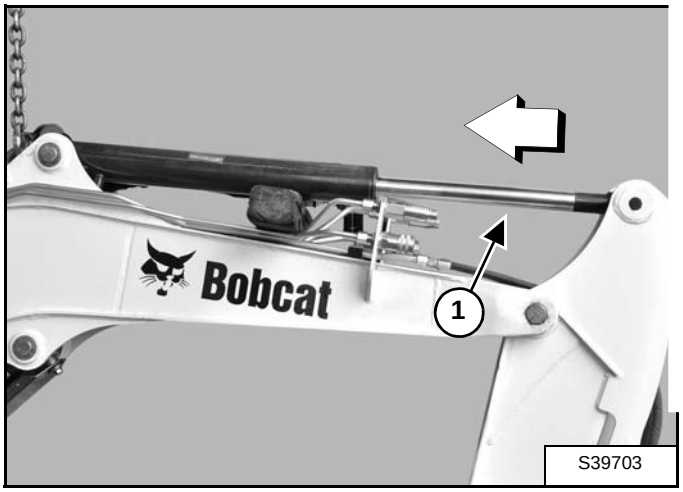
Figure 20-21-3



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-21-3]**.

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

Figure 20-21-4



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

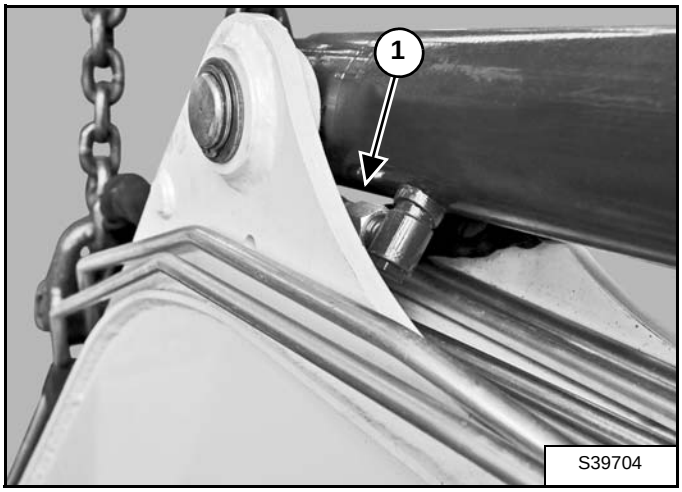
Testing (Cont'd)

⚠ WARNING

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

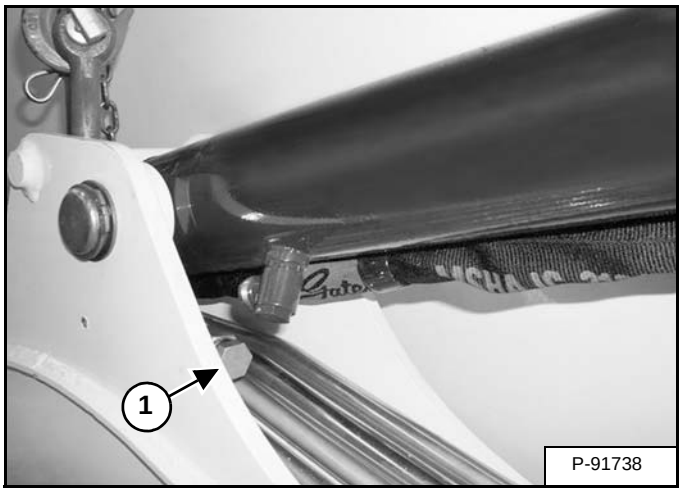
W-2145-EN-0210

Figure 20-21-5



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

Figure 20-21-6



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

Start the engine and retract the cylinder.

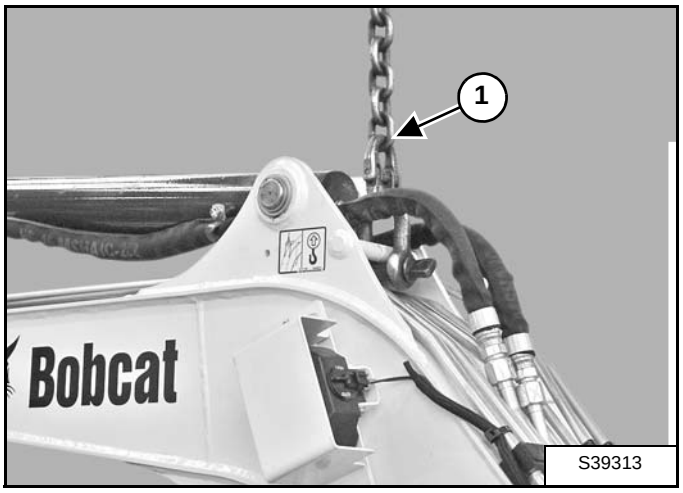
If there is any leakage from the base end fitting, remove the cylinder for repair or replacement.

Removal And Installation

Lower the work group to the earth.

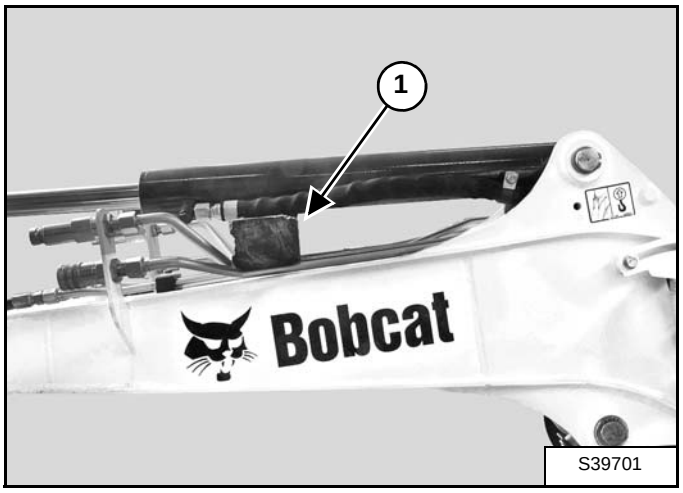
With the engine off, turn the key switch to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-21-7



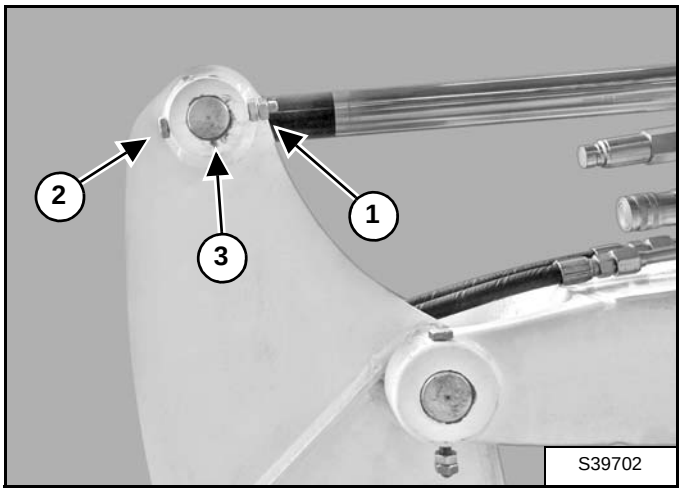
Support the boom with a chain hoist (Item 1) **[Figure 20-21-7]**.

Figure 20-21-8



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

Figure 20-21-9



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-21-9]**.

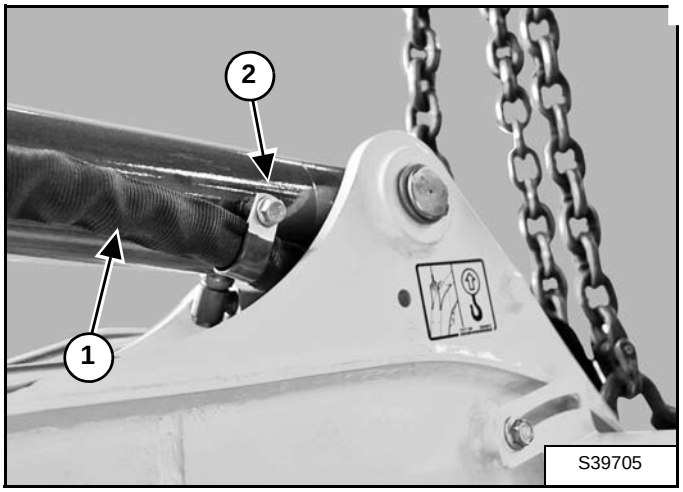
Remove the rod end pin (Item 3) **[Figure 20-21-9]**.

IMPORTANT

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

I-2003-088

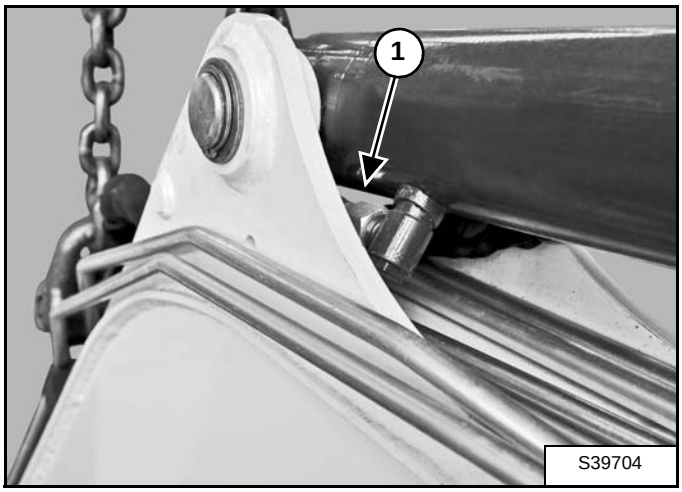
Figure 20-21-10



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

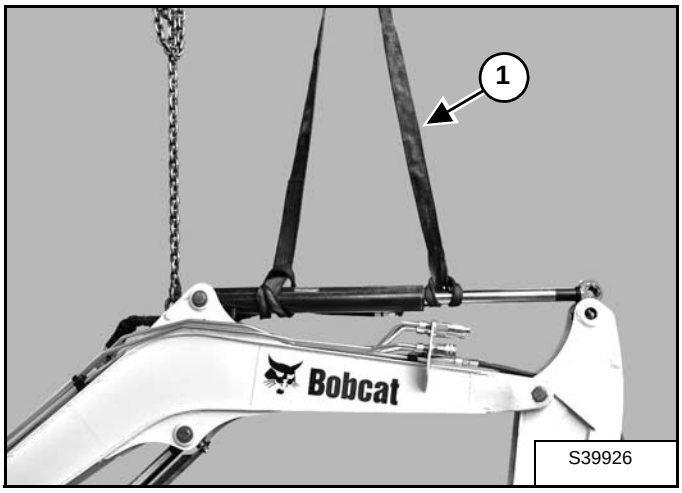
Removal And Installation (Cont'd)

Figure 20-21-11



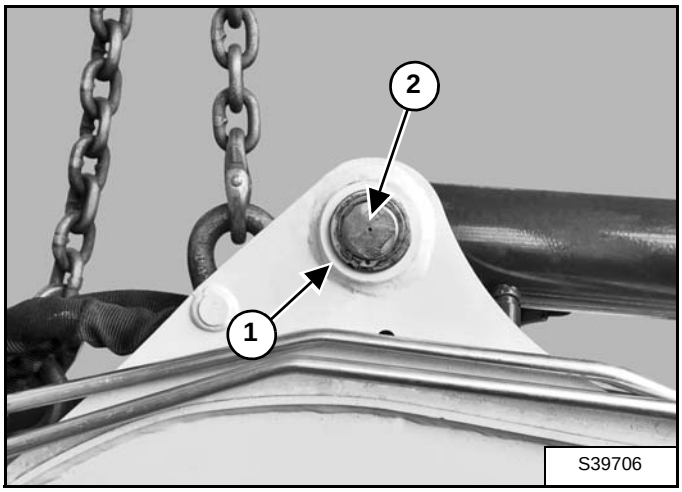
Remove and plug the hose (Item 1) **[Figure 20-21-11]**.

Figure 20-21-12



Install a sling (Item 1) **[Figure 20-21-12]** on the cylinder.

Figure 20-21-13

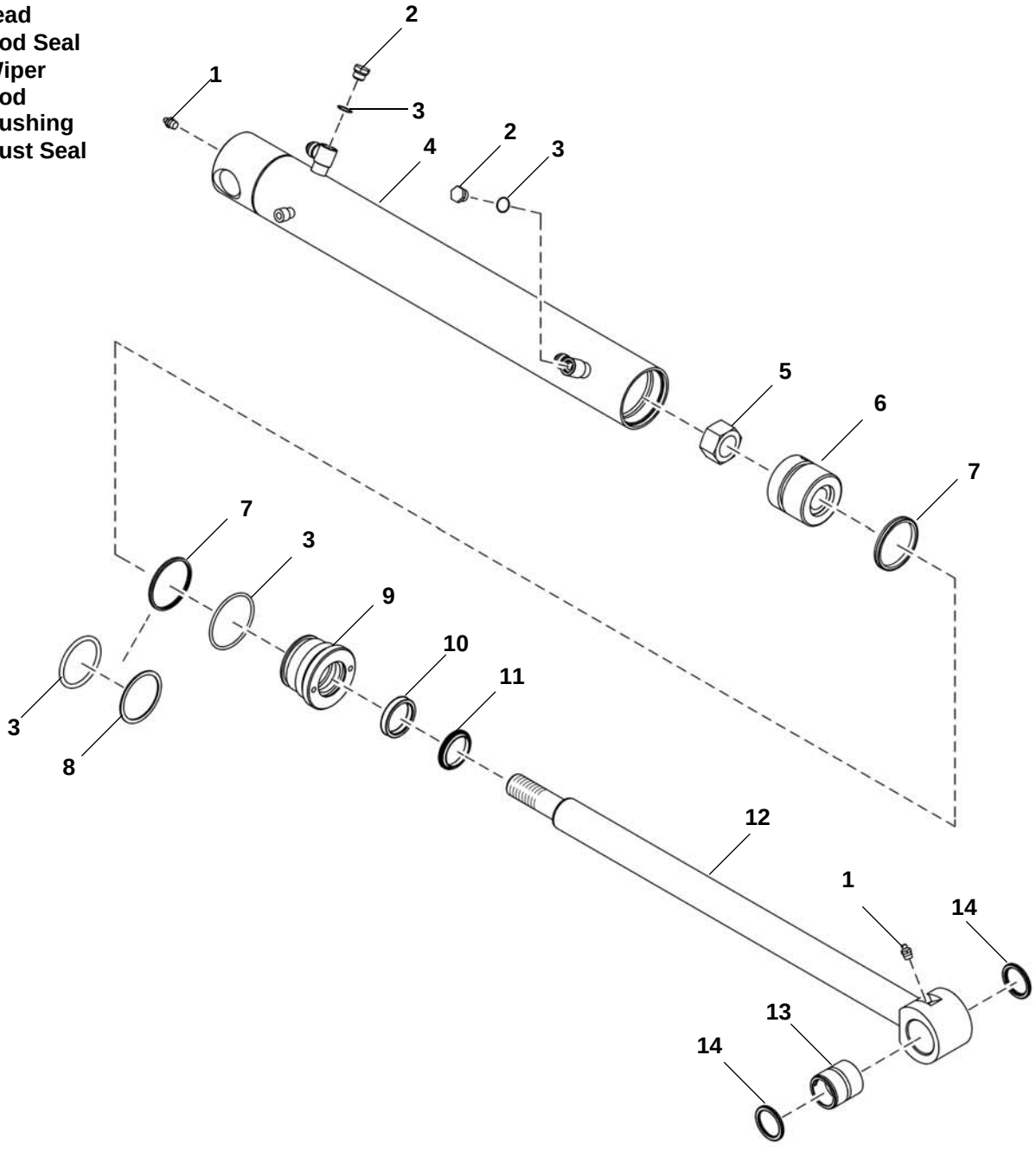


Remove the snap ring (Item 1), washer and base end pin (Item 2) **[Figure 20-21-13]**.

Remove the cylinder.

Parts Identification

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



NA6017S

Disassembly

Clean the outside of the cylinder before disassembly.

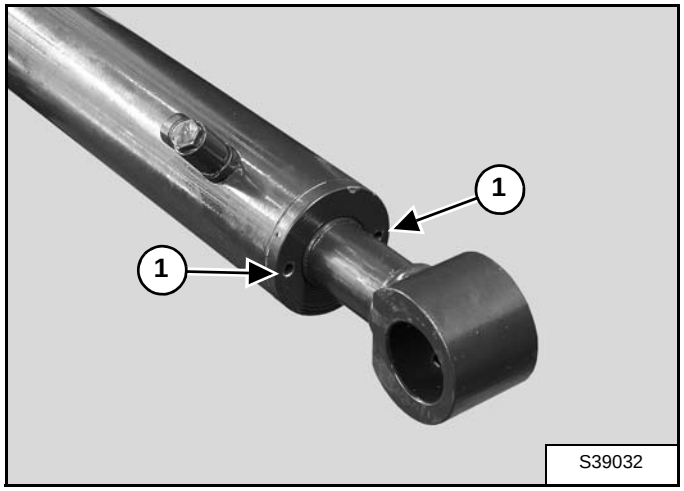
Use the following tools to disassemble the cylinder:

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

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

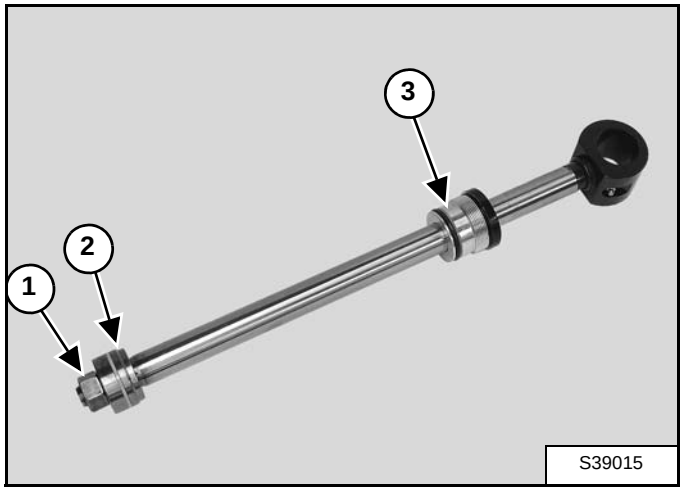
Put the base end of the cylinder in a vise.

Figure 20-21-14



Insert the Adjustable Gland Nut Wrench into the holes (Item 1) **[Figure 20-21-14]** to loosen the head.

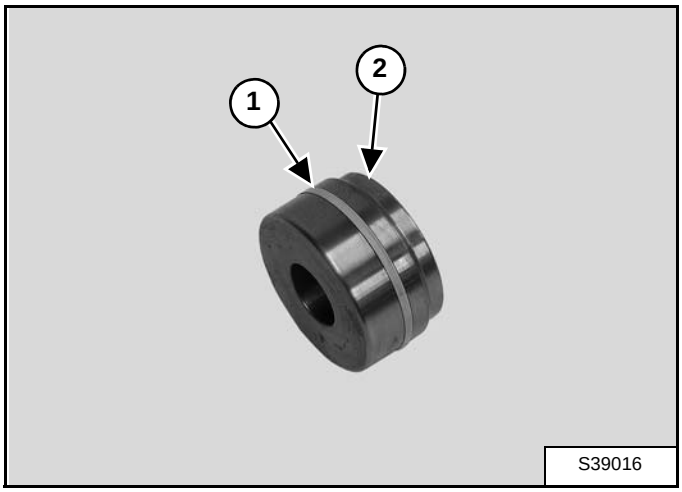
Figure 20-21-15



Remove the head and the rod assembly from the cylinder **[Figure 20-21-15]**. Put the rod end in a vise.

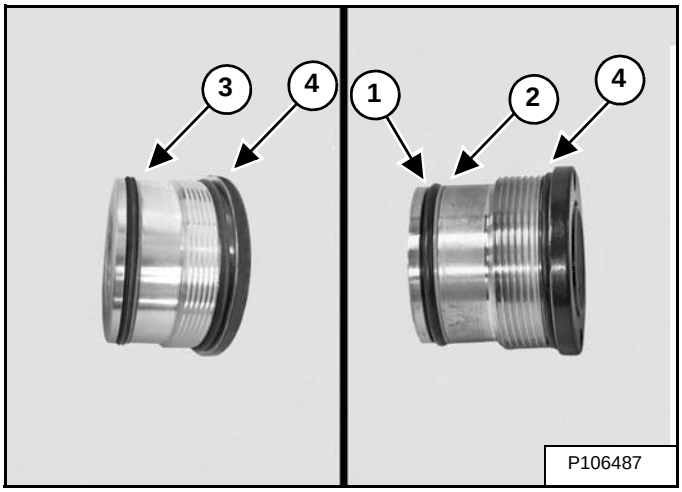
Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-21-15]**.

Figure 20-21-16



Remove the seal (Item 1) from the piston (Item 2) **[Figure 20-21-16]**.

Figure 20-21-17



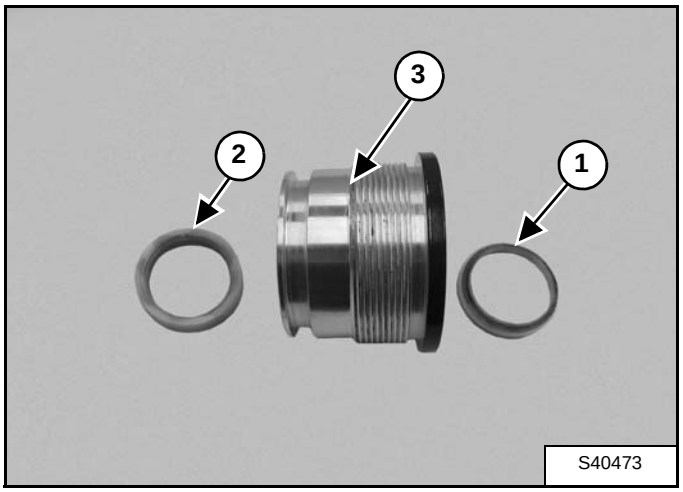
Remove the O-ring (Item 1) and the back-up ring (Item 2) or seal (Item 3) **[Figure 20-21-17]**.

NOTE: The seal kit may contain the O-ring / back-up ring or seal.

Remove the O-ring (Item 4) **[Figure 20-21-17]**.

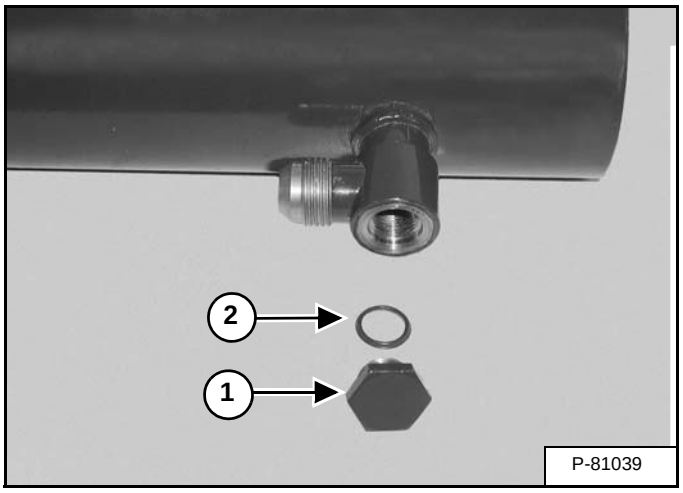
Disassembly (Cont'd)

Figure 20-21-18



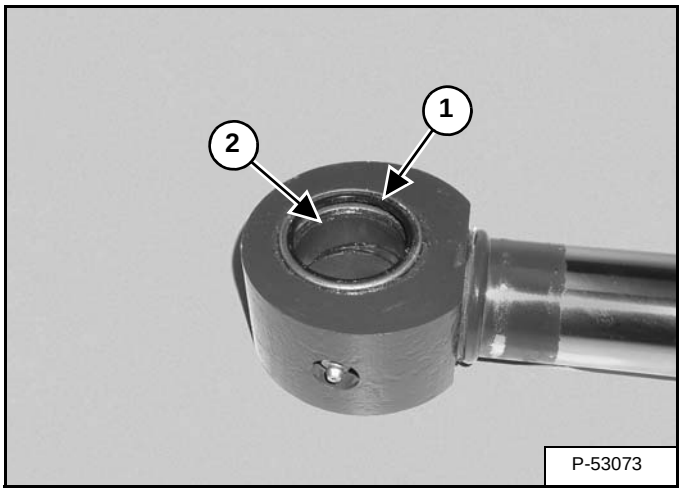
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-21-18]**.

Figure 20-21-19



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

Figure 20-21-20



Remove the dust seals (Item 1) and bushing (Item 2) **[Figure 20-21-20]** from the cylinder rod end.

Assembly

Clean all parts in solvent and dry with compressed air.

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

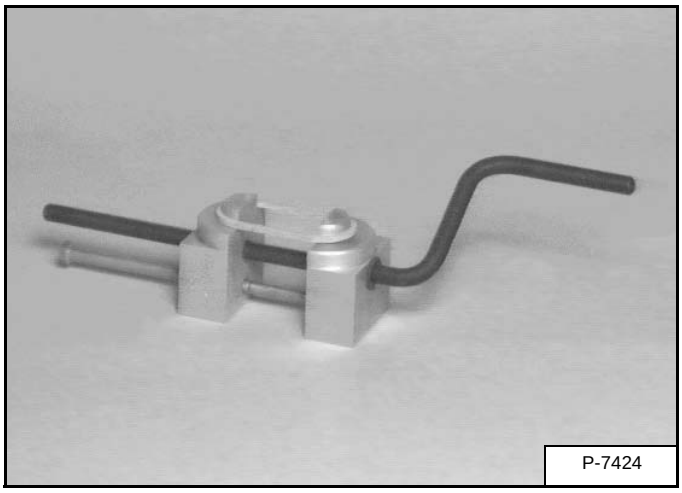
Always install new O-rings and seals during assembly.

Lubricate all O-rings and seals with hydraulic fluid 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 - Offset Pins

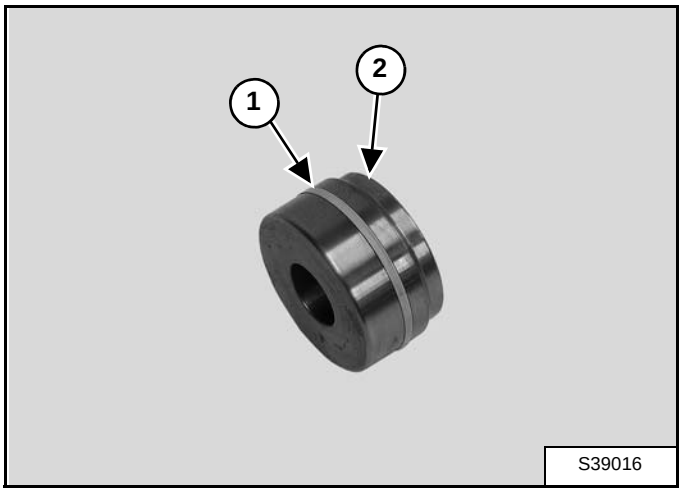
Figure 20-21-21



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

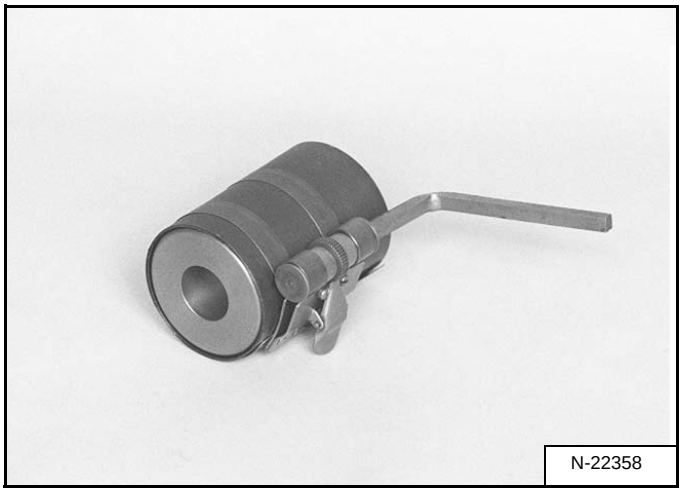
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-21-22



Install the seal (Item 1) on the piston (Item 2) **[Figure 20-21-22]**.

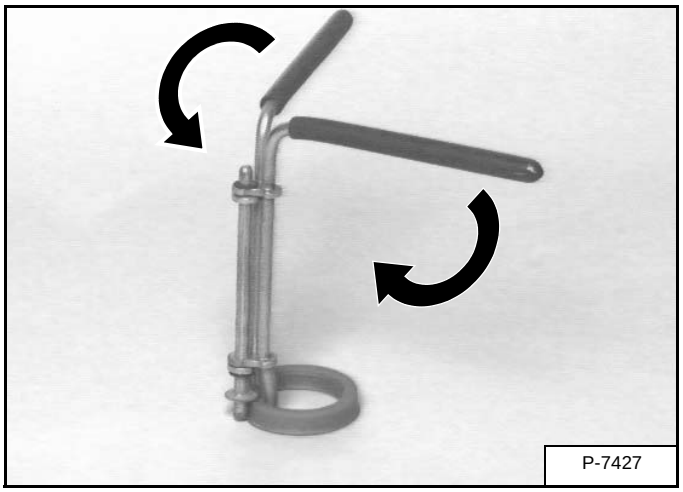
Figure 20-21-23



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for approximately 3 minutes **[Figure 20-21-23]**.

Assembly (Cont'd)

Figure 20-21-24

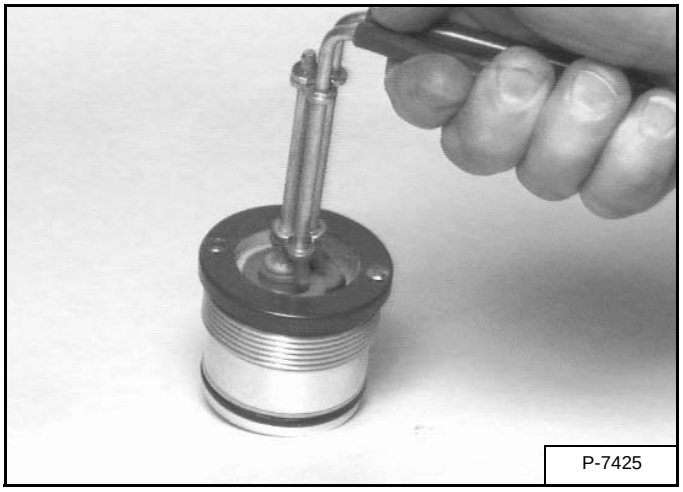


Install the rod seal on the rod seal tool **[Figure 20-21-24]**.

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

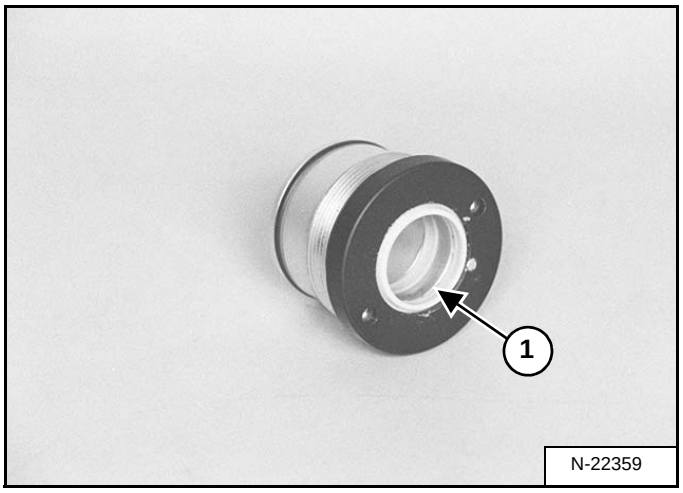
Rotate the handles to collapse the rod seal **[Figure 20-21-24]**.

Figure 20-21-25



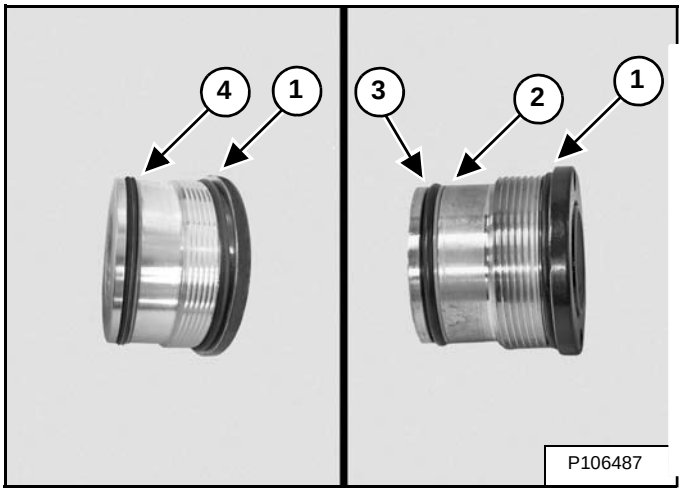
Install the rod seal in the head **[Figure 20-21-25]**.

Figure 20-21-26



Install the wiper seal with the wiper (Item 1) **[Figure 20-21-26]** toward the outside of the head.

Figure 20-21-27

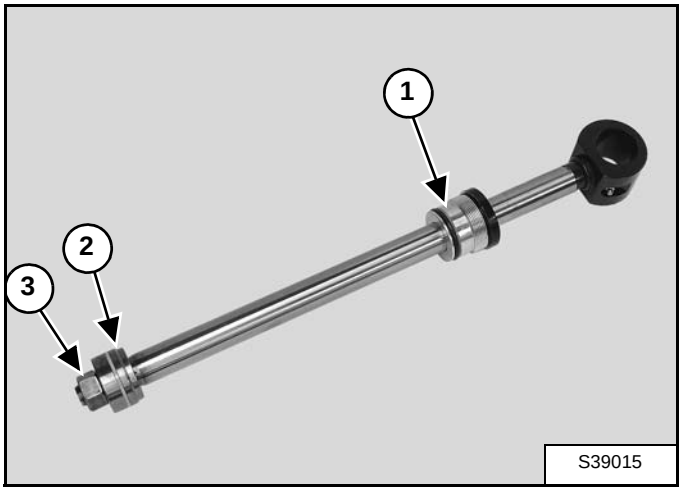


Install the O-ring (Item 1) **[Figure 20-21-27]**.

Install the back-up ring (Item 2) / O-ring (Item 3) or seal (Item 4) **[Figure 20-21-27]**.

Assembly (Cont'd)

Figure 20-21-28



Install the head (Item 1) and the piston (Item 2) **[Figure 20-21-28]** on the rod.

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

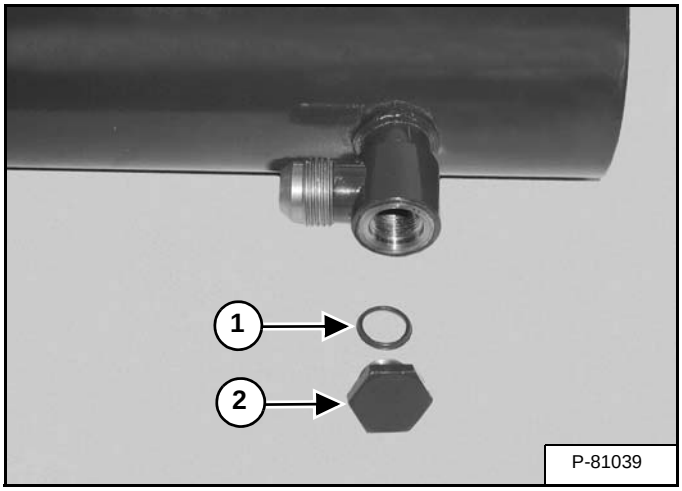
Provide an adequate support for the cylinder before tightening.

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

Install the nut (Item 3) **[Figure 20-21-28]**.

Tighten the nut to 1152,6 N•m (850 ft-lb) torque.

Figure 20-21-29

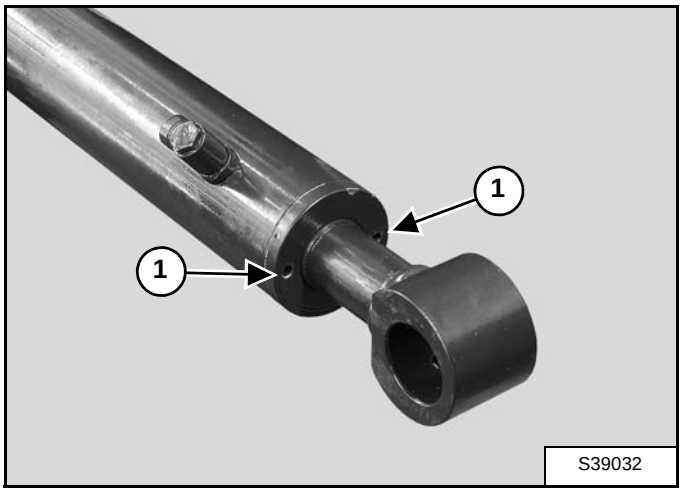


Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-21-29]**.

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

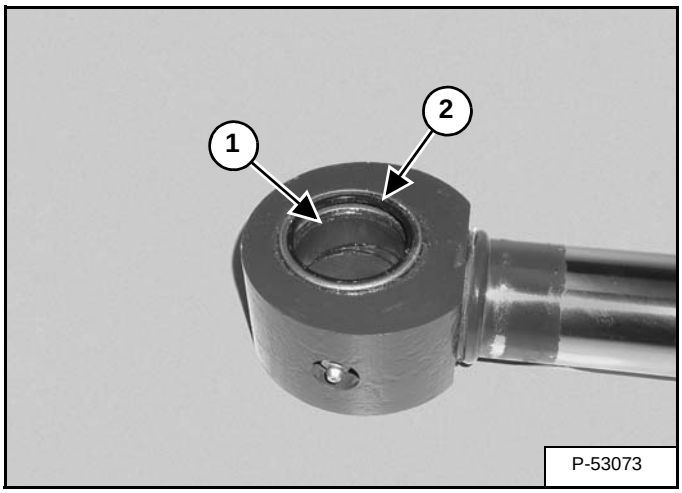
Put the base end of the cylinder in a vise.

Figure 20-21-30



Insert the Adjustable Gland Nut Wrench into the holes (Item 1) **[Figure 20-21-30]**. Tighten the head to 373 N•m (275 ft-lb) torque.

Figure 20-21-31



Install the bushing (Item 1) **[Figure 20-21-31]** on the cylinder rod end. Make sure the bushing is aligned with the grease channel in the cylinder.

Install the dust seal (Item 2) **[Figure 20-21-31]** on both sides of the rod end.

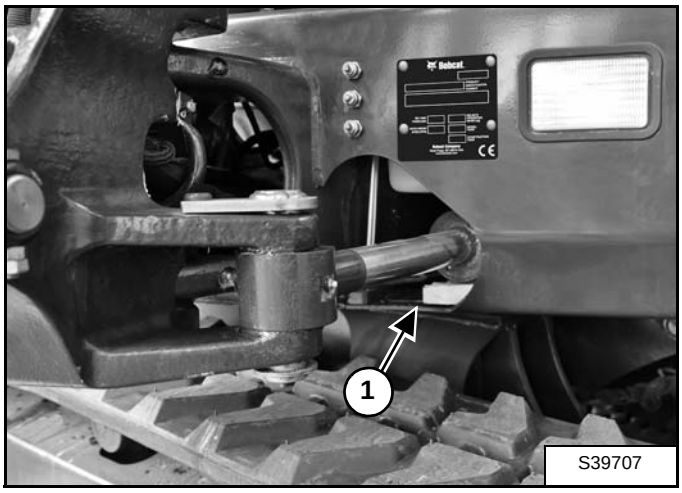
CYLINDER (BOOM SWING)

Testing

Lower the work group to the earth.

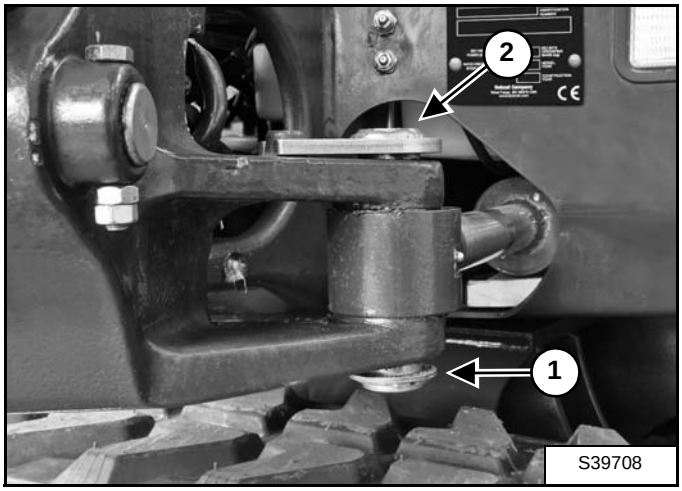
Remove the floor mat and floor panel. (See Removal And Installation on Page 40-110-1.)

Figure 20-22-1



Place a block (Item 1) **[Figure 20-22-1]** under the rod end of the boom swing cylinder.

Figure 20-22-2



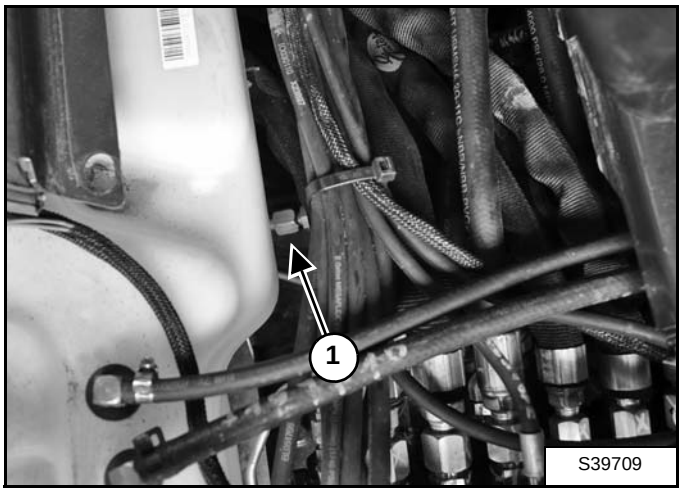
Remove the snap ring (Item 1) **[Figure 20-22-2]** and washer from the rod end pin of the cylinder.

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

Start the engine and fully retract the cylinder rod.

Stop the engine.

Figure 20-22-3



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

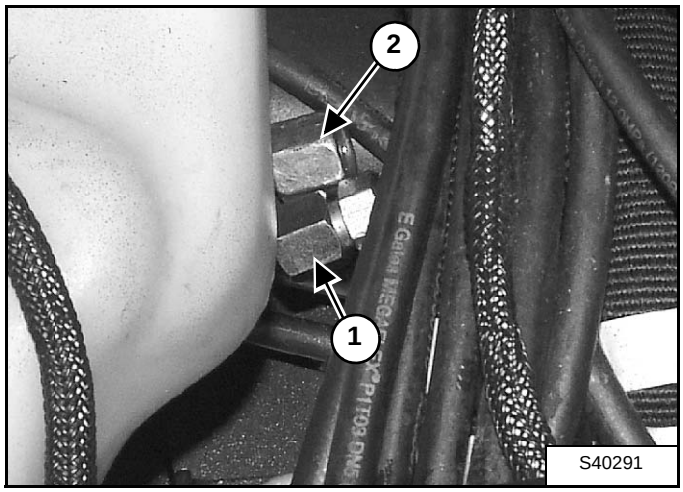
WARNING

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

W-2145-EN-021

Testing (Cont'd)

Figure 20-22-4



Install a cap (Item 1) **[Figure 20-22-4]** 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 20-22-4]** on the boom swing cylinder, remove the cylinder for repair or replacement.

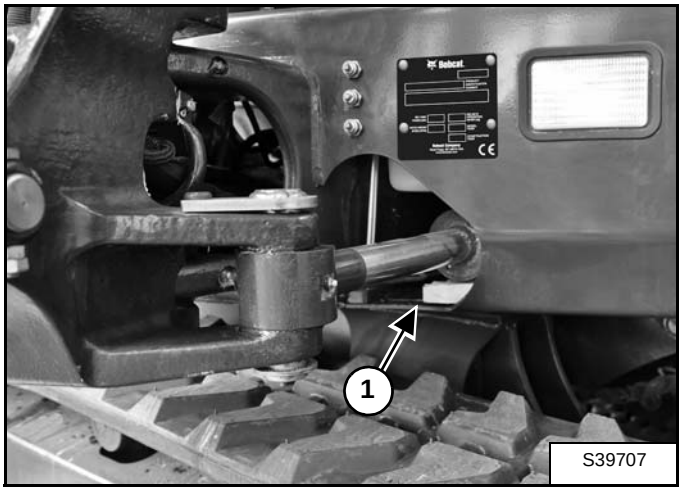
Removal And Installation

Lower the work group to the earth.

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

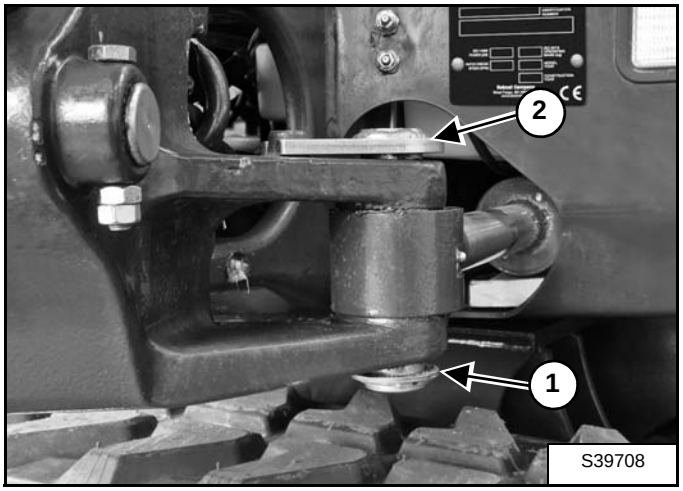
Remove the tool box cover. (See Removal And Installation on Page 40-220-1.)

Figure 20-22-5



Place a block (Item 1) **[Figure 20-22-5]** under the rod end of the boom swing cylinder.

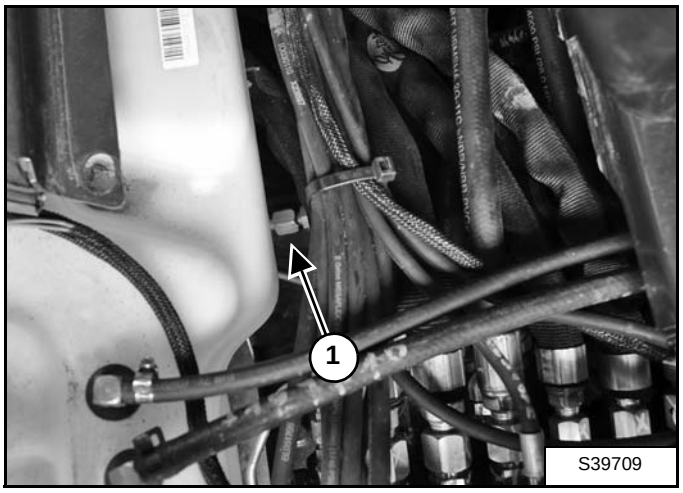
Figure 20-22-6



Remove the snap ring (Item 1) **[Figure 20-22-6]** and washer from the rod end pin of the cylinder.

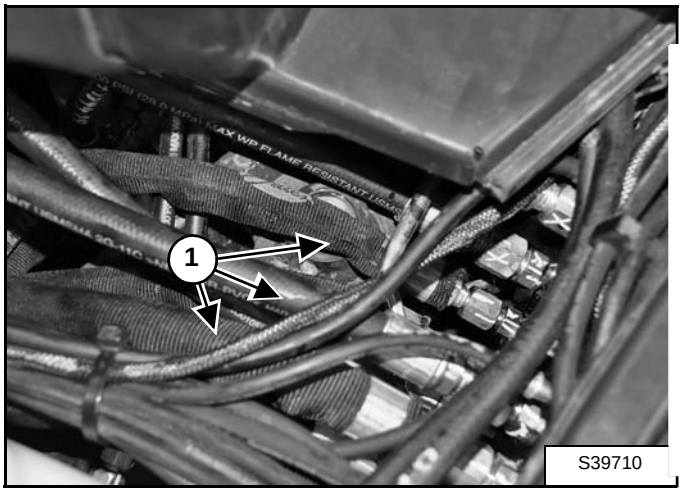
Remove the pin (Item 2) **[Figure 20-22-6]**.

Figure 20-22-7



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

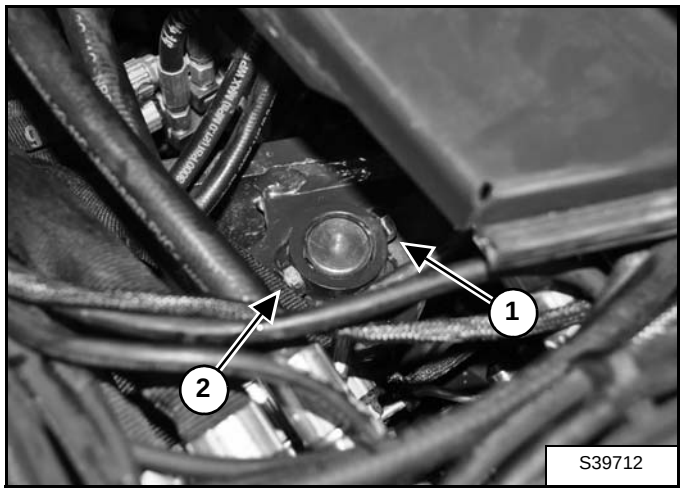
Figure 20-22-8



Remove the three hoses (Item 1) **[Figure 20-22-8]** for easier access.

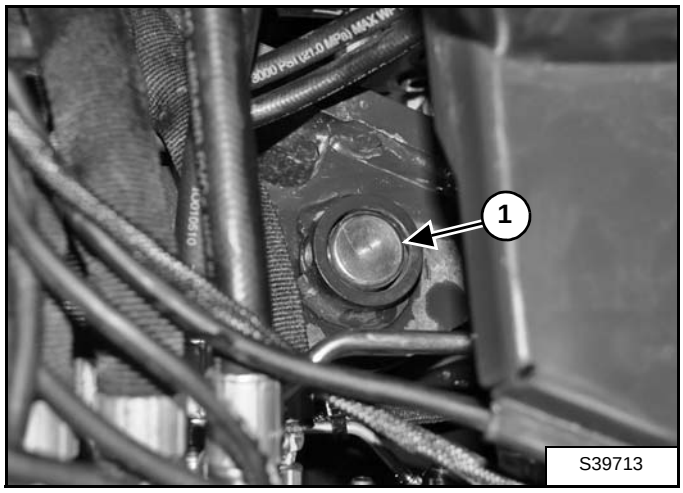
Removal And Installation (Cont'd)

Figure 20-22-9



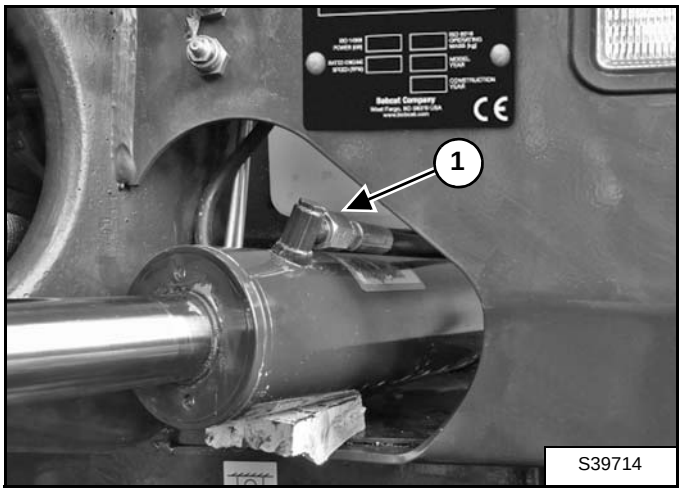
Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-22-9]**.

Figure 20-22-10



Remove the pin (Item 1) **[Figure 20-22-10]** from the base end of the cylinder.

Figure 20-22-11



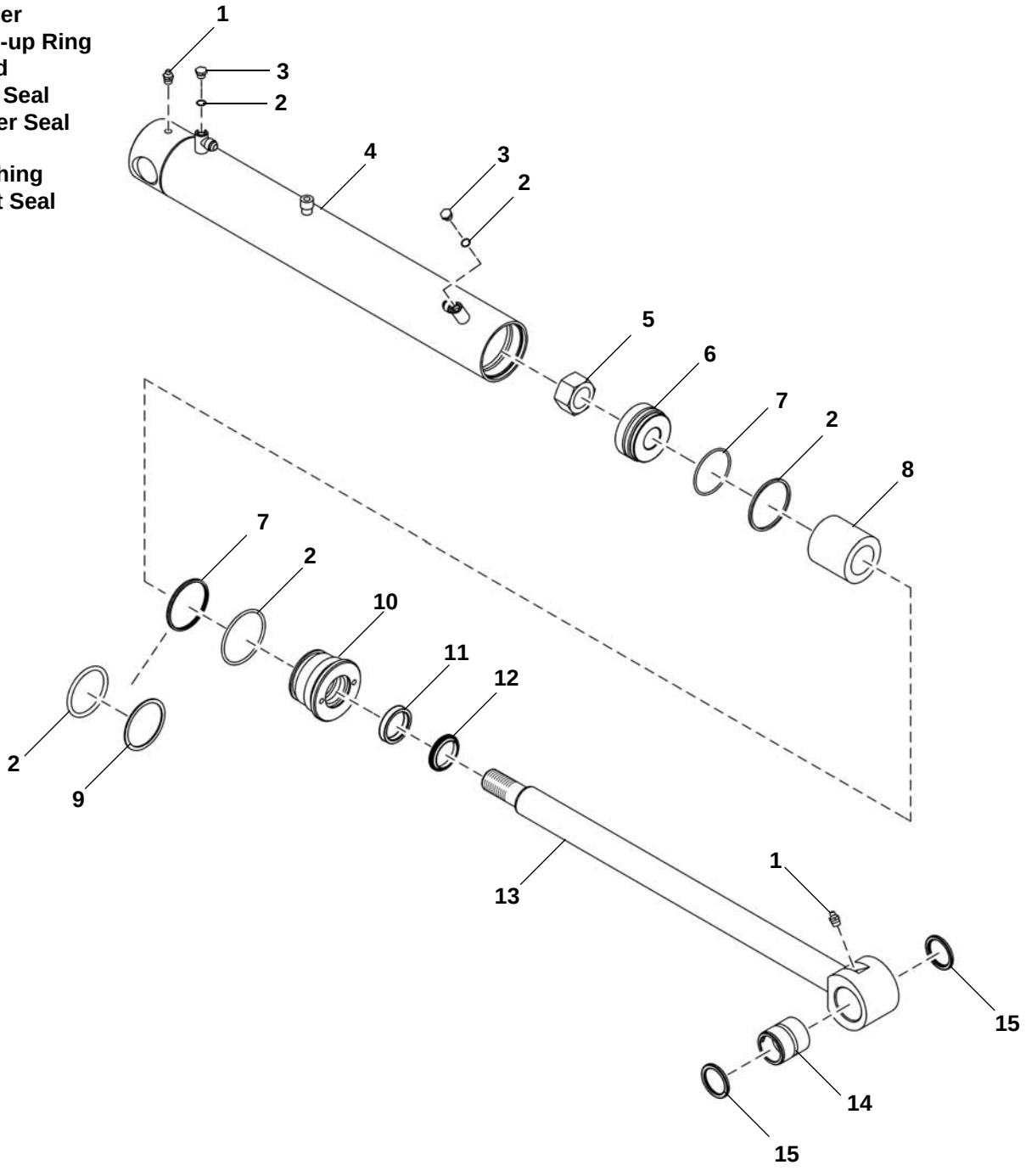
Remove the hose (Item 1) **[Figure 20-22-11]**

Slide the cylinder forward and remove the grease fitting hose.

Remove the cylinder.

Parts Identification

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



NA6020S

Disassembly

Clean the outside of the cylinder before disassembly.

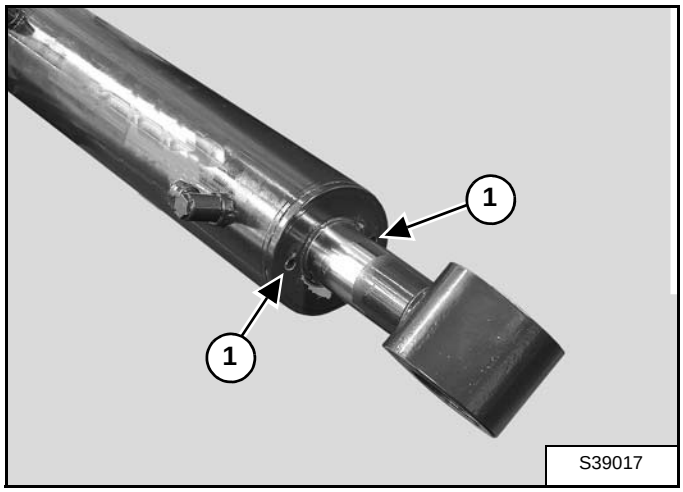
Use the following tools to disassemble the cylinder:

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.

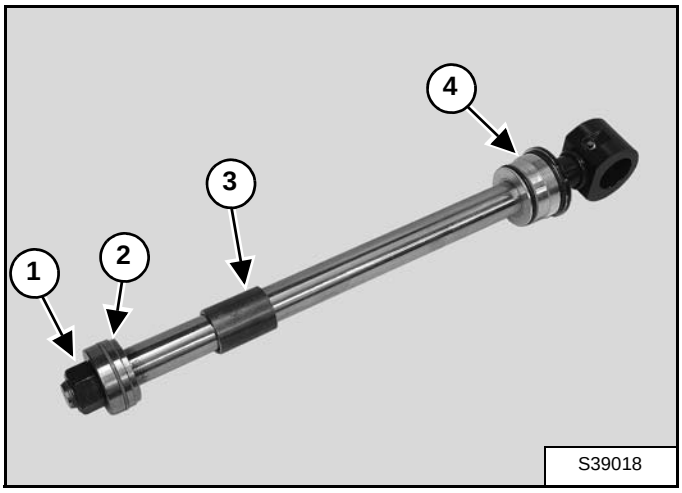
Put the base end of the cylinder in a vise.

Figure 20-22-12



Insert the Adjustable Gland Nut Wrench into the two holes (Item 1) **[Figure 20-22-12]** to loosen the head.

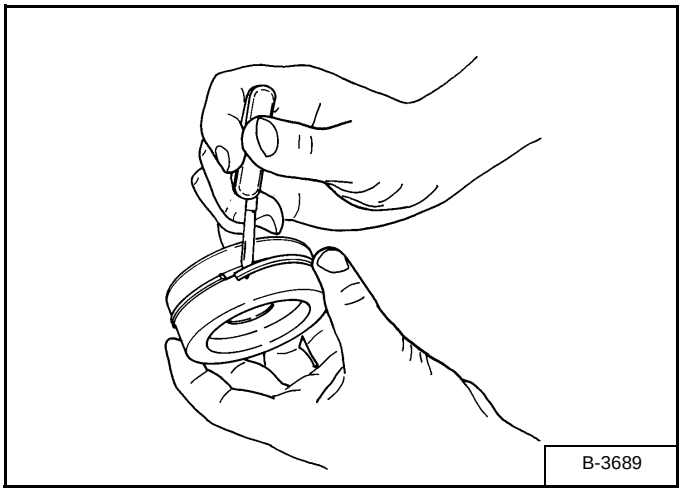
Figure 20-22-13



Remove the head and the rod assembly from the cylinder **[Figure 20-22-13]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2), spacer (Item 3) and head (Item 4) **[Figure 20-22-13]**.

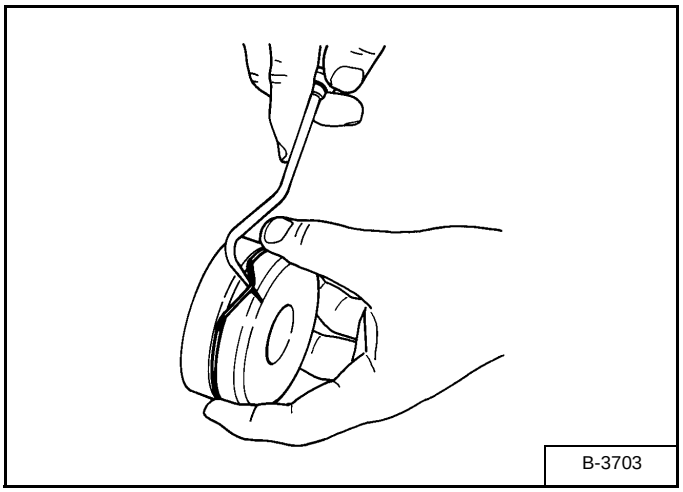
Figure 20-22-14



Cut the old Teflon™ seal and remove the seal from the piston **[Figure 20-22-14]**.

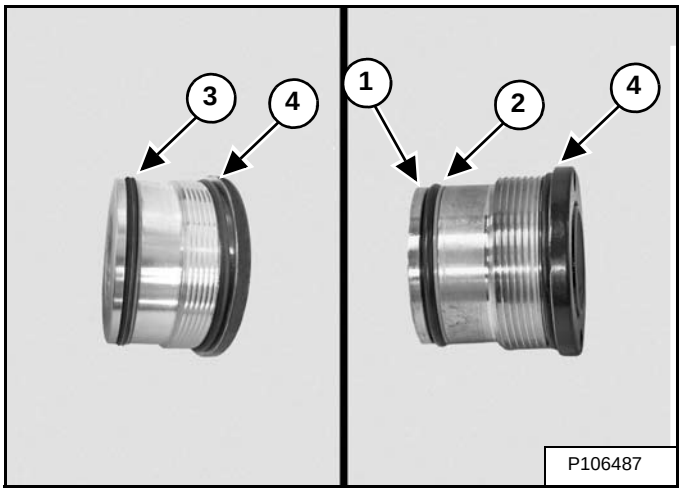
Disassembly (Cont'd)

Figure 20-22-15



Remove the O-ring from the piston **[Figure 20-22-15]**.

Figure 20-22-16

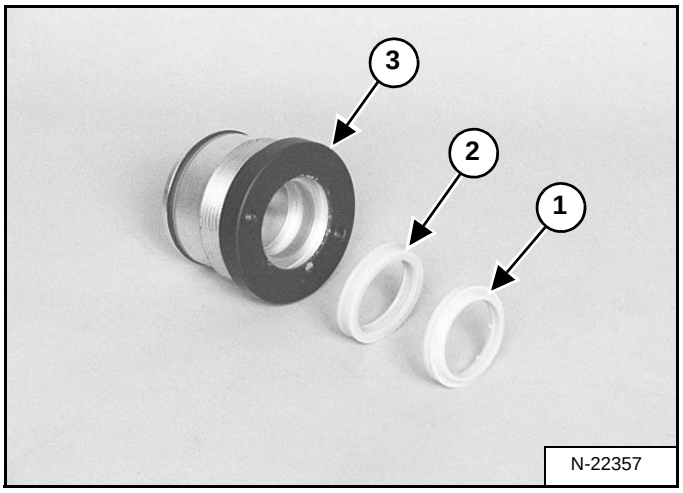


Remove the O-ring (Item 1) and the back-up ring (Item 2) or seal (Item 3) **[Figure 20-22-16]**.

NOTE: The seal kit may contain the O-ring / back-up ring or seal.

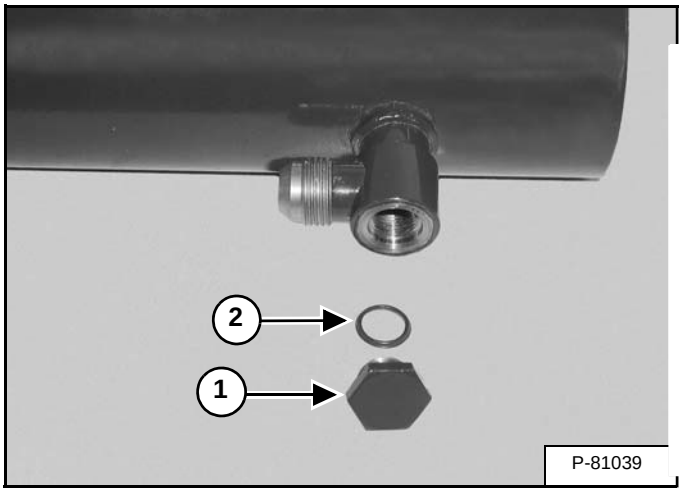
Remove the O-ring (Item 4) **[Figure 20-22-16]**.

Figure 20-22-17



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-22-17]**.

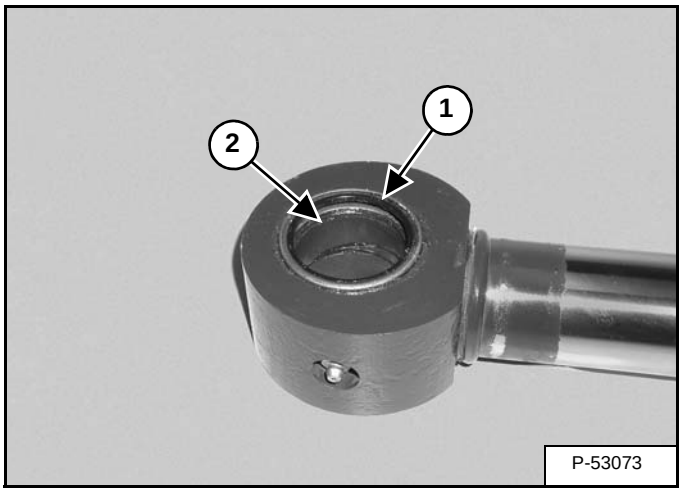
Figure 20-22-18



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-22-18]**.

Disassembly (Cont'd)

Figure 20-22-19



Remove the dust seals (Item 1) and bushing (Item 2) **[Figure 20-22-19]**.

Assembly

Clean all parts in solvent and dry with compressed air.

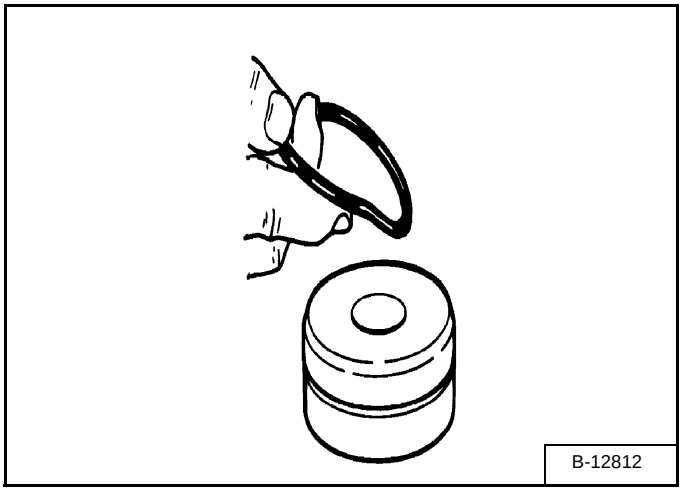
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Use the following tools to assemble the cylinder:

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

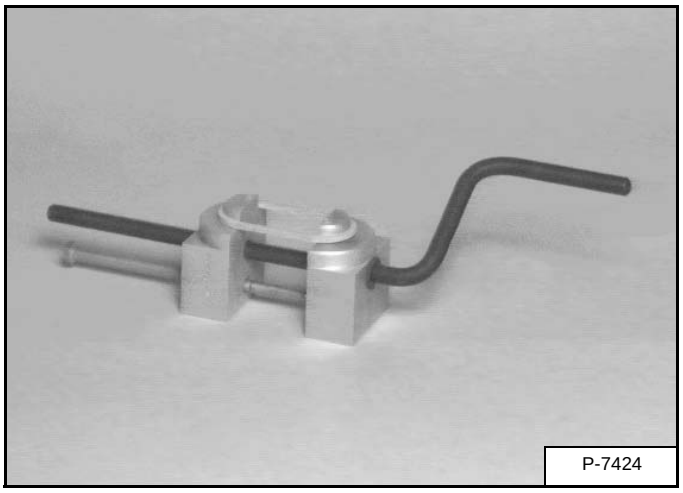
Figure 20-22-20



Install the O-ring on the piston **[Figure 20-22-20]**.

NOTE: Do not overstretch the seal.

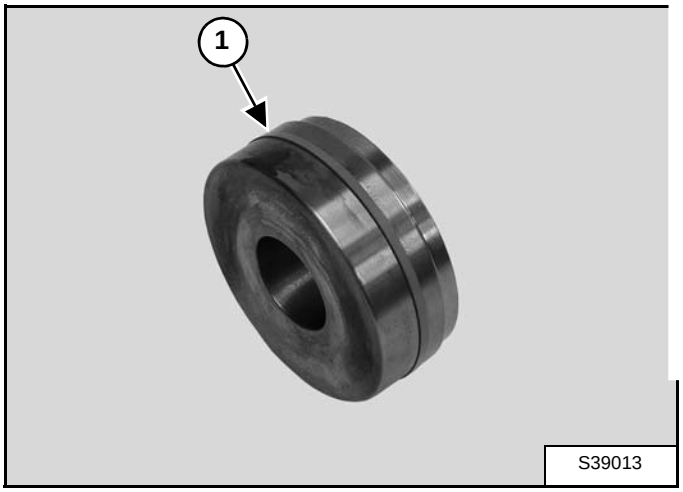
Figure 20-22-21



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.

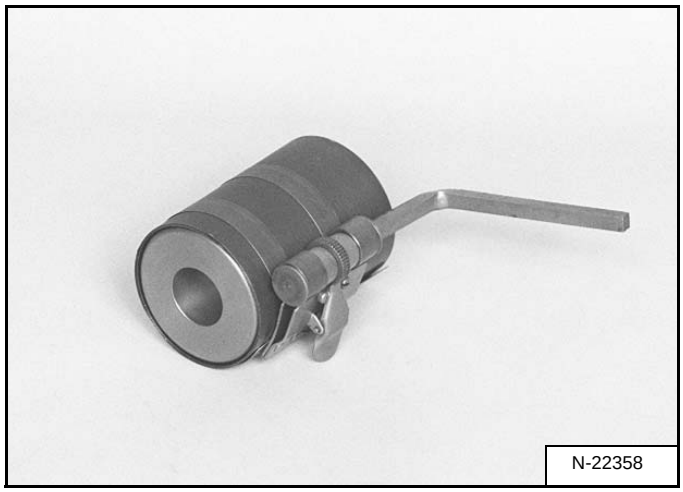
Figure 20-22-22



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

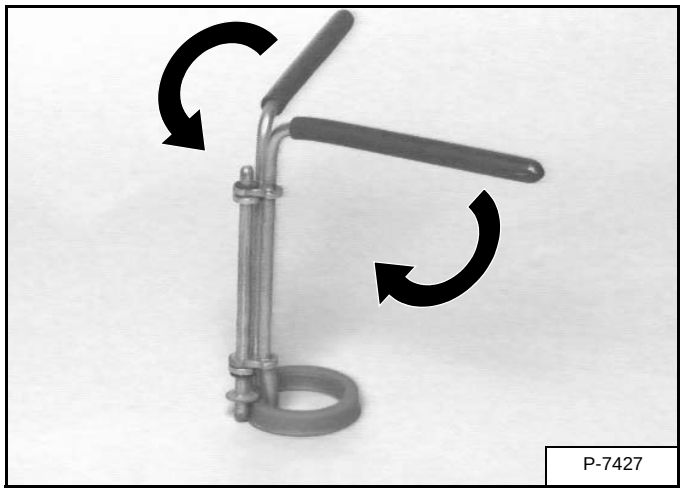
Assembly (Cont'd)

Figure 20-22-23



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for approximately 3 minutes **[Figure 20-22-23]**.

Figure 20-22-24

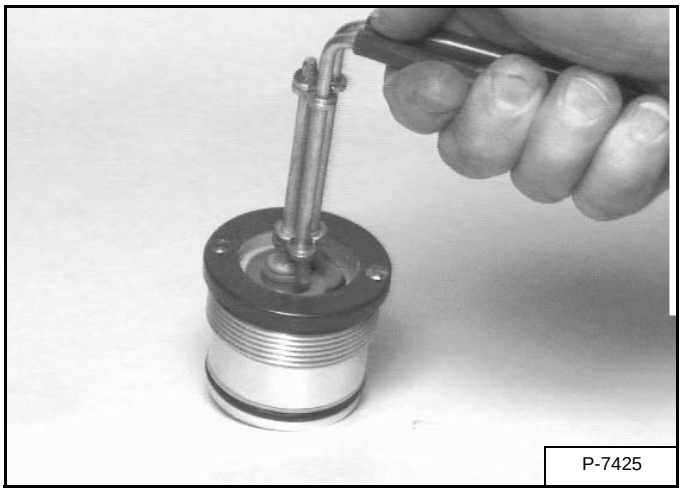


Install the rod seal on the rod seal tool **[Figure 20-22-24]**.

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

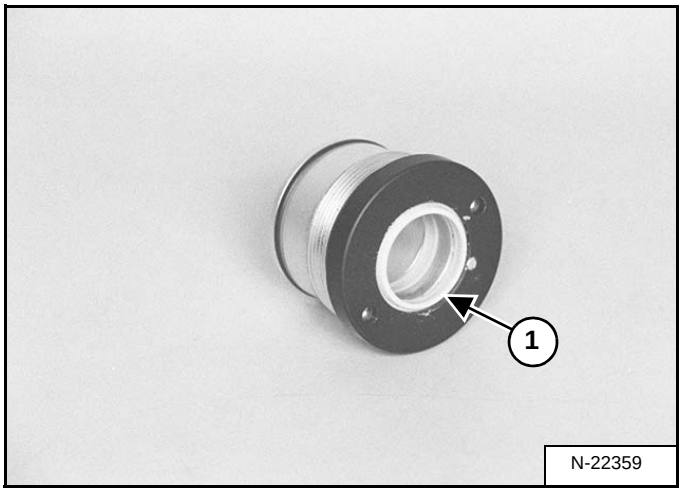
Rotate the handles to collapse the rod seal **[Figure 20-22-24]**.

Figure 20-22-25



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

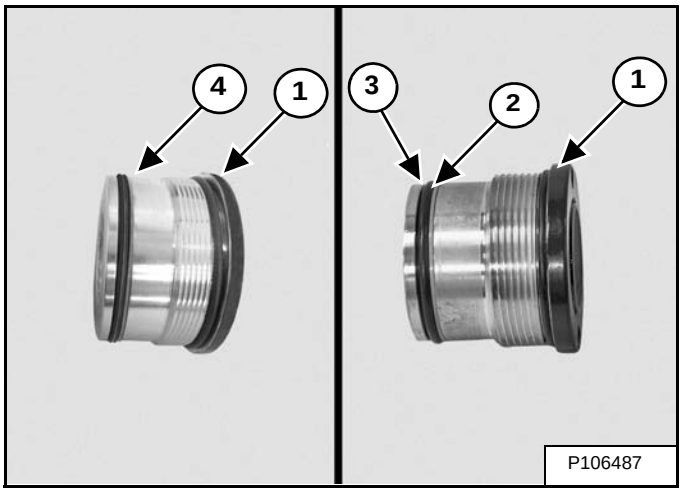
Figure 20-22-26



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

Assembly (Cont'd)

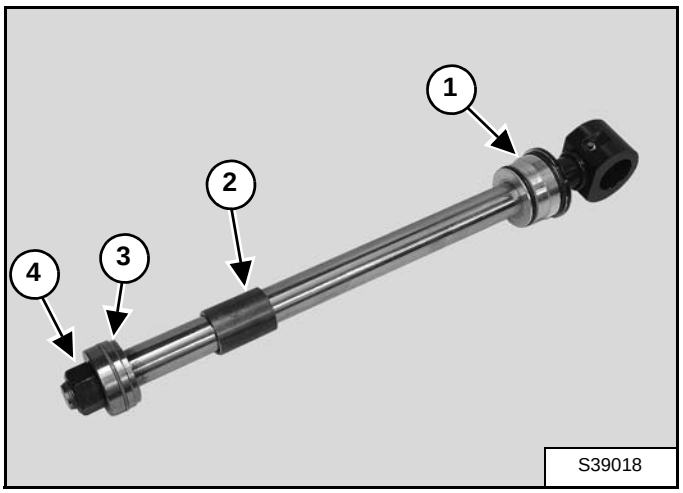
Figure 20-22-27



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

Install the back-up ring (Item 2) / O-ring (Item 3) or seal (Item 4) **[Figure 20-22-27]**.

Figure 20-22-28



Secure the rod end in a vise and provide an adequate support before applying any force to the cylinder.

Install the head (Item 1), spacer (Item 2) and the piston (Item 3) **[Figure 20-22-28]** on the rod as shown.

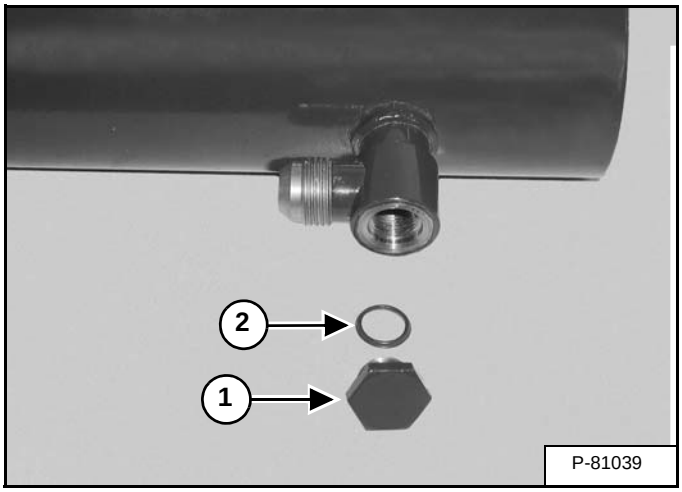
NOTE: Clean and dry the rod threads. Install a NEW NUT with preapplied Loctite®.

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 20-22-28]**. Tighten the nut to 1152,6 N•m (850 ft-lb) torque.

Figure 20-22-29

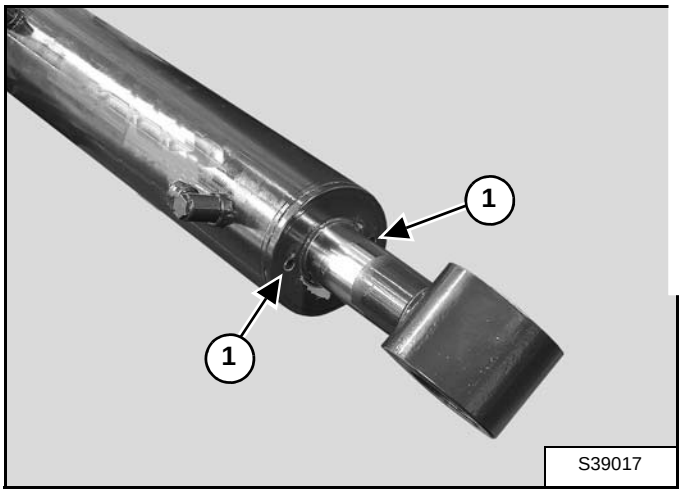


Install plug (Item 1) and O-ring (Item 2) **[Figure 20-22-29]**.

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

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

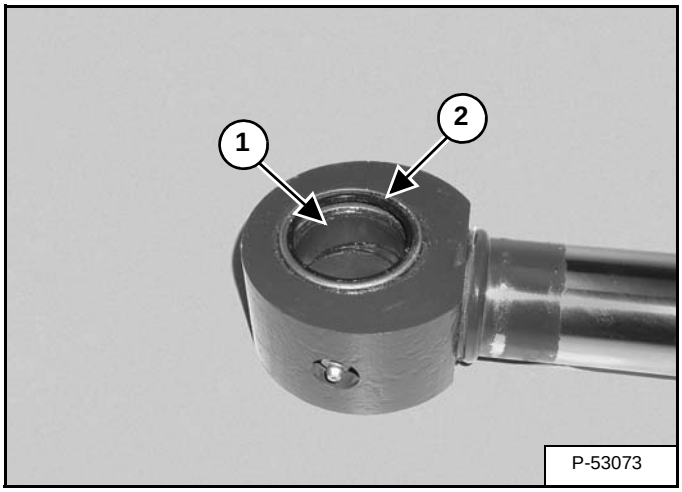
Figure 20-22-30



Insert the Adjustable Gland Nut Wrench into the two holes (Item 1) **[Figure 20-22-30]**. Tighten the head to 373 N•m (275 ft-lb) torque.

Assembly (Cont'd)

Figure 20-22-31



Install the bushing (Item 1) **[Figure 20-22-31]**. The bushing must be aligned with the grease channel in the rod end of the cylinder.

Install the dust seal (Item 2) **[Figure 20-22-31]** on both sides of the rod end.

CYLINDER (BUCKET)

Testing

Lower the work group to the earth.

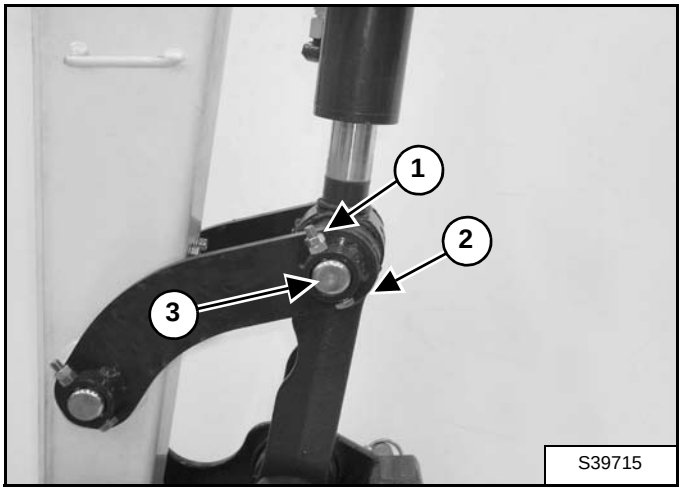
With the engine off, turn the key switch to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-23-1



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

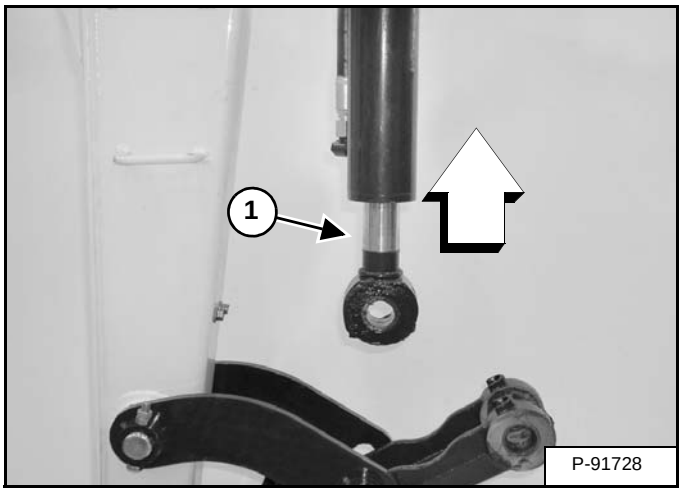
Figure 20-23-2



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

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

Figure 20-23-3



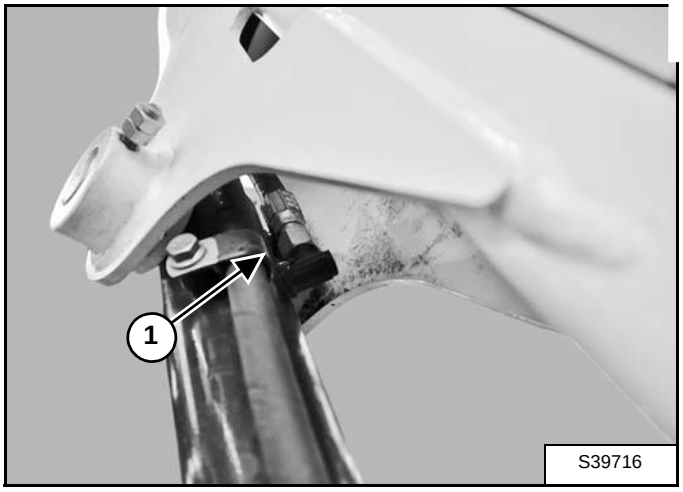
Start the engine and fully retract the cylinder rod (Item 1) **[Figure 20-23-3]**.

⚠ WARNING

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

W-2145-029

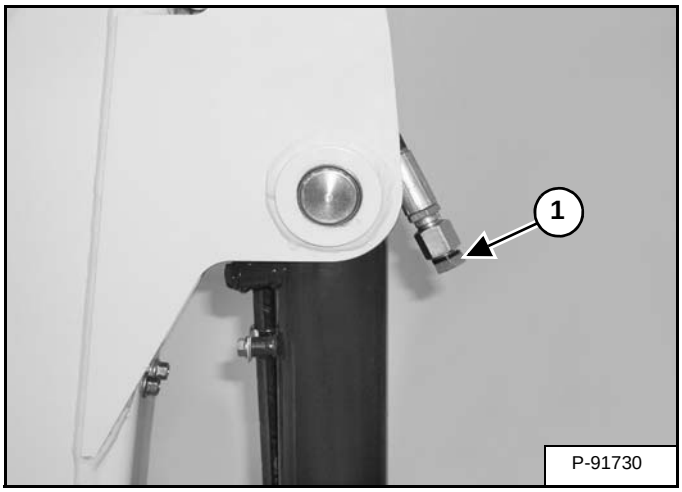
Figure 20-23-4



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

Testing (Cont'd)

Figure 20-23-5



Install a plug (Item 1) **[Figure 20-23-5]** 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.

Removal And Installation

Lower the work group to the earth.

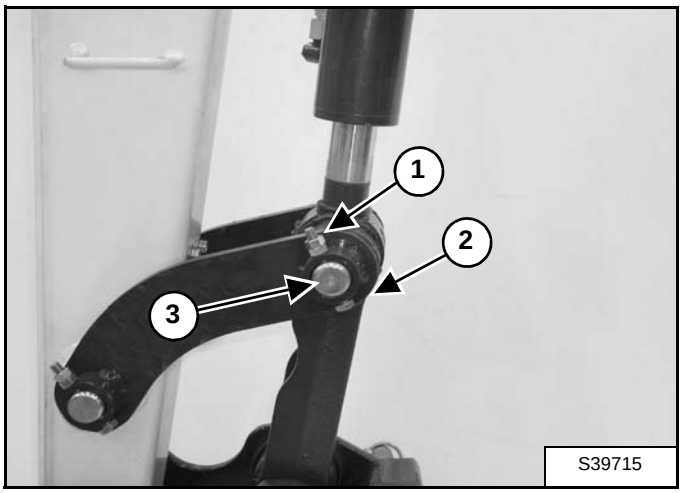
With the engine off, turn the key switch to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-23-6



Support the boom using a chain hoist **[Figure 20-23-6]**.

Figure 20-23-7

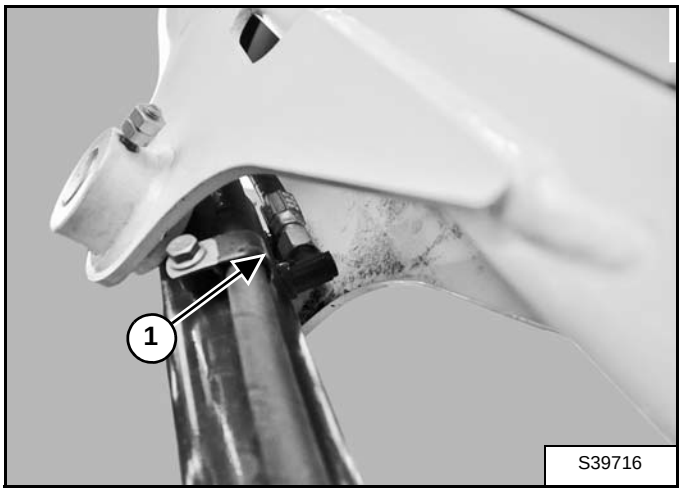


Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-23-7]**.

Remove the pin (Item 3) **[Figure 20-23-7]**.

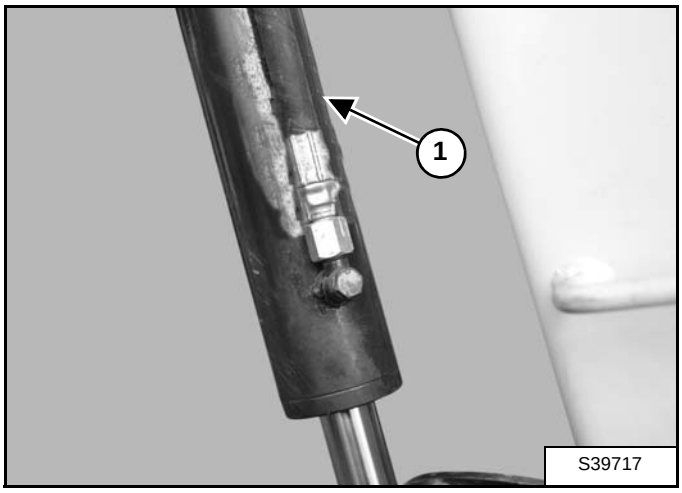
Removal And Installation (Cont'd)

Figure 20-23-8



Remove the hose (Item 1) **[Figure 20-23-8]**.

Figure 20-23-9



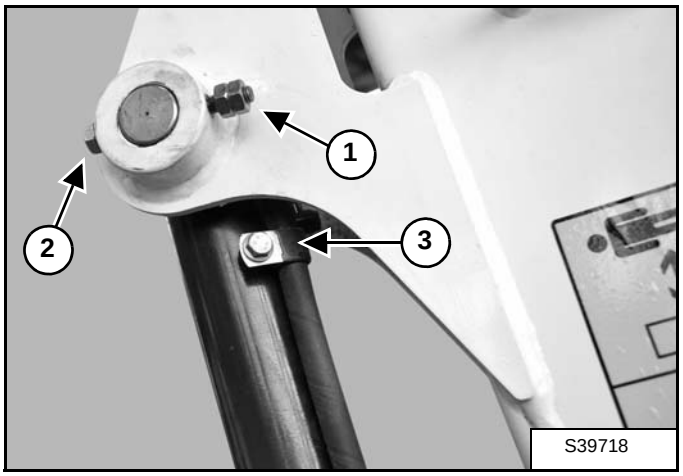
Remove the hose (Item 1) **[Figure 20-23-9]**.

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

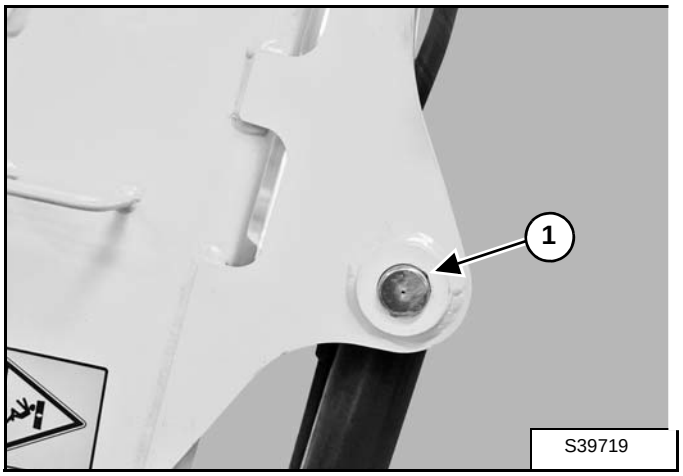
Figure 20-23-10



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-23-10]**.

Remove the hose clamp (Item 3) **[Figure 20-23-10]**.

Figure 20-23-11

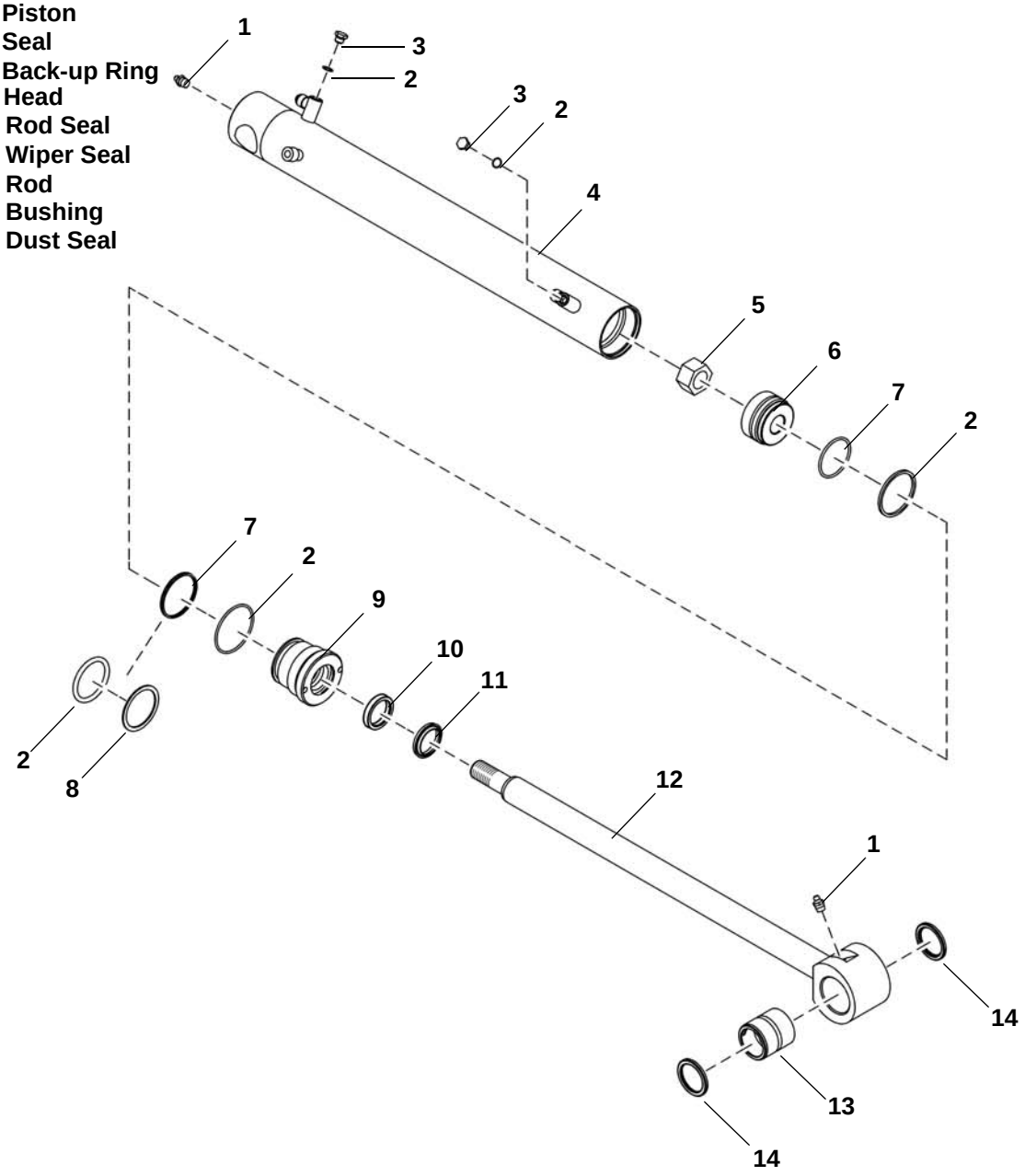


Remove the pin (Item 1) **[Figure 20-23-11]**.

Remove the cylinder.

Parts Identification

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



NA6021S

Disassembly

Clean the outside of the cylinder before disassembly.

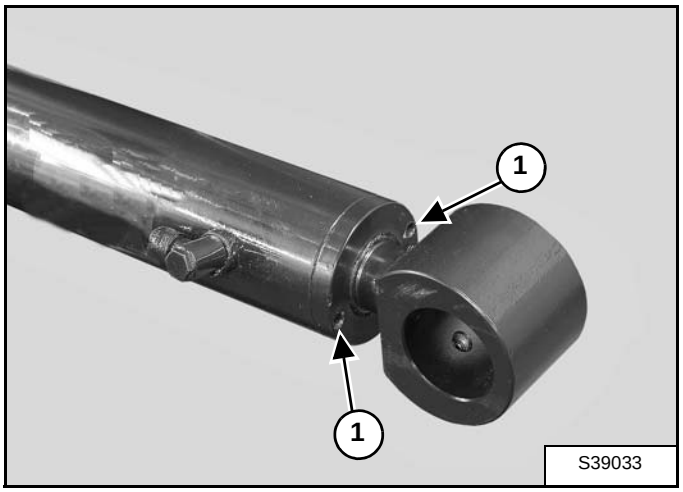
Use the following tools to disassemble the cylinder:

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

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

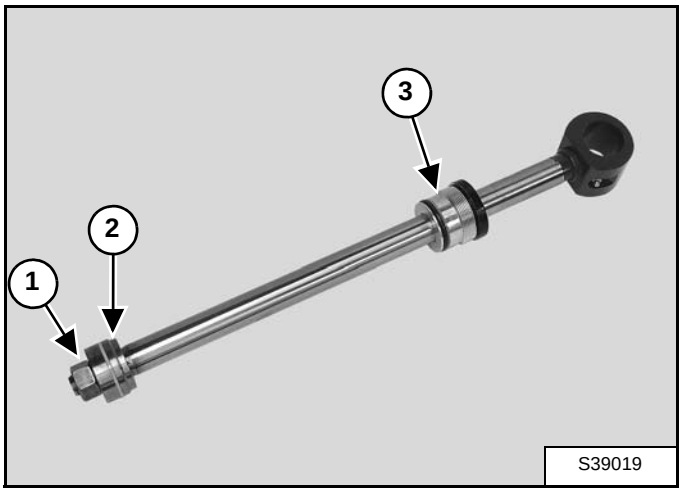
Put the base end of the cylinder in a vise.

Figure 20-23-12



Insert the Adjustable Gland Nut Wrench into the two holes (Item 1) **[Figure 20-23-12]** to loosen the head.

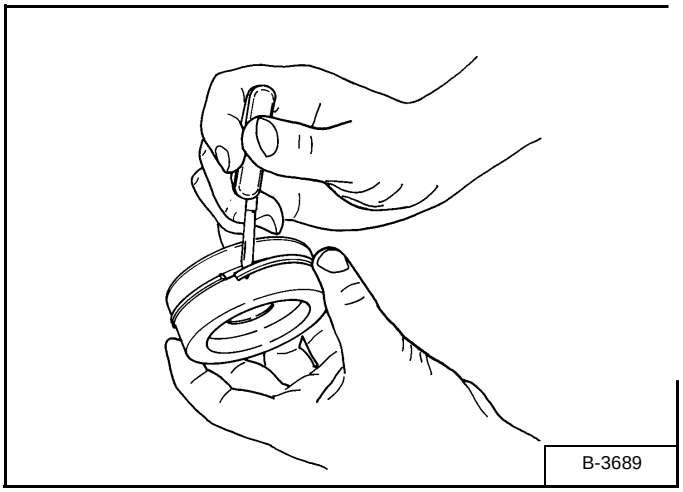
Figure 20-23-13



Remove the head and the rod assembly from the cylinder **[Figure 20-23-13]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-23-13]**.

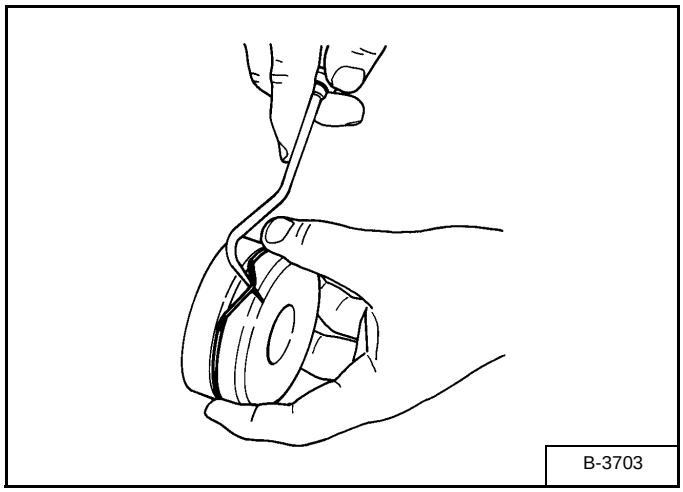
Figure 20-23-14



Cut the old Teflon™ seal and remove the seal from the piston **[Figure 20-23-14]**.

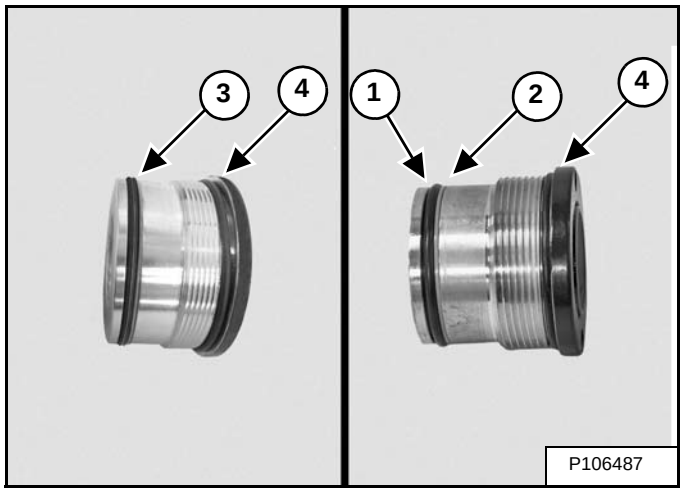
Disassembly (Cont'd)

Figure 20-23-15



Remove the O-ring from the piston **[Figure 20-23-15]**.

Figure 20-23-16

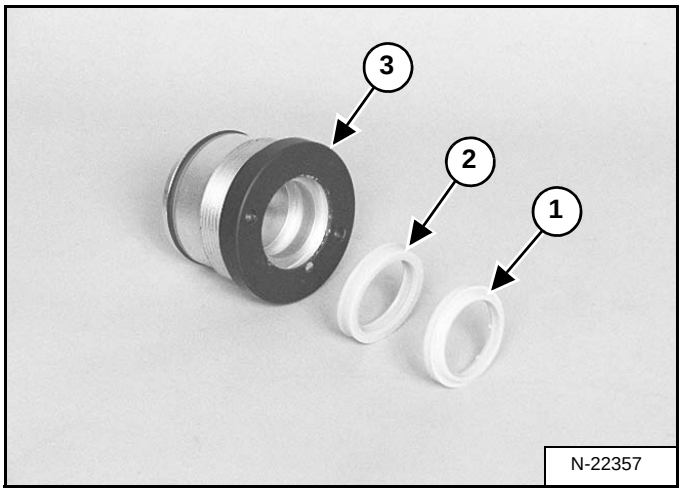


Remove the O-ring (Item 1) and the back-up ring (Item 2)or seal (Item 3) **[Figure 20-23-16]**.

NOTE: The seal kit may contain the O-ring / back-up ring or seal.

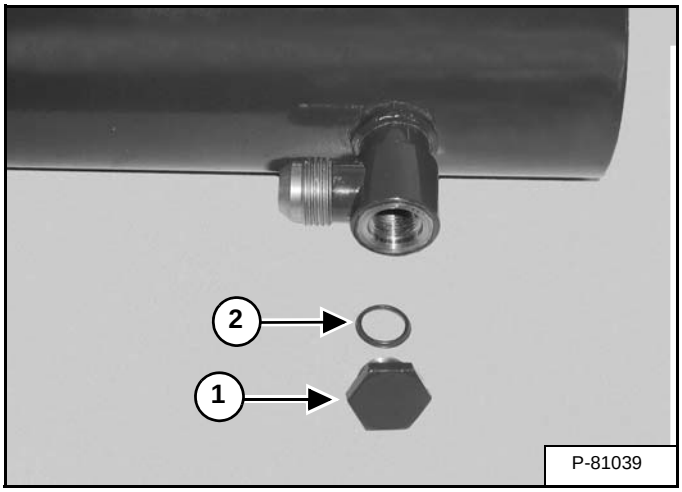
Remove the O-ring (Item 4) **[Figure 20-23-16]**.

Figure 20-23-17



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-23-17]**.

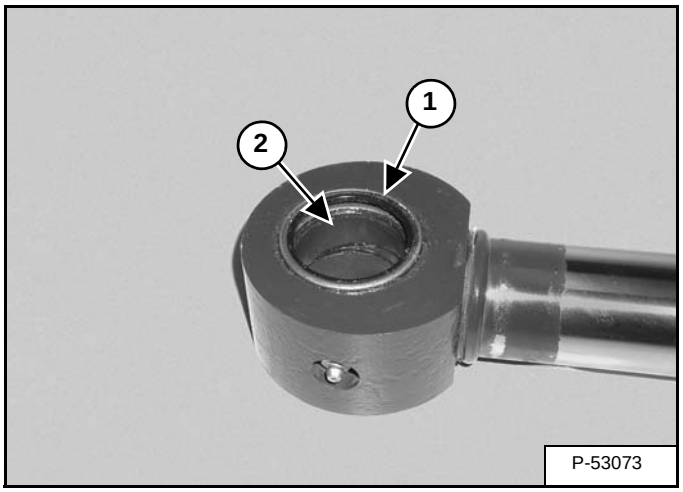
Figure 20-23-18



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-23-18]**.

Disassembly (Cont'd)

Figure 20-23-19



Remove the dust seals (Item 1) and bushing (Item 2) **[Figure 20-23-19]**.

Assembly

Clean all parts in solvent and dry with compressed air.

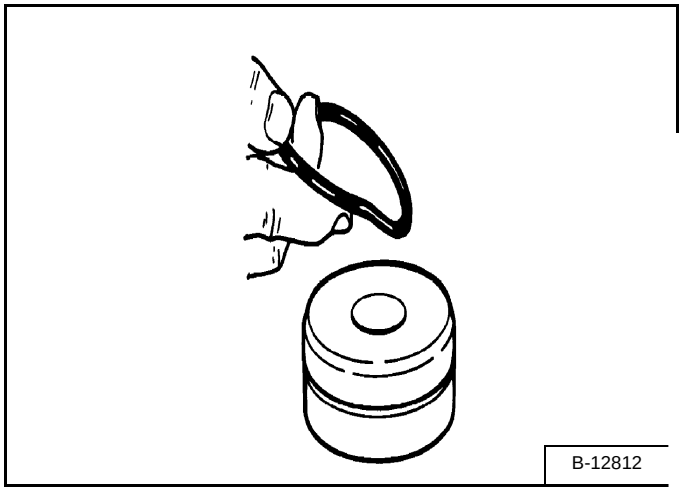
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Use the following tools to assemble the cylinder:

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

Figure 20-23-20

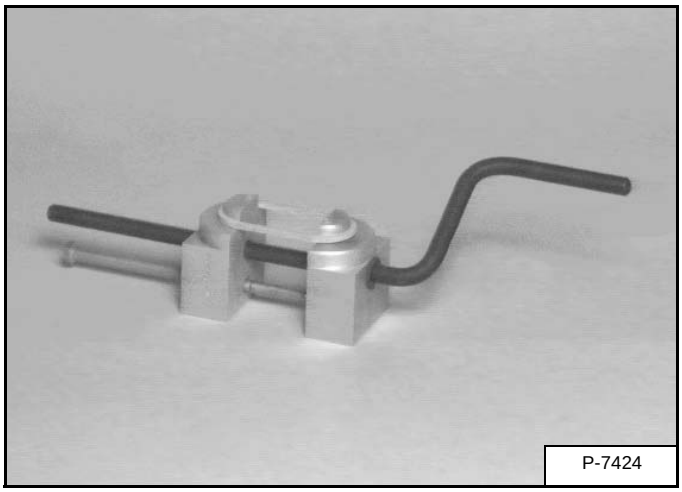


Install the O-ring on the piston **[Figure 20-23-20]**.

NOTE: Do not overstretch the O-ring.

Assembly (Cont'd)

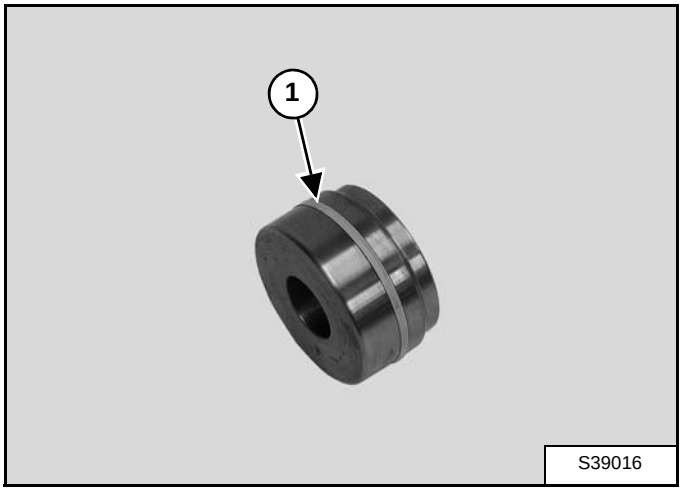
Figure 20-23-21



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-23-21]**.

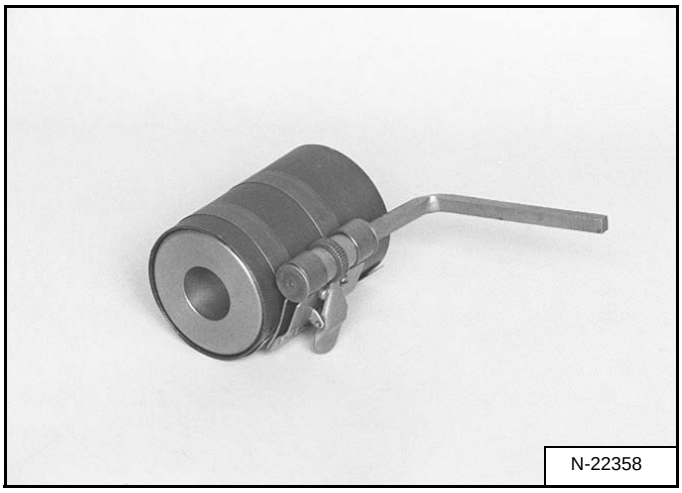
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-23-22



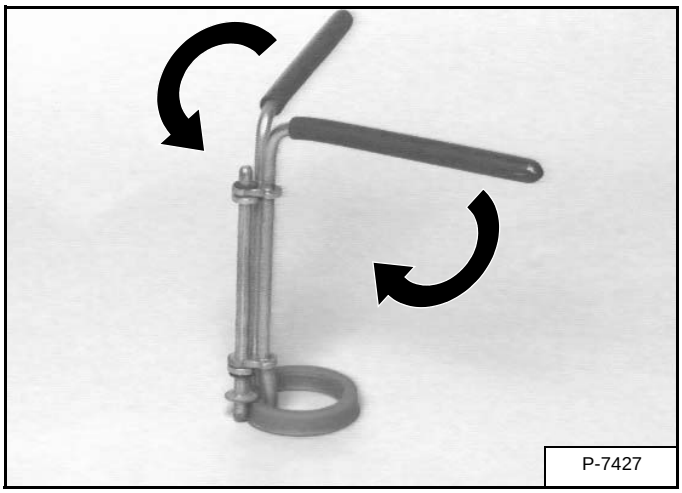
Install the seal (Item 1) **[Figure 20-23-22]** on the piston.

Figure 20-23-23



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

Figure 20-23-24



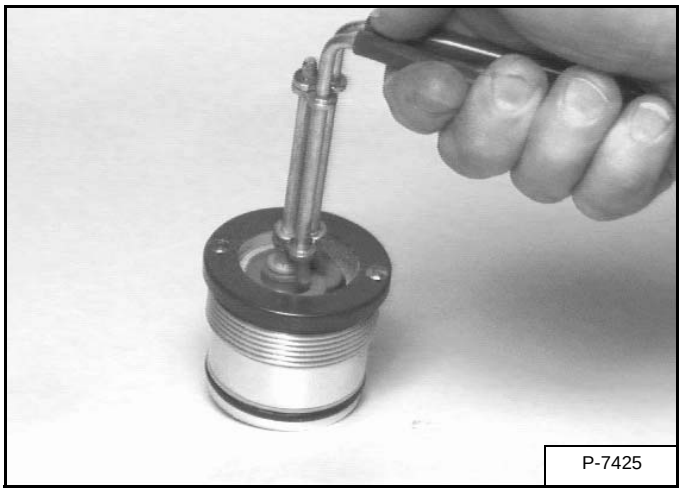
Install the rod seal on the rod seal tool **[Figure 20-23-24]**.

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 20-23-24]**.

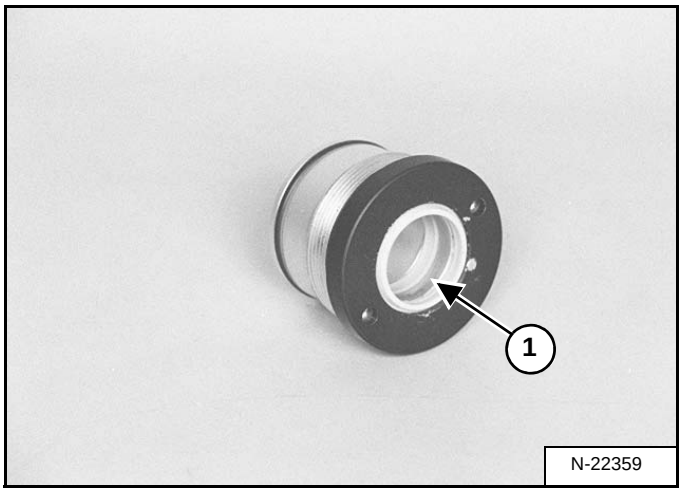
Assembly (Cont'd)

Figure 20-23-25



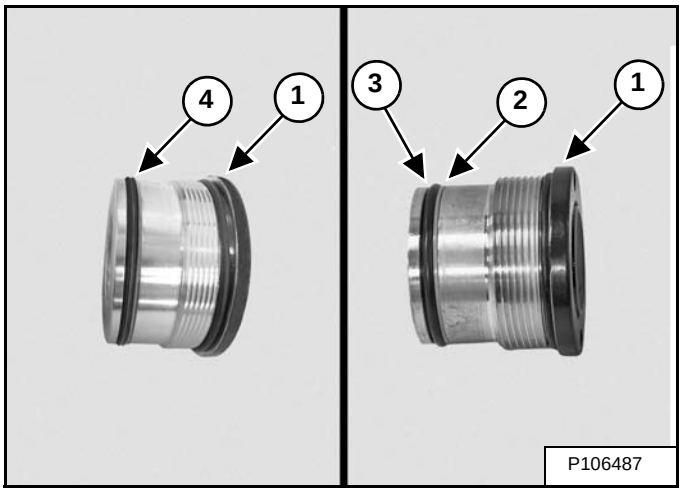
Install the rod seal in the head **[Figure 20-23-25]**.

Figure 20-23-26



Install the wiper seal with the wiper (Item 1) **[Figure 20-23-26]** toward the outside of the head.

Figure 20-23-27

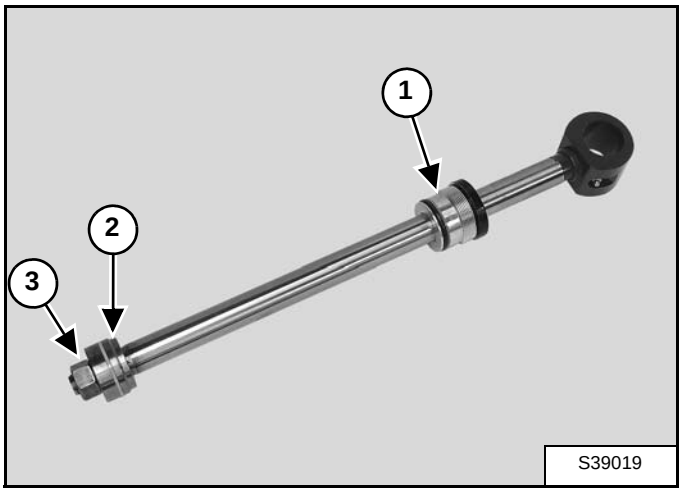


Install the O-ring (Item 1) **[Figure 20-23-27]**.

Install the back-up ring (Item 2) / O-ring (Item 3) or seal (Item 4).

Assembly (Cont'd)

Figure 20-23-28



Install the head (Item 1) and the piston (Item 2) **[Figure 20-23-28]** on the rod as shown.

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

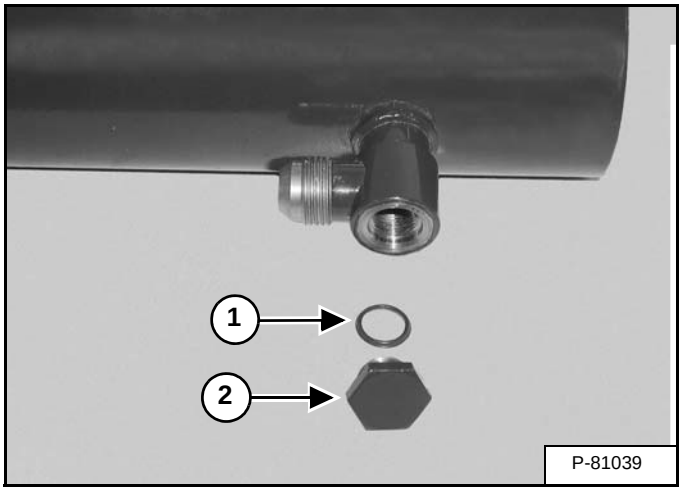
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-23-28]**.

Tighten the nut to 406,8 N•m (300 ft-lb) torque.

Figure 20-23-29

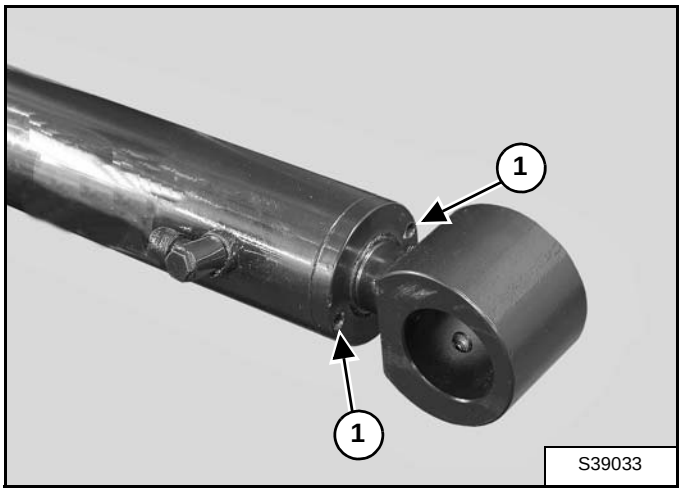


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-23-29]**.

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

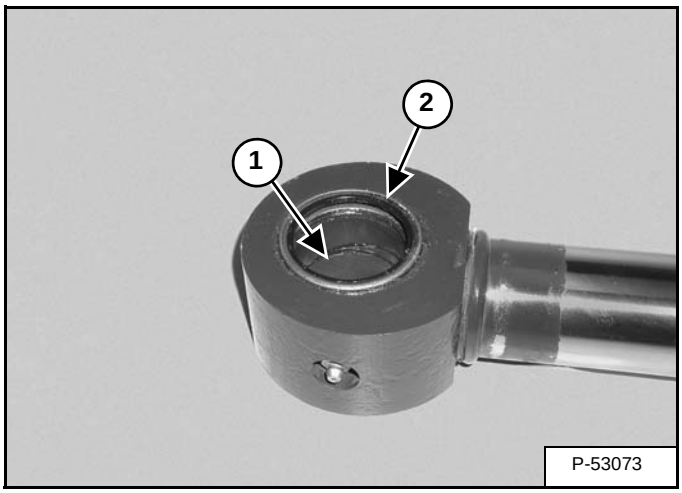
Put the base end of the cylinder in a vise.

Figure 20-23-30



Insert the Adjustable Gland Nut Wrench into the two holes (Item 1) **[Figure 20-23-30]**. Tighten the head to 271 N•m (200 ft-lb) torque.

Figure 20-23-31



Install the bushing (Item 1) **[Figure 20-23-31]**. The bushing must be aligned with the grease channel in the rod end of the cylinder.

Install the dust seal (Item 2) **[Figure 20-23-31]** on both sides of the rod end.

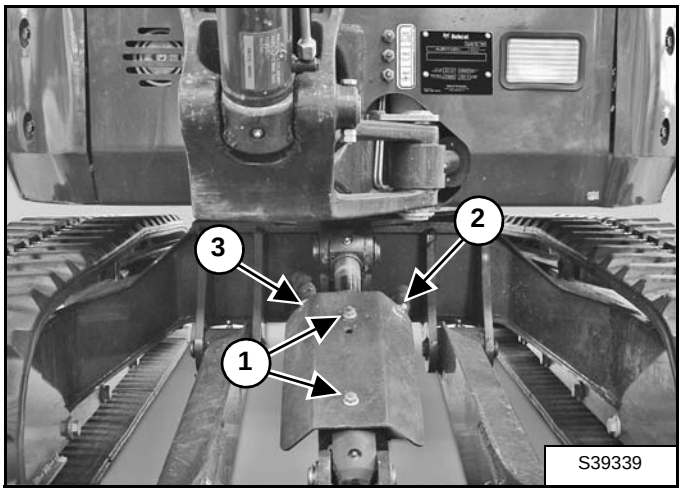
CYLINDER (BLADE)

Testing

Lower the work group to the earth.

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

Figure 20-24-1

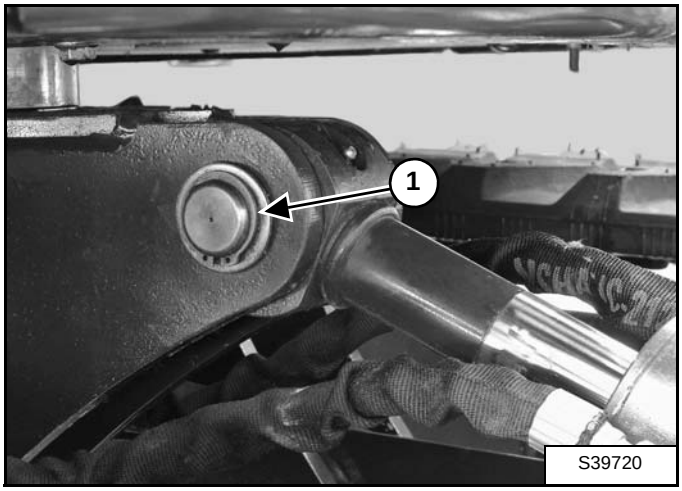


Remove the two nuts (Item 1) **[Figure 20-24-1]** from the studs.

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

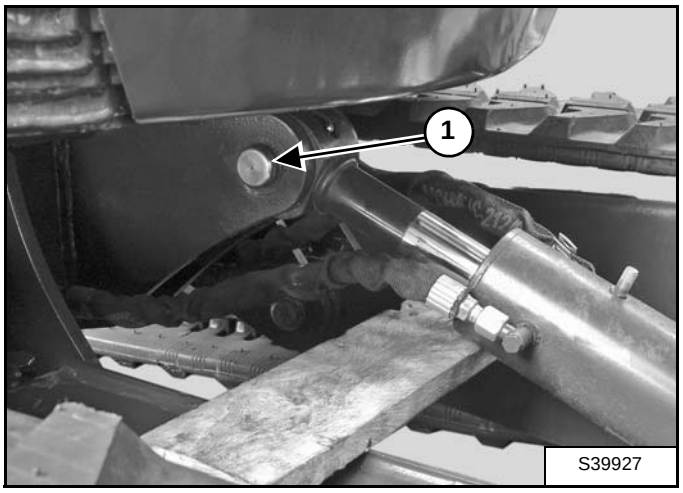
Remove the shield (Item 3) **[Figure 20-24-1]**.

Figure 20-24-2



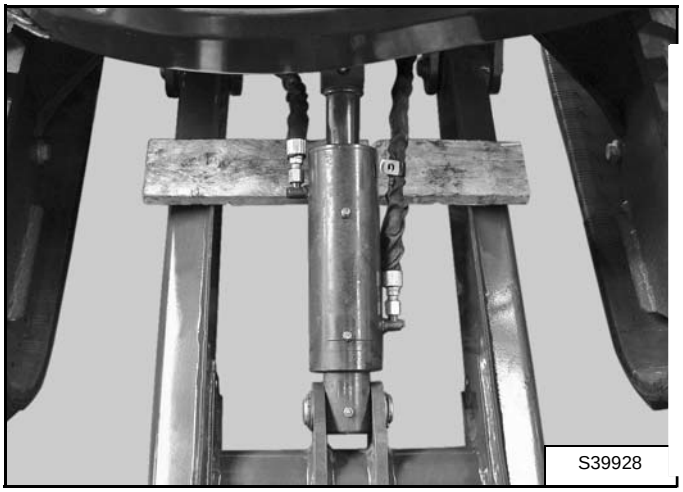
Remove the snap ring (Item 1) **[Figure 20-24-2]** and washer from the cylinder rod end.

Figure 20-24-3



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

Figure 20-24-4



Start the engine and retract the blade cylinder **[Figure 20-24-4]**.

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

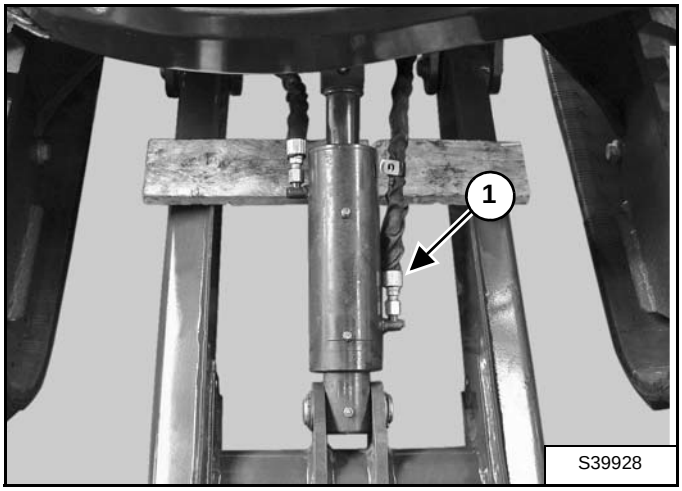
Testing (Cont'd)

WARNING

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

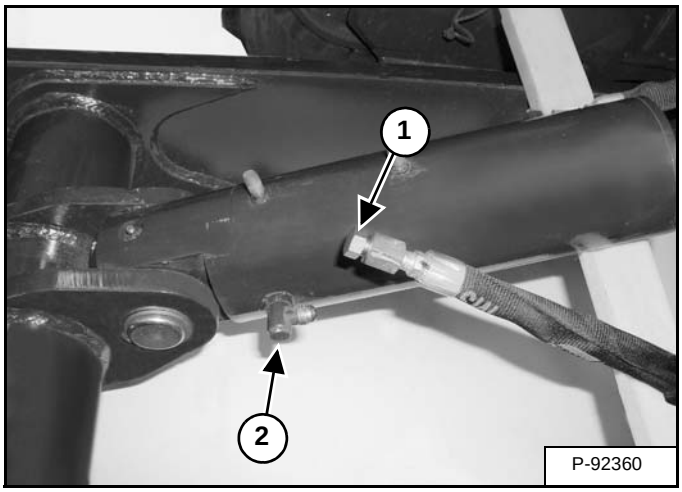
W-2145-0290

Figure 20-24-5



Remove the blade cylinder base end hose (Item 1) **[Figure 20-24-5]**.

Figure 20-24-6



Install a plug (Item 1) **[Figure 20-24-6]** on the hose fitting and tighten.

Start the engine and retract the blade cylinder.

If there is any leakage from the base end fitting (Item 2) **[Figure 20-24-6]** on the blade cylinder, remove the cylinder for repair or replacement.

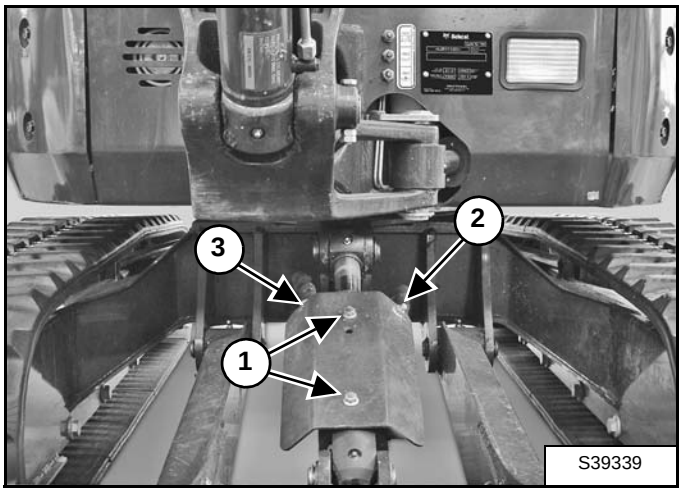
CYLINDER (BLADE) (CONT'D)

Removal And Installation

Lower the work group to the earth.

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

Figure 20-24-7

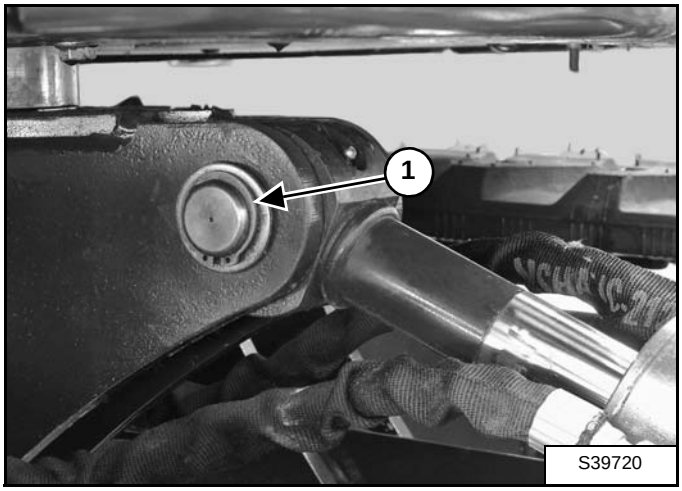


Remove the two nuts (Item 1) **[Figure 20-24-7]** from the studs.

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

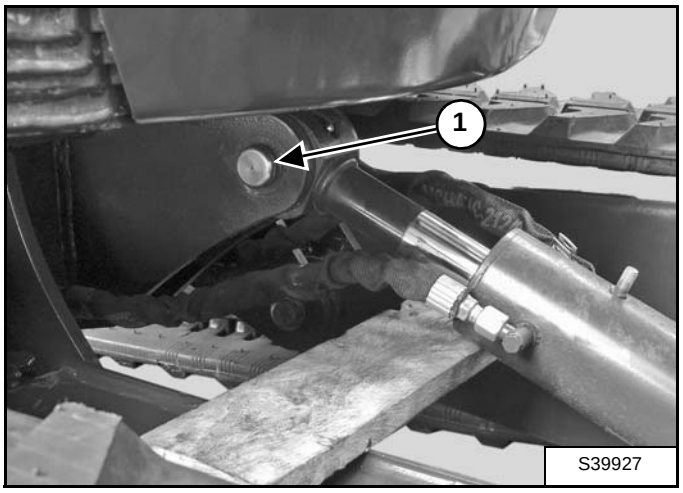
Remove the shield (Item 3) **[Figure 20-24-7]**.

Figure 20-24-8



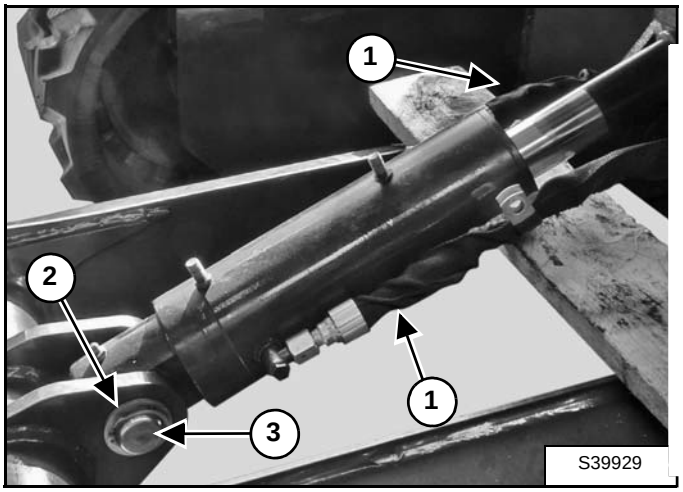
Remove the snap ring (Item 1) **[Figure 20-24-8]** and washer from the cylinder rod end.

Figure 20-24-9



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

Figure 20-24-10



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

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

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

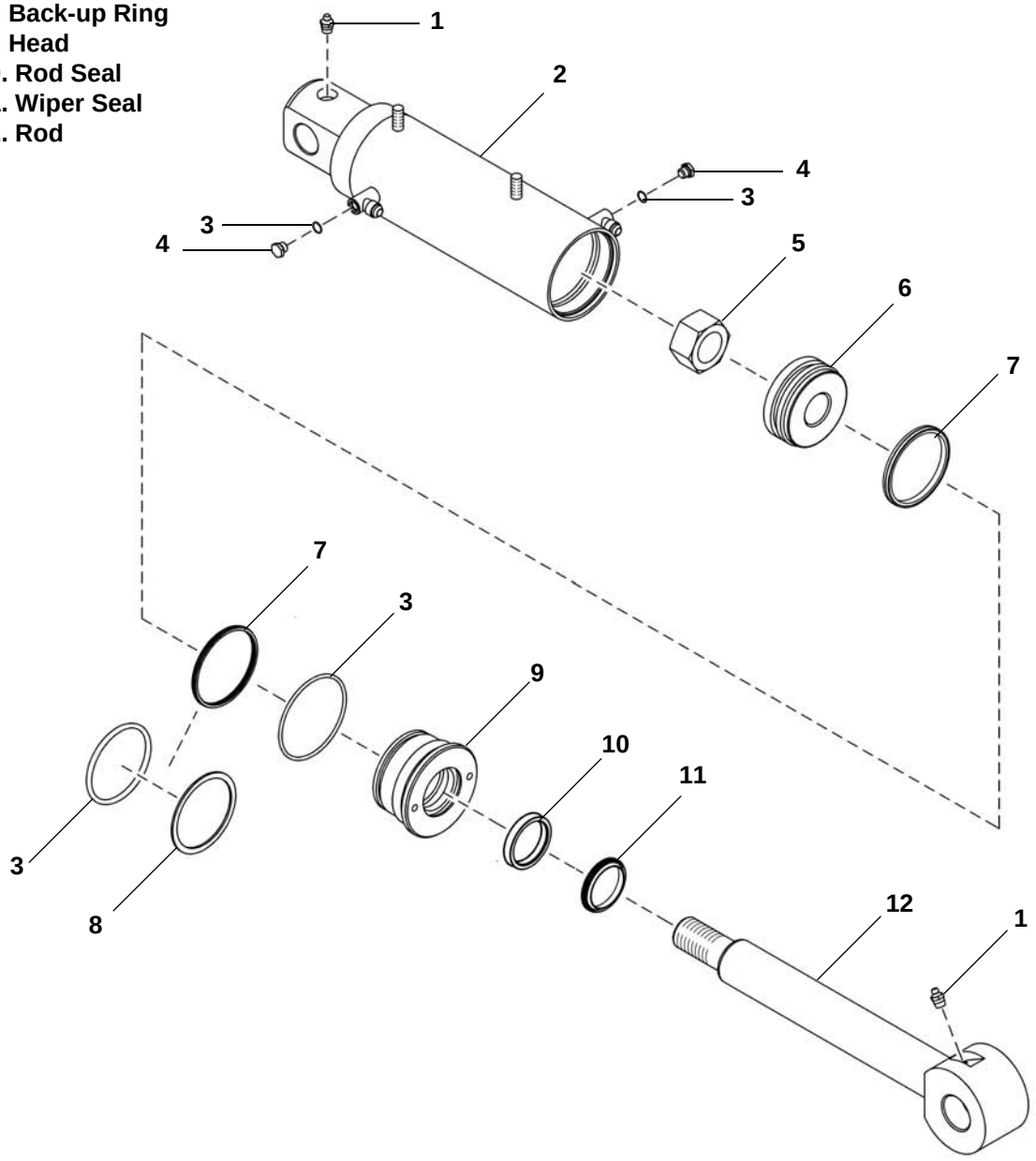
IMPORTANT

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

Parts Identification

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



NA6018S

Disassembly

Clean the outside of the cylinder before disassembly.

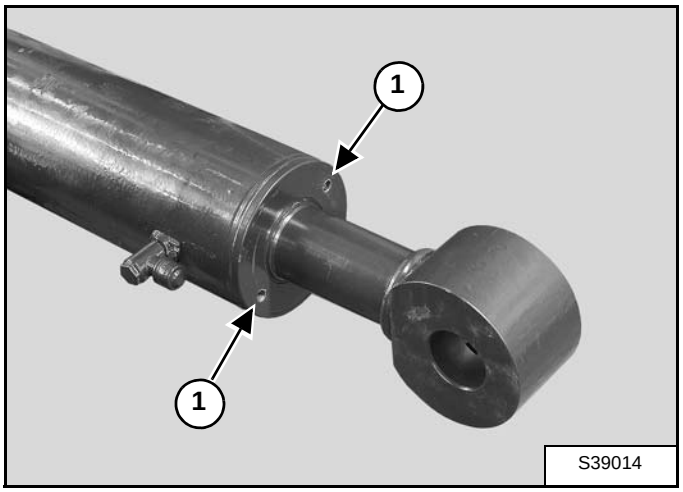
Use the following tools to disassemble the cylinder:

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

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

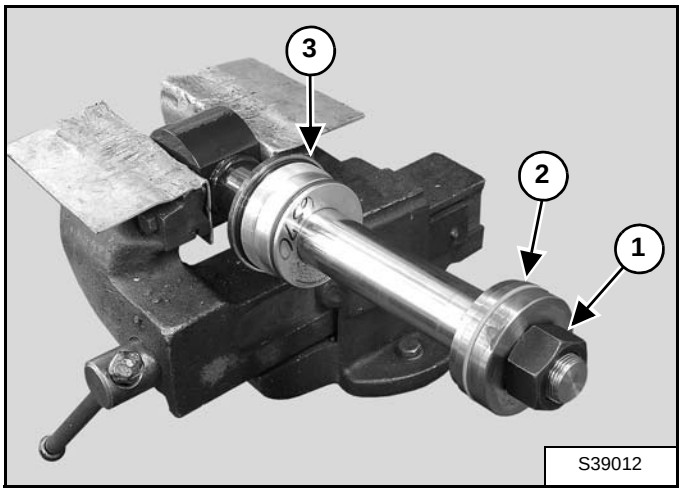
Put the base end of the cylinder in a vise.

Figure 20-24-11



Insert the Adjustable Gland Nut Wrench into the two holes (Item 1) **[Figure 20-24-11]** to loosen the head.

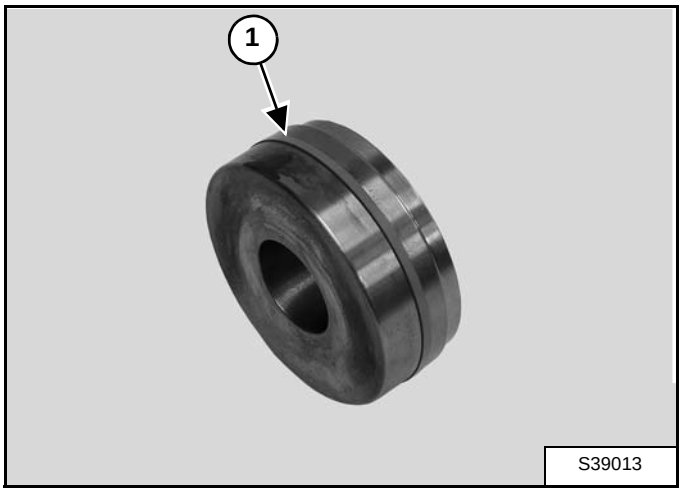
Figure 20-24-12



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

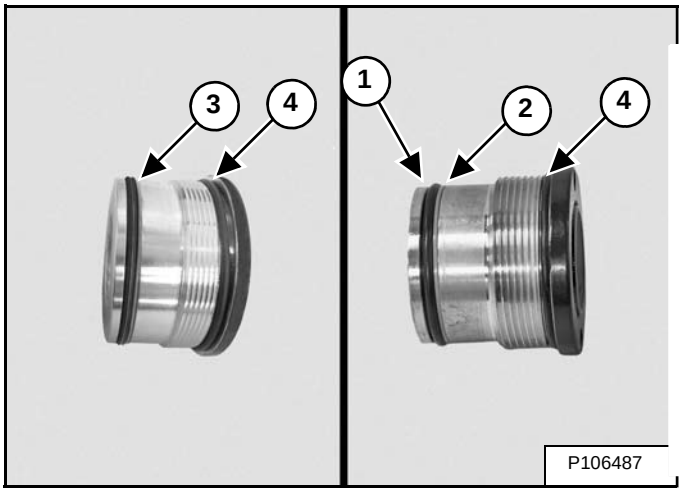
Remove the nut (Item 1), piston (Item 2), and head (Item 3) **[Figure 20-24-12]**.

Figure 20-24-13



Remove the seal (Item 1) **[Figure 20-24-13]** from the piston.

Figure 20-24-14



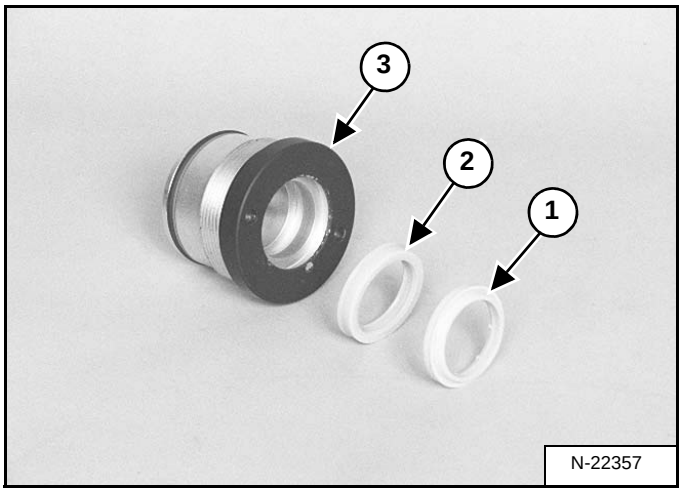
Remove the O-ring (Item 1) and the back-up ring (Item 2) or seal (Item 3) **[Figure 20-24-14]**.

NOTE: The seal kit may contain the O-ring / back-up ring or seal.

Remove the O-ring (Item 4) **[Figure 20-24-14]**.

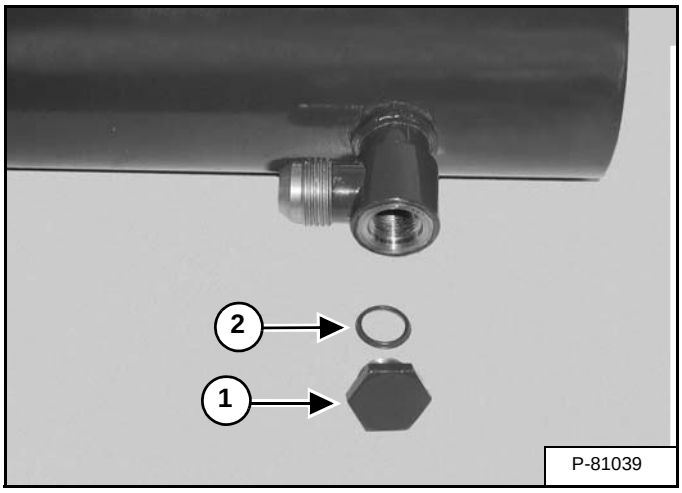
Disassembly (Cont'd)

Figure 20-24-15



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

Figure 20-24-16



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

Assembly

Clean all parts in solvent and dry with compressed air.

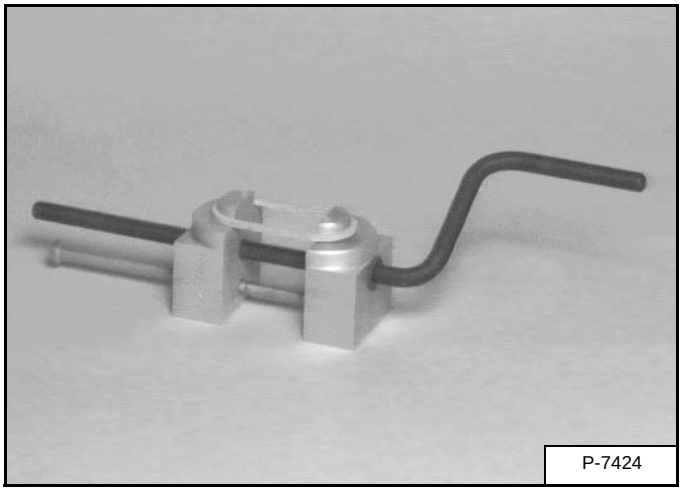
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Use the following tools to assemble the cylinder:

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

Figure 20-24-17

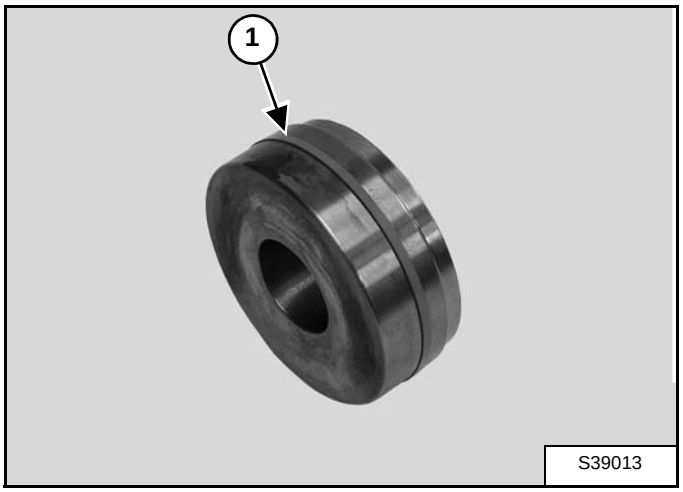


Install the new seal on the tool and slowly stretch it until it fits the piston **[Figure 20-24-17]**.

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

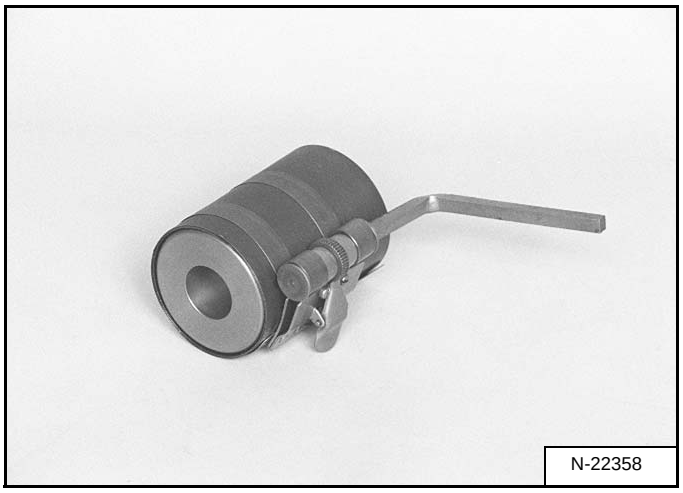
Assembly (Cont'd)

Figure 20-24-18



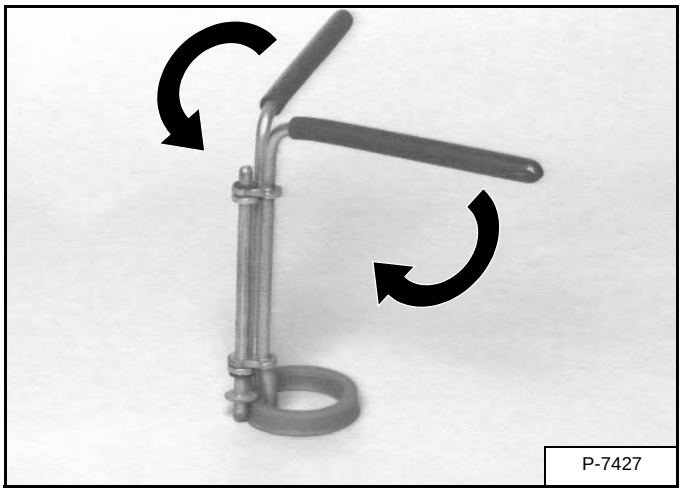
Install the seal (Item 1) **[Figure 20-24-18]** on the piston.

Figure 20-24-19



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for approximately 3 minutes **[Figure 20-24-19]**.

Figure 20-24-20

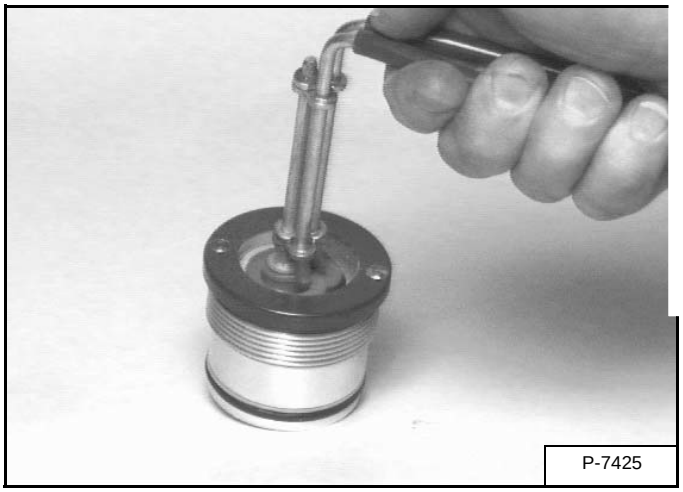


Install the rod seal on the rod seal tool **[Figure 20-24-20]**.

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

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

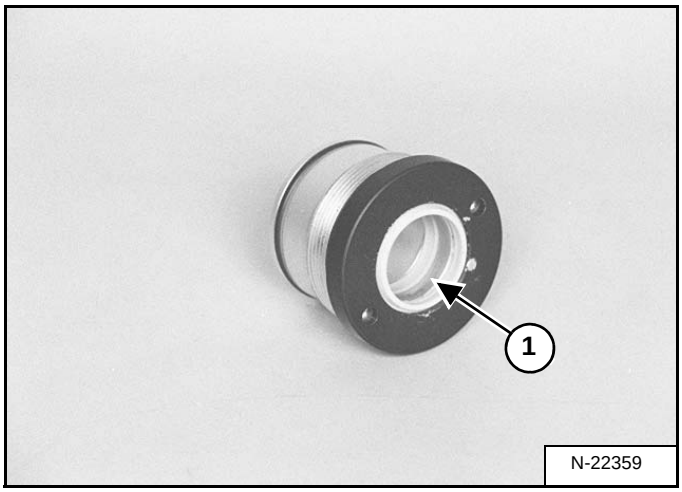
Figure 20-24-21



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

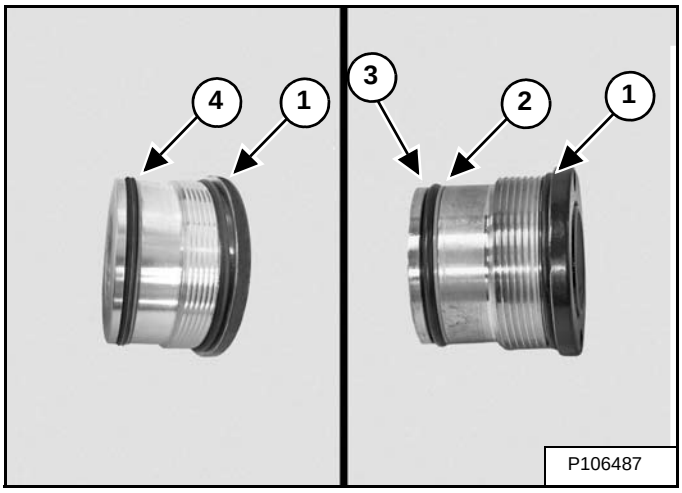
Assembly (Cont'd)

Figure 20-24-22



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

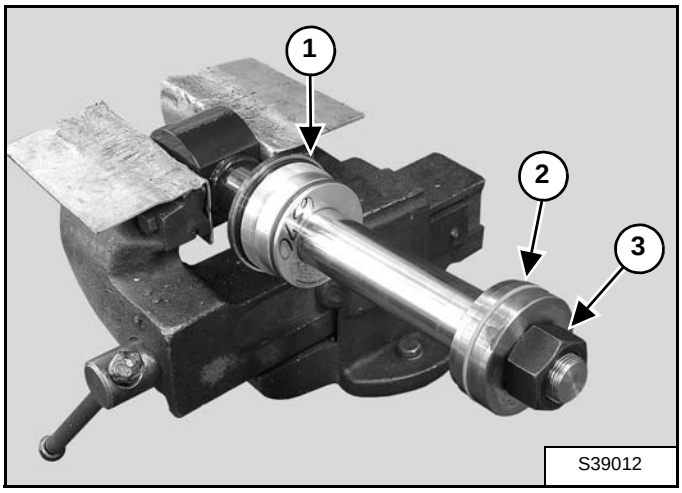
Figure 20-24-23



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

Install the back-up ring (Item 2) / O-ring (Item 3) or seal (Item 4) **[Figure 20-24-23]**.

Figure 20-24-24



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

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

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

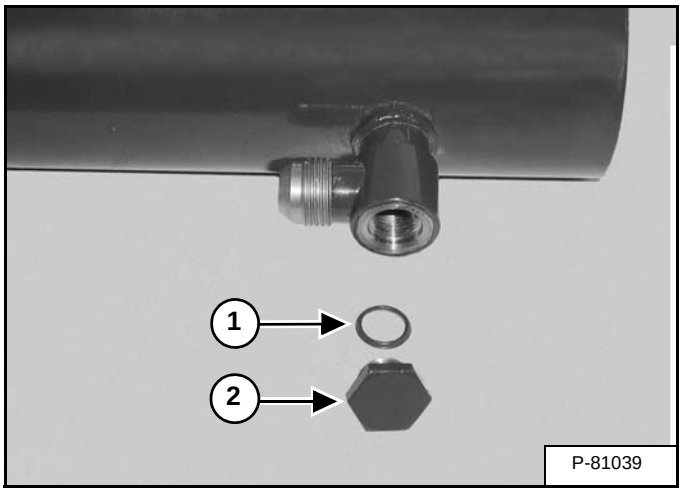
Provide an adequate support for the cylinder before tightening.

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

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

Assembly (Cont'd)

Figure 20-24-25

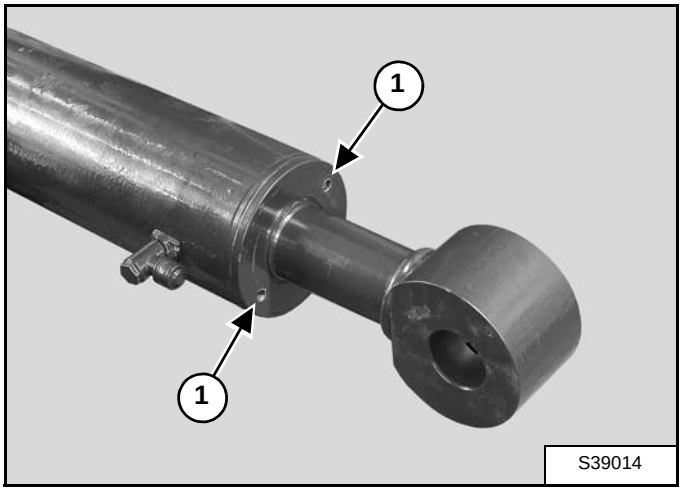


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-24-25]**.

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

Put the base end of the cylinder in a vise.

Figure 20-24-26



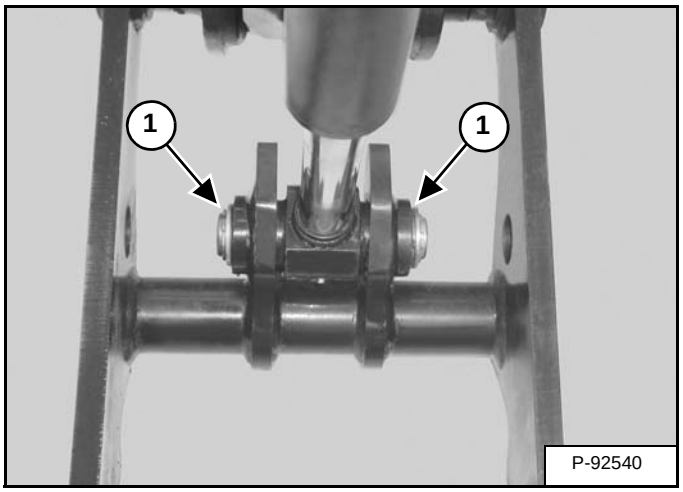
Insert the Adjustable Gland Nut Wrench into the two holes (Item 1) **[Figure 20-24-26]**. Tighten the head to 373 N•m (275 ft-lb) torque.


Bobcat®

CYLINDER (CLAMP)

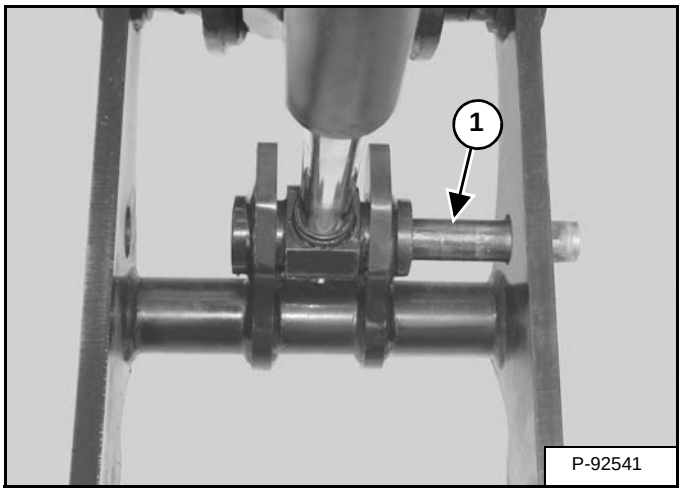
Testing

Figure 20-25-1



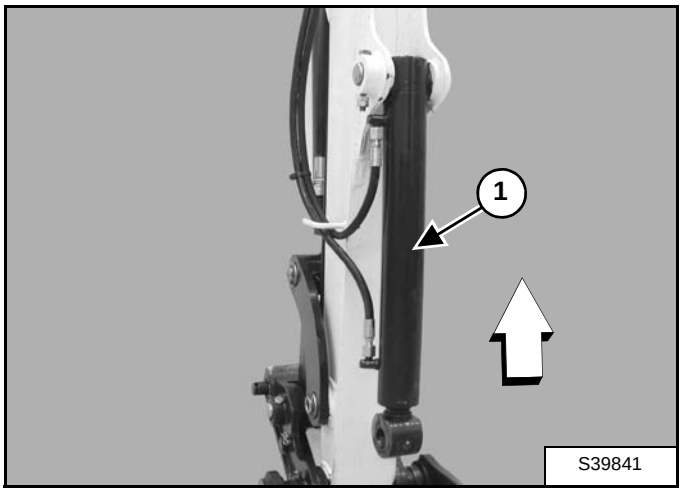
Remove the snap ring (Item 1) **[Figure 20-25-1]** and washer from the clamp cylinder pin.

Figure 20-25-2



Remove the pin (Item 1) **[Figure 20-25-2]** from the rod end of the clamp cylinder.

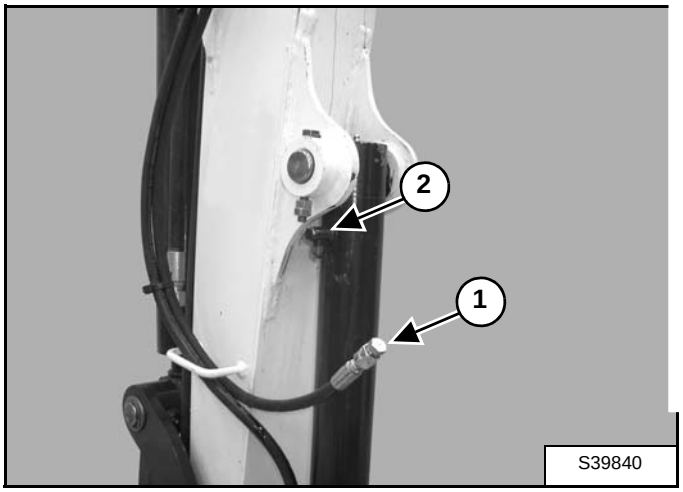
Figure 20-25-3



Start the engine and retract the clamp cylinder (Item 1) **[Figure 20-25-3]**.

Stop the engine.

Figure 20-25-4



Disconnect the hydraulic hose (Item 1) **[Figure 20-25-4]** from the base end of the cylinder.

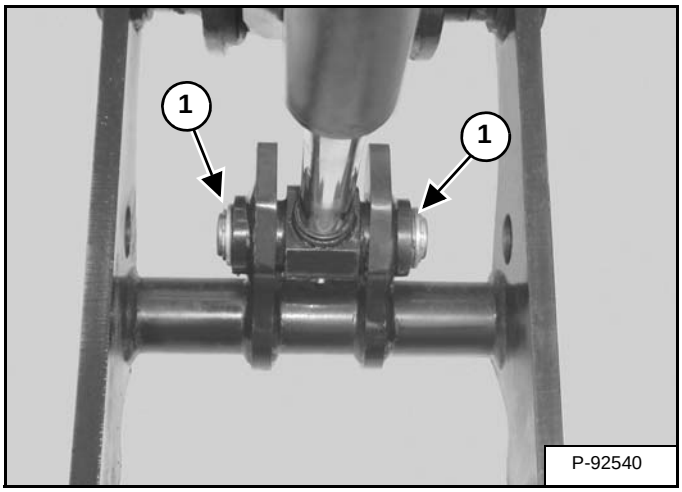
Plug the hydraulic hose (Item 1) **[Figure 20-25-4]**.

Start the engine and retract the cylinder.

If there is any oil leakage from the base end fitting (Item 2) **[Figure 20-25-4]** on the cylinder, remove the cylinder for repair or replacement.

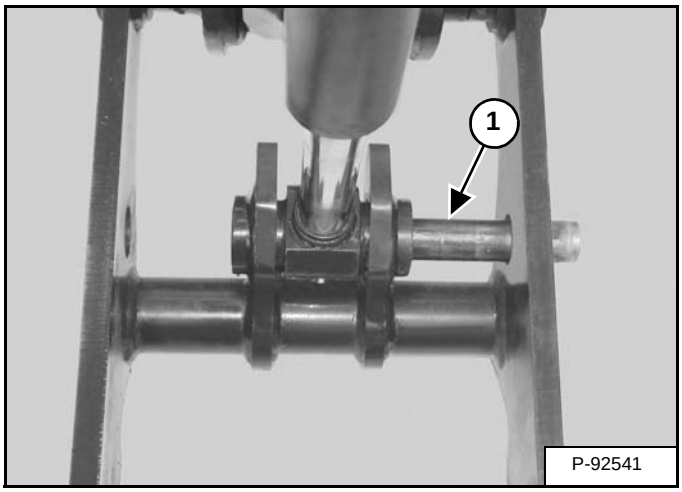
Removal And Installation

Figure 20-25-5



Remove the snap rings (Item 1) **[Figure 20-25-5]** and washers.

Figure 20-25-6

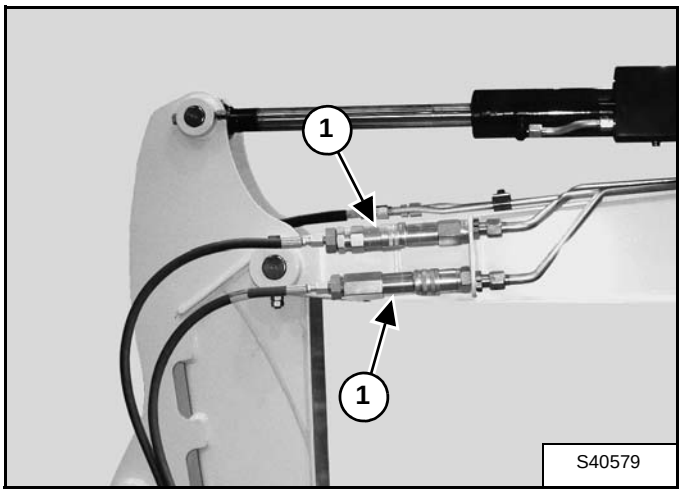


Remove the pin (Item 1) **[Figure 20-25-6]**.

Start the engine and retract the cylinder.

Stop the engine.

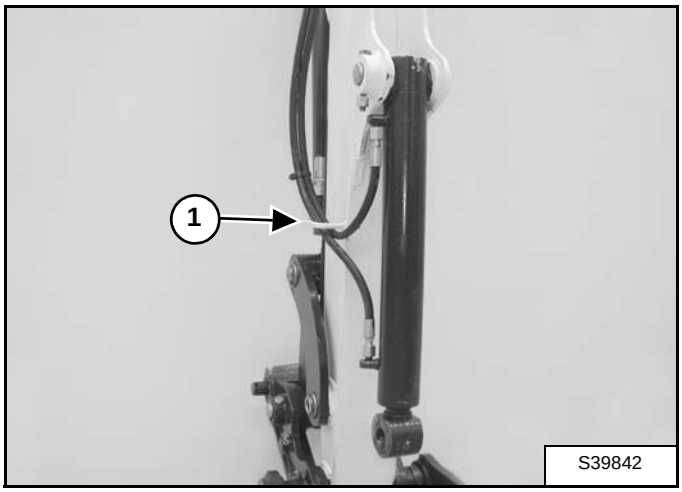
Figure 20-25-7



Disconnect the quick couplers (Item 1) **[Figure 20-25-7]**.

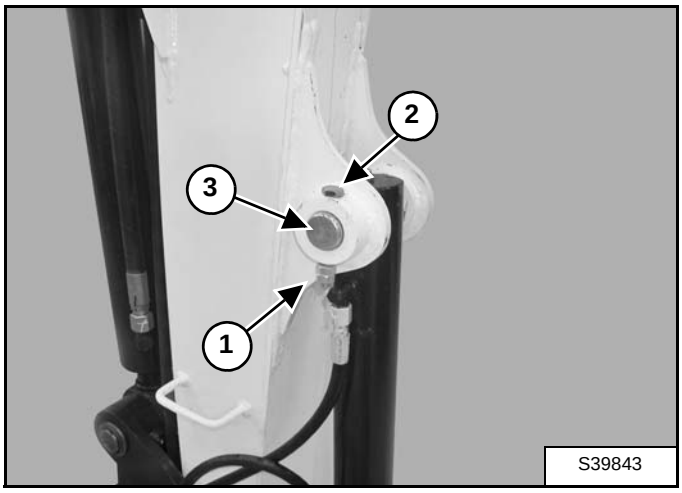
Removal And Installation (Cont'd)

Figure 20-25-8



Remove the hoses from the hose guide (Item 1) **[Figure 20-25-8]**.

Figure 20-25-9

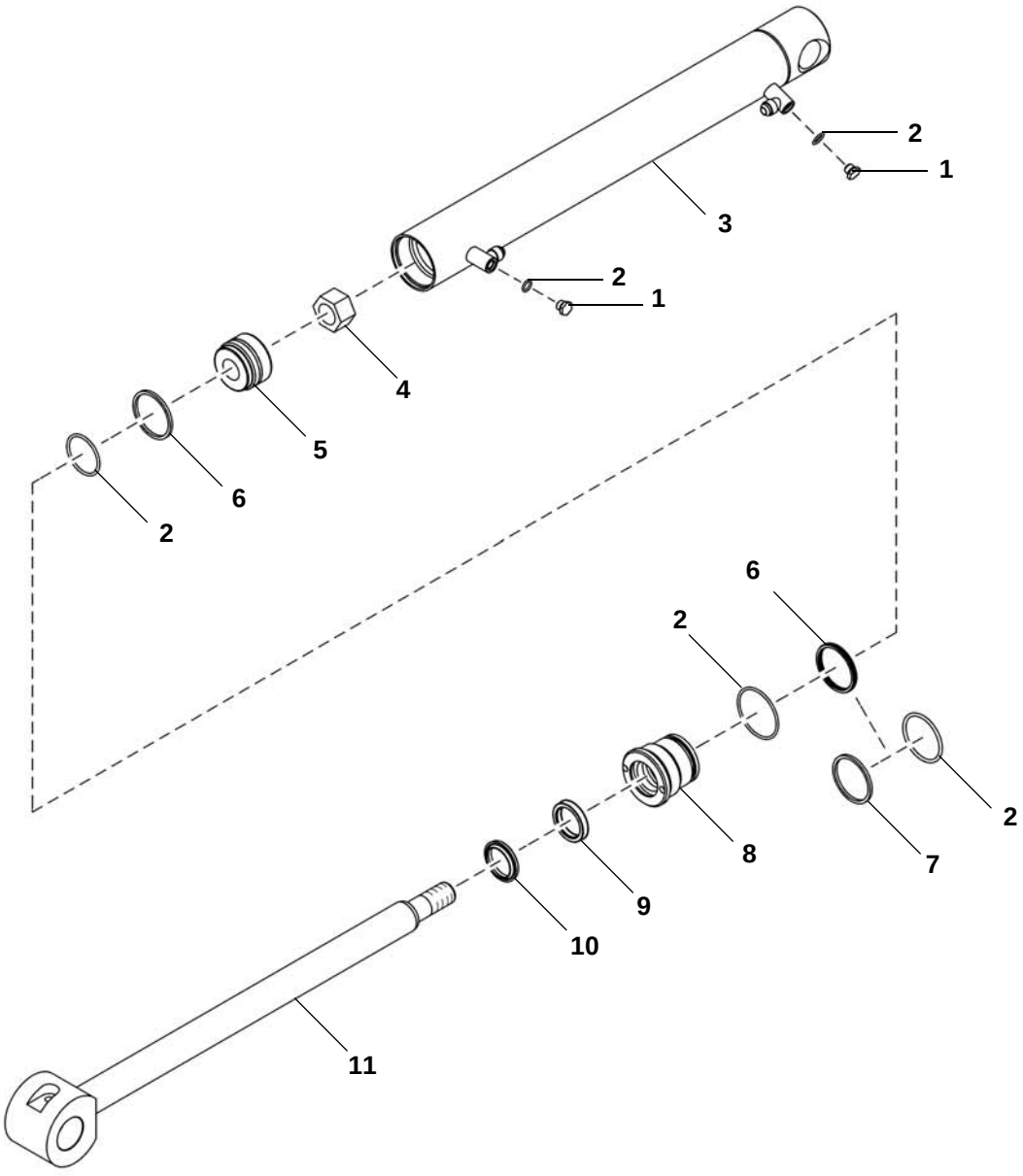


Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-25-9]**.

Remove the pin (Item 3) **[Figure 20-25-9]** and remove the cylinder.

Parts Identification

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



NA6303S

Disassembly

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

Clean the outside of the clamp cylinder before disassembly.

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

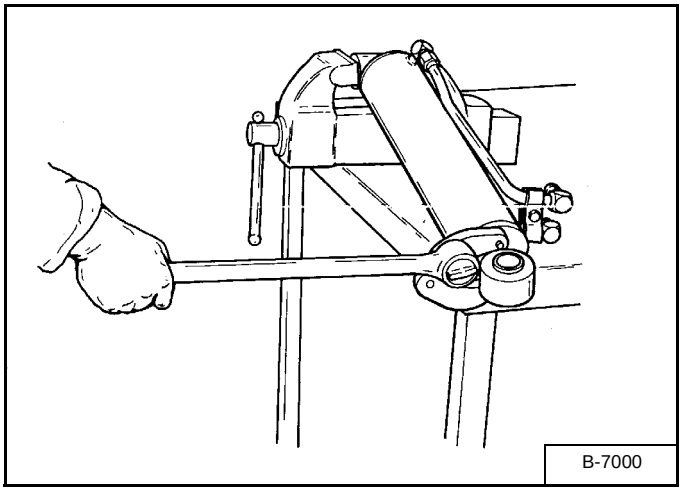
1. MEL1075 - Adjustable Gland Nut Wrench
2. MEL1074 - O-ring Seal Hook
3. MEL1033 - Rod Seal Installation Tool

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

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

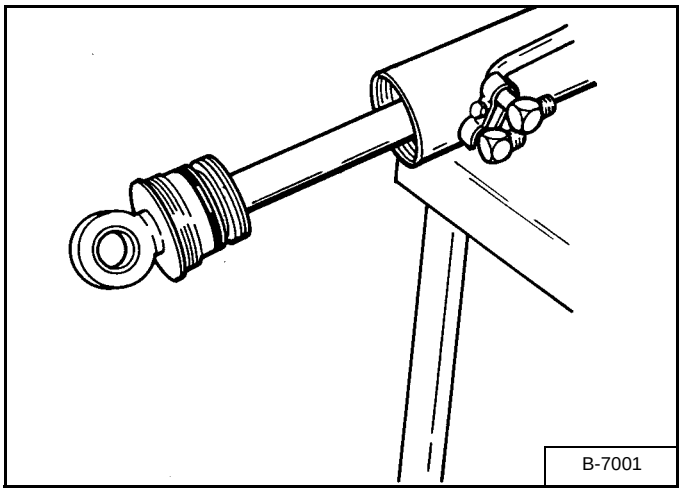
Put the base end of the cylinder in a vise.

Figure 20-25-10



Use the Adjustable Gland Nut Wrench to loosen the head **[Figure 20-25-10]**.

Figure 20-25-11

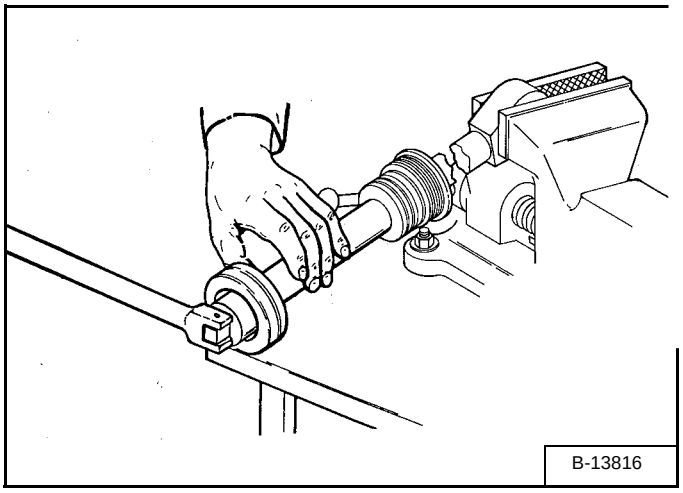


Remove the rod assembly from the cylinder housing **[Figure 20-25-11]**.

Remove the cylinder housing from the vise.

Put the rod end in the vise.

Figure 20-25-12

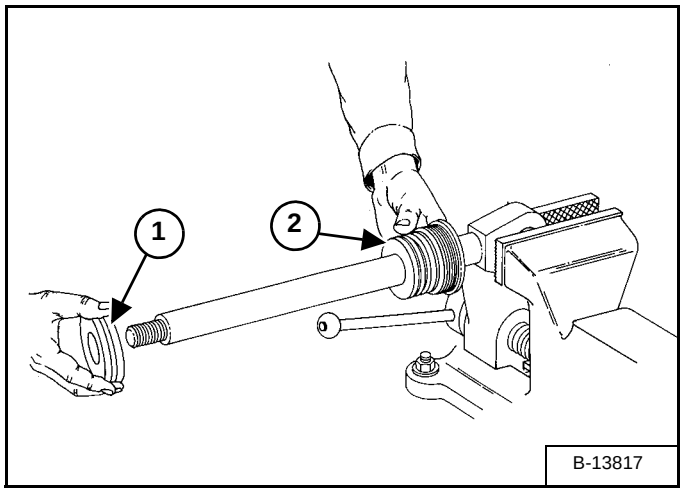


Loosen the nut from the piston end of the rod **[Figure 20-25-12]**.

CYLINDER (CLAMP) (CONT'D)

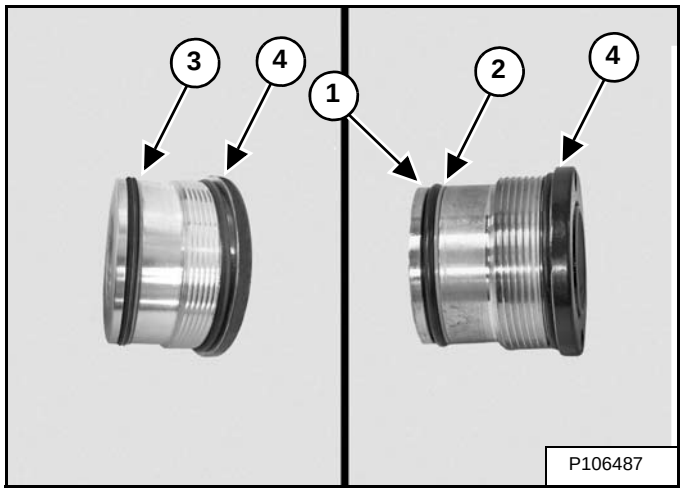
Disassembly (Cont'd)

Figure 20-25-13



Remove the piston (Item 1) and head (Item 2) **[Figure 20-25-13]**.

Figure 20-25-14

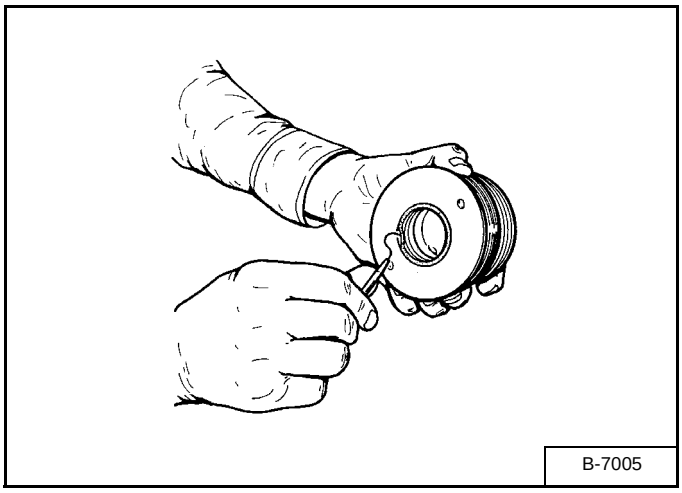


Remove the O-ring (Item 1), the back-up ring (Item 2) and seal (Item 3) **[Figure 20-25-14]**.

NOTE: The seal kit may contain the O-ring / back-up ring or seal.

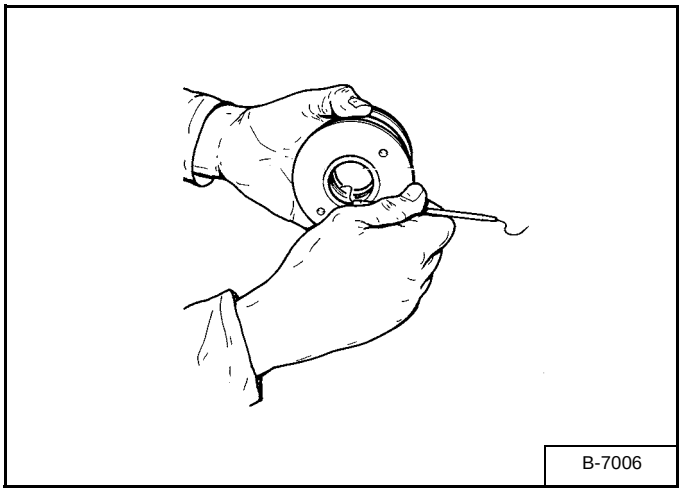
Remove the O-ring (Item 4) **[Figure 20-25-14]**.

Figure 20-25-15



Remove the wiper seal **[Figure 20-25-15]**.

Figure 20-25-16

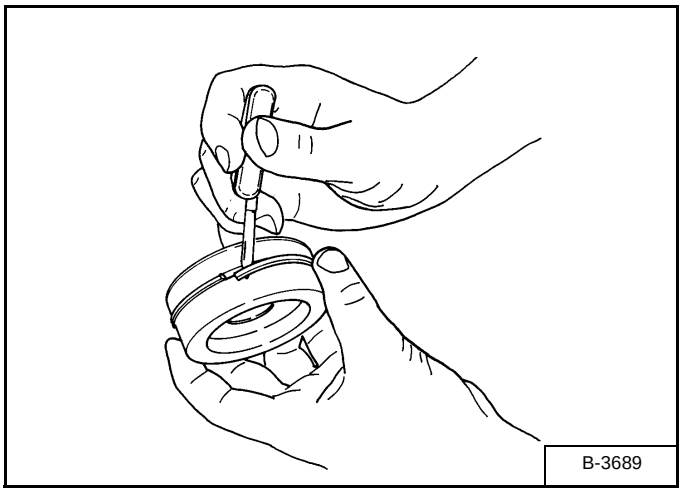


Remove the oil seal from the head **[Figure 20-25-16]**.

CYLINDER (CLAMP) (CONT'D)

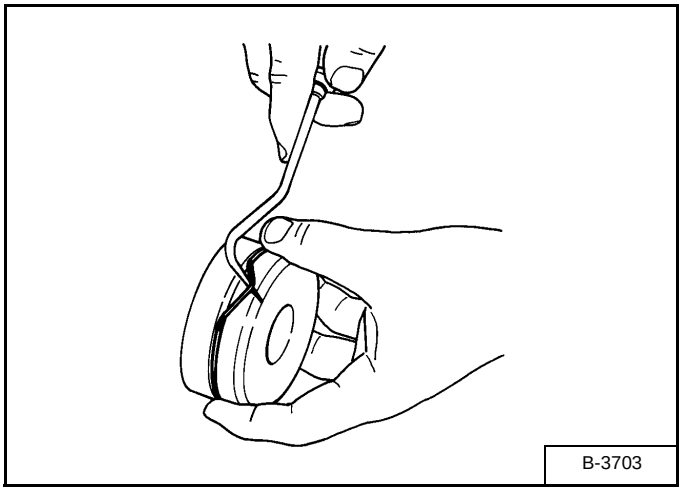
Disassembly (Cont'd)

Figure 20-25-17



Cut the old Teflon™ seal and remove the seal from the piston **[Figure 20-25-17]**.

Figure 20-25-18



Remove the O-ring from the piston **[Figure 20-25-18]**.

CYLINDER (CLAMP) (CONT'D)

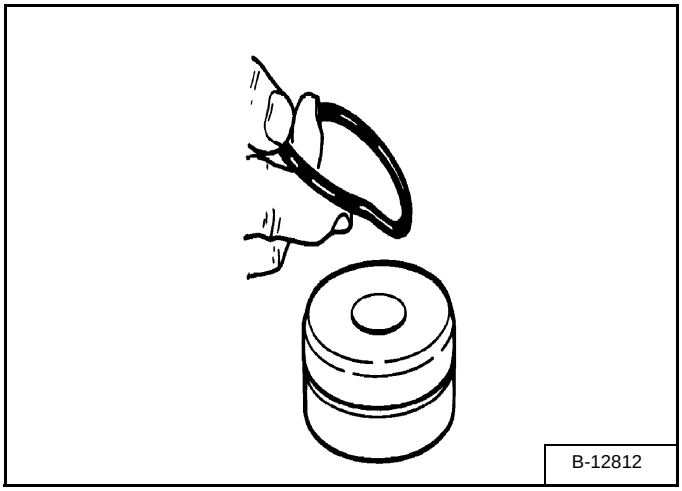
Assembly

Clean all parts in solvent and dry with compressed air.

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

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

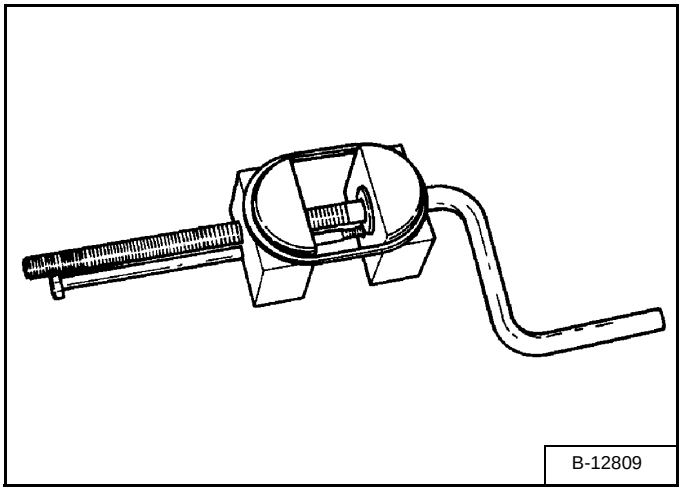
Figure 20-25-19



Install the O-ring on the piston **[Figure 20-25-19]**.

NOTE: Do not overstretch the seal.

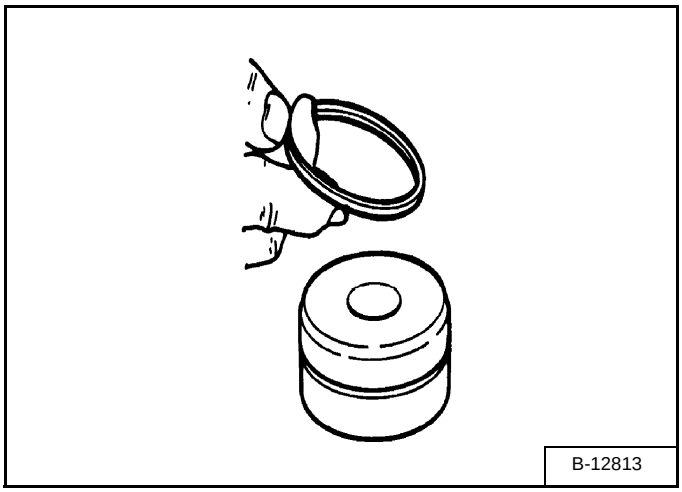
Figure 20-25-20



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

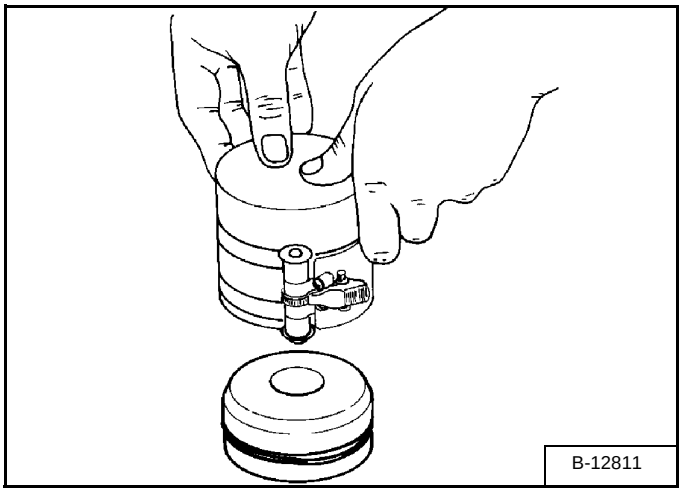
Allow the seal to stretch for 30 seconds before removing it from the tool.

Figure 20-25-21



Install the seal on the piston **[Figure 20-25-21]**.

Figure 20-25-22

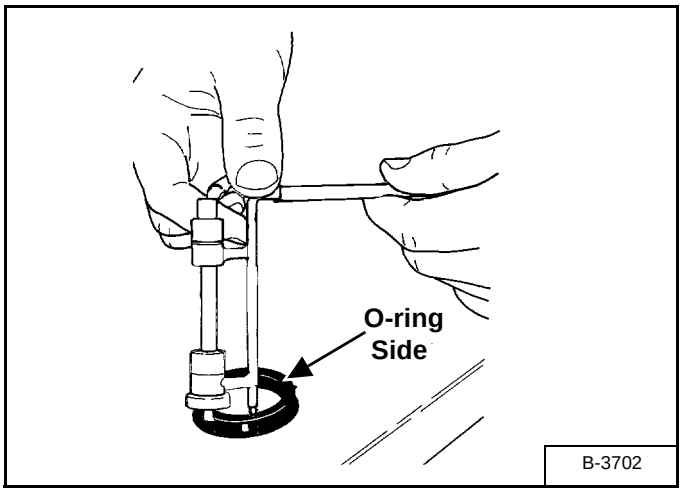


Use a ring compressor to compress the seal to the correct size **[Figure 20-25-22]**.

Leave the piston in the ring compressor for three minutes.

Assembly (Cont'd)

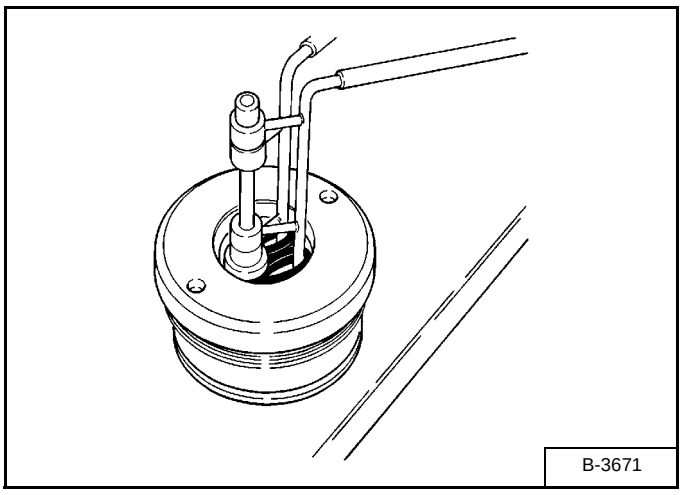
Figure 20-25-23



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

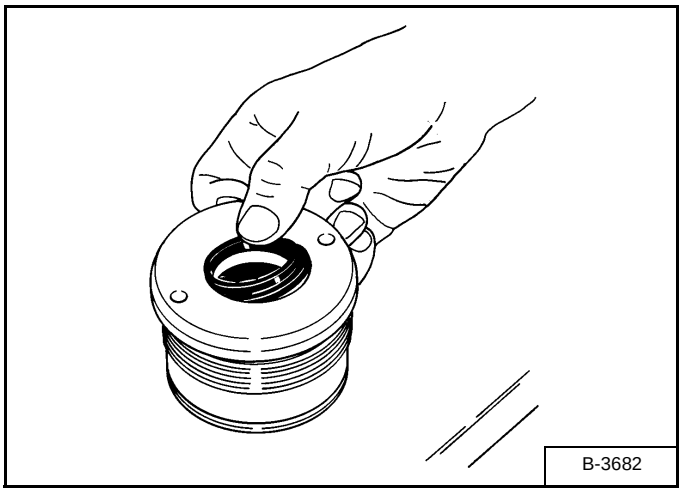
NOTE: The O-ring side of the oil seal goes toward the inside of the cylinder.

Figure 20-25-24



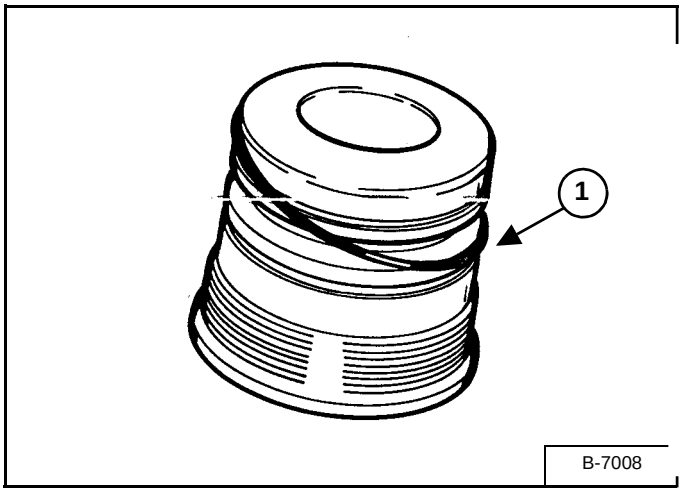
Install the oil seal in the head **[Figure 20-25-24]**.

Figure 20-25-25



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

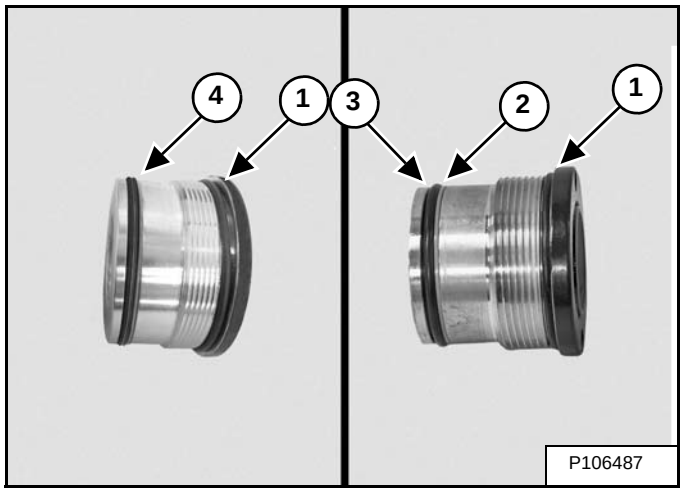
Figure 20-25-26



Install the O-ring (Item 1) **[Figure 20-25-26]** on the head.

Assembly (Cont'd)

Figure 20-25-27

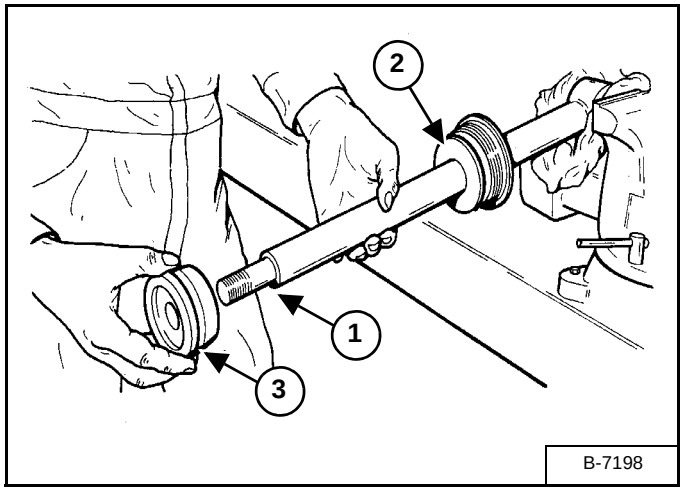


Install the O-ring (Item 1) **[Figure 20-25-27]**.

Install the back-up ring (Item 2) / O-ring (Item 3) or seal (Item 4) **[Figure 20-25-27]**.

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

Figure 20-25-28



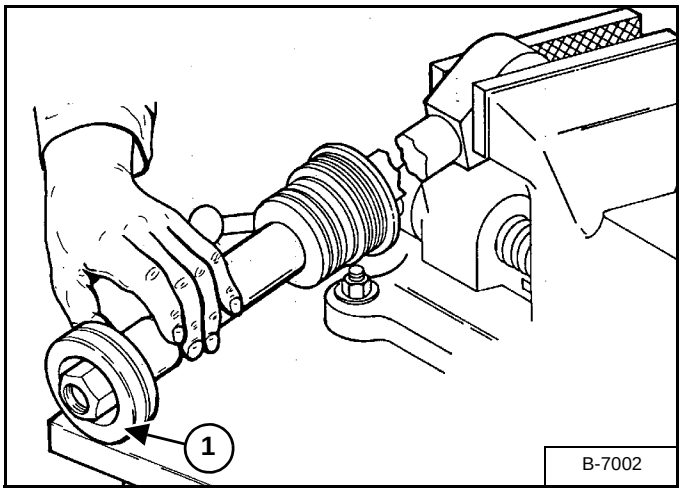
Inspect the beveled edge of the rod for nicks or sharp edges (Item 1) **[Figure 20-25-28]**. Remove these with a file prior to installing the head on the rod or damage to the seals can occur.

Install the head (Item 2) **[Figure 20-25-28]** on the rod.

Install the piston (Item 3) **[Figure 20-25-28]** on the rod.

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

Figure 20-25-29



Tighten the nut (Item 1) **[Figure 20-25-29]** to 406,8 N•m (300 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.

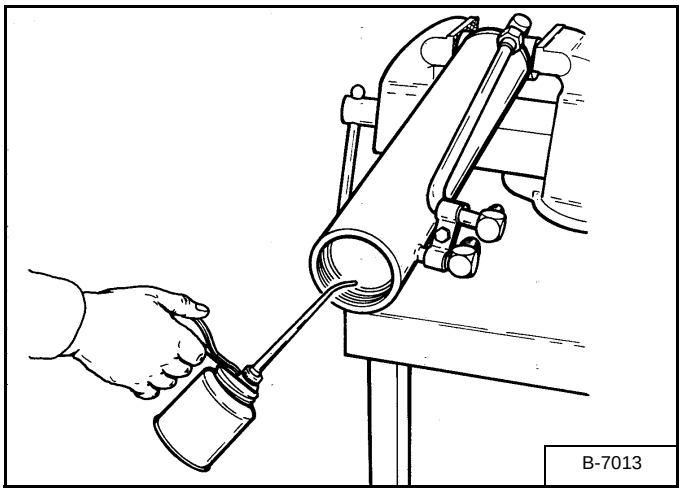
The following hones can be ordered from OTC Service Tools:

MEL1418 - 2 in
OEM6275 - 2.75 in - 3 in
OEM6270 - 3 in - 3.5 in
OEM6271 - 3.5 in - 4 in

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

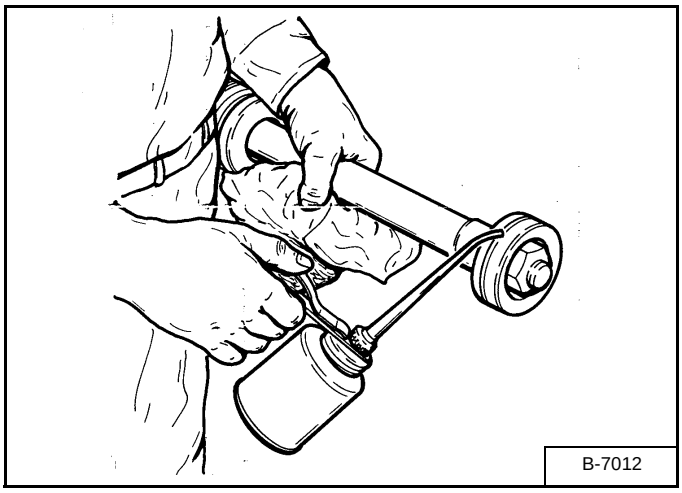
Assembly (Cont'd)

Figure 20-25-30



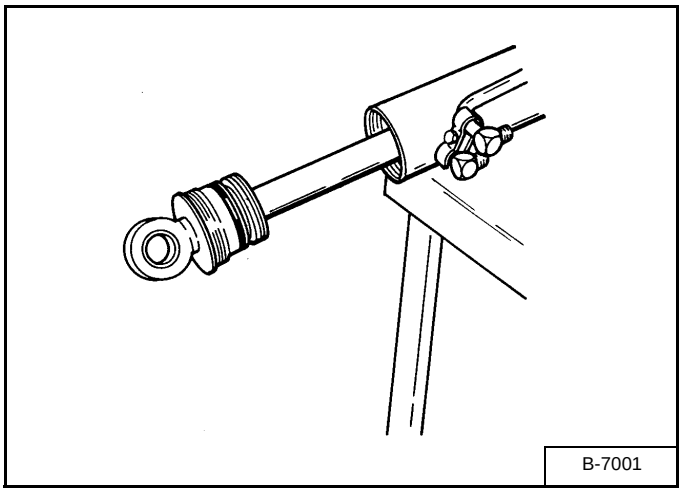
Apply oil to the seal surface of the housing **[Figure 20-25-30]**.

Figure 20-25-31



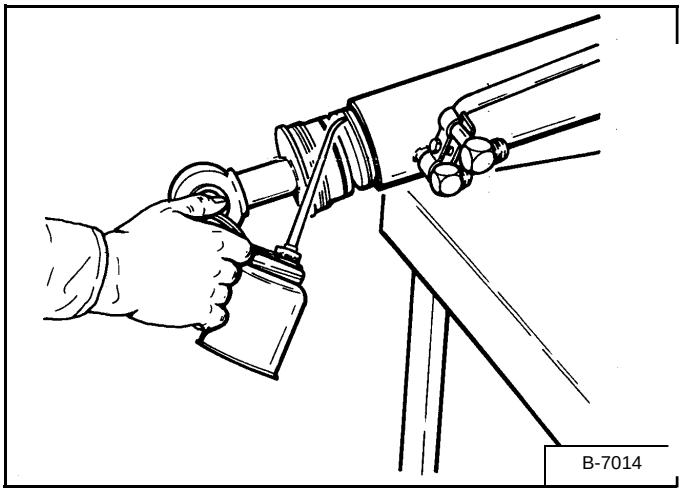
Apply oil to the Teflon™ seal on the piston **[Figure 20-25-31]**.

Figure 20-25-32



Install the rod assembly in the housing **[Figure 20-25-32]**.

Figure 20-25-33



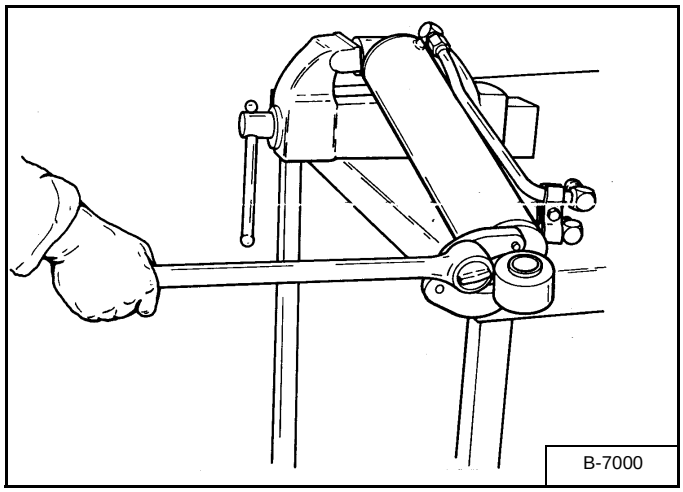
Apply oil to the seals on the head **[Figure 20-25-33]**.

Apply oil to the threads of the head.

CYLINDER (CLAMP) (CONT'D)

Assembly (Cont'd)

Figure 20-25-34



Tighten the head to 271 N•m (200 ft-lb) torque **[Figure 20-25-34]**.

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

VALVES (MAIN RELIEF)

Testing And Adjusting

The main relief valves limit the hydraulic system pressure by opening at a certain pressure and allowing the hydraulic fluid to flow back to the hydraulic reservoir.

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

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

MEL1355 - Test Kit includes the following:
MEL1355-3 - 34.5 MPa (345 bar) 5000 psi Gauge
MEL1355-12 - Coupler
MEL1355-9 - Thermometer

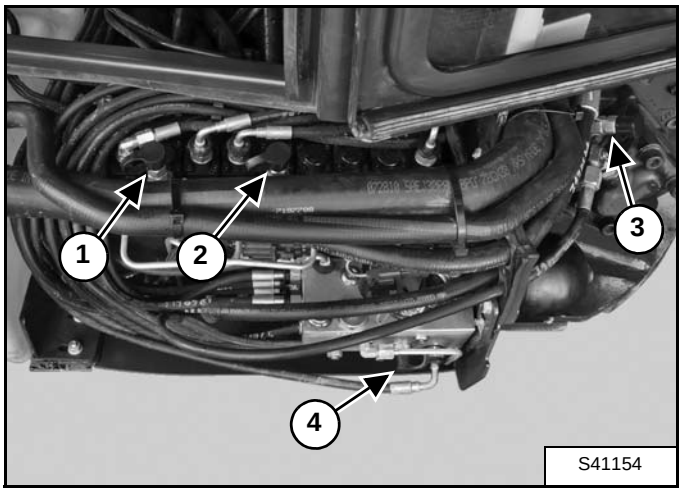
TEST CONDITIONS

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.

Figure 20-30-1



There are four test ports on the hydraulic circuit:

REF	PORT	CIRCUIT	TEST PORT LOCATION
1	P1	Pump 1	T - fitting on hydraulic control valve (RH travel section)
2	P2	Pump 2	T - fitting on hydraulic control valve (LH travel section)
3	P3	Pump 3	T - fitting on outlet of pump 3
4	G	Pump 4 (Pilot)	Manifold

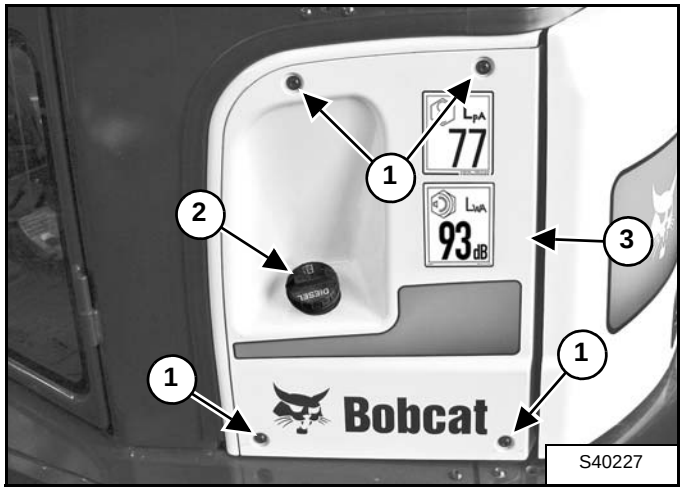
System Pressures At Gauge Port Specifications

SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET MPa (bar) (psi)	ACCEPTABLE RANGE MPa (bar) (psi)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	PUMP 4 (JOYSTICK PILOT)	G	3,2 (32) (464)	3,2 - 3,5 (32 - 35) (464 - 508)
SYSTEM STANDBY PRESSURE	NONE	THROUGH NEUTRAL	P1, P2 and P3	P1 = 1,0 (10) (145) P2 = 1,0 (10) (145) P3 = 1,5 (15) (218)	P1 = 0,7 - 1,3 (7 - 13) (102 - 189) P2 = 0,7 - 1,3 (7 - 13) (102 - 189) P3 = 1,2 - 1,8 (12 - 18) (174 - 261)
MAIN RELIEF ON CONTROL VALVE - LEFT	RH TRAVEL	PUMP 1	P1	24,0 (240) (3480)	23,5 - 24,5 (235 - 245) (3408 - 3553)
MAIN RELIEF ON CONTROL VALVE - CENTER	BUCKET	PUMP 2	P2	24,0 (240) (3480)	23,5 - 24,5 (235 - 245) (3408 - 3553)
MAIN RELIEF ON CONTROL VALVE - RIGHT	BOOM SWING	PUMP 3	P3	20,6 (206) (2987)	20,1 - 21,1 (201 - 211) (2915 - 3060)

Testing And Adjusting (Cont'd)

Remove the left upperstructure cover. (See Removal And Installation on Page 40-70-1.)

Figure 20-30-2



Remove the four bolts (Item 1), fuel cap (Item 2) and side cover (Item 3) **[Figure 20-30-2]**.

Reinstall the fuel cap (Item 2) **[Figure 20-30-2]**.

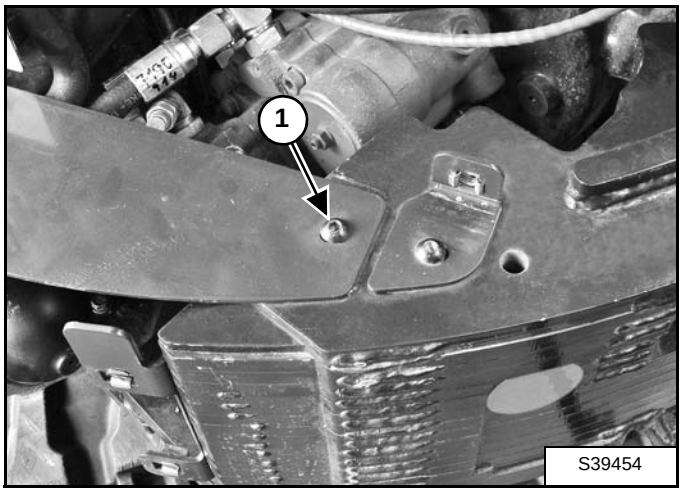
NOTE: Reinstall the fuel cap to prevent any contamination from entering the fuel tank.

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

Remove the long arm counterweight (if equipped). (See Long Arm Counterweight Removal And Installation on Page 40-90-4.)

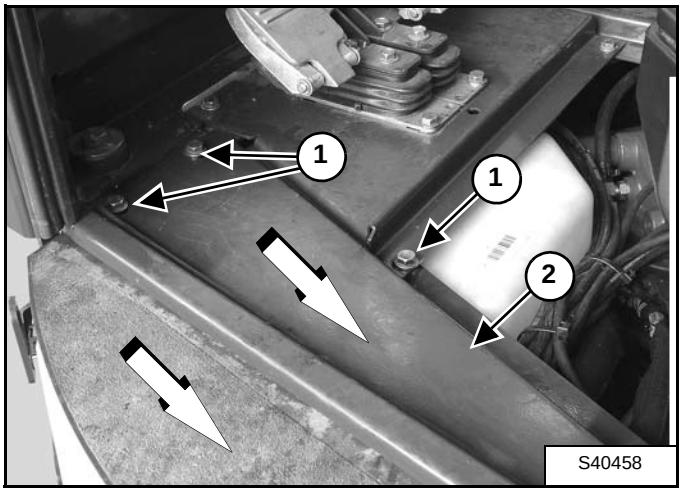
Remove the floor mat and floor panel. (See Removal And Installation on Page 40-110-1.)

Figure 20-30-3



Remove the screw (Item 1) **[Figure 20-30-3]**.

Figure 20-30-4



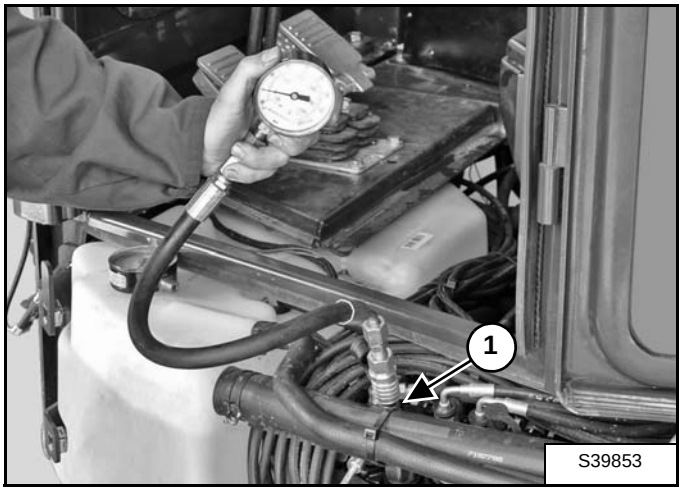
Remove the three bolts (Item 1) **[Figure 20-30-4]**.

Remove the floorplate (Item 2) **[Figure 20-30-4]** by sliding it towards the rear of the machine.

Testing And Adjusting (Cont'd)

Left Main Relief Valve (Right Hand Travel, Arm And Auxiliary Flow Valve Sections)

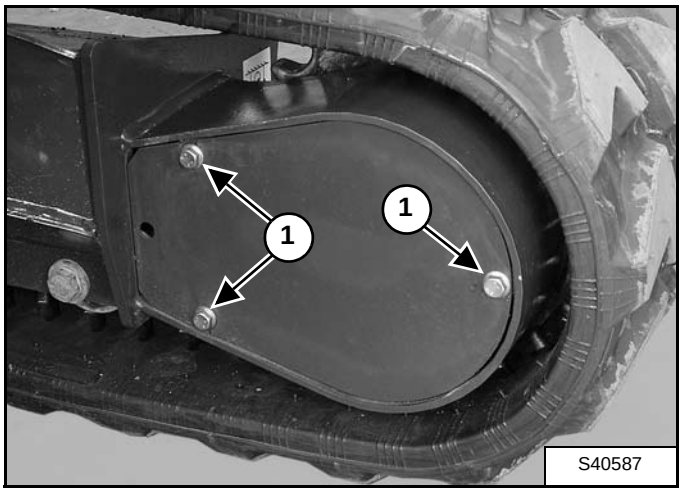
Figure 20-30-5



Connect the test gauge coupler and 34,5 MPa (345 bar) (5000 psi) gauge to the "P1" diagnostic coupler (Item 1) **[Figure 20-30-5]**.

Raise the machine on jackstands. (See LIFTING AND BLOCKING THE EXCAVATOR on Page 10-10-1.)

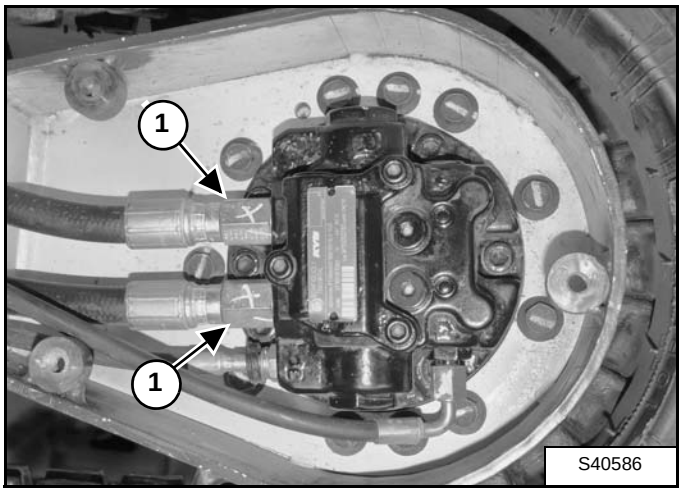
Figure 20-30-6



Remove the three bolts (Item 1) **[Figure 20-30-6]** from the right hand side track frame cover.

Remove the cover.

Figure 20-30-7



Remove the two hoses (Item 1) **[Figure 20-30-7]** from the right hand side travel motor.

Mark the hoses for correct installation.

Install caps on both hoses (Item 1) **[Figure 20-30-7]** Tighten the caps to standard torque value. (Se HYDRAULIC CONNECTION SPECIFICATIONS on Pag SPEC-40-1.)

NOTE: Make sure to work on the right hand sid travel motor.

IMPORTANT

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

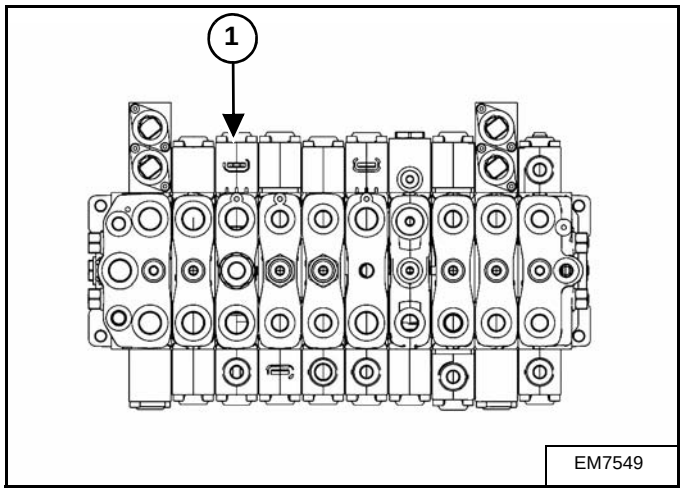
I-2003-0888

Testing And Adjusting (Cont'd)

Left Main Relief Valve (Right Hand Travel, Arm And Auxiliary Flow Valve Sections) (Cont'd)

Engage the RH travel circuit over relief and record the pressure.

Figure 20-30-8

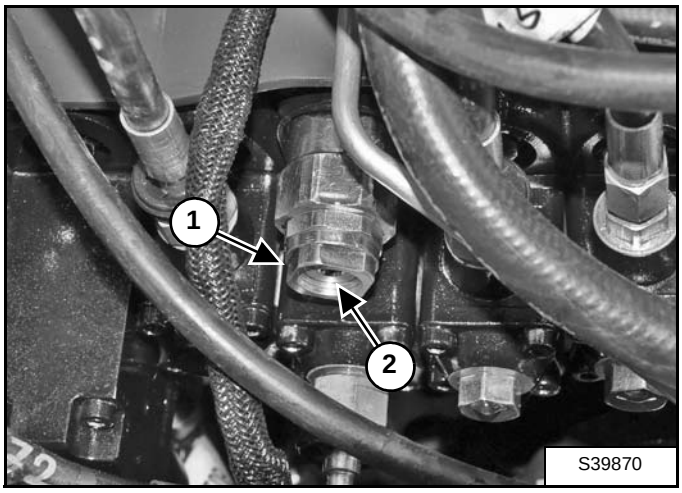


The left main relief valve (Item 1) **[Figure 20-30-8]** (located below the spool cover) pressure should be as follows:

A target pressure of 24,0 MPa (240 bar) (3480 psi) with an acceptable range of 23,5 - 24,5 MPa (235 - 245 bar) (3407 - 3503 psi).

Stop the engine.

Figure 20-30-9



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

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

NOTE: 90° turn is approximately 1 MPa (10 bar) (145 psi).

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

Retest the main relief valve after adjustment.

Remove the gauge.

Remove the caps and install the two hoses (Item 1) **[Figure 20-30-7]**.

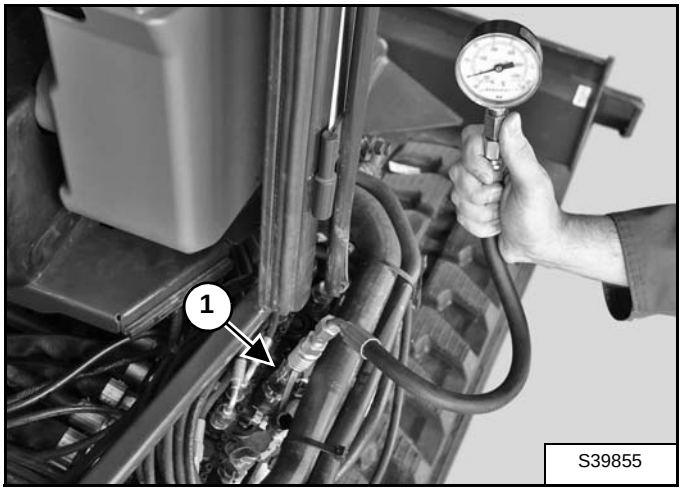
Install the cover with the three bolts (Item 1) **[Figure 20-30-6]**.

Remove the jackstands from the machine.

Testing And Adjusting (Cont'd)

Center Main Relief Valve (Left Hand Travel, Boom And Bucket Valve Sections)

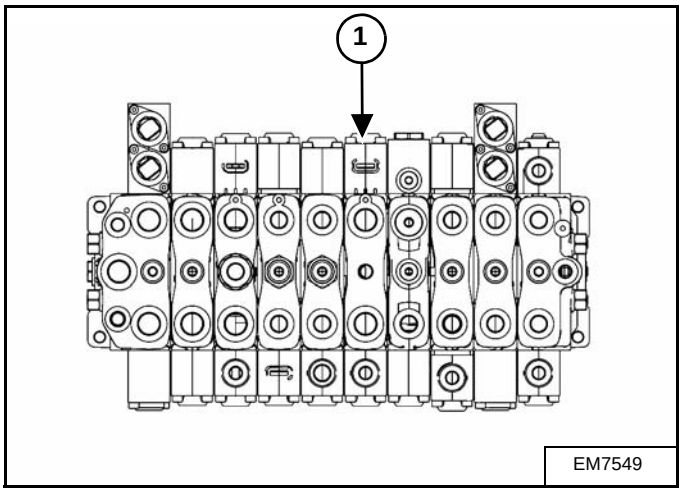
Figure 20-30-10



Connect the test gauge coupler and 34,5 MPa (345 bar) (5000 psi) gauge to the "P2" diagnostic coupler (Item 1) **[Figure 20-30-10]**.

Engage the bucket curl (or dump) over relief and record the pressure.

Figure 20-30-11

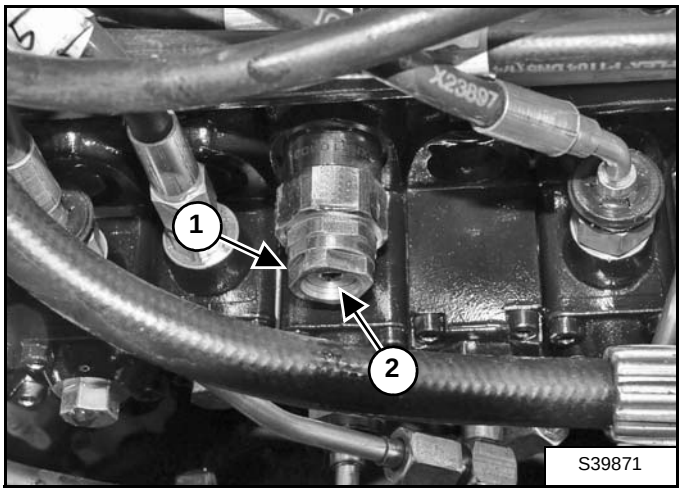


The center main relief valve (Item 1) **[Figure 20-30-11]** (located below the spool cover) pressure should be as follows:

A target pressure of 24,0 MPa (240 bar) (3480 psi) with an acceptable range of 23,5 - 24,5 MPa (235 - 245 bar) (3407 - 3503 psi).

Stop the engine.

Figure 20-30-12



If adjustment is needed, loosen the nut (Item 1) **[Figure 20-30-12]**.

Turn the adjustment screw (Item 2) **[Figure 20-30-12]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

NOTE: 90° turn is approximately 1 MPa (10 bar) (145 psi).

Tighten the nut (Item 1) **[Figure 20-30-12]**.

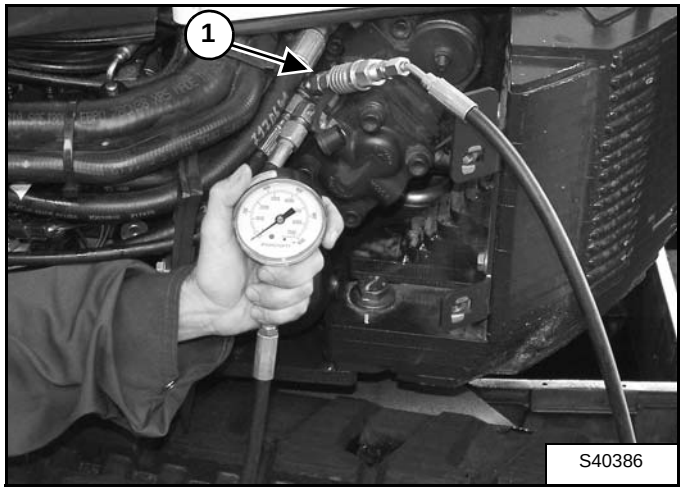
Retest the main relief valve after adjustment.

Remove the gauge.

Testing And Adjusting (Cont'd)

Right Relief Valve (Upperstructure Slew, Boom Swing And Blade Valve Sections)

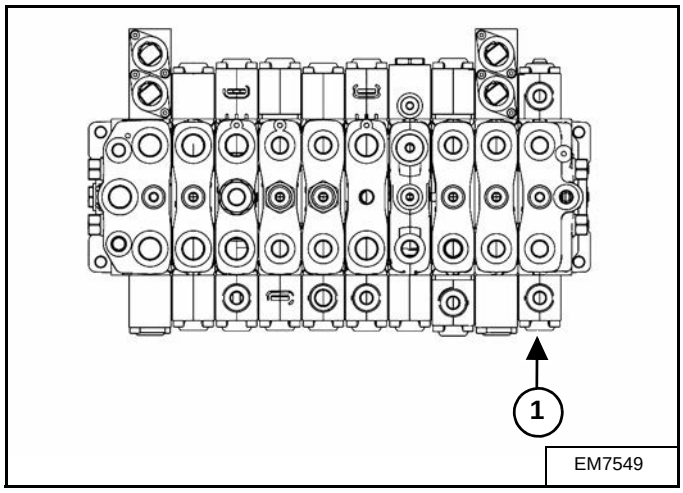
Figure 20-30-13



Connect the test gauge coupler and 34,5 MPa (345 bar) (5000 psi) gauge to the "P3" diagnostic coupler (Item 1) **[Figure 20-30-13]**.

Engage the blade up circuit over relief and record the pressure.

Figure 20-30-14

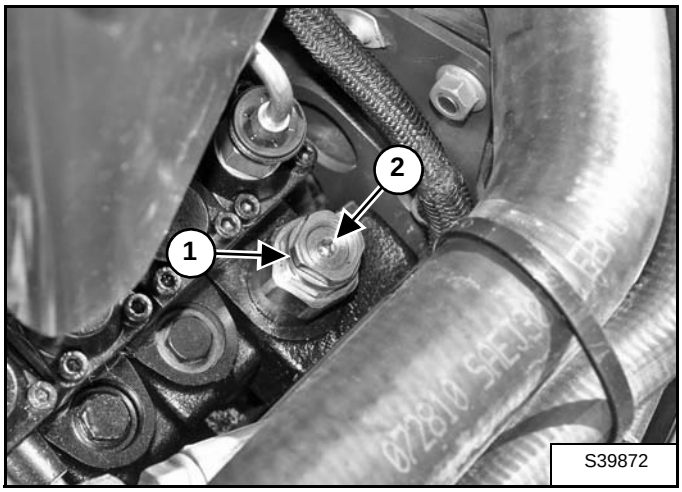


The right main relief valve (Item 1) **[Figure 20-30-14]** (located below the spool cover) pressure should be as follows:

A target pressure of 20,6 MPa (206 bar) (2987 psi) with an acceptable range of 20,1 - 21,1 MPa (201 - 211 bar) (2914 - 3060 psi).

Stop the engine.

Figure 20-30-15



If adjustment is needed, loosen the nut (Item 1) **[Figure 20-30-15]**.

Turn the adjustment screw (Item 2) **[Figure 20-30-15]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

NOTE: 90° turn is approximately 1 MPa (10 bar) (145 psi).

Tighten the nut (Item 1) **[Figure 20-30-15]**.

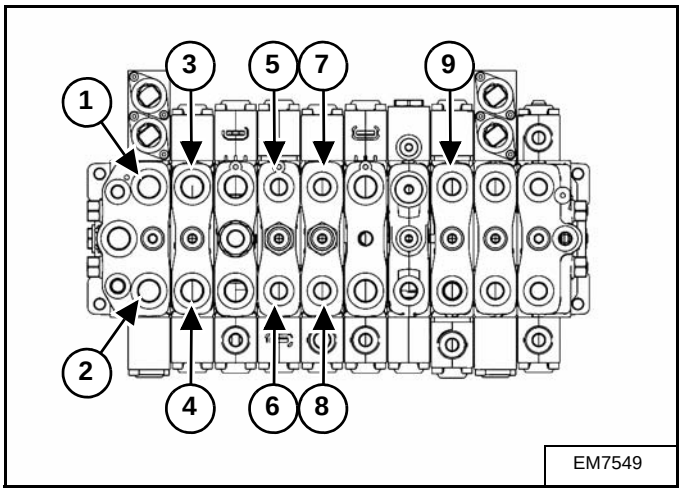
Retest the main relief valve after adjustment.

Remove the gauge.

VALVES (PORT RELIEF)

Testing And Adjusting

Figure 20-31-1



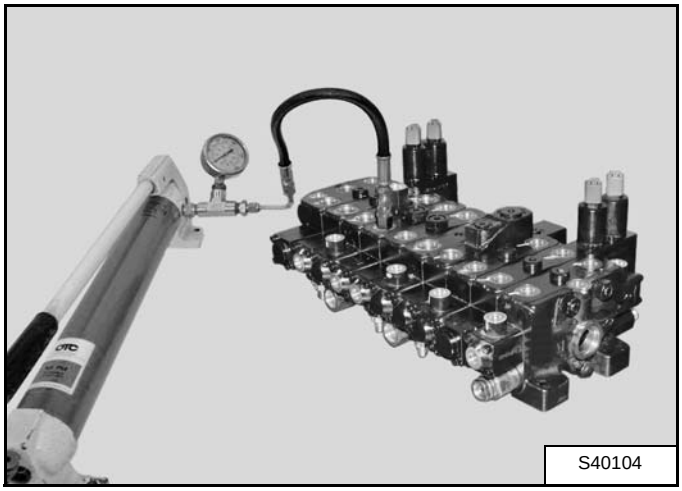
Port relief settings overview **[Figure 20-31-1]**:

REF	DESCRIPTION	TARGET PRESSURE MPa (bar) (psi)	ACCEPTABLE RANGE MPa (bar) (psi)
1	Aux Flow (Female Quick Coupler)	18 (180) (2610)	17,5 - 19,3 (175 - 193) (2537 - 2799)
2	Aux Flow (Male Quick Coupler)	18 (180) (2610)	17,5 - 19,3 (175 - 193) (2537 - 2799)
3	Arm (Rod End)	29 (290) (4205)	28,5 - 31,0 (285 - 310) (4132 - 4495)
4	Arm (Base End)	29 (290) (4205)	28,5 - 31,0 (285 - 310) (4132 - 4495)
5	Bucket (Rod End)	26 (260) (3770)	25,5 - 28,0 (255 - 280) (3697 - 4060)
6	Bucket (Base End)	26 (260) (3770)	25,5 - 28,0 (255 - 280) (3697 - 4060)
7	Boom (Rod End)	29 (290) (4205)	28,5 - 31,0 (285 - 310) (4132 - 4495)
8	Boom (Base End)	29 (290) (4205)	28,5 - 31,0 (285 - 310) (4132 - 4495)
9	Blade (Base End)	27 (270) (3915)	26,5 - 29,0 (265 - 290) (3842 - 4205)

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

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

Figure 20-31-2



Install the hand pump hose and a 34,5 MPa (345 bar) (5000 psi) pressure gauge into the valve section work port in which the port relief valve is located **[Figure 20 31-2]**. Slowly pressurize this section with the hand pum until the port relief valve opens and make a note of th pressure reading.

NOTE: Pumping the hand pump too fast will alter th pressure readings up to 340 kPa (3,4 bar) (5 psi).

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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Bobcat®

VALVES (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 - 5000 psi Gauge
- MEL1355-12 - Coupler
- MEL1355-9 - Thermometer

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.

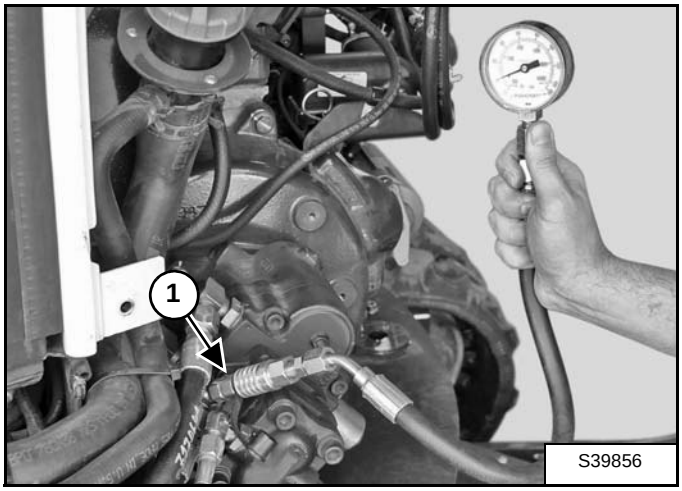
System Pressures At Gauge Port Specifications

SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET MPa (bar) (psi)	ACCEPTABLE RANGE MPa (bar) (psi)
SWING MOTOR - CROSS PORT RELIEF	SLEW RIGHT	PUMP 3	P3	19,1 (191) (2770)	18,6 - 19,6 (186 - 196) (2697 - 2842)
SWING MOTOR - CROSS PORT RELIEF	SLEW LEFT	PUMP 3	P3	19,1 (191) (2770)	18,6 - 19,6 (186 - 196) (2697 - 2842)

Testing (Cont'd)

Open upperstructure cover panel and tailgate.

Figure 20-32-1



Connect the test gauge coupler and 34,5 MPa (345 bar) (5000 psi) gauge to the diagnostic coupler (Item 1) **[Figure 20-32-1]**.

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

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 19,1 MPa (191 bar) (2770 psi) with an acceptable range of 18,6 - 20,0 MPa (186 - 200 bar) (2600 - 2900 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.

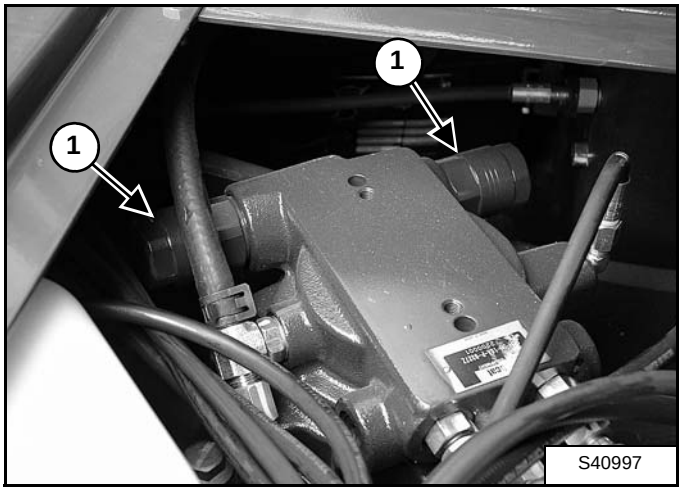
Removal And Installation

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-4.)

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

Remove the tool box. (See Removal And Installation on Page 40-220-1.)

Figure 20-32-2

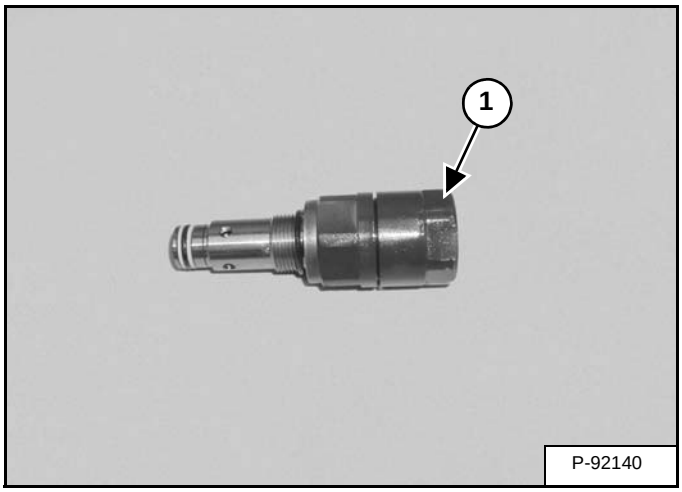


Mark and remove the crossport relief valves (Item 1) **[Figure 20-32-2]**.

NOTE: Install the valves in the original location.

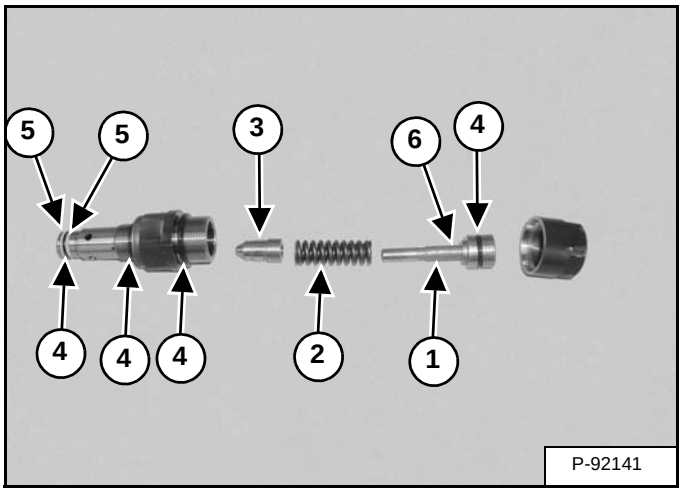
Disassembly And Assembly

Figure 20-32-3



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

Figure 20-32-4



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 20-32-4]**.

NOTE: Shims (Item 6) [Figure 20-32-4] can be installed on the spool. Always install the same number of shims that were removed.


Bobcat®

VALVES (PILOT PRESSURE RELIEF)

Testing And Adjusting

The pilot pressure valve supplies lower hydraulic pressure to joysticks.

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

MEL1355 - Test Kit includes the following
MEL1355-2 - 6,9 MPa (69 bar) (1000 psi) Gauge
MEL1355-9 - Thermometer

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.

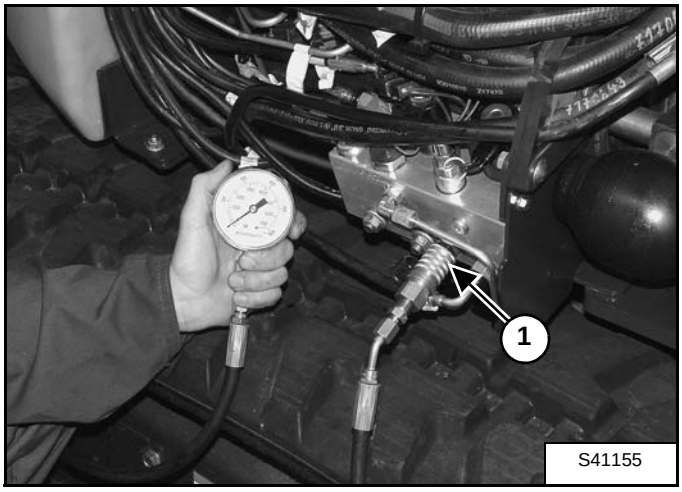
System Pressures At Gauge Port Specifications

SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET MPa (bar) (psi)	ACCEPTABLE RANGE MPa (bar) (psi)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	PUMP 4 (JOYSTICK PILOT)	G	3,2 (32) (464)	3,2 - 3,5 (32 - 35) (464 - 508)

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

Remove the left upperstructure cover. (See Removal And Installation on Page 40-70-1.)

Figure 20-33-1



Connect the test gauge coupler and 6,9 MPa (69 bar) (1000 psi) gauge from the test kit to the port “G” diagnostic coupler (Item 1) **[Figure 20-33-1]** to check the pressure relief valve.

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

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

Engage the bucket curl circuit and fully curl the bucket.

The pilot pressure relief valve pressure should be a follows:

A target pressure of 3,2 MPa (32 bar) (464 psi) with an acceptable range of 3,2 - 3,5 MPa (32 - 35 bar) (464 - 508 psi).

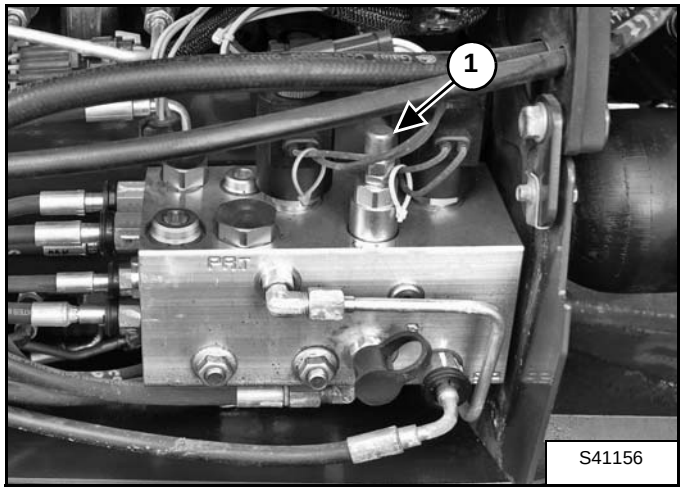
Move the engine speed control to low idle speed.

Stop the engine.

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

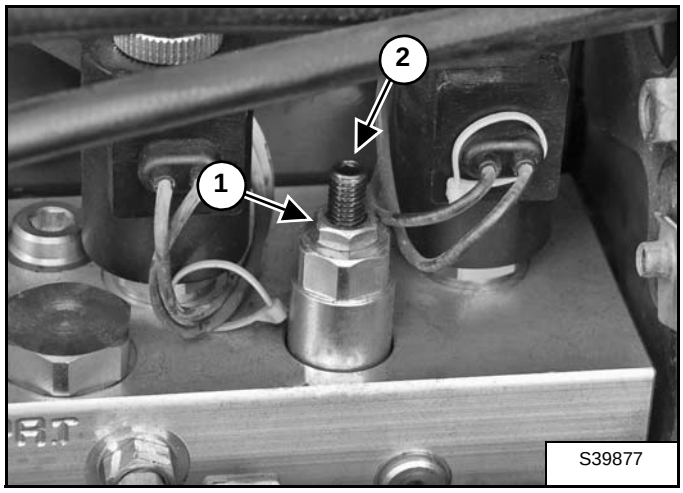
Testing And Adjusting The Pilot Pressure Relief Valve (Cont'd)

Figure 20-33-2



Remove the cap (Item 1) **[Figure 20-33-2]**.

Figure 20-33-3



Loosen the nut (Item 1) **[Figure 20-33-3]**.

Turn the adjustment screw (Item 2) **[Figure 20-33-3]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

NOTE: 90° turn is approximately 280 kPa (2,8 bar) (40 psi).

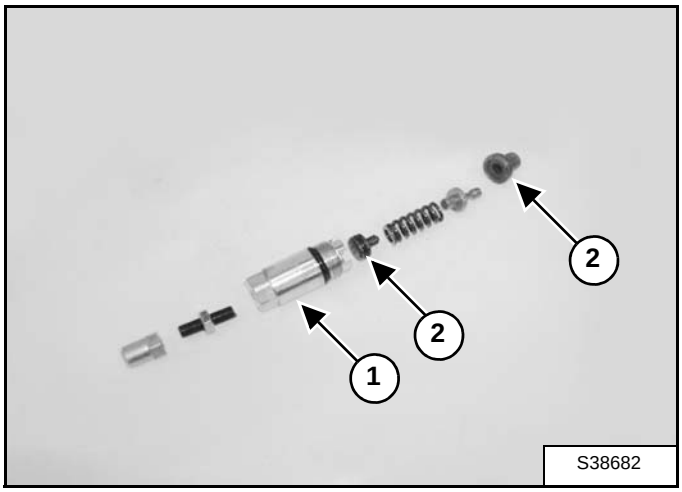
Tighten the nut (Item 1) **[Figure 20-33-3]**.

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 20-33-4



Inspect the valve (Item 1) **[Figure 20-33-4]** for damage. If damaged, replace the manifold assembly.

Inspect the O-rings (Item 2) **[Figure 20-33-4]** on the valve. If O-rings are worn or damaged, replace O-rings. (See Disassembly And Assembly on Page 20-60-5.)

Reinstall 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.

HYDRAULIC CONTROL VALVE

Removal And Installation

Turn the machine counterclockwise 90° for easier access.

Lower the boom / bucket and blade to the earth.

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

IMPORTANT

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

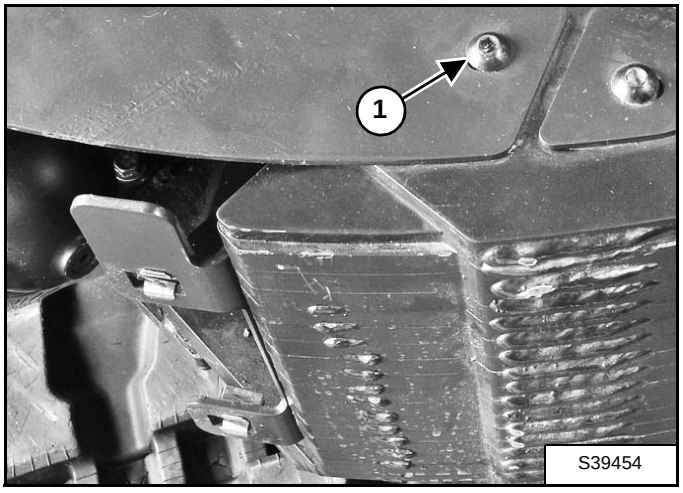
I-2003-0888

Drain the hydraulic reservoir. (See Removal And Installation on Page 20-140-1.)

Remove the left upperstructure cover (See Removal And Installation on Page 40-70-1.) and the side cover. *(See Removal And Installation on Page 40-190-1.)*

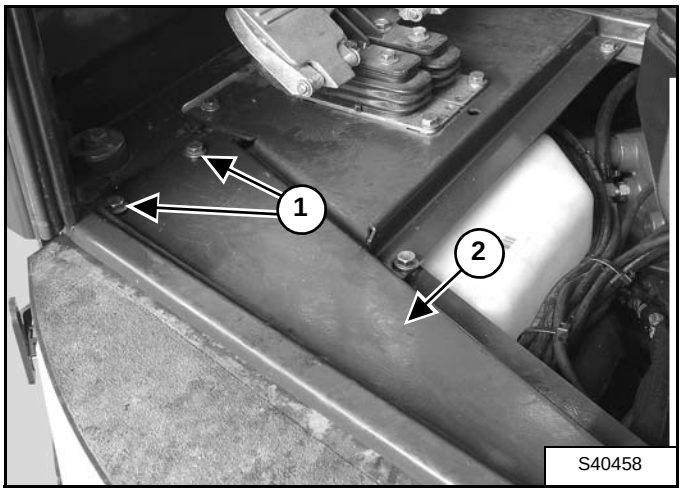
Remove the floor mat and floorplate. (See Removal And Installation on Page 40-110-1.)

Figure 20-40-1



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

Figure 20-40-2

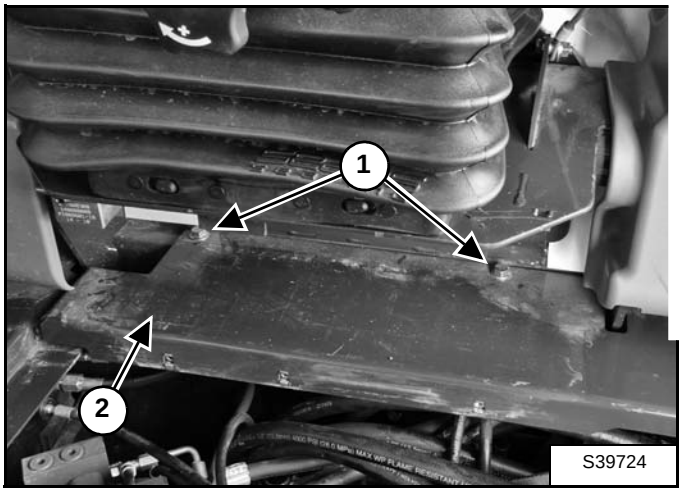


Remove the two bolts (Item 1) **[Figure 20-40-2]**.

Remove the floorplate (Item 2) **[Figure 20-40-2]**.

Remove the tool box. (See Removal And Installation on Page 40-220-1.)

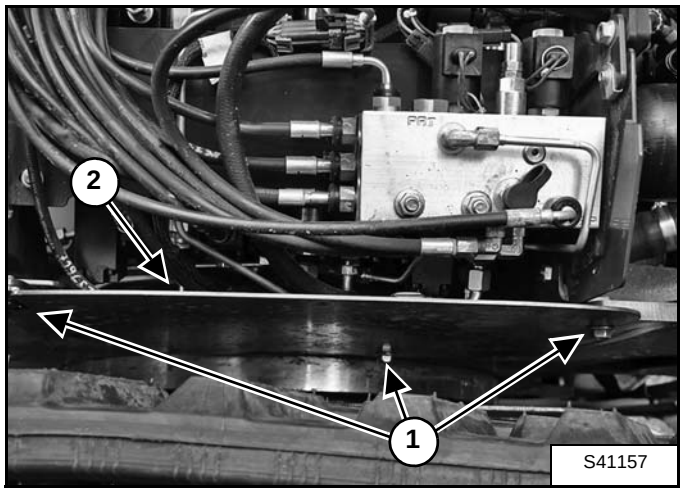
Figure 20-40-3



Remove the two bolts (Item 1) and the rear cover (Item 2) **[Figure 20-40-3]**.

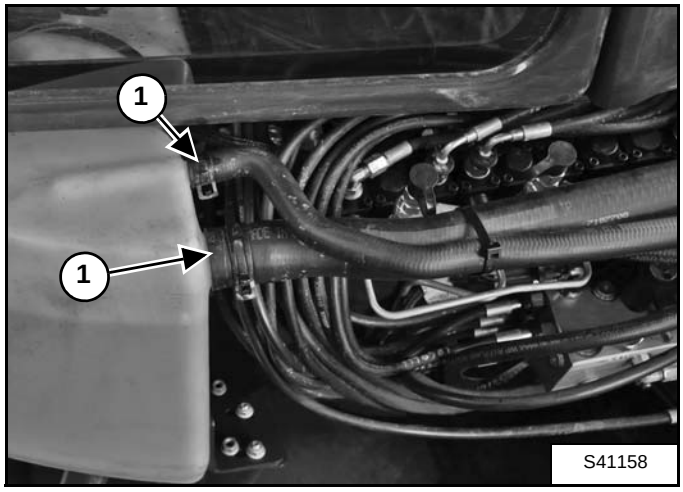
Removal And Installation (Cont'd)

Figure 20-40-4



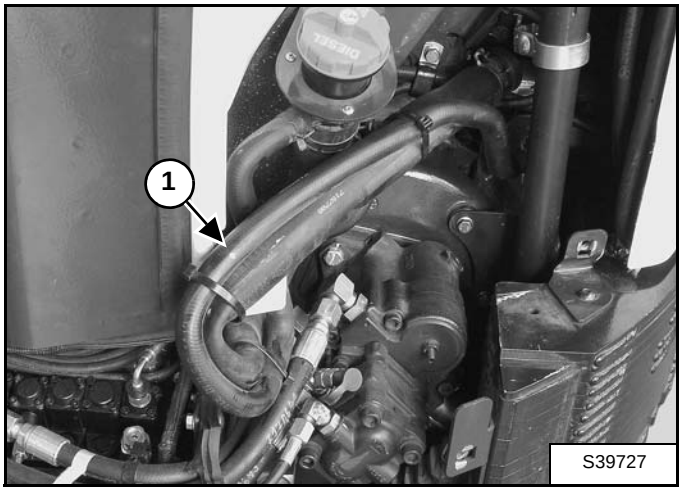
Remove the three bolts (Item 1) and the bottom plate (Item 2) **[Figure 20-40-4]**.

Figure 20-40-5



Disconnect the two fuel lines (Item 1) **[Figure 20-40-5]**.

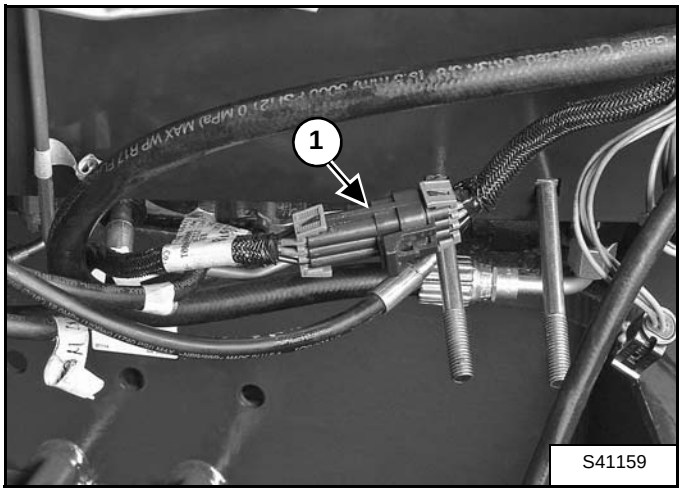
Figure 20-40-6



Pull back and secure both fuel lines (Item 1) **[Figure 20-40-6]** for better access.

Remove the manifold. (See Removal And Installation on Page 20-60-1.)

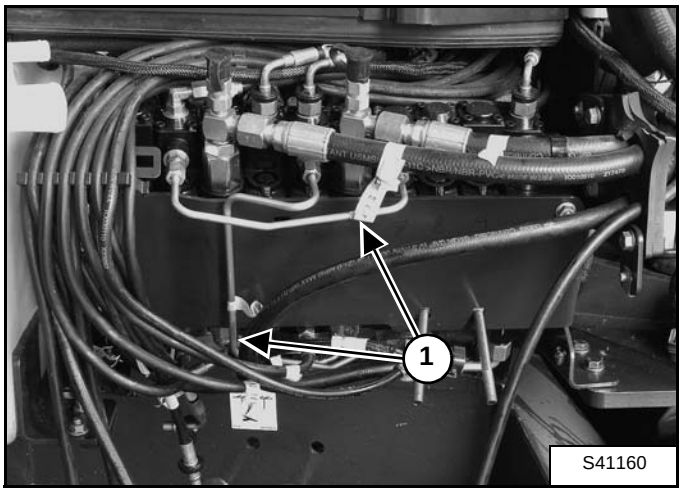
Figure 20-40-7



Disconnect the connector (Item 1) **[Figure 20-40-7]**.

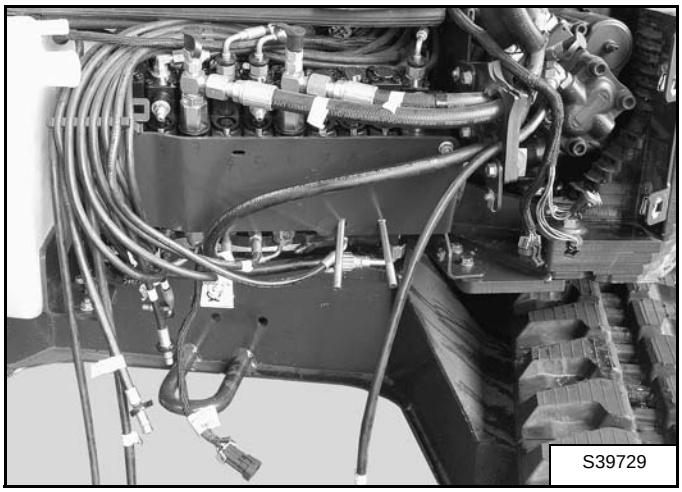
Removal And Installation (Cont'd)

Figure 20-40-8



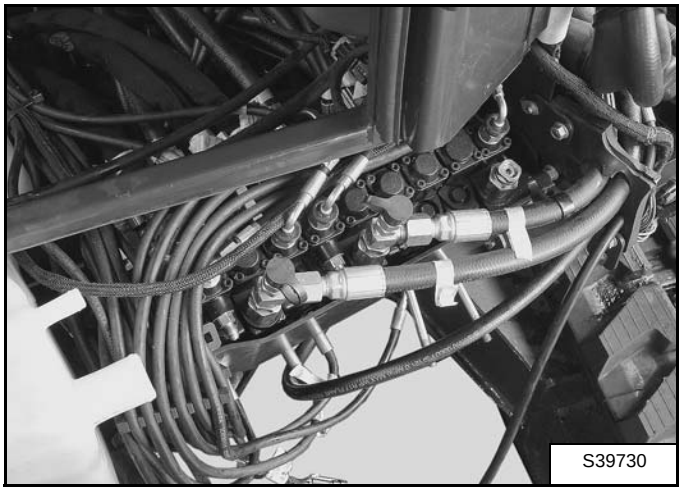
Mark, disconnect and remove all tubelines (Item 1) **[Figure 20-40-8]**.

Figure 20-40-9



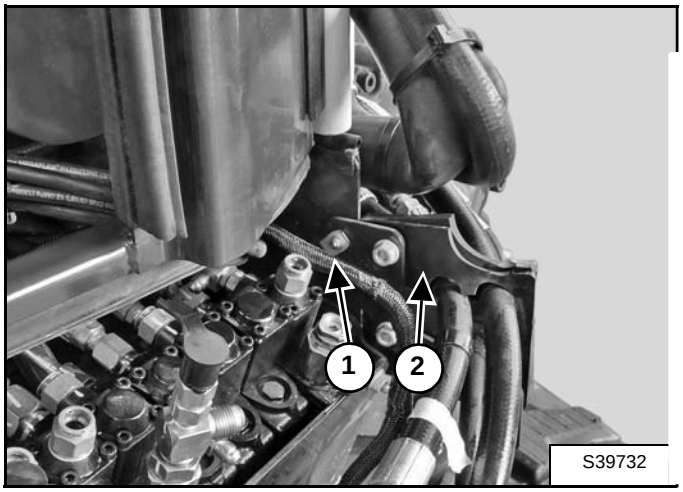
Mark all hoses **[Figure 20-40-9]**.

Figure 20-40-10



Disconnect and cap all hoses. Start with the upper connections **[Figure 20-40-10]**.

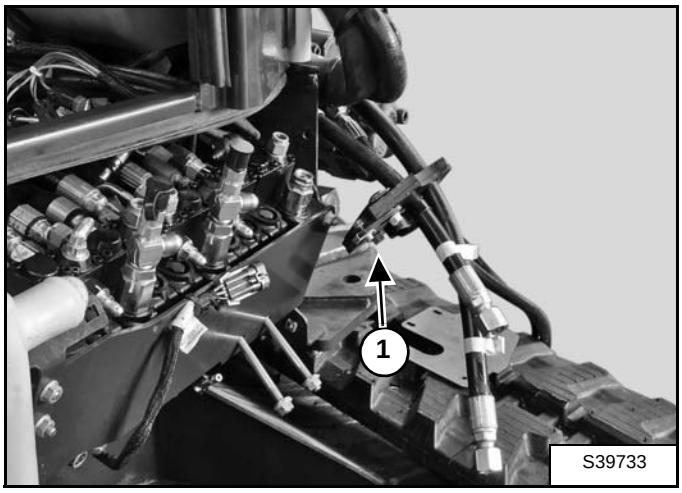
Figure 20-40-11



Remove the bolt (Item 1) and hose mounting bracket (Item 2) **[Figure 20-40-11]**.

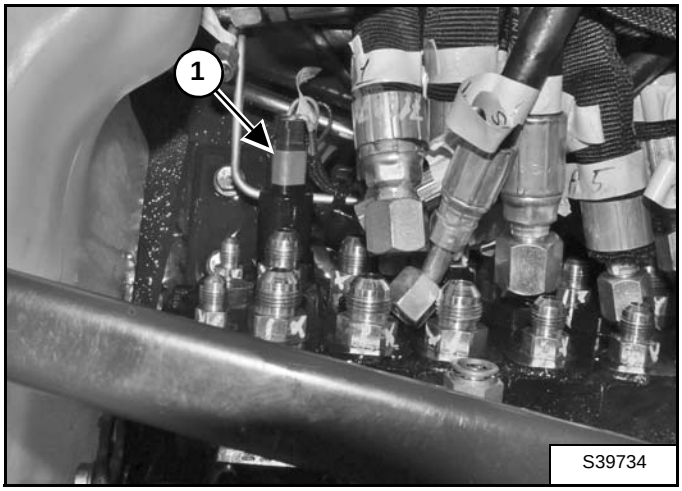
Removal And Installation (Cont'd)

Figure 20-40-12



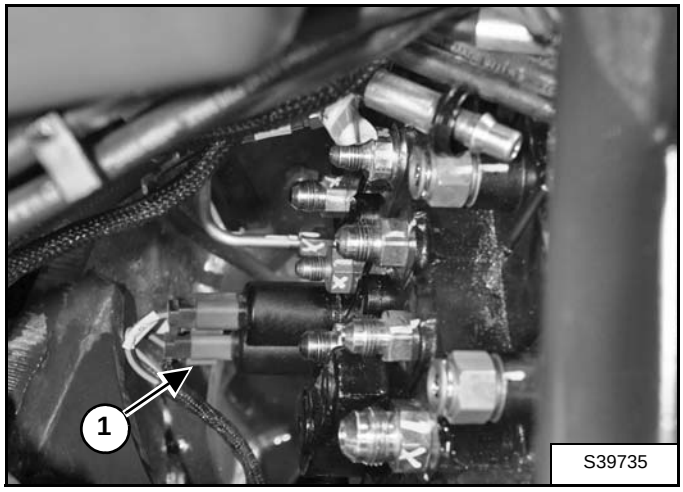
Reposition the hose mounting bracket (Item 1) **[Figure 20-40-12]** for better access.

Figure 20-40-13



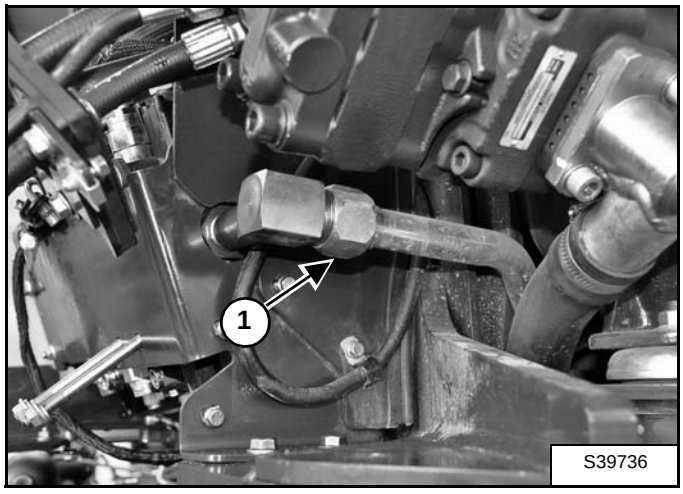
Disconnect the left solenoid wire harness (Item 1) **[Figure 20-40-13]**.

Figure 20-40-14



Disconnect the right solenoid wire harness (Item 1) **[Figure 20-40-14]**.

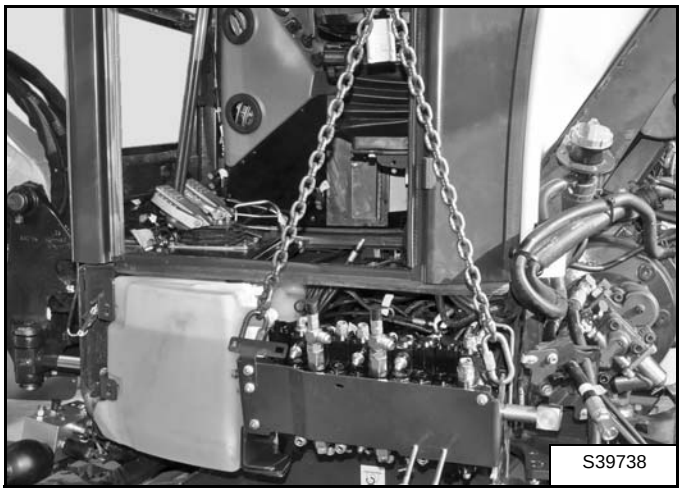
Figure 20-40-15



Disconnect the main hydraulic tubeline (Item 1) **[Figure 20-40-15]**.

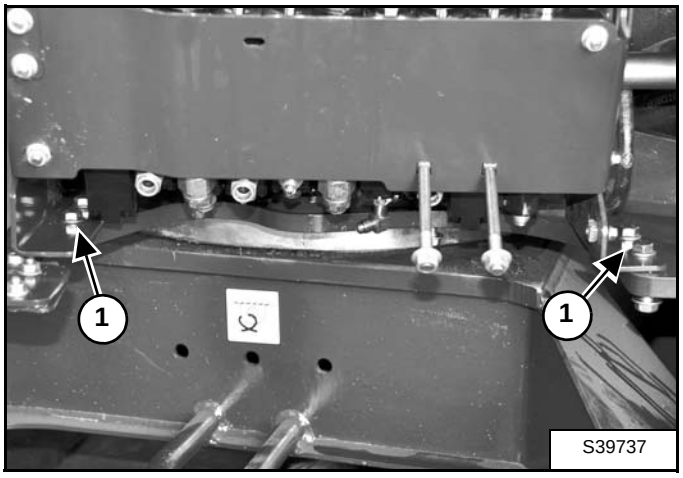
Removal And Installation (Cont'd)

Figure 20-40-16



Support the assembly with a chain hoist **[Figure 20-40-16]**.

Figure 20-40-17



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

Figure 20-40-18

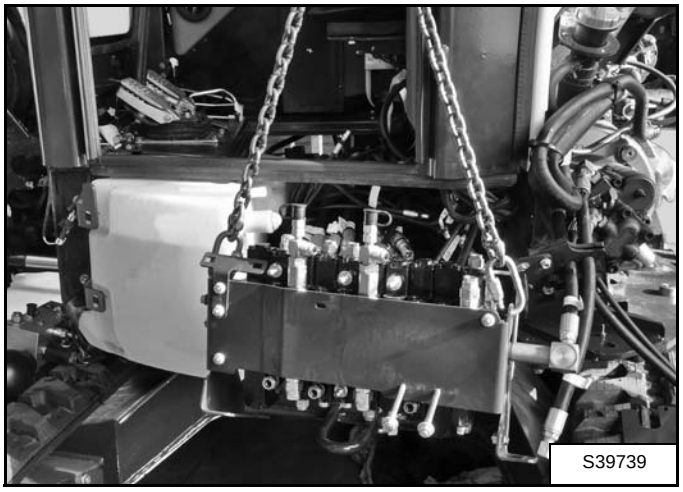
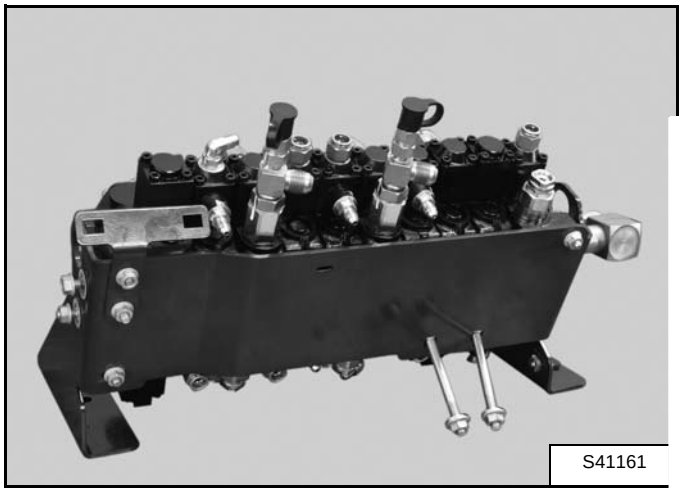


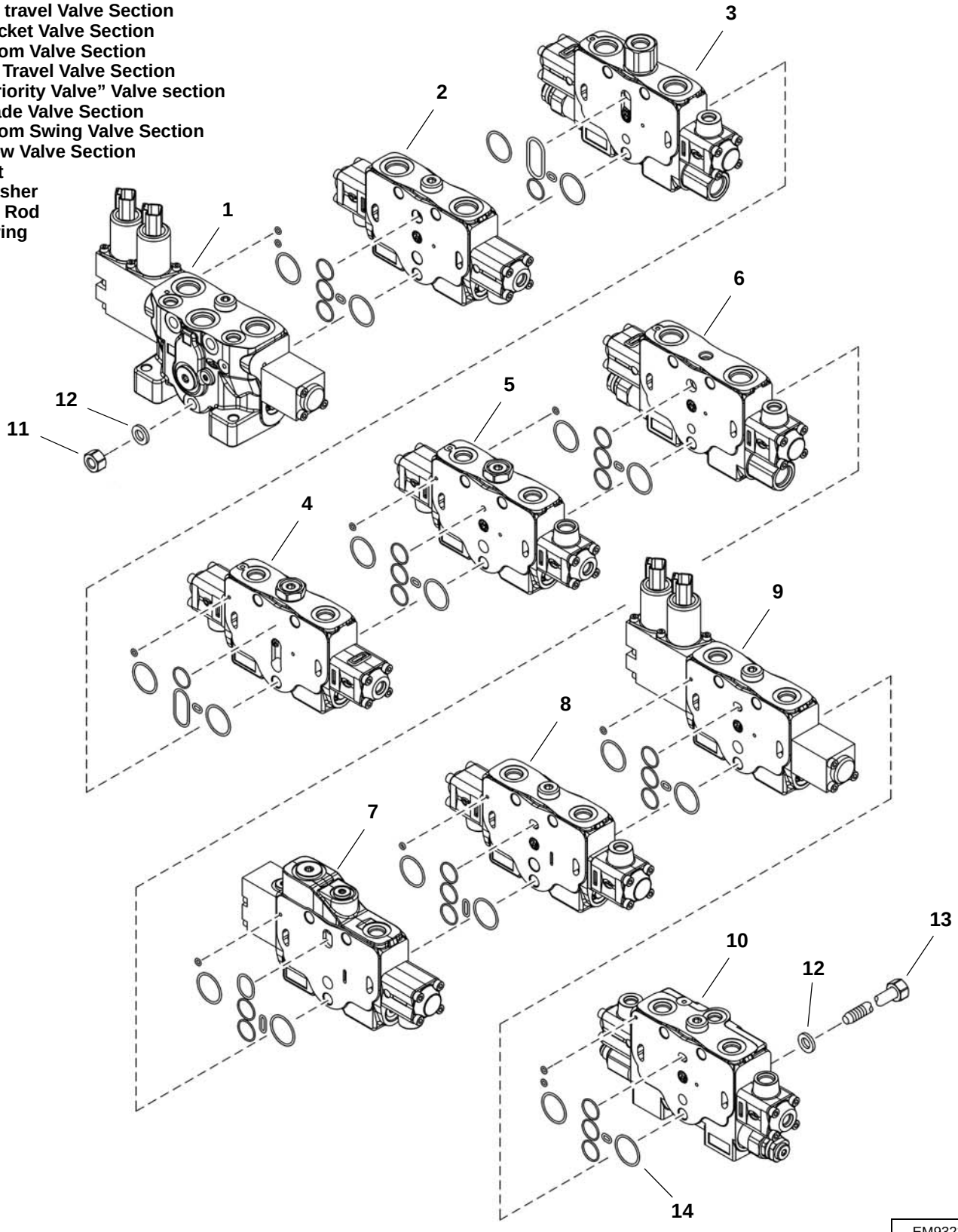
Figure 20-40-19



Remove the complete assembly from the excavator with the hoist and move the assembly to the workbench **[Figure 20-40-18]** and **[Figure 20-40-19]**.

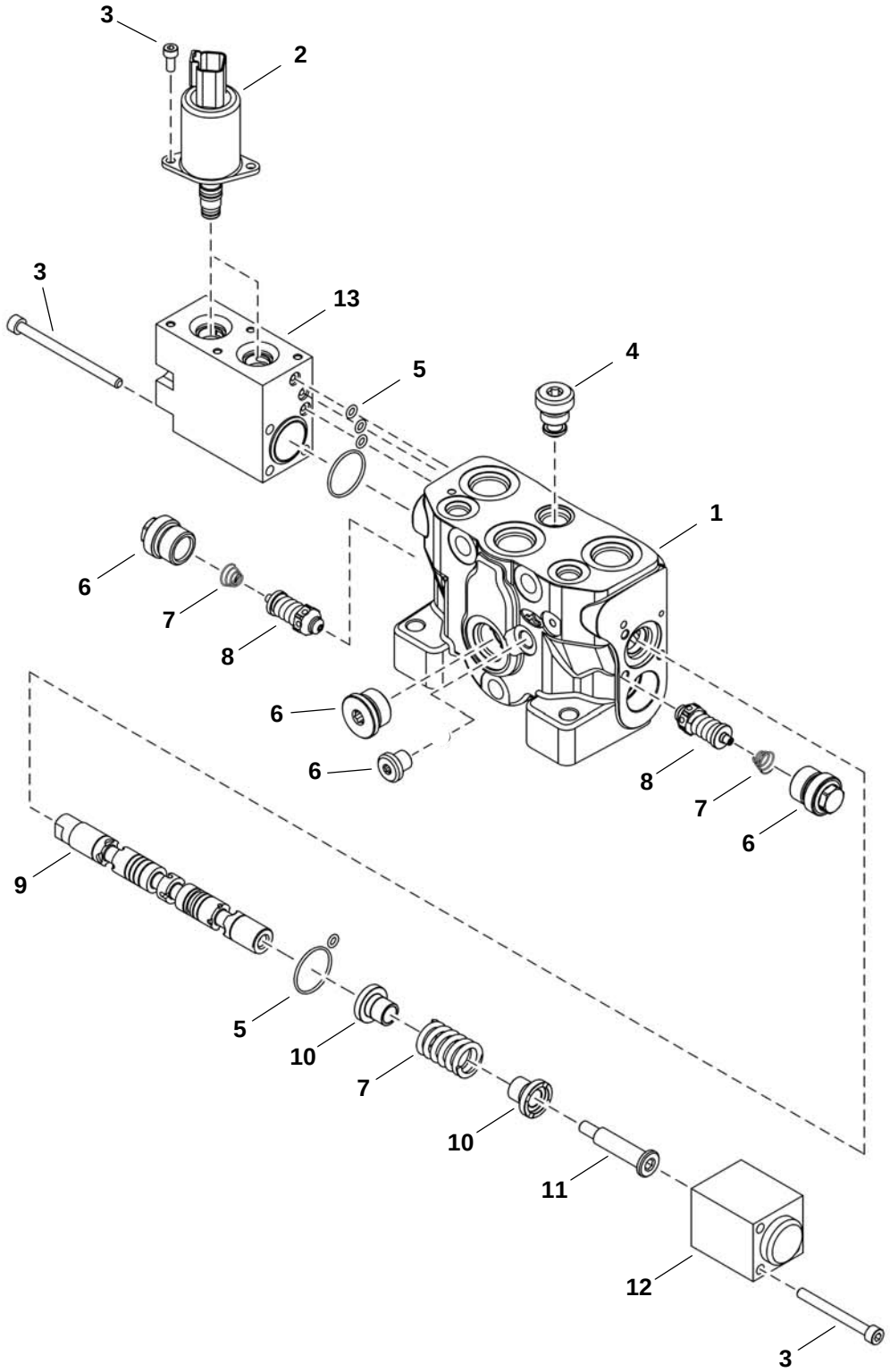
Parts Identification

1. Auxiliary Hydraulics Valve Section
2. Arm Valve Section
3. RH travel Valve Section
4. Bucket Valve Section
5. Boom Valve Section
6. LH Travel Valve Section
7. "Priority Valve" Valve section
8. Blade Valve Section
9. Boom Swing Valve Section
10. Slew Valve Section
11. Nut
12. Washer
13. Tie Rod
14. O-ring



Parts Identification (Cont'd)

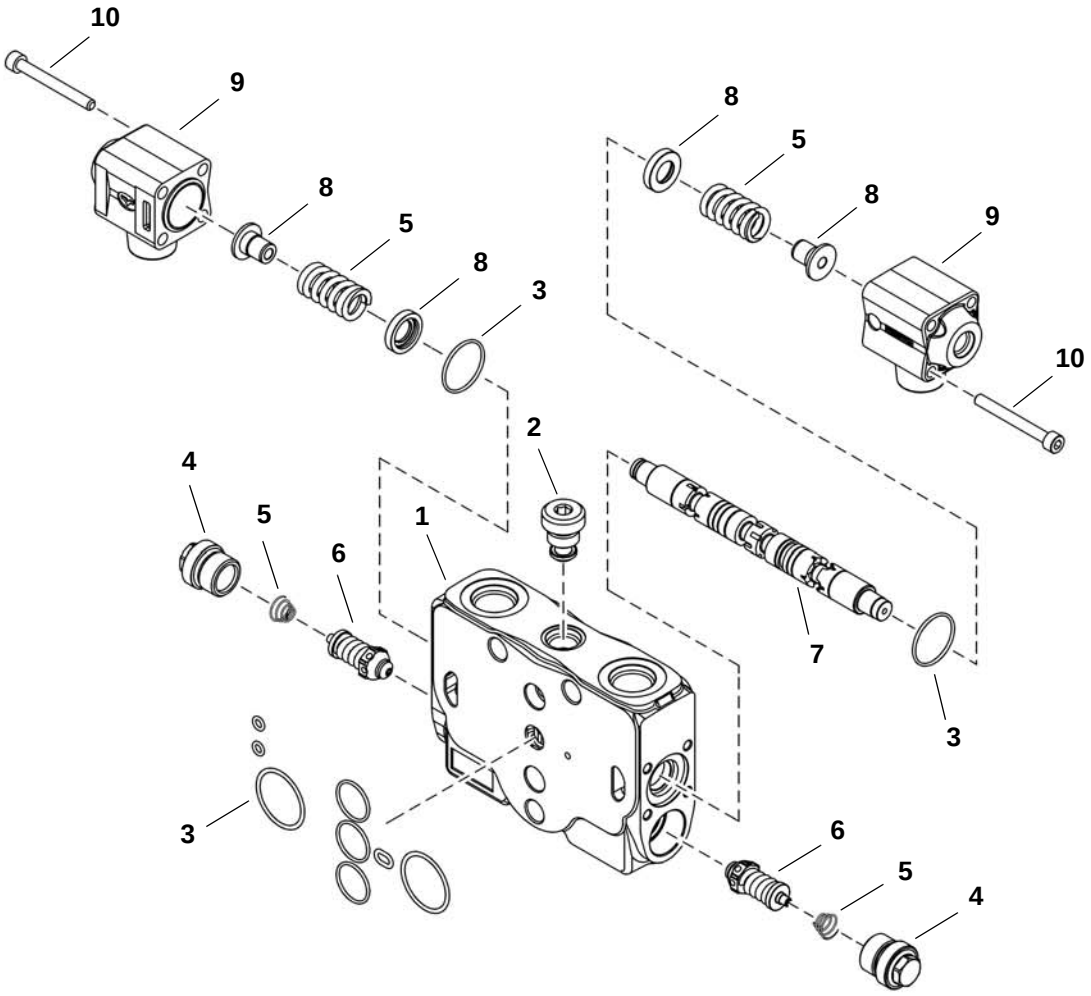
1. Auxiliary Hydraulics Valve Section Housing
2. Solenoid Valve
3. Screw
4. Check Valve
5. O-ring
6. Plug
7. Spring
8. Anti-Cavitation Valve
9. Spool
10. Spring Retainer
11. Bolt
12. Cover
13. Controller



NA5636S

Parts Identification (Cont'd)

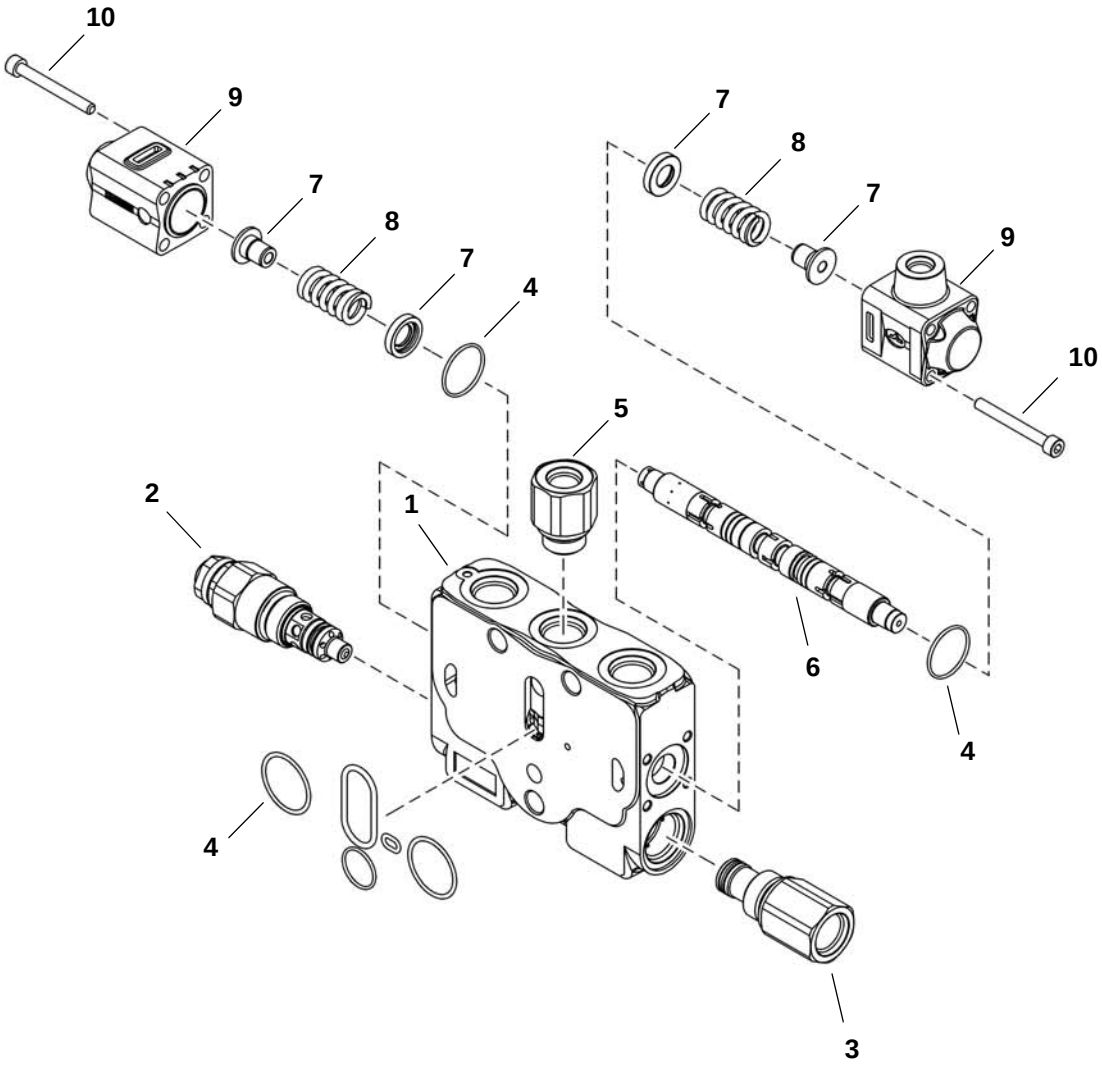
1. Arm Valve Section Housing
2. Check Valve
3. O-ring
4. Plug
5. Spring
6. Port Relief Valve
7. Spool
8. Spring Retainer
9. Cover
10. Bolt



NA5637S

Parts Identification (Cont'd)

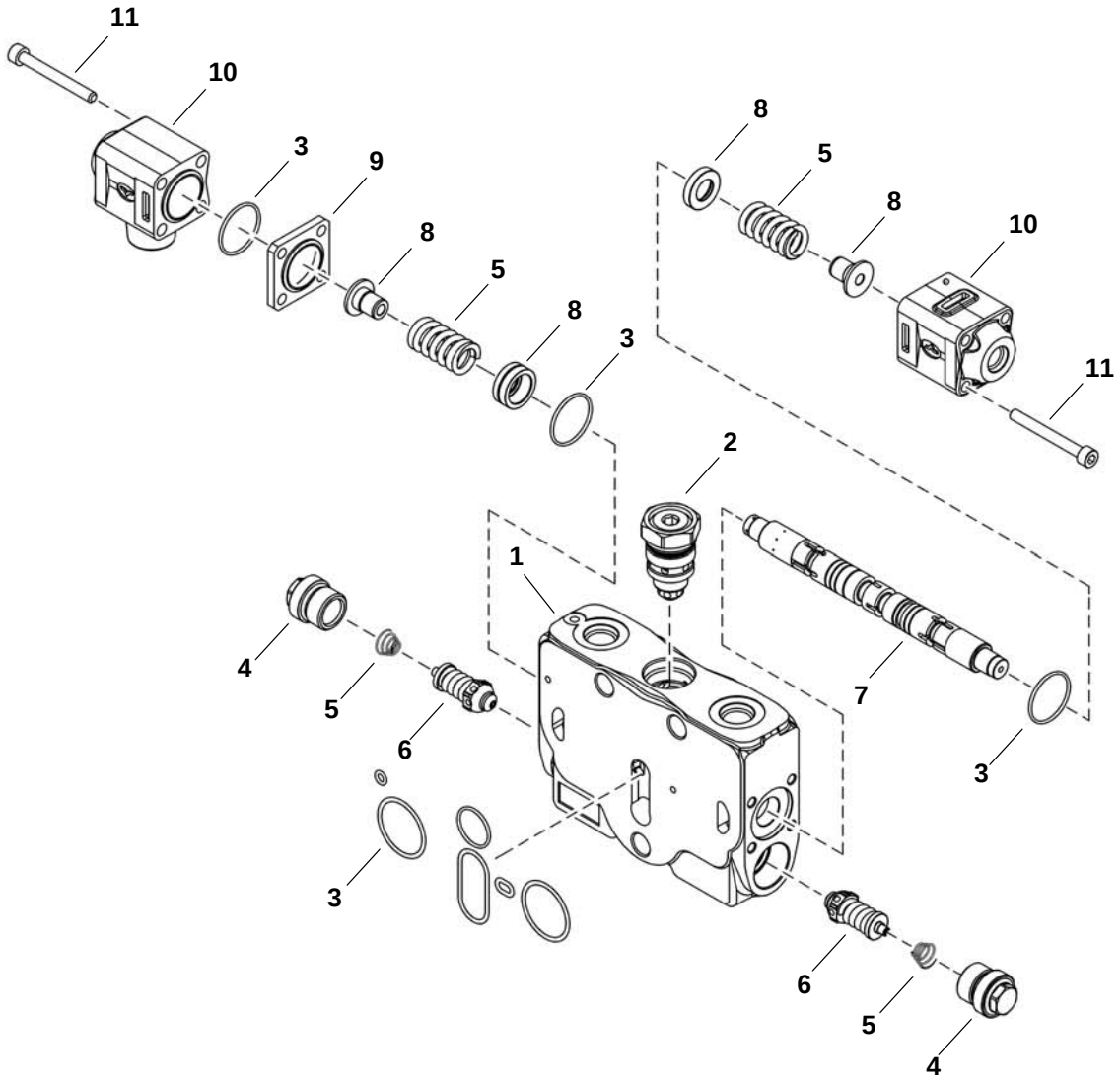
1. RH Travel Valve Section Housing
2. Port Relief / Anti-Cavitation Valve
3. Fitting
4. O-ring
5. Fitting
6. Spool
7. Spring Retainer
8. Spring
9. Cover
10. Screw



NA5638S

Parts Identification (Cont'd)

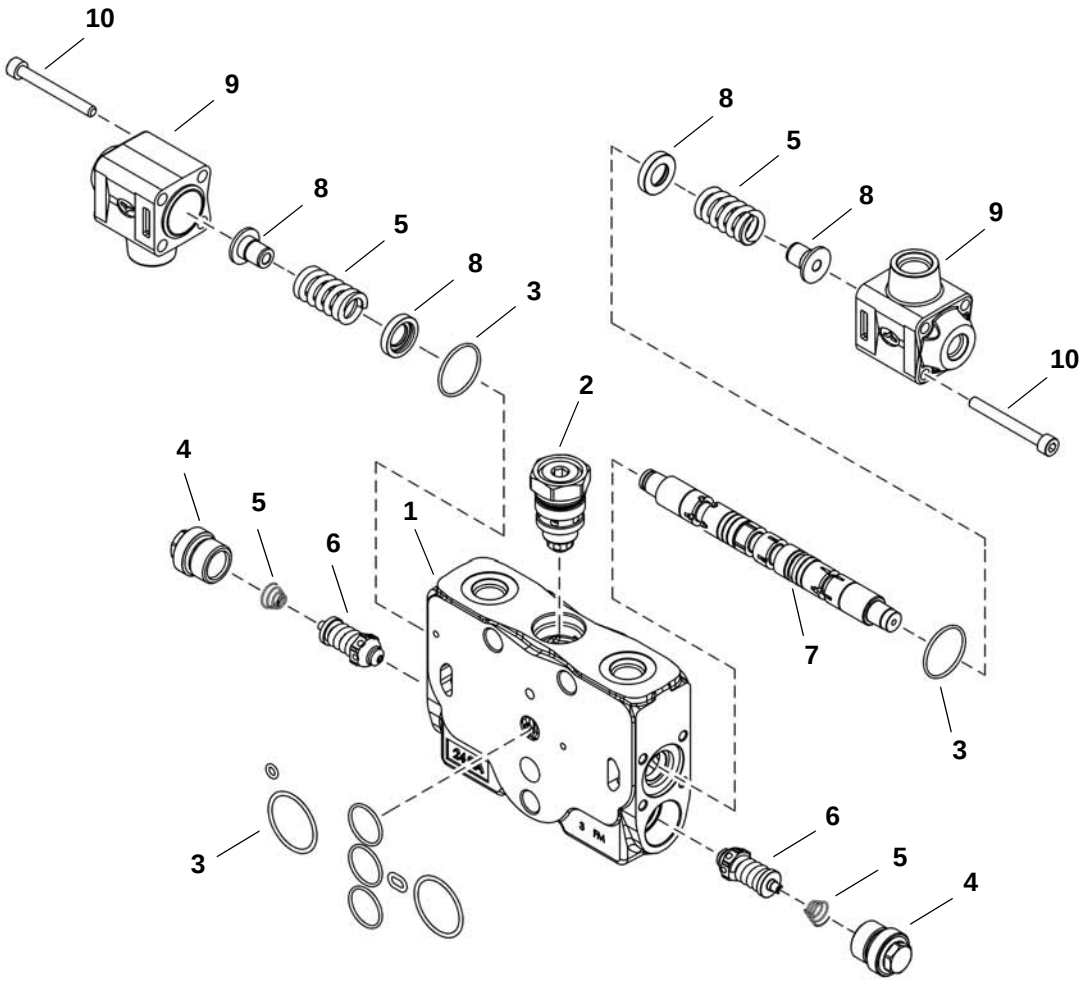
1. Bucket Valve Section Housing
2. Check Valve
3. Fitting
4. O-ring
5. Fitting
6. Spool
7. Spring Retainer
8. Spring
9. Spacer
10. Cover
11. Screw



NA5639S

Parts Identification (Cont'd)

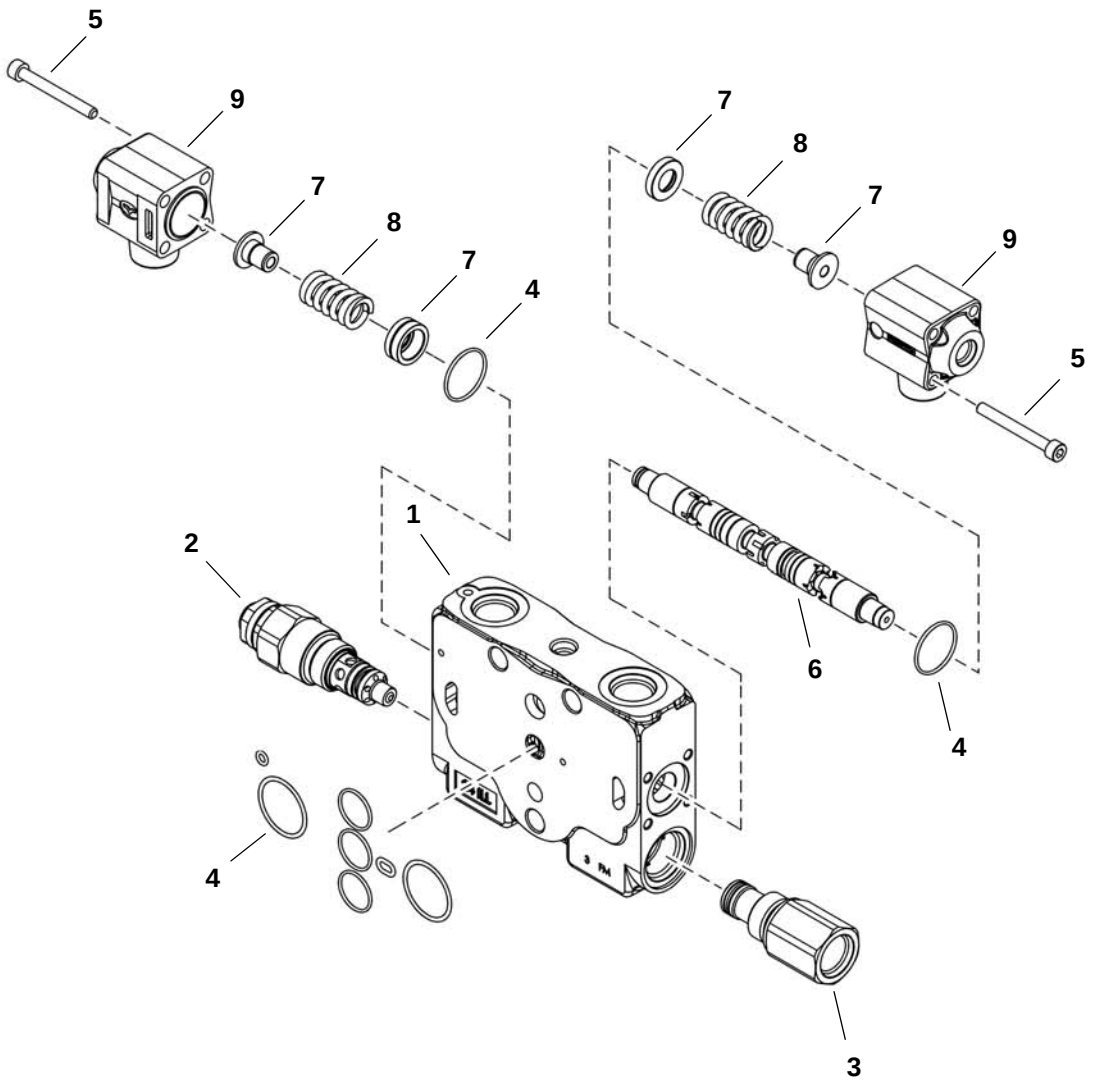
1. Boom Valve Section Housing
2. Check Valve
3. O-ring
4. Plug
5. Spring
6. Port Relief / Anti-Cavitation Valve
7. Spool
8. Spring Retainer
9. Cover
10. Bolt



NA5640S

Parts Identification (Cont'd)

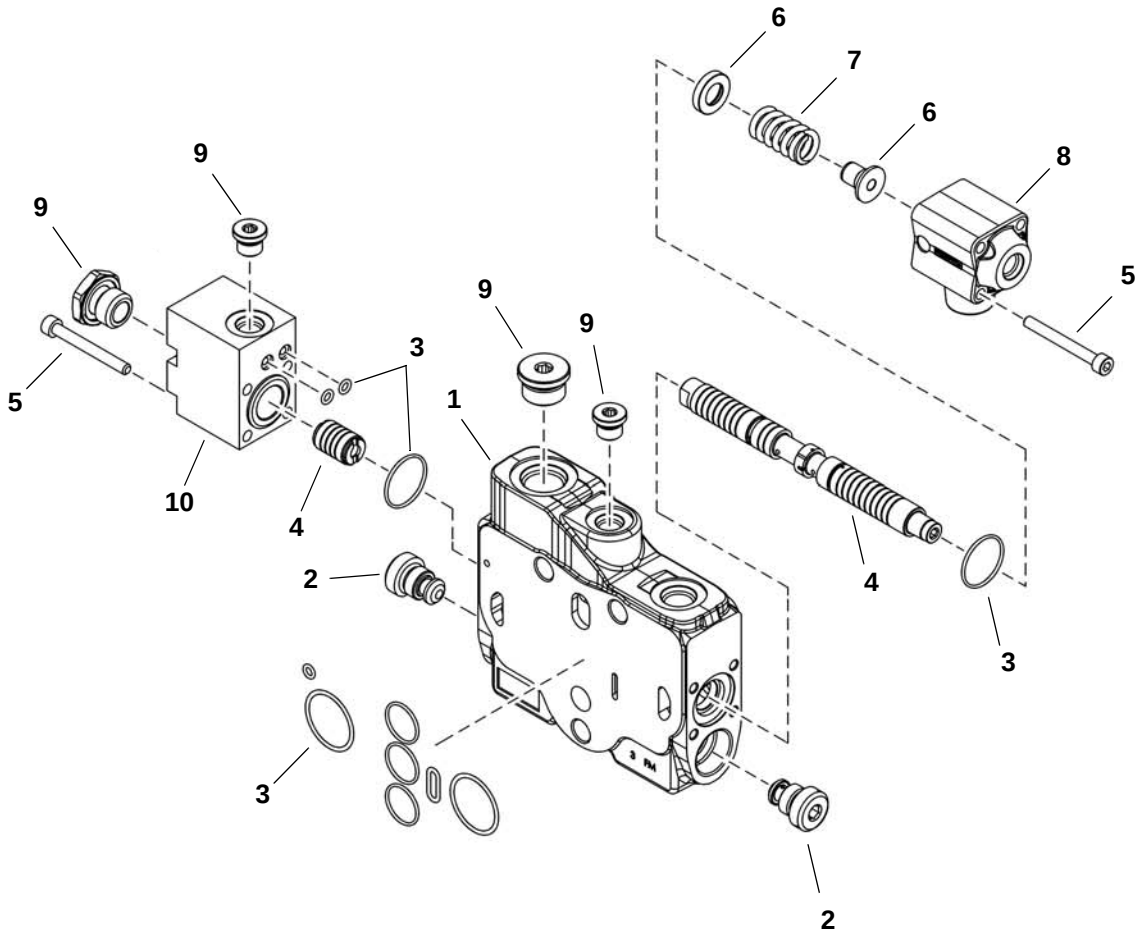
1. LH Travel Valve Housing
2. Port Relief / Anti-Cavitation Valve
3. Fitting
4. O-ring
5. Screw
6. Spool
7. Spring Retainer
8. Spring
9. Cover



NA5641S

Parts Identification (Cont'd)

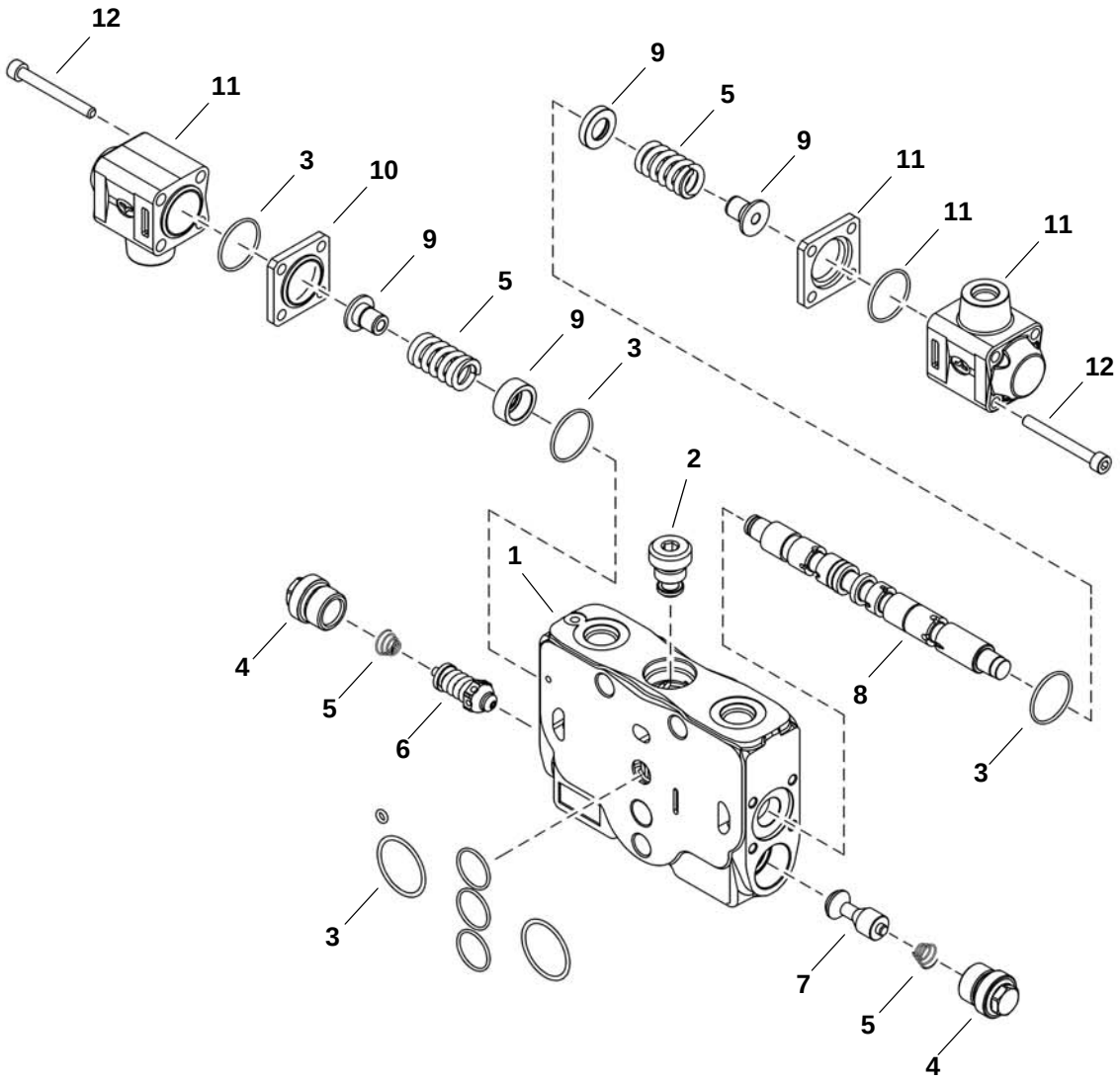
1. "Priority Valve" Valve Housing
2. Check Valve
3. O-ring
4. Screw
5. Spool
6. Spring Retainer
7. Spring
8. Cover
9. Plug
10. Controller



NA5642S

Parts Identification (Cont'd)

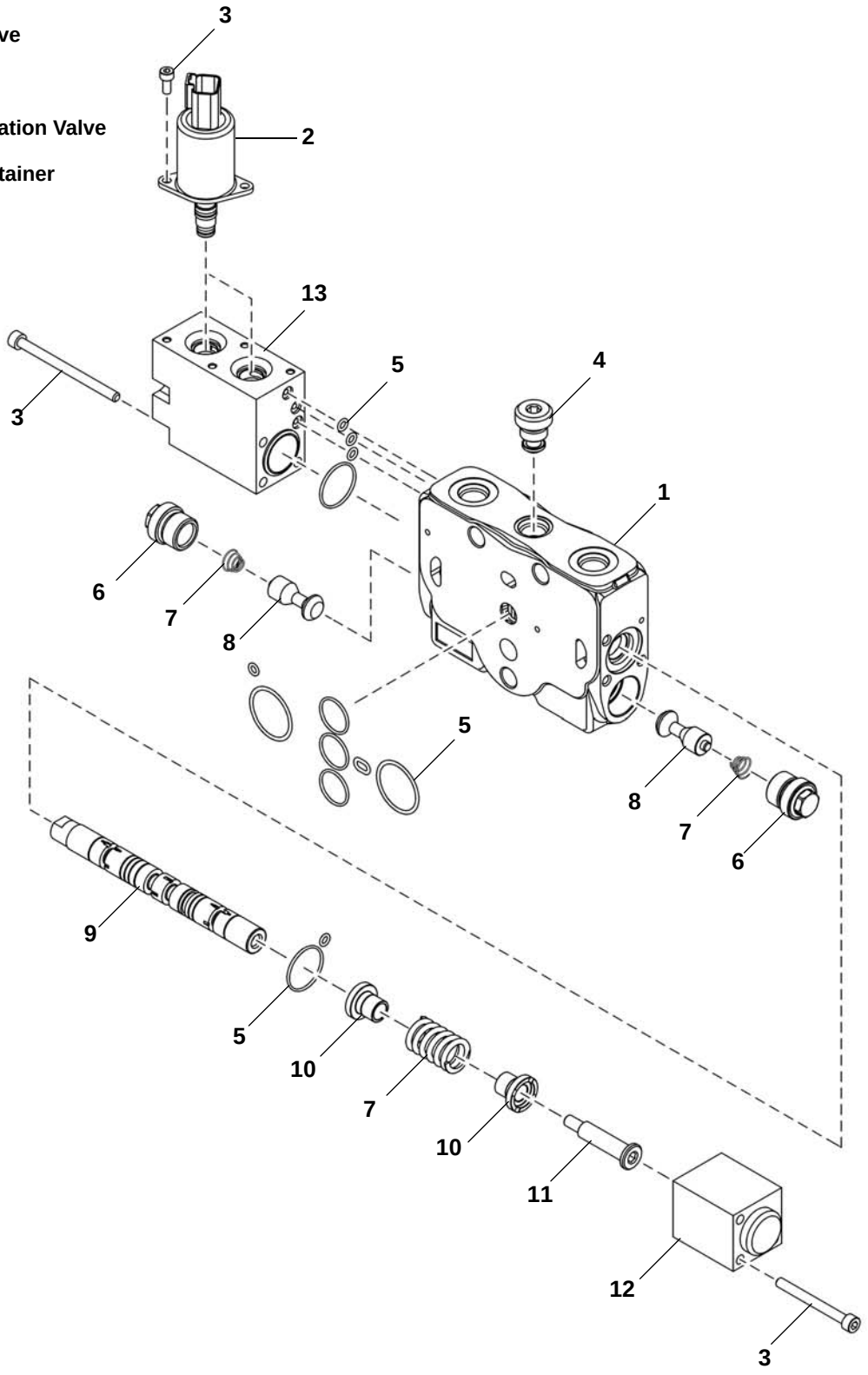
1. Blade Valve Housing
2. Check Valve
3. O-ring
4. Plug
5. Spring
6. Port Relief Valve
7. Shutter Valve
8. Spool
9. Spring Retainer
10. Spacer
11. Cover
12. Screw



NA5643S

Parts Identification (Cont'd)

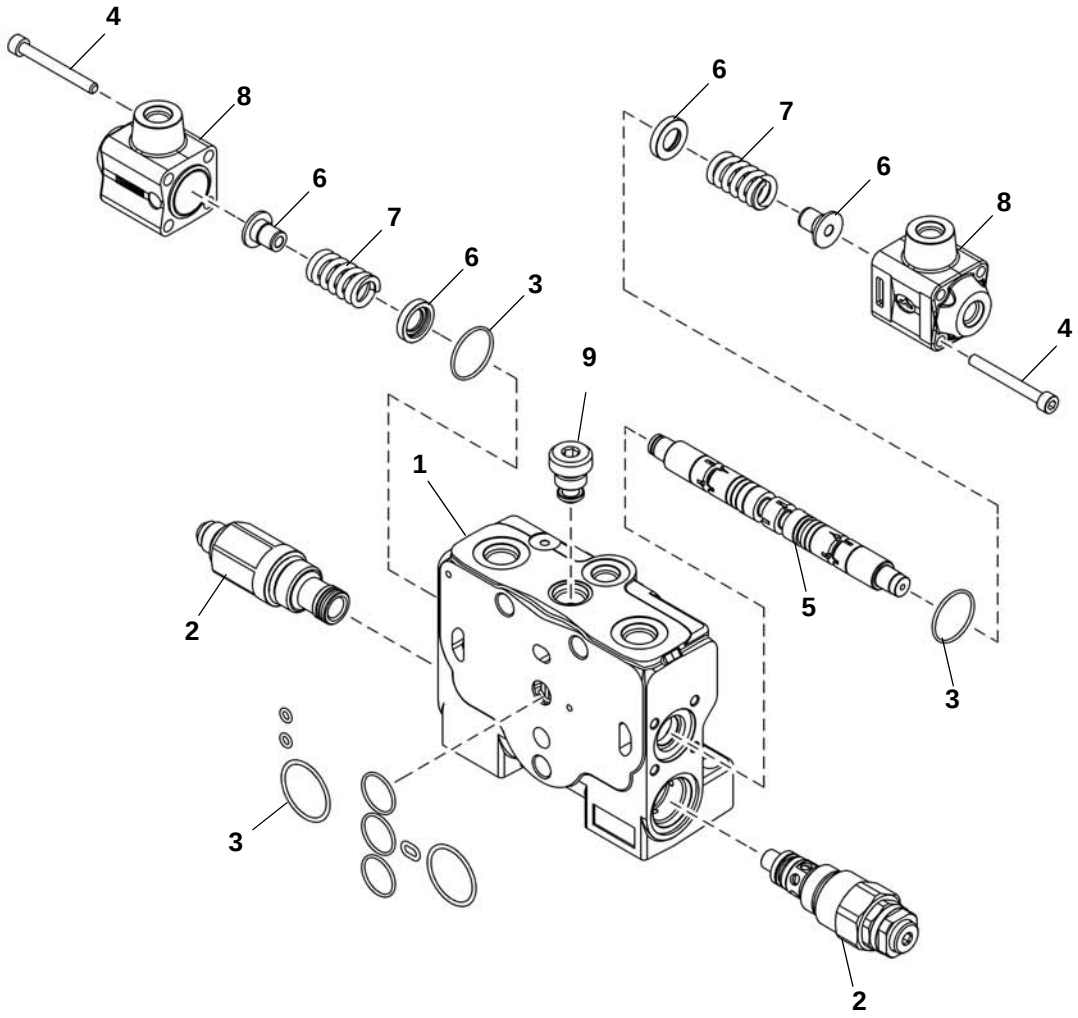
1. Boom Swing Valve Section Housing
2. Solenoid Valve
3. Screw
4. Check Valve
5. O-ring
6. Plug
7. Spring
8. Anti-Cavitation Valve
9. Spool
10. Spring Retainer
11. Bolt
12. Cover
13. Controller



NA5644S

Parts Identification (Cont'd)

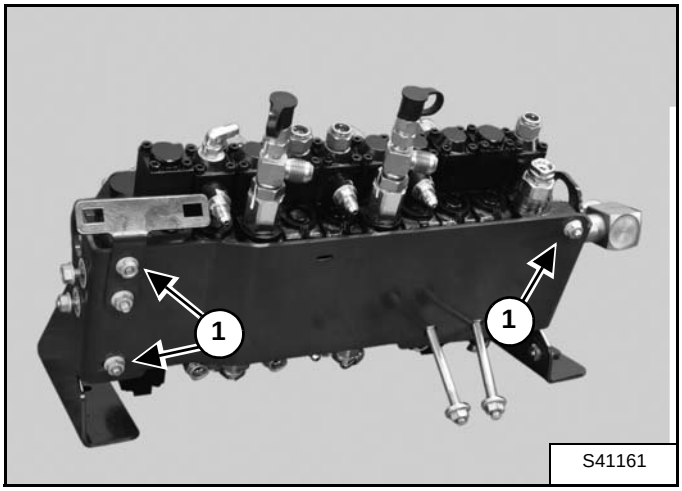
1. Slew Valve Section Housing
2. Port Relief / Anti-Cavitation Valve
3. O-ring
4. Screw
5. Spool
6. Spring Retainer
7. Spring
8. Cover
9. Check Valve



NA5645S

Disassembly

Figure 20-40-20



Remove the three nuts and bolts (Item 1) **[Figure 20-40-20]** and remove the mounting plate from the assembly.

Figure 20-40-21

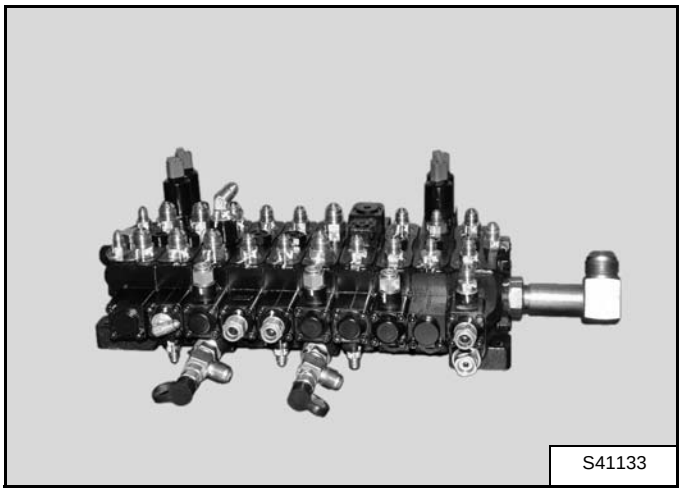


Figure 20-40-22

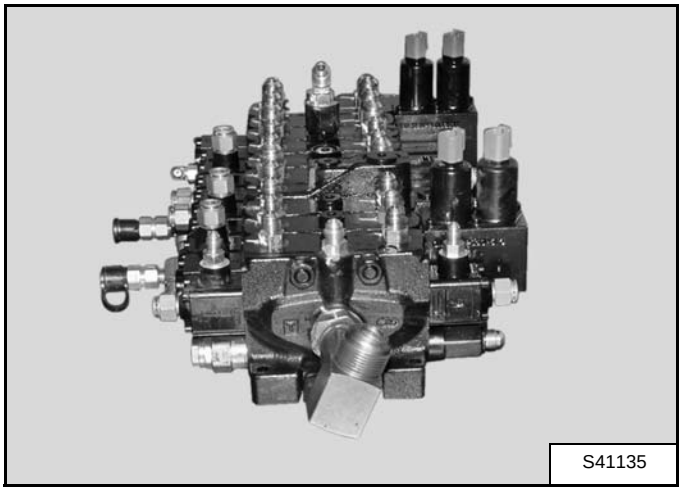
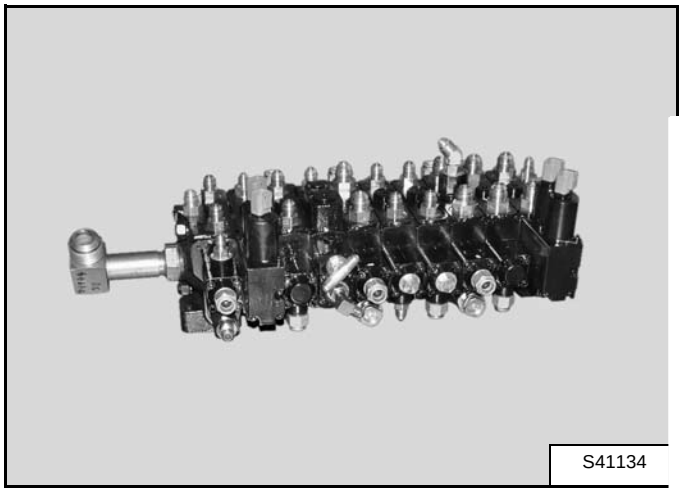


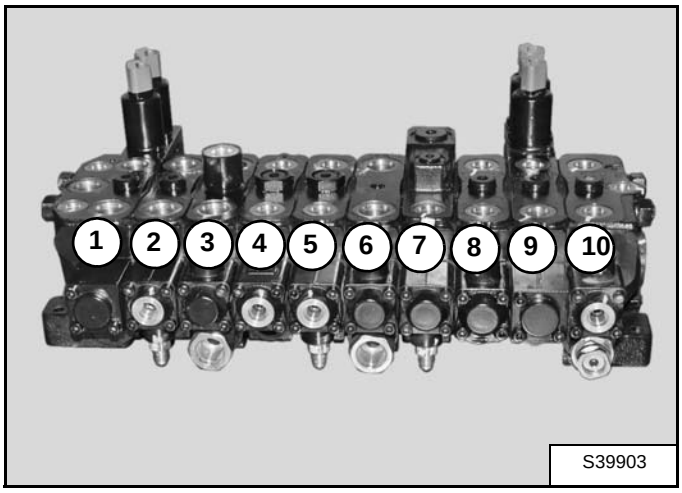
Figure 20-40-23



Remove all fittings from the assembly **[Figure 20-40-21]** **[Figure 20-40-22]** and **[Figure 20-40-23]**.

Disassembly (Cont'd)

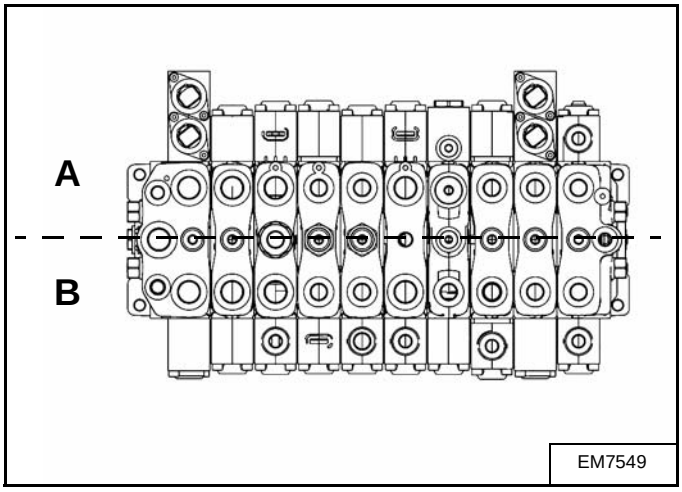
Figure 20-40-24



Mark the valve sections for ease of assembly **[Figure 20-40-24]**.

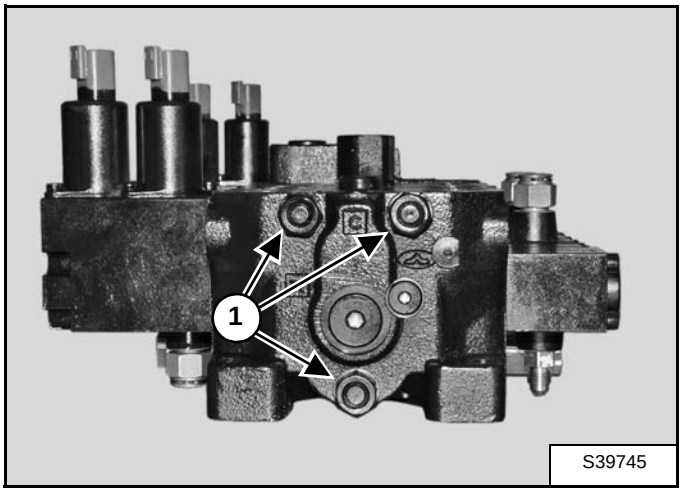
1. Auxiliary valve section
2. Arm valve section
3. RH Travel valve section
4. Bucket valve section
5. Boom valve section
6. LH Travel valve section
7. "Priority valve" valve section
8. Blade valve section
9. Boom swing section
10. Slew valve section

Figure 20-40-25



Mark the A and B port sides of the control valve **[Figure 20-40-25]**.

Figure 20-40-26



Remove the tie rod nuts (Item 1) **[Figure 20-40-26]** and the washers.

Auxiliary Valve Section Disassembly And Assembly

IMPORTANT

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

I-2003-0888

Remove the valve section from the rods.

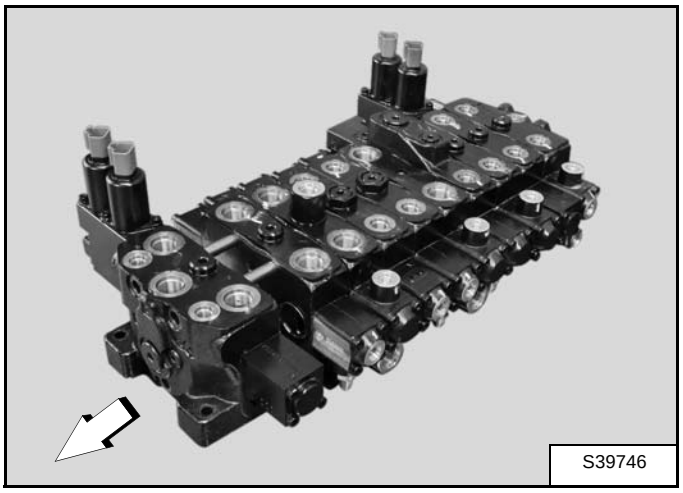
Clean the outside of valve section before disassembling.

NOTE: When removing the valve section from the rods, take care that all O-rings remain in place.

When disassembling the valve section:

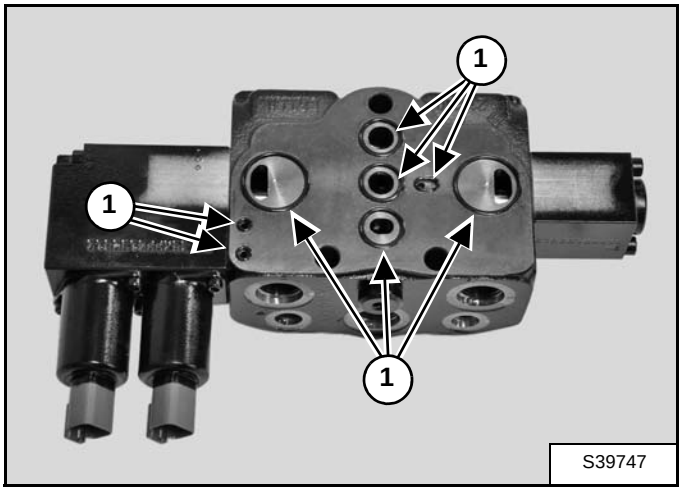
- Clean all parts in solvent and dry with compressed air.
- Inspect all parts for wear or damage. Replace any worn or damaged parts.
- Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-27



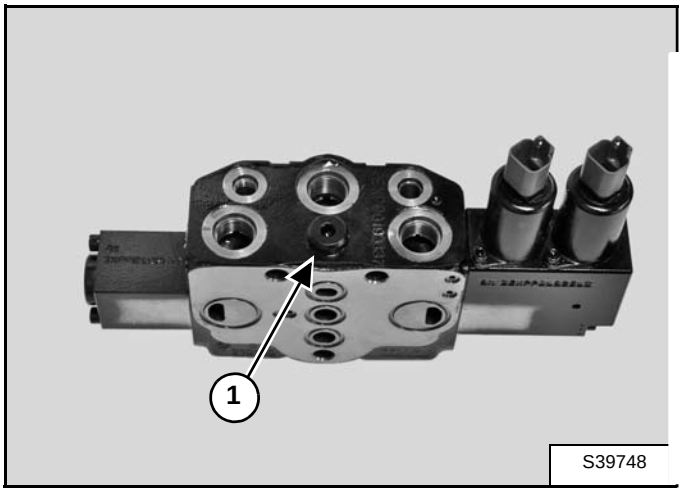
Slide the auxiliary valve section from the rods **[Figure 20-40-27]**.

Figure 20-40-28



Remove the eight O-rings (Item 1) **[Figure 20-40-28]**.

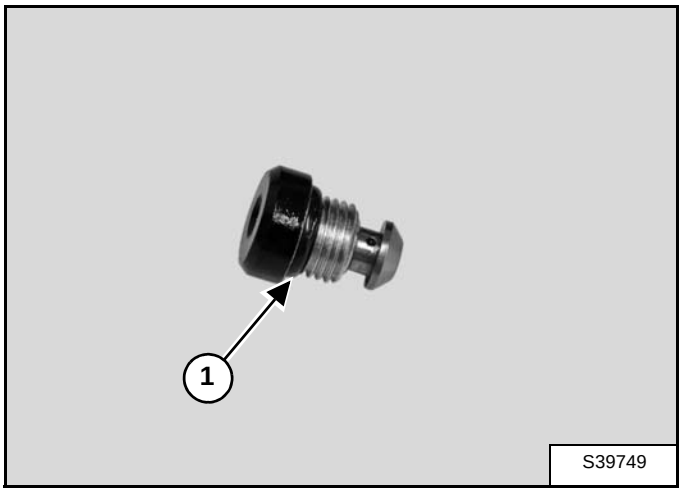
Figure 20-40-29



Remove all plugs and the load check valve (Item 1) **[Figure 20-40-29]**.

Auxiliary Valve Section Disassembly And Assembly (Cont'd)

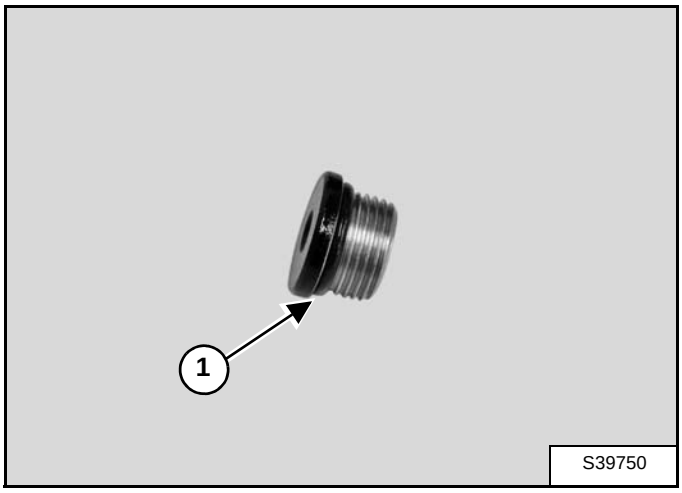
Figure 20-40-30



Remove the O-ring (Item 1) **[Figure 20-40-30]** from the load check valve.

Installation: Tighten the load check valve to 24 N•m (17.7 ft-lb) torque.

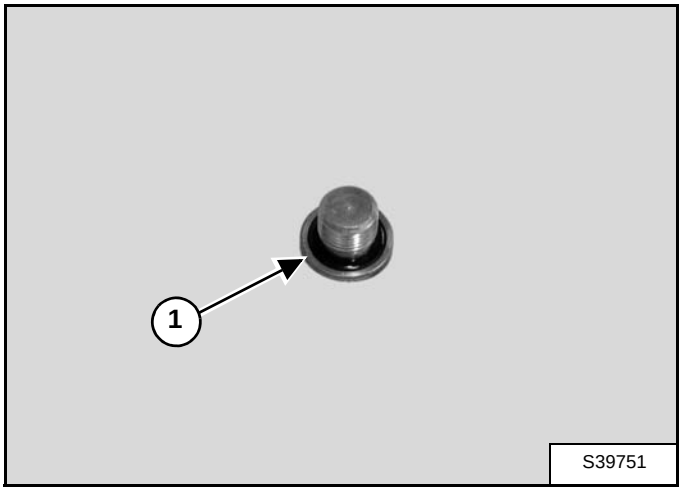
Figure 20-40-31



Remove the O-ring (Item 1) **[Figure 20-40-31]** from the front plug.

Installation: Tighten the plug to 24 N•m (17.7 ft-lb) torque.

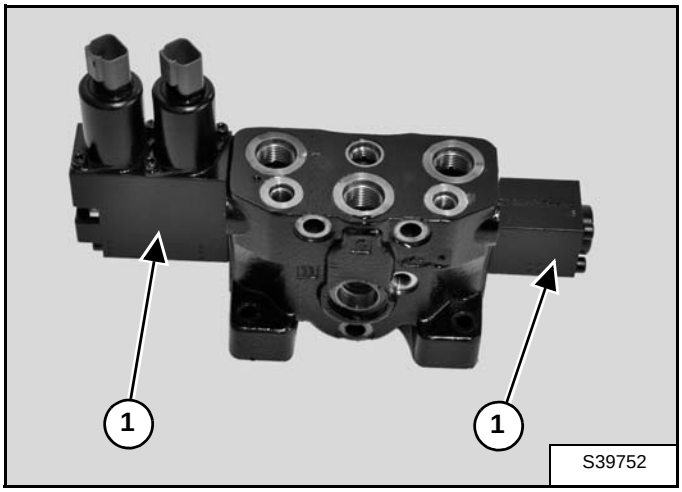
Figure 20-40-32



Remove the O-ring (Item 1) **[Figure 20-40-32]** from the plug.

Installation: Tighten the plug to 9,8 N•m (86.7 in-lb) torque.

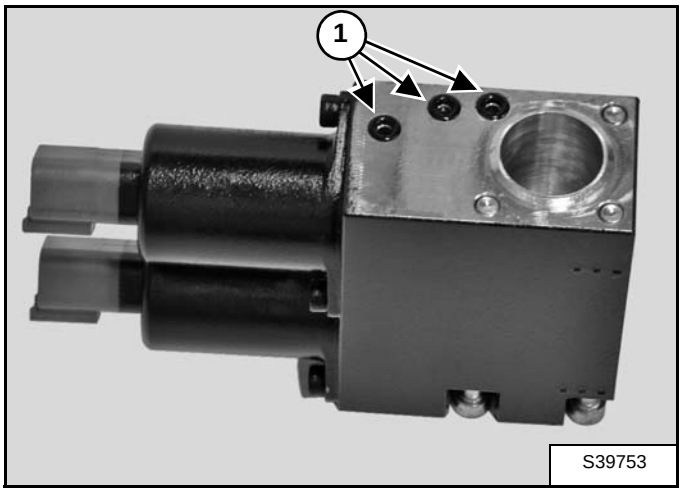
Figure 20-40-33



Remove the hexagon screw and remove both spool covers (Item 1) **[Figure 20-40-33]**.

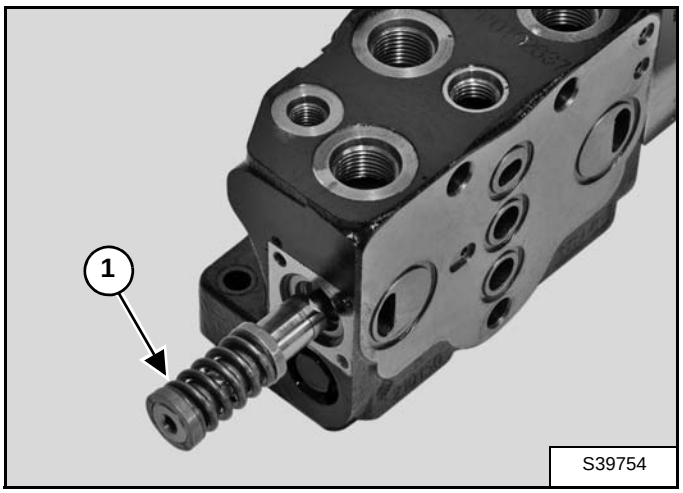
Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-34



Remove the three O-rings (Item 1) **[Figure 20-40-34]**.

Figure 20-40-35

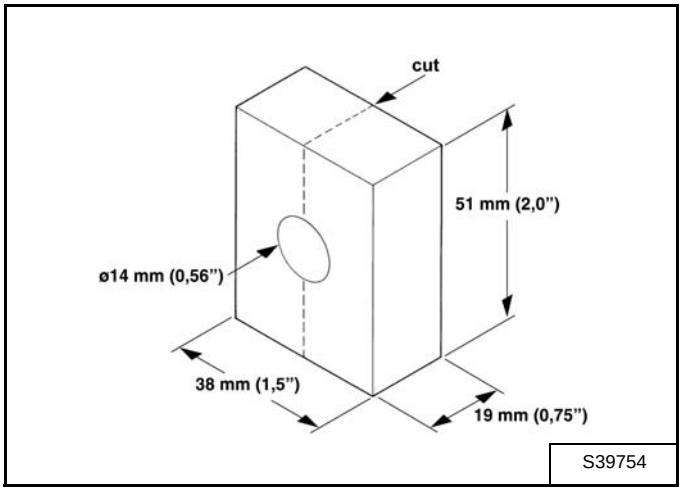


Gently pull the spool assembly (Item 1) **[Figure 20-40-35]** out of the valve.

The spool and valve block are not serviced separately.

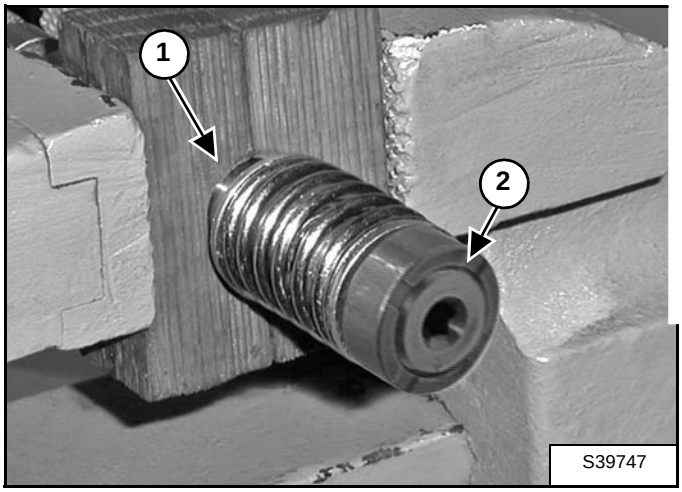
NOTE: When the spool is removed, use care not to scratch the spool surface. Do not interchange spools and valve blocks.

Figure 20-40-36



To remove the spring assembly from the spool, a holding fixture will have to be made from a 19 mm thick x 38 mm wide x 51 mm long (0.75 in x 1.500 in x 2.0 in) piece of hardwood. Drill a 14 mm hole (0.563 in) in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-36]**.

Figure 20-40-37

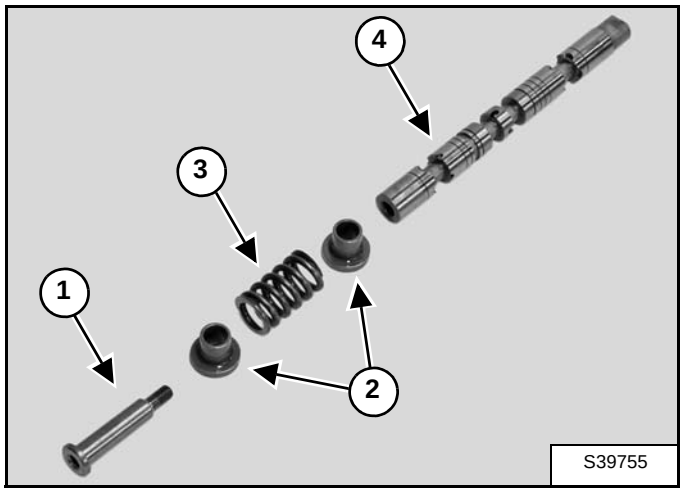


Using the wood block, clamp the spool (Item 1) in a vise and unscrew (Item 2) **[Figure 20-40-37]** the spring assembly.

NOTE: Use only hardwood blocks to grip the spool, or the spool will be damaged.

Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-38

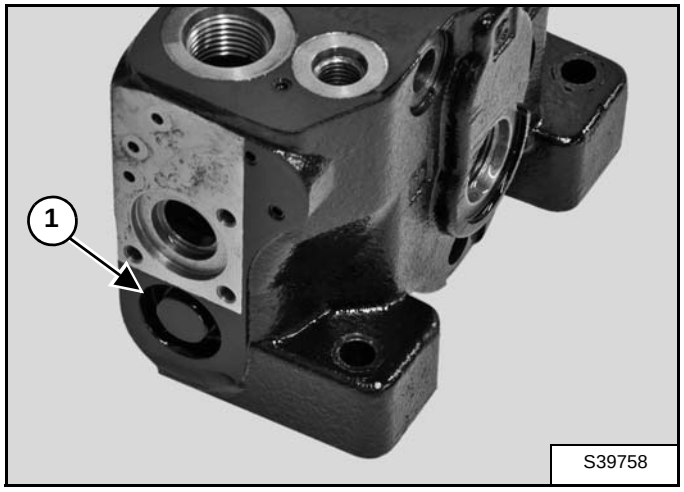


Remove the spring assembly, spring screw (Item 1), spring seat (Item 2), spring (Item 3) and spool (Item 4) **[Figure 20-40-38]**.

Installation: Tighten the spring screw to 9,8 N•m (86.7 in-lb) torque.

Installation: Install the spool assembly and then both spool covers and tighten the cover screws to 6,6 N•m (58.4 in-lb) torque.

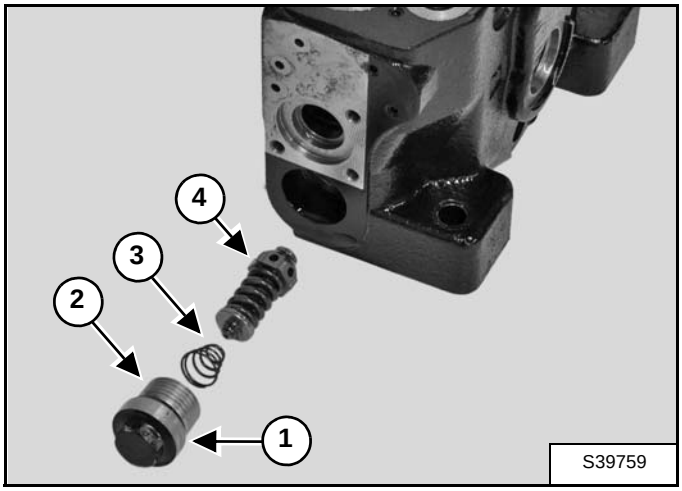
Figure 20-40-39



Remove the plug (Item 1) **[Figure 20-40-39]**.

Installation: Tighten the plug to 9,8 N•m (86.7 in-lb) torque.

Figure 20-40-40



Remove the spring (Item 3) and spring kit (Item 4) from the valve section body **[Figure 20-40-40]**.
Removing O-ring from plug should be separate.

NOTE: Assemble the hydraulic spools positioning the code toward port B and the grooves toward port A.

Arm Valve Section Disassembly And Assembly

IMPORTANT

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

I-2003-0888

Remove the valve section from the rods.

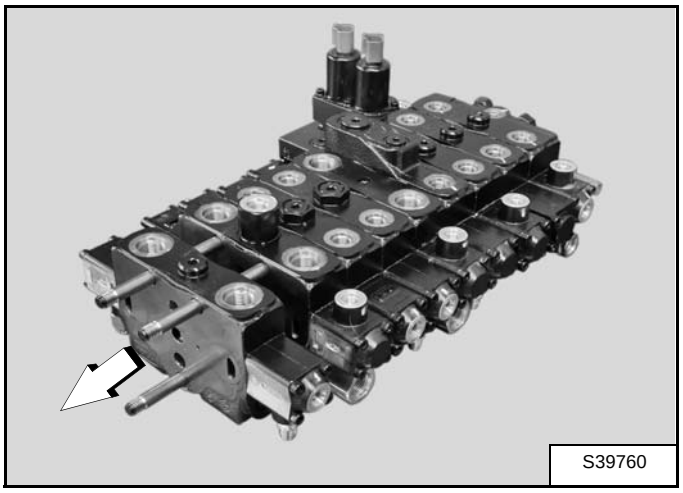
Clean the outside of valve section before disassembling.

NOTE: When removing the valve section from the rods, take careful that all O-rings remain in place.

When disassembling the valve section:

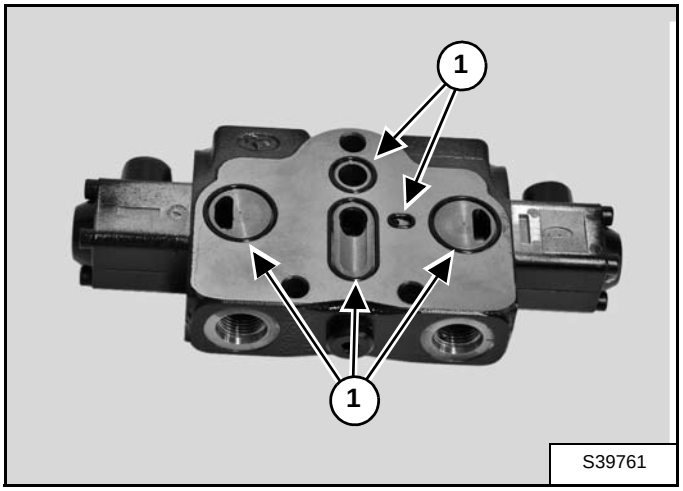
- Clean all parts in solvent and dry with compressed air.
- Inspect all parts for wear or damage. Replace any worn or damaged parts.
- Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-41



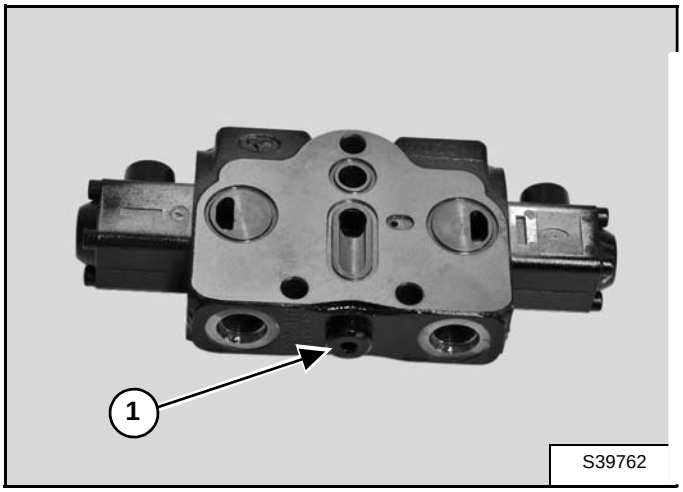
Slide the arm valve section from the rods **[Figure 20-40-41]**.

Figure 20-40-42



Remove the five O-rings (Item 1) **[Figure 20-40-42]**.

Figure 20-40-43

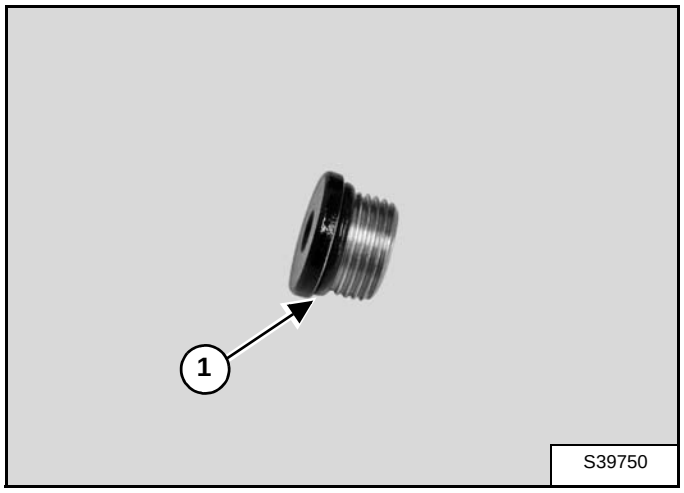


Remove the plug (Item 1) **[Figure 20-40-43]**.

Installation: Tighten the plug to 24 N•m (17.7 ft-lb) torque.

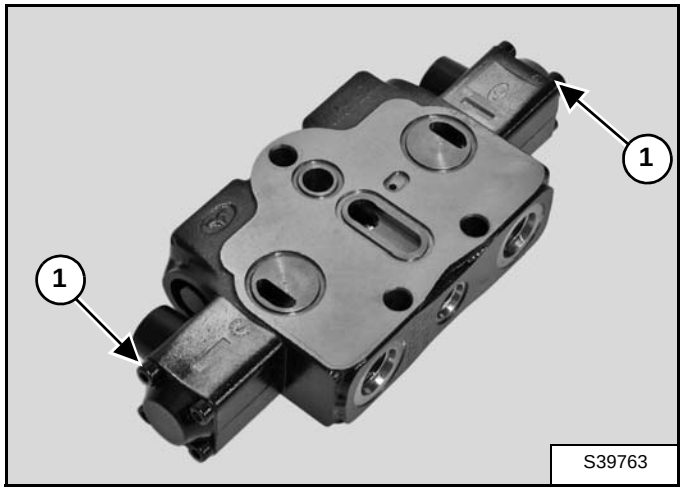
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-44



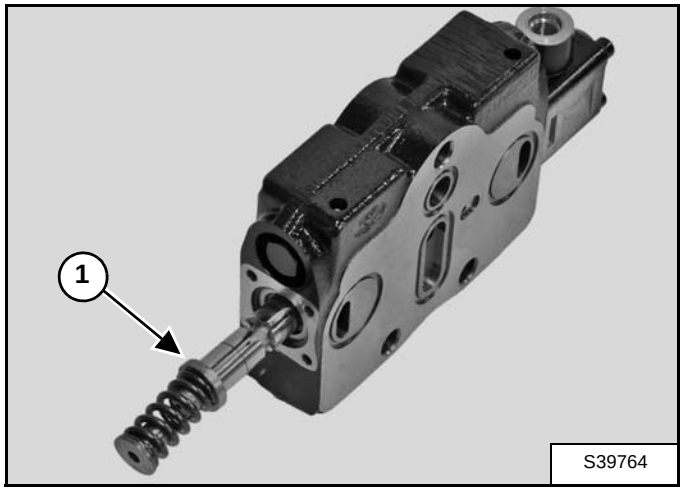
Remove the O-ring (Item 1) **[Figure 20-40-44]** from the plug.

Figure 20-40-45



Remove both spool covers (Item 1) **[Figure 20-40-45]** by removing the eight hexagon screws.

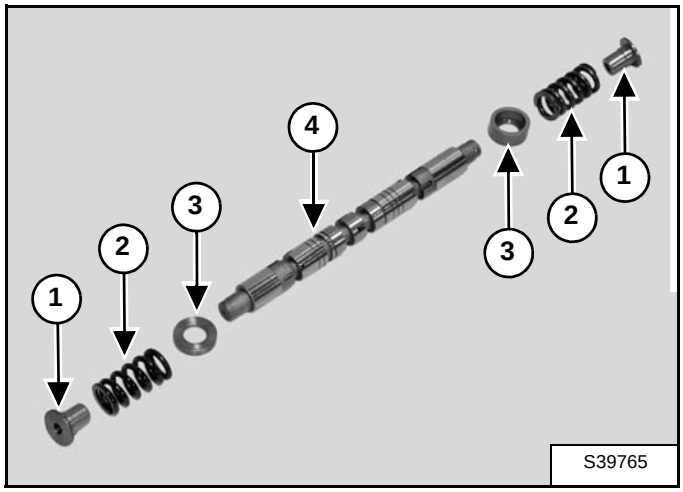
Figure 20-40-46



Gently pull the spool assembly (Item 1) **[Figure 20-40-46]** out of the valve.

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

Figure 20-40-47



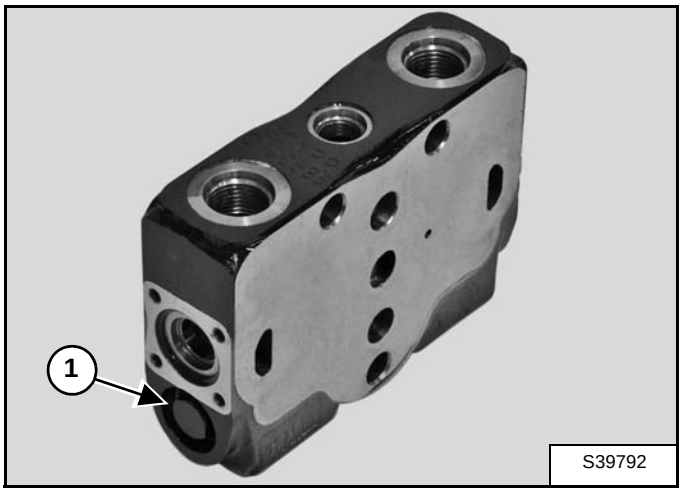
Remove the spool assembly: spring retainer (Item 1), spring (Item 2), spring seat (Item 3) **[Figure 20-40-47]** and the spool (Item 4).

Installation: Install the spool assembly and then both spool covers and tighten the cover screws to 6,6 N•m (58.4 in-lb) torque.

NOTE: Assemble the hydraulic spools positioning the code toward port B and the grooves toward port A.

Arm Valve Section Disassembly And Assembly (Cont'd)

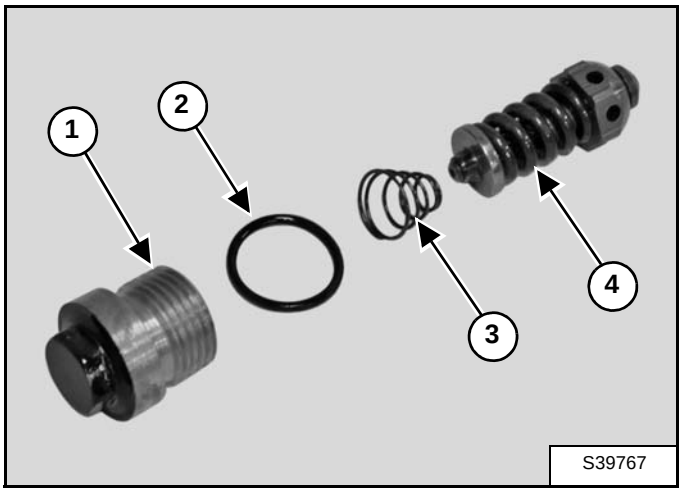
Figure 20-40-48



Remove the plugs (Item 1) **[Figure 20-40-48]** on both sides of the valve.

Installation: Tighten the plugs to 9,8 N•m (86.7 in-lb) torque.

Figure 20-40-49



Remove the O-ring (Item 2) from the plug (Item 1), the spring (Item 3) and the spring kit (Item 4) **[Figure 20-40-49]**.

NOTE: Both plugs are the same. Repeat the procedure for the other plug.

RH Travel Valve Section Disassembly And Assembly

IMPORTANT

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

I-2003-0888

Remove the valve section from the rods.

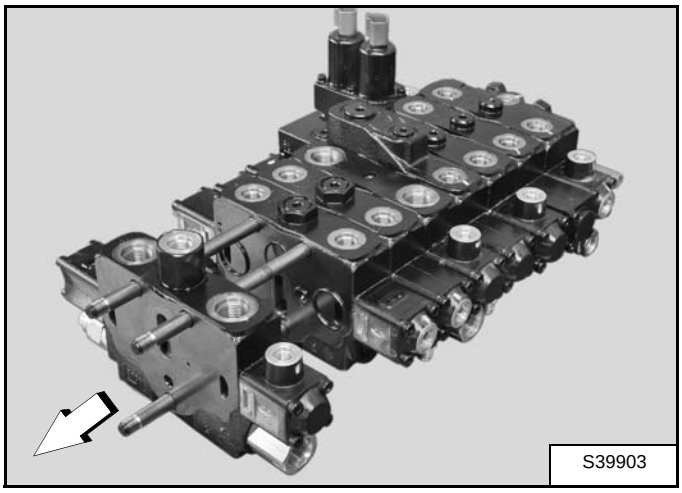
Clean the outside of valve section before disassembling.

NOTE: When removing the valve section from the rods, take care that all O-rings stay remain in place.

When disassembling the valve section:

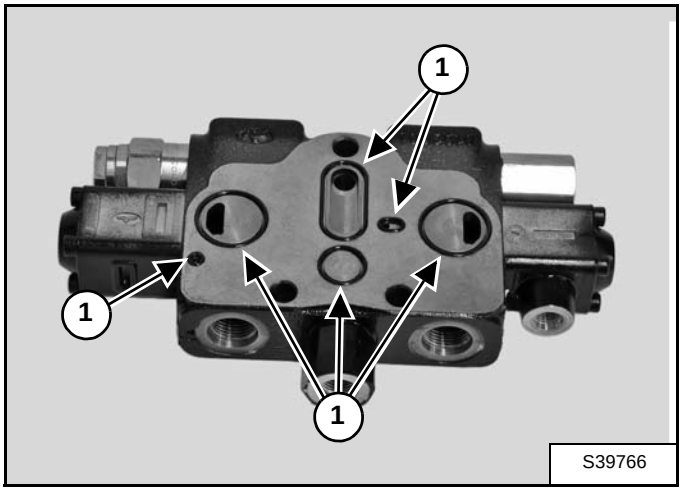
- Clean all parts in solvent and dry with compressed air.
- Inspect all parts for wear or damage. Replace any worn or damaged parts.
- Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-50



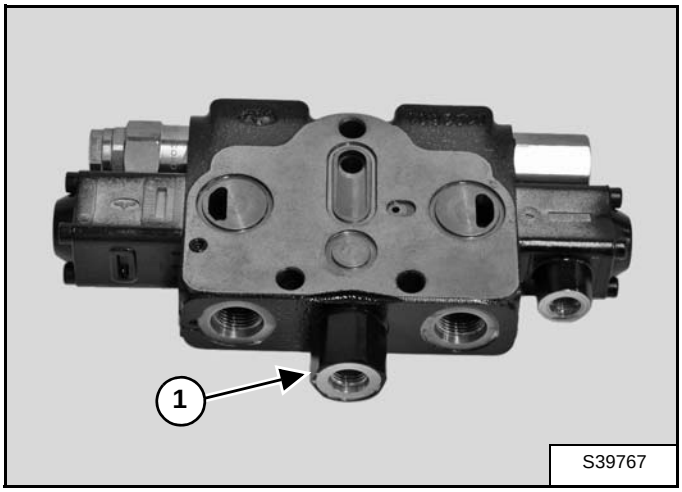
Slide the RH travel valve from the rods **[Figure 20-40-50]**.

Figure 20-40-51



Remove the six O-rings (Item 1) **[Figure 20-40-51]**.

Figure 20-40-52

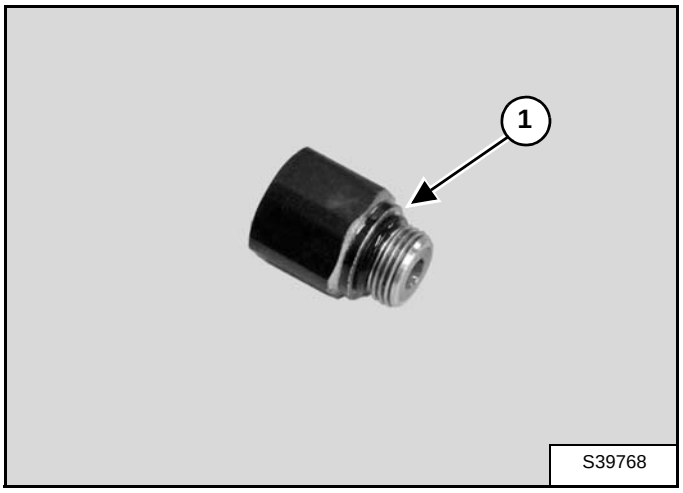


Remove the fitting (Item 1) **[Figure 20-40-52]**.

Installation: Tighten the fitting to 42 N•m (31 ft-lb) torque.

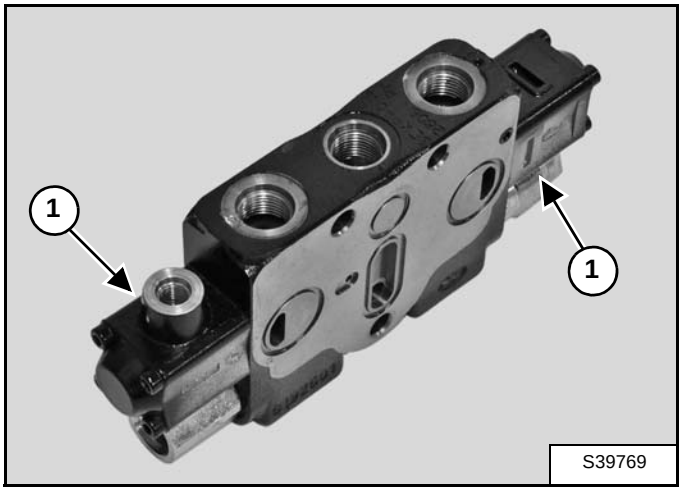
RH Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-53



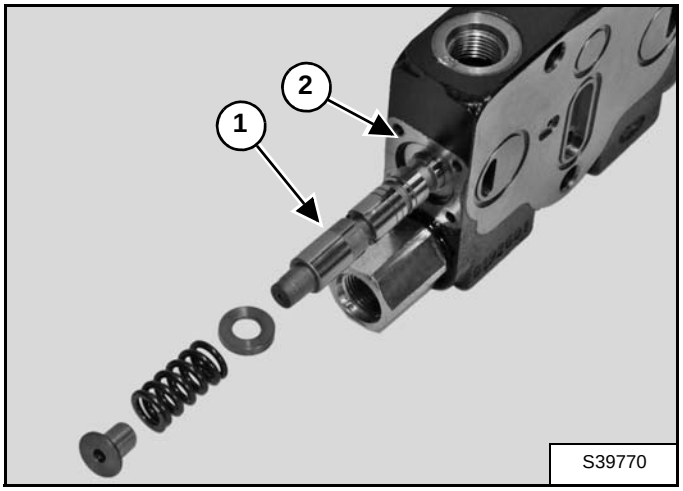
Remove the O-ring (Item 1) **[Figure 20-40-53]** from the fitting.

Figure 20-40-54



Remove both spool covers (Item 1) **[Figure 20-40-54]** by removing the hexagon screws.

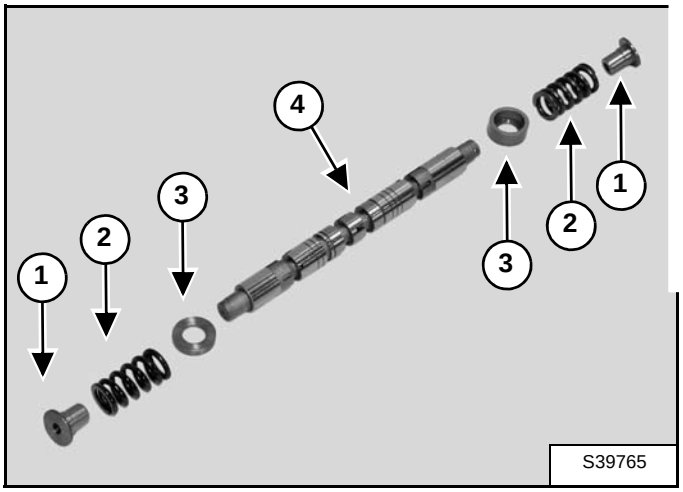
Figure 20-40-55



Gently pull the spool assembly (Item 1) out of the valve. Remove the O-ring (Item 2) **[Figure 20-40-55]** on both sides of the valve.

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

Figure 20-40-56



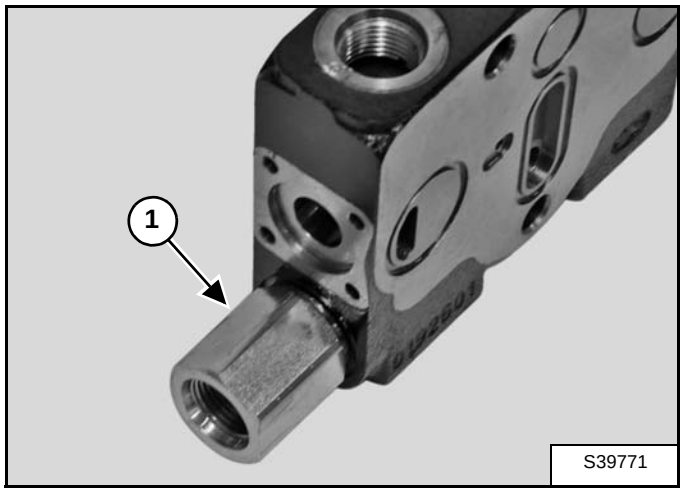
Remove the spool assembly: spring retainer (Item 1), spring (Item 2), spring seat (Item 3) and the spool (Item 4) **[Figure 20-40-56]**.

Installation: Install the spool assembly and then both spool covers and tighten the cover screws to 6,6 N•m (58.41 in-lb) torque.

NOTE: Assemble the hydraulic spools positioning the code toward port B and the grooves toward port A.

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

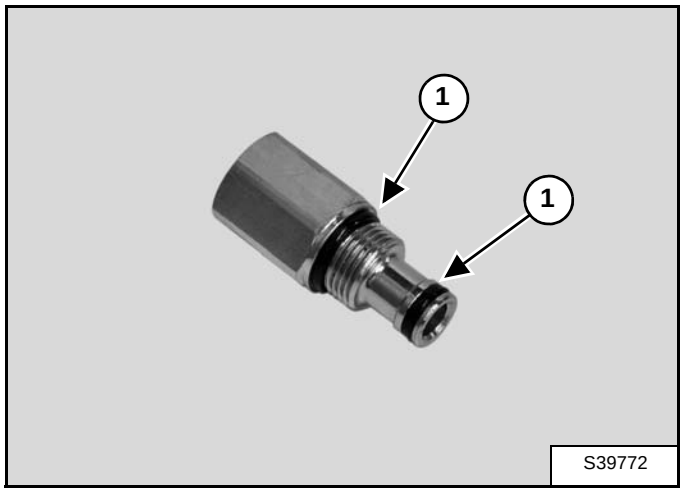
Figure 20-40-57



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

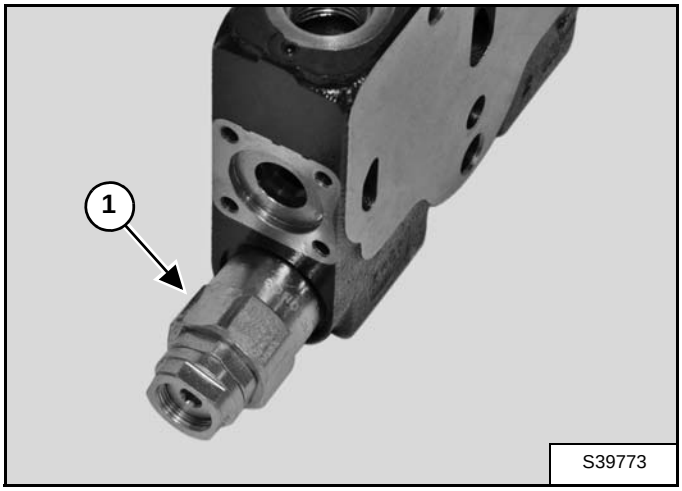
Installation: Tighten the fitting to 42 N•m (31 ft-lb) torque.

Figure 20-40-58



Remove the O-rings (Item 1) **[Figure 20-40-58]** from the fitting.

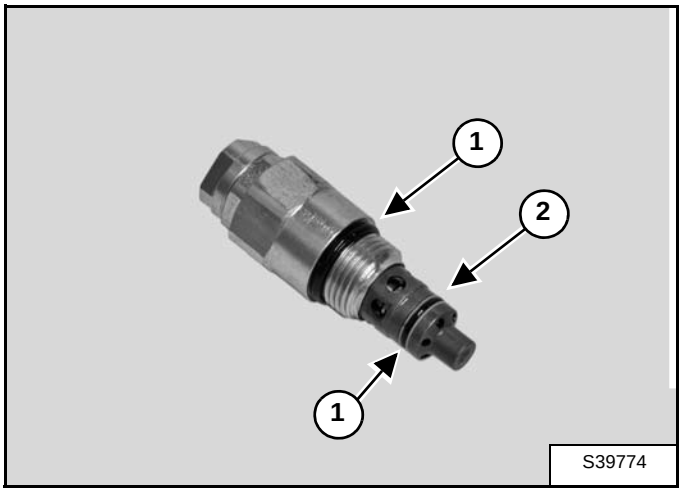
Figure 20-40-59



Remove the port relief valve (Item 1) **[Figure 20-40-59]**.

Installation: Tighten the port relief valve to 50 N•m (36.9 ft-lb) torque.

Figure 20-40-60



Remove the O-rings (Item 1) and the two back-up ring (Item 2) **[Figure 20-40-60]** from the port relief valve.

Bucket Valve Section Disassembly And Assembly

IMPORTANT

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

I-2003-0888

Remove the valve section from the rods.

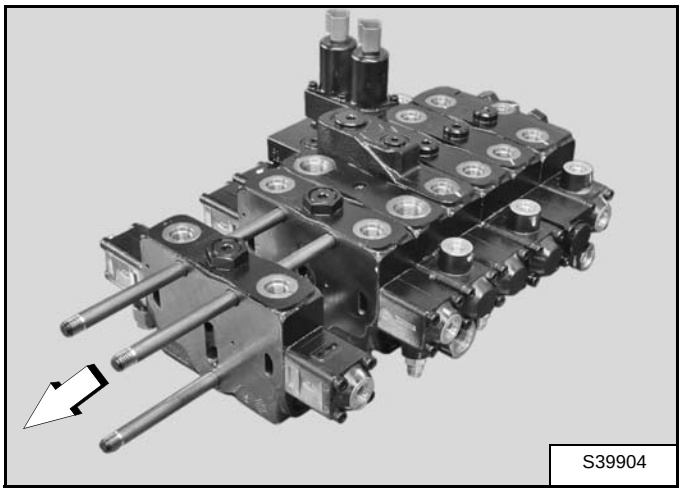
Clean the outside of valve section before disassembling.

NOTE: When removing the valve section from the rods, take care that all O-rings remain in place.

When disassembling the valve section:

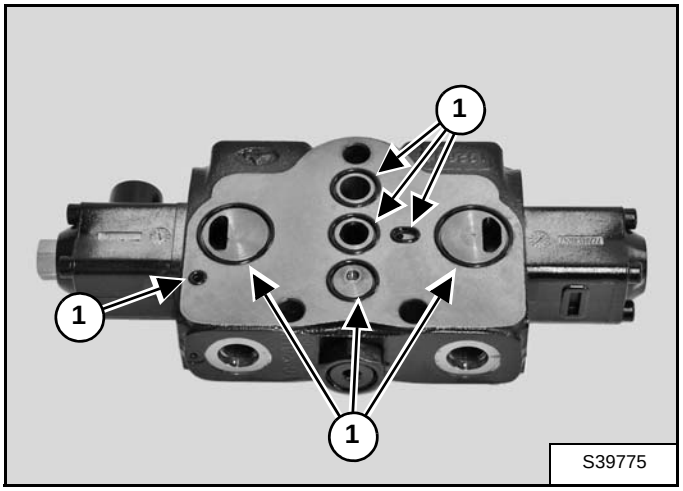
- Clean all parts in solvent and dry with compressed air.
- Inspect all parts for wear or damage. Replace any worn or damaged parts.
- Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-61



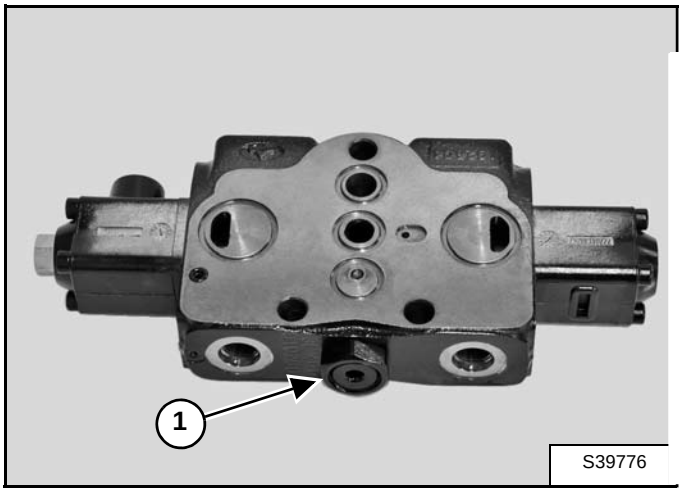
Slide the bucket valve section from the rods **[Figure 20-40-61]**.

Figure 20-40-62



Remove the seven O-rings (Item 1) **[Figure 20-40-62]**.

Figure 20-40-63

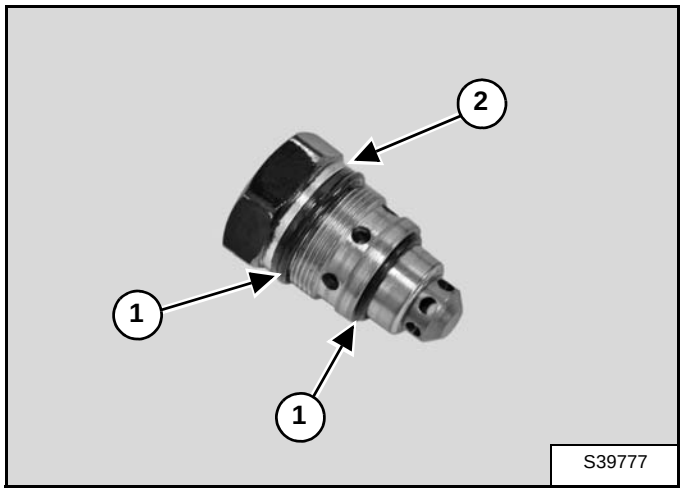


Remove the check valve (Item 1) **[Figure 20-40-63]**.

Installation: Tighten the check valve to 42 N•m (31 ft-lb) torque.

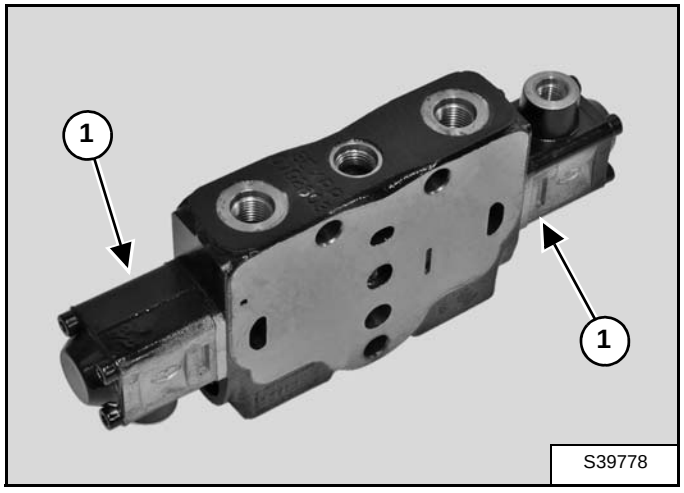
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-64



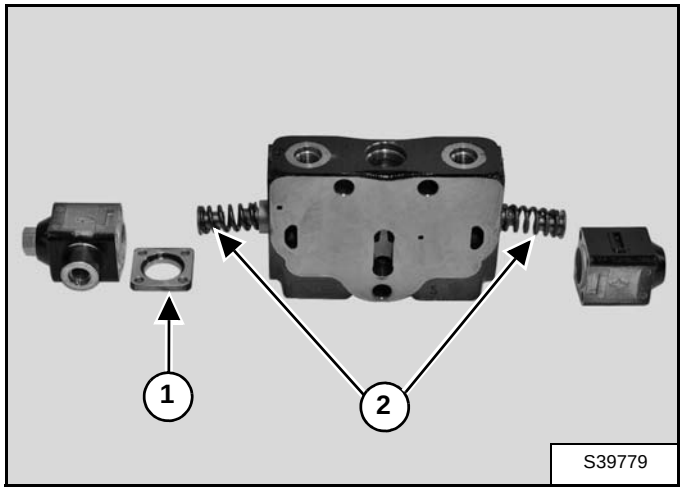
Remove the O-rings (Item 1) and the back-up ring (Item 2) **[Figure 20-40-64]**.

Figure 20-40-65



Remove the hexagon screws to remove both spool covers (Item 1) **[Figure 20-40-65]**.

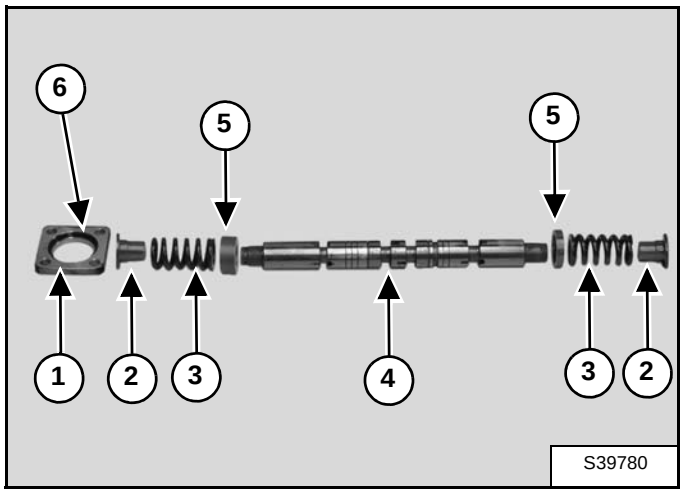
Figure 20-40-66



Remove the spacer (Item 1) and both springs (Item 2) **[Figure 20-40-66]** with their spring retainer. Gently pull the spool out of the valve.

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

Figure 20-40-67



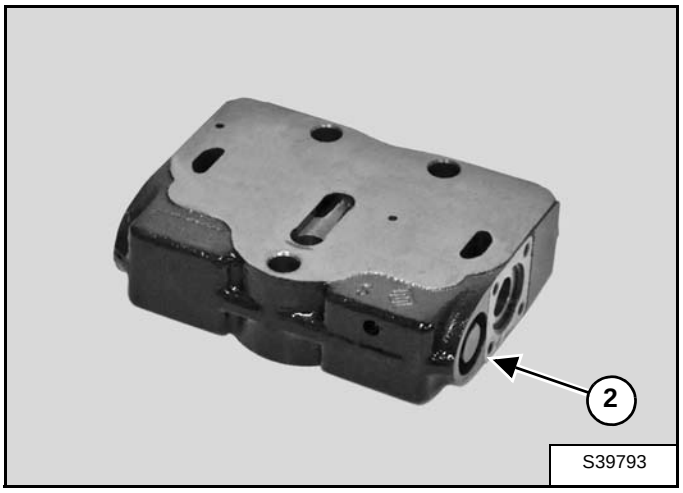
Remove the spool assembly: spacer (Item 1), spring seat (Item 2), spring (Item 3), spool (Item 4) and spring retainers (Item 5). Remove the O-ring (Item 6) from the spacer (Item 1) **[Figure 20-40-67]**.

Installation: Install the spool assembly and then both spool covers and tighten the cover screws to 6,6 N•m (58.4 in-lb) torque.

NOTE: Assemble the hydraulic spools positioning the code toward port B and the grooves toward port A.

Bucket Valve Section Disassembly And Assembly (Cont'd)

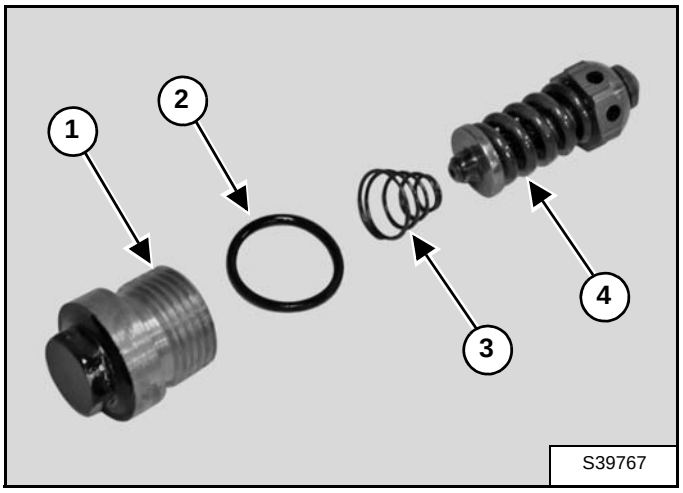
Figure 20-40-68



Remove the plugs (Item 1) **[Figure 20-40-68]** on both sides of the valve.

Installation: Tighten the plugs to 9,8 N•m (86.7 in-lb) torque.

Figure 20-40-69



Remove the O-ring (Item 2) from the plug (Item 1), the spring (Item 3) and the spring kit (Item 4) **[Figure 20-40-69]**.

NOTE: Both plugs are the same. Repeat the procedure for the other plug.

Boom Valve Section Disassembly And Assembly

Boom valve disassembly and assembly follows the same procedures as described in bucket valve section disassembly and assembly. (See Bucket Valve Section Disassembly And Assembly on Page 20-40-29.)

LH Travel Valve Section Disassembly And Assembly

LH travel valve disassembly and assembly follows the same procedures as described in RH travel valve section disassembly and assembly. (See RH Travel Valve Section Disassembly And Assembly on Page 20-40-26.)

"Priority Valve" Valve Section Disassembly And Assembly

IMPORTANT

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

I-2003-0888

Remove the valve section from the rods.

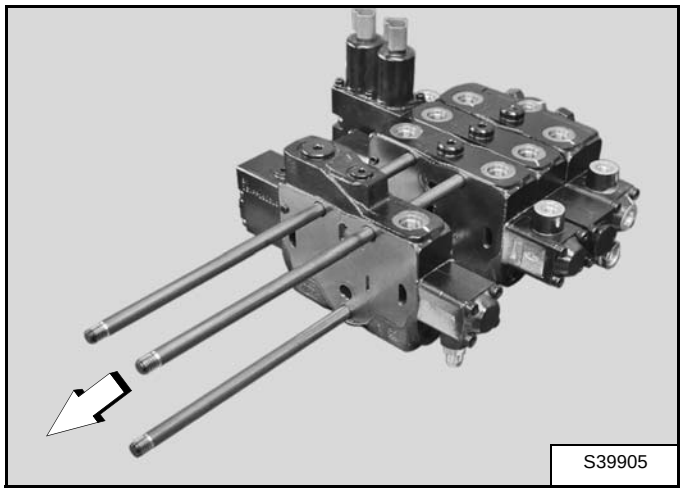
Clean the outside of valve section before disassembling.

NOTE: When removing the valve section from the rods, take care that all O-rings remain in place.

When disassembling the valve section:

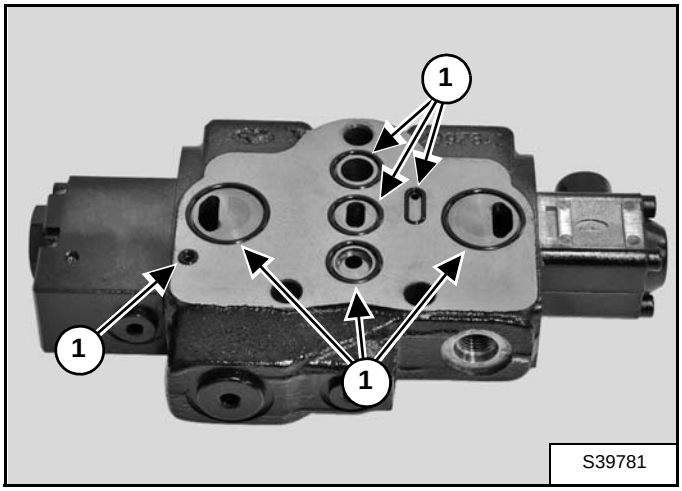
- Clean all parts in solvent and dry with compressed air.
- Inspect all parts for wear or damage. Replace any worn or damaged parts.
- Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-70



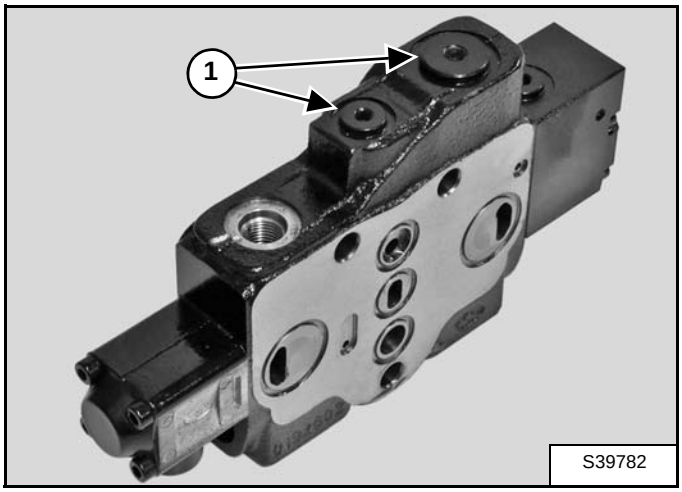
Slide the "Priority Valve" Valve Section from the rods **[Figure 20-40-70]**.

Figure 20-40-71



Remove the seven O-rings (Item 1) **[Figure 20-40-71]**.

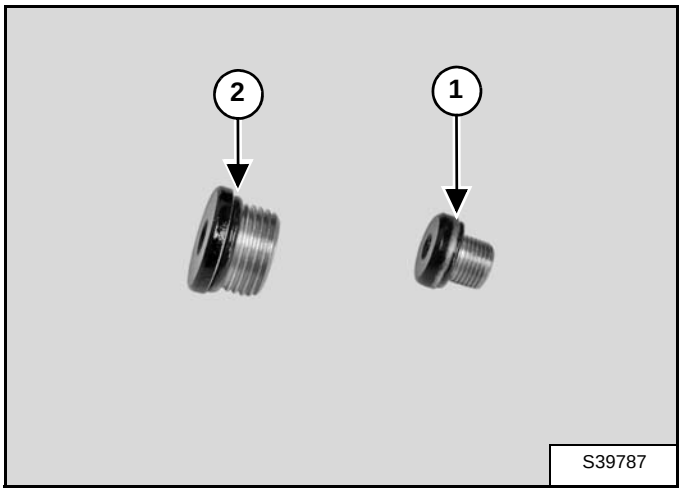
Figure 20-40-72



Remove both plugs (Item 1) **[Figure 20-40-72]**.

"Priority Valve" Valve Section Disassembly And Assembly (Cont'd)

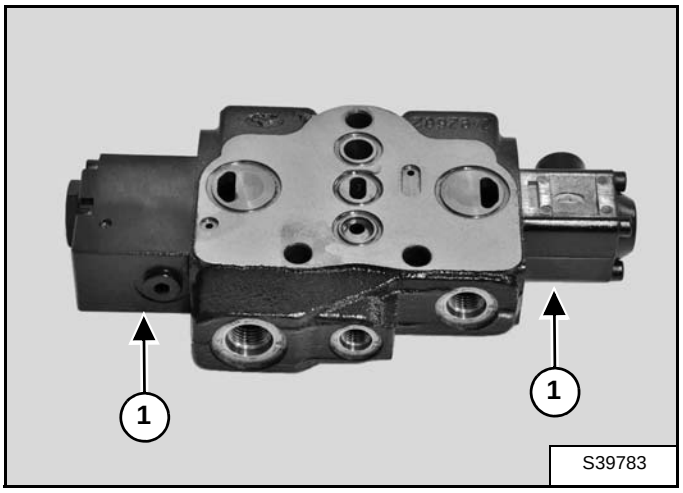
Figure 20-40-73



Remove the O-ring **[Figure 20-40-73]** from both plugs.

Installation: Tighten the plug (Item 2) to 9,8 N•m (86.7 in-lb) torque. Tighten the plug (Item 1) **[Figure 20-40-73]**.

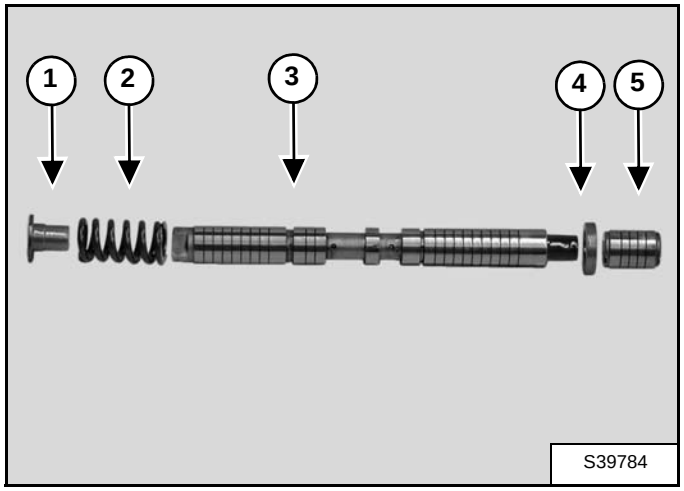
Figure 20-40-74



Remove the hexagon screws to remove both spool covers (Item 1) **[Figure 20-40-74]**. Gently pull the spool out of the valve.

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

Figure 20-40-75



Remove the spool assembly: spring seat (Item 1), spring (Item 2), the spool (Item 3), the ring seal (Item 4) and the piston (Item 5) **[Figure 20-40-75]**.

Installation: Install the spool assembly and then both spool covers and tighten the cover screws to 6,6 N• (58.41 in-lb) torque.

NOTE: Assemble the hydraulic spools positionin the code toward port B and the groove toward port A.

Blade Valve Section Disassembly And Assembly

IMPORTANT

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

I-2003-0888

Remove the valve section from the rods.

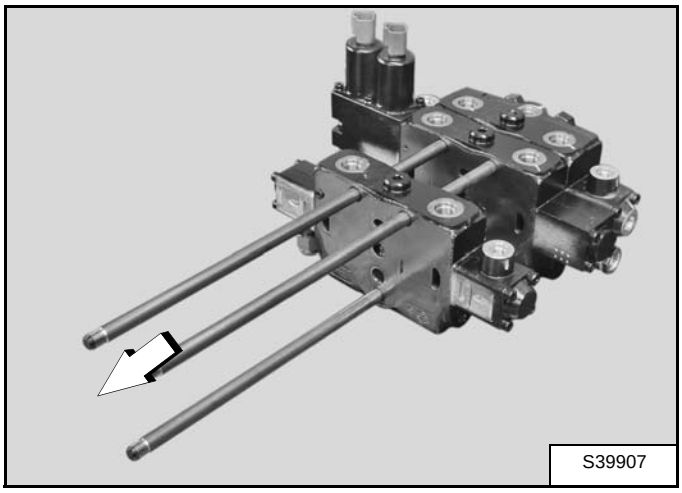
Clean the outside of valve section before disassembling.

NOTE: When removing the valve section from the rods, take care that all O-rings remain in place.

When disassembling the valve section:

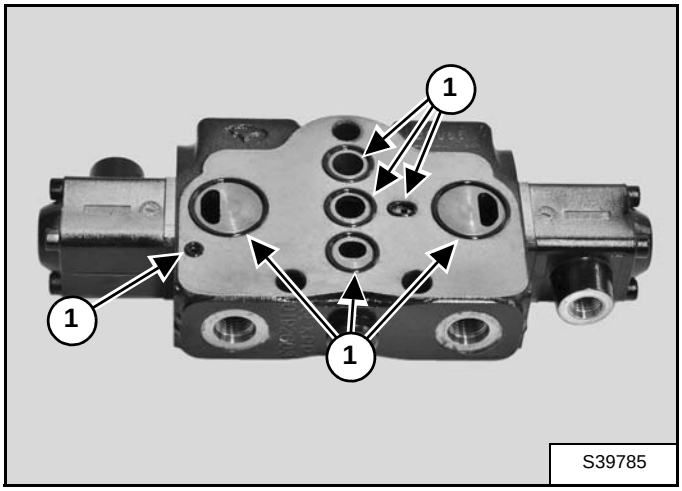
- Clean all parts in solvent and dry with compressed air.
- Inspect all parts for wear or damage. Replace any worn or damaged parts.
- Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-76



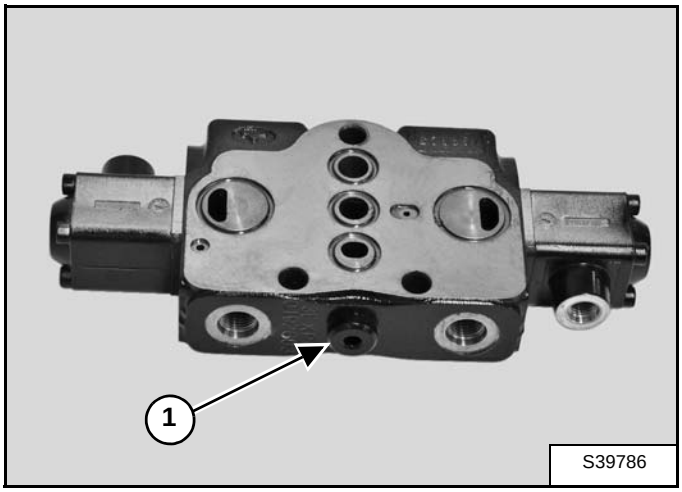
Slide the blade valve section from the rods **[Figure 20-40-76]**.

Figure 20-40-77



Remove the seven O-rings (Item 1) **[Figure 20-40-77]**.

Figure 20-40-78

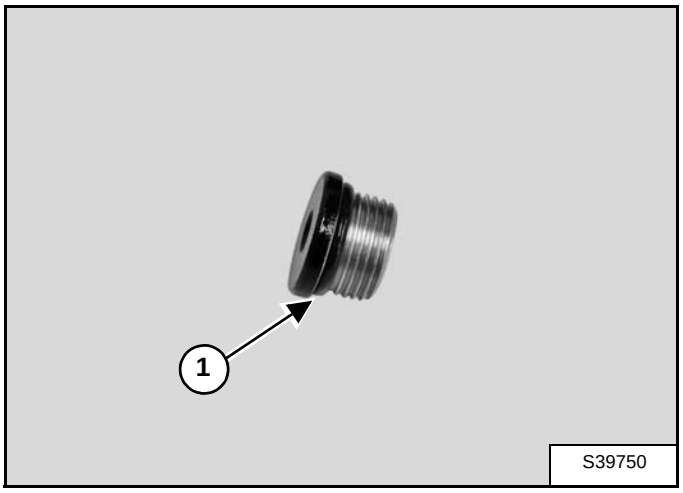


Remove the plug (Item 1) **[Figure 20-40-78]**.

Installation: Tighten the plug to 24 N•m (17.7 ft-lb) torque.

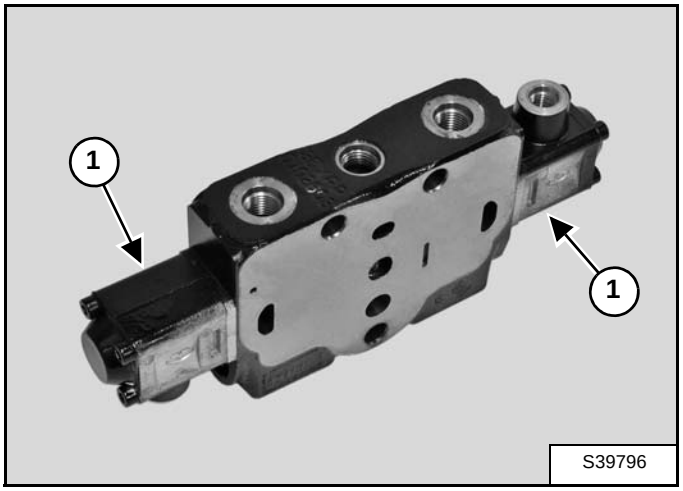
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-79



Remove the O-ring (Item 1) **[Figure 20-40-79]** from the plug.

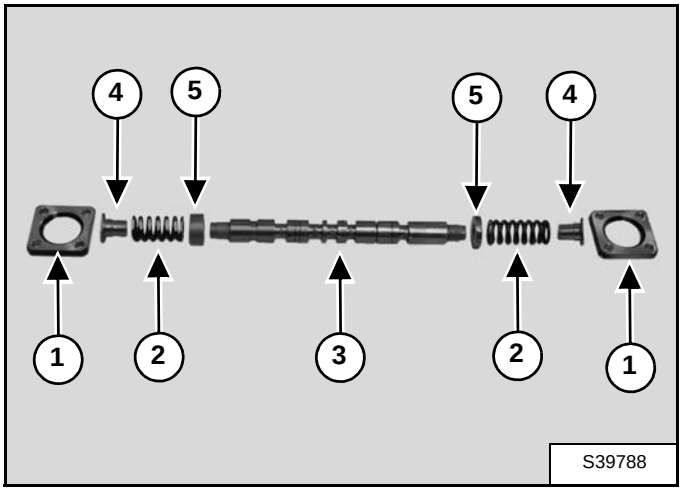
Figure 20-40-80



Remove both spool covers (Item 1) **[Figure 20-40-80]** and gently pull the spool assembly out of the valve.

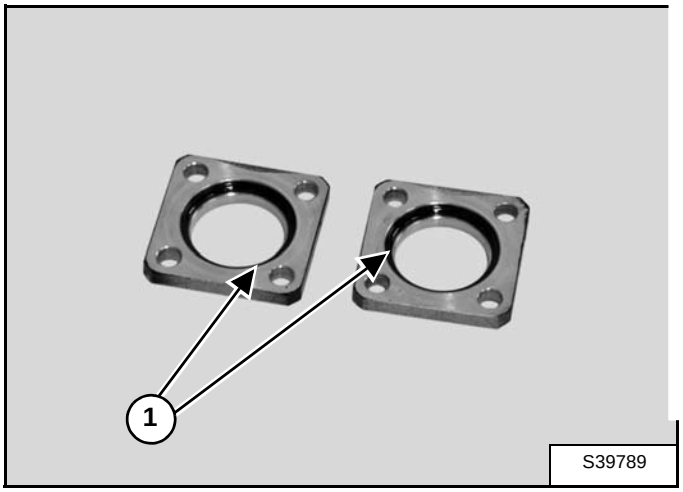
NOTE: When the spool is removed, use care not to scratch the spool surface. Do not interchange spools and valve blocks.

Figure 20-40-81



Remove the spool assembly: spacer (Item 1), spring seat (Item 4), spring (Item 2), spring retainer (Item 5) and the spool (Item 3) **[Figure 20-40-81]**.

Figure 20-40-82



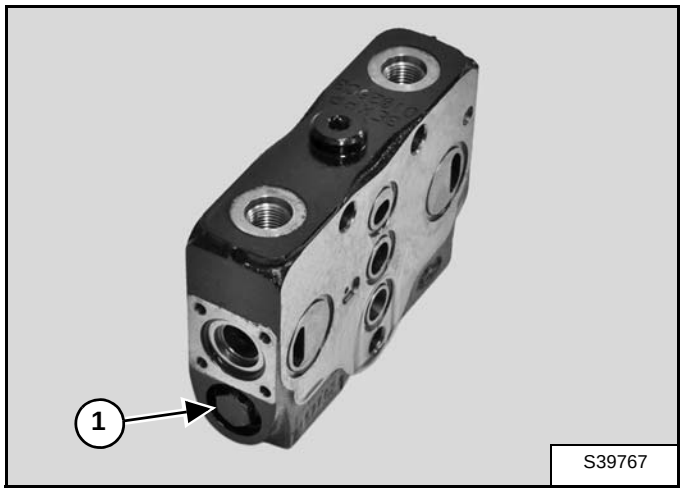
Remove the O-rings (Item 1) **[Figure 20-40-82]** from both spacers.

Installation: Install the spool assembly and then both spool covers and tighten the cover screws to 6,6 N•m (58.4 in-lb) torque.

NOTE: Assemble the hydraulic spools positioning the code toward port B and the grooves toward port A.

Blade Valve Section Disassembly And Assembly (Cont'd)

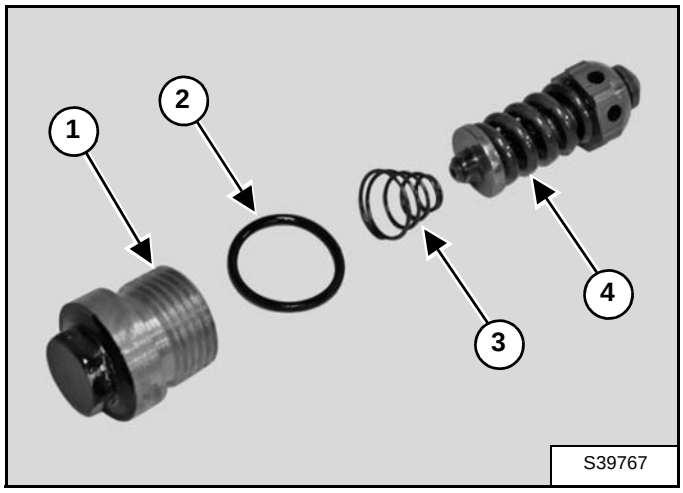
Figure 20-40-83



Remove the plug (Item 1) **[Figure 20-40-83]**.

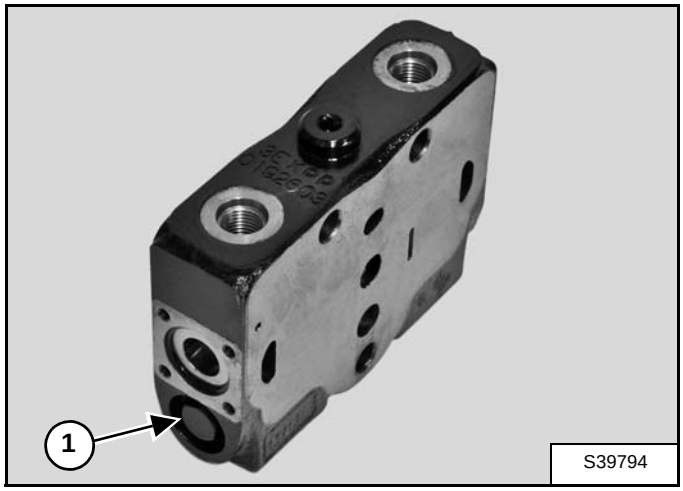
Installation: Tighten the plug to 9,8 N•m (86.7 in-lb) torque.

Figure 20-40-84



Remove the O-ring (Item 2) from the plug (Item 1), the spring (Item 3) and the spring kit (Item 4) **[Figure 20-40-84]**.

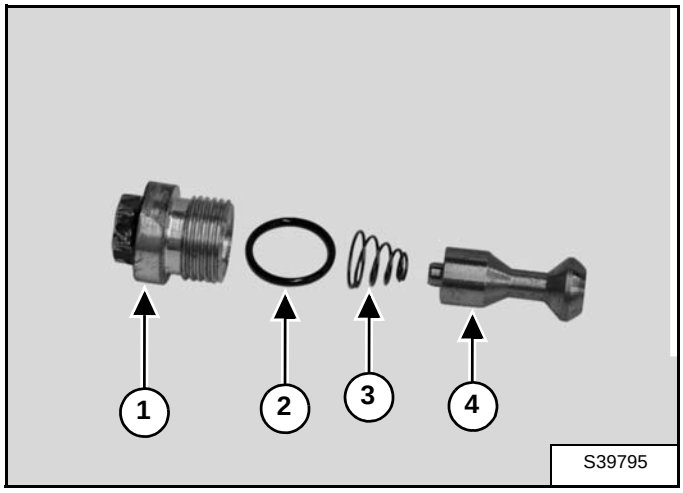
Figure 20-40-85



Remove the plug (Item 1) **[Figure 20-40-85]**.

Installation: Tighten the plug to 9,8 N•m (86.7 in-lb) torque.

Figure 20-40-86



Remove the O-ring (Item 2) from the plug (Item 1), the spring (Item 3) and the shutter valve (Item 4) **[Figure 20-40-86]**.

Boom Swing Valve Section Disassembly And Assembly

IMPORTANT

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

I-2003-0888

Remove the valve section from the rods.

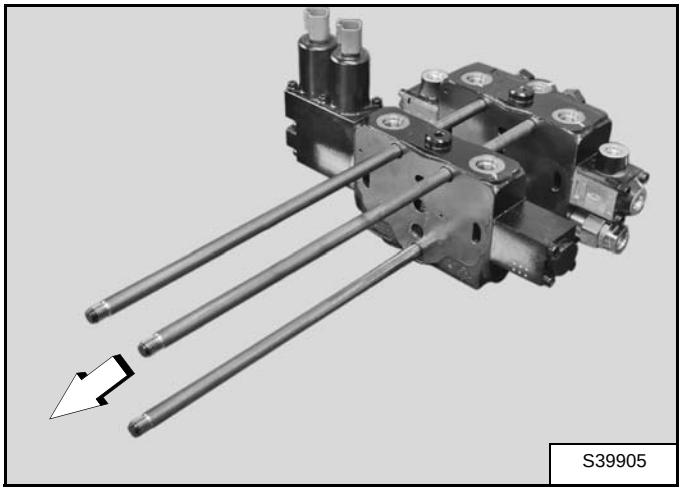
Clean the outside of valve section before disassembling.

NOTE: When removing the valve section from the rods, take care that all O-rings remain in place.

When disassembling the valve section:

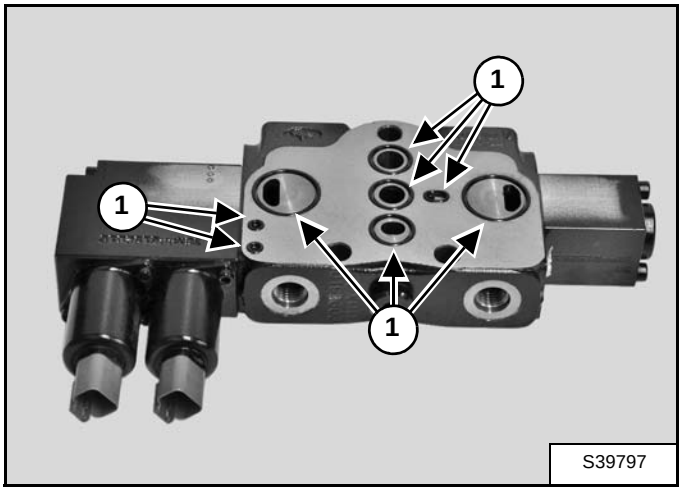
- Clean all parts in solvent and dry with compressed air.
- Inspect all parts for wear or damage. Replace any worn or damaged parts.
- Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-87



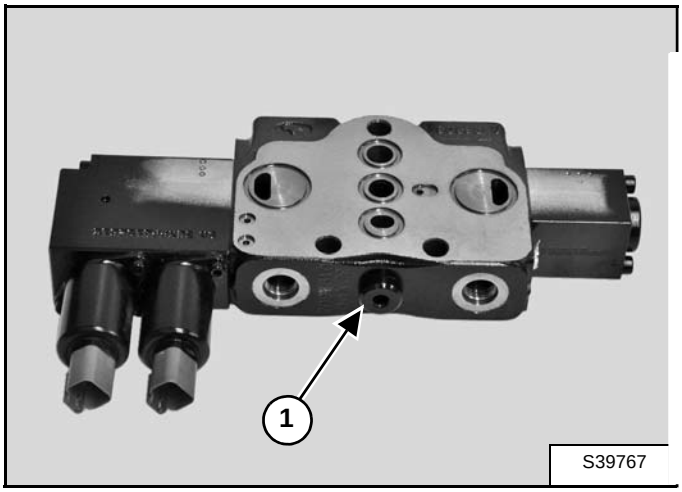
Slide the boom swing valve section from the rods **[Figure 20-40-87]**.

Figure 20-40-88



Remove the eight O-rings **[Figure 20-40-88]**.

Figure 20-40-89

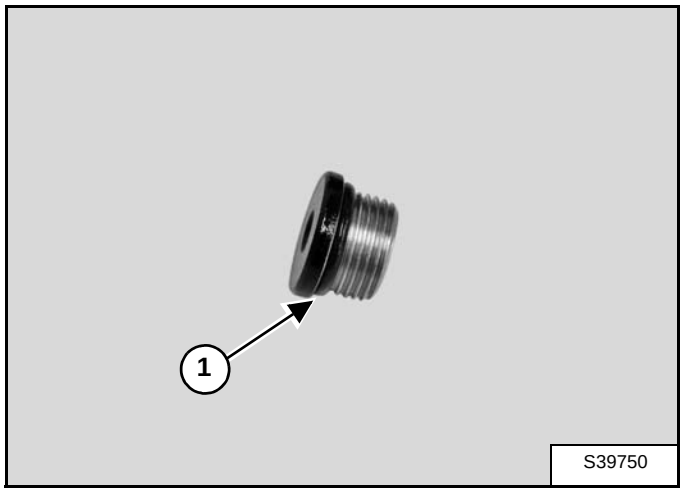


Remove the plug (Item 1) **[Figure 20-40-89]**.

Installation: Tighten the plug to 24 N•m (17.7 ft-lb) torque.

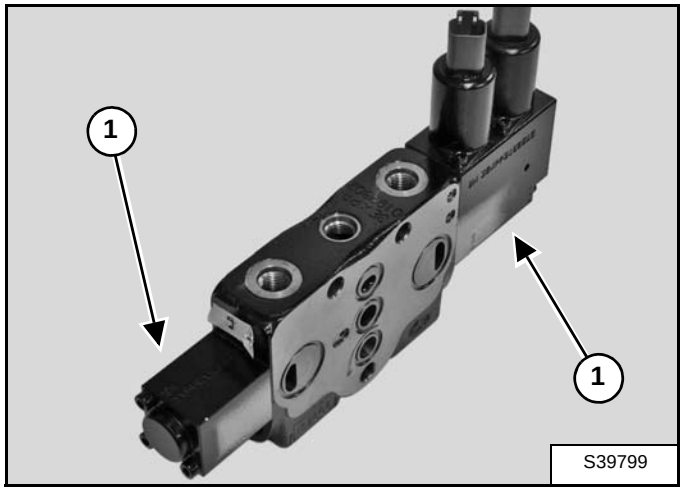
Boom Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-90



Remove the O-ring (Item 1) **[Figure 20-40-90]** from the plug.

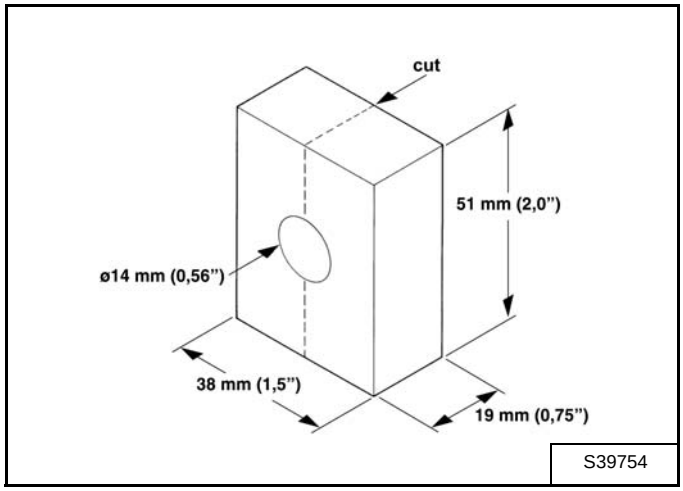
Figure 20-40-91



Remove both spool covers (Item 1) **[Figure 20-40-91]** and gently pull the spool assembly out of the valve.

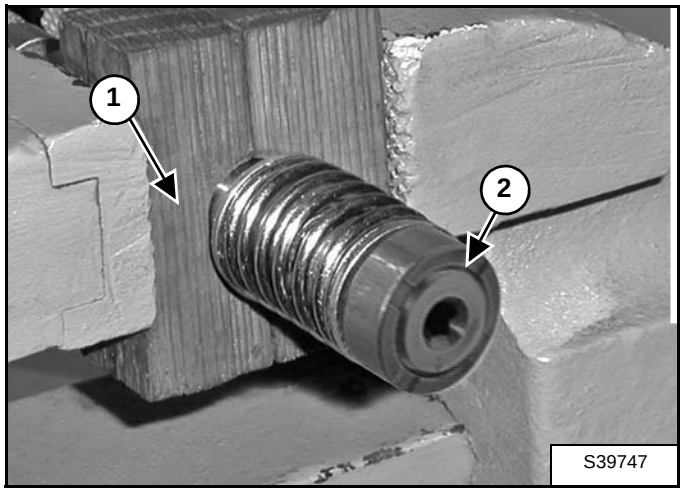
NOTE: When the spool is removed, use care not to scratch the spool surface. Do not interchange spools and valve blocks.

Figure 20-40-92



To remove the spring assembly from the spool, a holding fixture will have to be made from a 19 mm thick x 38 mm wide x 51 mm long (0.75 in x 1.500 in x 2.0 in) piece of hardwood. Drill a 14 mm hole (0.563 in) in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-92]**.

Figure 20-40-93

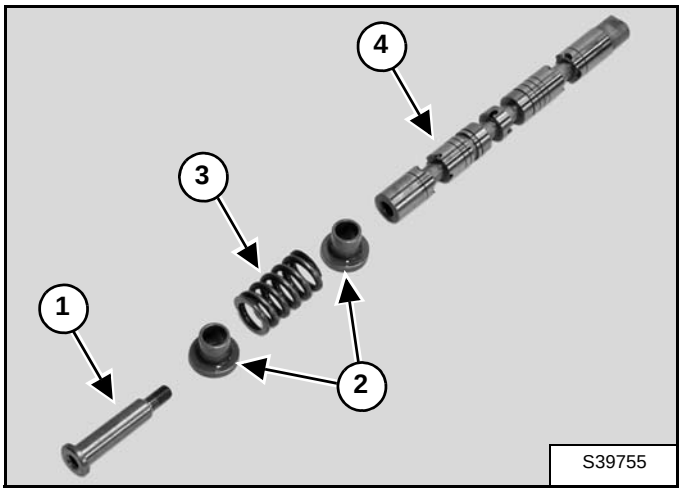


Using the wood block, clamp the spool (Item 1) in a vise and unscrew (Item 2) **[Figure 20-40-93]** the spring assembly.

NOTE: Use only hardwood blocks to grip the spool, or the spool will be damaged.

Boom Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-94



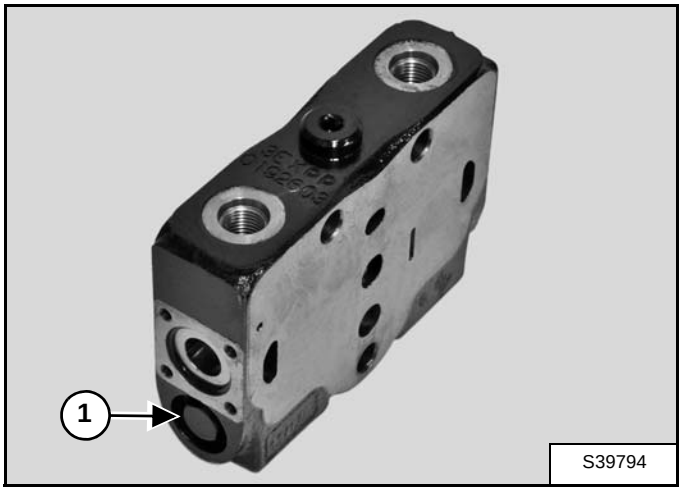
Remove the spring assembly spring screw (Item 1), spring seat (Item 2), spring (Item 3) and spool (Item 4) **[Figure 20-40-94]**.

Installation: Tighten the spring screw to 9,8 N•m (86.7 in-lb) torque.

Installation: Install the spool assembly and then both spool covers and tighten the cover screws to 6,6 N•m (58.4 in-lb).

NOTE: Assemble the hydraulic spools positioning the code toward port B and the grooves toward port A.

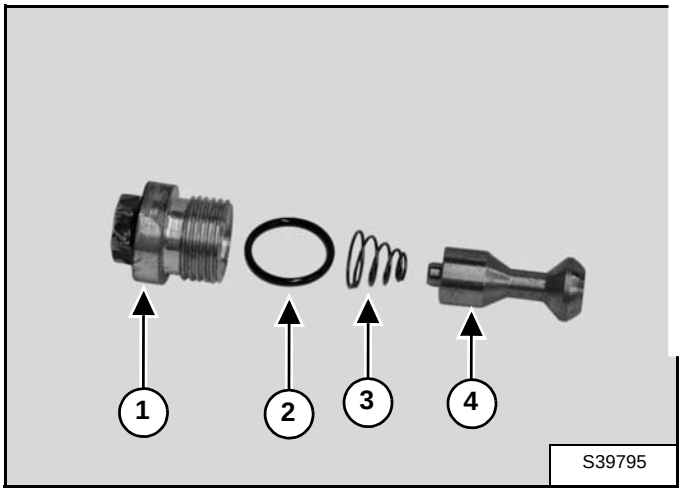
Figure 20-40-95



Remove the plug (Item 1) **[Figure 20-40-95]** on both sides of the valve.

Installation: Tighten the plugs to 9,8 N•m (86.7 in-lb) torque.

Figure 20-40-96



Remove the O-ring (Item 2) from the plug (Item 1), the spring (Item 3) and the shutter valve (Item 4) **[Figure 20-40-96]**.

NOTE: Both plugs are the same. Repeat the procedure for the other plug.

Slew Valve Section Disassembly And Assembly

IMPORTANT

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

I-2003-0888

Remove the valve section from the rods.

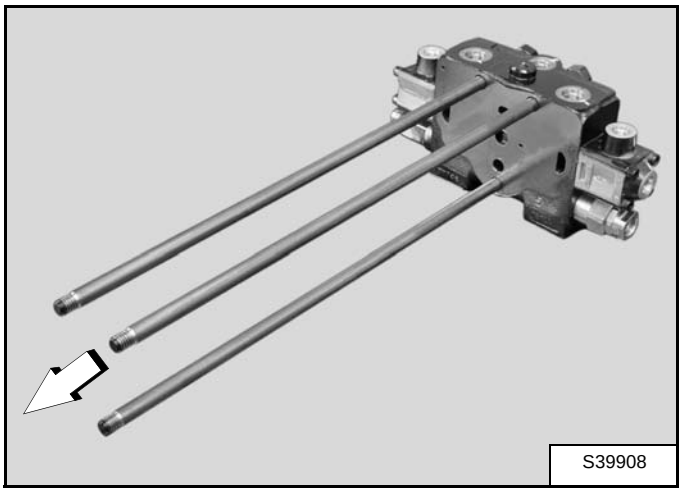
Clean the outside of valve section before disassembling.

NOTE: When removing the valve section from the rods, take care that all O-rings remain in place.

When disassembling the valve section:

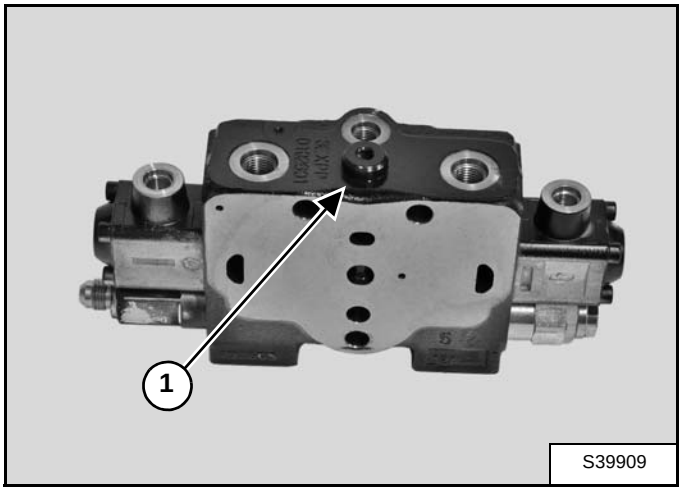
- Clean all parts in solvent and dry with compressed air.
- Inspect all parts for wear or damage. Replace any worn or damaged parts.
- Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-97



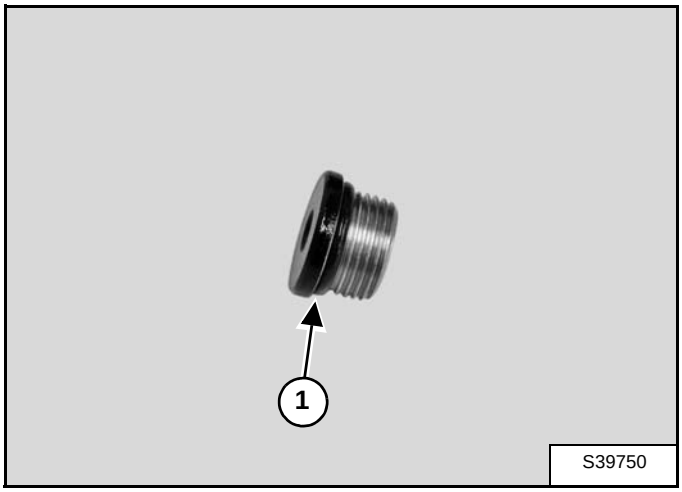
Slide the slew valve section from the rods section **[Figure 20-40-97]**.

Figure 20-40-98



Remove the plug (Item 1) **[Figure 20-40-98]**.

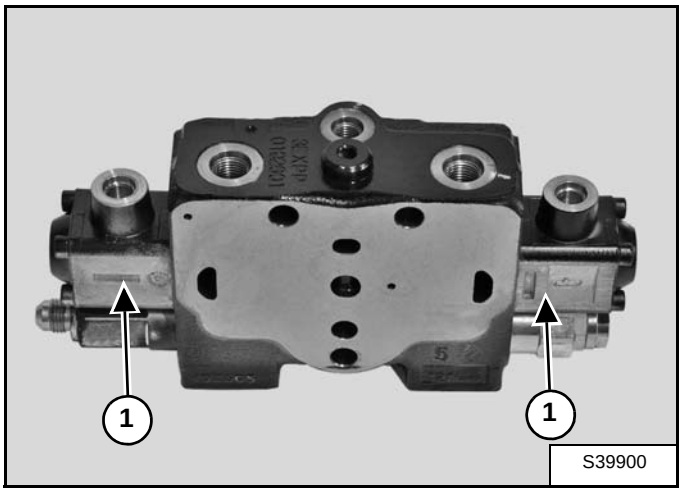
Figure 20-40-99



Remove the O-ring (Item 1) from the plug **[Figure 20-40-99]**.

Slew Valve Section Disassembly And Assembly (Cont'd)

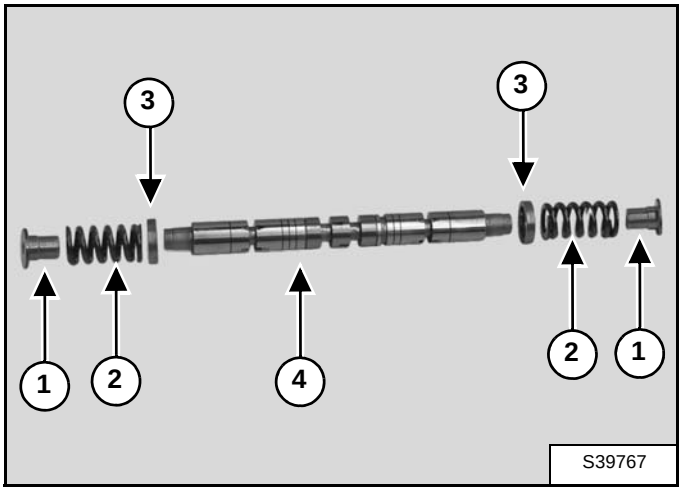
Figure 20-40-100



Remove both spool covers (Item 1) and gently pull the spool assembly out of the valve **[Figure 20-40-100]**.

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

Figure 20-40-101

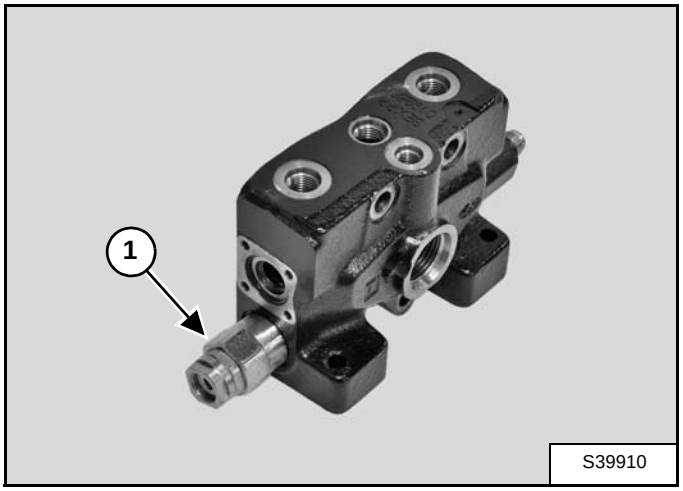


Remove the spool assembly: spring seat (Item 1), spring (Item 2), spring retainer (Item 3) and the spool (Item 4) **[Figure 20-40-101]**.

Installation: Install the spool assembly and then both spool covers and tighten the cover screws to 6,6 N•m (58.4 in-lb) torque.

NOTE: Assemble the hydraulic spools positioning the code toward port B and the grooves toward port A.

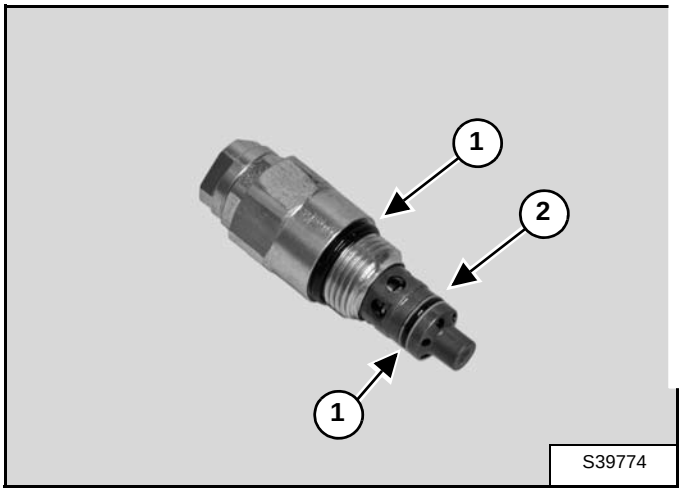
Figure 20-40-102



Remove the port relief valve (Item 1) **[Figure 20-40-102]**.

Installation: Tighten the port relief valve to 50 N•m (36.9 ft-lb) torque.

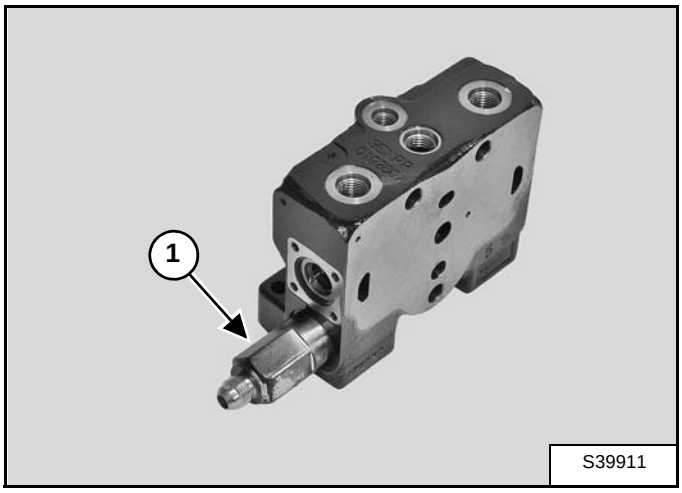
Figure 20-40-103



Remove the O-rings (Item 1) and the back-up ring (Item 2) **[Figure 20-40-103]** from the port relief valve.

Slew Valve Section Disassembly and Assembly (Cont'd)

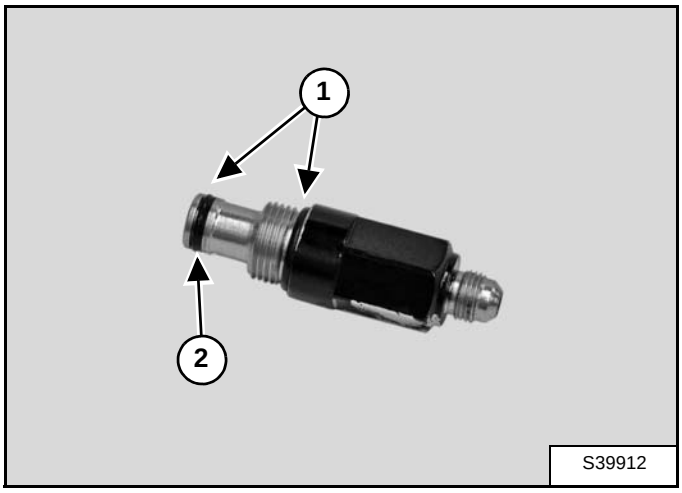
Figure 20-40-104



Remove the inlet fitting (Item 1) **[Figure 20-40-104]**.

Installation: Tighten the inlet fitting to 42 N•m (31 ft-lb) torque.

Figure 20-40-105



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-105]**.

Assembly

IMPORTANT

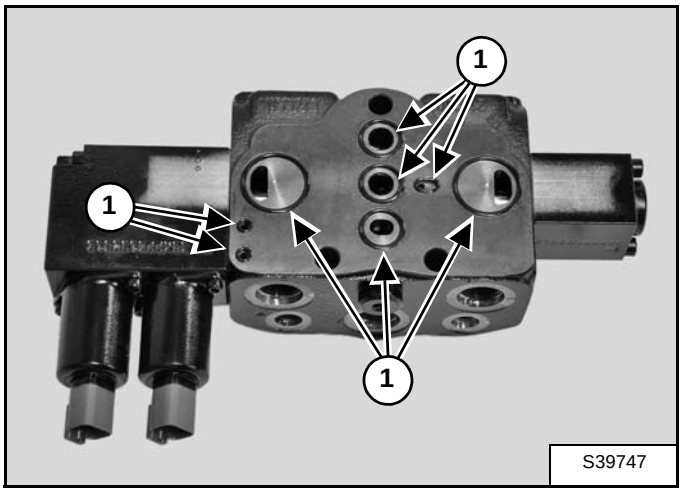
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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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.

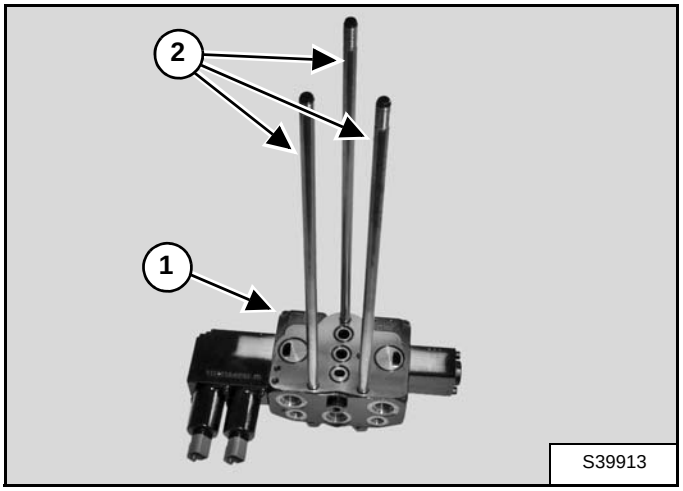
NOTE: Install the valves section on the tie rods, so that each O-ring section faces upwards.

Figure 20-40-106



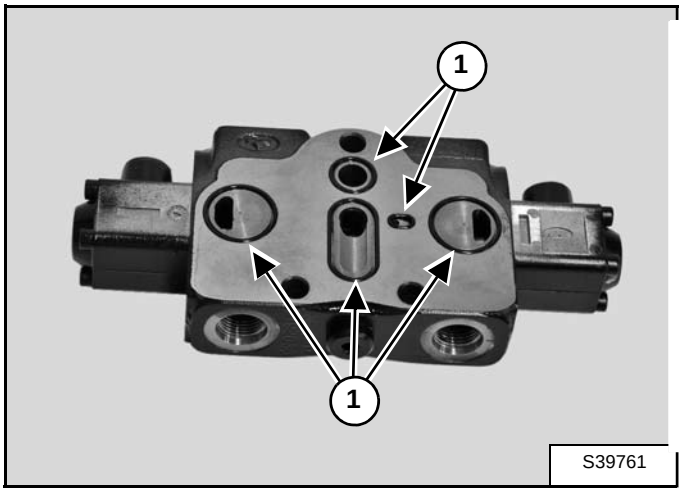
Install the O-rings (Item 1) **[Figure 20-40-106]** on the auxiliary valve section.

Figure 20-40-107



Install the auxiliary valve section (Item 1) on the tie rods (Item 2) **[Figure 20-40-107]**.

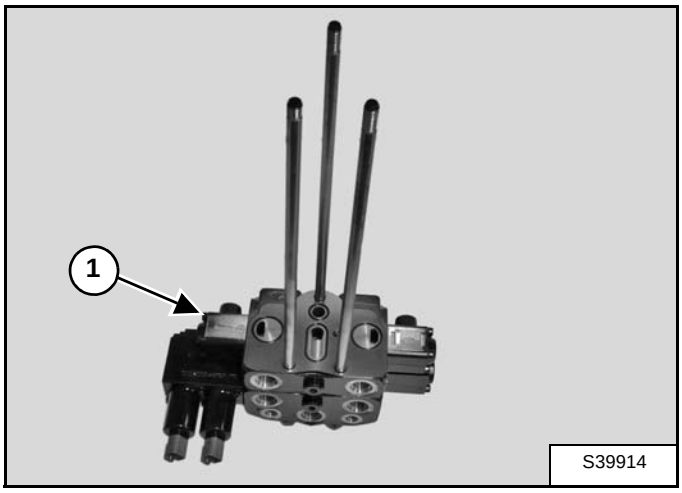
Figure 20-40-108



Install the O-rings (Item 1) **[Figure 20-40-108]** on the arm valve section.

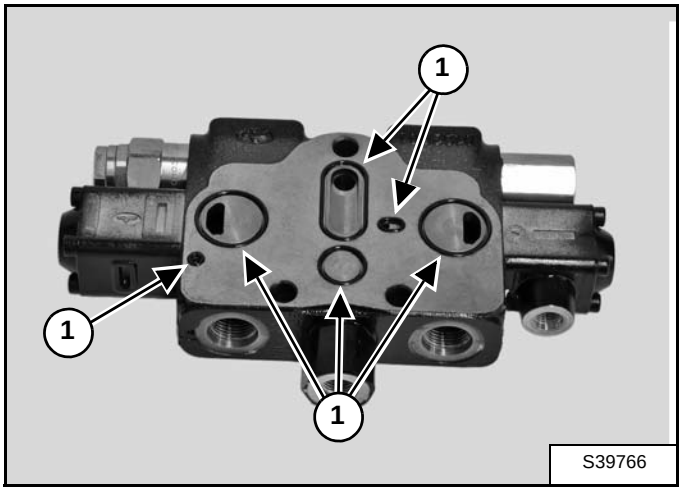
Assembly (Cont'd)

Figure 20-40-109



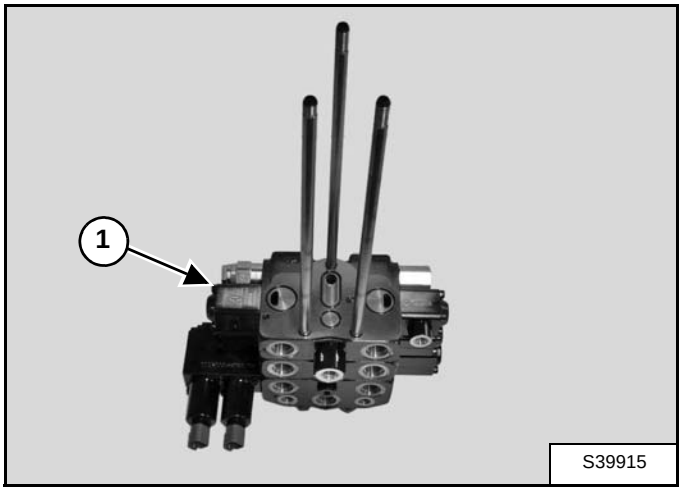
Install the arm valve section (Item 1) **[Figure 20-40-109]** on the tie rods.

Figure 20-40-110



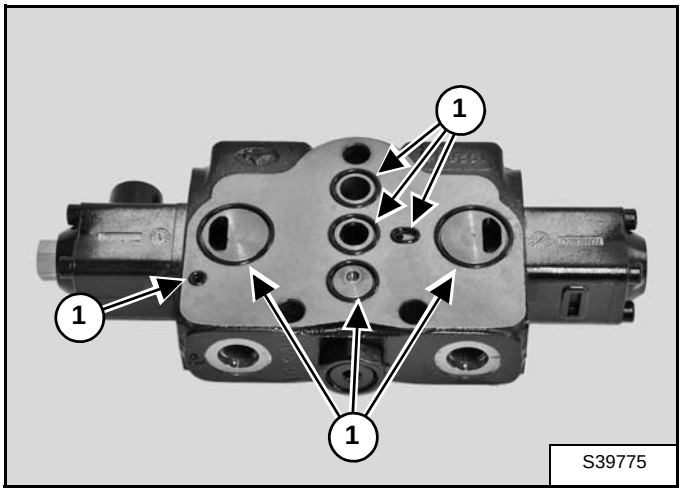
Install the O-rings (Item 1) **[Figure 20-40-110]** on the RH travel valve section.

Figure 20-40-111



Install the RH travel valve section (Item 1) **[Figure 20-40-111]** on the tie rods.

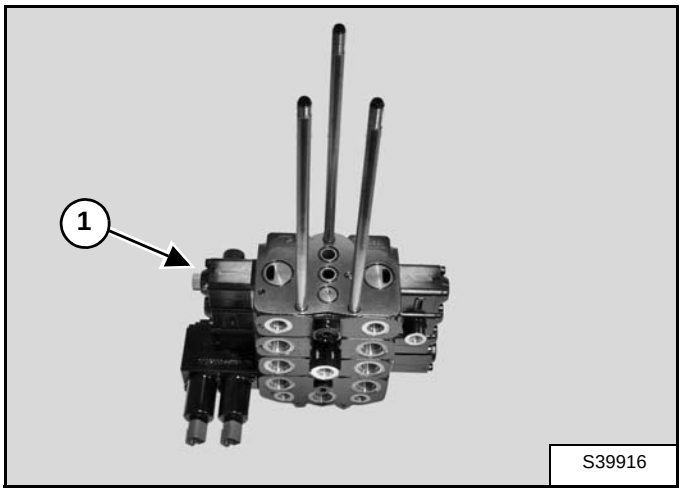
Figure 20-40-112



Install the O-rings (Item 1) **[Figure 20-40-112]** on the bucket valve section.

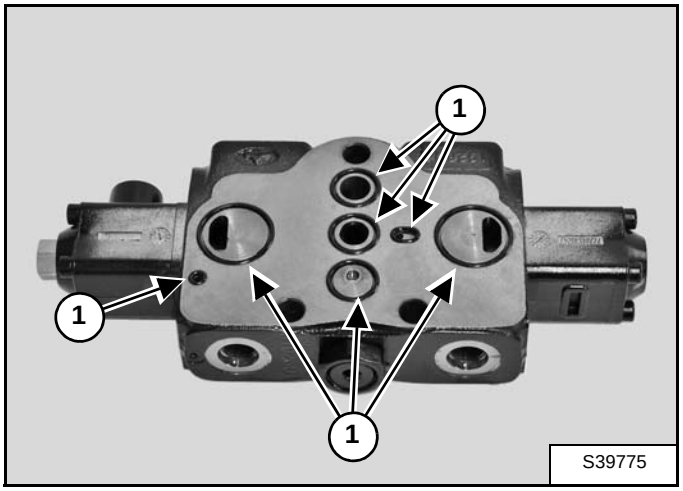
Assembly (Cont'd)

Figure 20-40-113



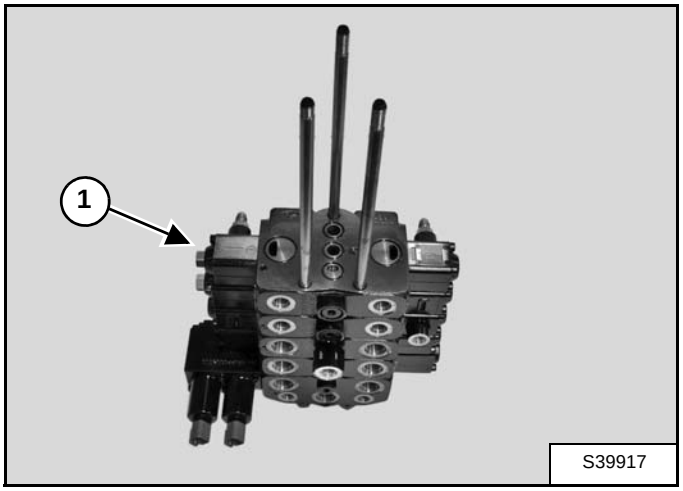
Install the bucket valve section (Item 1) **[Figure 20-40-113]** on the tie rods.

Figure 20-40-114



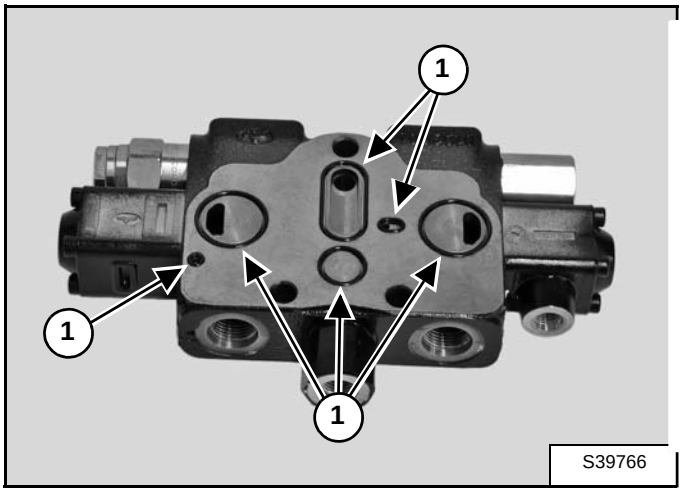
Install the O-rings (Item 1) **[Figure 20-40-114]** on the boom valve section.

Figure 20-40-115



Install the boom valve section (Item 1) **[Figure 20-40-115]** on the tie rods.

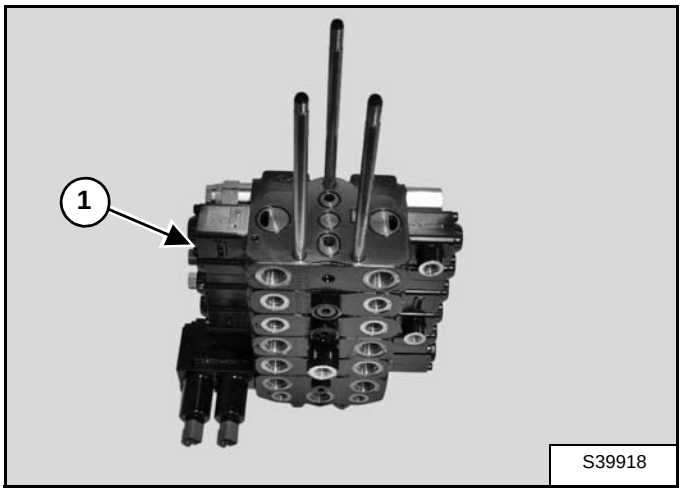
Figure 20-40-116



Install the O-rings (Item 1) **[Figure 20-40-116]** on the LH travel valve section.

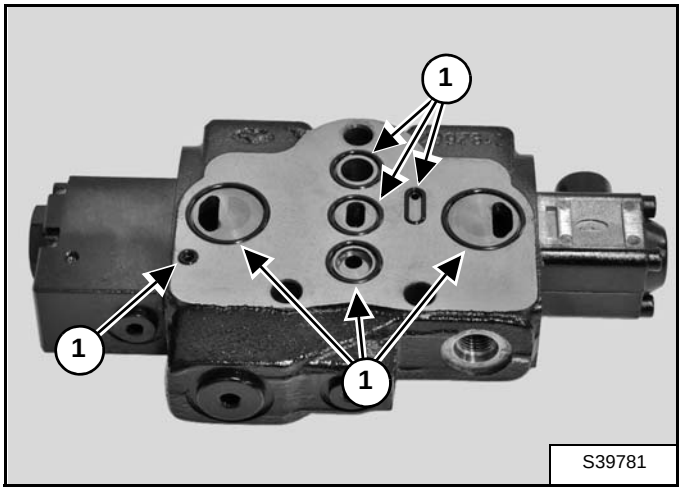
Assembly (Cont'd)

Figure 20-40-117



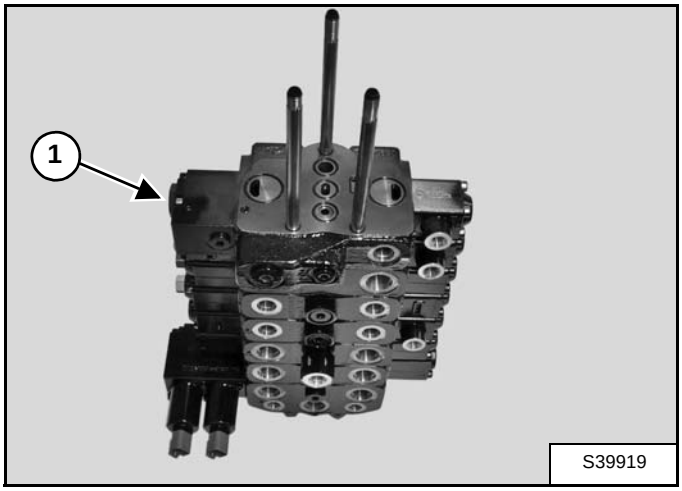
Install the LH travel valve section (Item 1) **[Figure 20-40-117]** on the tie rods.

Figure 20-40-118



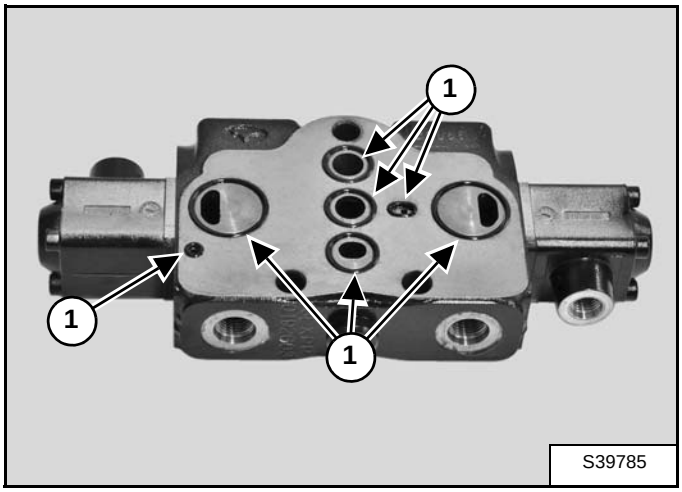
Install the O-rings (Item 1) **[Figure 20-40-118]** on the "Priority valve" valve section.

Figure 20-40-119



Install the "Priority valve" valve section (Item 1) **[Figure 20-40-119]** on the tie rods.

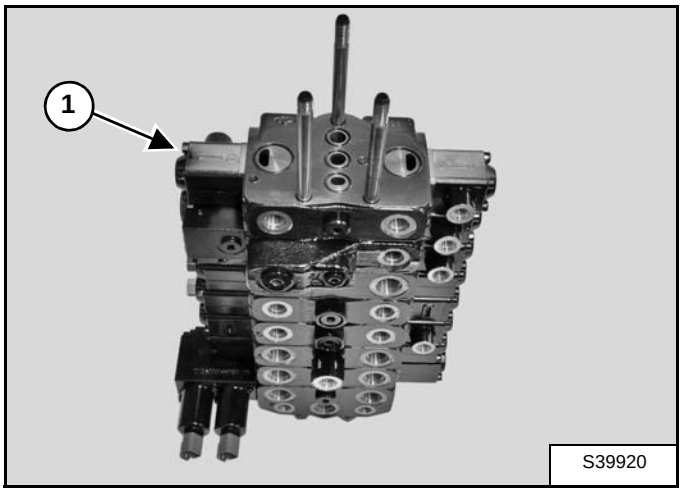
Figure 20-40-120



Install the O-rings (Item 1) **[Figure 20-40-120]** on the blade valve section.

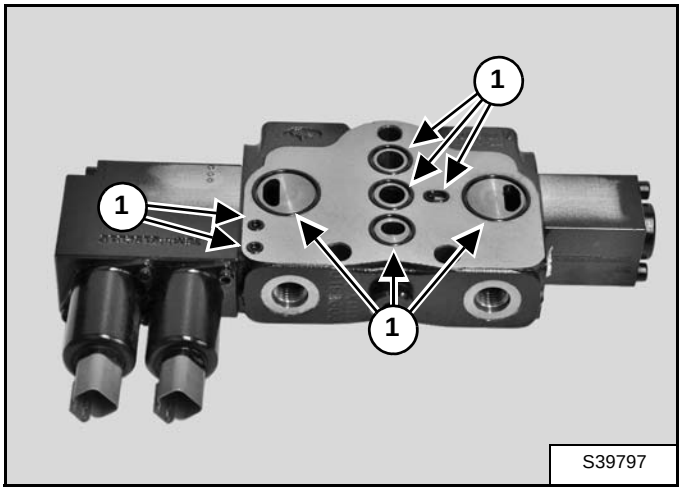
Assembly (Cont'd)

Figure 20-40-121



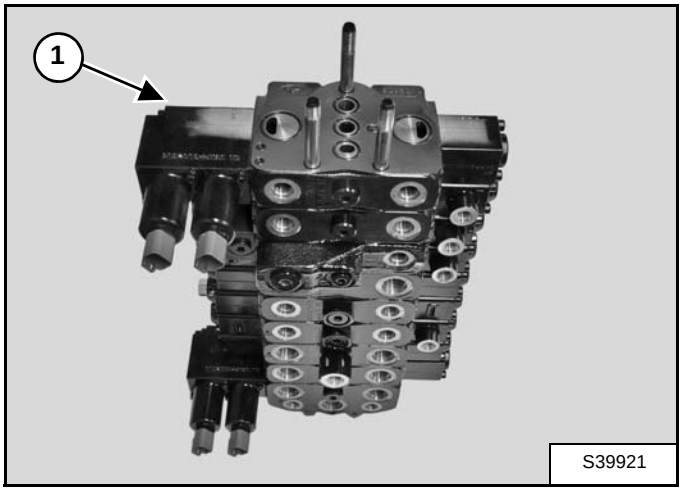
Install the blade valve section (Item 1) **[Figure 20-40-121]** on the tie rods.

Figure 20-40-122



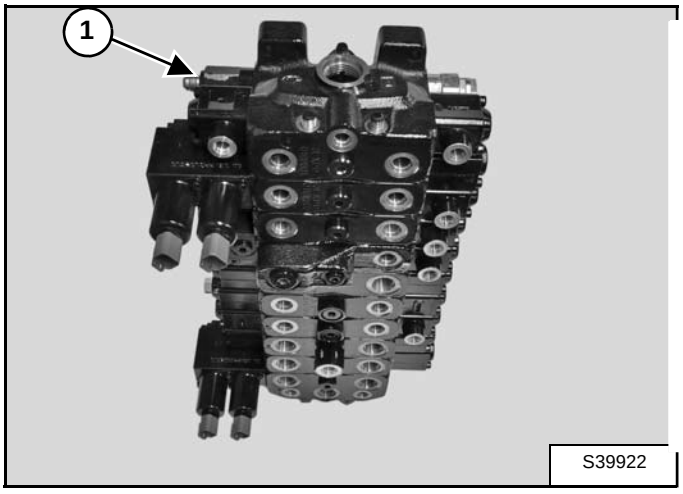
Install the O-rings (Item 1) **[Figure 20-40-122]** on the boom swing valve section.

Figure 20-40-123



Install the boom swing valve section (Item 1) **[Figure 20-40-123]** on the tie rods.

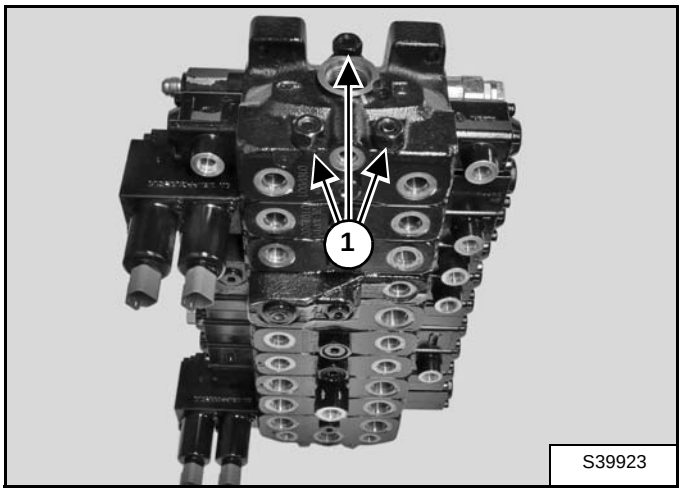
Figure 20-40-124



Install the slew valve section (Item 1) **[Figure 20-40-124]** on the tie rods.

Assembly (Cont'd)

Figure 20-40-125



Install the washers and nuts (Item 1) **[Figure 20-40-125]** on the tie rods, finger tight.

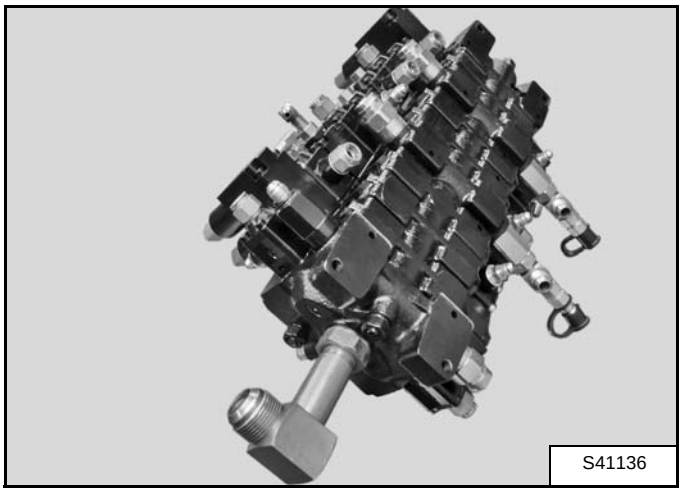
Be sure the valve assembly does not rock on a flat surface.

Initially tighten the tie rod nuts (Item 1) **[Figure 20-40-125]** to 13 N•m (10 ft-lb) torque.

Finally tighten the tie rod nuts (Item 1) **[Figure 20-40-125]** to 36 N•m (25 ft-lb) torque.

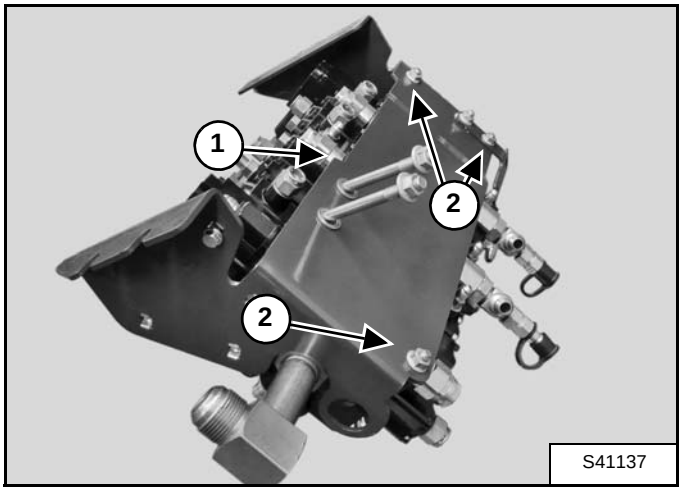
Install all fittings and tighten with standard torque values.

Figure 20-40-126



Place the valve assembly as shown on the picture for easy installing of the mounting plate **[Figure 20-40-126]**.

Figure 20-40-127



Install the mounting plate (Item 1). Install the three bolts and tighten the nuts (Item 2) **[Figure 20-40-127]** with standard torque values.

Move the assembly by means of a chain hoist and install on the excavator. (See Removal And Installation on Page 20-40-1.)

HYDRAULIC PUMP

Description

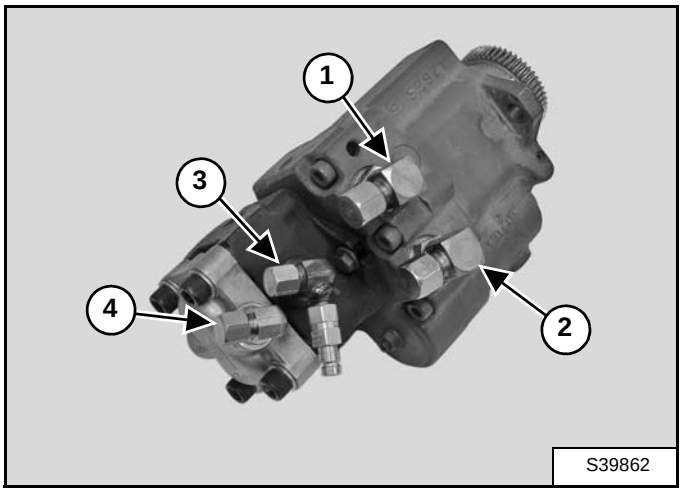
The hydraulic pump consists of a dual piston pump and two gear pumps. The piston pump and P3 gear pump supply high pressure to the control valve. The P4 gear pump supplies pilot pressure to the manifold.

IMPORTANT

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

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Figure 20-50-1



Pump outlet 1 (Item 1) **[Figure 20-50-1]** provides hydraulic fluid to the right hand travel, arm and auxiliary hydraulic flow valve sections.

Pump outlet 2 (Item 2) **[Figure 20-50-1]** provides hydraulic fluid flow to the left hand travel, boom and bucket valve sections.

Pump outlet 3 (gear pump) (Item 3) **[Figure 20-50-1]** provides hydraulic fluid flow to the upperstructure slew, boom swing and blade valve sections.

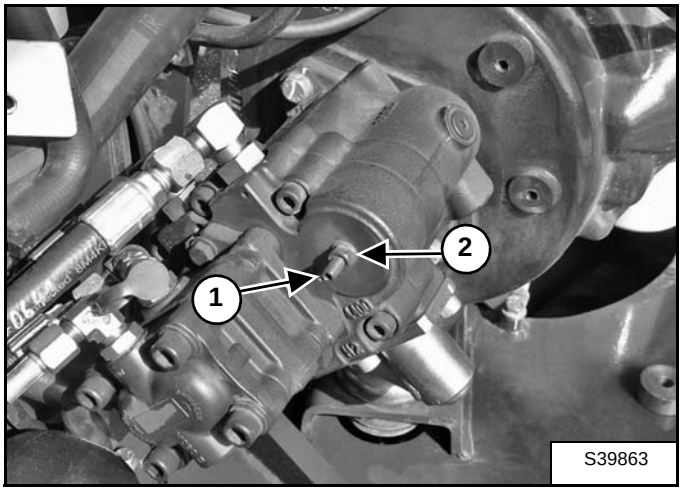
Pump outlet 4 (gear pump) (Item 4) **[Figure 20-50-1]** provides hydraulic fluid flow to the pilot and auto idle circuit.

Torque Adjustment

Prior to making any torque adjustment, all piston and gear pump tests must be completed and are to rated specifications. (See the following pages for pump tests.)

Prior to making any torque adjustment, make sure the no load engine rpm is correct. (See Engine on Page SPEC-10-10.)

Figure 20-50-2



The adjustment screw (Item 1) **[Figure 20-50-2]** is used to match the maximum hydraulic horsepower of the pump to the maximum rated engine horsepower.

Remove any auxiliary hydraulic attachments from the excavator.

Start the engine and move the speed control to the high idle position.

Engage the following hydraulic functions, and continue to engage the functions.

Engage the auxiliary hydraulics.
Extend the bucket cylinder.
Extend the arm cylinder.
Extend the boom cylinder.
Extend the boom swing cylinder.
Engage the upperstructure slew.

With all the above hydraulic functions engaged, the engine speed must maintain 2400 rpm.

Loosen the nut (Item 2) **[Figure 20-50-2]** and turn the adjustment screw clockwise to increase pump torque, counterclockwise to decrease pump torque.

Tighten the nut and retest the pump.

Increase or decrease pump torque until correct engine rpm is maintained.

Testing The Piston Pump P1

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

The following tool will be needed for the hydraulic pump test:

MEL10003 - Hydraulic Tester

Stop the engine.

Remove the left upperstructure cover. (See Removal And Installation on Page 40-70-1.)

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

Figure 20-50-3

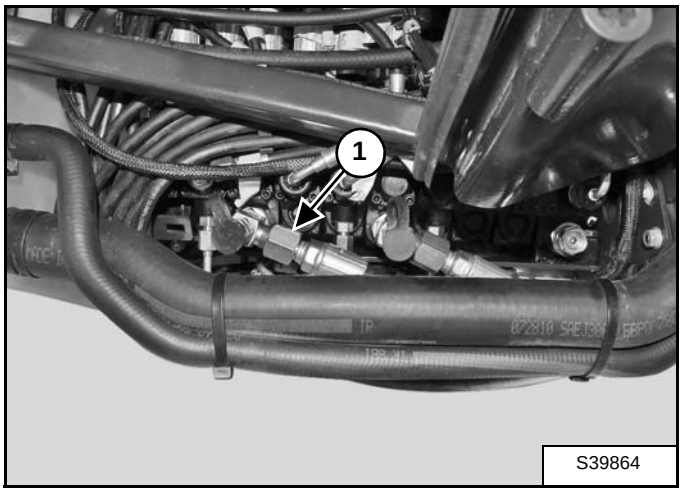
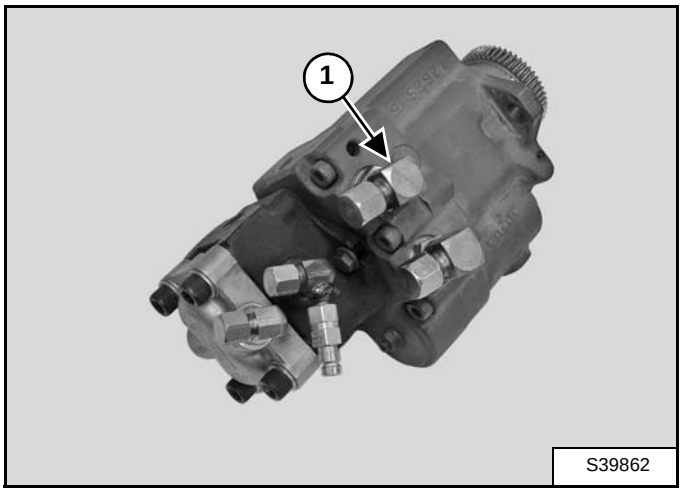


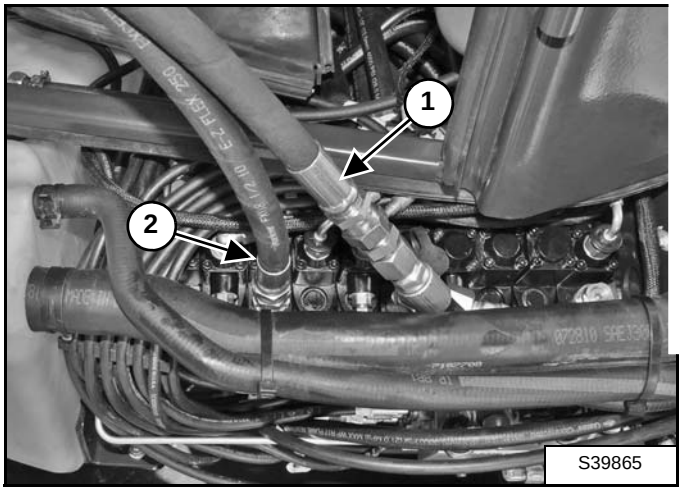
Figure 20-50-4



NOTE: Pump removed in [Figure 20-50-4] for photo clarity only.

At the control valve, remove the outlet hose (Item 1) **[Figure 20-50-3]** coming from the hydraulic pump (Item 1) **[Figure 20-50-4]** being tested.

Figure 20-50-5

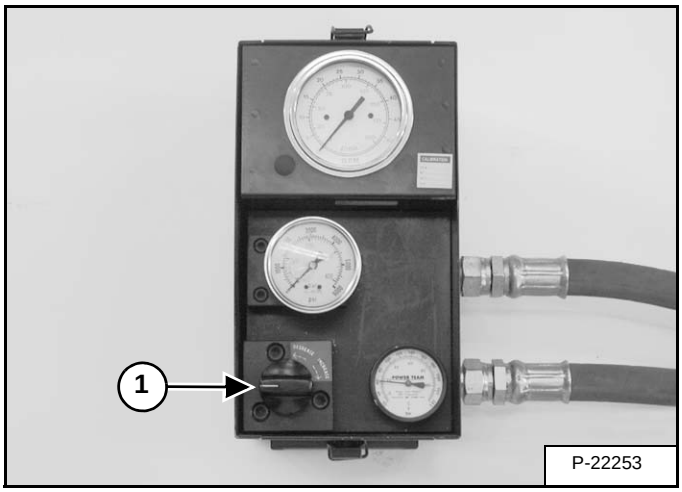


Connect the inlet side (Item 1) **[Figure 20-50-5]** of the tester to the hose coming from the hydraulic pump.

Connect the outlet side (Item 2) **[Figure 20-50-5]** of the tester to the control valve, where the hose has been removed.

Testing The Piston Pump P1 (Cont'd)

Figure 20-50-6



NOTE: Open the flow control knob (Item 1) [Figure 20-50-6] fully to prevent pump damage. This is a direct pump test. There is no relief valve in the system.

Start the engine and run at low rpm. Make sure the tester is connected correctly. If no flow is indicated at the tester, the hoses are connected wrong.

Increase the engine speed to full rpm. Warm the hydraulic fluid to 66°C (150°F) by turning the restrictor valve until the gauge reads about 6,9 MPa (69 bar) (1000 psi). Do not exceed system pressure.

After the temperature is correct, open the restrictor valve fully.

Record the pump free flow L/min (U.S. gpm).

Pump flow on a new piston pump is 28,8 L/min (7.6 U.S. gpm). (Value also valid for P2 testing.)

Close the flow control knob (Item 1) **[Figure 20-50-6]** slowly to 0,69 MPa (6,9 bar) (100 psi) below the P1 relief valve setting (24 MPa [240 bar] [3480 psi]). (Value also valid for P2 testing.)

Record the pump high pressure flow L/min (U.S. gpm).

NOTE: The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (L/min)}}{\text{FREE FLOW (L/min)}} \text{ x100}$$

If the high pressure flow is less than 80% of free flow, remove the hydraulic pump for repair or replacement.

Testing The Piston Pump P2

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

The following tool will be needed for the hydraulic pump test:

MEL10003 - Hydraulic Tester

Stop the engine.

Remove the left upperstructure cover. (See Removal And Installation on Page 40-70-1.)

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

Figure 20-50-7

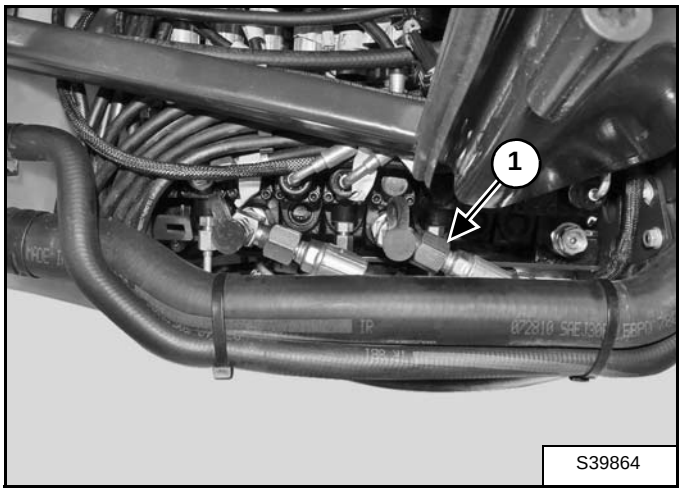
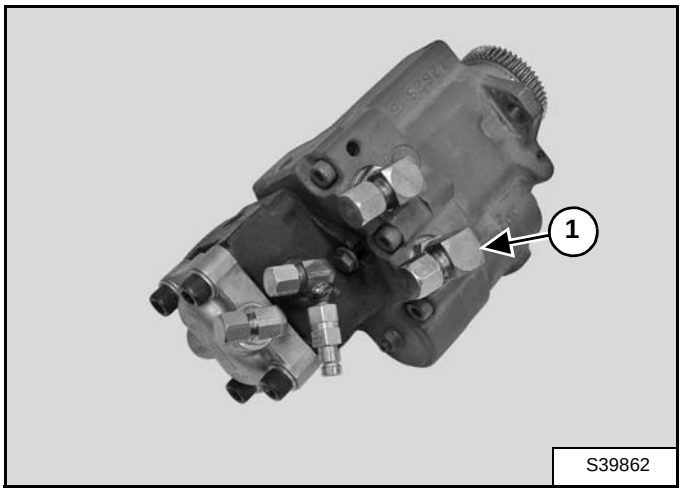


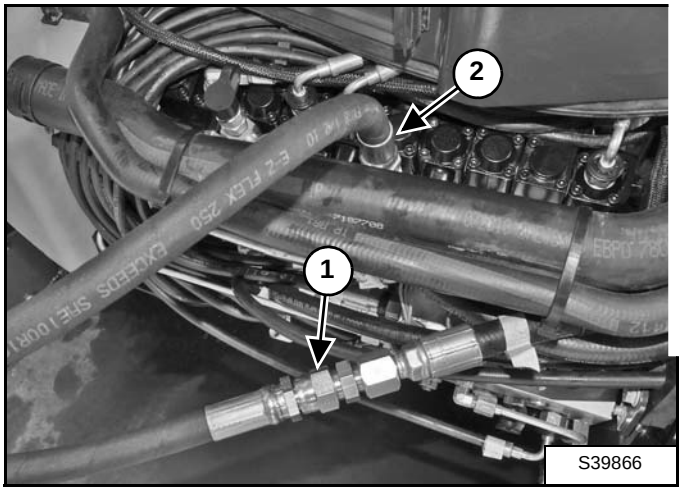
Figure 20-50-8



NOTE: Pump removed in [Figure 20-50-8] for photo clarity only.

At the control valve, remove the outlet hose (Item 1) **[Figure 20-50-7]** coming from the hydraulic pump (Item 1) **[Figure 20-50-8]** being tested.

Figure 20-50-9



Connect the inlet side (Item 1) **[Figure 20-50-9]** of the tester to the hose coming from the hydraulic pump.

Connect the outlet side (Item 2) **[Figure 20-50-9]** of the tester to the control valve, where the hose has been removed.

Except for the connection locations, this testing procedure is identical to the previous procedure.
(See Testing The Piston Pump P1 on Page 20-50-3.)

The pump free flow and pump pressure flow must be equal to the values of P1.

Testing The Gear Pump P3

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

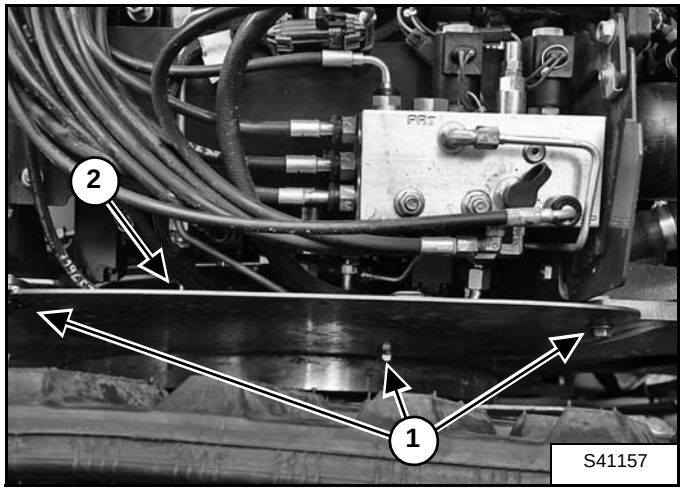
The following tool will be needed for the hydraulic pump test:

MEL10003 - Hydraulic Tester

Stop the engine.

Remove the left upperstructure cover. (See Removal And Installation on Page 40-70-1.)

Figure 20-50-10



Remove the three bolts (Item 1) and the bottom plate (Item 2) **[Figure 20-50-10]**.

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

Figure 20-50-11

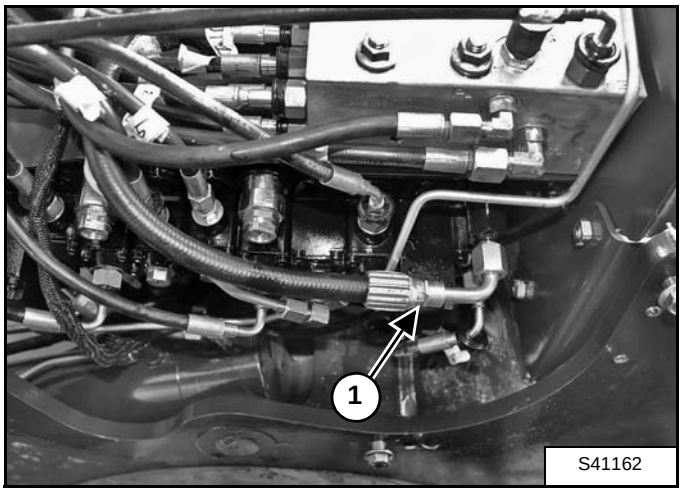
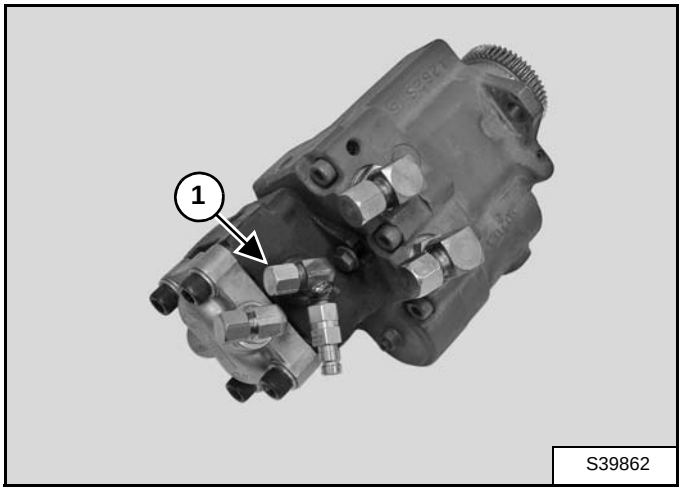


Figure 20-50-12

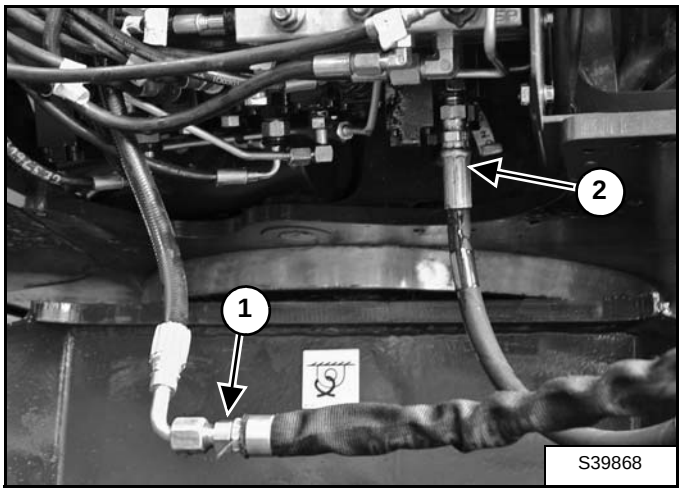


NOTE: Pump removed in [Figure 20-50-12] for photo clarity only.

Remove the outlet hose (Item 1) **[Figure 20-50-11]** and **[Figure 20-50-12]** from the gear pump.

Testing The Gear Pump P3 (Cont'd)

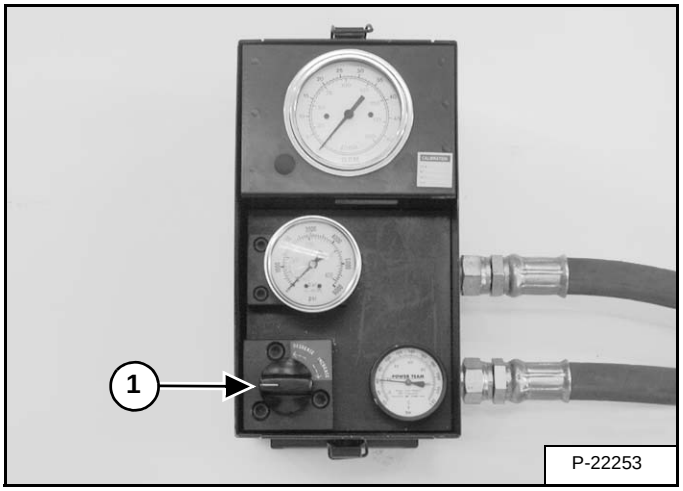
Figure 20-50-13



Connect the inlet side (Item 1) **[Figure 20-50-13]** of the tester to the hose coming from the hydraulic pump.

Connect the outlet side of the tester (Item 2) **[Figure 20-50-13]** to the manifold, where the hose has been removed.

Figure 20-50-14



NOTE: Open the flow control knob (Item 1) [Figure 20-50-14] fully to prevent pump damage. This is a direct pump test. There is no relief valve in the system.

Start the engine and run at low rpm. Make sure the tester is connected correctly. If no flow is indicated at the tester, the hoses are connected wrong.

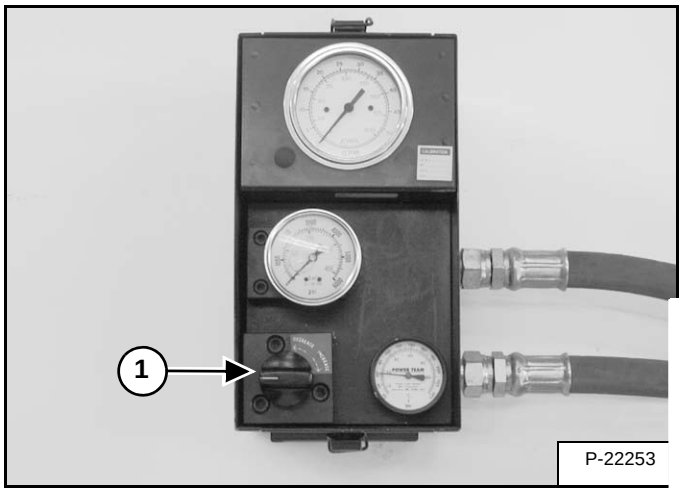
Increase the engine speed to full rpm. Warm the hydraulic fluid to 66°C (150°F) by turning the restrictor valve until the gauge reads about 6,9 MPa (69 bar) (1000 psi). Do not exceed system pressure.

After the temperature is correct, open the restrictor valve fully.

Record the pump free flow L/min (U.S. gpm).

Pump flow on a new gear pump is 18,4 L/min (4.9 U.S. gpm).

Figure 20-50-15



Close the flow control knob (Item 1) **[Figure 20-50-15** slowly to 0.69 MPa (6,9 bar) (100 psi) below the relie valve setting (20,6 [206 bar] [2987 psi]).

Record the pump high pressure flow L/min (U.S. gpm).

NOTE: The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (L/min)}}{\text{FREE FLOW (L/min)}} \text{ x100}$$

If the high pressure flow is less than 80% of free flow, remove the hydraulic pump for repair or replacement.

Testing The Gear Pump P4

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

The following tool will be needed for the hydraulic pump test:

MEL10003 - Hydraulic Tester

Stop the engine.

Remove the left upperstructure cover. (See Removal And Installation on Page 40-70-1.)

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

Figure 20-50-16

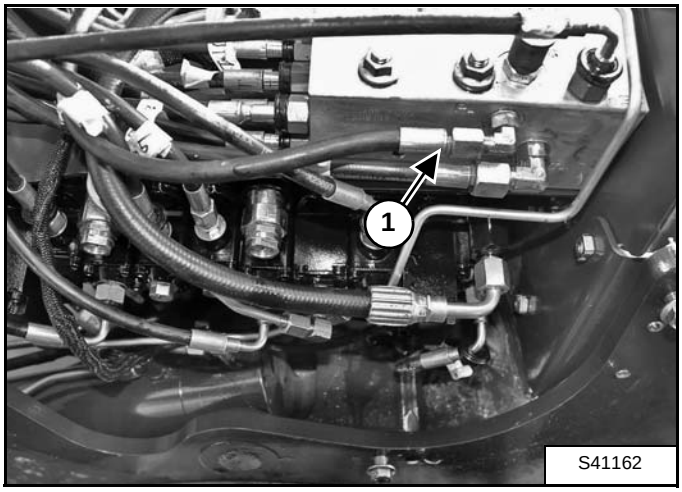
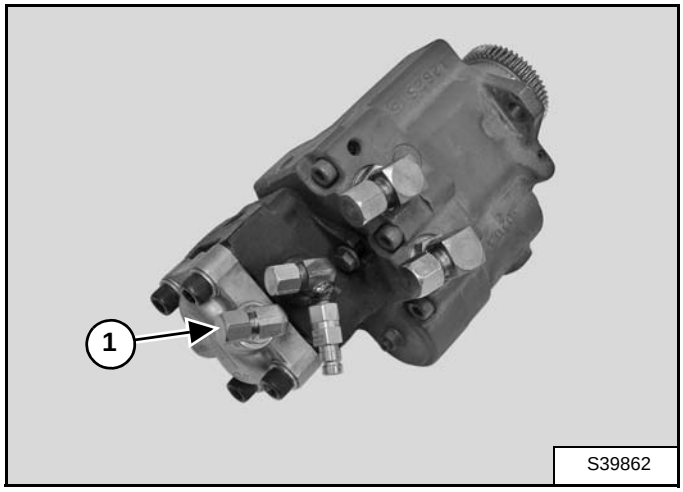


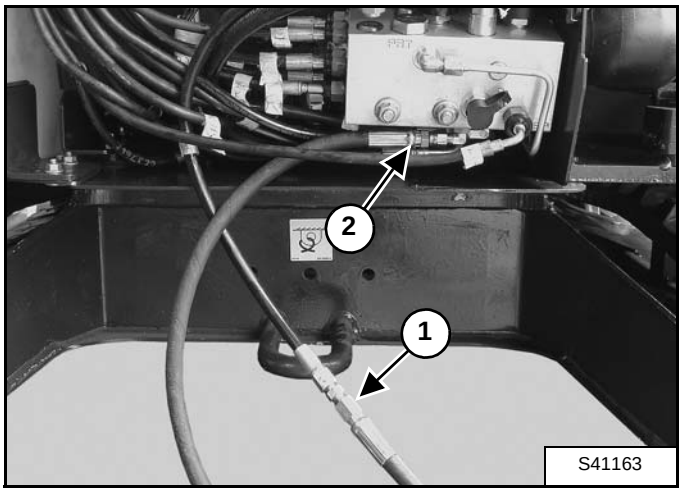
Figure 20-50-17



NOTE: Pump removed in [Figure 20-50-17] for photo clarity only.

Remove the outlet hose (Item 1) **[Figure 20-50-16]** and **[Figure 20-50-17]** from the gear pump.

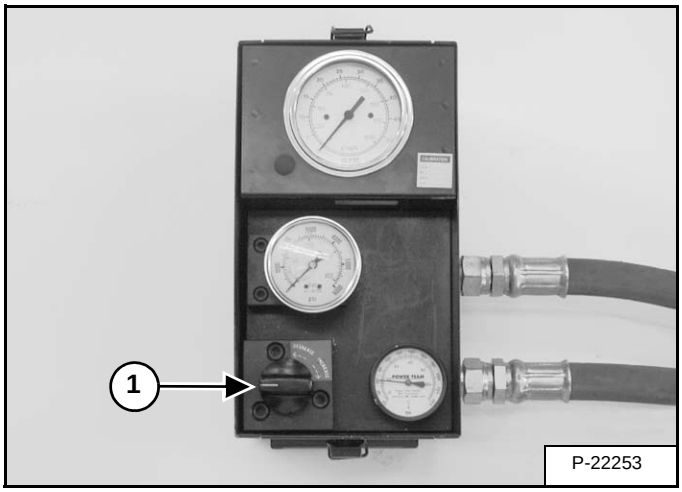
Figure 20-50-18



Connect the inlet side (Item 1) **[Figure 20-50-18]** of the tester to the hose coming from the hydraulic pump.

Connect the outlet side of the tester (Item 2) **[Figure 20-50-18]** to the manifold, where the hose has been removed.

Figure 20-50-19



NOTE: Open the flow control knob (Item 1) [Figure 20-50-19] fully to prevent pump damage. This is a direct pump test. There is no relief valve in the system.

Start the engine and run at low rpm. Make sure the tester is connected correctly. If no flow is indicated at the tester, the hoses are connected wrong.

Increase the engine speed to full rpm. Warm the hydraulic fluid to 66°C (150°F) by turning the restrictor valve until the gauge reads about 6,9 MPa (69 bar) (1000 psi). Do not exceed system pressure.

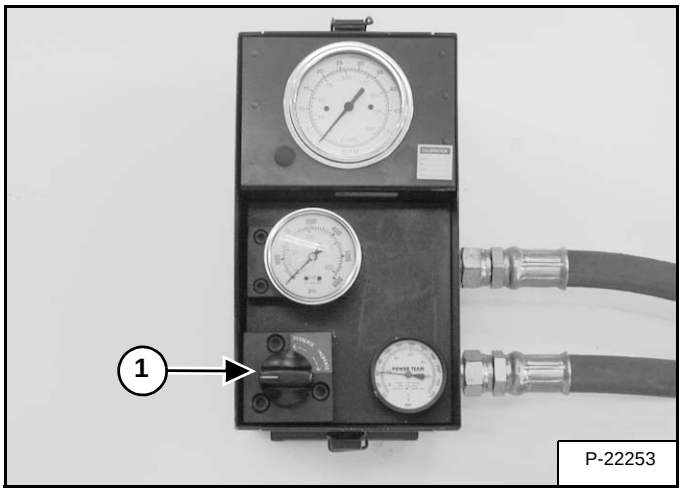
After the temperature is correct, open the restrictor valve fully.

Testing The Gear Pump P4 (Cont'd)

Record the pump free flow L/min (U.S. gpm).

Pump flow on a new gear pump is 6,1 L/min (1.6 U.S. gpm) @ 2250 rpm.

Figure 20-50-20



Close the flow control knob (Item 1) **[Figure 20-50-20]** slowly to the pilot pressure relief valve setting (3,2 MPa [32 bar] [464 psi]).

Record the pump high pressure flow L/min (U.S. gpm).

NOTE: The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (L/min)}}{\text{FREE FLOW (L/min)}} \text{ x100}$$

If the high pressure flow is less than 80% of free flow, remove the hydraulic pump for repair or replacement.

Testing Auxiliary Hydraulic Flow

The auxiliary hydraulic flow is the flow of pump outlet 1.

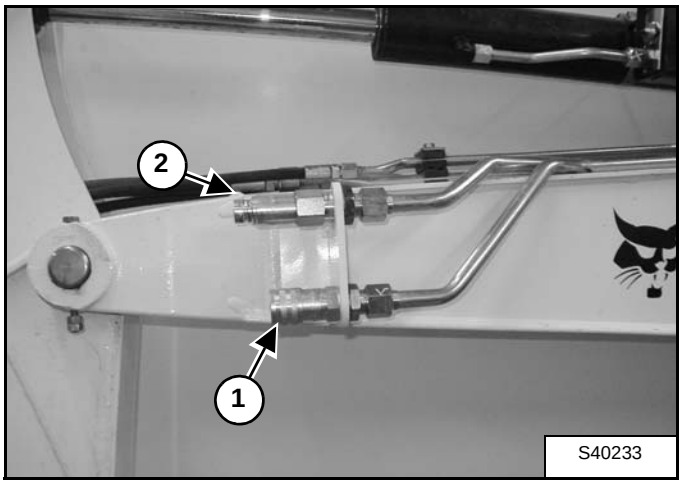
All testing is done with the hydraulic fluid at operating temperature and the engine at high idle speed setting. (See Engine on Page SPEC-10-10.)

The following tool will be needed for the auxiliary hydraulic flow test:

MEL10003 - Hydraulic Tester.

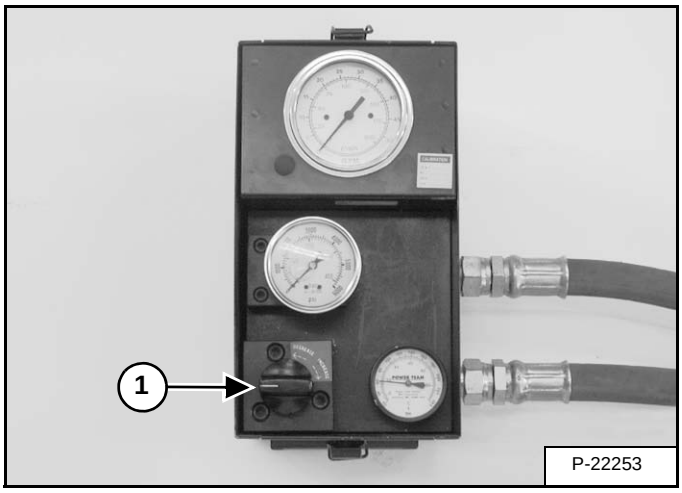
Stop the engine.

Figure 20-50-21



Connect the inlet side of the tester to the female coupler (Item 1). Connect the outlet side of the tester to the male coupler (Item 2) **[Figure 20-50-21]**.

Figure 20-50-22



NOTE: Open the flow control knob (Item 1) [Figure 20-50-22] fully.

Start the engine, and run at low rpm. Engage the auxiliary hydraulic circuit.

NOTE: When engaging the auxiliary hydraulic circuit, make sure the female coupler is pressure and the male coupler is return.

Make sure the tester is connected correctly. If no flow is indicated at the tester, the hoses are connected wrong.

Increase the engine speed to full rpm. Warm the hydraulic fluid to 66°C (150°F) by turning the restrictor valve until the gauge reads about 6,9 MPa (69 bar) (1000 psi). Do not exceed system pressure.

After the temperature is correct, open the restrictor valve fully.

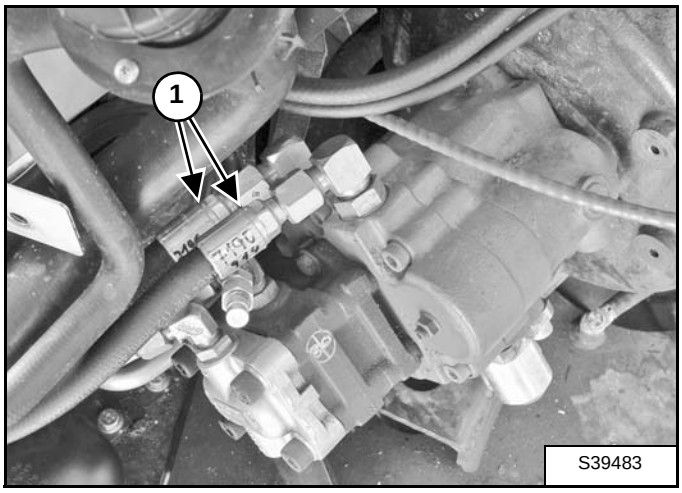
Record the auxiliary hydraulic free flow L/min (U.S. gpm).

Removal And Installation

Remove the counterweight. (See Removal And Installation on Page 40-90-1.)

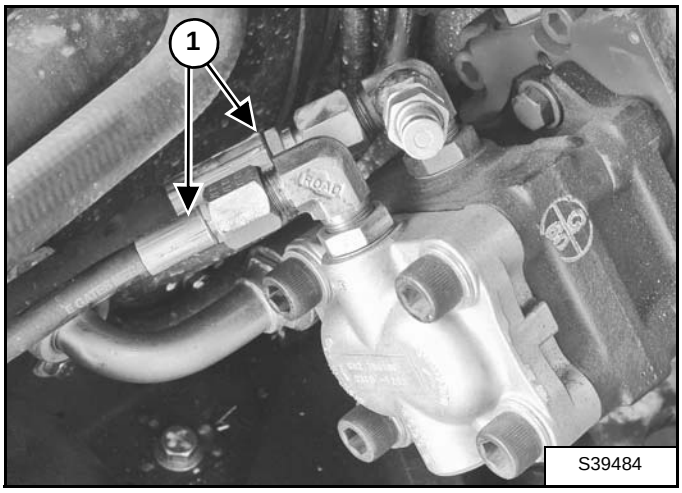
Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-4.)

Figure 20-50-23



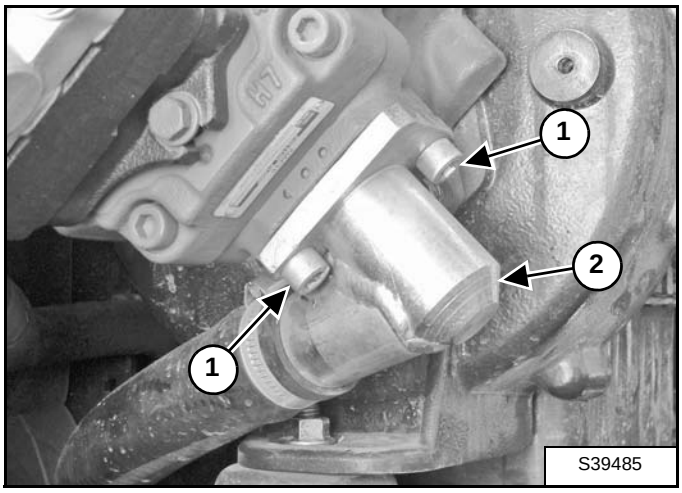
Mark and remove the two hoses (Item 1) **[Figure 20-50-23]**.

Figure 20-50-24



Mark and remove the two hoses (Item 1) **[Figure 20-50-24]**.

Figure 20-50-25

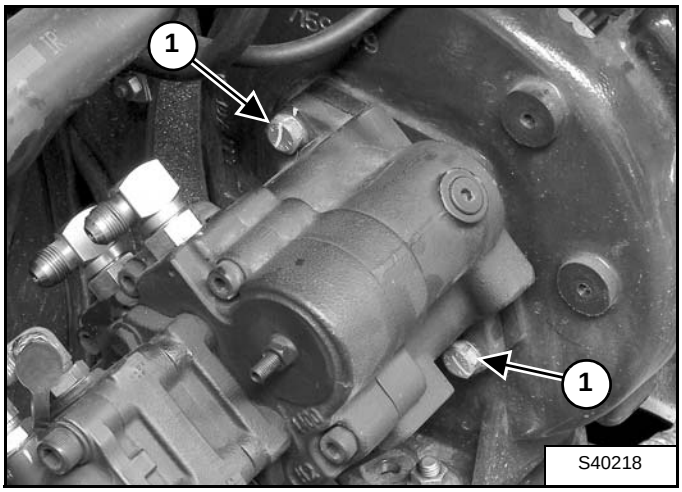


Remove the two bolts (Item 1) and inlet (Item 2) **[Figure 20-50-25]**.

Installation: Tighten the bolts to 30 - 35 N•m (22.1 - 25.8 ft-lb).

Removal And Installation (Cont'd)

Figure 20-50-26



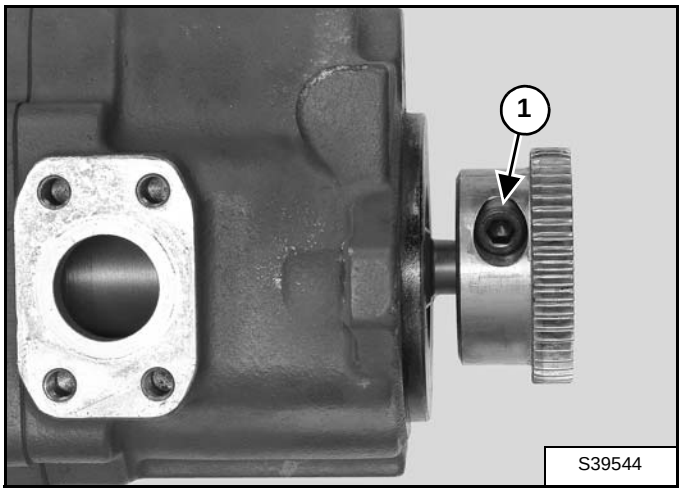
Remove the two bolts (Item 1) **[Figure 20-50-26]**.

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 Startup on Page 20-50-13.)

Coupler Removal And Installation

Figure 20-50-27

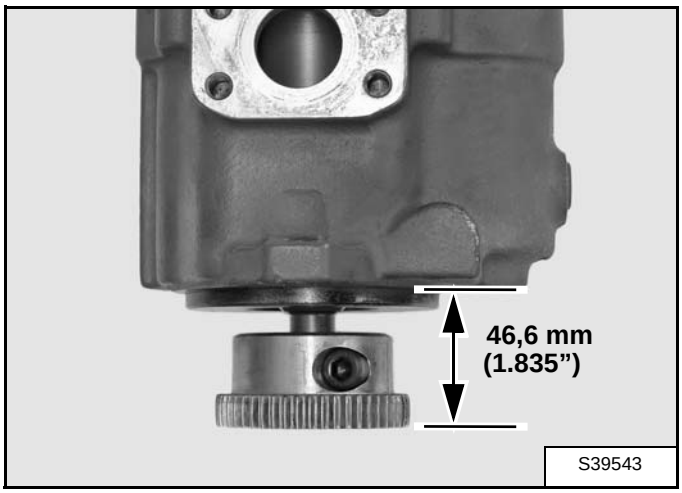


Remove the bolt (Item 1) **[Figure 20-50-27]** from the coupler.

Slide the coupler off of the pump shaft.

Installation: Tighten the bolt (Item 1) **[Figure 20-50-27]** to 49 - 60 N•m (36 - 44 ft-lb) torque.

Figure 20-50-28

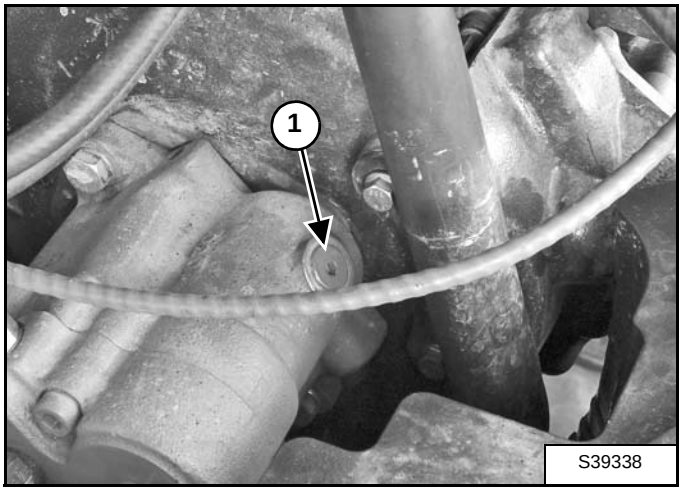


When installing the coupler, maintain 46,6 mm (1.835 in) overall length from the pump housing to the coupler edge **[Figure 20-50-28]**.

Hydraulic Pump Startup

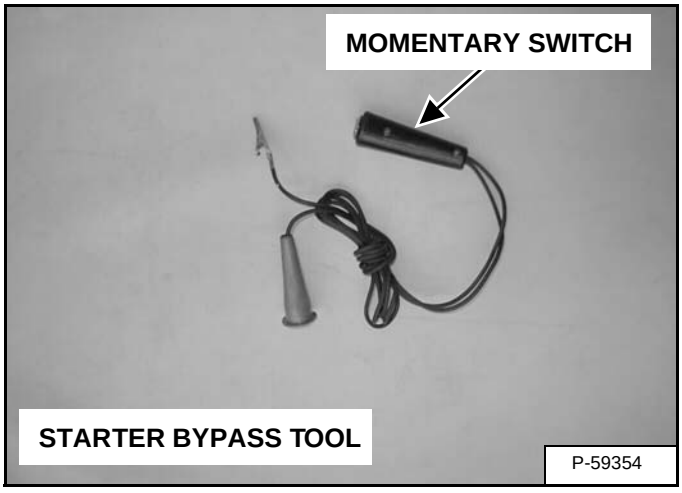
NOTE: This procedure is to prevent a dry startup of the hydraulic pump.

Figure 20-50-29



Loosen the case plug (Item 1) **[Figure 20-50-29]** until all the air is purged from the pump housing.

Figure 20-50-30



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 20-50-30]**.

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 20-50-31

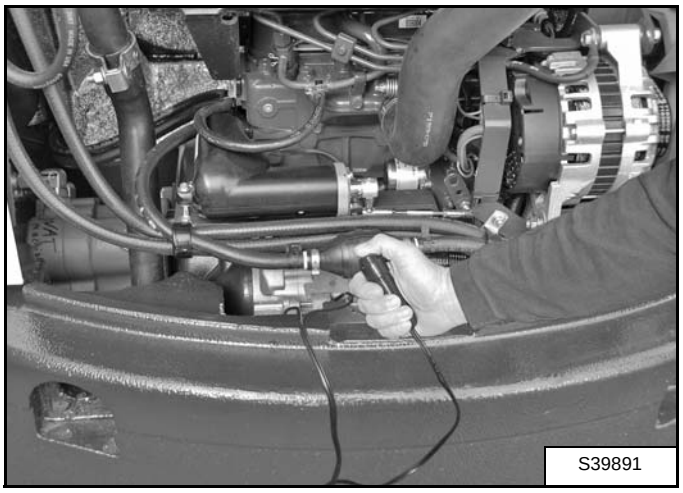
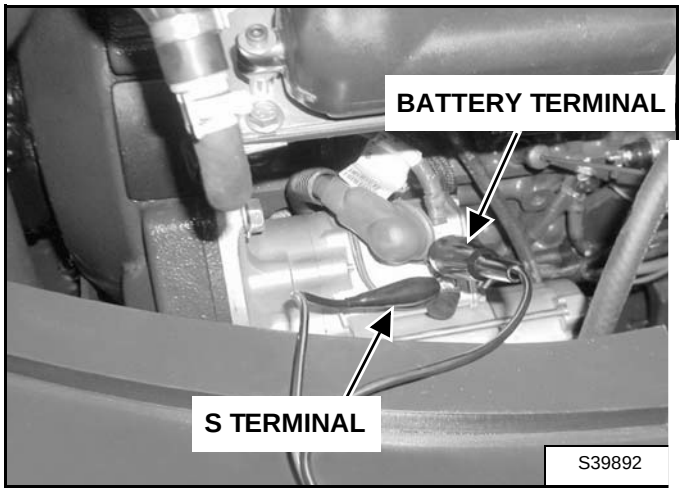


Figure 20-50-32



Connect the starter bypass tool to the starter solenoi 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 20-50-31]** and **[Figure 20-50-32]**.

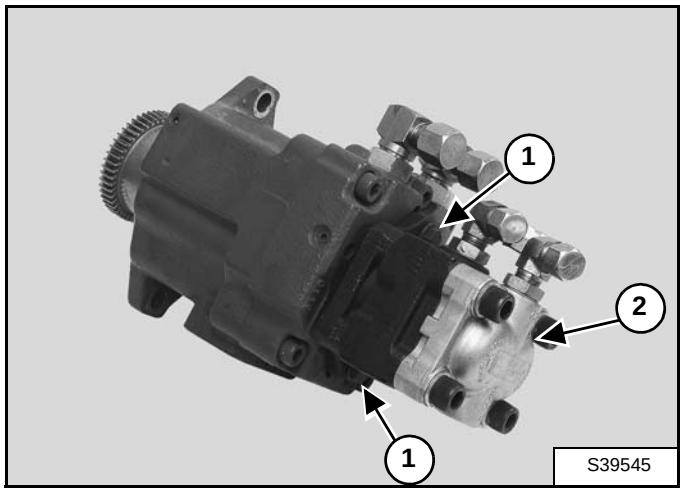
Start the excavator from the operator cab and run the engine at low idle for 1 - 2 minutes without operating the hydraulics.

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 10-120-4.)

Gear Pump Disassembly And Assembly

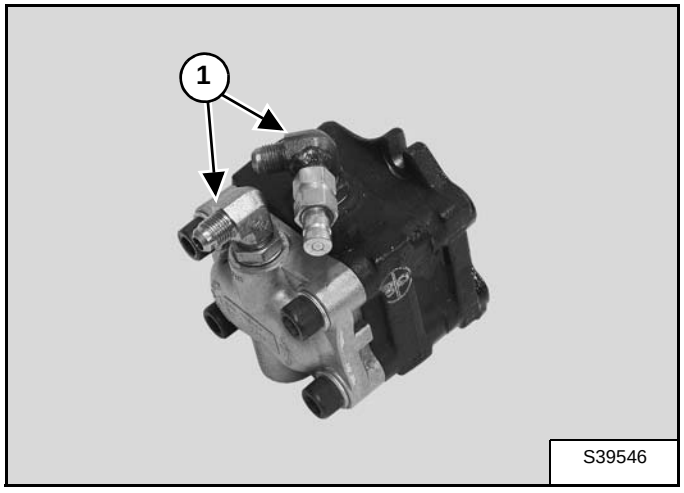
Figure 20-50-33



Remove the two bolts (Item 1) and gear pump (Item 2) **[Figure 20-50-33]**.

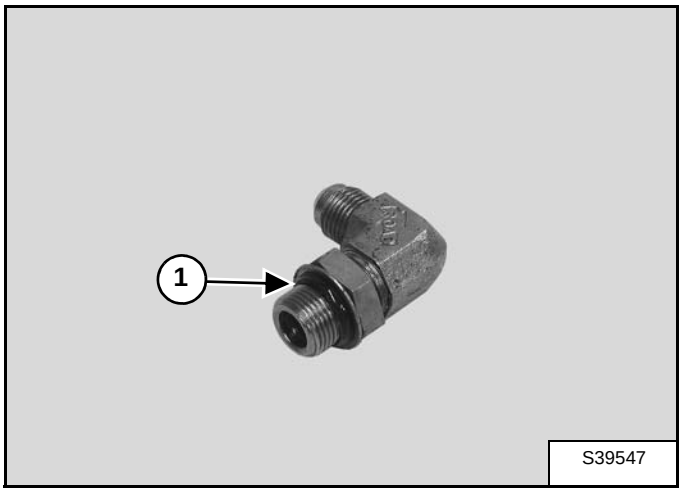
Installation: Tighten the bolts to 20,6 - 24,5 N•m (15.2 - 18.1 ft-lb) torque.

Figure 20-50-34



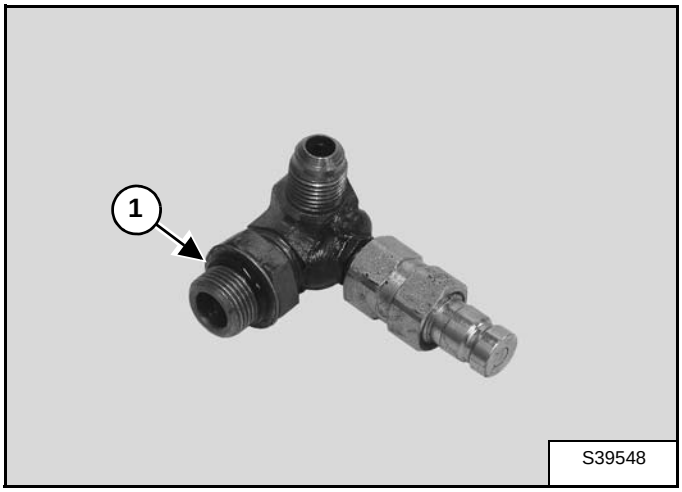
Remove the two fittings (Item 1) **[Figure 20-50-34]**.

Figure 20-50-35



Remove the O-ring (Item 1) **[Figure 20-50-35]** from the fitting.

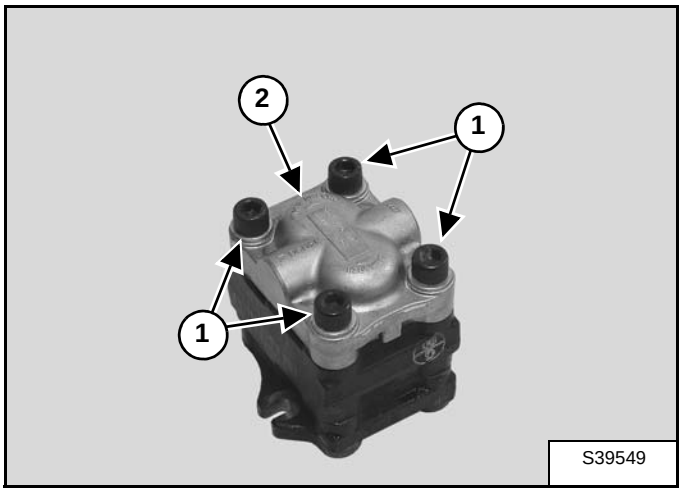
Figure 20-50-36



Remove the O-ring (Item 1) **[Figure 20-50-36]**.

Gear Pump Disassembly And Assembly (Cont'd)

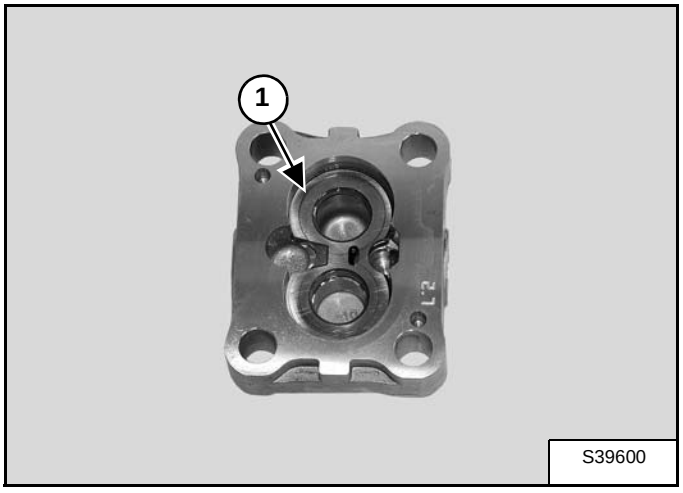
Figure 20-50-37



Remove the four bolts (Item 1) and cover (Item 2) **[Figure 20-50-37]**.

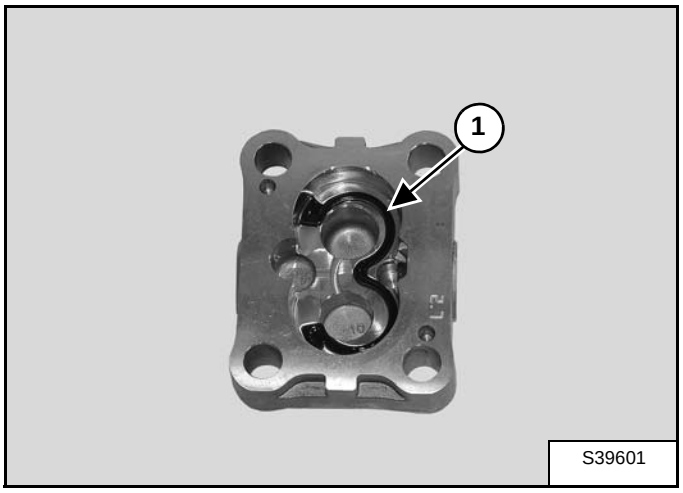
Installation: Tighten the bolts to 26 - 32 N•m (19 - 24 ft-lb) torque.

Figure 20-50-38



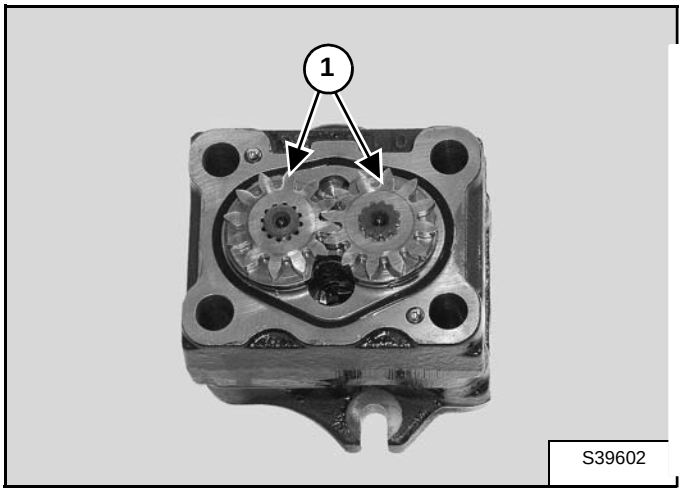
Remove the wear plate (Item 1) **[Figure 20-50-38]** from the cover.

Figure 20-50-39



Remove the seal (Item 1) **[Figure 20-50-39]** from the cover.

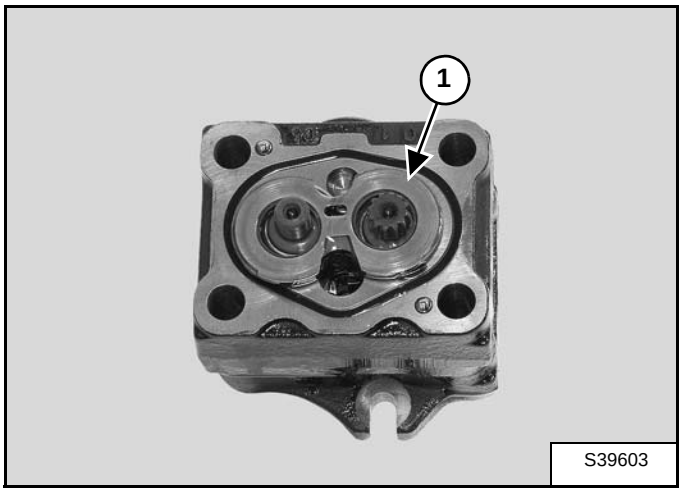
Figure 20-50-40



Remove the two gears (Item 1) **[Figure 20-50-40]**.

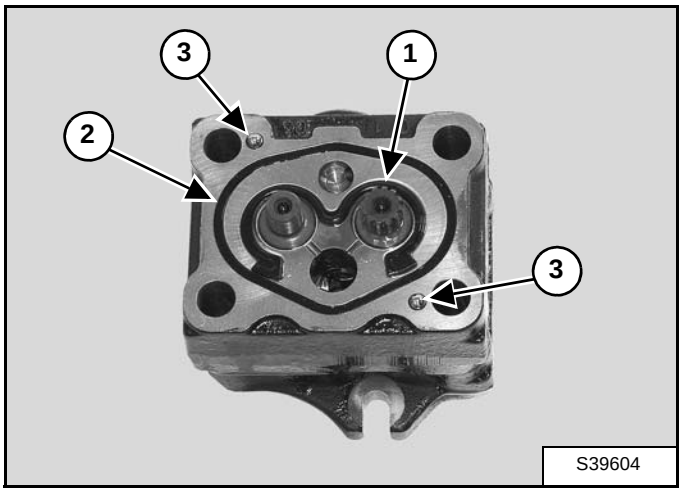
Gear Pump Disassembly And Assembly (Cont'd)

Figure 20-50-41



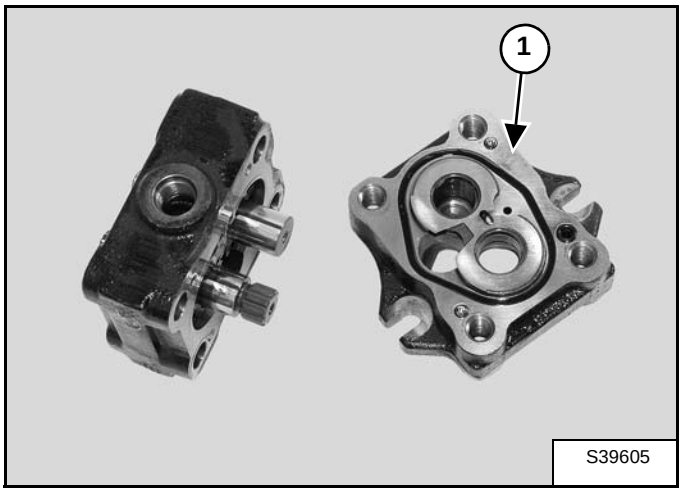
Remove the wear plate (Item 1) **[Figure 20-50-41]**.

Figure 20-50-42



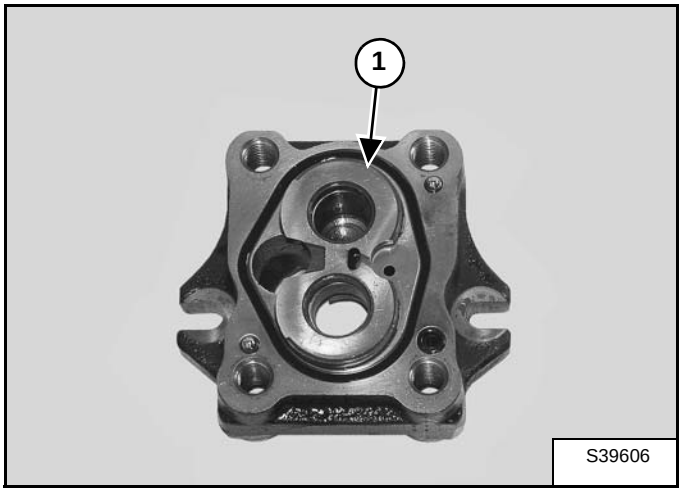
Remove the seal (Item 1), O-ring (Item 2) and two steel balls (Item 3) **[Figure 20-50-42]**.

Figure 20-50-43



Remove the section (Item 1) **[Figure 20-50-43]**.

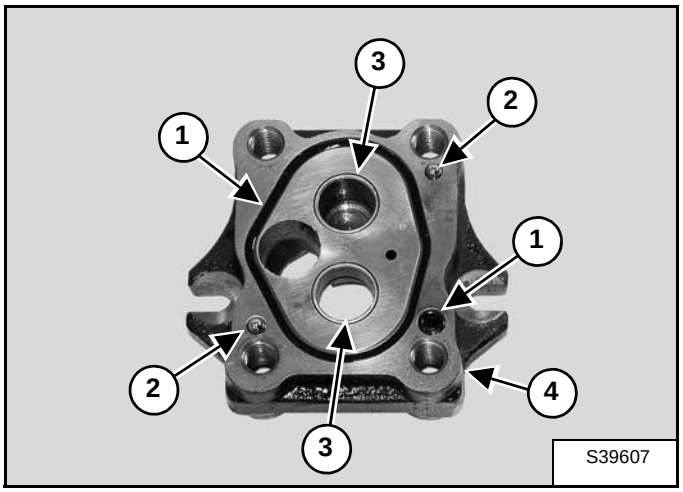
Figure 20-50-44



Remove the wear plate (Item 1) **[Figure 20-50-44]**.

Gear Pump Disassembly And Assembly (Cont'd)

Figure 20-50-45



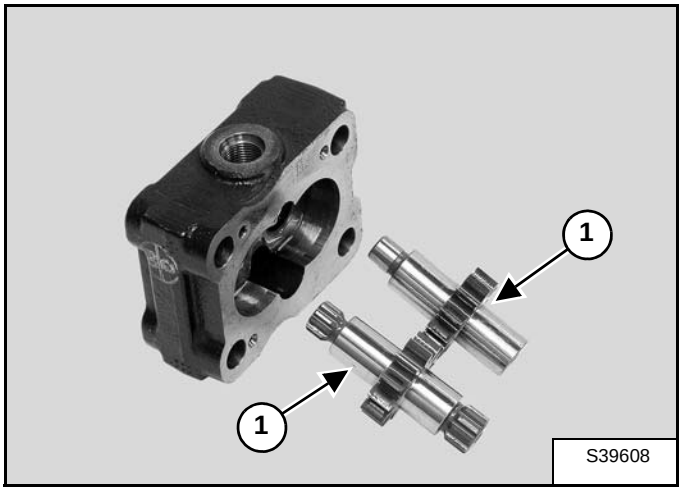
Remove the O-rings (Item 1) **[Figure 20-50-45]**.

Remove the two steel balls (Item 2) **[Figure 20-50-45]**.

Inspect the bushings (Item 3) **[Figure 20-50-45]** for wear or damage.

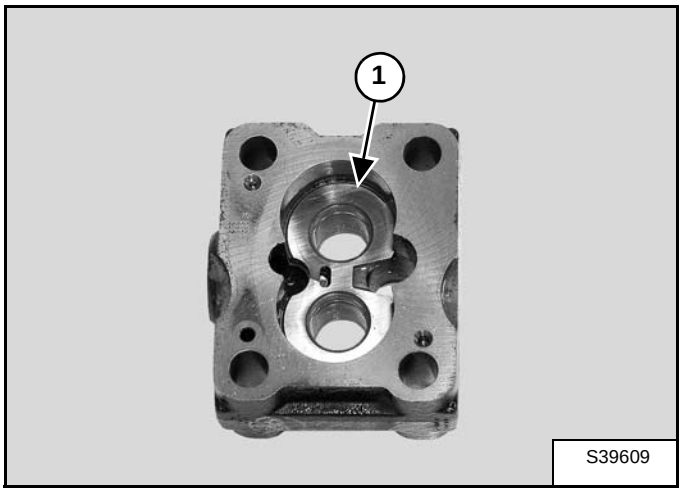
NOTE: The bushings are not serviceable. if the bushings are worn or damaged, replace the housing assembly (Item 4) [Figure 20-50-45].

Figure 20-50-46



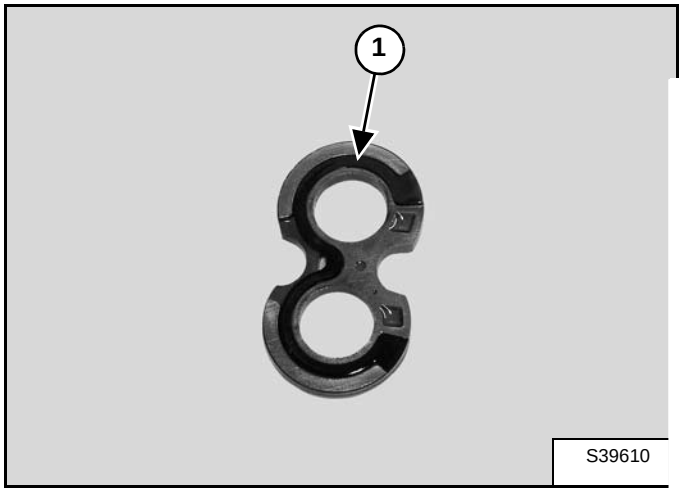
Remove the gears (Item 1) **[Figure 20-50-46]**.

Figure 20-50-47



Remove the wear plate (Item 1) **[Figure 20-50-47]**.

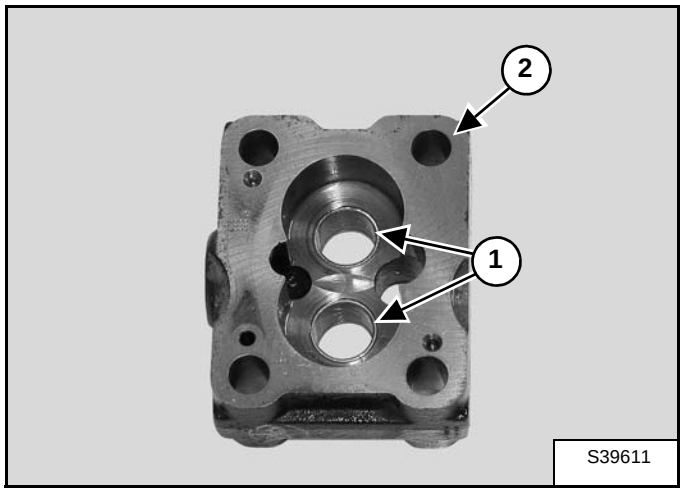
Figure 20-50-48



Remove the seal (Item 1) **[Figure 20-50-48]** from the wear plate.

Gear Pump Disassembly And Assembly (Cont'd)

Figure 20-50-49

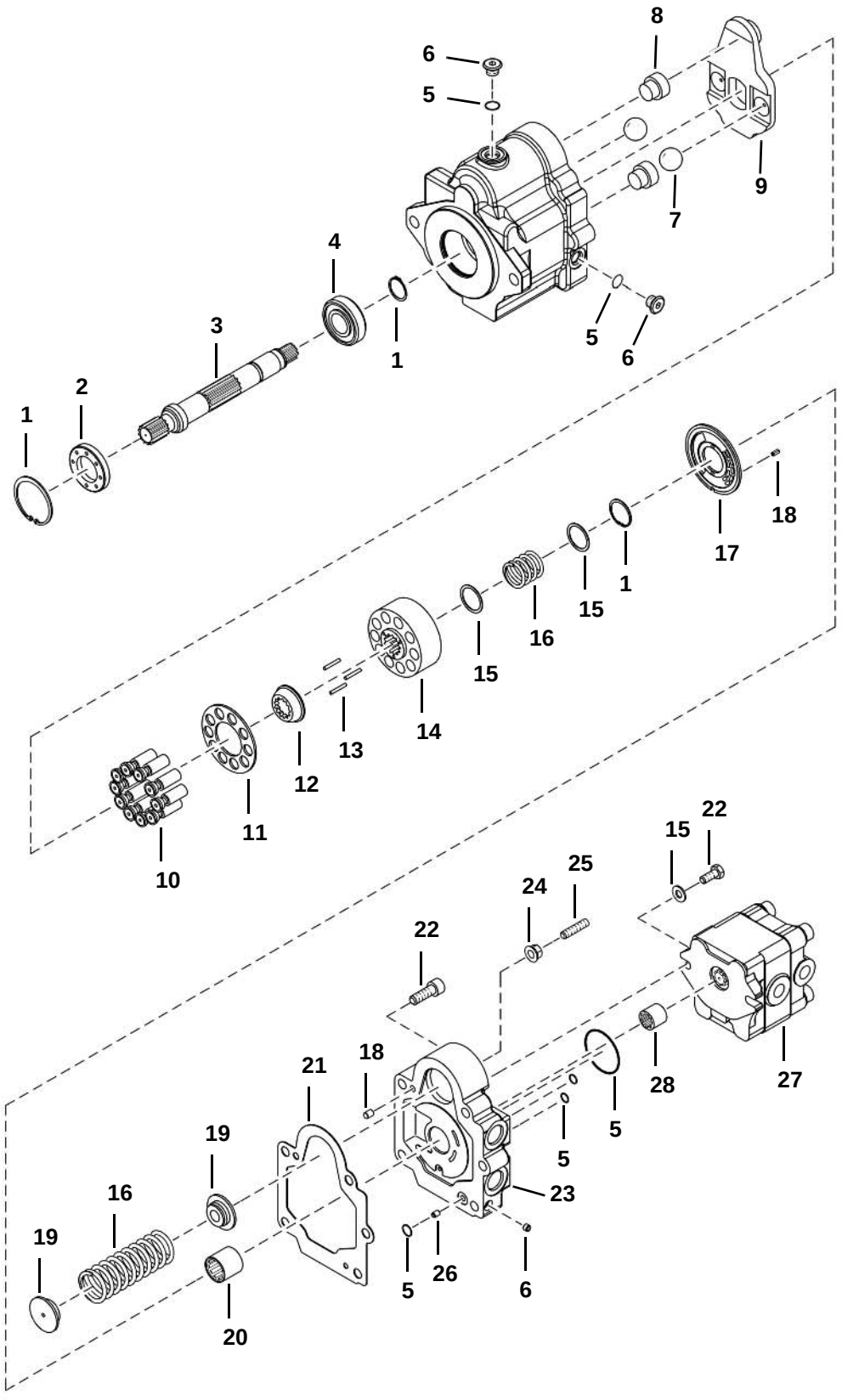


Inspect the bushings (Item 1) **[Figure 20-50-49]** for wear or damage.

NOTE: The bushings are not serviceable. if the bushings are worn or damaged, replace the housing assembly (Item 2) [Figure 20-50-49].

Piston Pump Parts Identification

1. Snap Ring
2. Seal
3. Shaft
4. Bearing
5. O-ring
6. Plug
7. Ball
8. Stopper Pin
9. Swash Plate
10. Pistons
11. Piston Retainer
12. Retainer Guide
13. Pin
14. Cylinder Block
15. Washer
16. Spring
17. Valve Plate
18. Pin
19. Spring Retainer
20. Needle Bearing
21. Gasket
22. Bolt
23. Housing
24. Nut
25. Screw
26. Orifice
27. Gear Pumps
28. Coupler

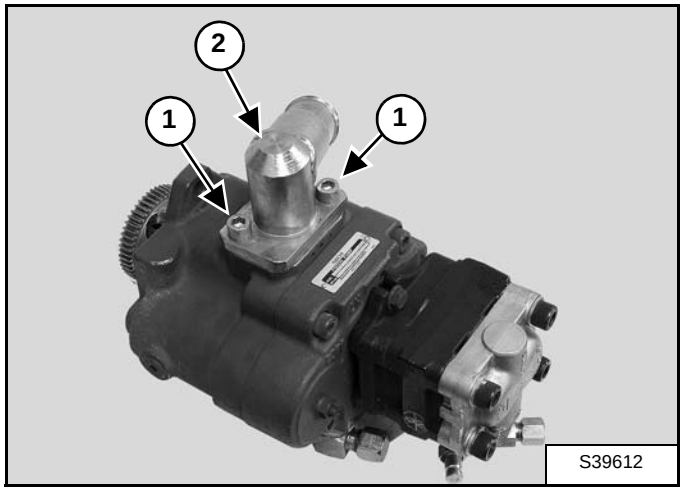


EM9315

Piston Pump Disassembly And Assembly

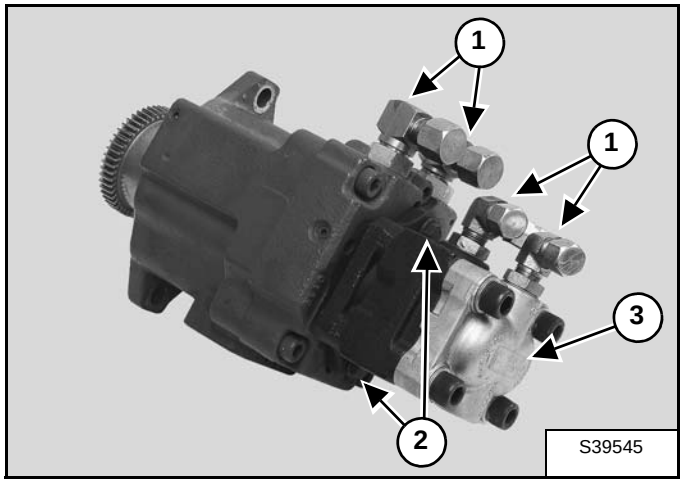
Clean the outside of the hydraulic pump before disassembly.

Figure 20-50-50



Remove the two bolts (Item 1), inlet housing (Item 2) **[Figure 20-50-50]** and O-ring.

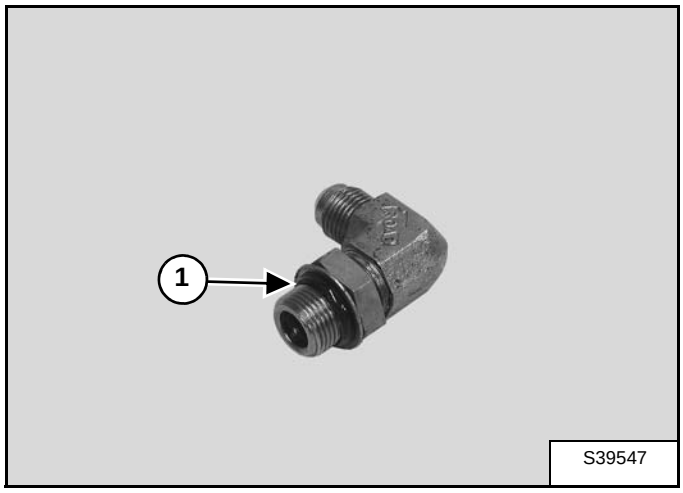
Figure 20-50-51



Remove the fittings (Item 1). Remove the two bolts (Item 2) and remove the gear pump (Item 3) **[Figure 20-50-51]**.

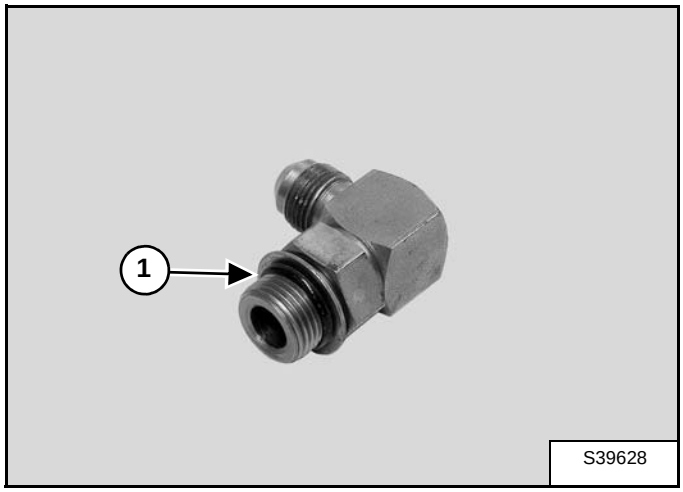
Installation: Tighten the bolts to 20,6 - 24,5 N•m (15.2 - 18.1 ft-lb) torque.

Figure 20-50-52



Remove the O-ring (Item 1) **[Figure 20-50-52]** from the fitting.

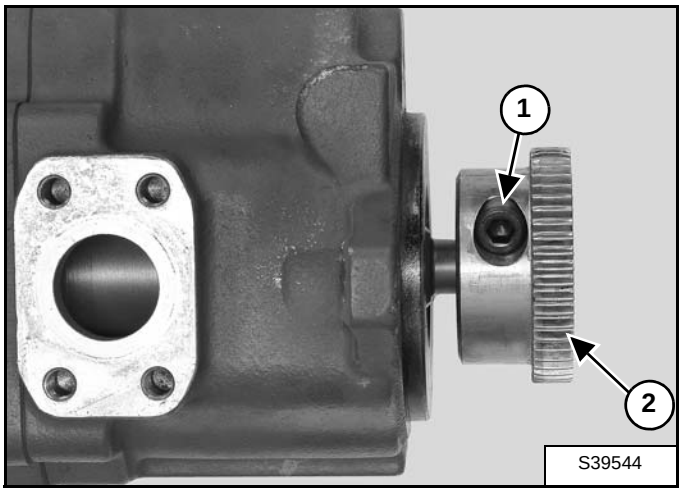
Figure 20-50-53



Remove the O-ring (Item 1) **[Figure 20-50-53]** from the fitting.

Piston Pump Disassembly And Assembly (Cont'd)

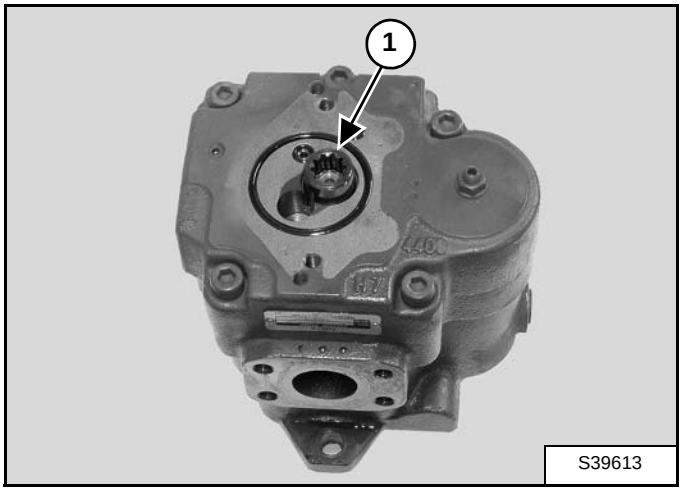
Figure 20-50-54



Remove the bolt (Item 1) and coupler (Item 2) **[Figure 20-50-54]**.

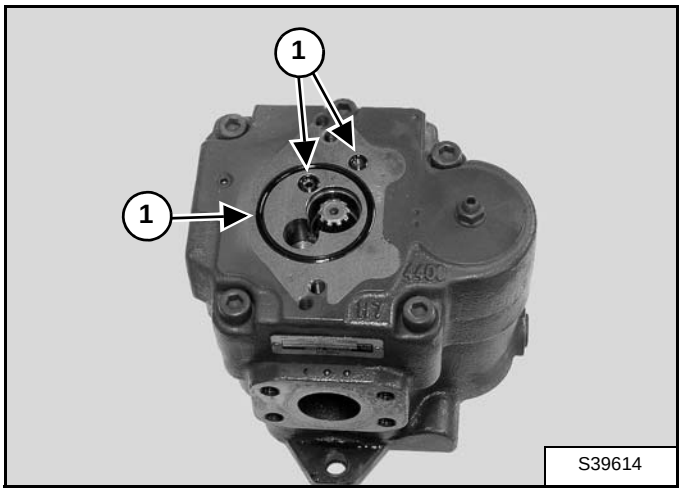
Installation: (See Coupler Removal And Installation on Page 20-50-12.)

Figure 20-50-55



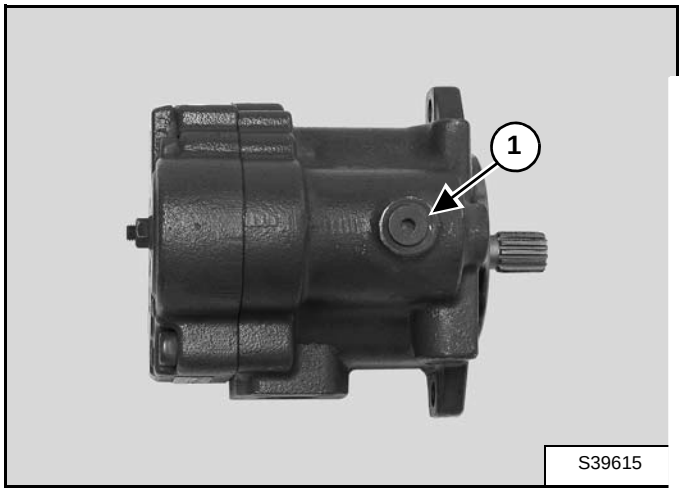
Remove the shaft coupler (Item 1) **[Figure 20-50-55]**.

Figure 20-50-56



Remove the three O-rings (Item 1) **[Figure 20-50-56]**.

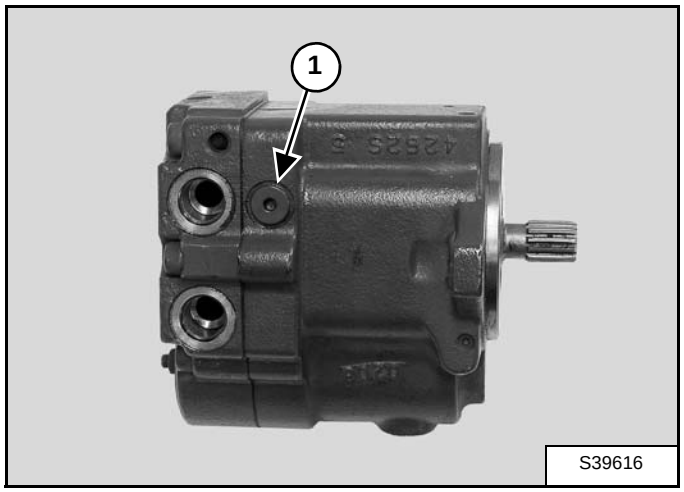
Figure 20-50-57



Remove the plug (Item 1) **[Figure 20-50-57]**.

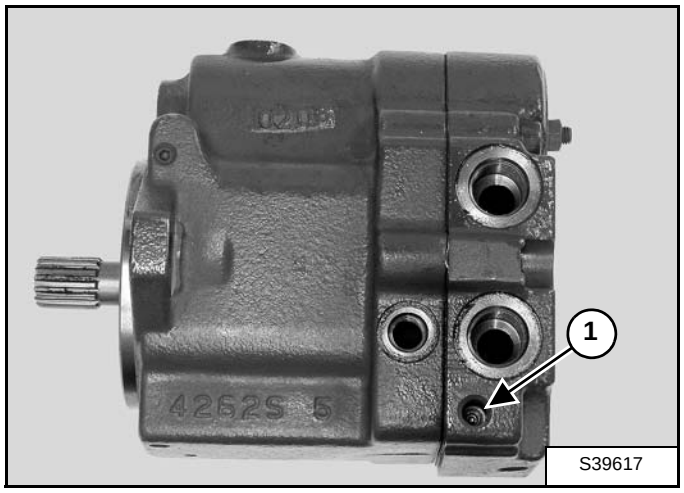
Piston Pump Disassembly And Assembly (Cont'd)

Figure 20-50-58



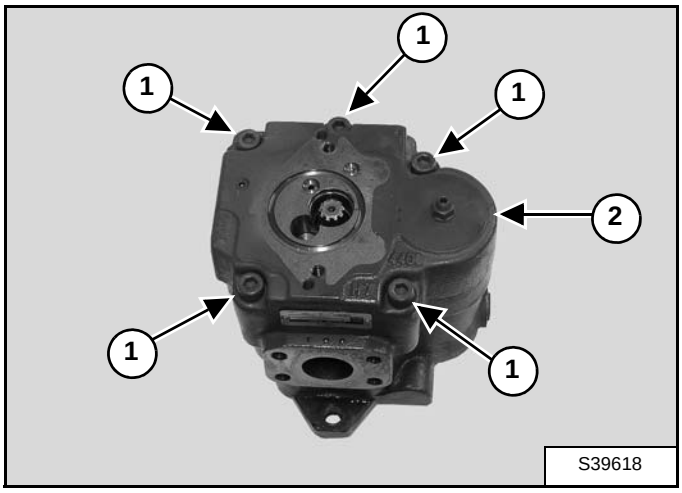
Remove the plug (Item 1) **[Figure 20-50-58]**.

Figure 20-50-59



Remove the plug (Item 1) **[Figure 20-50-59]**.

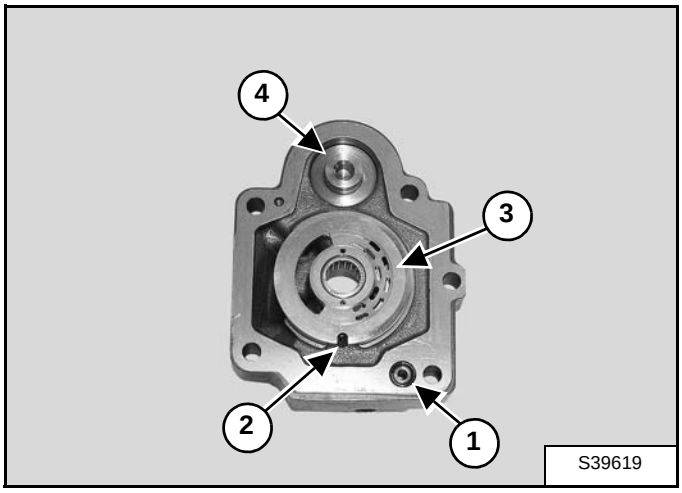
Figure 20-50-60



Remove the five bolts (Item 1) and remove the cover (Item 2) **[Figure 20-50-60]**.

Installation: Tighten the bolts to 54 - 63,7 N•m (39.8 - 47.0 ft-lb) torque.

Figure 20-50-61



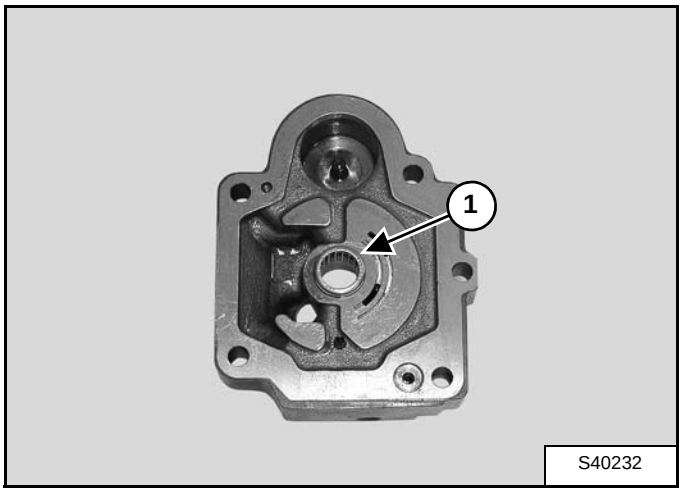
Remove the O-ring (Item 1) **[Figure 20-50-61]**.

Remove the roll pin (Item 2) and wear plate (Item 3) **[Figure 20-50-61]**.

Remove the spring holder (Item 4) **[Figure 20-50-61]**.

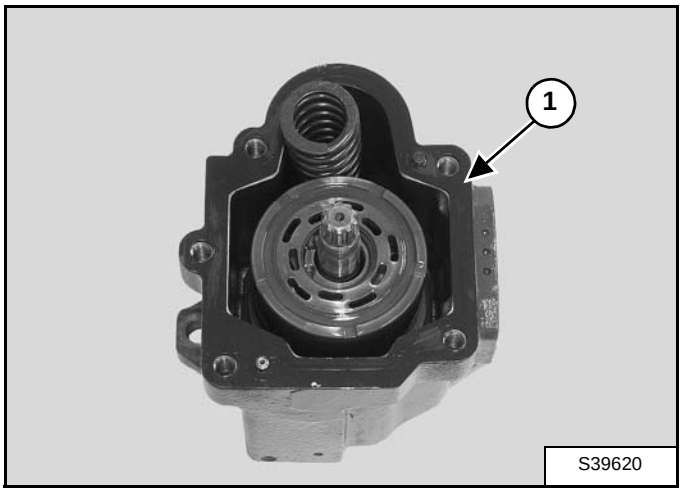
Piston Pump Disassembly And Assembly (Cont'd)

Figure 20-50-62



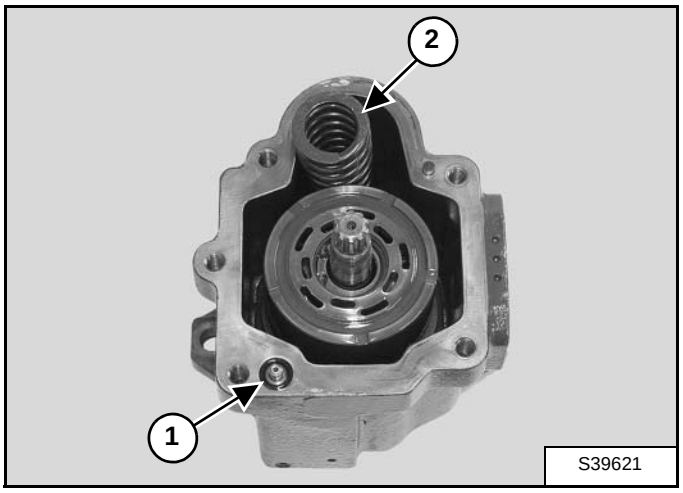
Remove the needle bearing (Item 1) **[Figure 20-50-62]**.

Figure 20-50-63



Remove the gasket (Item 1) **[Figure 20-50-63]**.

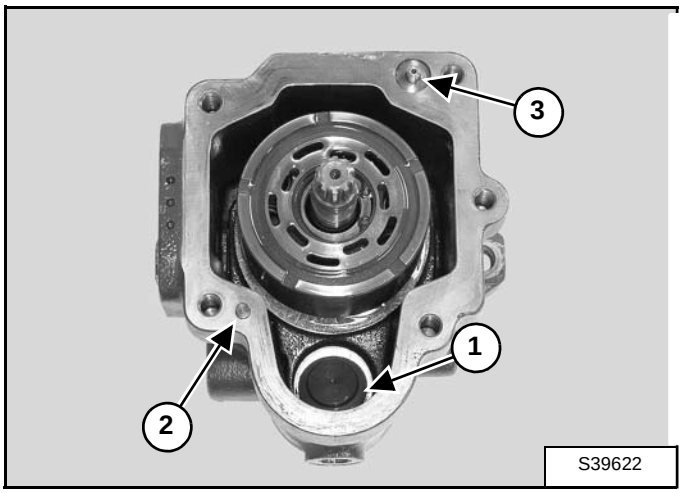
Figure 20-50-64



Remove the O-ring (Item 1) **[Figure 20-50-64]**.

Remove the spring (Item 2) **[Figure 20-50-64]**.

Figure 20-50-65



Remove the spring seat (Item 1) **[Figure 20-50-65]**.

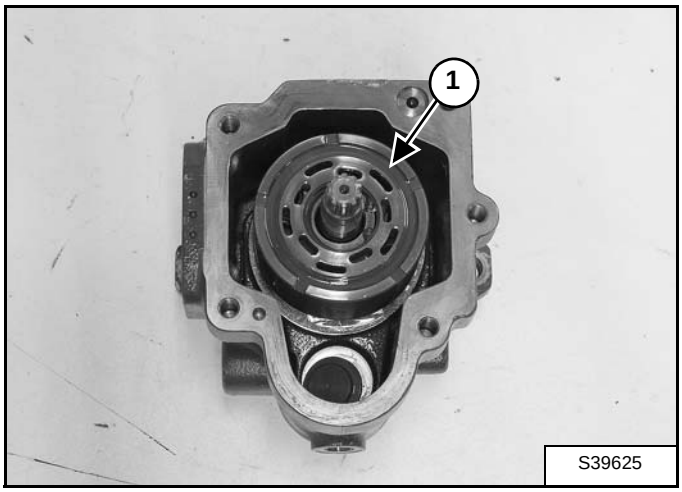
Remove the pin (Item 2) **[Figure 20-50-65]**.

Remove the orifice (Item 3) **[Figure 20-50-65]**.

Inspect the orifice for damage and contamination.

Piston Pump Disassembly And Assembly (Cont'd)

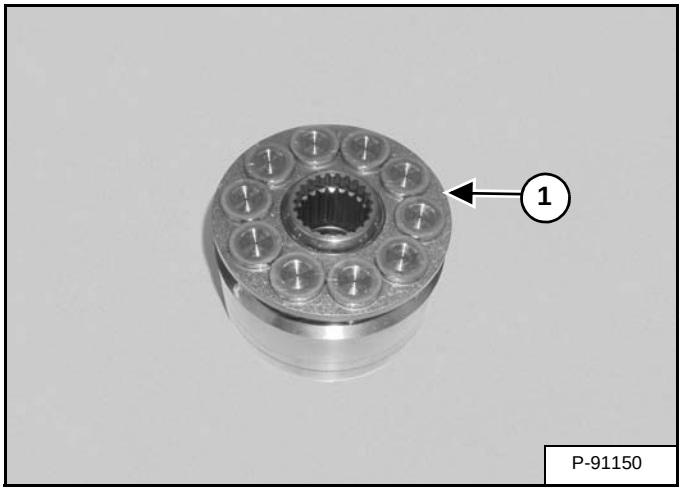
Figure 20-50-66



Remove the rotating group (Item 1) **[Figure 20-50-66]**.

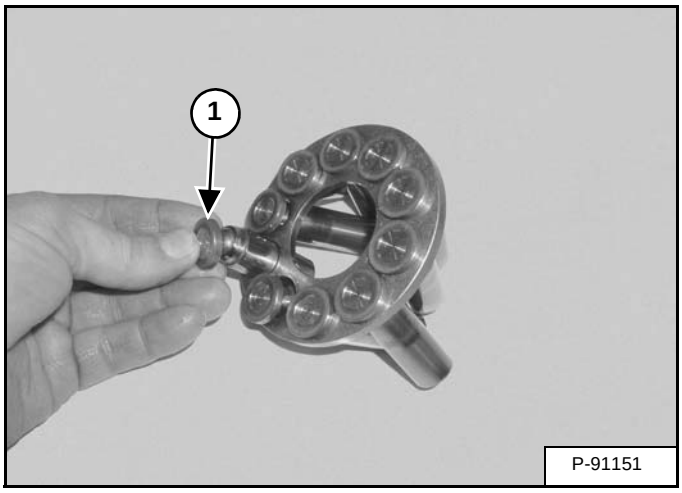
NOTE: Make sure to keep the rotating group assembled upon removal. The piston / retainer assembly (Item 1) [Figure 20-50-67] may come loose.

Figure 20-50-67



Remove the piston / retainer assembly (Item 1) **[Figure 20-50-67]**.

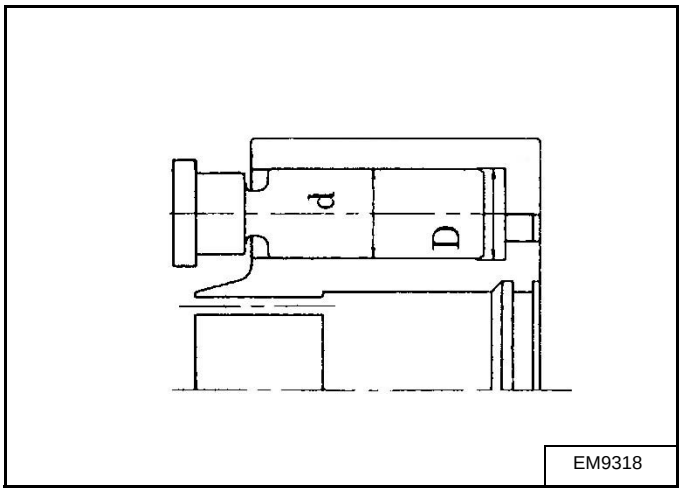
Figure 20-50-68



Remove the pistons (Item 1) **[Figure 20-50-68]** from the retainer.

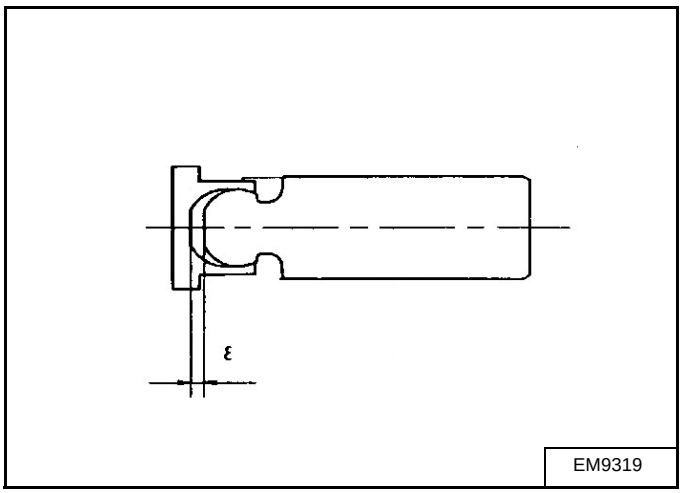
Piston Pump Disassembly And Assembly (Cont'd)

Figure 20-50-69



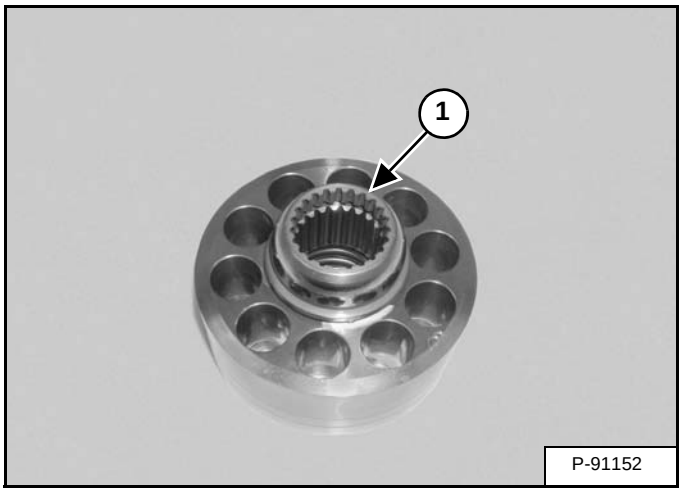
Inspect the difference between the inner diameter of cylinder barrel (D) and the outer diameter of piston (d) **[Figure 20-50-69]**. The difference should be less than 0.05 mm (0.002 in).

Figure 20-50-70



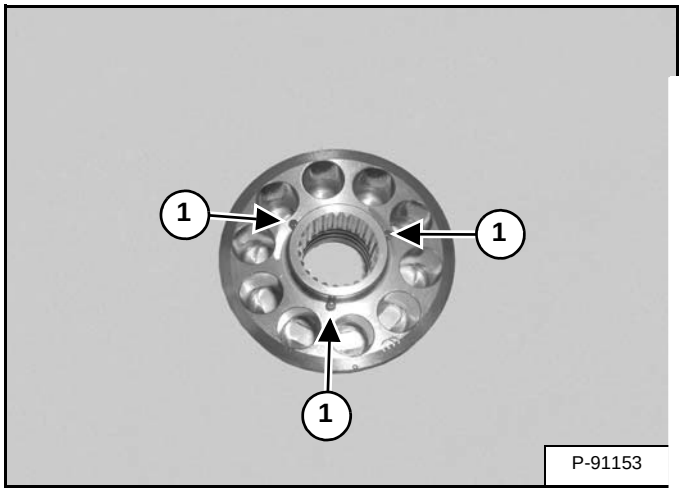
The clearance between the piston and shoe **[Figure 20-50-70]** should be less than 0.2 mm (0.008 in).

Figure 20-50-71



Remove the retainer guide (Item 1) **[Figure 20-50-71]**.

Figure 20-50-72

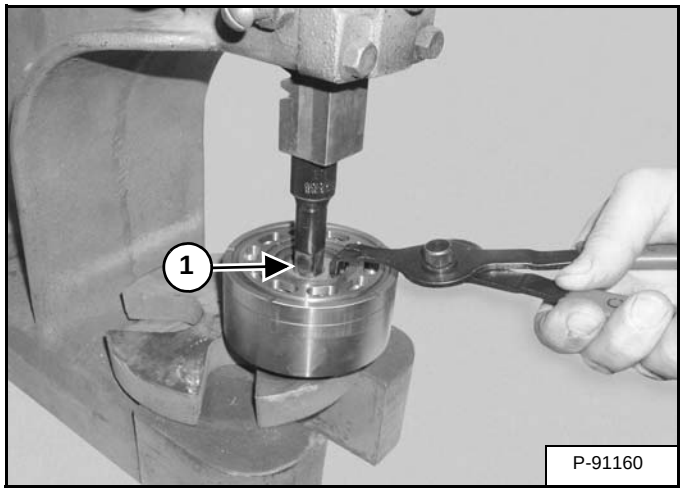


Remove the three pins (Item 1) **[Figure 20-50-72]**.

Check pins (Item 1) **[Figure 20-50-72]** to see if they are all the same length.

Piston Pump Disassembly And Assembly (Cont'd)

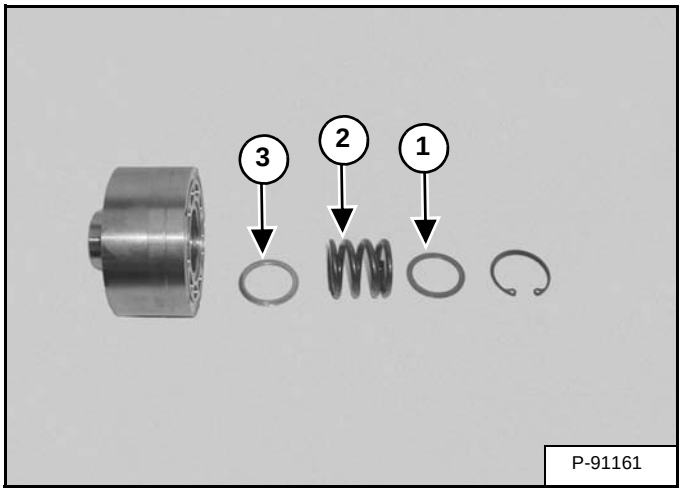
Figure 20-50-73



Using a press and an appropriate sized spacer (Item 1) **[Figure 20-50-73]**, compress the spring in the cylinder block.

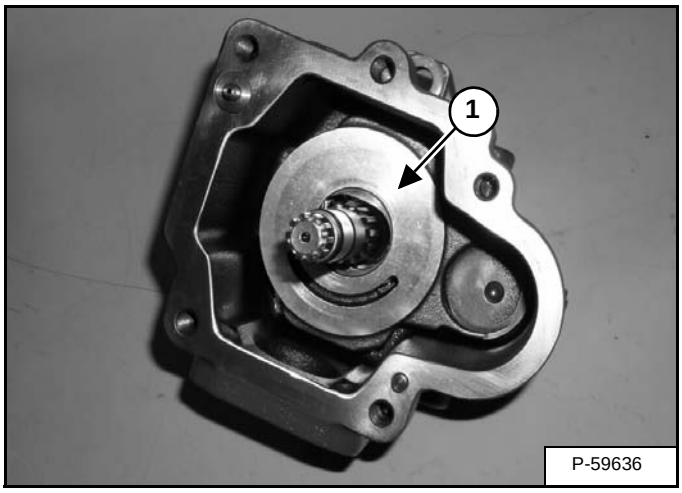
Remove the snap ring **[Figure 20-50-73]**.

Figure 20-50-74



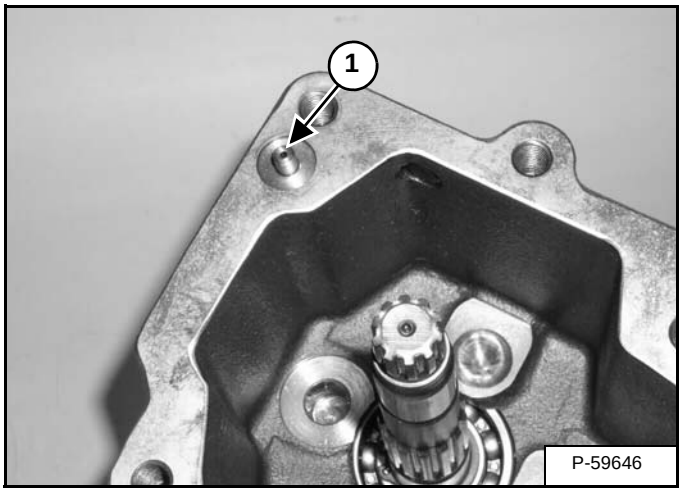
Remove the top washer (Item 1), spring (Item 2) and bottom washer (Item 3) **[Figure 20-50-74]**.

Figure 20-50-75



Remove the swash plate (Item 1) **[Figure 20-50-75]** from the pump housing.

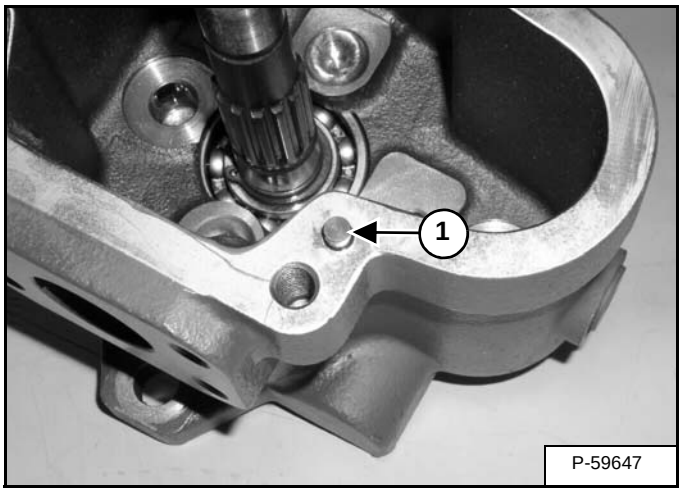
Figure 20-50-76



Remove the pin (Item 1) **[Figure 20-50-76]** from the pump housing.

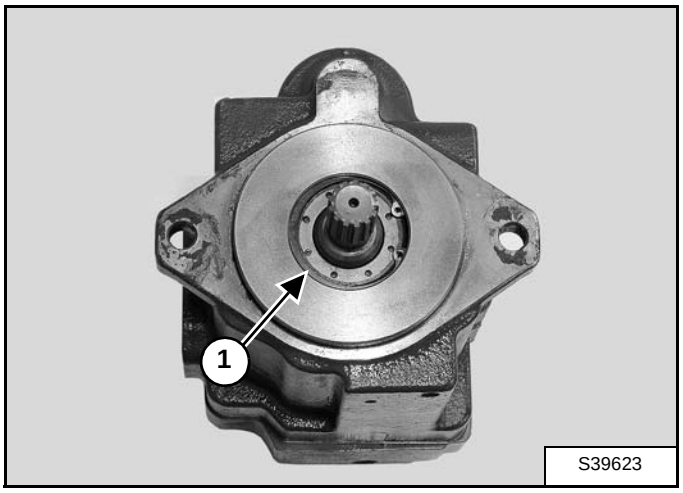
Piston Pump Disassembly And Assembly (Cont'd)

Figure 20-50-77



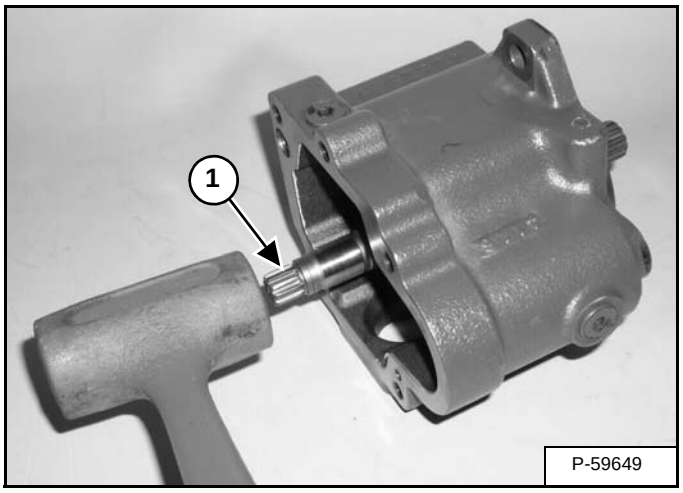
Remove the pin (Item 1) **[Figure 20-50-77]** from the pump housing.

Figure 20-50-78



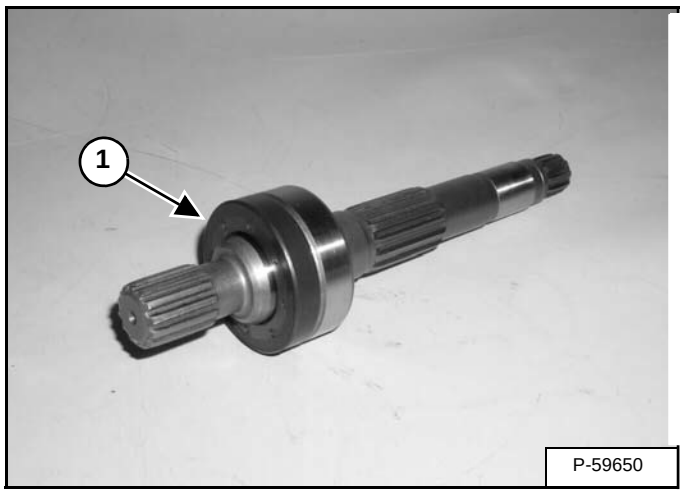
Remove the snap ring (Item 1) **[Figure 20-50-78]**.

Figure 20-50-79



Remove the shaft bearing assembly (Item 1) **[Figure 20-50-79]** from the pump housing by tapping the other end of the shaft.

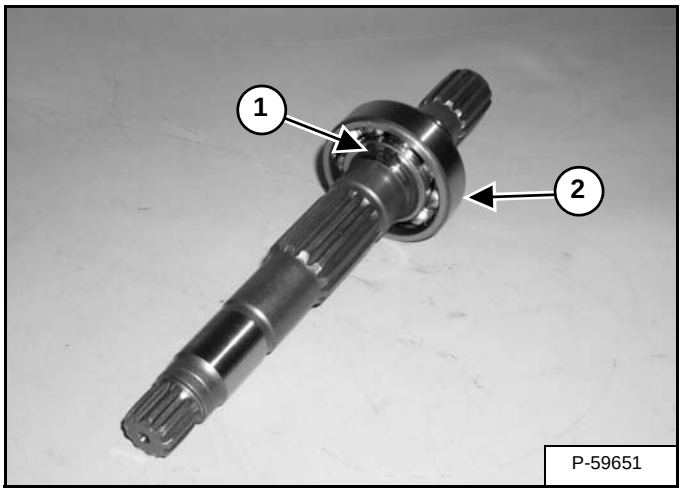
Figure 20-50-80



Remove the seal (Item 1) **[Figure 20-50-80]** from the shaft.

Piston Pump Disassembly And Assembly (Cont'd)

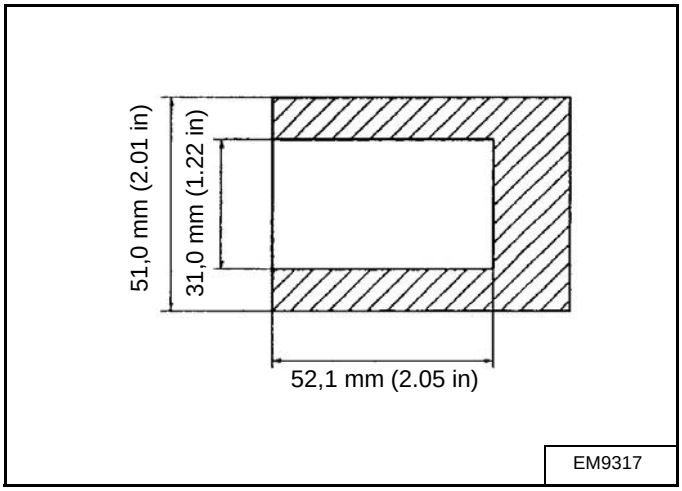
Figure 20-50-81



Remove the snap ring (Item 1) **[Figure 20-50-81]** from the shaft.

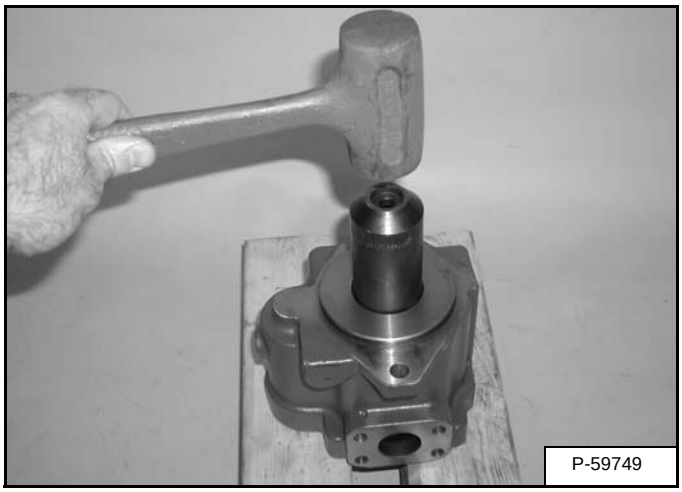
Remove the bearing (Item 2) **[Figure 20-50-81]** from the shaft.

Figure 20-50-82



Installation: Manufacture or find a tool with dimensions as shown **[Figure 20-50-82]**, needed to install the oil seal into the pump housing.

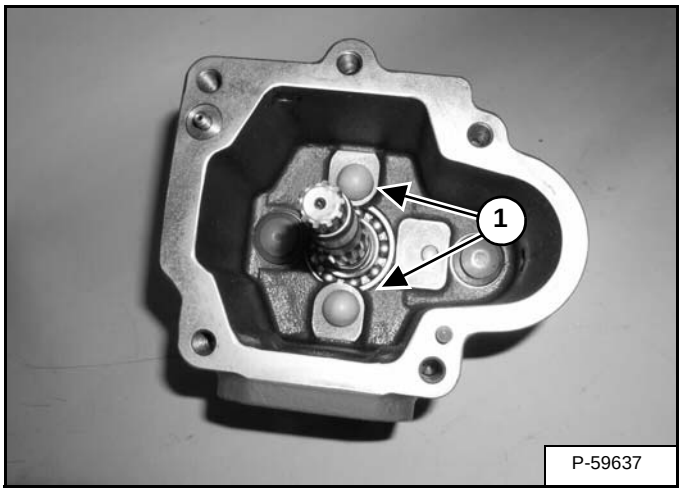
Figure 20-50-83



Installation: Install the shaft bearing and seal assembly **[Figure 20-50-79]** into the pump housing by using the special tooling **[Figure 20-50-82]** and **[Figure 20-50-83]**.

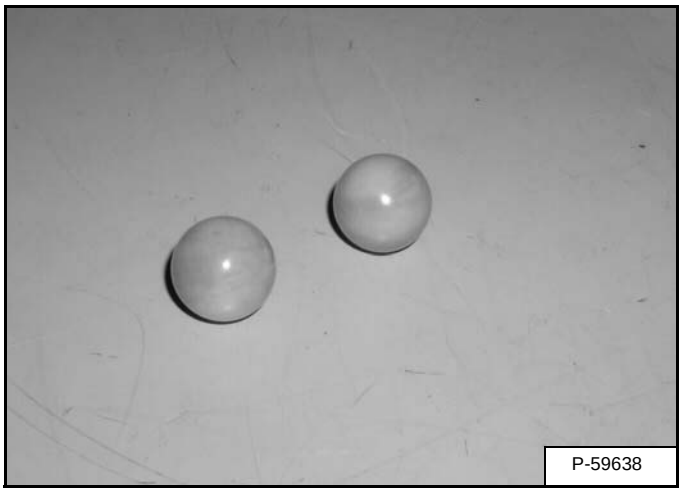
Piston Pump Disassembly And Assembly (Cont'd)

Figure 20-50-84



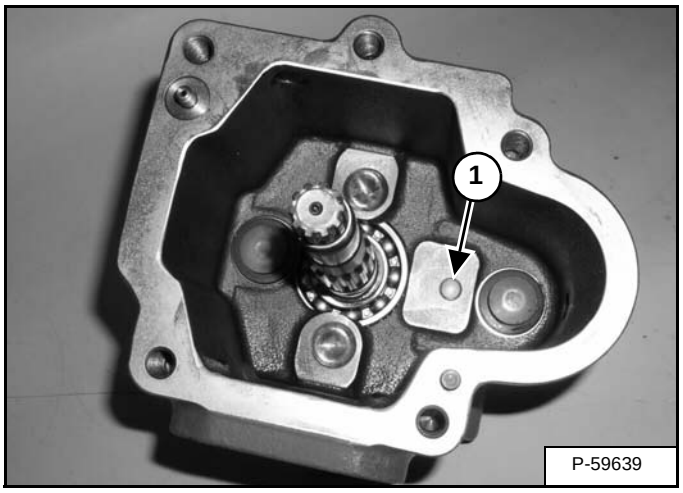
Remove the balls (Item 1) **[Figure 20-50-84]** from the pump housing.

Figure 20-50-85



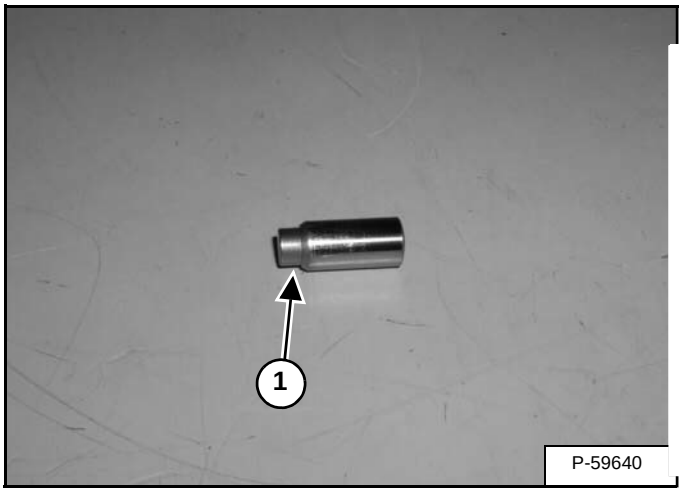
Visually inspect the balls for scratches, abnormal wear or damage **[Figure 20-50-85]**.

Figure 20-50-86



Remove the rod (Item 1) **[Figure 20-50-86]** from the pump housing.

Figure 20-50-87



Installation: The step in the rod (Item 1) **[Figure 20-50-87]** must be inserted into the pump housing first.

Piston Pump Disassembly (Cont'd)

Figure 20-50-88

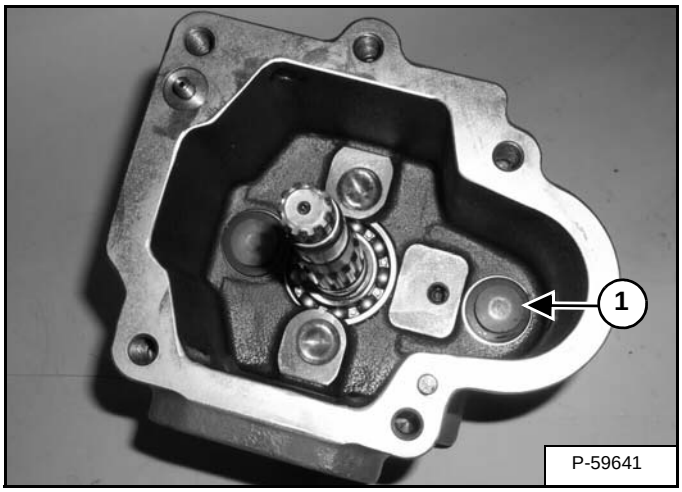
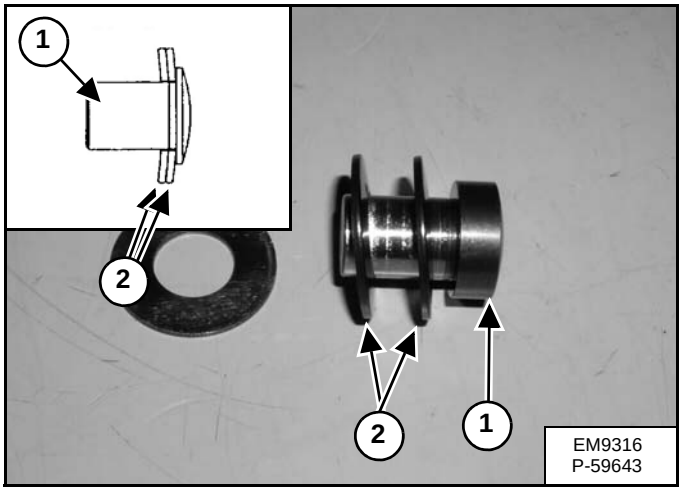


Figure 20-50-89



Remove the stopper pin A (Item 1) **[Figure 20-50-88]** and **[Figure 20-50-89]** and the two spring washers (Item 2) **[Figure 20-50-89]** from the pump housing.

Figure 20-50-90

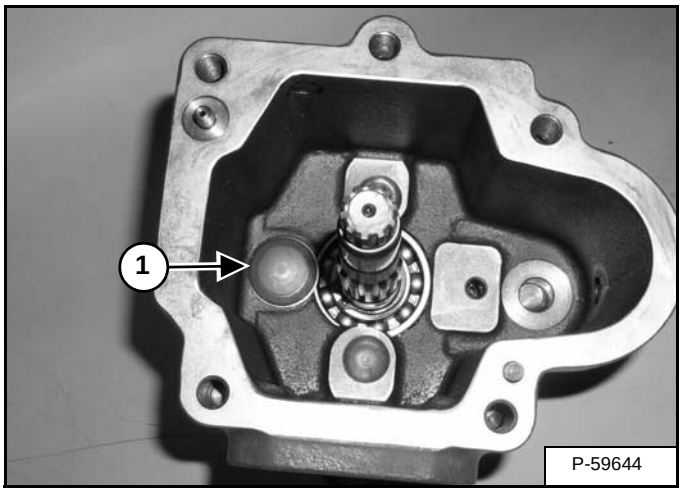
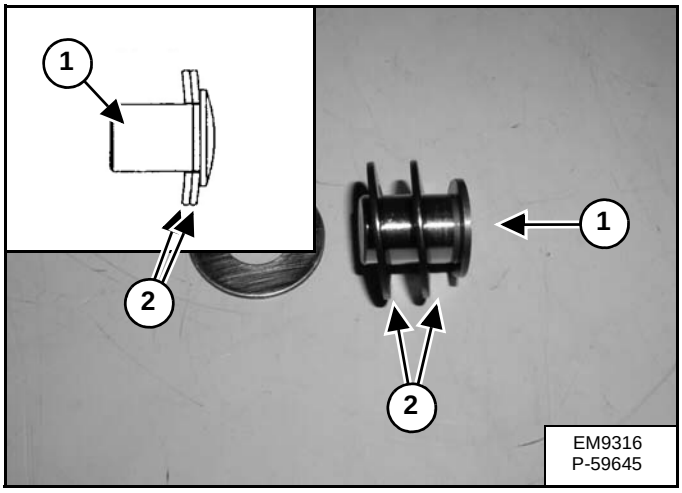


Figure 20-50-91



Remove the stopper pin B (Item 1) **[Figure 20-50-90]** and **[Figure 20-50-91]** and the two spring washers (Item 2) **[Figure 20-50-91]** from the pump housing.

MANIFOLD ASSEMBLY / ACCUMULATOR

Description

The manifold body contains a two speed solenoid and a console (joystick) lockout solenoid.

There is a 3,2 MPa (32 bar) (464 psi) pilot relief valve.

The body is connected to the accumulator.

The manifold supplies target pressure of 3,2 MPa (32 bar) (464 psi) with an acceptable range of 3,2 - 3,5 MPa (32 - 35 bar) (464 - 508 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 switch in the ON position.

Removal And Installation

With the engine off, turn the key switch 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 10-120-4.)

Remove the left upperstructure cover. (See Removal And Installation on Page 40-70-1.)

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

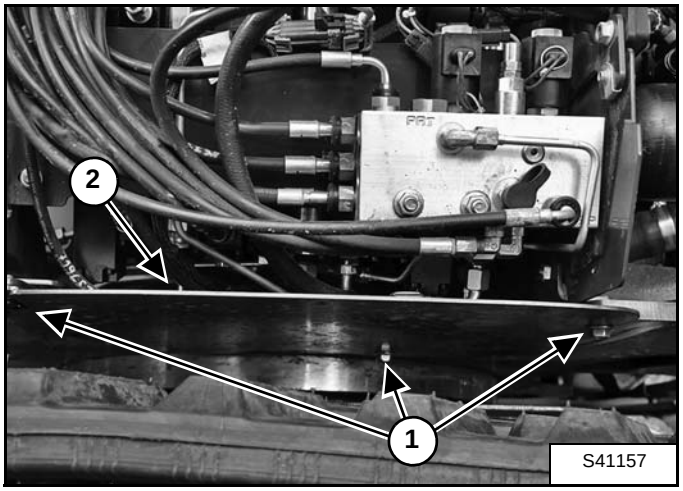
⚠ WARNING

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

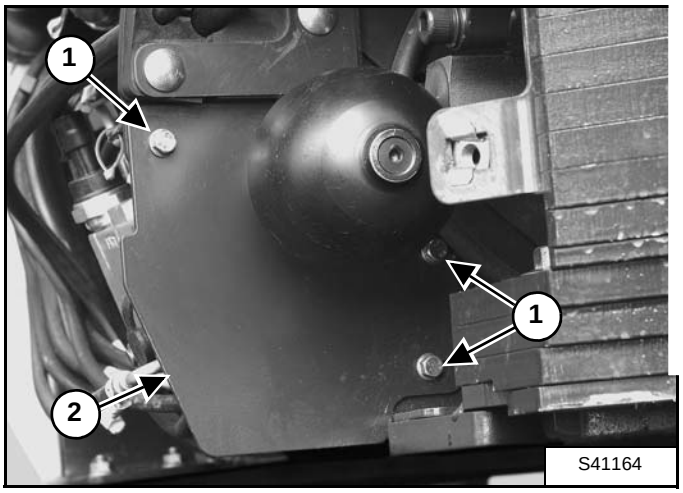
NOTE: Mark the hoses, tubelines and wire harnesses for correct installation.

Figure 20-60-1



Remove the three bolts (Item 1) and the bottom plate (Item 2) **[Figure 20-60-1]**.

Figure 20-60-2

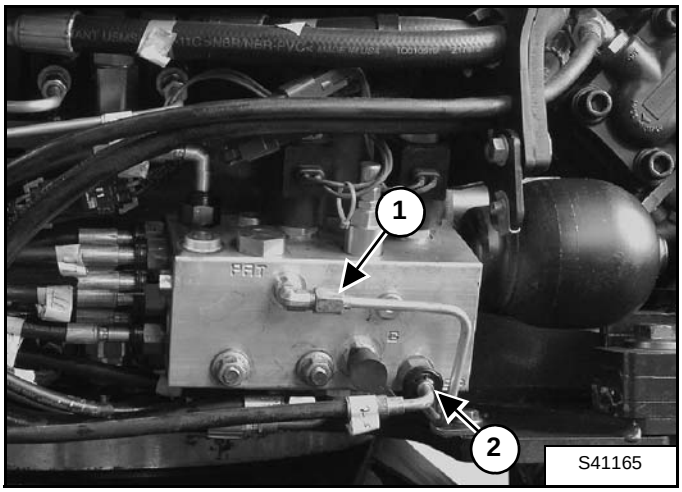


Remove the three bolts (Item 1) and the bracket (Item 2) **[Figure 20-60-2]**.

MANIFOLD ASSEMBLY / ACCUMULATOR (CONT'D)

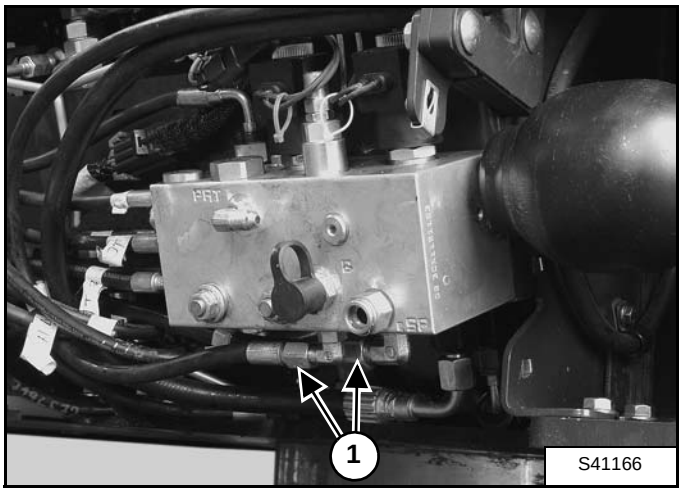
Removal And Installation (Cont'd)

Figure 20-60-3



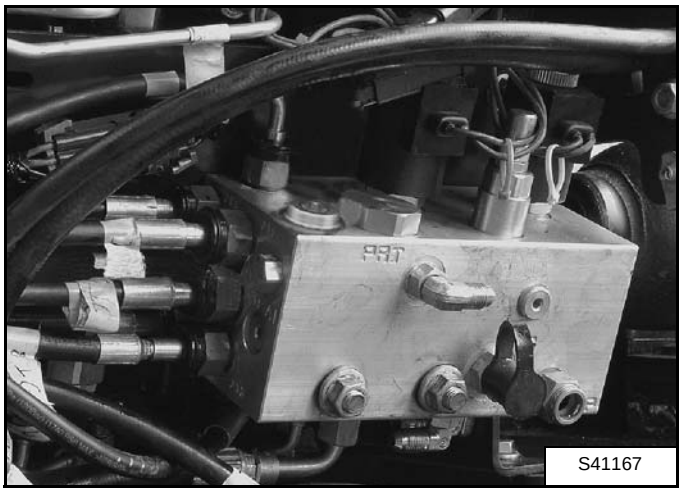
Remove tubeline (Item 1) and disconnect hose (Item 2) **[Figure 20-60-3]** from the manifold.

Figure 20-60-4



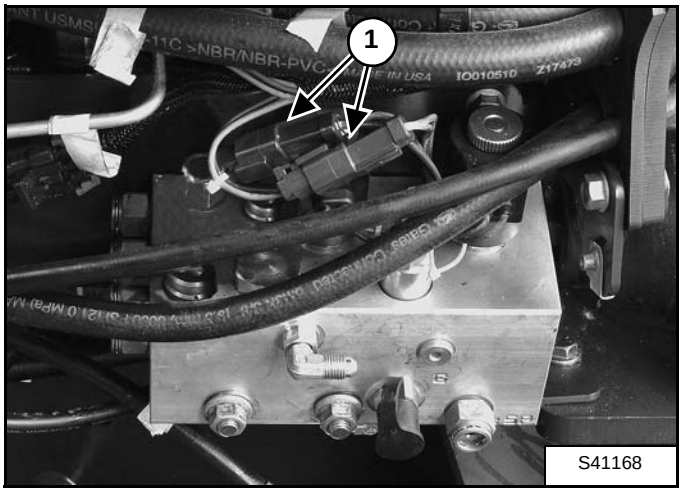
Disconnect the two hoses (Item 1) **[Figure 20-60-4]** from the bottom of the manifold.

Figure 20-60-5



Disconnect the seven hoses from the side of the manifold **[Figure 20-60-5]**.

Figure 20-60-6



Disconnect the wire harnesses (Item 1) from the coils **[Figure 20-60-6]**.

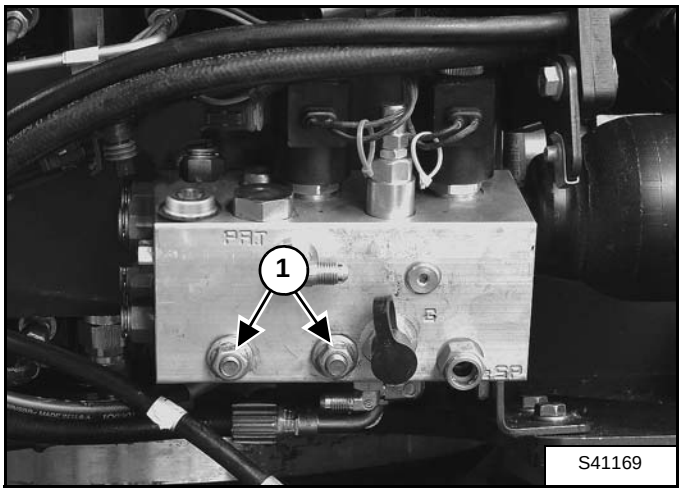
Installation: The harness and the solenoids have color coded tie-straps for correct installation of the harness connectors:

- Yellow = 2nd speed solenoid
- Green = Console (joystick) lockout solenoid

If any tie-straps are missing, mark the connectors for ease of installation.

Removal And Installation (Cont'd)

Figure 20-60-7

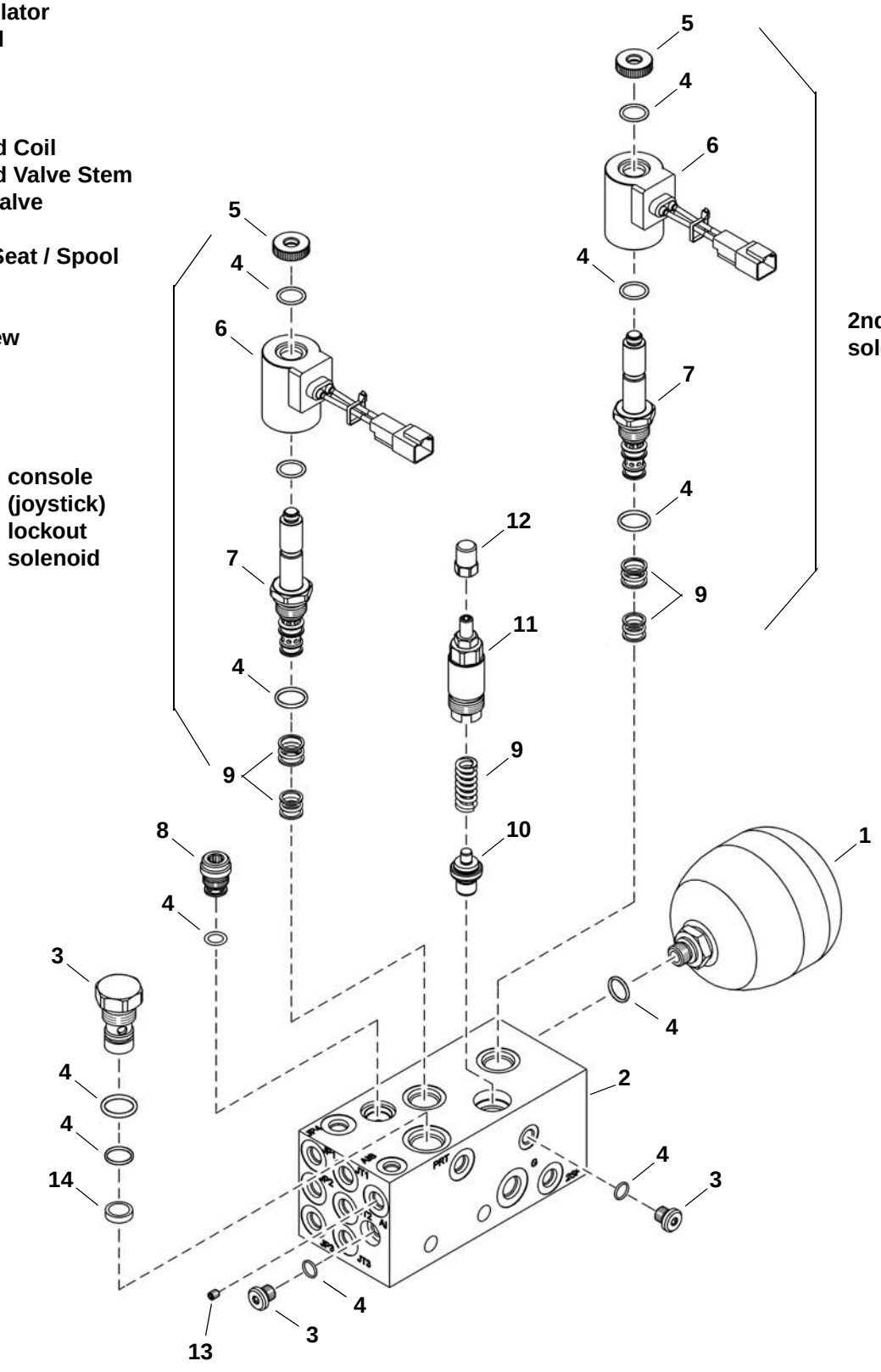


Remove the nuts (Item 1) **[Figure 20-60-7]** and remove the manifold.

MANIFOLD ASSEMBLY / ACCUMULATOR (CONT'D)

Parts Identification

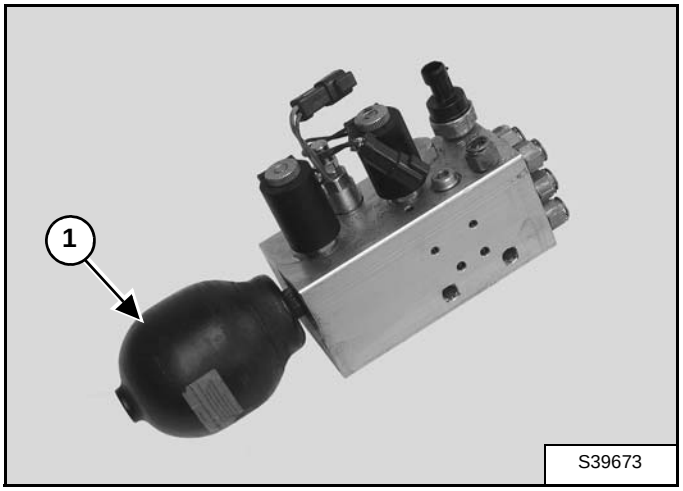
1. Accumulator
2. Manifold
3. Plug
4. O-ring
5. Nut
6. Solenoid Coil
7. Solenoid Valve Stem
8. Check Valve
9. Spring
10. Spring Seat / Spool
11. Body
12. Cap
13. Set Screw
14. Screen



Disassembly And Assembly

Clean the outside of the manifold assembly / accumulator before disassembly.

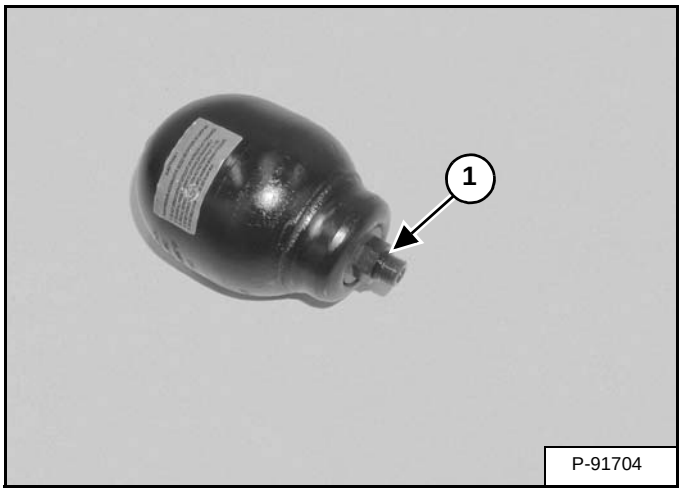
Figure 20-60-8



Remove the accumulator (Item 1) **[Figure 20-60-8]** from the manifold.

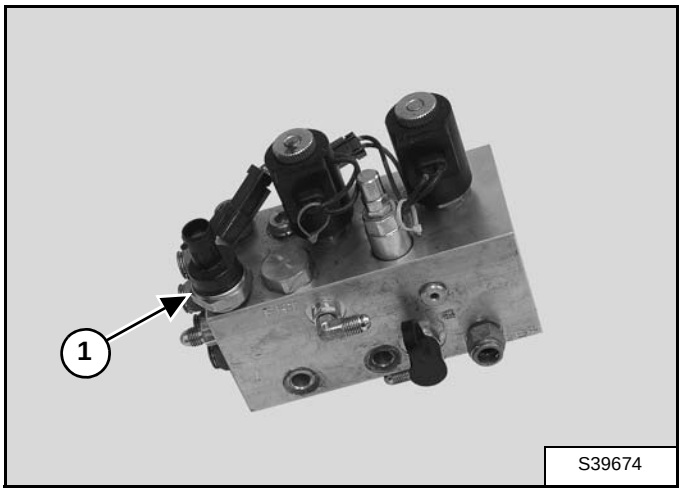
Installation: Tighten the accumulator to 40 - 45 N•m (29.5 - 33.2 ft-lb) torque.

Figure 20-60-9



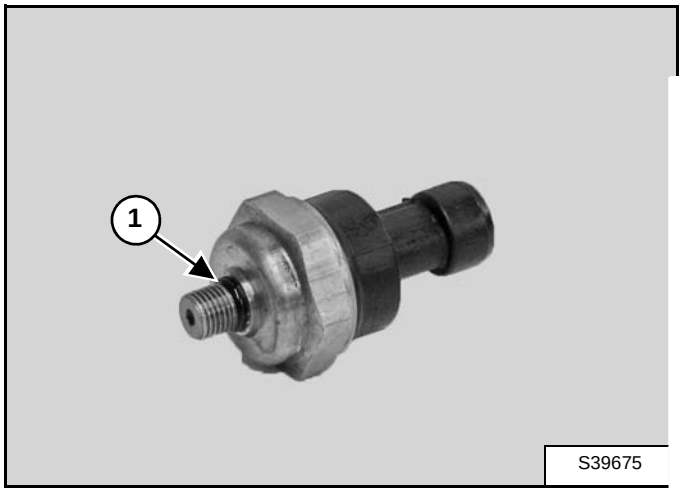
Remove the O-ring (Item 1) **[Figure 20-60-9]** from the accumulator.

Figure 20-60-10



Remove the switch (Item 1) **[Figure 20-60-10]**.

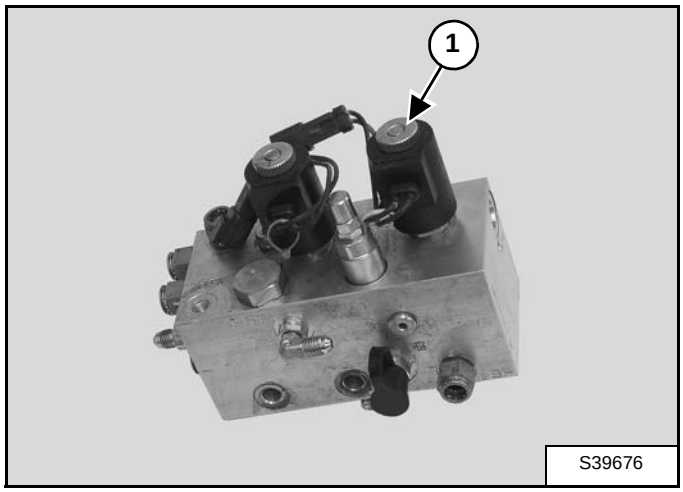
Figure 20-60-11



Remove the O-ring (Item 1) **[Figure 20-60-11]** from the switch.

Disassembly And Assembly (Cont'd)

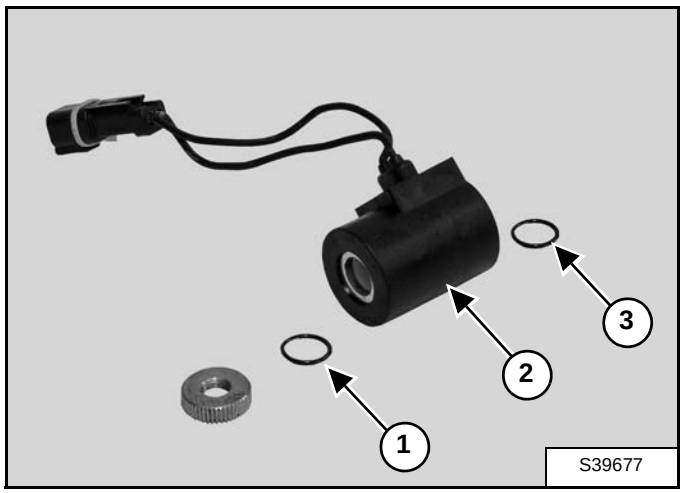
Figure 20-60-12



Remove the nut (Item 1) **[Figure 20-60-12]**.

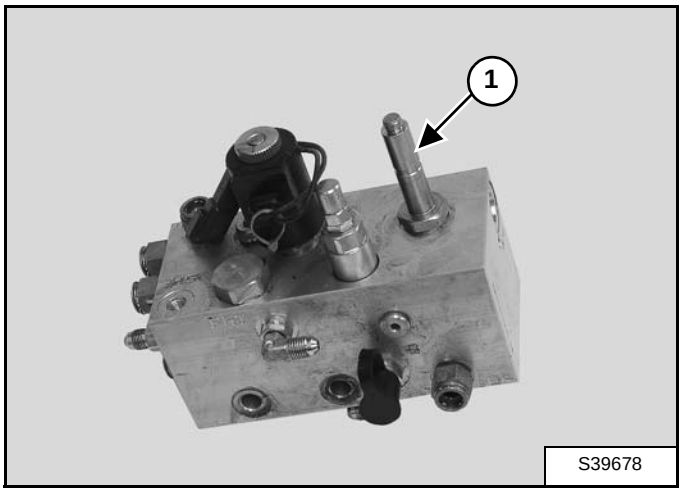
Installation: Tighten the nut to 4 - 6 N•m (35.4 - 53.1 in-lb) torque.

Figure 20-60-13



Remove the O-ring (Item 1), solenoid coil (Item 2) and O-ring (Item 3) **[Figure 20-60-13]**.

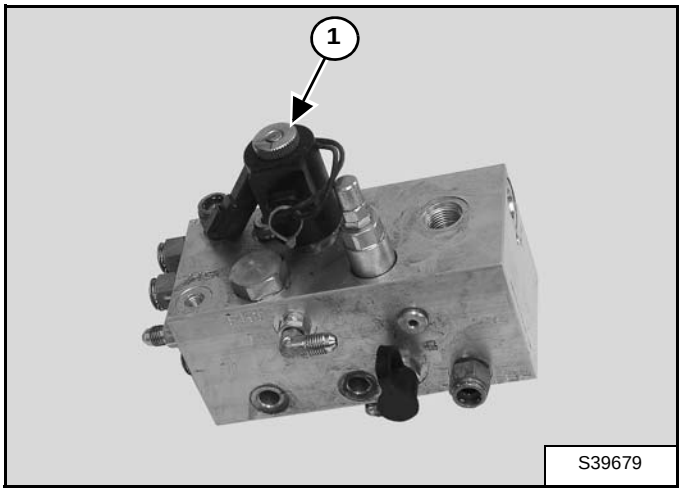
Figure 20-60-14



Remove the solenoid valve stem (Item 1) **[Figure 20-60-14]**.

Installation: Tighten the stem to 27 - 33 N•m (19.9 - 24.3 ft-lb) torque.

Figure 20-60-15

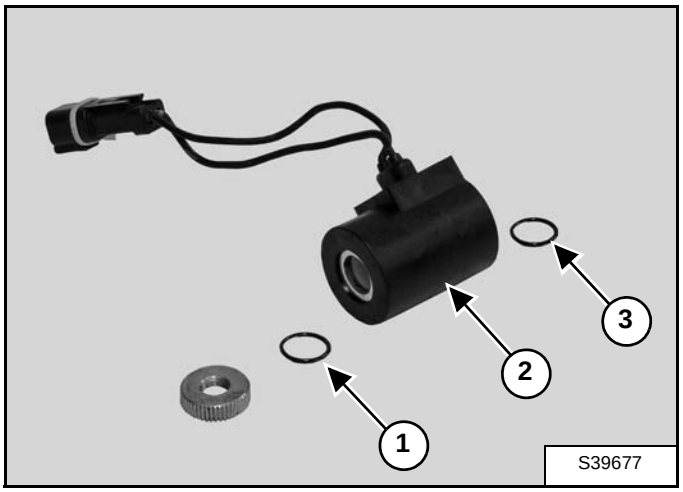


Remove the nut (Item 1) **[Figure 20-60-15]**.

Installation: Tighten the nut to 4 - 6 N•m (35.4 - 53.1 in-lb) torque.

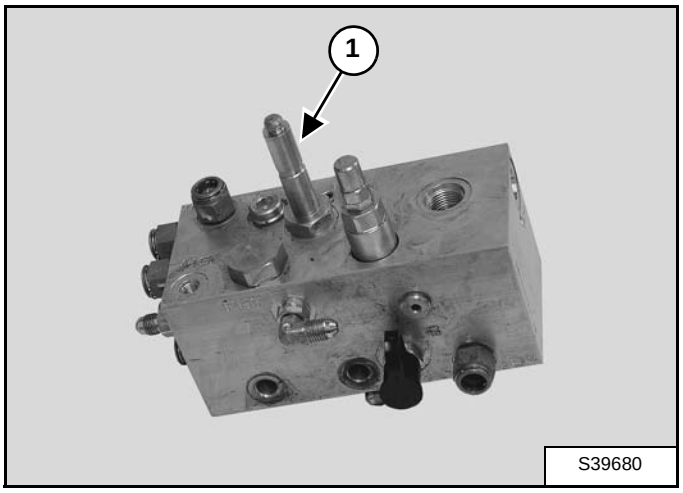
Disassembly And Assembly (Cont'd)

Figure 20-60-16



Remove the O-ring (Item 1), solenoid coil (Item 2) and O-ring (Item 3) **[Figure 20-60-16]**.

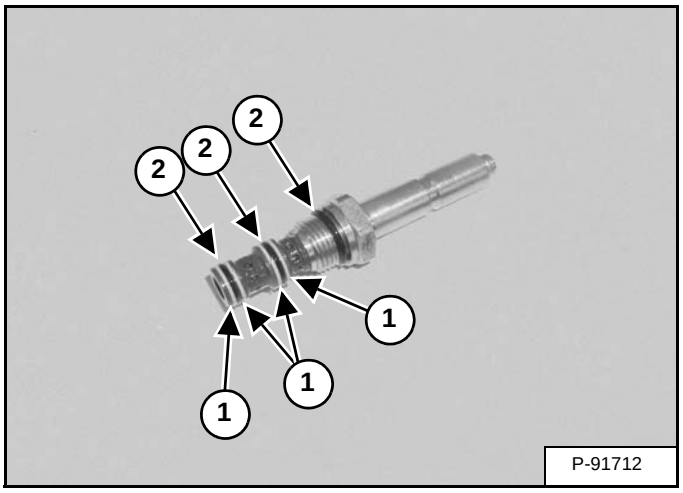
Figure 20-60-17



Remove the solenoid valve stem (Item 1) **[Figure 20-60-17]**.

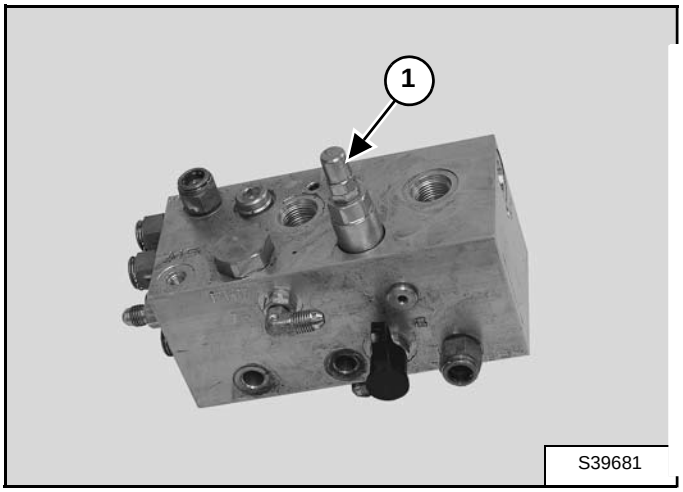
Installation: Tighten the stem to 27 - 33 N•m (19.9 - 24.3 ft-lb) torque.

Figure 20-60-18



Remove the back-up rings (Item 1) and O-rings (Item 2) **[Figure 20-60-18]** from both solenoid valve stems.

Figure 20-60-19

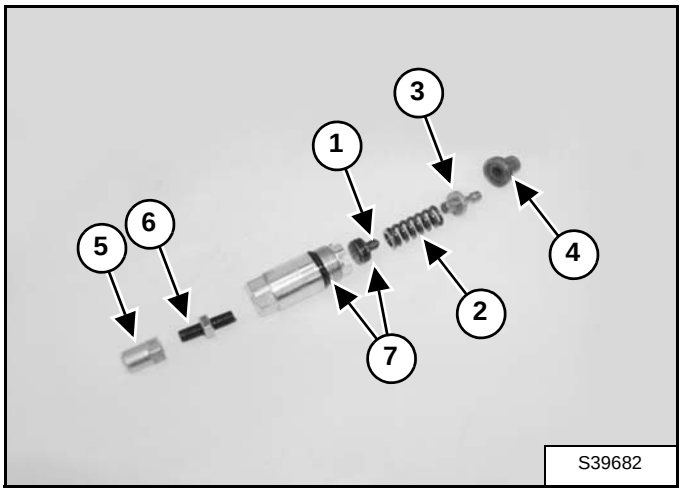


Remove the pilot relief valve (Item 1) **[Figure 20-60-19]**.

Installation: Tighten the pilot relief valve to 40,5 - 49,5 N•m (29.9 - 36.5 ft-lb) torque.

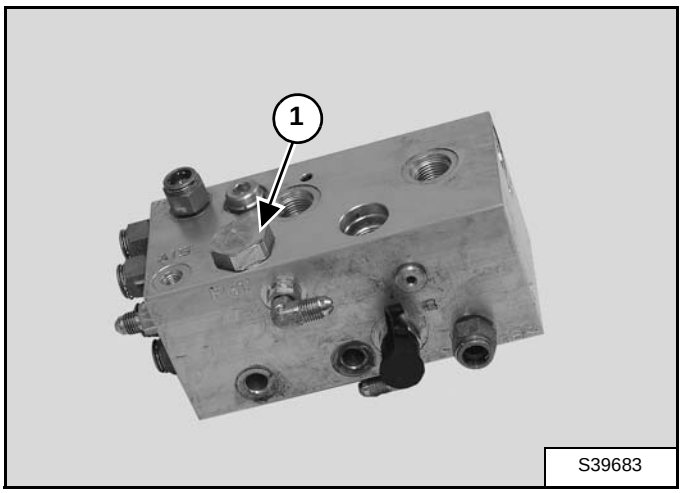
Disassembly And Assembly (Cont'd)

Figure 20-60-20



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 20-60-20]**.

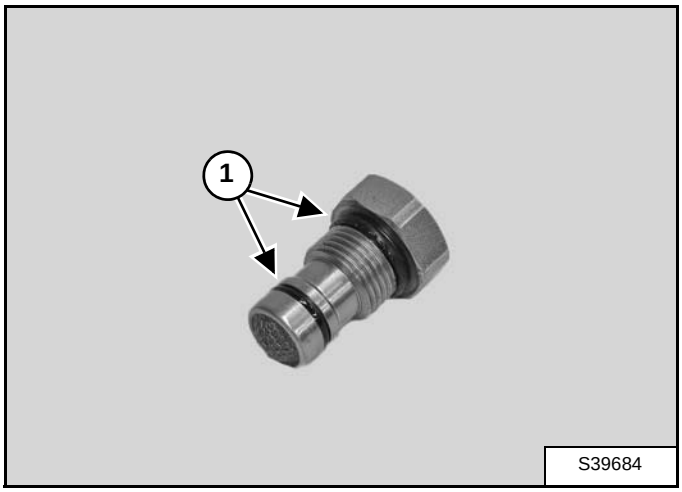
Figure 20-60-21



Remove the plug (Item 1) **[Figure 20-60-21]**.

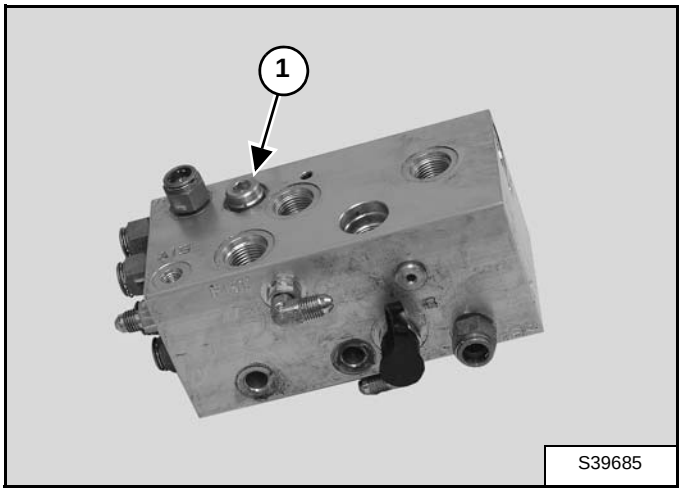
Installation: Tighten the plug to 31,5 - 38,5 N•m (23.2 - 28.4 ft-lb) torque.

Figure 20-60-22



Remove the O-rings (Item 1) **[Figure 20-60-22]**.

Figure 20-60-23

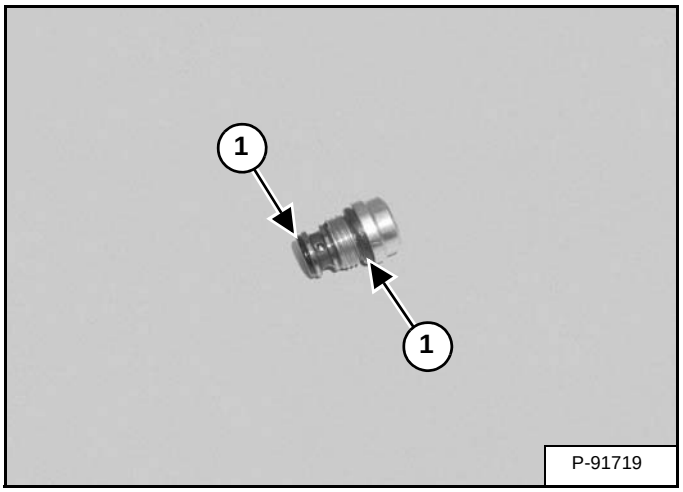


Remove the check valve assembly (Item 1) **[Figure 20-60-23]**.

Installation: Tighten the check valve to 36 - 44 N•m (26.6 - 32.5 ft-lb) torque.

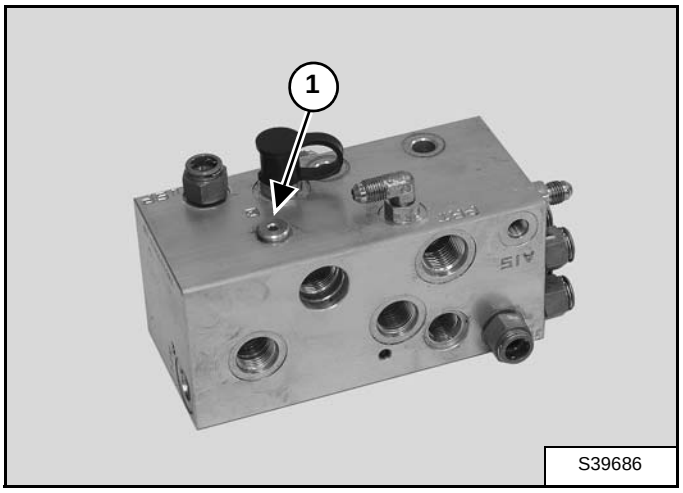
Disassembly And Assembly (Cont'd)

Figure 20-60-24



Remove the O-rings (Item 1) **[Figure 20-60-24]**.

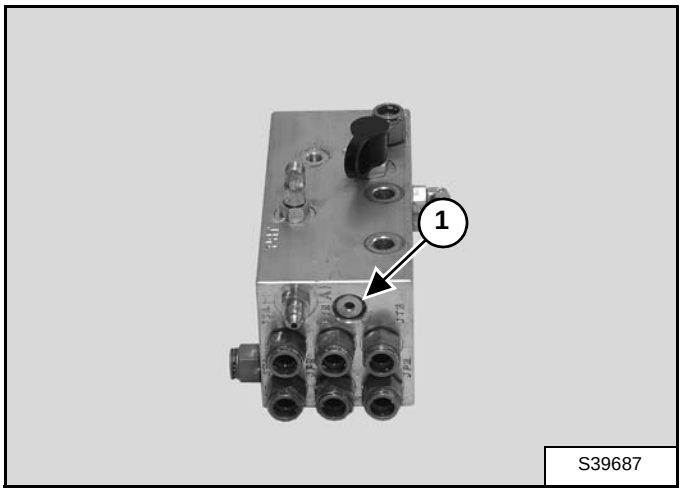
Figure 20-60-25



Remove the plug (Item 1) **[Figure 20-60-25]**.

Installation: Tighten the plug to 13,5 - 16,5 N•m (10 - 12.2 ft-lb) torque.

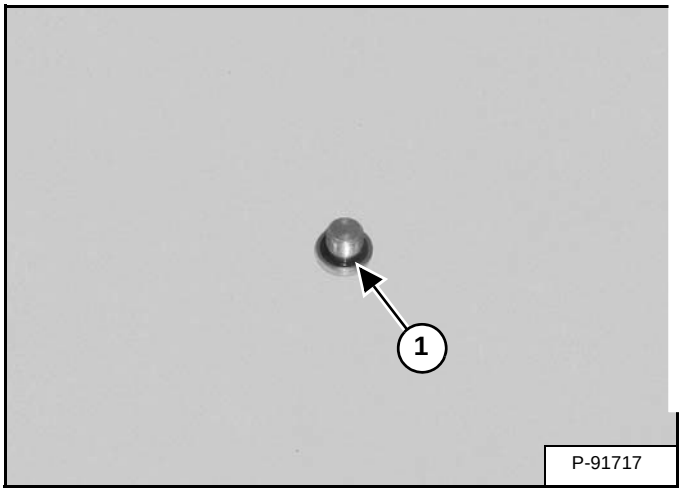
Figure 20-60-26



Remove the plug (Item 1) **[Figure 20-60-26]**.

Installation: Tighten the plug to 13,5 - 16,5 N•m (10 - 12.2 ft-lb) torque.

Figure 20-60-27



Remove the O-ring (Item 1) **[Figure 20-60-27]** from both plugs.

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.


Bobcat®

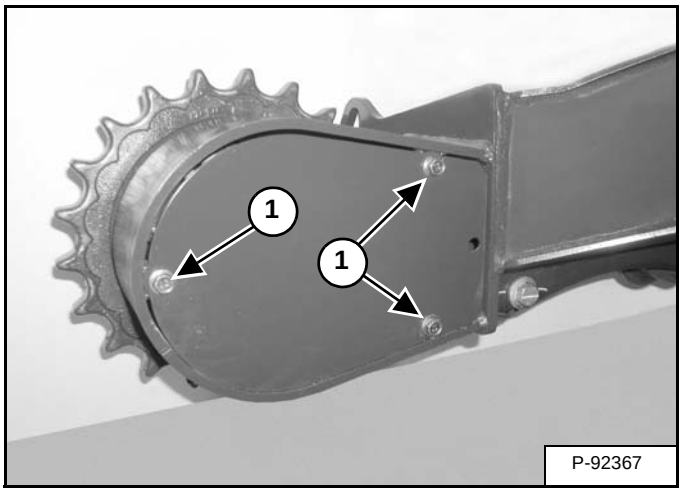
TRAVEL MOTOR

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.

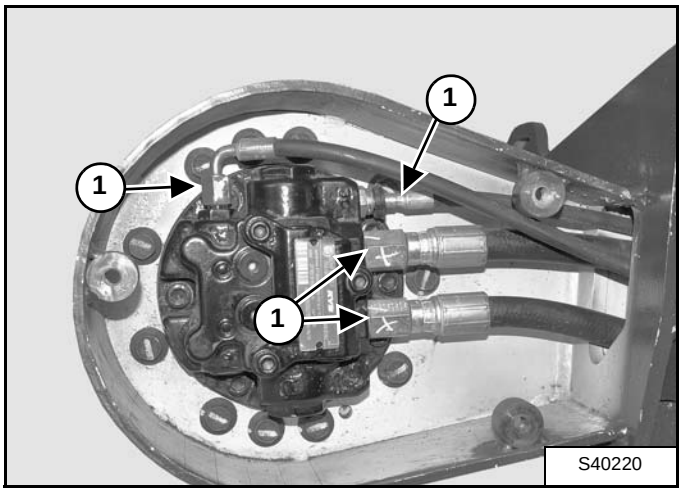
IMPORTANT

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

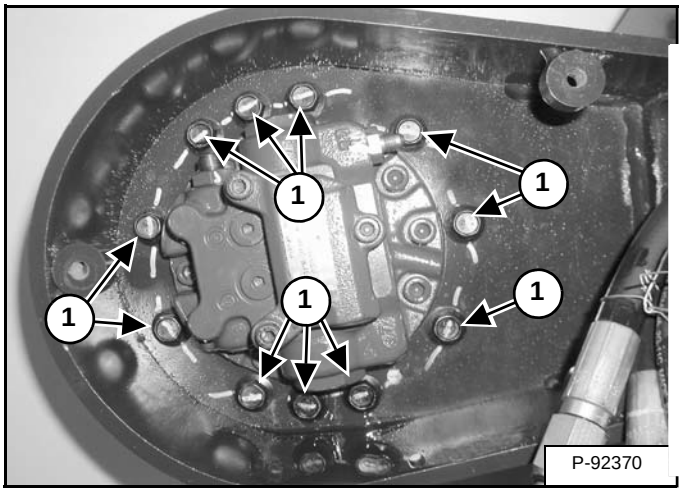
Mark the hoses for correct installation.

Figure 20-70-2



Remove the hoses (Item 1) **[Figure 20-70-2]** from the travel motor.

Figure 20-70-3

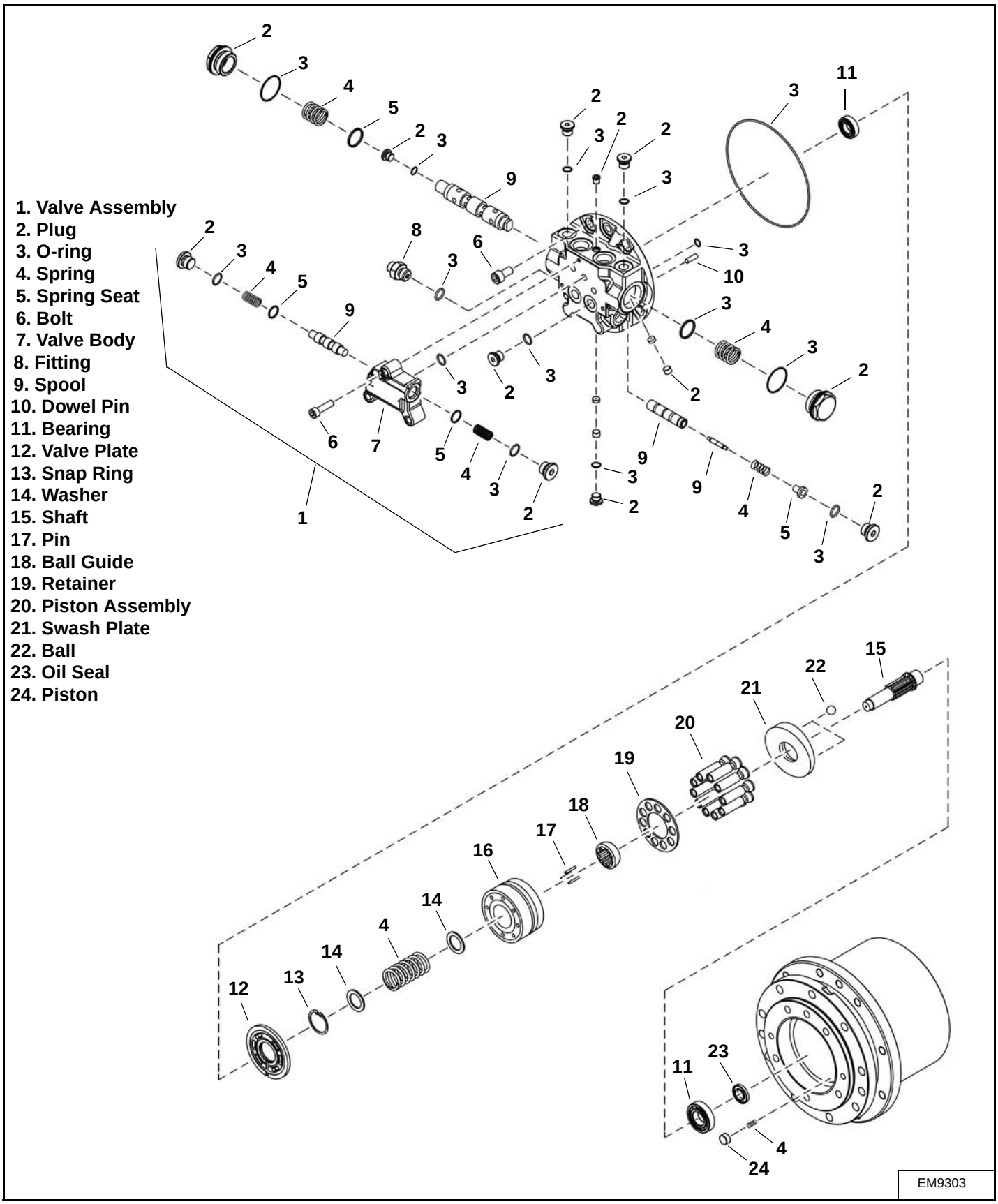


Remove the bolts (Item 1) **[Figure 20-70-3]** from the travel motor.

Installation: Apply thread lock (Loctite® 243) to the bolts and tighten to 105 - 115 N•m (78 - 85 ft-lb) torque.

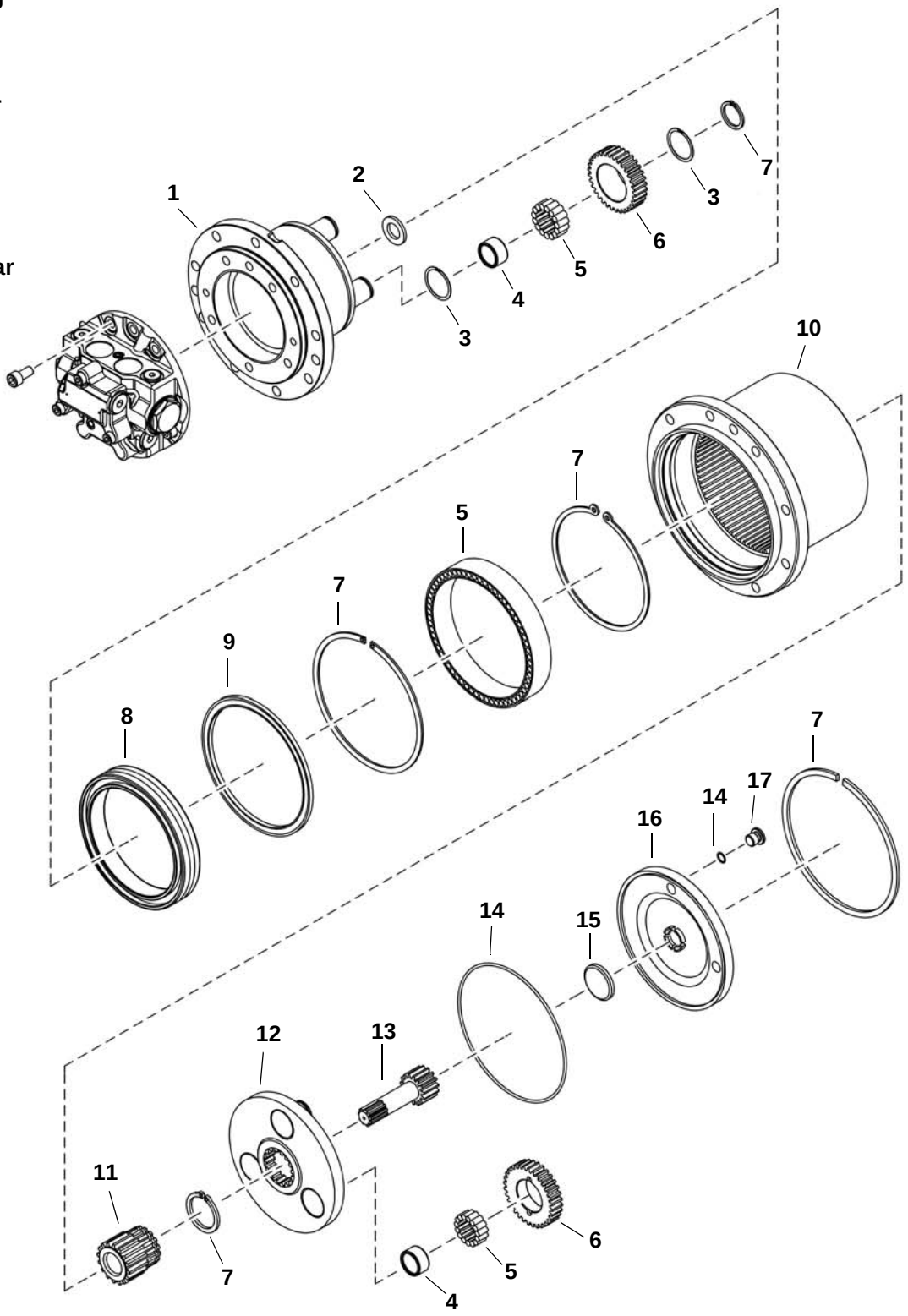
Remove the travel motor from the track frame.

Parts Identification Hydraulic Motor



Parts Identification Gear Reduction Hub

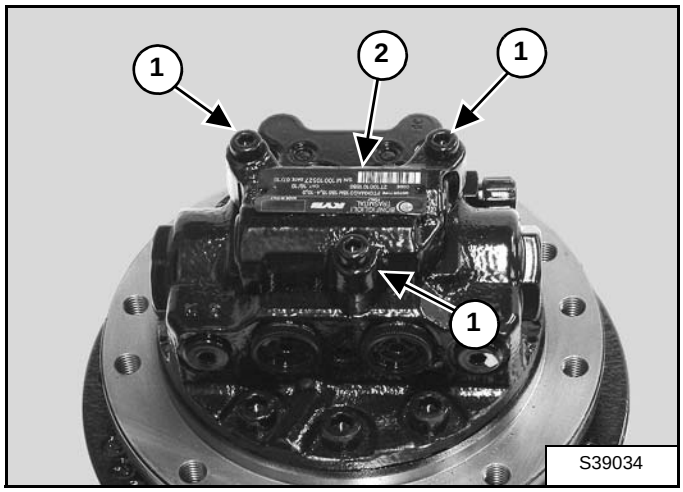
1. Hub
2. Centering Ring
3. Thrust Washer
4. Inner Race
5. Bearing
6. Planetary Gear
7. Snap Ring
8. Floating Seal
9. Disc
10. Housing
11. Sun Gear
12. Planetary Gear Carrier
13. Shaft
14. O-ring
15. Friction Disc
16. Cover
17. Plug



NA5620S

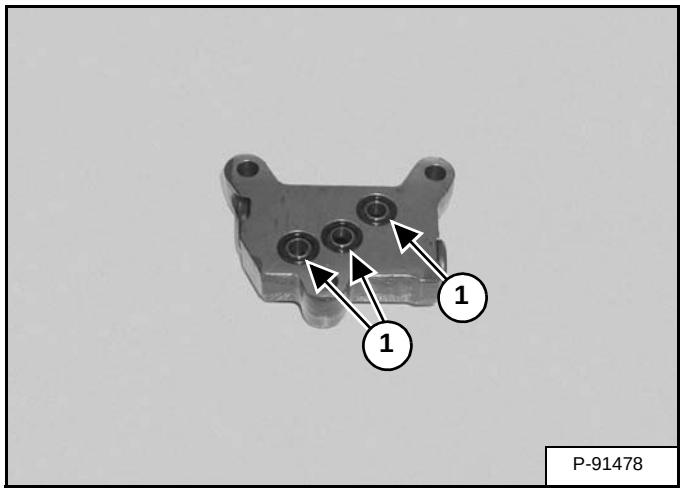
Disassembly

Figure 20-70-4



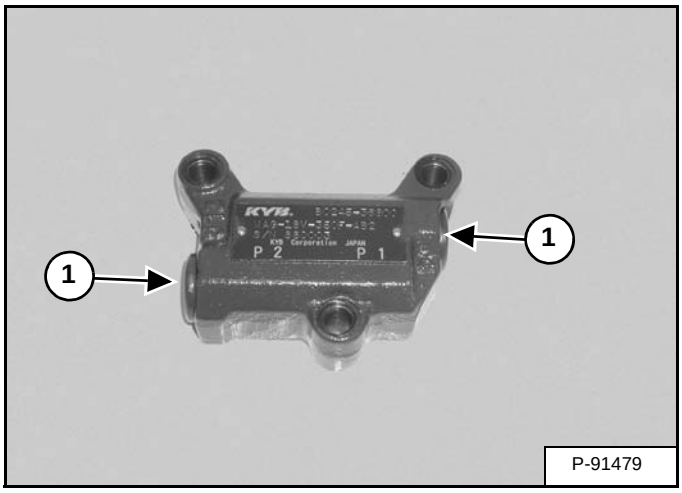
Remove the three bolts (Item 1) and remove the valve (Item 2) **[Figure 20-70-4]**.

Figure 20-70-5



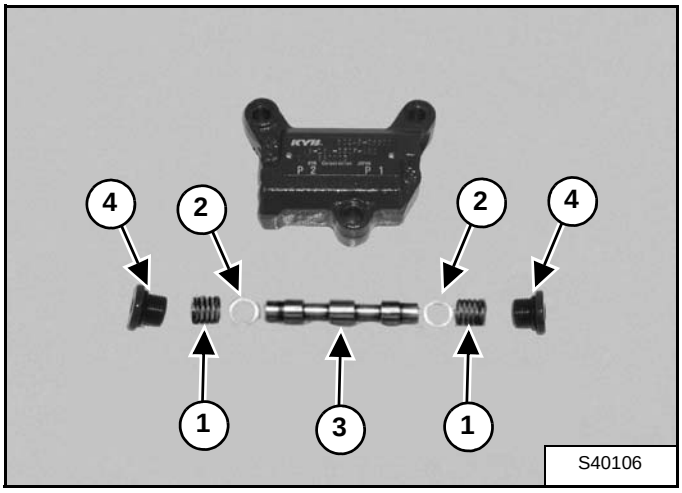
Remove the O-rings (Item 1) **[Figure 20-70-5]**.

Figure 20-70-6



Remove the plugs (Item 1) **[Figure 20-70-6]**.

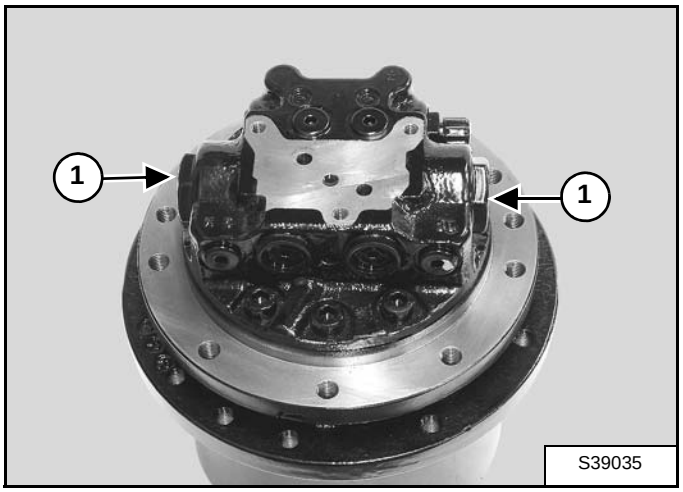
Figure 20-70-7



Remove the springs (Item 1), spring seats (Item 2) and spool (Item 3). Remove the O-rings (Item 4) **[Figure 20-70-7]** from the plugs.

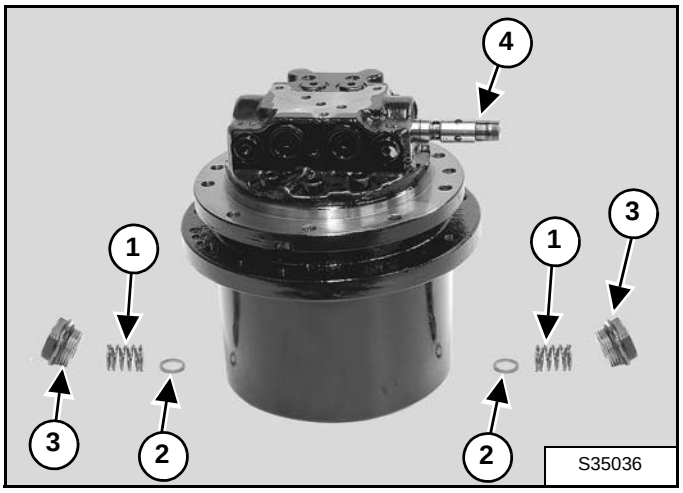
Disassembly (Cont'd)

Figure 20-70-8



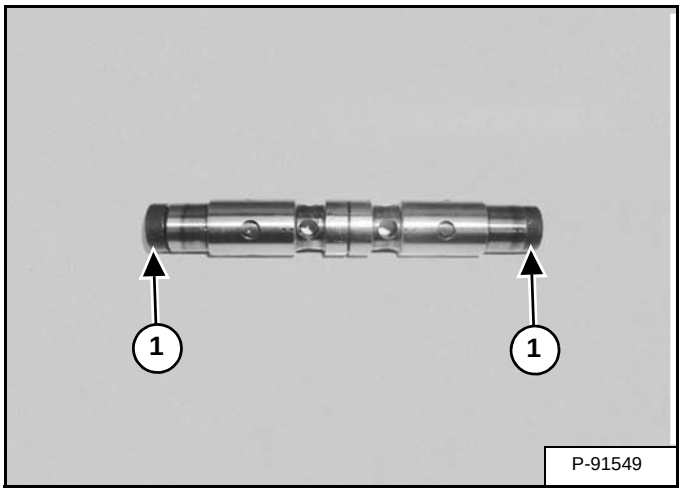
Remove the plugs (Item 1) **[Figure 20-70-8]**.

Figure 20-70-9



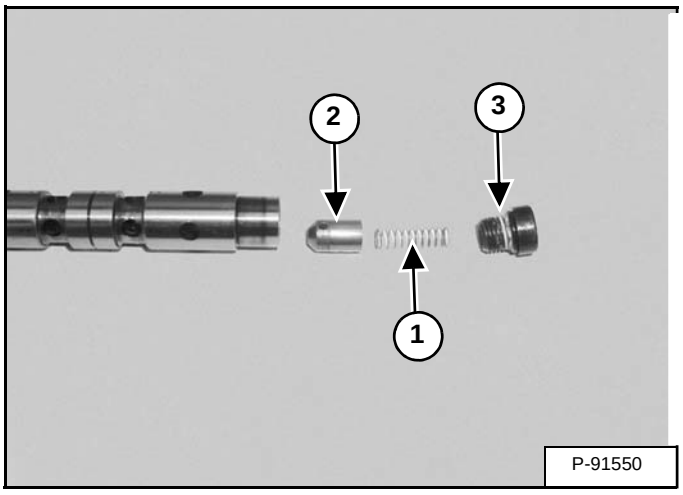
Remove the springs (Item 1) and spring seats (Item 2). Remove the O-rings (Item 3) from the plugs. Remove the spool (Item 4) **[Figure 20-70-9]** from the housing.

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.

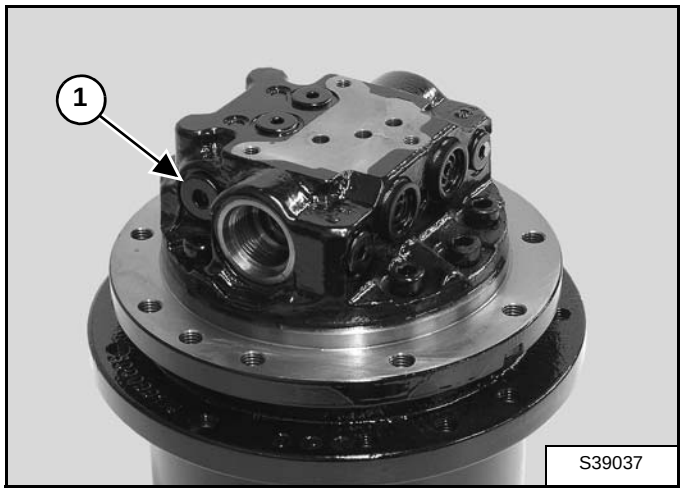
Figure 20-70-11



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.

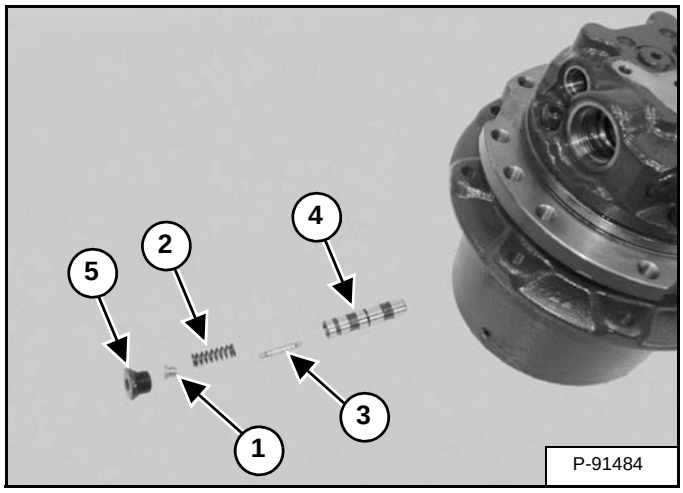
Disassembly (Cont'd)

Figure 20-70-12



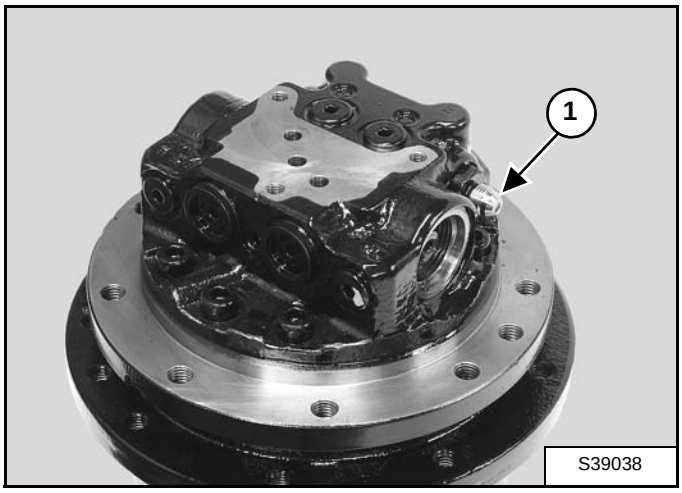
Remove the plug (Item 1) **[Figure 20-70-12]**.

Figure 20-70-13



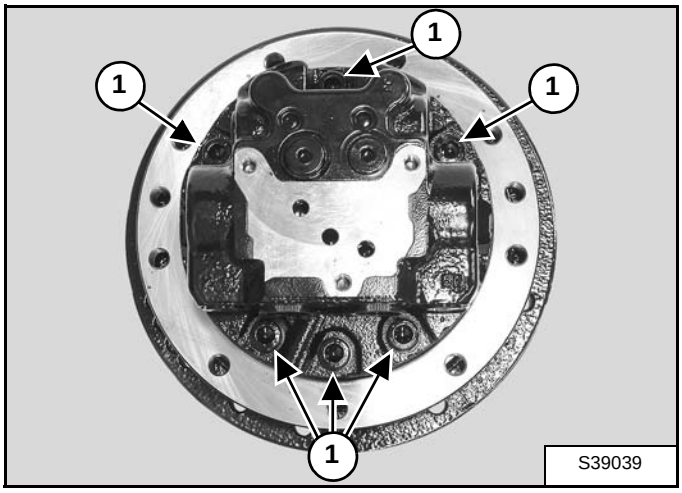
Remove the spring seat (Item 1), spring (Item 2), inner spool (Item 3) and outer spool (Item 4). Remove the O-ring (Item 5) **[Figure 20-70-13]** from the plug.

Figure 20-70-14



Remove the fitting (Item 1) **[Figure 20-70-14]**.

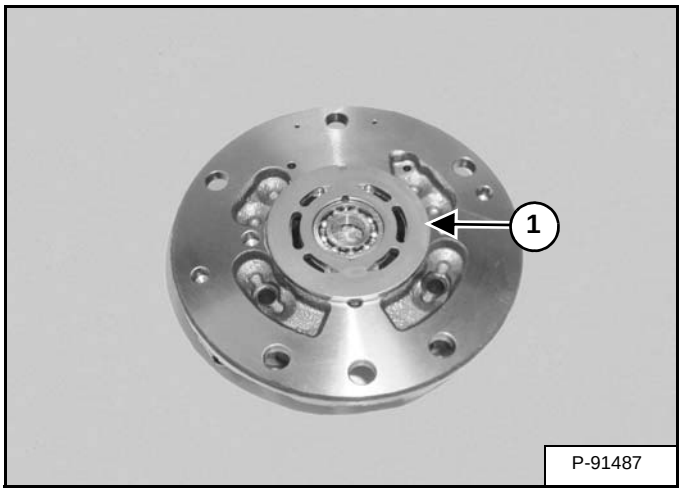
Figure 20-70-15



Remove the bolts (Item 1) **[Figure 20-70-15]** and remove the end cap.

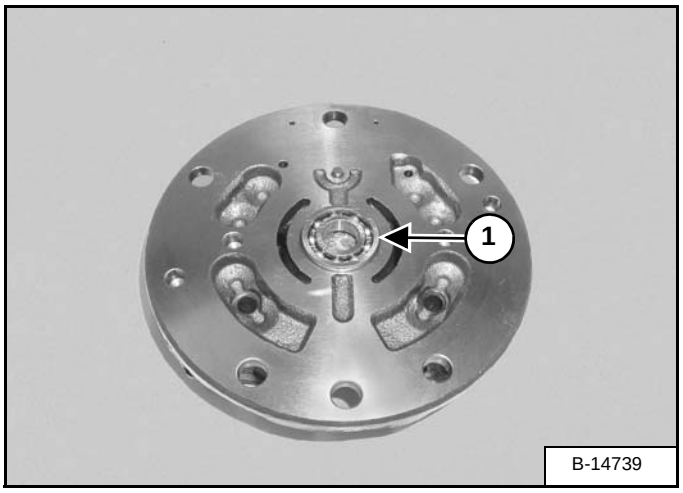
Disassembly (Cont'd)

Figure 20-70-16



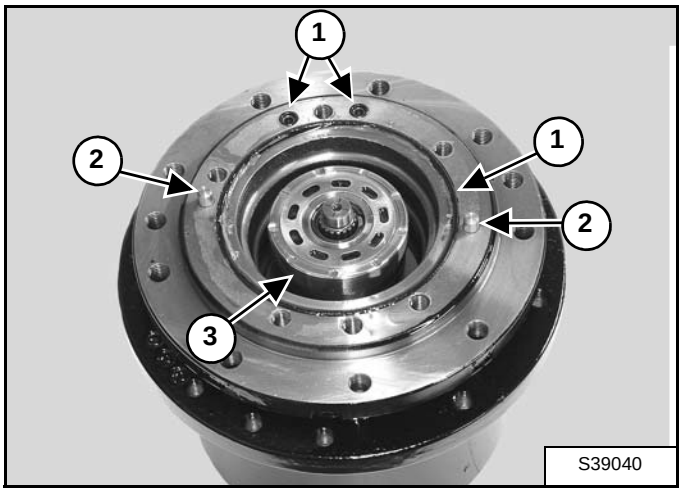
Remove the valve plate (Item 1) **[Figure 20-70-16]**.

Figure 20-70-17



Remove the bearing (Item 1) **[Figure 20-70-17]**.

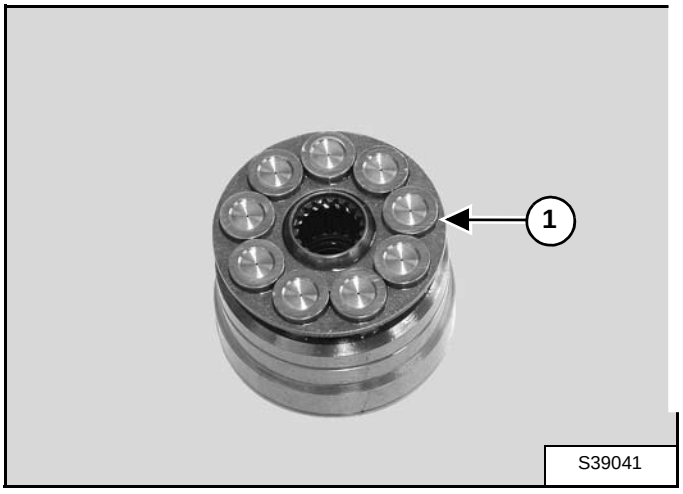
Figure 20-70-18



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

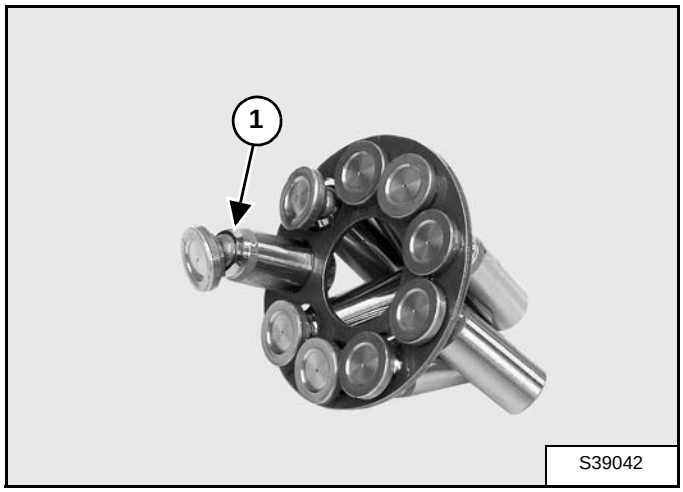


Remove the piston assemblies / retainer (Item 1) **[Figure 20-70-19]** from the cylinder block.

NOTE: It is not important that the pistons are installed in the original bores.

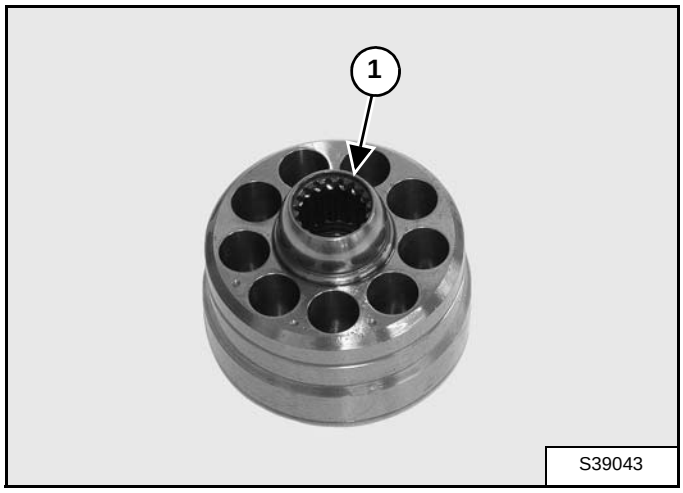
Disassembly (Cont'd)

Figure 20-70-20



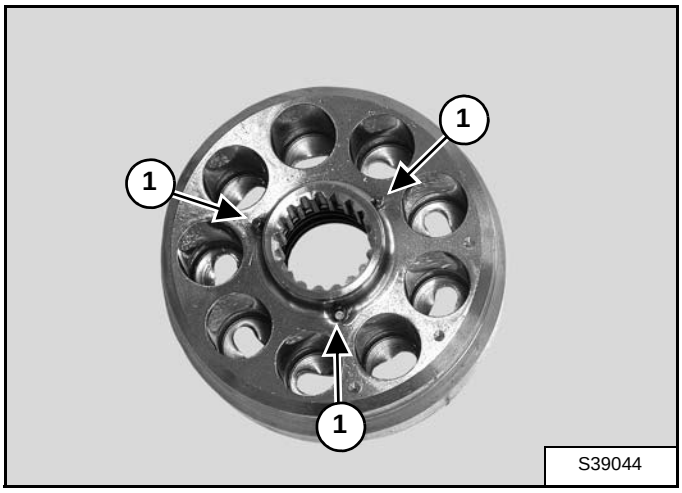
Remove the piston assemblies (Item 1) **[Figure 20-70-20]** from the retainer.

Figure 20-70-21



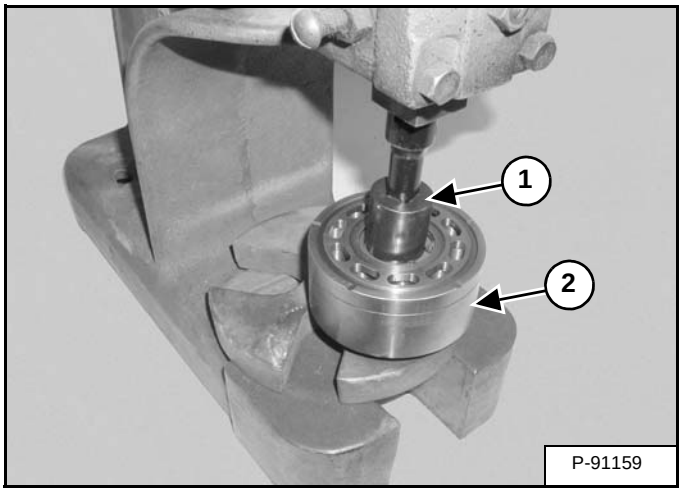
Remove the ball guide (Item 1) **[Figure 20-70-21]**.

Figure 20-70-22



Remove the three pins (Item 1) **[Figure 20-70-22]**.

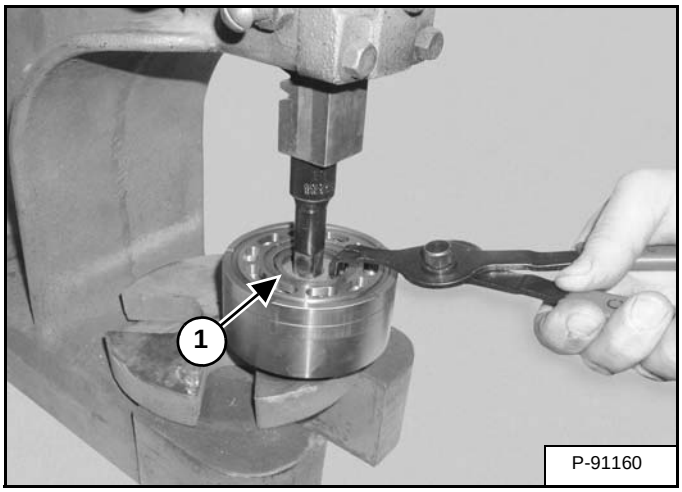
Figure 20-70-23



Using a press and an appropriate sized spacer (Item 1), compress the spring in the cylinder block (Item 2) **[Figure 20-70-23]**.

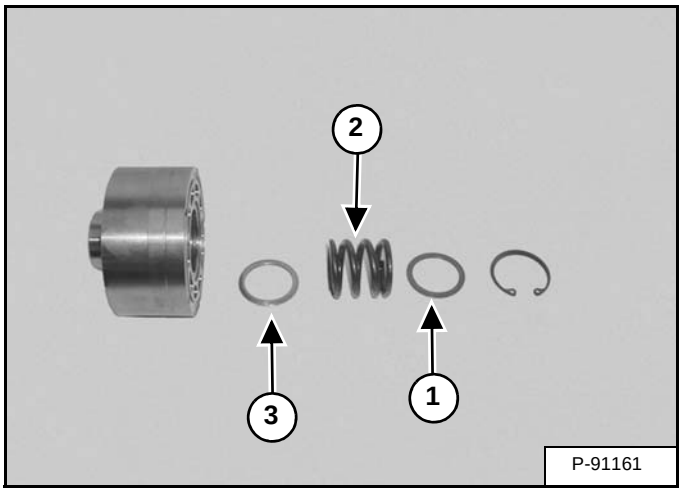
Disassembly (Cont'd)

Figure 20-70-24



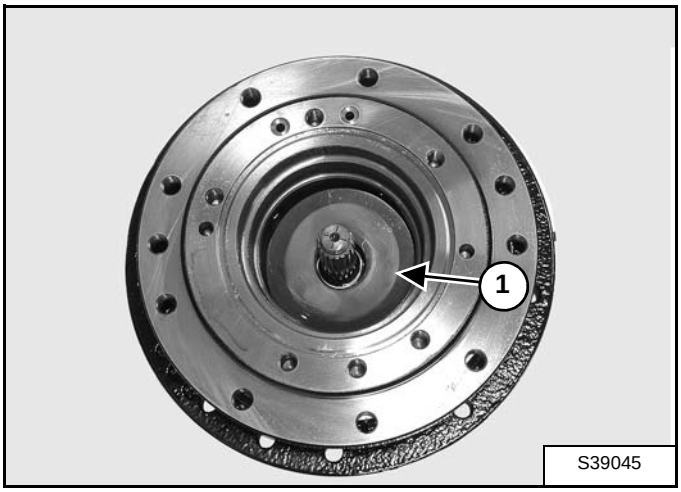
Remove the snap ring (Item 1) **[Figure 20-70-24]**. Remove the cylinder block from the press.

Figure 20-70-25



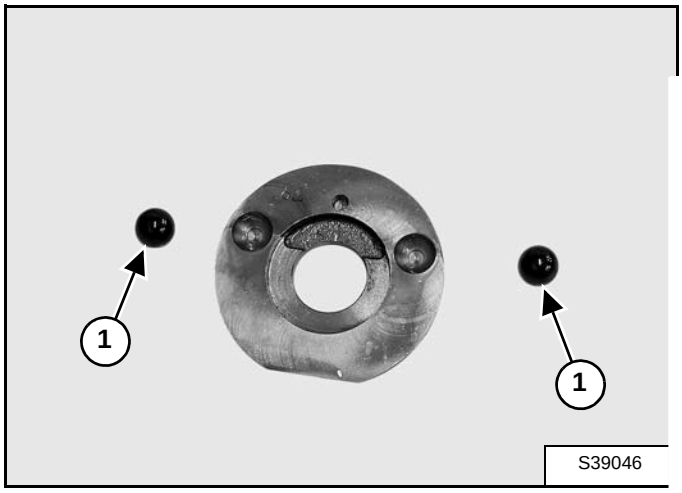
Remove the top washer (Item 1), spring (Item 2) and bottom washer (Item 3) **[Figure 20-70-25]**.

Figure 20-70-26



Remove the swash plate (Item 1) **[Figure 20-70-26]**.

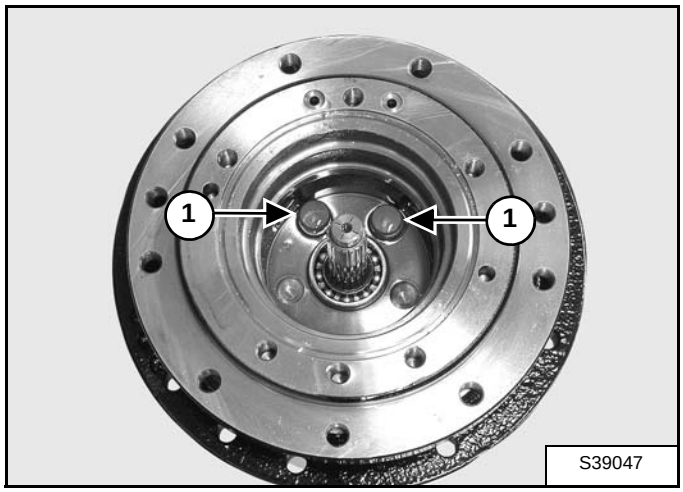
Figure 20-70-27



Remove the steel balls (Item 1) **[Figure 20-70-27]** from the bottom of the swash plate.

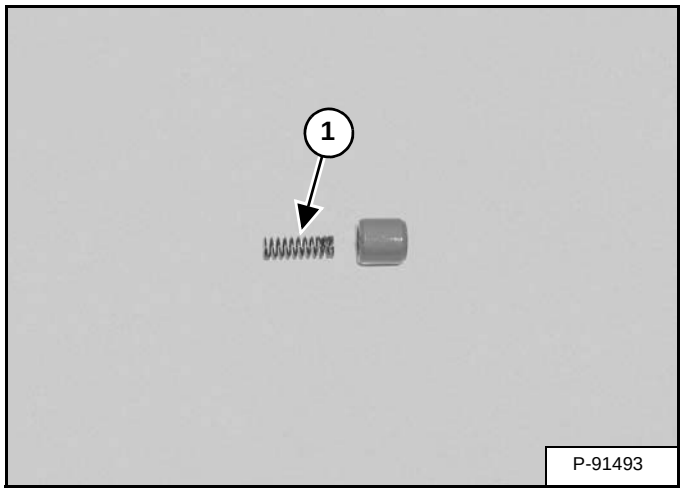
Disassembly (Cont'd)

Figure 20-70-28



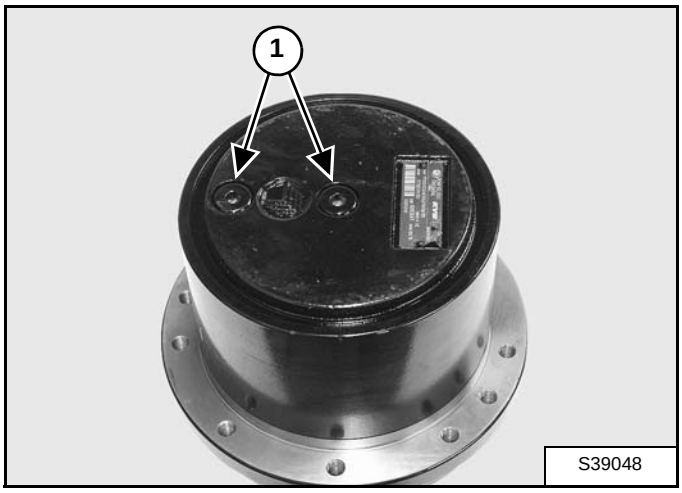
Remove the piston assemblies (Item 1) **[Figure 20-70-28]**.

Figure 20-70-29



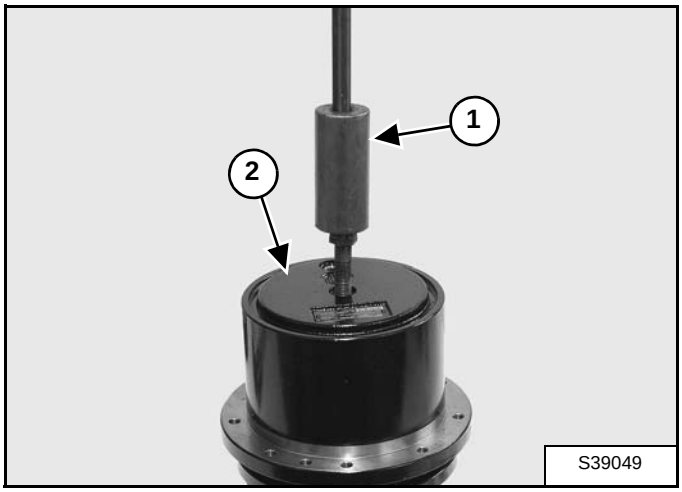
Remove the spring (Item 1) **[Figure 20-70-29]** from the piston.

Figure 20-70-30



Remove the two plugs (Item 1) **[Figure 20-70-30]** from the cover.

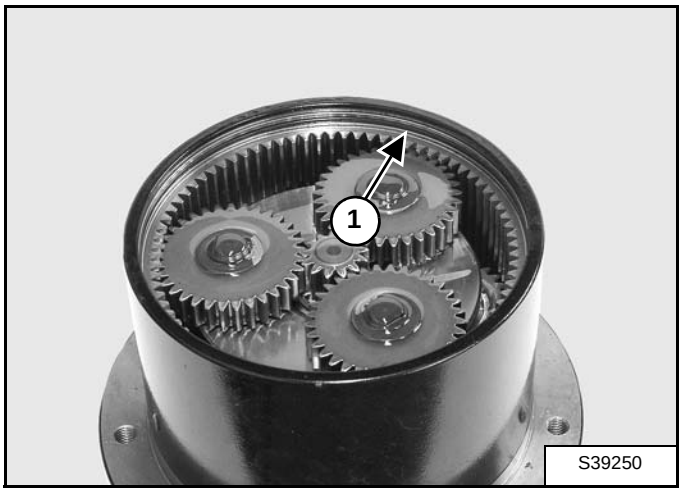
Figure 20-70-31



Install a puller (Item 1) in the center port. Remove the cover (Item 2) **[Figure 20-70-31]**.

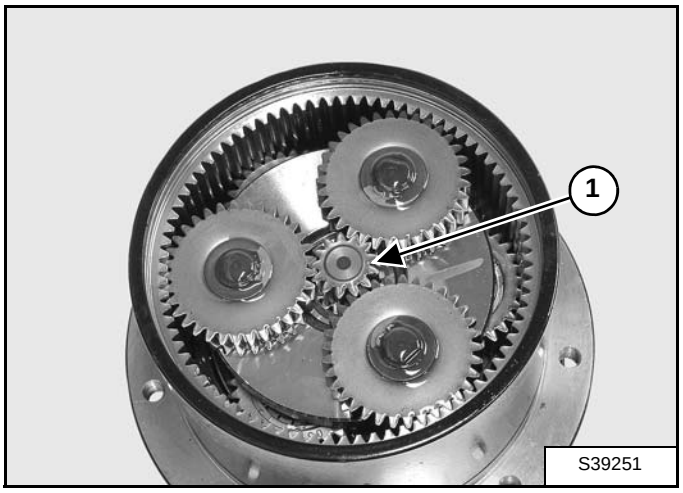
Disassembly (Cont'd)

Figure 20-70-32



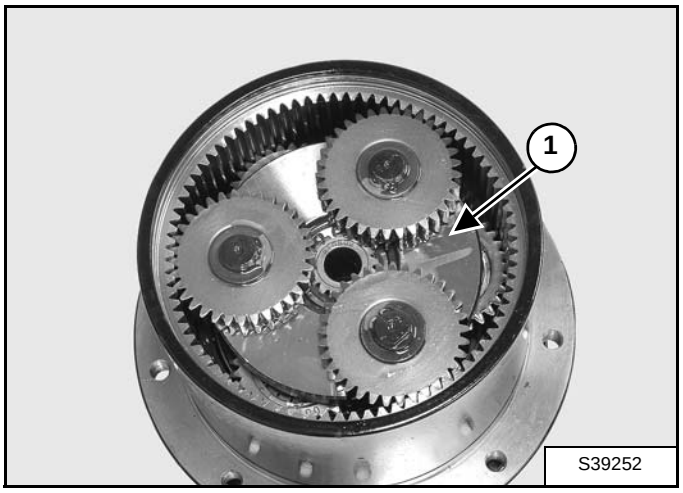
Remove the O-ring (Item 1) **[Figure 20-70-32]** from the housing.

Figure 20-70-33



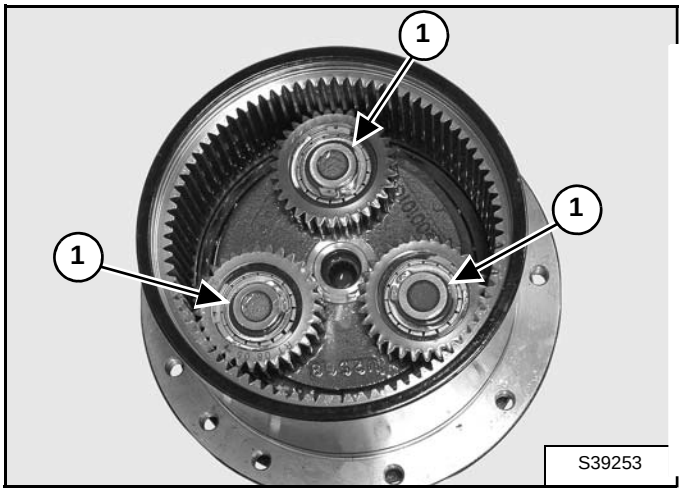
Remove the sun gear (Item 1) **[Figure 20-70-33]**.

Figure 20-70-34



Remove the planetary gear assembly (Item 1) **[Figure 20-70-34]**.

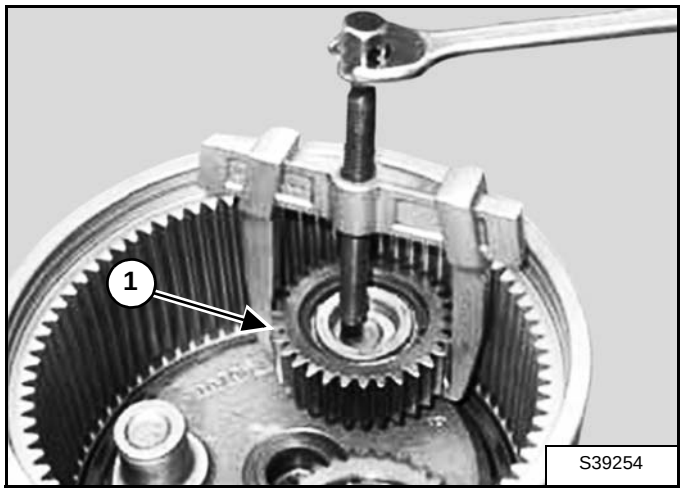
Figure 20-70-35



Remove the snap rings (Item 1) **[Figure 20-70-35]** from the studs.

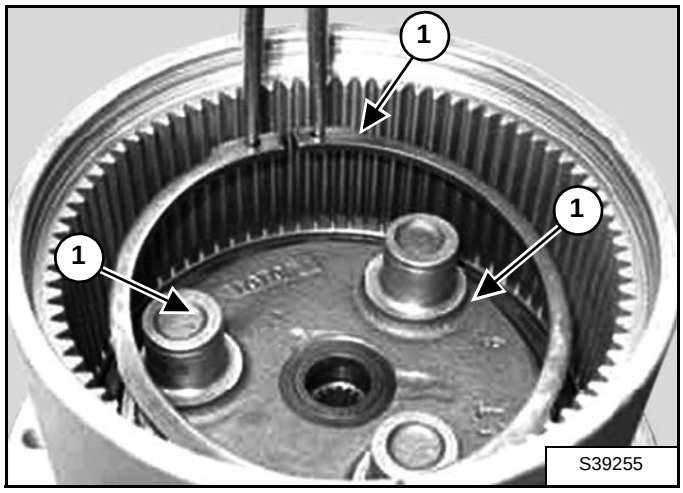
Disassembly (Cont'd)

Figure 20-70-36



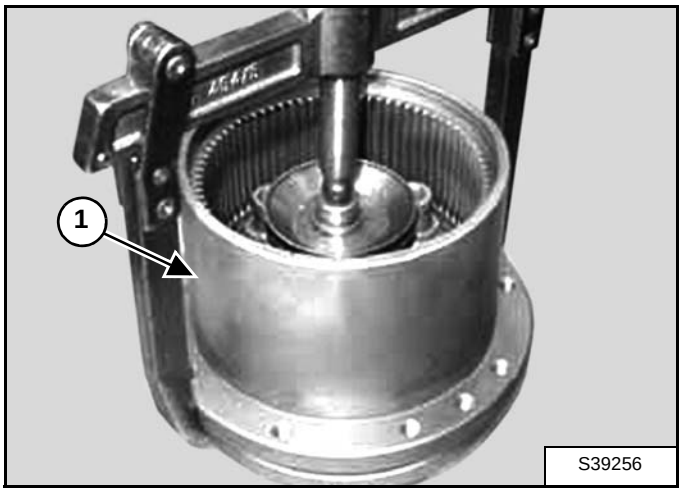
Remove the three planetary gears (Item 1) **[Figure 20-70-36]** using a puller.

Figure 20-70-37



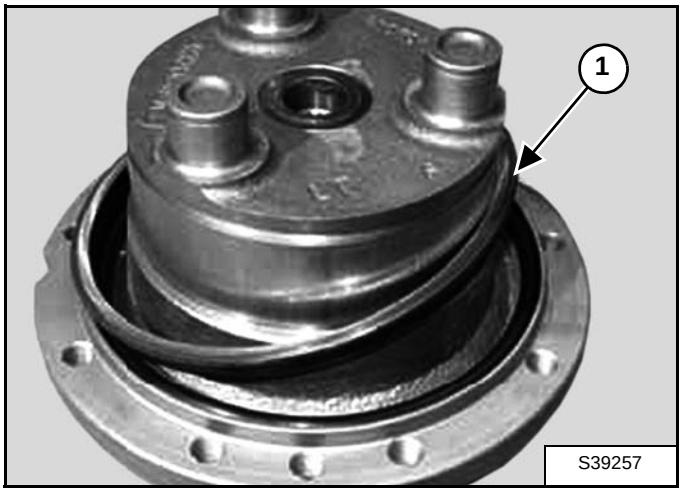
Remove the snap ring (Item 1) **[Figure 20-70-37]**.

Figure 20-70-38



Remove the housing (Item 1) **[Figure 20-70-38]** using a puller.

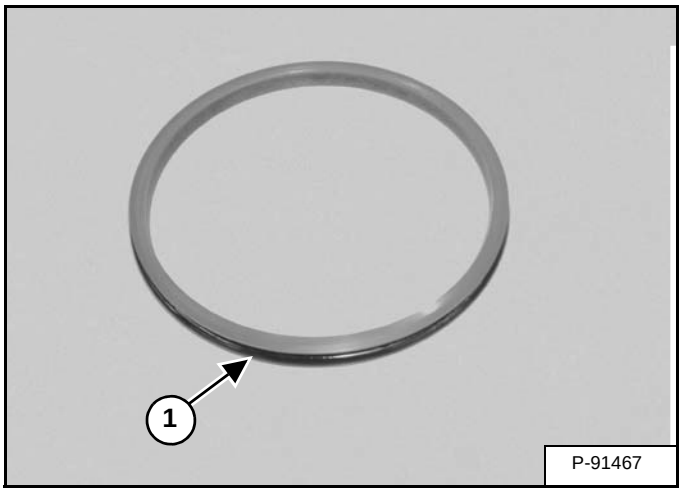
Figure 20-70-39



Remove the floating seal (Item 1) **[Figure 20-70-39]**.

Disassembly (Cont'd)

Figure 20-70-40



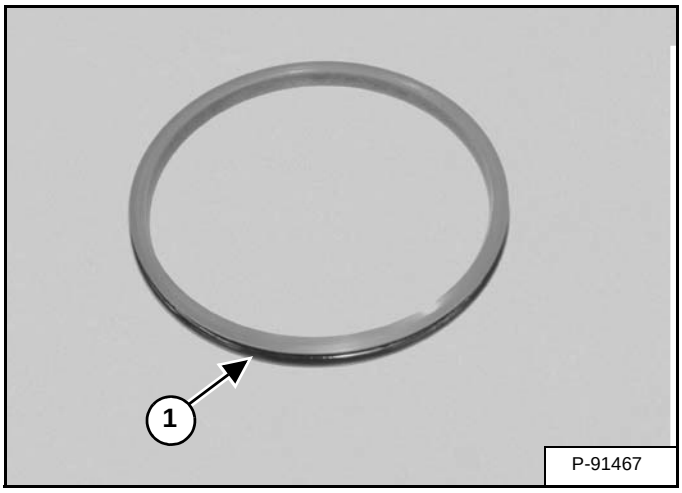
Remove the O-ring (Item 1) **[Figure 20-70-40]** from the seal ring.

Figure 20-70-41



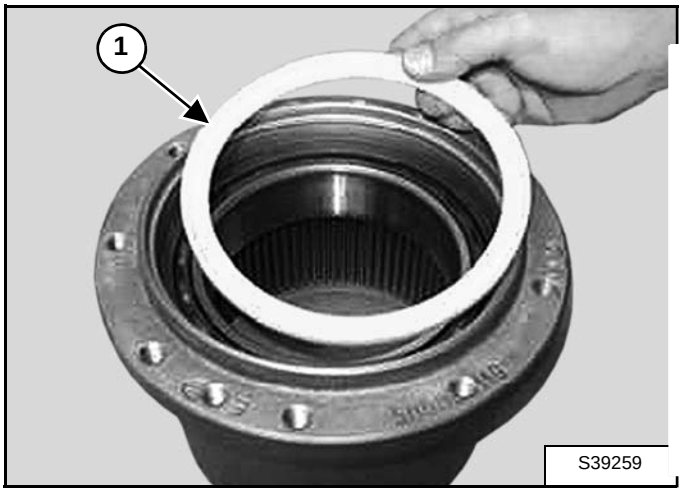
Remove the floating seal (Item 1) **[Figure 20-70-41]** from the housing.

Figure 20-70-42



Remove the O-ring (Item 1) **[Figure 20-70-42]** from the seal ring.

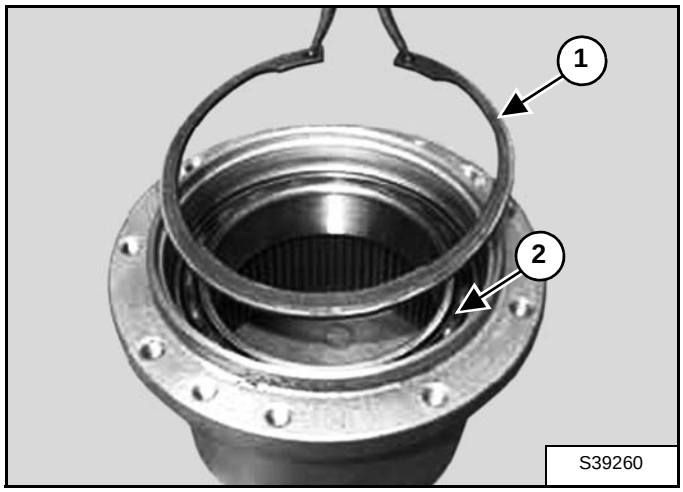
Figure 20-70-43



Remove the spacer (Item 1) **[Figure 20-70-43]** from the housing.

Disassembly (Cont'd)

Figure 20-70-44



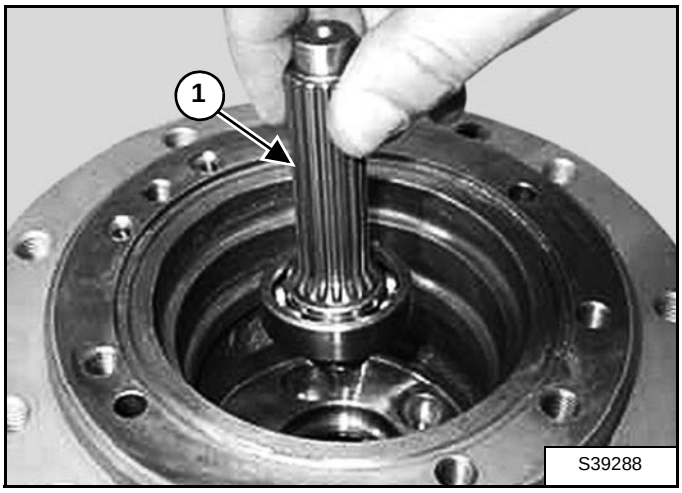
Remove the snap ring (Item 1) **[Figure 20-70-44]** from the housing.

Figure 20-70-45



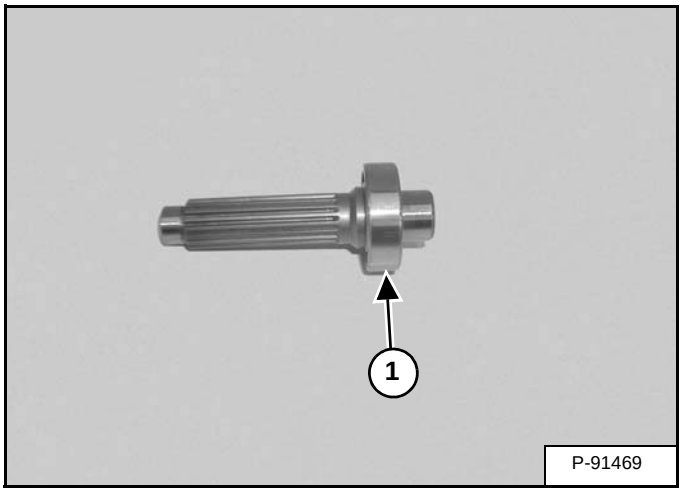
Remove the bearing (Item 1) **[Figure 20-70-44]** from the housing using a puller **[Figure 20-70-45]**.

Figure 20-70-46



Remove the shaft / bearing assembly (Item 1) **[Figure 20-70-46]**.

Figure 20-70-47

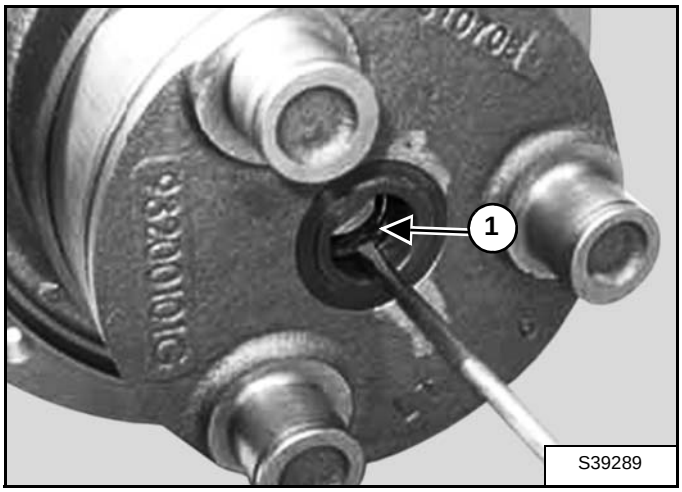


Remove the bearing (Item 1) **[Figure 20-70-47]** from the shaft.

TRAVEL MOTOR (CONT'D)

Disassembly (Cont'd)

Figure 20-70-48



Remove the seal (Item 1) **[Figure 20-70-48]**.

Assembly

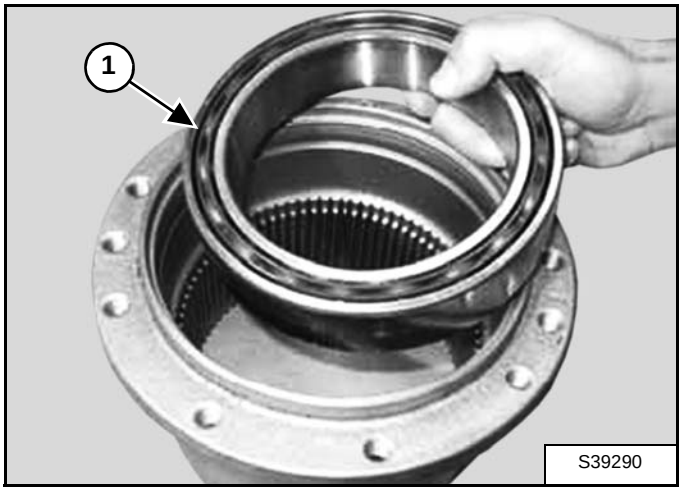
Clean all parts in solvent and dry with compressed air. Inspect all parts and replace any that are damaged.

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:

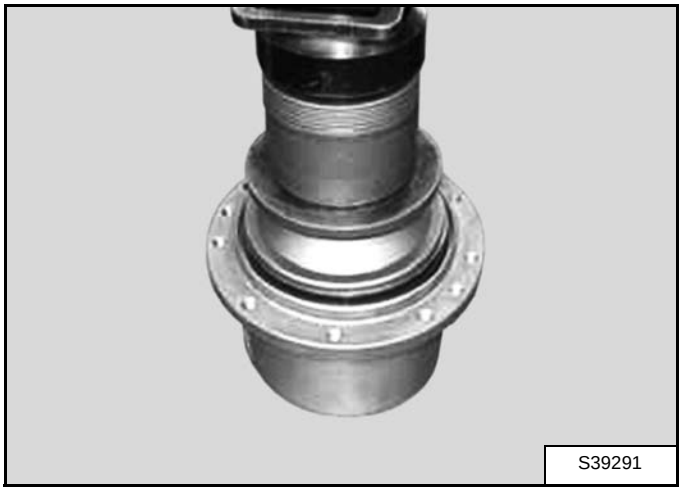
MEL1413 - Seal Installation Tool

Figure 20-70-49



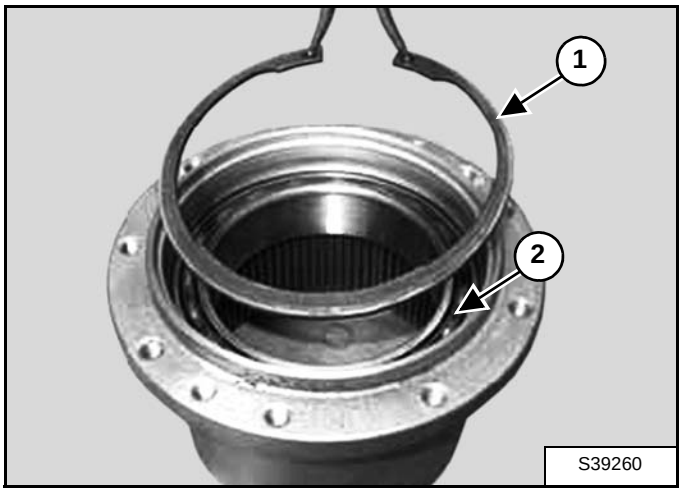
Position the bearing (Item 1) **[Figure 20-70-49]** in the housing.

Figure 20-70-50



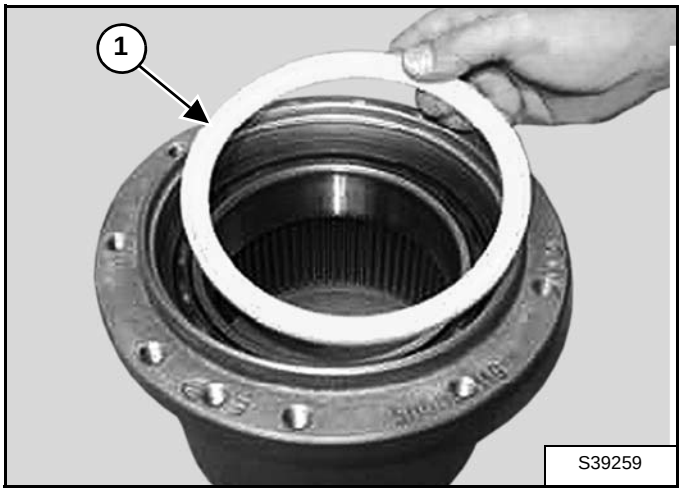
Install the bearing in the housing using a press **[Figure 20-70-50]**.

Figure 20-70-51



Install the snap ring (Item 1) **[Figure 20-70-51]** in the housing.

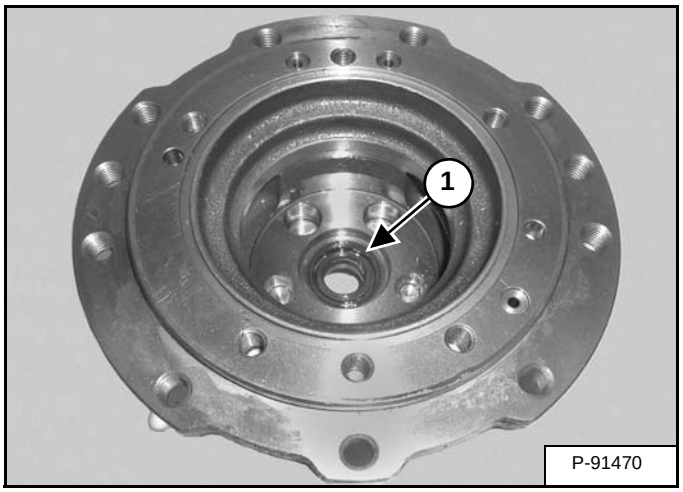
Figure 20-70-52



Install the spacer (Item 1) **[Figure 20-70-52]** in the housing.

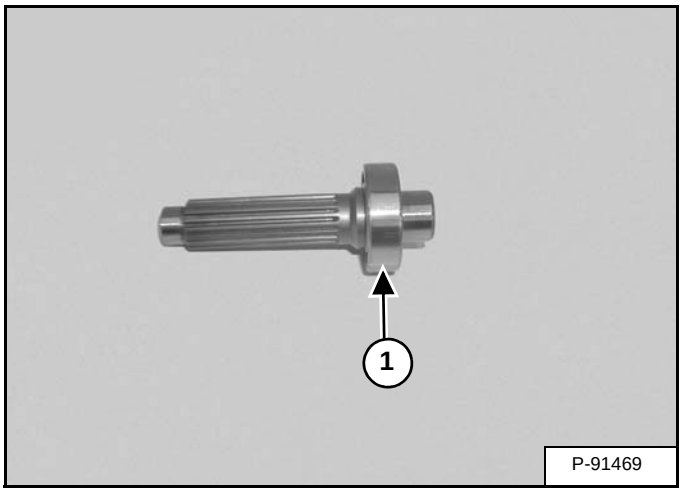
Assembly (Cont'd)

Figure 20-70-53



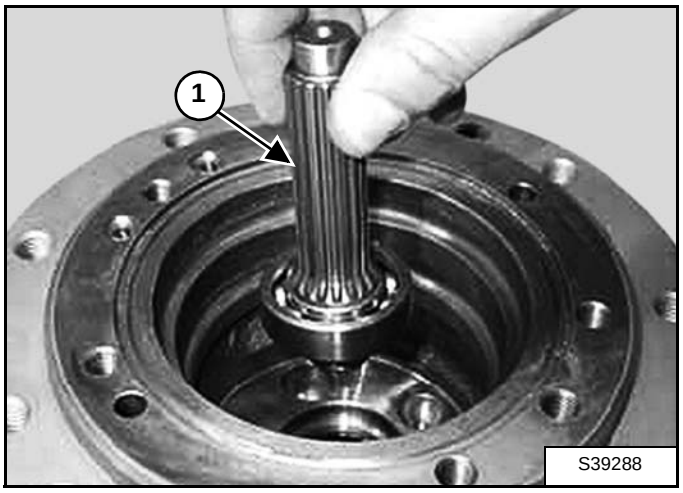
Install the oil seal (Item 1) **[Figure 20-70-53]**.

Figure 20-70-54



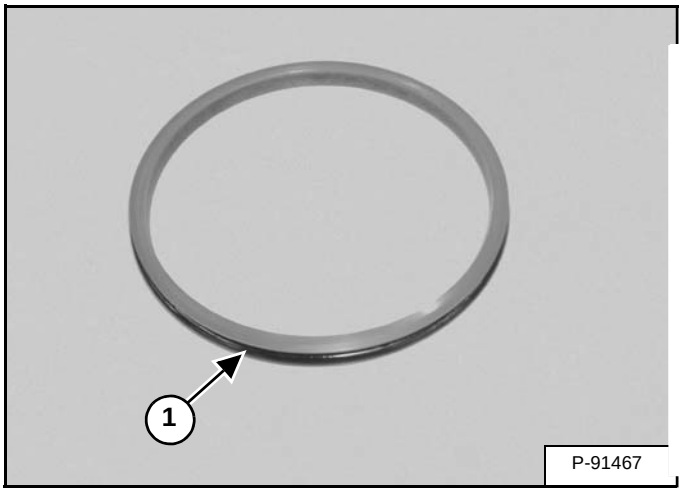
Install the bearing (Item 1) **[Figure 20-70-54]**.

Figure 20-70-55



Install the shaft / bearing assembly in the hub (Item 1) **[Figure 20-70-55]**.

Figure 20-70-56



Install the O-ring (Item 1) **[Figure 20-70-56]** 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.

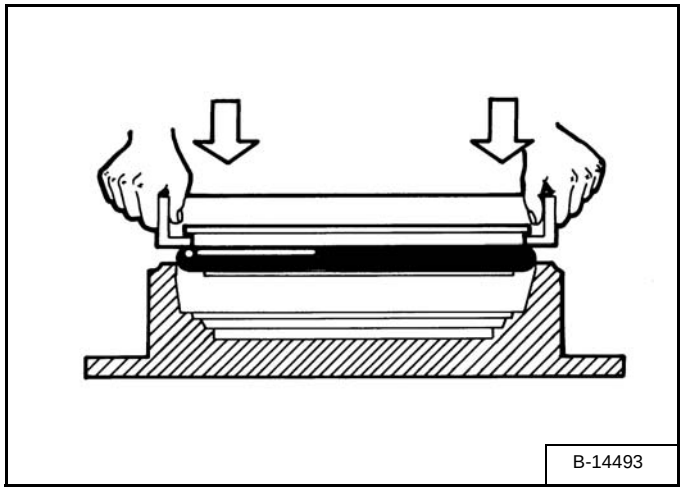
Assembly (Cont'd)

Install the seal seating tool (MEL1413) 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 20-70-57



Shake off the excess alcohol and install the seal ring assembly on the hub **[Figure 20-70-57]**.

Use firm even pressure on the installation tool (MEL1413) to install the O-ring in the motor housing.

Repeat the procedure for the housing.

Figure 20-70-58

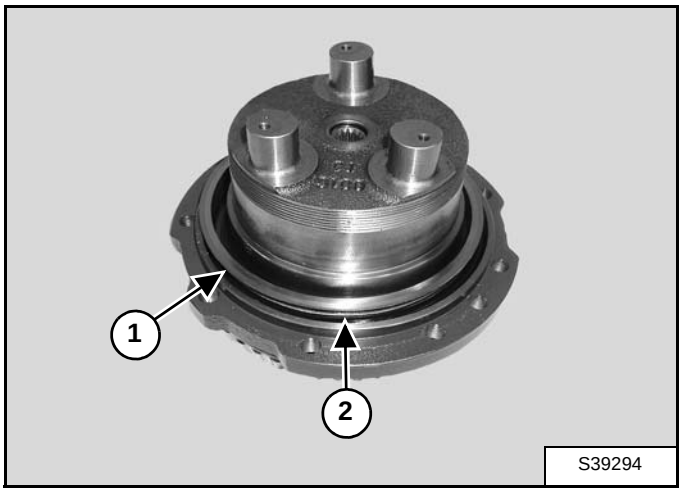
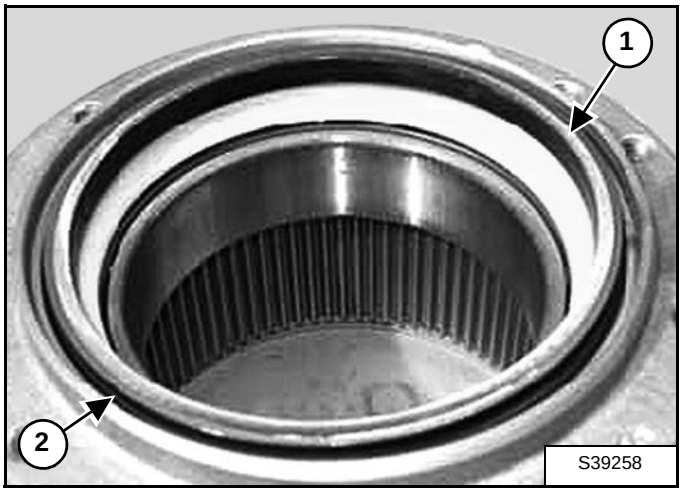


Figure 20-70-59

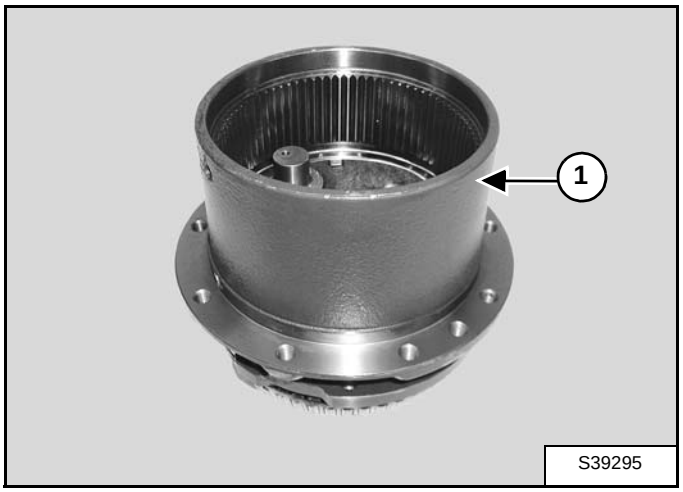


After the seal ring (Item 1) **[Figure 20-70-58]** is installed, check the stand out height in four places, 90° apart.

Apply a light film of oil to the seal ring lapped face (Item 2) **[Figure 20-70-58]** and **[Figure 20-70-59]**.

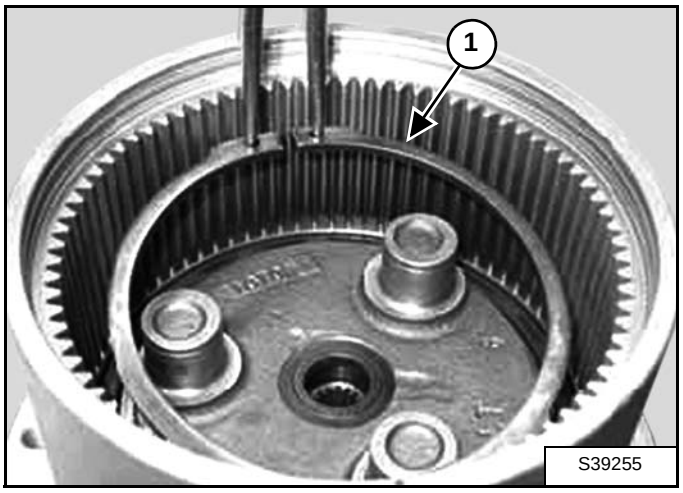
Assembly (Cont'd)

Figure 20-70-60



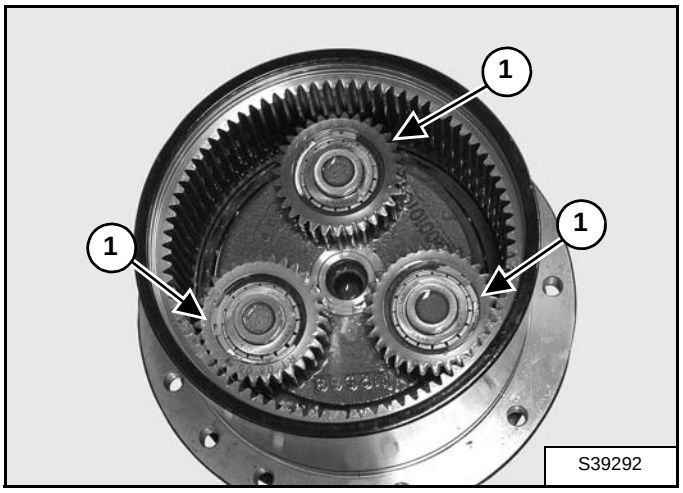
Install the housing (Item 1) **[Figure 20-70-60]** on the hub.

Figure 20-70-61



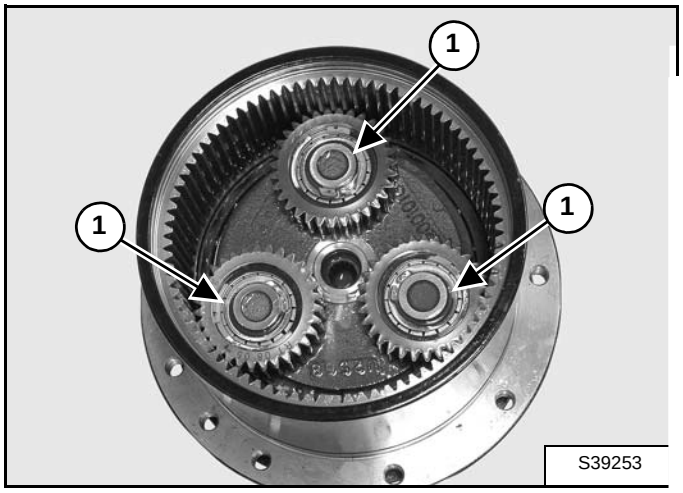
Install the snap ring (Item 1) **[Figure 20-70-61]**.

Figure 20-70-62



Install the planetary gears (Item 1) **[Figure 20-70-62]**.

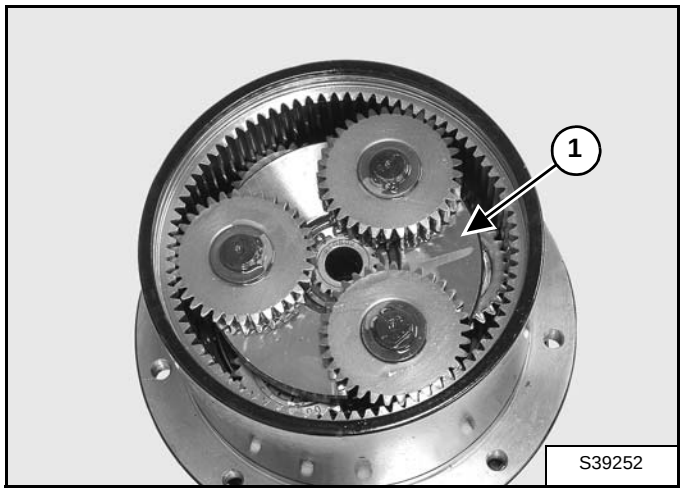
Figure 20-70-63



Install the inner snap rings (Item 1) **[Figure 20-70-63]** on the gear studs.

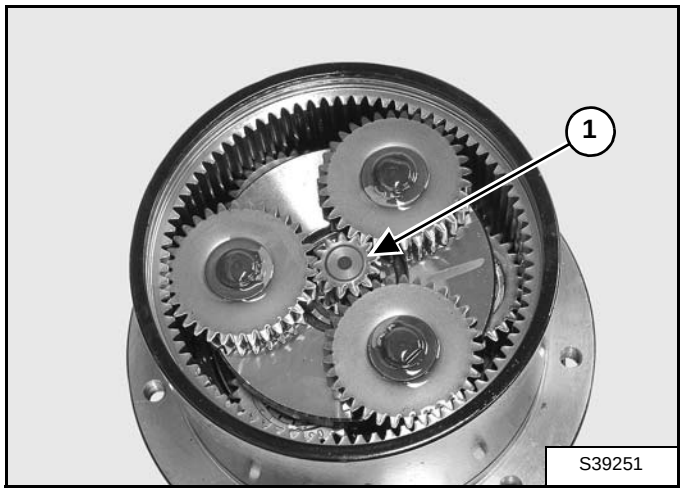
Assembly (Cont'd)

Figure 20-70-64



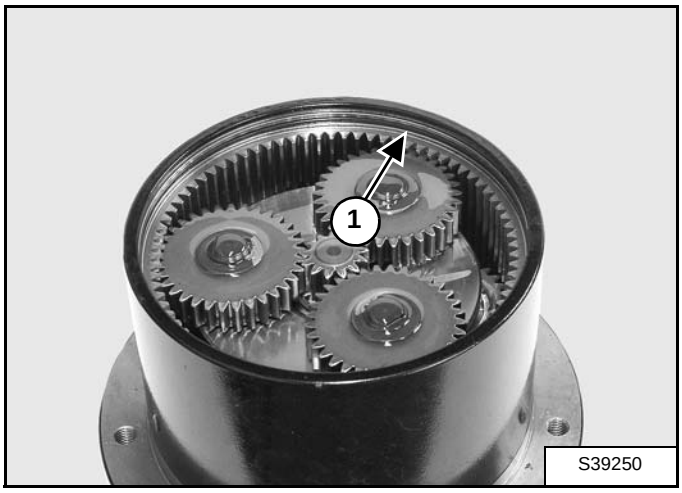
Install the planetary gear assembly (Item 1) **[Figure 20-70-64]**.

Figure 20-70-65



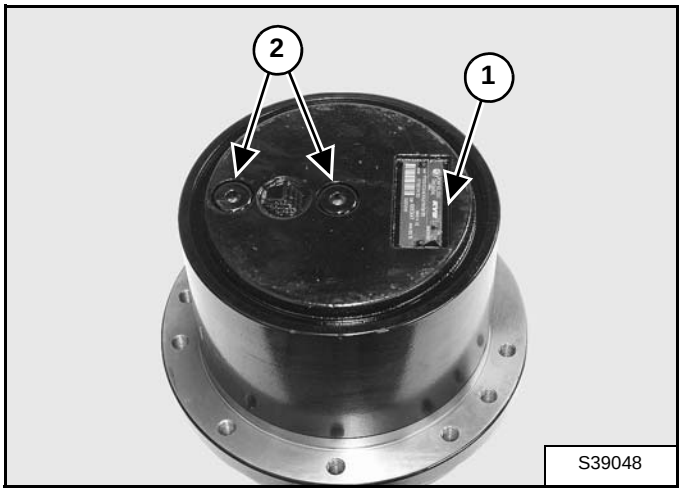
Install the sun gear (Item 1) **[Figure 20-70-65]**.

Figure 20-70-66



Install the O-ring (Item 1) **[Figure 20-70-66]** on the housing.

Figure 20-70-67



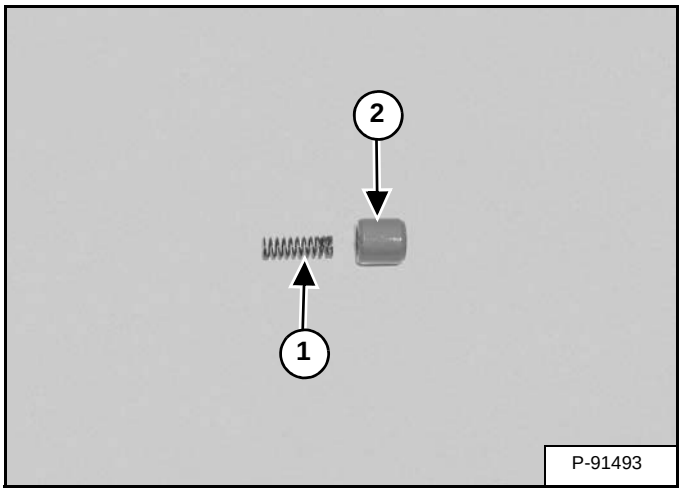
Install the cover (Item 1) **[Figure 20-70-67]**.

Install the two plugs (Item 2) **[Figure 20-70-67]** on the cover.

Tighten the plugs (Item 2) **[Figure 20-70-67]** to 20 - 30 N•m (14.8 - 22.1 ft-lb) torque.

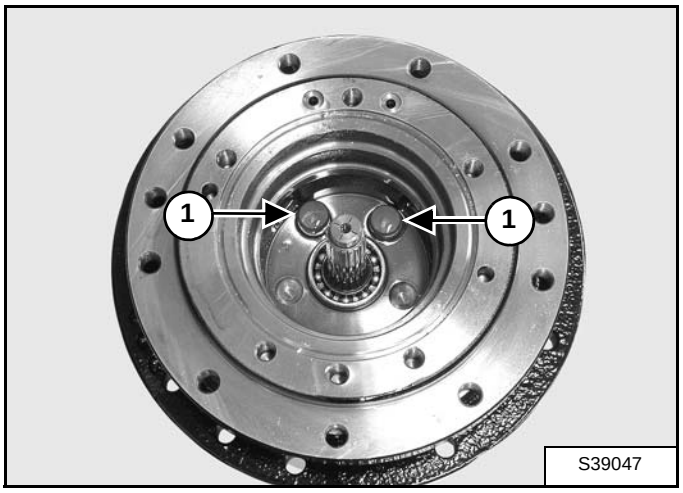
Assembly (Cont'd)

Figure 20-70-68



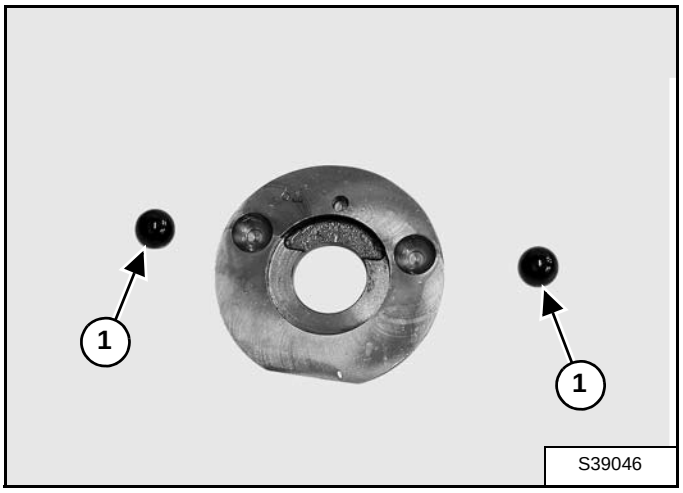
Install the springs (Item 1) in both of the pistons (Item 2) **[Figure 20-70-68]**.

Figure 20-70-69



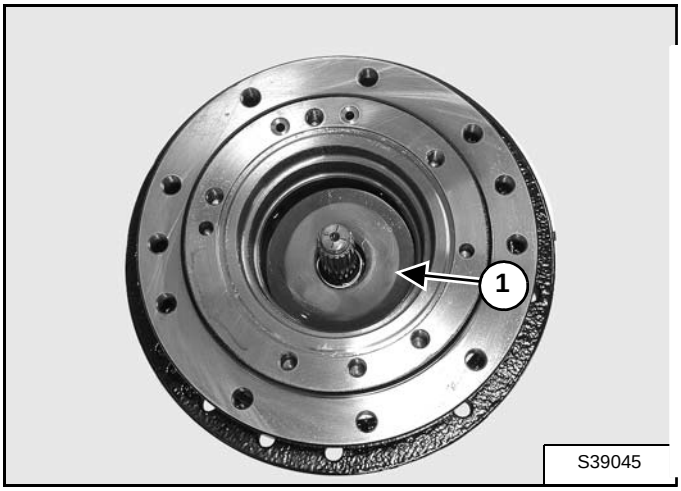
Install the piston / spring assembly (Item 1) **[Figure 20-70-69]** in the piston bores.

Figure 20-70-70



Install the steel balls (Item 1) **[Figure 20-70-70]** in the sockets on the swash plate.

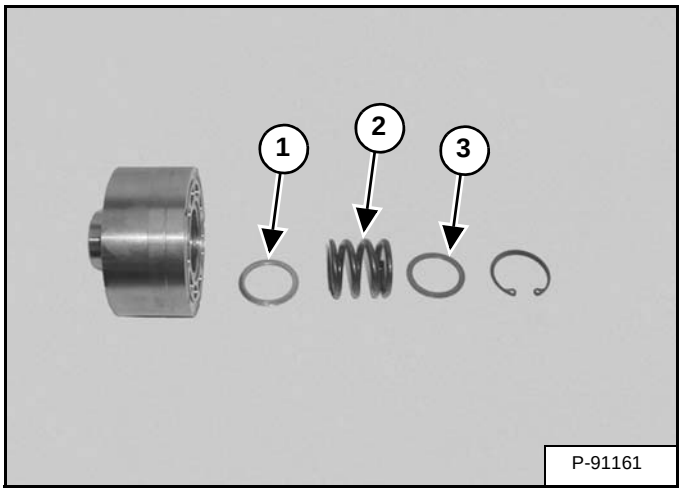
Figure 20-70-71



Install the swash plate assembly (Item 1) **[Figure 20-70-71]** in the housing.

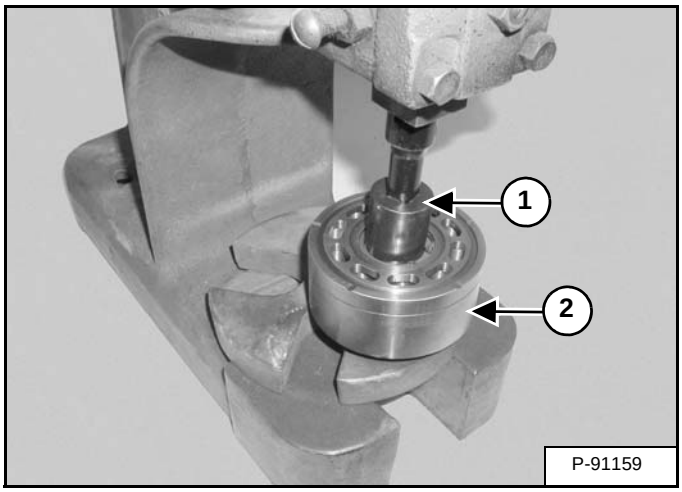
Assembly (Cont'd)

Figure 20-70-72



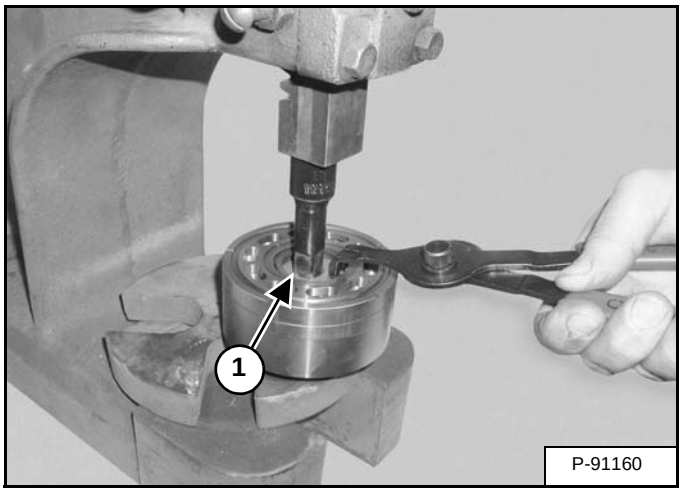
Install the bottom washer (Item 1), spring (Item 2) and top washer (Item 3) **[Figure 20-70-72]**.

Figure 20-70-73



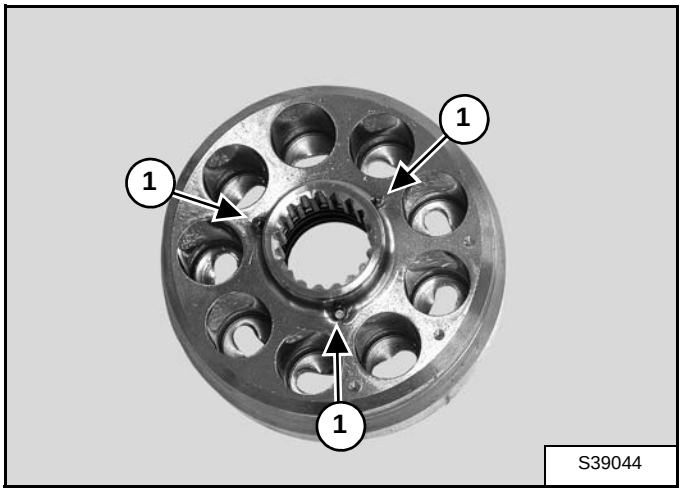
Using a press and an appropriate sized spacer (Item 1), compress the spring in the cylinder block (Item 2) **[Figure 20-70-73]**.

Figure 20-70-74



Install the snap ring (Item 1) **[Figure 20-70-74]** in the cylinder block. Remove the cylinder block from the press.

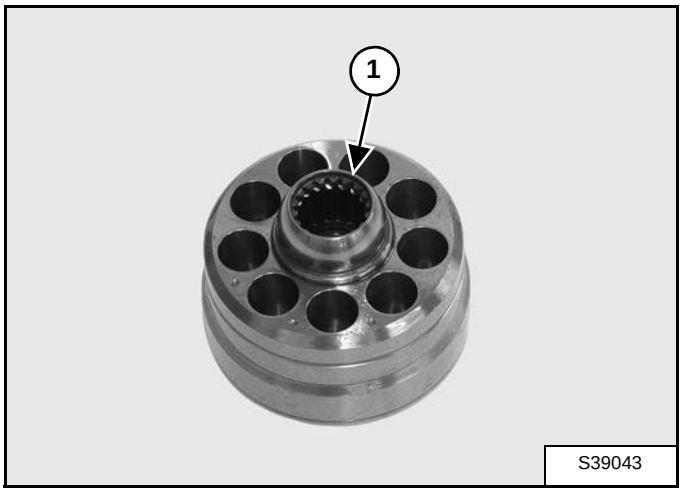
Figure 20-70-75



Install the three pins (Item 1) **[Figure 20-70-75]** in the cylinder block.

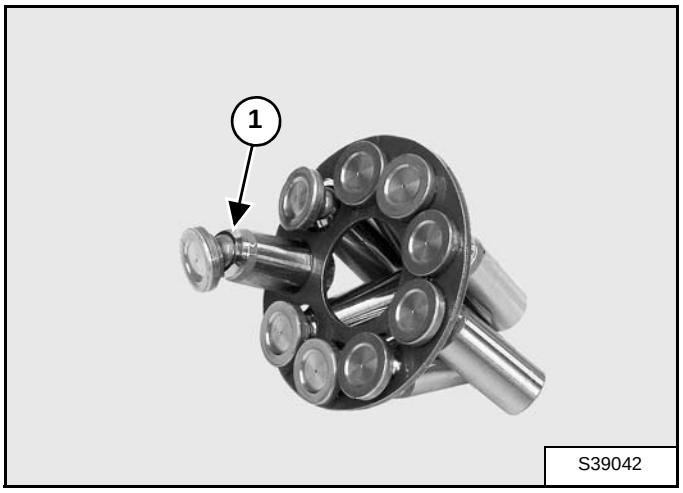
Assembly (Cont'd)

Figure 20-70-76



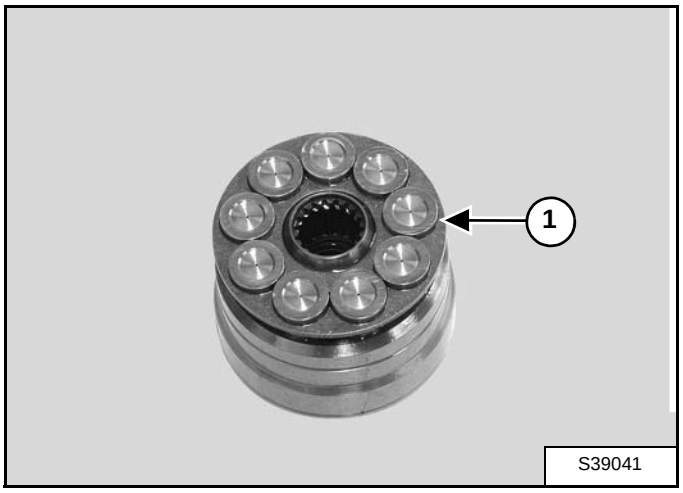
Install the ball guide (Item 1) **[Figure 20-70-76]**.

Figure 20-70-77



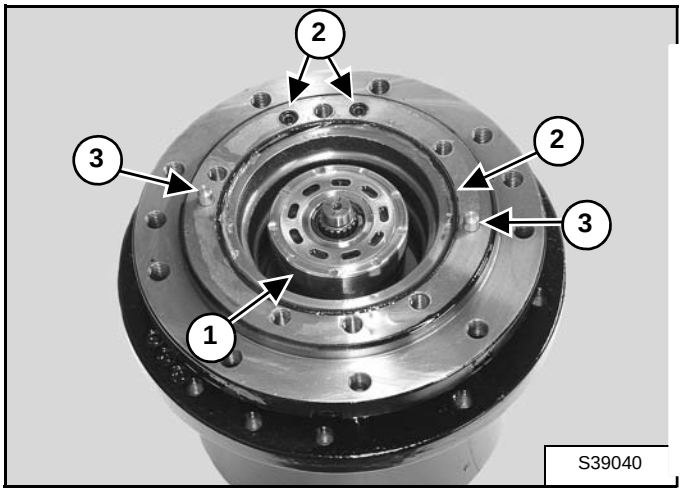
Install the piston assemblies (Item 1) **[Figure 20-70-77]** in the retainer.

Figure 20-70-78



Install the piston assemblies / retainer (Item 1) **[Figure 20-70-78]** in the cylinder block.

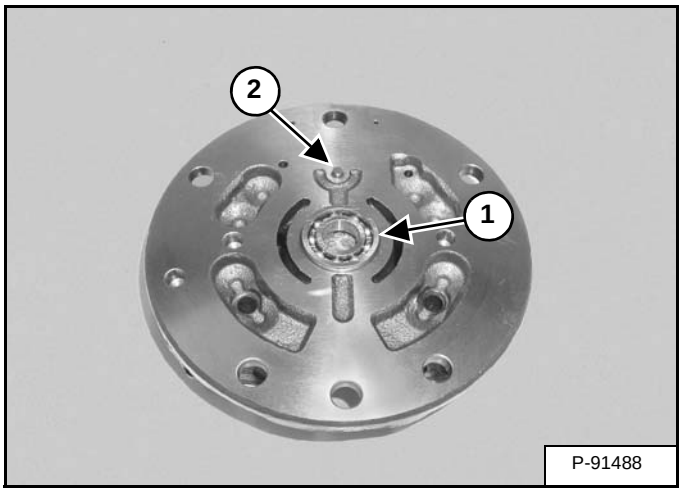
Figure 20-70-79



Install the rotating group (Item 1) in the housing. Install the O-rings (Item 2) and dowel pins (Item 3) **[Figure 20-70-79]**.

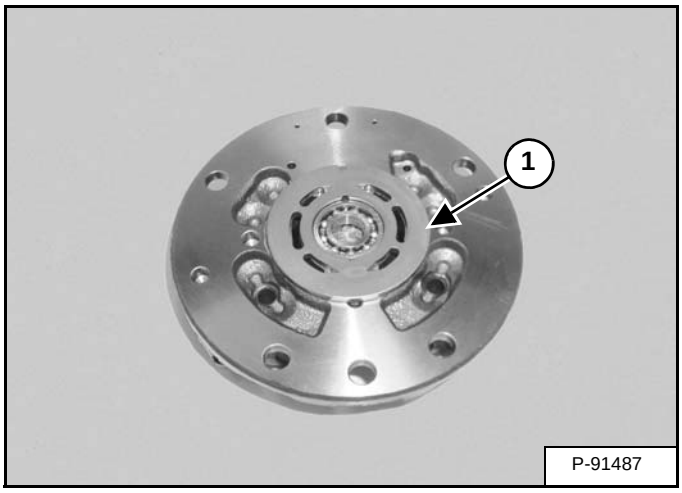
Assembly (Cont'd)

Figure 20-70-80



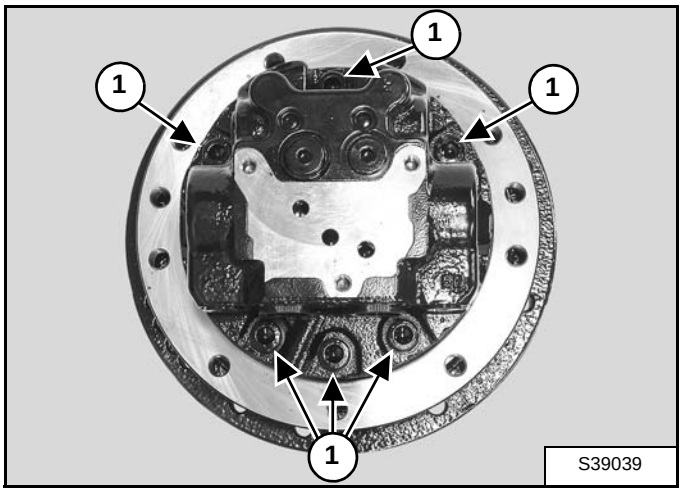
Install the bearing (Item 1). Install the pin (Item 2) **[Figure 20-70-80]**.

Figure 20-70-81



Install the valve plate (Item 1) **[Figure 20-70-81]**.

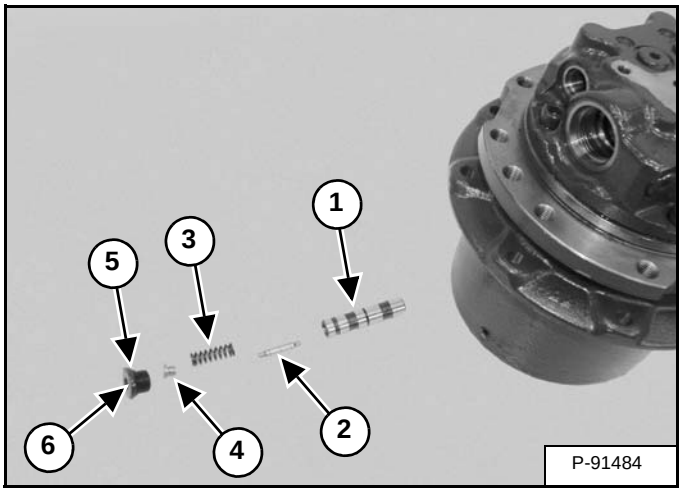
Figure 20-70-82



Install the end cap (Item 1) **[Figure 20-70-82]** and bolts.

Tighten the bolts to 35,1 - 38,9 N•m (25.9 - 28.7 ft-lb) torque.

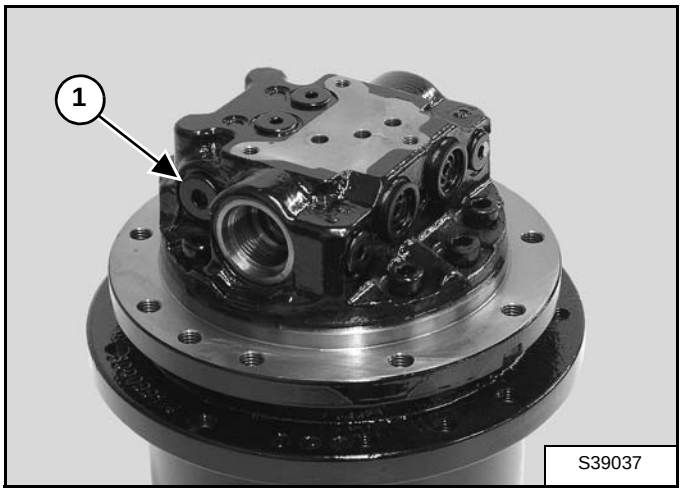
Figure 20-70-83



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 20-70-83]**.

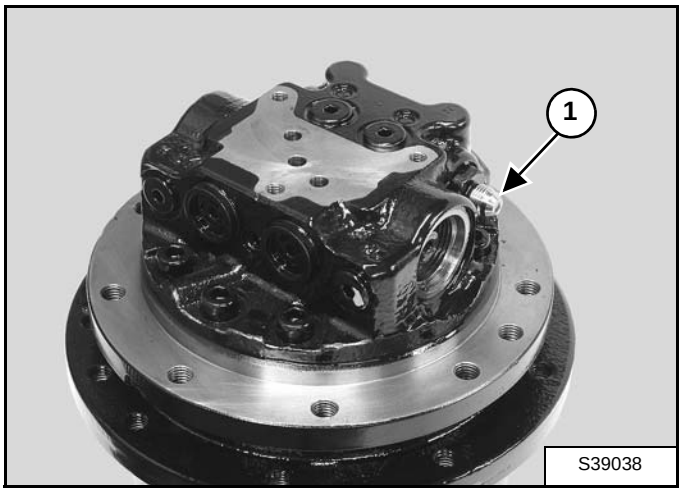
Assembly (Cont'd)

Figure 20-70-84



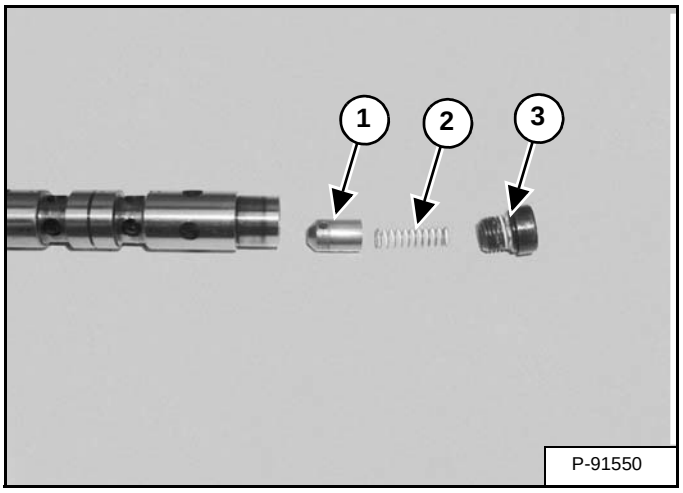
Install the plug (Item 1) **[Figure 20-70-84]**. Tighten the plug to 49 - 58,8 N•m (36.2 - 43.4 ft-lb) torque.

Figure 20-70-85



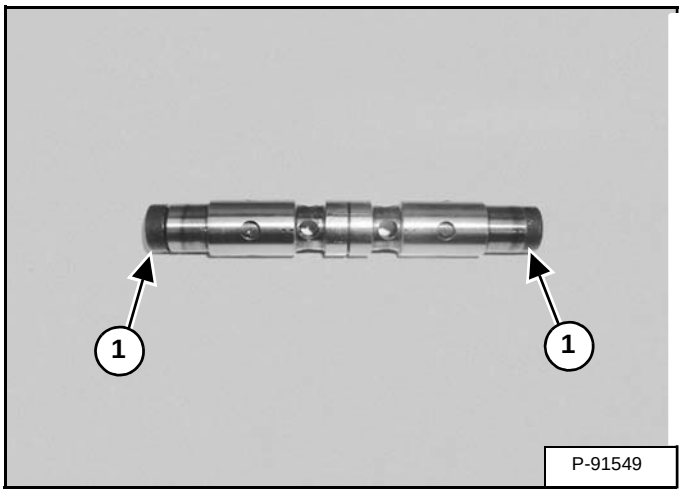
Install the fitting (Item 1) **[Figure 20-70-85]**.

Figure 20-70-86



Install the check valves (Item 1) and springs (Item 2) in both ends of the spool. Install the O-rings (Item 3) **[Figure 20-70-86]** on the plugs.

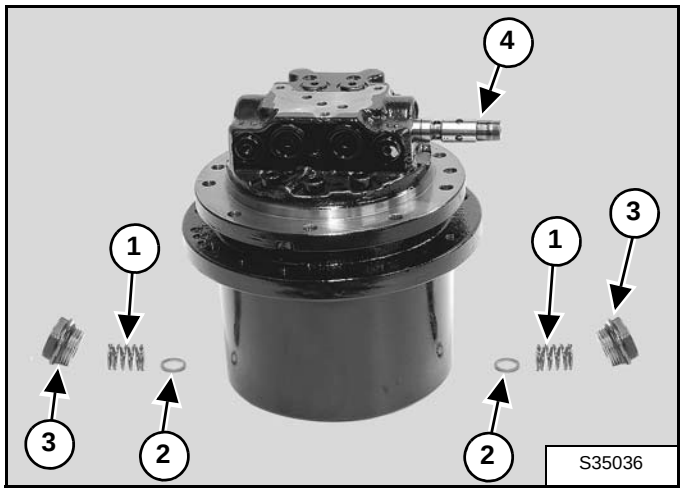
Figure 20-70-87



Apply Loctite® 271 to the plug threads and install the plugs (Item 1) **[Figure 20-70-87]**. Tighten the plugs to 21,8 - 34,4 N•m (16.1 - 25.4 ft-lb) torque.

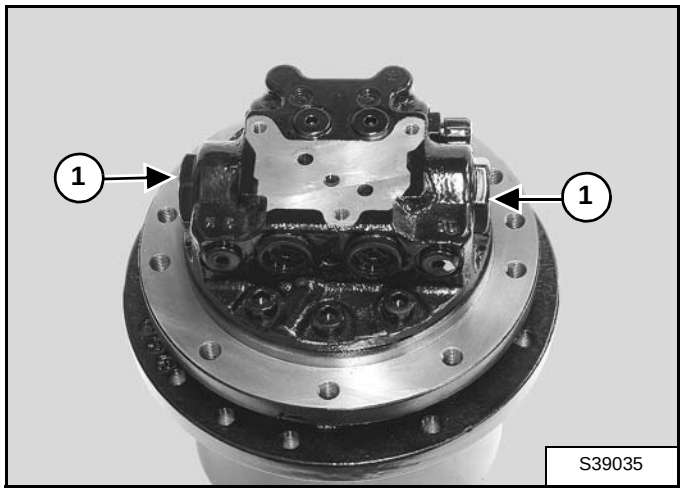
Assembly (Cont'd)

Figure 20-70-88



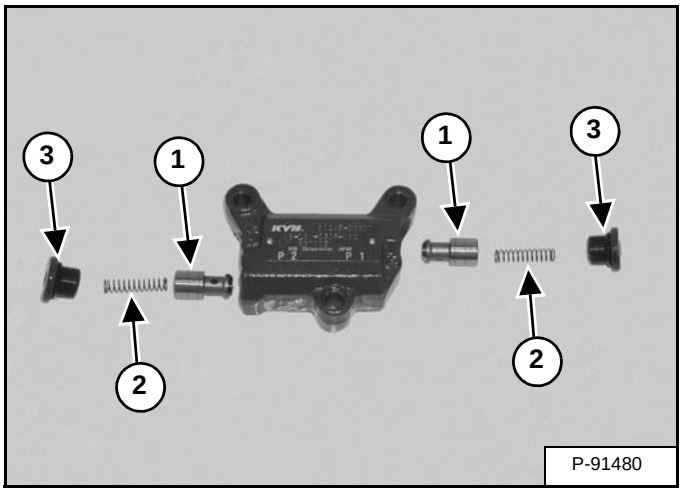
Install the spool (Item 4). Install the spring seats (Item 3) and springs (Item 1). Install the O-rings (Item 2) **[Figure 20-70-88]** on the plugs.

Figure 20-70-89



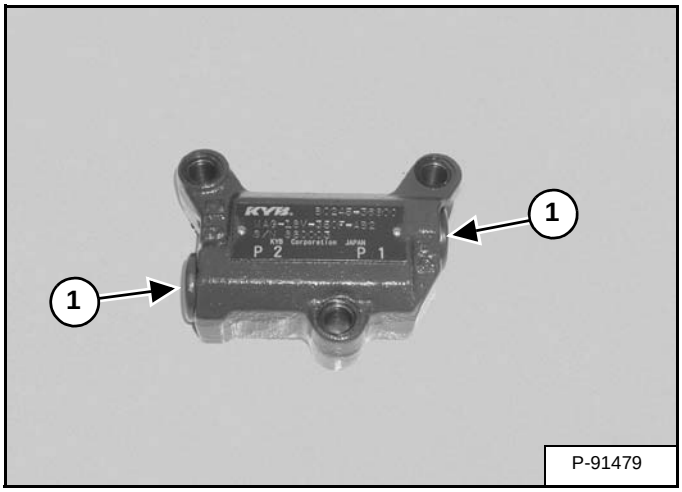
Install the plugs (Item 1) **[Figure 20-70-89]**. Tighten the plugs to 235 - 245 N•m (173 - 181 ft-lb) torque.

Figure 20-70-90



Install the poppets (Item 1) and springs (Item 2). Install the O-rings (Item 3) **[Figure 20-70-90]** on the plugs.

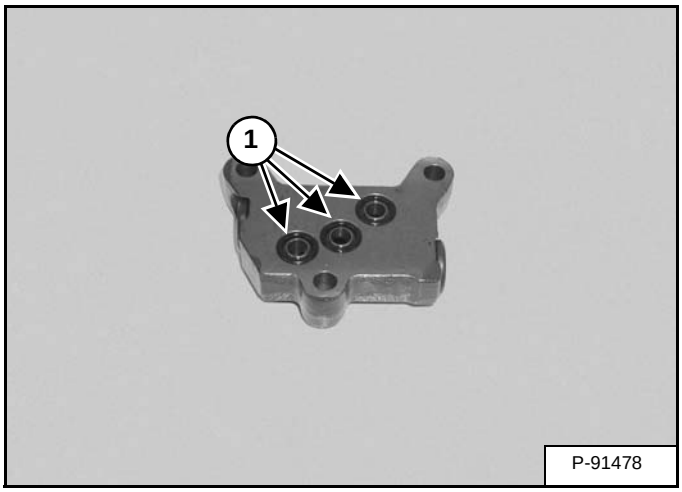
Figure 20-70-91



Install the plugs (Item 1) **[Figure 20-70-91]**. Tighten the plugs to 49 - 59 N•m (36 - 43 ft-lb) torque.

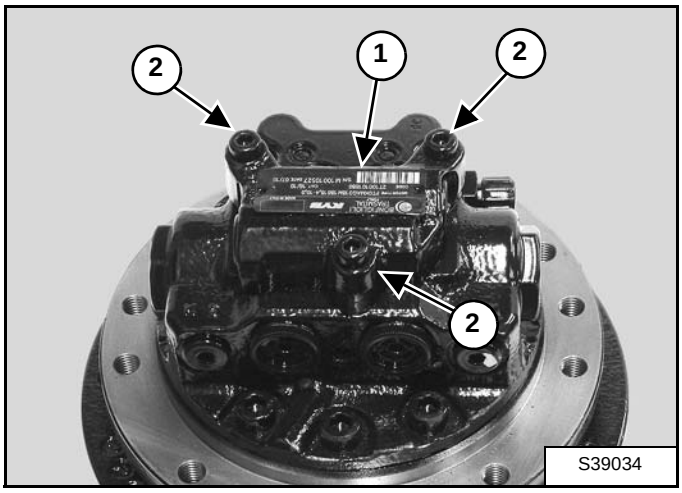
Assembly (Cont'd)

Figure 20-70-92



Install the O-rings (Item 1) **[Figure 20-70-92]**.

Figure 20-70-93



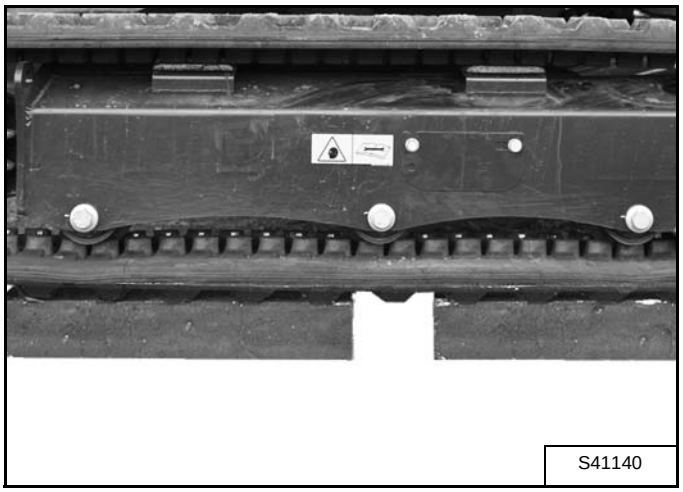
Install the valve (Item 1) on the motor. Install the bolts (Item 2) **[Figure 20-70-93]**. Tighten the bolts to 28 - 32 N•m (20.7 - 23.6 ft-lb) torque.


Bobcat®

SWIVEL JOINT (EARLY MODELS)

Removal And Installation

Figure 20-80-1

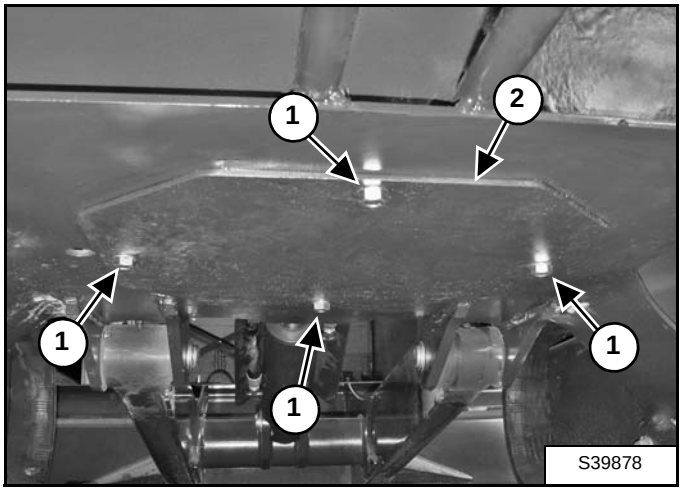


Block the excavator up as shown **[Figure 20-80-1]**.

Remove the tool box. (See Removal And Installation on Page 40-220-1.)

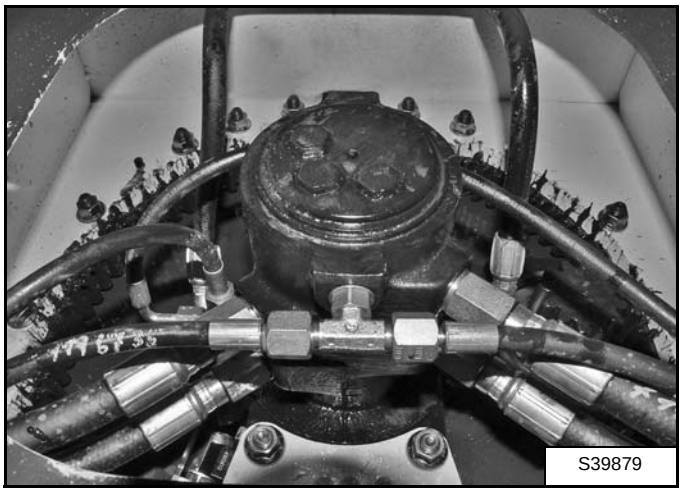
Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-4.)

Figure 20-80-2



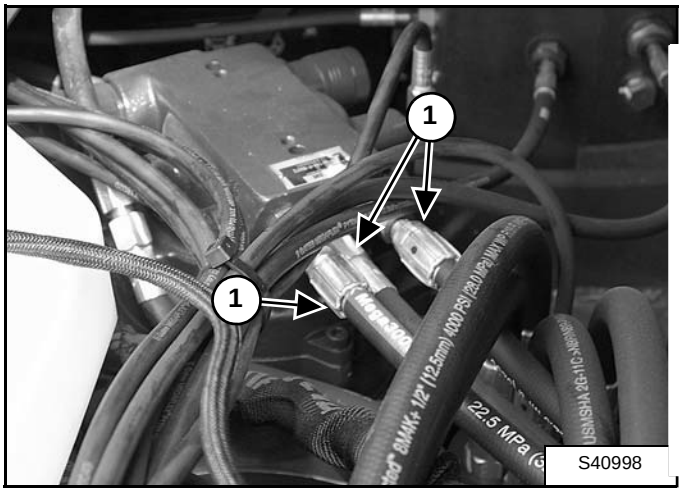
Remove the four bolts (Item 1) and remove the cover (Item 2) **[Figure 20-80-2]**.

Figure 20-80-3



Mark and remove the hoses from the bottom of the swivel joint **[Figure 20-80-3]**.

Figure 20-80-4

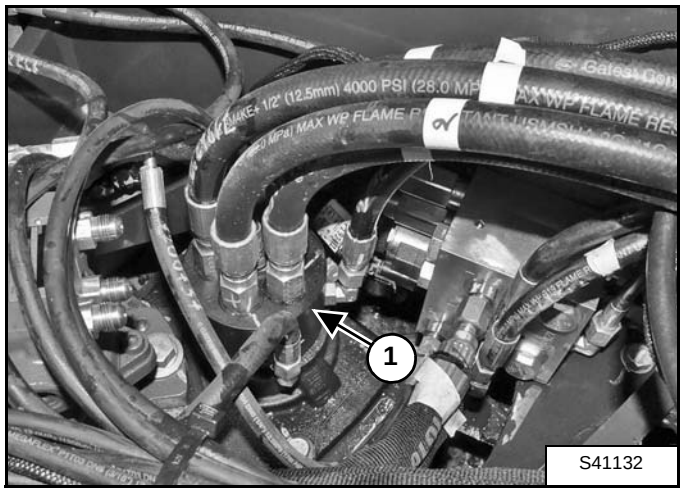


For better accessibility, remove the three hoses (Item 1) **[Figure 20-80-4]** from the swing motor.

SWIVEL JOINT(EARLY MODELS) (CONT'D)

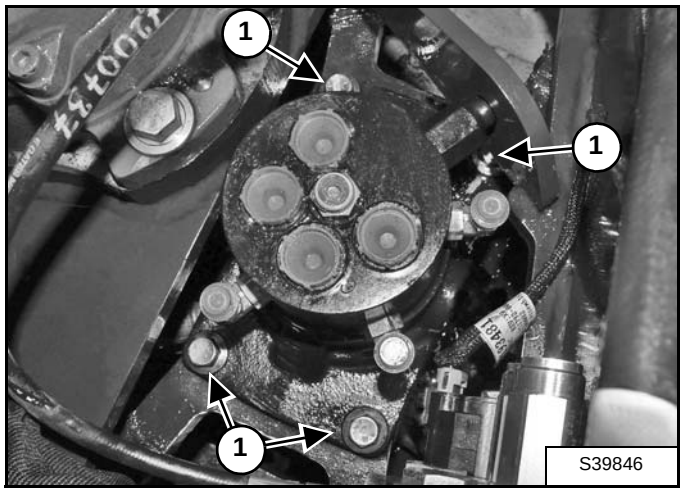
Removal And Installation (Cont'd)

Figure 20-80-5



Remove the eight hoses from the top and side of the swivel joint (Item 1) **[Figure 20-80-5]**.

Figure 20-80-6

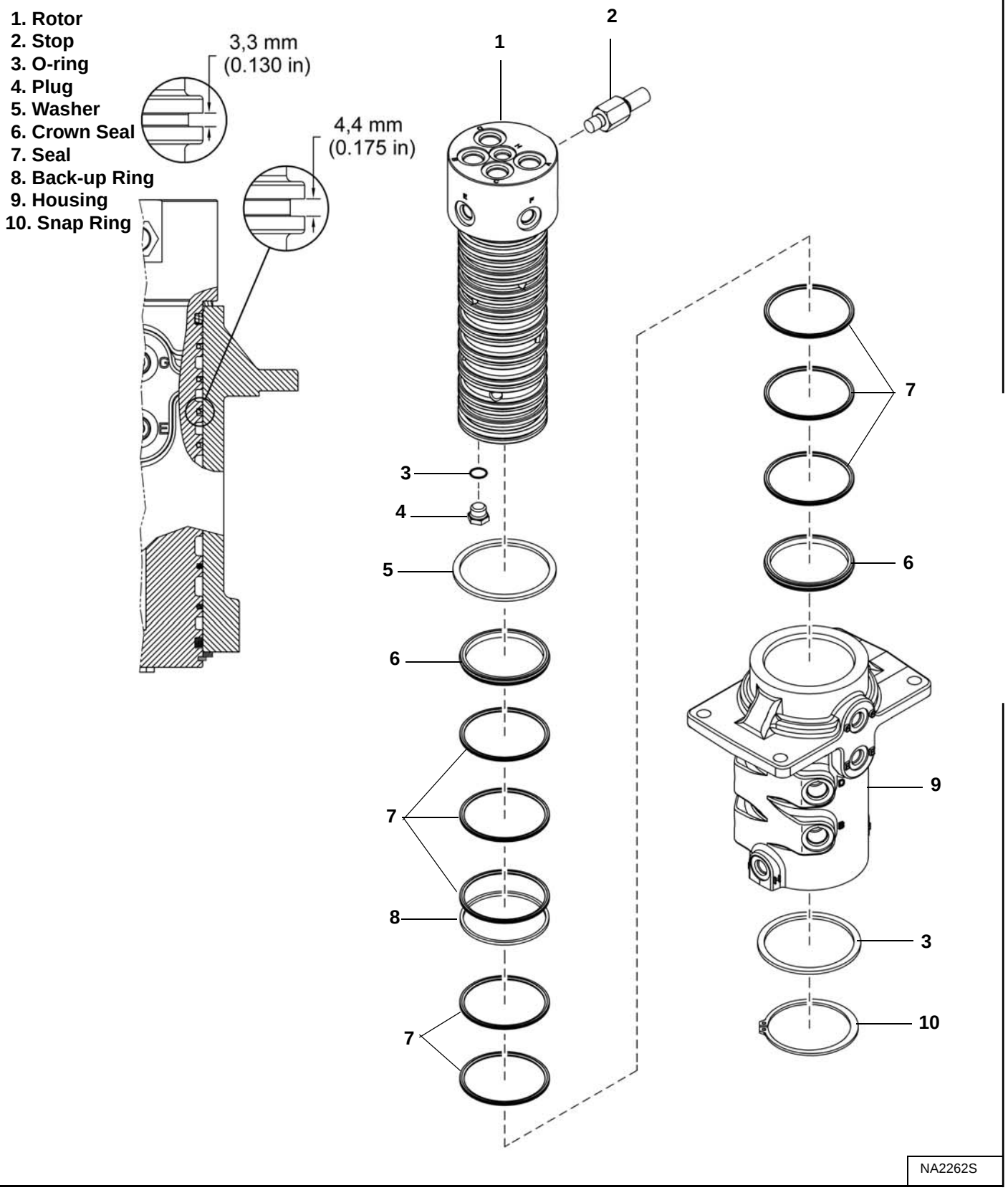


Remove the four bolts (Item 1) **[Figure 20-80-6]** and nuts from the swivel joint.

Installations: Tighten the bolts to 75 - 85 N•m (55.3 - 62.7 ft-lb) torque.

Lower the swivel joint out the bottom of the excavator.

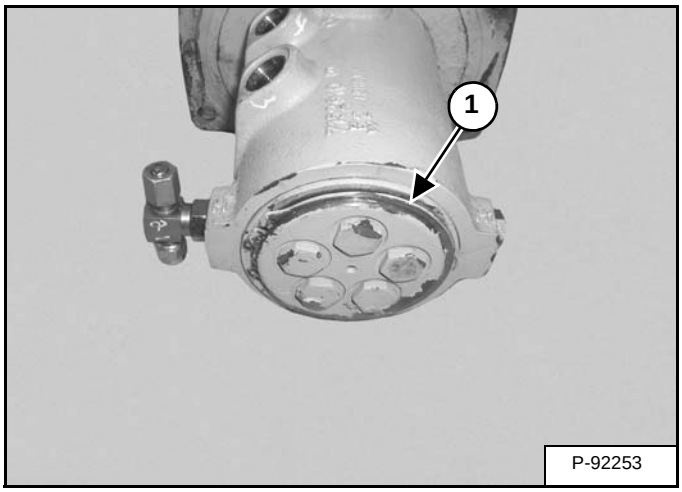
Parts Identification



SWIVEL JOINT (EARLY MODELS) (CONT'D)

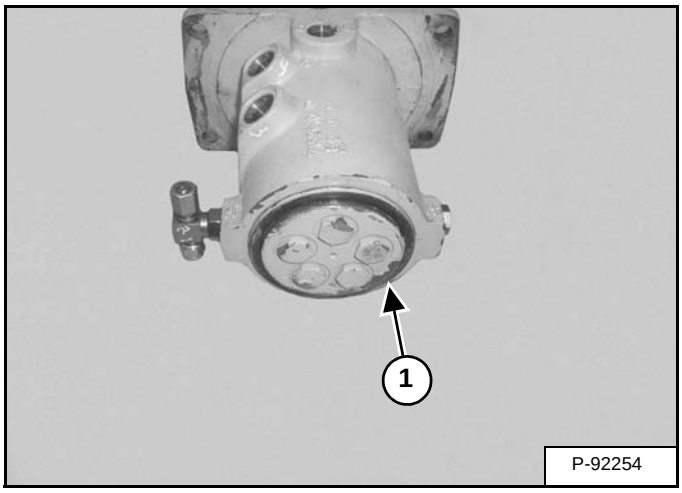
Disassembly And Assembly

Figure 20-80-7



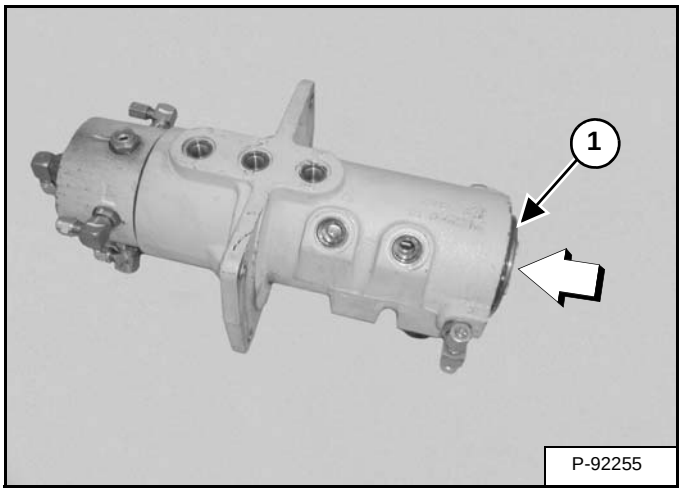
Remove the snap ring (Item 1) **[Figure 20-80-7]**.

Figure 20-80-8



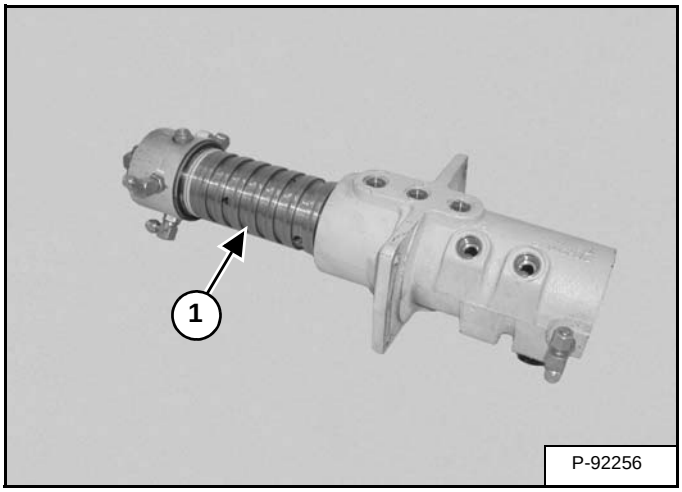
Remove the nylon ring (Item 1) **[Figure 20-80-8]**.

Figure 20-80-9



Tap the rotor (Item 1) **[Figure 20-80-9]** out of the housing.

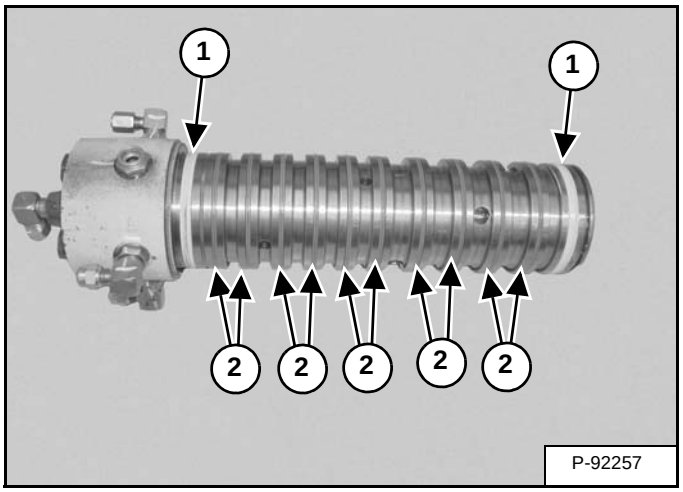
Figure 20-80-10



Continue to remove the rotor (Item 1) **[Figure 20-80-10]** until the rotor is out of the housing.

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]**.

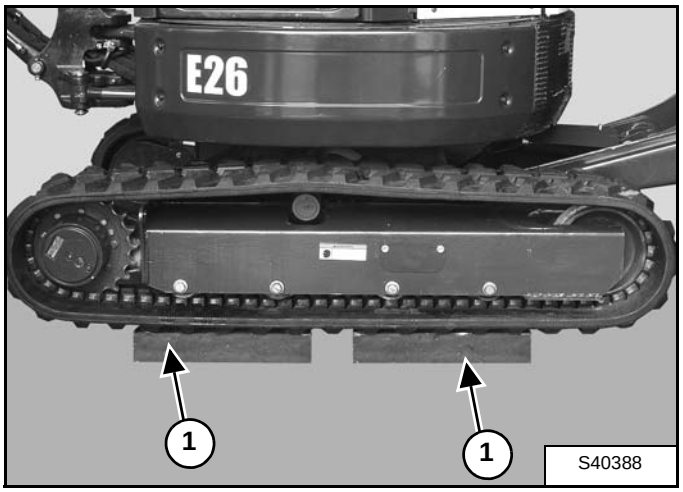
Assembly: Heat the crown seals and seals in hydraulic fluid for three minutes at 54°C (130°F) before installing the seals on the rotor.


Bobcat®

SWIVEL JOINT (LATER MODELS)

Removal And Installation

Figure 20-81-1

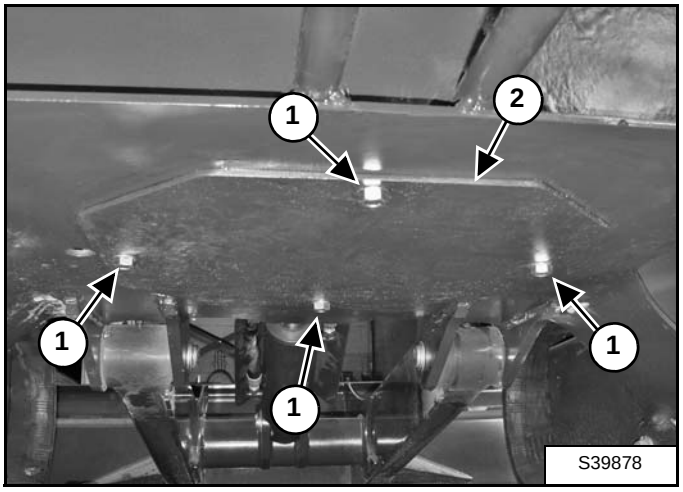


Block the excavator up as shown **[Figure 20-81-1]**.

Remove the tool box. (See Removal And Installation on Page 40-220-1.)

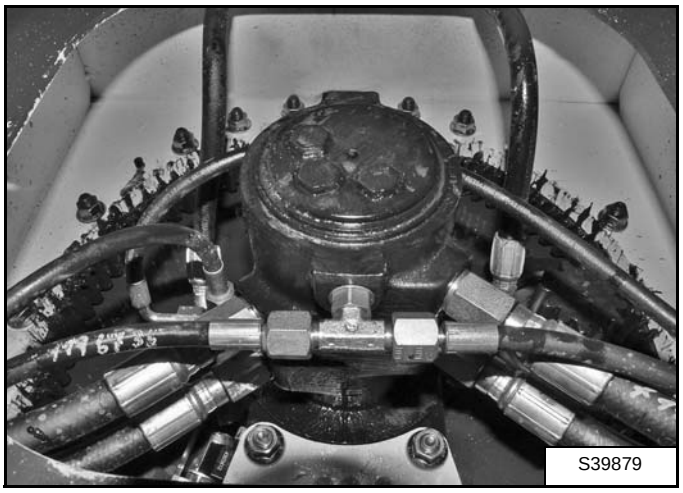
Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-4.)

Figure 20-81-2



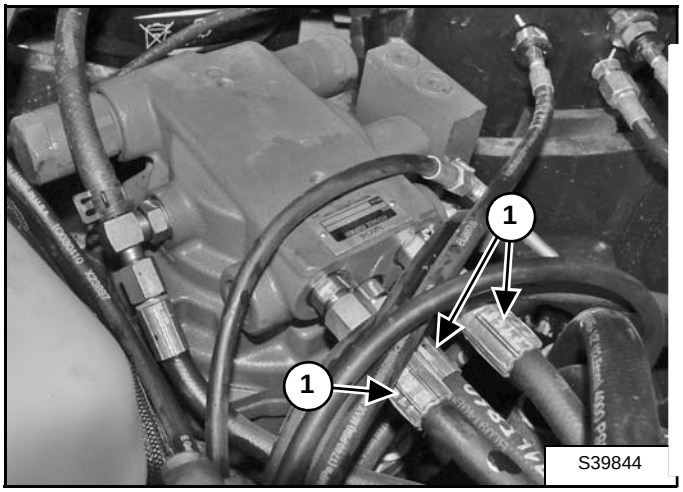
Remove the four bolts (Item 1) and remove the cover (Item 2) **[Figure 20-81-2]**.

Figure 20-81-3



Mark and remove the hoses from the bottom of the swivel joint **[Figure 20-81-3]**.

Figure 20-81-4

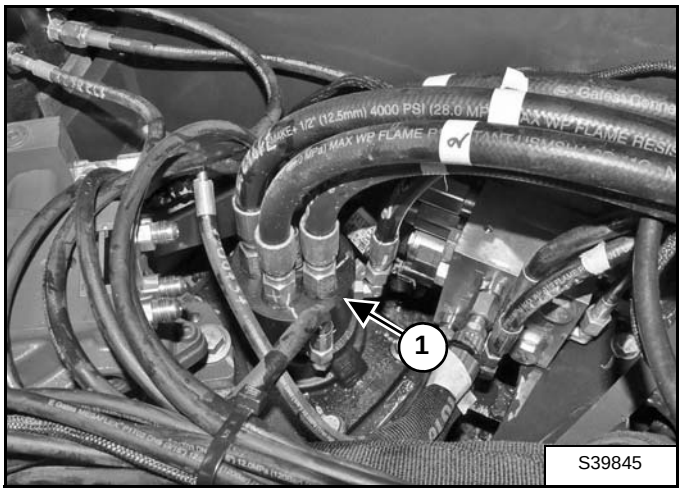


For better accessibility, remove the three hoses (Item 1) **[Figure 20-81-4]** from the swing motor.

SWIVEL JOINT (LATER MODELS) (CONT'D)

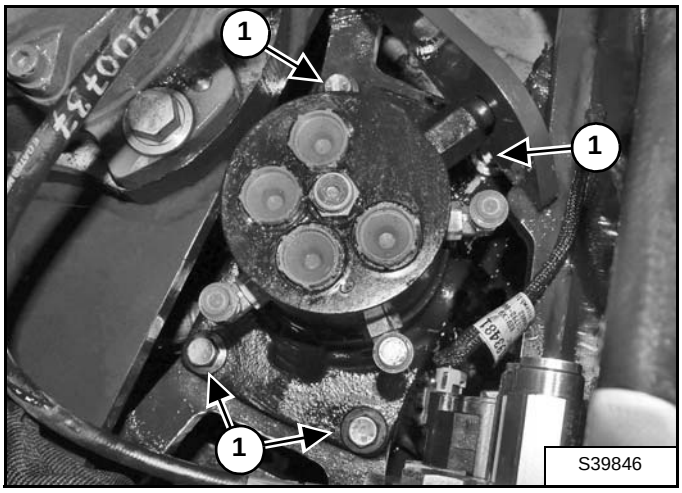
Removal And Installation (Cont'd)

Figure 20-81-5



Remove the eight hoses from the top and side of the swivel joint (Item 1) **[Figure 20-81-5]**.

Figure 20-81-6



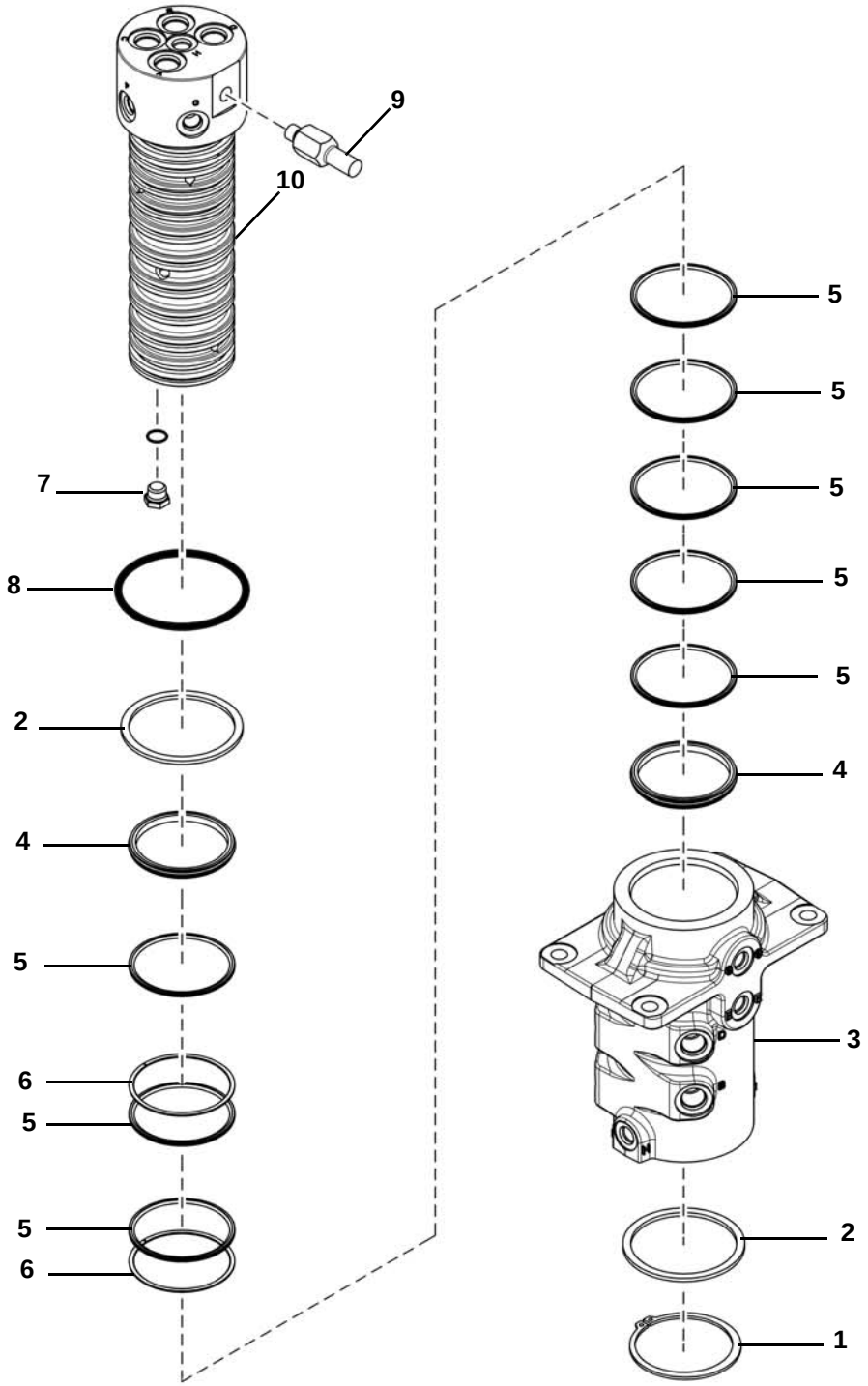
Remove the four bolts (Item 1) **[Figure 20-81-6]** and nuts from the swivel joint.

Installations: Tighten the bolts to 75 - 85 N•m (55.3 - 62.7 ft-lb) torque.

Lower the swivel joint out the bottom of the excavator.

Parts Identification

1. Snap Ring
2. Washer
3. Housing
4. Seal
5. Seal
6. Back-up Ring
7. Plug
8. O-ring
9. Stop
10. Spool

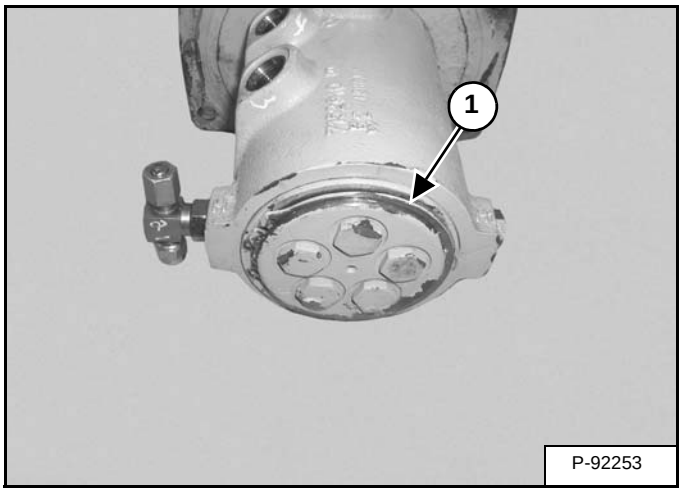


NA10978S

SWIVEL JOINT (LATER MODELS) (CONT'D)

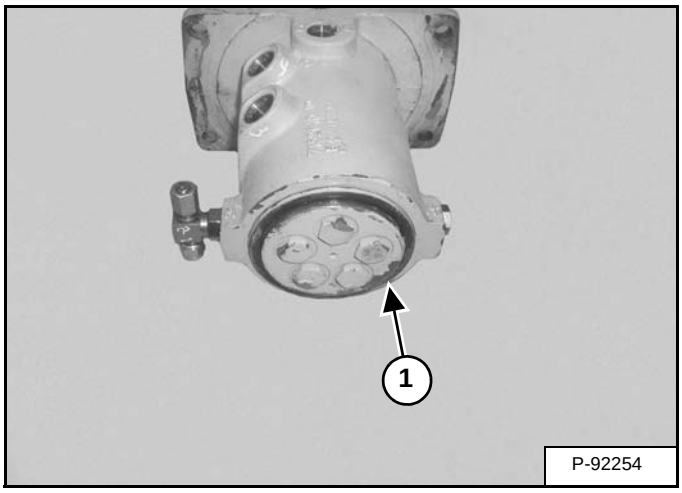
Disassembly And Assembly

Figure 20-81-7



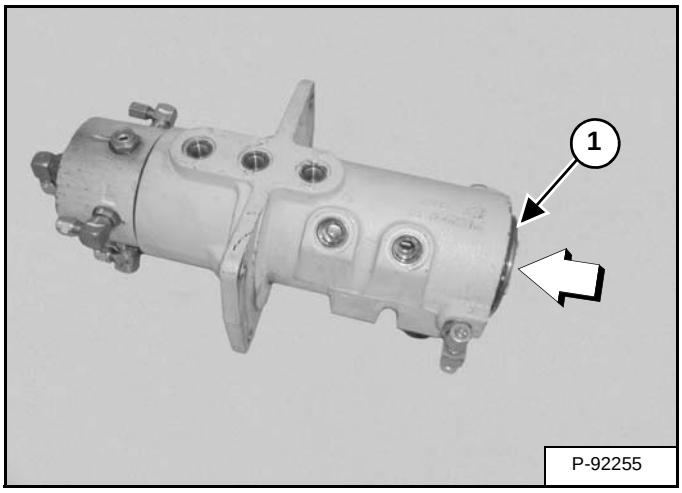
Remove the snap ring (Item 1) **[Figure 20-81-7]**.

Figure 20-81-8



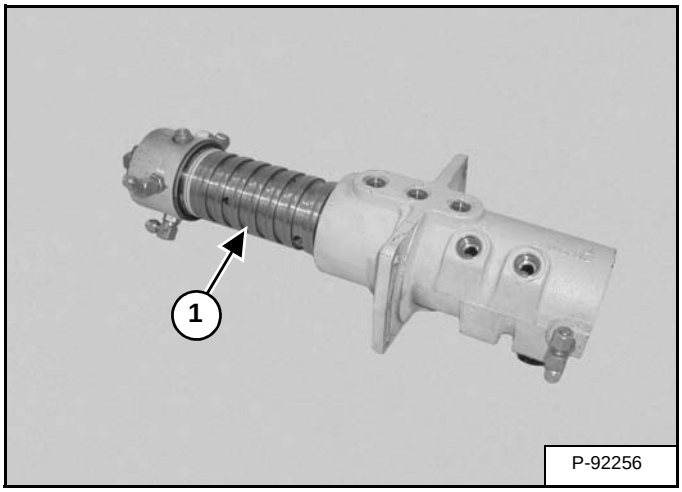
Remove the nylon ring (Item 1) **[Figure 20-81-8]**.

Figure 20-81-9



Tap the rotor (Item 1) **[Figure 20-81-9]** out of the housing.

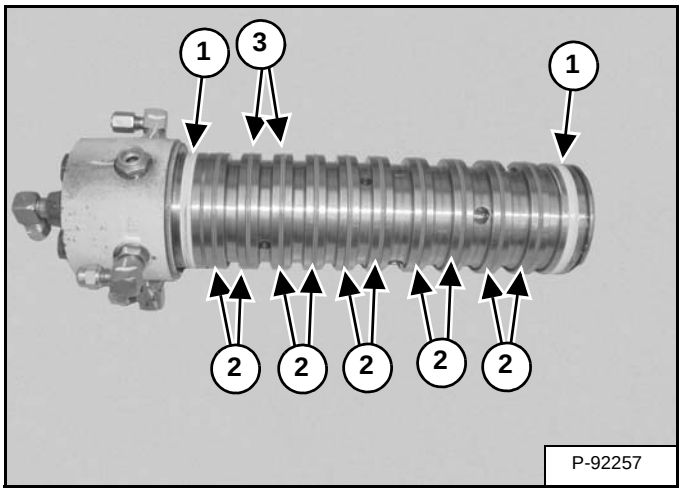
Figure 20-81-10



Continue to remove the rotor (Item 1) **[Figure 20-81-10]** until the rotor is out of the housing.

Disassembly And Assembly (Cont'd)

Figure 20-81-11



Remove the crown seals (Item 1) and remove the seals (Item 2) **[Figure 20-81-11]**.

Remove the back-up ring (Item 3) **[Figure 20-81-11]** from the second and third seal groove.

Assembly: Heat the crown seals and seals in hydraulic fluid for three minutes at 54°C (130°F) before installing the seals on the rotor.


Bobcat®

SWING MOTOR

Removal And Installation

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-4.)

IMPORTANT

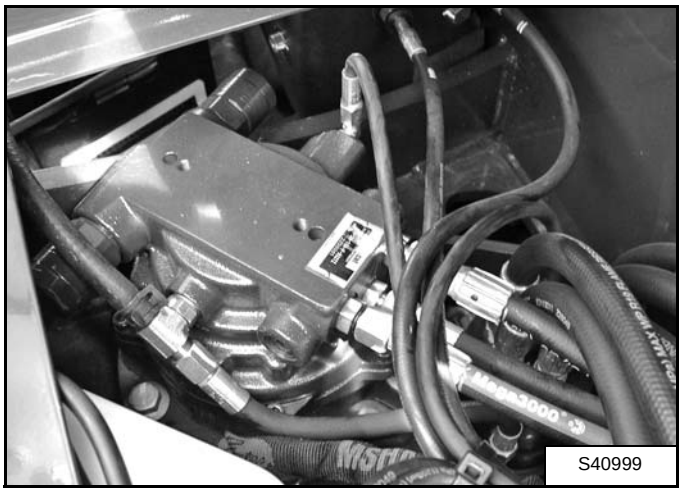
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

Remove the left upperstructure cover (See Removal And Installation on Page 40-70-1.) and the tailgate cover (See Removal And Installation on Page 40-190-1.)

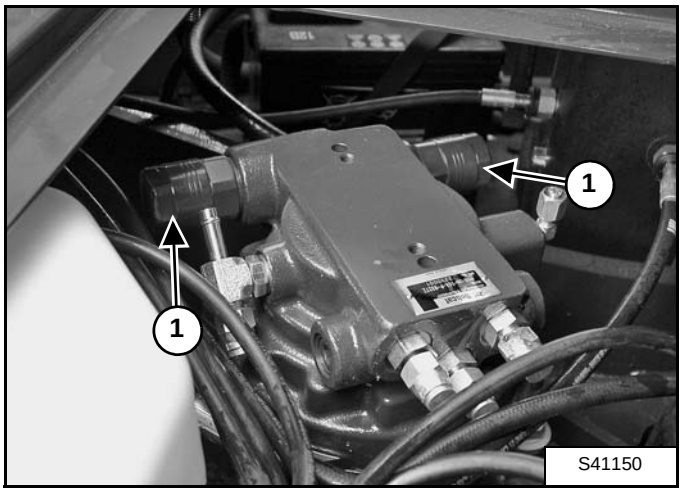
Remove the tool box. (See Removal And Installation on Page 40-220-1.)

Figure 20-90-1



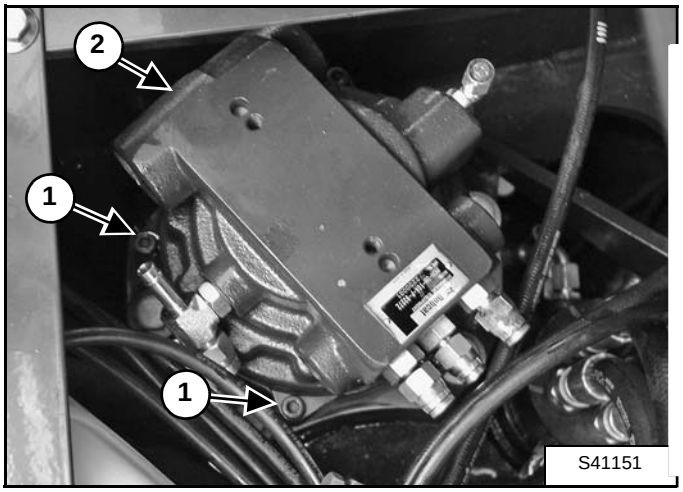
Remove and cap all hoses from the swing motor **[Figure 20-90-1]**.

Figure 20-90-2



Remove the counterbalance valves (Item 1) **[Figure 20-90-2]**.

Figure 20-90-3



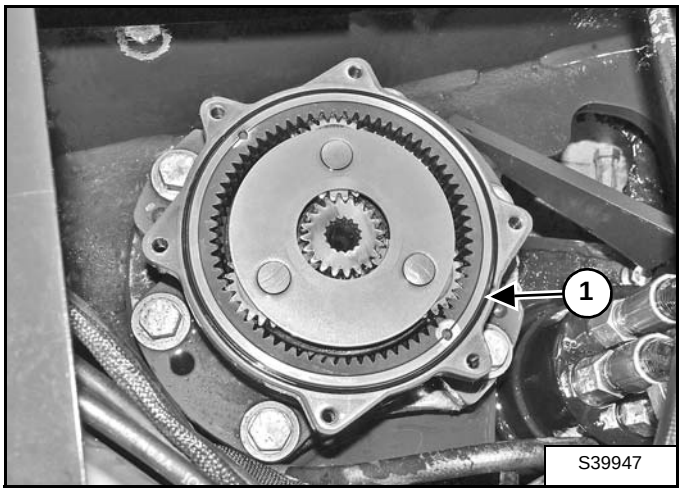
Remove the six bolts (Item 1) **[Figure 20-90-3]**.

Remove the swing motor (Item 2) **[Figure 20-90-3]**.

Installation: Tighten the bolts to 35 - 39 N•m (25.5 - 28.5 ft-lb) torque.

Removal And Installation (Cont'd)

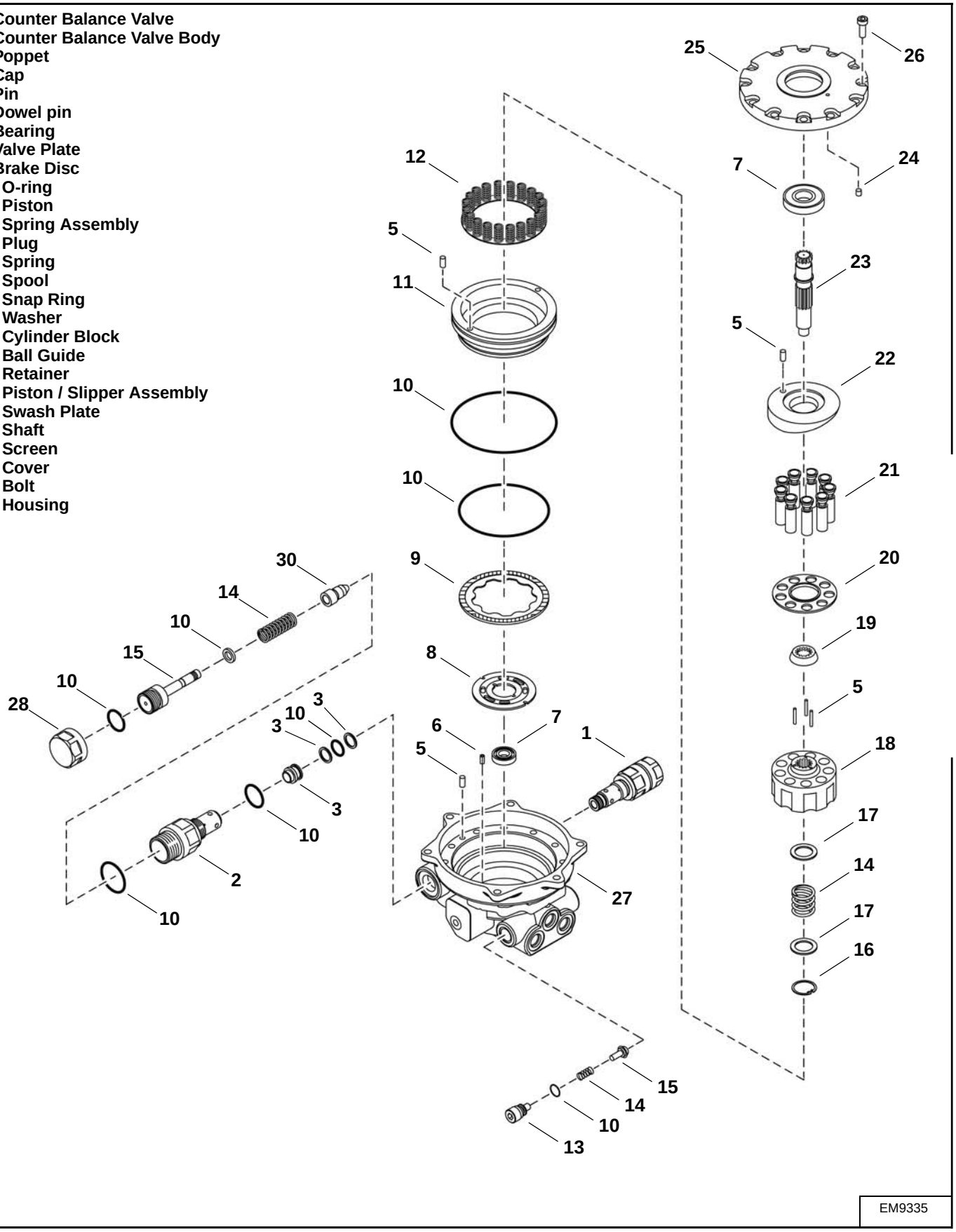
Figure 20-90-4



Remove the O-ring (Item 1) **[Figure 20-90-4]** from the swing motor drive carrier.

Parts Identification

1. Counter Balance Valve
2. Counter Balance Valve Body
3. Poppet
4. Cap
5. Pin
6. Dowel pin
7. Bearing
8. Valve Plate
9. Brake Disc
10. O-ring
11. Piston
12. Spring Assembly
13. Plug
14. Spring
15. Spool
16. Snap Ring
17. Washer
18. Cylinder Block
19. Ball Guide
20. Retainer
21. Piston / Slipper Assembly
22. Swash Plate
23. Shaft
24. Screen
25. Cover
26. Bolt
27. Housing



Disassembly And Assembly

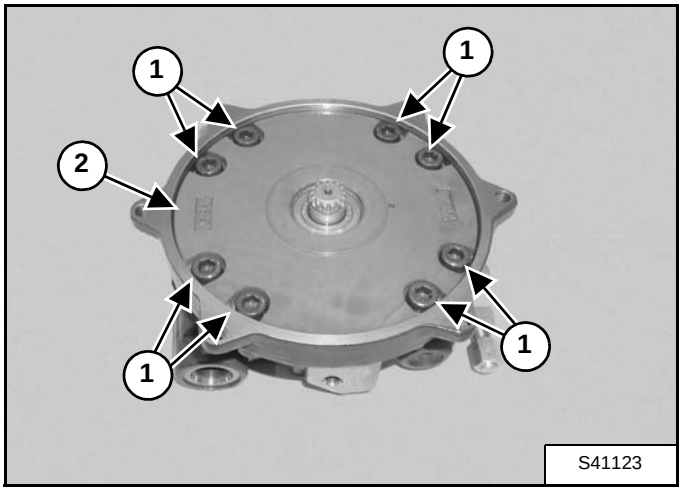
IMPORTANT

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

I-2003-0888

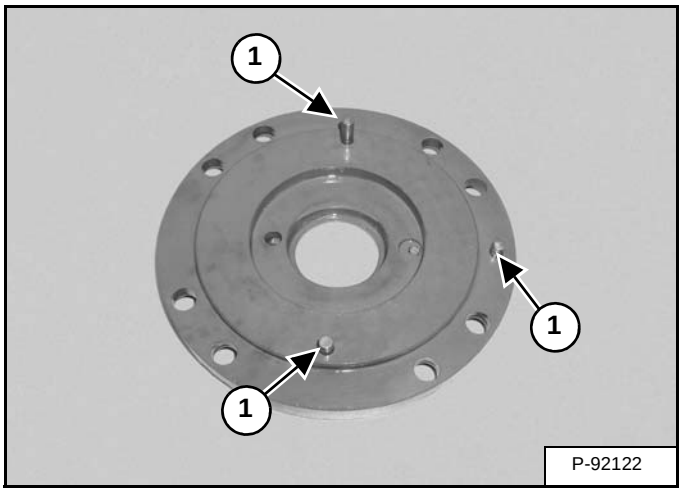
- Clean all parts in solvent and dry with compressed air.
- Inspect all parts for wear or damage. Replace any worn or damaged parts.
- Always install new seals and O-rings. Lubricate all seals and O-rings with clean and hydraulic fluid before installation.

Figure 20-90-5



Remove the bolts (Item 1) and cover (Item 2) **[Figure 20-90-5]**.

Figure 20-90-6



Remove the dowel pins (Item 1) **[Figure 20-90-6]**.

Figure 20-90-7

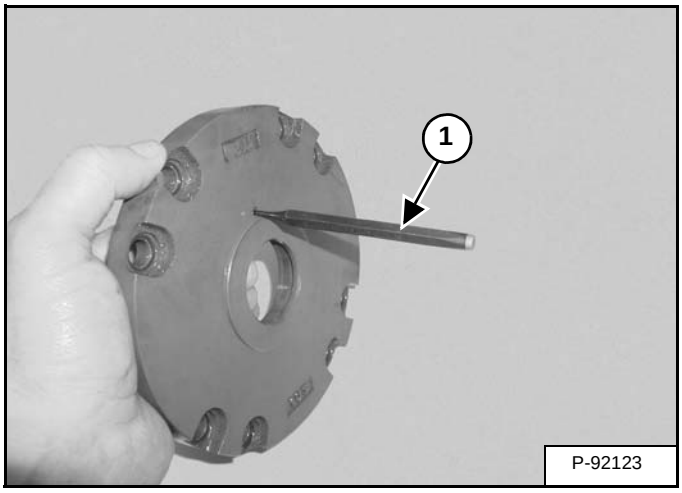
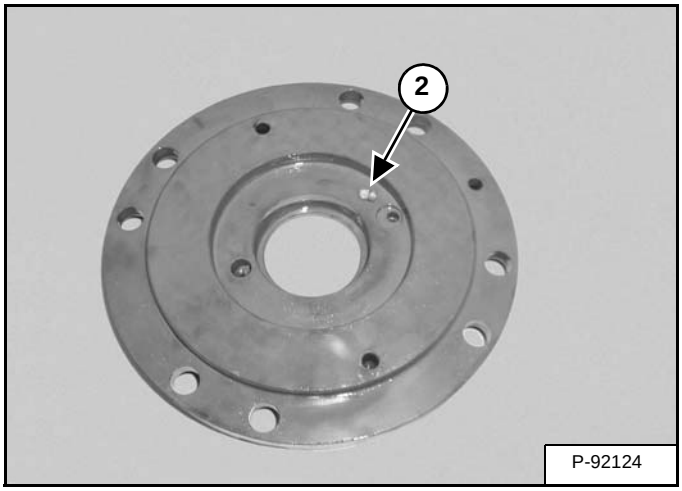


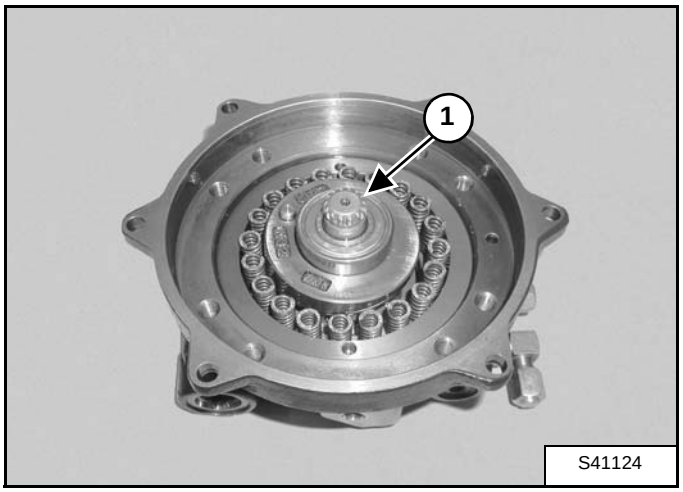
Figure 20-90-8



Use a punch (Item 1) **[Figure 20-90-7]** to push the screen (Item 2) **[Figure 20-90-8]** out of the cover.

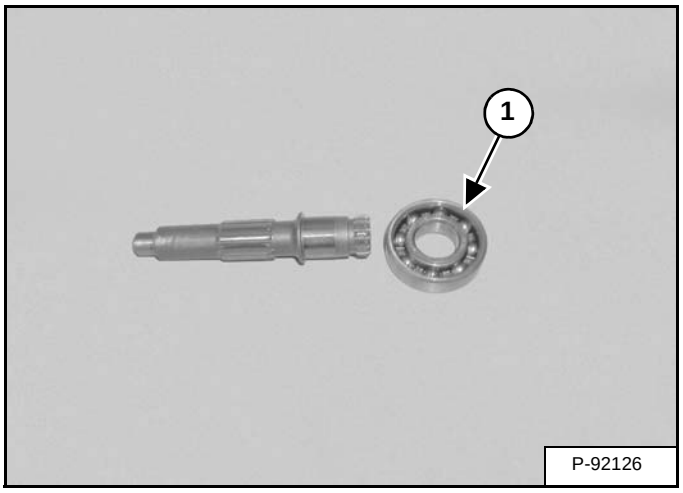
Disassembly And Assembly (Cont'd)

Figure 20-90-9



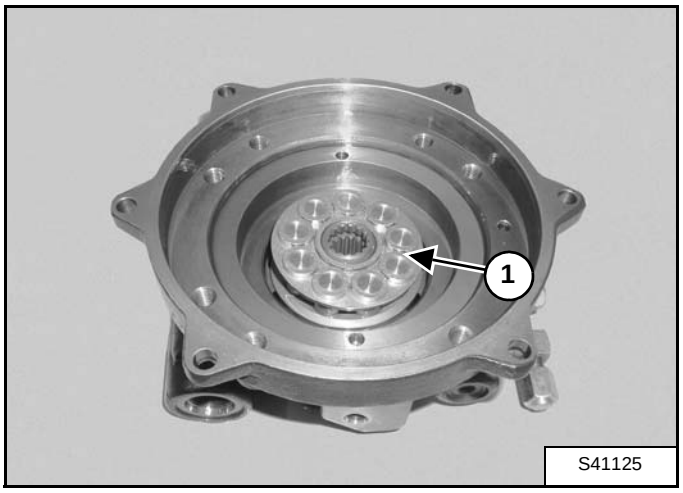
Remove the shaft / bearing assembly (Item 1) **[Figure 20-90-9]**.

Figure 20-90-10



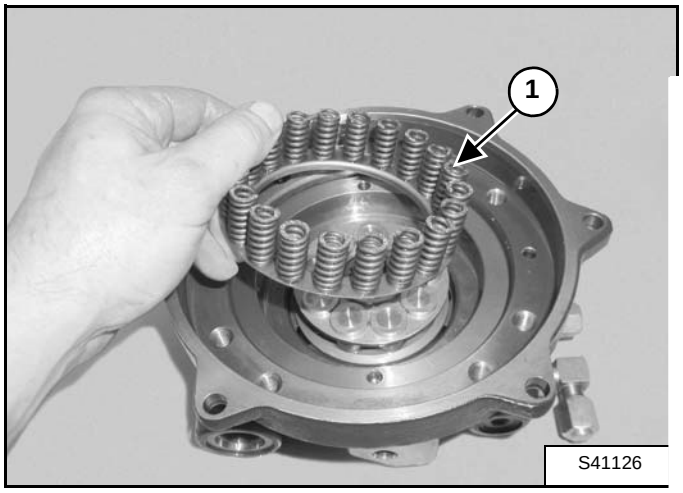
Remove the bearing (Item 1) **[Figure 20-90-10]** from the shaft.

Figure 20-90-11



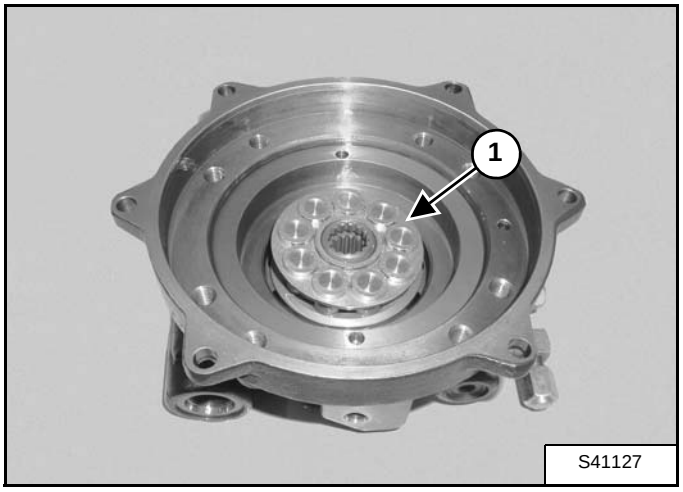
Remove the swash plate (Item 1) **[Figure 20-90-11]**.

Figure 20-90-12



Remove the spring assembly (Item 1) **[Figure 20-90-12]**.

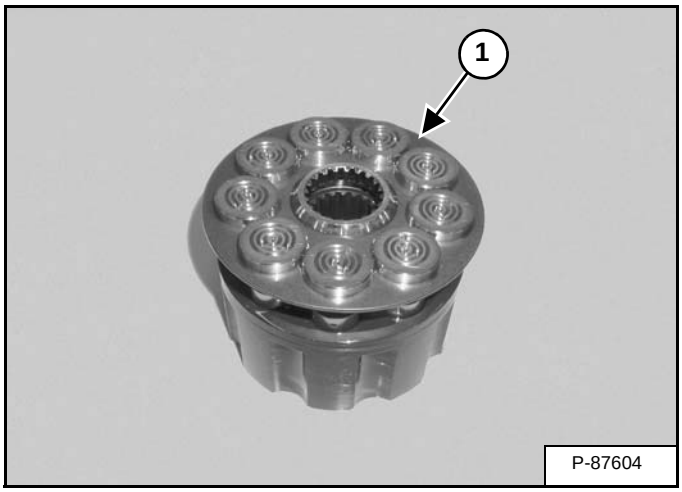
Figure 20-90-13



Remove the rotating group (Item 1) **[Figure 20-90-13]**.

Disassembly And Assembly (Cont'd)

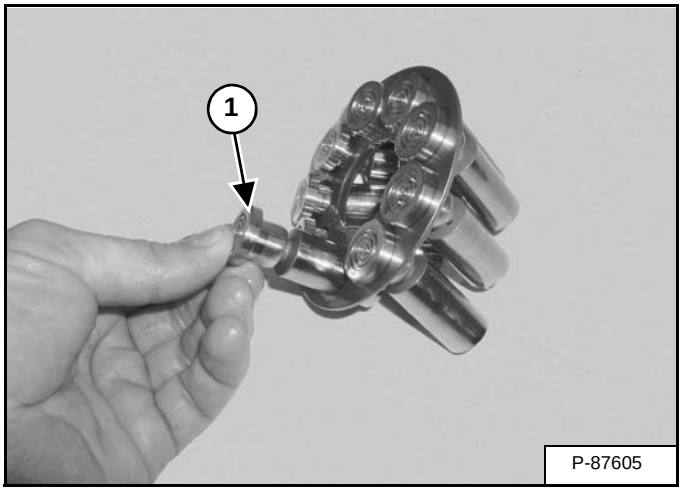
Figure 20-90-14



Remove the piston assemblies / retainer (Item 1) **[Figure 20-90-14]** from the cylinder block.

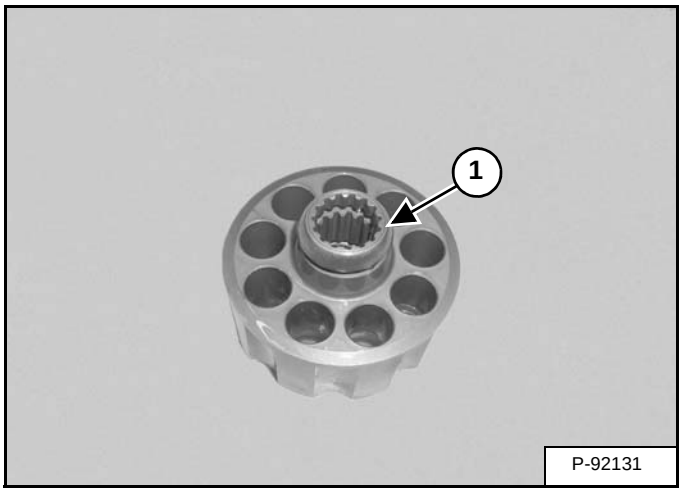
NOTE: It is not important that the pistons are installed in the original bores.

Figure 20-90-15



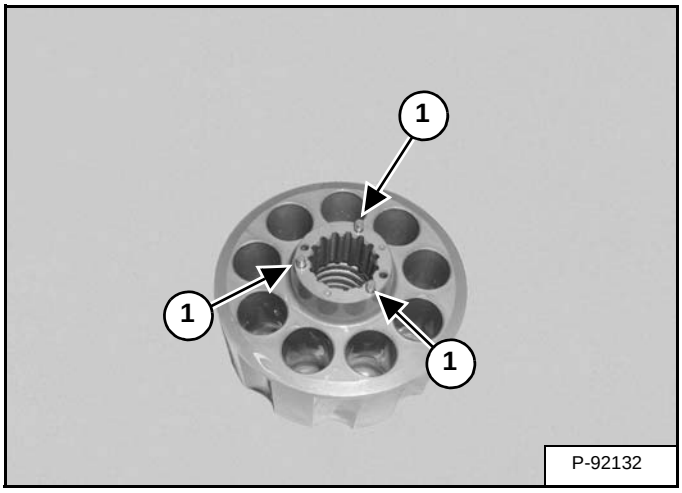
Remove the piston assemblies (Item 1) **[Figure 20-90-15]** from the retainer.

Figure 20-90-16



Remove the ball guide (Item 1) **[Figure 20-90-16]**.

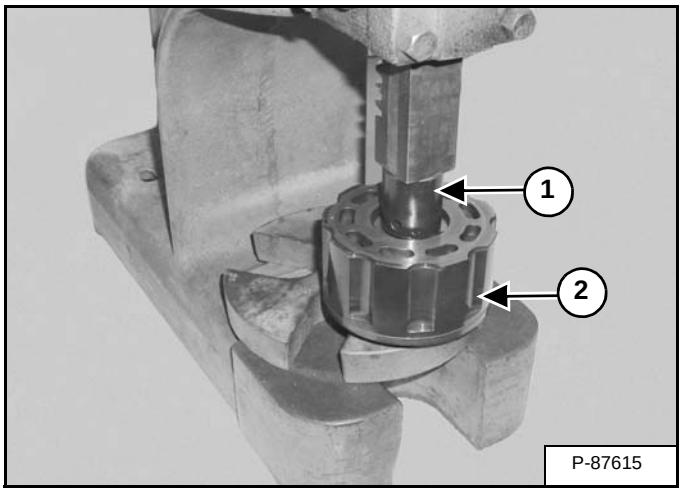
Figure 20-90-17



Remove the three pins (Item 1) **[Figure 20-90-17]**.

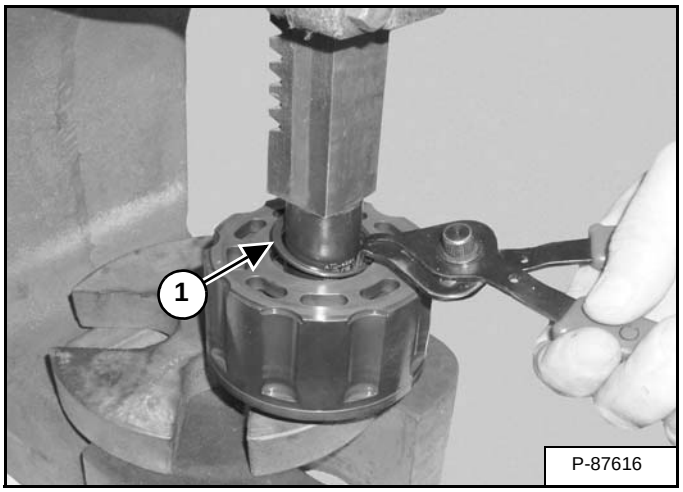
Disassembly And Assembly (Cont'd)

Figure 20-90-18



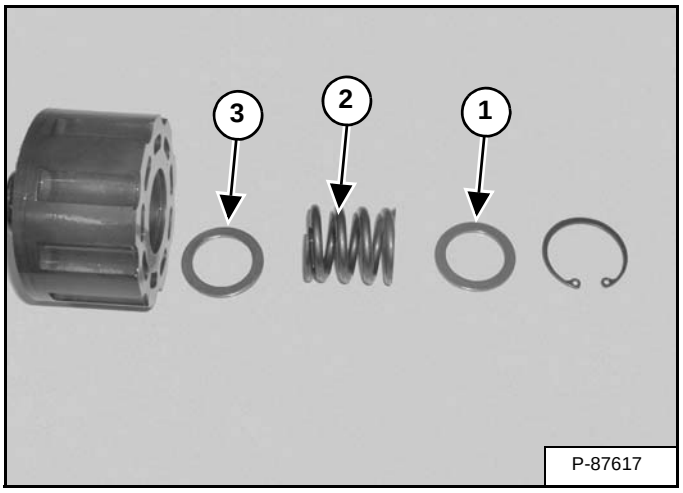
Using a press and an appropriate sized spacer (Item 1), compress the spring in the cylinder block (Item 2) **[Figure 20-90-18]**.

Figure 20-90-19



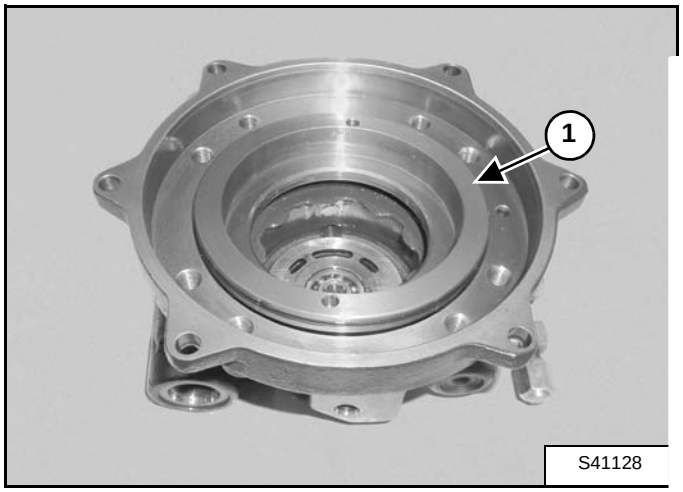
Remove the snap ring (Item 1) **[Figure 20-90-19]**. Remove the cylinder block from the press.

Figure 20-90-20



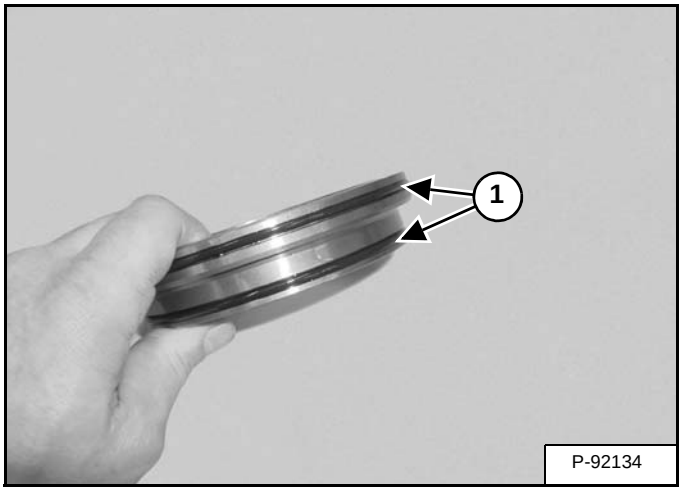
Remove the top washer (Item 1), spring (Item 2) and bottom washer (Item 3) **[Figure 20-90-20]**.

Figure 20-90-21



Remove the brake piston (Item 1) **[Figure 20-90-21]**.

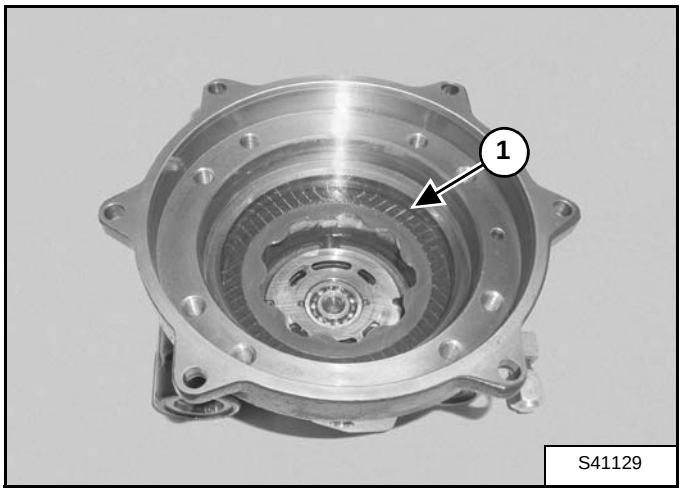
Figure 20-90-22



Remove the O-rings (Item 1) **[Figure 20-90-22]**.

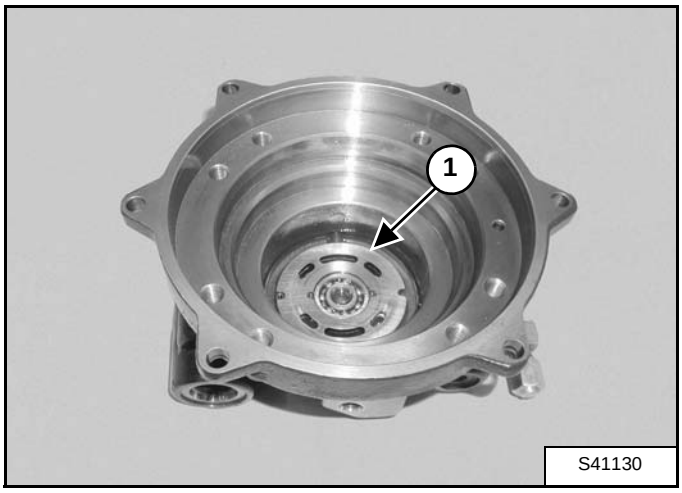
Disassembly And Assembly (Cont'd)

Figure 20-90-23



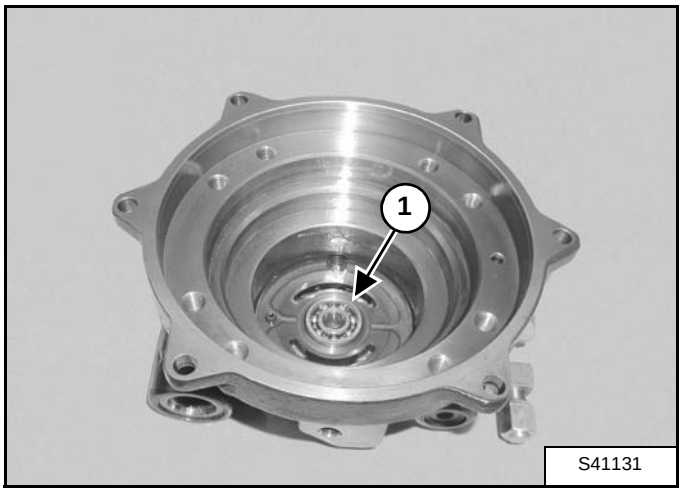
Remove the brake disc (Item 1) **[Figure 20-90-23]**.

Figure 20-90-24



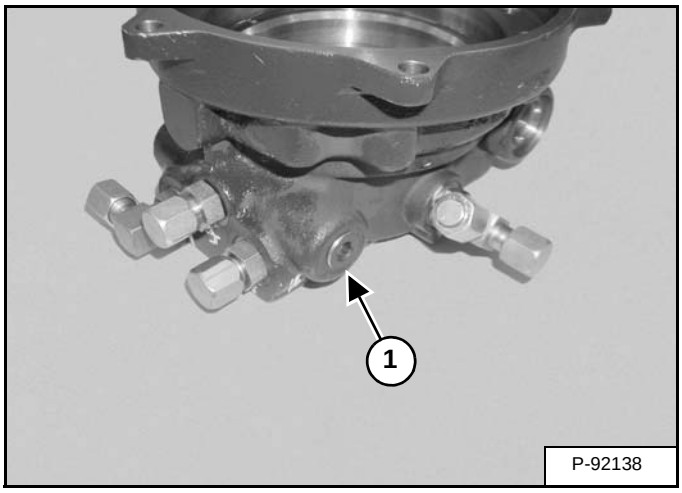
Remove the valve plate (Item 1) **[Figure 20-90-24]**.

Figure 20-90-25



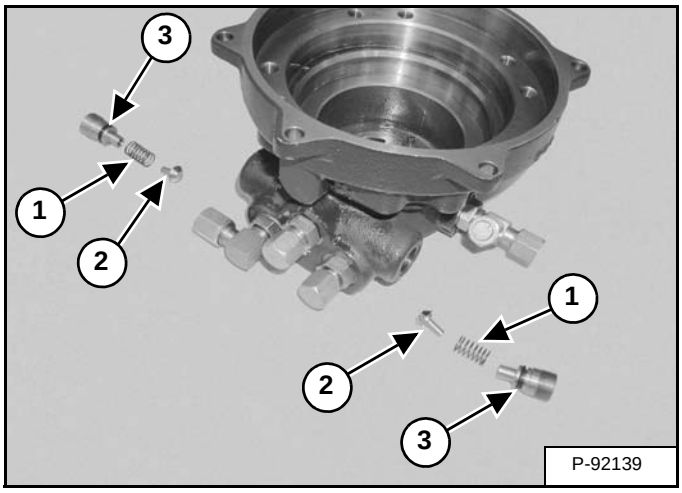
Remove the bearing (Item 1) **[Figure 20-90-25]**.

Figure 20-90-26



Remove the plug (Item 1) **[Figure 20-90-26]** from both sides of the housing.

Figure 20-90-27



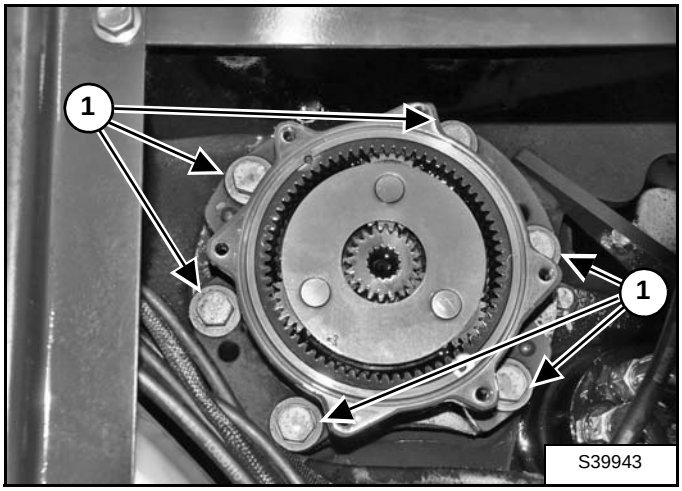
Remove the spring (Item 1) and poppet (Item 2). Remove the O-rings (Item 3) **[Figure 20-90-27]**.

SWING MOTOR (DRIVE CARRIER)

Removal And Installation

Remove the swing motor. (See Removal And Installation on Page 20-90-1.)

Figure 20-91-1

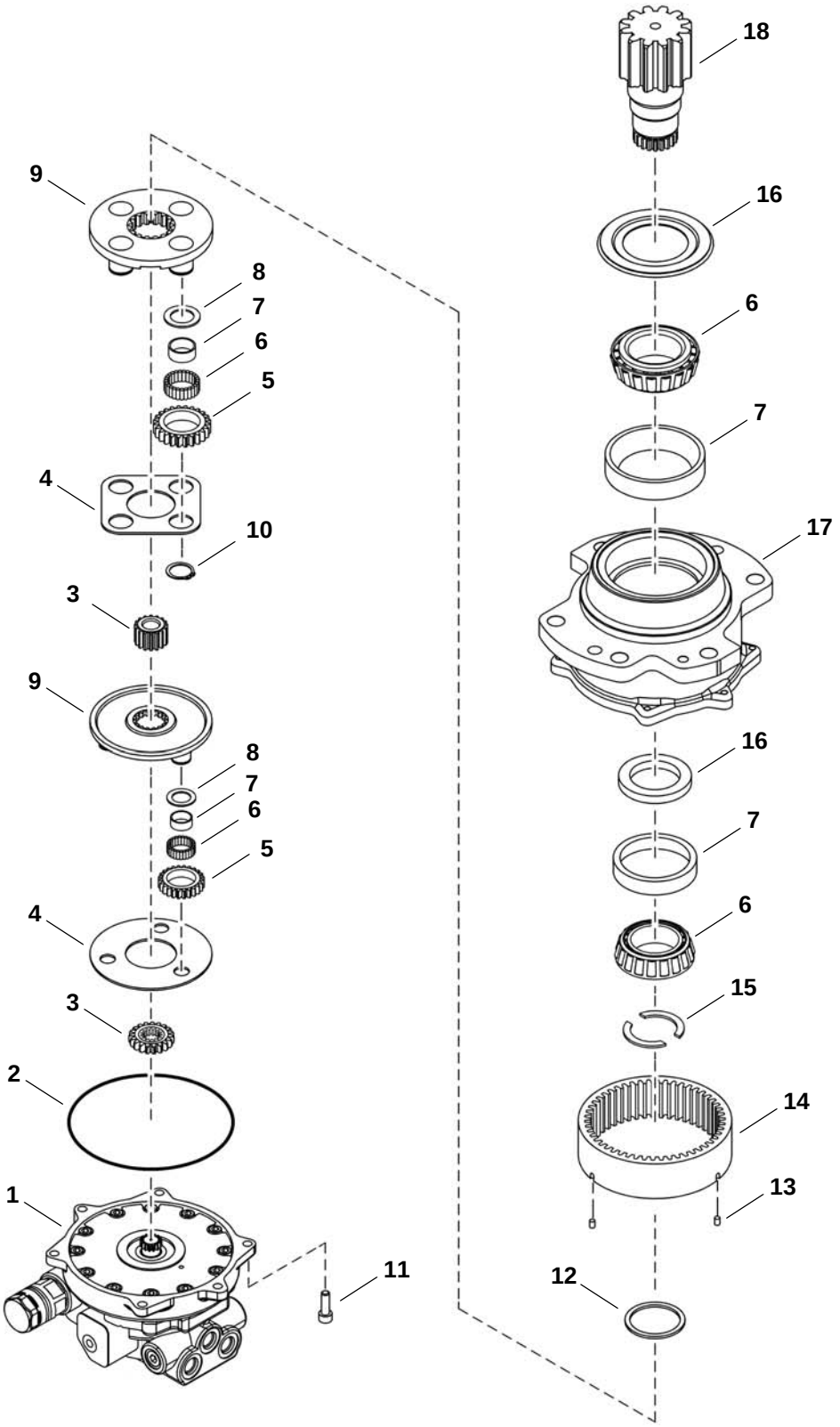


Remove the six bolts (Item 1) **[Figure 20-91-1]** and remove the carrier.

Installation: Tighten the bolts to 255 - 285 N•m (188 - 210 ft-lb) torque.

Parts Identification

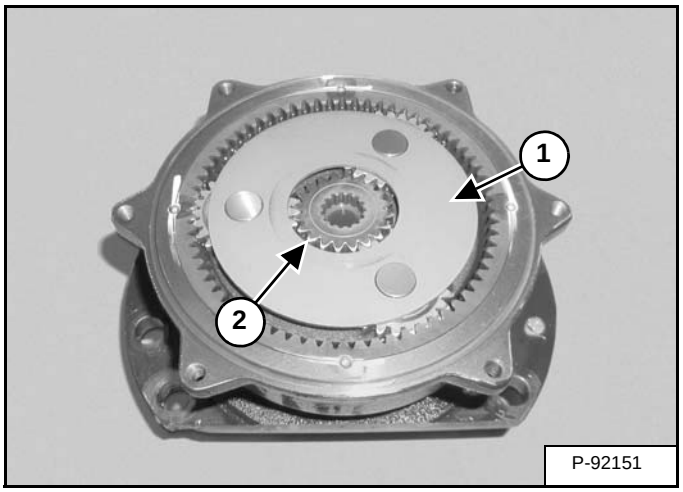
1. Swing Motor
2. O-ring
3. Sun Gear
4. Thrust Plate
5. Planetary Gear
6. Bearing
7. Race
8. Thrust Washer
9. Carrier
10. Snap Ring
11. Bolt
12. Retainer
13. Pin
14. Internal Gear
15. Split Ring
16. Seal
17. Housing
18. Shaft



EM9624

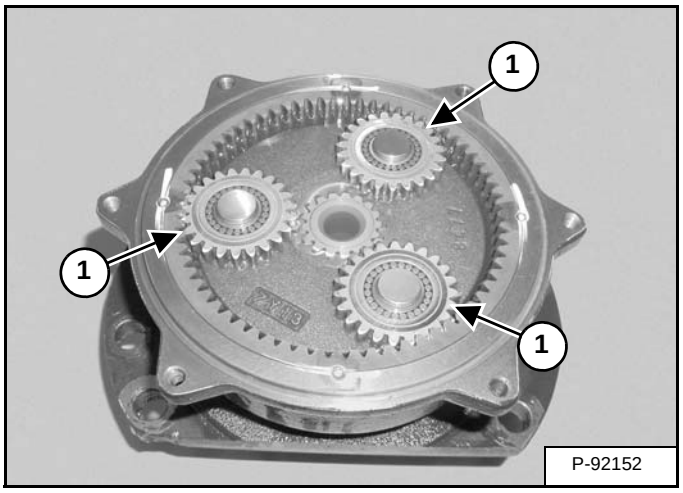
Disassembly And Assembly

Figure 20-91-2



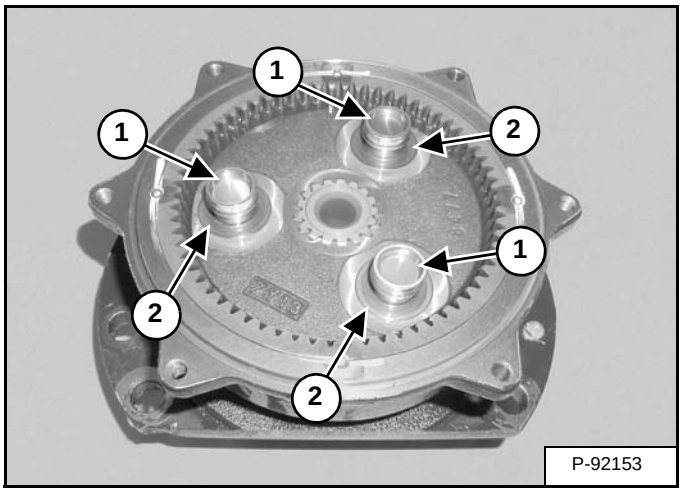
Remove the thrust plate (Item 1) and sun gear (Item 2) **[Figure 20-91-2]**.

Figure 20-91-3



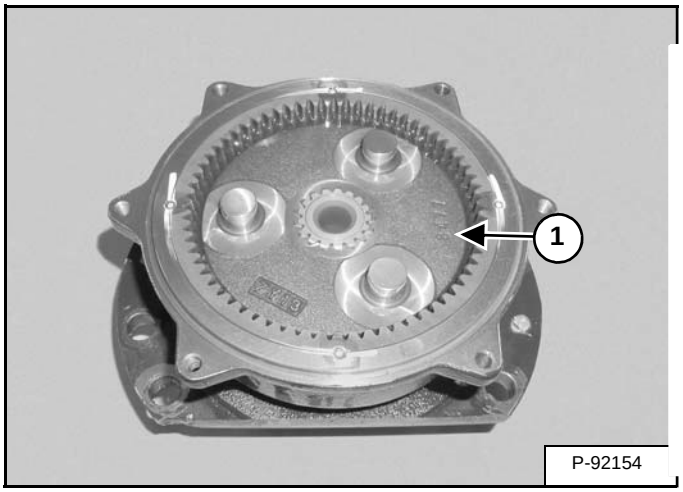
Remove the planetary gears (Item 1) **[Figure 20-91-3]** and roller bearings.

Figure 20-91-4



Remove the bearing races (Item 1) and thrust washers (Item 2) **[Figure 20-91-4]**.

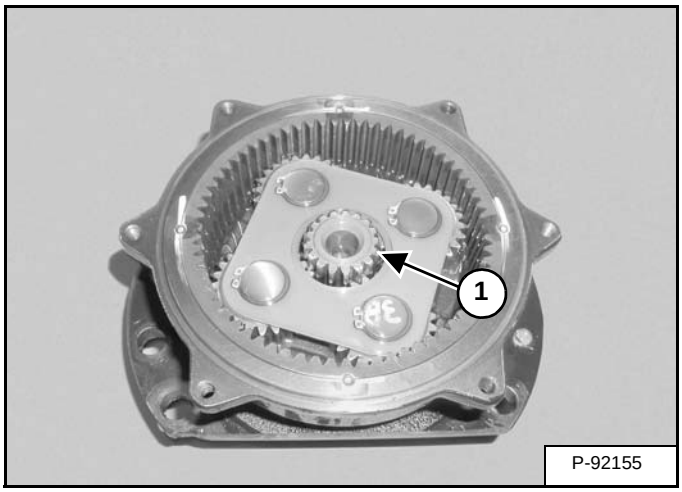
Figure 20-91-5



Remove the carrier (Item 1) **[Figure 20-91-5]**.

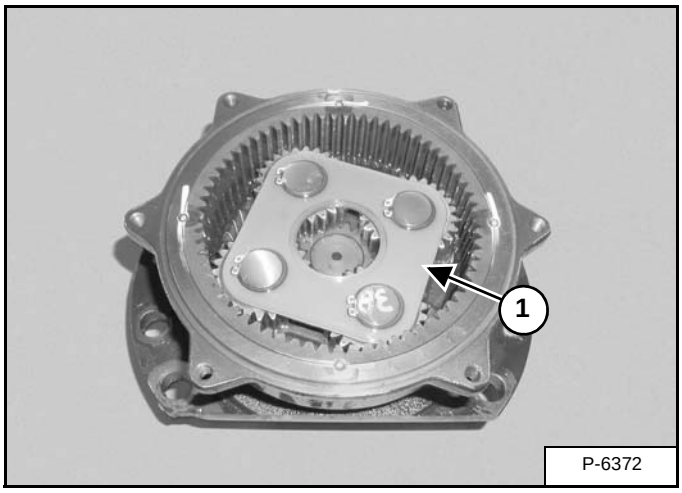
Disassembly And Assembly (Cont'd)

Figure 20-91-6



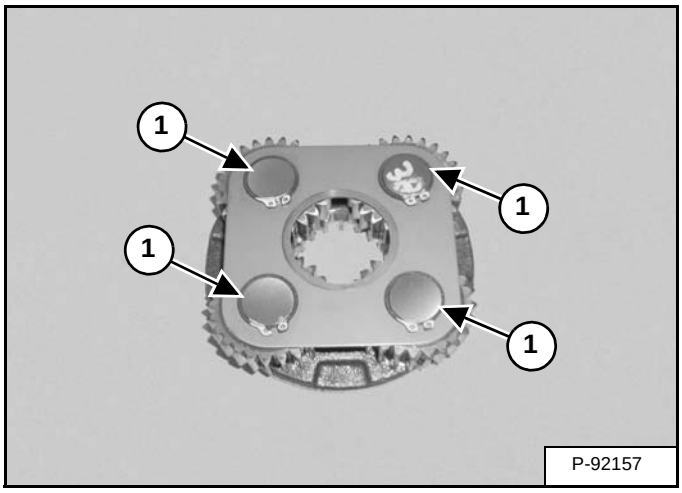
Remove the sun gear (Item 1) **[Figure 20-91-6]**.

Figure 20-91-7



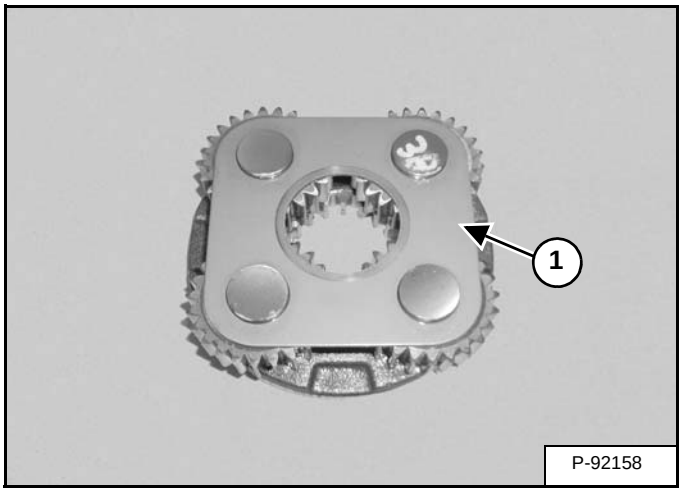
Remove the carrier / gear assembly (Item 1) **[Figure 20-91-7]**.

Figure 20-91-8



Remove the snap rings (Item 1) **[Figure 20-91-8]**.

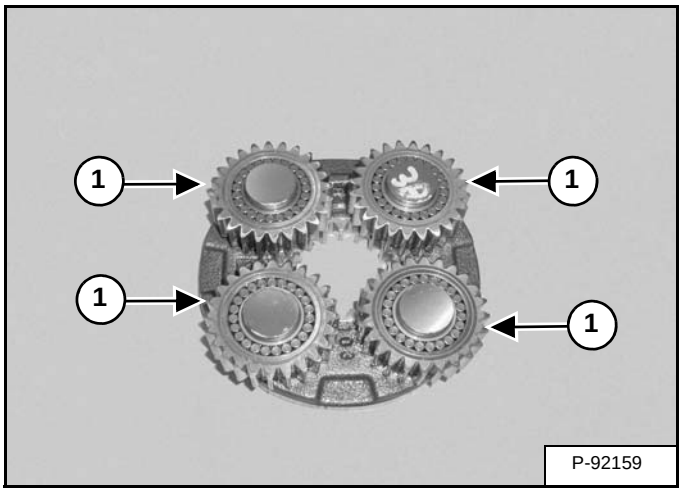
Figure 20-91-9



Remove the plate (Item 1) **[Figure 20-91-9]**.

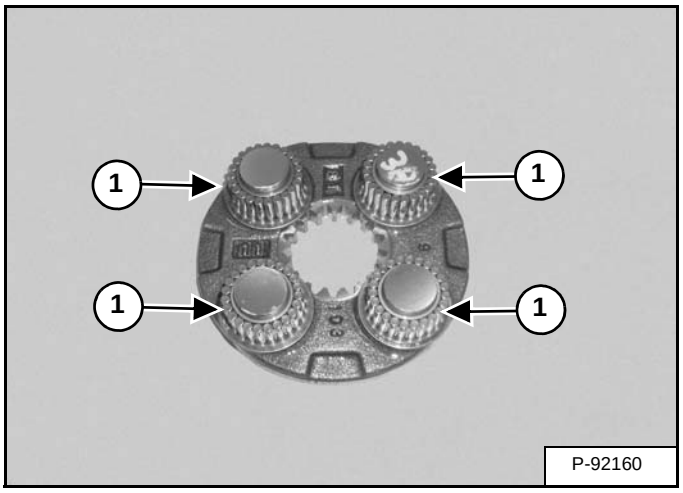
Disassembly And Assembly (Cont'd)

Figure 20-91-10



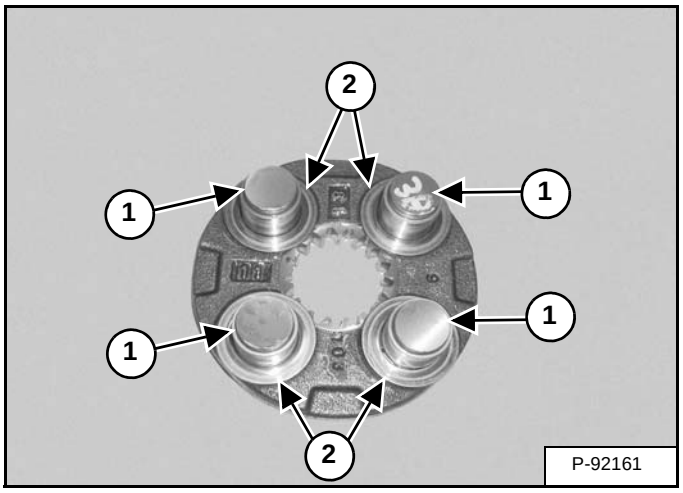
Remove the planetary gears (Item 1) **[Figure 20-91-10]**.

Figure 20-91-11



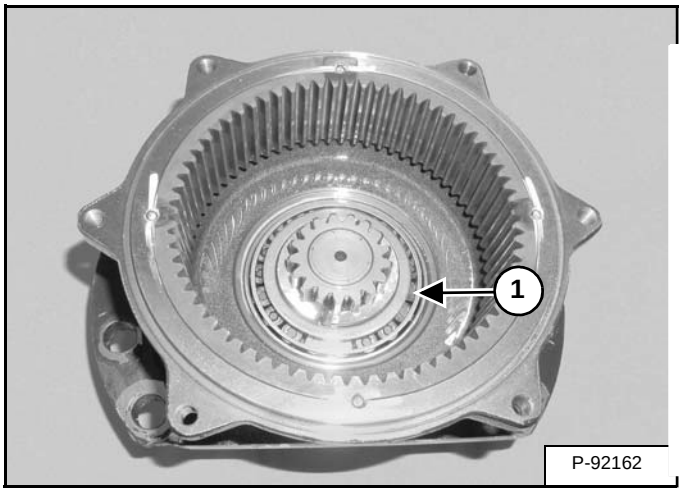
Remove the bearings (Item 1) **[Figure 20-91-11]**.

Figure 20-91-12



Remove the races (Item 1) and thrust washers (Item 2) **[Figure 20-91-12]**.

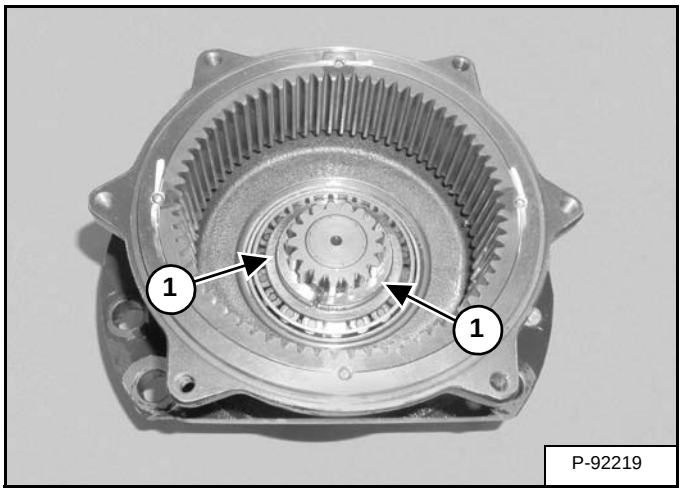
Figure 20-91-13



Remove the retainer (Item 1) **[Figure 20-91-13]**.

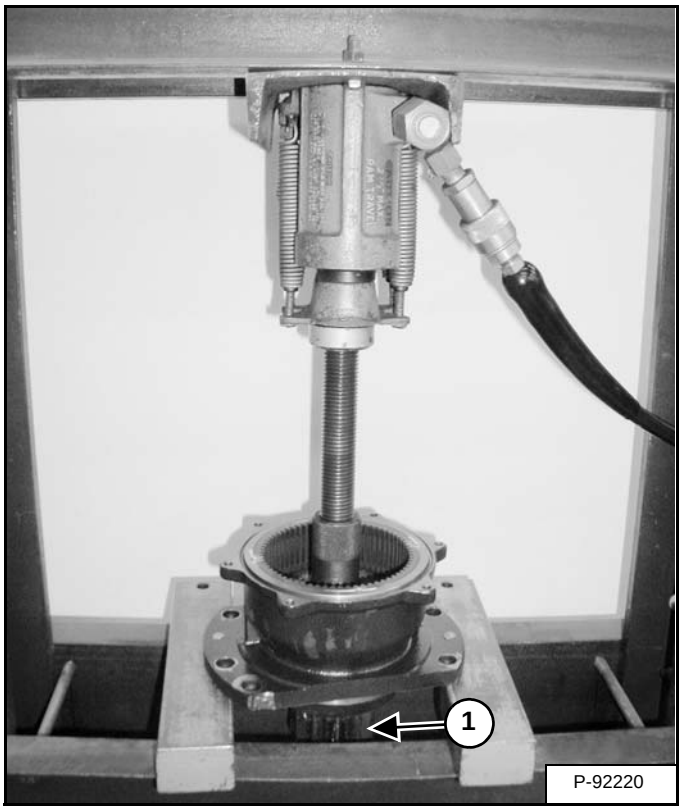
Disassembly And Assembly (Cont'd)

Figure 20-91-14



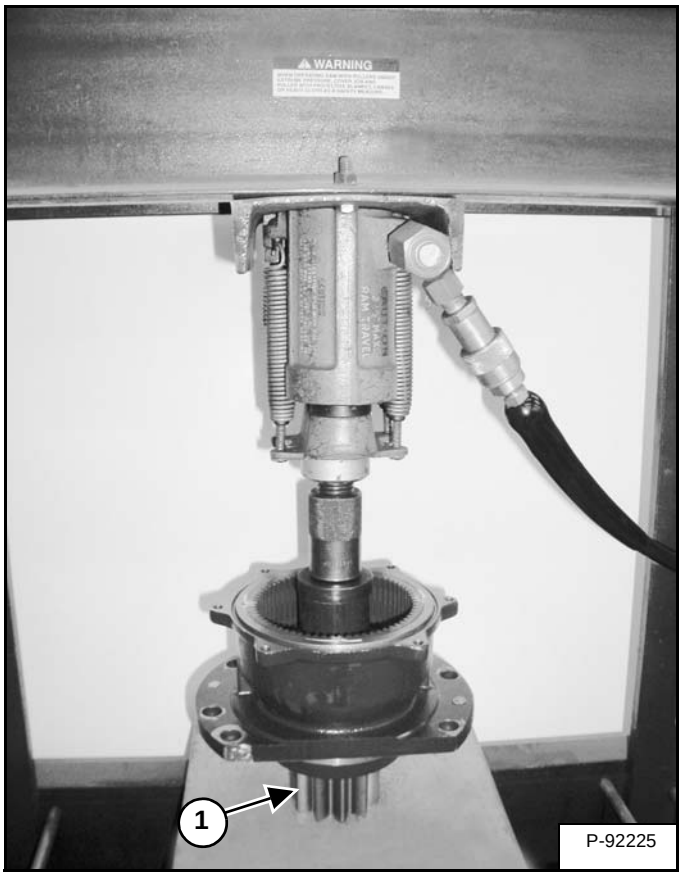
Remove the split rings (Item 1) **[Figure 20-91-14]**.

Figure 20-91-15



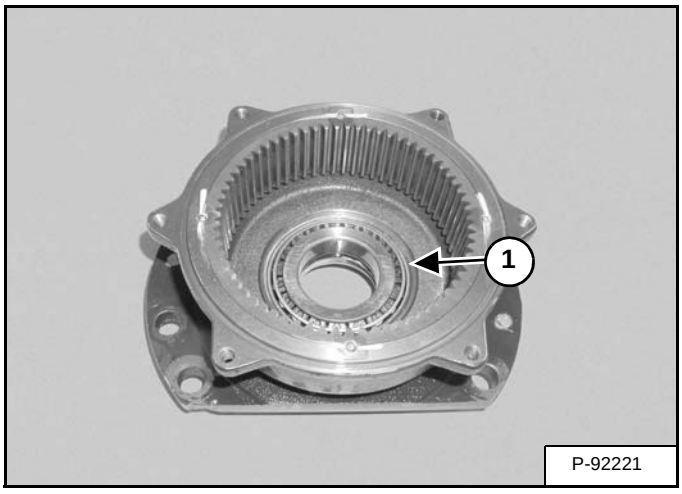
Press the shaft assembly (Item 1) **[Figure 20-91-15]** out of the housing.

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.

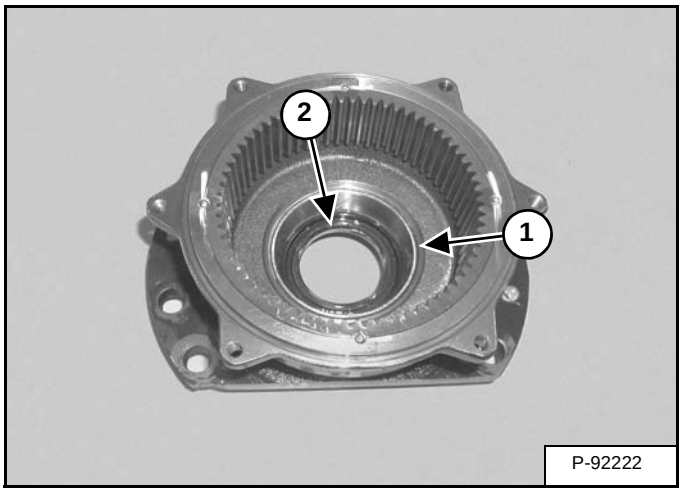
Figure 20-91-17



Remove the bearing (Item 1) **[Figure 20-91-17]** from the housing.

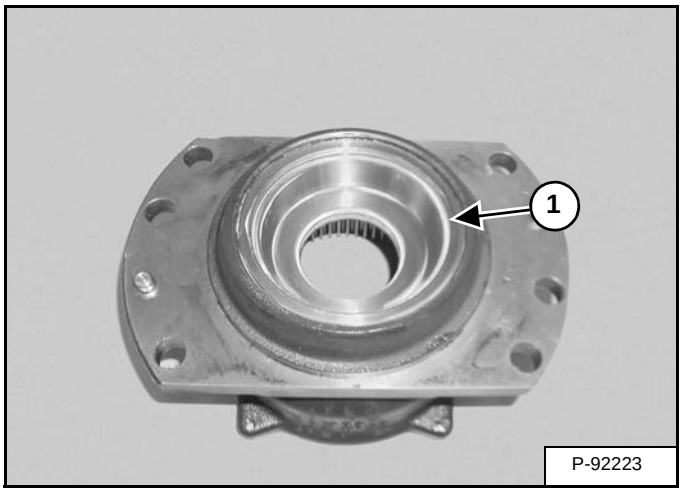
Disassembly And Assembly (Cont'd)

Figure 20-91-18



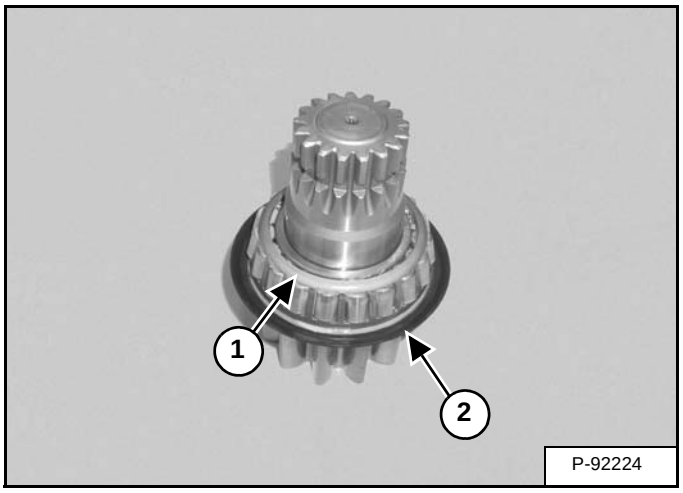
Remove the bearing race (Item 1) and seal (Item 2) **[Figure 20-91-18]**.

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.


Bobcat®

CONTROL PATTERN SELECTOR VALVE

Removal And Installation

Remove the tool box. (See Removal And Installation on Page 40-210-1.)

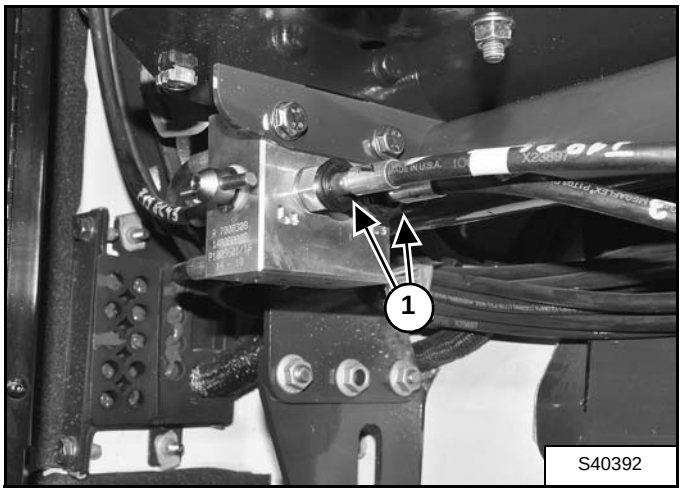
Mark all hydraulic hoses for proper installation.

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.

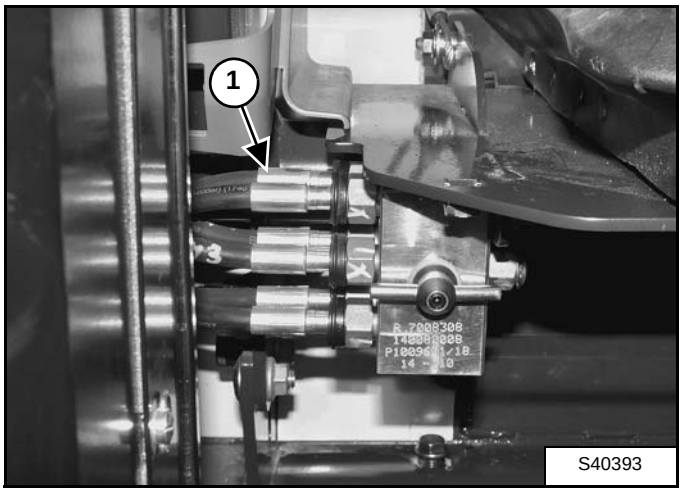
I-2003-0888

Figure 20-100-1



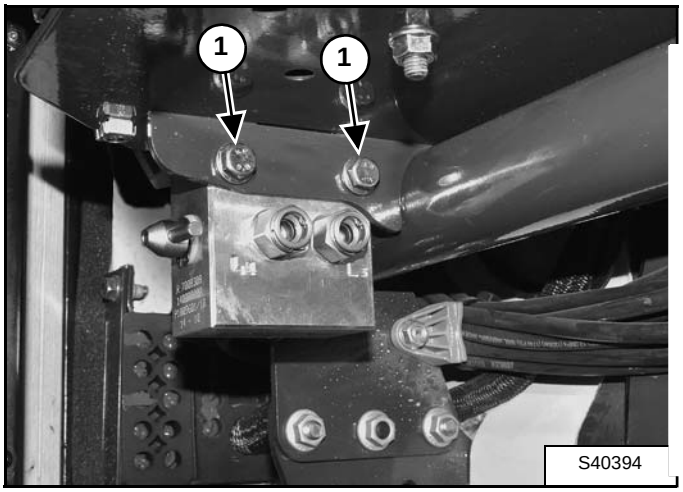
Remove the two hydraulic hoses from the control pattern selector valve (Item 1) **[Figure 20-100-1]**.

Figure 20-100-2



Remove the six hydraulic hoses from the control pattern selector valve (Item 1) **[Figure 20-100-2]**.

Figure 20-100-3



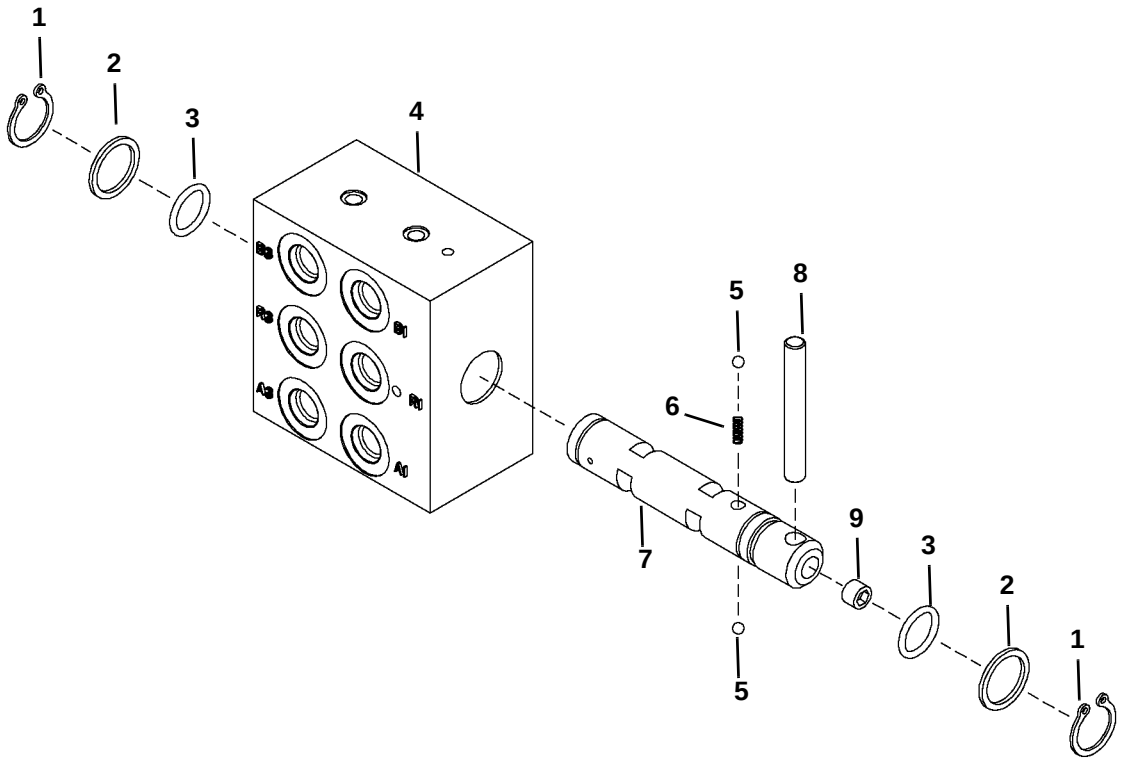
Remove the bolts (Item 1) **[Figure 20-100-3]**.

Remove the control pattern selector valve from the excavator.

CONTROL PATTERN SELECTOR VALVE (CONT'D)

Parts Identification

1. Snap Ring
2. Nylon Washer
3. O-ring
4. Body
5. Ball
6. Spring
7. Spool
8. Handle
9. Plug

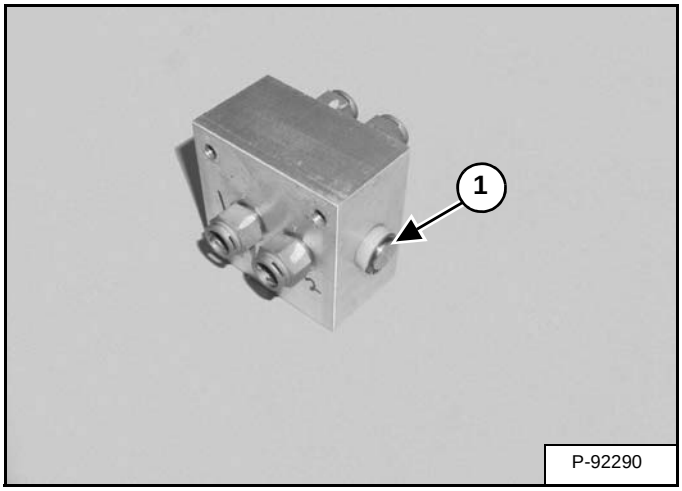


NA2118

Disassembly And Assembly

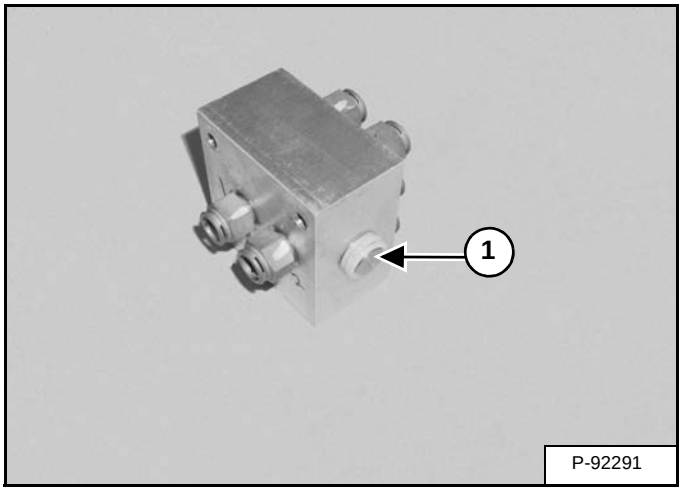
Clean the outside of the valve before disassembly.

Figure 20-100-4



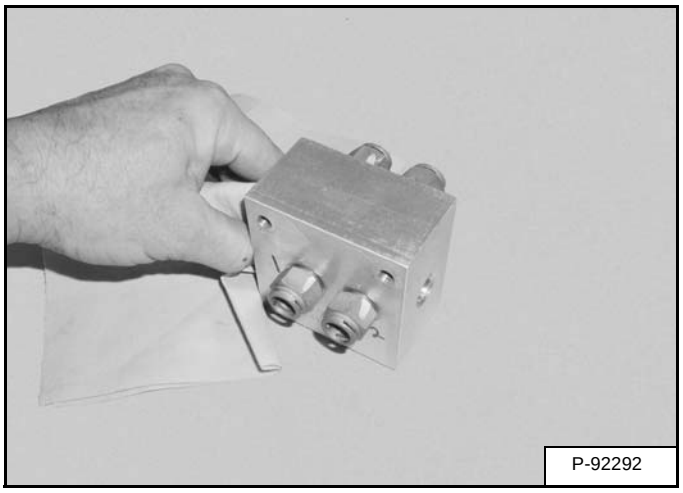
Remove the snap ring (Item 1) **[Figure 20-100-4]**.

Figure 20-100-5



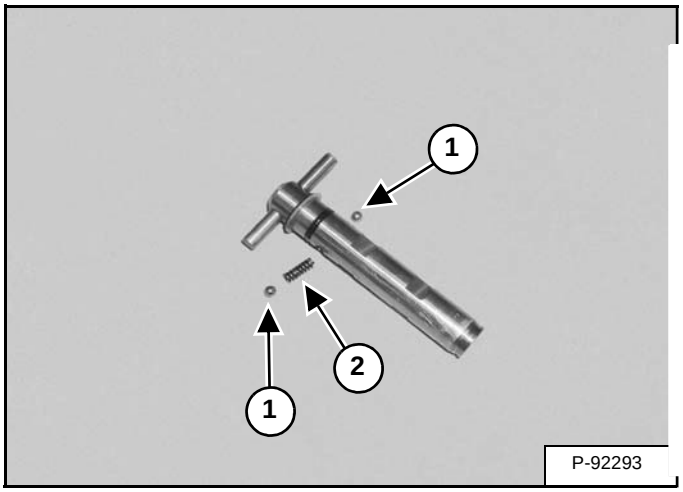
Remove the nylon washers (Item 1) **[Figure 20-100-5]**.

Figure 20-100-6



Wrap a shop towel around the spool and pull the spool out of the valve **[Figure 20-100-6]**.

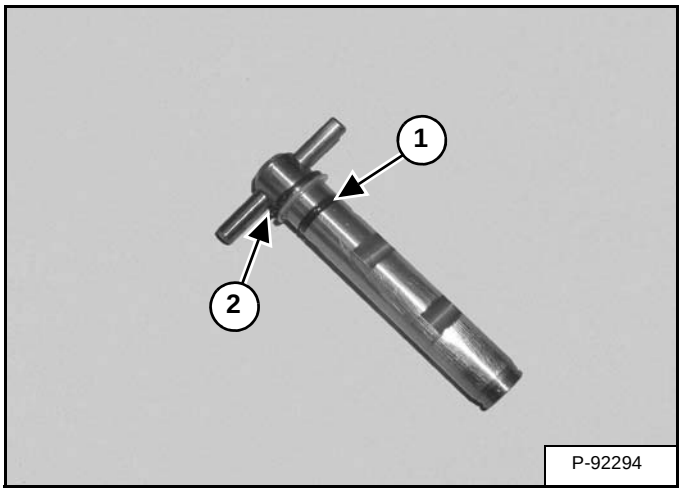
Figure 20-100-7



Remove the detent balls (Item 1) and spring (Item 2)7**[Figure 20-100-7]**.

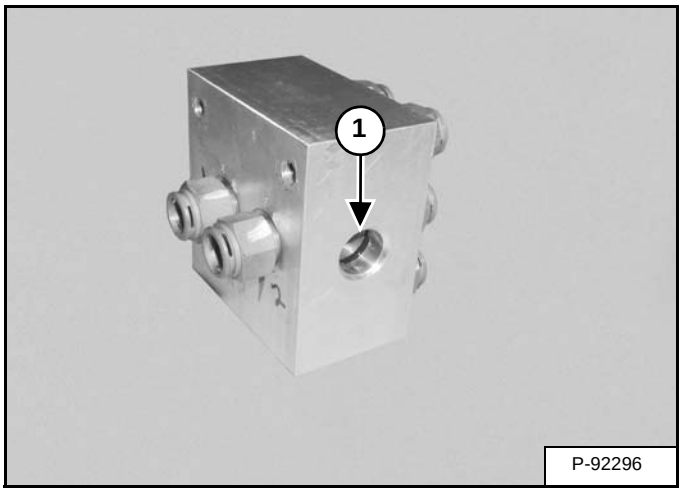
Disassembly And Assembly (Cont'd)

Figure 20-100-8



Remove the O-ring (Item 1) and nylon washer (Item 2) **[Figure 20-100-8]**.

Figure 20-100-9



Remove the O-ring (Item 1) **[Figure 20-100-9]** from the valve body.

RIGHT CONTROL LEVER (JOYSTICK) (S/N AB8B11001 - AB8B11080)

Testing

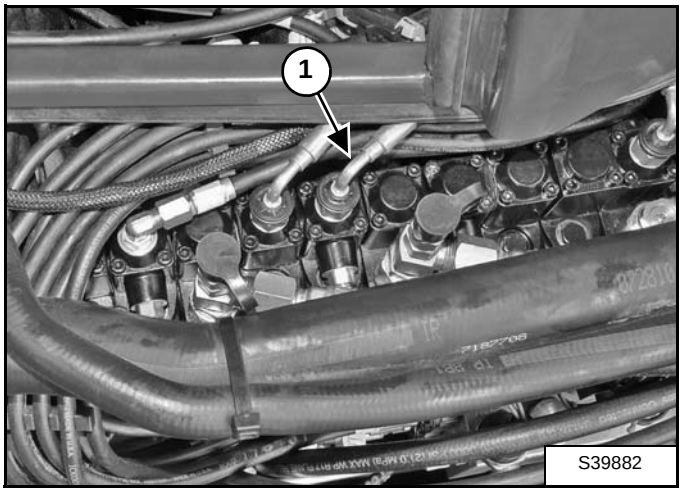
The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

Stop the engine.

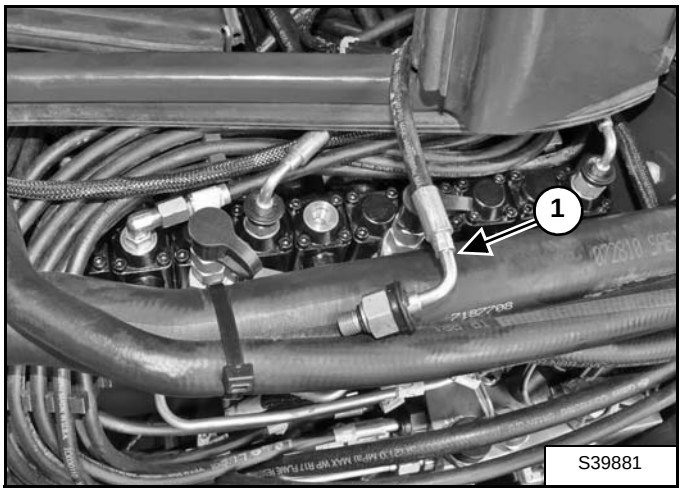
Remove the left upperstructure cover.

Figure 20-110-1



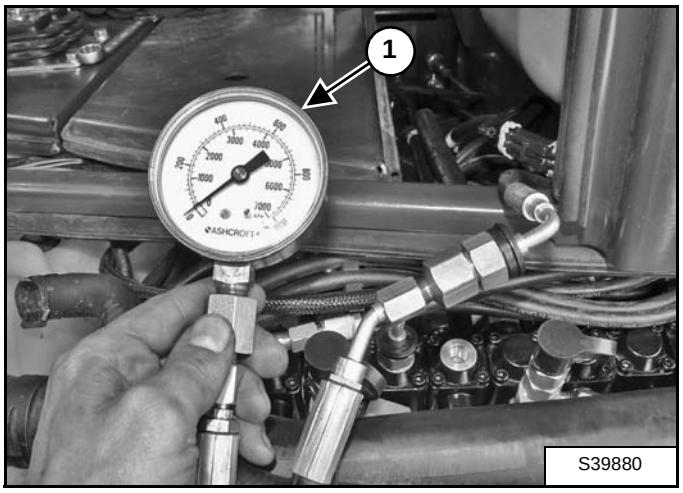
At the control valve assembly, find the pilot line (Item 1) **[Figure 20-110-1]** of the control lever (joystick) that is to be checked. (Boom, Bucket) (Boom shown)

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 7 MPa (70 bar) (1000 psi) gauge (Item 1) **[Figure 20-110-3]** on the pilot line. Start the excavator, and warm the hydraulic fluid to operating temperature.

Engage the circuit to be tested. Record the operating pressure.

The operating pressure should be approximately 3,2 - 3, MPa (32 - 35 bar) (464 - 508 psi).

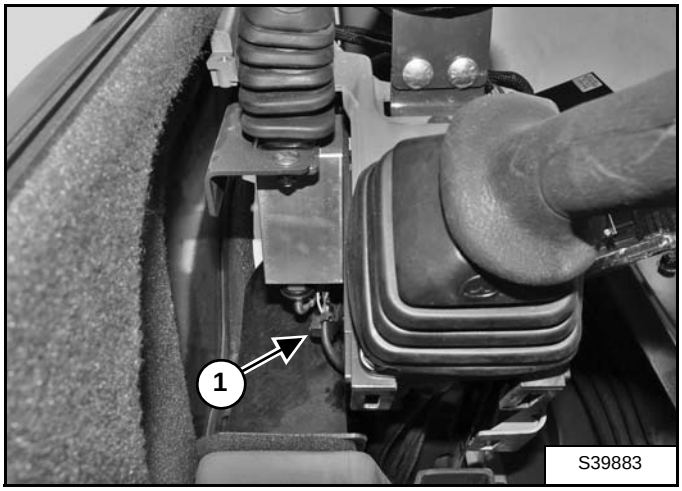
If the operating pressure is correct, check the valv section spool for proper operation. If the operatin pressure is incorrect, remove the pilot pressure relie valve, clean, install and retest. (See Testing An Adjusting on Page 20-33-1.)

If the pressure is still incorrect replace the pilot pressur relief reducing valve. (See Testing And Adjusting on Pag 20-33-1.)

RIGHT CONTROL LEVER (JOYSTICK) (S/N AB8B11001 - AB8B11080) (CONT'D)

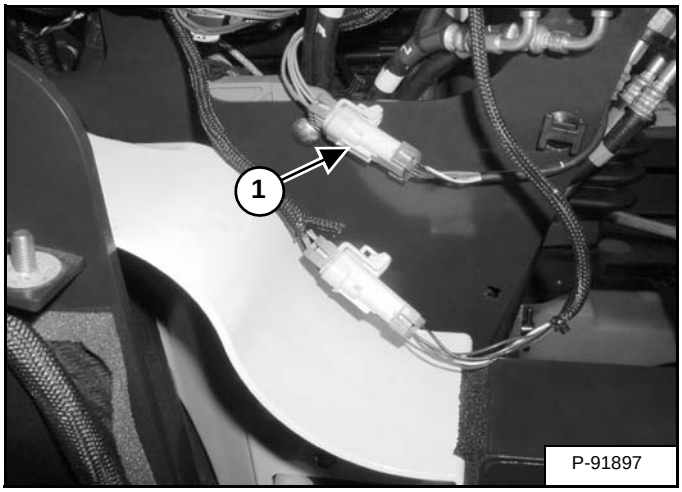
Handle Removal And Installation

Figure 20-110-4



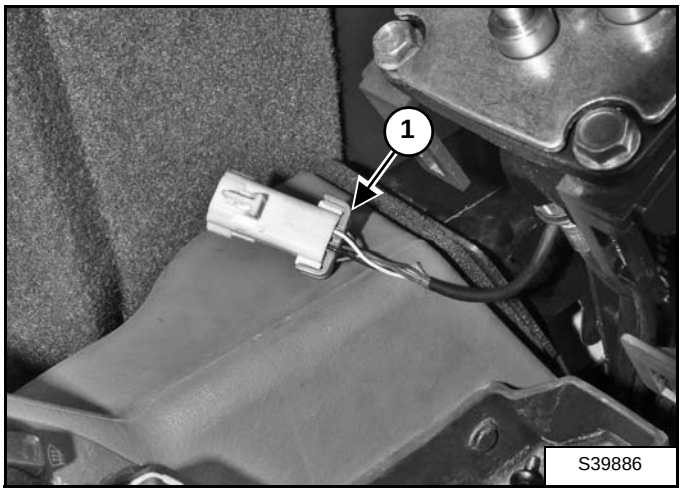
Cut and remove the cable tie (Item 1) **[Figure 20-110-4]**.

Figure 20-110-5



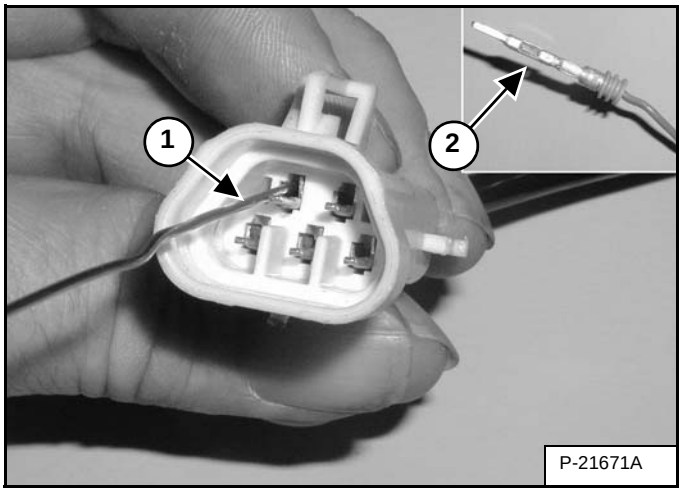
Disconnect the wire harness (Item 1) **[Figure 20-110-5]**.

Figure 20-110-6



Remove the lock (Item 1) **[Figure 20-110-6]** from the electrical connector.

Figure 20-110-7



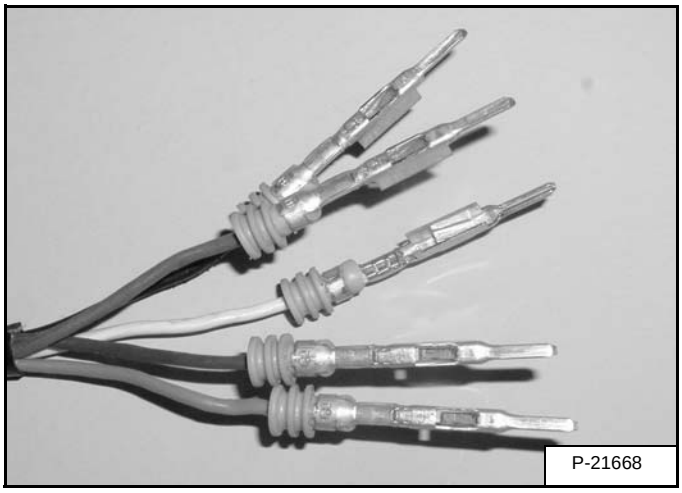
With a small piece of wire (Item 1), depress the wire terminal tabs (Item 2) **[Figure 20-110-7]**.

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.

Handle Removal And Installation (Cont'd)

Figure 20-110-8

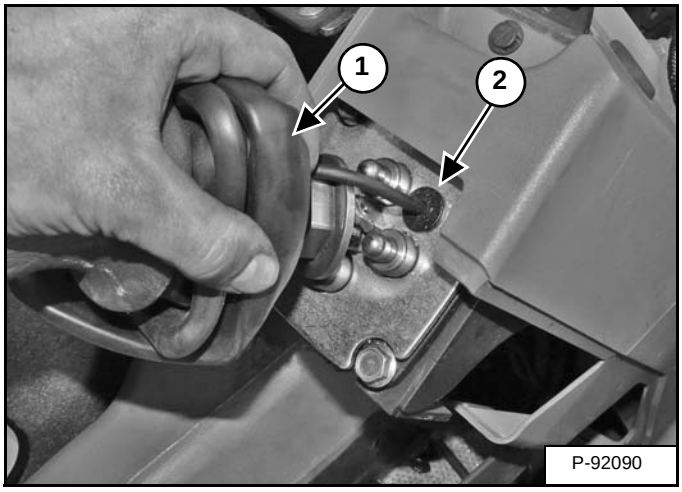


Installation: The wires **[Figure 20-110-8]** must be installed in the proper locations in the wire connector, listed below.

A Green	C Red	E White
B Brown	D Black	

Check each wire to be certain the tab locks into position.

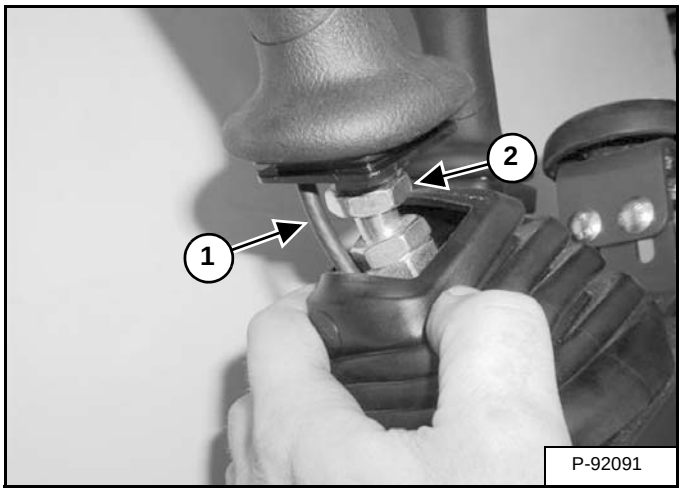
Figure 20-110-9



Raise the boot (Item 1) and pull the grommet (Item 2) **[Figure 20-110-9]** up out of the housing.

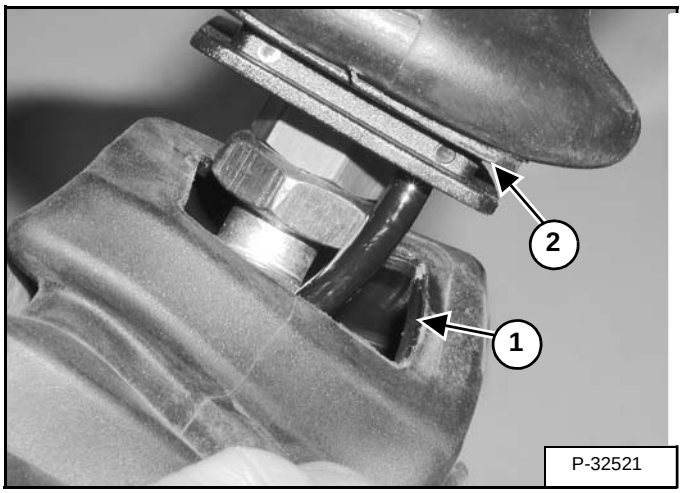
Remove the wire and grommet.

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



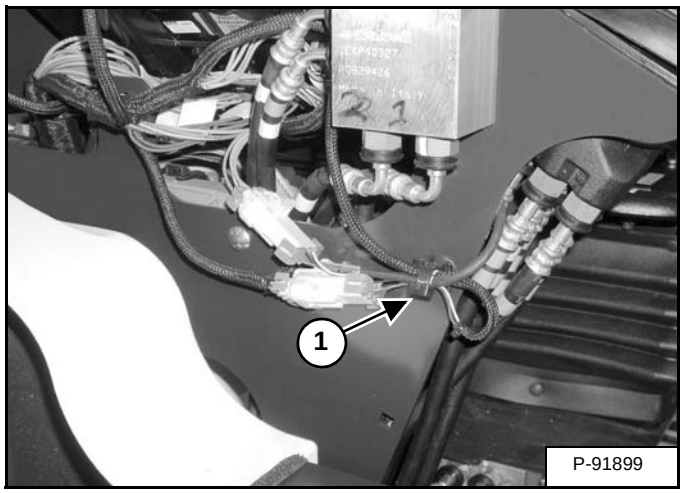
Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-110-11]**.

RIGHT CONTROL LEVER (JOYSTICK) (S/N AB8B11001 - AB8B11080) (CONT'D)

Joystick Assembly Removal And Installation

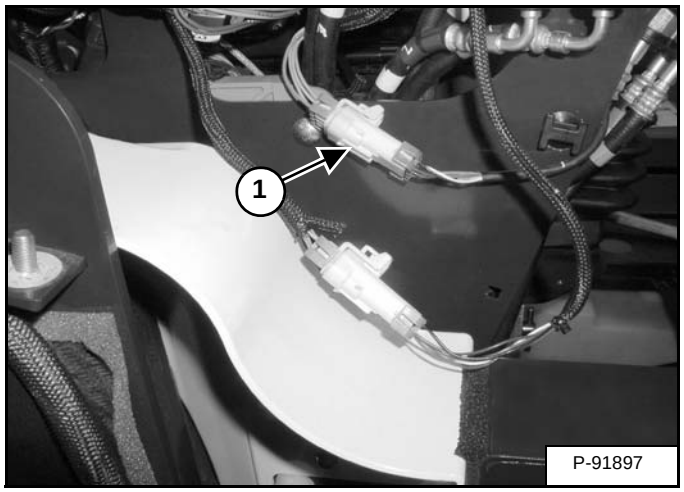
Remove the console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 20-110-12



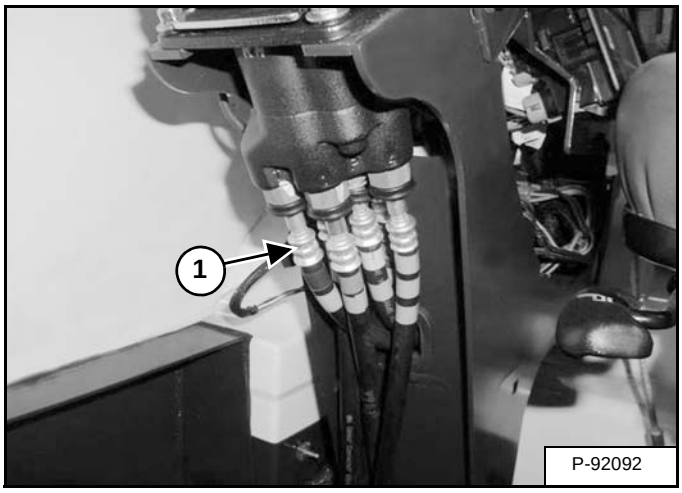
Cut and remove the cable tie (Item 1) **[Figure 20-110-12]**.

Figure 20-110-13



Disconnect the wire harness (Item 1) **[Figure 20-110-13]**.

Figure 20-110-14



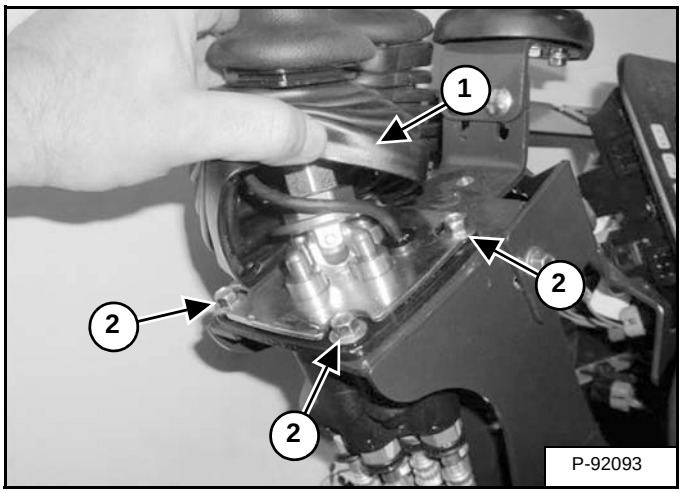
Mark and remove the hoses (Item 1) **[Figure 20-110-14]**.

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



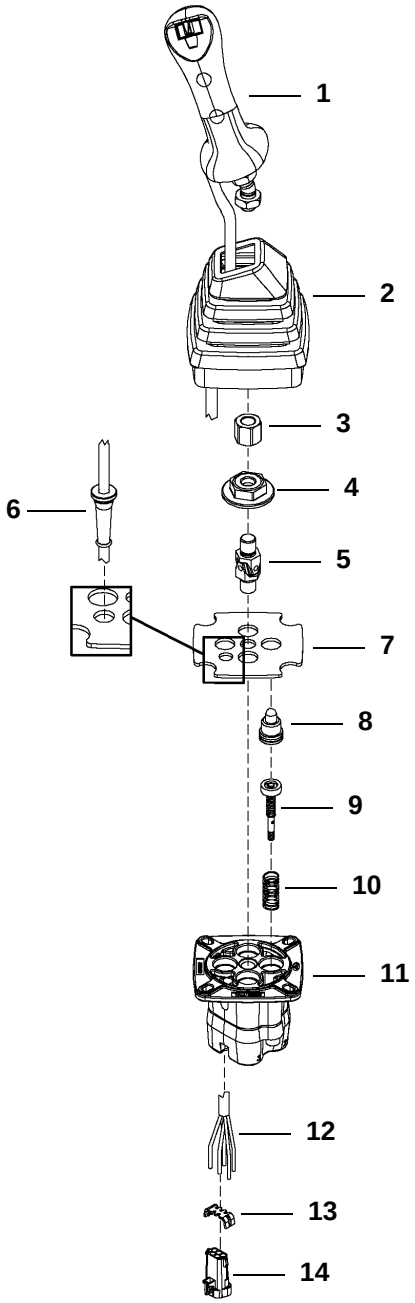
Pull the boot (Item 1) **[Figure 20-110-15]** up from the mounting plate.

Remove the bolts (Item 2) **[Figure 20-110-15]**.

Remove the joystick assembly.

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

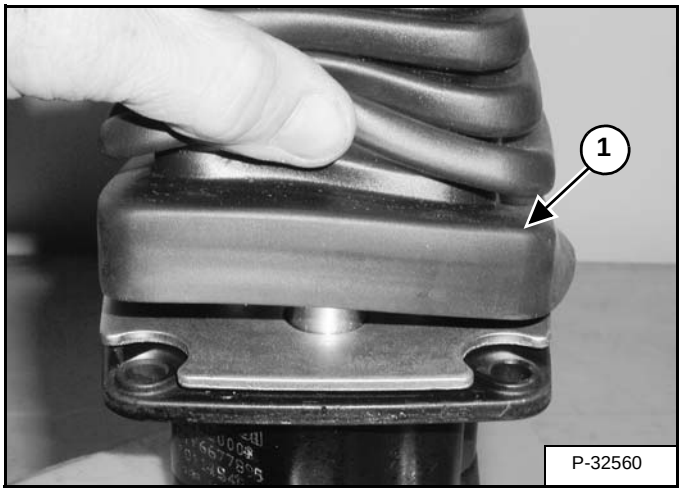
RIGHT CONTROL LEVER (JOYSTICK) (S/N AB8B11001 - AB8B11080) (CONT'D)

Disassembly

Remove the right handle. (See Handle Removal And Installation on Page 20-110-2.)

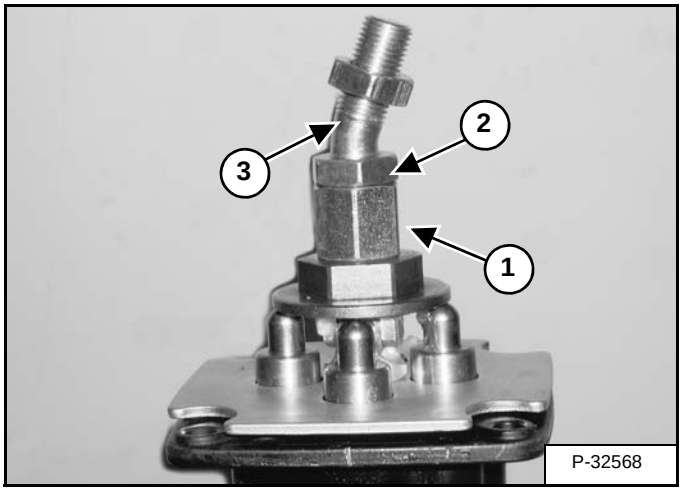
Clean the outside of the control lever before disassembly.

Figure 20-110-16



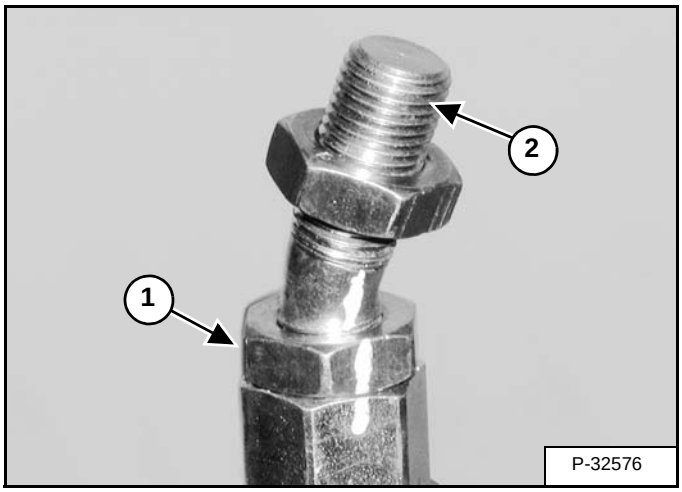
Remove the boot (Item 1) **[Figure 20-110-16]**.

Figure 20-110-17



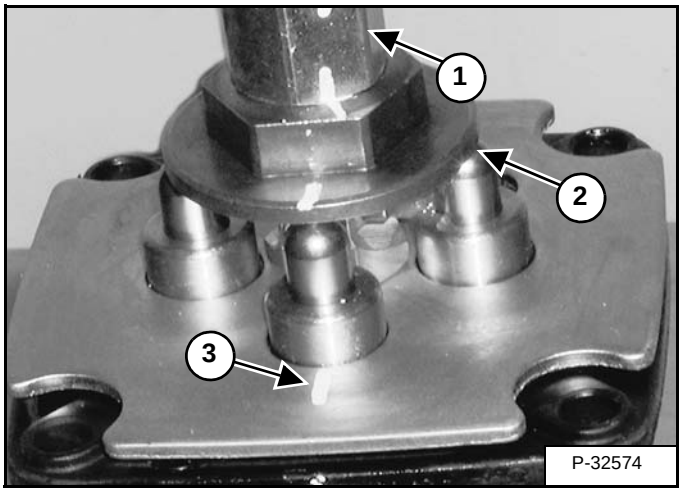
Mark the coupler (Item 1), nut (Item 2), and connector (Item 3) **[Figure 20-110-17]** for ease of assembly.

Figure 20-110-18



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-110-18]**.

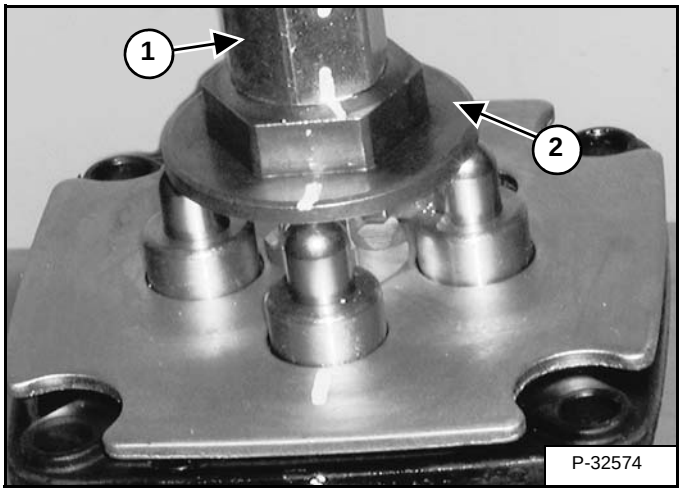
Figure 20-110-19



Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-110-19]** for ease of assembly.

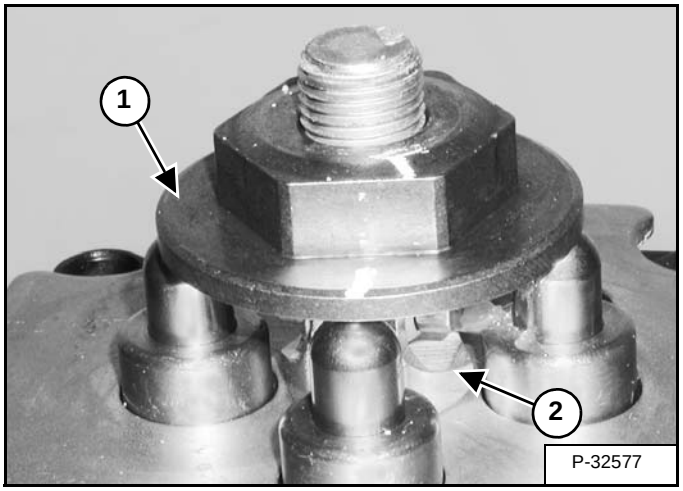
Disassembly (Cont'd)

Figure 20-110-20



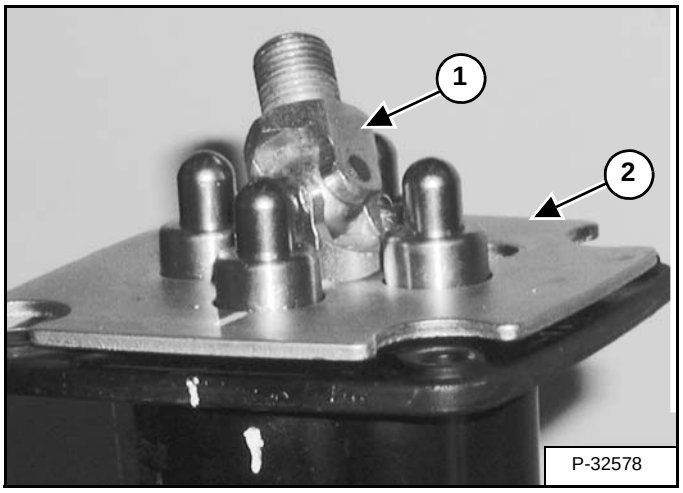
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-110-20]**.

Figure 20-110-21



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-110-21]**.

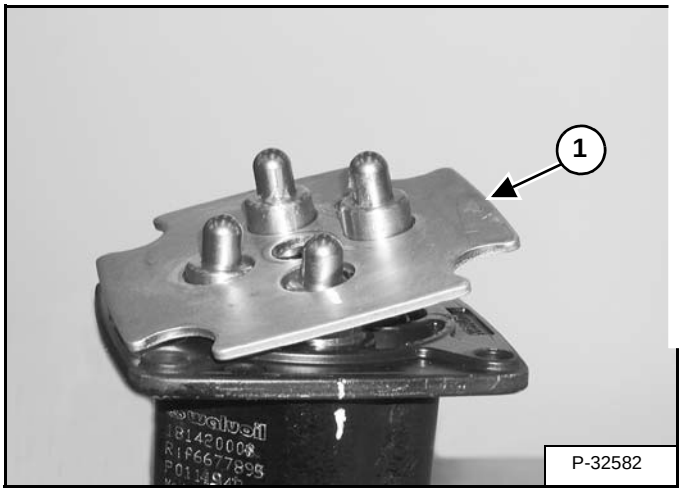
Figure 20-110-22



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

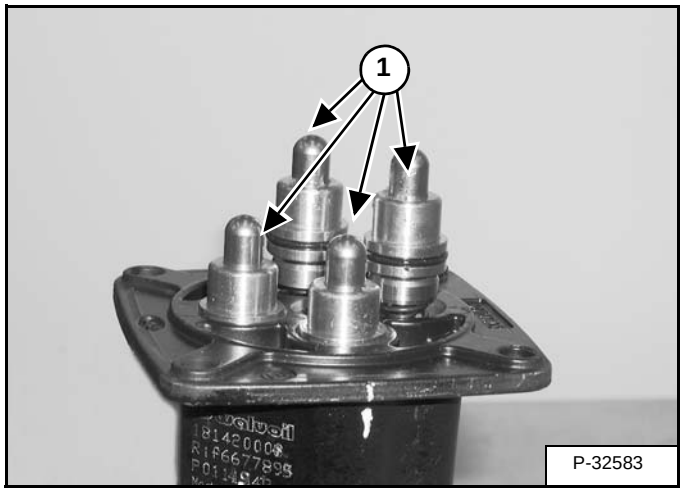


Remove the plate (Item 1) **[Figure 20-110-23]**.

RIGHT CONTROL LEVER (JOYSTICK) (S/N AB8B11001 - AB8B11080) (CONT'D)

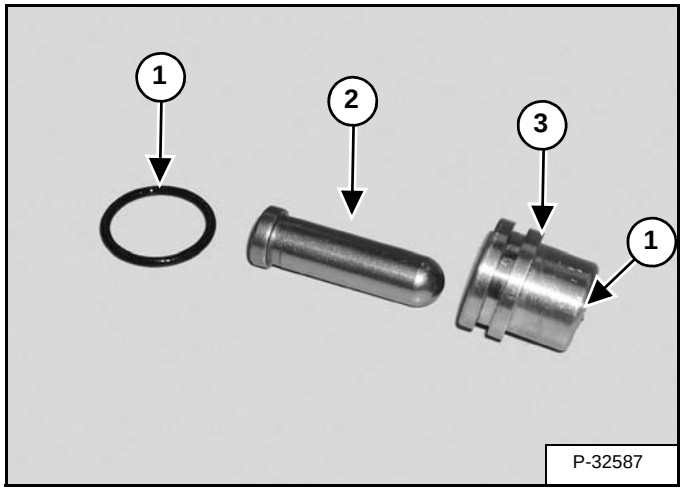
Disassembly (Cont'd)

Figure 20-110-24



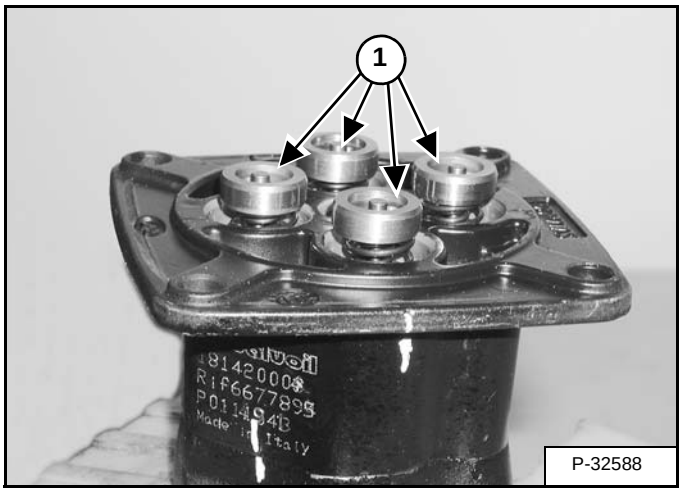
Remove the plunger assemblies (Item 1) **[Figure 20-110-24]**.

Figure 20-110-25



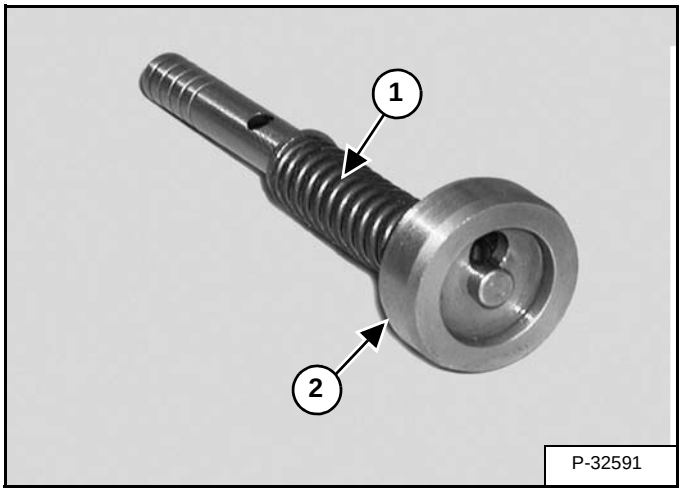
Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-110-25]**.

Figure 20-110-26



Remove the spool assemblies (Item 1) **[Figure 20-110-26]**.

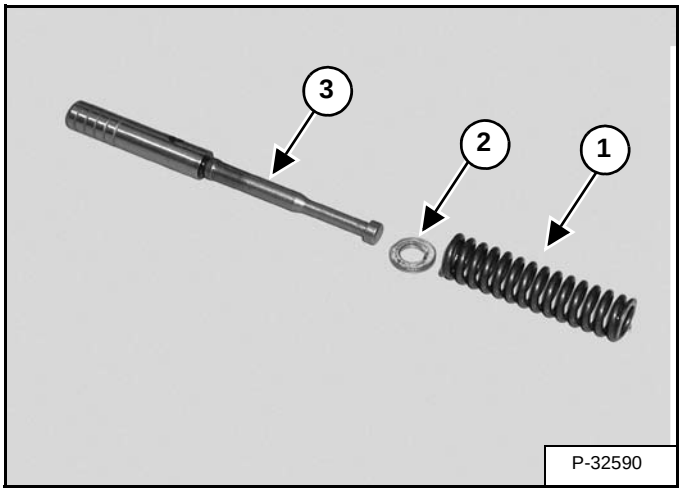
Figure 20-110-27



Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-110-27]**.

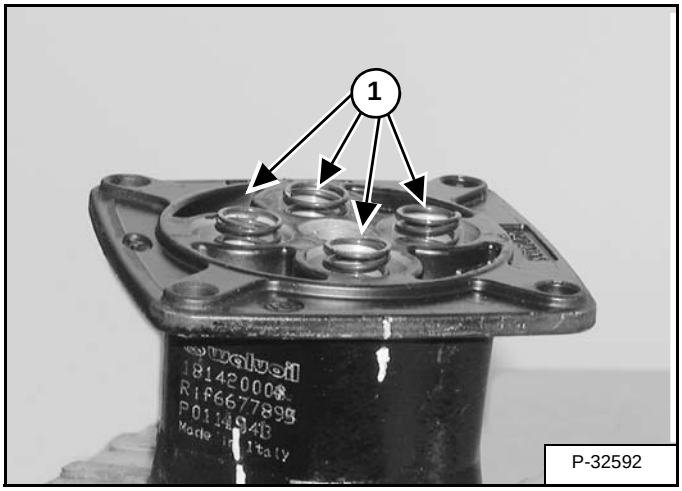
Disassembly (Cont'd)

Figure 20-110-28



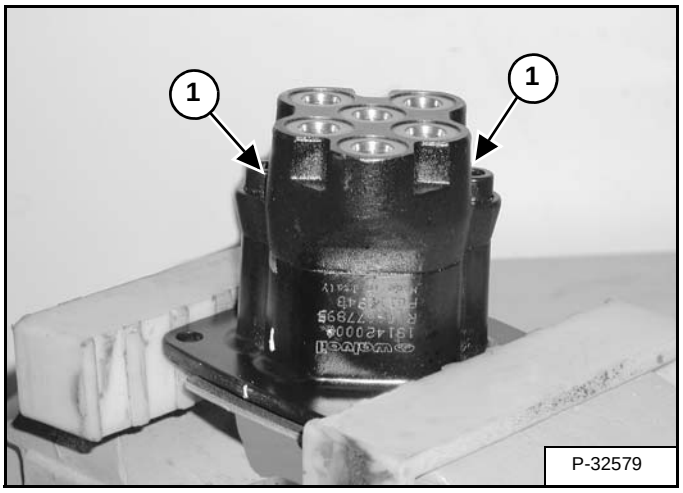
Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-110-28]**.

Figure 20-110-29



Remove the springs (Item 1) **[Figure 20-110-29]** from the housing.

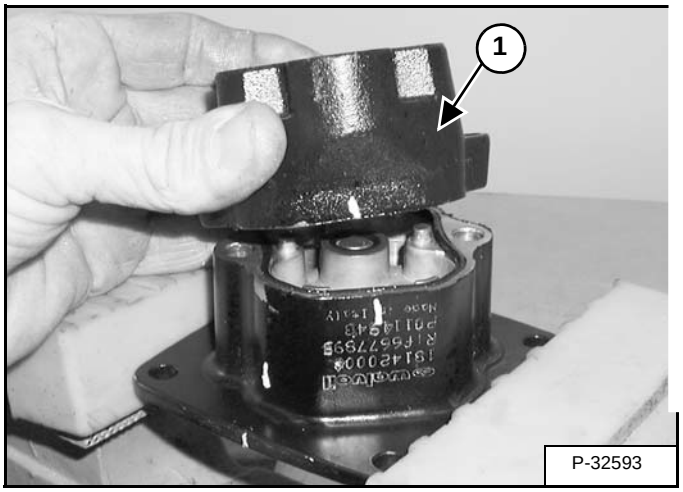
Figure 20-110-30



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

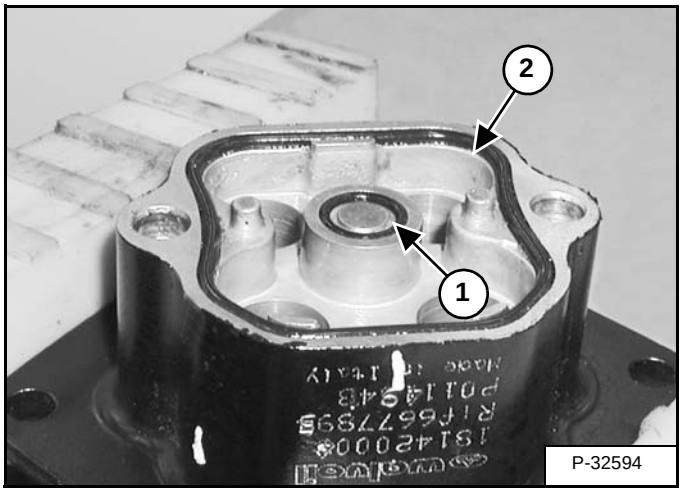


Remove the end cap (Item 1) **[Figure 20-110-31]**.

RIGHT CONTROL LEVER (JOYSTICK) (S/N AB8B11001 - AB8B11080) (CONT'D)

Disassembly (Cont'd)

Figure 20-110-32



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-110-32]**.

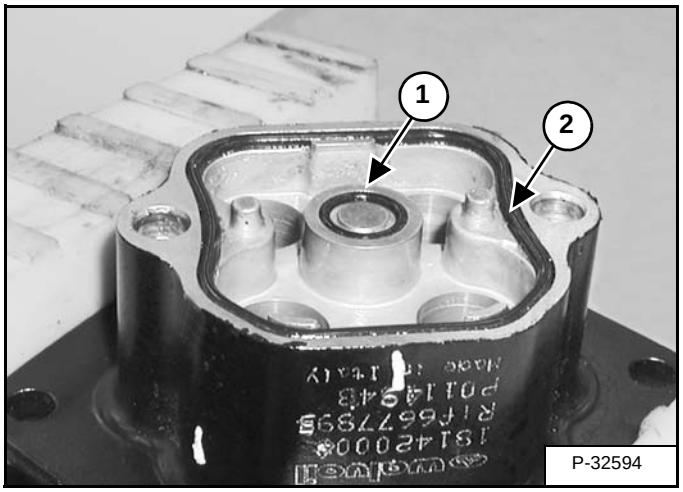
Assembly

Clean all parts in solvent and dry with compressed air.

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

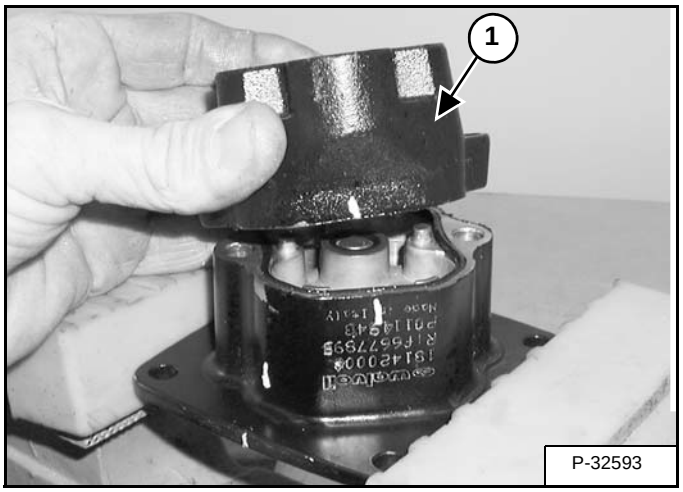
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-110-33



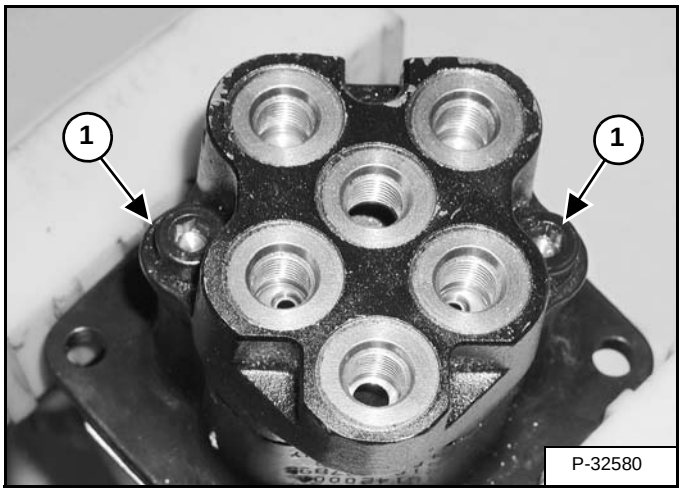
Clamp the housing in a vise equipped with padded jaws. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-110-33]**.

Figure 20-110-34



Install the end cap (Item 1) **[Figure 20-110-34]**.

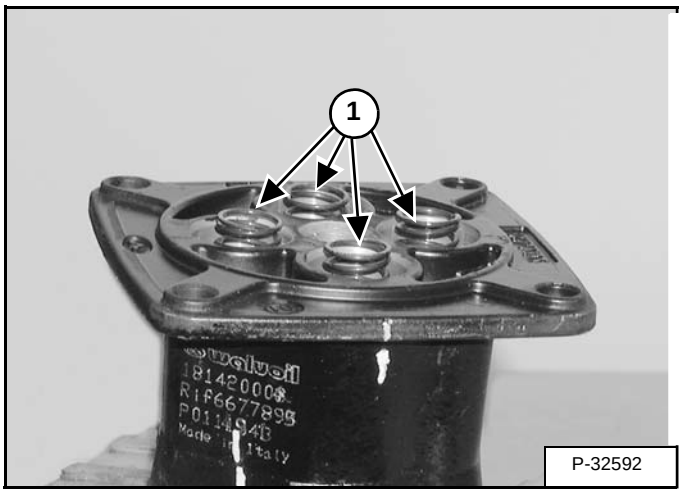
Figure 20-110-35



Install the two bolts (Item 1) **[Figure 20-110-35]**.

Turn the housing over.

Figure 20-110-36

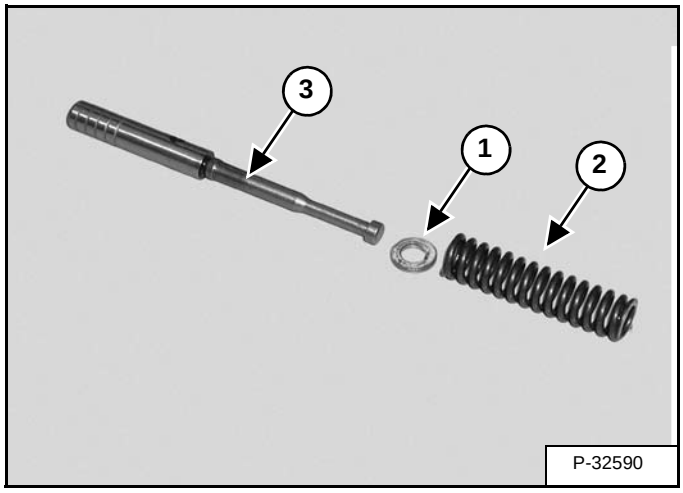


Install the springs (Item 1) **[Figure 20-110-36]**.

RIGHT CONTROL LEVER (JOYSTICK) (S/N AB8B11001 - AB8B11080) (CONT'D)

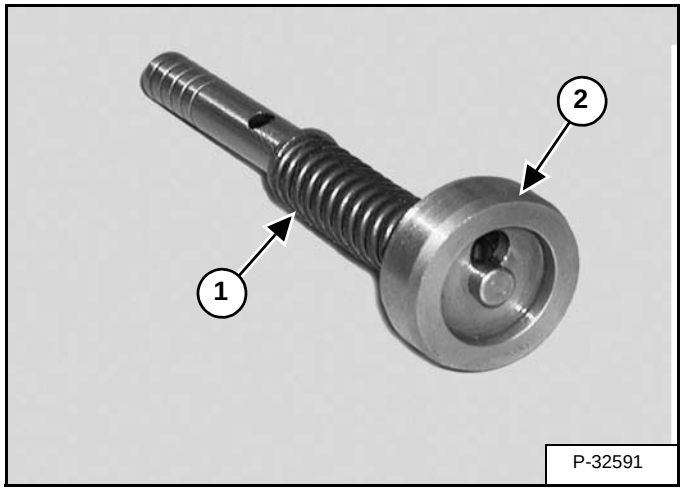
Assembly (Cont'd)

Figure 20-110-37



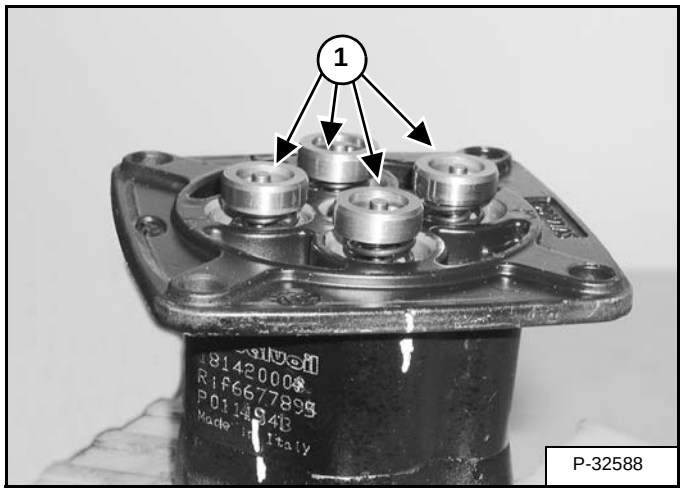
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-110-37]**.

Figure 20-110-38



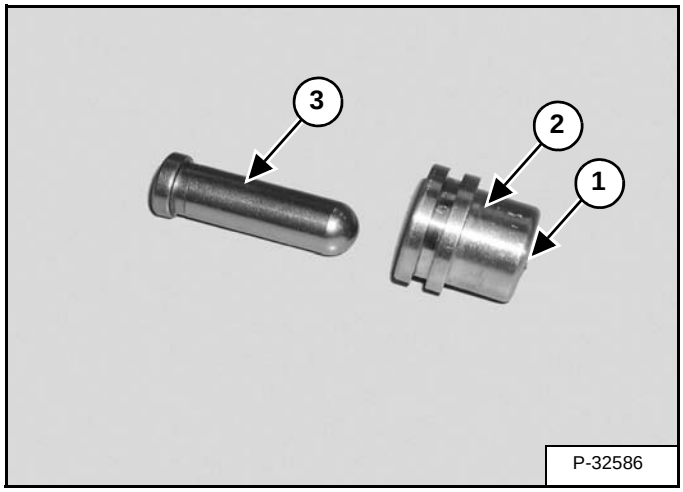
Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-110-38]**.

Figure 20-110-39



Install the spool assemblies (Item 1) **[Figure 20-110-39]** into the housing.

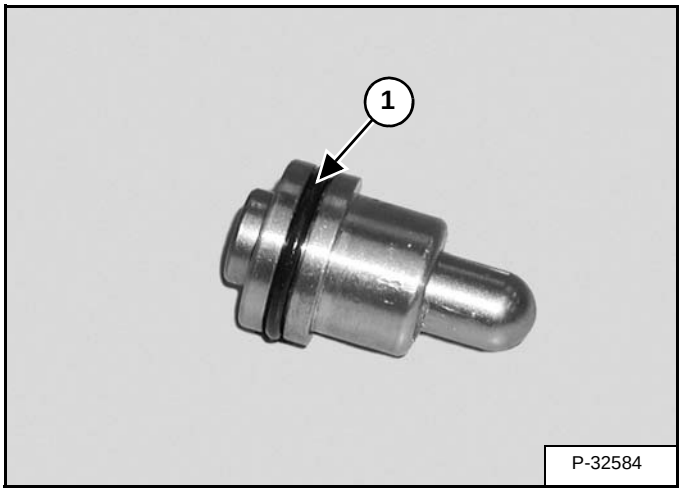
Figure 20-110-40



Install the O-ring (Item 1) into the bushing (Item 2). Install the plunger (Item 3) **[Figure 20-110-40]** into the bushing.

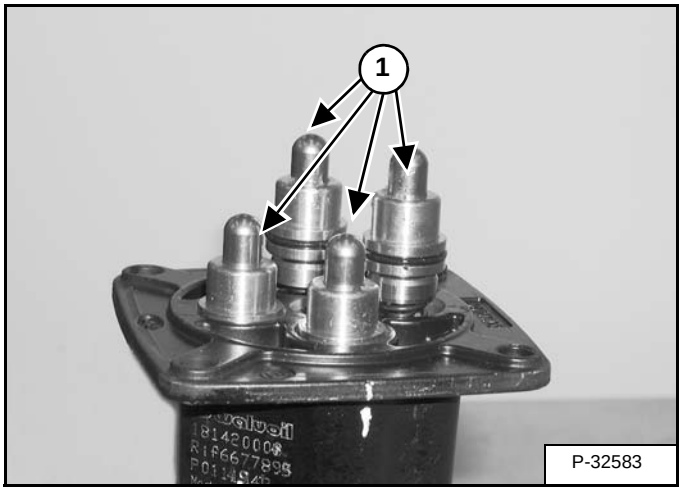
Assembly (Cont'd)

Figure 20-110-41



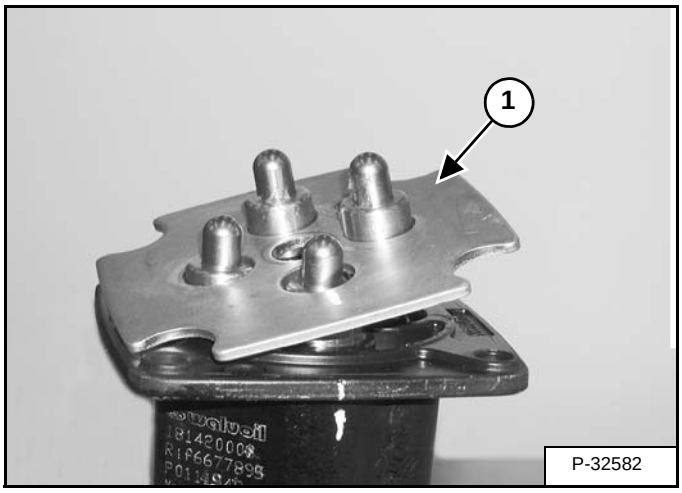
Install the O-ring (Item 1) **[Figure 20-110-41]** on the bushing.

Figure 20-110-42



Install the plunger assemblies (Item 1) **[Figure 20-110-42]** into the housing.

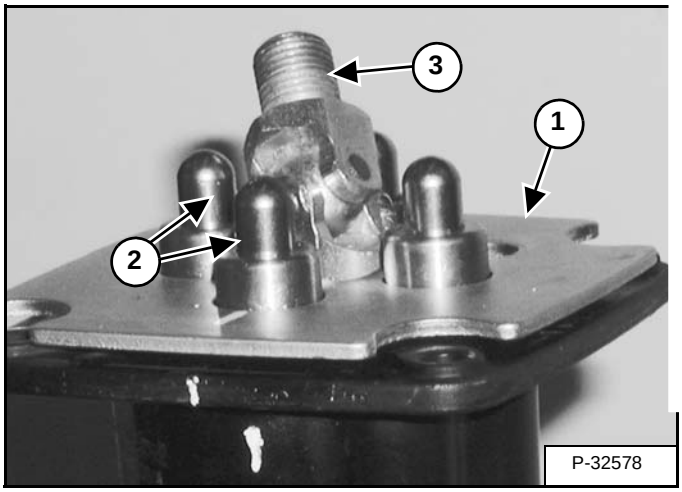
Figure 20-110-43



Install the plate (Item 1) **[Figure 20-110-43]**.

NOTE: Spring pressure can dislodge the plunger assemblies until the plate is secured in place.

Figure 20-110-44

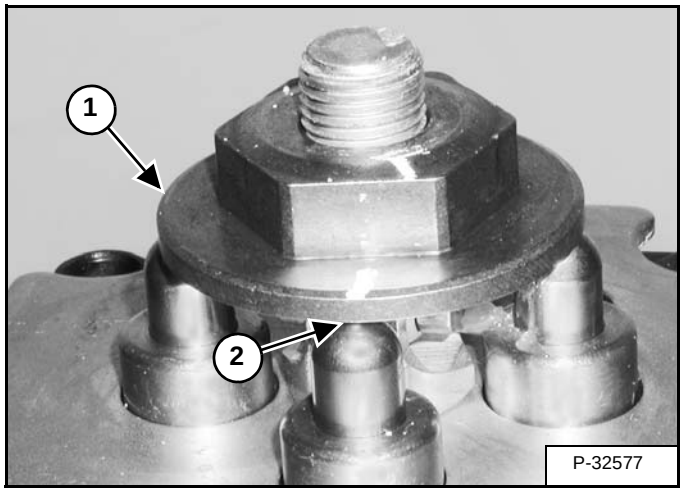


Press down on the plate (Item 1) keeping the plunger assemblies (Item 2) fully seated and install the U-joint (Item 3) **[Figure 20-110-44]**.

RIGHT CONTROL LEVER (JOYSTICK) (S/N AB8B11001 - AB8B11080) (CONT'D)

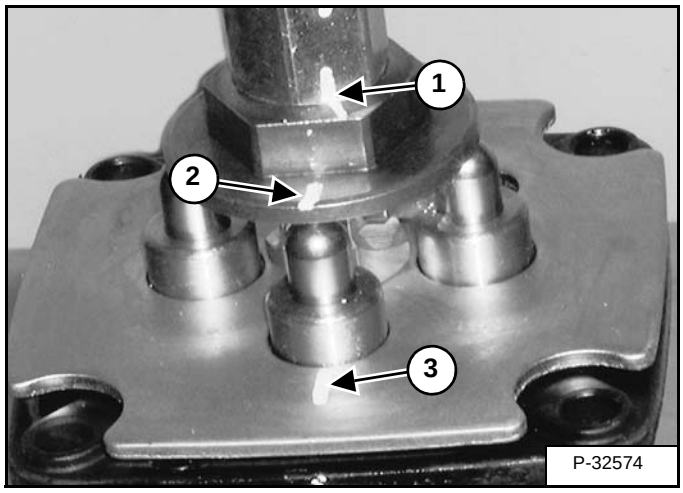
Assembly (Cont'd)

Figure 20-110-45



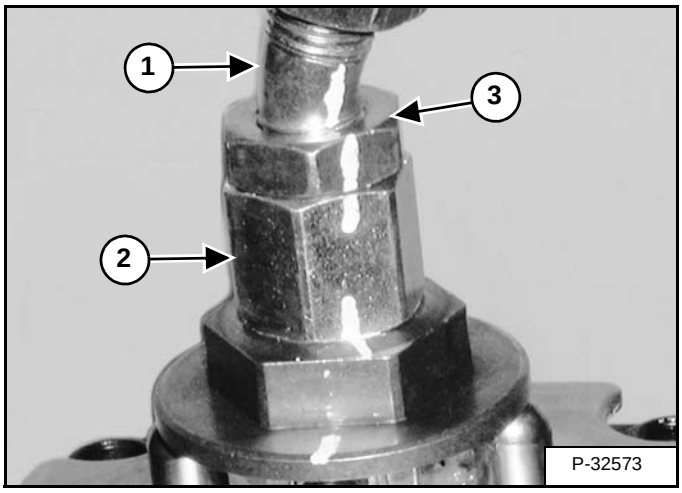
Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-110-45]**.

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.

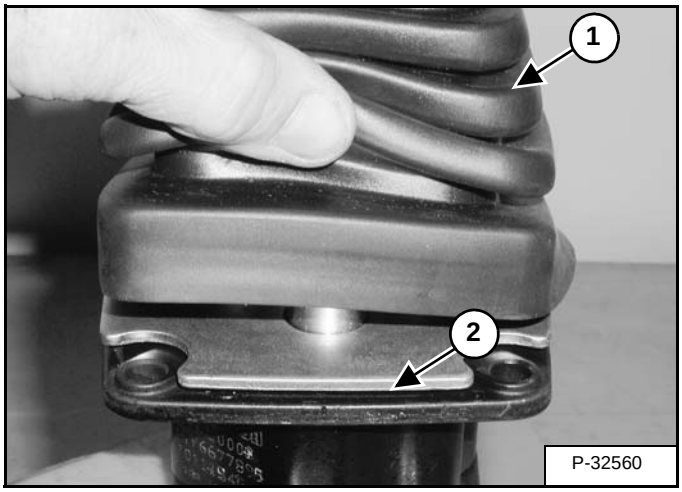
Figure 20-110-47



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]**.

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.)

RIGHT CONTROL LEVER (JOYSTICK) (S/N AB8B11081 & ABOVE)

Testing

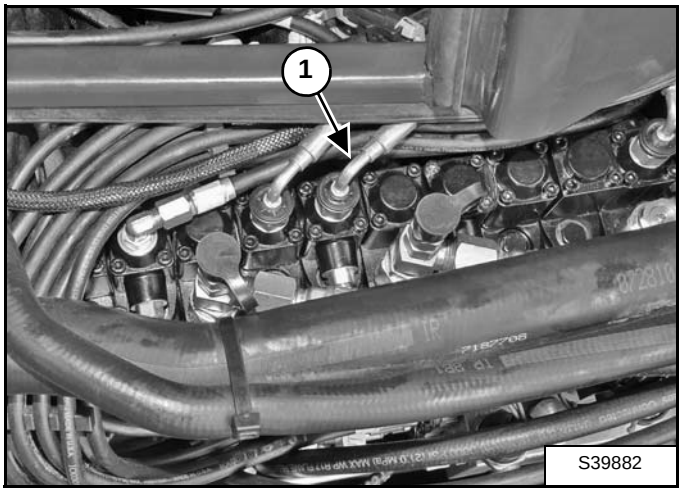
The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

Stop the engine.

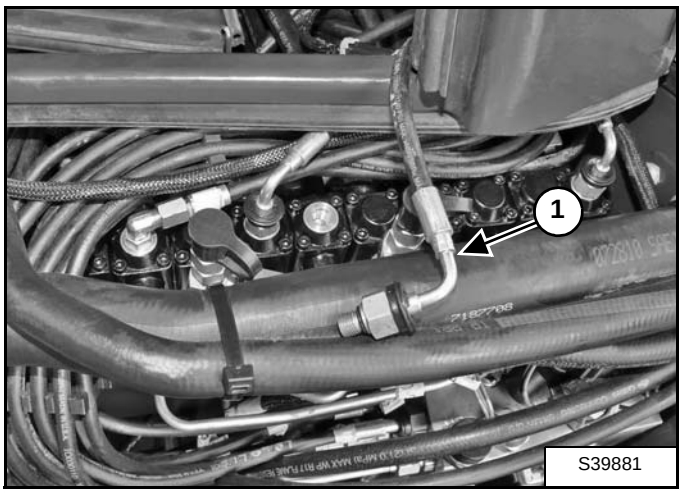
Remove the left upperstructure cover. (See Removal And Installation on Page 40-70-1.)

Figure 20-111-1



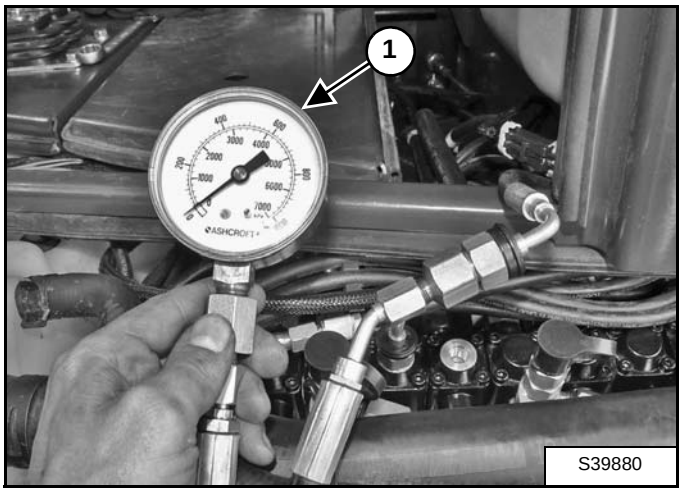
At the control valve assembly, find the pilot line (Item 1) **[Figure 20-111-1]** of the control lever (joystick) that is to be checked. (Boom, Bucket) (Boom shown)

Figure 20-111-2



Disconnect the hydraulic hose (Item 1) **[Figure 20-111-2]** and fitting from the control valve.

Figure 20-111-3



From the test kit install a 7 MPa (70 bar) (1000 psi) gauge (Item 1) **[Figure 20-111-3]** on the pilot line. Start the excavator, and warm the hydraulic fluid to operating temperature.

Engage the circuit to be tested. Record the operating pressure.

The operating pressure should be approximately 3,2 - 3, MPa (32 - 35 bar) (464 - 508 psi).

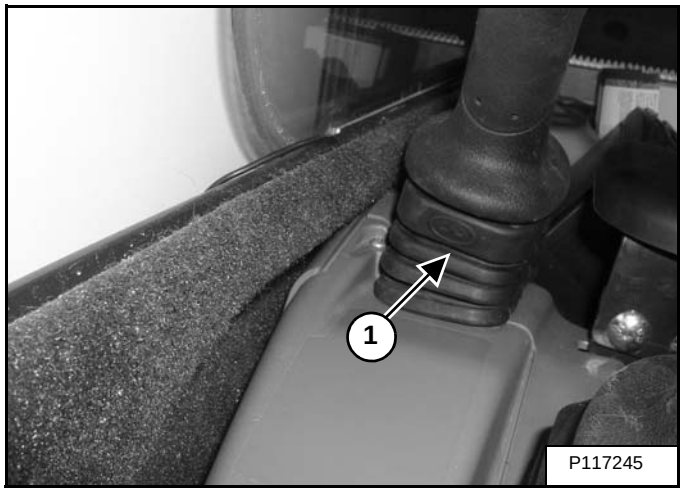
If the operating pressure is correct, check the valv section spool for proper operation. If the operatin pressure is incorrect, remove the pilot pressure relie valve, clean, install and retest. (See Testing on Page 20 111-1.)

If the pressure is still incorrect replace the pilot pressur relief reducing valve. (See Testing And Adjusting on Pag 20-33-1.)

RIGHT CONTROL LEVER (JOYSTICK) (S/N AB8B11081 & ABOVE) (CONT'D)

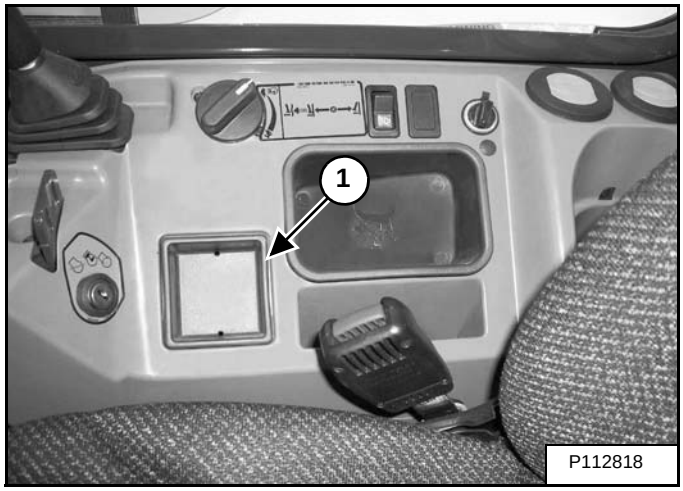
Handle Removal And Installation

Figure 20-111-4



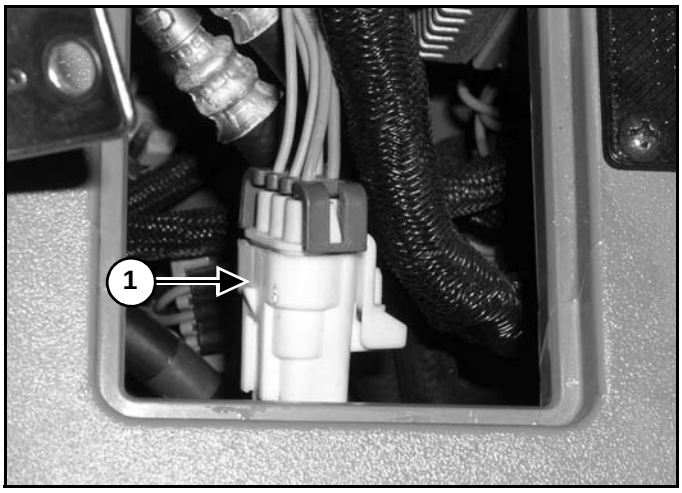
Lift the boot (Item 1) **[Figure 20-111-4]** up and over the handle.

Figure 20-111-5



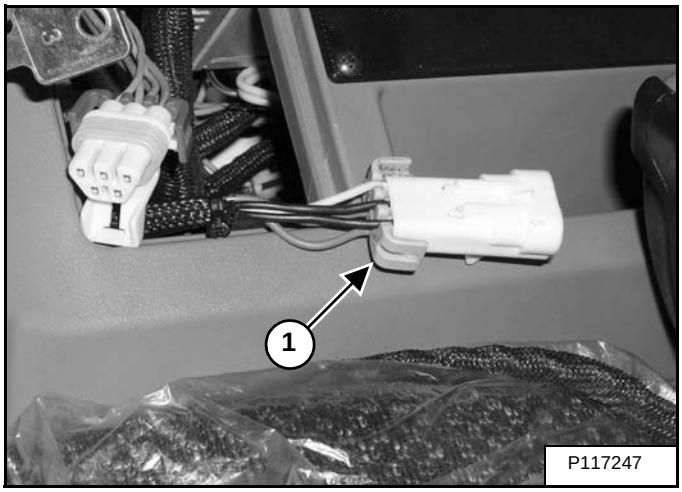
Remove the storage compartment (Item 1) **[Figure 20-111-5]**.

Figure 20-111-6



Disconnect the joystick harness (Item 1) **[Figure 20-111-6]** by releasing the lock and pulling on the connector. Do not pull on the wiring.

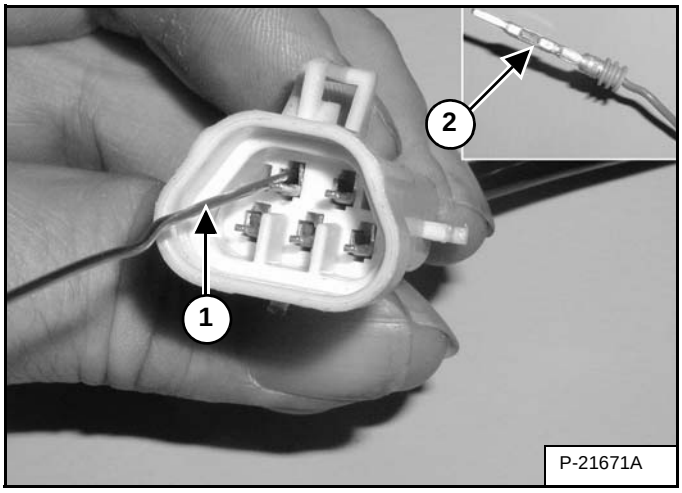
Figure 20-111-7



Remove the lock (Item 1) **[Figure 20-111-7]** from the electrical connector.

Handle Removal And Installation (Cont'd)

Figure 20-111-8

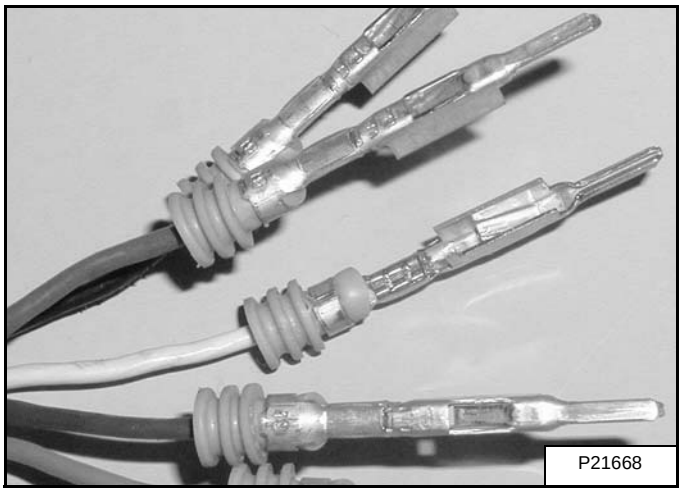


With a small piece of wire (Item 1), depress the wire terminal tabs (Item 2) **[Figure 20-111-8]**.

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 20-111-8]** on each wire before installing the electrical connector.

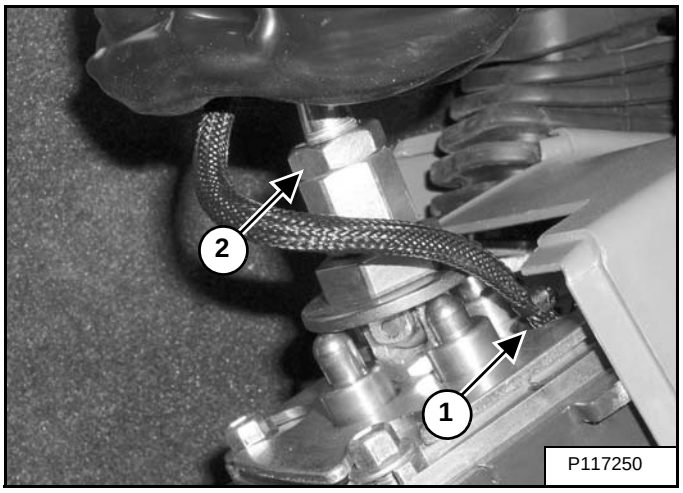
Figure 20-111-9



Installation: The wires **[Figure 20-111-9]** must be installed in the proper locations in the wire connector, listed below.

A Yellow	C Black	E Brown
B Black	D Red	

Figure 20-111-10



Pull the grommet (Item 1), depress the wire terminal tabs (Item 2) **[Figure 20-111-10]** up out of the housing.

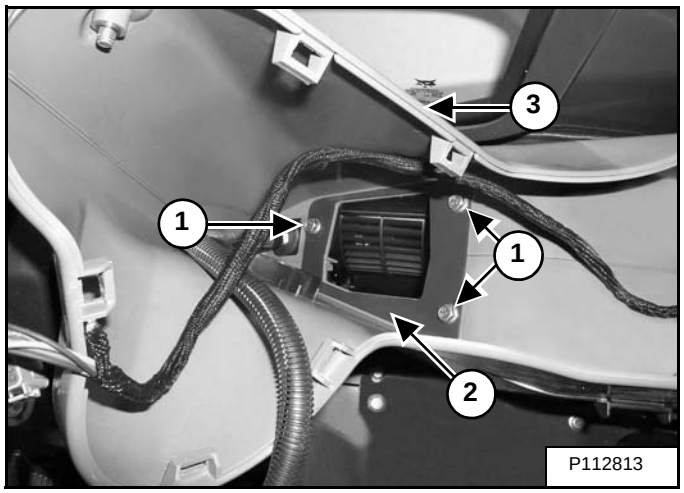
Loosen the nut (Item 2) **[Figure 20-111-10]** and remove the handle.

RIGHT CONTROL LEVER (JOYSTICK) (S/N AB8B11081 & ABOVE) (CONT'D)

Joystick Assembly Removal And Installation

Remove the instrument panel. (See Removal And Installation on Page 70-30-1.)

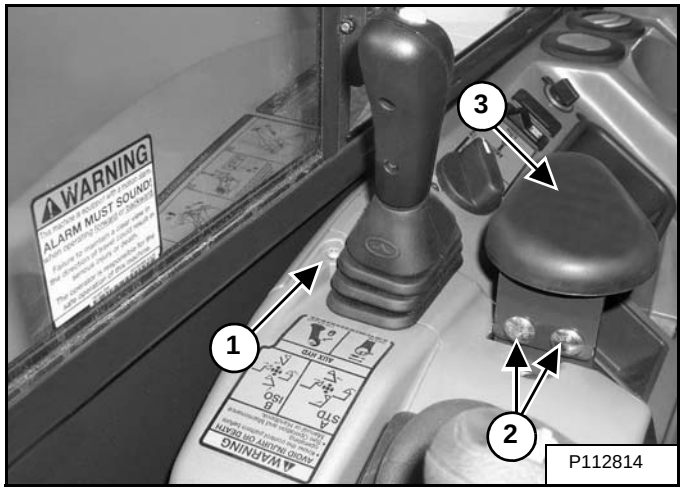
Figure 20-111-11



Remove the bolts (Item 1) and plate (Item 2) **[Figure 20-111-11]**.

Remove the HVAC duct (Item 3) **[Figure 20-111-11]**

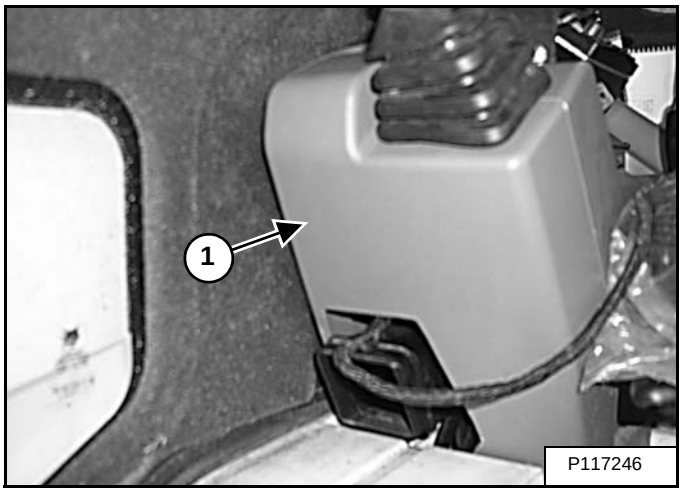
Figure 20-111-12



Remove the screw (Item 1) **[Figure 20-111-12]**.

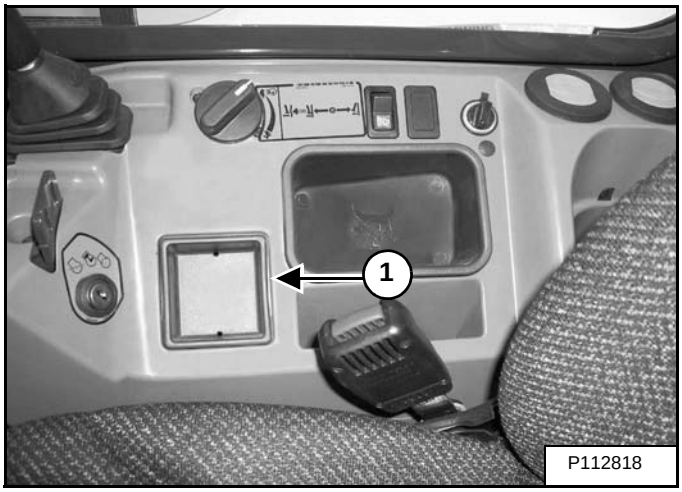
Remove the two bolts (Item 2), nuts and armrest (Item 3) **[Figure 20-111-12]**.

Figure 20-111-13



Pull the front cover (Item 1) **[Figure 20-111-13]** towards the front of the excavator and remove the cover.

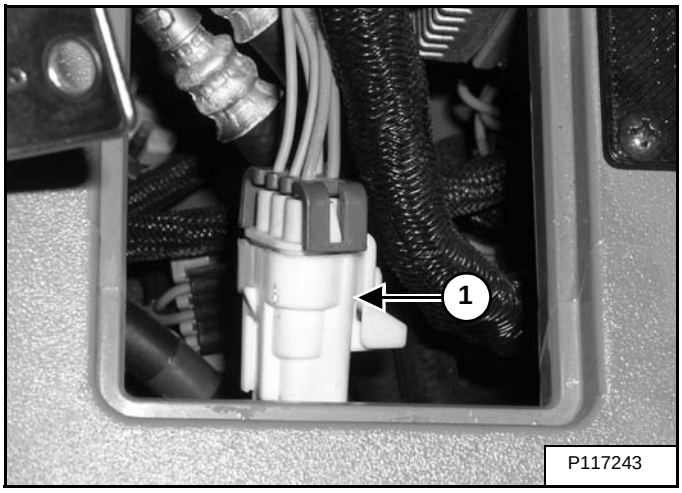
Figure 20-111-14



Remove the storage compartment (Item 1) **[Figure 20-111-14]**.

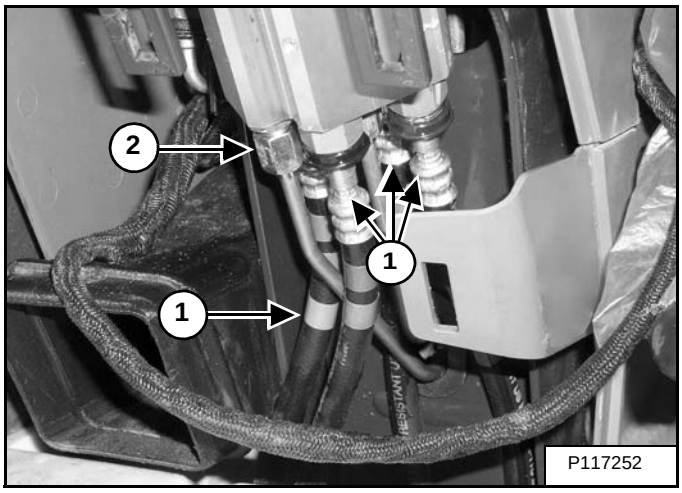
Joystick Assembly Removal And Installation (Cont'd)

Figure 20-111-15



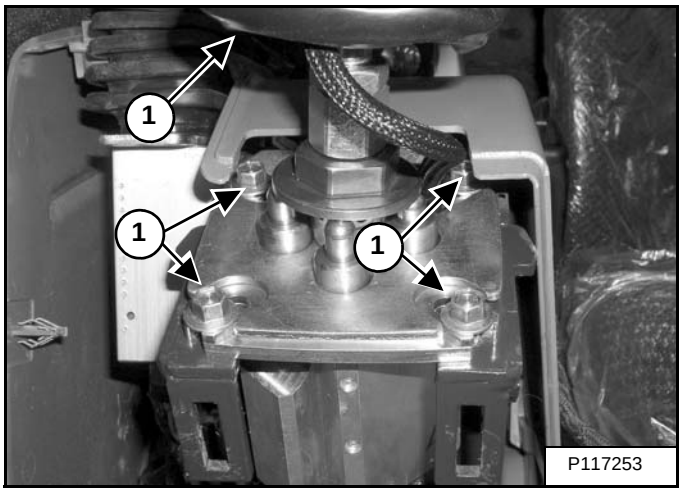
Disconnect the joystick wire harness (Item 1) **[Figure 20-111-15]** by releasing the lock and pulling on the connector. Do not pull on the wiring.

Figure 20-111-16



Mark and remove the hoses (Item 1) and tubelines (Item 2) **[Figure 20-111-16]**.

Figure 20-111-17



Pull the boot (Item 1) **[Figure 20-111-17]** up from the mounting plate.

Remove the bolts (Item 2) **[Figure 20-111-17]**.

Remove the joystick assembly.

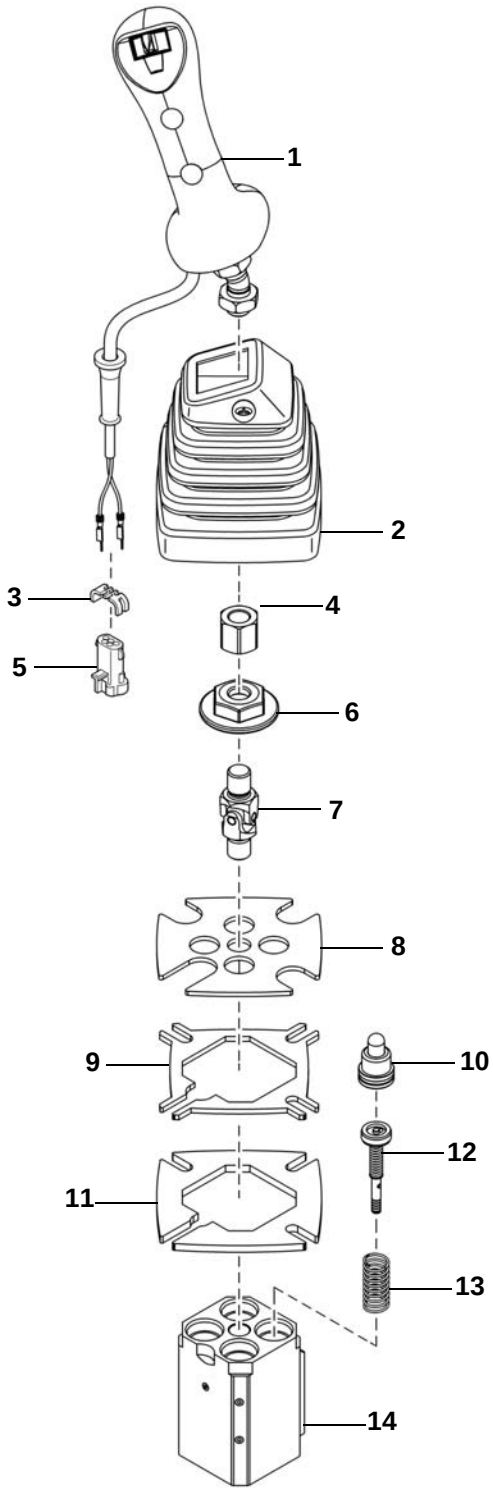
IMPORTANT

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

I-2003-088

Parts Identification

1. Handle
2. Boot
3. Lock
4. Coupler
5. Connector
6. Control Plate
7. U-Joint
8. Square Flange
9. Intermediate Flange
10. Plunger
11. Inferior Flange
12. Spool
13. Spring
14. Housing



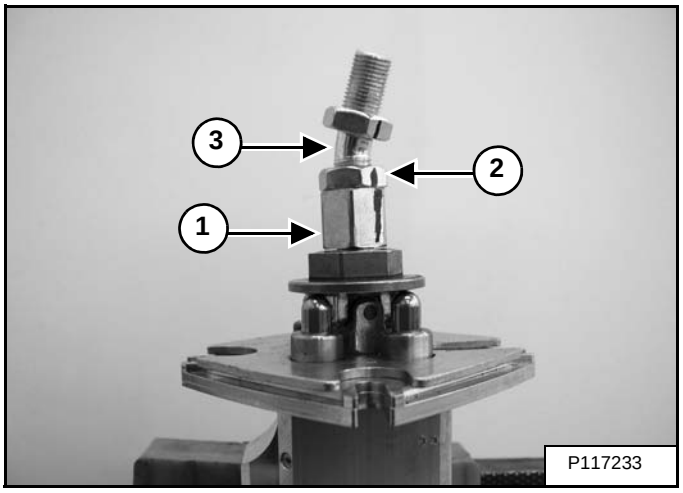
NA8064S

Disassembly

Remove the right handle. (See Handle Removal And Installation on Page 20-111-2.)

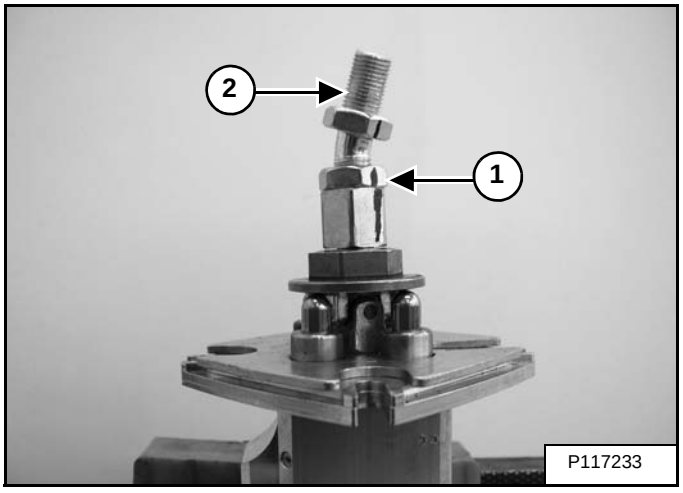
Clean the outside of the control lever before disassembly.

Figure 20-111-18



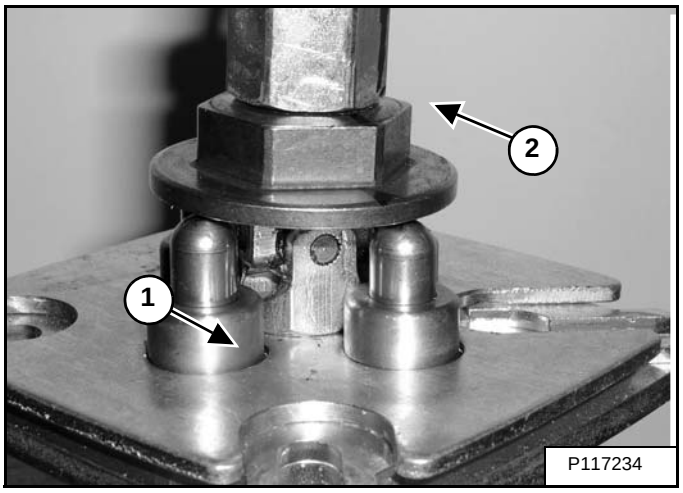
Mark the coupler (Item 1), nut (Item 2), and connector (Item 3) **[Figure 20-111-18]** for ease of assembly.

Figure 20-111-19



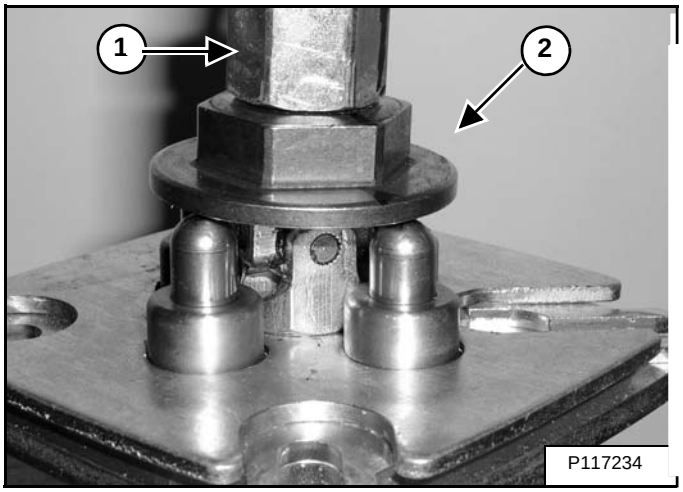
Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-111-19]**.

Figure 20-111-20



Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-111-20]** for ease of assembly.

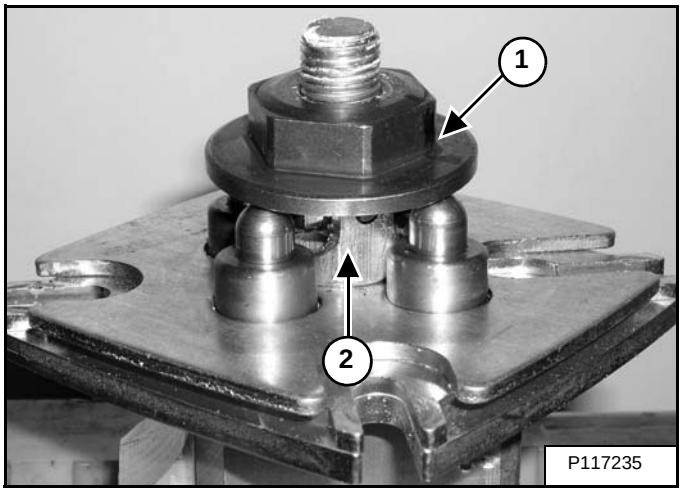
Figure 20-111-21



Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-111-21]**.

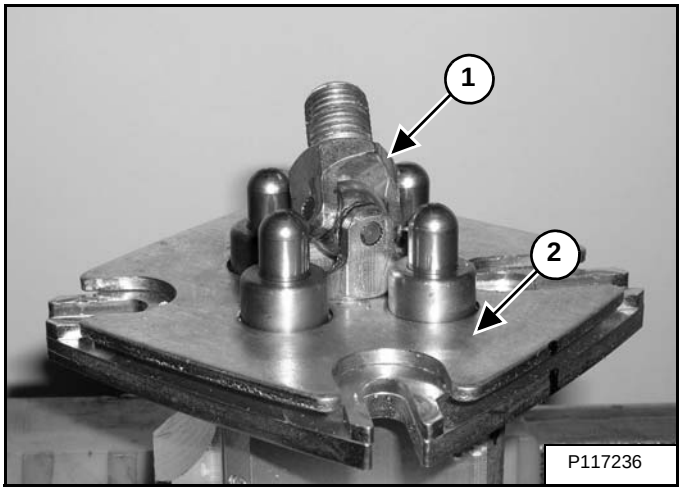
Disassembly (Cont'd)

Figure 20-111-22



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-111-22]**.

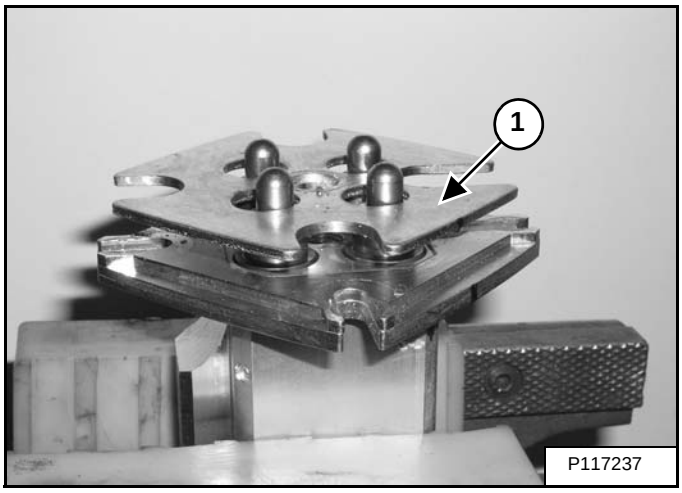
Figure 20-111-23



Mark the plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-111-23]**.

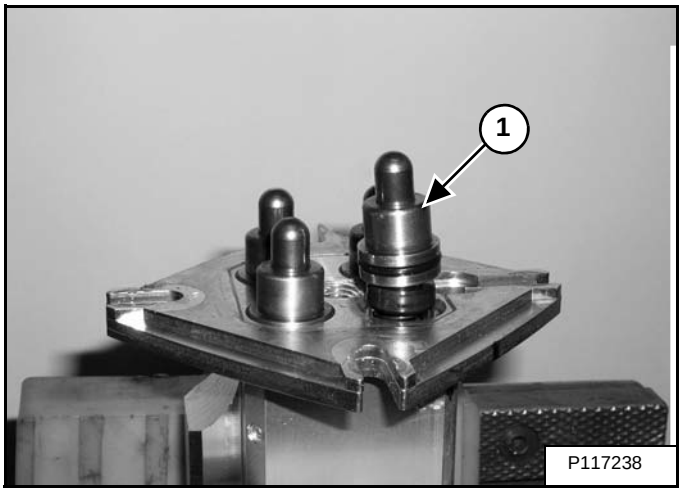
NOTE: The plate (Item 2) [Figure 20-111-23] is spring loaded and will come up as the U-joint is removed.

Figure 20-111-24



Remove the plate (Item 1) **[Figure 20-111-24]**.

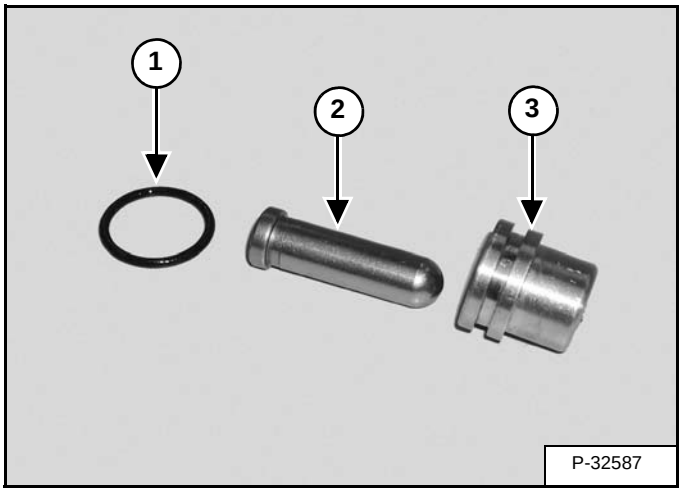
Figure 20-111-25



Remove the plunger assemblies (Item 1) **[Figure 20-111-25]**.

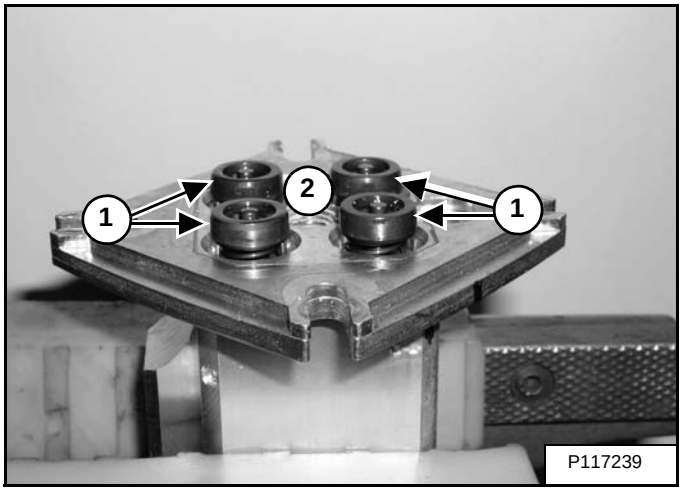
Disassembly (Cont'd)

Figure 20-111-26



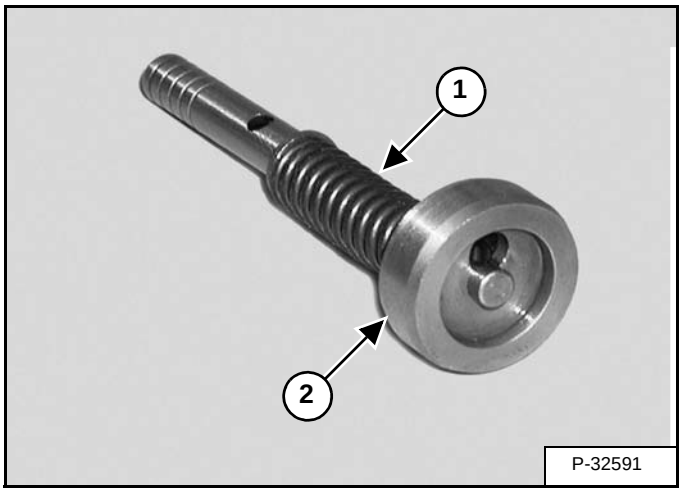
Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-111-26]**.

Figure 20-111-27



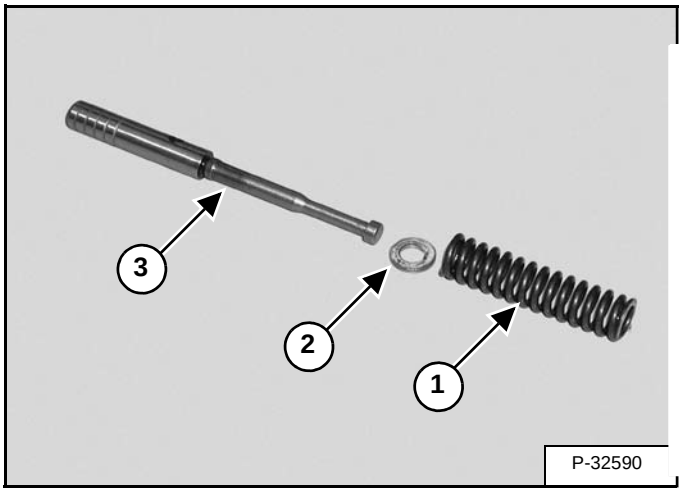
Remove the spool assemblies (Item 1) **[Figure 20-111-27]**.

Figure 20-111-28



Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-111-28]**.

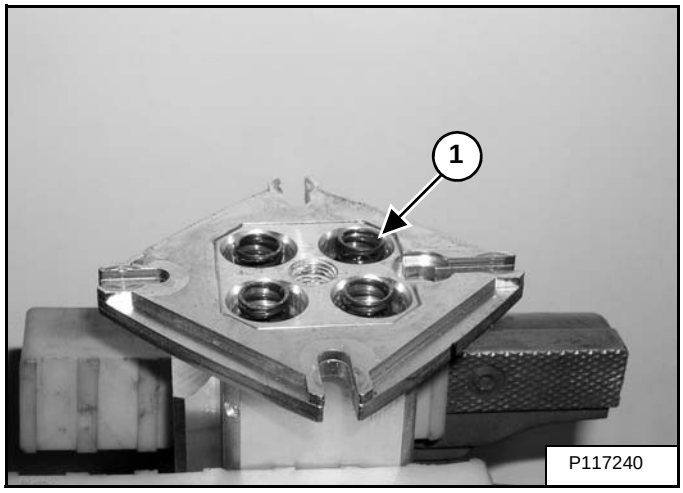
Figure 20-111-29



Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-111-29]**.

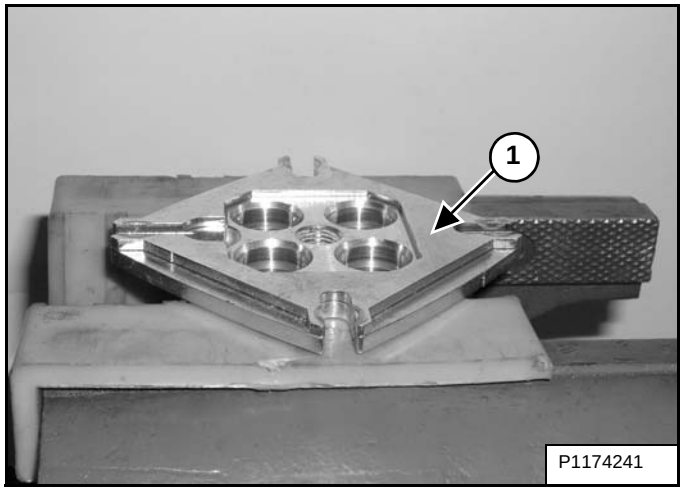
Disassembly (Cont'd)

Figure 20-111-30



Remove the springs (Item 1) **[Figure 20-111-30]** from the housing.

Figure 20-111-31



Remove the plate (Item 1) **[Figure 20-111-31]**.

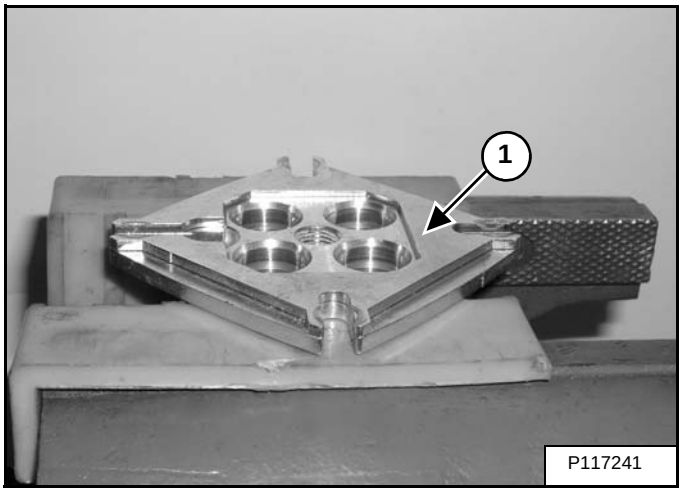
Assembly

Clean all parts in solvent and dry with compressed air.

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

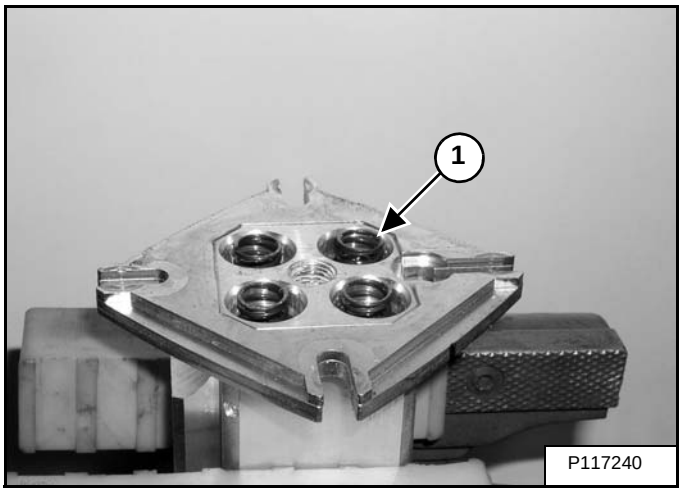
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-111-32



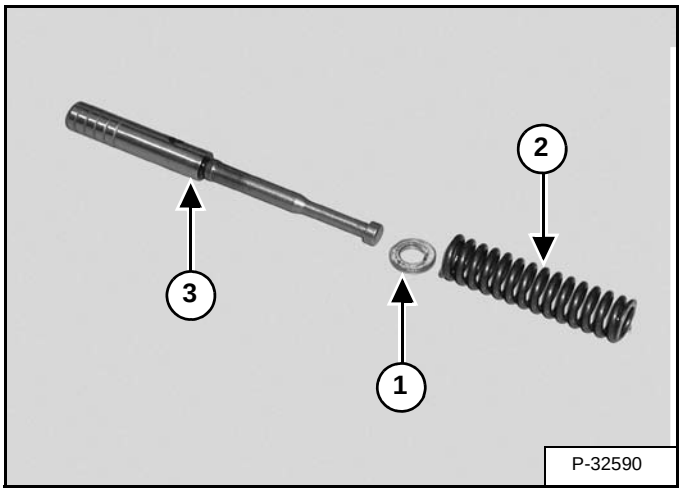
Install the plate (Item 1) **[Figure 20-111-32]**.

Figure 20-111-33



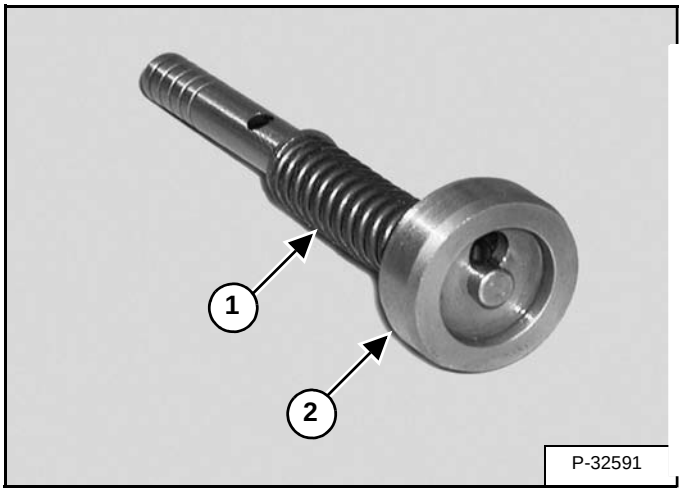
Install the springs (Item 1) **[Figure 20-111-33]**.

Figure 20-111-34



Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-111-34]**.

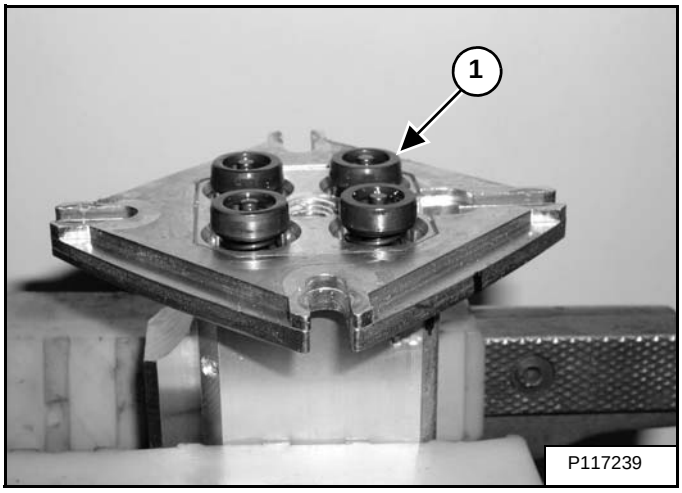
Figure 20-111-35



Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-111-35]**.

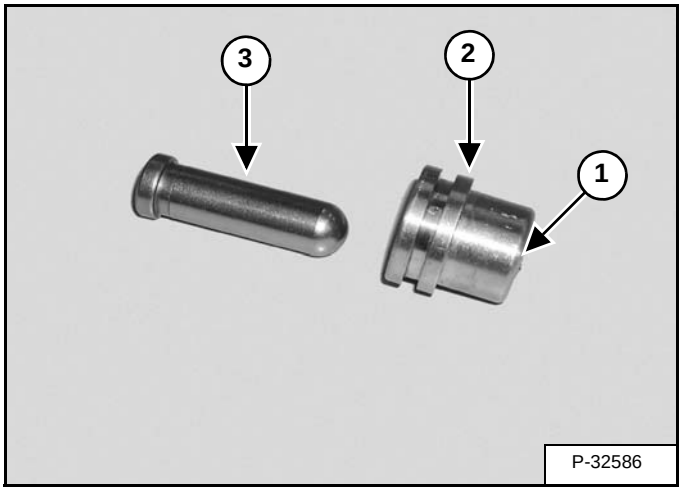
Assembly (Cont'd)

Figure 20-111-36



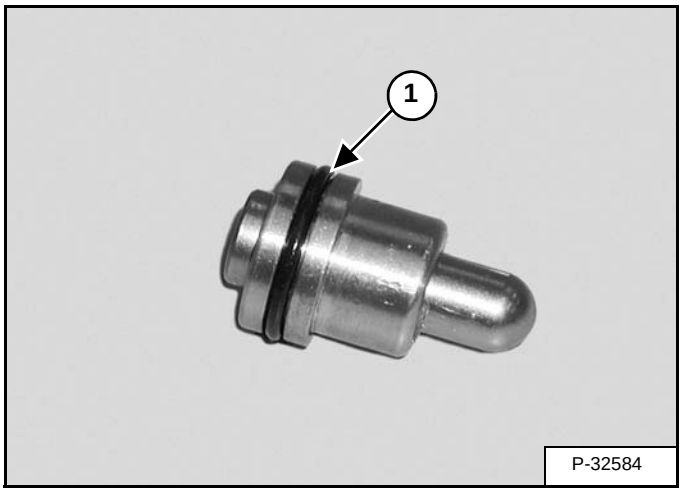
Install the spool assemblies (Item 1) **[Figure 20-111-36]** into the housing.

Figure 20-111-37



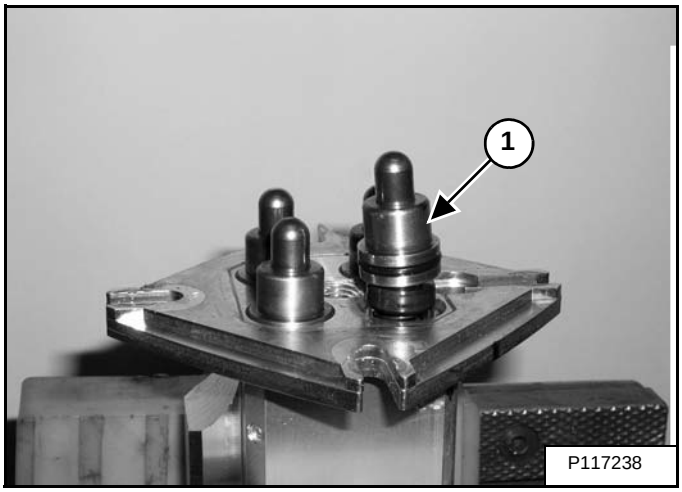
Install the O-ring (Item 1) into the bushing (Item 2). Install the plunger (Item 3) **[Figure 20-111-37]** into the bushing.

Figure 20-111-38



Install the O-ring (Item 1) **[Figure 20-111-38]** on the bushing.

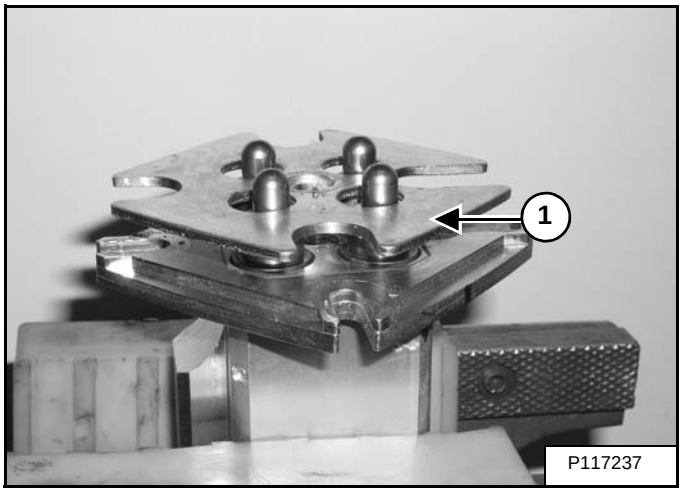
Figure 20-111-39



Install the plunger assemblies (Item 1) **[Figure 20-111-39]** into the housing.

Assembly (Cont'd)

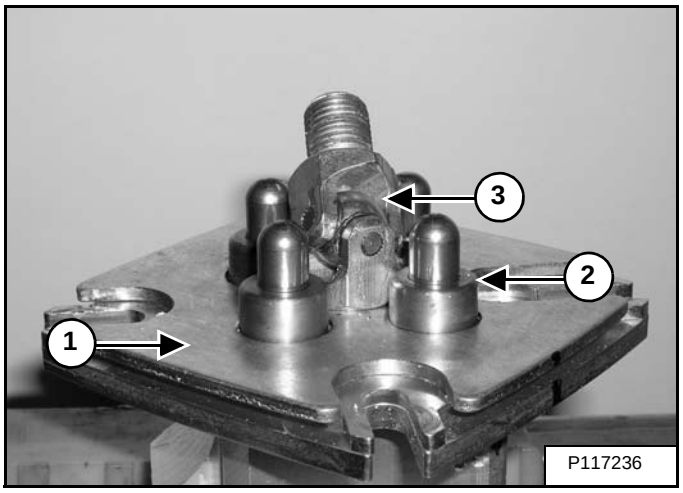
Figure 20-111-40



Install the plate (Item 1) **[Figure 20-111-40]**.

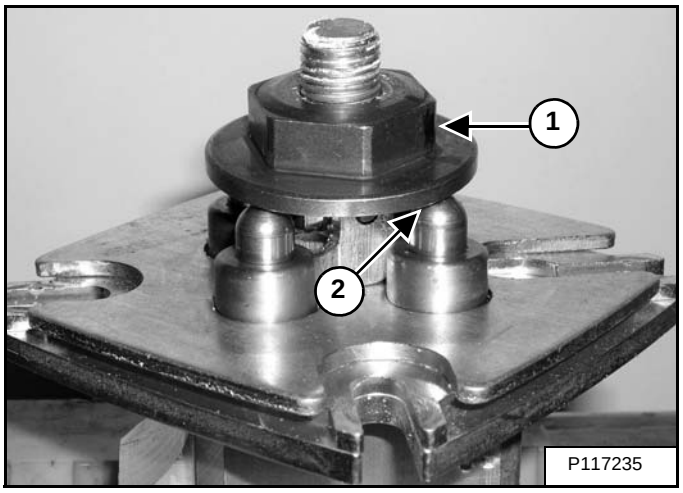
NOTE: Spring pressure can dislodge the plunger assemblies until the plate is secured in place.

Figure 20-111-41



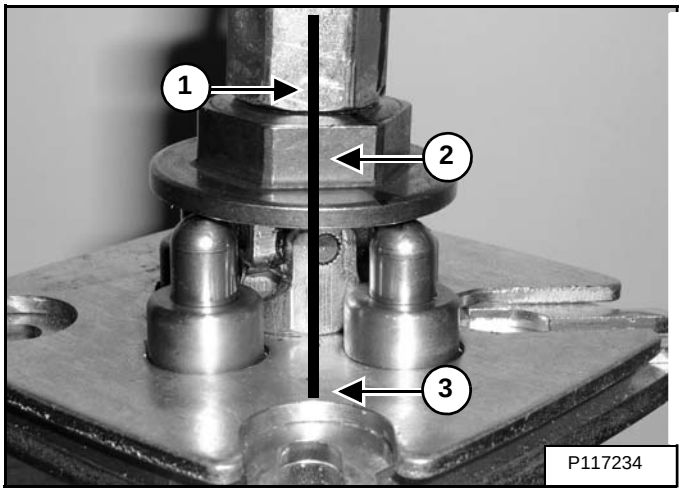
Press down on the plate (Item 1) keeping the plunger assemblies (Item 2) fully seated and install the U-joint (Item 3) **[Figure 20-111-41]**.

Figure 20-111-42



Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-111-42]**.

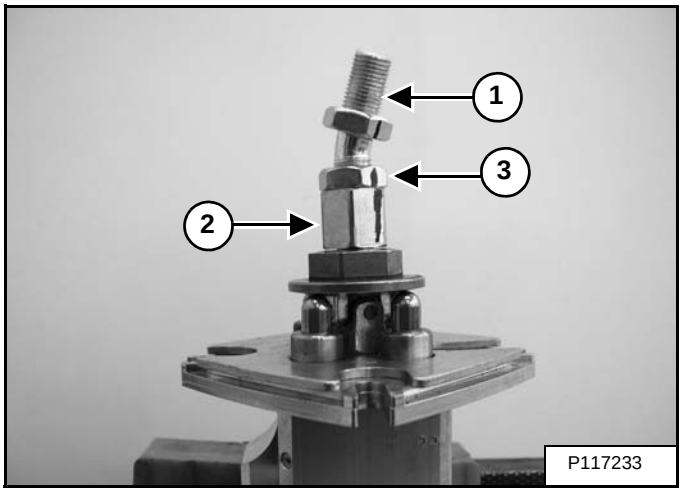
Figure 20-111-43



Align the coupler (Item 1) with the control plate (Item 2) and plate (Item 3) **[Figure 20-111-43]**. Tighten the coupler.

Assembly (Cont'd)

Figure 20-111-44



Install the connector (Item 1) **[Figure 20-111-44]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-111-44]**.

Install the handle. (See Handle Removal And Installation on Page 20-111-2.)

LEFT CONTROL LEVER (JOYSTICK) (S/N AB8B11001 - AB8B11080)

Testing

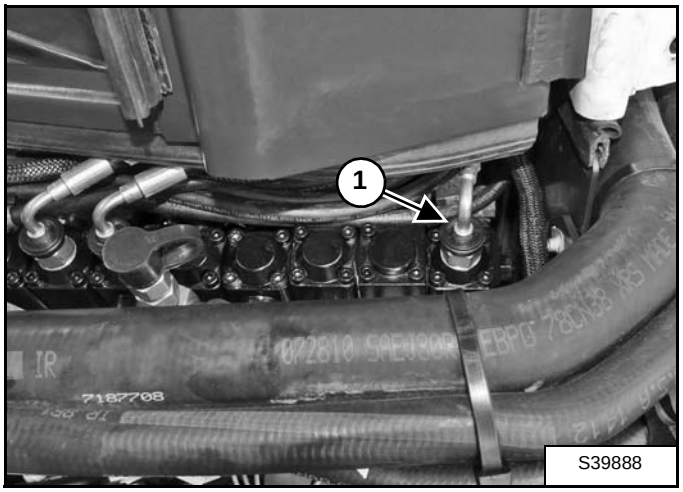
The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

Stop the engine.

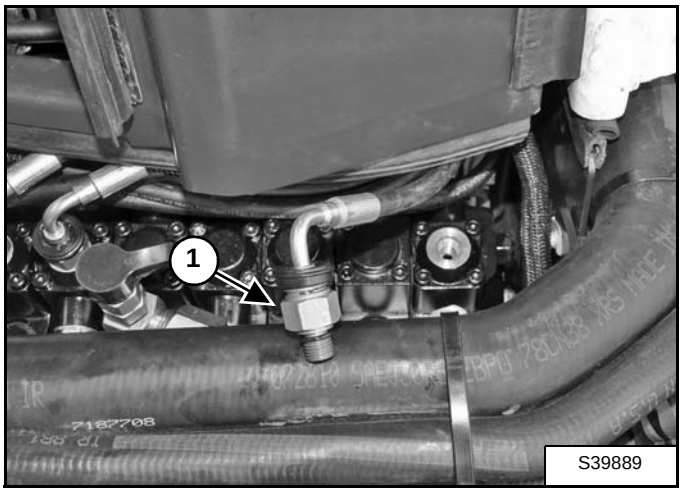
Remove the left upperstructure cover.

Figure 20-120-1



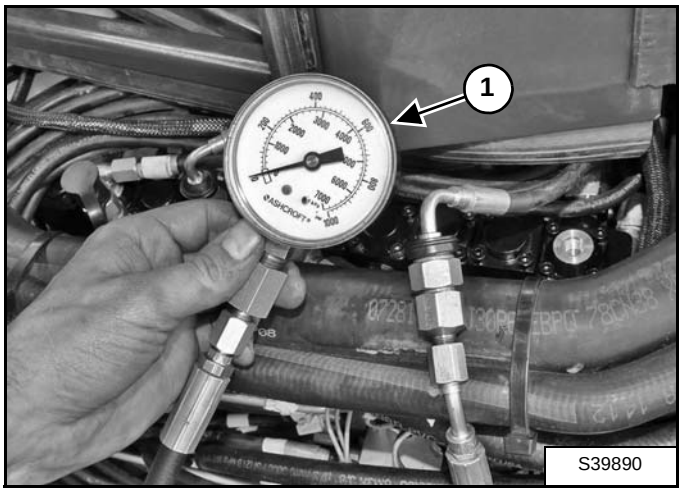
At the control valve assembly (Item 1) **[Figure 20-120-1]**, find the pilot line of the control lever (joystick) that is to be checked. (Arm, Slew) (Slew Shown)

Figure 20-120-2



Disconnect the hydraulic fitting (Item 1) **[Figure 20-120-2]** from the control valve.

Figure 20-120-3



From the test kit install a 7 MPa (70 bar) (1000 psi) gauge (Item 1) **[Figure 20-120-3]** on the pilot line. Start the excavator, and warm the hydraulic fluid to operating temperature.

Engage the circuit to be tested. Record the operating pressure.

The operating pressure should be approximately 3,2 - 3, MPa (32 - 35 bar) (464 - 508 psi).

If the operating pressure is correct, check the valv section spool for proper operation. If the operatin pressure is incorrect, remove the pilot pressure relie valve, clean, install and retest. (See Testing An Adjusting on Page 20-33-1.)

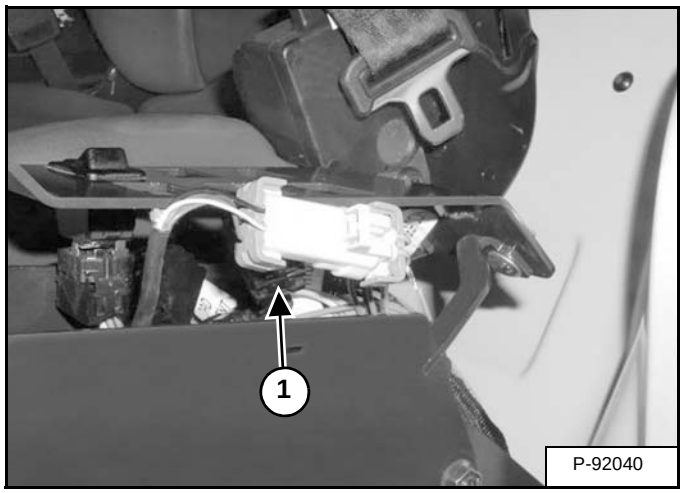
If the pressure is still incorrect replace the pilot pressur relief valve. (See Testing And Adjusting on Page 20-33 1.)

LEFT CONTROL LEVER (JOYSTICK) (S/N AB8B11001 - AB8B11080) (CONT'D)

Handle Removal And Installation

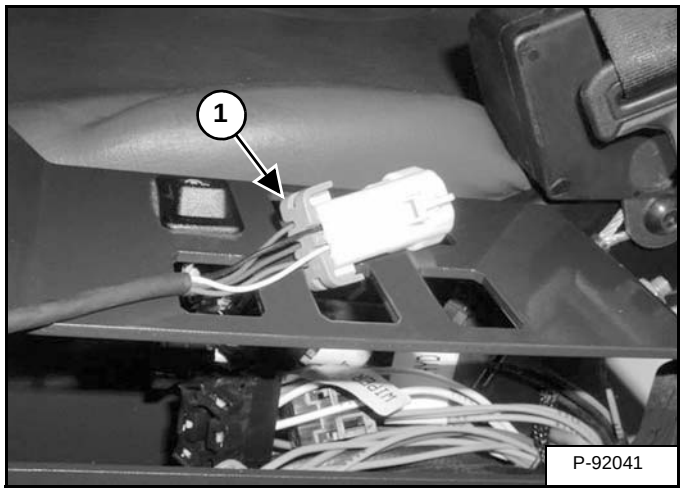
Remove the left console cover. (See Console Removal And Installation on Page 40-60-6.)

Figure 20-120-4



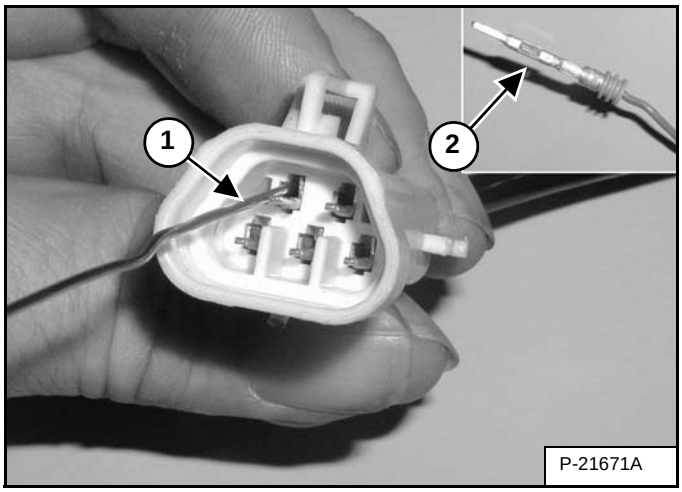
Disconnect the wire harness (Item 1) **[Figure 20-120-4]**.

Figure 20-120-5



Remove the lock (Item 1) **[Figure 20-120-5]** from the electrical connector.

Figure 20-120-6



With a small piece of wire (Item 1), depress the wire terminal tabs (Item 2) **[Figure 20-120-6]**.

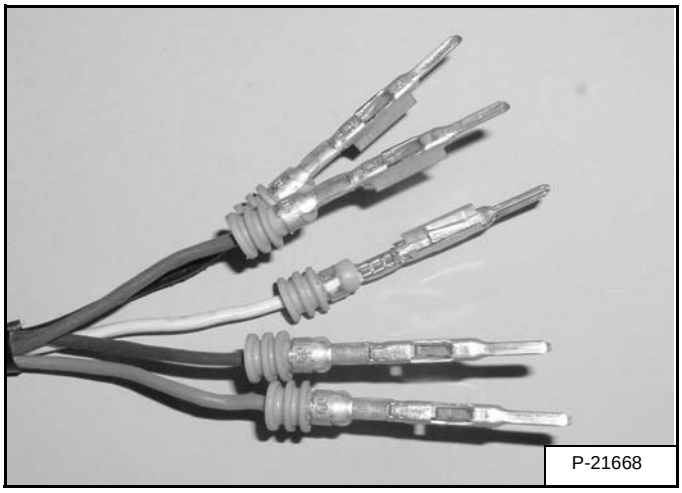
Carefully remove the individual wires from the back of the electrical connector.

Installation: Use a small piece of wire and re-bend the tab (Item 2) **[Figure 20-120-6]** on each wire before installing the electrical connector.

Remove the control handle (joystick) assembly from the excavator.

Handle Removal And Installation (Cont'd)

Figure 20-120-7

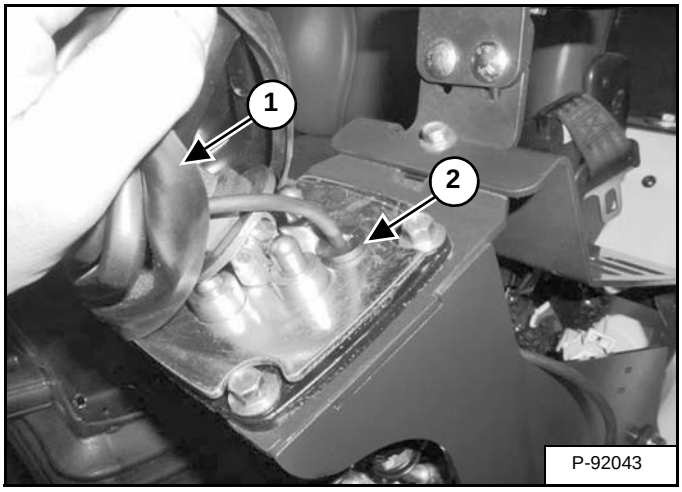


Installation: The wires **[Figure 20-120-7]** must be installed in the proper locations in the wire connector, listed below.

A Green	C Red	E White
B Brown	D Black	

Check each wire to be certain the tab locks into position.

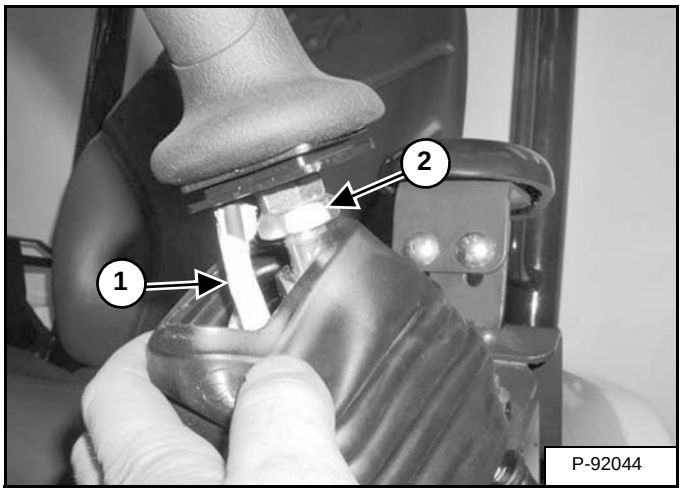
Figure 20-120-8



Raise the boot (Item 1) and pull the grommet (Item 2) up **[Figure 20-120-8]** out of the housing.

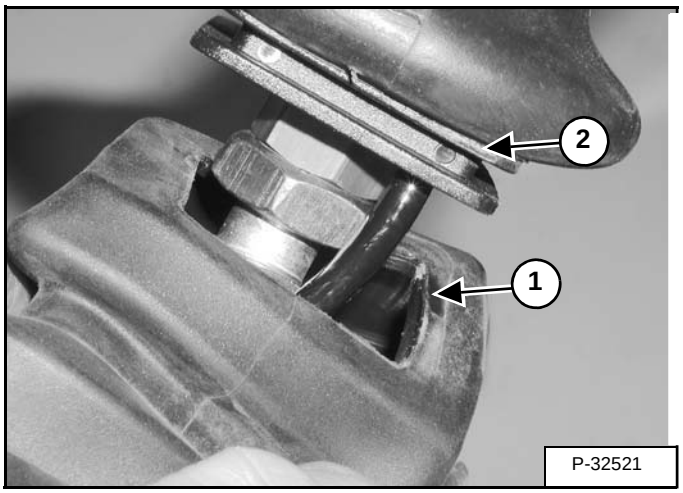
Remove the wire and grommet.

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

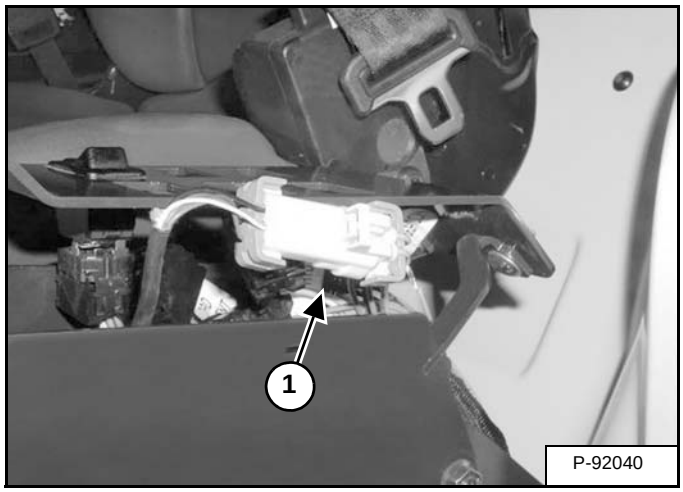


Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-120-10]**.

Joystick Assembly Removal And Installation

Remove the left console cover. (See Console Removal And Installation on Page 40-60-6.)

Figure 20-120-11



Disconnect the wire harness (Item 1) **[Figure 20-120-11]**.

Figure 20-120-12



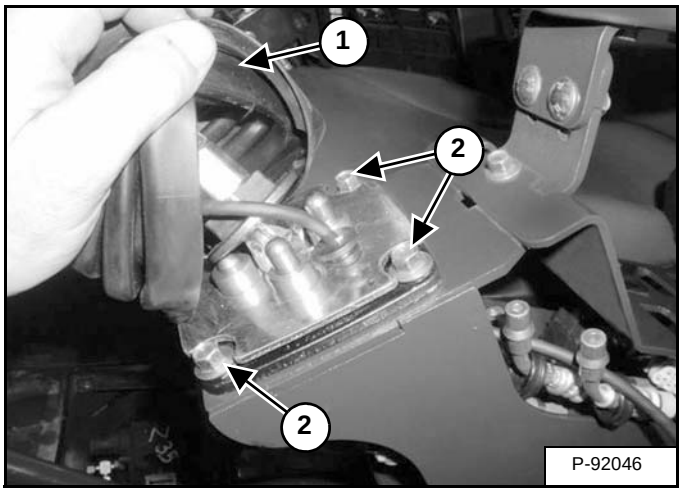
Mark and remove the hoses **[Figure 20-120-12]**.

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.

I-2003-0888

Figure 20-120-13



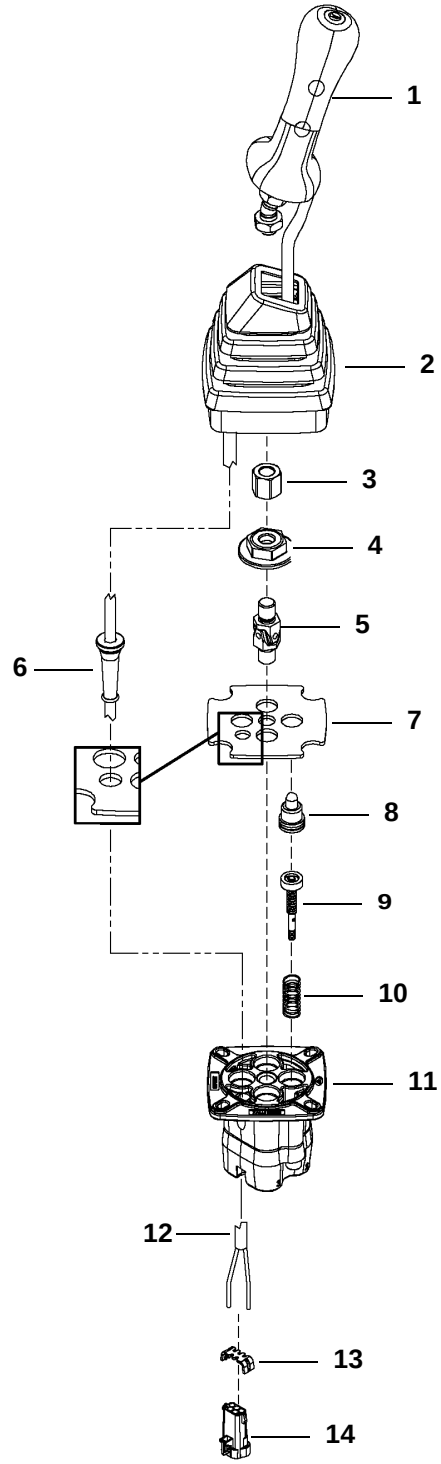
Pull the boot (Item 1) **[Figure 20-120-13]** up from the mounting plate.

Remove the bolts (Item 2) **[Figure 20-120-13]**.

Remove the joystick assembly.

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

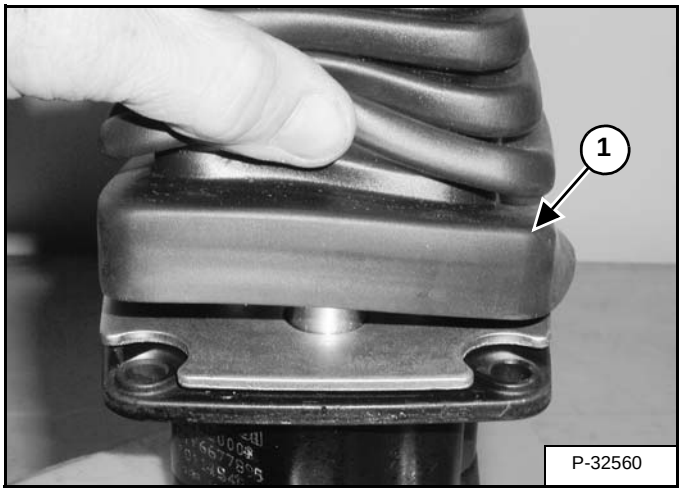
LEFT CONTROL LEVER (JOYSTICK) (S/N AB8B11001 - AB8B11080) (CONT'D)

Disassembly

Remove the left handle. (See Handle Removal And Installation on Page 20-120-2.)

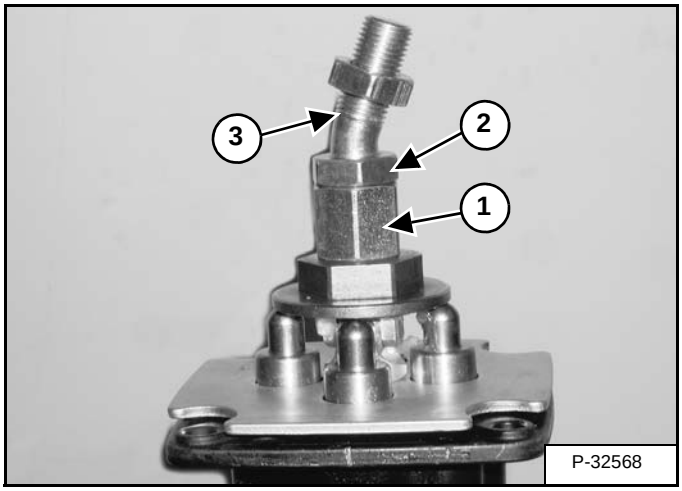
Clean the outside of the control lever before disassembly.

Figure 20-120-14



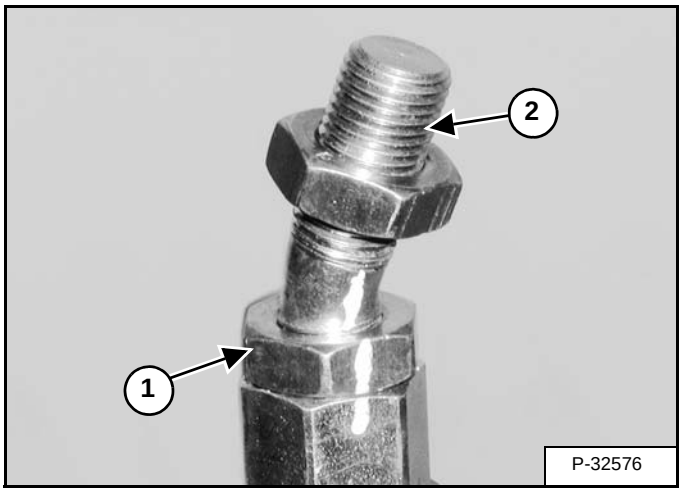
Remove the boot (Item 1) **[Figure 20-120-14]**.

Figure 20-120-15



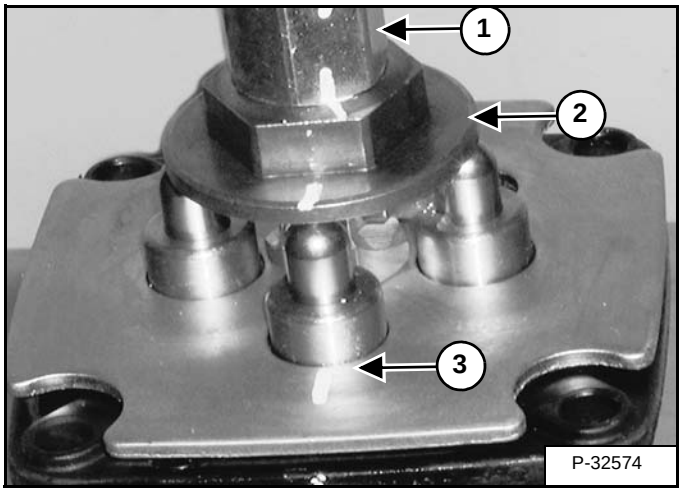
Mark the coupler (Item 1), nut (Item 2), and connector (Item 3) **[Figure 20-120-15]** for ease of assembly.

Figure 20-120-16



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-120-16]**.

Figure 20-120-17

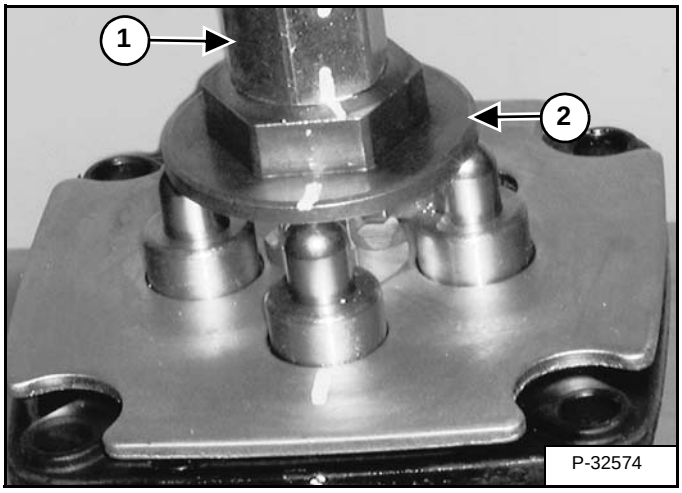


Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-120-17]** for ease of assembly.

LEFT CONTROL LEVER (JOYSTICK) (S/N AB8B11001 - AB8B11080) (CONT'D)

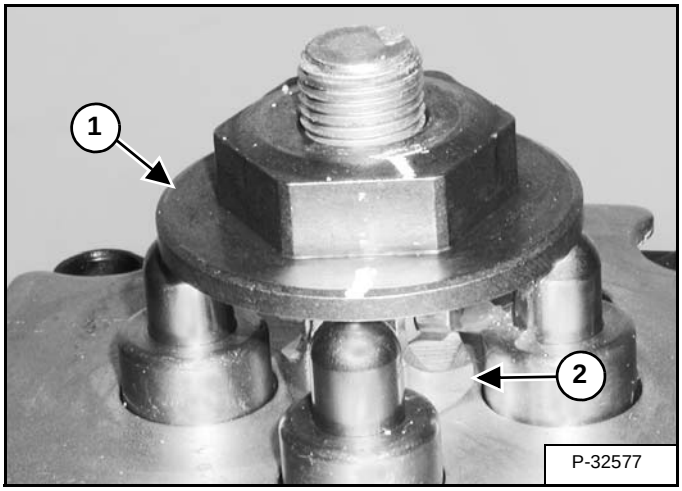
Disassembly (Cont'd)

Figure 20-120-18



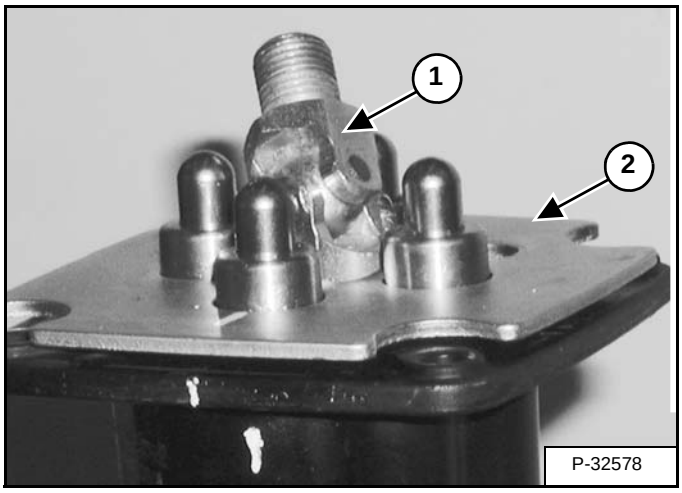
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-120-18]**.

Figure 20-120-19



Remove the control plate (Item 1) from the U-joint (Item 2) **[Figure 20-120-19]**.

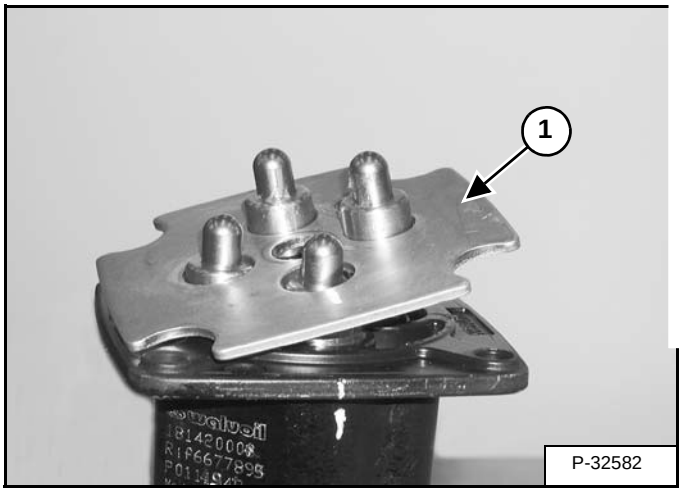
Figure 20-120-20



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

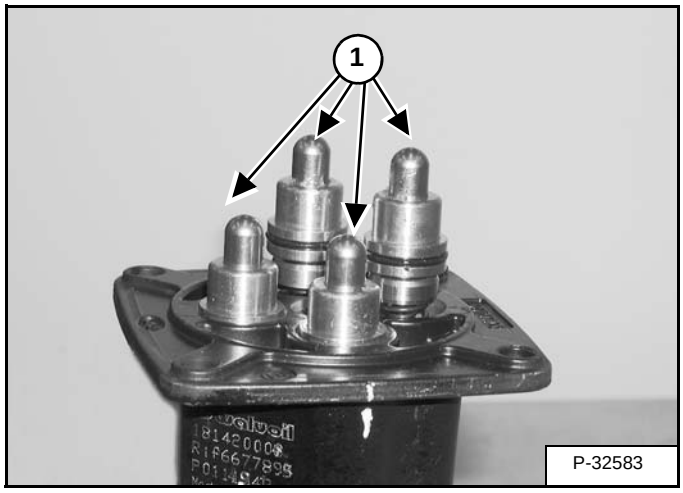


Remove the plate (Item 1) **[Figure 20-120-21]**.

LEFT CONTROL LEVER (JOYSTICK) (S/N AB8B11001 - AB8B11080) (CONT'D)

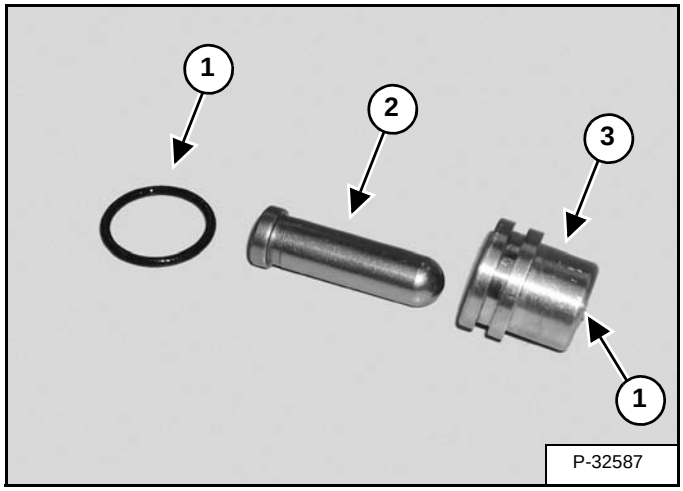
Disassembly (Cont'd)

Figure 20-120-22



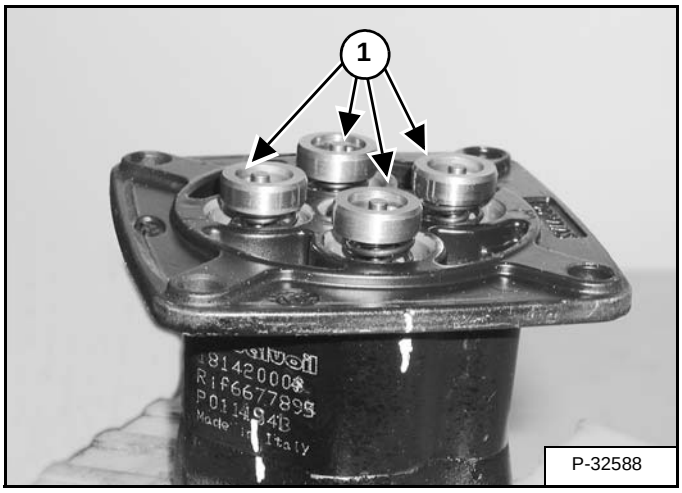
Remove the plunger assemblies (Item 1) **[Figure 20-120-22]**.

Figure 20-120-23



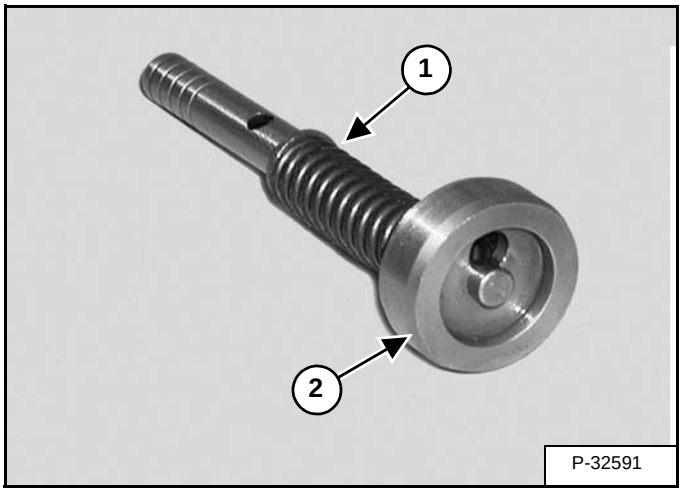
Remove the O-rings (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-120-23]**.

Figure 20-120-24



Remove the spool assemblies (Item 1) **[Figure 20-120-24]**.

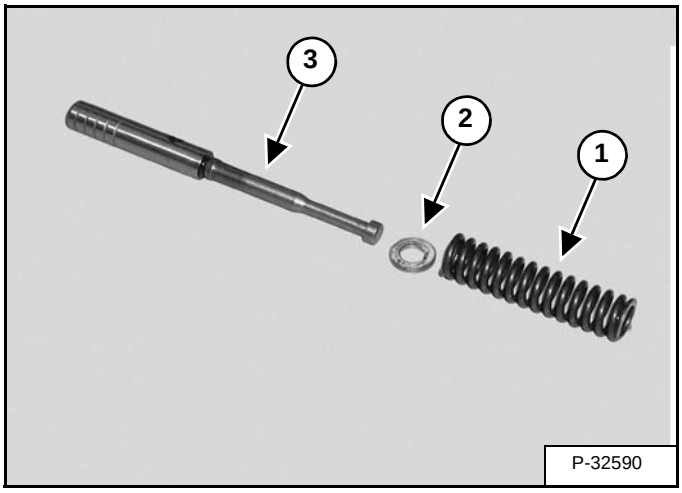
Figure 20-120-25



Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-120-25]**.

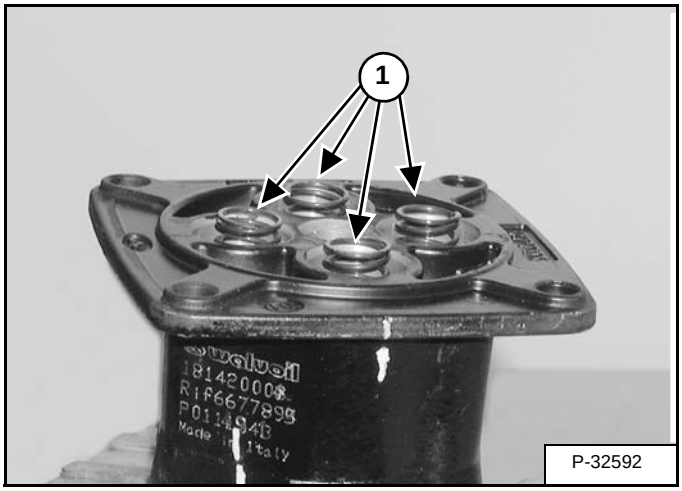
Disassembly (Cont'd)

Figure 20-120-26



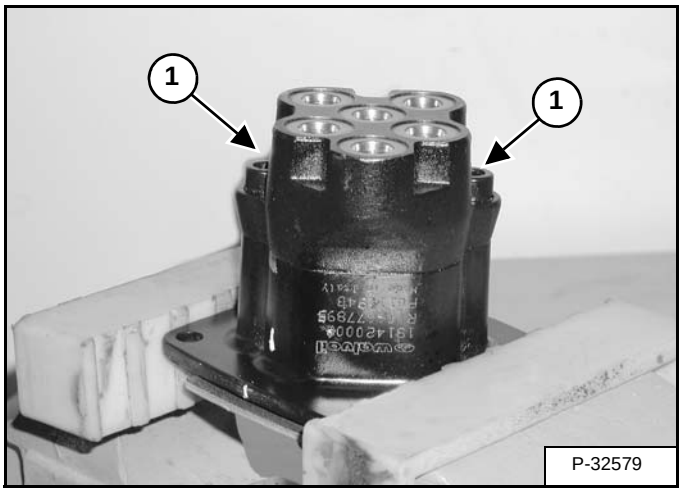
Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-120-26]**.

Figure 20-120-27



Remove the springs (Item 1) **[Figure 20-120-27]** from the housing.

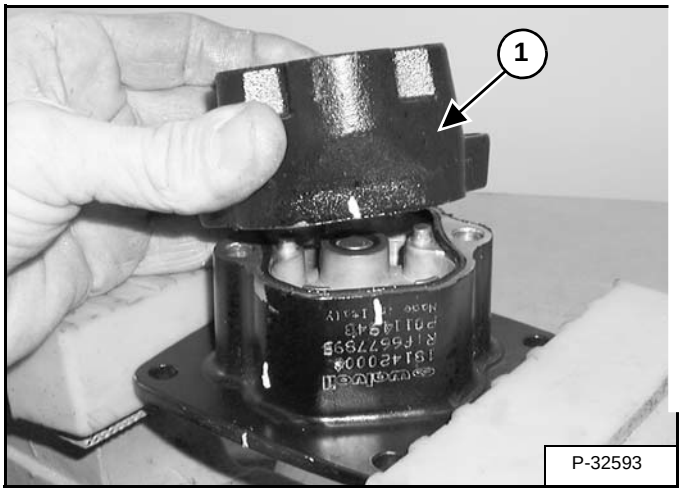
Figure 20-120-28



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]**.

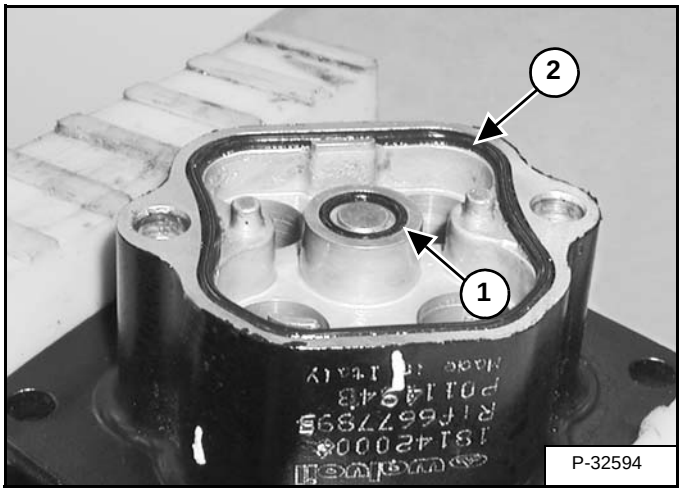
Figure 20-120-29



Remove the end cap (Item 1) **[Figure 20-120-29]**.

Disassembly (Cont'd)

Figure 20-120-30



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-120-30]**.

LEFT CONTROL LEVER (JOYSTICK) (S/N AB8B11001 - AB8B11080) (CONT'D)

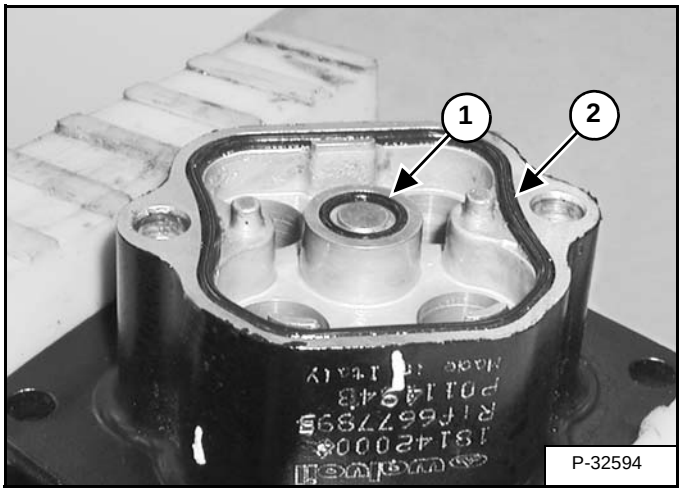
Assembly

Clean all parts in solvent and dry with compressed air.

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

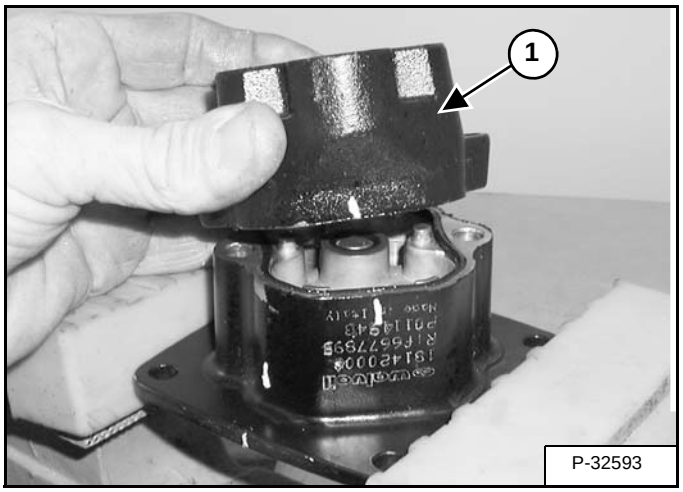
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-120-31



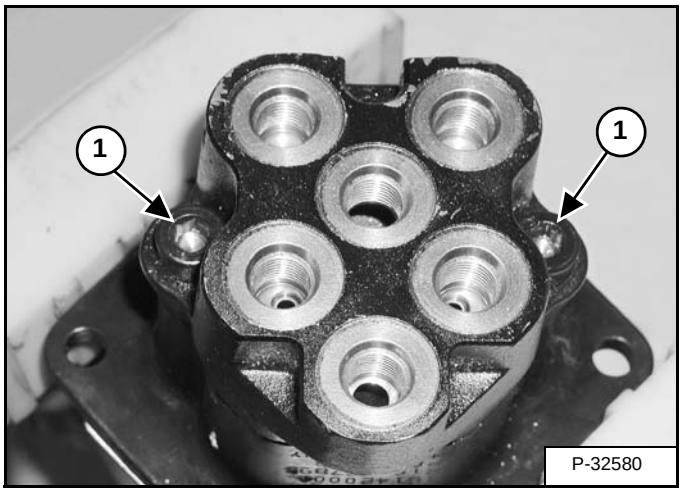
Clamp the housing in a vise equipped with padded jaws. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-120-31]**.

Figure 20-120-32



Install the end cap (Item 1) **[Figure 20-120-32]**.

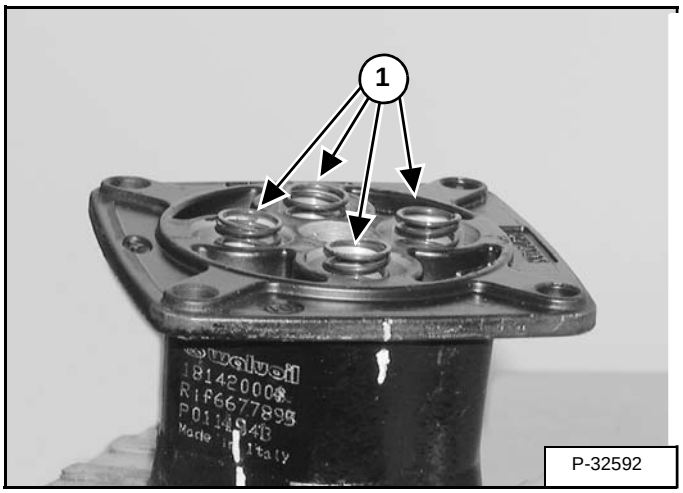
Figure 20-120-33



Install the bolts (Item 1) **[Figure 20-120-33]**.

Turn the housing over.

Figure 20-120-34

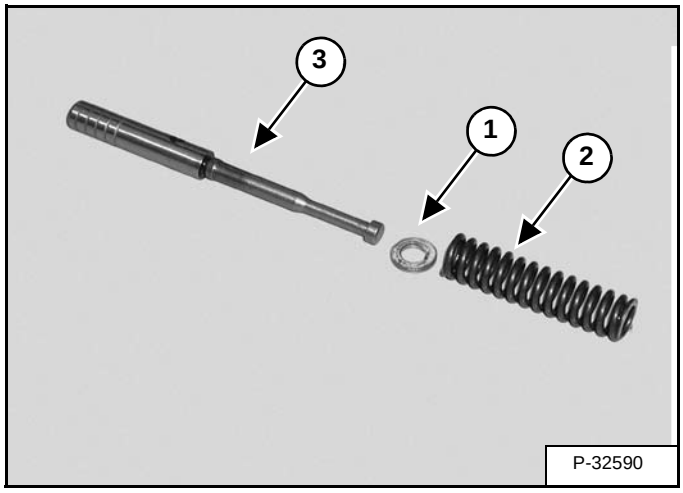


Install the springs (Item 1) **[Figure 20-120-34]**.

LEFT CONTROL LEVER (JOYSTICK) (S/N AB8B11001 - AB8B11080) (CONT'D)

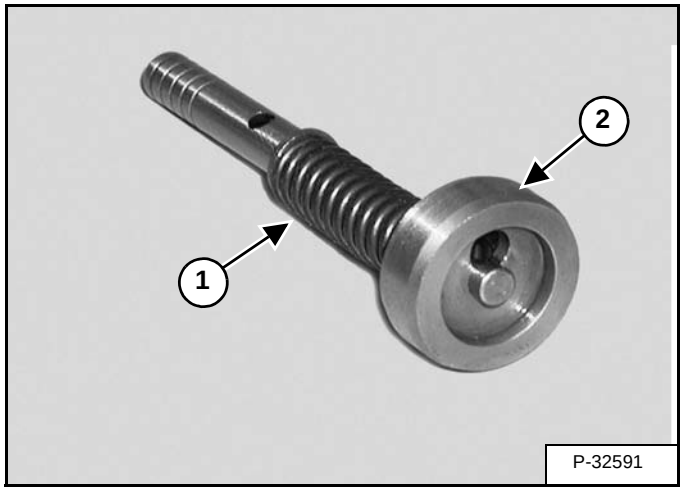
Assembly (Cont'd)

Figure 20-120-35



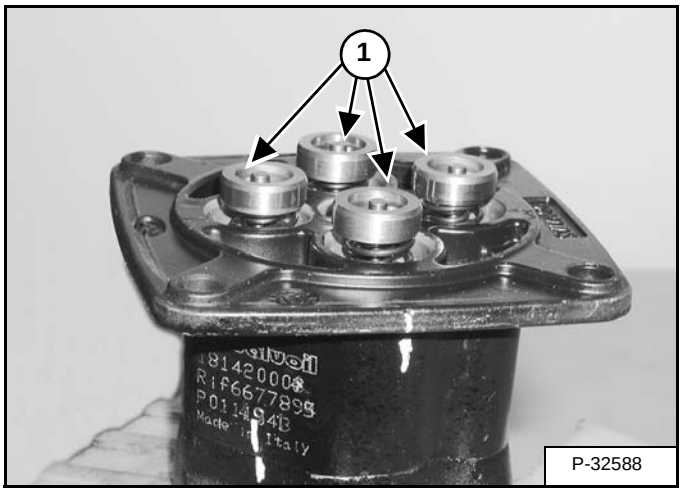
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-120-35]**.

Figure 20-120-36



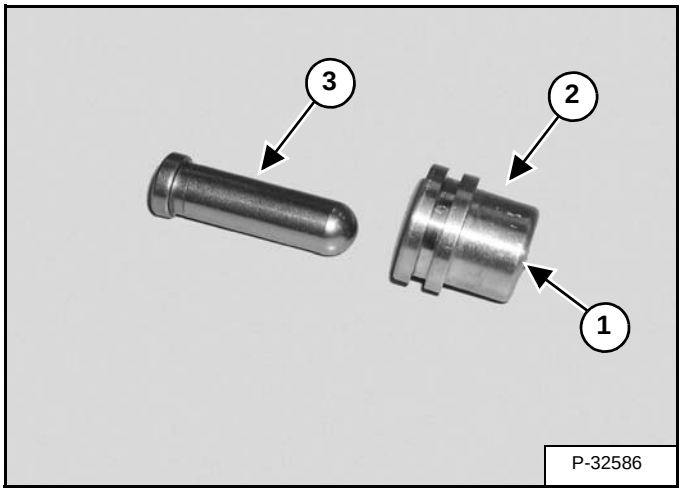
Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-120-36]**.

Figure 20-120-37



Install the spool assemblies (Item 1) **[Figure 20-120-37]** into the housing.

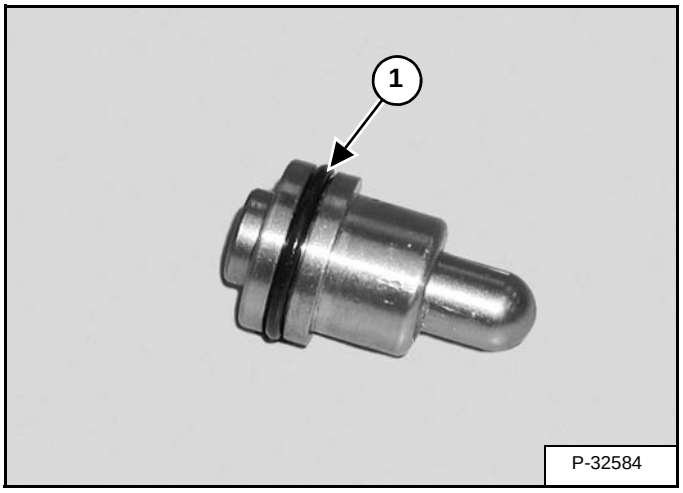
Figure 20-120-38



Install the O-ring (Item 1) into the bushing (Item 2). Install the plunger (Item 3) **[Figure 20-120-38]** into the bushing.

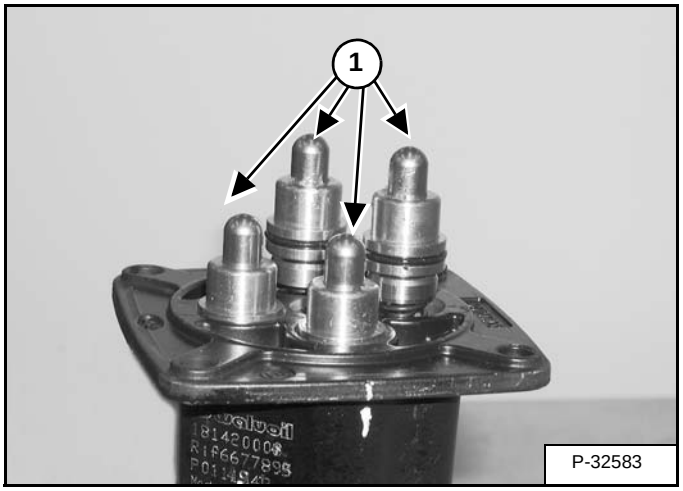
Assembly (Cont'd)

Figure 20-120-39



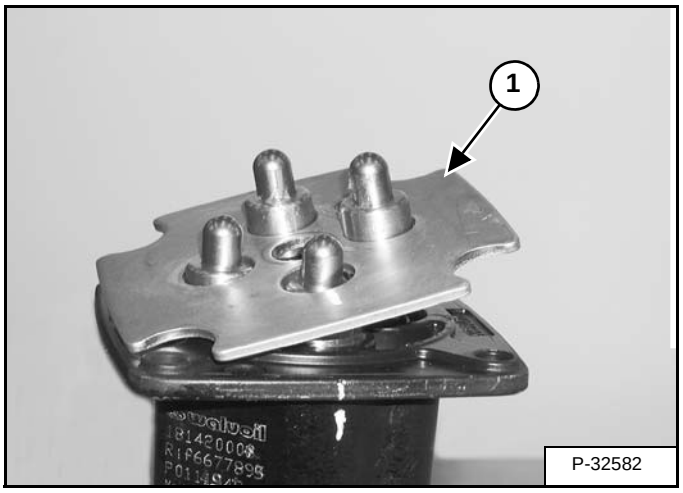
Install the O-ring (Item 1) **[Figure 20-120-39]** on the bushing.

Figure 20-120-40



Install the plunger assemblies (Item 1) **[Figure 20-120-40]** into the housing.

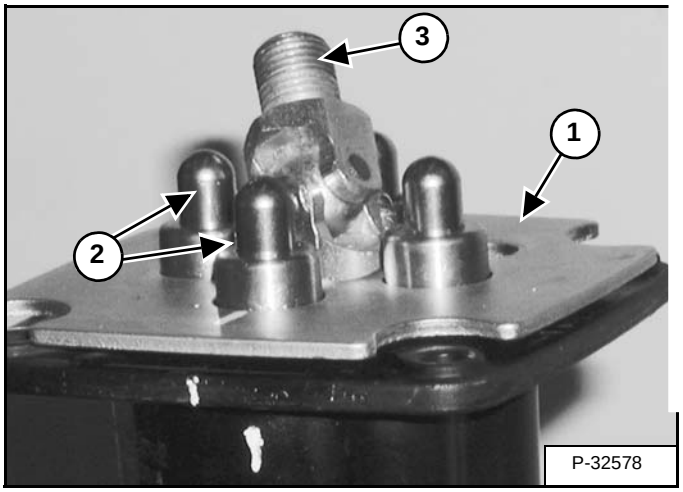
Figure 20-120-41



Install the plate (Item 1) **[Figure 20-120-41]**.

NOTE: Spring pressure can dislodge the plunger assemblies until the plate is secured in place.

Figure 20-120-42

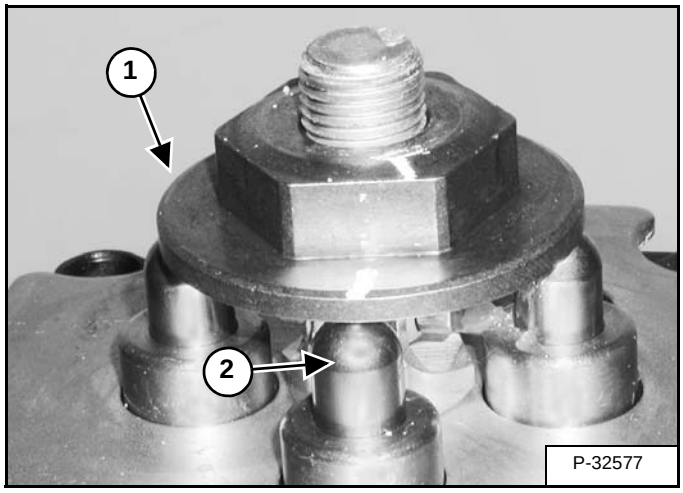


Press down on the plate (Item 1) keeping the plunger assemblies (Item 2) fully seated and install the U-joint (Item 3) **[Figure 20-120-42]**.

LEFT CONTROL LEVER (JOYSTICK) (S/N AB8B11001 - AB8B11080) (CONT'D)

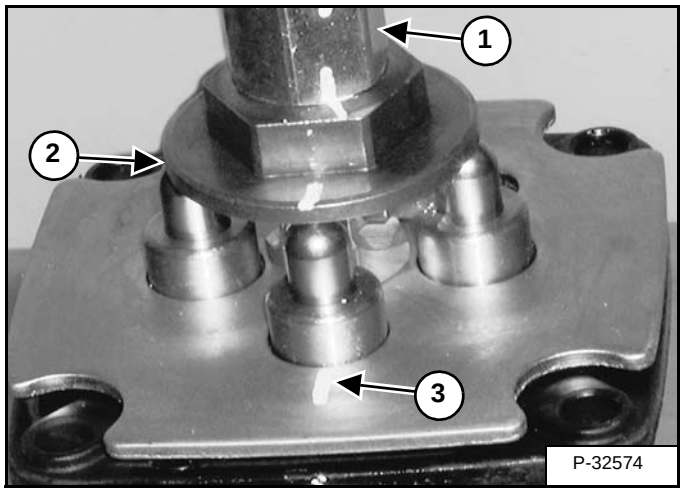
Assembly (Cont'd)

Figure 20-120-43



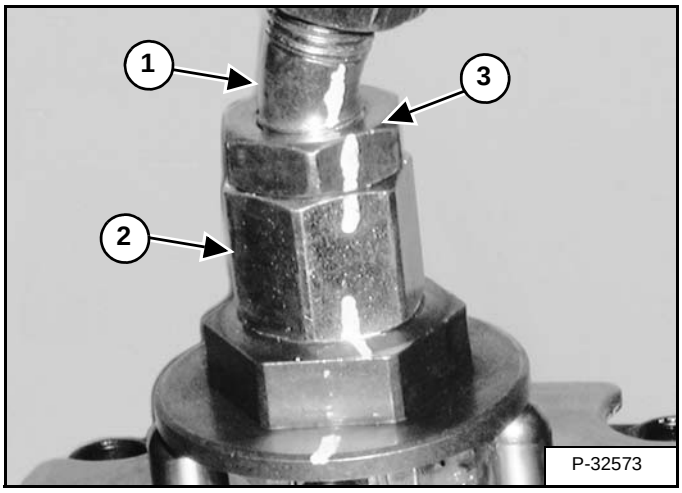
Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-120-43]**.

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.

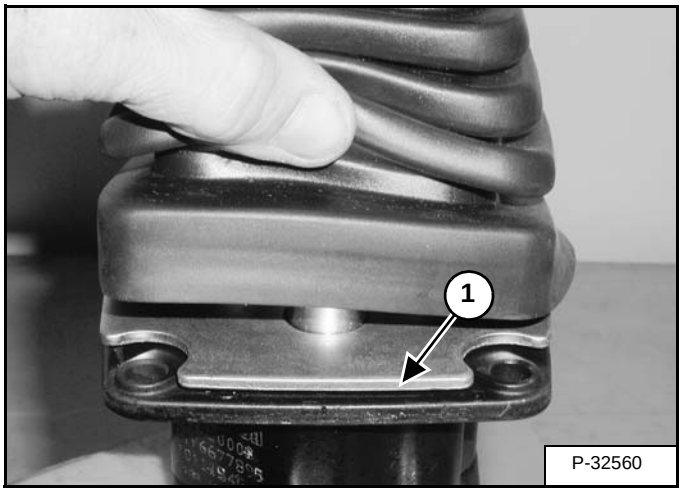
Figure 20-120-45



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]**.

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.)

LEFT CONTROL LEVER (JOYSTICK) (S/N AB8B11081 & ABOVE)

Testing

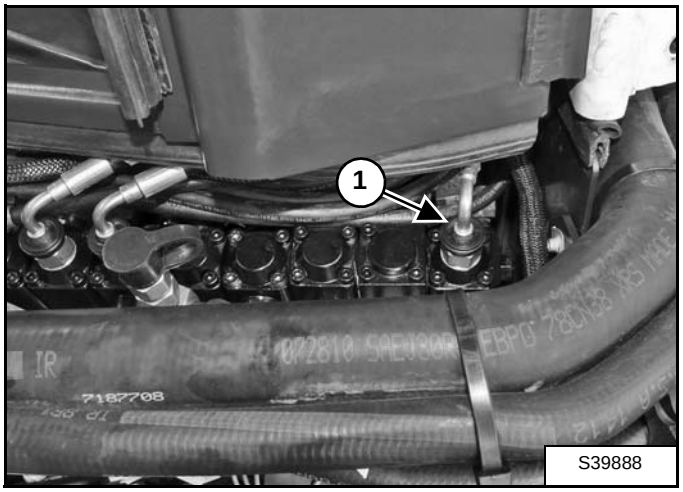
The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

Stop the engine.

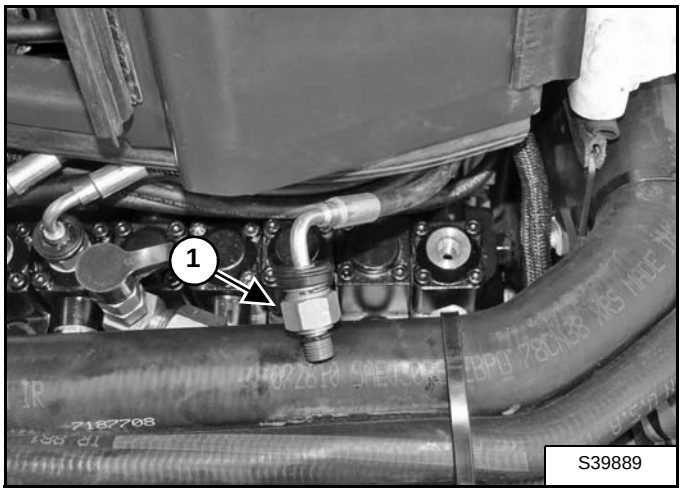
Remove the left upperstructure cover.

Figure 20-121-1



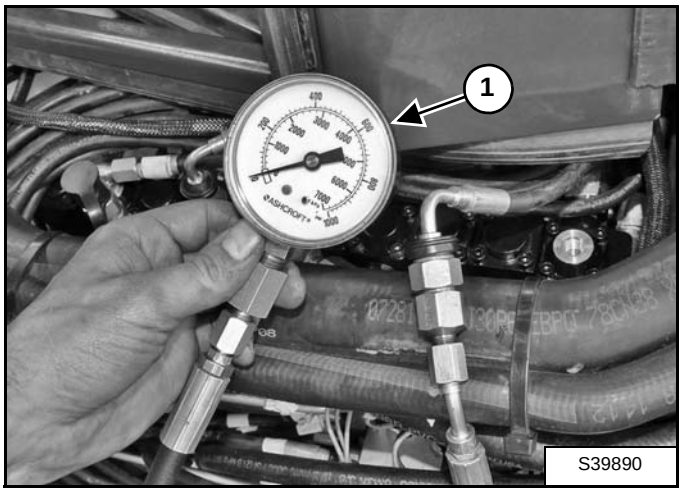
At the control valve assembly (Item 1) **[Figure 20-121-1]**, find the pilot line of the control lever (joystick) that is to be checked. (Arm, Slew) (Slew Shown)

Figure 20-121-2



Disconnect the hydraulic fitting (Item 1) **[Figure 20-121-2]** from the control valve.

Figure 20-121-3



From the test kit install a 7 MPa (70 bar) (1000 psi) gauge (Item 1) **[Figure 20-121-3]** on the pilot line. Start the excavator, and warm the hydraulic fluid to operating temperature.

Engage the circuit to be tested. Record the operating pressure.

The operating pressure should be approximately 3,2 - 3, MPa (32 - 35 bar) (464 - 508 psi).

If the operating pressure is correct, check the valv section spool for proper operation. If the operatin pressure is incorrect, remove the pilot pressure relie valve, clean, install and retest. (See Testing An Adjusting on Page 20-33-1.)

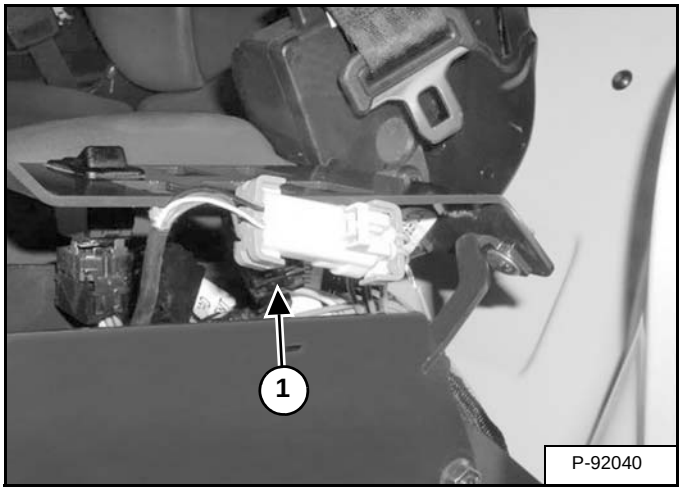
If the pressure is still incorrect replace the pilot pressur relief valve. (See Testing And Adjusting on Page 20-33 1.)

LEFT CONTROL LEVER (JOYSTICK) (S/N AB8B11081 & ABOVE) (CONT'D)

Handle Removal And Installation

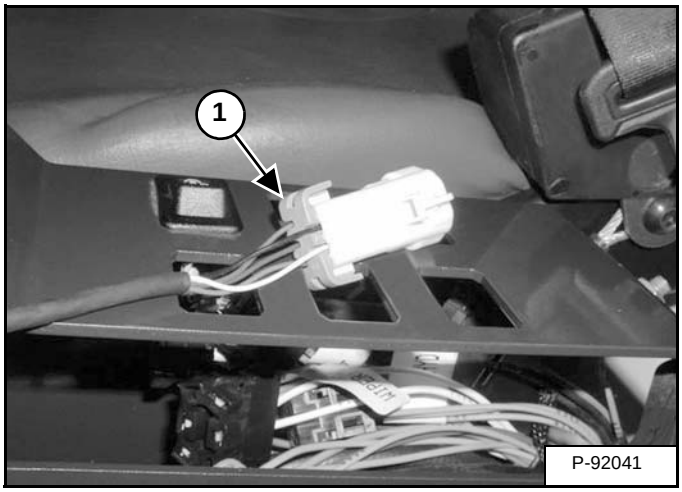
Remove the left console cover. (See Console Removal And Installation on Page 40-60-6.)

Figure 20-121-4



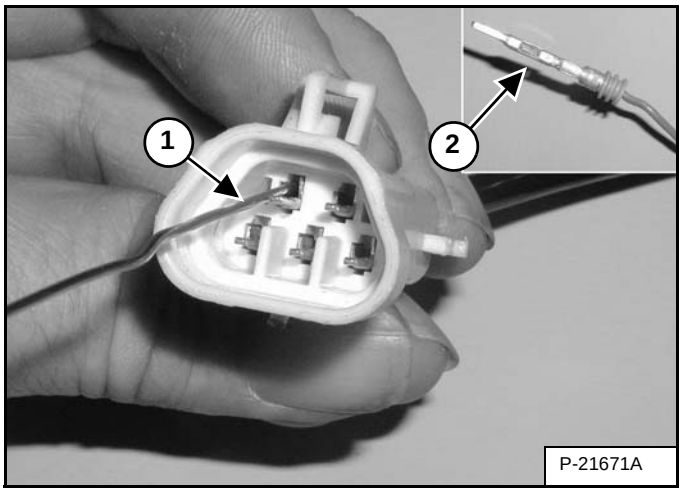
Disconnect the wire harness (Item 1) **[Figure 20-121-4]**.

Figure 20-121-5



Remove the lock (Item 1) **[Figure 20-121-5]** from the electrical connector.

Figure 20-121-6



With a small piece of wire (Item 1), depress the wire terminal tabs (Item 2) **[Figure 20-121-6]**.

Carefully remove the individual wires from the back of the electrical connector.

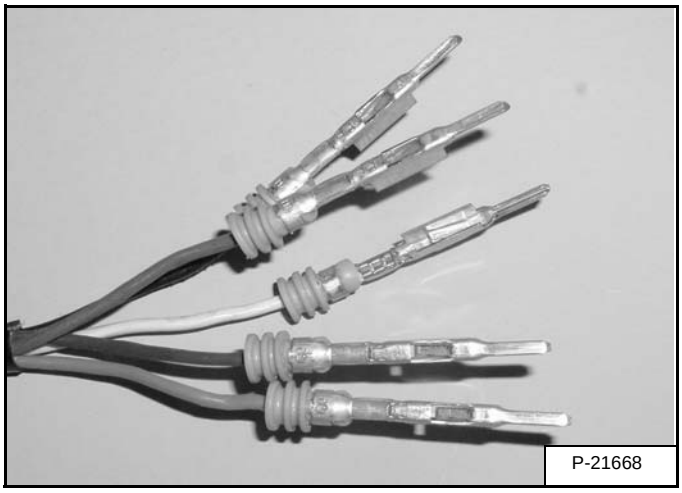
Installation: Use a small piece of wire and re-bend the tab (Item 2) **[Figure 20-121-6]** on each wire before installing the electrical connector.

Remove the control handle (joystick) assembly from the excavator.

LEFT CONTROL LEVER (JOYSTICK) (S/N AB8B11081 & ABOVE) (CONT'D)

Handle Removal And Installation (Cont'd)

Figure 20-121-7

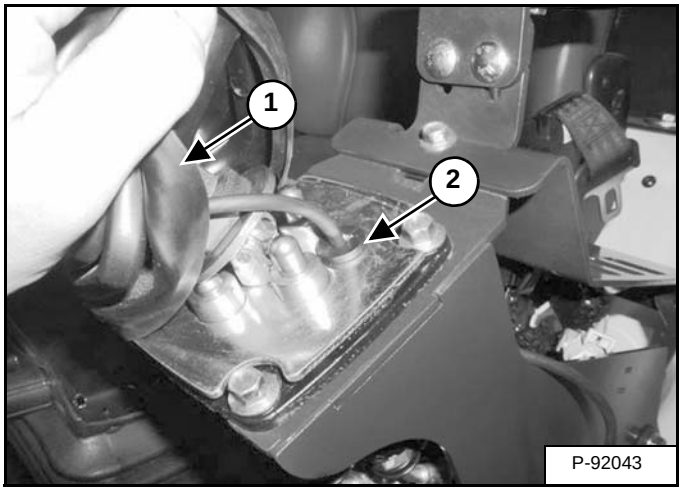


Installation: The wires **[Figure 20-121-7]** must be installed in the proper locations in the wire connector, listed below.

A Green	C Red	E White
B Brown	D Black	

Check each wire to be certain the tab locks into position.

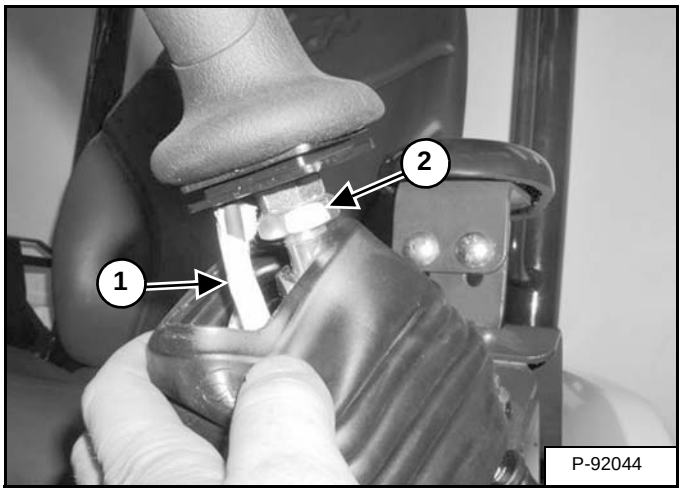
Figure 20-121-8



Raise the boot (Item 1) and pull the grommet (Item 2) up **[Figure 20-121-8]** out of the housing.

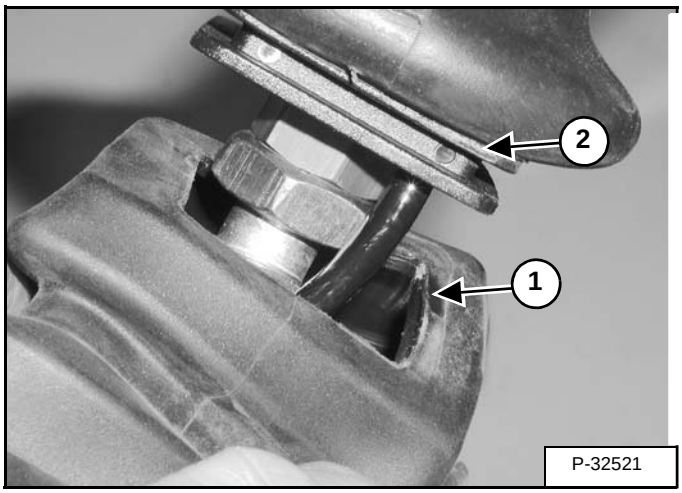
Remove the wire and grommet.

Figure 20-121-9



Pull the boot down and pull the wire harness (Item 1) out of the boot. Loosen the nut (Item 2) **[Figure 20-121-9]** and remove the handle.

Figure 20-121-10

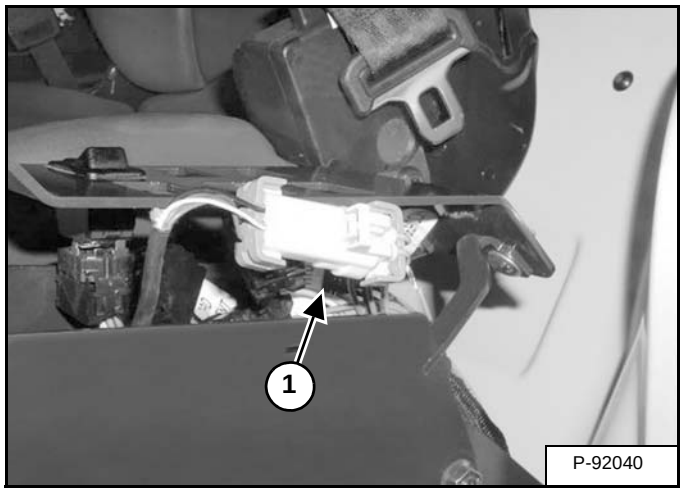


Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-121-10]**.

Joystick Assembly Removal And Installation

Remove the left console cover. (See Console Removal And Installation on Page 40-60-6.)

Figure 20-121-11



Disconnect the wire harness (Item 1) **[Figure 20-121-11]**.

Figure 20-121-12



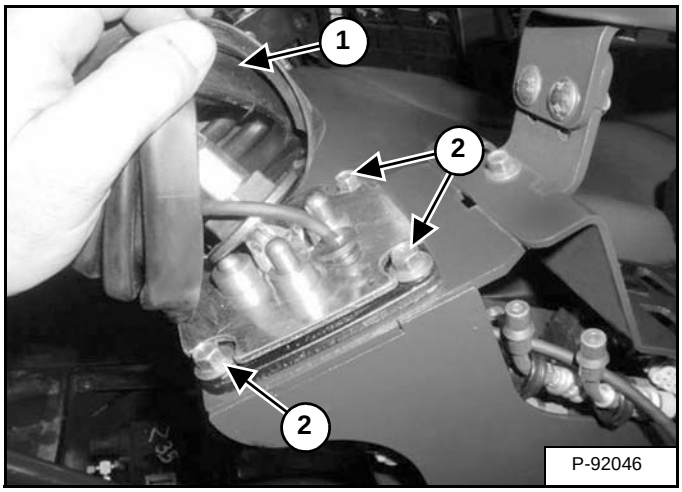
Mark and remove the hoses **[Figure 20-121-12]**.

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 20-121-13



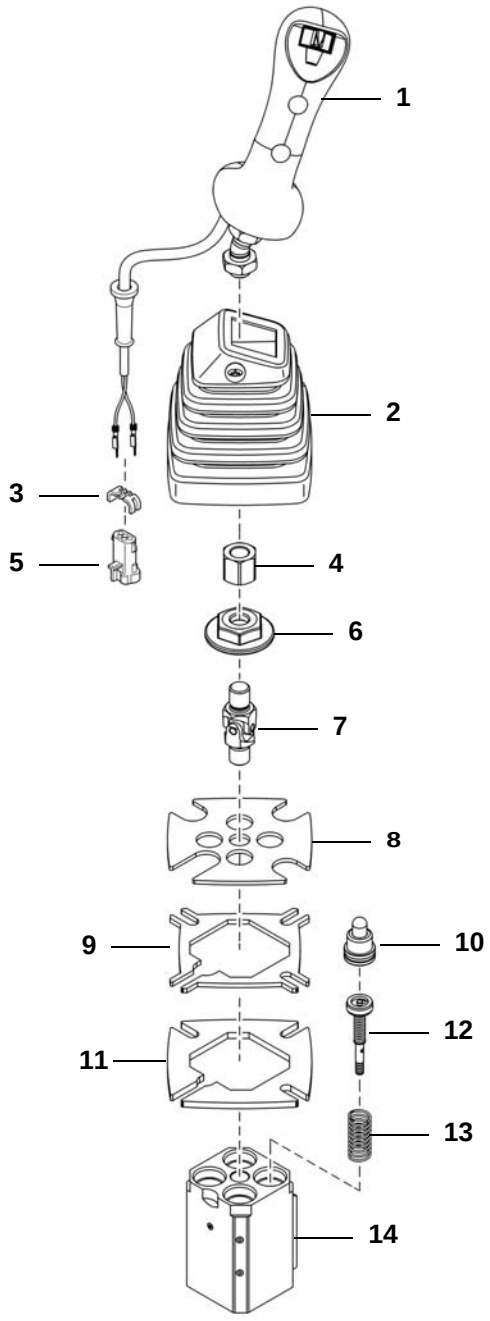
Pull the boot (Item 1) **[Figure 20-121-13]** up from the mounting plate.

Remove the bolts (Item 2) **[Figure 20-121-13]**.

Remove the joystick assembly.

Parts Identification

1. Handle
2. Boot
3. Lock
4. Coupler
5. Connector
6. Control Plate
7. U-joint
8. Square Flange
9. Intermediate Flange
10. Plunger
11. Inferior Flange
12. Spool
13. Spring
14. Housing



NA8065S

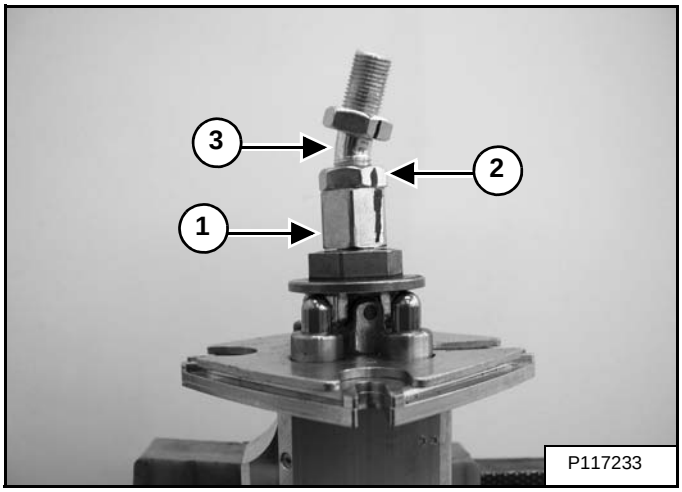
LEFT CONTROL LEVER (JOYSTICK) (S/N AB8B11081 & ABOVE) (CONT'D)

Disassembly

Remove the left handle. (See Handle Removal And Installation on Page 20-121-2.)

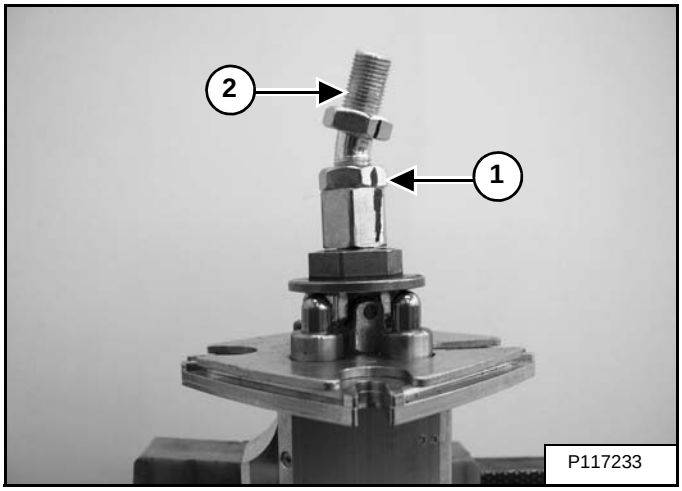
Clean the outside of the control lever before disassembly.

Figure 20-121-14



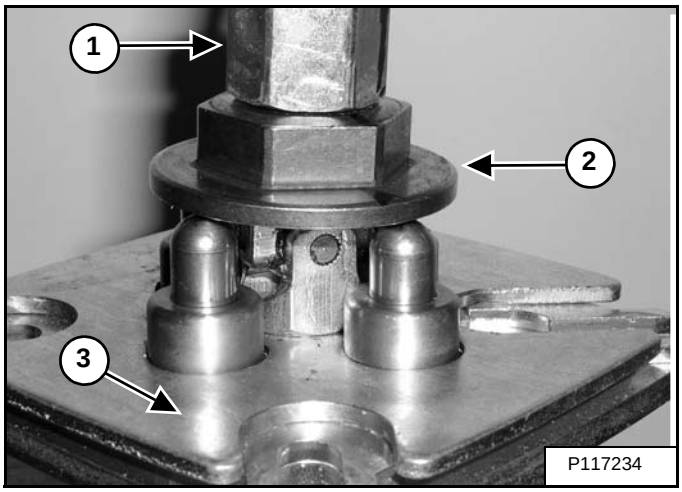
Mark the coupler (Item 1), nut (Item 2), and connector (Item 3) **[Figure 20-121-14]** for ease of assembly.

Figure 20-121-15



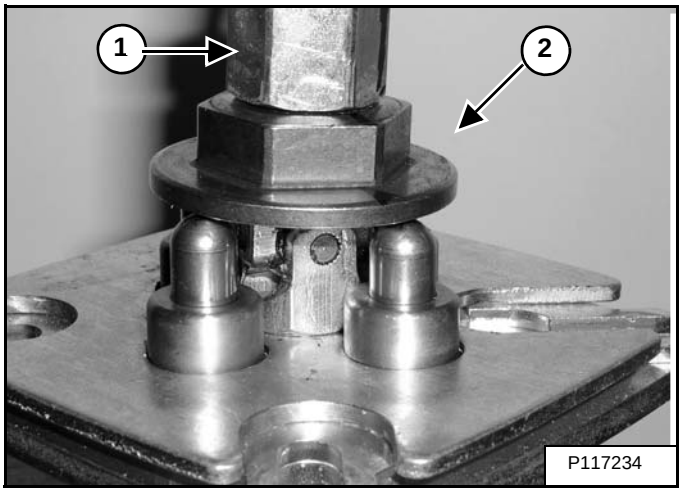
Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-121-15]**.

Figure 20-121-16



Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-121-16]** for ease of assembly.

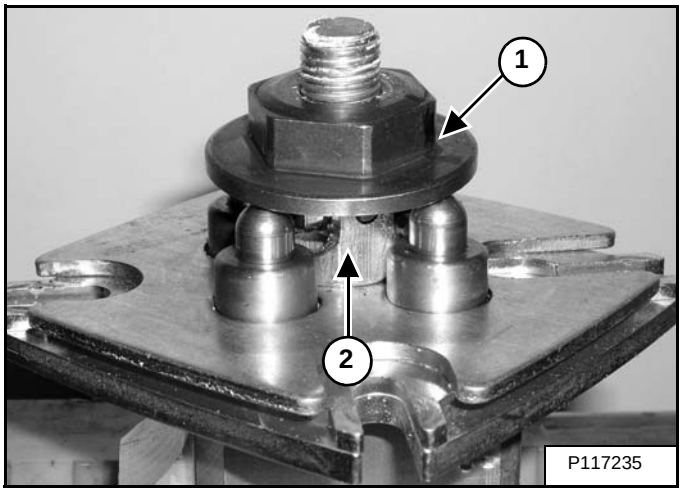
Figure 20-121-17



Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-121-17]**.

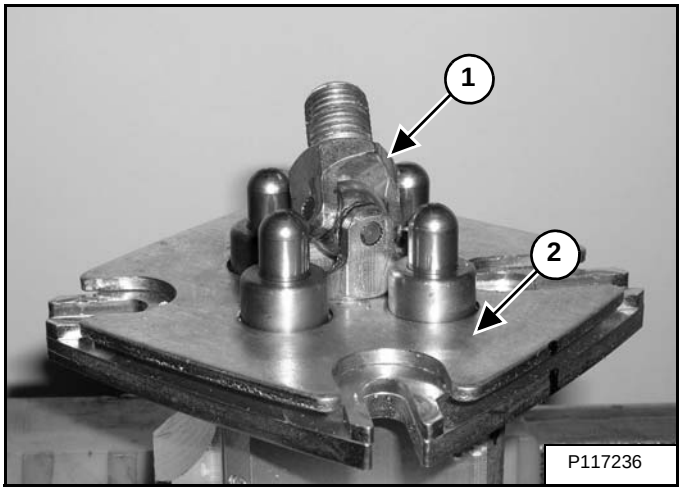
Disassembly (Cont'd)

Figure 20-121-18



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-121-18]**.

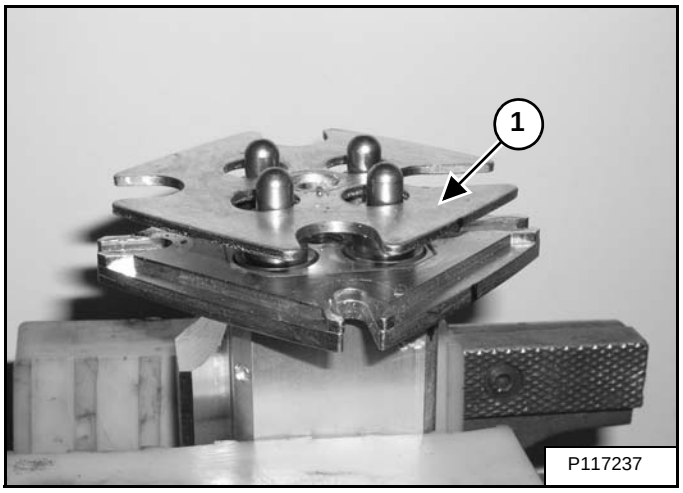
Figure 20-121-19



Mark the plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-121-19]**.

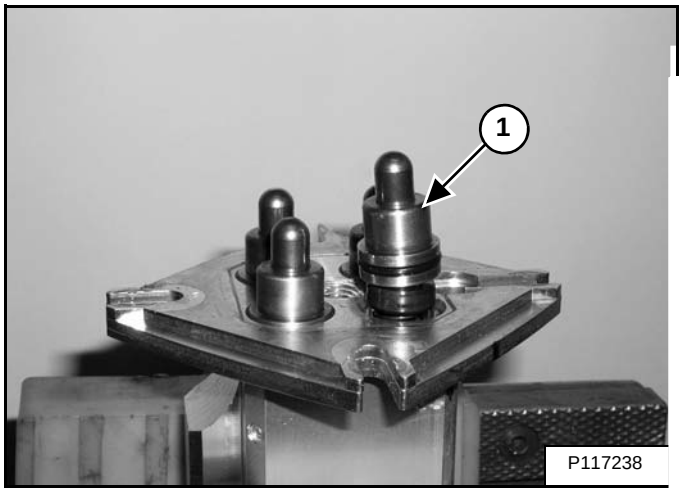
NOTE: The plate (Item 2) [Figure 20-121-19] is spring loaded and will come up as the U-joint is removed.

Figure 20-121-20



Remove the plate (Item 1) **[Figure 20-121-20]**.

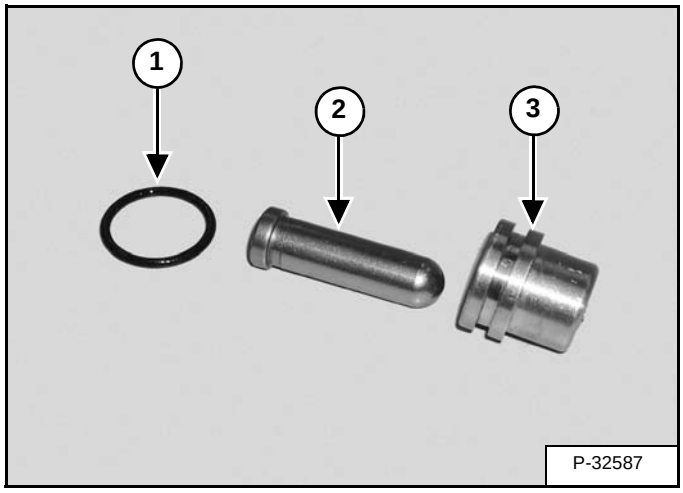
Figure 20-121-21



Remove the plunger assemblies (Item 1) **[Figure 20-121-21]**.

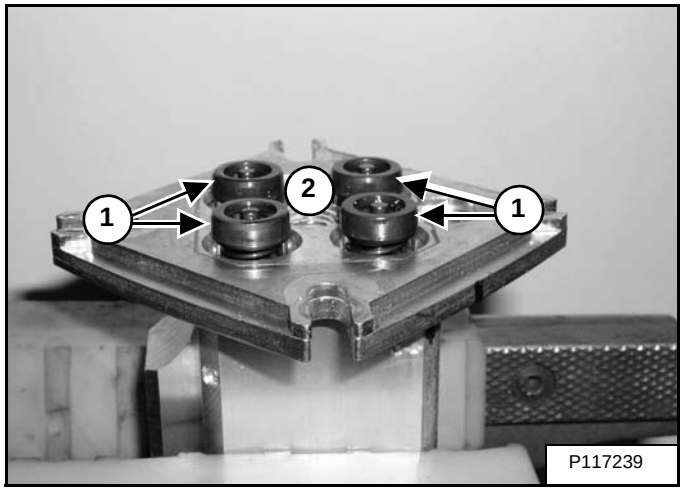
Disassembly (Cont'd)

Figure 20-121-22



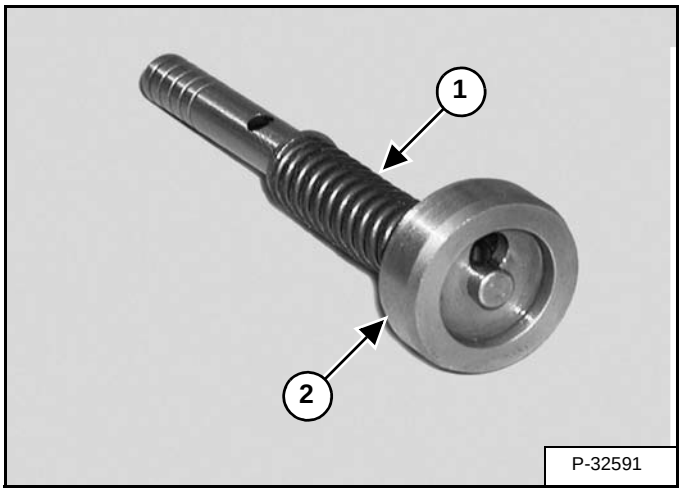
Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-121-22]**.

Figure 20-121-23



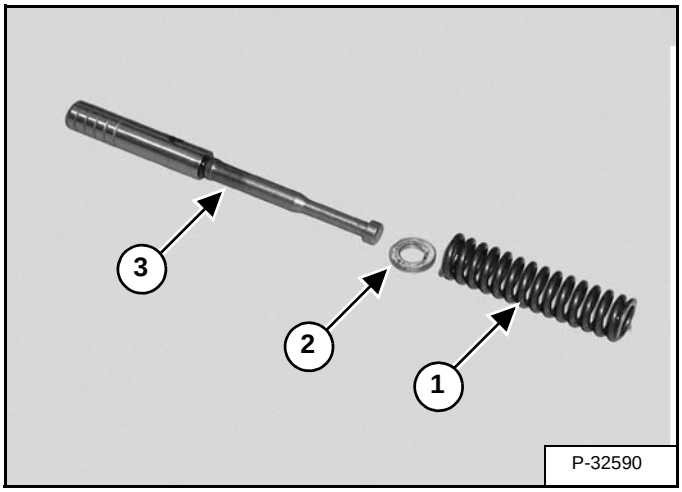
Remove the spool assemblies (Item 1) **[Figure 20-121-23]**.

Figure 20-121-24



Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-121-24]**.

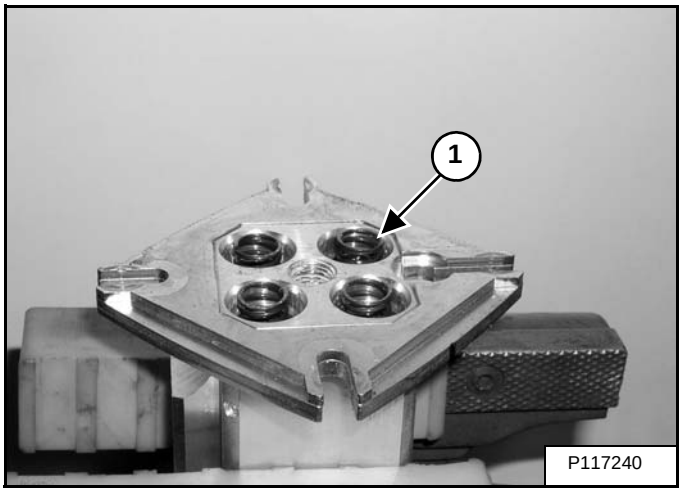
Figure 20-121-25



Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-121-25]**.

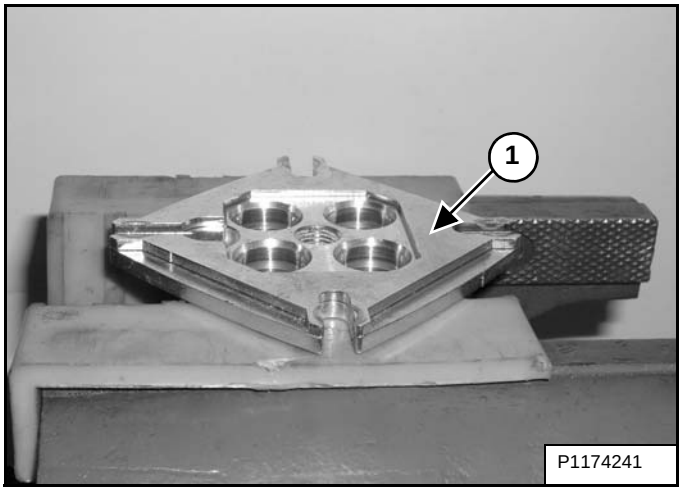
Disassembly (Cont'd)

Figure 20-121-26



Remove the springs (Item 1) **[Figure 20-121-26]** from the housing.

Figure 20-121-27



Remove the plate (Item 1) **[Figure 20-121-27]**.

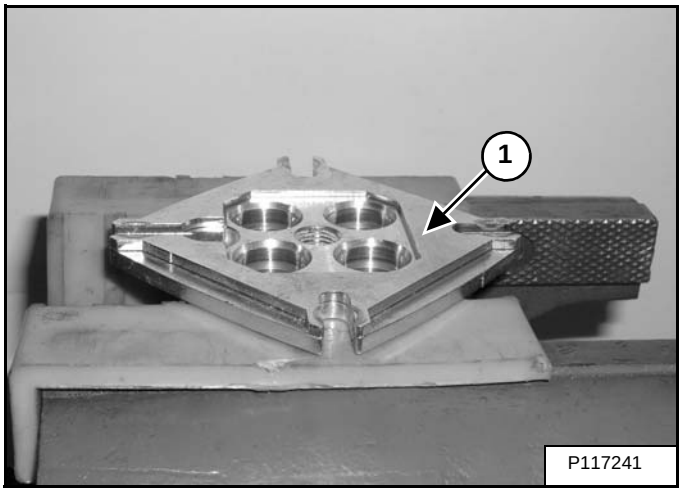
Assembly

Clean all parts in solvent and dry with compressed air.

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

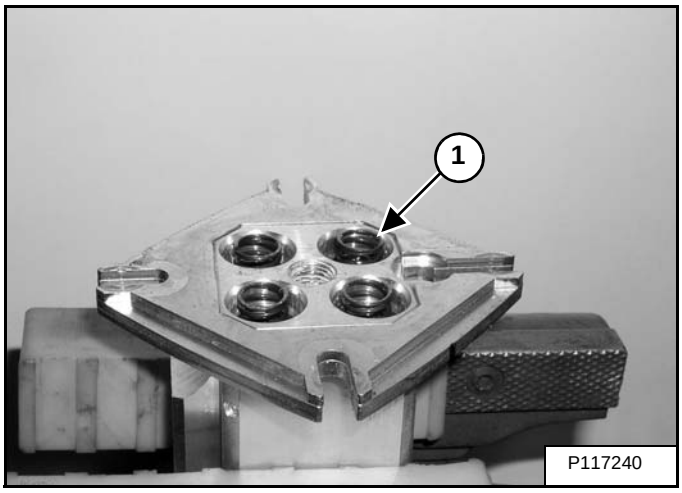
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-121-28



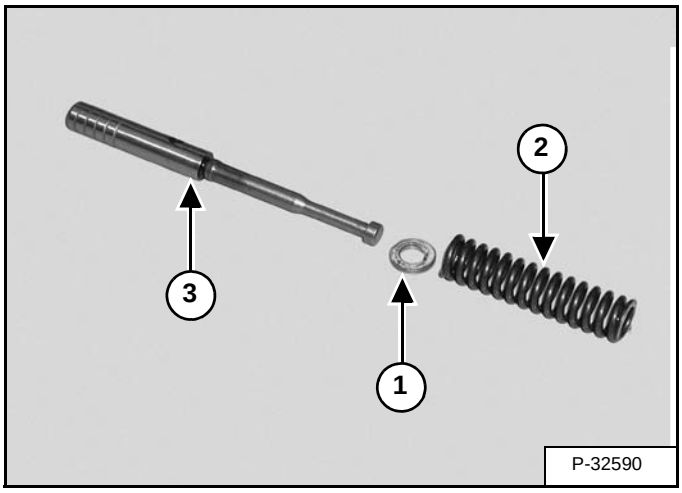
Install the plate (Item 1) **[Figure 20-121-28]**.

Figure 20-121-29



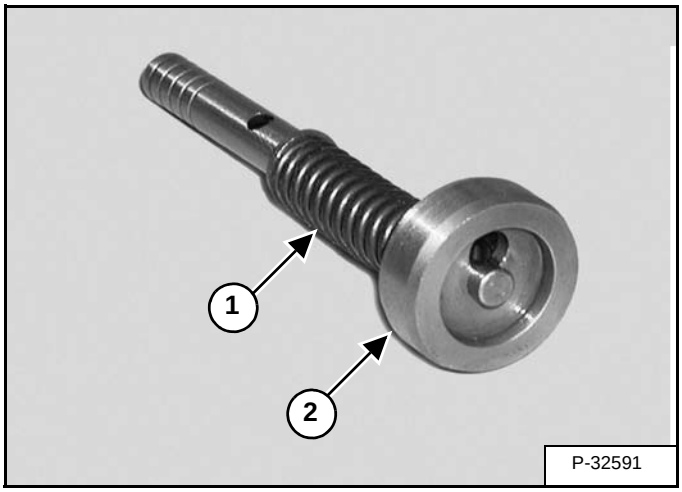
Install the springs (Item 1) **[Figure 20-121-29]**.

Figure 20-121-30



Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-121-30]**.

Figure 20-121-31

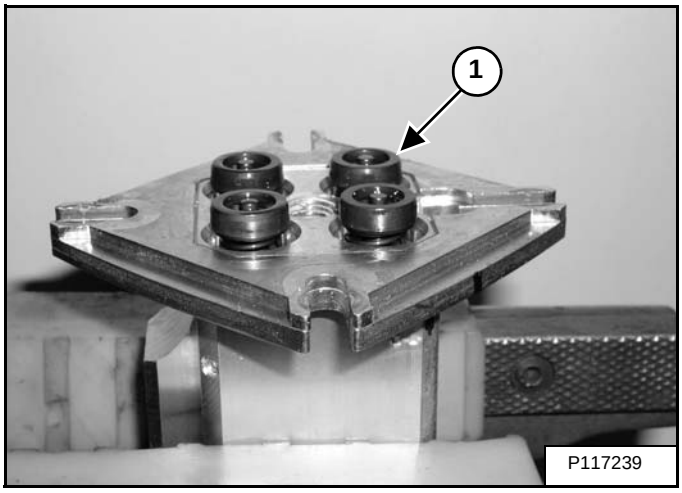


Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-121-31]**.

LEFT CONTROL LEVER (JOYSTICK) (S/N AB8B11081 & ABOVE) (CONT'D)

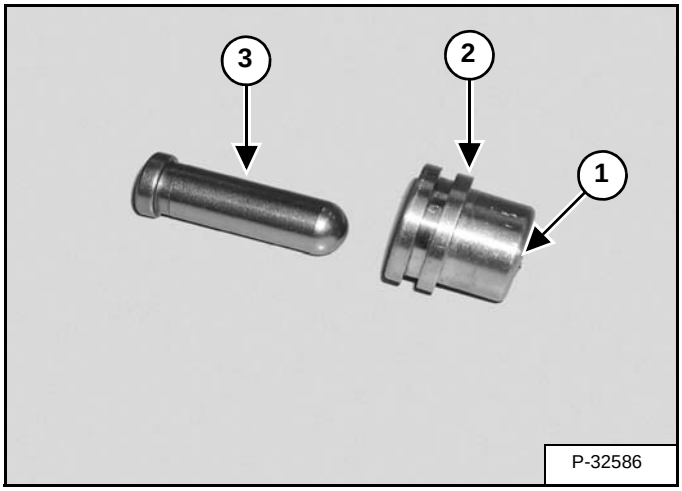
Assembly (Cont'd)

Figure 20-121-32



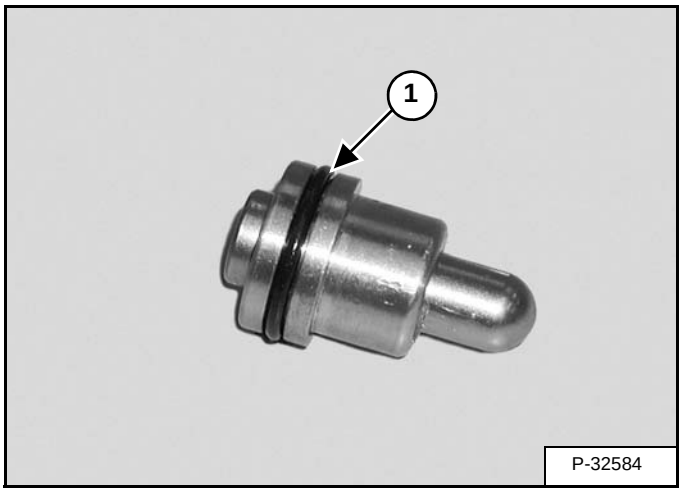
Install the spool assemblies (Item 1) **[Figure 20-121-32]** into the housing.

Figure 20-121-33



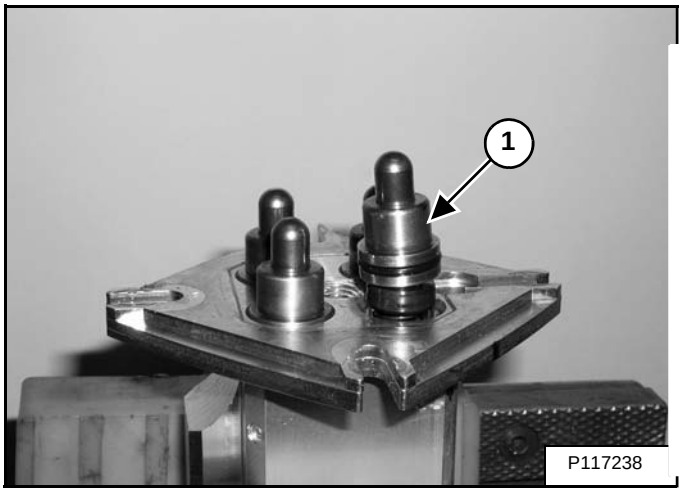
Install the O-ring (Item 1) into the bushing (Item 2). Install the plunger (Item 3) **[Figure 20-121-33]** into the bushing.

Figure 20-121-34



Install the O-ring (Item 1) **[Figure 20-121-34]** on the bushing.

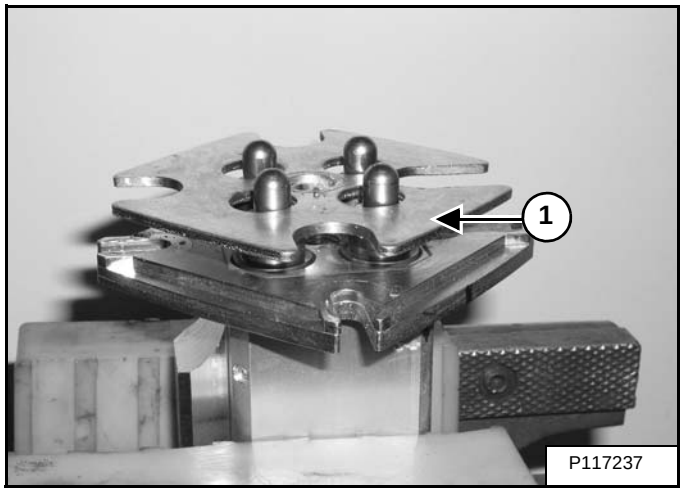
Figure 20-121-35



Install the plunger assemblies (Item 1) **[Figure 20-121-35]** into the housing.

Assembly (Cont'd)

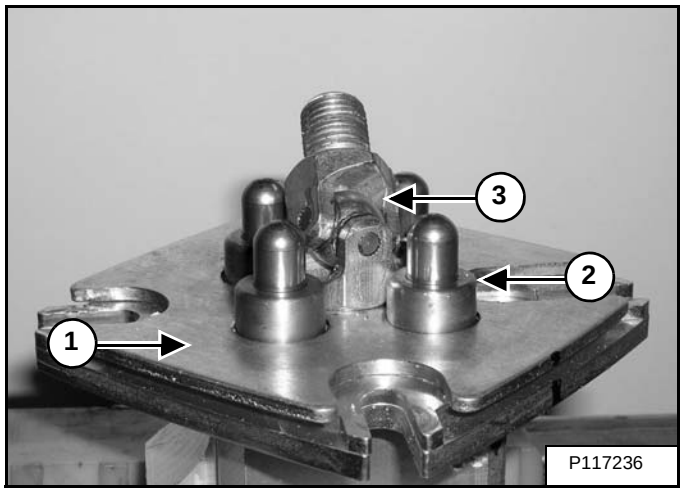
Figure 20-121-36



Install the plate (Item 1) **[Figure 20-121-36]**.

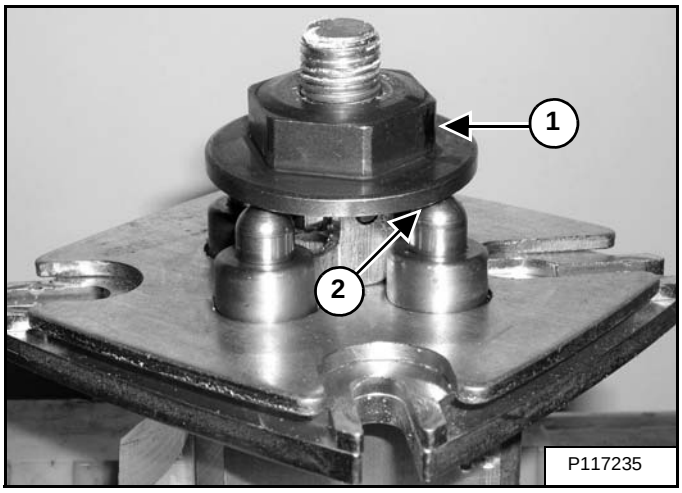
NOTE: Spring pressure can dislodge the plunger assemblies until the plate is secured in place.

Figure 20-121-37



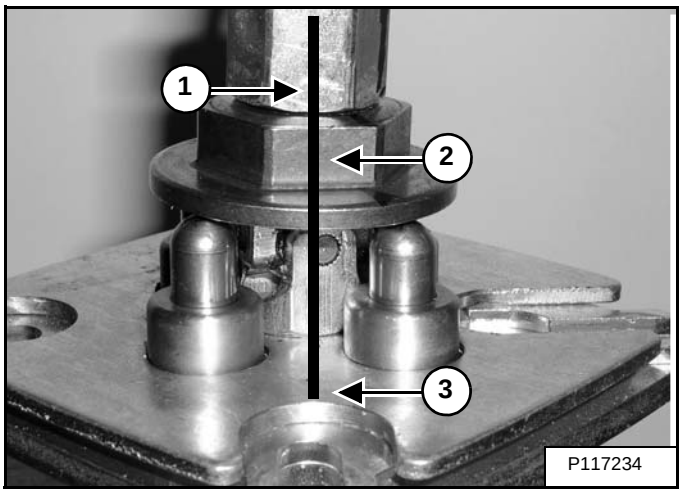
Press down on the plate (Item 1) keeping the plunger assemblies (Item 2) fully seated and install the U-joint (Item 3) **[Figure 20-121-37]**.

Figure 20-121-38



Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-121-38]**.

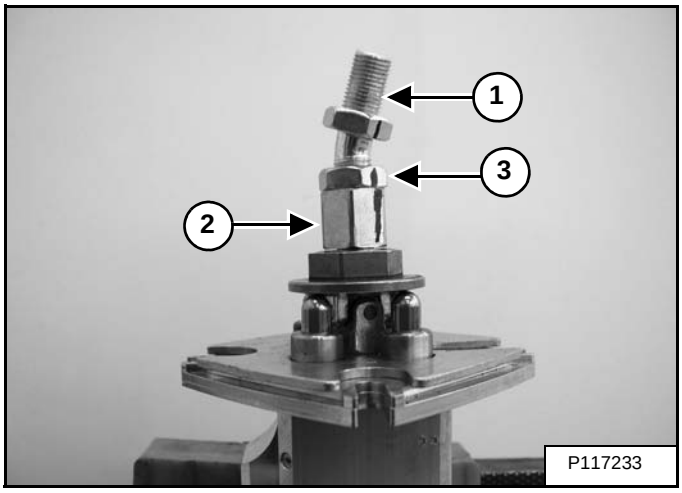
Figure 20-121-39



Align the coupler (Item 1) with the control plate (Item 2) and plate (Item 3) **[Figure 20-121-39]**. Tighten the coupler.

Assembly (Cont'd)

Figure 20-121-40



Install the connector (Item 1) **[Figure 20-121-40]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-121-40]**.

Install the handle. (See Handle Removal And Installation on Page 20-121-2.)


Bobcat®

HYDRAULIC FILTER MOUNT

Removal And Installation

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-4.)

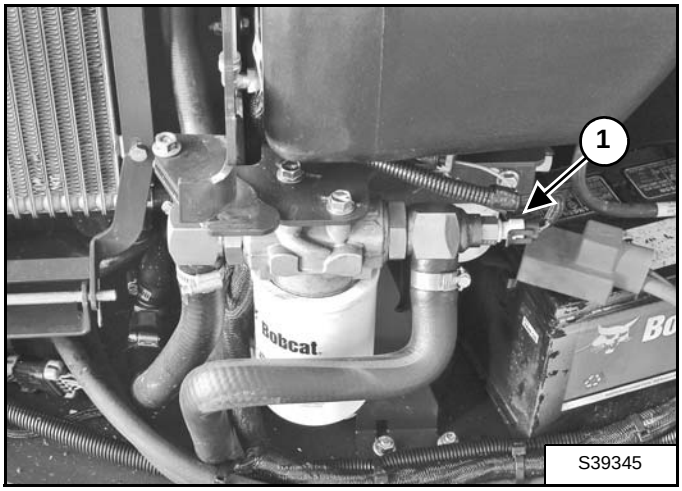
IMPORTANT

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

I-2003-0888

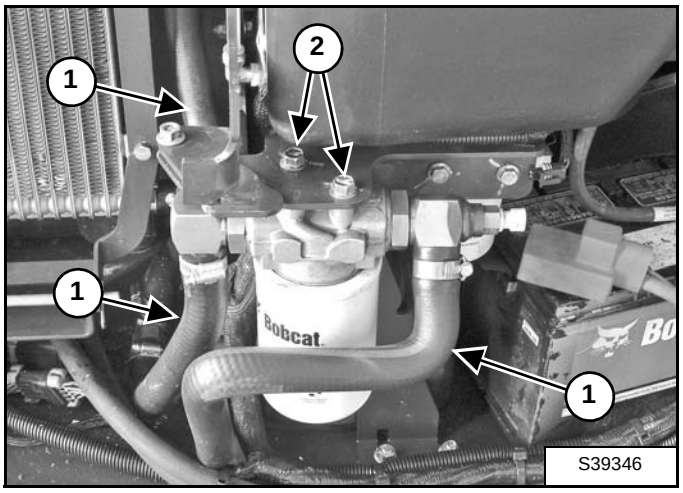
Remove the right upperstructure cover. (See Removal And Installation on Page 40-80-1.)

Figure 20-130-1



Remove the wire harness (Item 1) **[Figure 20-130-1]**.

Figure 20-130-2



Loosen the clamps and remove the three hoses (Item 1) **[Figure 20-130-2]**.

Installation: Tighten the clamps to 6 - 6,5 N•m (52.8 - 57.6 in-lb) torque.

Remove the two bolts (Item 2) **[Figure 20-130-2]** an remove the filter mount assembly.


Bobcat

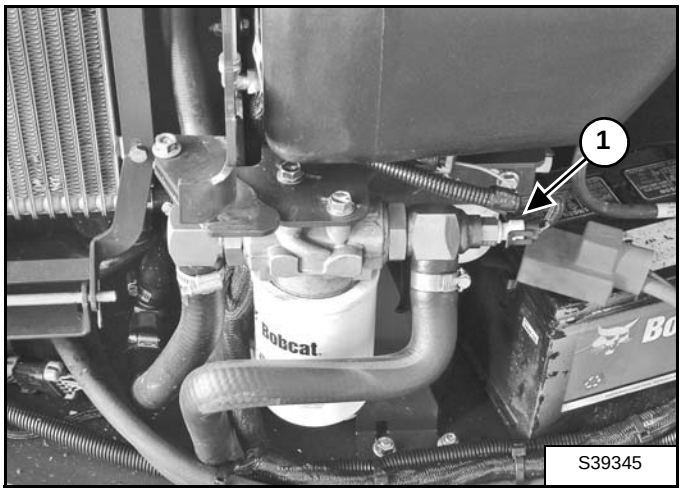
HYDRAULIC RESERVOIR

Removal And Installation

Drain the reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-4.)

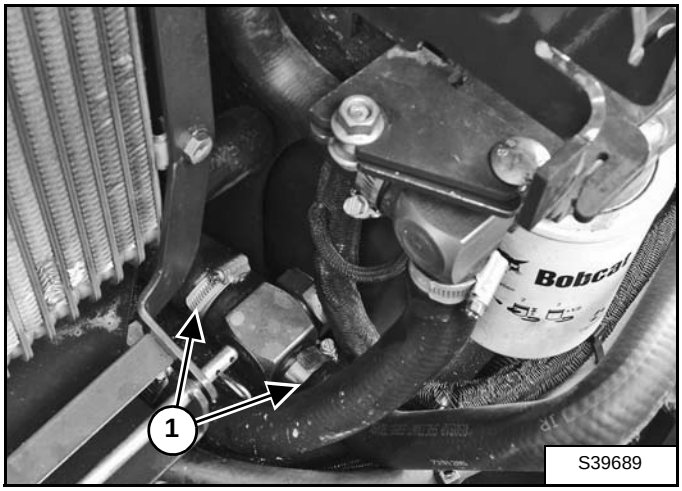
Remove the right upperstructure cover. (See Removal And Installation on Page 40-80-1.)

Figure 20-140-1



Remove the wire harness (Item 1) **[Figure 20-140-1]**.

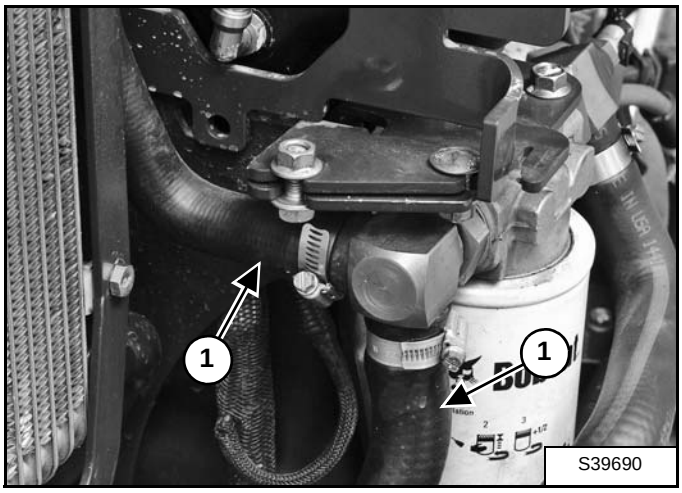
Figure 20-140-2



Loosen the clamps and remove the suction hoses (Item 1) **[Figure 20-140-2]**.

Installation: Tighten the clamps to 6 - 6,5 N•m (52.8 - 57.6 in-lb) torque.

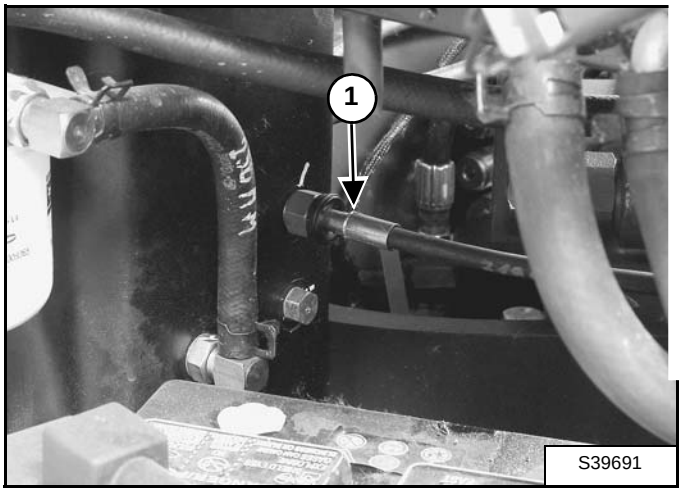
Figure 20-140-3



Loosen the clamps and remove the two hoses (Item 1) **[Figure 20-140-3]** from the filter.

Installation: Tighten the clamps to 6 - 6,5 N•m (52.8 - 57.6 in-lb) torque.

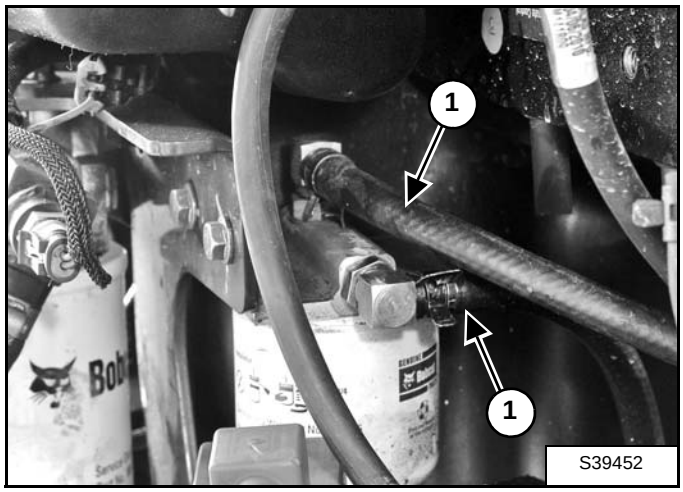
Figure 20-140-4



Mark and remove the hose (Item 1) **[Figure 20-140-4]** from the hydraulic reservoir.

Removal And Installation (Cont'd)

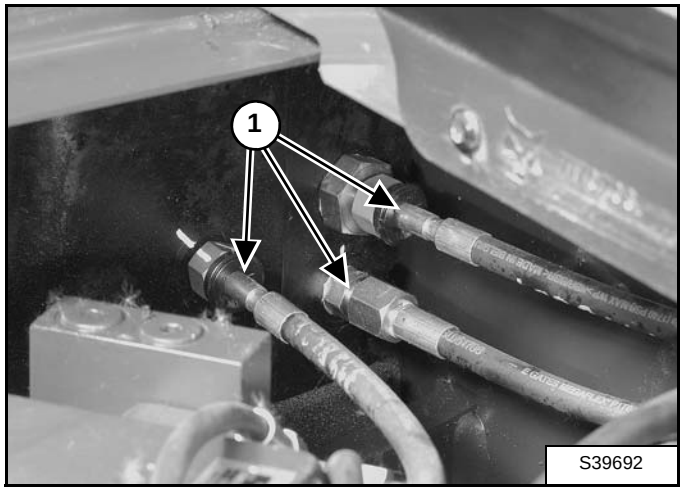
Figure 20-140-5



Remove and plug the two hoses (Item 1) **[Figure 20-140-5]**.

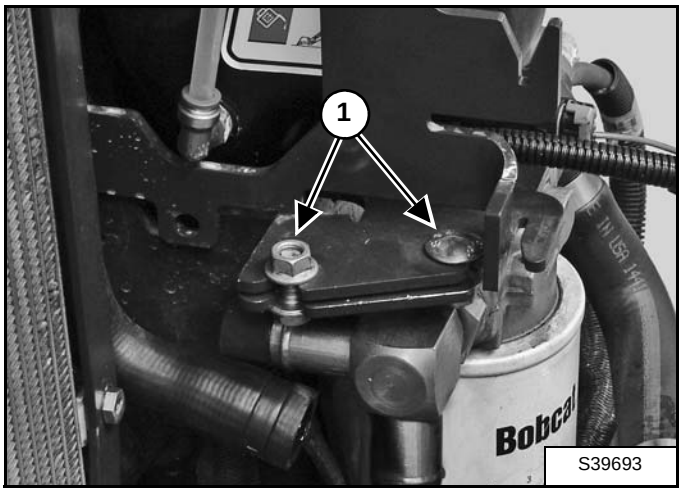
Remove the floor mat and center floorplate. (See Removal And Installation on Page 40-110-1.)

Figure 20-140-6



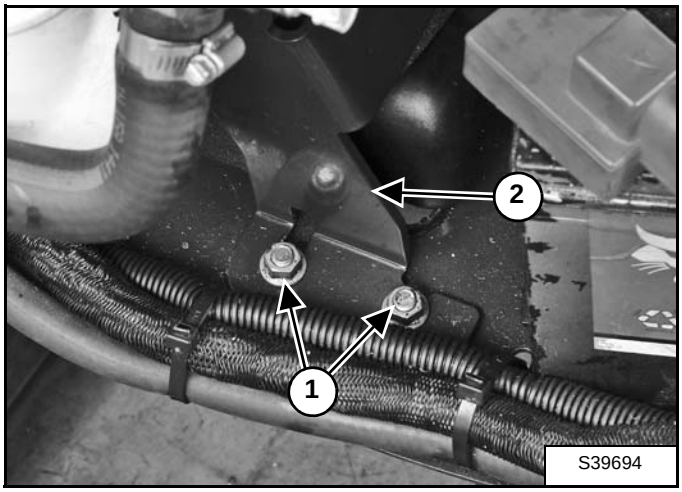
Remove the three hoses (Item 1) **[Figure 20-140-6]** from the hydraulic reservoir.

Figure 20-140-7



Remove the two nuts and bolts (Item 1) **[Figure 20-140-7]** from the bracket.

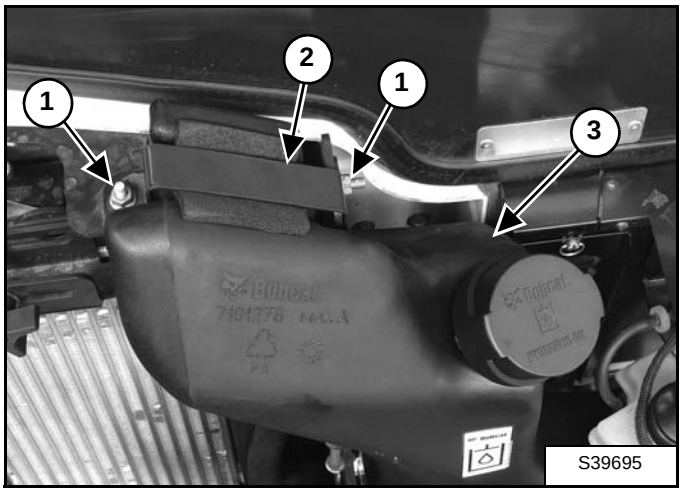
Figure 20-140-8



Remove the nuts (Item 1) and bracket assembly (Item 2) **[Figure 20-140-8]**.

Removal And Installation (Cont'd)

Figure 20-140-9



Remove the nuts (Item 1) and bracket (Item 2) **[Figure 20-140-9]**.

Remove the hydraulic reservoir (Item 3) **[Figure 20-140-9]**.


Bobcat®

OIL COOLER

Removal And Installation

IMPORTANT

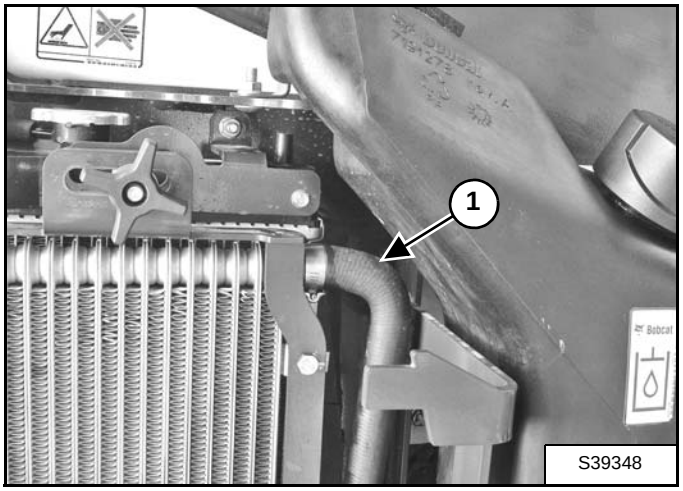
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

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

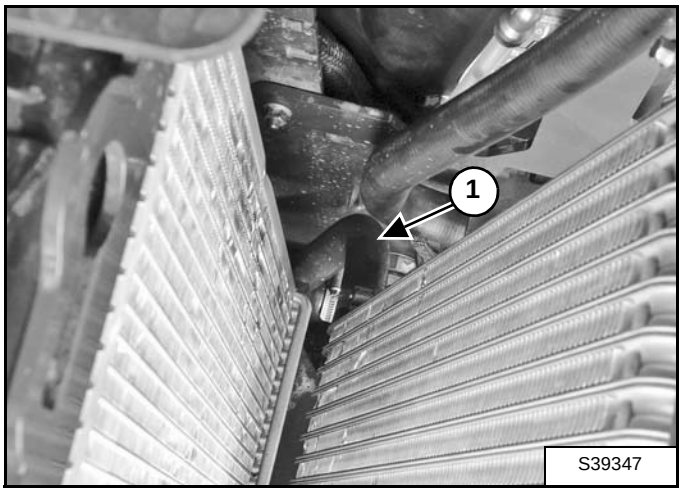
Open the tailgate. (See Opening And Closing on Page 10-50-1.)

Figure 20-150-1



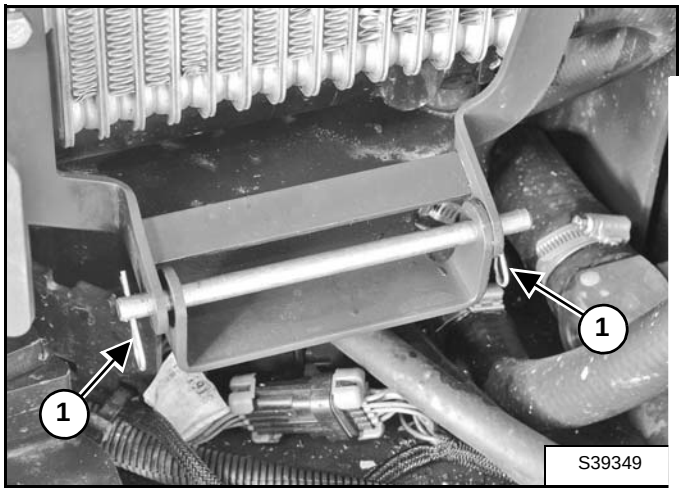
Remove the top hose (Item 1) **[Figure 20-150-1]**.

Figure 20-150-2



Remove the bottom hose (Item 1) **[Figure 20-150-2]**.

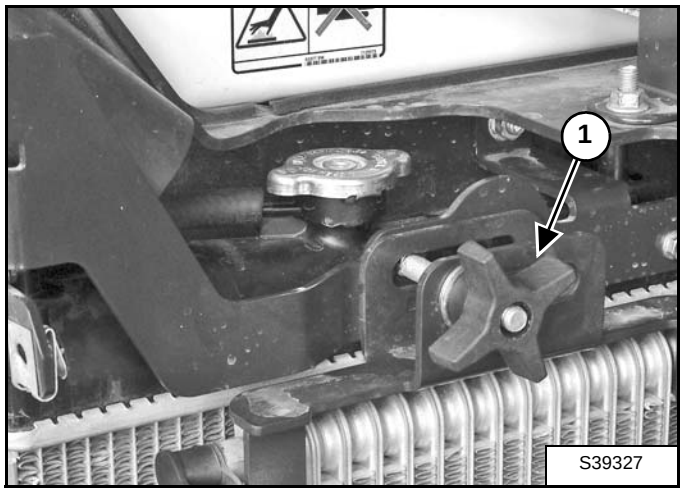
Figure 20-150-3



Remove the clips (Item 1) **[Figure 20-150-3]**.

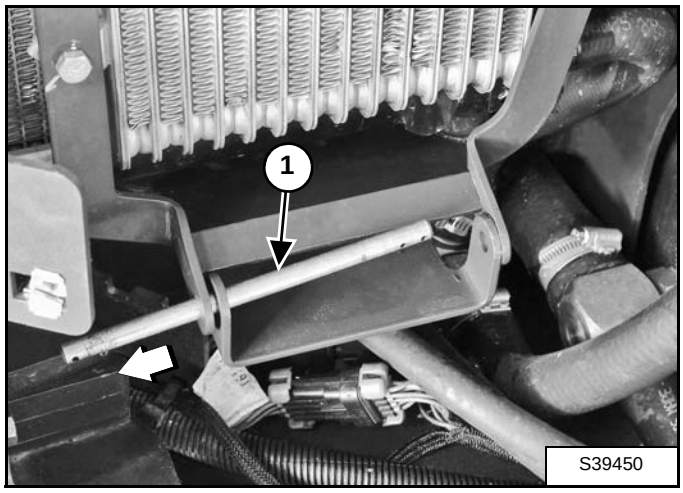
Removal And Installation (Cont'd)

Figure 20-150-4



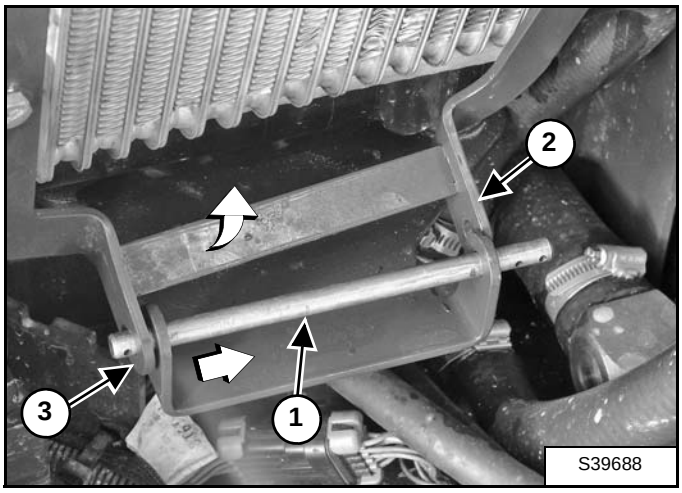
Loosen the lock (Item 1) **[Figure 20-150-4]**.

Figure 20-150-5



Tilt the cooler slightly away from the radiator. Slide the pivot rod (Item 1) **[Figure 20-150-5]** toward the rear of the excavator.

Figure 20-150-6



Raise the front of the cooler and slide the rod (Item 1) toward the front of the excavator. Slide the rod along 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.

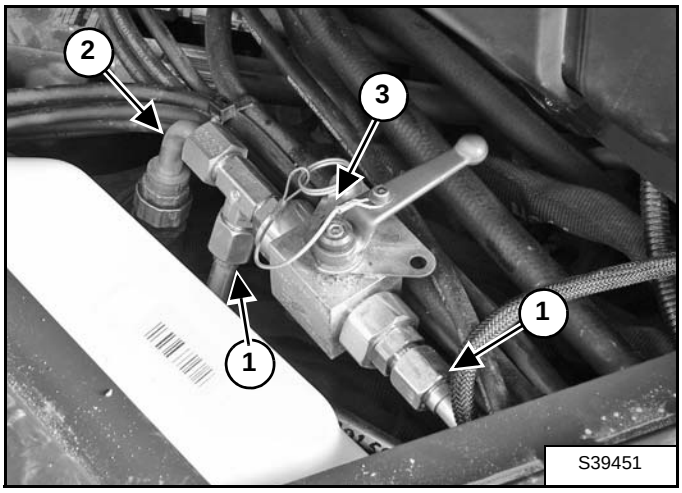
DIRECT TO TANK VALVE

Removal And Installation

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-4.)

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

Figure 20-160-1



Remove the tubelines (Item 1) and hose (Item 2) from the direct to tank valve (Item 3) **[Figure 20-160-1]** and remove valve from the excavator.

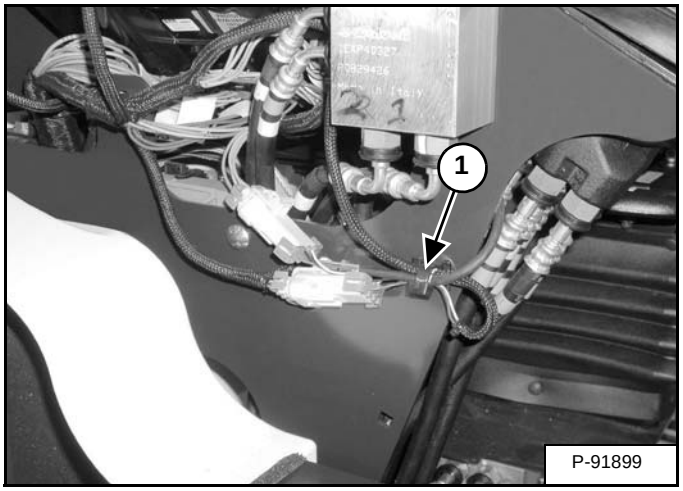

Bobcat®

BLADE CONTROL LEVER

Handle Removal And Installation

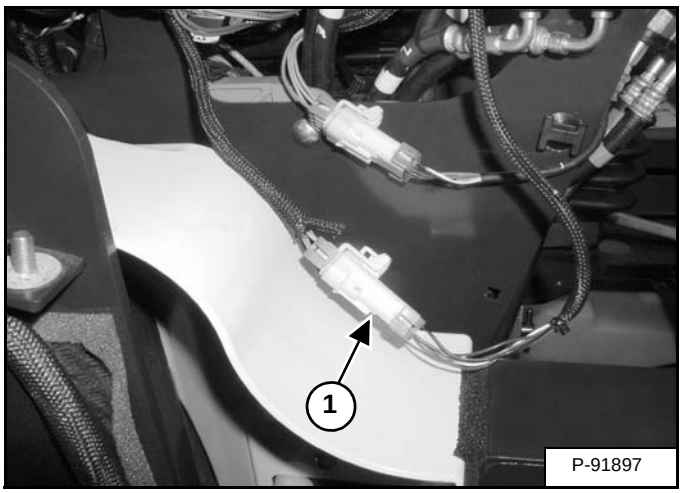
Remove the right console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 20-170-1



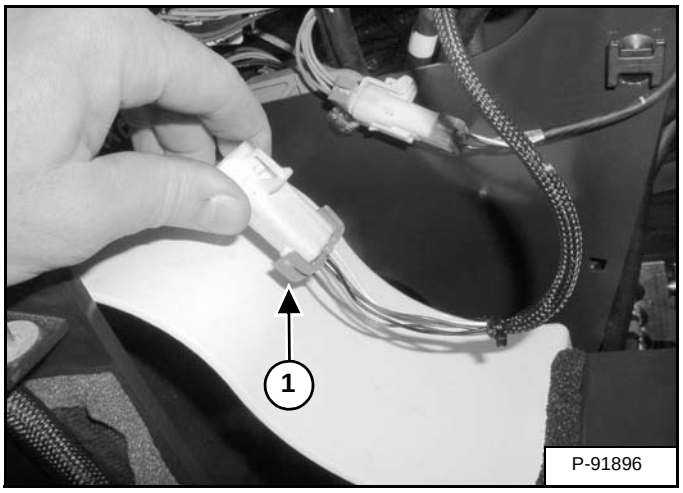
Cut and remove the cable tie (Item 1) **[Figure 20-170-1]**.

Figure 20-170-2



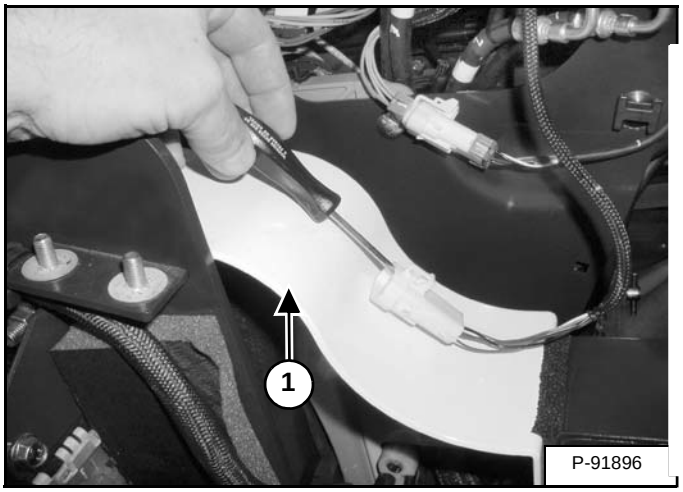
Disconnect the wire harness (Item 1) **[Figure 20-170-2]**.

Figure 20-170-3



Remove the connector lock (Item 1) **[Figure 20-170-3]** from the connector.

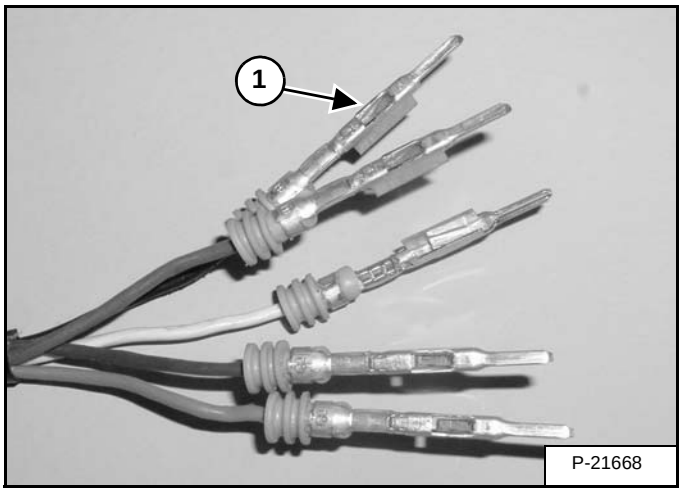
Figure 20-170-4



Depress the wire terminal tabs and remove the wires from the back of the electrical connector **[Figure 20-170-4]**.

Handle Removal And Installation (Cont'd)

Figure 20-170-5



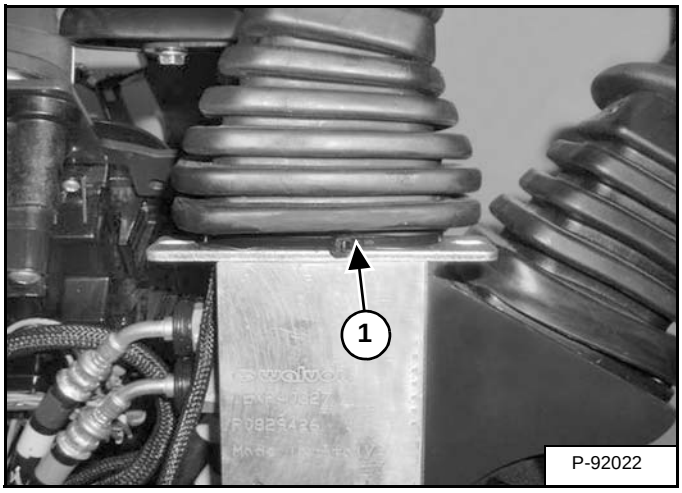
Installation: Re-bend the tab (Item 1) **[Figure 20-170-5]** on each wire before installing the electrical connector.

Installation: The wires must be installed in the proper locations in the wire connector, listed below:

A Green	C Red	E White
B Brown	D Black	

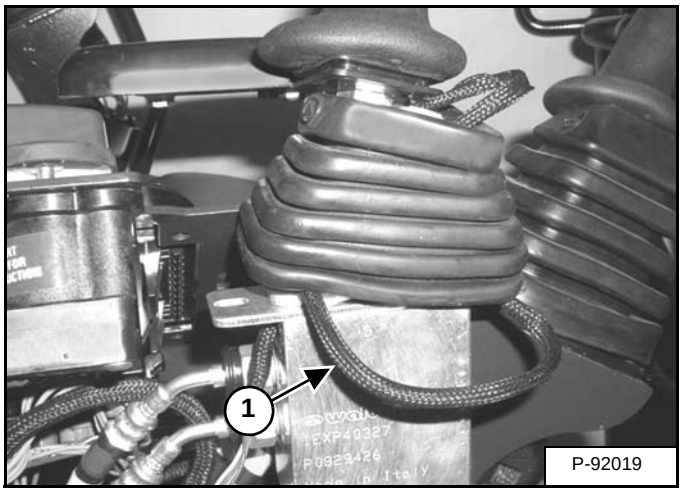
Check each wire to be certain the tab locks into position.

Figure 20-170-6



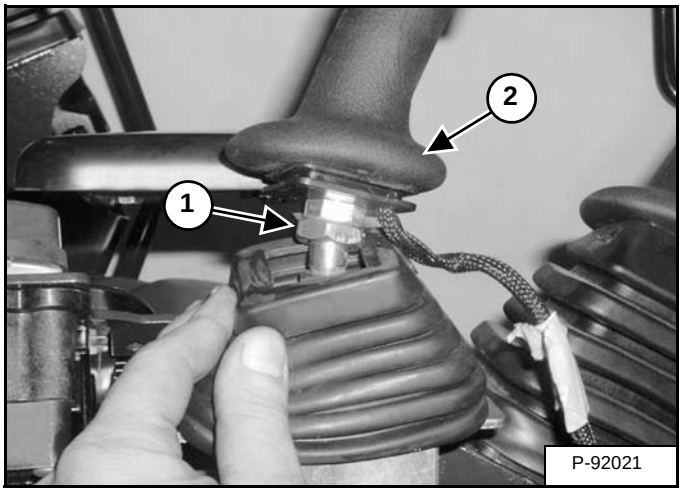
Cut and remove the cable tie (Item 1) **[Figure 20-170-6]**.

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

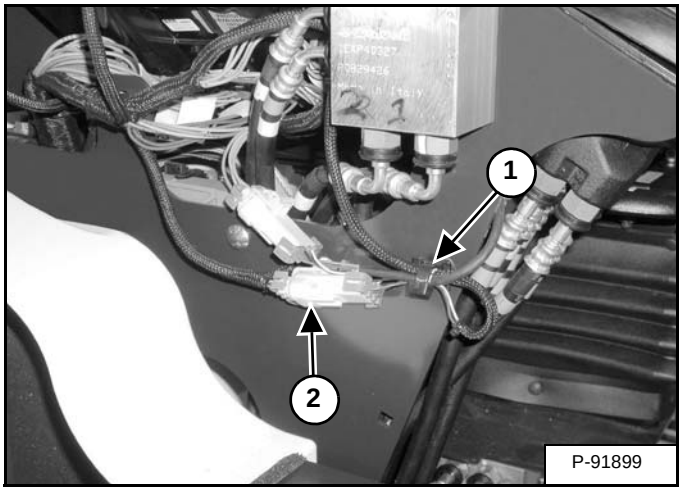


Loosen the locknut (Item 1) and remove the handle (Item 2) **[Figure 20-170-8]**.

Removal And Installation

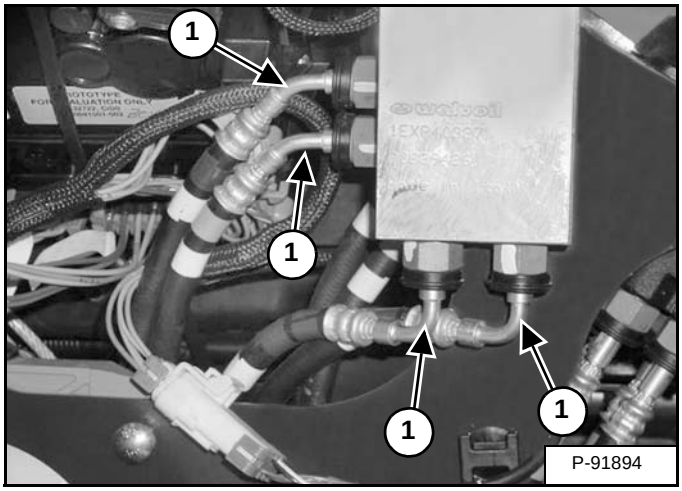
Remove the right console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

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

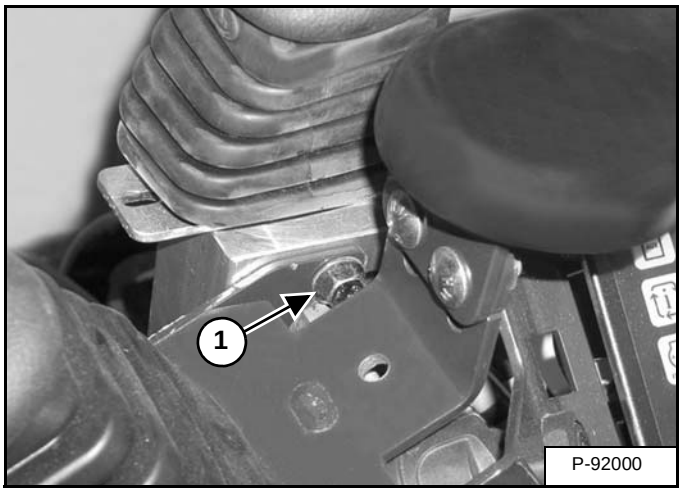
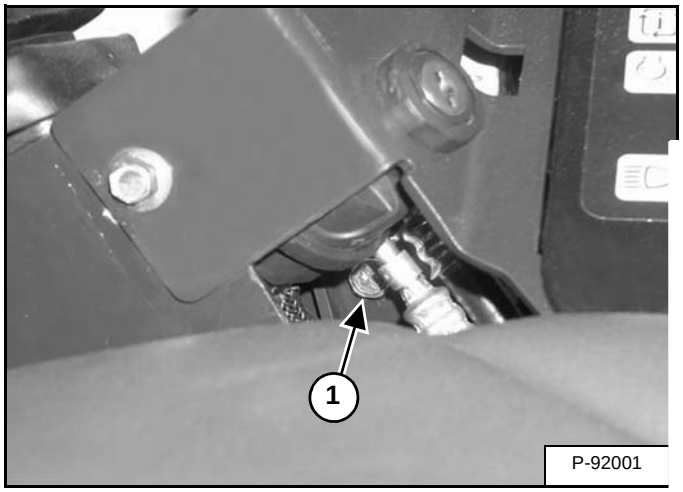


Figure 20-170-12

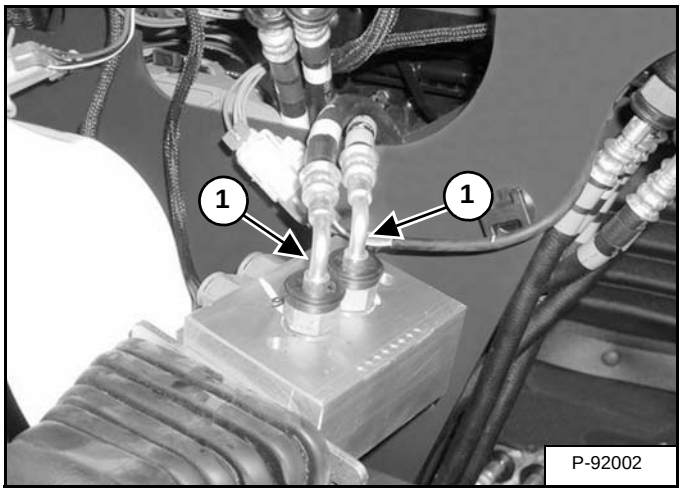


Remove the bolts (Item 1) **[Figure 20-170-11]** an **[Figure 20-170-12]**.

BLADE CONTROL LEVER (CONT'D)

Removal And Installation (Cont'd)

Figure 20-170-13

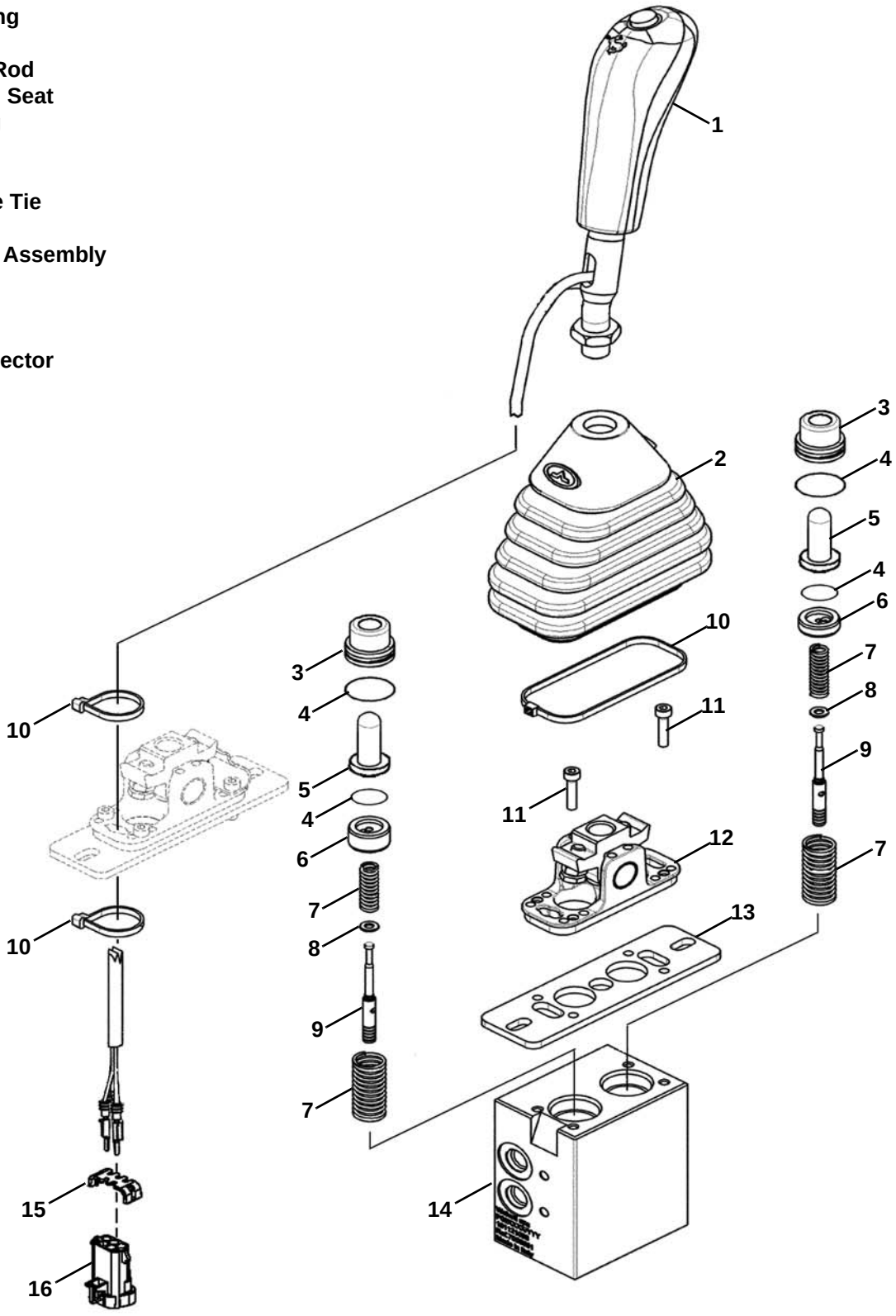


Tilt the control away from the console and remove the two hoses (Item 1) **[Figure 20-170-13]**.

Remove the control.

Parts Identification

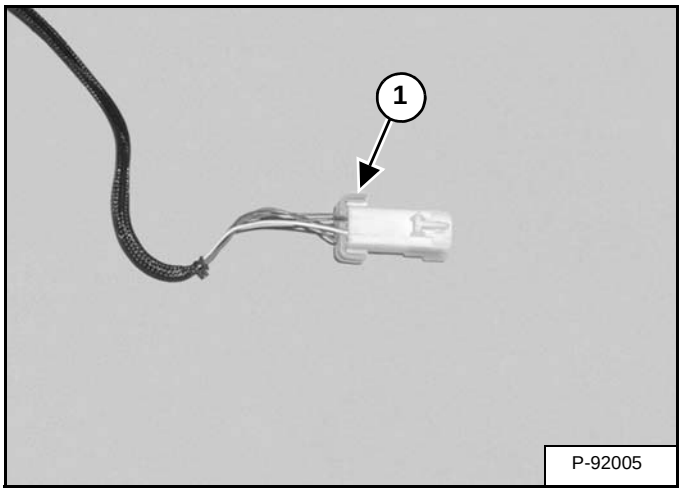
1. Handle
2. Boot
3. Bushing
4. O-ring
5. Push Rod
6. Spring Seat
7. Spring
8. Shim
9. Spool
10. Cable Tie
11. Bolt
12. Pivot Assembly
13. Plate
14. Body
15. Lock
16. Connector



EM9625

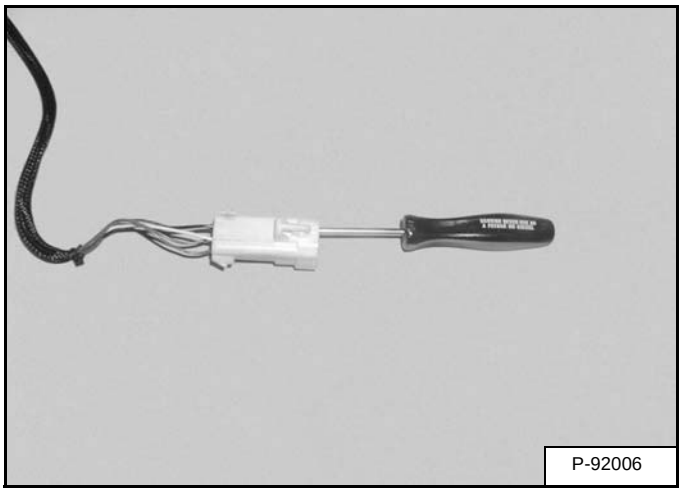
Disassembly And Assembly

Figure 20-170-14



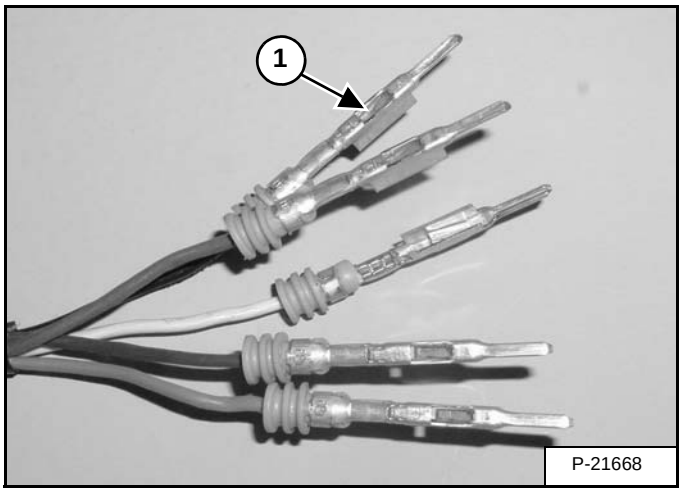
Remove the connector lock (Item 1) **[Figure 20-170-14]**.

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



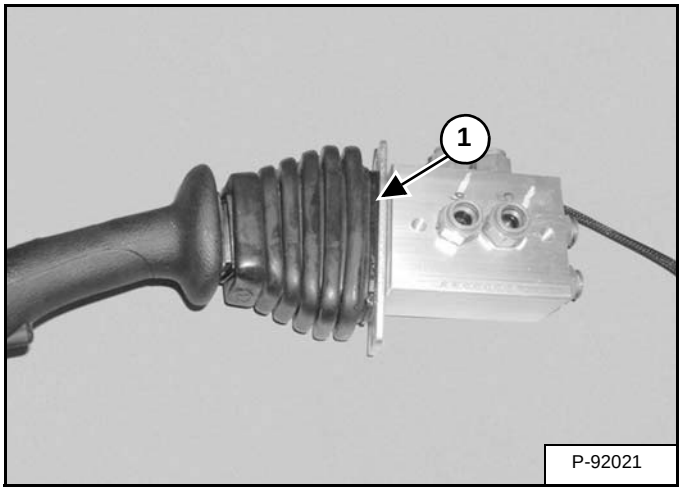
Installation: Re-bend the tab (Item 1) **[Figure 20-170-16]** on each wire before installing the electrical connector.

Installation: The wires must be installed in the proper locations in the wire connector, listed below:

A Green	C Red	E White
B Brown	D Black	

Check each wire to be certain the tab locks into position.

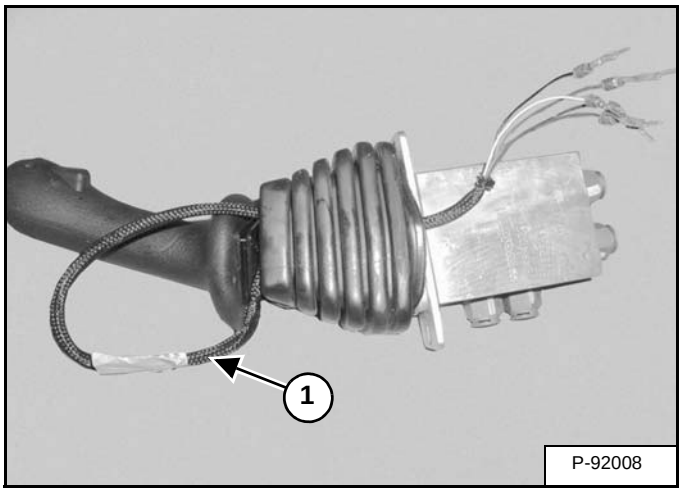
Figure 20-170-17



Cut and remove the cable tie (Item 1) **[Figure 20-170-17]**.

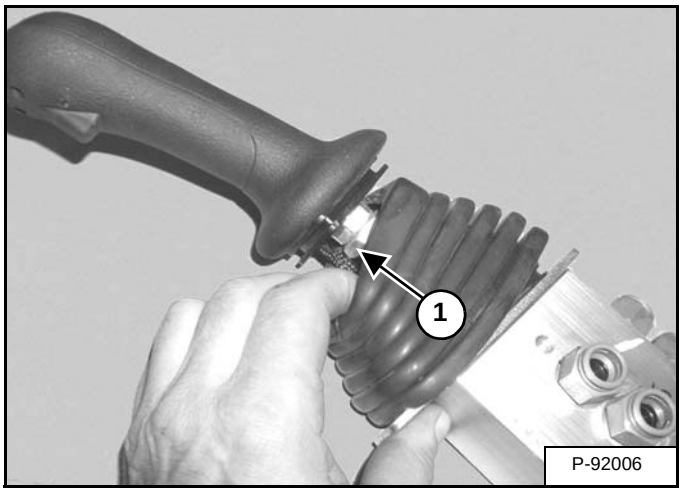
Disassembly And Assembly (Cont'd)

Figure 20-170-18



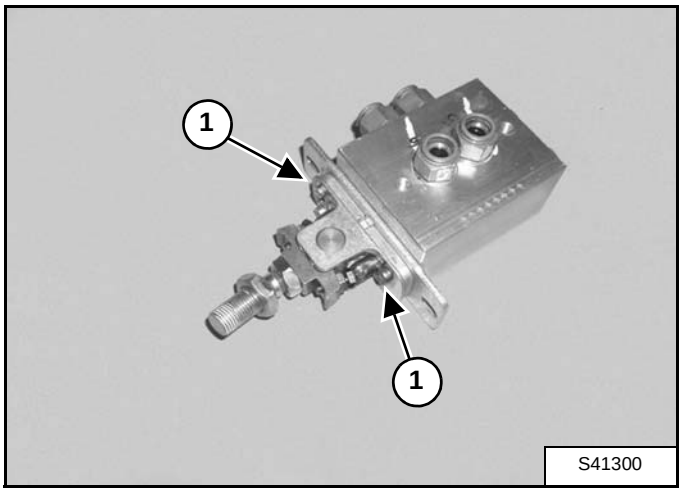
Route the harness (Item 1) **[Figure 20-170-18]** through the top of the dust boot.

Figure 20-170-19



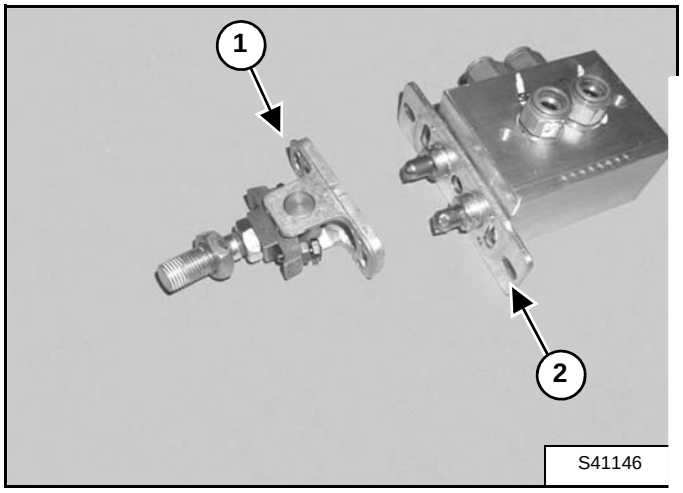
Loosen the nut (Item 1) **[Figure 20-170-19]** and remove the handle and dust boot.

Figure 20-170-20



Remove the four bolts (Item 1) **[Figure 20-170-20]**.

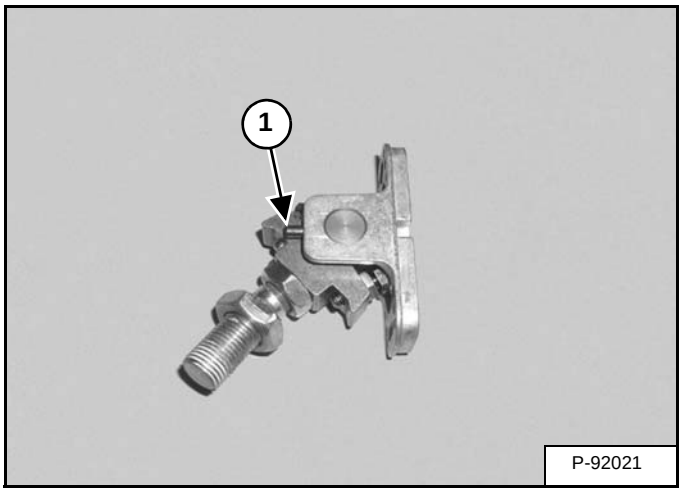
Figure 20-170-21



Remove the pivot assembly (Item 1) and plate (Item 2) **[Figure 20-170-21]**.

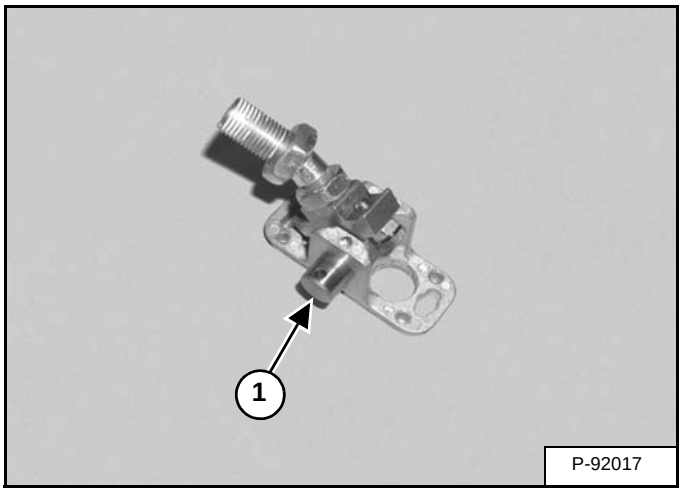
Disassembly And Assembly (Cont'd)

Figure 20-170-22



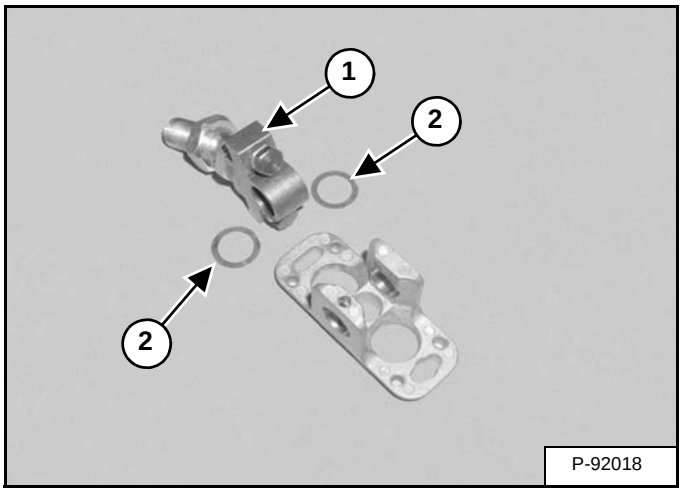
Remove the roll pin (Item 1) **[Figure 20-170-22]**.

Figure 20-170-23



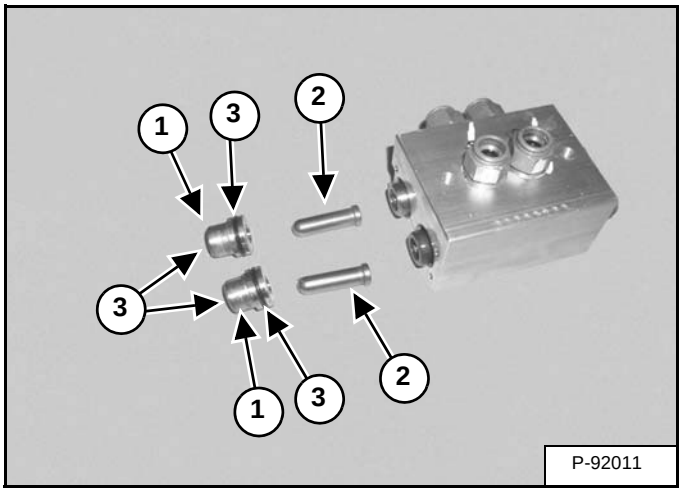
Remove the pivot pin (Item 1) **[Figure 20-170-23]**.

Figure 20-170-24



Remove the lever (Item 1). Remove the shim (Item 2) **[Figure 20-170-24]** from both sides of the lever.

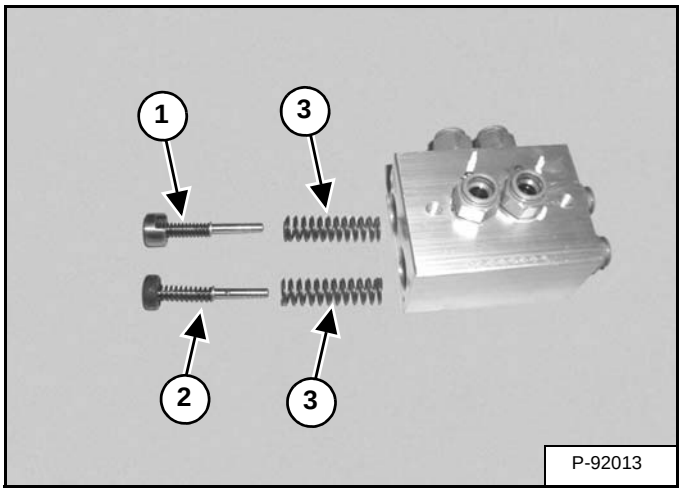
Figure 20-170-25



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.

Disassembly And Assembly (Cont'd)

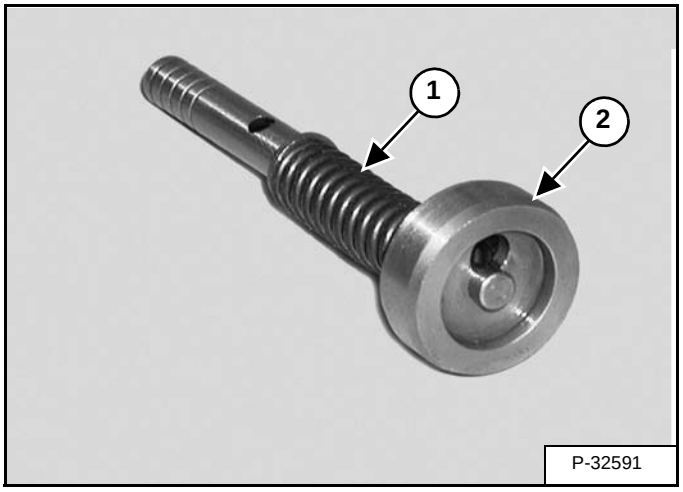
Figure 20-170-26



Remove the blade raise spool assembly (Item 1), blade lower / float spool assembly (Item 2) and springs (Item 3) **[Figure 20-170-26]**.

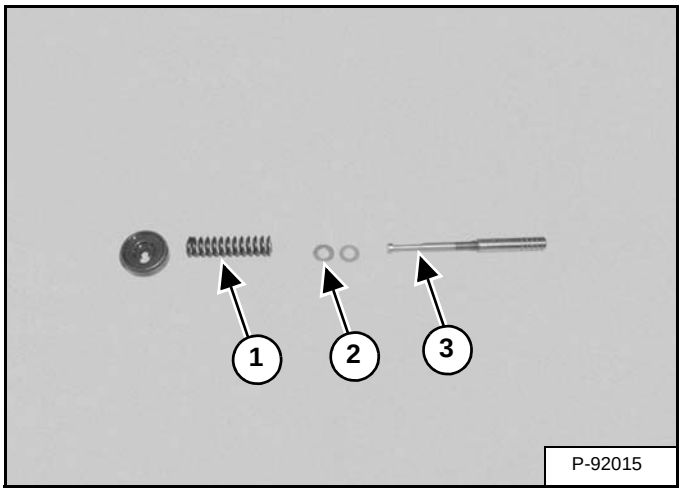
NOTE: The spool assemblies must be installed in the correct bores or the float function of the blade will not work correctly.

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]**.

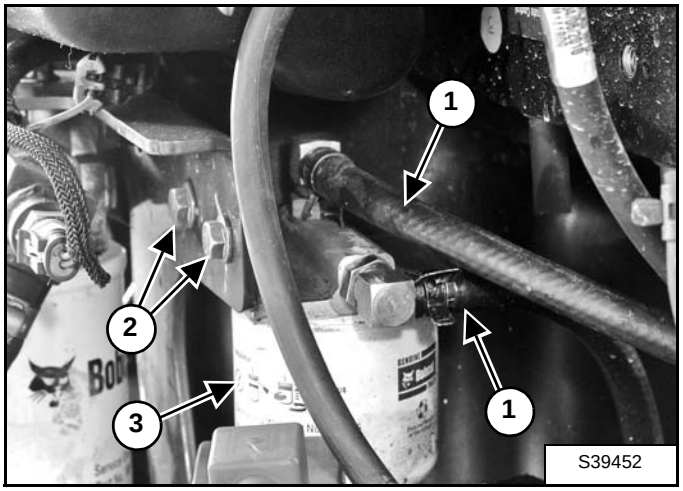

Bobcat®

CASE DRAIN FILTER MOUNT

Removal And Installation

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

Figure 20-180-1



Remove and plug the two hoses (Item 1) **[Figure 20-180-1]**.

Remove the two bolts (Item 2) **[Figure 20-180-1]**.

Remove the filter and filter mount (Item 3) **[Figure 20-180-1]**.


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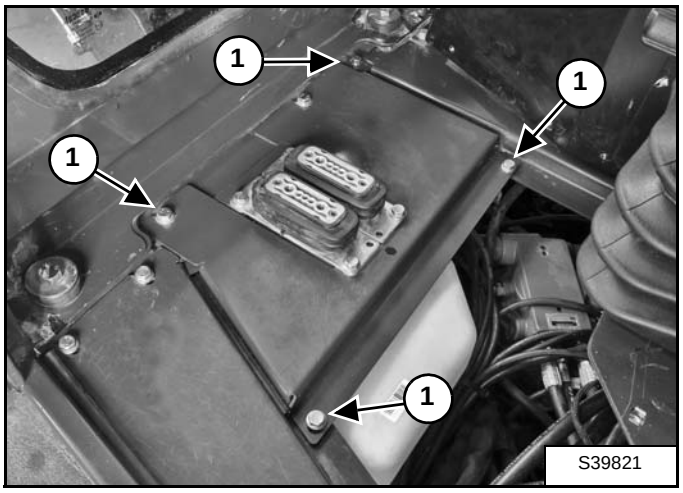
TRAVEL CONTROL VALVE

Removal And Installation

Remove the travel levers. (See Removal And Installation on Page 40-100-1.)

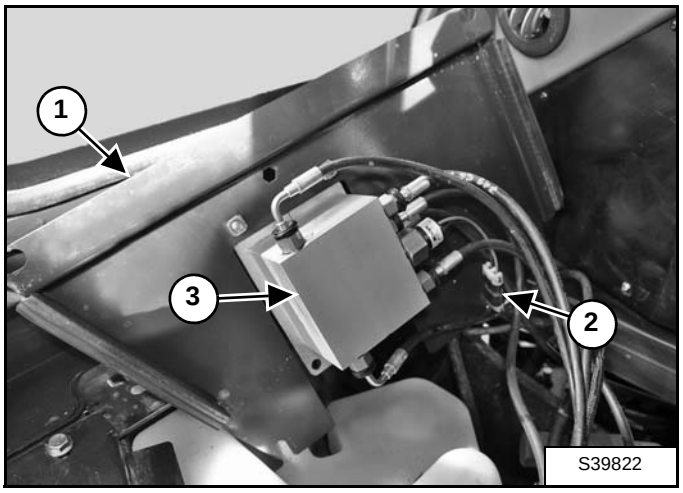
Remove the floor mat and center floorplate. (See Removal And Installation on Page 40-110-1.)

Figure 20-190-1



Remove the four bolts (Item 1) **[Figure 20-190-1]** from the front floorplate.

Figure 20-190-2



Tip the plate (Item 1) **[Figure 20-190-2]** towards the front window.

Disconnect the electrical connector (Item 2) **[Figure 20-190-2]**.

Mark and remove the six hoses from the travel control valve (Item 3) **[Figure 20-190-2]**.

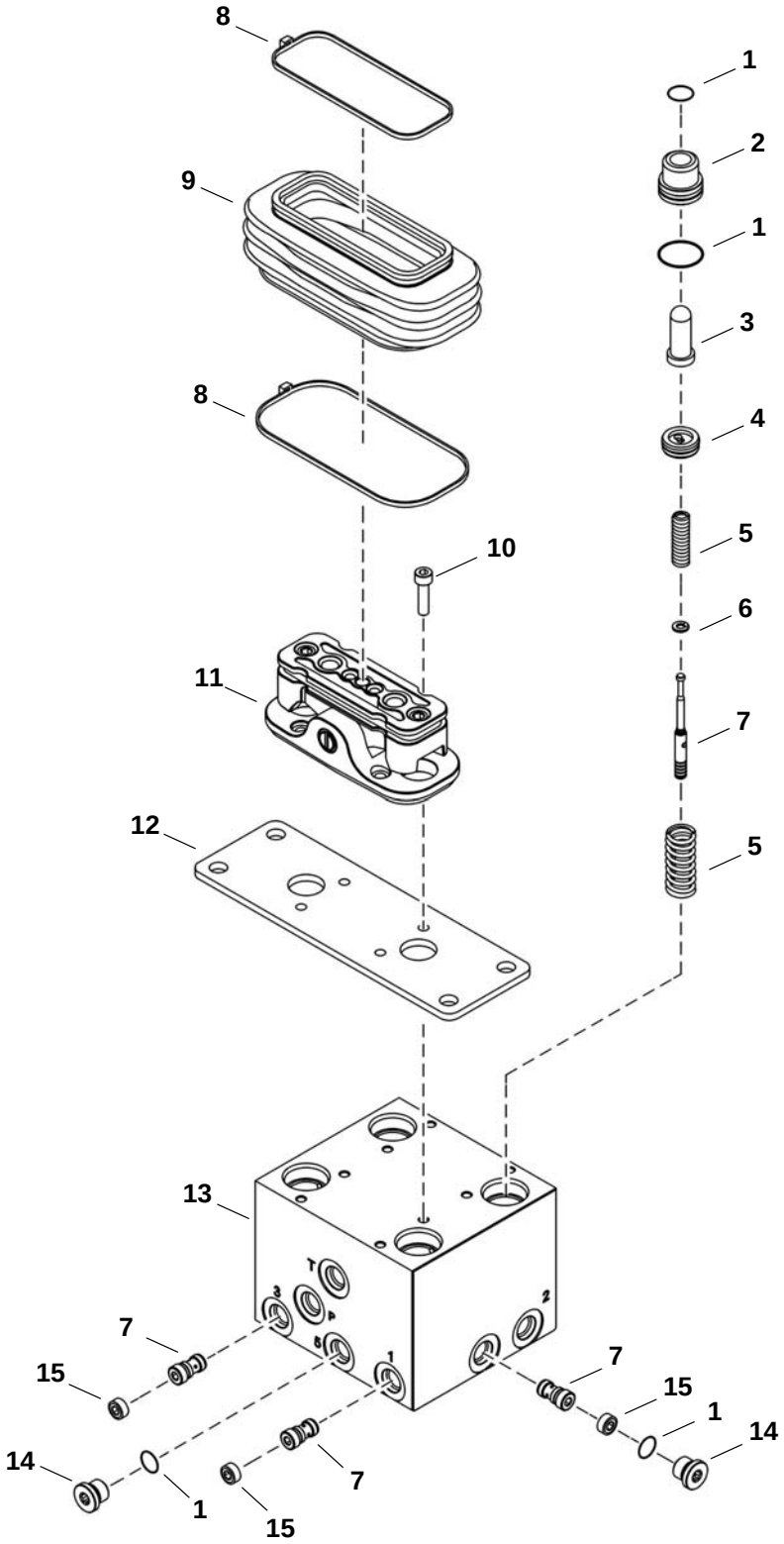
IMPORTANT

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

Parts Identification

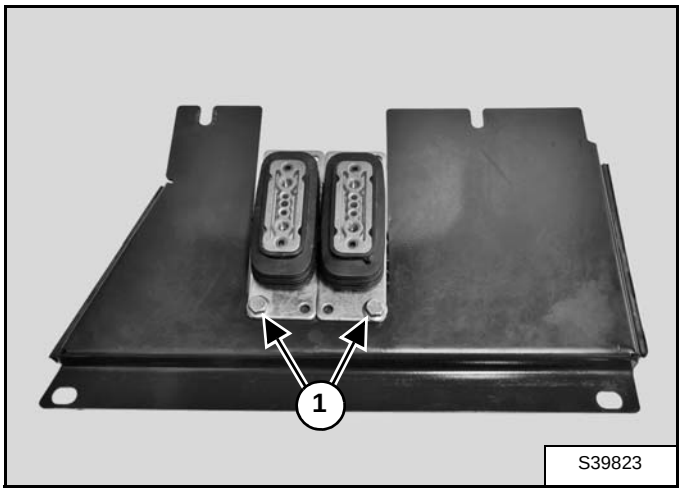
1. O-ring
2. Bushing
3. Plunger
4. Spring Seat
5. Spring
6. Shim
7. Spool
8. Cable Tie
9. Dust Boot
10. Screw
11. Pivot Assembly
12. Plate
13. Valve Body
14. Plug
15. Nut



EM9301

Disassembly And Assembly

Figure 20-190-3

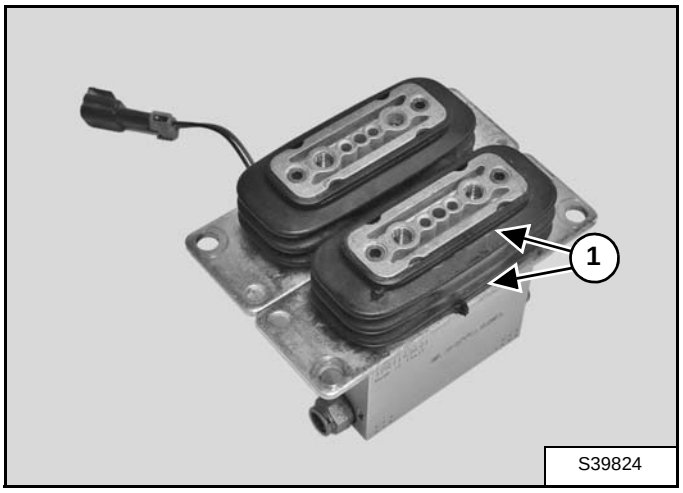


Remove the bolts (Item 1) **[Figure 20-190-3]** and nuts. Remove the valve from the floorplate.

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

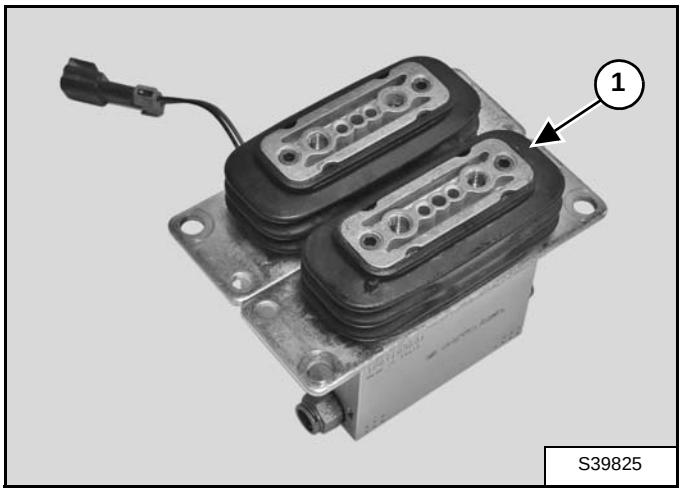
NOTE: The procedure is shown on the left travel side of the valve. The procedure is the same for both sides of the valve.

Figure 20-190-4



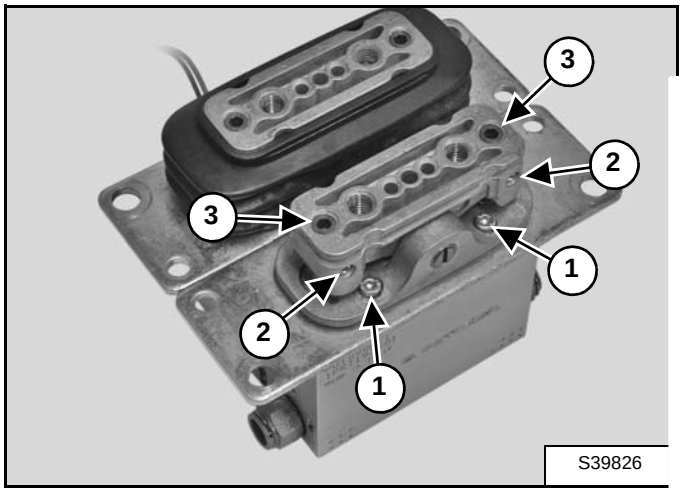
Cut and remove the two cable ties (Item 1) **[Figure 20-190-4]**.

Figure 20-190-5



Remove the dust boot (Item 1) **[Figure 20-190-5]**.

Figure 20-190-6



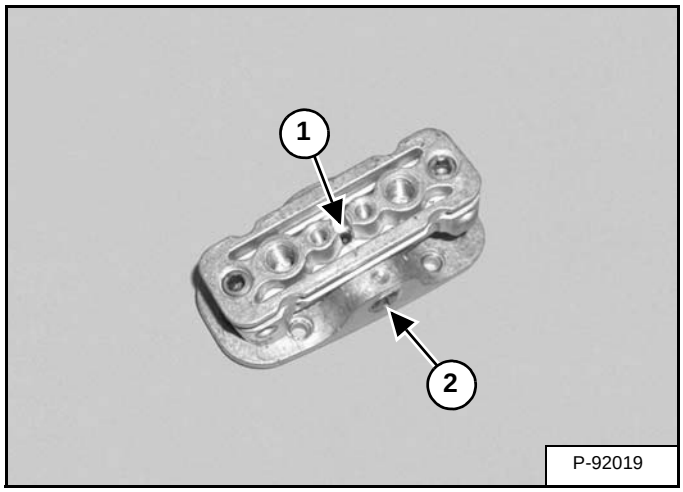
Remove the four screws (Item 1) **[Figure 20-190-6]** and remove the pivot assembly.

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.

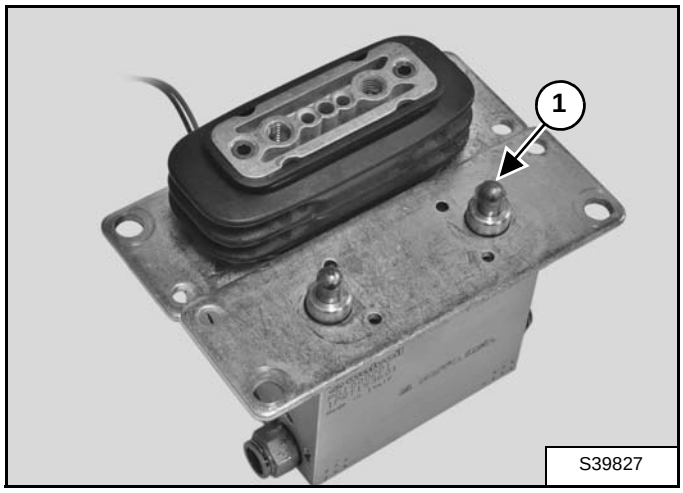
Disassembly And Assembly (Cont'd)

Figure 20-190-7



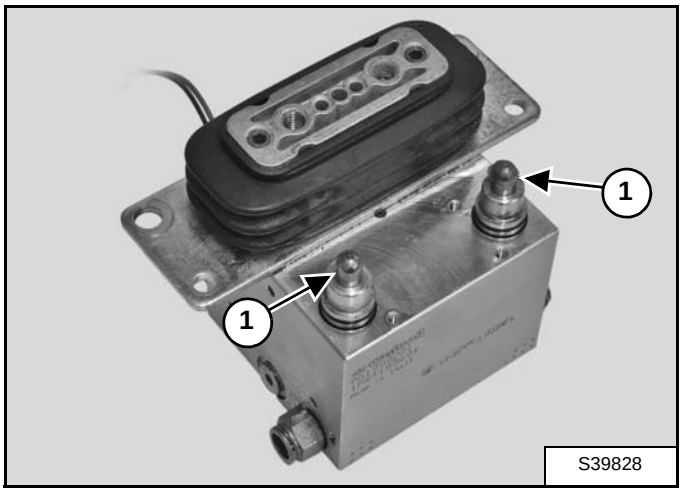
Loosen the screw (Item 1) and remove the pivot pin (Item 2) **[Figure 20-190-7]**.

Figure 20-190-8



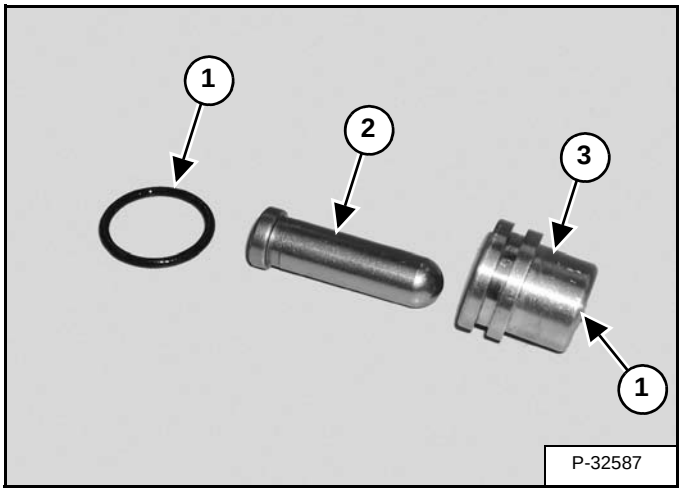
Remove the plate (Item 1) **[Figure 20-190-8]**.

Figure 20-190-9



Remove the plunger assemblies (Item 1) **[Figure 20-190-9]**.

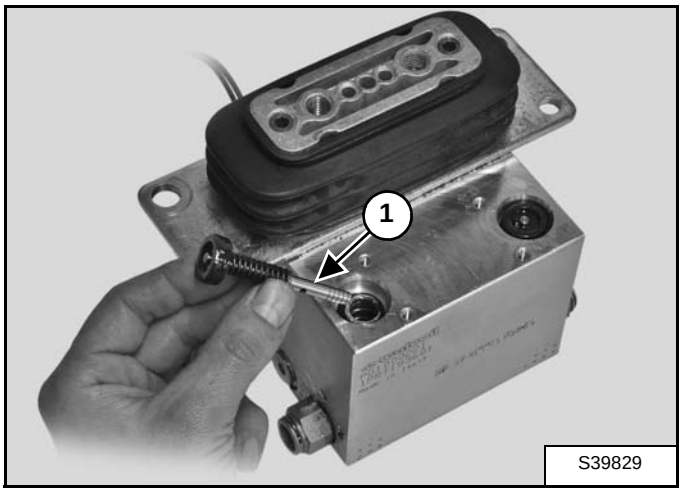
Figure 20-190-10



Remove the O-rings (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-190-10]**.

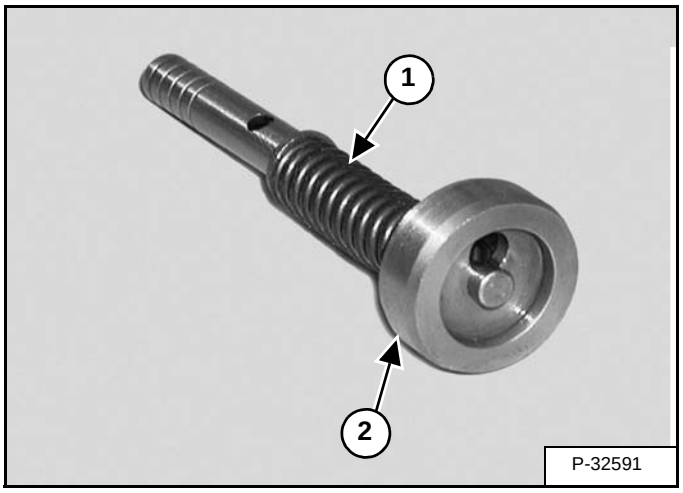
Disassembly And Assembly (Cont'd)

Figure 20-190-11



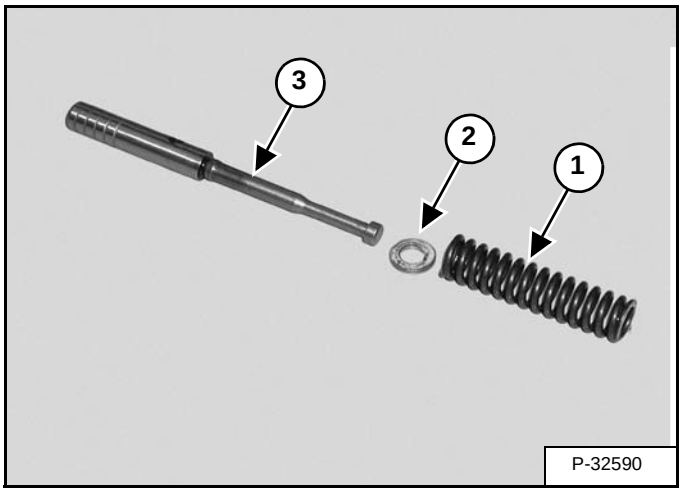
Remove the spool assemblies (Item 1) **[Figure 20-190-11]**.

Figure 20-190-12



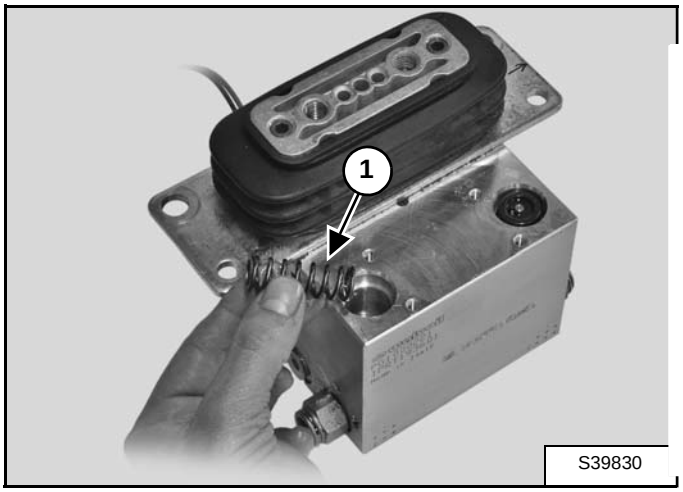
Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-190-12]**.

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

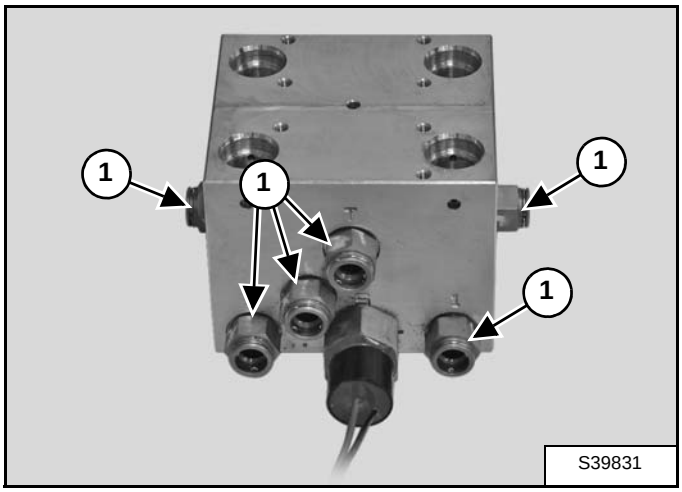


Remove the spring (Item 1) **[Figure 20-190-14]**.

Repeat the procedure for the right travel side of the valve.

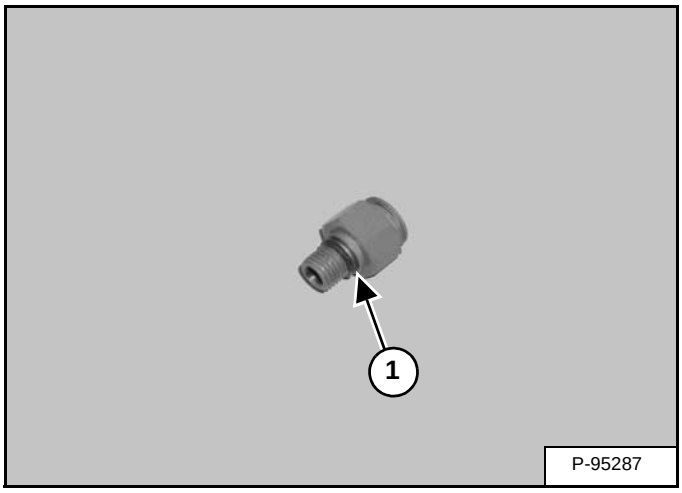
Disassembly And Assembly (Cont'd)

Figure 20-190-15



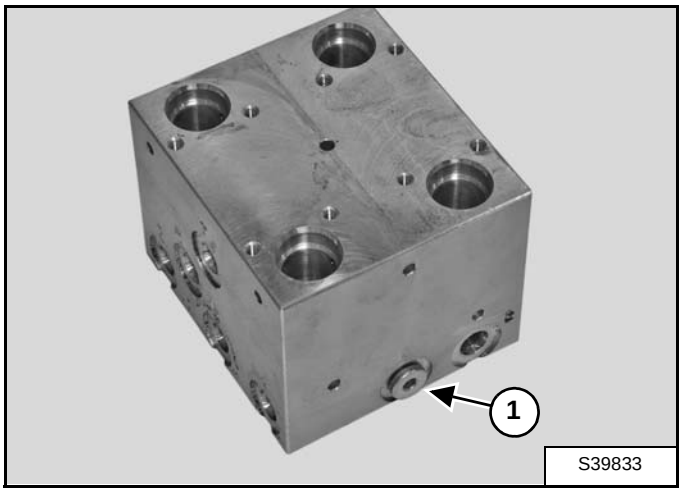
Remove the fittings (Item 1) **[Figure 20-190-15]**.

Figure 20-190-16



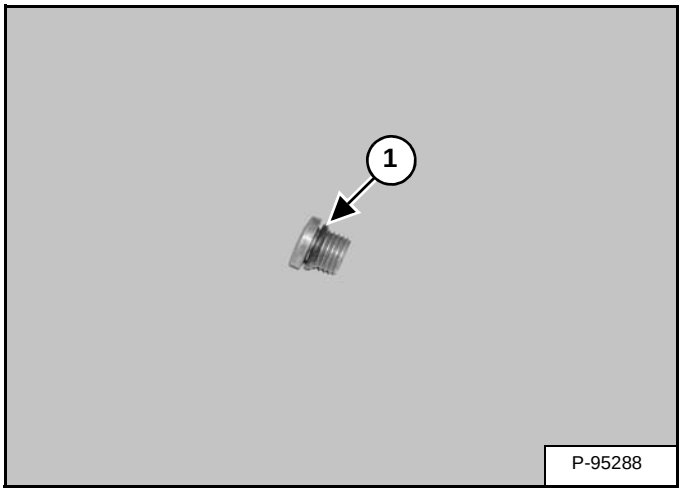
Remove the O-rings (Item 1) **[Figure 20-190-16]** from the fittings.

Figure 20-190-17



Remove the plug (Item 1) **[Figure 20-190-17]**.

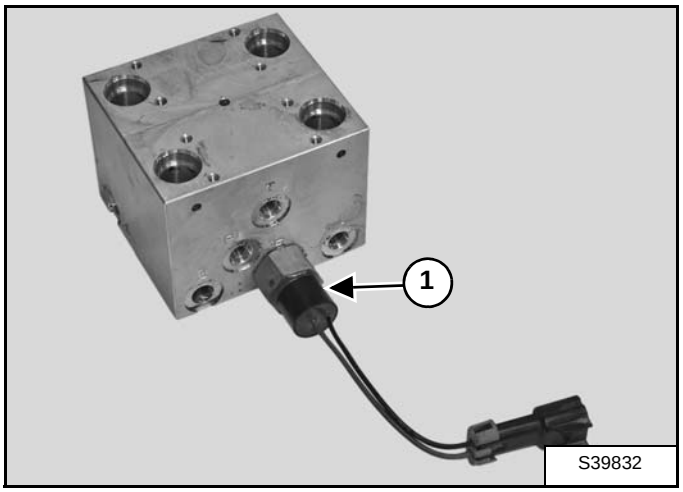
Figure 20-190-18



Remove the O-ring (Item 1) **[Figure 20-190-19]** from the plug.

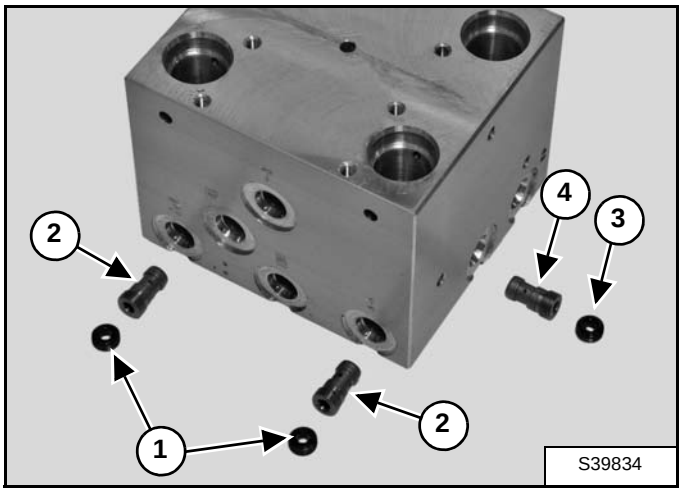
Disassembly And Assembly (Cont'd)

Figure 20-190-19



Remove the pressure switch (Item 1) **[Figure 20-190-19]**.

Figure 20-190-20



Remove the nut (Item 1) **[Figure 20-190-20]**.

Installation: Tighten the nut to 9,8 N•m (86.73 in-lb) torque.

Remove the spool (Item 2) **[Figure 20-190-20]**.

Remove the nut (Item 3) **[Figure 20-190-20]**.

Installation: Tighten the nut to 9,8 N•m (86.73 in-lb) torque.

Remove the spool (Item 4) **[Figure 20-190-20]**.

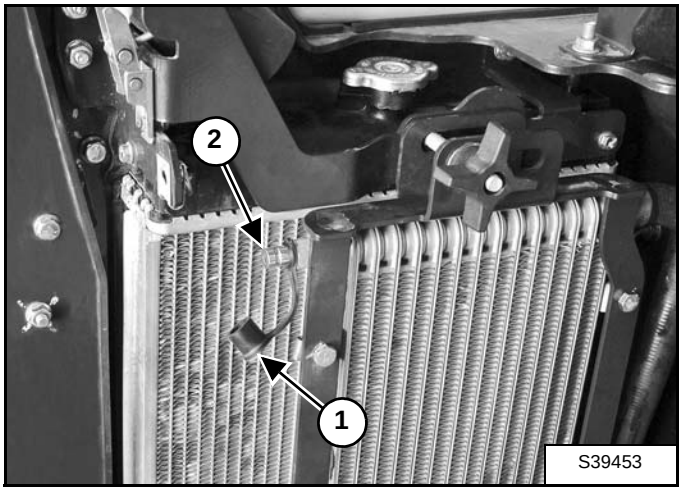

Bobcat®

REMOVING AIR FROM THE HYDRAULIC SYSTEM

Procedure

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

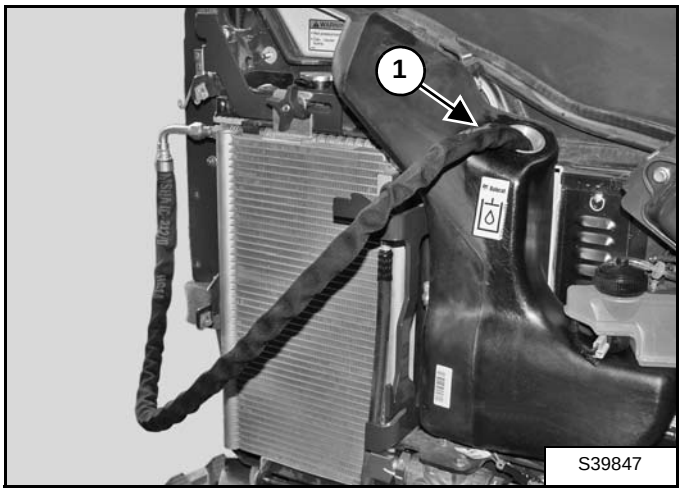
Figure 20-200-1



Remove the cover (Item 1) from the male quick coupler (Item 2) **[Figure 20-200-1]**.

Install a female quick coupler and hose on the male quick coupler (Item 2) **[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.


Bobcat®

SECONDARY AUXILIARY VALVE (EARLY MODELS)

Removal And Installation

Lower the work group to the earth.

Stop the engine.

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

IMPORTANT

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

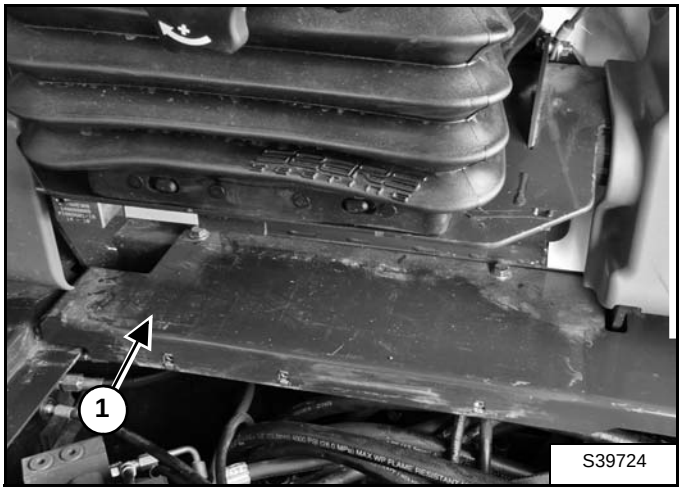
I-2003-0888

Drain the hydraulic reservoir. (See Removal And Installation on Page 20-140-1.)

Remove the left upper structure cover. (See Removal And Installation on Page 40-70-1.)

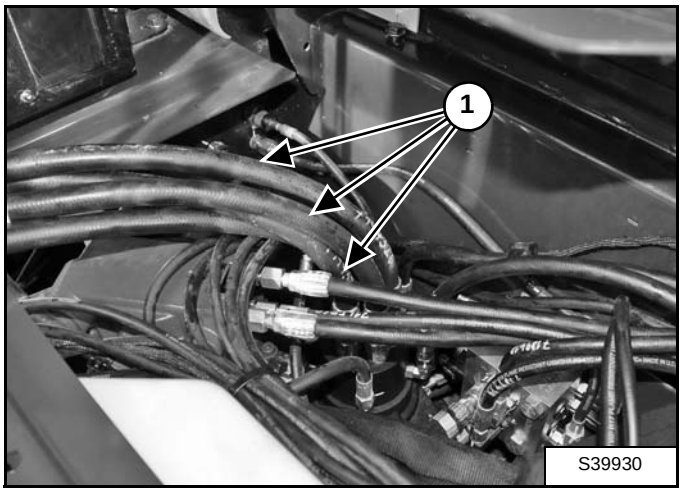
Remove the tool box. (See Removal And Installation on Page 40-220-1.)

Figure 20-210-1



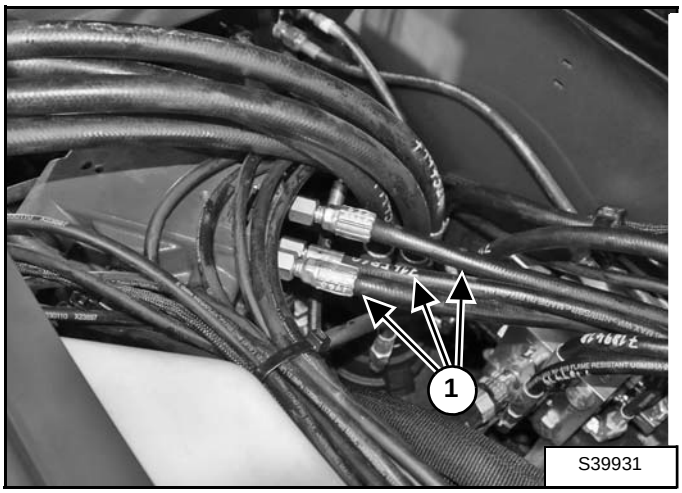
Remove the rear cover (Item 1) **[Figure 20-210-1]**.

Figure 20-210-2



Mark, disconnect and plug the three hoses (Item 1) **[Figure 20-210-2]** for easier access. (See Removal And Installation on Page 20-40-1.)

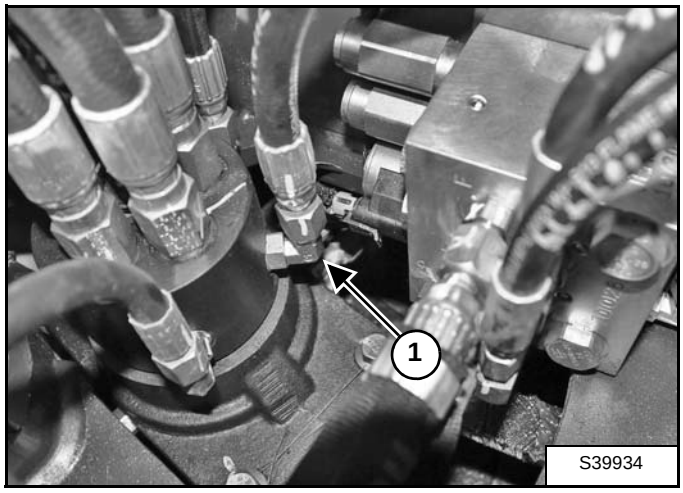
Figure 20-210-3



Mark, disconnect and plug the hoses from the slew motor (Item 1) **[Figure 20-210-3]** for easier access.

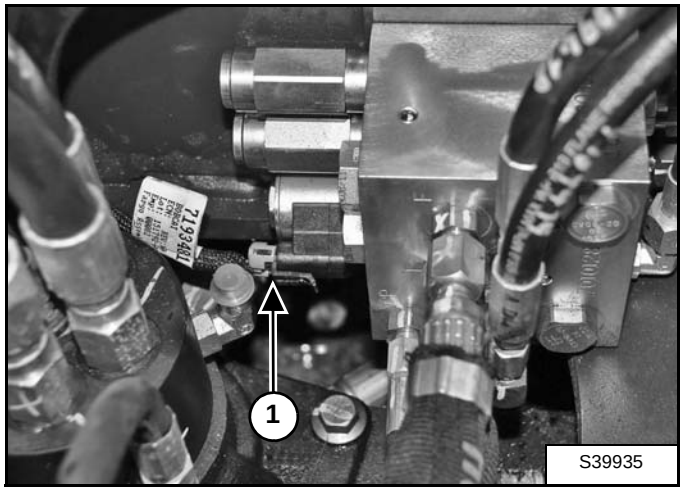
Removal And Installation (Cont'd)

Figure 20-210-4



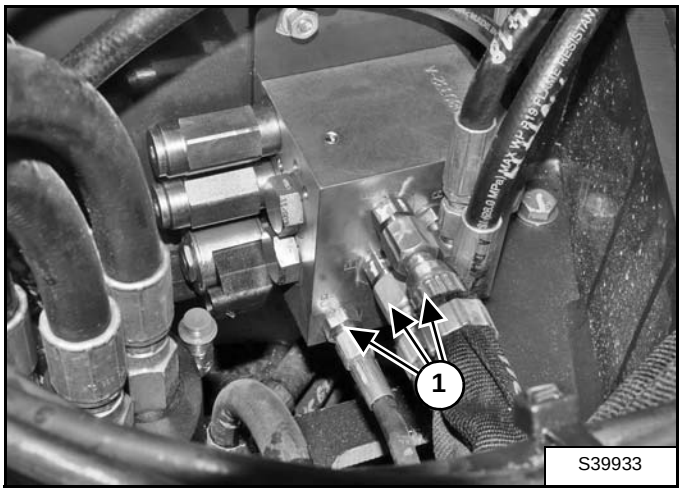
Mark, disconnect and plug the hose (Item 1) **[Figure 20-210-4]**. Plug the fitting.

Figure 20-210-5



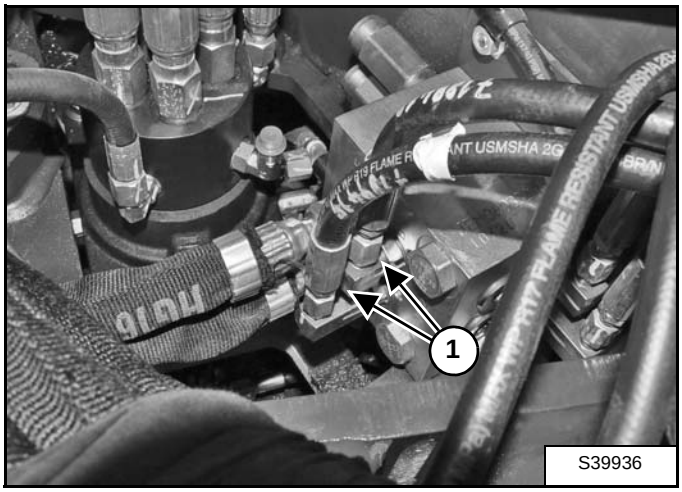
Remove the solenoid wire harness (Item 1) **[Figure 20-210-5]**.

Figure 20-210-6



Mark, disconnect and plug the hoses (Item 1) **[Figure 20-210-6]**.

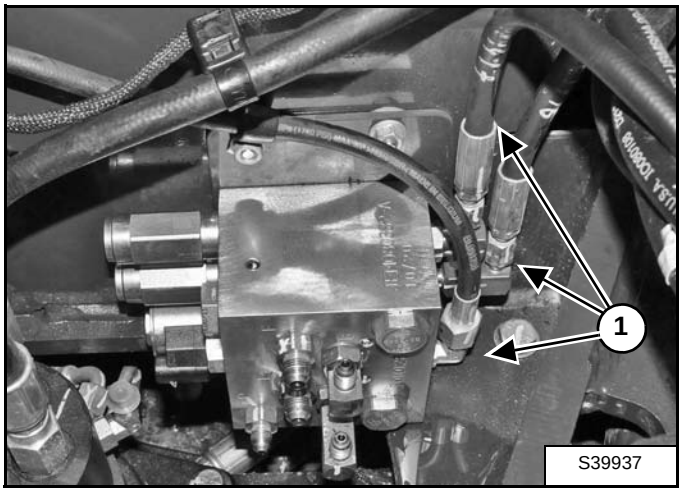
Figure 20-210-7



Mark, disconnect and plug the hoses (Item 1) **[Figure 20-210-7]**.

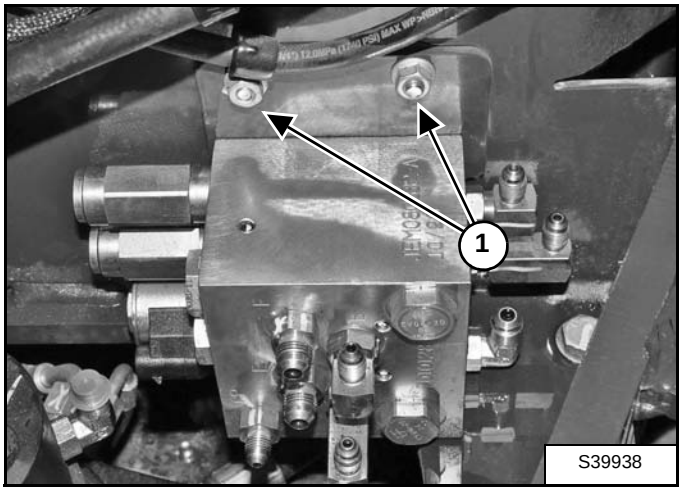
Removal And Installation (Cont'd)

Figure 20-210-8



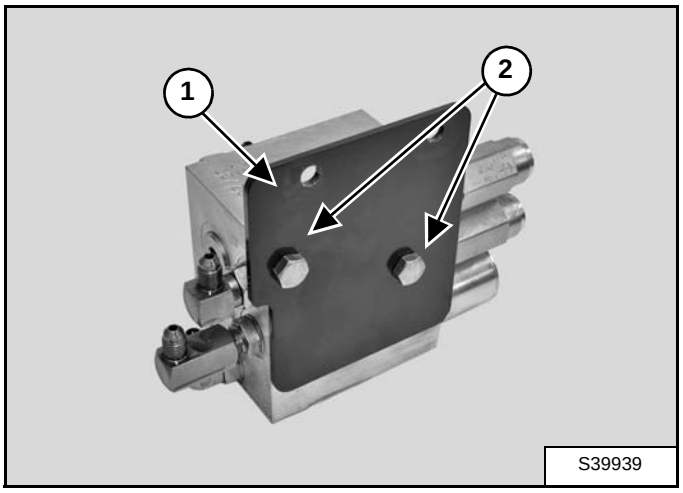
Mark, disconnect and plug the hoses (Item 1) **[Figure 20-210-8]**.

Figure 20-210-9



Remove the two bolts and nuts (Item 1) **[Figure 20-210-9]** and remove the secondary auxiliary valve.

Figure 20-210-10

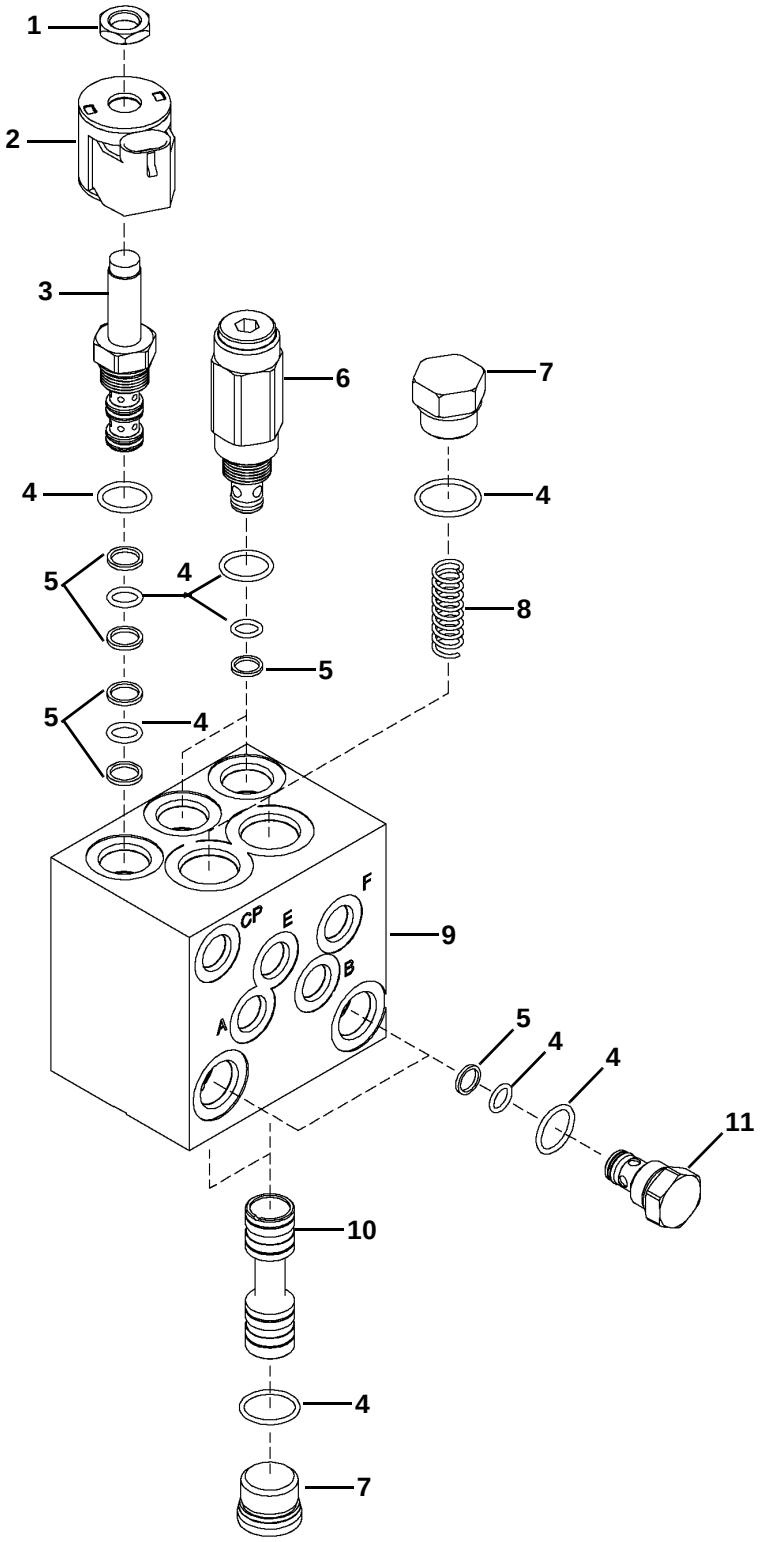


Move the valve to the workbench and remove the backplate (Item 1) by removing the two bolts (Item 2) **[Figure 20-210-10]**.

SECONDARY AUXILIARY VALVE (EARLY MODELS) (CONT'D)

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



NA2303S

Disassembly And Assembly

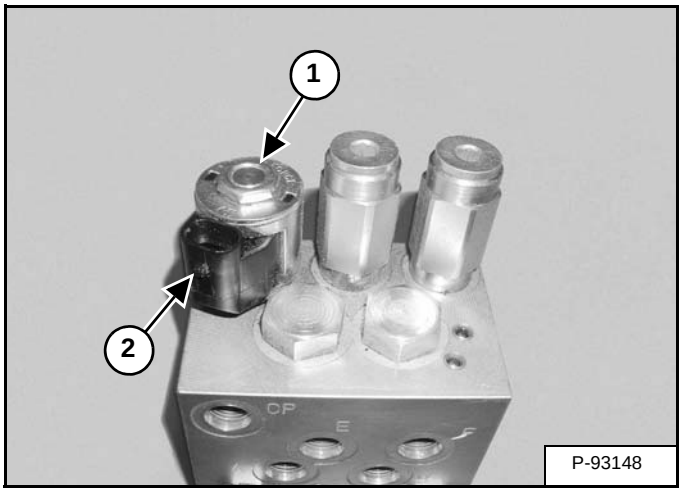
IMPORTANT

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

I-2003-0888

- Clean all parts in solvent and dry with compressed air.
- Inspect all parts for wear or damage. Replace any worn or damaged parts.
- Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

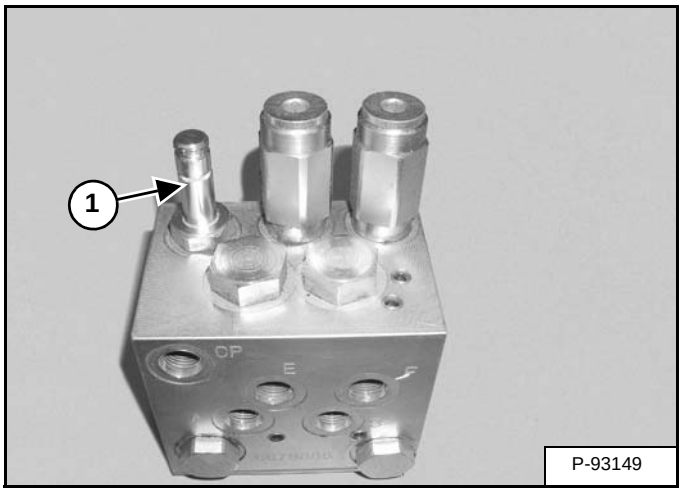
Figure 20-210-11



Remove the nut (Item 1) and coil (Item 2) **[Figure 20-210-11]**.

Installation: Tighten the nut to 5 - 8 N•m (44.25 - 70.8 in-lb) torque.

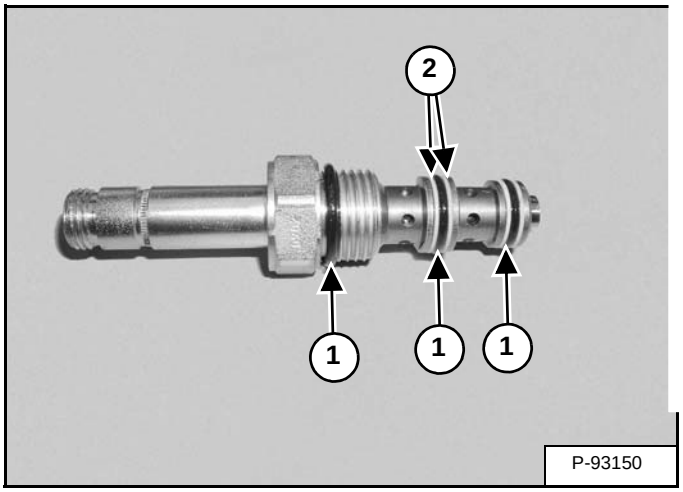
Figure 20-210-12



Remove the stem (Item 1) **[Figure 20-210-12]**.

Installation: Tighten the stem to 41 - 47 N•m (30 - 35 ft-lb) torque.

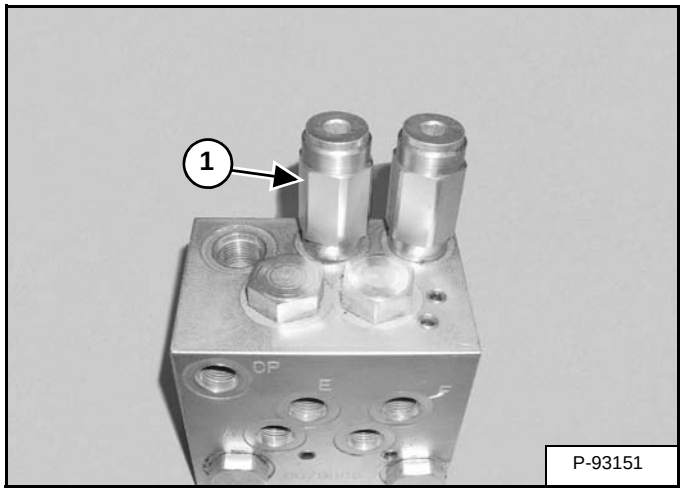
Figure 20-210-13



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-210-13]**.

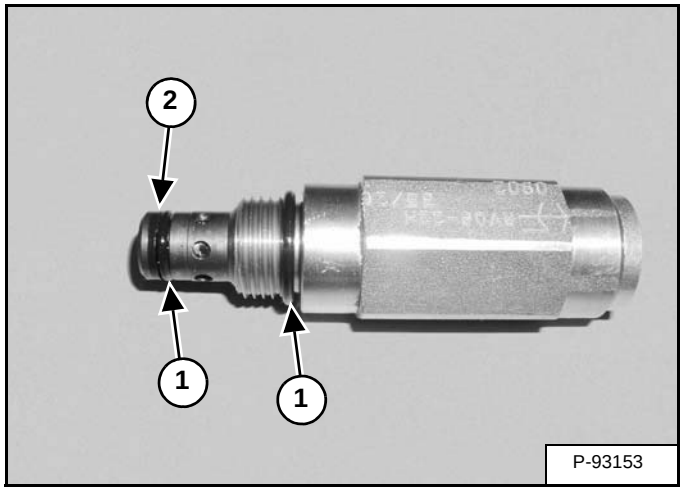
Disassembly And Assembly (Cont'd)

Figure 20-210-14



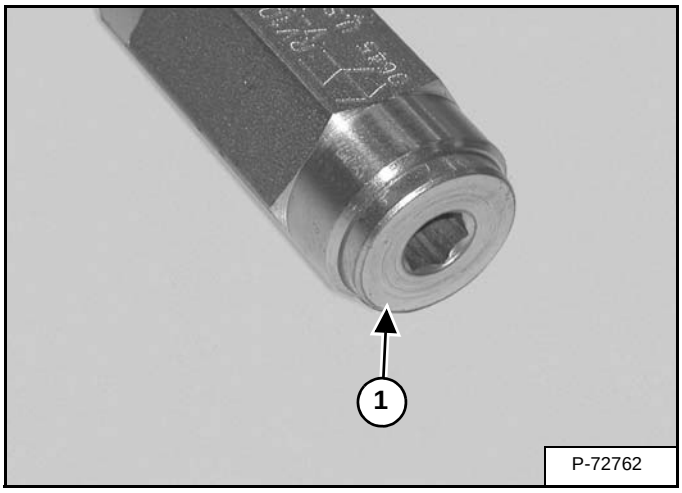
Remove the valve (Item 1) **[Figure 20-210-14]**.

Figure 20-210-15



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-210-15]**.

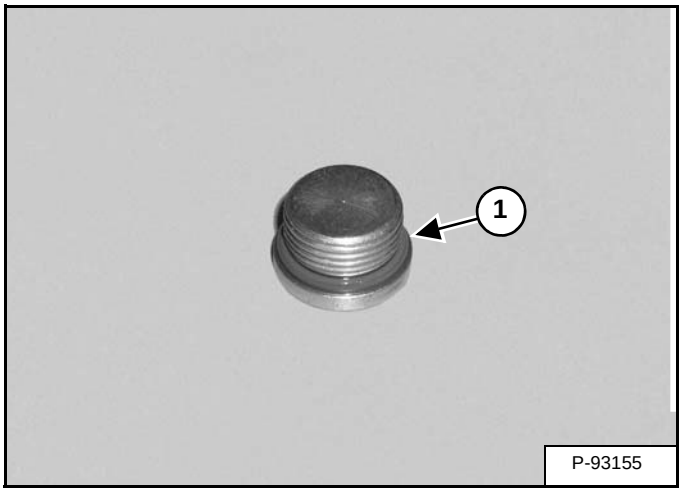
Figure 20-210-16



Remove the plug (Item 1) **[Figure 20-210-16]**.

Installation: Tighten the plug to 27,1 N•m (20 ft-lb) torque.

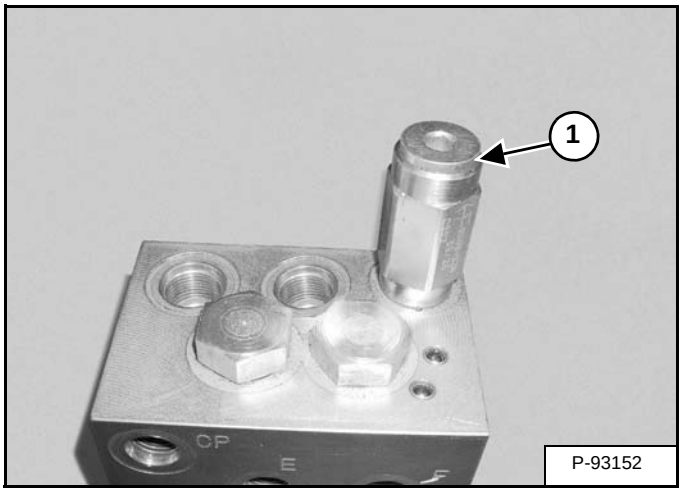
Figure 20-210-17



Remove the O-ring (Item 1) **[Figure 20-210-17]**.

Disassembly And Assembly (Cont'd)

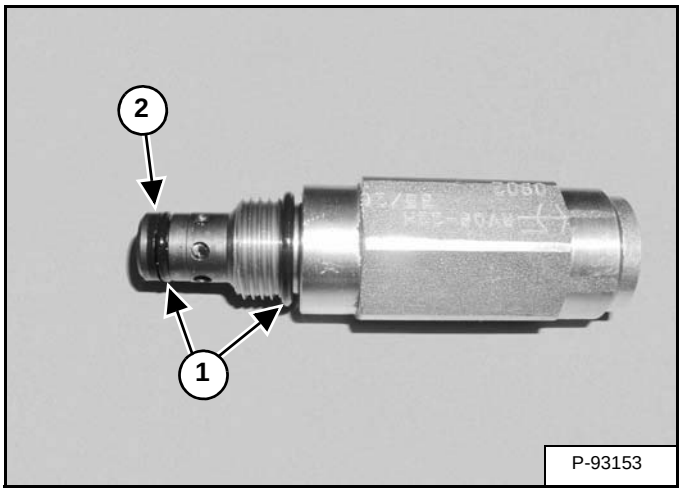
Figure 20-210-18



Remove the valve (Item 1) **[Figure 20-210-18]**.

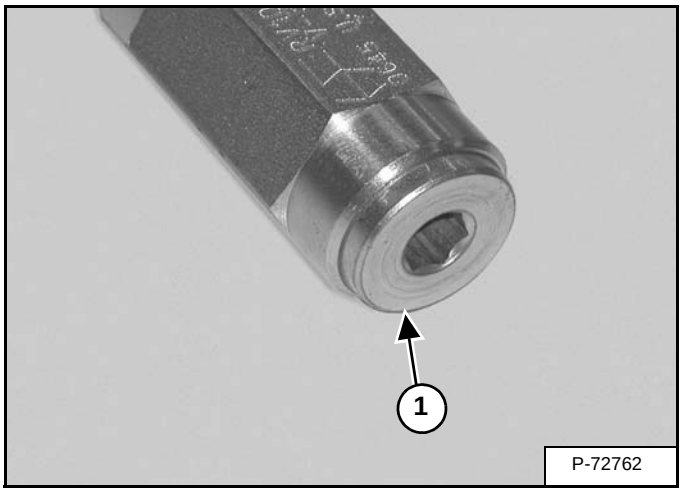
Installation: Tighten the valve to 41 - 47 N•m (30 - 35 ft-lb) torque.

Figure 20-210-19



Remove the O-ring (Item 1) and back-up rings (Item 2) **[Figure 20-210-19]**.

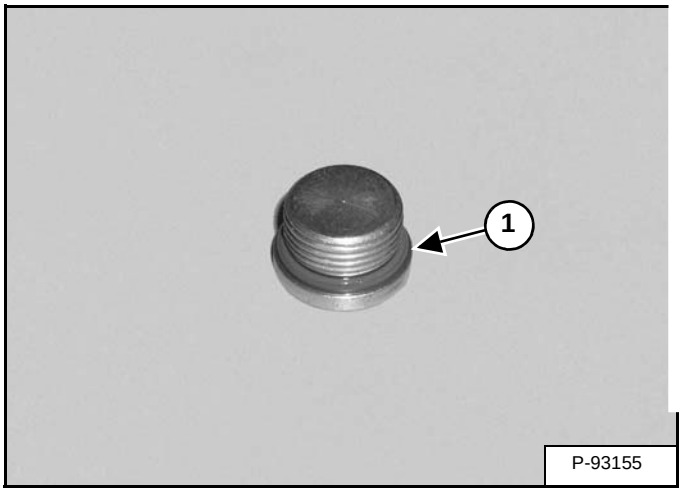
Figure 20-210-20



Remove the plug (Item 1) **[Figure 20-210-20]**.

Installation: Tighten the plug to 27,1 N•m (20 ft-lb) torque.

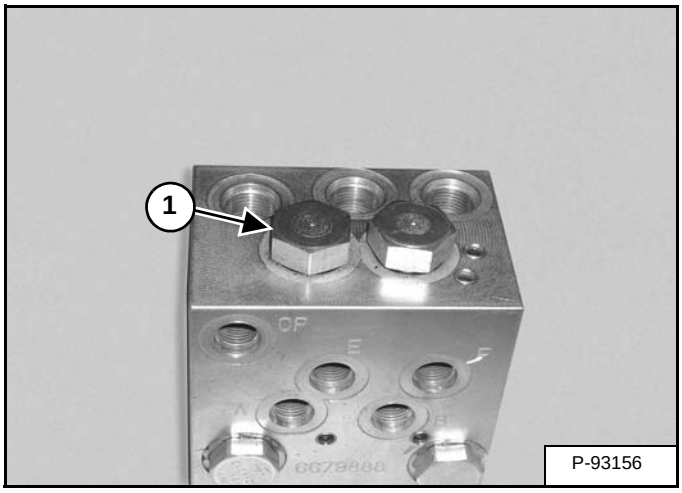
Figure 20-210-21



Remove the O-ring (Item 1) **[Figure 20-210-21]**.

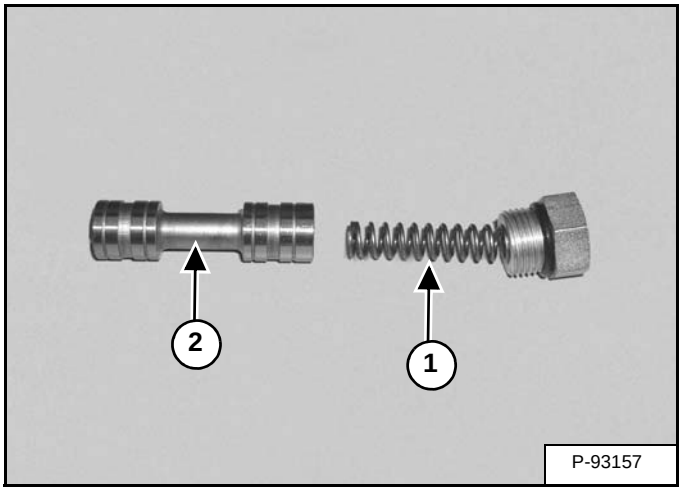
Disassembly And Assembly (Cont'd)

Figure 20-210-22



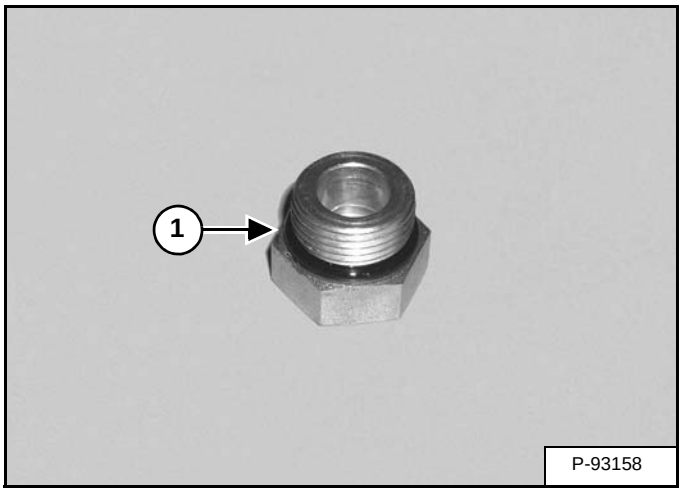
Remove the plug (Item 1) **[Figure 20-210-22]**.

Figure 20-210-23



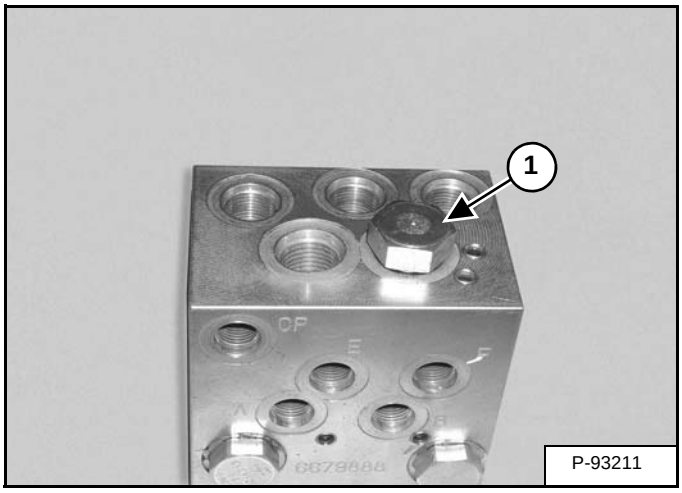
Remove the spring (Item 1) and spool (Item 2) **[Figure 20-210-23]**.

Figure 20-210-24



Remove the O-ring (Item 1) **[Figure 20-210-24]**.

Figure 20-210-25

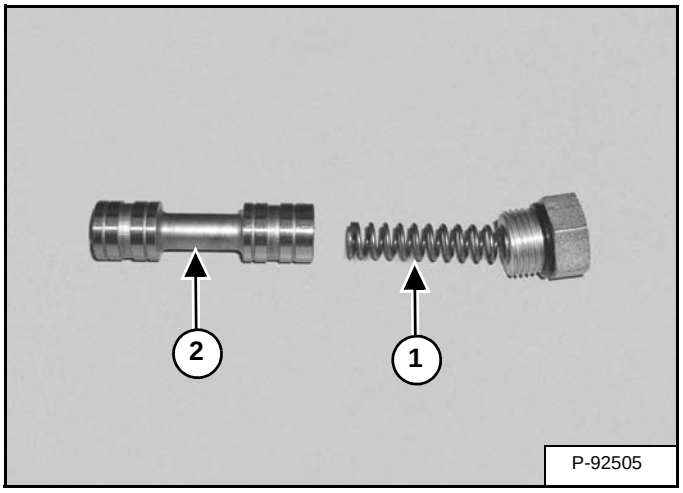


Remove the plug (Item 1) **[Figure 20-210-25]**.

SECONDARY AUXILIARY VALVE (EARLY MODELS) (CONT'D)

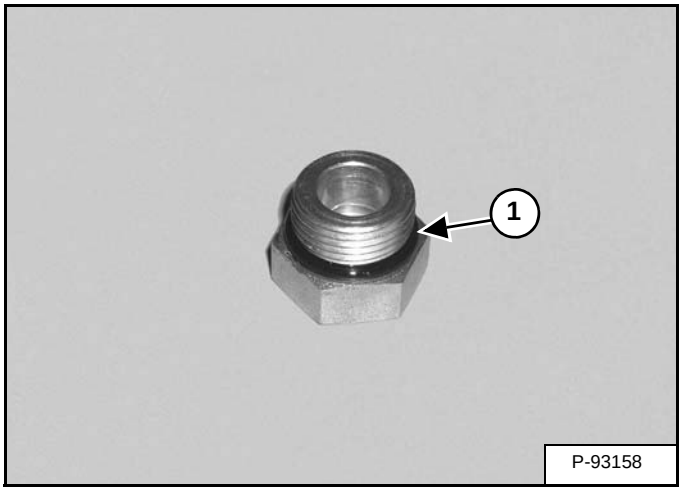
Disassembly And Assembly (Cont'd)

Figure 20-210-26



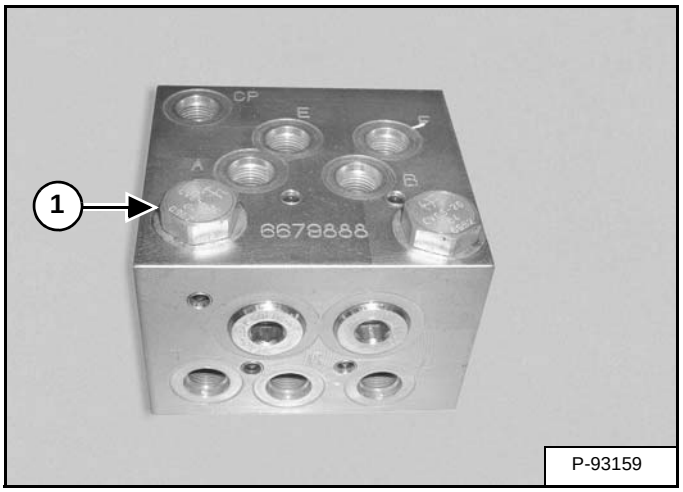
Remove the spring (Item 1) and spool (Item 2) **[Figure 20-210-26]**.

Figure 20-210-27



Remove the O-ring (Item 1) **[Figure 20-210-27]**.

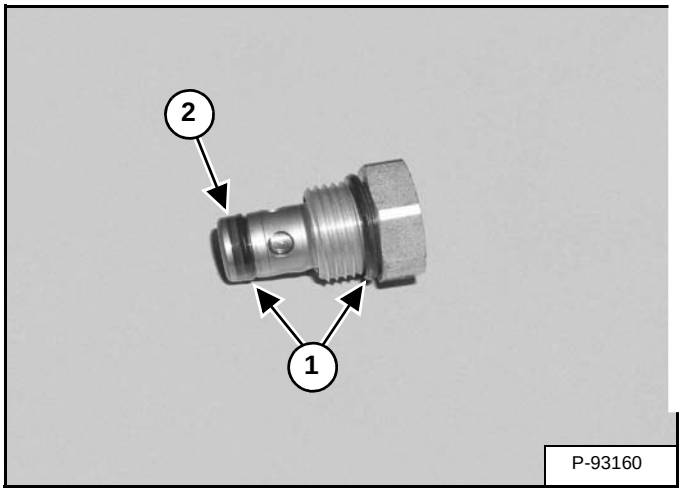
Figure 20-210-28



Remove the check valve (Item 1) **[Figure 20-210-28]**.

Installation: Tighten the check valve to 41 - 47 N•m (30 - 35 ft-lb) torque.

Figure 20-210-29

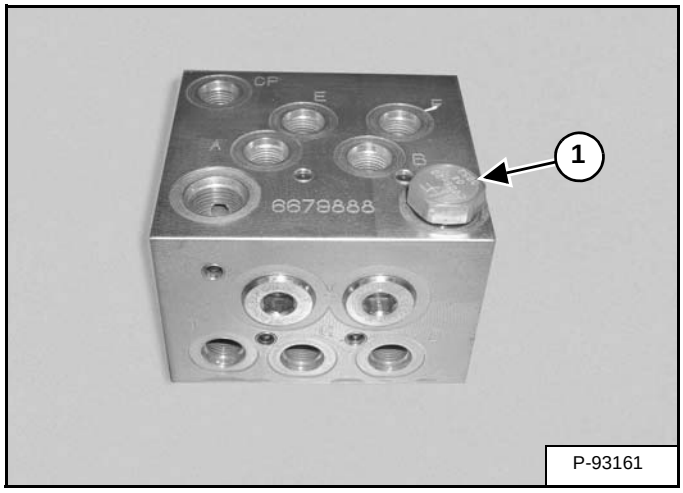


Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-210-29]**.

SECONDARY AUXILIARY VALVE (EARLY MODELS) (CONT'D)

Disassembly And Assembly (Cont'd)

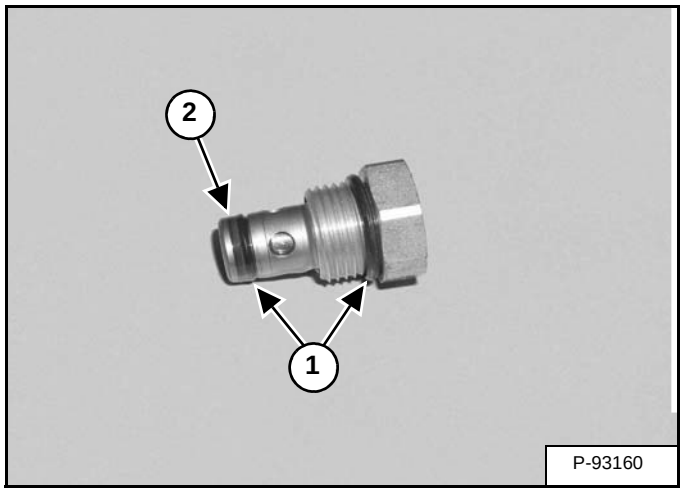
Figure 20-210-30



Remove the check valve (Item 1) **[Figure 20-210-30]**.

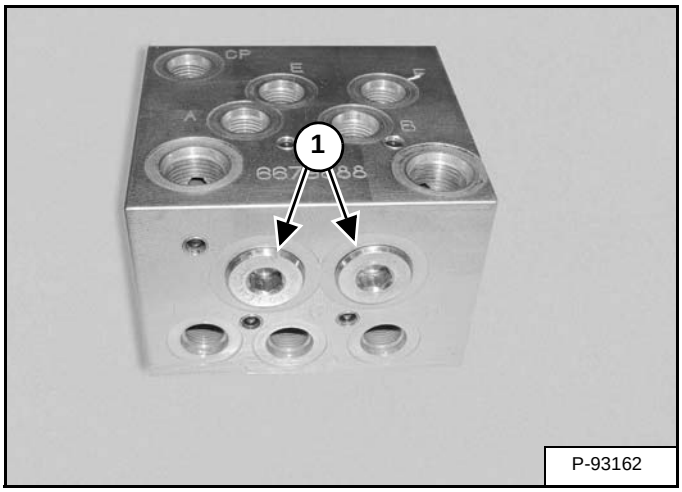
Installation: Tighten the check valve to 41 - 47 N•m (30 - 35 ft-lb) torque.

Figure 20-210-31



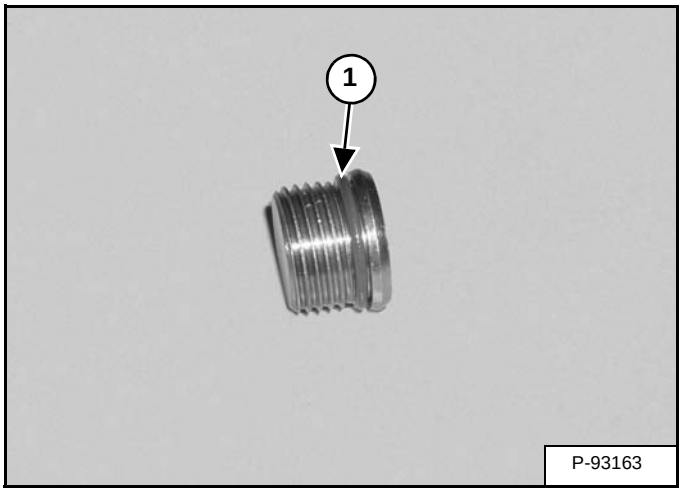
Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-210-31]**.

Figure 20-210-32



Remove the plugs (Item 1) **[Figure 20-210-32]**.

Figure 20-210-33



Remove the O-rings (Item 1) **[Figure 20-210-33]**.

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.

SECONDARY AUXILIARY VALVE (LATER MODELS)

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.

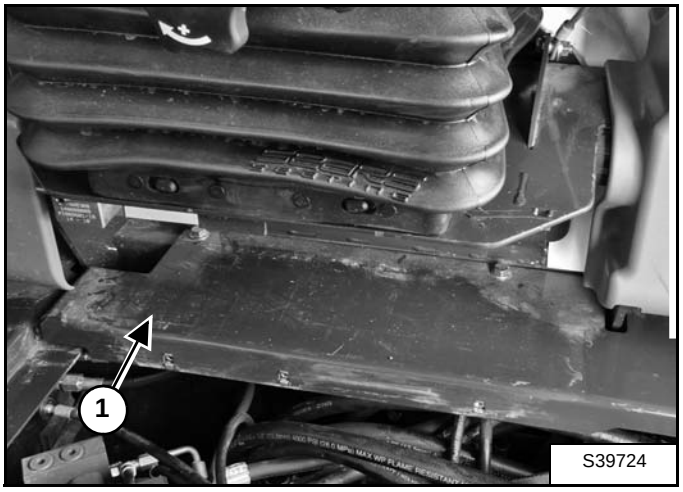
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Drain the hydraulic reservoir. (See Removal And Installation on Page 20-130-1.)

Remove the left upper structure cover. (See Removal And Installation on Page 40-70-1.)

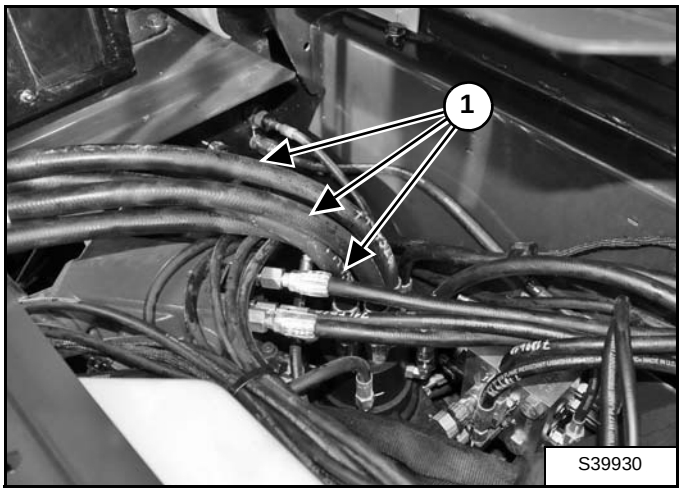
Remove the tool box. (See Removal And Installation on Page 40-220-1.)

Figure 20-211-1



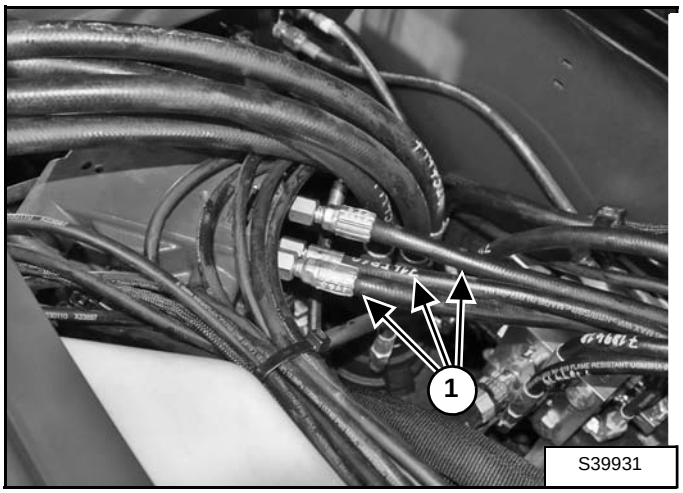
Remove the rear cover (Item 1) **[Figure 20-211-1]**.

Figure 20-211-2



Mark, disconnect and plug the three hoses (Item 1) **[Figure 20-211-2]** for easier access. (See Removal And Installation on Page 20-40-1.)

Figure 20-211-3

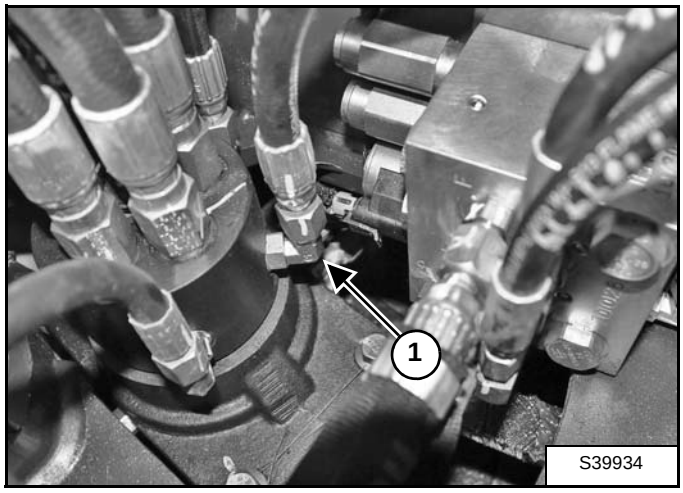


Mark, disconnect and plug the hoses from the slew motor (Item 1) **[Figure 20-211-3]** for easier access.

SECONDARY AUXILIARY VALVE (LATER MODELS) (CONT'D)

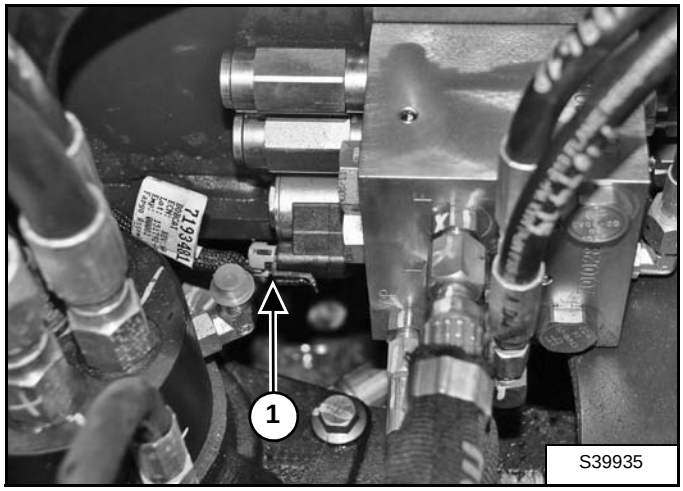
Removal And Installation (Cont'd)

Figure 20-211-4



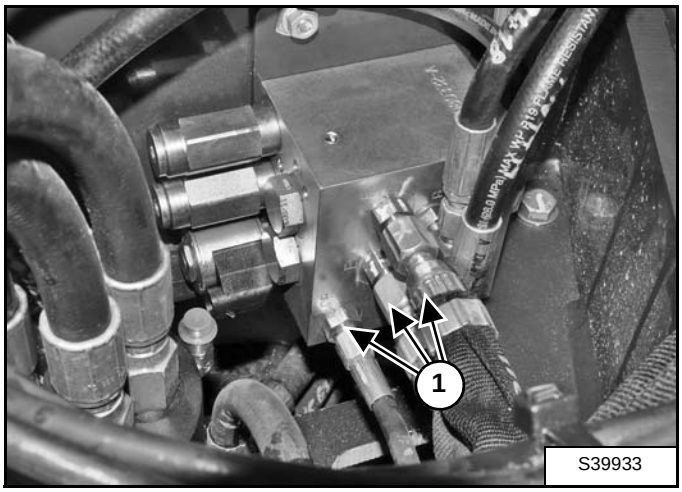
Mark, disconnect and plug the hose (Item 1) **[Figure 20-211-4]**. Plug the fitting.

Figure 20-211-5



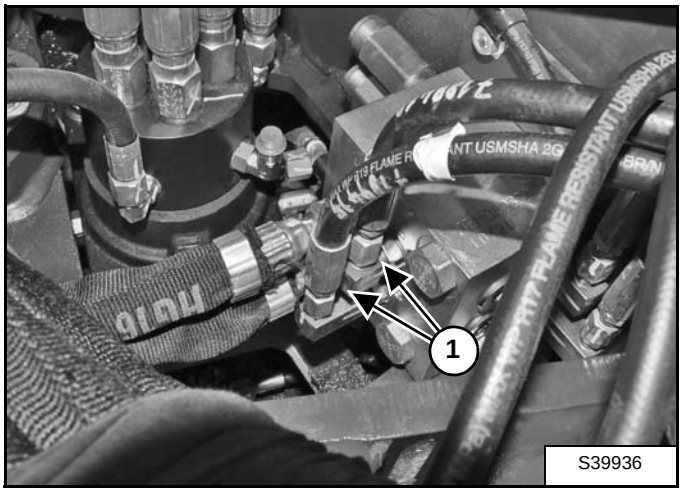
Remove the solenoid wire harness (Item 1) **[Figure 20-211-5]**.

Figure 20-211-6



Mark, disconnect and plug the hoses (Item 1) **[Figure 20-211-6]**.

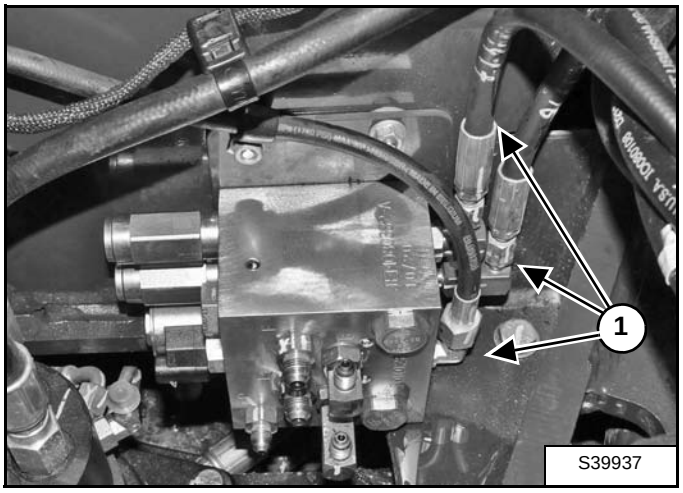
Figure 20-211-7



Mark, disconnect and plug the hoses (Item 1) **[Figure 20-211-7]**.

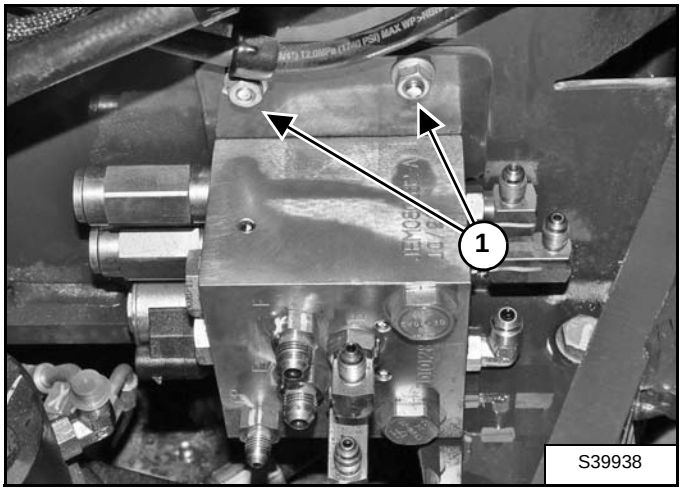
Removal And Installation (Cont'd)

Figure 20-211-8



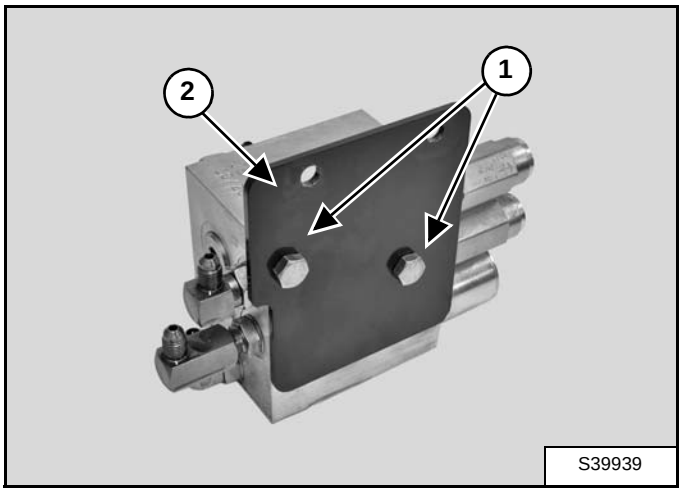
Mark, disconnect and plug the hoses (Item 1) **[Figure 20-211-8]**.

Figure 20-211-9



Remove the two bolts and nuts (Item 1) **[Figure 20-211-9]** and remove the secondary auxiliary valve.

Figure 20-211-10

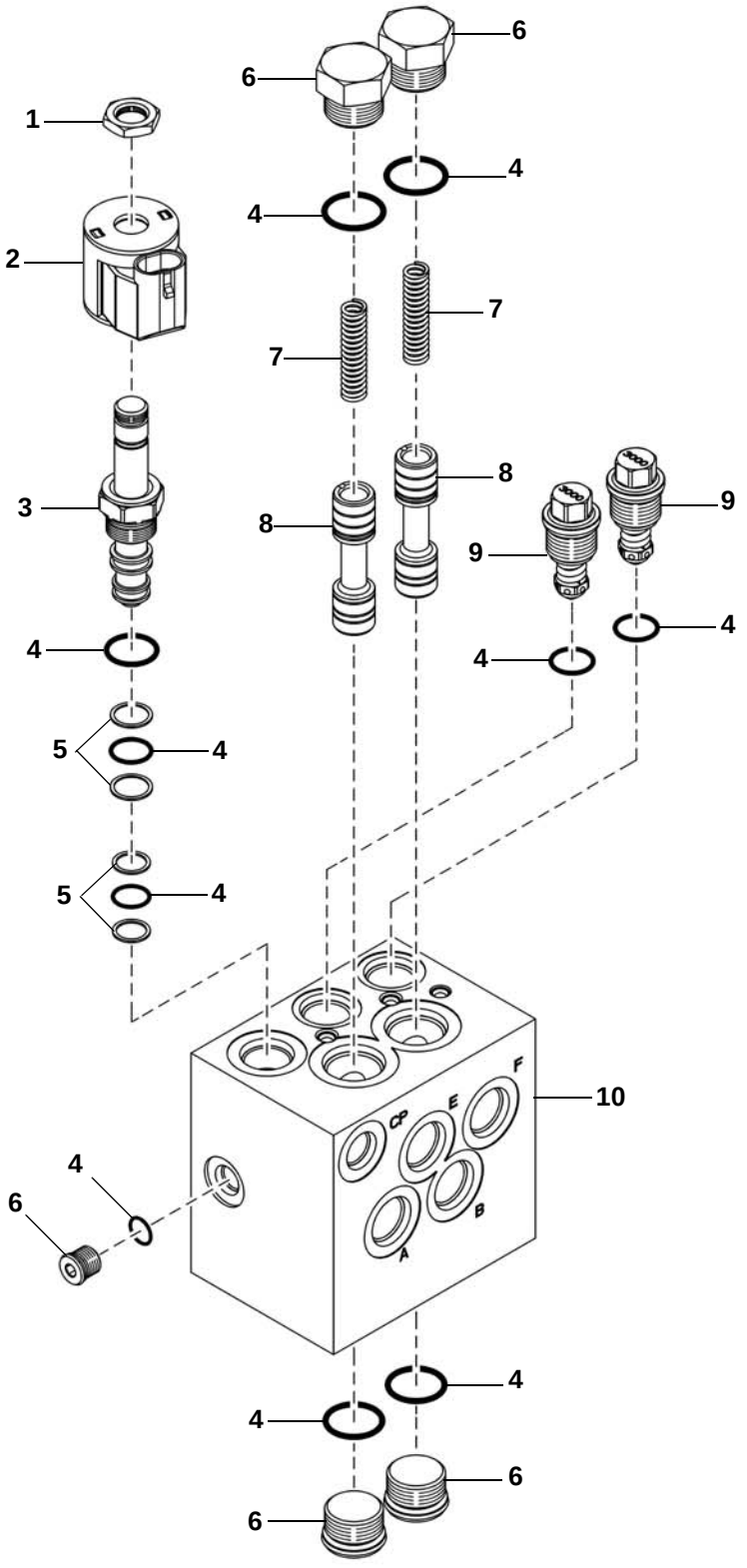


Remove the bolts (Item 1) and plate (Item 2) **[Figure 20-211-10]**.

SECONDARY AUXILIARY VALVE (LATER MODELS) (CONT'D)

Parts Identification

1. Nut
2. Coil
3. Solenoid
4. O-ring
5. Back-up Ring
6. Plug
7. Spring
8. Spool
9. Relief Valve
10. Body



Disassembly And Assembly

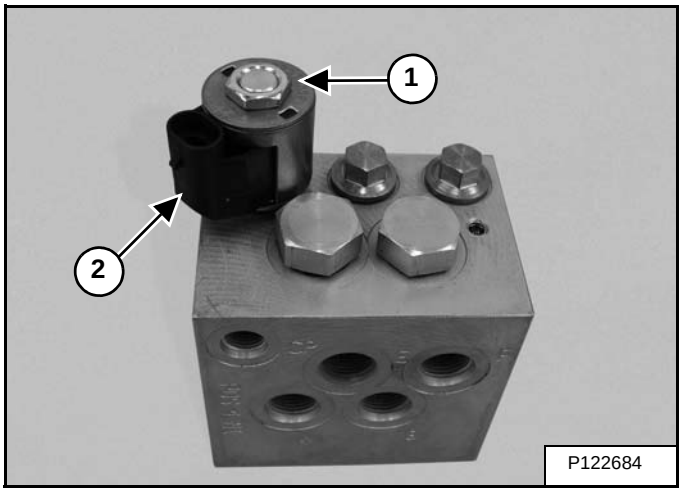
IMPORTANT

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

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- Clean all parts in solvent and dry with compressed air.
- Inspect all parts for wear or damage. Replace any worn or damaged parts.
- Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

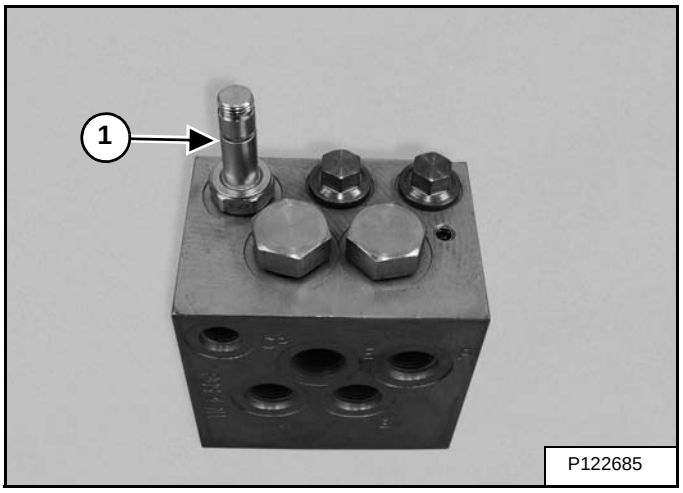
Figure 20-211-11



Remove the nut (Item 1) and coil (Item 2) **[Figure 20-211-11]**.

Installation: Tighten the nut to 7 N•m (5 ft-lb) torque.

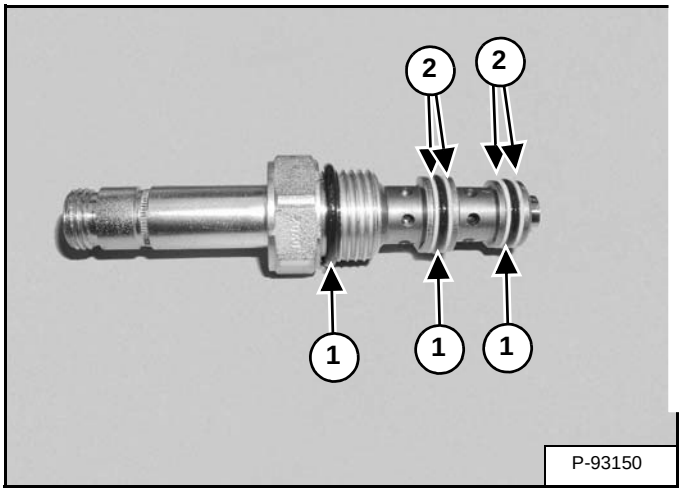
Figure 20-211-12



Remove the solenoid (Item 1) **[Figure 20-211-12]**.

Installation: Tighten the solenoid to 24 - 30 N•m (18 - 22 ft-lb) torque.

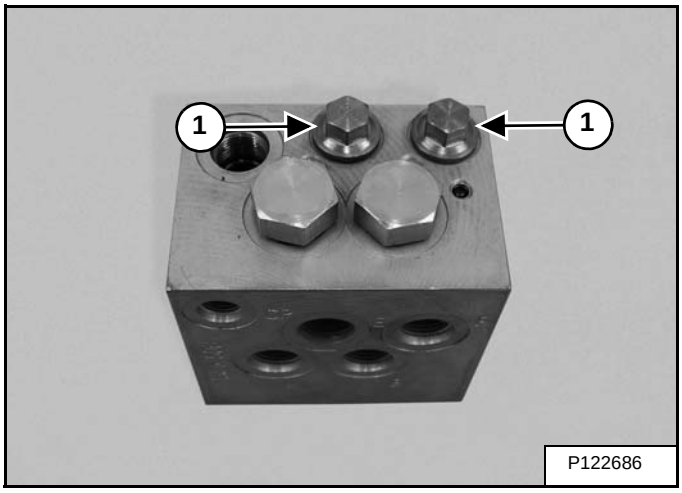
Figure 20-211-13



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-211-13]**.

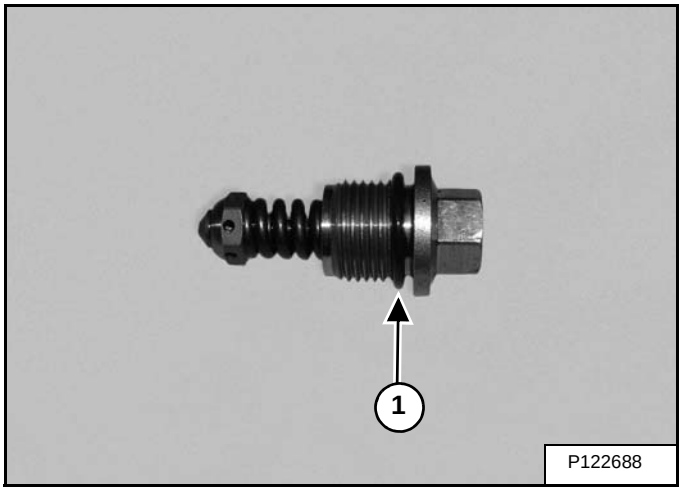
Disassembly And Assembly (Cont'd)

Figure 20-211-14



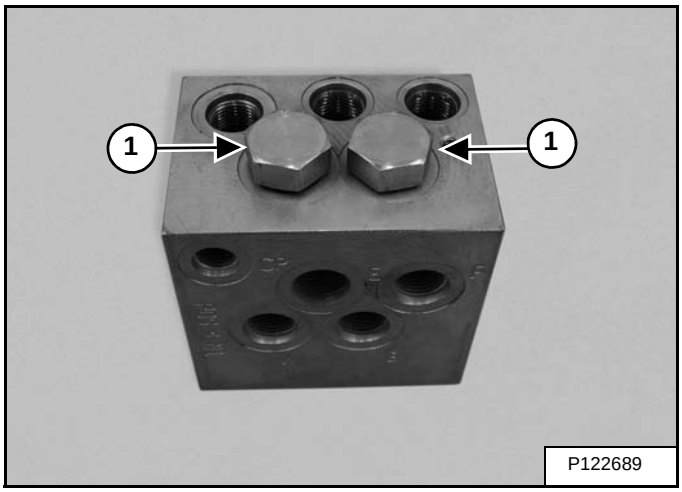
Remove the relief valves (Item 1) **[Figure 20-211-14]**.

Figure 20-211-15



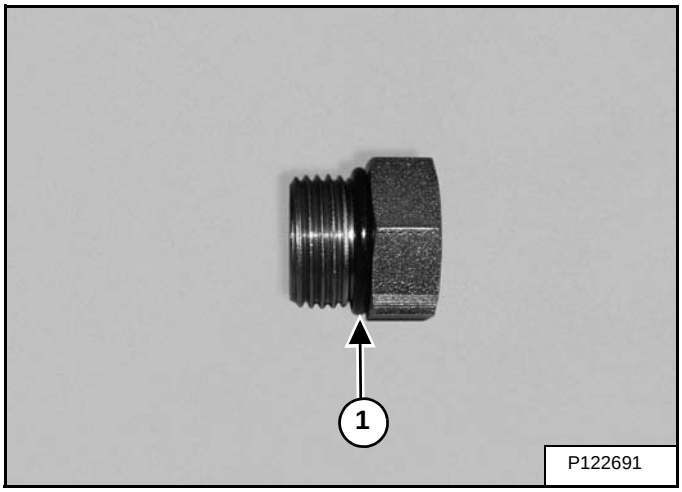
Remove the O-ring (Item 1) **[Figure 20-211-15]**.

Figure 20-211-16



Remove the plugs (Item 1) **[Figure 20-211-16]**.

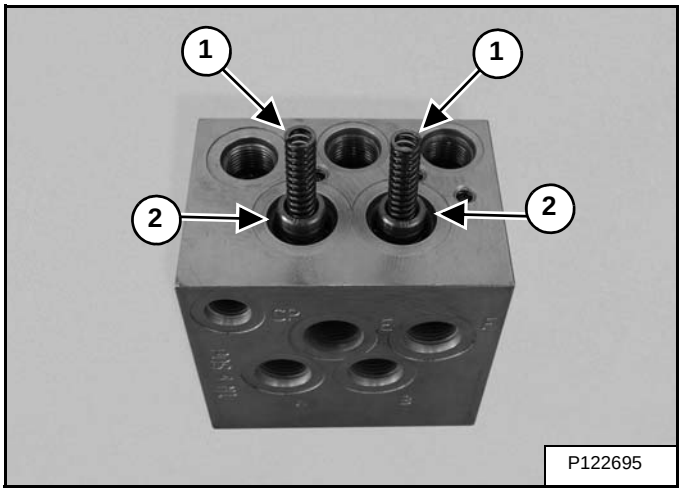
Figure 20-211-17



Remove the O-ring (Item 1) **[Figure 20-211-17]**.

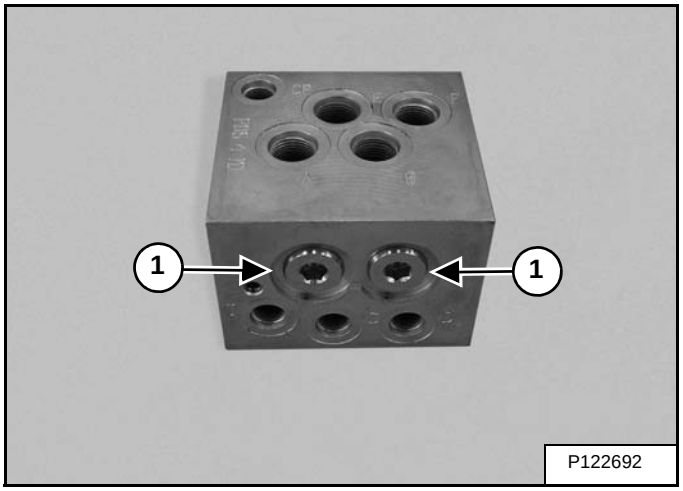
Disassembly And Assembly (Cont'd)

Figure 20-211-18



Remove the springs (Item 1) and spools (Item 2) **[Figure 20-211-18]**.

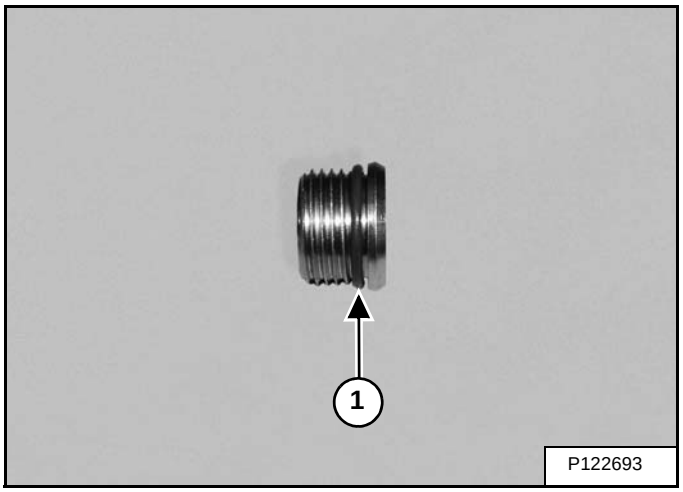
Figure 20-211-19



Remove the plugs (Item 1) **[Figure 20-211-19]**.

Tighten the plugs to 96 - 107 N•m (71 - 79 ft-lb) torque.

Figure 20-211-20



Remove the O-rings (Item 1) **[Figure 20-211-20]**.

Clean all parts in solvent and dry with compressed air.

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

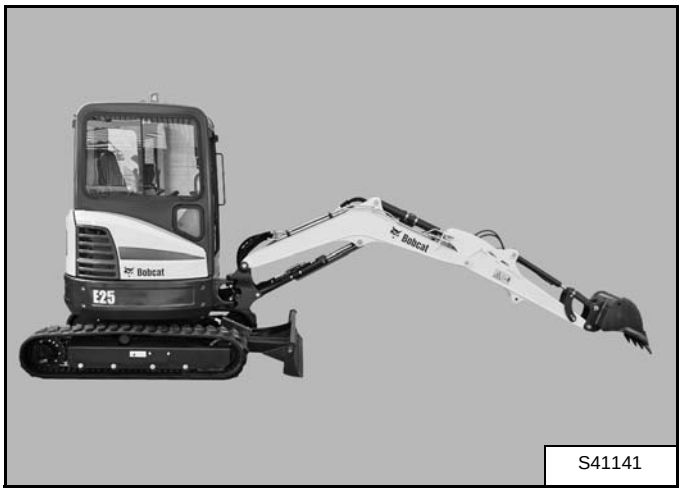
Always install new O-rings. Lubricate the O-rings wit clean hydraulic fluid before installation.


Bobcat®

VALVE (BOOM LOCK)

Removal And Installation

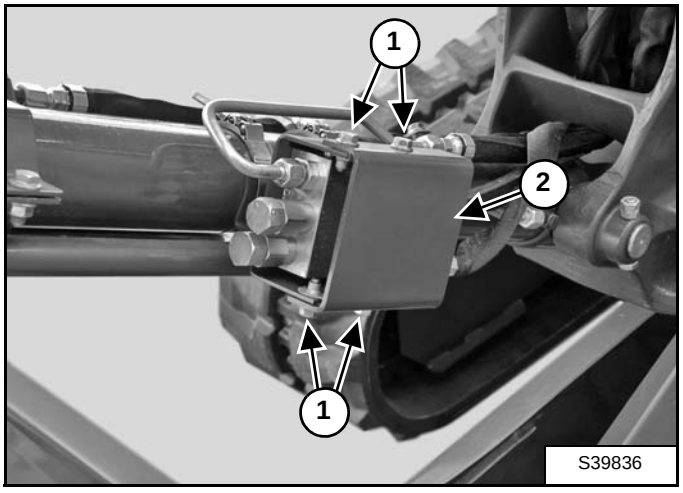
Figure 20-220-1



Lower the work group to the earth **[Figure 20-220-1]**.

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

Figure 20-220-2



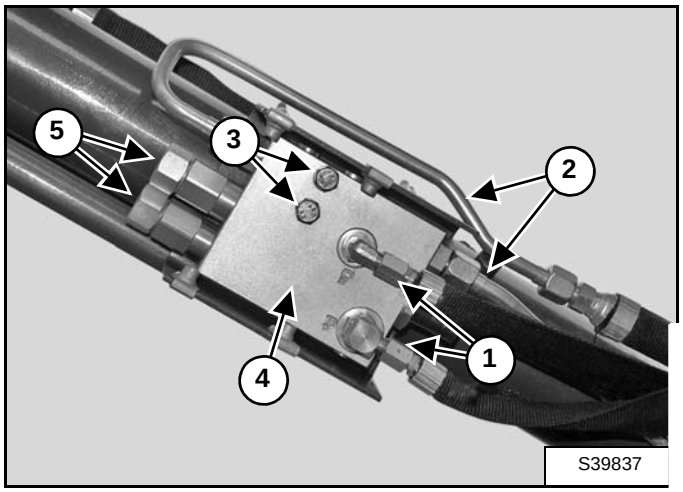
Remove the four bolts (Item 1) and cover (Item 2) **[Figure 20-220-2]**.

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 20-220-3



Remove the hoses (Item 1) **[Figure 20-220-3]**.

Remove the tubelines (Item 2) **[Figure 20-220-3]**.

Remove the nuts (Item 3) and bolts. Remove the valv (Item 4) **[Figure 20-220-3]**.

The load holding valve is not serviceable. If the relief valves (Item 5) **[Figure 20-220-3]** have been tampered with, the complete valve assembly must be replaced.


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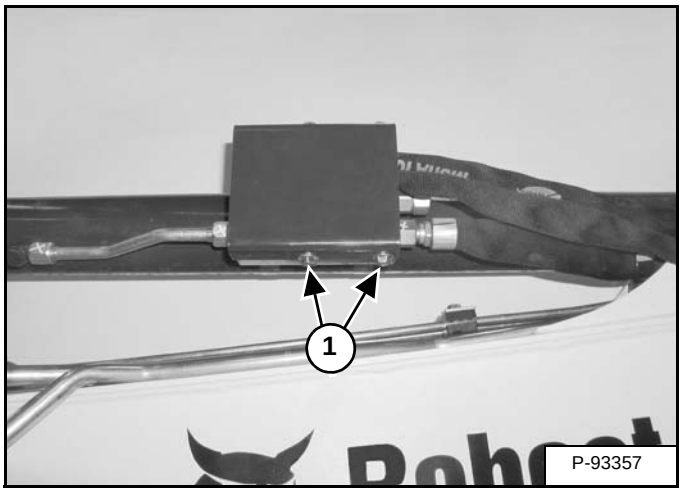
VALVE (ARM LOCK)

Removal And Installation

Lower the work equipment to the earth.

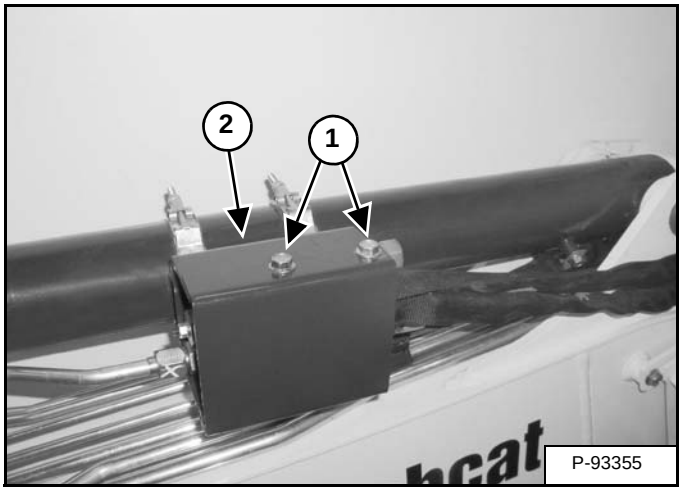
With the engine off, turn the key switch to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-221-1



Remove the bolts (Item 1) **[Figure 20-221-1]**.

Figure 20-221-2



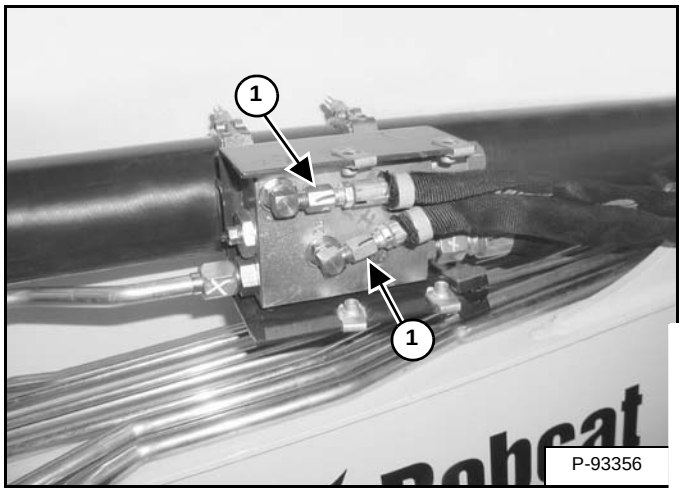
Remove the bolts (Item 1) and cover (Item 2) **[Figure 20-221-2]**.

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.

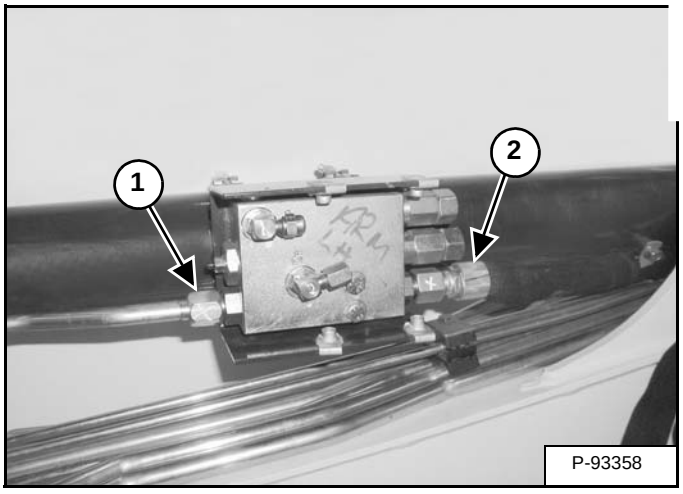
I-2003-0888

Figure 20-221-3



Remove the hoses (Item 1) **[Figure 20-221-3]**.

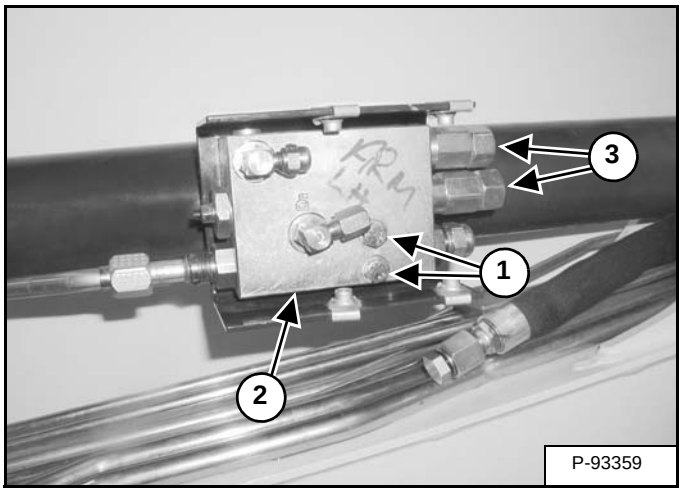
Figure 20-221-4



Remove the tubeline (Item 1) and hose (Item 2) **[Figure 20-221-4]**.

Removal And Installation (Cont'd)

Figure 20-221-5



Remove the bolts (Item 1) and nuts. Remove the valve (Item 2) **[Figure 20-221-5]**.

The load holding valve is not serviceable. If the relief valves (Item 3) **[Figure 20-221-5]** have been tampered with, the complete valve assembly must be replaced.

UNDERCARRIAGE

BLADE 30-10-1
Removal And Installation 30-10-1

TRACK UNDERCARRIAGE COMPONENTS 30-20-1
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Swing Bearing Removal 30-40-1
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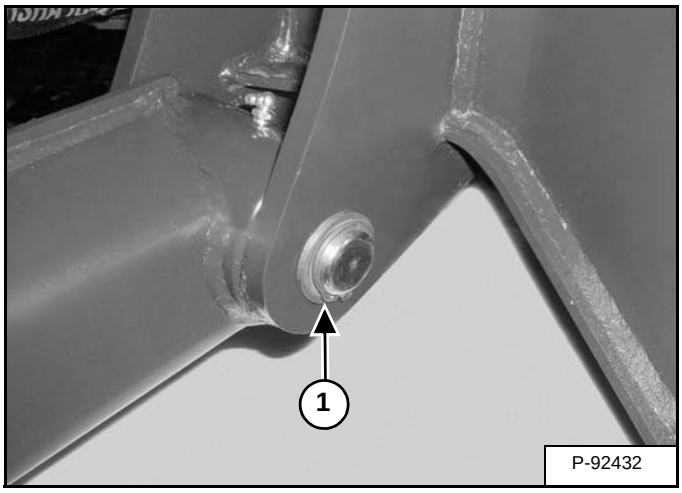
BLADE

Removal And Installation

Lower the blade and bucket to the earth.

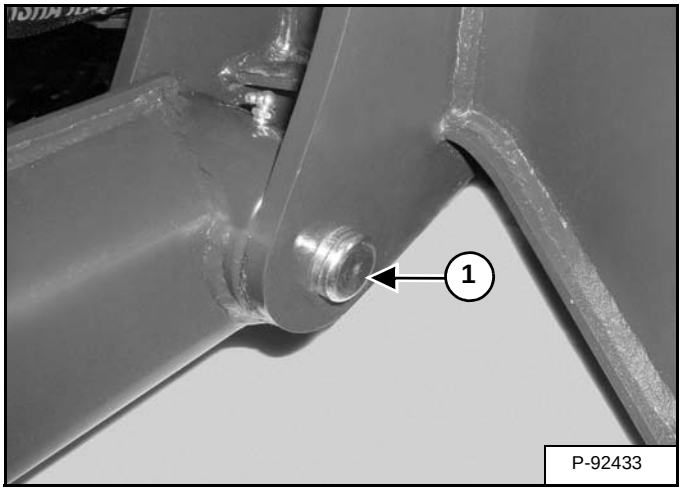
Remove the blade cylinder. (See Removal And Installation on Page 20-24-3.)

Figure 30-10-1



Remove the snap ring (Item 1) **[Figure 30-10-1]** and washer from the blade arm pivot 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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TRACK UNDERCARRIAGE COMPONENTS

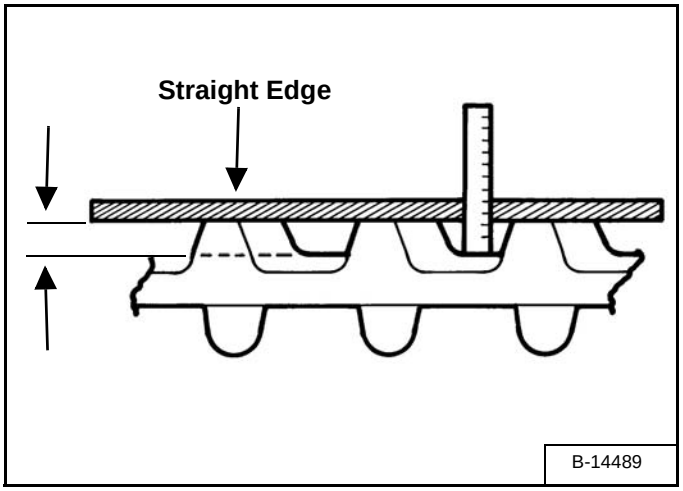
Description

The track undercarriage components consist of the front idler, top sliders, bottom rollers, drive motor and track frame.

Track Lug Height

The lug height of a new rubber track is 25 mm (0.984 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 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.

Checking Tension

NOTE: The wear of the pins and bushings on the undercarriage vary with the working conditions and the different types of soil conditions. It is necessary to inspect track tension to maintain the correct tension. See service schedule for the correct service interval. (See Maintenance Intervals on Page 10-50-1.)

Raise the side of the machine (approximately 102 mm [4 in]) using the boom and arm.

Figure 30-20-2

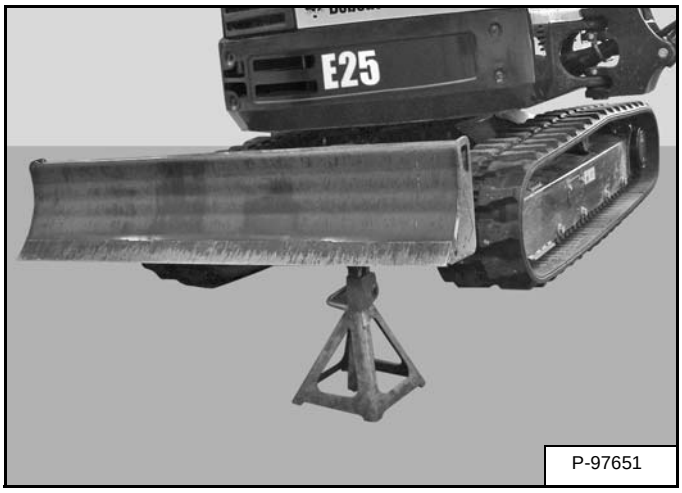
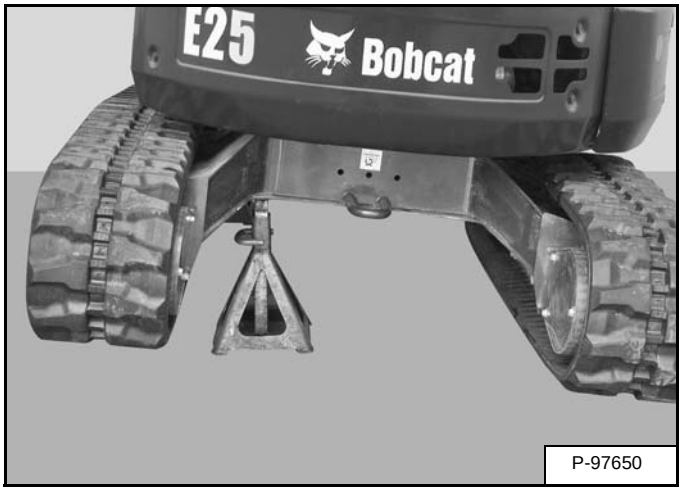


Figure 30-20-3



Raise the blade fully and install jackstands **[Figure 30-20-2]** and **[Figure 30-20-3]** under the blade and track frame. Raise the boom until all machine weight is on the jackstands.

Stop the engine.

⚠ WARNING

AVOID INJURY

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

W-2142-0903

Rubber Track Clearance

Figure 30-20-4

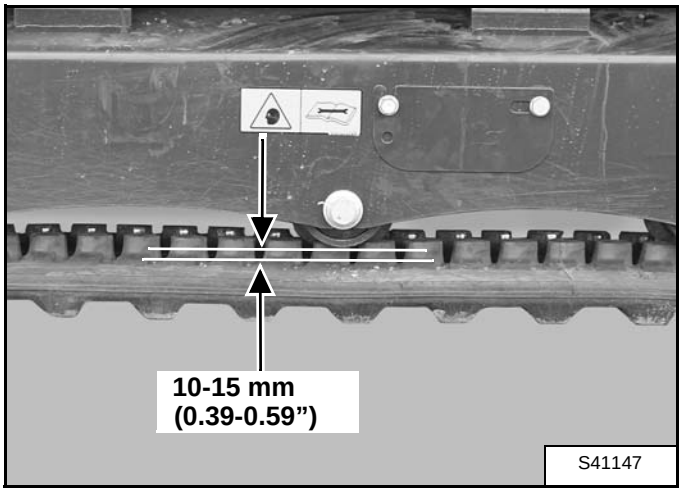
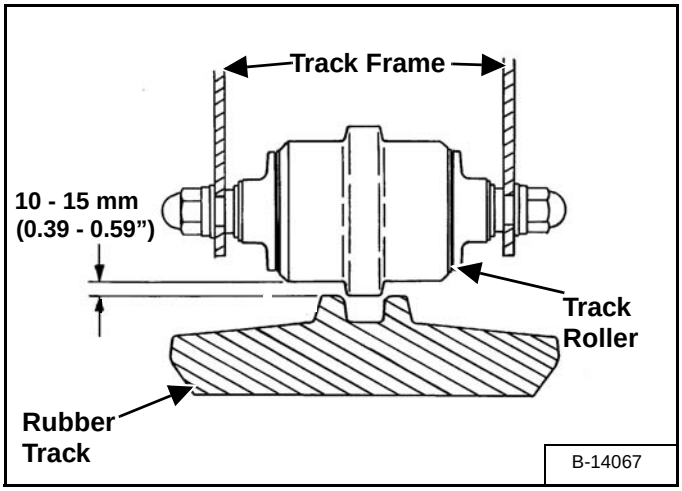


Figure 30-20-5

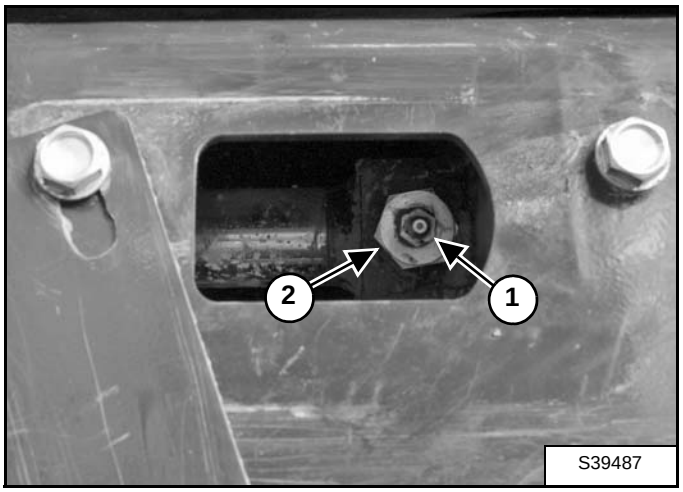


Measure the clearance at the middle track roller. Do not get fingers into pinch points between the track and the track roller. Use a bolt or a dowel of the appropriate size to check the gap between the contact edge of the roller and the top edge of the track guide **[Figure 30-20-4]** and **[Figure 30-20-5]**.

Track Clearance	10 - 15 mm (0.39 - 0.59 in)

Adjusting Tension

Figure 30-20-6



Loosen the access cover bolts and pivot the access cover open **[Figure 30-20-6]**.

Increase Track Tension

Add grease to the fitting (Item 1) **[Figure 30-20-6]** until the track tension is correct.

Decrease Track Tension

⚠ WARNING

AVOID INJURY OR DEATH

If grease fitting is removed before pressure is released, the fitting can come off with great force and cause serious injury or death.

W-2490-0104

Pressure must be released from the grease cylinder to decrease track tension.

Loosen the bleed fitting (NOT the grease fitting) (Item 2) **[Figure 30-20-6]** and release pressure until the track tension is correct.

NOTE: Do not loosen the bleed fitting (Item 2) [Figure 30-20-6] for more than eight turns.

Tighten the bleed fitting to 80 - 100 N•m (59 - 74 ft-lb torque.

Pivot the access cover closed and tighten the acces cover bolts.

Raise the machine and remove the jackstands.

Repeat the procedure for the other side.

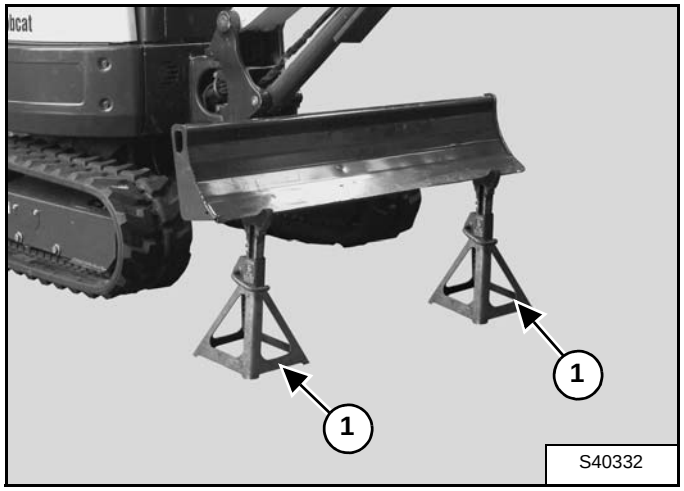
Dispose of grease in an environmentally safe manner.

Track Removal And Installation

Lift and block both sides of the machine as follows:

Raise the blade fully.

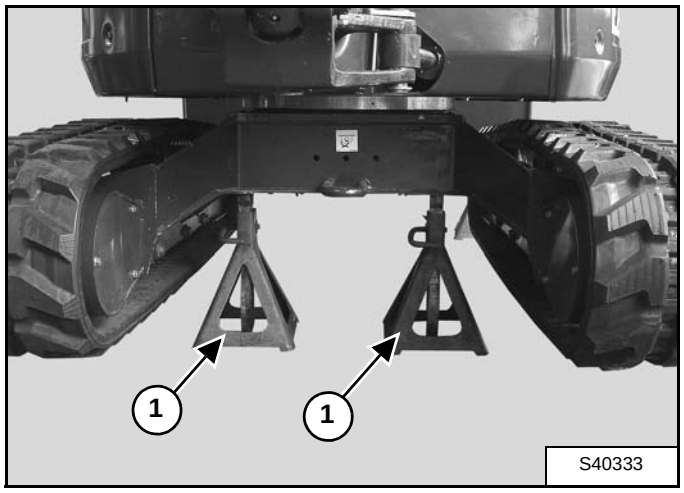
Figure 30-20-7



Use the boom and arm to lift the blade end of the machine up about 75 mm (3.0 in) and install jackstands (Item 1) **[Figure 30-20-7]** under the blade.

Raise the boom.

Figure 30-20-8



Swing the upperstructure 180° and use the boom and arm to slowly lift the opposite end of the undercarriage and install jackstands under the undercarriage **[Figure 30-20-8]**.

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.)

With the excavator raised and the bleed fitting loosened, start the excavator.

Slowly turn the track in the forward direction.

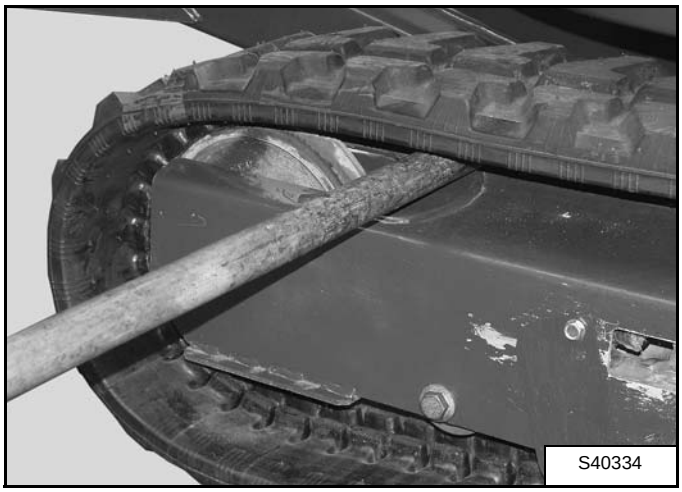
⚠ WARNING

AVOID INJURY OR DEATH

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

W-2173-0195

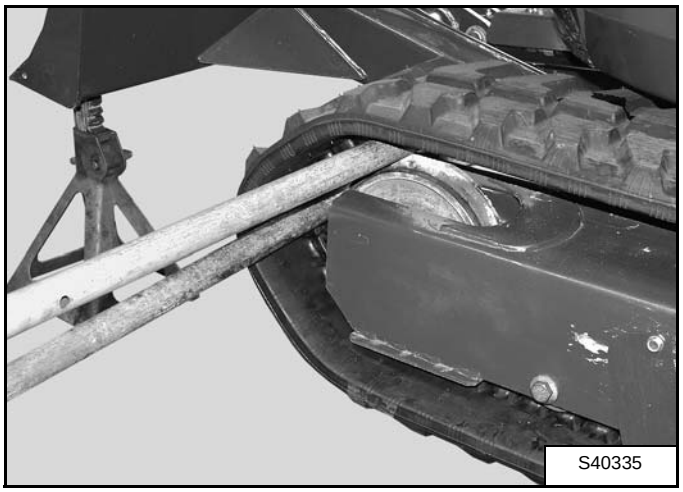
Figure 30-20-9



Insert a steel rod or pipe. (Approximately 30 mm [1.250 in] diameter) between the track and the idler wheel **[Figure 30-20-9]**.

Track Removal And Installation (Cont'd)

Figure 30-20-10



Insert a second steel rod or pipe, at a distance of two lugs, between the track and the idler wheel **[Figure 30-20-10]**. Continue to turn the track until the first pipe contacts the track frame.

Stop the engine.

Figure 30-20-11



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 30-20-11]**.

Remove the track.

To install the rubber track:

Put the track over the rear drive sprocket lugs.

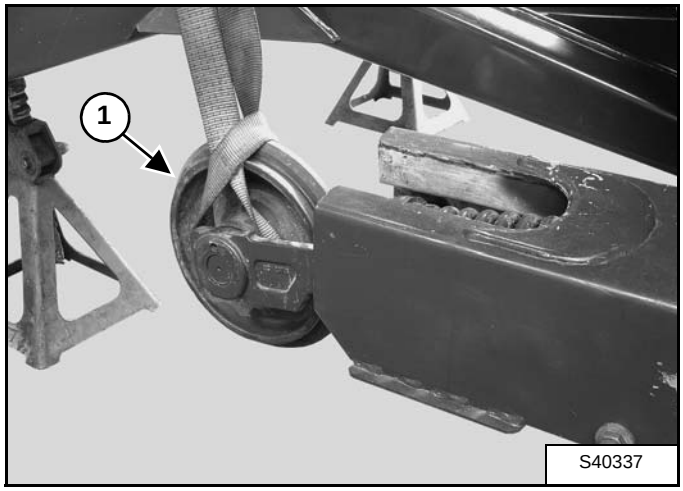
Put the front of the track onto the front idler wheel.

Adding grease to the track tensioner. (See Adjustin Tension on Page 30-20-3.)

Idler Removal And Installation

Remove the track. (See Track Removal And Installation on Page 30-20-4.)

Figure 30-20-12

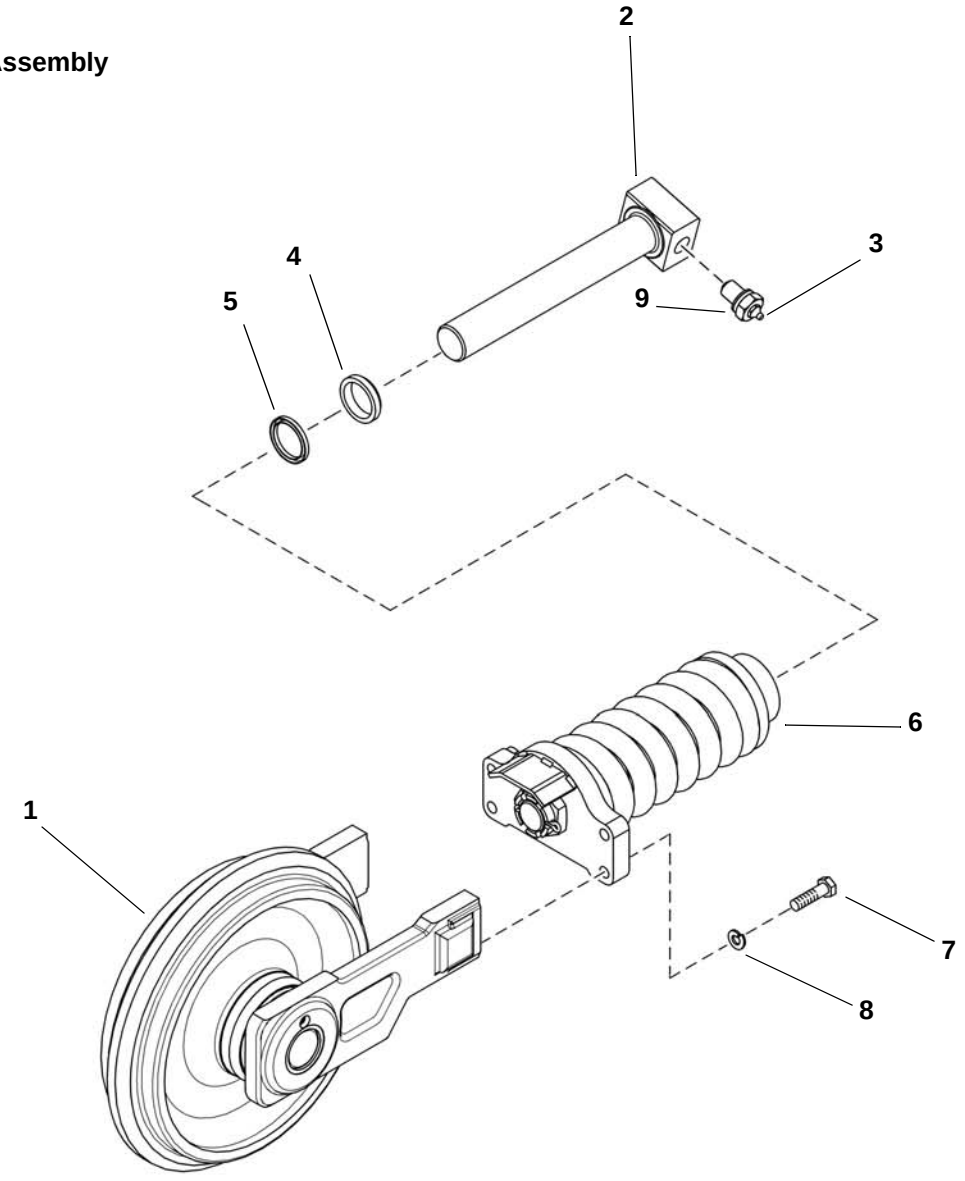


Install a strap and hoist to the track idler (Item 1) **[Figure 30-20-12]**.

Slide the track idler (Item 1) **[Figure 30-20-12]** out of the track frame.

Idler Parts Identification

1. Idler Assembly
2. Tensioner Rod
3. Grease Fitting
4. Wiper Seal
5. O-ring
6. Coil Spring Assembly
7. Bolt
8. Washer
9. Bleed Valve

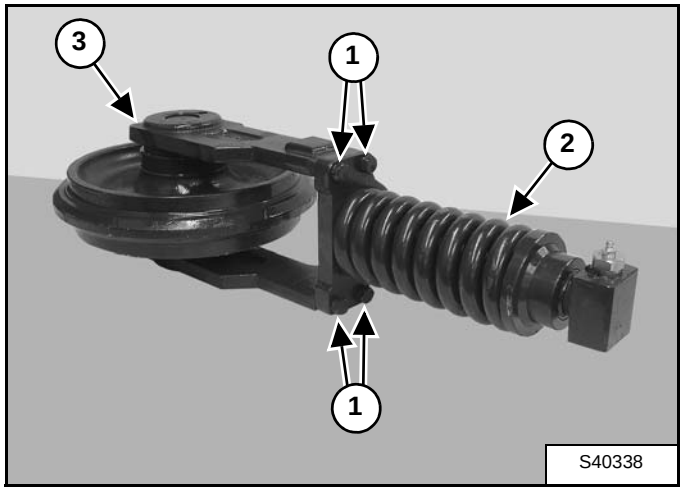


NA6066S

Track Idler Disassembly

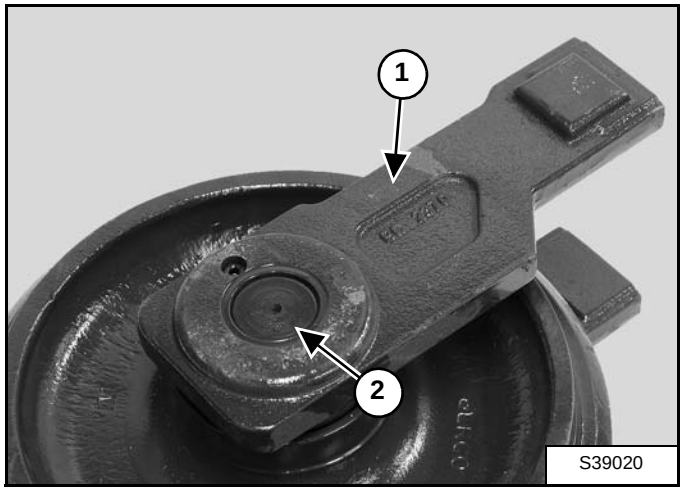
Remove the track idler. (See Idler Removal And Installation on Page 30-20-6.)

Figure 30-20-13



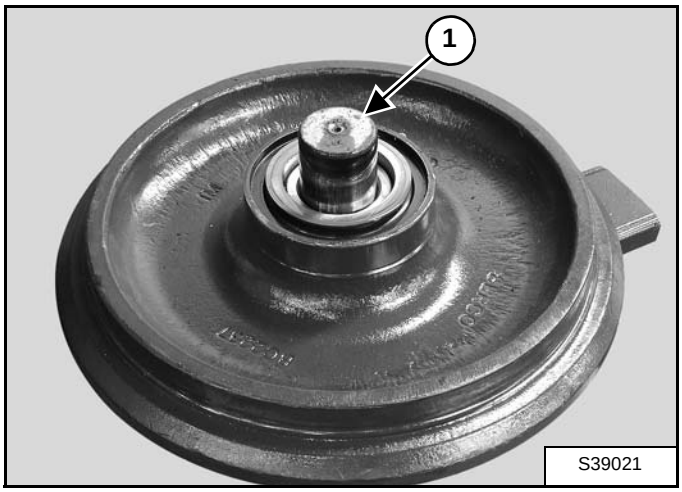
Remove the four bolts (Item 1) and remove the track tensioner (Item 2) from the track idler (Item 3) **[Figure 30-20-13]**.

Figure 30-20-14



Apply heat and remove the block (Item 1) from both sides of the shaft (Item 2) **[Figure 30-20-14]** using a puller.

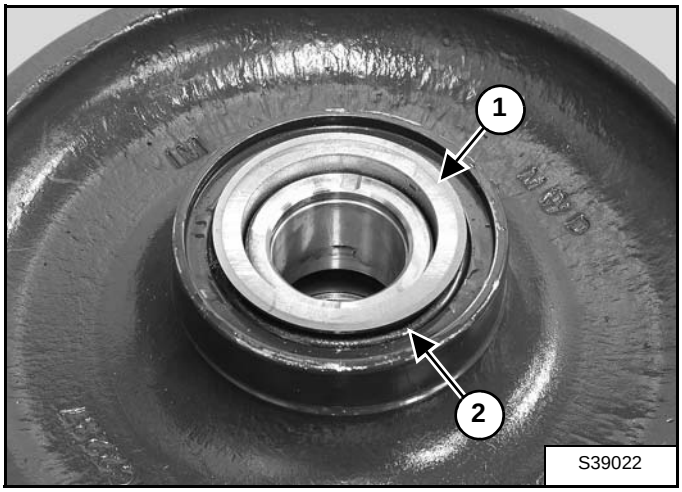
Figure 30-20-15



Remove any corrosion or paint from both ends of the exposed shaft (Item 1) **[Figure 30-20-15]** that could affect seal removal or damage the new seal during installation.

Remove the shaft (Item 1) **[Figure 30-20-15]** from the idler.

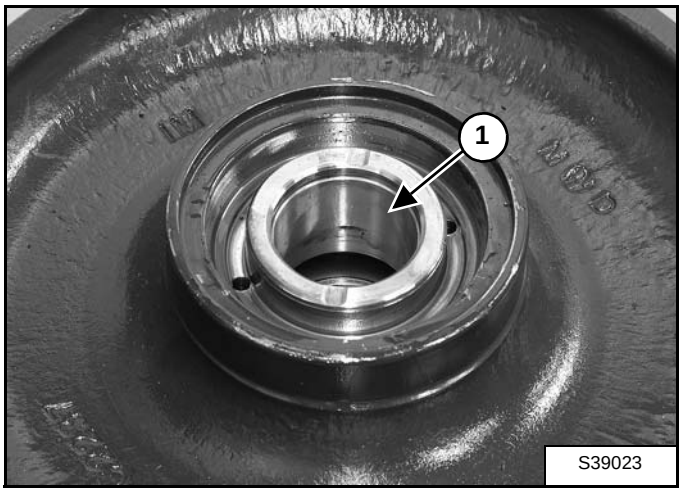
Figure 30-20-16



Remove the spacer (Item 1) and O-ring (Item 2) **[Figure 30-20-16]** from both sides of the idler.

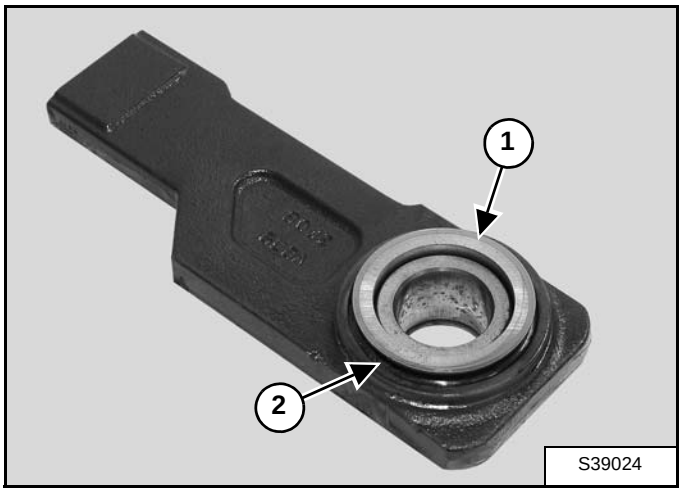
Track Idler Disassembly (Cont'd)

Figure 30-20-17



Remove the bushing (Item 1) from both sides of the idler **[Figure 30-20-17]**.

Figure 30-20-18

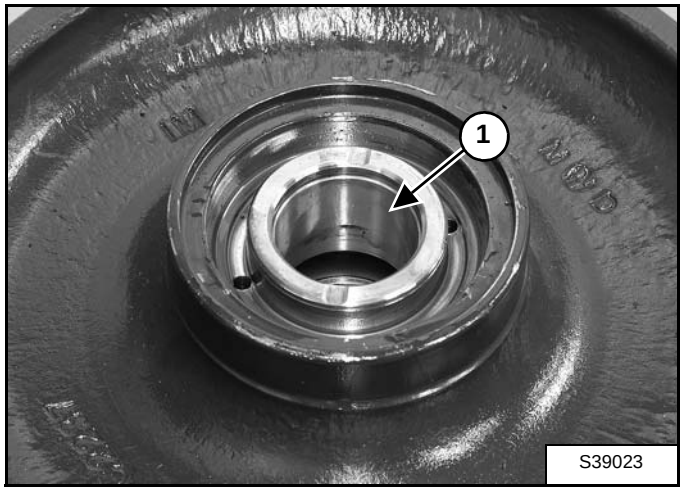


Remove the spacer (Item 1) and O-ring (Item 2) **[Figure 30-20-18]** from both blocks.

Track Idler Assembly

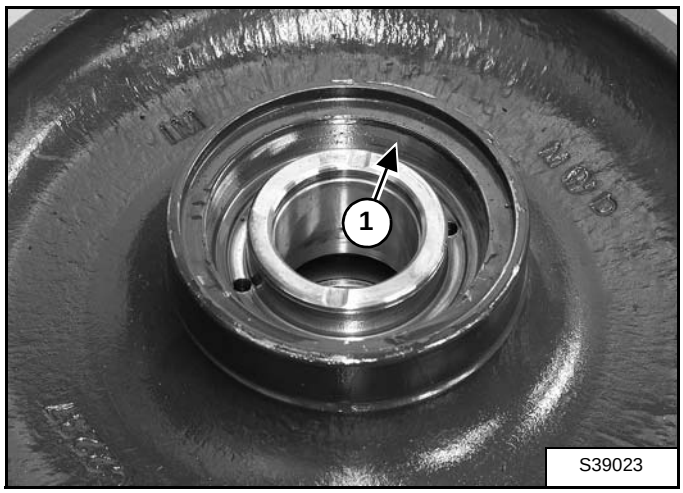
Clean all parts in solvent and dry with compressed air.

Figure 30-20-19



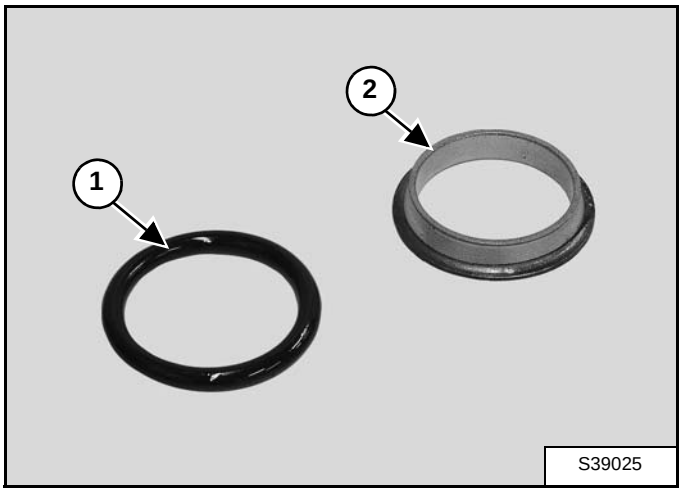
Install a bushing (Item 1) on both sides of the idler **[Figure 30-20-19]**.

Figure 30-20-20



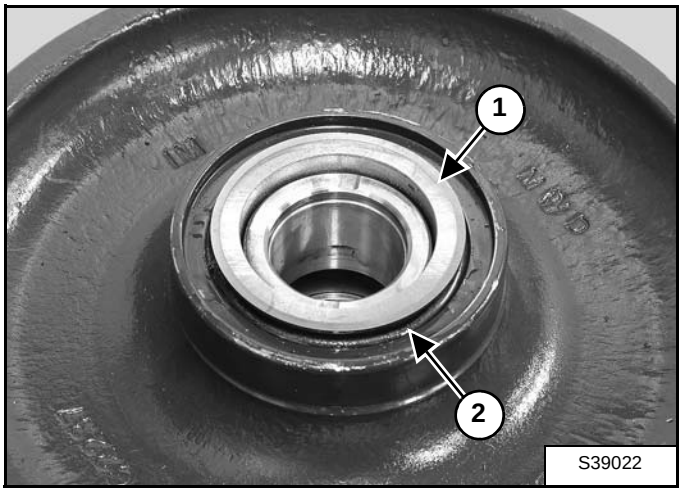
Remove all paint and corrosion from the seal surface (Item 1) **[Figure 30-20-20]** on both sides of the idler.

Figure 30-20-21



Install a new O-ring (Item 1) on the spacer (Item 2) **[Figure 30-20-21]**.

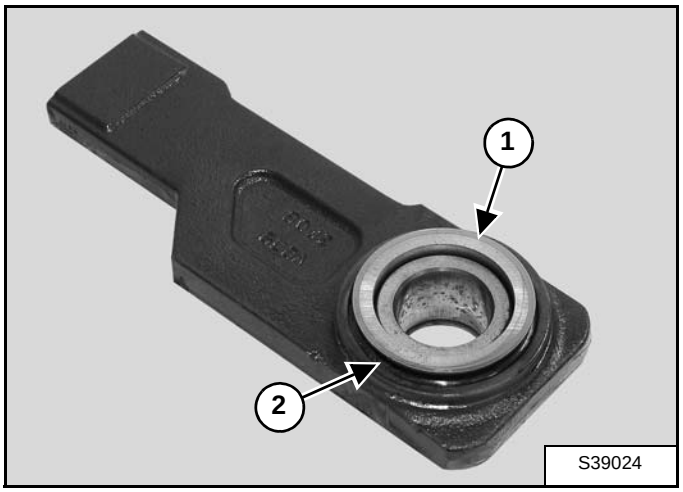
Figure 30-20-22



Install the spacer (Item 1) and new O-ring (Item 2) **[Figure 30-20-22]** on both sides of the idler.

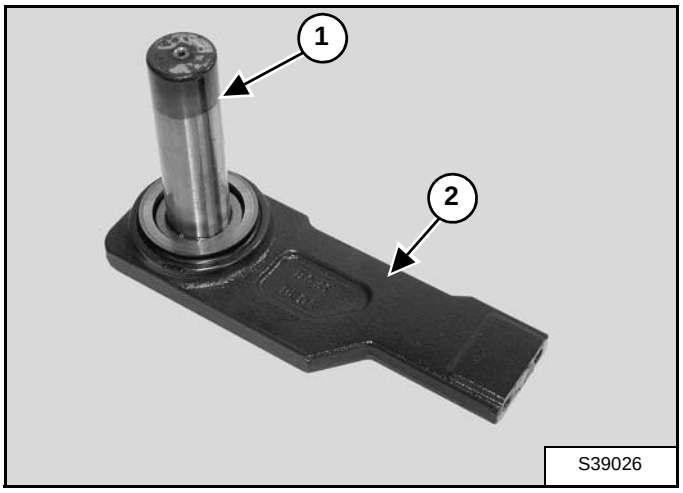
Track Idler Assembly (Cont'd)

Figure 30-20-23



Install the spacer (Item 1) and new O-ring (Item 2) **[Figure 30-20-23]** on both blocks.

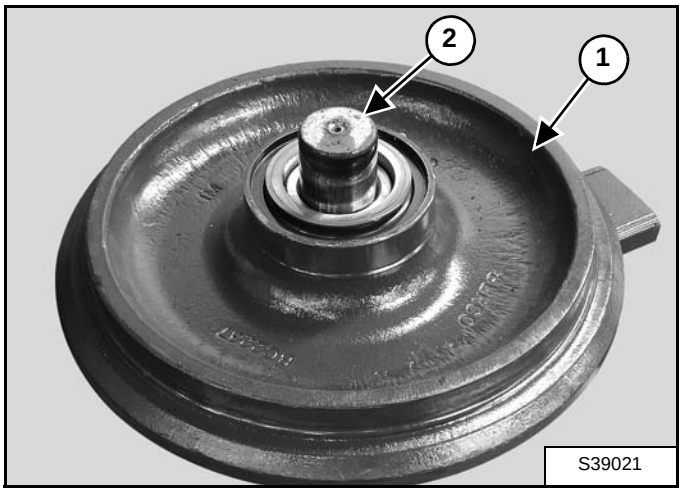
Figure 30-20-24



Install the shaft (Item 1) on one of the blocks (Item 2) **[Figure 30-20-24]** using a press.

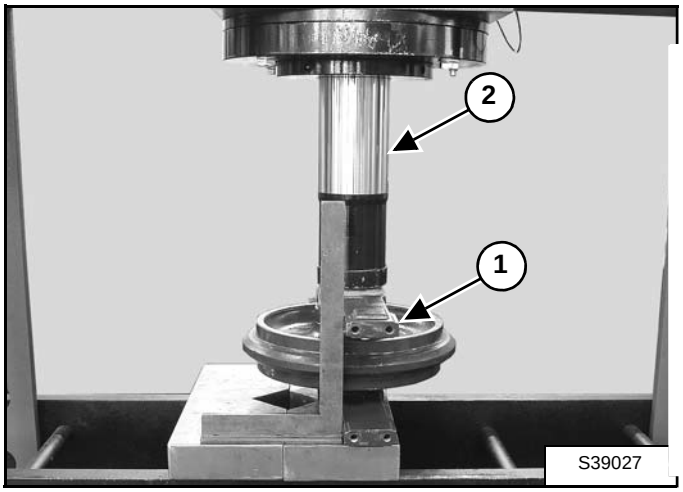
NOTE: Apply Loctite® 601 to the shaft hole in the block before installation. Remove all residue after installation.

Figure 30-20-25



Install the idler (Item 1) over the shaft (Item 2) **[Figure 30-20-25]**.

Figure 30-20-26



Apply Loctite® 601 to the shaft hole in the block.

Align the blocks and install the block (Item 1) on the shaft using a press (Item 2) **[Figure 30-20-26]**.

Track Tensioner Removal And Installation

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY.

⚠ WARNING



P-62574

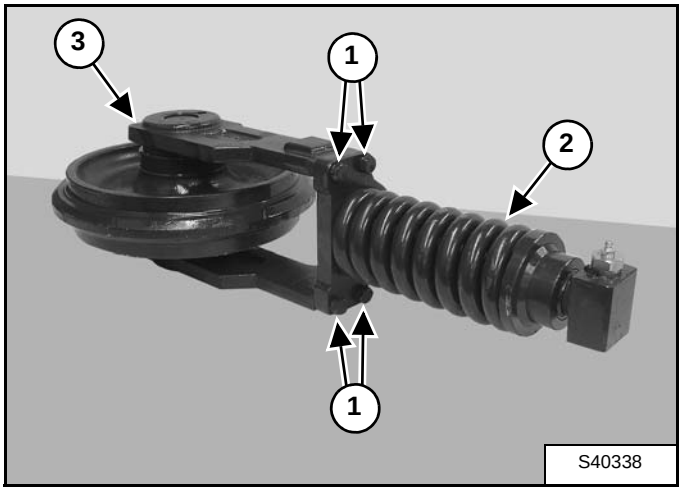
AVOID INJURY OR DEATH

- **Spring loaded components under pressure can cause serious injury or death.**
- **Do not disassemble the coil spring assembly**

W-2617-1004

Remove the track idler. (See Idler Removal And Installation on Page 30-20-6.)

Figure 30-20-27



Remove the four bolts (Item 1) and remove the track tensioner (Item 2) from the track idler (Item 3) **[Figure 30-20-27]**.

Figure 30-20-28

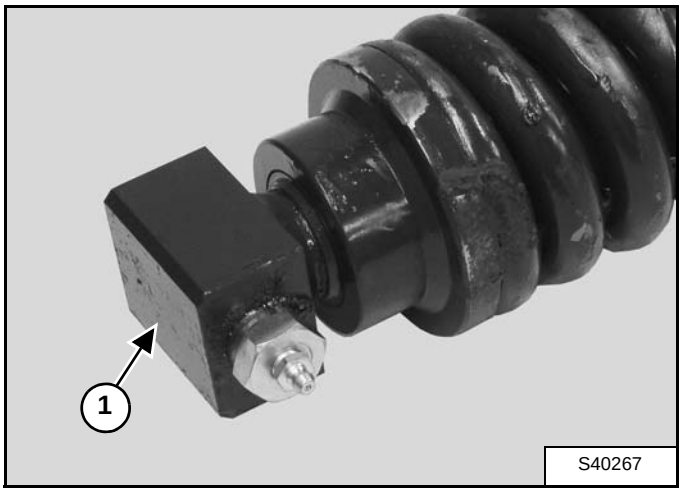
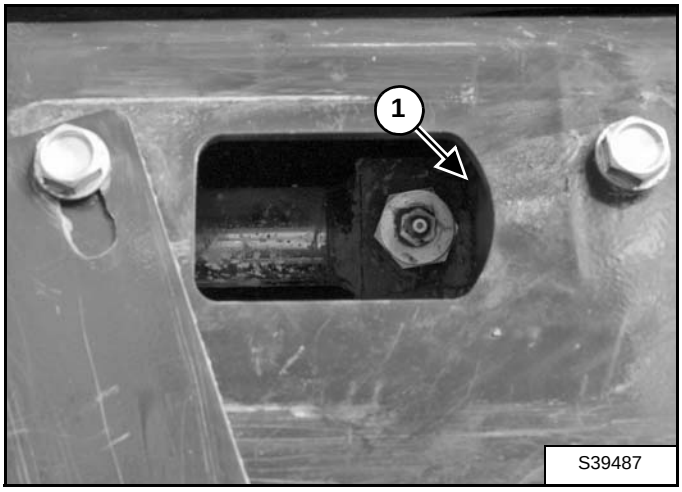


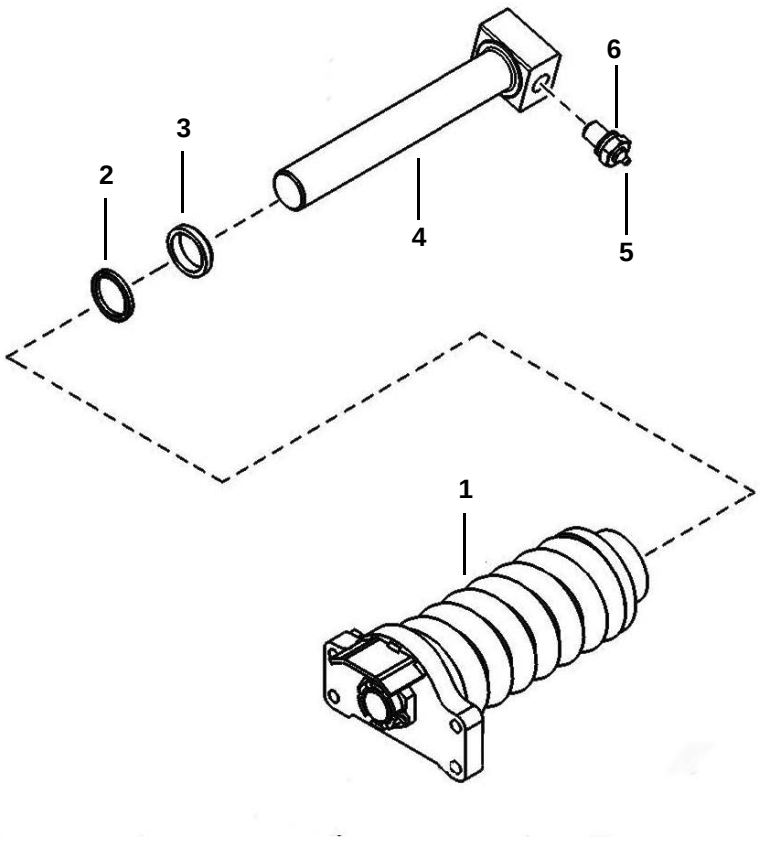
Figure 30-20-29



The flat side of the grease cylinder rod end (Item 1) **[Figure 30-20-28]** must fully contact the track frame (Item 1) **[Figure 30-20-29]**.

Track Tensioner Parts Identification

1. Coil Spring Assembly
2. O-ring
3. Wiper Seal
4. Rod
5. Grease Fitting
6. Bleed Valve



PE-3893S

Track Tensioner Disassembly And Assembly

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY.

⚠ WARNING



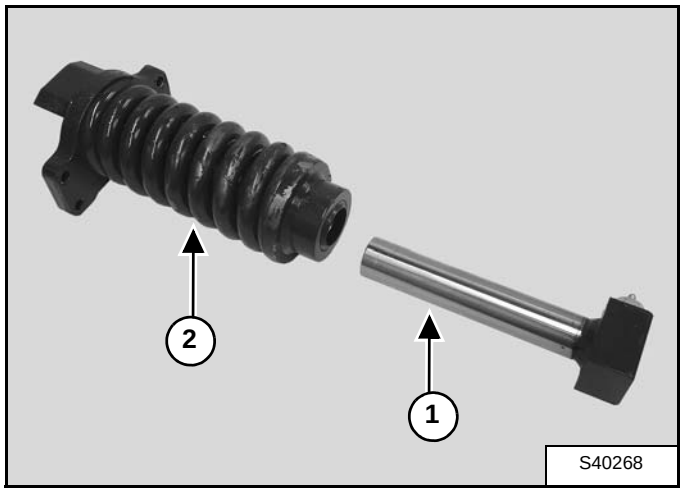
P-62574

AVOID INJURY OR DEATH

- **Spring loaded components under pressure can cause serious injury or death.**
- **Do not disassemble the coil spring assembly**

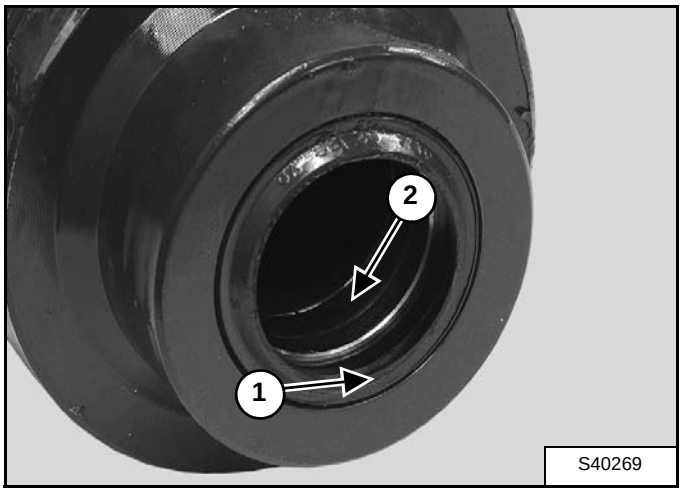
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Figure 30-20-30



Remove the rod (Item 1) from the coil spring assembly (Item 2) **[Figure 30-20-30]**.

Figure 30-20-31



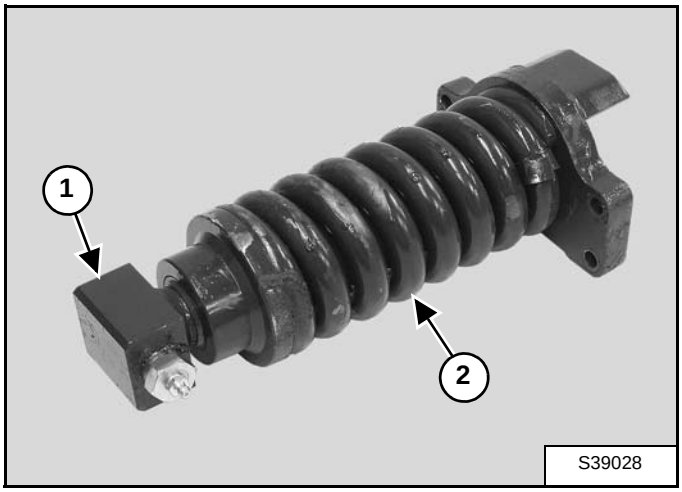
Remove Wiper seal (Item 1) **[Figure 30-20-31]** from the coil spring assembly seating.

Remove the O-ring (Item 2) from the coil spring assembly seating **[Figure 30-20-31]**.

Installation: Apply oil to both the wiper seal and the O-ring before installation.

Clean the coil spring assembly seating before replacing with new or re-using old parts.

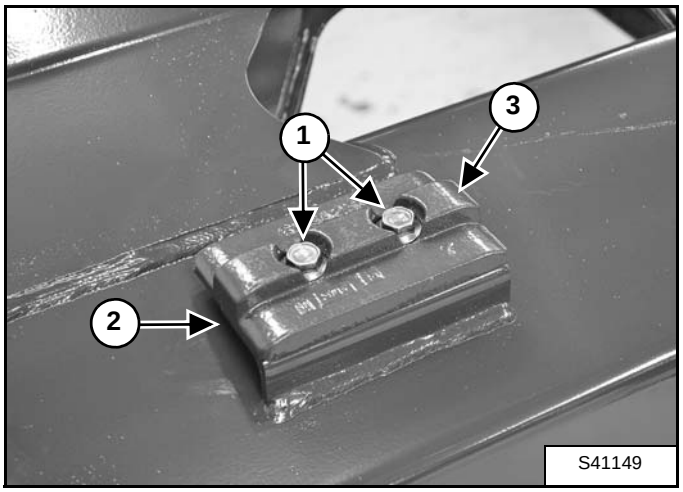
Figure 30-20-32



After installing the wiper seal and O-ring (Item 1 and 2) **[Figure 30-20-31]** slide the rod (Item 1) back into the coil spring assembly (Item 2) **[Figure 30-20-32]**.

Top Slider Removal And Installation

Figure 30-20-33

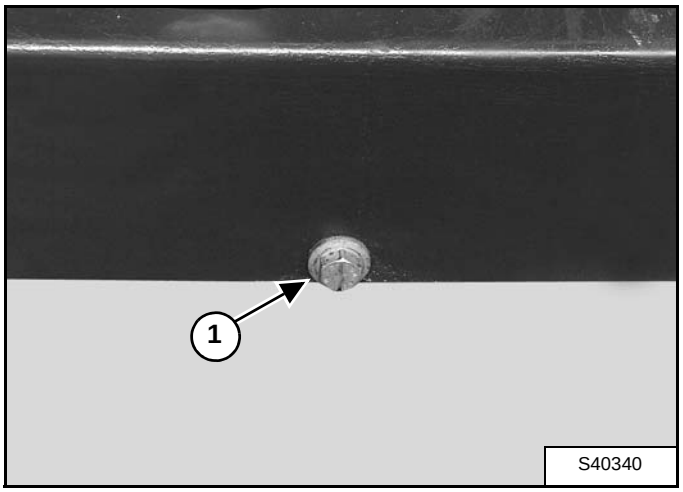


Loosen the two bolts (Item 1) and nuts (Item 2) **[Figure 30-20-33]**.

Remove the top slider (Item 3) **[Figure 30-20-33]**.

Roller Removal And Installation

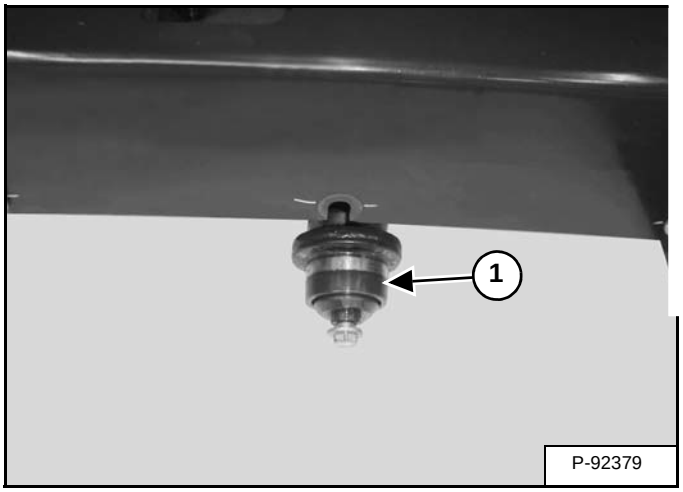
Figure 30-20-34



Loosen the bolts (Item 1) **[Figure 30-20-34]** on the track roller on both sides of the track frame.

Installation: Tighten the bolts to 370 - 410 Nm (275 - 300 ft-lb) torque.

Figure 30-20-35

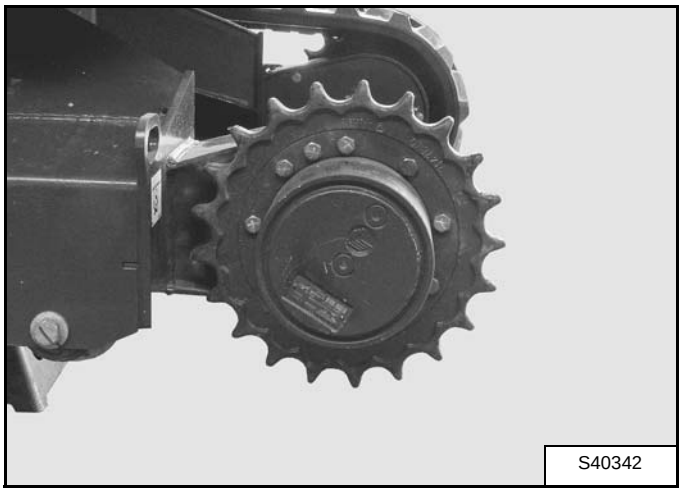


Remove the bottom roller (Item 1) **[Figure 30-20-35]**.

NOTE: The rollers are not serviceable. Replace the roller if it is damaged.

Sprocket Removal And Installation

Figure 30-20-36



Remove the drive sprocket bolts **[Figure 30-20-36]**.

Installation: Put thread adhesive (Loctite® 243) on the bolts and tighten to 108 N•m (80 ft-lb) torque.

Remove the drive sprocket from the travel motor.

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

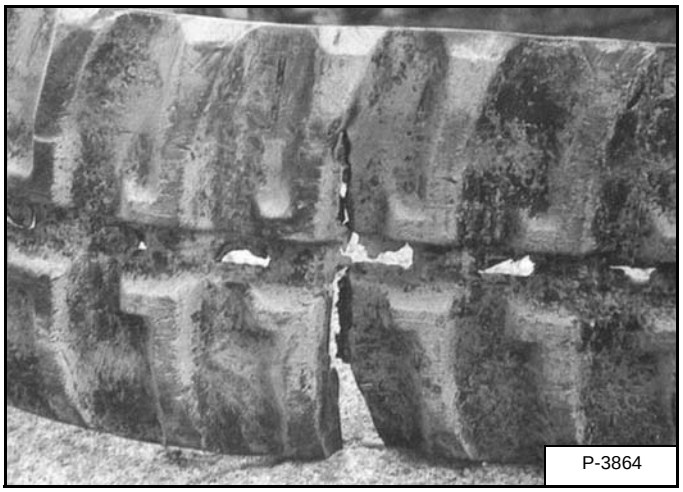
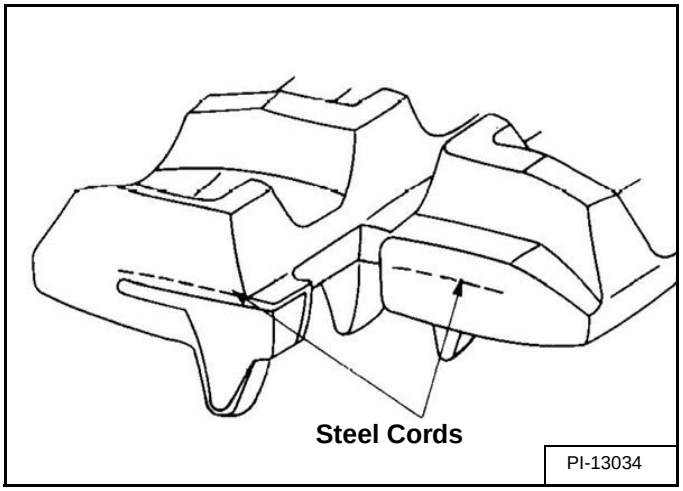


Figure 30-30-2



Damage:

Embedded steel cords are cut off **[Figure 30-30-1]** and **[Figure 30-30-2]**.

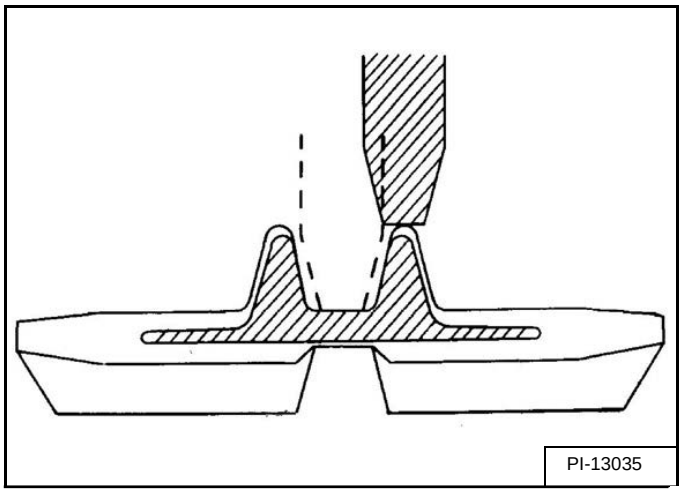
Replacement:

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 detracking, the idler or sprocke rides on the projections of the embedded metal **[Figur 30-30-3]**.

When the rubber track has become detracked projections of rubber track get stuck between the frame o the undercarriage.

The rubber track is clogged with stones or foreig objects.

When moisture invades through a cut on the lug sid rubber surface, the embedded steel cords will corrode. The deterioration of the design strength can lead to the breaking off of the steel cords.

Prevention:

The following preventions should be taken to minimize the risk of this damage:

Periodical checking on site of the recommended track tension.

Avoiding quick turns on bumpy and rocky fields.

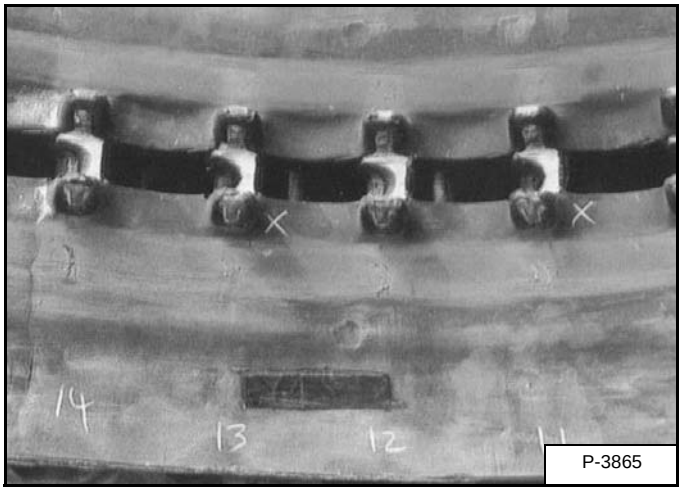
Drive carefully to avoid having stones and other articles clog the rubber tracks.

Driving over sharp objects should be avoided. If this is impossible, do not make turns while driving over sharp objects.

Track Damage Identification (Cont'd)

Abrasion Of Embedded Metals

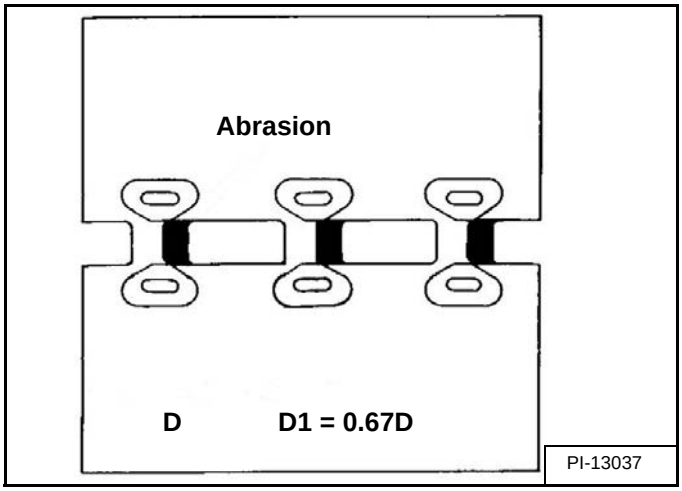
Figure 30-30-4



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.

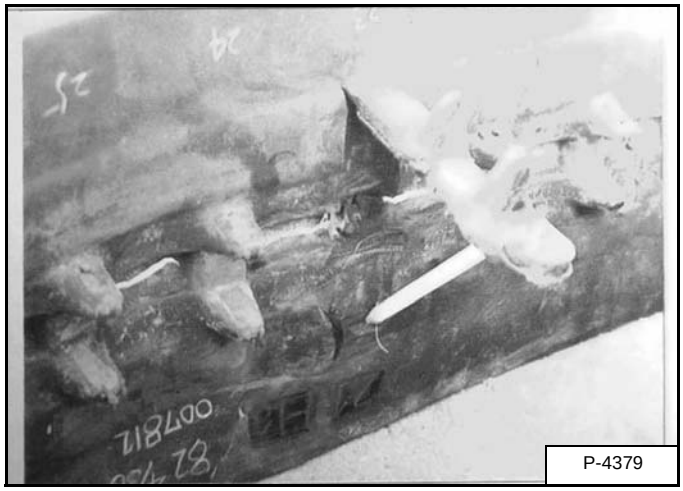
Rubber tracks are used on sandy fields.

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.

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:

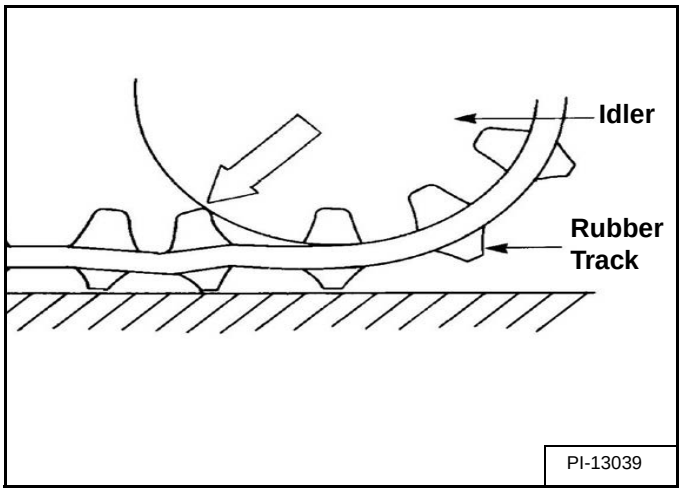
Even a partial separation of embedded metals requires replacement of the track.

Track Damage Identification (Cont'd)

Causes of the damage:

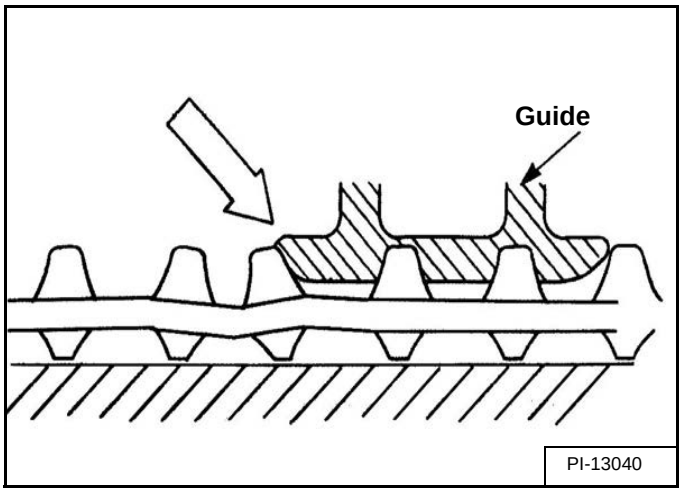
Embedded metals are adhered between the steel cords and the rubber body. The following cases generate external forces greater than the adhesion strength, causing separation of the embedded metals:

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]**.

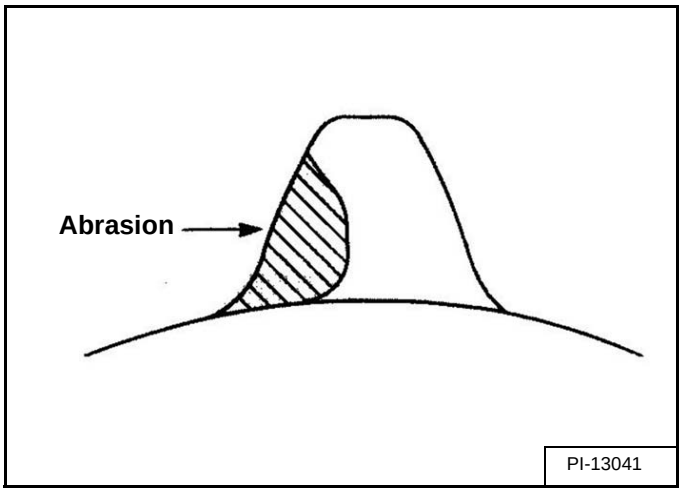
Figure 30-30-8



When a rubber track has become detracked, it becomes stuck between the guide or the undercarriage frame, causing the separation of embedded metals **[Figure 30-30-8]**.

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 stee cords:

Track tension should be periodically checked.

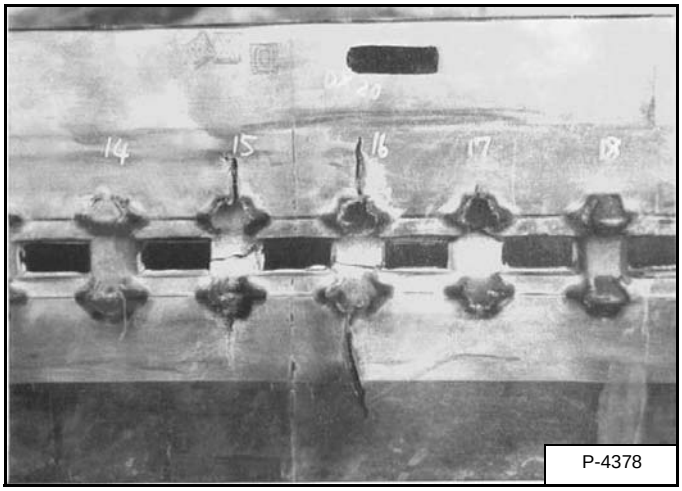
Quick turns on bumpy and rocky fields should b avoided.

If abnormal wear of sprockets is observed; the should be immediately replaced.

Track Damage Identification (Cont'd)

Separation Of Embedded Metals Due To Corrosion

Figure 30-30-10



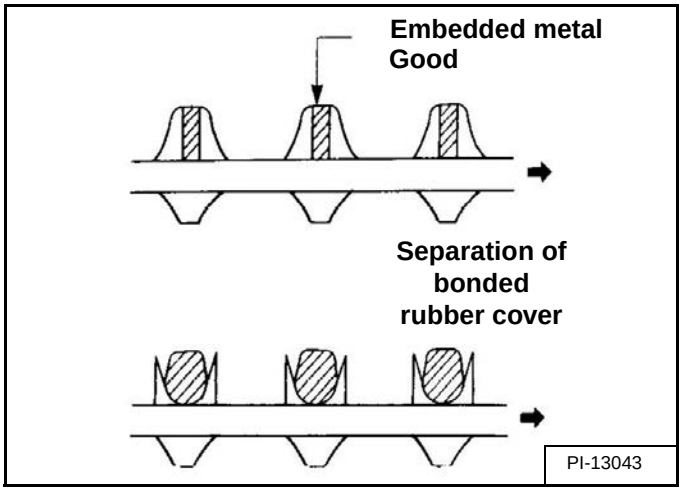
Damage:

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.

Figure 30-30-11



Causes of the damage:

Embedded metals are bonded to the rubber body. The following operating conditions cause embedded metals to corrode, causing deterioration of the bonding, and finally resulting in separation of the embedded metals from the rubber body **[Figure 30-30-11]**.

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:

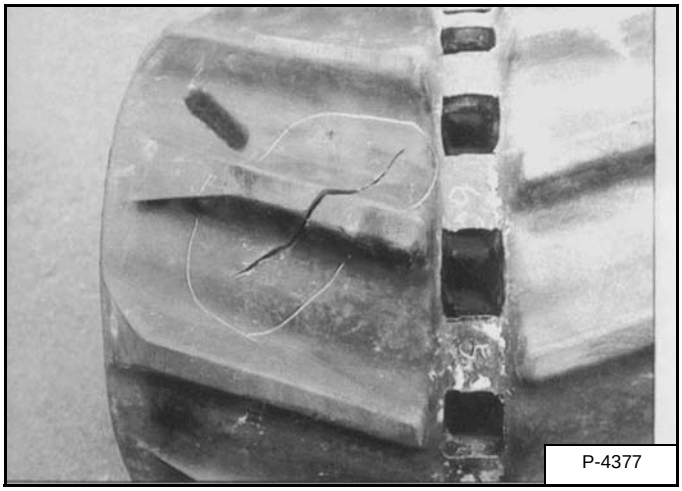
If rubber tracks are used under such field conditions as described under (Causes of the damage). The tracks should be washed with plenty of water. After being completely dried, they should be stored correctly.

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.

Track Damage Identification (Cont'd)

Cuts On The Lug Side Rubber

Figure 30-30-12



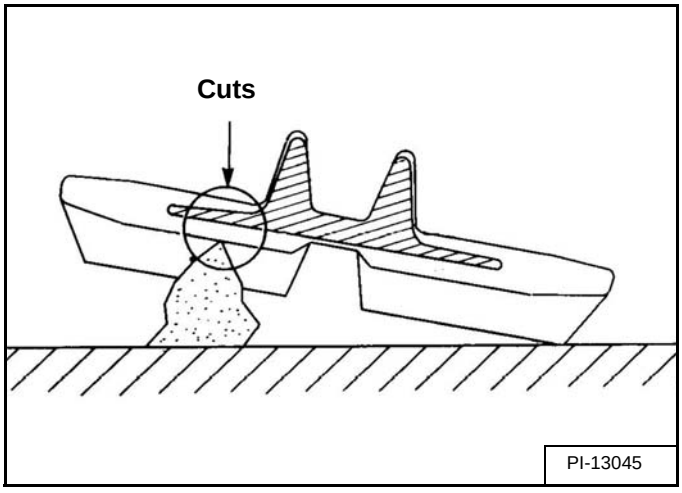
Damage:

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.

Figure 30-30-13



Causes of the damage:

When rubber tracks drive over projections or sharp stones in the fields, the concentrated forces applied cause cuts on the lug side rubber surface. In case of making turns on projections, the lug side rubber surface will have an even higher chance to be cut. If the cuts run through the embedded steel cords, it might result in the 'steel cords' breakage due to their corrosion. It is highly recommended to repair the cuts with cold vulcanization rubber as soon as they are observed **[Figure 30-30-13]**.

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, hig speed, quick turns and overloading should be avoided.

Track Damage Identification (Cont'd)

Cracks On The Lug Side Rubber Due To Fatigue

Figure 30-30-14

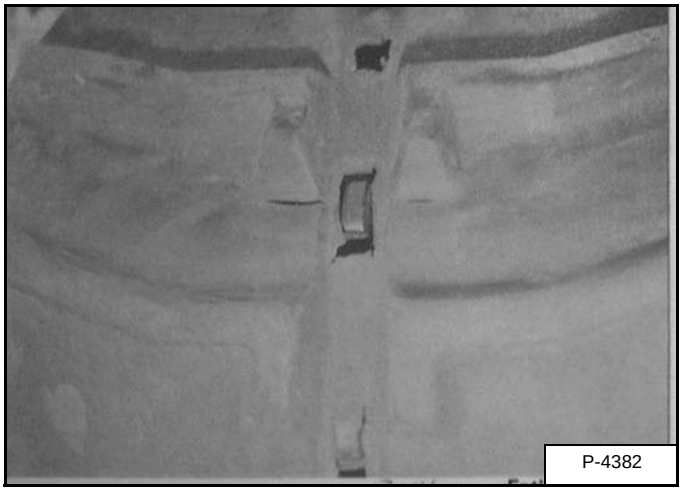
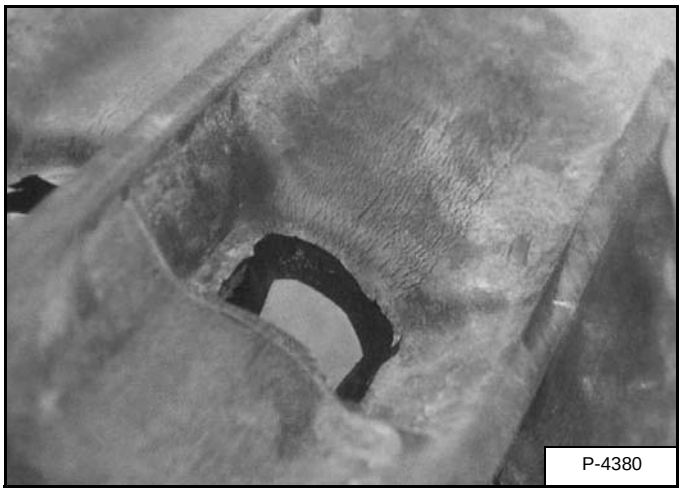


Figure 30-30-15



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 damage 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 damage 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.

Track Damage Identification (Cont'd)

Lug Abrasion

Figure 30-30-16

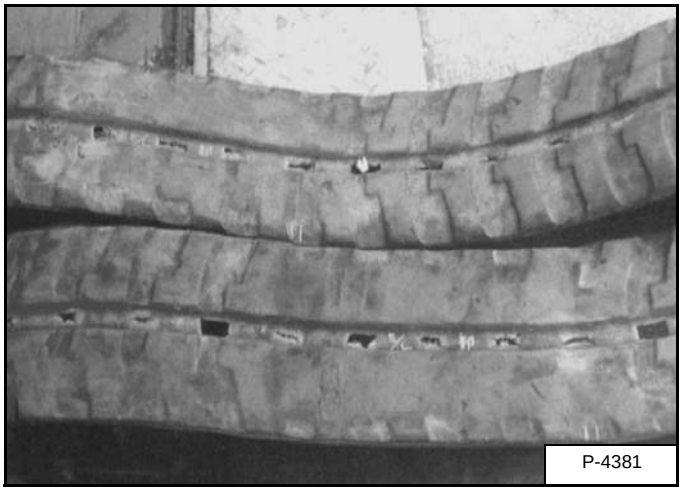
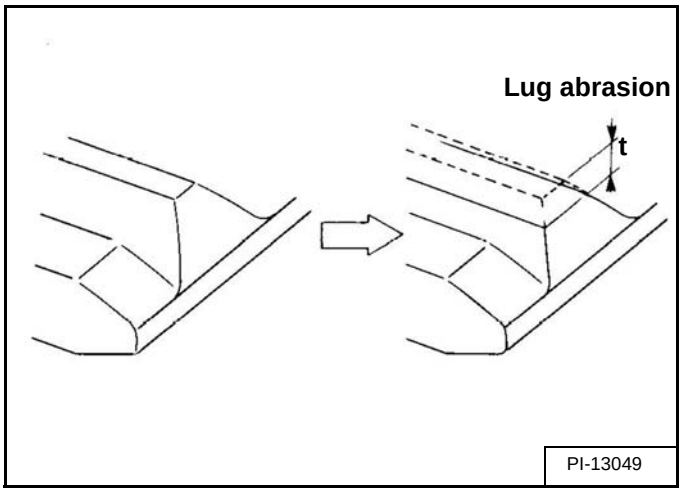


Figure 30-30-17



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

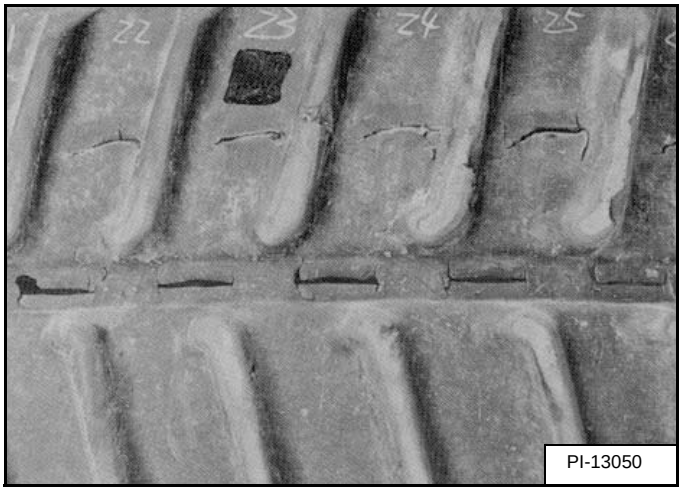
Driving up and down hilly paths with slippage

Making frequent turns on paths covered with rocks and wood

Track Damage Identification (Cont'd)

Cracks And Cuts On The Lug Side Rubber

Figure 30-30-18



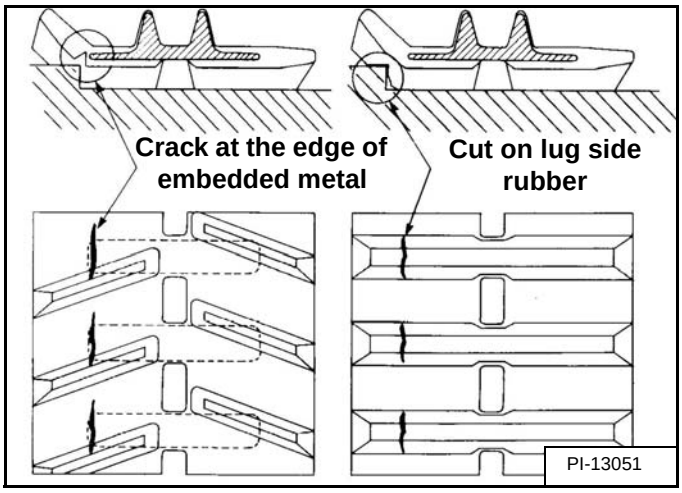
Damage:

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]**.

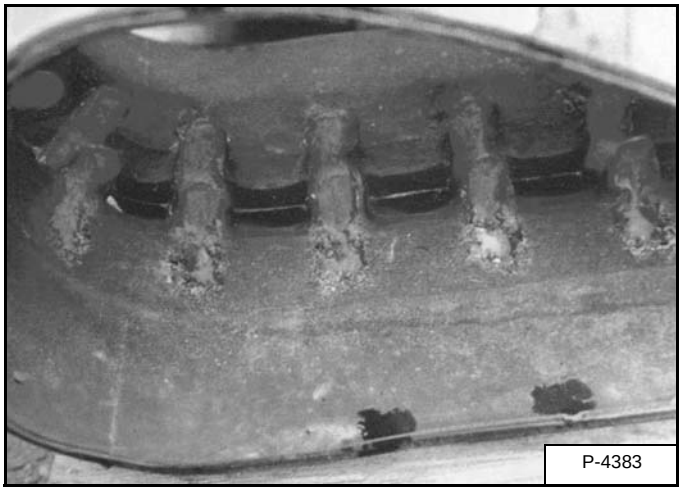
Prevention:

To avoid extensive stress applied to the lug root where metals are embedded, machine operators are requested to avoid driving over stumps and ridges.

Track Damage Identification (Cont'd)

Abrasion Of The Track Roller Side

Figure 30-30-20



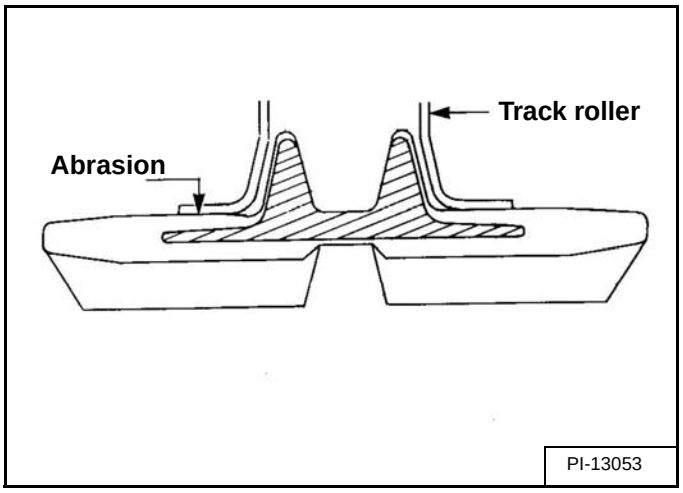
Damage:

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 becoming 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 **[Figur 30-30-21]**.

The level of abrasion is highly dependent on terrai conditions. A higher level of abrasion will occur when th rubber tracks are operated in fields covered with man stones and gravel. Small stones hardened with mud stuck to the track rollers increase the abrasion level. Afte an extended period of abrasion, it will be more likely fo exposed embedded metals to catch moisture through th inside steel cords, which can cause breakage of stee 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.

Track Damage Identification (Cont'd)

Cuts On The Edges Of Track Roller Side

Figure 30-30-22

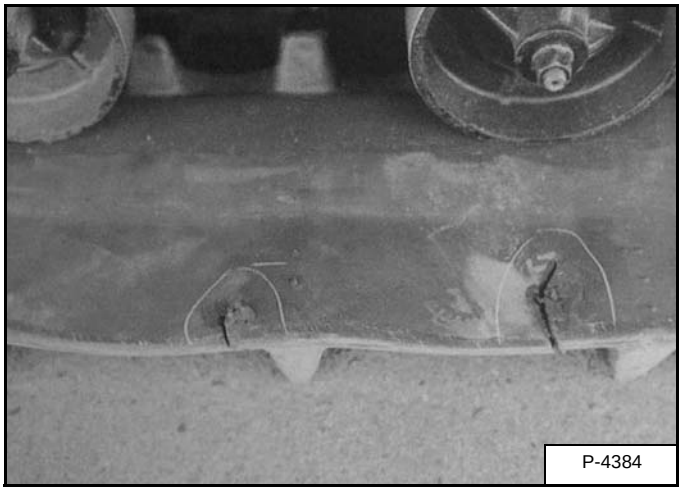
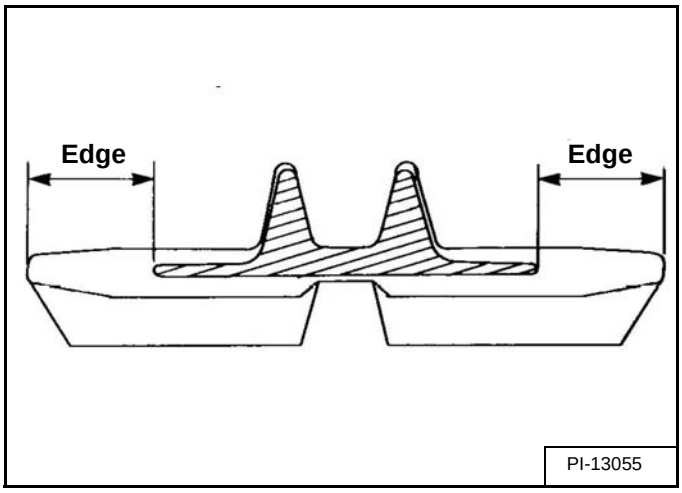


Figure 30-30-23



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]**.

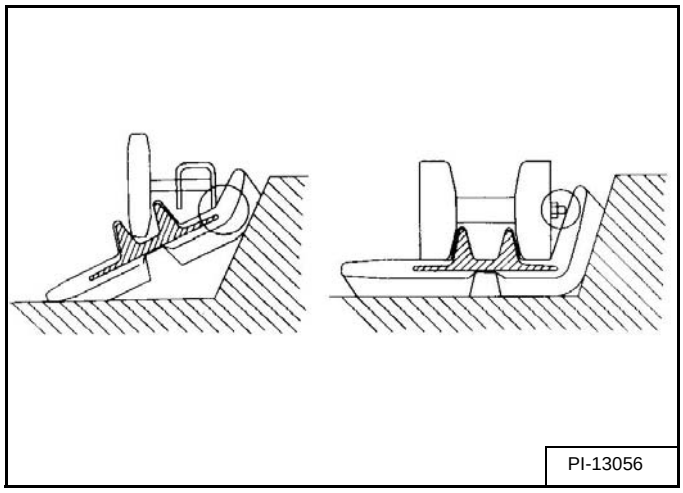
Replacement:

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.

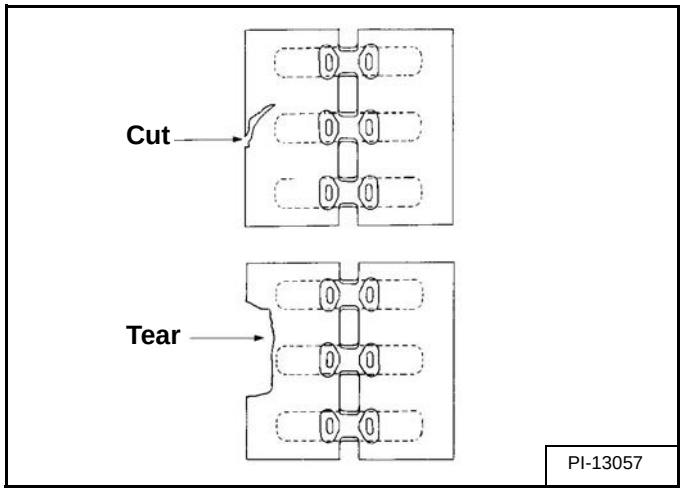
Figure 30-30-24



In case of damage by objects on the operating earth:

The edges of rubber track are often deformed largely due to a bumpy earth 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 that have become detracked, the rubber tracks can 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]**.

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 earth. 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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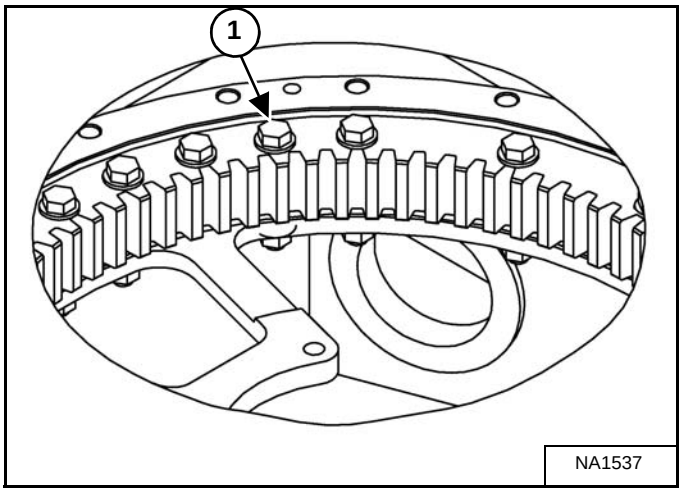
SWING CIRCLE GEAR

Swing Bearing Removal

Remove the upperstructure. (See Removal on Page 40-10-1.)

Mark the swing bearing to track frame.

Figure 30-40-1



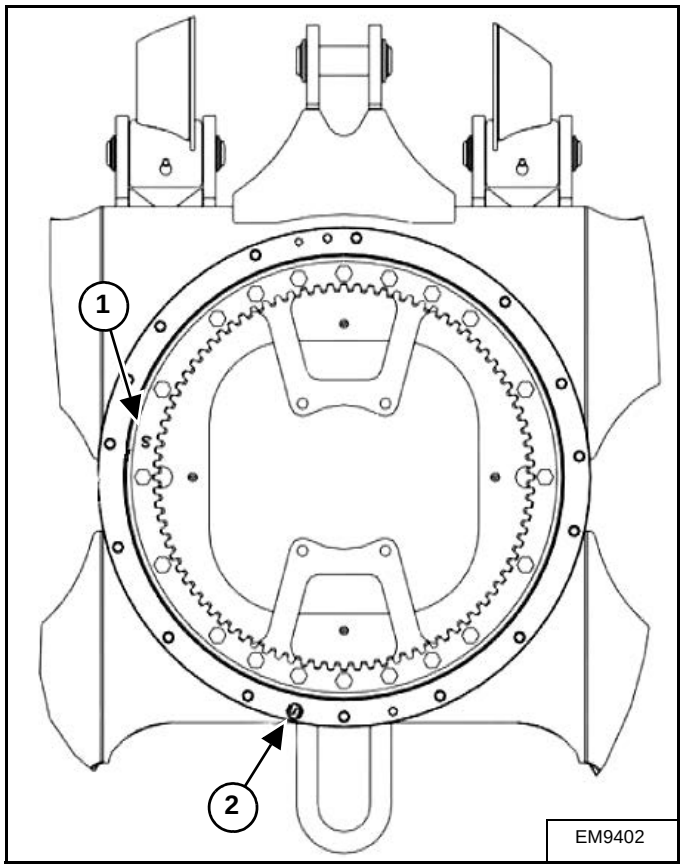
Remove the 20 bolts (Item 1) **[Figure 30-40-1]** and nuts that hold the swing bearing to the track frame.

Remove the swing bearing.

Clean and inspect the grease cover for damage. Replace as necessary.

Swing Bearing Installation

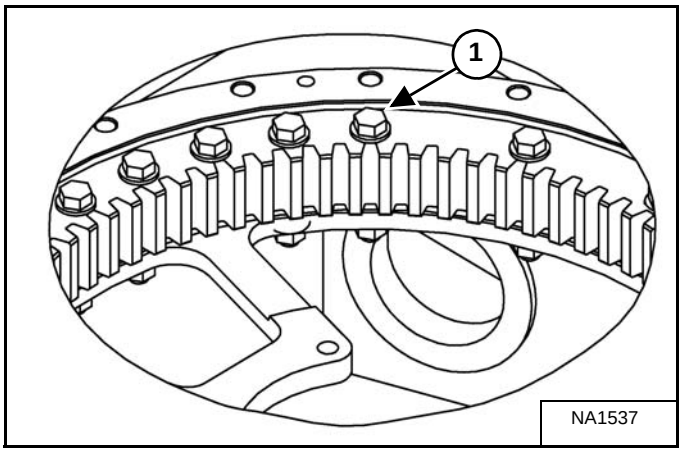
Figure 30-40-2



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]** is at the rear of the machine.

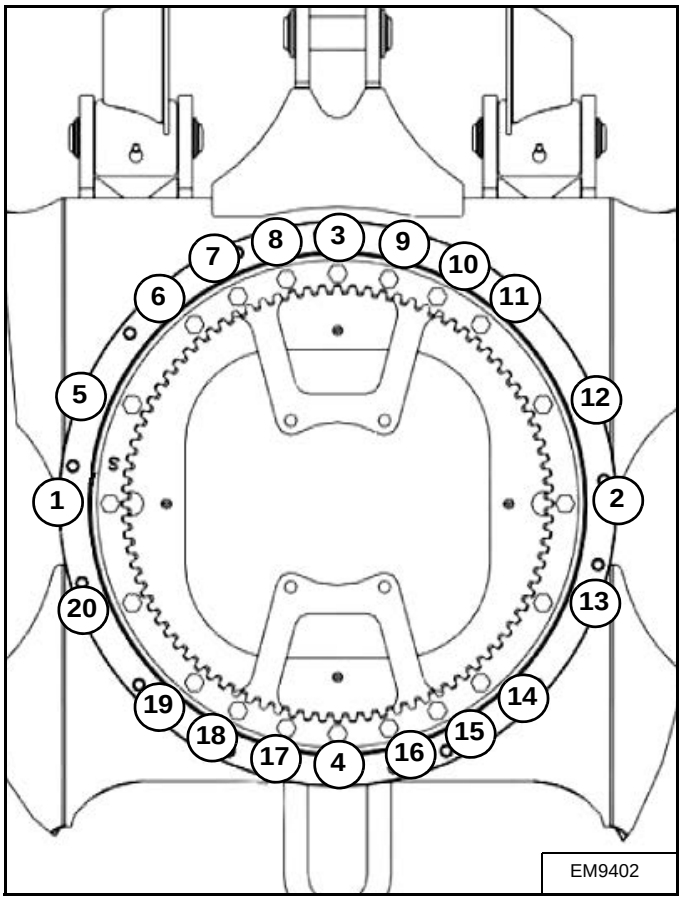
Figure 30-40-3



Install the swing bearing bolts (Item 1) **[Figure 30-40-3]** and nuts. Do not yet tighten the bolts.

Swing Bearing Installation (Cont'd)

Figure 30-40-4



Tighten the bolts in the correct sequence (#1 to #20) 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.

NOTE: The first relubrication of the raceway and of the gear must be carried out directly after installation.

Weekly greasing of the pinion and the gear is recommended in normal conditions, and daily greasing in extreme conditions or coastal regions.


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UPPERSTRUCTURE AND SWING SECTION

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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 40-210-1.)

Remove the counterweight. (See Removal And Installation on Page 40-90-1.)

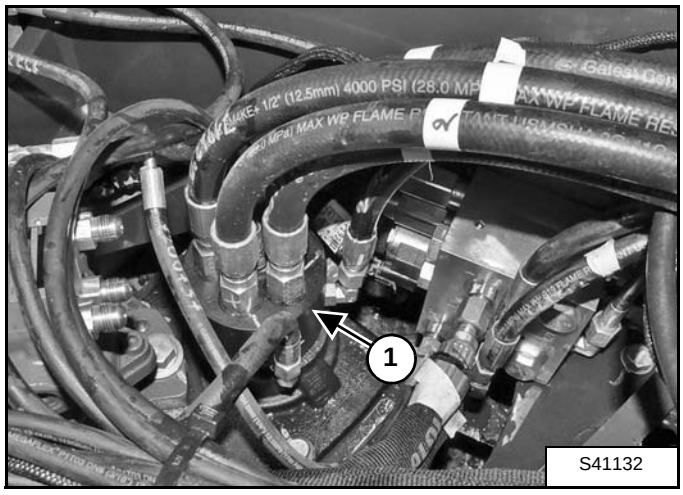
Remove the travel control valve. (See Removal And Installation on Page 20-190-1.)

Remove the hydraulic control valve. (See Removal And Installation on Page 20-40-1.)

Remove the fuel tank. (See Removal And Installation on Page 40-120-1.)

Remove the swing motor. (See Removal And Installation on Page 20-90-1.)

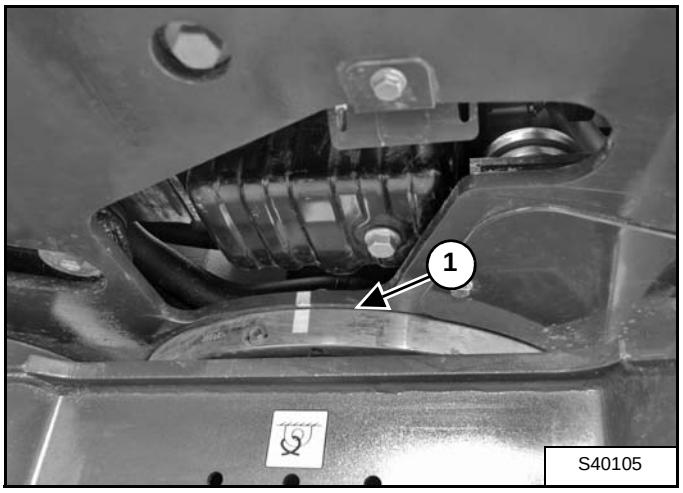
Figure 40-10-1



Remove the hoses from the top of the swivel joint (Item 1) **[Figure 40-10-1]**.

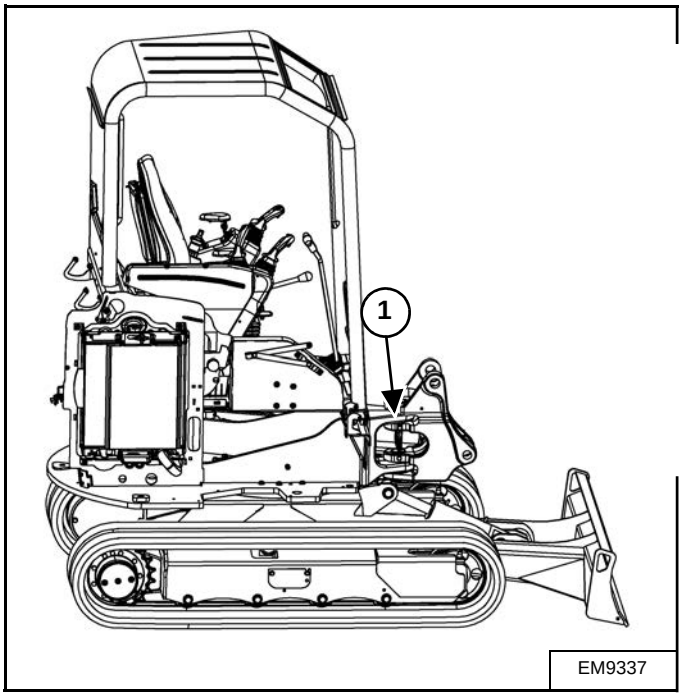
Remove the swing motor drive carrier. (See Removal And Installation on Page 20-91-1.)

Figure 40-10-2



Mark the upperstructure to swing bearing and to the track frame for assembly (Item 1) **[Figure 40-10-2]**.

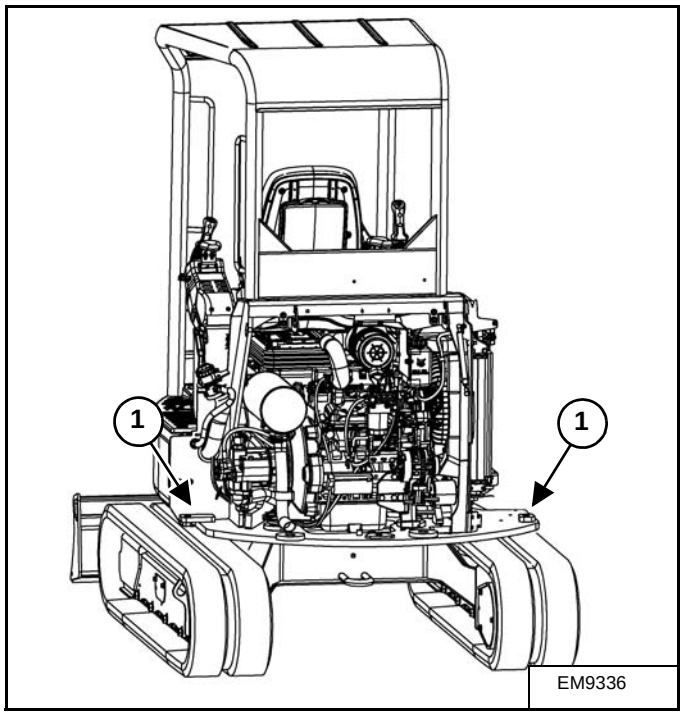
Figure 40-10-3



Fasten a chain through the front of the excavator frame (Item 1) **[Figure 40-10-3]**.

Removal (Cont'd)

Figure 40-10-4

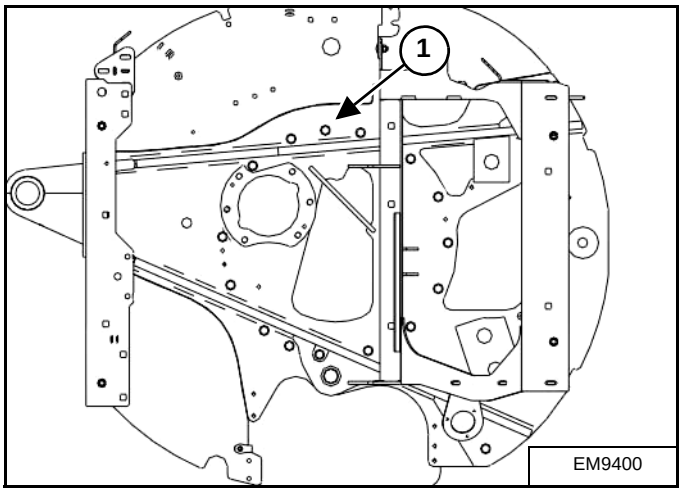


Fasten chains to the counterweight mounts (Item 1) **[Figure 40-10-4]**.

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 degrees from each other (Item 1) **[Figure 40-10-5]**.

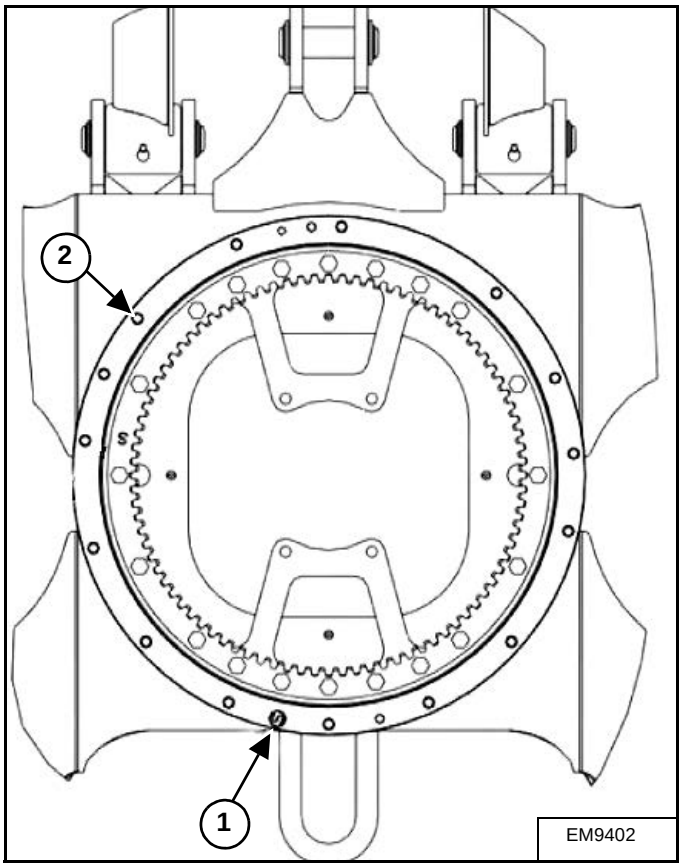
NOTE: For disassembly safety a minimum of four evenly spaced bolts must remain installed, to be removed later.

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.

Installation

Figure 40-10-6

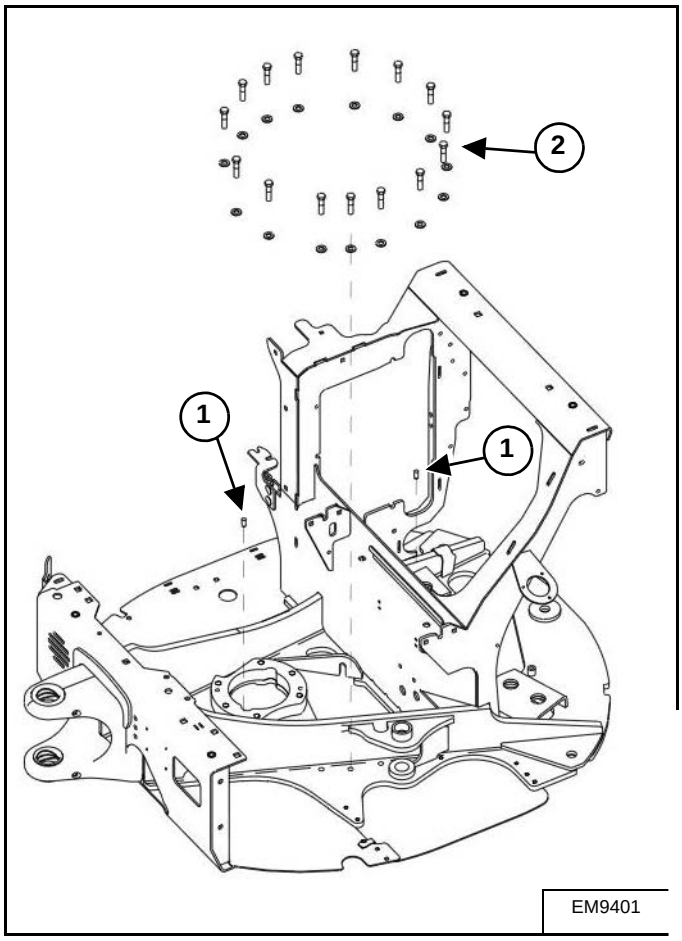


Rotate the swing bearing so the outside soft zone (Item 1) **[Figure 40-10-6]** is at the rear of the machine as shown.

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.

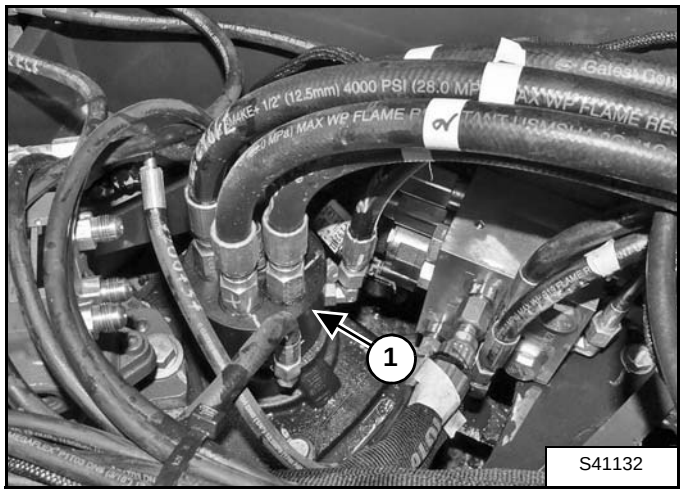
Installation (Cont'd)

Install the swing motor drive carrier. (See Removal And Installation on Page 20-91-1.)

Check the backlash between the three gear teeth marked in green. This should be at least 0.03 x module. After final tightening of bolts and installation, the backlash must be checked with a feeler gauge or lead wire. There must be some backlash present through 360°.

Install the swing motor. (See Removal And Installation on Page 20-90-1.)

Figure 40-10-8



Install the hoses (Item 1) **[Figure 40-10-8]** on the swivel joint.

Remove the chains and lifting fixture.

Install the fuel tank. (See Removal And Installation 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 40-210-1.)

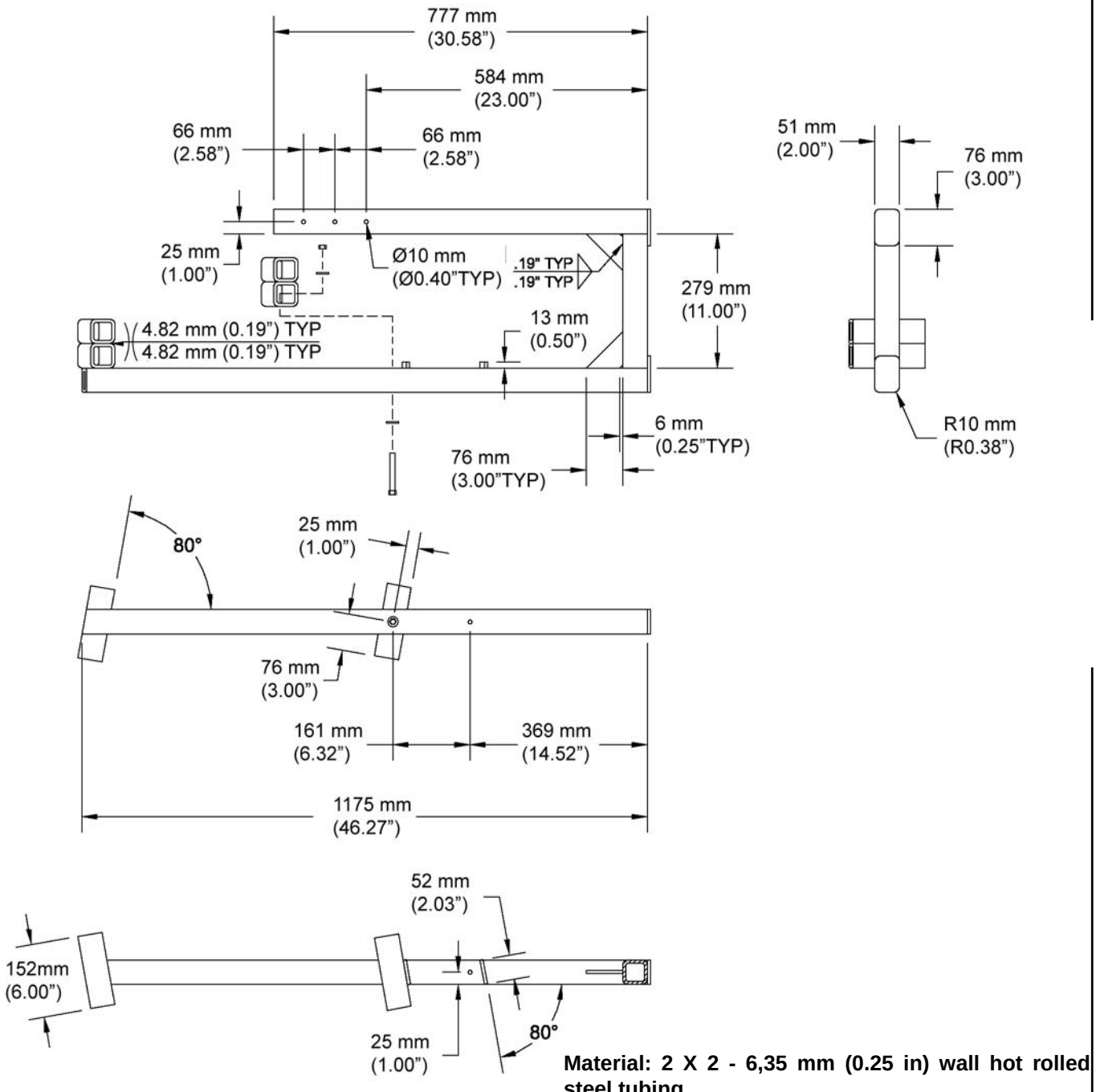
Install the boom. (See Removal And Installation on Page 40-150-1.)

ROPS CANOPY

Removal And Installation

Build the service lifting bracket used to remove and install the ROPS canopy. Use the dimensions shown **[Figure 40-20-1]** to build the service lifting bracket.

Figure 40-20-1



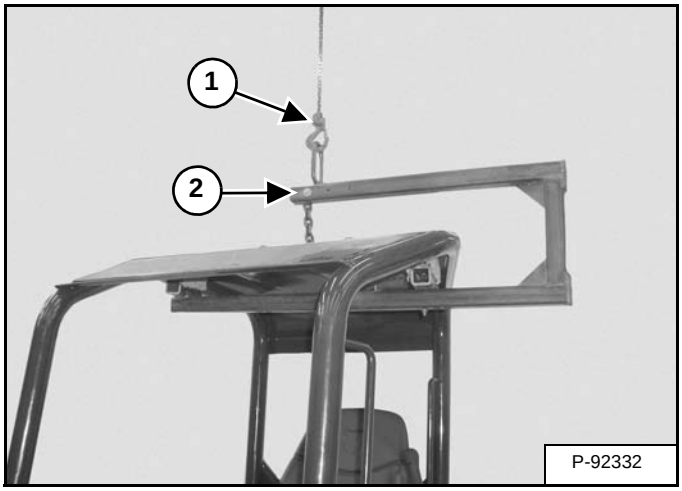
Material: 2 X 2 - 6,35 mm (0.25 in) wall hot rolled steel tubing
6,35 mm (0.25 in) hot rolled steel plate

EM8947

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]**.

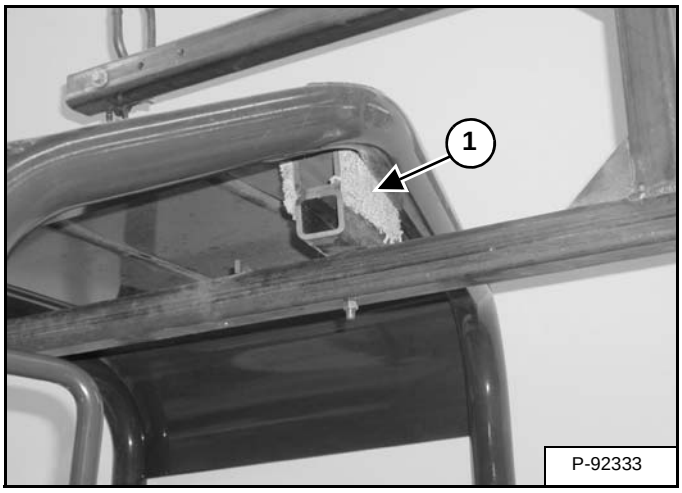
NOTE: Use a chain hoist of sufficient capacity.

⚠ 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.

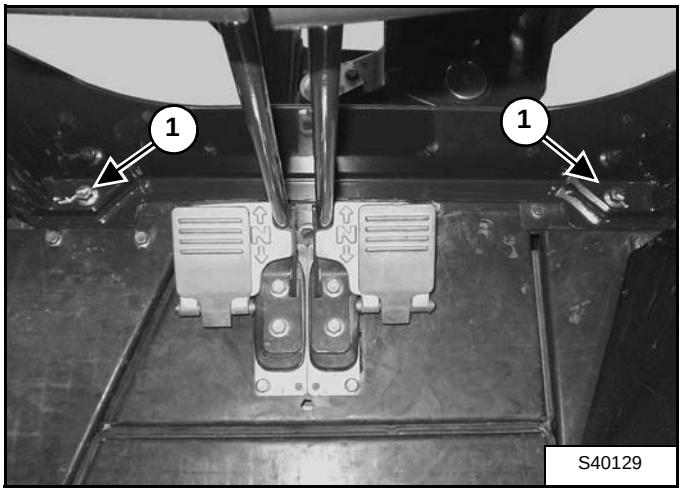
W-2384-1000

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



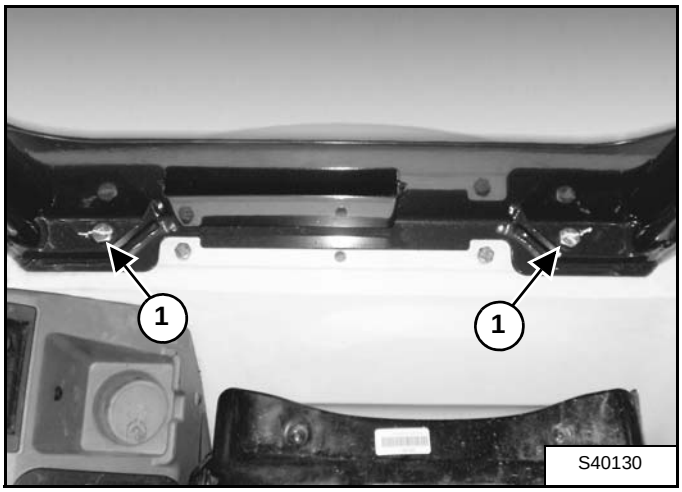
Remove the bolts and washers (Item 1) **[Figure 40-20-4]** from the front of the canopy.

Installation: Tighten the bolts to 160 - 180 N•m (118 - 133 ft-lb) torque.

Remove the canopy.

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.

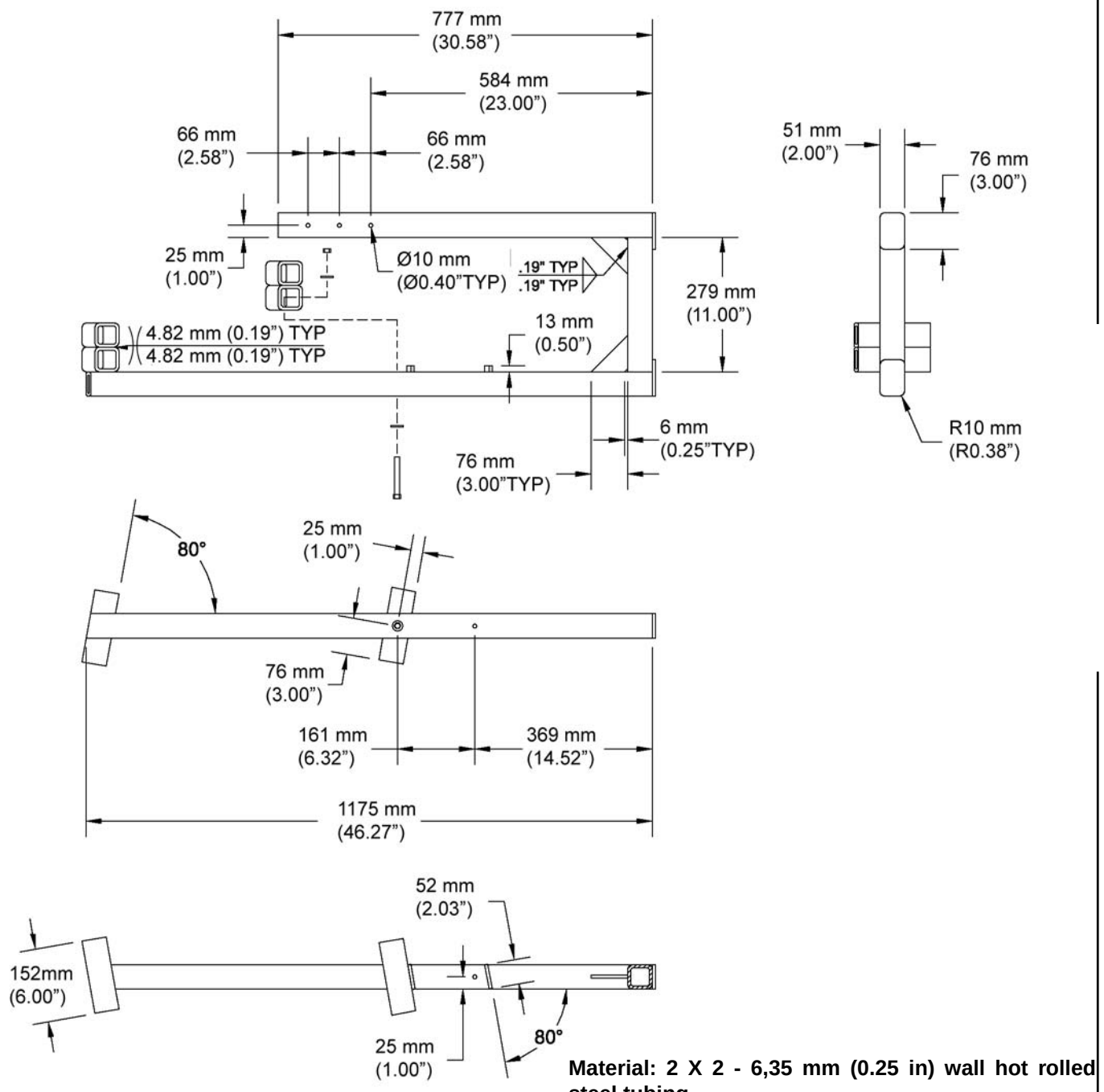

Bobcat®

CAB

Removal And Installation

Build the service lifting bracket used to remove and install the cab. Use the dimensions shown **[Figure 40-30-1]** to build the service lifting bracket.

Figure 40-30-1

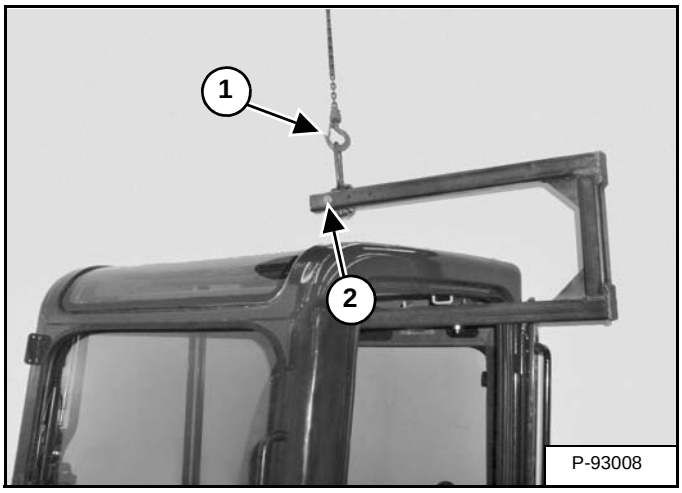


Removal And Installation (Cont'd)

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

Remove 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]**.

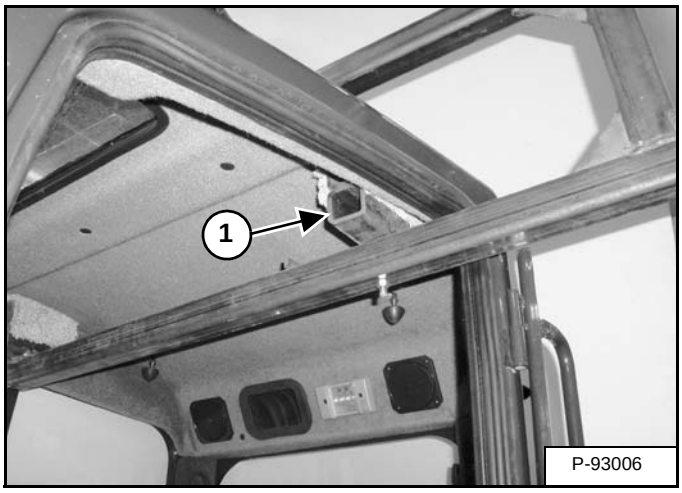
NOTE: Use a chain hoist of sufficient capacity.

⚠ 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.

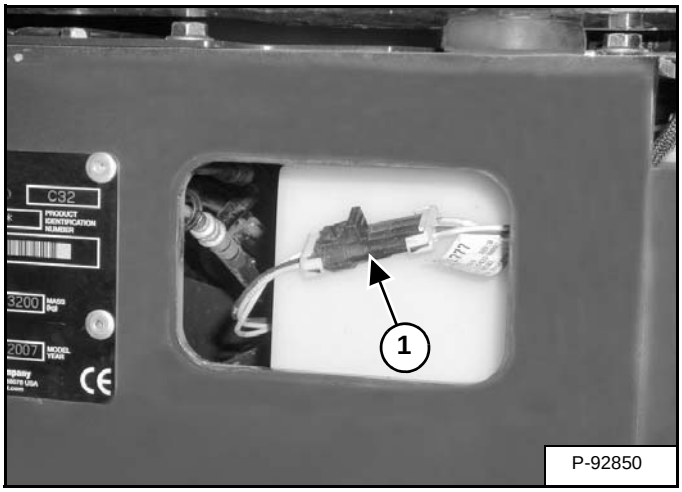
W-2384-1000

Figure 40-30-3



Adjust the lifting bracket to the proper width by moving the bracket (Item 1) **[Figure 40-30-3]**.

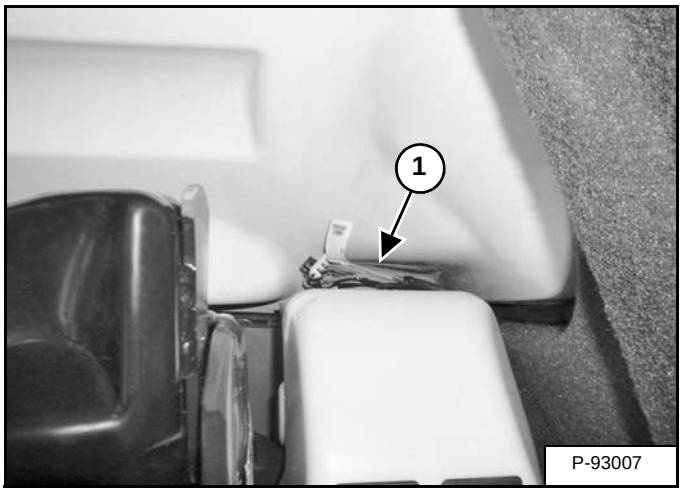
Figure 40-30-4



Disconnect the wire harness (Item 1) **[Figure 40-30-4]**.

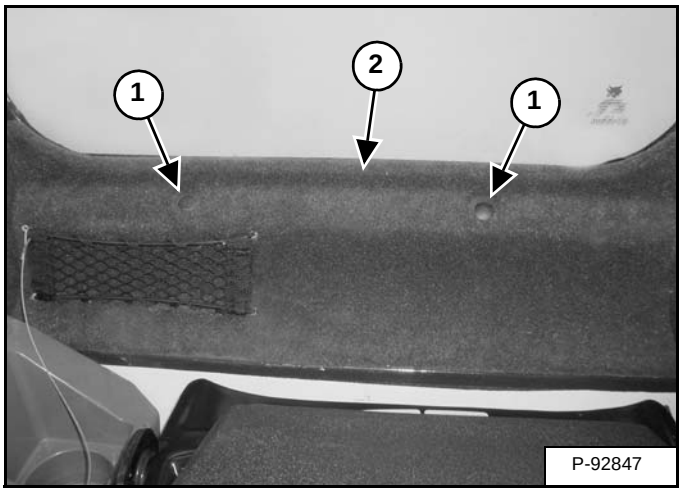
Removal And Installation (Cont'd)

Figure 40-30-5



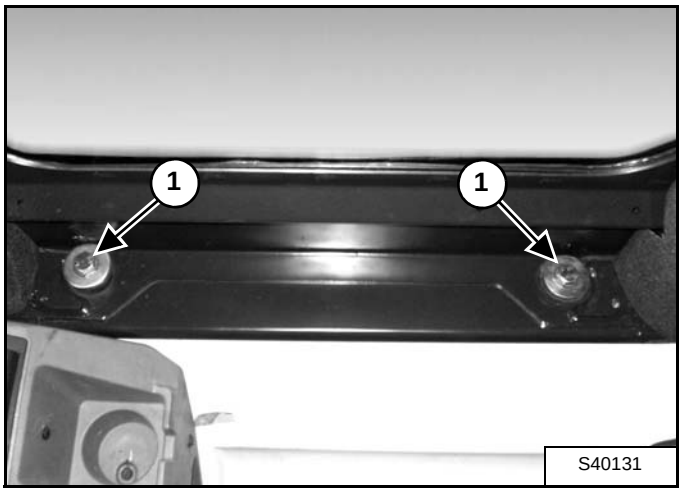
Disconnect both wire harnesses (Item 1) **[Figure 40-30-5]** from the bottom of the left console.

Figure 40-30-6



Remove the fasteners (Item 1) and remove the cover (Item 2) **[Figure 40-30-6]**.

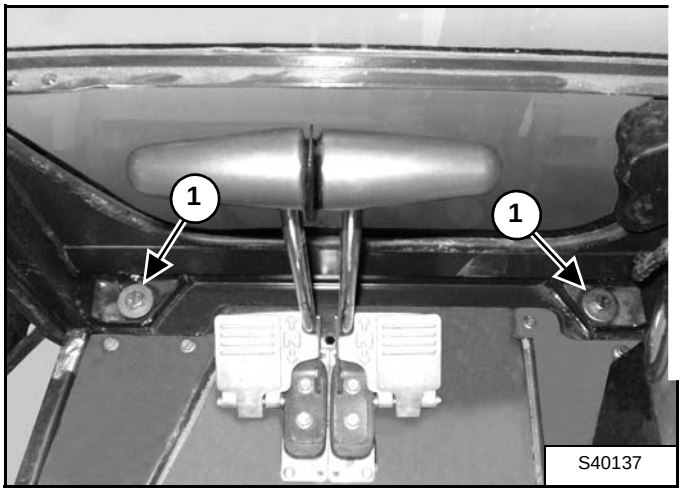
Figure 40-30-7



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

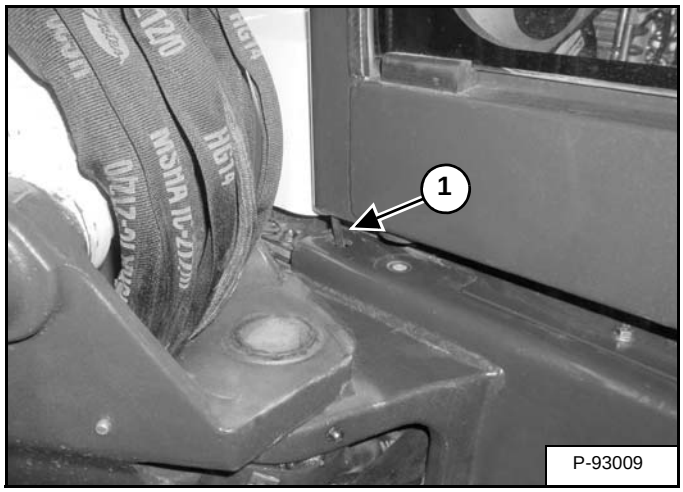


Remove the bolts and washers (Item 1) **[Figure 40-30-8]** from the front of the cab.

Installation: Tighten the bolts to 160 - 180 N•m (118 - 133 ft-lb) torque.

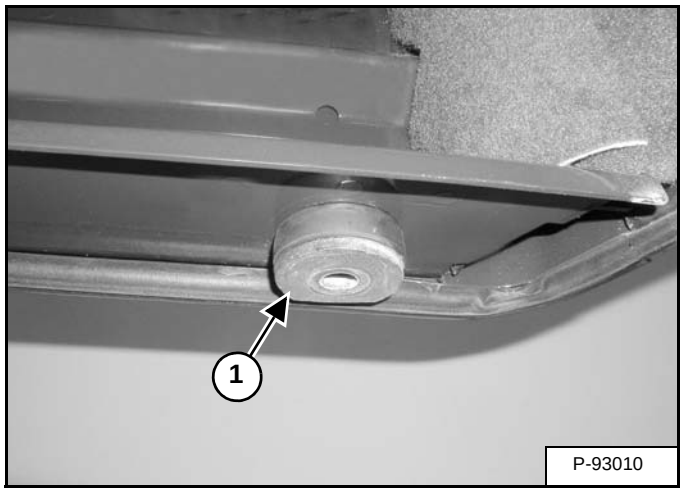
Removal And Installation (Cont'd)

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

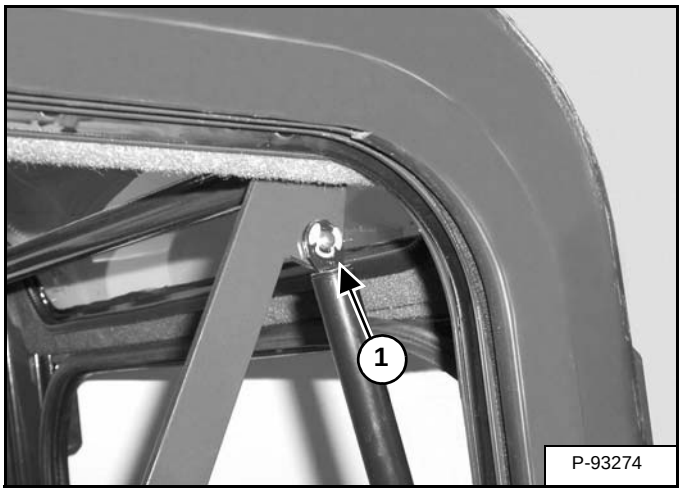


The door can be removed from the cab by slowly swinging the door back and forth while lifting up on the door **[Figure 40-30-11]**.

Installation: Align the hinges and swing the door back and forth until the door weight settles the hinges to full engagement.

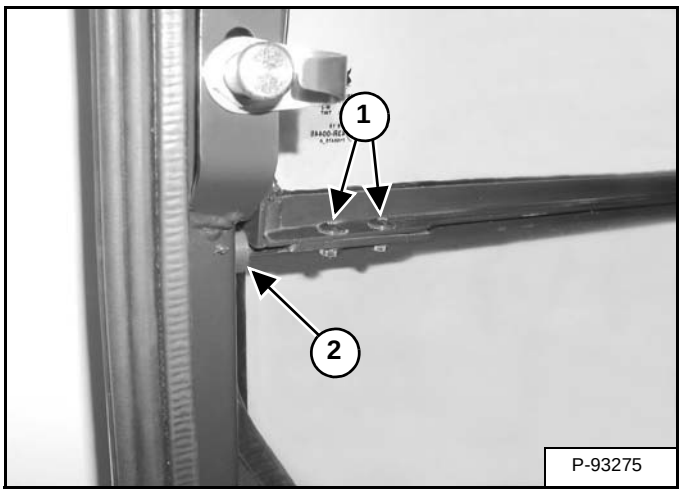
Front Window Removal And Installation

Figure 40-30-12



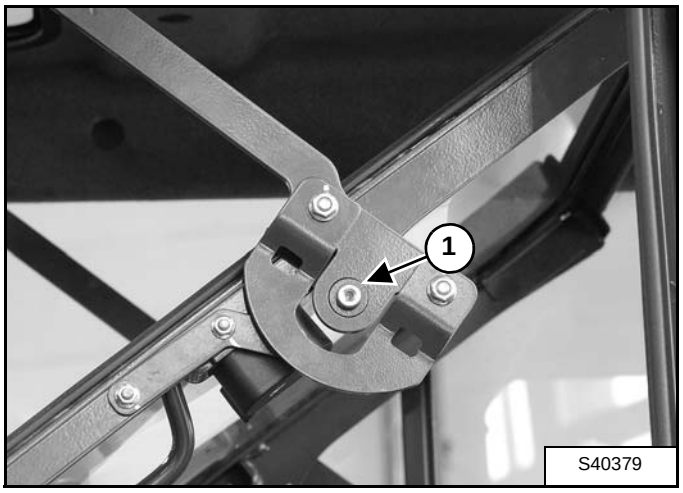
With a second person supporting the window, partially raise the window. Remove the clips (Item 1) **[Figure 40-30-12]** from the gas strut on both sides of the window. Remove the gas strut from the mount.

Figure 40-30-13



Remove the two screws (Item 1) and remove the roller (Item 2) **[Figure 40-30-13]**.

Figure 40-30-14



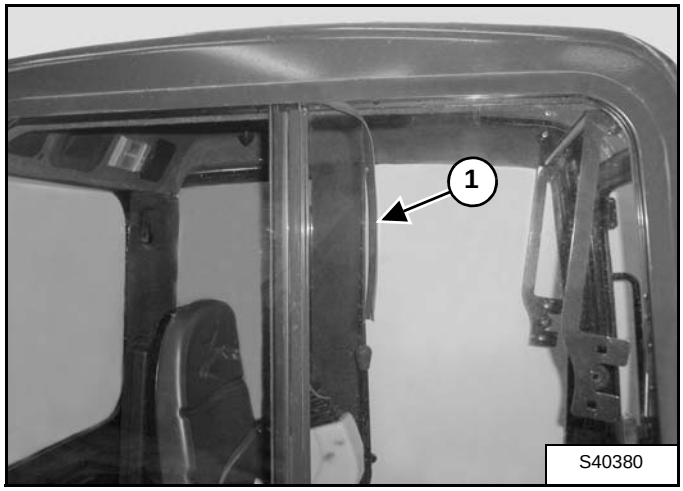
Remove the shoulder bolts (Item 1) **[Figure 40-30-14]** and nuts from both sides of the window.

Remove the front window.

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



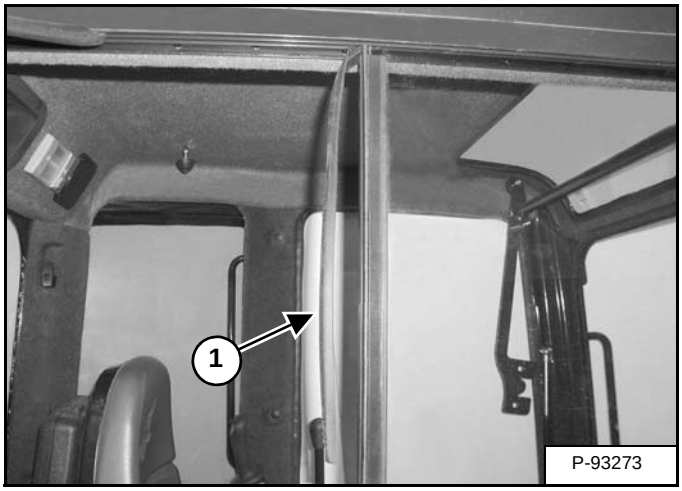
Lift the window up into the top channel and tilt the bottom edge out **[Figure 40-30-16]**. Remove the window from the cab.

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

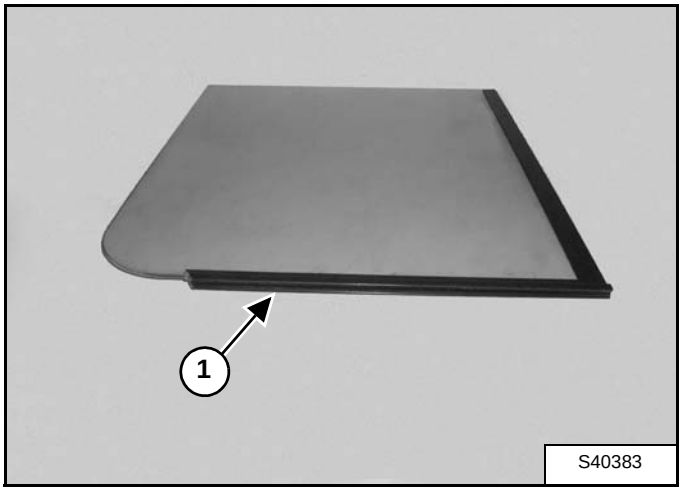


Lift the window up into the top channel and tilt the bottom edge out **[Figure 40-30-18]**. Remove the window from the cab.

Right Side Front And Rear Sliding Window Weather Strip Removal And Installation

Remove the window.

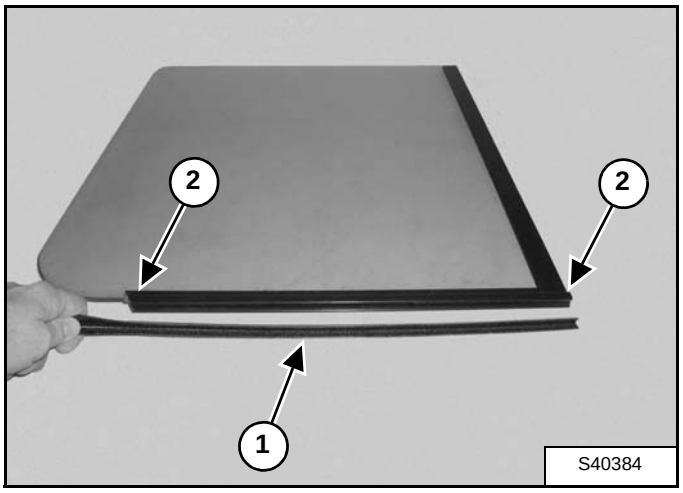
Figure 40-30-19



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

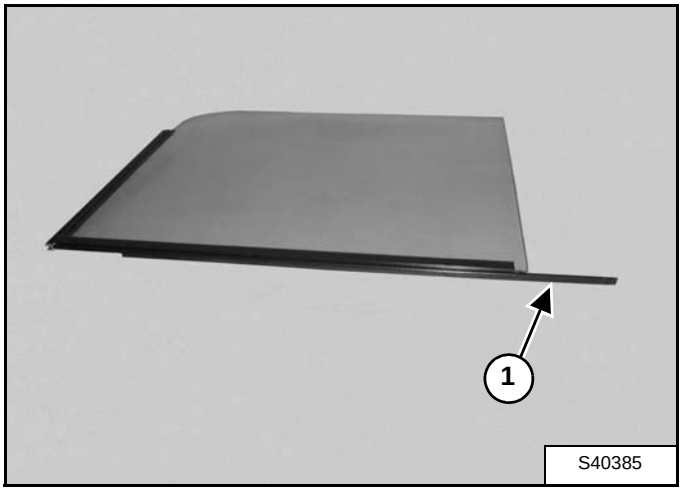


Install the new weather strip (Item 1). Cut the weather strip flush with the ends of the window channel (Item 2) **[Figure 40-30-20]**.

Right Side Front And Rear Sliding Window Wiper Strip Removal And Installation

Remove the window.

Figure 40-30-21

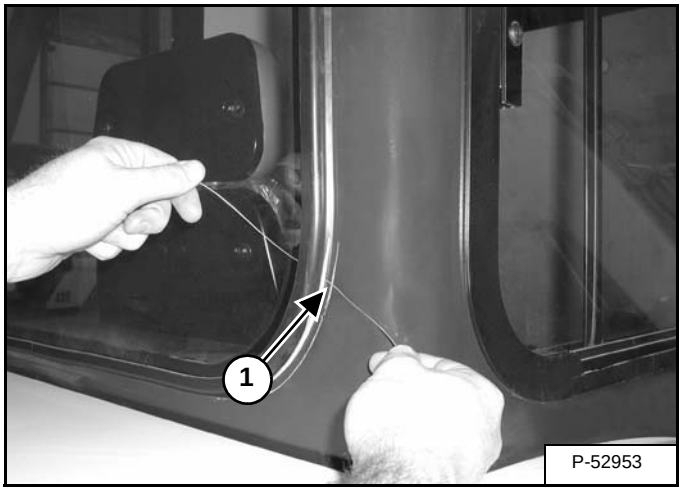


Remove the wiper strip (Item 1) **[Figure 40-30-21]** from the window channel.

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.

Glass Installation

Top And Rear Glass

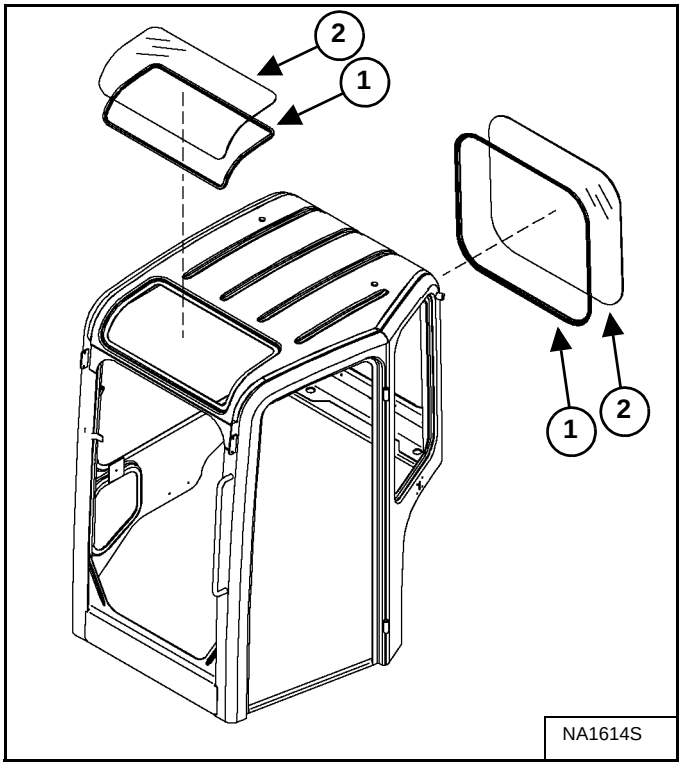
Remove the majority of the old urethane adhesive from the perimeter of the cab.

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.

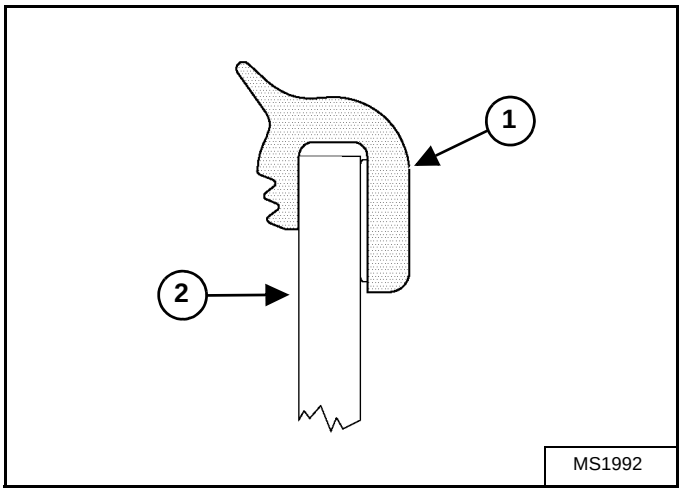
Clean the metal surfaces with general purposes adhesive cleaner. Clean the glass surface with glass cleaner.

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



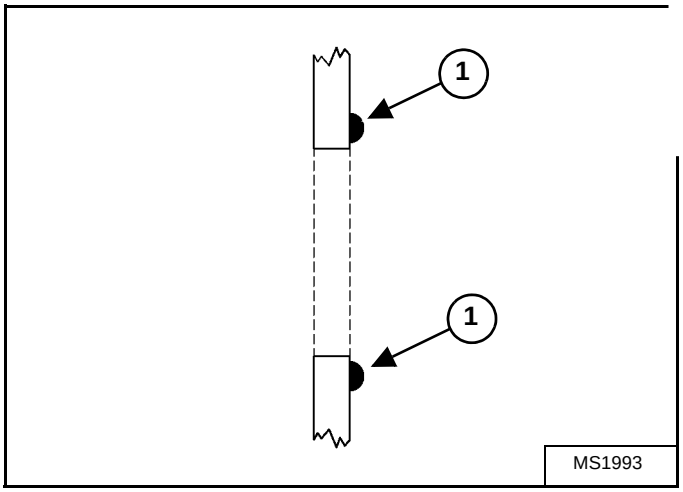
Shake the combo primer for one minute.

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 razor blade.

Cut the tip of the adhesive tube to the desired shape an size to provide a bead height sufficient to give goo contact with the glass around the entire perimeter.

Figure 40-30-25

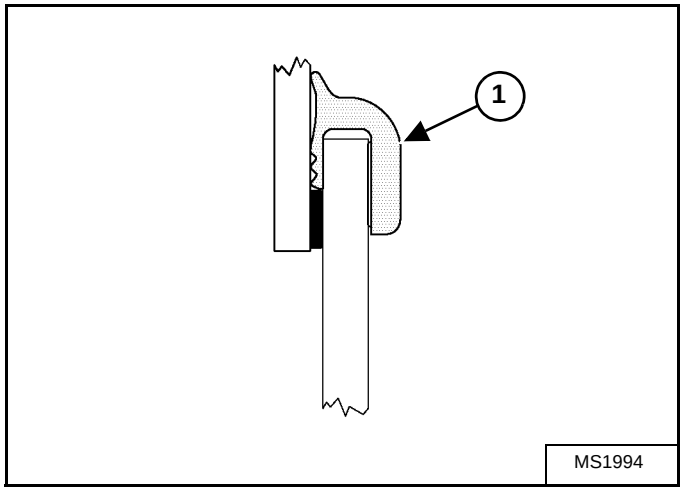


Apply a 6,4 X 9,5 mm (0.25 X 0.375 in) bead of urethane adhesive (Item 1) **[Figure 40-30-25]** to the perimeter of the cab.

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

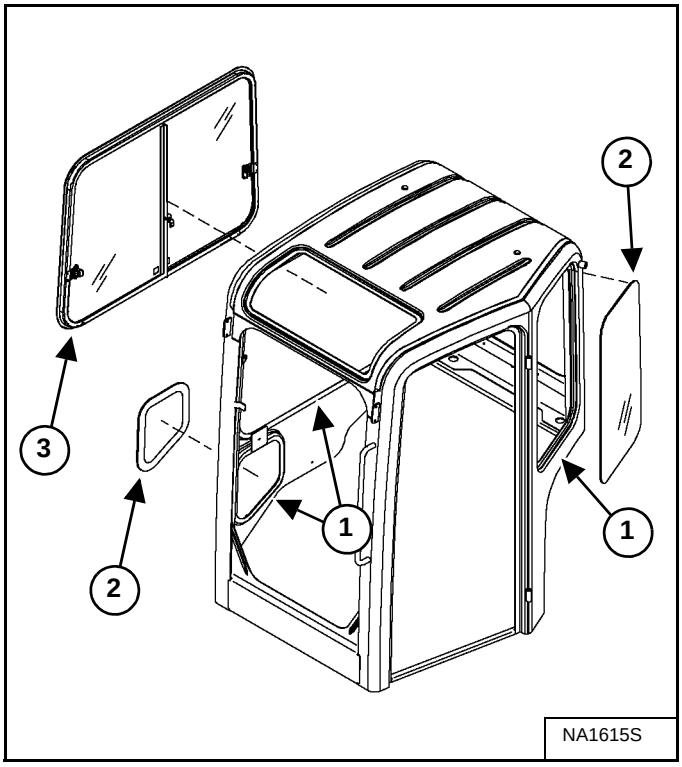
Remove the majority of the old urethane adhesive from the perimeter of the cab.

Prime and paint any bare metal or scratches.

Clean the metal surfaces with general purpose 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 (Item 3) **[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.

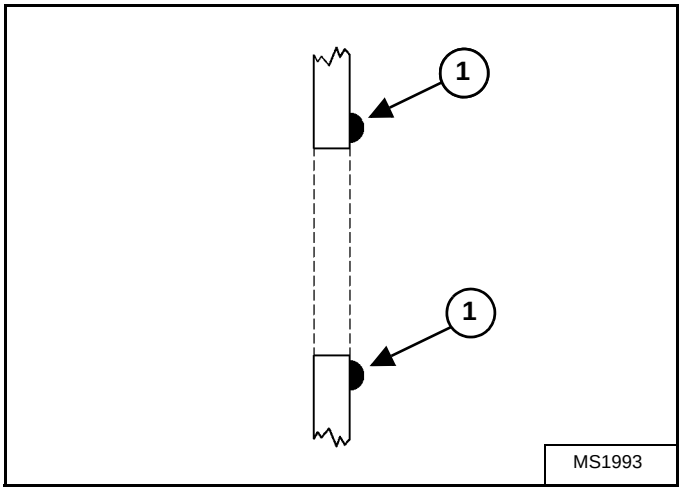
I-2236-0105

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.

Glass Installation (Cont'd)

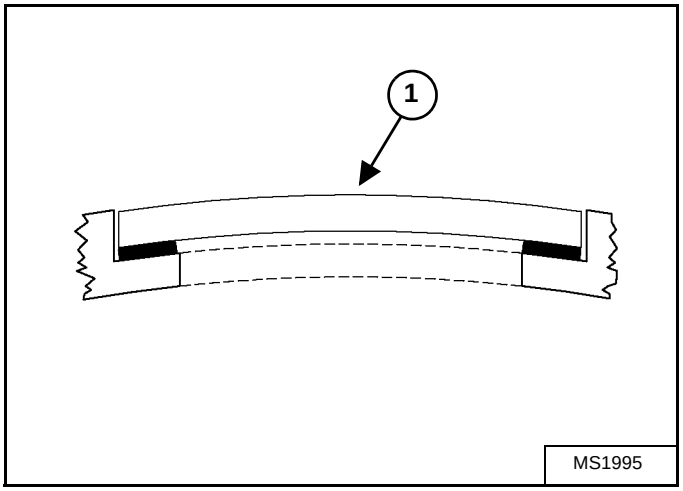
Right And Left Side Glass (Cont'd)

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.

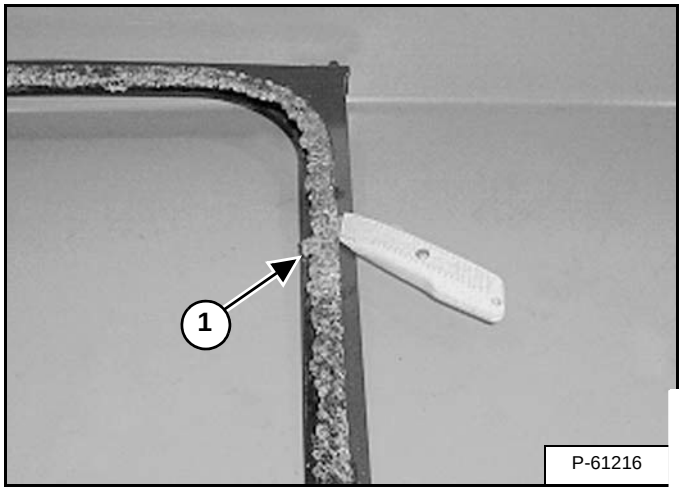
Remove the tape after the adhesive is cured.

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.

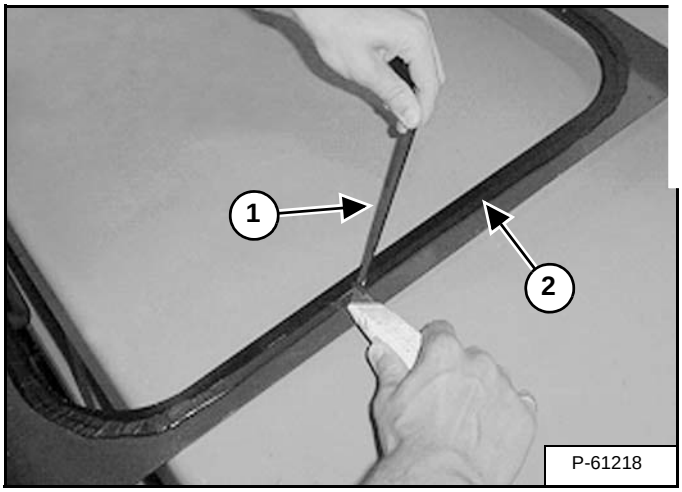
Remove the front window or door that is to be repaired from the excavator.

Figure 40-30-30



Remove the broken glass (Item 1) **[Figure 40-30-30]**.

Figure 40-30-31



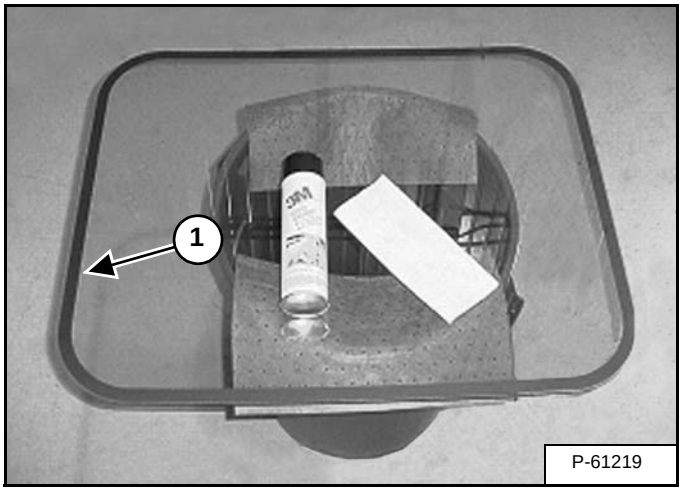
Cut and remove the old urethane adhesive (Item 1) and leaving less than a 0,79 mm (0.03 in) thick layer (Item 2) **[Figure 40-30-31]** for the new adhesive to bond to.

NOTE: Use care not to scratch the paint on the frame.

Glass Installation (Cont'd)

Door And Front Window Glass (Cont'd)

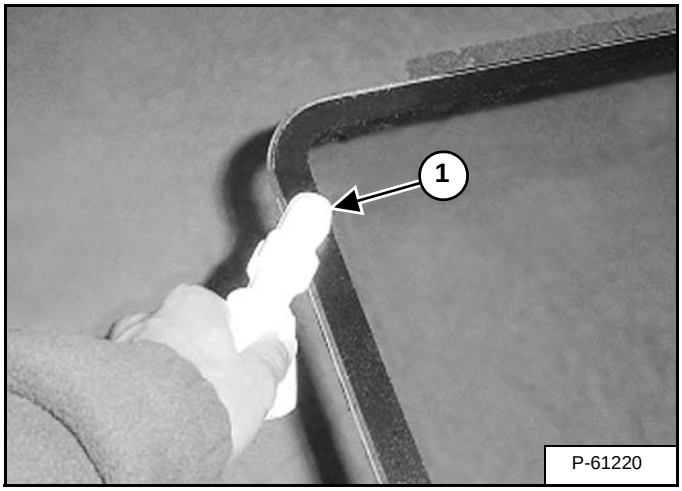
Figure 40-30-32



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 pane with glass cleaner.

Figure 40-30-33



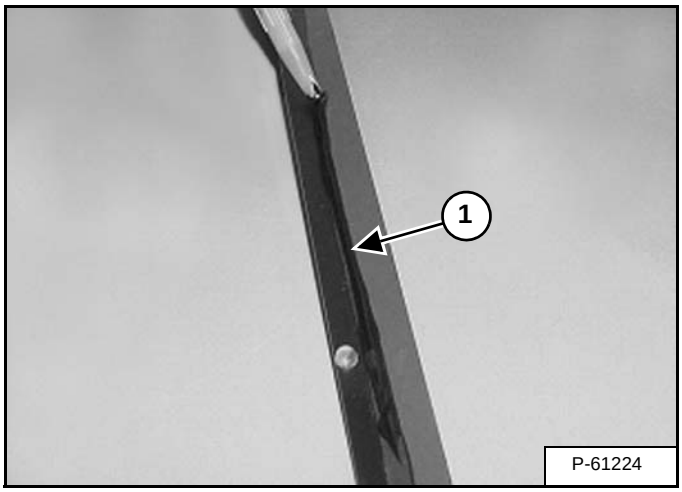
Apply one coat of combo primer (Item 1) **[Figure 40-30-33]** on the painted edge of the glass.

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 can be removed from the glass using a razor blade.

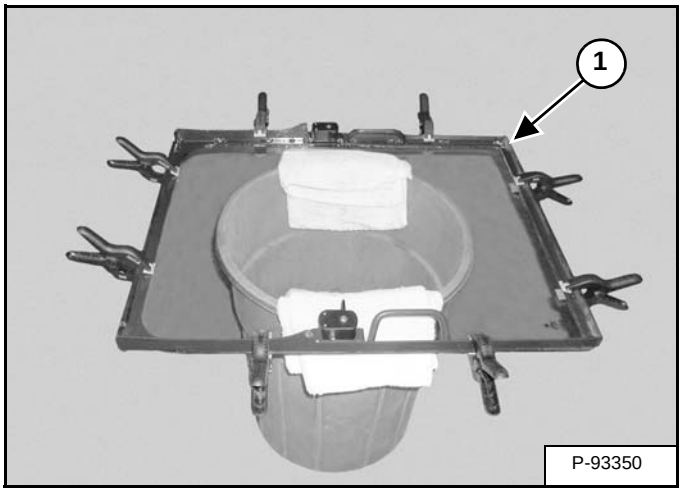
Figure 40-30-34



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

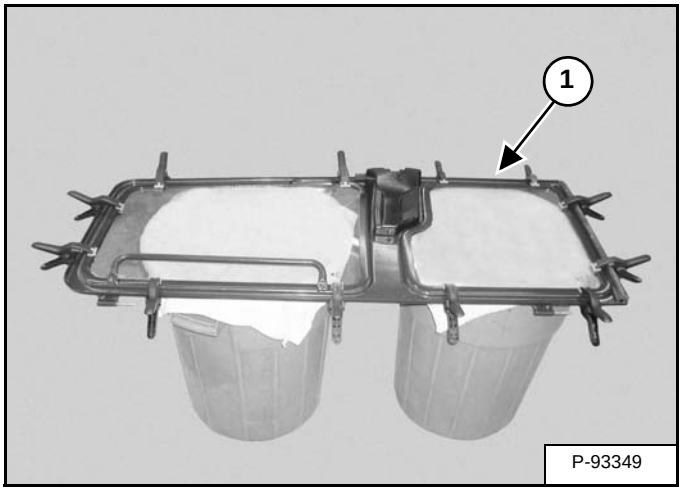
If the glass has direct contact with the metal frame, the glass may break due to machine vibration.

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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 8 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.)


Bobcat®

SEAT

Removal And Installation

Figure 40-40-1

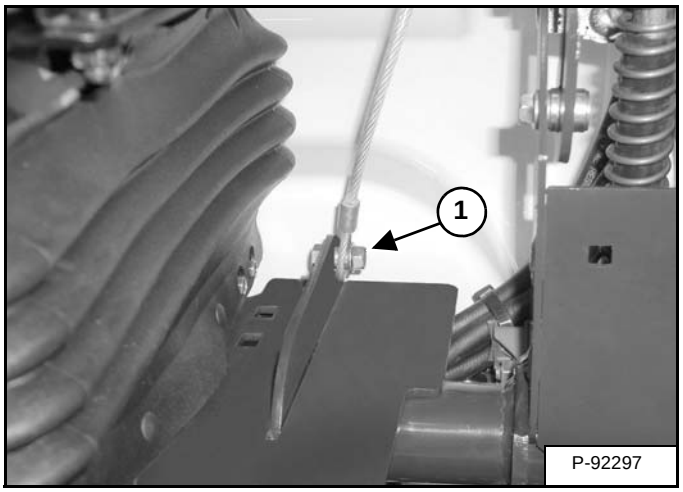
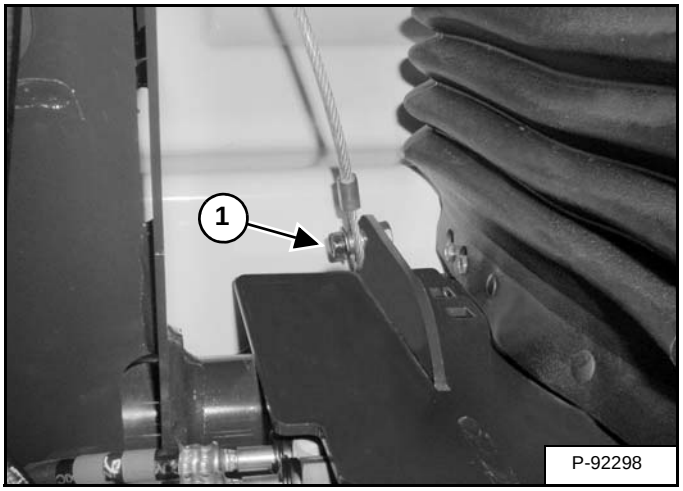


Figure 40-40-2



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

Figure 40-40-3

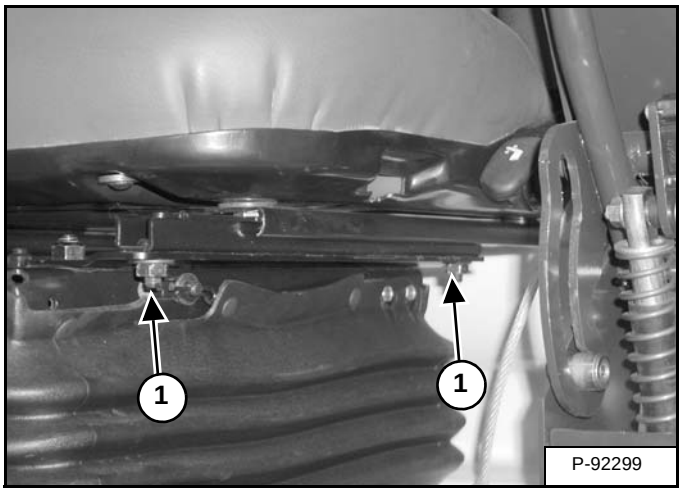
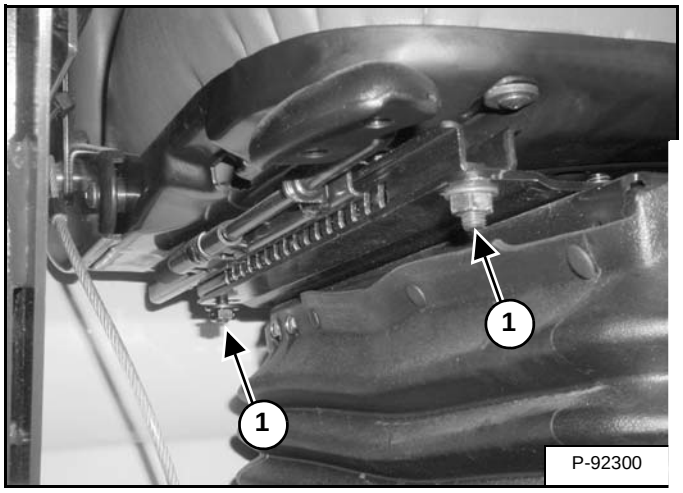


Figure 40-40-4



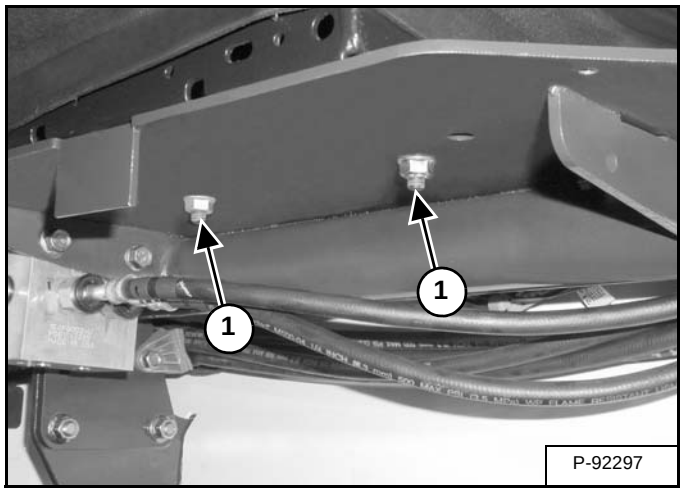
Remove the nuts (Item 1) **[Figure 40-40-3]** and **[Figur 40-40-4]** from the seat rails.

Remove the seat.

SEAT (CONT'D)

Seat Mount Removal And Installation

Figure 40-40-5



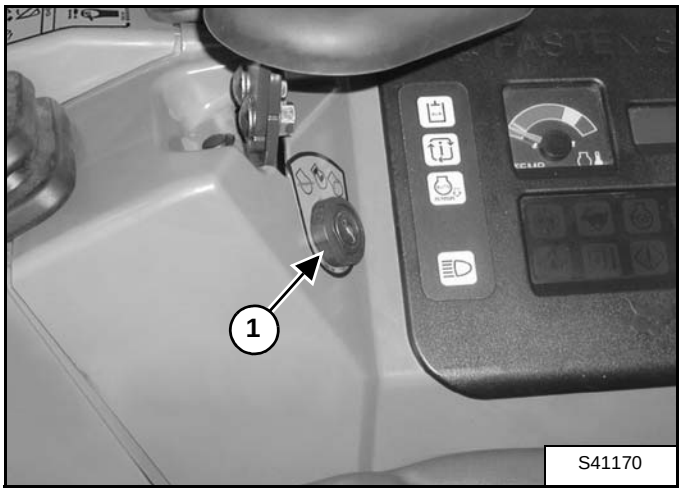
Remove the four nuts (Item 1) **[Figure 40-40-5]**.

Remove the seat mount.

RIGHT CONSOLE (S/N AB8B11001 - AB8B11999)

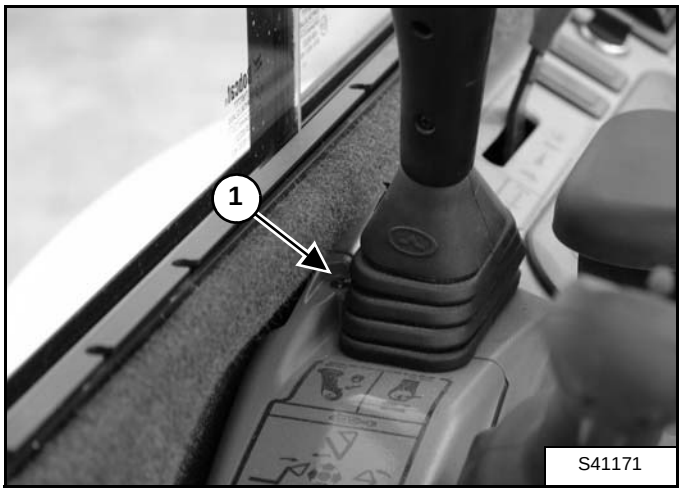
Console Cover Removal And Installation

Figure 40-50-1



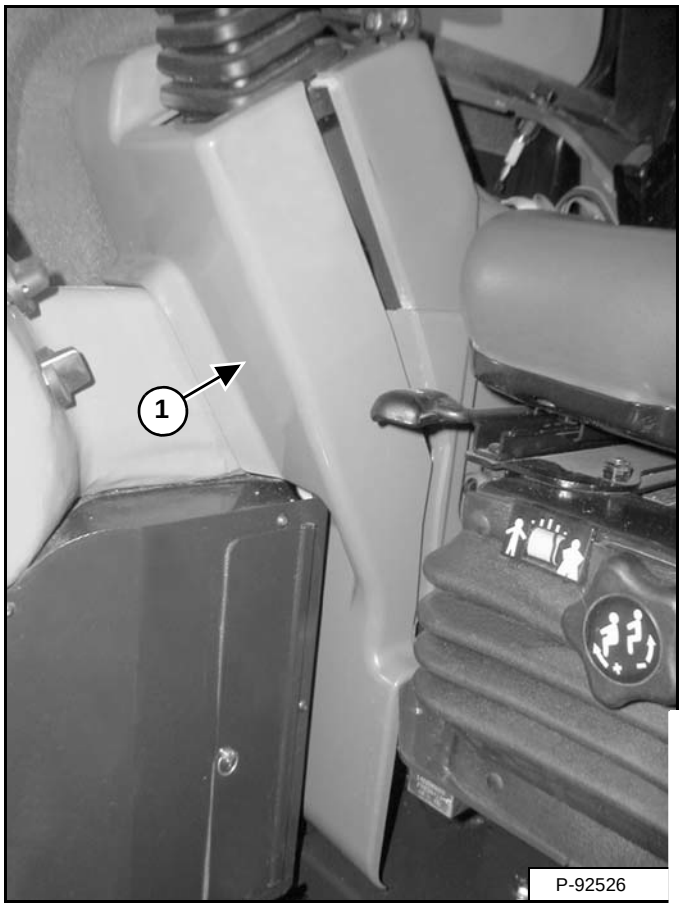
Remove the nut (Item 1) **[Figure 40-50-1]** from the key switch. Lower the switch into the console.

Figure 40-50-2



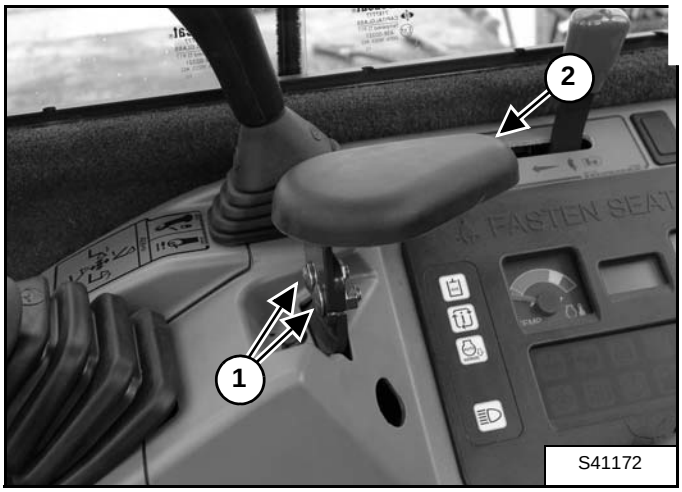
Remove the screw (Item 1) **[Figure 40-50-2]**.

Figure 40-50-3



Pull the cover (Item 1) **[Figure 40-50-3]** toward the fron of the excavator and remove the cover.

Figure 40-50-4

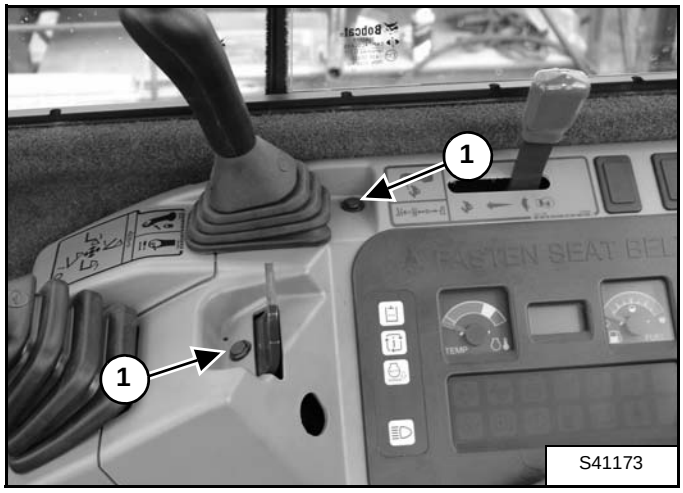


Remove the two bolts (Item 1) and nuts. Remove the armrest (Item 2) **[Figure 40-50-4]**.

RIGHT CONSOLE (S/N AB8B11001 - AB8B11999) (CONT'D)

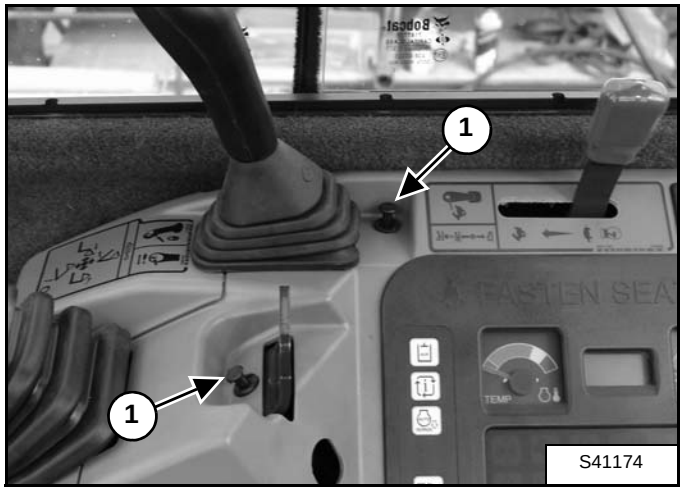
Console Cover Removal And Installation (Cont'd)

Figure 40-50-5



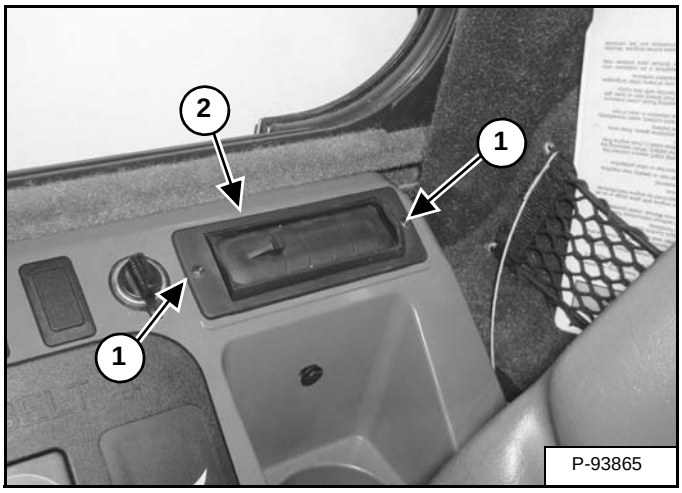
Pull up on the center pin (Item 1) **[Figure 40-50-5]**.

Figure 40-50-6



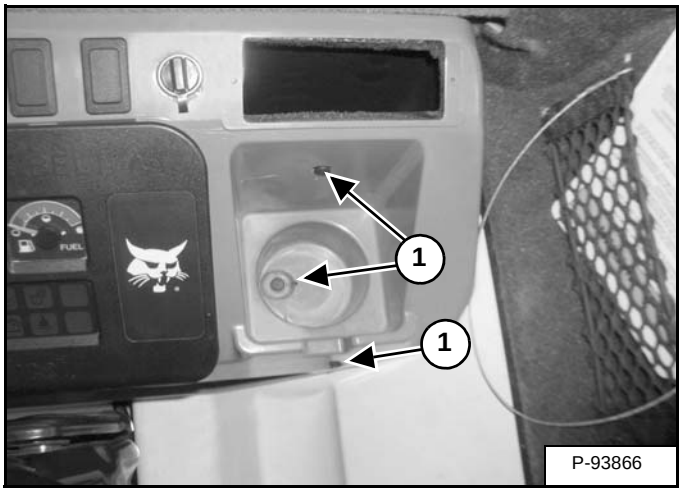
Remove the pin assembly (Item 1) **[Figure 40-50-6]**.

Figure 40-50-7



Remove the two screws (Item 1). Remove the louver (Item 2) **[Figure 40-50-7]**.

Figure 40-50-8

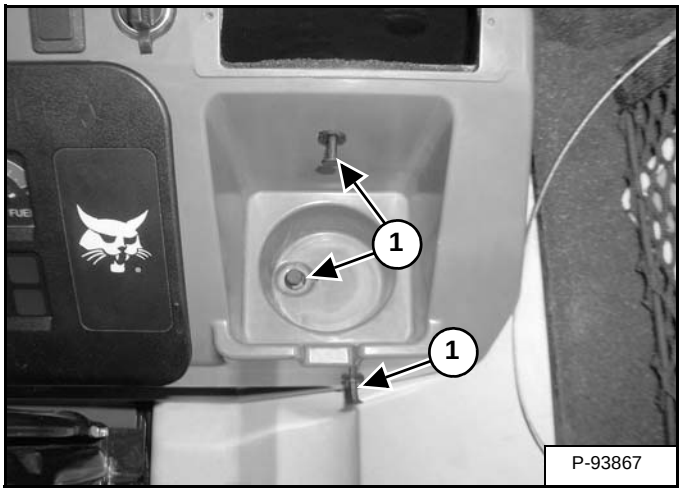


Pull up on the center pin (Item 1) **[Figure 40-50-8]**.

RIGHT CONSOLE (S/N AB8B11001 - AB8B11999) (CONT'D)

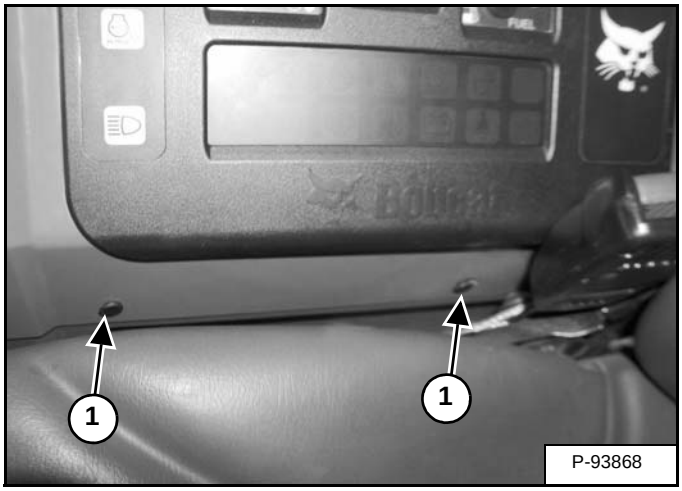
Console Cover Removal And Installation (Cont'd)

Figure 40-50-9



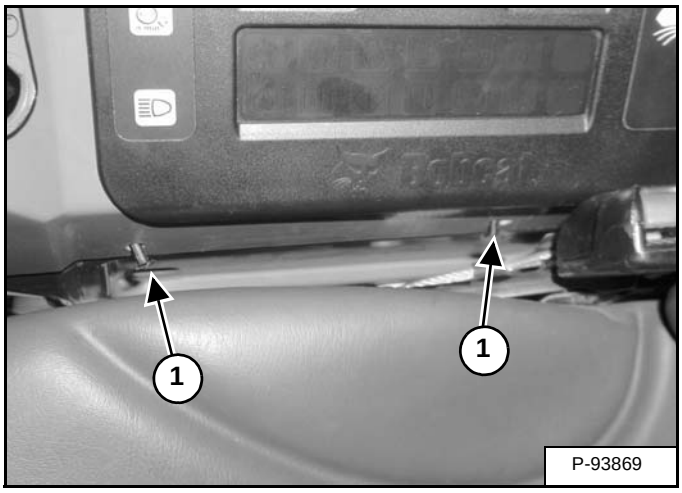
Remove the pin assembly (Item 1) **[Figure 40-50-9]**.

Figure 40-50-10



Pull up on the center pin (Item 1) **[Figure 40-50-10]**.

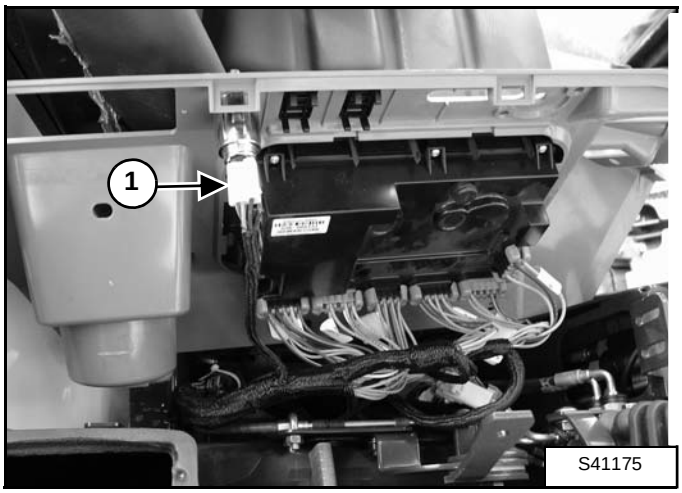
Figure 40-50-11



Remove the pin assembly (Item 1) **[Figure 40-50-11]**.

Standard Engine Speed Control Lever

Figure 40-50-12

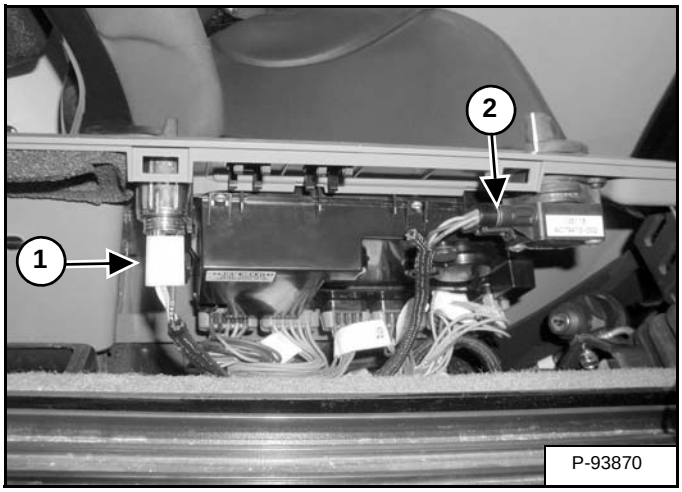


Tilt the cover forward and disconnect the auxiliary power outlet wire harness (Item 1) **[Figure 40-50-12]**.

Console Cover Removal And Installation (Cont'd)

Optional Engine Speed Control Dial Gauge (Auto-Idle)

Figure 40-50-13



Tilt the cover forward and disconnect the auxiliary power outlet wire harness (Item 1) and the engine speed control wire harness (Item 2) **[Figure 40-50-13]**.

All Machines

Figure 40-50-14

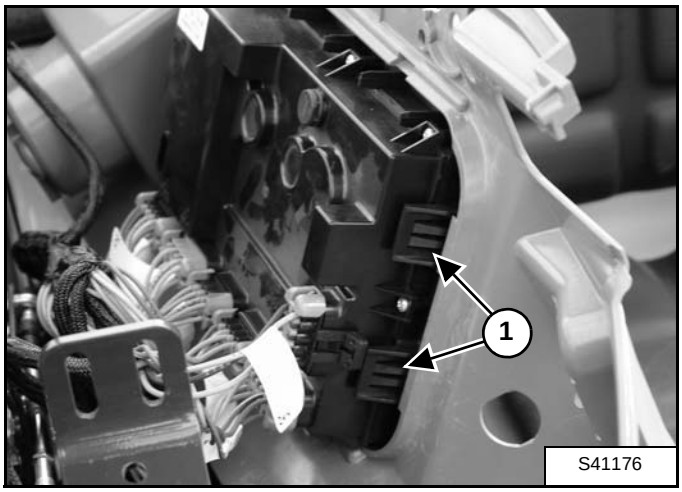
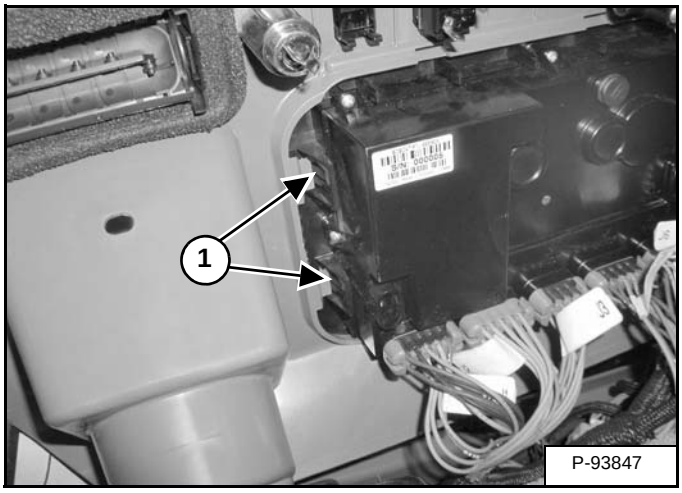


Figure 40-50-15

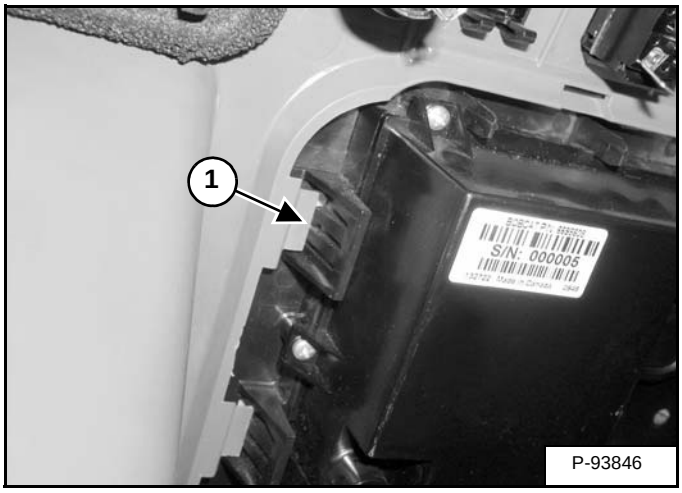


Depress the tabs (Item 1) **[Figure 40-50-14]** and **[Figure 40-50-15]** on the controller.

RIGHT CONSOLE (S/N AB8B11001 - AB8B11999) (CONT'D)

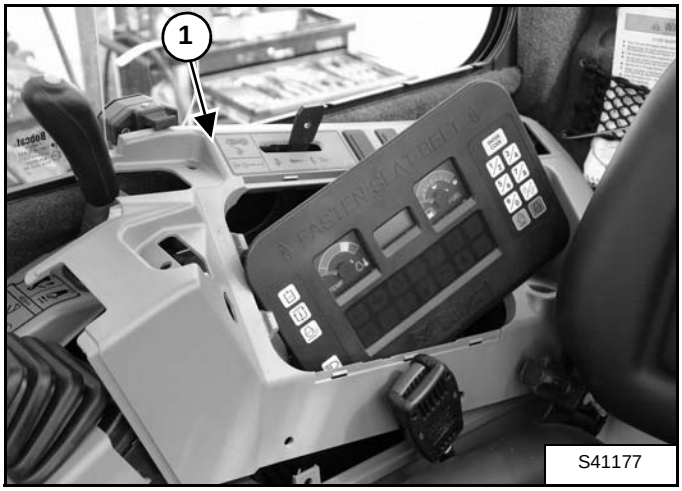
Console Cover Removal And Installation (Cont'd)

Figure 40-50-16



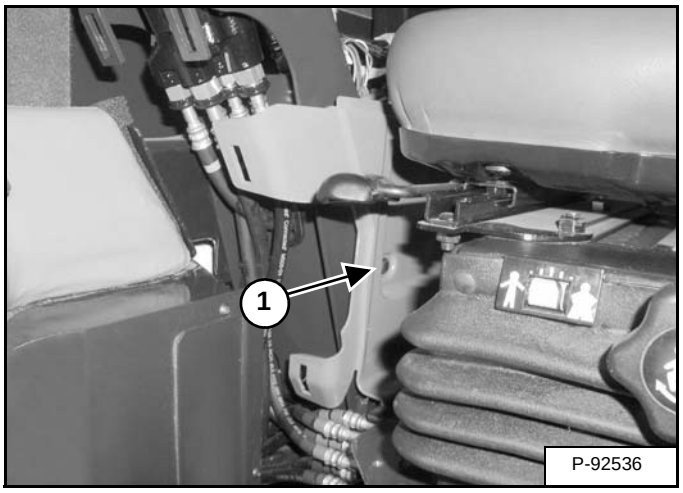
Installation: The tabs (Item 1) **[Figure 40-50-16]** must fully engage the console cover.

Figure 40-50-17



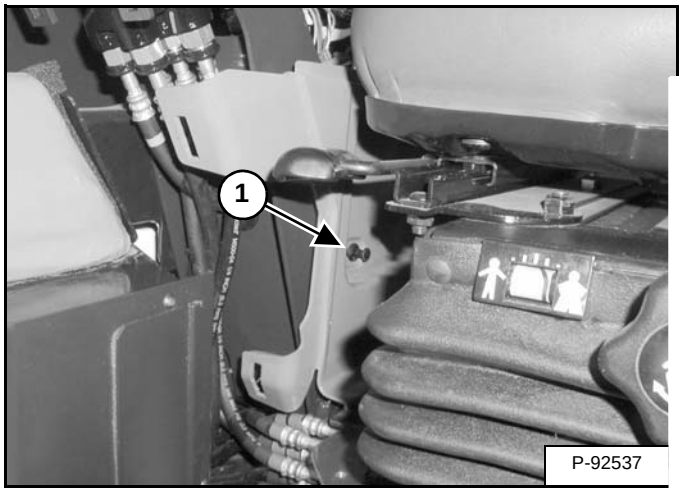
Remove the cover (Item 1) **[Figure 40-50-17]**.

Figure 40-50-18



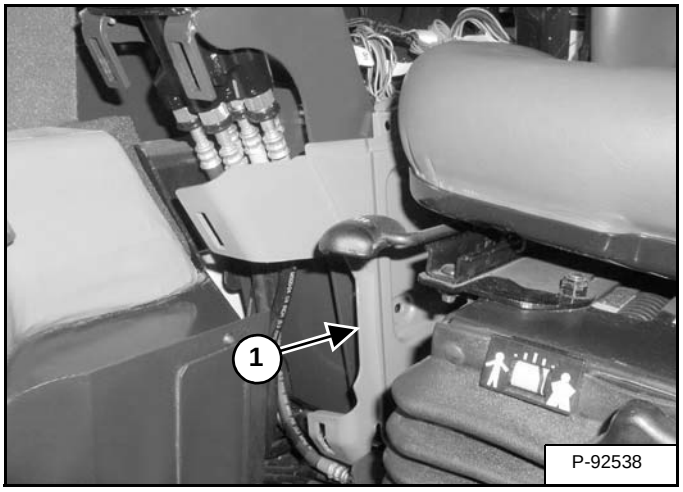
Pull up on the center pin (Item 1) **[Figure 40-50-18]**.

Figure 40-50-19



Remove the pin assembly (Item 1) **[Figure 40-50-19]**.

Figure 40-50-20



Remove the cover (Item 1) **[Figure 40-50-20]**.

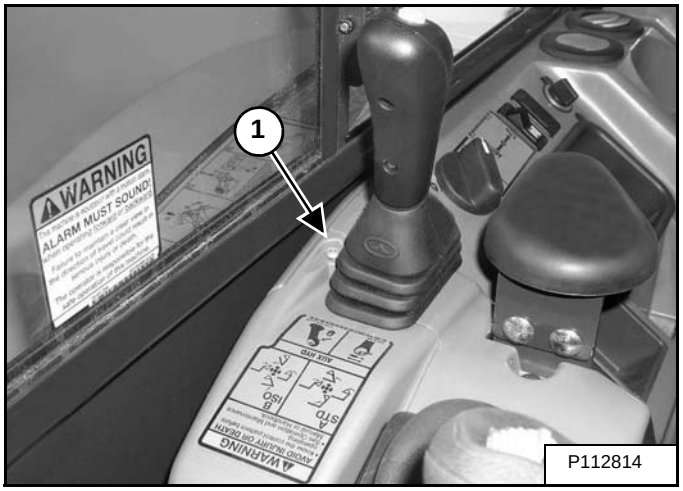

Bobcat®

RIGHT CONSOLE (S/N AB8B12001 & ABOVE)

Console Cover Removal And Installation

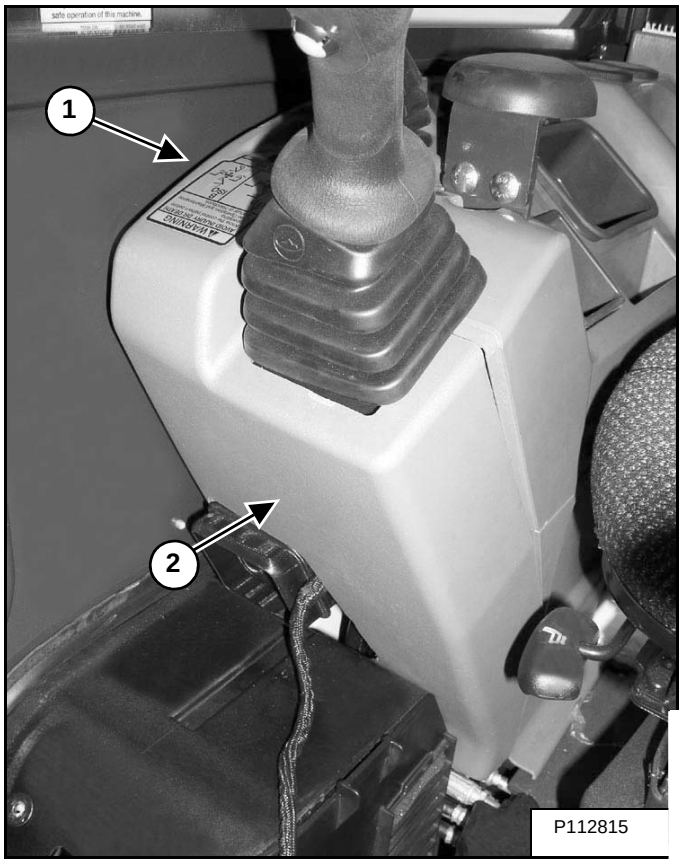
Remove the instrument panel / controller. (See Removal And Installation on Page 50-101-1.)

Figure 40-51-1



Remove the screw (Item 1) **[Figure 40-51-1]**.

Figure 40-51-2



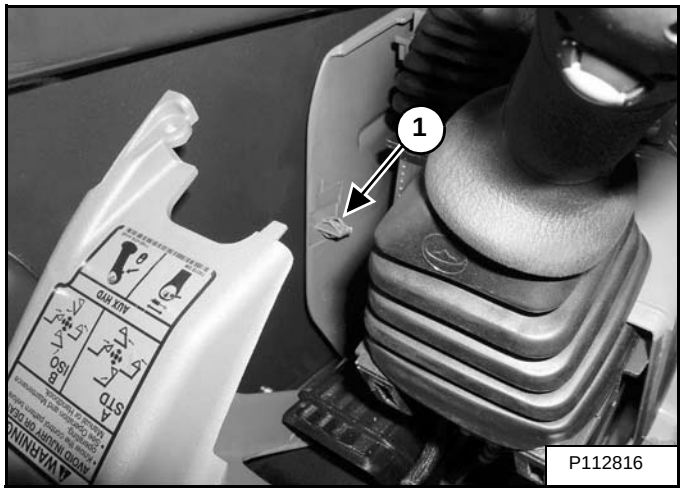
Pull the side cover (Item 1) away from the front cove (Item 2) **[Figure 40-51-2]**.

Pull the front cover (Item 2) **[Figure 40-51-2]** towards th front of the excavator and remove the cover.

RIGHT CONSOLE (S/N AB8B12001 & ABOVE) (CONT'D)

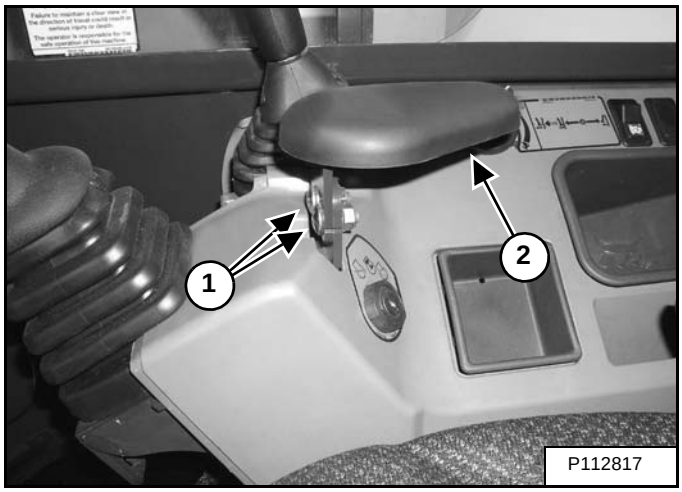
Console Cover Removal And Installation (Cont'd)

Figure 40-51-3



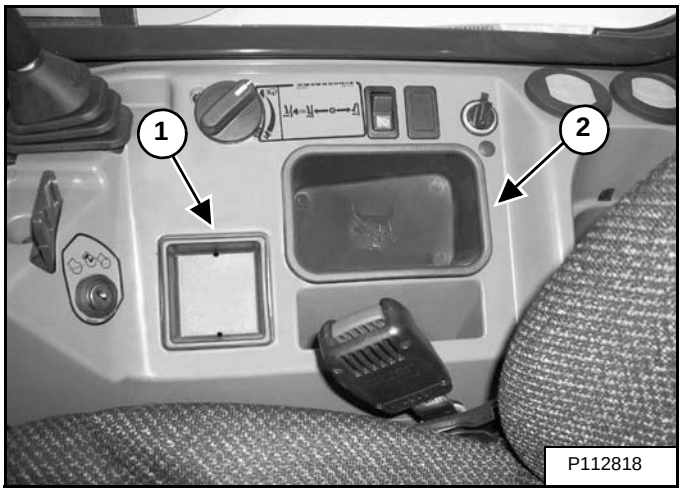
Installation: Install the tab (Item 1) **[Figure 40-51-3]** of the side cover into the front cover.

Figure 40-51-4



Remove the two bolts (Item 1) and nuts. Remove the armrest (Item 2) **[Figure 40-51-4]**.

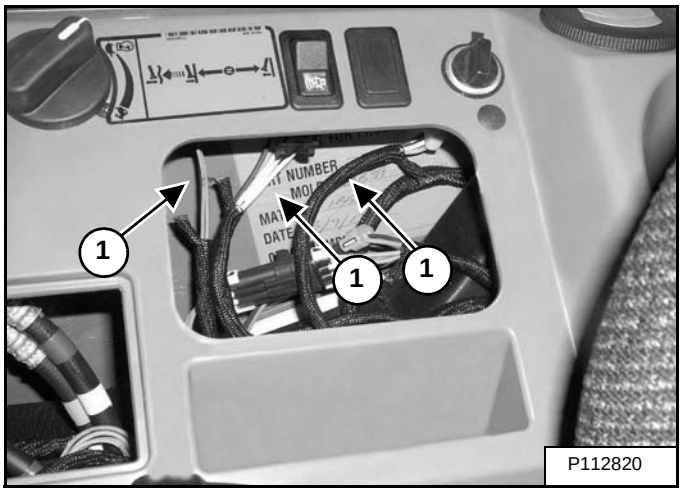
Figure 40-51-5



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.

Figure 40-51-6

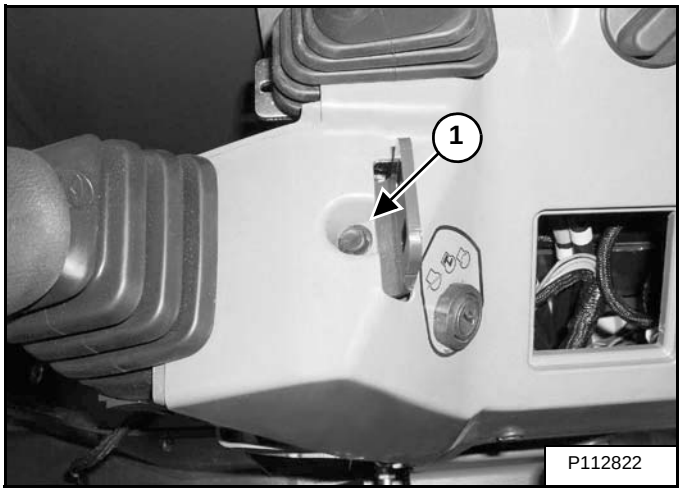


Disconnect the wire harness (Item 1) **[Figure 40-51-6]** from the engine speed control, switches and auxiliary power outlet.

RIGHT CONSOLE (S/N AB8B12001 & ABOVE) (CONT'D)

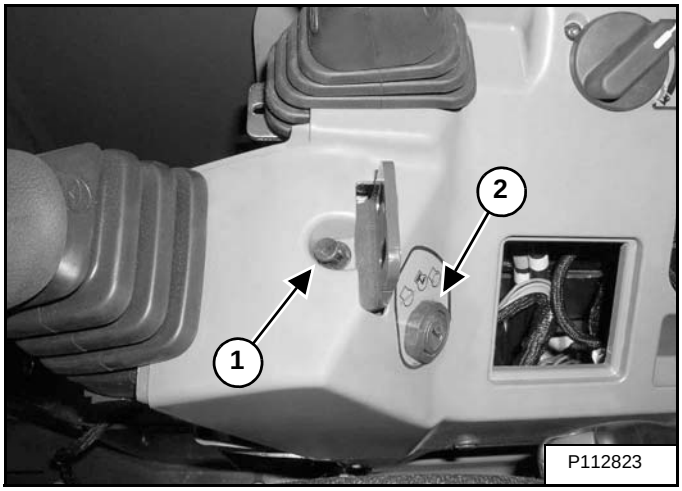
Console Cover Removal And Installation (Cont'd)

Figure 40-51-7



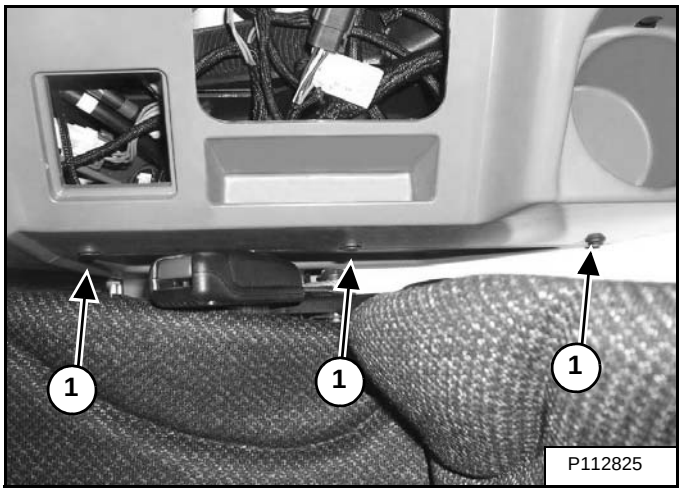
Pull up on the center pin (Item 1) **[Figure 40-51-7]**.

Figure 40-51-8



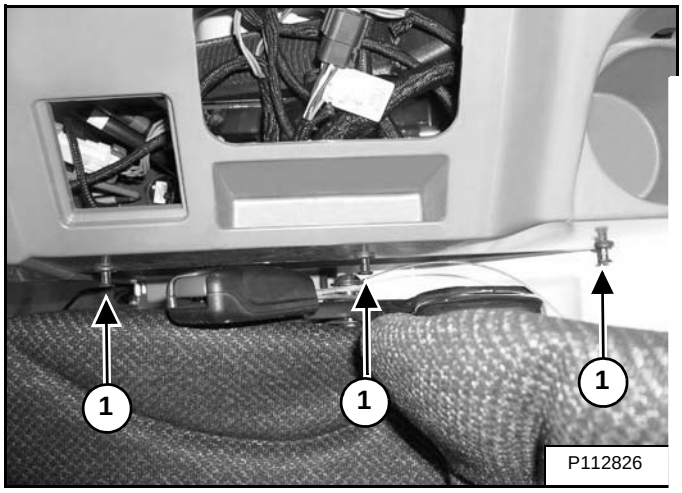
Remove the pin assembly (Item 1). Remove the nut (Item 2) **[Figure 40-51-8]** from the key switch. Lower the switch into the console.

Figure 40-51-9



Pull up on the center pin (Item 1) **[Figure 40-51-9]**.

Figure 40-51-10

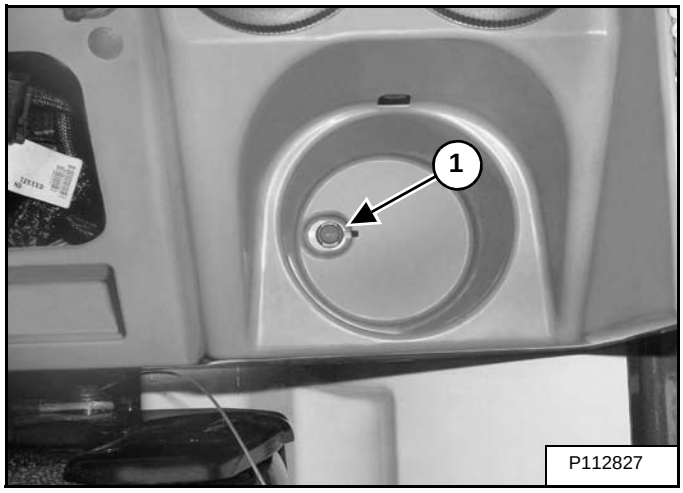


Remove the pin assembly (Item 1) **[Figure 40-51-10]**.

RIGHT CONSOLE (S/N AB8B12001 & ABOVE) (CONT'D)

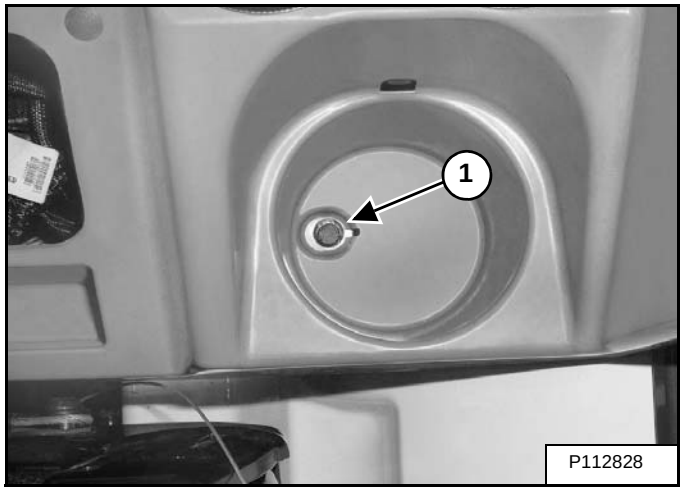
Console Cover Removal And Installation (Cont'd)

Figure 40-51-11



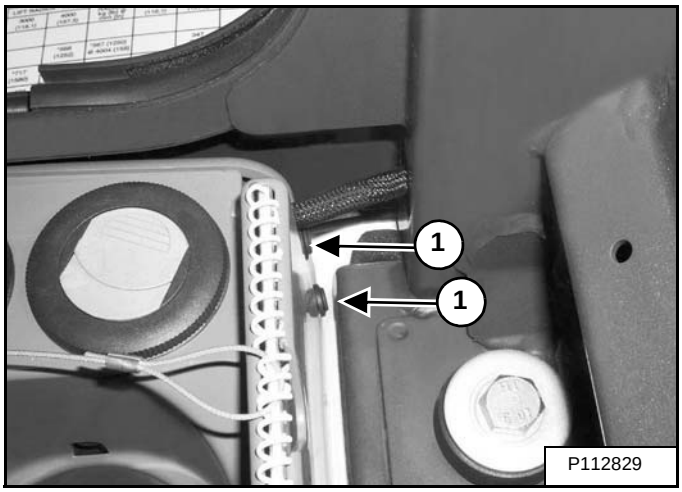
Pull up on the center pin (Item 1) **[Figure 40-51-11]**.

Figure 40-51-12



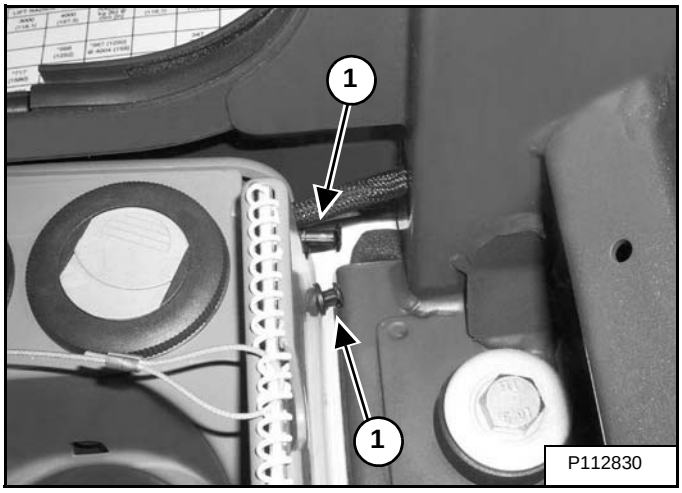
Remove the pin assembly (Item 1) **[Figure 40-51-12]**.

Figure 40-51-13



Pull up on the center pin (Item 1) **[Figure 40-51-13]**.

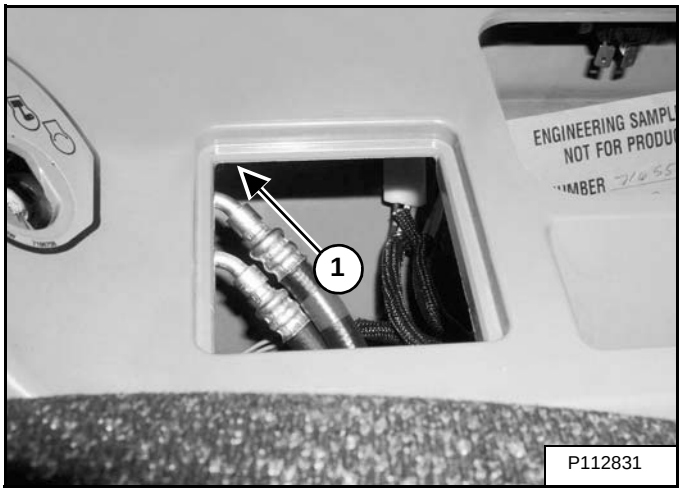
Figure 40-51-14



Remove the pin assembly (Item 1) **[Figure 40-51-14]**.

Console Cover Removal And Installation (Cont'd)

Figure 40-51-15



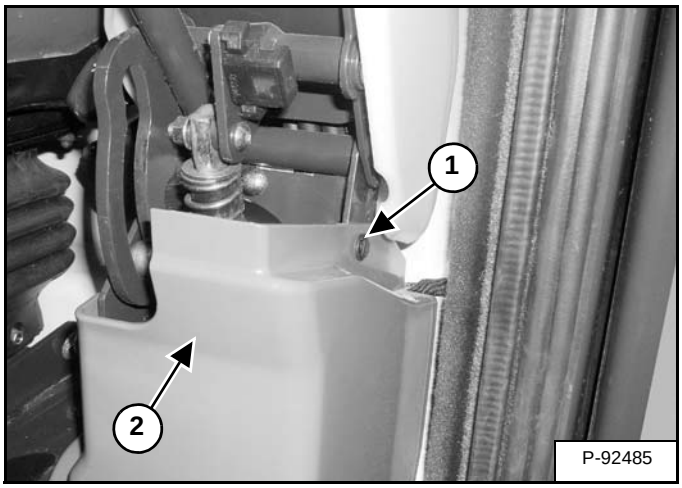
Loosen the nut (Item 1) **[Figure 40-51-15]** and bolt located under the console cover. Remove the cover.


Bobcat®

LEFT CONSOLE

Lower Console Cover Removal And Installation

Figure 40-60-1

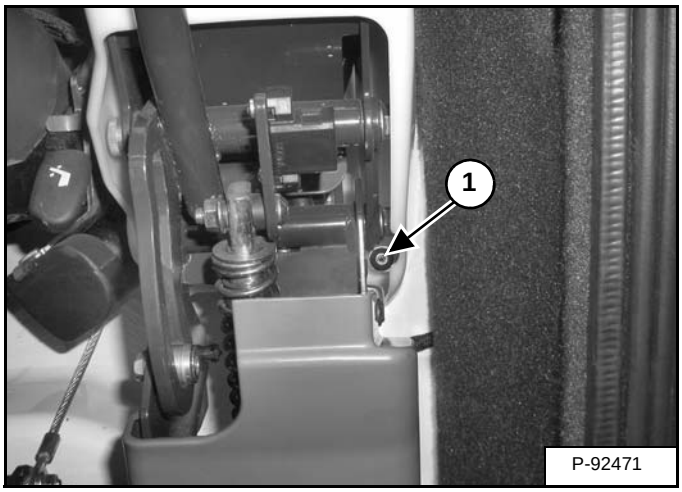


Pull out on the center of the plastic fastener assembly (Item 1) **[Figure 40-60-1]** (both sides).

Remove the fastener assembly and cover (Item 2) **[Figure 40-60-1]**.

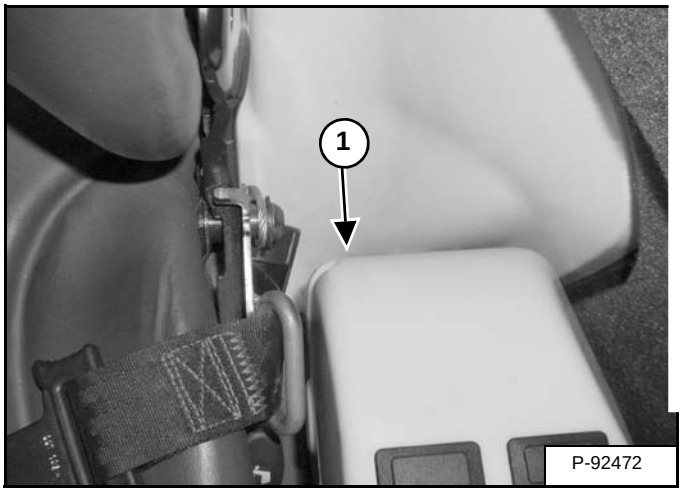
Upper Console Cover Removal And Installation

Figure 40-60-2



Remove the screw (Item 1) **[Figure 40-60-2]** and lower the console.

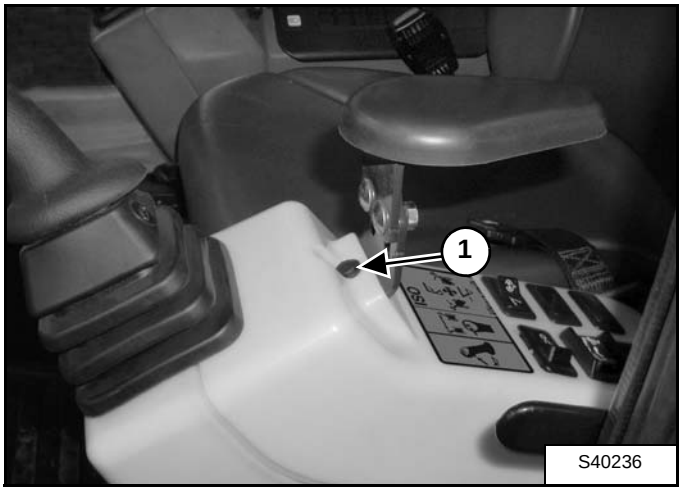
Figure 40-60-3



Remove the screw (Item 1) **[Figure 40-60-3]** from the rear of the cover.

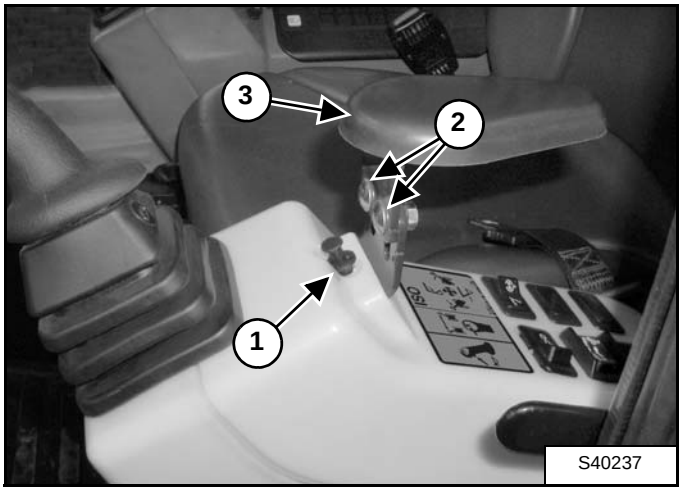
Upper Console Cover Removal And Installation (Cont'd)

Figure 40-60-4



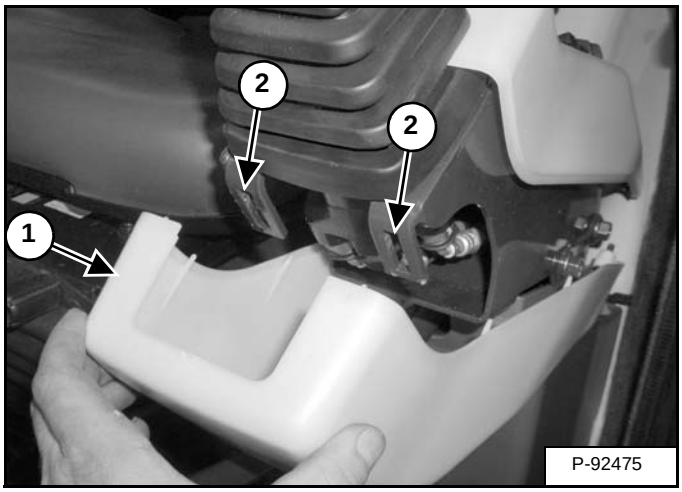
Pull up on the center of the plastic fastener (Item 1) **[Figure 40-60-4]**.

Figure 40-60-5



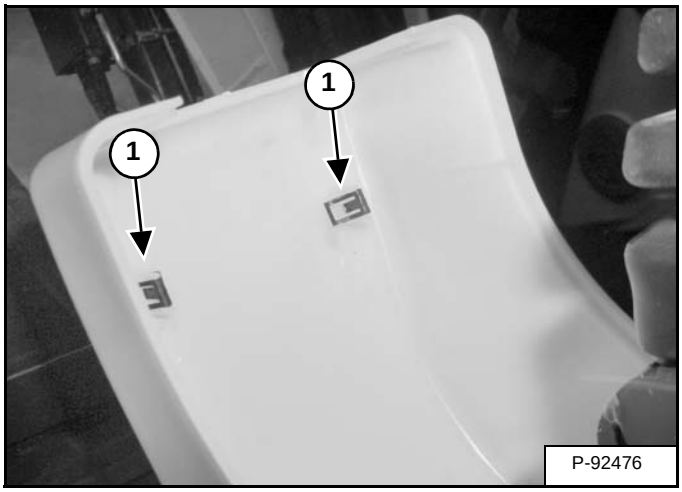
Remove the fastener assembly (Item 1). Remove the bolts (Item 2) and nuts. Remove the armrest (Item 3) **[Figure 40-60-5]**.

Figure 40-60-6



Pull down on the front of the bottom cover (Item 1) **[Figure 40-60-6]**.

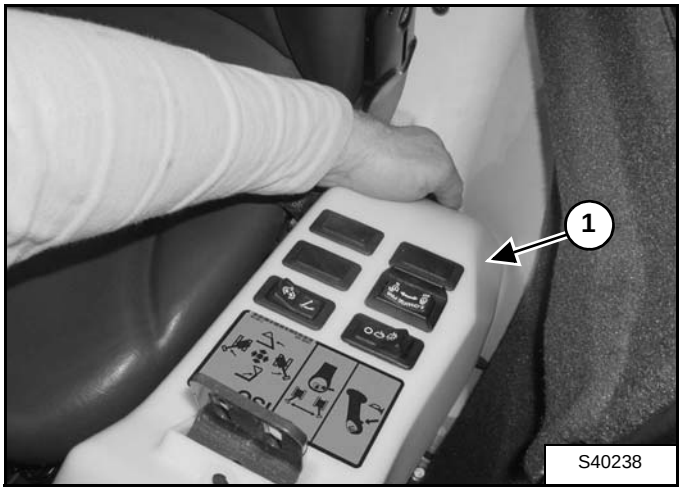
Figure 40-60-7



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]**.

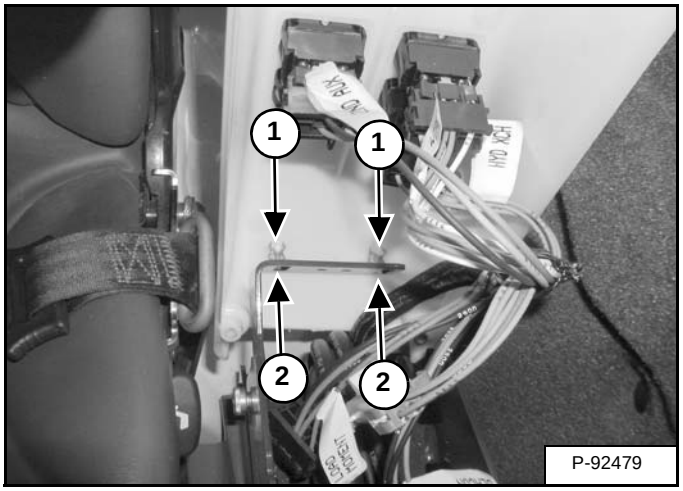
Upper Console Cover Removal And Installation (Cont'd)

Figure 40-60-8



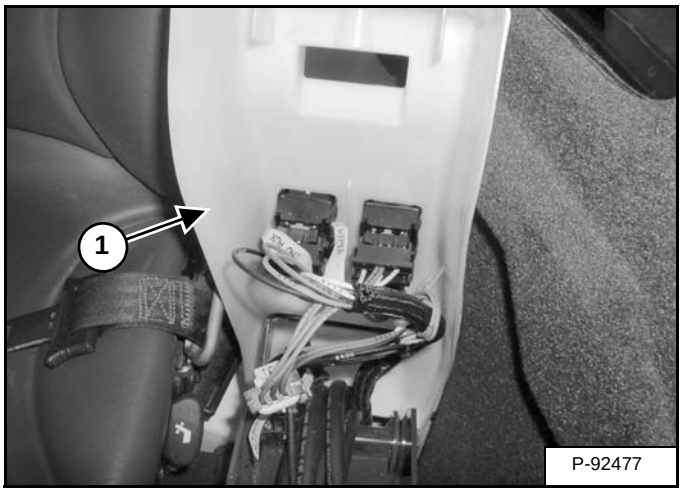
Pull up on the rear of the top cover (Item 1) **[Figure 40-60-8]**.

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]**.

Figure 40-60-10



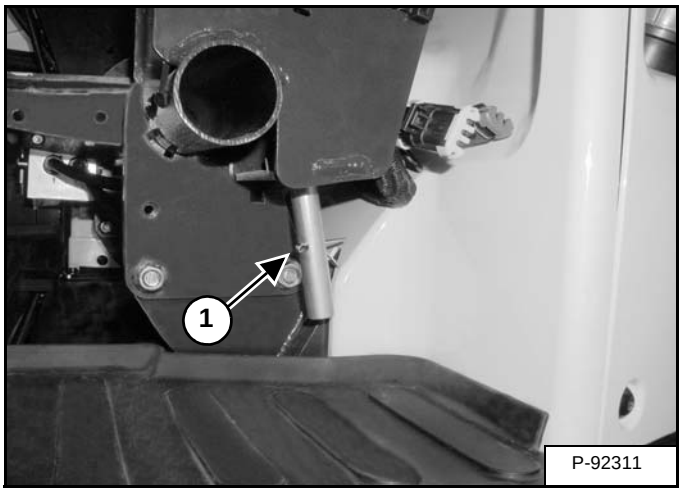
Disconnect the wire harness from the switches and remove the top cover (Item 1) **[Figure 40-60-10]**.

Compression Spring Removal And Installation

Remove the lower console cover. (See Lower Console Cover Removal And Installation on Page 40-60-1.)

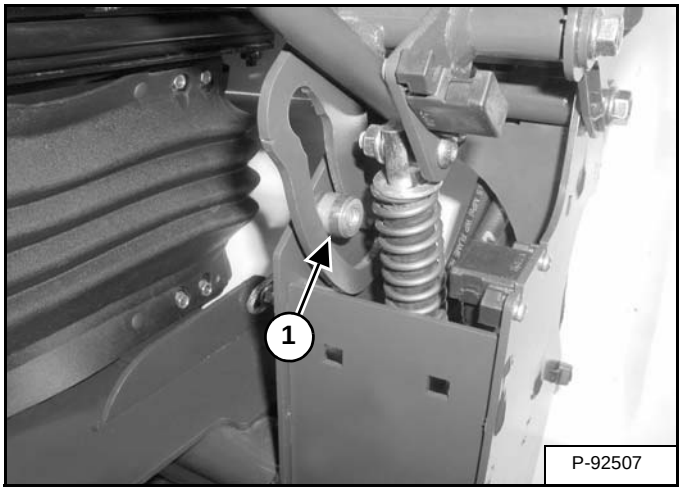
Lower the console.

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

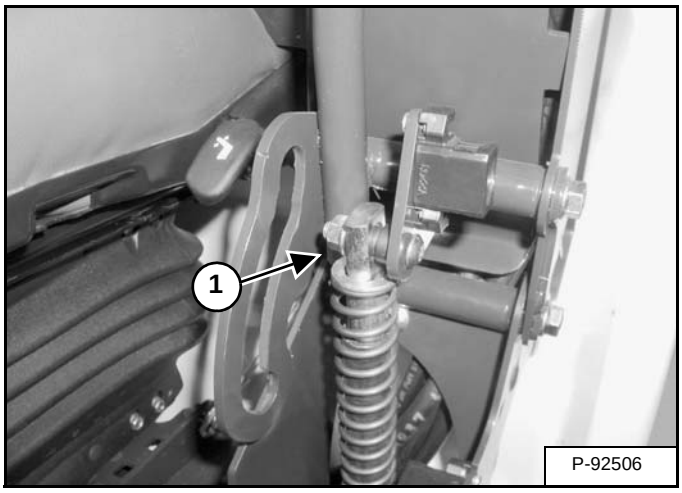


Support the console in the raised position. Remove the bolt and roller (Item 1) **[Figure 40-60-12]**.

Lower the console and remove the pin from the rod.

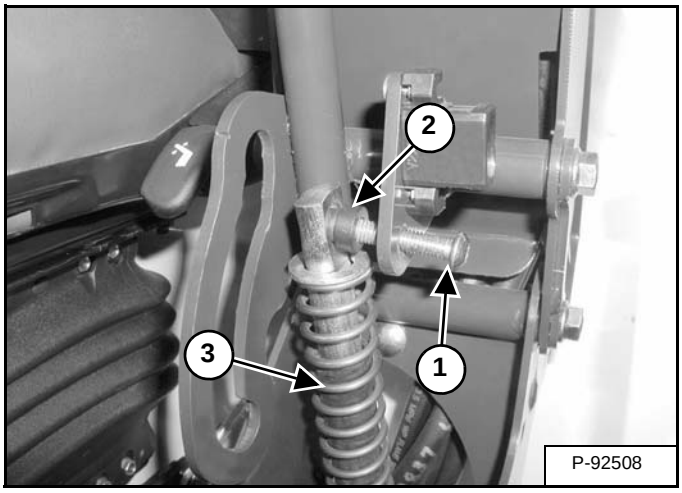
Raise and support the console.

Figure 40-60-13



Remove the nut (Item 1) **[Figure 40-60-13]**.

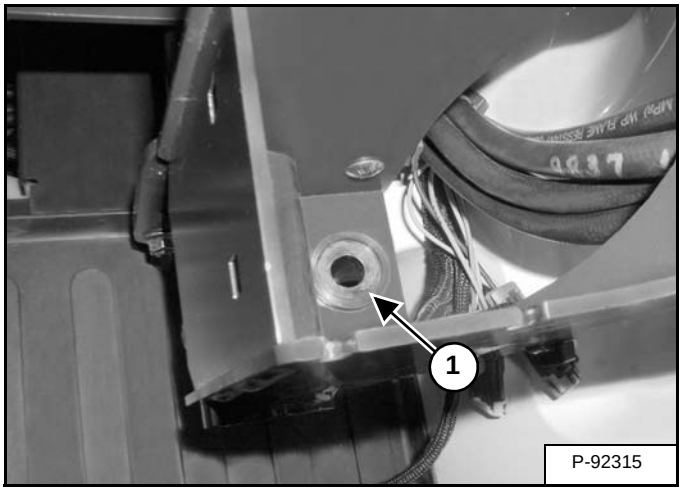
Figure 40-60-14



Remove the bolt (Item 1) and bushing (Item 2). Remove the spring assembly (Item 3) **[Figure 40-60-14]** from the console.

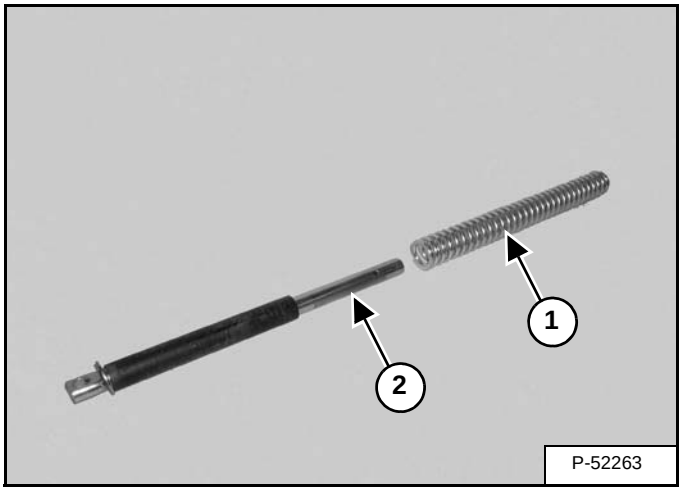
Compression Spring Removal And Installation (Cont'd)

Figure 40-60-15



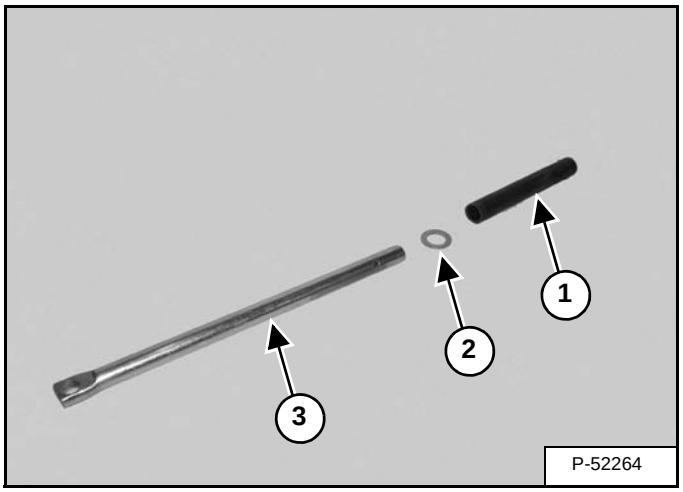
Remove the bushing (Item 1) **[Figure 40-60-15]** from the bottom of the console.

Figure 40-60-16



Remove the spring (Item 1) from the shaft (Item 2) **[Figure 40-60-16]**.

Figure 40-60-17



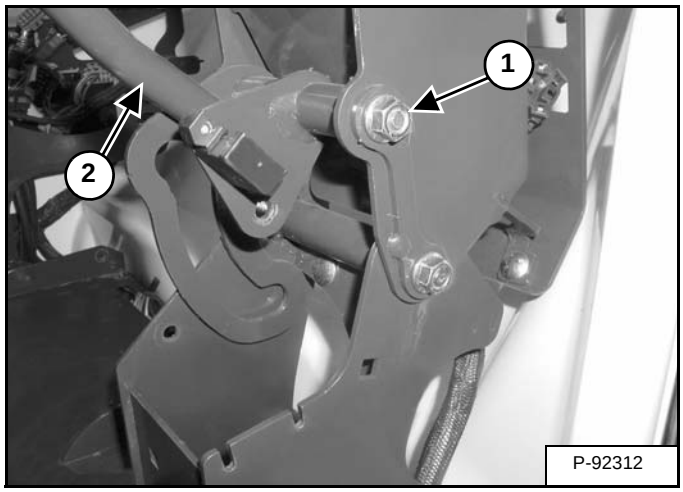
Remove the sleeve (Item 1) and washer (Item 2) from the shaft (Item 3) **[Figure 40-60-17]**.

Lock Lever Removal And Installation

Remove the lower console cover. (See Console Removal And Installation on Page 40-60-6.)

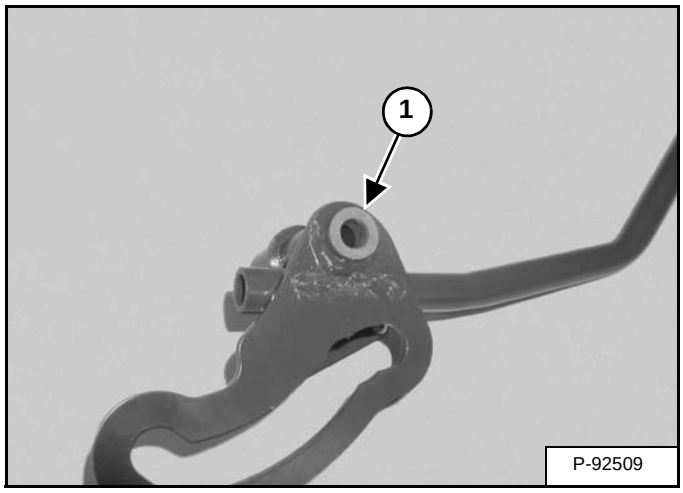
Remove the compression spring assembly from the console. (See Compression Spring Removal And Installation on Page 40-60-4.)

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

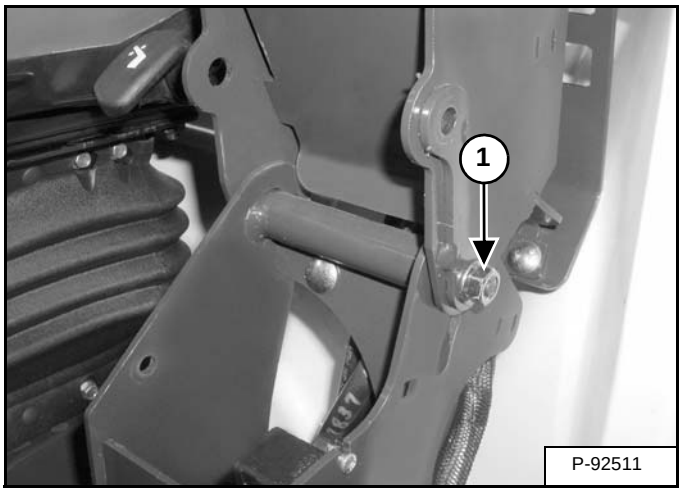
Remove the upper console cover. (See Upper Console Cover Removal And Installation on Page 40-60-1.)

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 40-60-6.)

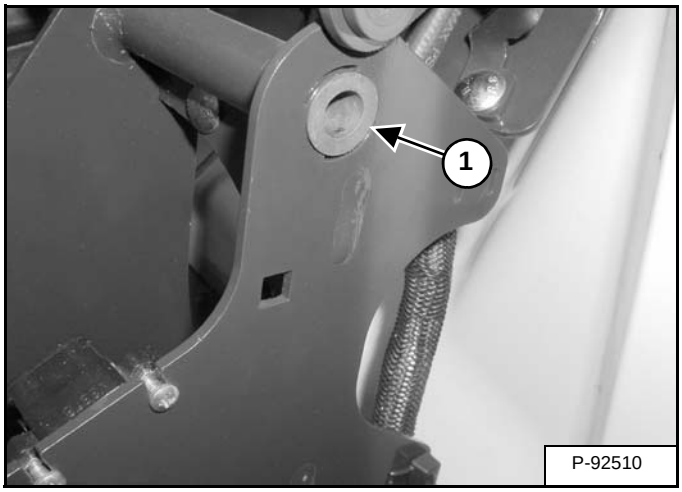
Figure 40-60-20



Remove the nut (Item 1) **[Figure 40-60-20]** and bolt.

Remove the console.

Figure 40-60-21

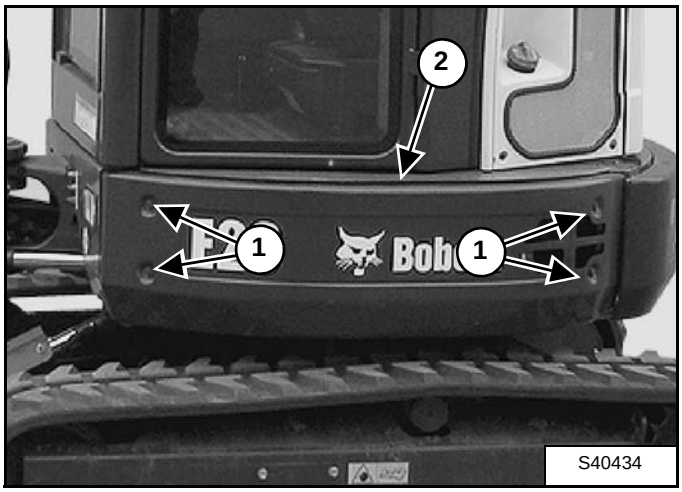


Remove the bushings (Item 1) **[Figure 40-60-21]**.

LEFT UPPERSTRUCTURE COVER

Removal And Installation

Figure 40-70-1



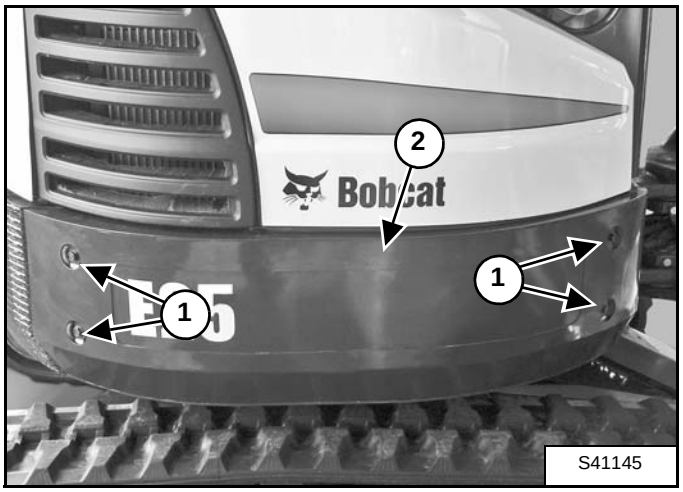
Remove the bolts (Item 1) and remove the cover (Item 2) **[Figure 40-70-1]**.


Bobcat®

RIGHT UPPERSTRUCTURE COVER

Removal And Installation

Figure 40-80-1



Remove the bolts (Item 1). Remove the cover (Item 2) **[Figure 40-80-1]**.


Bobcat®

COUNTERWEIGHT

Removal And Installation

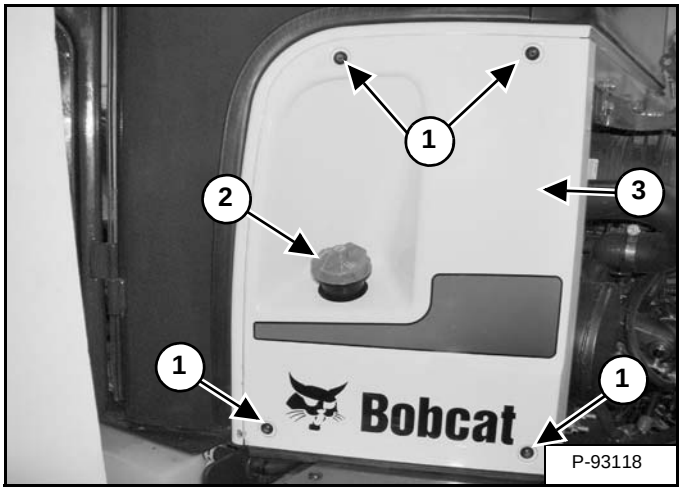
Remove the left upperstructure cover. (See Removal And Installation on Page 40-70-1.)

Remove the right upperstructure 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

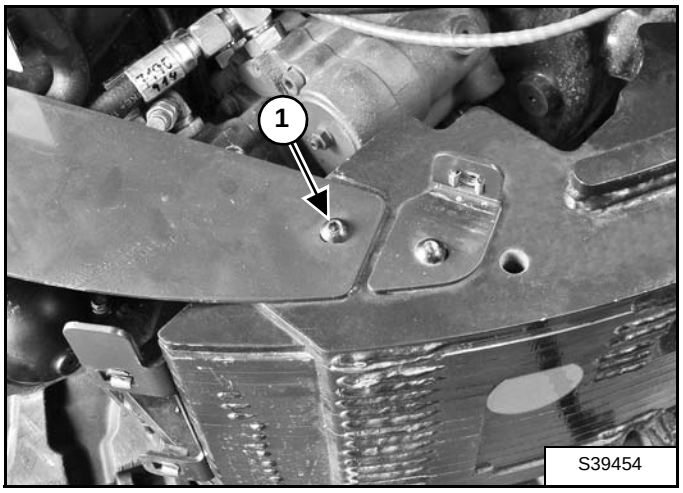


Remove the four bolts (Item 1), fuel cap (Item 2) and side cover (Item 3) **[Figure 40-90-1]**.

Reinstall the fuel cap (Item 2) **[Figure 40-90-1]**.

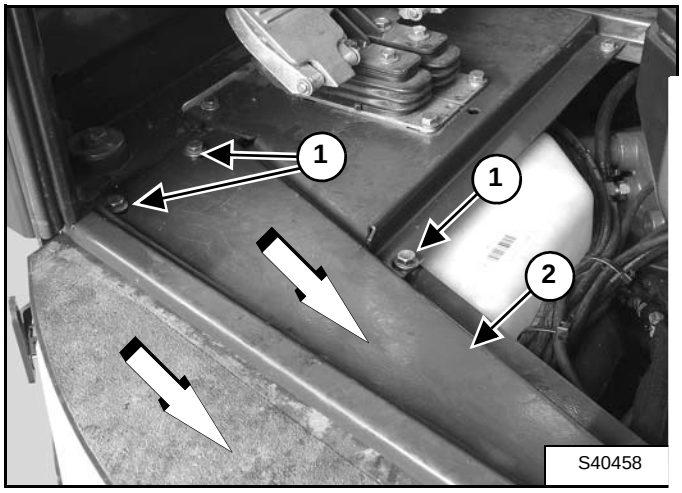
NOTE: Reinstall the fuel cap to prevent any contamination from entering the fuel tank.

Figure 40-90-2



Remove the screw (Item 1) **[Figure 40-90-2]**.

Figure 40-90-3



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

Remove the three bolts (Item 1) **[Figure 40-90-3]**.

Remove the upperstructure cover (Item 2) **[Figure 40-90-3]** by sliding it towards the rear of the machine.

COUNTERWEIGHT (CONT'D)

Removal And Installation (Cont'd)

Figure 40-90-4

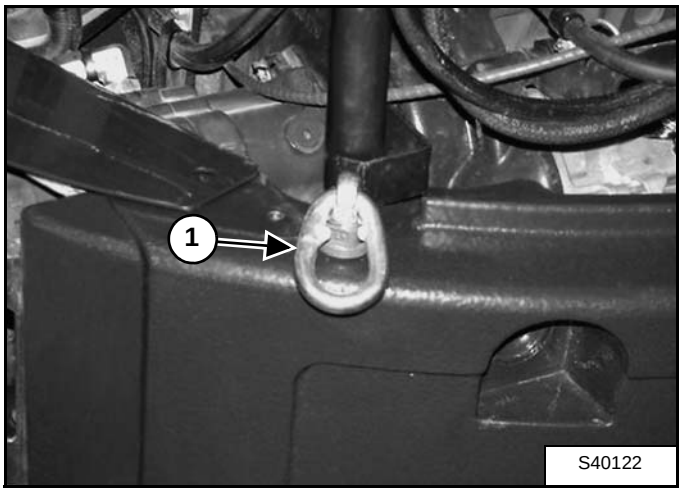
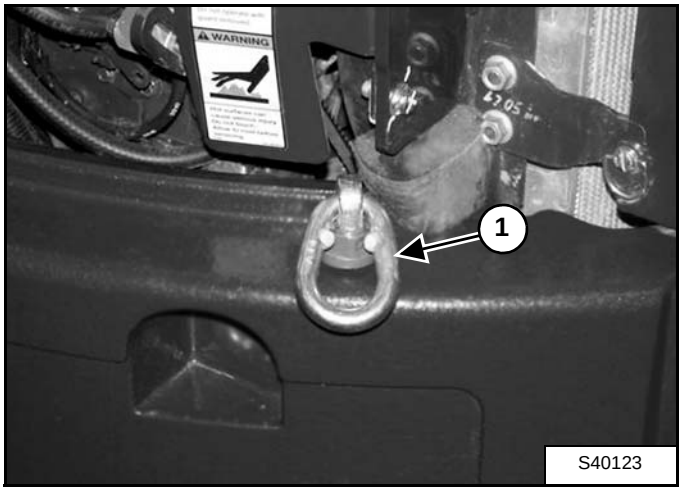


Figure 40-90-5



Install lifting brackets (Item 1) **[Figure 40-90-4]** and **[Figure 40-90-5]**.

Figure 40-90-6

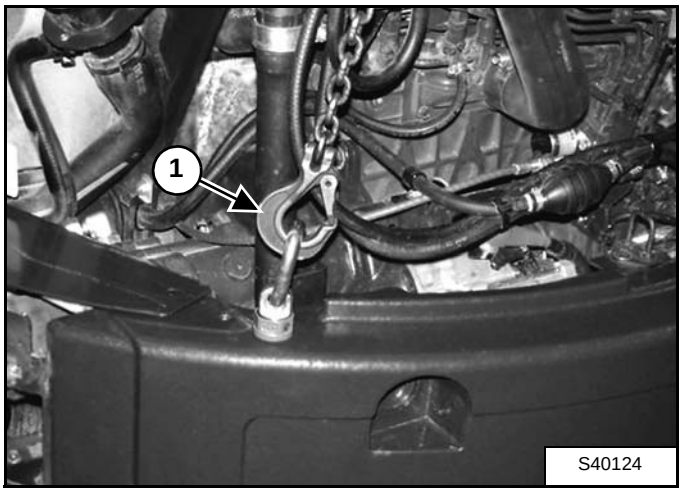
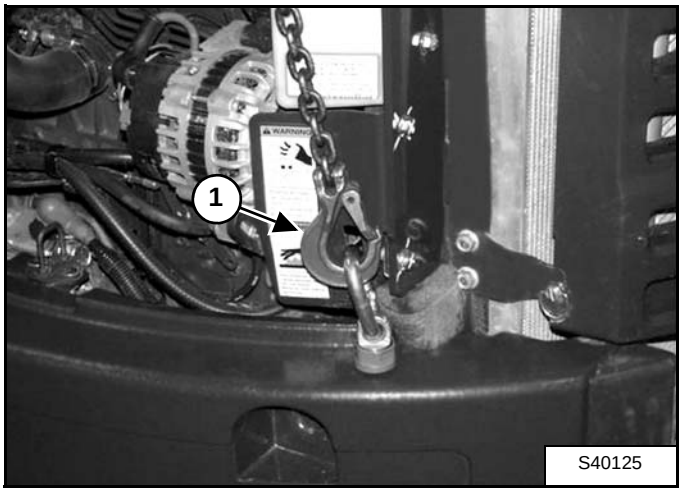


Figure 40-90-7



Attach a chain (Item 1) **[Figure 40-90-6]** and **[Figure 40-90-7]** and hoist to the lifting brackets.

Removal And Installation (Cont'd)

Figure 40-90-8

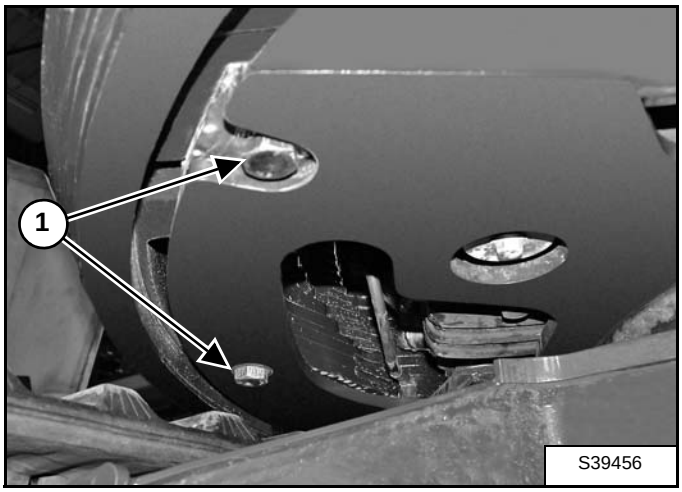
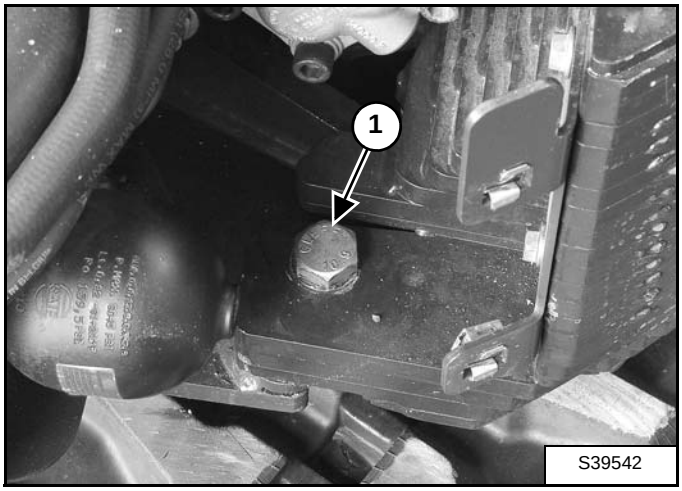


Figure 40-90-9



Remove the bolts (Item 1) **[Figure 40-90-8]** and **[Figure 40-90-9]**.

Installation: Tighten the bolts to 490 - 550 N•m (360 - 405 ft-lb) torque.

Remove the counterweight.

Long Arm Counterweight Removal And Installation

Remove the tailgate. (See Removal And Installation on Page 40-190-1.)

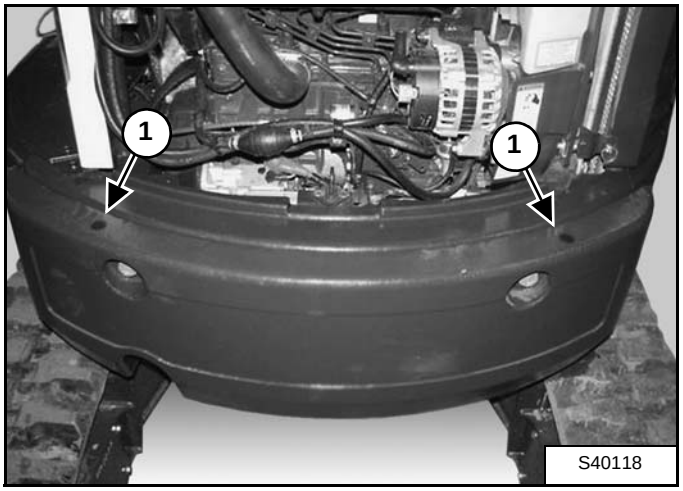
⚠ WARNING

AVOID INJURY OR DEATH

Never get under the counterweights during the installation or removal procedure.

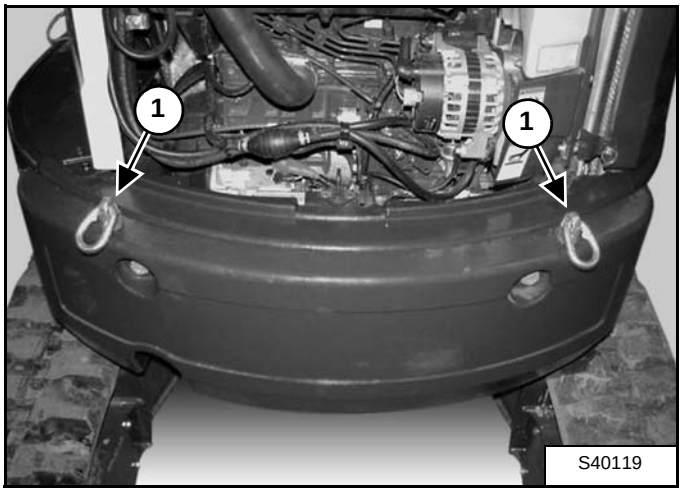
W-2383-1000

Figure 40-90-10



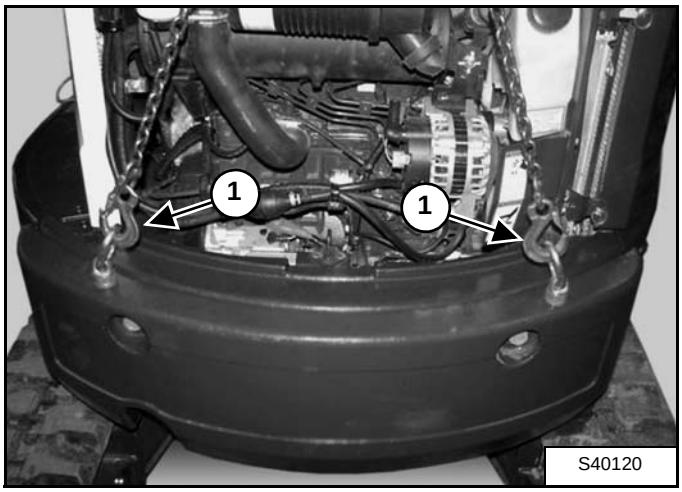
Remove the plugs (Item 1) **[Figure 40-90-10]**.

Figure 40-90-11



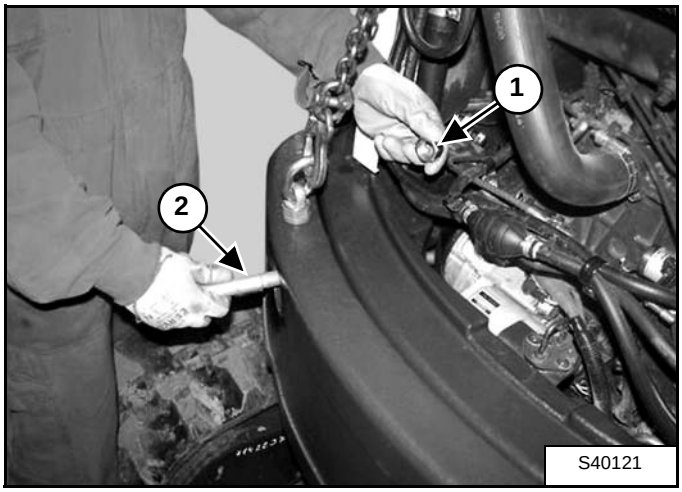
Install lifting brackets (Item 1) **[Figure 40-90-11]**.

Figure 40-90-12



Attach a chain (Item 1) **[Figure 40-90-12]** and hoist to the lifting brackets.

Figure 40-90-13



Remove the nuts (Item 1) and bolts (Item 2) **[Figure 40-90-13]**.

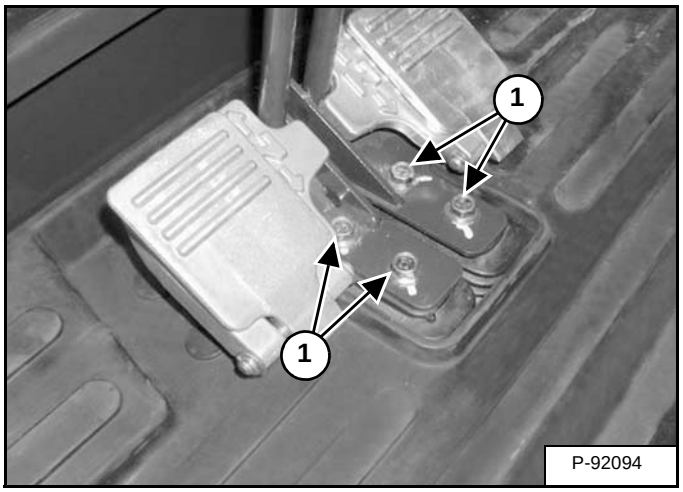
Installation: Tighten the bolts to 490 - 550 N•m (360 - 405 ft-lb) torque.

Remove the counterweight.

TRAVEL LEVERS AND PEDALS

Removal And Installation

Figure 40-100-1

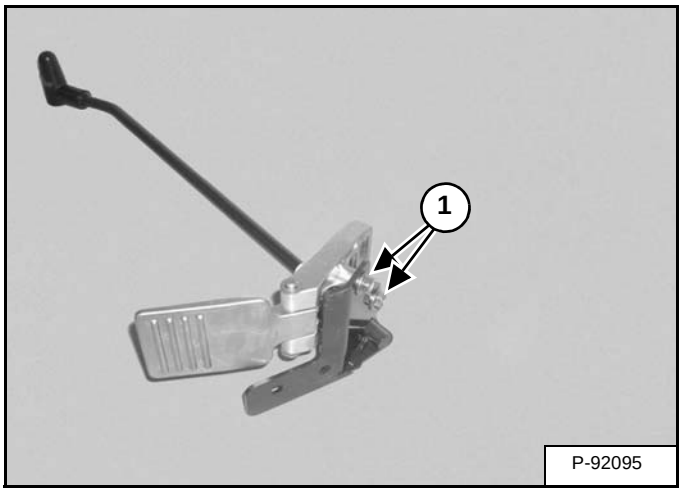


Remove the bolts (Item 1) **[Figure 40-100-1]**.

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

Disassembly And Assembly

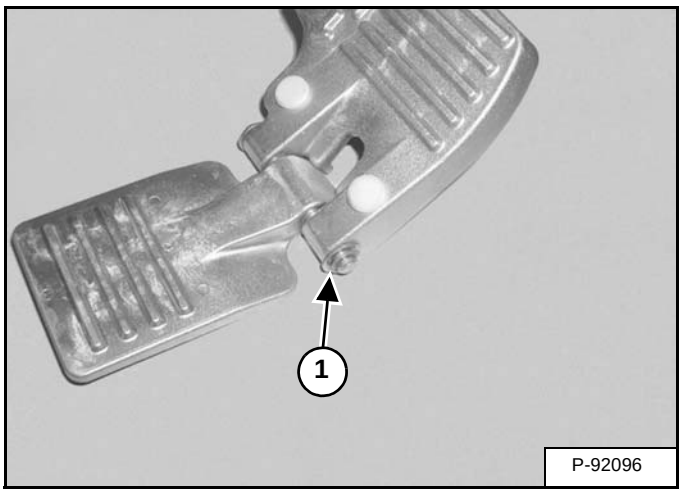
Figure 40-100-2



Remove the bolts (Item 1) **[Figure 40-100-2]**.

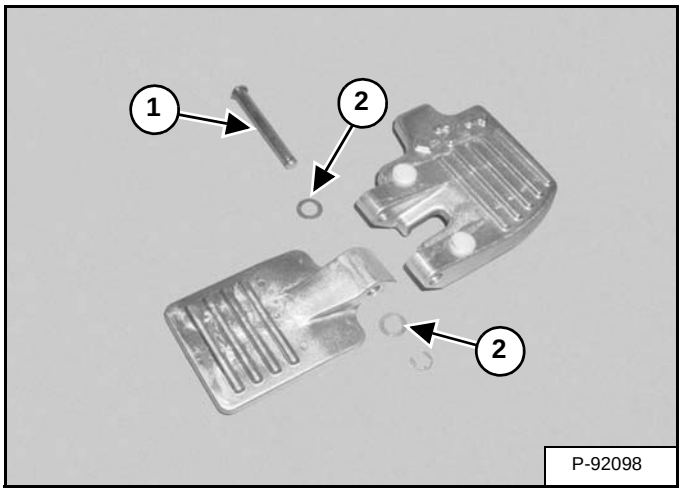
Installation: Tighten the bolts to 43 - 47 N•m (32 - 35 ft-lb) torque.

Figure 40-100-3



Remove the clip (Item 1) **[Figure 40-100-3]**.

Figure 40-100-4

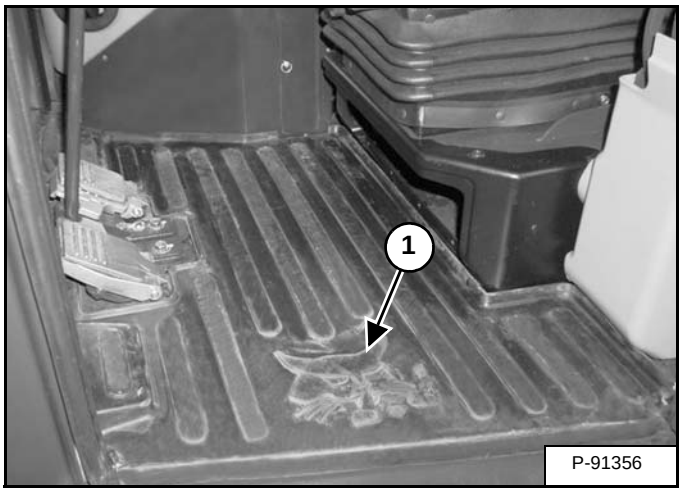


Remove the pin (Item 1) and washers (Item 2) **[Figure 40-100-4]**. Separate the foot pedal.

FLOOR MAT

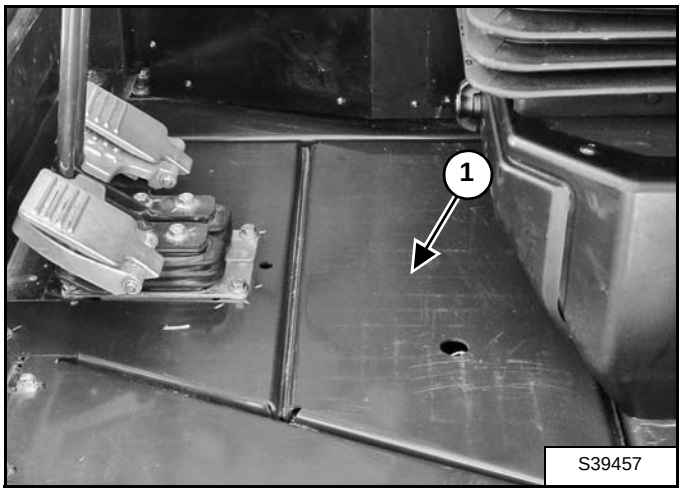
Removal And Installation

Figure 40-110-1



Lift up and remove the floor mat (Item 1) **[Figure 40-110-1]**.

Figure 40-110-2



Lift up and remove the floor panel (Item 1) **[Figure 40-110-2]**.


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FUEL TANK

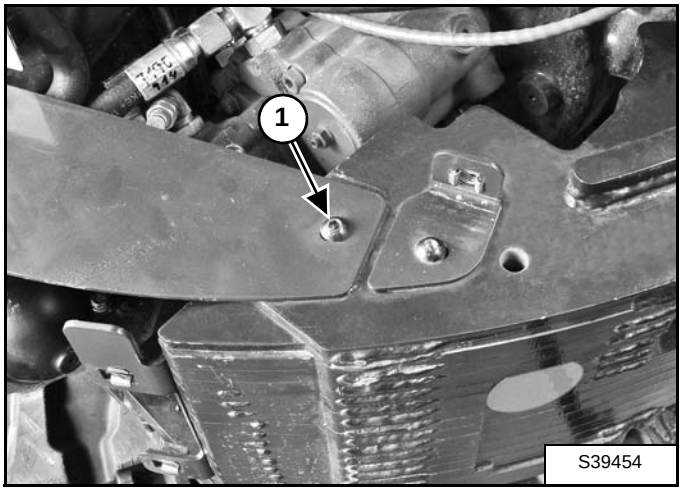
Removal And Installation

Drain the fuel tank. (See Draining The Fuel Tank on Page 10-100-3.)

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

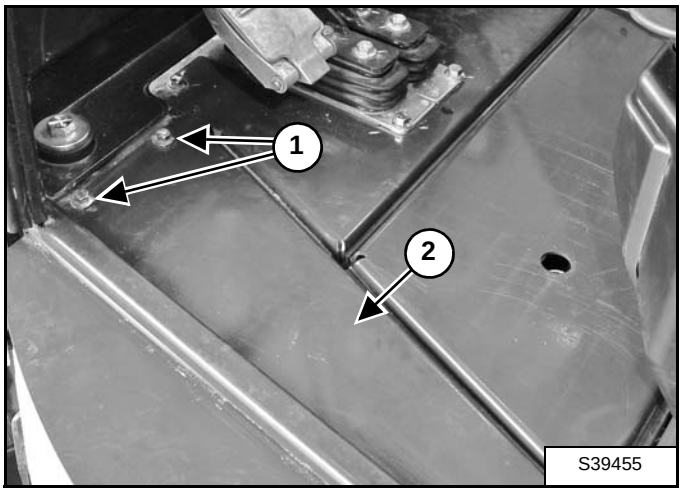
Remove the left upperstructure cover. (See Removal And Installation on Page 40-70-1.)

Figure 40-120-1



Remove the screw (Item 1) **[Figure 40-120-1]**.

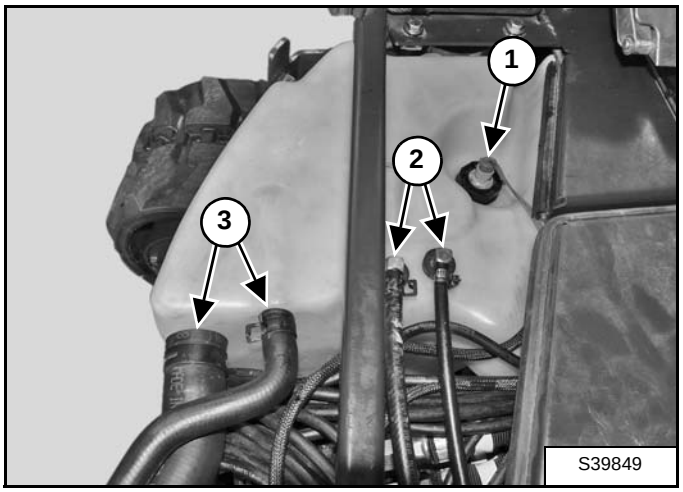
Figure 40-120-2



Remove the two bolts (Item 1) **[Figure 40-120-2]**.

Remove the upperstructure cover (Item 2) **[Figure 40-120-2]**.

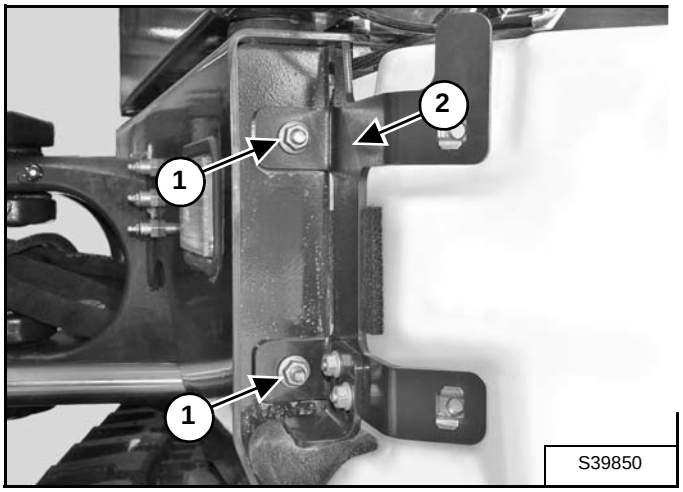
Figure 40-120-3



Disconnect the wire harness (Item 1). Remove the hoses (Item 2) **[Figure 40-120-3]**.

Remove the two hoses (Item 3) **[Figure 40-120-3]**.

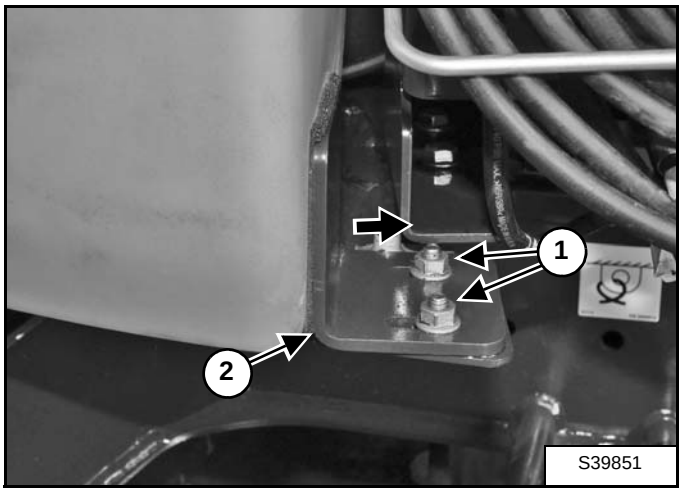
Figure 40-120-4



Remove the two nuts (Item 1) and bracket (Item 2) **[Figure 40-120-4]**.

Removal And Installation (Cont'd)

Figure 40-120-5



Loosen the two nuts (Item 1) and slide the bracket (Item 2) **[Figure 40-120-5]** to the right.

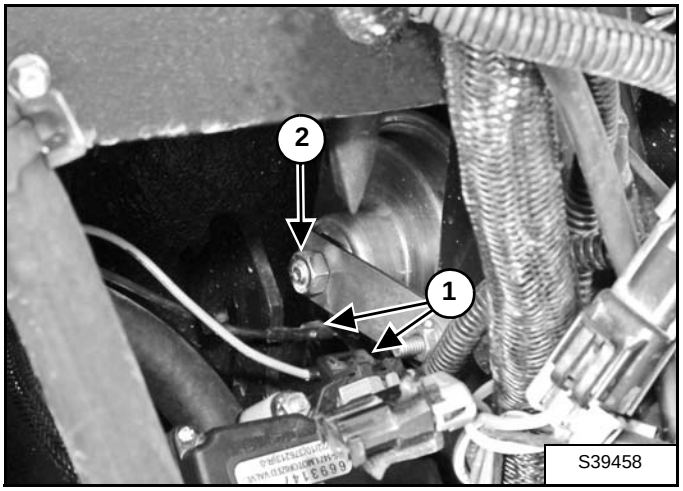
Remove the tank.

HORN

Removal And Installation

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

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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SWING FRAME

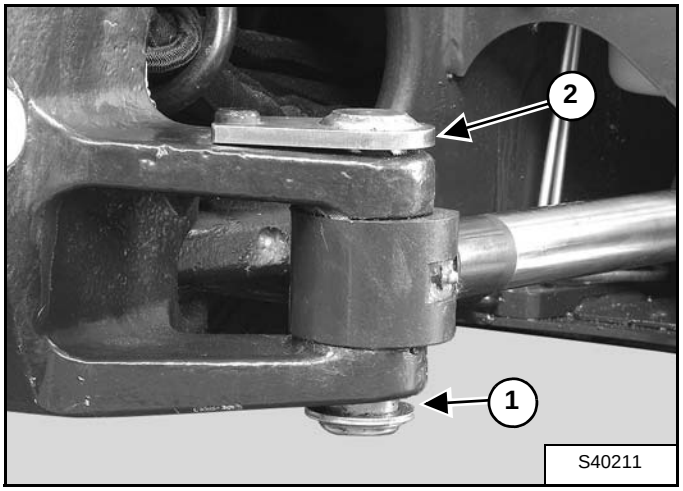
Removal And Installation

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.)

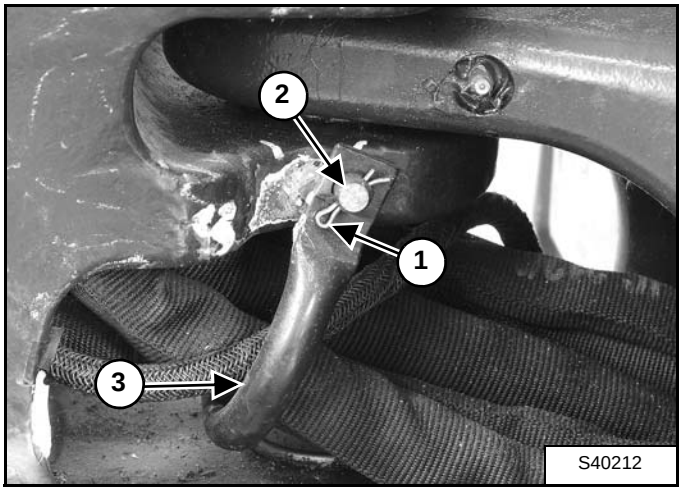
Remove the boom. (See Removal And Installation on Page 40-150-1.)

Figure 40-140-1



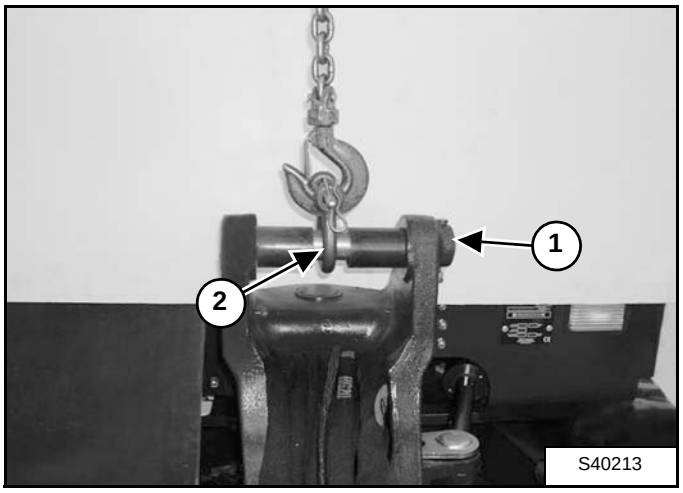
Remove the snap ring (Item 1), washer, and pin (Item 2) **[Figure 40-140-1]** from the rod end of the swing cylinder.

Figure 40-140-2



Remove the cotter pin (Item 1), retaining pin (Item 2) and hose bracket (Item 3) **[Figure 40-140-2]**.

Figure 40-140-3



Install the boom pin (Item 1) using spacers to position a lifting clevis (Item 2) **[Figure 40-140-3]** 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 swin frame pivot pins without the lower pin bein supported. Excess pressure can cause the swin frame casting to crack.

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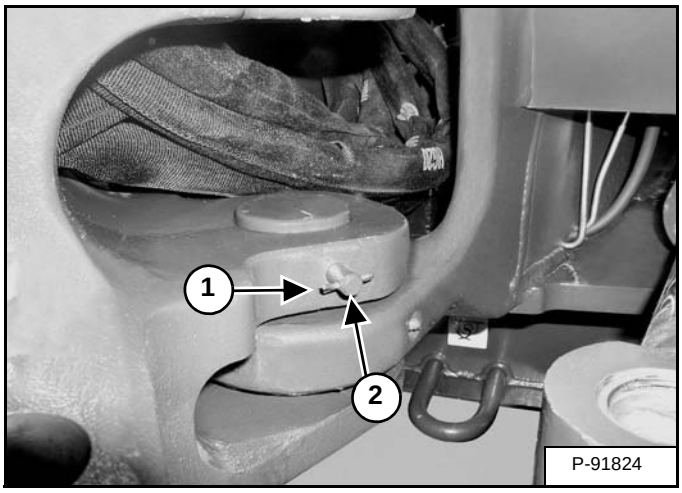
Removal And Installation (Cont'd)

Figure 40-140-4



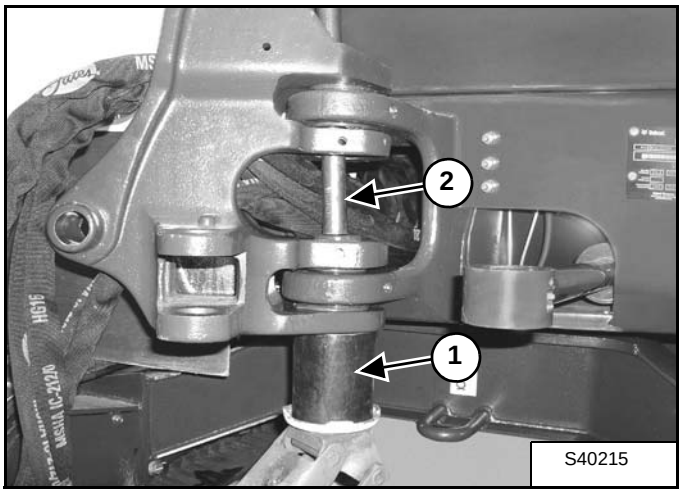
Install a porta-power between the top and bottom pins and press the top pin out **[Figure 40-140-4]**.

Figure 40-140-5



Remove the cotter pin (Item 1) and retaining pin (Item 2) **[Figure 40-140-5]**.

Figure 40-140-6

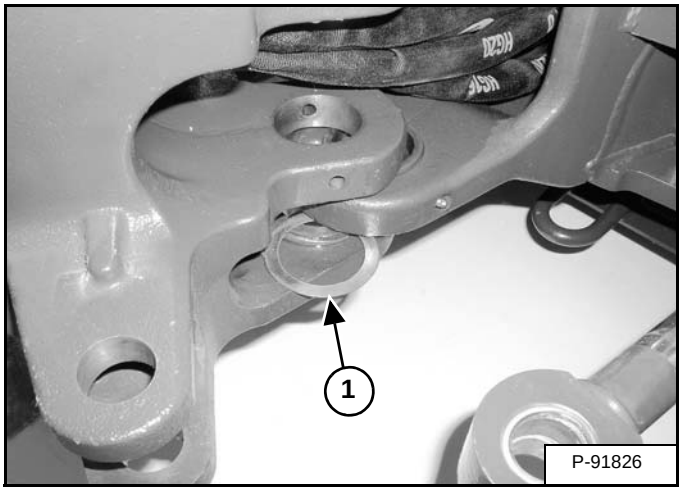


Install a spacer tube (Item 1) **[Figure 40-140-6]** and jack under the swing frame to support the casting. The spacer tube must be large enough to allow the pin to be driven in the center of the spacer tube for pin removal.

Use a large punch (Item 2) **[Figure 40-140-6]** 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 40-140-7



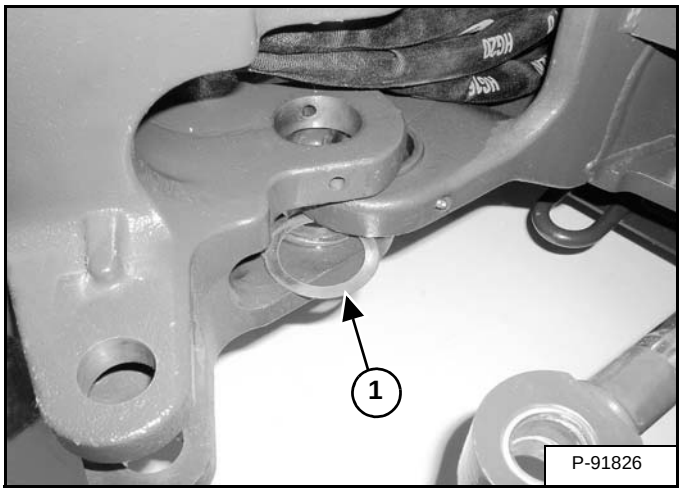
Remove the bottom spacer (Item 1) **[Figure 40-140-7]** from the swing frame.

Remove the swing frame.

Inspect the bushings for damage. Replace damaged bushings as necessary. (See Bushing Removal on Page 40-140-4.)

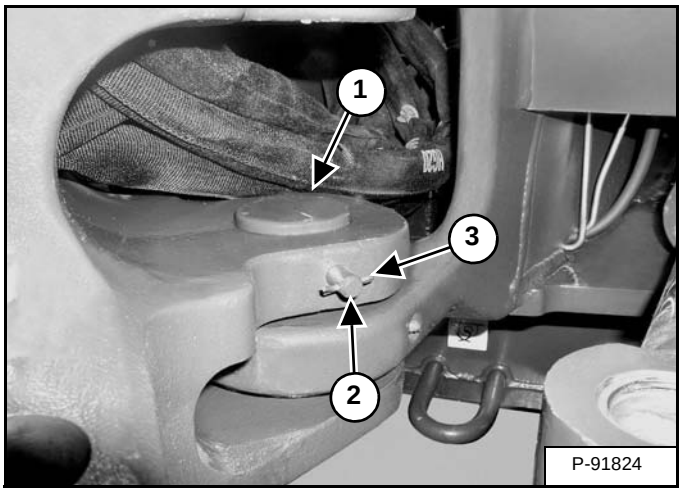
Removal And Installation (Cont'd)

Figure 40-140-8



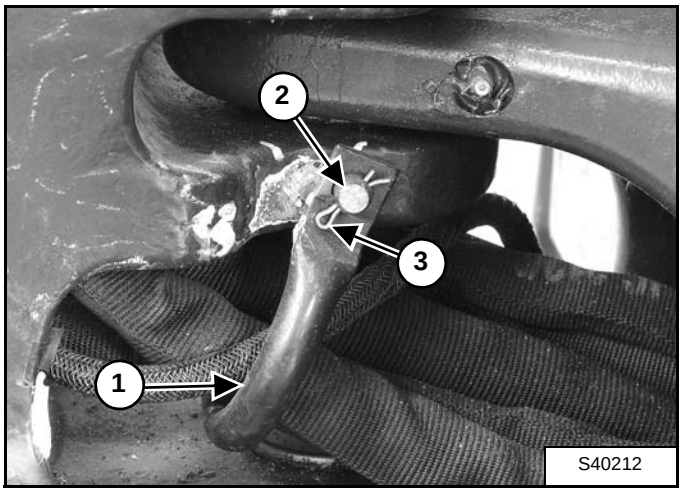
Installation: Install the bottom spacer (Item 1) **[Figure 40-140-8]** on the swing frame. Install the swing frame.

Figure 40-140-9



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 40-140-9]**. Lift up on the boom swing frame.

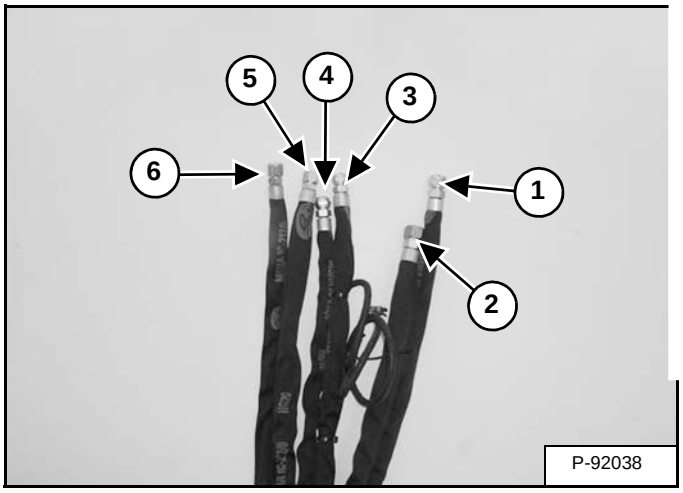
Figure 40-140-10



Installation: Install the top pivot pin, hose bracket (Item 1), retaining pin (Item 2) and cotter pin (Item 3) **[Figure 40-140-10]**.

Boom Swing Frame Hose Routing

Figure 40-140-11



Route the hoses through the swing frame as follows **[Figure 40-140-11]**:

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

Bushing Removal

IMPORTANT

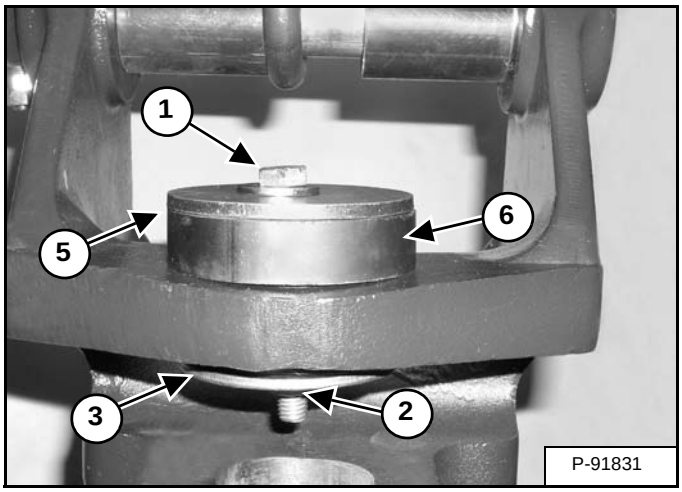
Do Not point (hammer) on the boom swing bracket. Excess pressure can cause the casting to crack.

I-2095-1195

The following parts will be needed for removal and installation of the swing frame bushings:

1. Bolt - 20 x 150 mm or (3/4 x 6 in) or long.
2. Nut - 20 mm or (3/4 in).
3. Washer - 22 mm I.D. x 73 mm O.D. x 10 mm thick or (7/8 I.D. x 2-7/8 O.D. x 3/8 in thick).
4. Washer - 22 mm I.D. x 83 mm O.D. x 10 mm thick or (7/8 I.D. x 3-1/4 O.D. x 3/8 in thick).
5. Washer - 22 mm I.D. 95 mm O.D. x 13 mm thick or (7/8 I.D. x 3-3/4 O.D. x 1/2 in thick).
6. Spacer - 86 mm I.D. x 98 mm O.D. x 45mm thick or (3-3/8 I.D. x 3-7/8 O.D. x 1-3/4 in thick).

Figure 40-140-12



Install the spacer (Item 6) and washer (Item 5) **[Figure 40-140-12]** over the flanged end of the bushing.

The spacer (Item 5) **[Figure 40-140-12]** must be centered over the bushing to avoid contact between the bushing and the spacer during removal.

Install the washer (Item 3) **[Figure 40-140-12]** 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 40-140-12]** through the washers and the spacer.

Tighten the bolt and nut to remove the bushing from the casting.

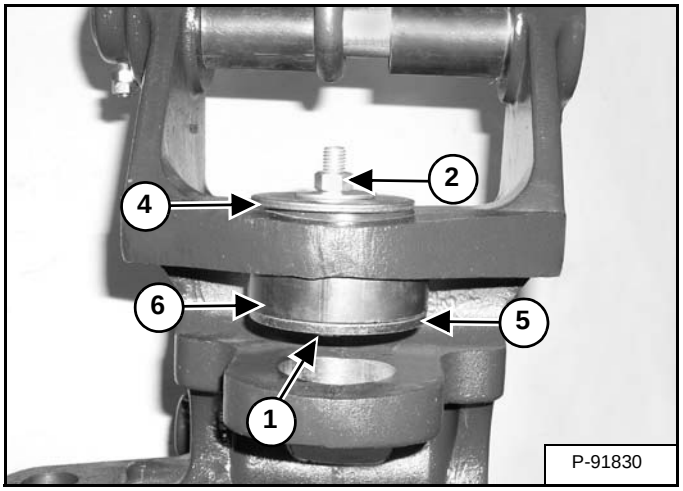
Bushing Installation

Apply a film of grease to the outer diameter of the bushing and to the inner diameter of the casting.

Centre 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 40-140-13



Put the washer (Item 4) **[Figure 40-140-13]** over the flanged end of the bushing.

Put the spacer (Item 6) and the washer (Item 5) **[Figure 40-140-13]** over the bushing hole casting. Centre the spacer and the washer over the bushing hole.

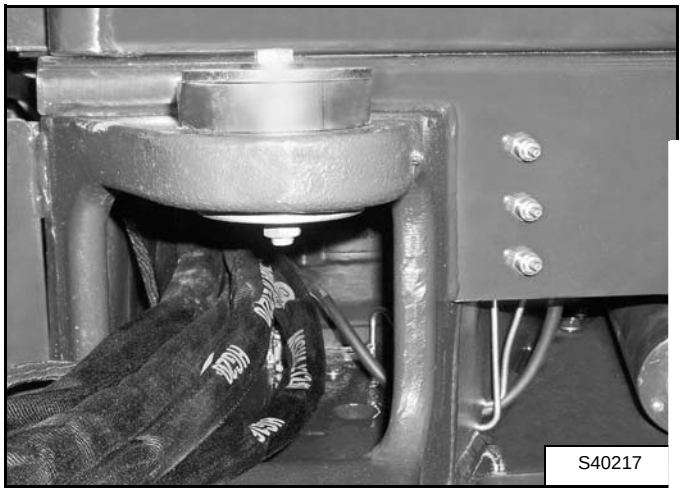
Install the bolt (Item 1) through the washers, the spacer and the bushing. Install the nut (Item 2) **[Figure 40-140-13]**.

Tighten the bolt and nut until the bushing is seated in the casting.

Figure 40-140-14



Figure 40-140-15



The same procedure is used to remove and install th bushings in the frame castings **[Figure 40-140-14]** and **[Figure 40-140-15]**.


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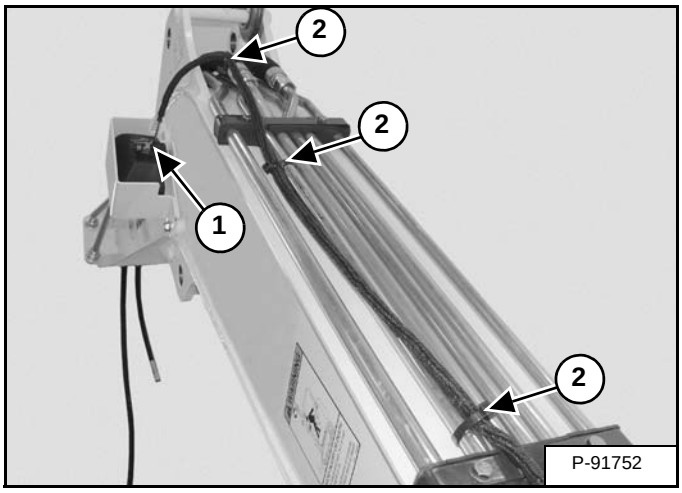
BOOM

Removal And Installation

Remove the arm. (See Removal And Installation on Page 40-160-1.)

Remove the boom cylinder. (See Removal And Installation on Page 20-20-3.)

Figure 40-150-1



Disconnect the wire harness (Item 1) **[Figure 40-150-1]**.

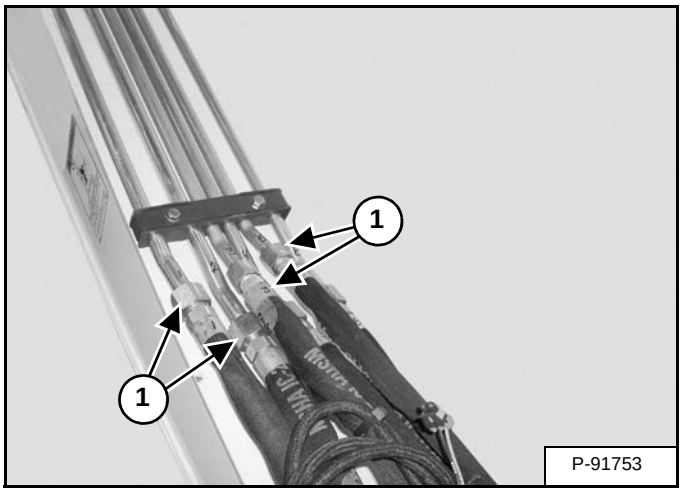
Cut and remove the cable ties (Item 2) **[Figure 40-150-1]**.

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.

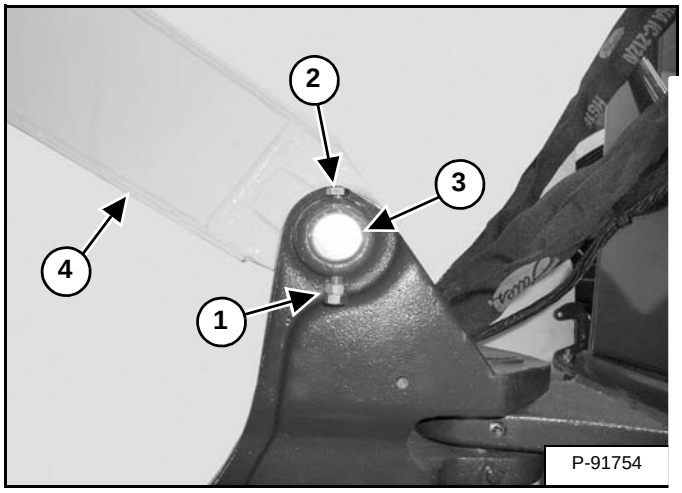
I-2003-0888

Figure 40-150-2



Mark and remove the hoses (Item 1) **[Figure 40-150-2]**.

Figure 40-150-3

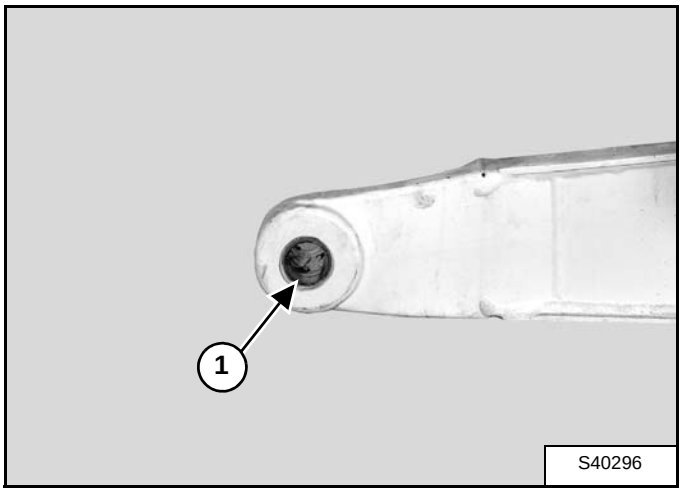


Remove the nuts (Item 1), bolt (Item 2) and pin (Item 3) **[Figure 40-150-3]**.

Remove the boom (Item 4) **[Figure 40-150-3]**.

Removal And Installation (Cont'd)

Figure 40-150-4

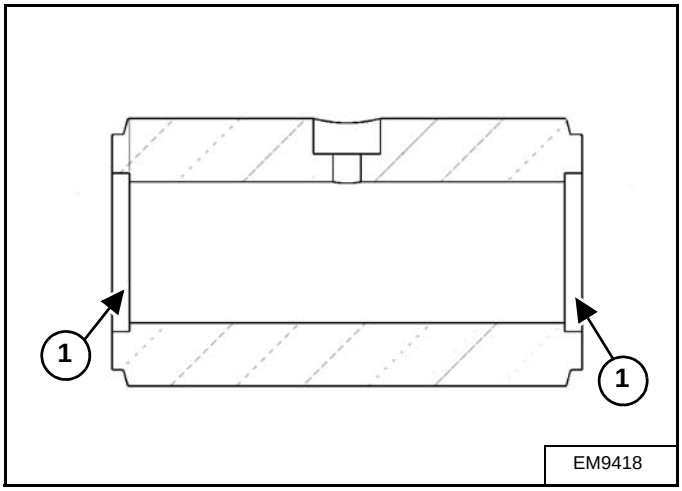


Remove the seals (Item 1) **[Figure 40-150-4]** from both sides of the boom.

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) (Item 1) in the pin boss **[Figure 40-150-5]** on both sides of the boom.

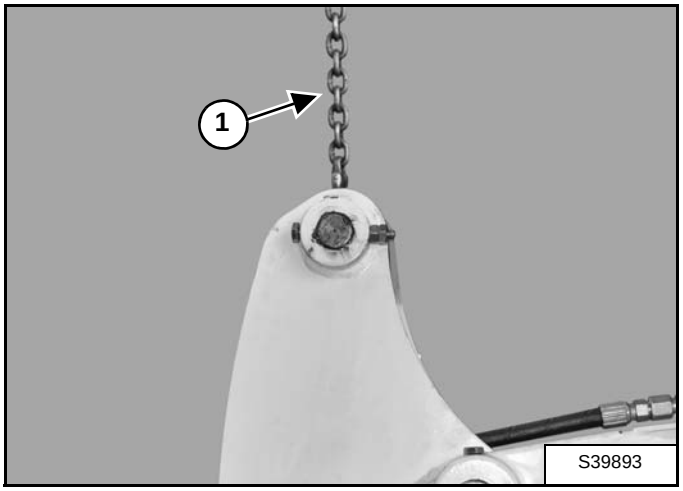
Install new seals on both sides of the boom.

ARM (STANDARD AND LONG)

Removal And Installation

Remove the arm cylinder. (See Removal And Installation on Page 20-21-3.)

Figure 40-160-1



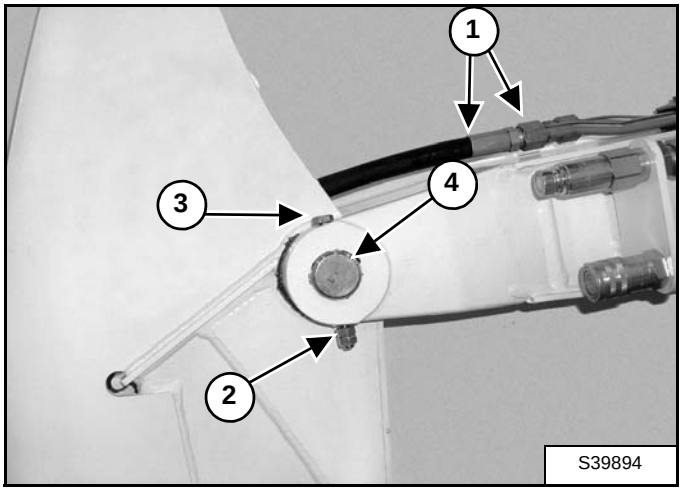
Support the arm with a chain hoist (Item 1) **[Figure 40-160-1]**.

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.

I-2003-0888

Figure 40-160-2



Remove the hydraulic hoses (Item 1) **[Figure 40-160-2]**.

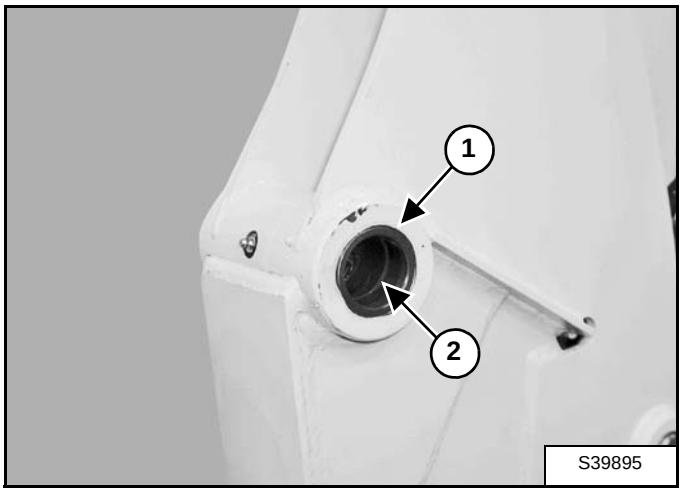
Remove the nuts (Item 2) and bolt (Item 3) **[Figure 40-160-2]**.

Remove the pin (Item 4) **[Figure 40-160-2]**.

Remove the arm from the boom.

Arm To Boom Bushing Removal And Installation

Figure 40-160-3

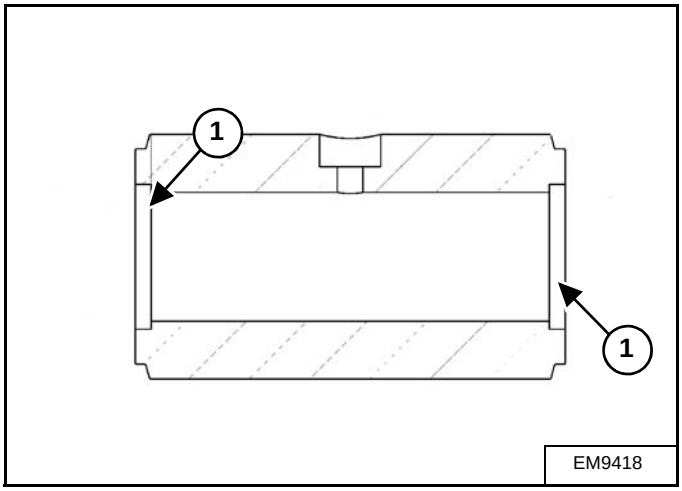


Remove the seals (Item 1) **[Figure 40-160-3]** from both sides of the arm.

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

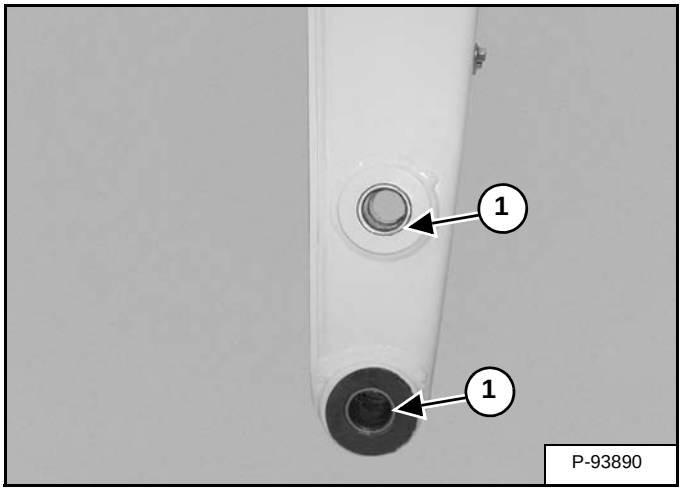


Install the bushings until they are seated 5 mm (0.197 in) in the pin boss (Item 1) **[Figure 40-160-4]** (both sides).

Install new seals on both sides of the arm.

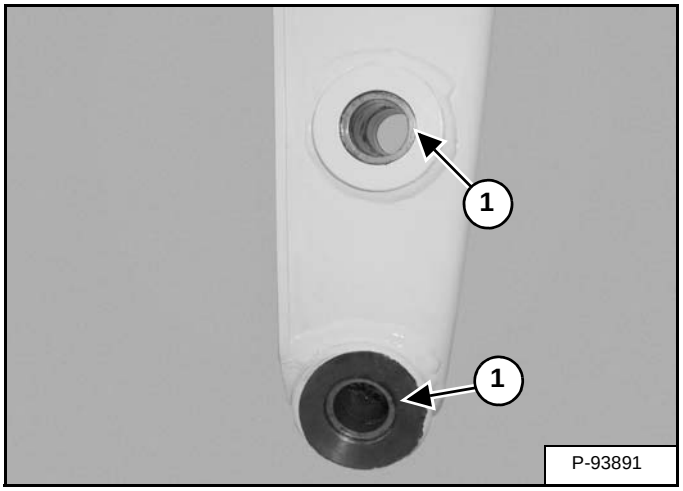
Arm To Bucket And Bucket Link Bushing Removal And Installation

Figure 40-160-5



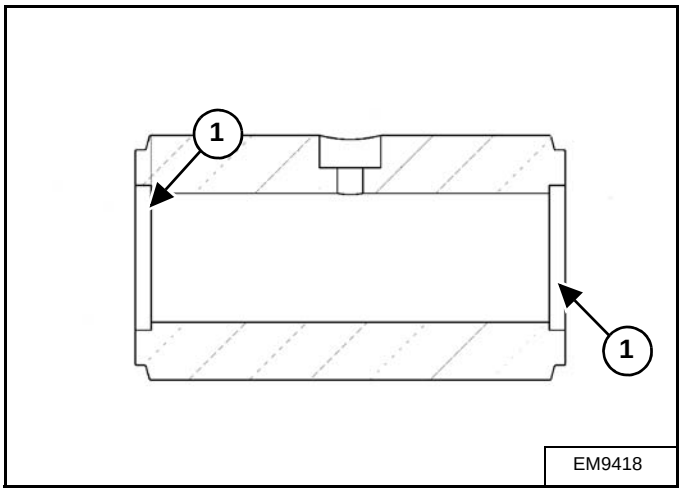
Remove the seals (Item 1) **[Figure 40-160-5]** from both sides of the arm.

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 (Item 1) **[Figure 40-160-7]** (both sides).

Install new seals on both sides of the arm.


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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.**

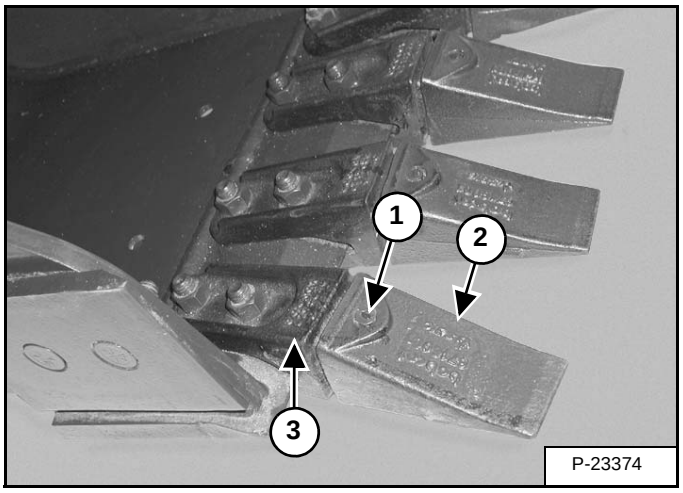
W-2505-0604

Position the bucket so the bucket teeth are at a 30° angle up from the earth for accessibility to the teeth.

Lower the boom until the bucket is fully on the earth.

Stop the engine and exit the excavator.

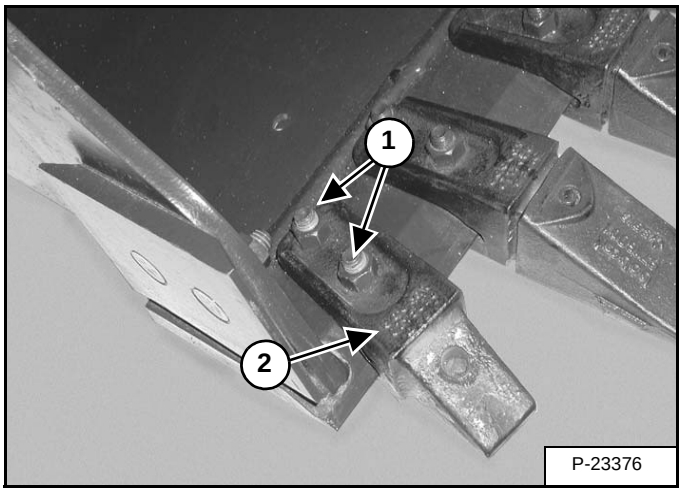
Figure 40-170-1



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]**.

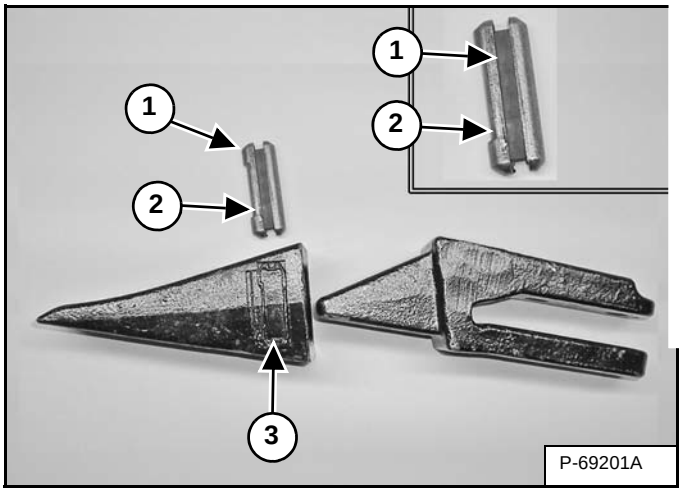
Figure 40-170-2



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

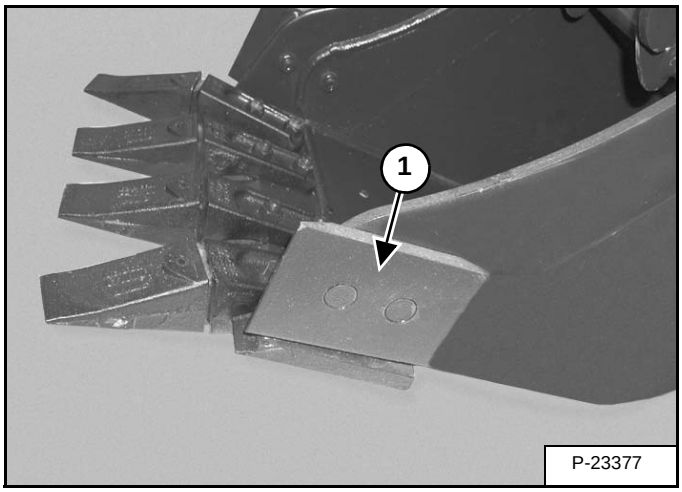


The retaining pin (Item 1) must be installed as shown [notch (Item 2) to the front] for proper fit and tooth retention. The side of the tooth point (Item 3) **[Figure 40-170-3]** also shows the correct orientation of the retaining pin.

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.

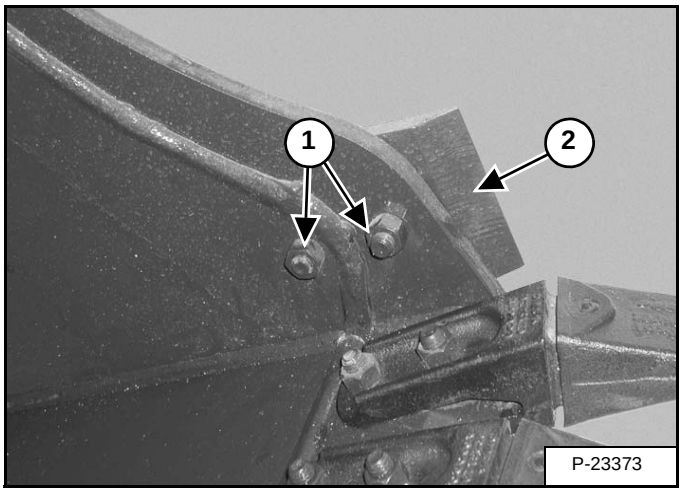
Bucket Side Cutting Edge Removal And Installation

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]**.

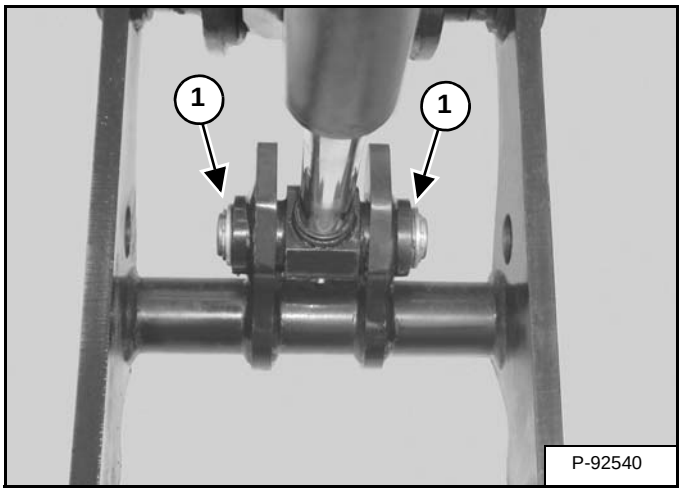
CLAMP

Removal And Installation

Remove the bucket. (See Operation & Maintenance Manual for correct removal procedure.)

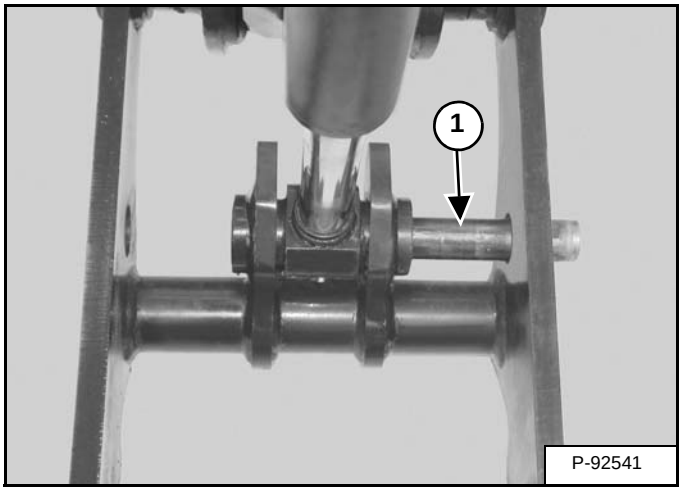
Lower the clamp to the earth.

Figure 40-180-1



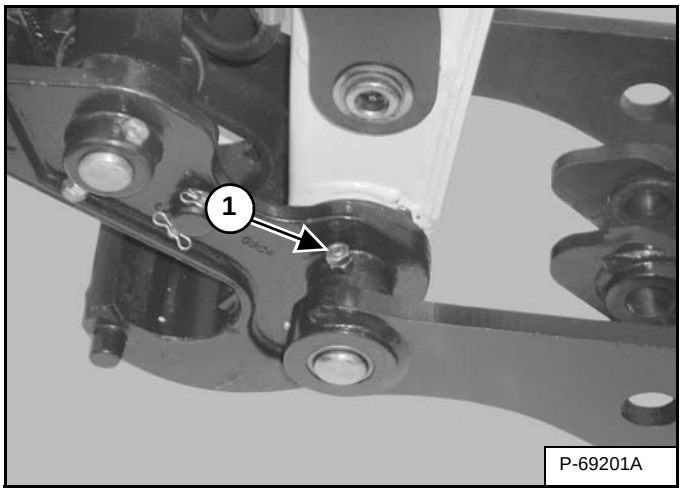
Remove the snap ring (Item 1) **[Figure 40-180-1]** and washers from the rod end of the clamp cylinder.

Figure 40-180-2



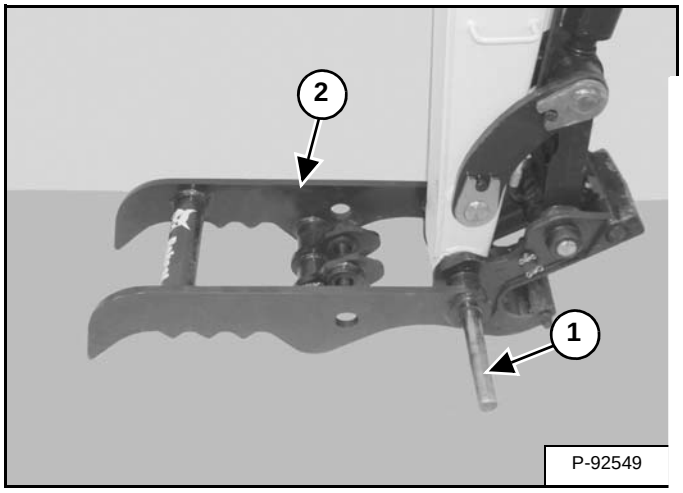
Remove the pin (Item 1) **[Figure 40-180-2]**.

Figure 40-180-3



Remove the nuts and bolt (Item 1) **[Figure 40-180-3]**.

Figure 40-180-4



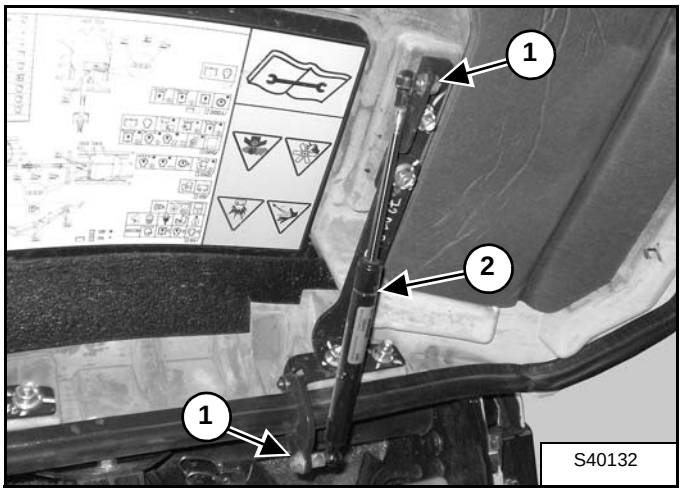
Remove the pin (Item 1) and clamp (Item 2) **[Figure 40-180-4]**.


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TAILGATE

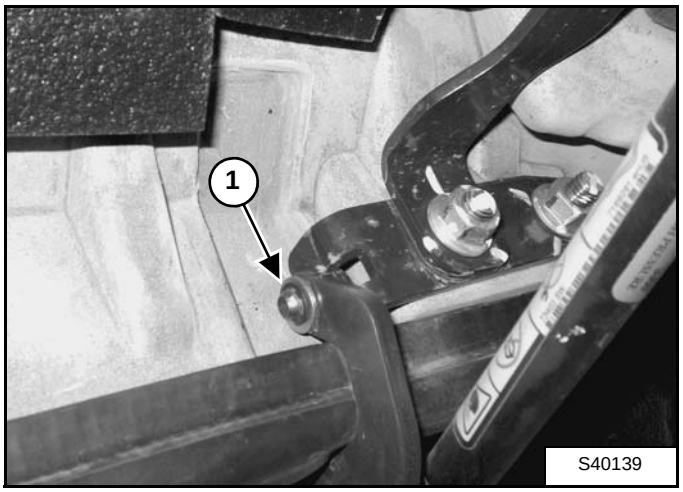
Removal And Installation

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



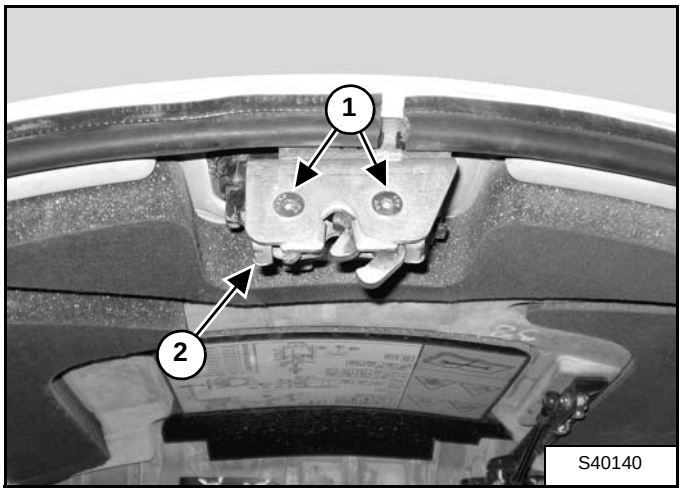
Remove the clip (Item 1) **[Figure 40-190-2]** and washer from both hinges.

Remove the tailgate.

TAILGATE (CONT'D)

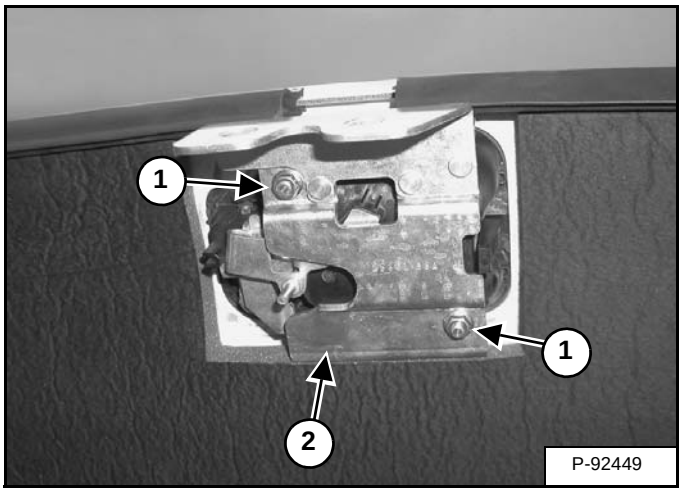
Latch Removal And Installation

Figure 40-190-3



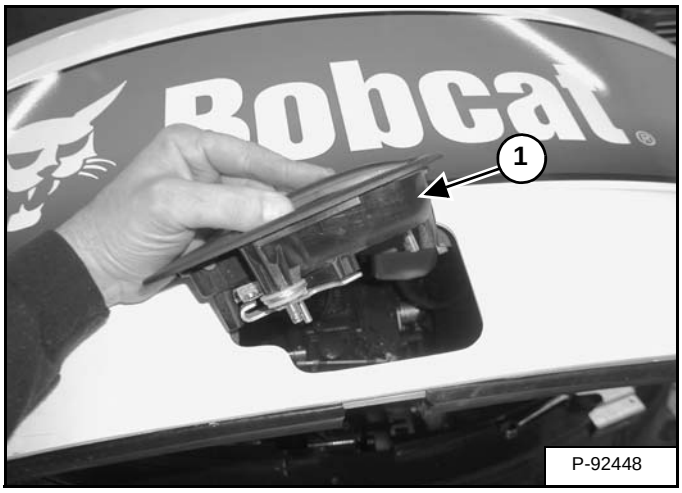
Remove the bolts (Item 1) and the latch (Item 2) **[Figure 40-190-3]**.

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]**.

QUICK COUPLER (KLAC™ SYSTEM)

Removal

Remove the bucket. (See Operation & Maintenance Manual for the correct removal procedure.)

⚠ WARNING

AVOID INJURY OR DEATH

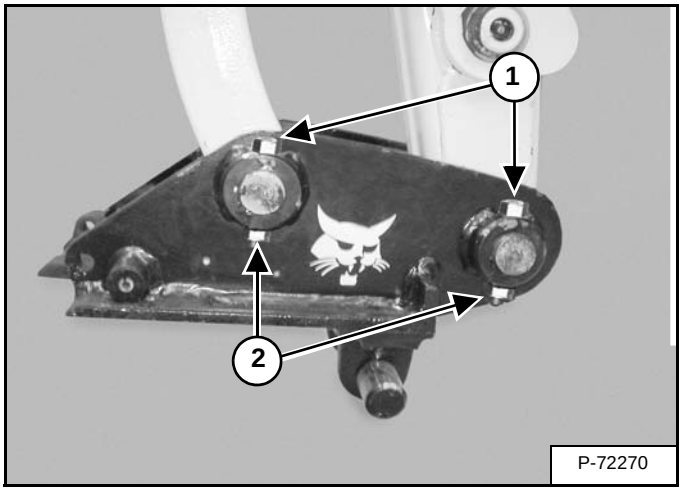
Wear safety glasses to prevent eye injury when any of the following conditions exist:

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

W-2019-0907

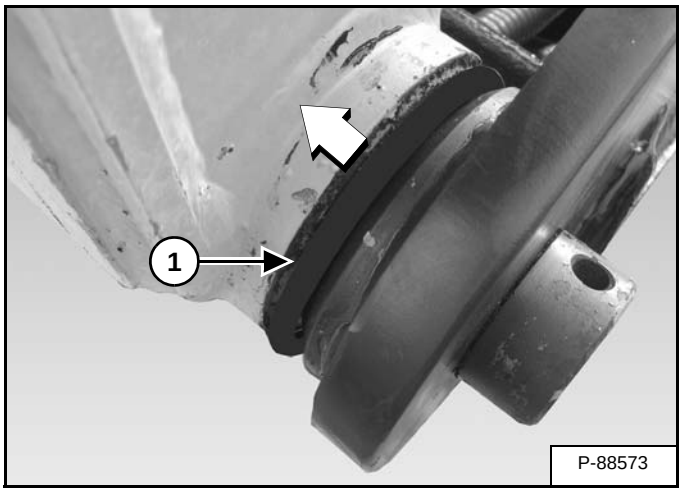
NOTE: Place the arm on the earth with the coupler mounting pin facing toward the excavator.

Figure 40-200-1



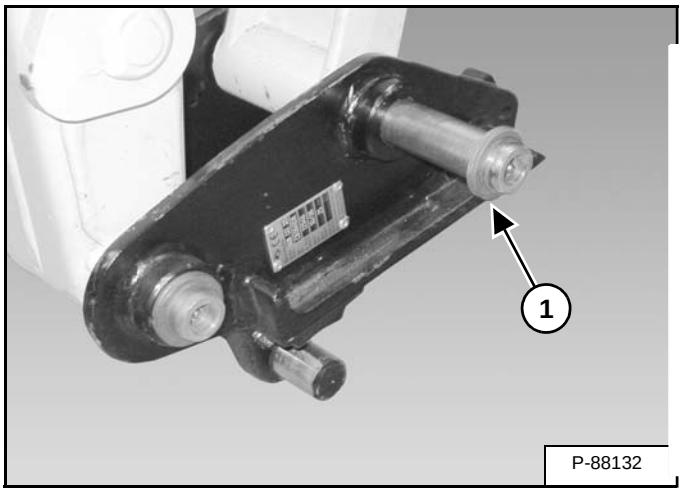
Remove the two retaining bolts (Item 1) and nuts (Item 2) **[Figure 40-200-1]**.

Figure 40-200-2



Slide the O-rings (Item 1) **[Figure 40-200-2]** onto the arm and bucket link of the excavator (both sides).

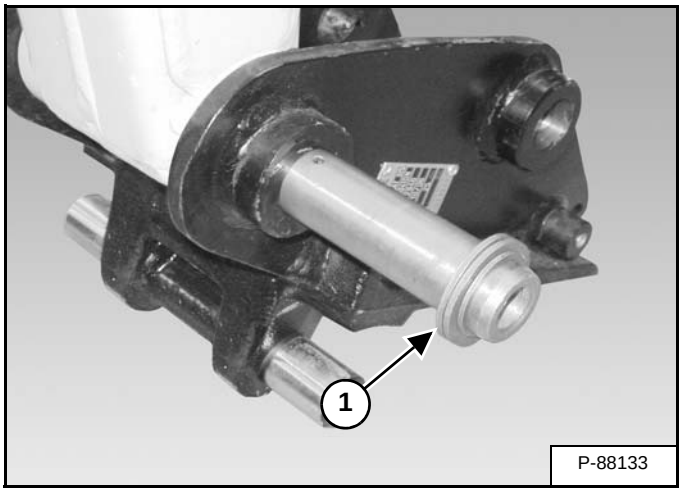
Figure 40-200-3



Remove the pin assembly (Item 1) **[Figure 40-200-3]** from the coupler and bucket link mounting hole.

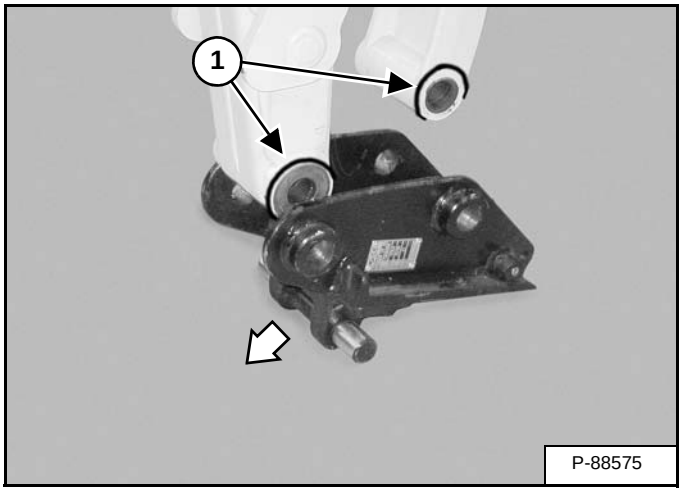
Removal (Cont'd)

Figure 40-200-4



Remove the pin assembly (Item 1) **[Figure 40-200-4]** from the coupler and arm mounting hole.

Figure 40-200-5



Remove the coupler from the arm **[Figure 40-200-5]**.

Remove the O-rings (Item 1) **[Figure 40-200-5]** from the arm and bucket link of the excavator (both sides).

Installation

WARNING

AVOID INJURY OR DEATH

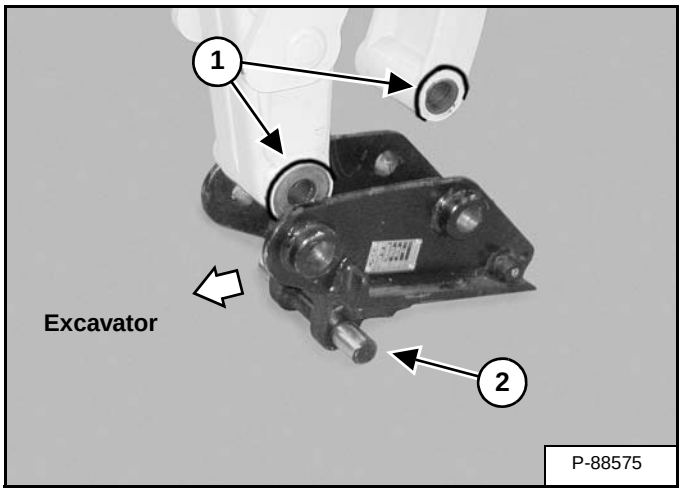
Wear safety glasses to prevent eye injury when any of the following conditions exist:

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

W-2019-0907

NOTE: DO NOT lubricate the quick coupler. Lubricant will cause dirt to collect on the coupler and interfere with the proper movement of the coupler components. (Only lubricate the two mounting pins when installation is complete.)

Figure 40-200-6



Slide the O-rings (Item 1) **[Figure 40-200-6]** onto the arm and bucket link of the machine (both sides).

NOTE: Place the coupler on the earth with the mounting pin (Item 2) [Figure 40-200-6] facing toward the excavator.

WARNING

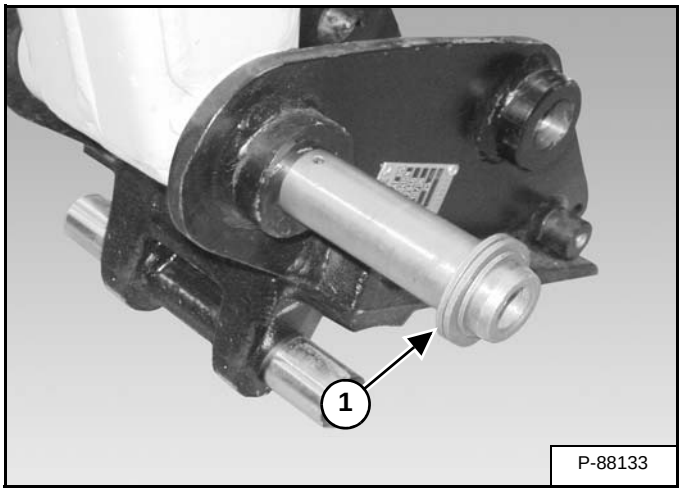
AVOID INJURY

Keep fingers and hands out of pinch points when latching and unlatching the attachment quick coupler.

W-2541-1106

Installation (Cont'd)

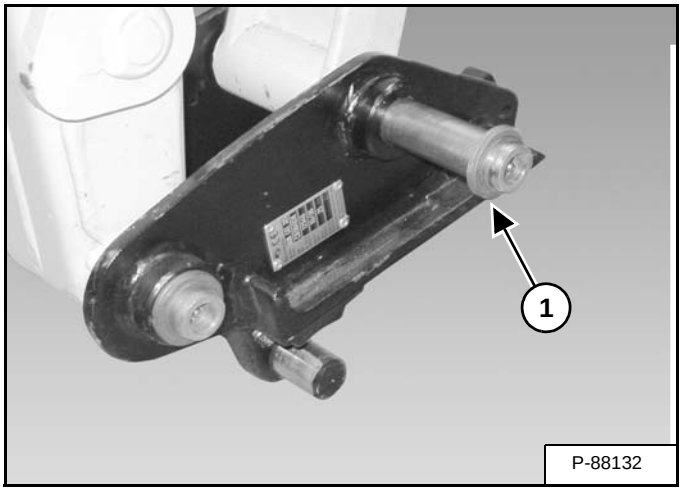
Figure 40-200-7



Align the arm mounting hole and the coupler mounting hole.

Install the existing pin assembly (Item 1) **[Figure 40-200-7]** through the coupler and arm mounting hole.

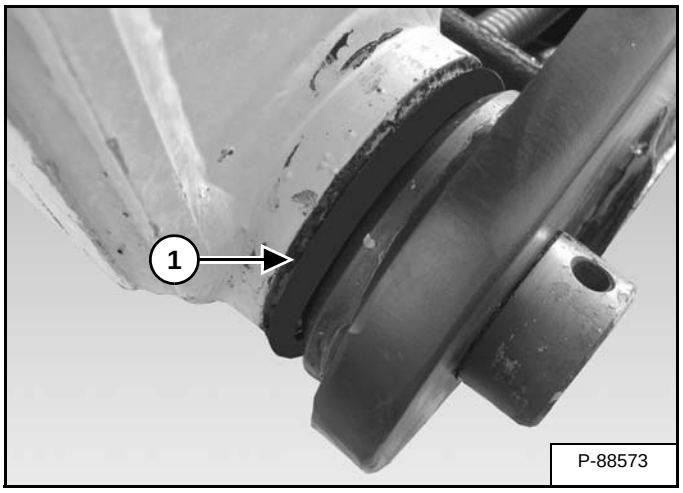
Figure 40-200-8



Align the bucket link mounting hole and the coupler mounting hole.

Install the existing pin assembly (Item 1) **[Figure 40-200-8]** through the coupler and bucket link mounting hole.

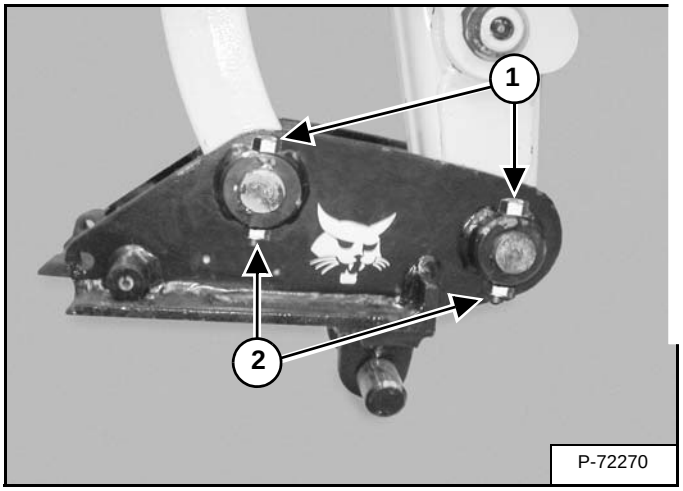
Figure 40-200-9



Slide O-rings (Item 1) **[Figure 40-200-9]** into position between the coupler and the arm and bucket link of the machine.

NOTE: The O-rings will help prevent dirt and debris from entering the pivot points of the coupler.

Figure 40-200-10



Align the holes of the connecting pins with the holes in the coupler.

Install the two retaining bolts (Item 1) and nuts (Item 2) **[Figure 40-200-10]**. Tighten the nuts securely against the coupler.


Bobcat®

QUICK COUPLER (BOBCAT HYDRAULIC PIN GRABBER COUPLER HPG2)

Troubleshooting

System errors are indicated by the green light on the switch flashing and/or repeating buzzer chirps. Refer to the error indicator table.

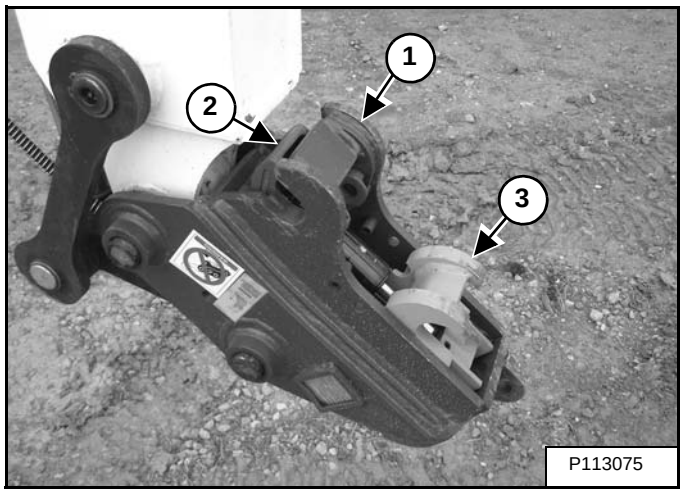
PIN GRABBER ERROR INDICATORS			
CHIRP	**FLASHES**	**FAULT**	**POSSIBLE CAUSE**
1	1	SOLENOID	• SOLENOID • SOLENOID CONNECTOR • CONTROLLER CONNECTOR • HARNESS
2	2	PRESSURE SENSOR	• PRESSURE SENSOR • PRESSURE SENSOR CONNECTOR • CONTROLLER CONNECTOR • HARNESS
	3	BUZZER	• BUZZER • BUZZER CONNECTORS • CONTROLLER CONNECTOR • HARNESS
1,2,3		SWITCH LED	• SWITCH

If the coupler is not functioning properly, and there are no system errors, refer to the table.

PIN GRABBER		
PROBLEM	**CAUSE**	**CORRECTION**
Safety locks not releasing.	Low hydraulic pressure	Check pressure.
	Faulty pressure switch.	Replace pressure switch.
	Faulty check valve.	Clean or replace check valve.
	Faulty cylinder.	Replace cylinder.
Safety locks releasing during operation.	Faulty seals in cylinder.	Repair cylinder.
	Faulty check valve.	Clean or replace check valve.
	Faulty cylinder.	Replace cylinder.
Safety locks close when changing attachments.	Faulty check valve or pilot valve.	Clean or replace check valve or pilot valve.
	Faulty cylinder.	Replace cylinder.

Daily Inspection

Figure 40-201-1



Remove all dirt and debris from the quick coupler. Inspect the fixed hook (Item 1), safety lock (Item 2,) and sliding hook (Item 3) **[Figure 40-201-1]** for wear or damage.

Repair or replace damaged parts.

Removal And Installation

WARNING

AVOID INJURY OR DEATH

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

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

W-2019-0907

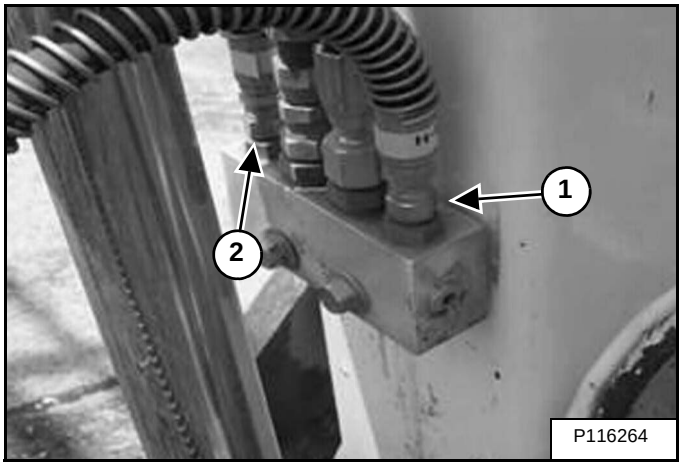
Remove the bucket. (See Operation & Maintenance Manual for correct removal procedure.)

Figure 40-201-2



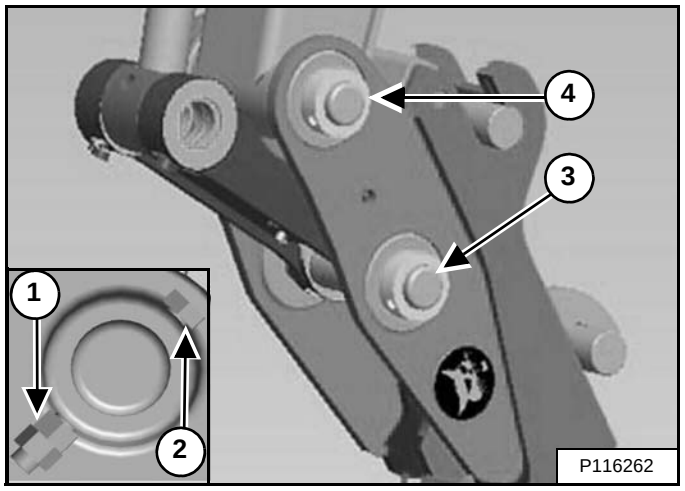
Support the boom with a hoist **[Figure 40-201-2]**.

Figure 40-201-3



Mark and remove the coupler hydraulic hoses (Item 1) and (Item 2) **[Figure 40-201-3]** from the manifold.

Figure 40-201-4

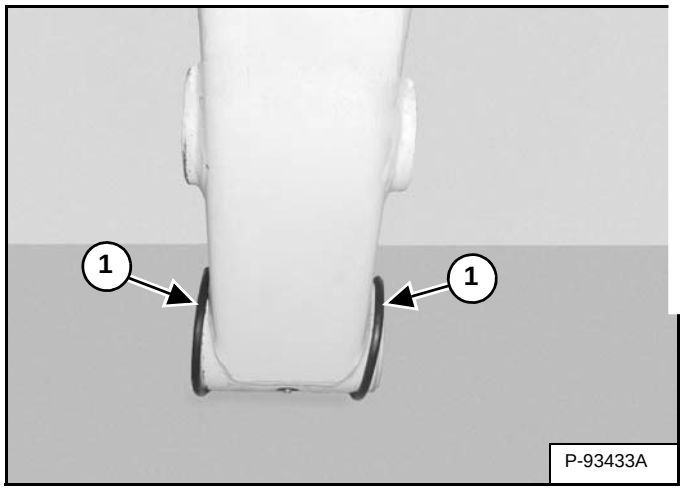


Remove the two nuts (Item 1) and bolt (Item 2) from the bucket link pin boss (Item 3) and quick coupler pin boss (Item 4) **[Figure 40-201-4]**.

Remove the bucket link and coupler pins.

Remove the coupler assembly.

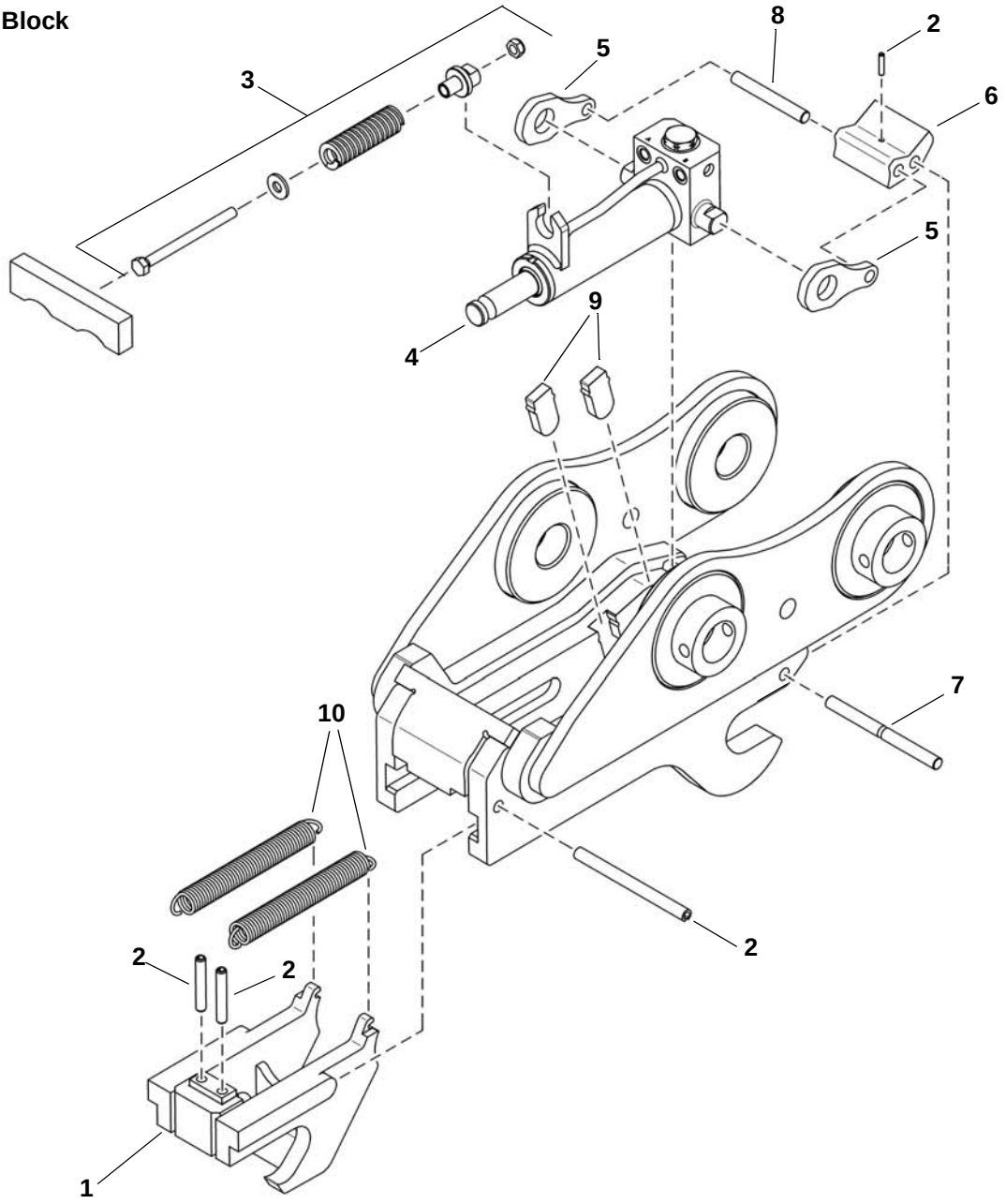
Figure 40-201-5



Remove the O-rings (Item 1) **[Figure 40-201-5]**.

Parts Identification

1. Sliding Hook
2. Roll Pin
3. Spring Assembly
4. Hydraulic Cylinder
5. Link
6. Safety Lock
7. Lock Pin
8. Lock Link Pin
9. Rubber Block
10. Spring

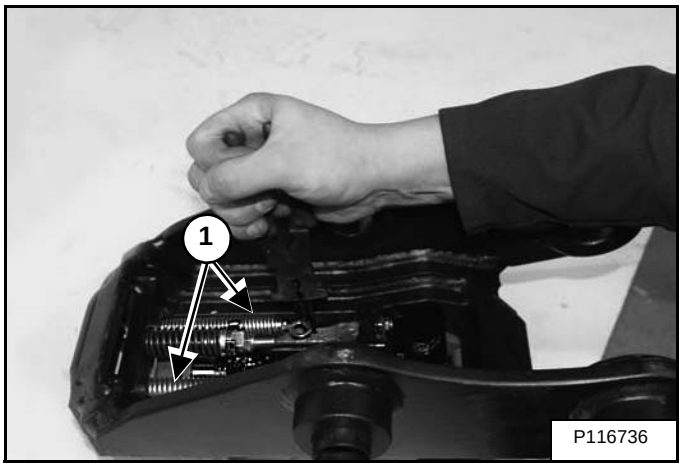


NA10341S

Disassembly And Assembly

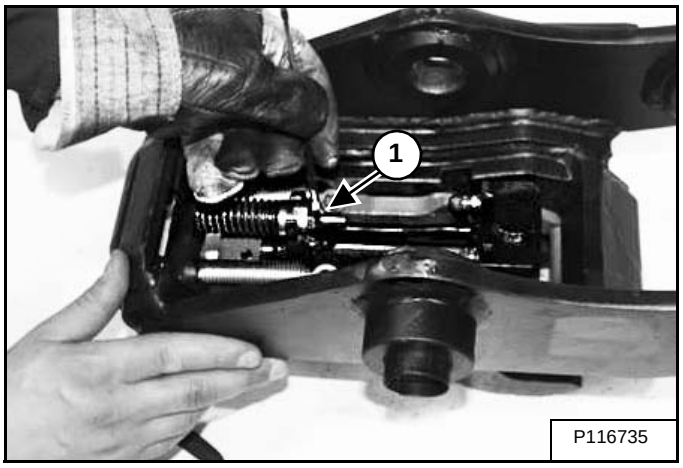
NOTE: Actual coupler may vary from photos, but procedures remain the same.

Figure 40-201-6



Remove the springs (Item 1) **[Figure 40-201-6]**.

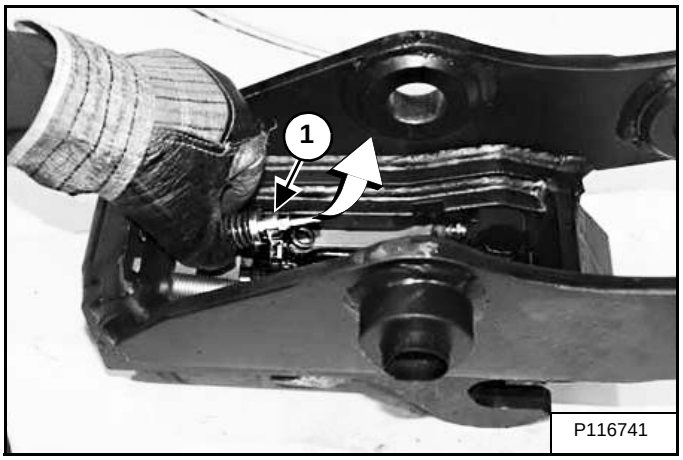
Figure 40-201-7



Tighten the spring assembly nut (Item 1) **[Figure 40-201-7]** until the spring assembly is free from the housing.

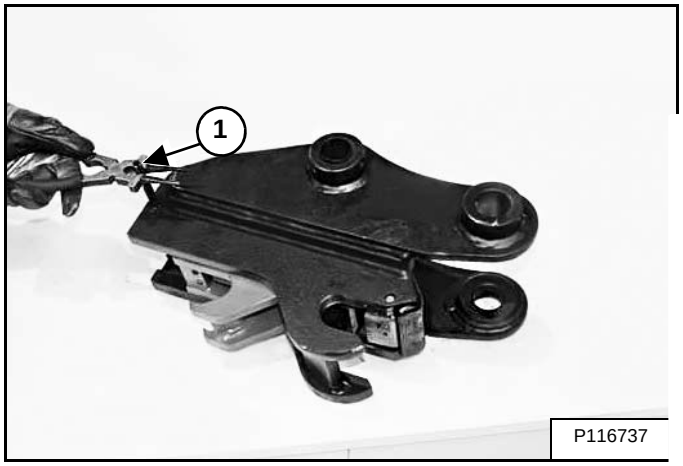
NOTE: Keep the flats of the spring retainers in line with the mounts for reassembly.

Figure 40-201-8



Remove the spring assembly (Item 1) **[Figure 40-201-8]**.

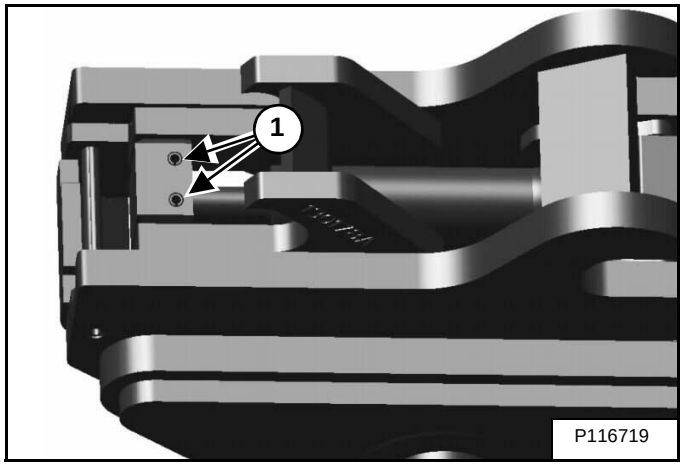
Figure 40-201-9



Remove the roll pin (Item 1) **[Figure 40-201-9]**.

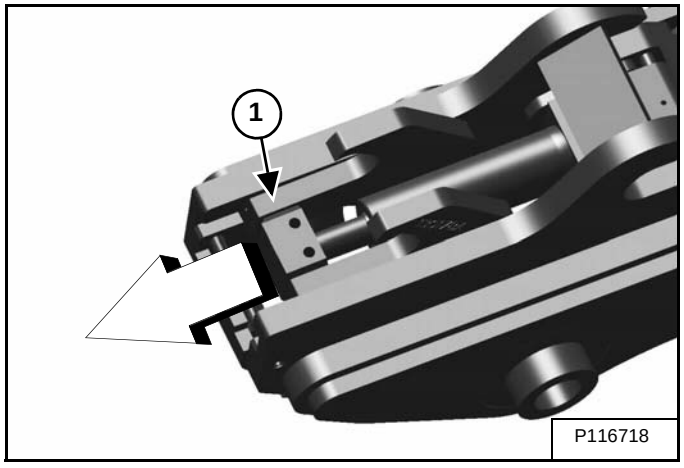
Disassembly And Assembly (Cont'd)

Figure 40-201-10



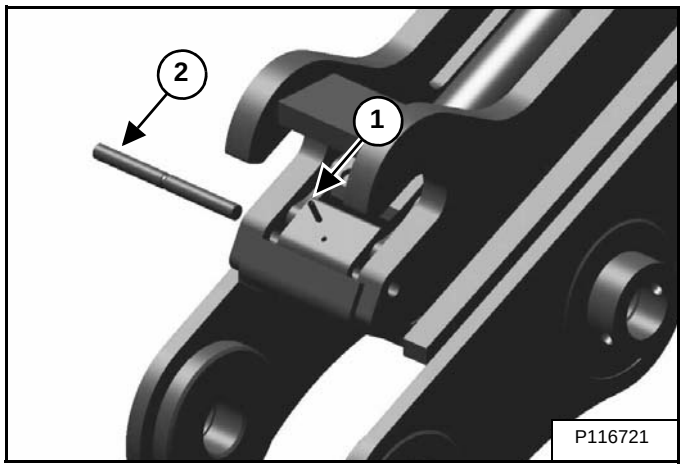
Remove the cylinder retaining pins (Item 1) **[Figure 40-201-10]** from the sliding hook.

Figure 40-201-11



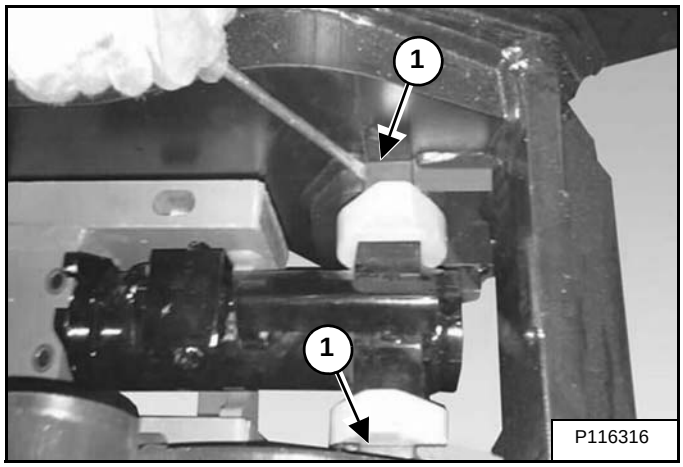
Remove the sliding hook (Item 1) **[Figure 40-201-11]**.

Figure 40-201-12



Remove the roll pin (Item 1) and safety lock pivot pin (Item 2) **[Figure 40-201-12]**.

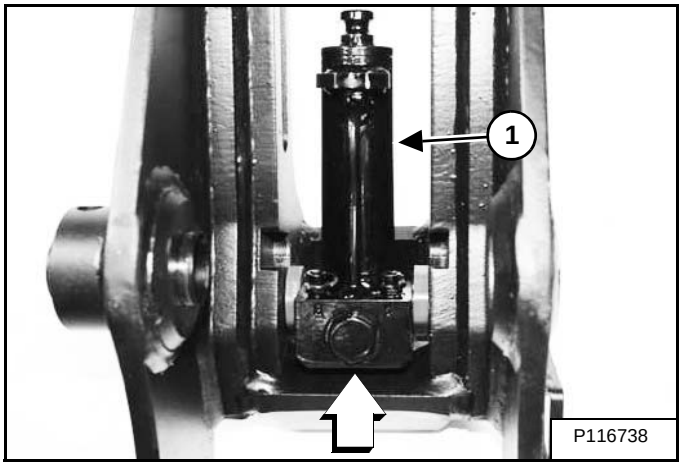
Figure 40-201-13



Pry out the rubber blocks (Item 1) **[Figure 40-201-13]**.

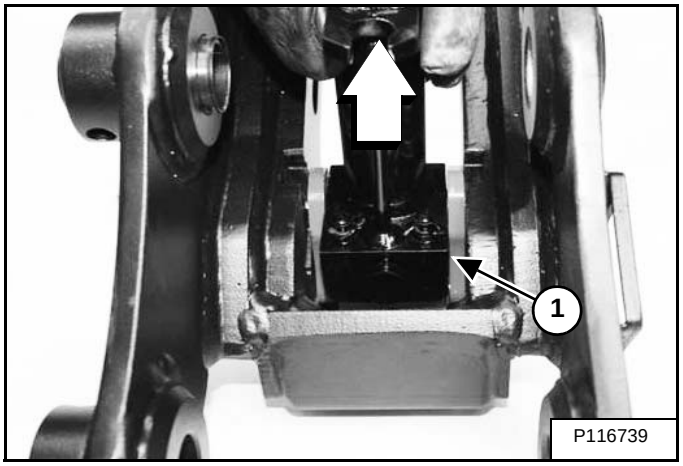
Disassembly And Assembly (Cont'd)

Figure 40-201-14



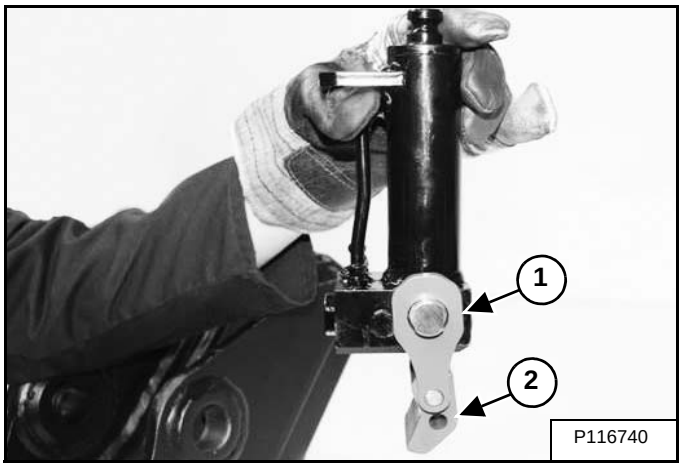
Slide the cylinder assembly (Item 1) **[Figure 40-201-14]** toward the middle of the frame.

Figure 40-201-15



Rotate the cylinder (Item 1) **[Figure 40-201-15]** up and lift it from the frame.

Figure 40-201-16



Remove the links (Item 1) and the safety latch (Item 2) **[Figure 40-201-16]**.

Inspect and replace parts as necessary.

Reverse procedures for reassembly.


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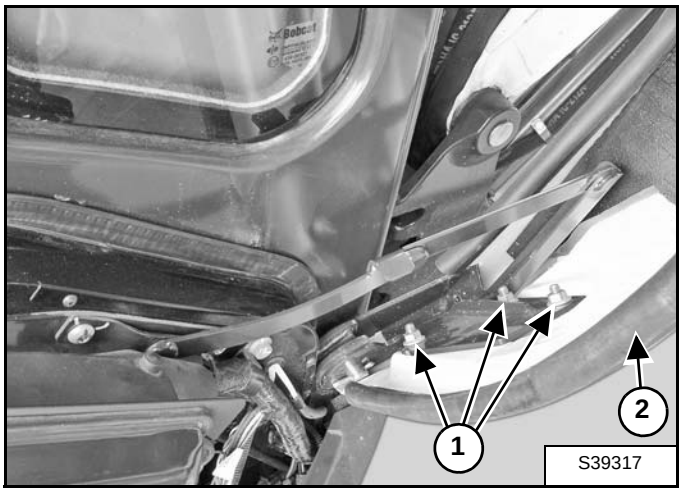
RIGHT SIDE COVER

Removal And Installation

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

Support the right side cover while removing hardware.

Figure 40-210-1



Remove the three nuts and remove the right side cover (Item 2) **[Figure 40-210-1]**.

Installation: Tighten the nuts to 41 N•m (30 ft-lb) torque.

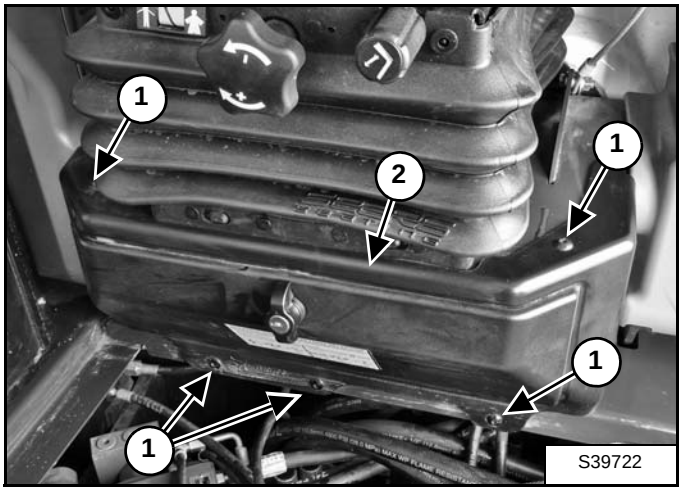

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TOOL BOX

Removal And Installation

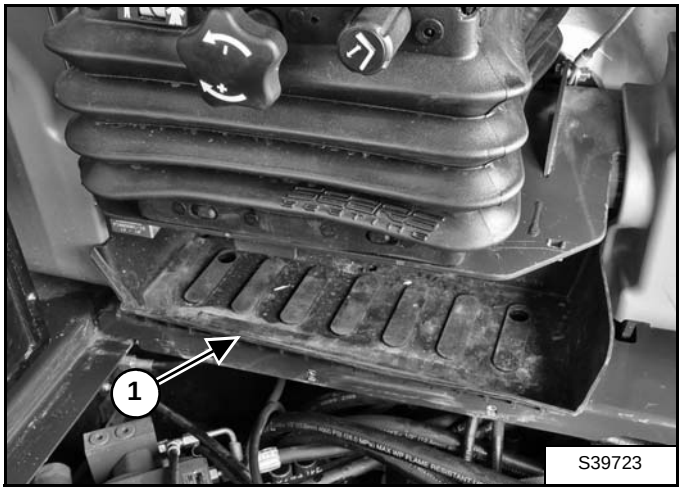
Remove the floor mat and floor panel. (See Removal And Installation on Page 40-110-1.)

Figure 40-220-1



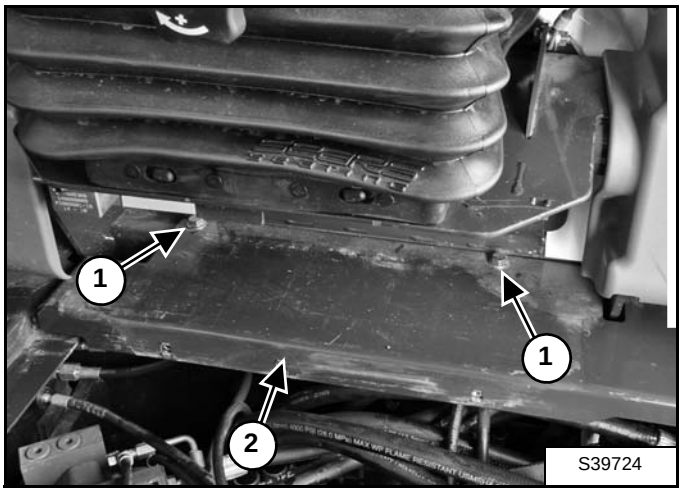
Remove the five screws (Item 1) and tool box cover (Item 2) **[Figure 40-220-1]**.

Figure 40-220-2



Remove the rubber liner (Item 1) **[Figure 40-220-2]**.

Figure 40-220-3



Remove the two bolts (Item 1) and floorplate (Item 2) **[Figure 40-220-3]**.


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CONNECTORS ASSIGNMENT

CONNECTOR	DESCRIPTION	PINS	SHEET
C001	FRAME TO ENGINE	3	7
C002	FRAME TO ENGINE	10	7
C003	FUEL SOLENOID	3	7
C004	ENGINE COOLANT TEMPERATURE	3	7
C005	SPEED SENSOR	3	7
C006	ALTERNATOR	2	7
C007	FRAME TO LH CONSOLE	8	5, 8, 12
C008	FRAME TO LH CONSOLE	10	5, 8, 11, 12
C009	RIGHT JOYSTICK	5	9
C010	BLADE JOYSTICK	6	9
C011	IGNITION	6	10
C012	REMOTE TOOL / ACD	7	6
C014	FUEL SENSOR	2	12
C016	AUX SOCKET	2	10
C017	WASHER BOTTLE	2	12
C018	FRAME TO BOOM LIGHT	2	11
C019	HEATER / HVAC SUPPLY	2	14
C020	FRAME TO MOTION ALARM	2	14
C022	LH TO WIPER	3	12
C024	FRAME TO LOAD MOMENT	2	8
C028	RFID	6	6
C031	FRONT ROD	2	9
C032	FRONT BASE	2	9
C033	WORKGROUP LOCKOUT	2	8
C034	2 SPEED	2	8
C035	OFFSET ROD	2	9
C036	OFFSET BASE	2	9
C040	AI ACTUATOR	8	13
C041	FRAME TO JUMPER	3	13
C042	THROTTLE CONTROL	6	13
C045	AI SENSE PRESSURE	3	13
C050	FRAME TO AUTO IDLE	6	13
C107	LEFT JOYSTICK	5	8
C108	CONSOLE SENSOR	3	8
C109	LOAD MOMENT SWITCH	6	5, 8
C110	BEACON SWITCH	6	5, 11
C111	WIPER SWITCH	6	12
C112	FRAME LIGHT	2	11
C114	2nd AUX SWITCH	6	8
C115	LH CONSOLE TO 2nd AUX	2	8

CONNECTORS ASSIGNMENT

CONNECTOR	DESCRIPTION	PINS	SHEET
C150	FRAME TO MAIN VALVE	6	9
C218	CAB TO LIGHT REAR	2	11
C219	CAB TO BEACON / STROBE	2	11
C220	RADIO	6	12
C300	HYD TEMP SENSOR	2	9
C301	HYD FILTER SWITCH	2	9
C460	BOOM LIGHT TO FRAME	2	11
C463	LH CONSOLE TO CAB	2	5, 11
C464	WIPER TO LH CONSOLE	3	12
C466	CAB LIGHT	3	11
C468	BOOM LIGHT	2	11
C469	LH CONSOLE TO CAB	3	11, 12
C623	HVAC BOX TO CLUTCH	3	14
C625	LIGHT TO REAR LIGHT	2	11
C626	RIGHT FRONT LIGHT	2	11
C627	LEFT FRONT LIGHT		11
C628	WIPER		12
C631	CLUTCH		14
C635	DRYER SWITCH		14
C705	BEACON / STROBE		11
C706	BEACON / STROBE TO CAB		11
C707	REAR LIGHT		11
C708	REAR LIGHT TO LIGHT		11
C709	REAR LIGHT TO CAB		11
C714	MA DISABLE SWITCH	6	14
P1	PRESSURE SWITCH	2	14
P3	LATCHING RELAY	4	14
P4	RELAY	5	14
T001	GLOW PLUGS	1	7
T002	ENGINE OIL SWITCH	1	7
T003	ALTERNATOR_B	1	7
T004	ALTERNATOR_GND	1	7
T005	STARTER_B	1	7
T006	STARTER_S	1	7
T008	ENGINE_GND	1	7
T009	BATTERY_POS	1	4
T010	BATTERY_NEG	1	4
T011	STARTER_GND	1	7

CONNECTORS ASSIGNMENT

CONNECTOR	DESCRIPTION	PINS	SHEET
T012	ENGINE BAY FRAME GND	1	7
T014	FRAME_GND	1	5
T017	BUZZER +	1	10
T018	BUZZER -	1	10
T019	DISCONNECT	1	5
T020	DISCONNECT	1	5
T100	HORN	1	10
T101	HORN	1	10
T203	LEFT SPEAKER	1	12
T204	LEFT SPEAKER	1	12
T205	RIGHT SPEAKER	1	12
T206	RIGHT SPEAKER	1	12
T301	HYD FILTER SWITCH	1	9
T302	HYD FILTER SWITCH	1	9
TM1	MOTION ALARM	1	14
TM2	MOTION ALARM	1	14
P001	FUSE RELAY CENTER - FRC	56	4, 7, 11, 14

MA = Motion Alarm
AI = Auto-Idle
AIC = Auto-Idle Controller
ACD = Attachment Control Device
RFID = Radio Frequency Identification

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WIRING SCHEMATIC
E25 (S/N AB8B11001 - AB8B11999)
Sheet 1 of 14

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CONNECTOR ASSIGNMENT (PANEL/DISPLAY CONTROLLER)			
PIN	**FUNCTION**	**PIN**	**FUNCTION**
J1-A	STARTER	J4-A	SPARE
J1-B	FUEL HOLD	J4-B	GLOW PLUG STATUS
J1-C	LIGHT RELAY	J4-C	FUEL PULL STATUS
J1-D	GROUND	J4-D	STARTER STATUS
J1-E	BATTERY	J4-E	KEY
J1-F	BATTERY	J4-F	HYD OIL FILTER
J1-G	GROUND	J4-G	ENGINE OIL PRESSURE
J1-H	GLOW PLUG RELAY	J4-H	SPARE
J1-J	FUEL PULL	J4-J	CRANK
J1-K	SWITCH POWER RELAY	J4-K	SPEED SENSOR
J2-A	FRONT AUX ROD	J5-A	CAN LOW
J2-B	FRONT AUX BASE	J5-B	CAN HIGH
J2-C	SPARE	J5-C	SPARE
J2-D	JOYSTICK ENABLE	J5-D	SPARE
J2-E	SPARE	J5-E	2 SPEED
J2-F	SPARE	J5-F	AUX PADDLE
J2-G	2 SPEED	J5-G	DETENT
J2-H	SPARE	J5-H	SPARE
J2-J	BUZZER	J5-J	SPARE
J2-K	LOAD MOMENT	J5-K	CAN SHIELD
J3-A	FUEL SENSOR	J6-A	BOOM SWING RETURN
J3-B	ENGINE COOLANT TEMPERATURE	J6-B	SPARE
J3-C	HYD OIL TEMPERATURE	J6-C	SPARE
J3-D	CONSOLE SENSOR	J6-D	BOOM SWING ROD
J3-E	AI SENSE PRESSURE	J6-E	SPARE
J3-F	OFFSET PADDLE	J6-F	SPARE
J3-G	SENSOR POWER (8V)	J6-G	SPARE
J3-H	SENSOR GROUND	J6-H	SPARE
		J6-J	SPARE
		J6-K	BOOM SWING BASE

CONNECTOR ASSIGNMENT (AIC - AUTO IDLE CONTROLLER)	
PIN	**FUNCTION**
J1A-A	SENSOR POWER (5V)
J1A-B	SWITCHED POWER
J1A-C	SPARE
J1A-D	CAN HIGH
J1A-E	CAN LOW
J1A-F	SPARE
J1A-G	SENSOR GROUND
J1A-H	SPARE
J2A-A	ACTUATOR CONTROL
J2A-B	UNSWITCHED POWER
J2A-C	UNSWITCHED POWER
J2A-D	SPARE
J2A-E	SPARE
J2A-F	SPARE
A-G	SPARE
A-H	GROUND
A-J	GROUND
A-K	ACTUATOR CONTROL
A-A	SPARE
A-B	SPARE
A-C	SPARE
A-D	SPARE
A-E	ACTUATOR FEEDBACK
J3A-F	SPARE
J3A-G	SPARE
J3A-H	SPARE
J3A-J	THROTTLE CONTROL
J3A-K	SPARE

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WIRING SCHEMATIC
E25 (S/N AB8B11001 - AB8B11999)
Sheet 2 of 14

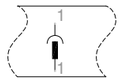
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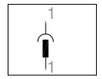
WIRE CATEGORIES FOR COLORS AND NUMBER RANGE			
GROUP DESCRIPTION	**GROUP NUMBER RANGE**	**WIRE COLOR**	**COLOR CODE**
BATT FEED, GENERAL	1000 THROUGH 1499	RED	RED
BATT FEED, FUSED	1000 THROUGH 1499	RED/WHITE	RED/WHT
BATT FEED, SWITCHED	1500 THROUGH 1999	ORANGE/WHITE	RNG/WHT
GROUNDING	2000 THROUGH 2999	BLACK	BLK
MONITORING	3000 THROUGH 3999	LIGHT BLUE	LBL
HYDRAULIC	4000 THROUGH 4999	LIGHT GREEN	LGN
LIGHTS	6000 THROUGH 6999	PINK	PNK
ACCESSORIES	7000 THROUGH 7999	WHITE	WHT
ENGINE	8000 THROUGH 8999	TAN	TAN
COMMUNICATION	9000 THROUGH 9999	PURPLE	PUR

LEGEND

PARTIAL CONNECTOR



CONNECTOR



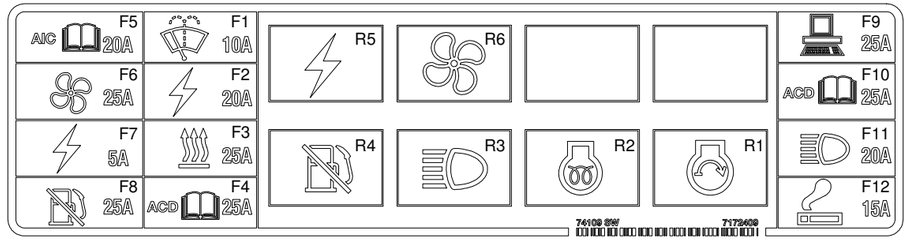
WIRE BREAK
(TWO WIRE BREAKS
JOIN ONE WIRE)

SHEET #

SCHEMATIC INDEX	
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POWER	PAGE 4
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CAN BUS	PAGE 6
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FRAME	PAGE 10
LIGHTS, BEACON, STROBE	PAGE 11
RADIO, WIPER, FUEL	PAGE 12
AUTO IDLE	PAGE 13
HEATER, HVAC, MOTION ALARM	PAGE 14

HARNESSES PN# E26	
HARNESS FRAME	7195840
HARNESS LH CONSOLE	7161916
HARNESS ENGINE	7195838 OR 7195839
HARNESS DIFF SWITCH	7198838
HARNESS MAIN VALVE	7188078
HARNESS BOOM LIGHT	7135895
HARNESS AUTO IDLE	7201238
HARNESS JUMPER	7192507
HARNESS 2nd AUXILIARY	7193481
HARNESS MOTION ALARM	7193556
HARNESS CAB	7171741
HARNESS WIPER	7171777
HARNESS LIGHT REAR	7173612
HARNESS LIGHT	7173482
HARNESS BEACON / STROBE	7172972

FUSE RELAY CENTER



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E25 (S/N AB8B11001 - AB8B11999
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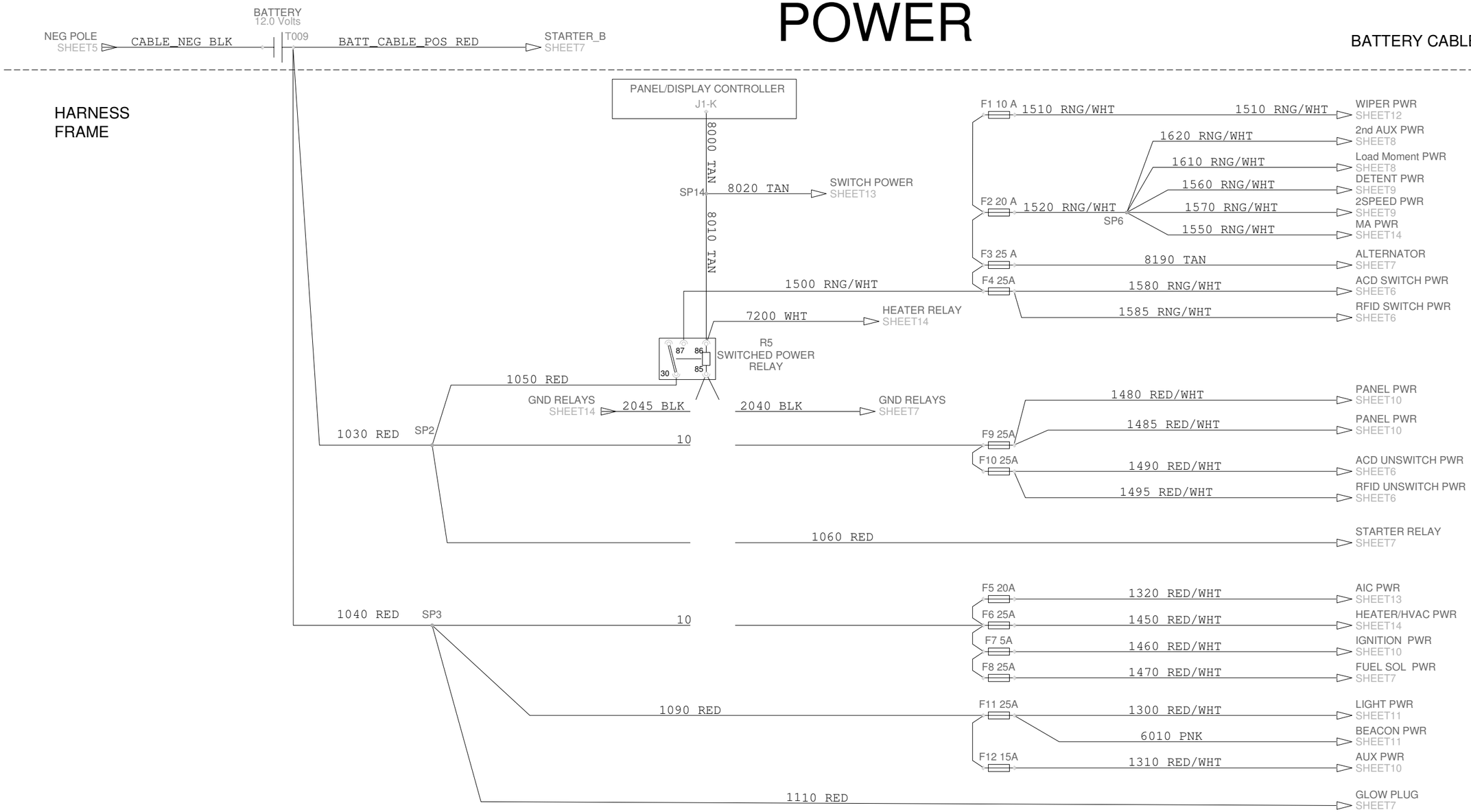
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POWER

BATTERY CABLES



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GROUND

HARNESS
FRAME

HEATER/HVAC GND SHEET14 — 2400 BLK
RELAYS GND SHEET7 — 2080 BLK
AUX GND SHEET10 — 2270 BLK
WASHER GND SHEET12 — 2280 BLK
ACD GND SHEET6 — 2110 BLK
RFID GND SHEET6 — 2440 BLK
AIC GND SHEET13 — 2340 BLK
PANEL GND SHEET10 — 2320 BLK
PANEL GND SHEET10 — 2310 BLK
MA GND SHEET14 — 2300 BLK

SP4 — 2090 BLK

BOOM LIGHT GND SHEET11 — 2290 BLK
HORN GND SHEET10 — 2650 BLK
ENABLE GND SHEET8 — 2190 BLK
2SPD GND SHEET8 — 2170 BLK
FRONT GND SHEET9 — 2135 BLK
BUZZER GND SHEET10 — 2330 BLK
FILTER GND SHEET9 — 2350 BLK

SP5 — 2100 BLK — T014
FRAME GND

HARNESS
LH CONSOLE

SWITCHES GND SHEET12 — 2235 BLK
WIPER GND SHEET12 — 2960 BLK
2nd AUX GND SHEET8 — 2260 BLK
FRAME LIGHT GND SHEET11 — 2250 BLK

SP25 — 2230 BLK — C007 (G G) — 2230 BLK

HARNESS CAB

WORK LIGHT GND SHEET11 — 2860 BLK
BEACON GND SHEET11 — 2870 BLK
CAB LIGHT GND SHEET11 — 2880 BLK
RADIO GND SHEET12 — 2975 BLK

SC12 — 2950 BLK — C463 (B B) — 2950 BLK — C110 (6 6) BEACON SWITCH — 2900 BLK — C109 (6 6) LOAD MOMENT SWITCH — 2220 BLK — C008 (D D) — 2220 BLK

BATTERY CABLES

BATTERY DISCONNECT — CABLE_NEG BLK — NEG POLE SHEET4
CABLE_NEG BLK — FRAME GNG

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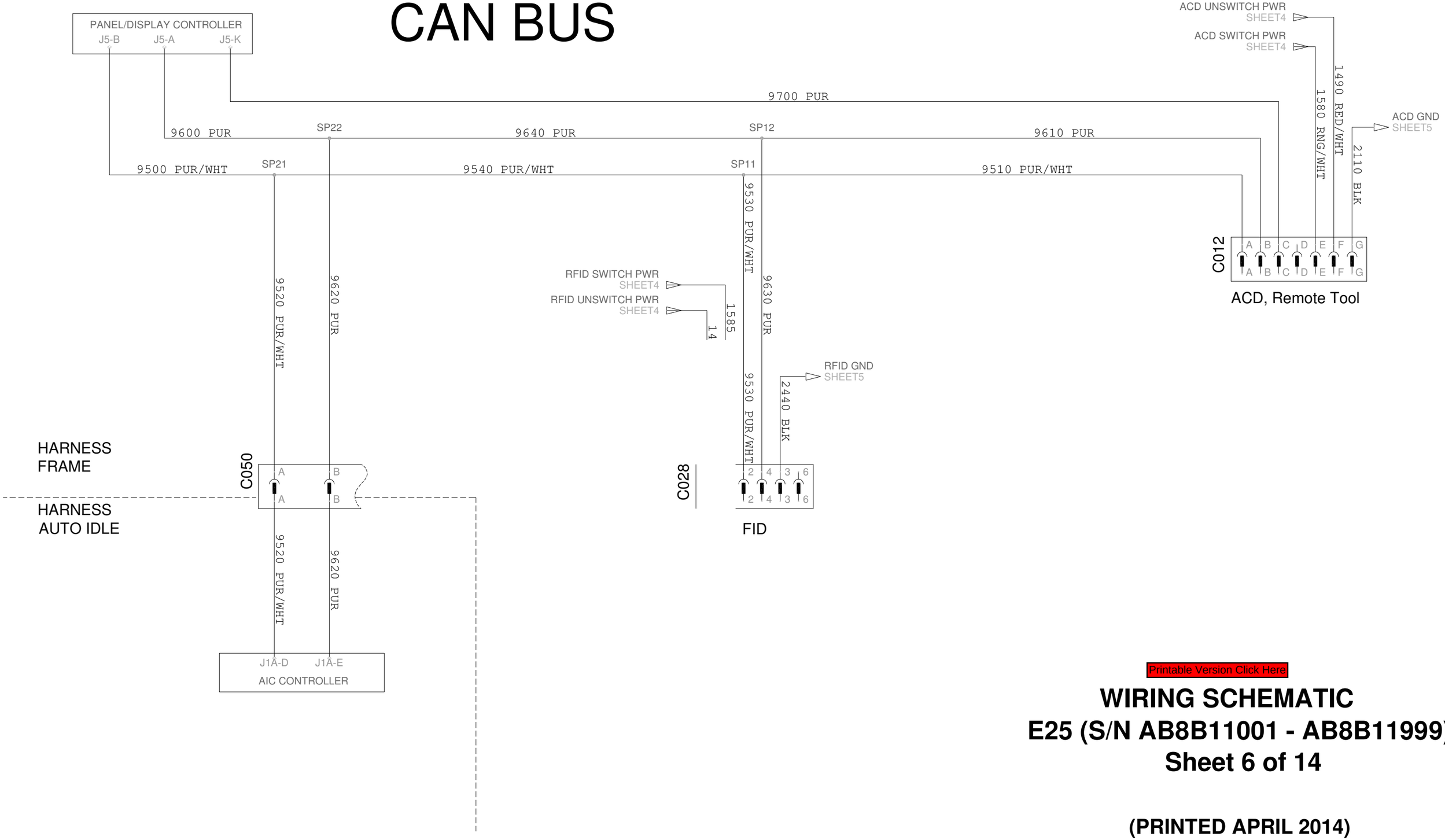
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969 01 838

CAN BUS



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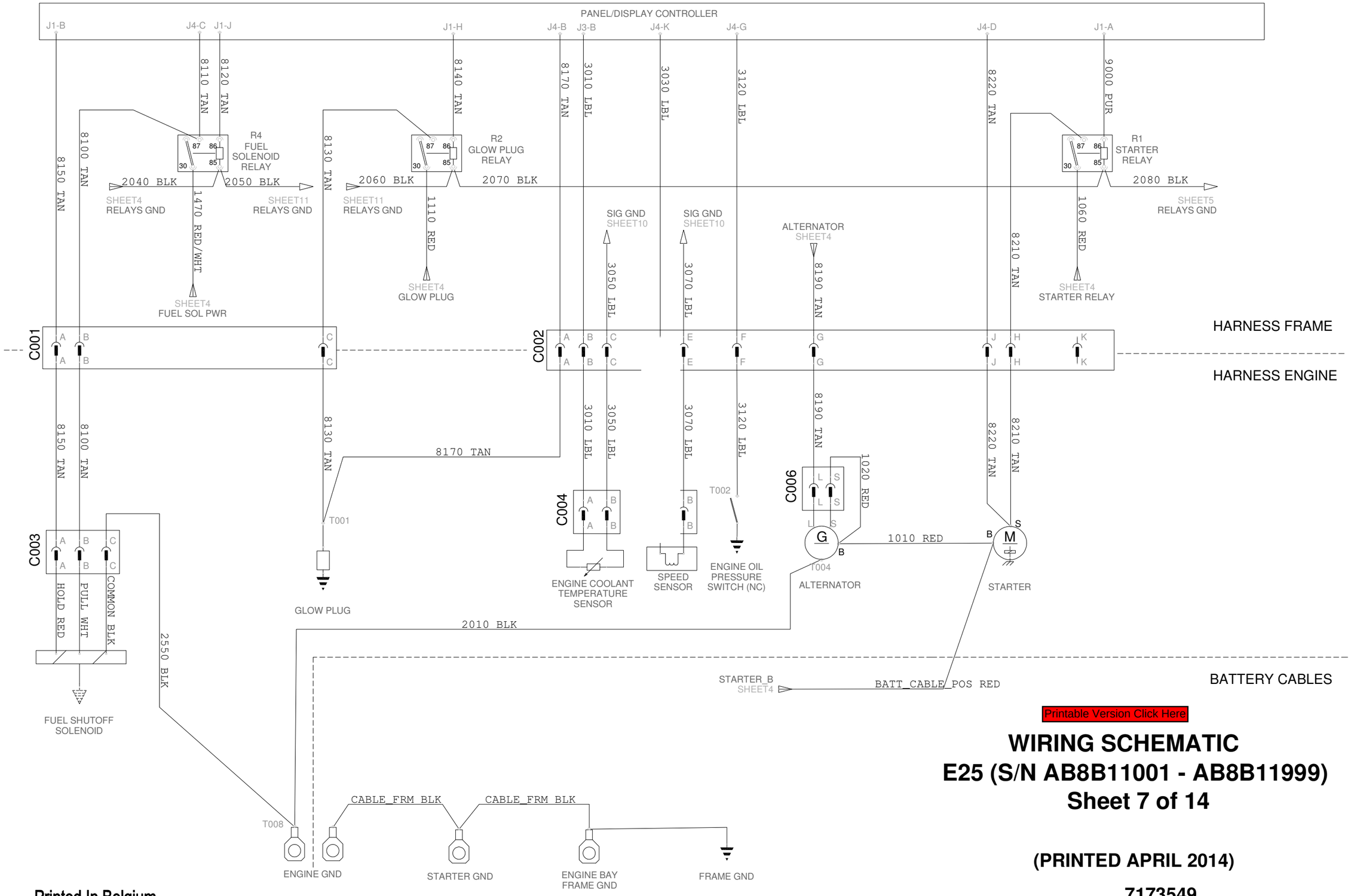
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E25 (S/N AB8B11001 - AB8B11999)
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ENGINE



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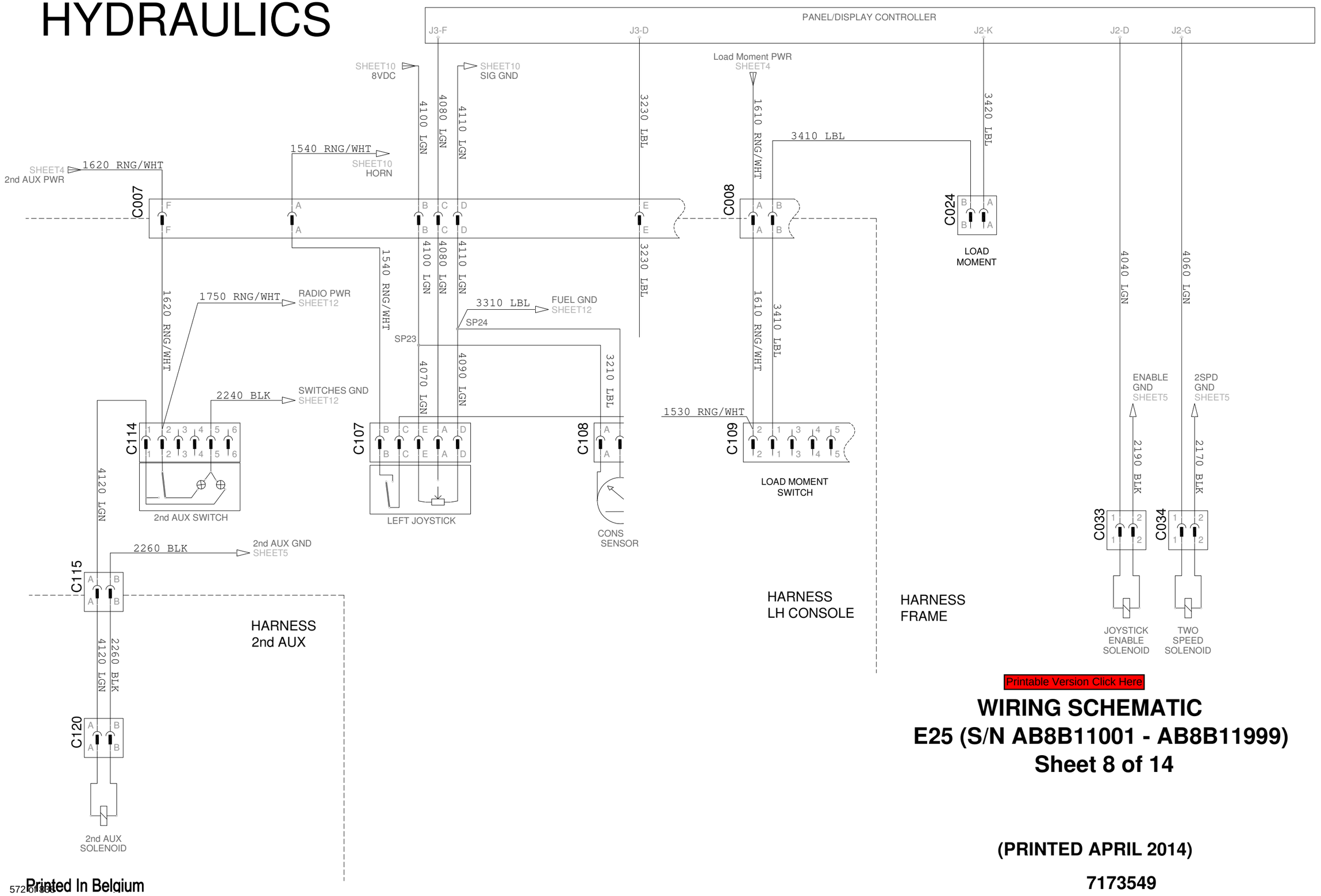
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E25 (S/N AB8B11001 - AB8B11999)
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HYDRAULICS



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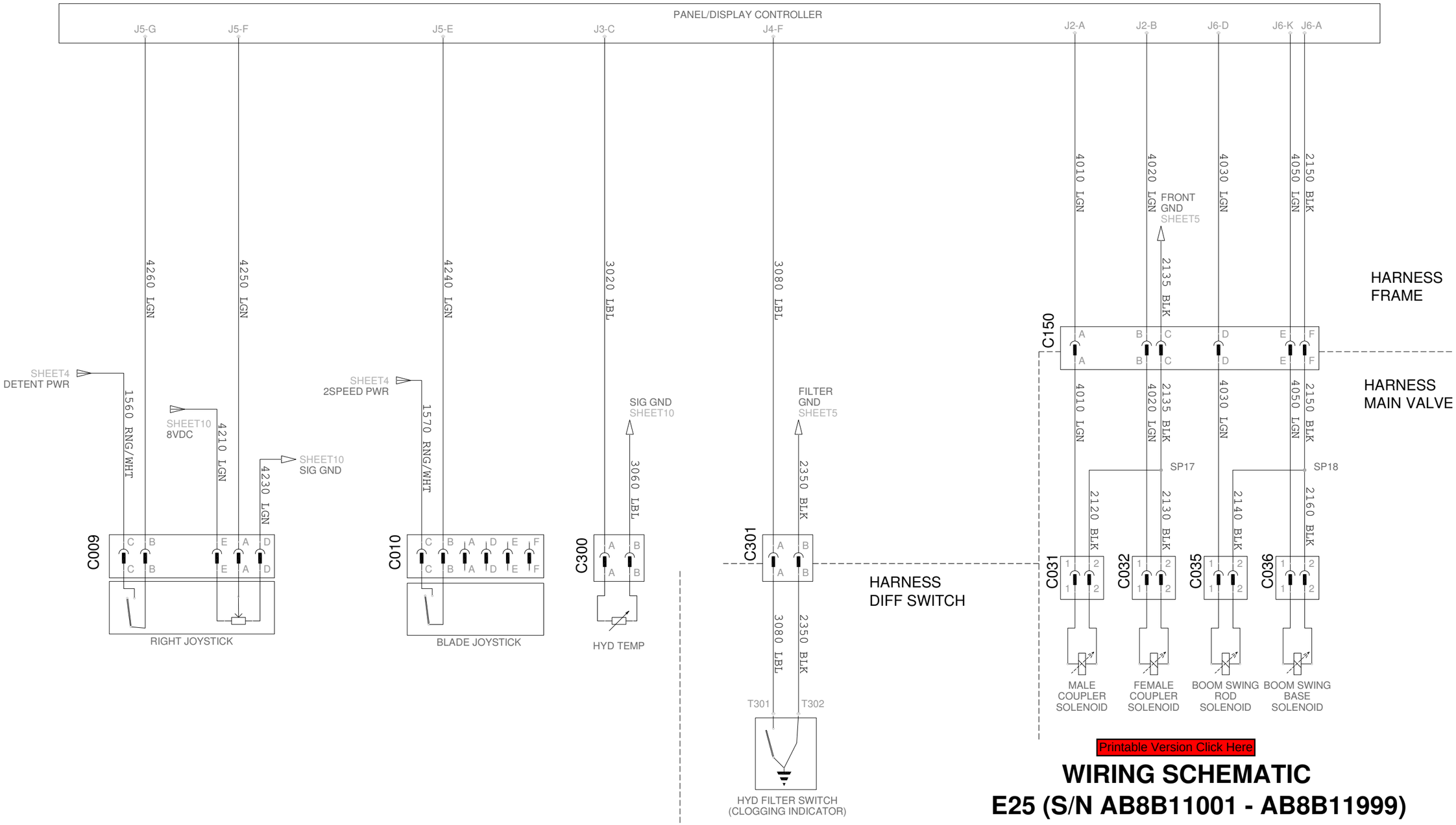
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HYDRAULICS



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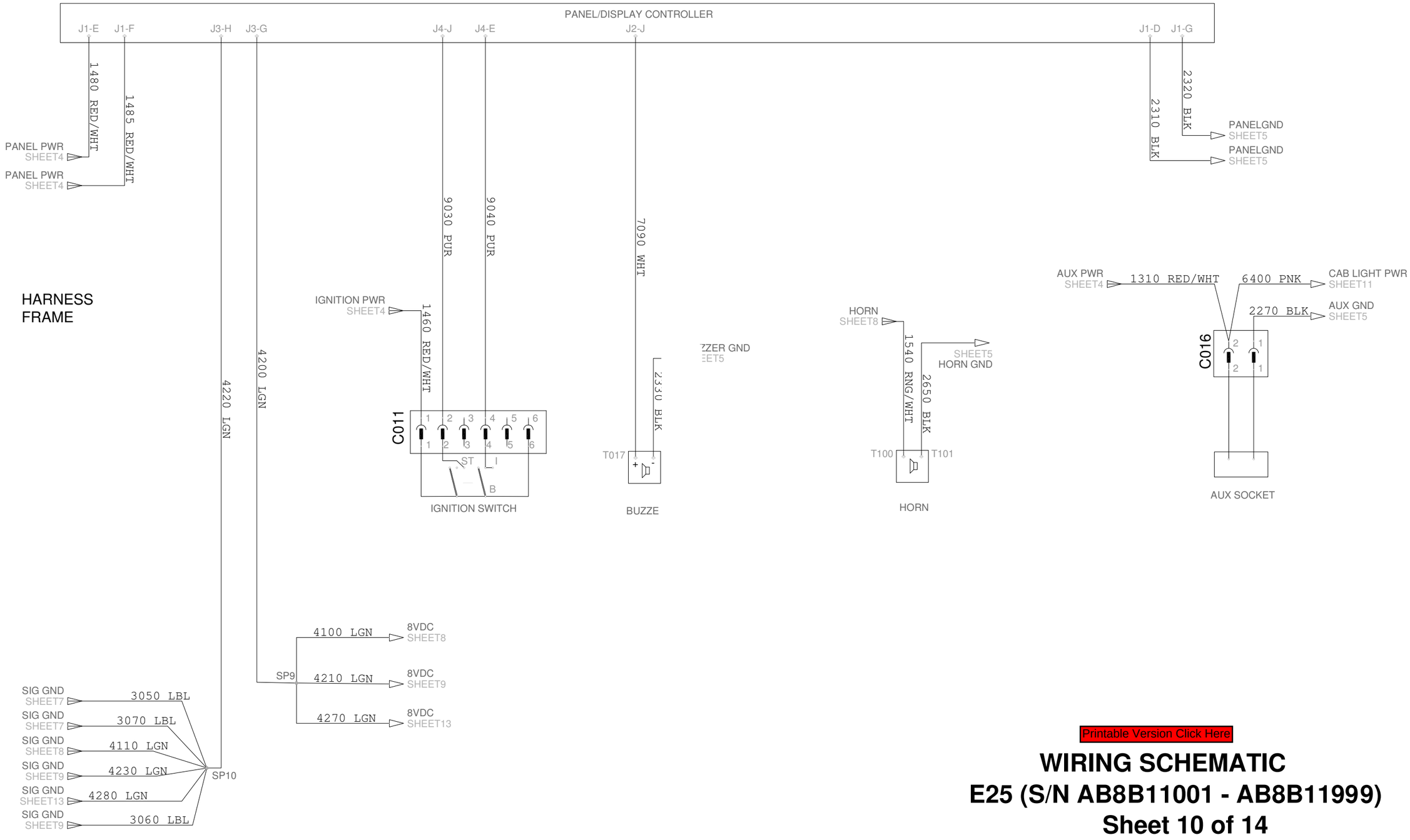
WIRING SCHEMATIC
E25 (S/N AB8B11001 - AB8B11999)
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FRAME



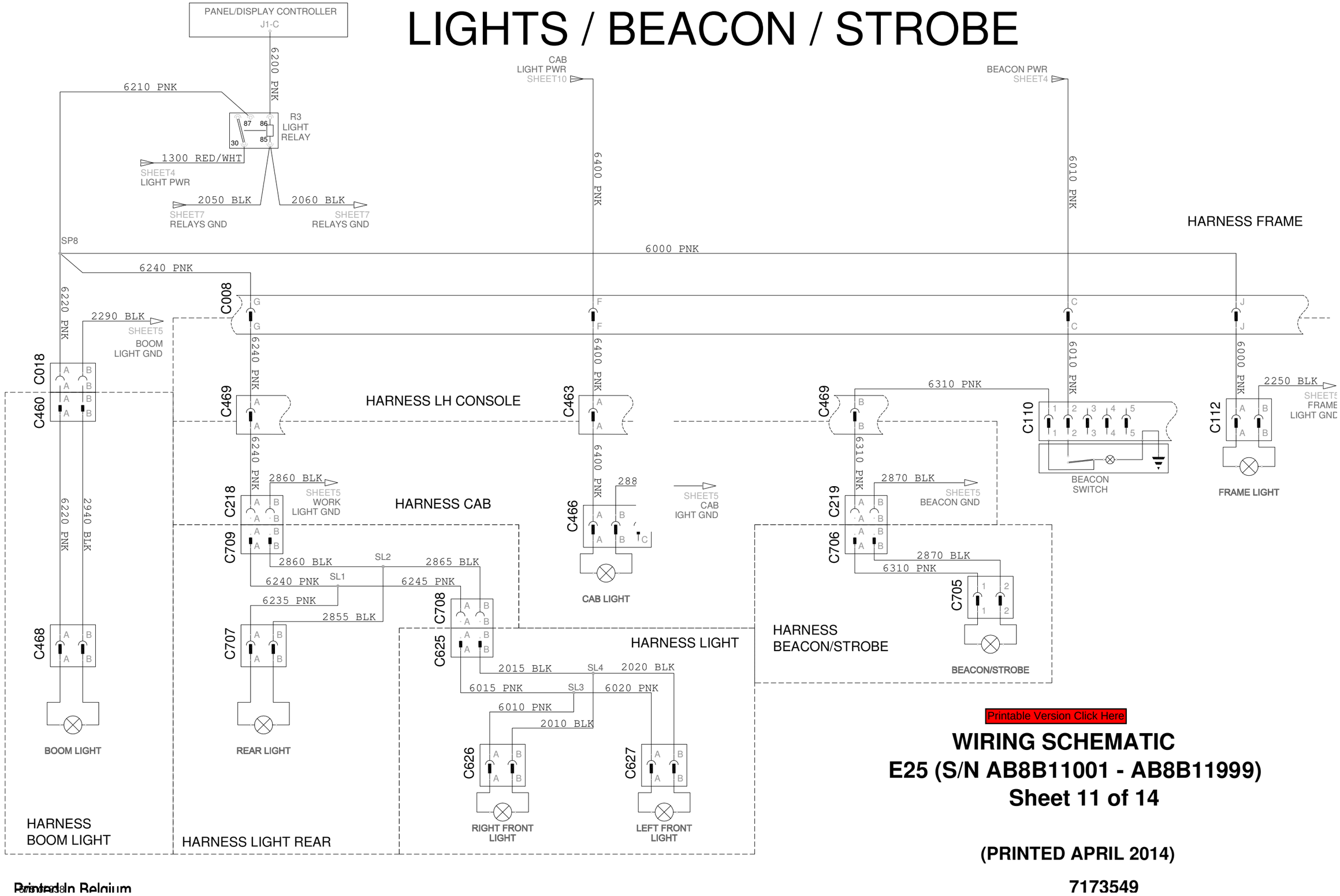
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WIRING SCHEMATIC
E25 (S/N AB8B11001 - AB8B11999)
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LIGHTS / BEACON / STROBE



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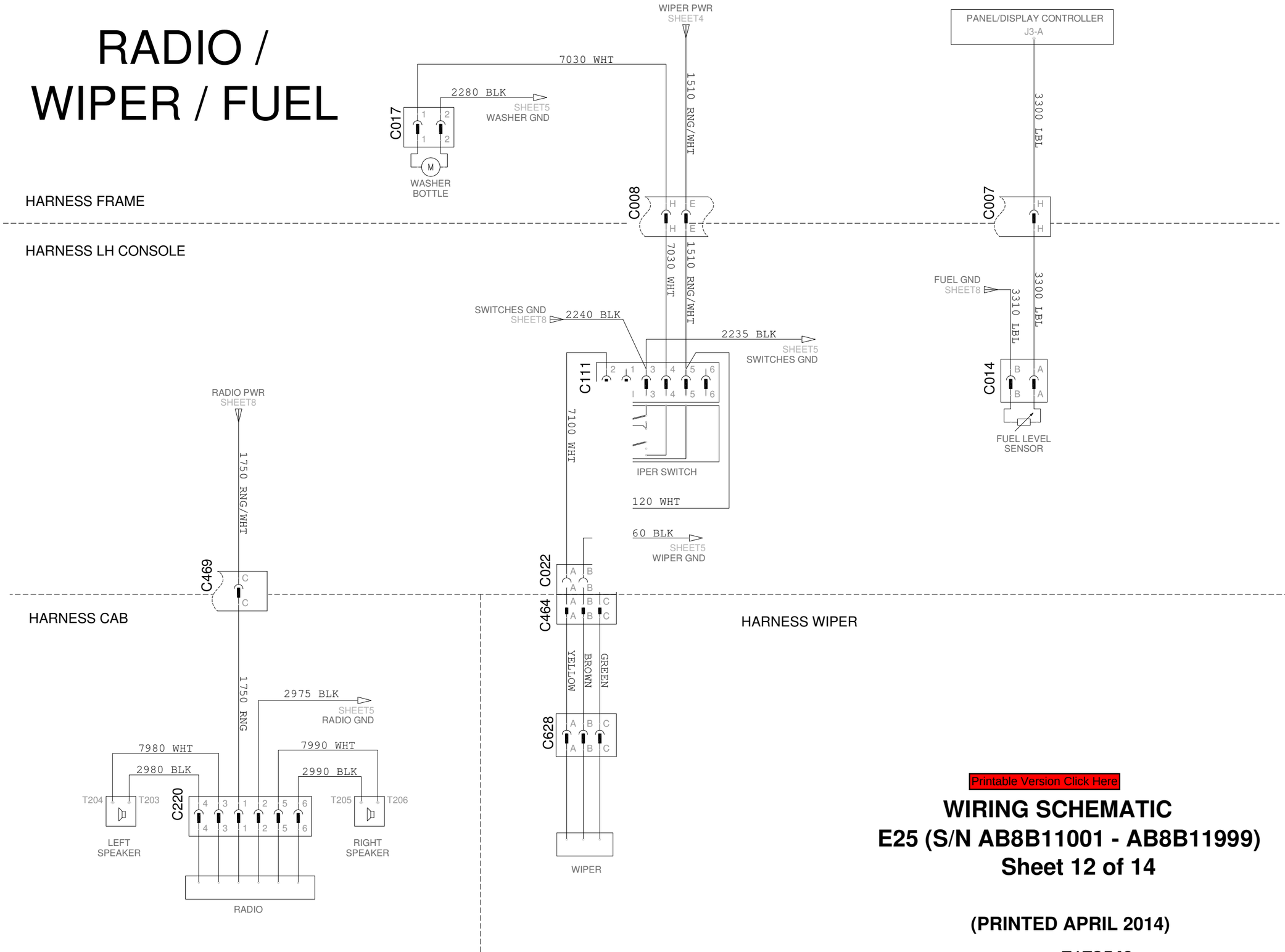
WIRING SCHEMATIC
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RADIO / WIPER / FUEL



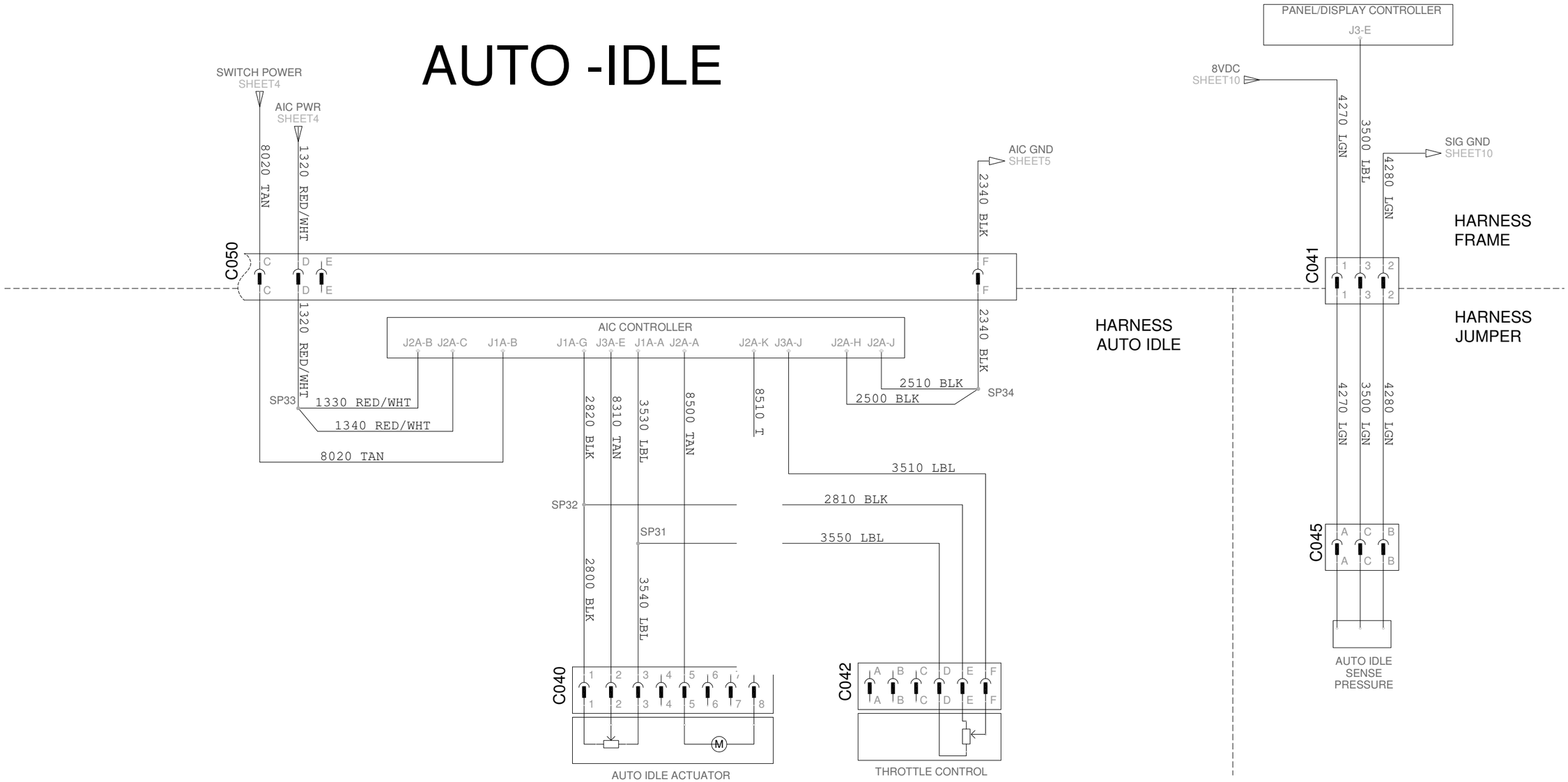
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AUTO -IDLE



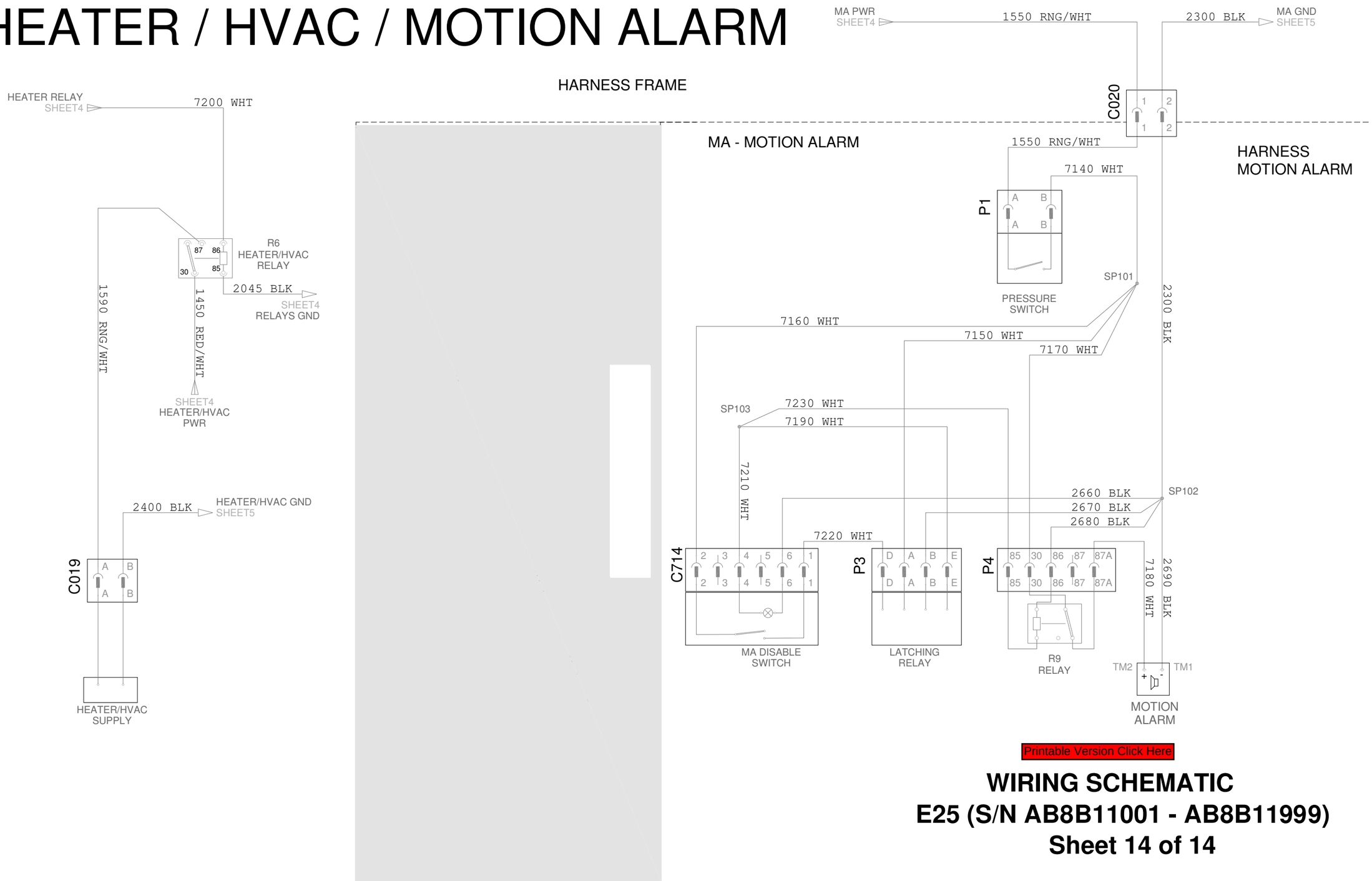
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HEATER / HVAC / MOTION ALARM



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WIRING SCHEMATIC
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CONNECTORS ASSIGNMENT

CONNECTOR	DESCRIPTION	PINS	SHEET
C001	FRAME TO ENGINE	3	7
C002	FRAME TO ENGINE	10	7
C003	FUEL SOLENOID	3	7
C004	ENGINE COOLANT TEMPERATURE	3	7
C005	SPEED SENSOR	3	7
C006	ALTERNATOR	2	7
C007	FRAME TO LH CONSOLE	8	5, 8, 12
C008	FRAME TO LH CONSOLE	10	5, 8, 11, 12
C009	RIGHT JOYSTICK	5	9
C010	BLADE JOYSTICK	6	9
C011	IGNITION	6	10
C012	REMOTE TOOL / ACD	7	6
C014	FUEL SENSOR	2	12
C016	AUX SOCKET	2	10
C017	WASHER BOTTLE	2	12
C018	FRAME TO BOOM LIGHT	2	11
C019	HEATER / HVAC SUPPLY	2	14
C020	FRAME TO MOTION ALARM	2	14
C022	LH TO WIPER	3	12
C024	FRAME TO LOAD MOMENT	2	8
C028	RFID	6	6
C029	KEYPAD	6	6
C031	FRONT ROD	2	9
C032	FRONT BASE	2	9
C033	WORKGROUP LOCKOUT	2	8
C034	2 SPEED	2	8
C035	OFFSET ROD	2	9
C036	OFFSET BASE	2	9
C040	AI ACTUATOR	8	13
C041	FRAME TO JUMPER	3	13
C042	THROTTLE CONTROL	6	13
C045	AI SENSE PRESSURE	3	13
C050	FRAME TO AUTO IDLE	6	13
C107	LEFT JOYSTICK	5	8
C108	CONSOLE SENSOR	3	8
C109	LOAD MOMENT SWITCH	6	5, 8
C110	BEACON SWITCH	6	5, 11
C111	WIPER SWITCH	6	12
C112	FRAME LIGHT	2	11
C114	2nd AUX SWITCH	6	8
C115	LH CONSOLE TO 2nd AUX	2	8
C120	2nd AUX SOL	2	8

CONNECTORS ASSIGNMENT

CONNECTOR	DESCRIPTION	PINS	SHEET
C150	FRAME TO MAIN VALVE	6	9
C218	CAB TO LIGHT REAR	2	11
C219	CAB TO BEACON / STROBE	2	11
C220	RADIO	6	12
C300	HYD TEMP SENSOR	2	9
C301	HYD FILTER SWITCH	2	9
C460	BOOM LIGHT TO FRAME	2	11
C463	LH CONSOLE TO CAB	2	5, 11
C464	WIPER TO LH CONSOLE	3	12
C466	CAB LIGHT	3	11
C468	BOOM LIGHT	2	11
C469	LH CONSOLE TO CAB	3	11, 12
C611	PANEL (BLACK)	12	6
C623	HVAC BOX TO CLUTCH	3	14
C625	LIGHT TO REAR LIGHT	2	11
C626	RIGHT FRONT LIGHT	2	11
C627	LEFT IGHT	2	11
C628		3	12
C631		2	14
C635	DR TCH	2	14
C705	BEA OBE	2	11
C706	BEACON E TO CAB	2	11
C707	R T	2	11
C708	REAR LIGHT	2	11
C709	REAR D CAB	2	11
C714	MA DI WITCH	6	14
P1	PRESSURE SWITCH	2	14
P3	LATCHING RELAY	4	14
P4	RELAY	5	14
T001	GLOW PLUGS	1	7
T002	ENGINE OIL SWITCH	1	7
T003	ALTERNATOR_B	1	7
T004	ALTERNATOR_GND	1	7
T005	STARTER_B	1	7
T006	STARTER_S	1	7
T008	ENGINE_GND	1	7
T009	BATTERY_POS	1	4
T010	BATTERY_NEG	1	4
T011	STARTER_GND	1	7

CONNECTORS ASSIGNMENT

CONNECTOR	DESCRIPTION	PINS	SHEET
T012	ENGINE BAY FRAME GND	1	7
T014	FRAME_GND	1	5
T017	BUZZER +	1	10
T018	BUZZER -	1	10
T019	DISCONNECT	1	5
T020	DISCONNECT	1	5
T100	HORN	1	10
T101	HORN	1	10
T203	LEFT SPEAKER	1	12
T204	LEFT SPEAKER	1	12
T205	RIGHT SPEAKER	1	12
T206	RIGHT SPEAKER	1	12
T301	HYD FILTER SWITCH	1	9
T302	HYD FILTER SWITCH	1	9
TM1	MOTION ALARM	1	14
TM2	MOTION ALARM	1	14
J1A	CONTROLLER PRIMARY	34	4, 7, 8, 9, 10, 11, 14
J1B	CONTROLLER PRIMARY	26	6, 7, 8, 9, 10, 12, 13
J1A	AUTO IDLE CONTROLLER	8	13
J2A	AUTO IDLE CONTROLLER	10	13
J3A	AUTO IDLE CONTROLLER	10	13
P001	FUSE RELAY CENTER - FRC	56	4, 7, 11, 14

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J1 CONNECTOR ASSIGNMENTS (CONTROLLER PRIMARY)			
PIN	FUNCTION	PIN	FUNCTION
A-01	AUX ROD RETURN	B-01	LOAD SENSE PRESSURE SENSOR
A-02	OFFSET ROD RETURN	B-02	UNSWITCHED BATTERY P1
A-03	FUEL PULL RELAY	B-03	UNSWITCHED BATTERY P2
A-04	SWITCHED POWER OUT RELAY	B-04	FUEL SOL HOLD
A-05	LIGHT 1 RELAY	B-05	OFFSET ROD SOL
A-06	GLOW PLUG RELAY	B-06	2 SPEED SOL
A-07	STARTER RELAY	B-07	OFFSET BASE SOL
A-08	WARNING BUZZER	B-08	CAN_LO_1
A-09	HVAC RELAY - INHIBIT DURING CRANK	B-09	CAN_HI_1
A-10	OFFSET BASE RETURN	B-10	OFFSET POT INPUT
A-11	THROTTLE CONTROL INPUT (ONLY FOR AI)	B-11	CONSOLE POSITION SENSOR
A-12	AUX POT INPUT	B-12	FUEL LEVEL SENSOR
A-13	2 SPEED SWITCH INPUT	B-13	AUX ROD SOL
A-14	GLOW PLUG RELAY FDBK	B-14	CAN_HI_2
A-15	ENGINE SPEED SENSOR	B-15	GROUND P1
A-16	NOT USED ON SPHX	B-16	GROUND P2
A-17	NOT USED ON SPHX	B-17	SENSOR GROUND REFERENCE
A-18	AUX BASE RETURN	B-18	ENGINE COOLANT TEMP SENSOR
A-19	SPARE	B-19	AUX BASE SOL
A-20	LOAD MOMENT SENSOR	B-20	CAN_LO_2
A-21	SWITCHED POWER OUT RELAY FDBK	B-21	REMOTE KEY
A-22	STARTER RELAY FDBK	B-22	KEY RUN
A-23	NOT USED ONSPHX	B-23	SENSOR SUPPLY 1 (8
A-24	CRANK INPUT	B-24	SENSOR SUPPLY 1 (5
A-25	ENGINE OIL PRESSURE SWITCH	B-25	NOT USED ON SP
A-26	WORK GROUP SOL RETURN	B-26	WORK GROUP S
A-27	NOT USED ON SPHX		
A-28	NOT USED ON SPHX		
A-29	AUX DETENT		
A-30	FUEL PULL RELAY FDBK		
A-31	SPARE		
A-32	HYD OIL TEMP SENSOR		
A-33	TRAVEL LEVER POS SWITCH/SENS		
A-34	HYD OIL FILTER BYPASS SWITCH		

CONNECTOR ASSIGNMENT (AIC - AUTO IDLE CONTROLLER)	
PIN	FUNCTION
J1A-A	SENSOR POWER (5V)
J1A-B	SWITCHED POWER
J1A-C	SPARE
J1A-D	CAN HIGH
J1A-E	CAN LOW
J1A-F	SPARE
J1A-G	SENSOR GROUND
J1A-H	SPARE
J2A-A	ACTUATOR CONTROL
J2A-B	UNSWITCHED POWER
J2A-C	UNSWITCHED POWER
J2A-D	SPARE
J2A-E	SPARE
J2A-F	SPARE
J2A-G	SPARE
J2A-H	GROUND
J2A-J	GROUND
J2A-K	ACTUATOR CONTROL
J3A-A	SPARE
J3A-B	SPARE
J3A-C	SPARE
J3A-D	SPARE
J3A-E	ACTUATOR FEEDBACK
J3A-F	SPARE
J3A-G	SPARE
J3A-H	SPARE
J3A-J	THROTTLE CONTROL
J3A-K	SPARE

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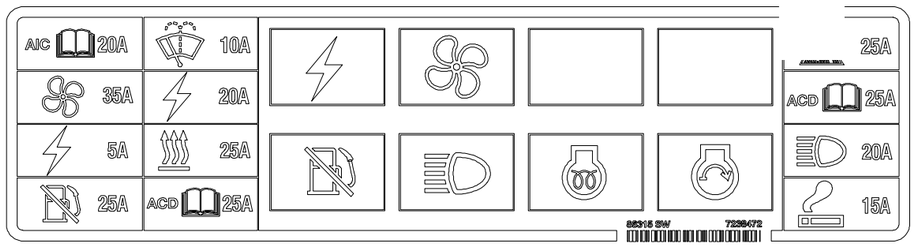
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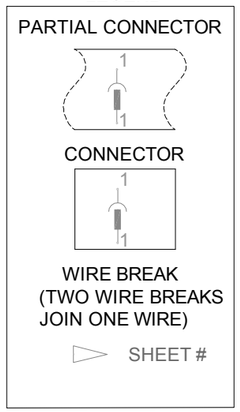
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WIRE CATEGORIES FOR COLORS AND NUMBER RANGE			
GROUP DESCRIPTION	**GROUP NUMBER RANGE**	**WIRE COLOR**	**COLOR CODE**
BATT FEED, GENERAL	1000 THROUGH 1499	RED	RED
BATT FEED, FUSED	1000 THROUGH 1499	RED/WHITE	RED/WHT
BATT FEED, SWITCHED	1500 THROUGH 1999	ORANGE/WHITE	RNG/WHT
BATTERY GROUND	2000 THROUGH 2999	BLACK	BLK
CONTROLLER GROUND	2000 THROUGH 2999	BROWN	BRN
MONITORING	3000 THROUGH 3999	LIGHT BLUE	LBL
HYDRAULIC	4000 THROUGH 4999	LIGHT GREEN	LGN
CONTROLLER SUPLY (5V, 8V)	5000 THROUGH 5999	YELLOW	YEL
LIGHTS	6000 THROUGH 6999	PINK	PNK
OTHER FUNCTIONS	7000 THROUGH 7999	WHITE	WHT
ENGINE	8000 THROUGH 8999	TAN	TAN
COMMUNICATION CAN LO	90XX, 92XX, 94XX, 96XX, 98XX	PURPLE	PUR
COMMUNICATION CAN HI	91XX, 93XX, 95XX, 97XX, 99XX	PURPLE/WHITE	PUR/WHT

FUSE RELAY CENTER



LEGEND



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RADIO, WIPER, FUEL	PAGE 12
AUTO IDLE	PAGE 13
HEATER, HVAC, MOTION ALARM	PAGE 14

HARNESSES PN# E25, E26	
HARNESS FRAME	7242976
HARNESS LH CONSOLE	7234503
HARNESS ENGINE EMEA / NA	7195838 / 7195839
HARNESS DIFF SWITCH	7198838
HARNESS MAIN VALVE	7234504
HARNESS BOOM LIGHT	7135895
HARNESS AUTO IDLE (IF EQUIPTED)	7201238
HARNESS JUMPER (IF EQUIPTED)	7192507
HARNESS 2nd AUX (IF EQUIPTED)	7193481
HARNESS MOTION ALARM (IF EQUIPTED)	7246261
HARNESS CAB (IF EQUIPTED)	7225809
HARNESS WIPER (IF EQUIPTED)	7171777
HARNESS LIGHT (IF EQUIPTED)	7173482 / 7244464
HARNESS BEACON / STROBE (IF EQUIPTED)	7172972
HARNESS AC CLUTCH (IF EQUIPTED)	7168895

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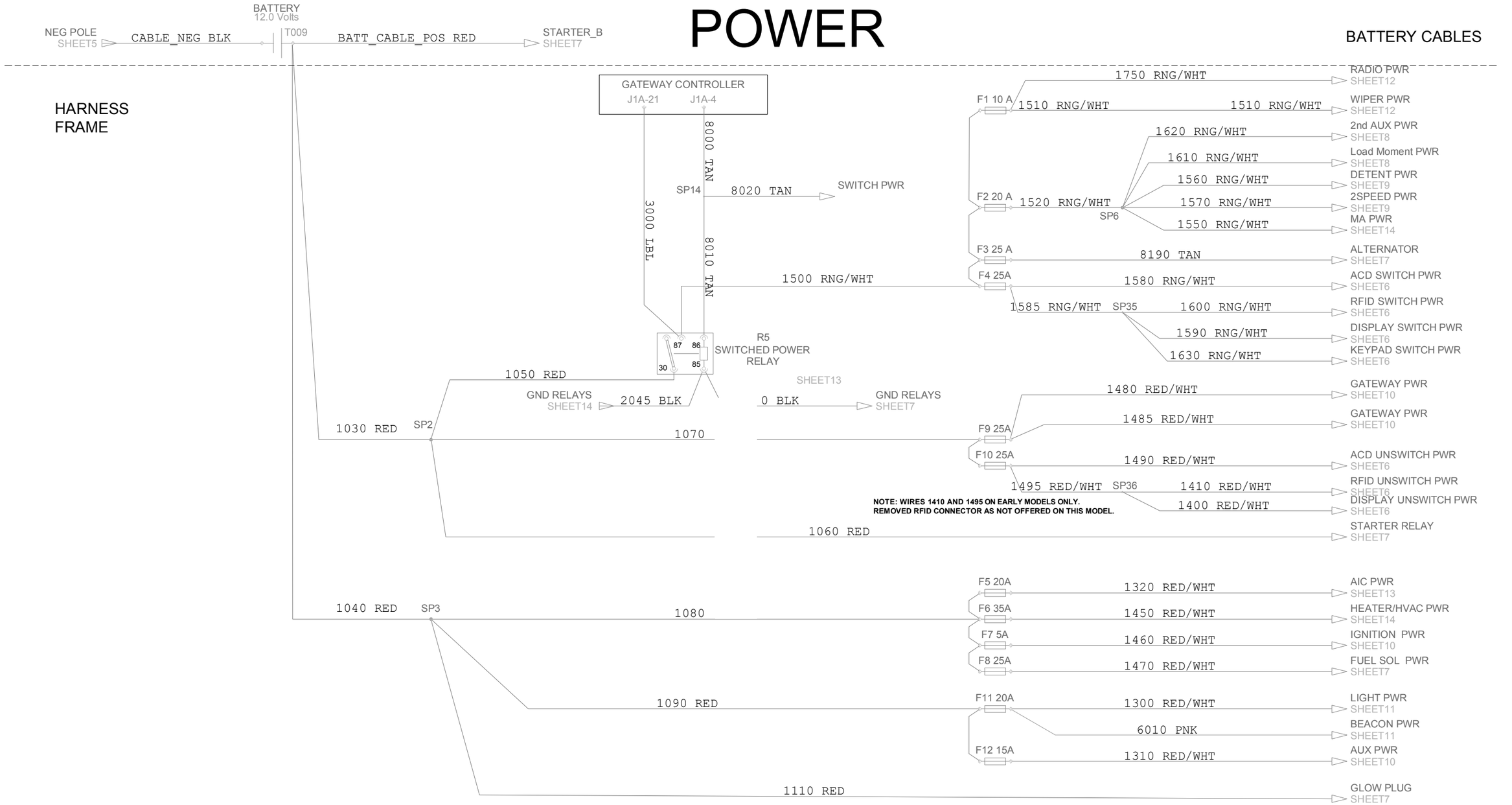
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POWER



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GROUND

HARNESS
FRAME

HEATER/HVAC GND SHEET14 — 2400 BLK
RELAYS GND SHEET7 — 2080 BLK
AUX GND SHEET10 — 2270 BLK
WASHER GND SHEET12 — 2280 BLK
ACD GND SHEET6 — 2110 BLK
RFID GND SHEET6 — 2440 BLK
NOTE: WIRE 2440 ON EARLY MODELS ONLY. REMOVED RFID CONNECTOR AS NOT OFFERED ON THIS MODEL.
AI GND SHEET13 — 2340 BLK
PANEL GND SHEET10 — 2320 BLK
PANEL GND SHEET10 — 2310 BLK
MA GND SHEET14 — 2300 BLK
DISPLAY GND SHEET6 — 2360 BLK

SP4 — 2090 BLK

BATTERY CABLES

BATTERY DISCONNECT — CABLE_NEG BLK — NEG POLE SHEET4
CABLE_NEG BLK — FRAME GNG

HARNESS CAB

WORK LIGHT GND SHEET11 — SC12950 BLK
BEACON GND SHEET11 — 2870 BLK
CAB LIGHT GND SHEET11 — 2880 BLK
RADIO GND SHEET12 — 2975 BLK

C463 (B B) — 2950 BLK

BOOM LIGHT GND SHEET11 — 2290 BLK
HORN GND SHEET10 — 2650 BLK
KEYPAD GND SHEET6 — 2200 BLK
2SPD GND SHEET8 — 2170 BLK
BUZZER GND SHEET10 — 2330 BLK
FILTER GND SHEET9 — 2350 BLK

SP5 — 2100 BLK — T014 — FRAME GND

HARNESS
LH CONSOLE

SWITCHES GND SHEET12 — 2235 BLK
WIPER GND SHEET12 — 2960 BLK
2nd AUX GND SHEET8 — 2260 BLK
FRAME LIGHT GND SHEET11 — 2250 BLK
SP25 — 2230 BLK

C007 (G G) — 2230 BLK

C008 (D D) — 2220 BLK

2900 BLK — C110 (6 6) — BEACON SWITCH
2220 BLK — C109 (6 6) — LOAD MOMENT SWITCH

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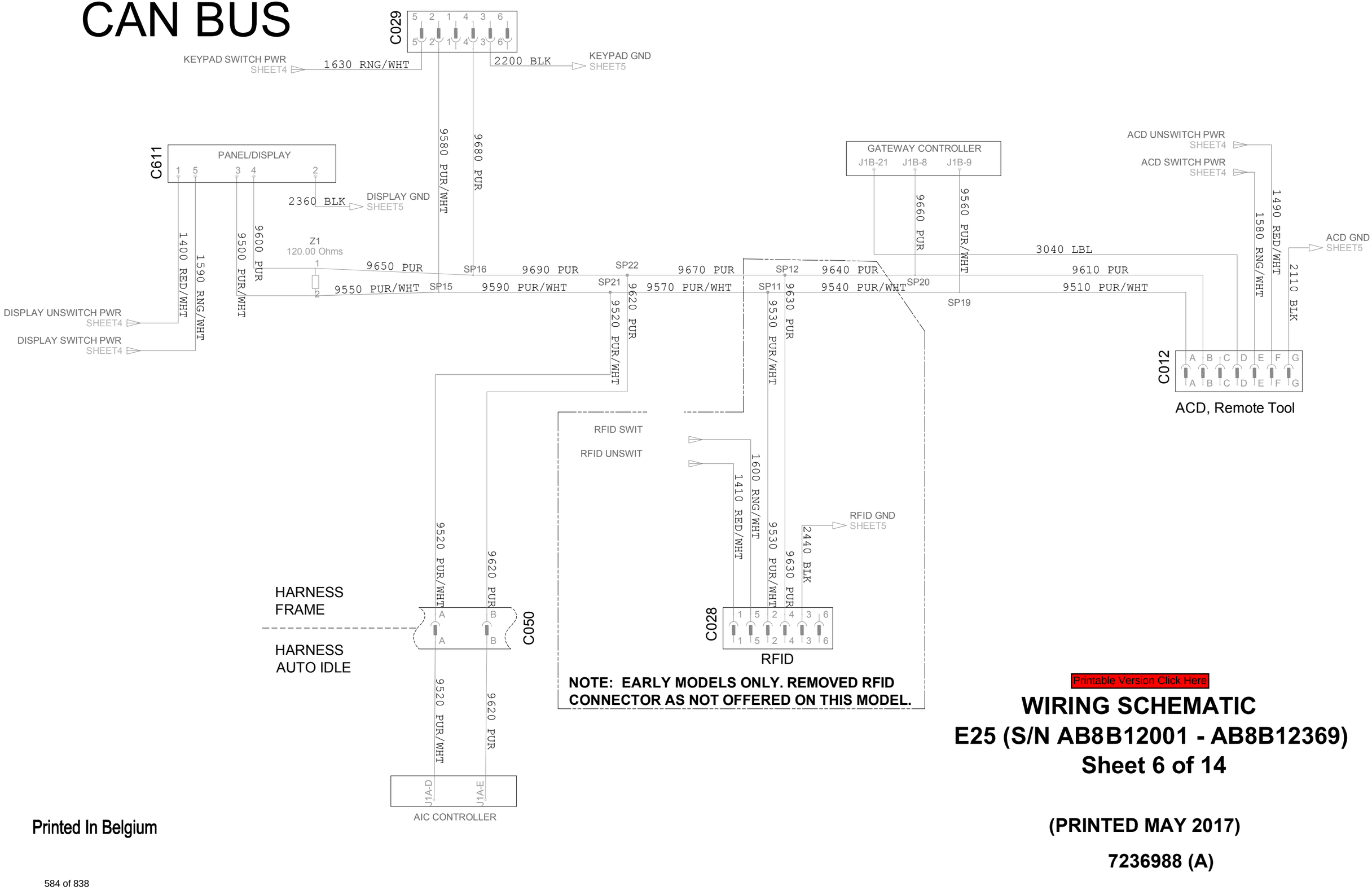
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CAN BUS



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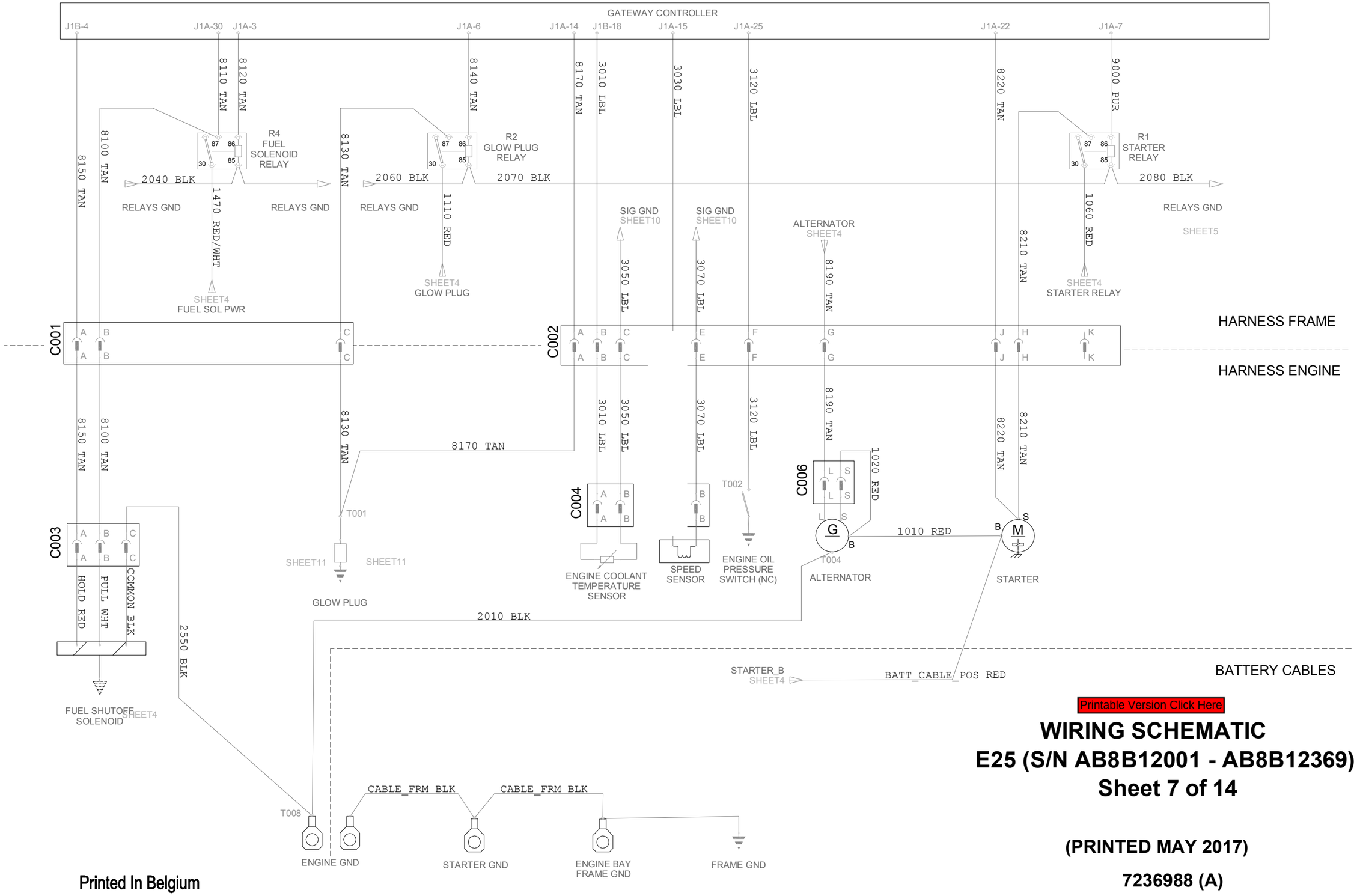
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E25 (S/N AB8B12001 - AB8B12369)
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ENGINE



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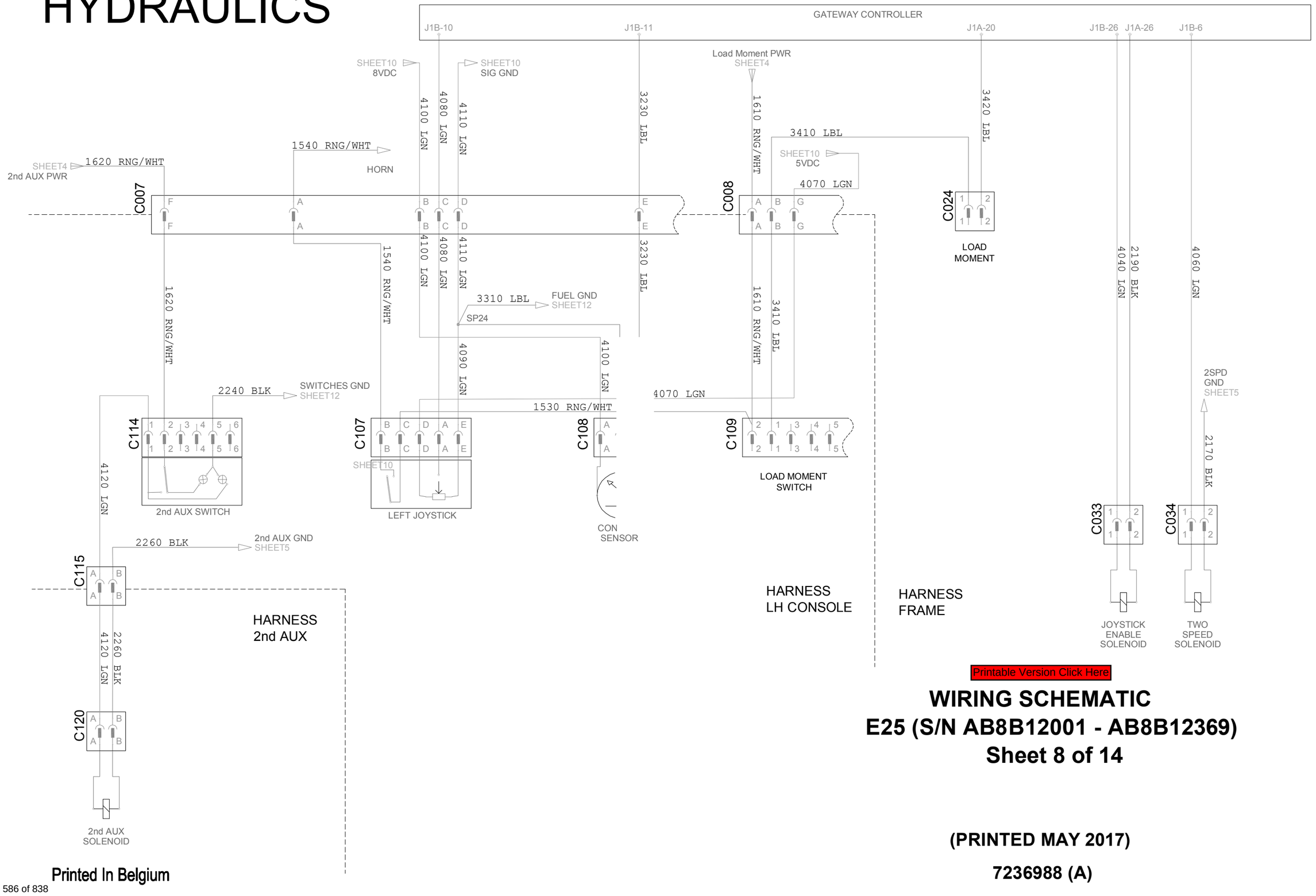
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HYDRAULICS



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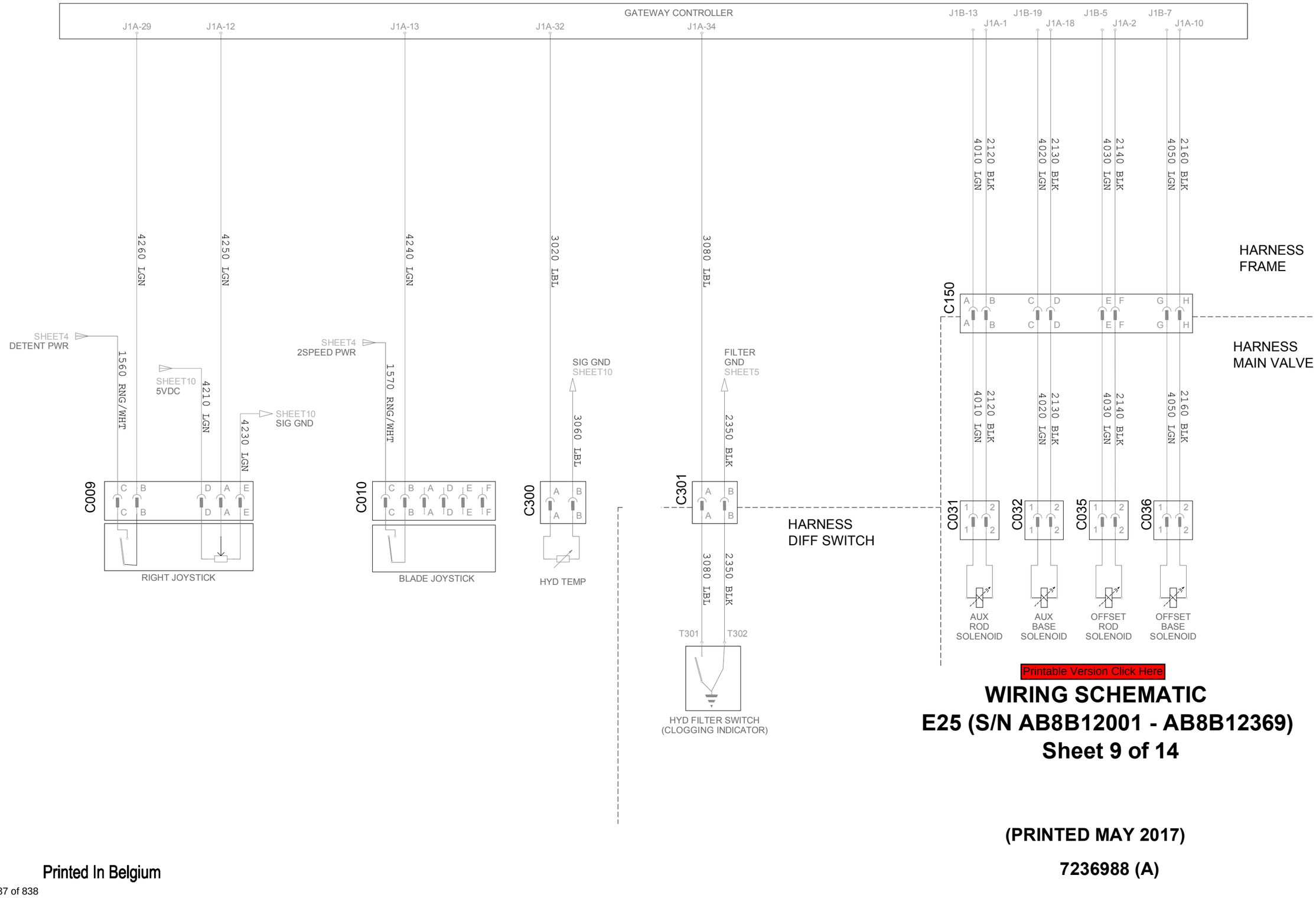
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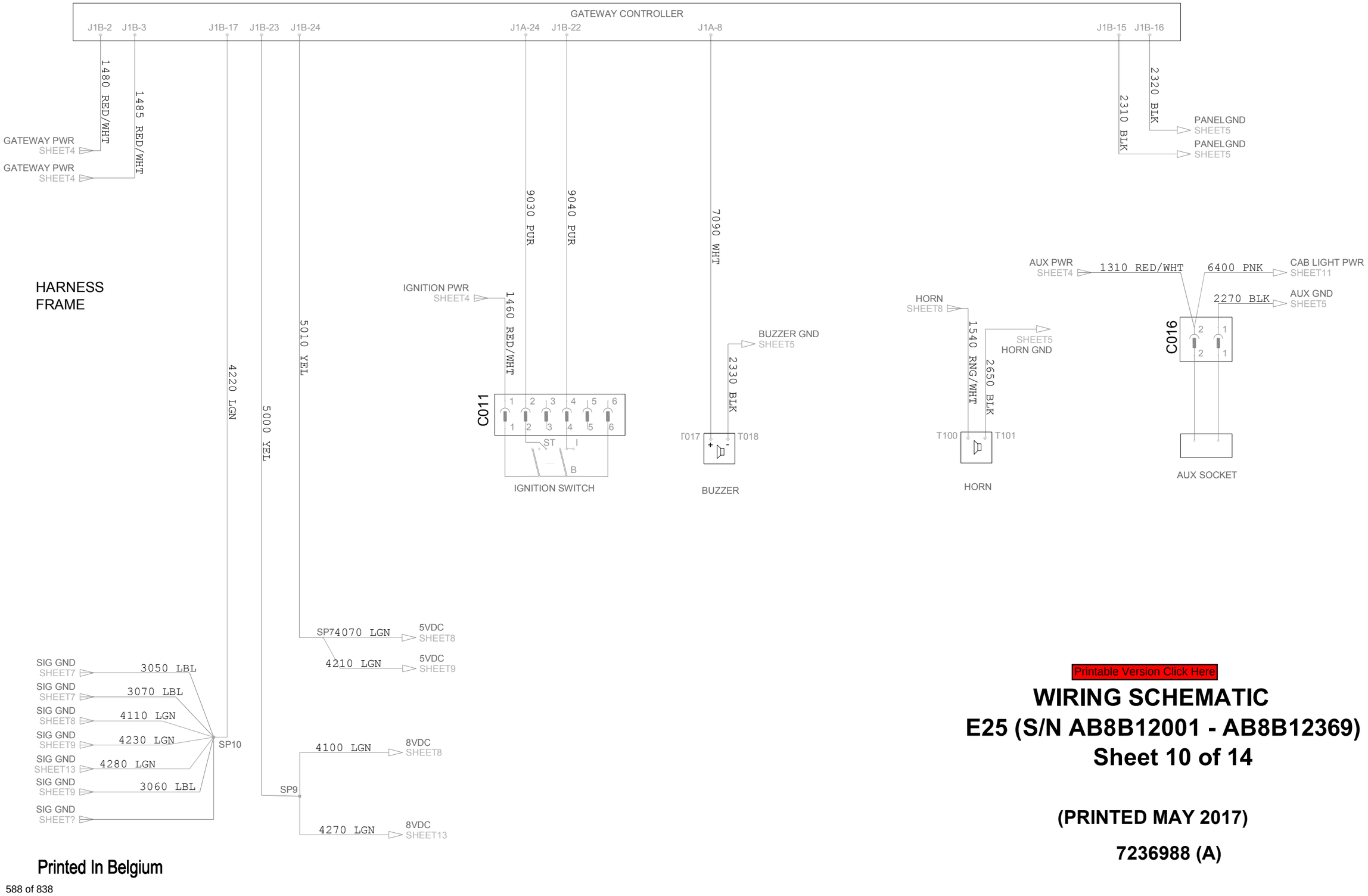
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FRAME



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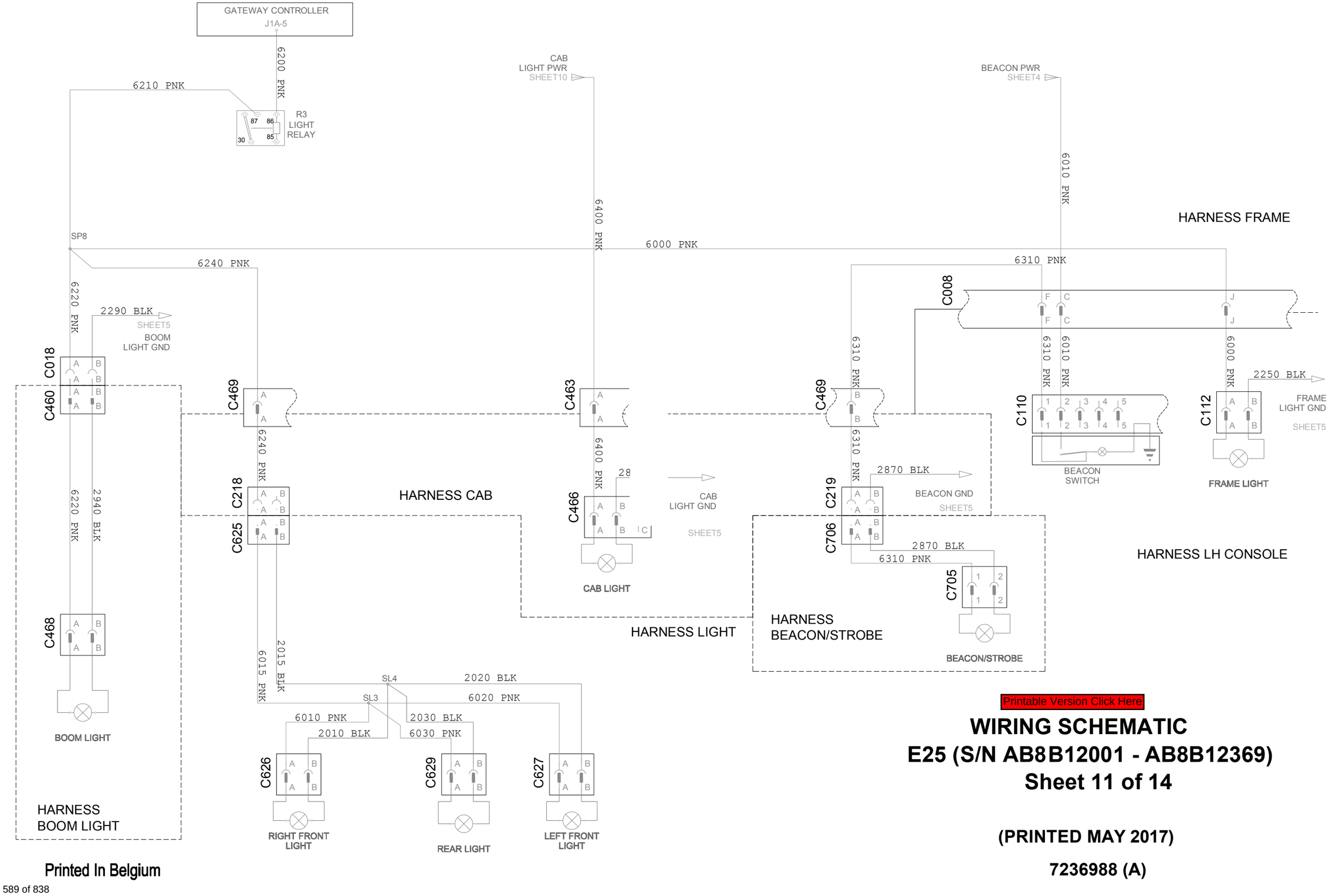
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LIGHTS / BEACON / STROBE



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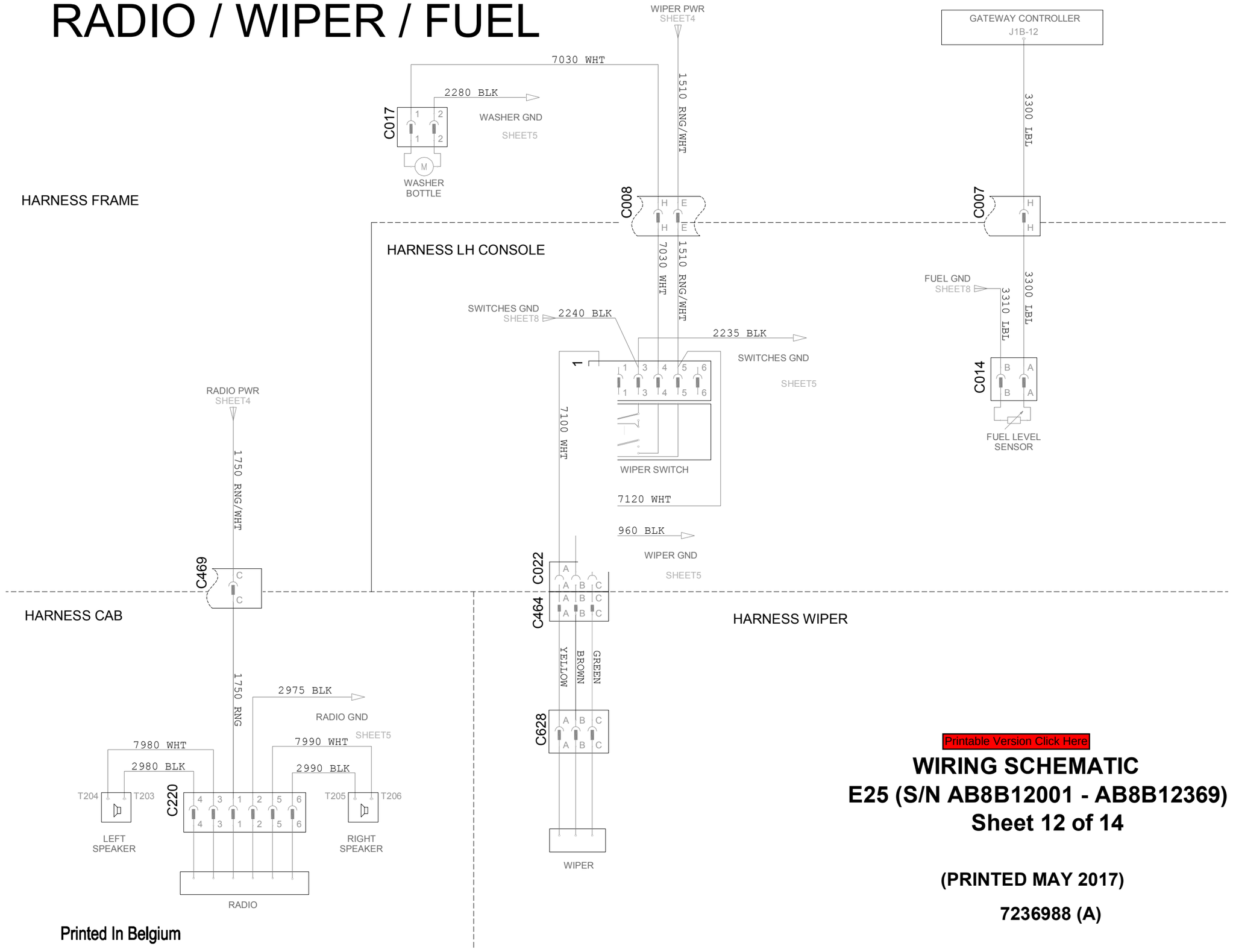
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RADIO / WIPER / FUEL



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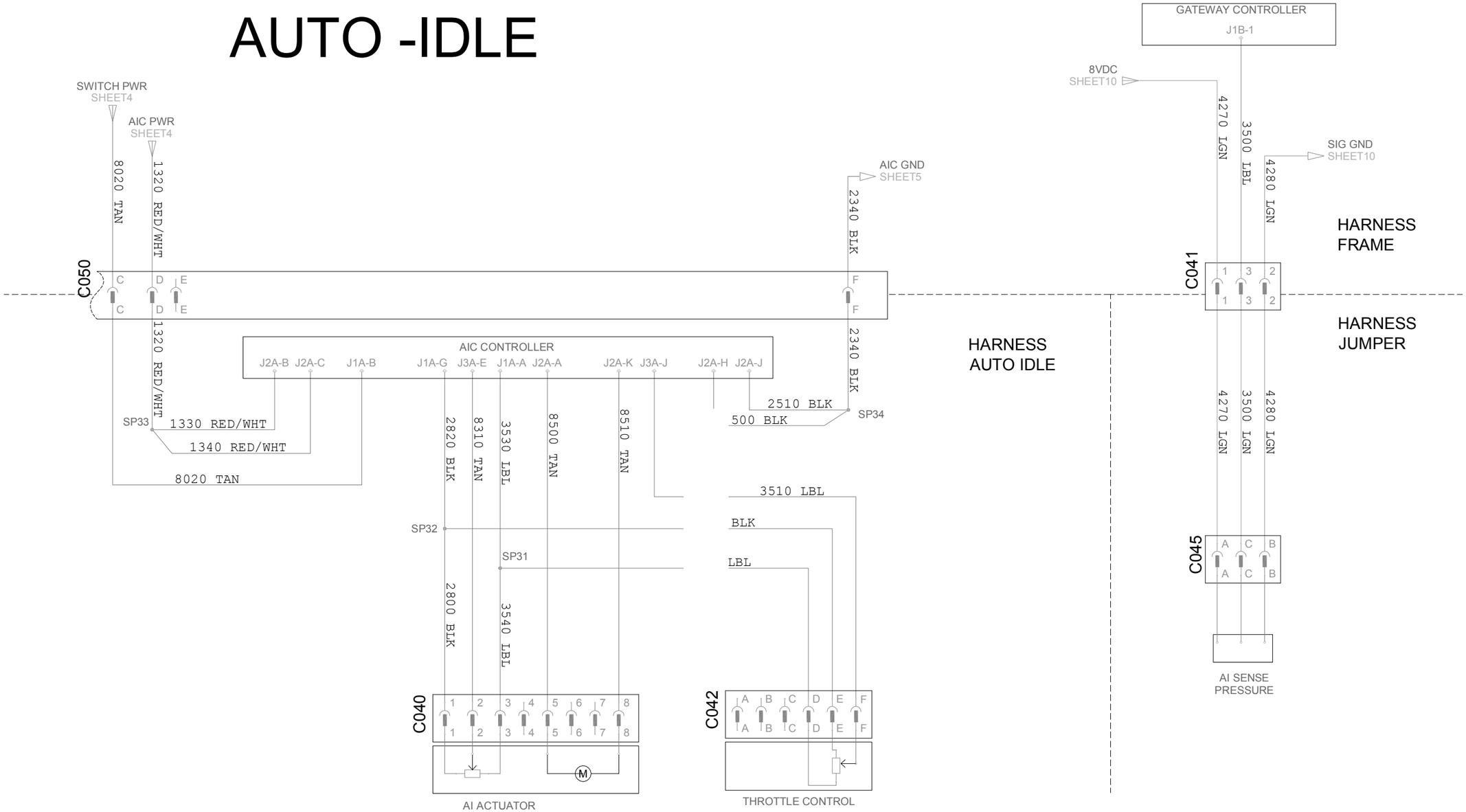
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AUTO -IDLE



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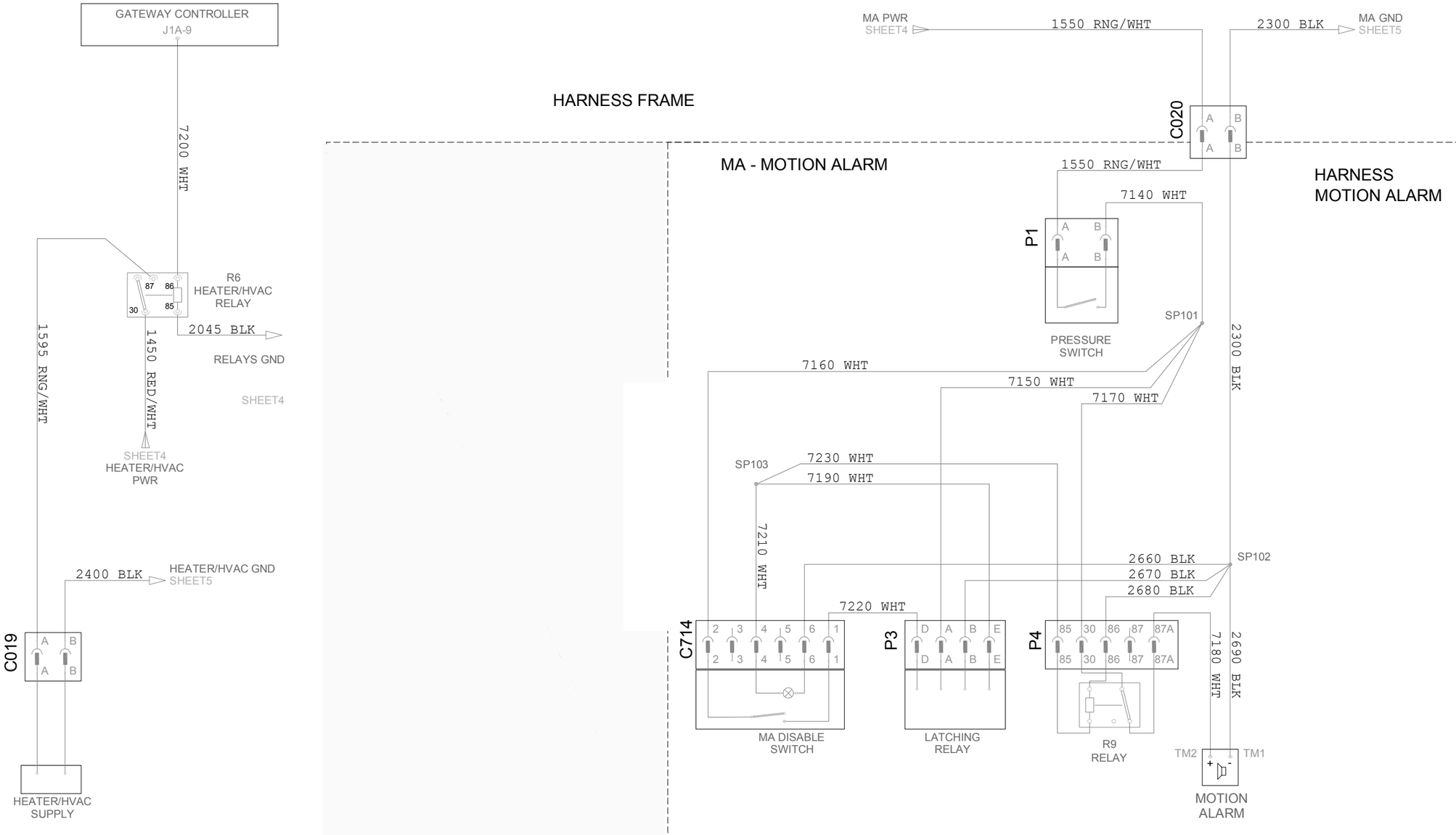
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HEATER / HVAC / MOTION ALARM



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E25 (S/N AB8B12001 - AB8B12369)
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CONNECTORS ASSIGNMENT

CONNECTOR	DESCRIPTION	PINS	SHEET
C001	FRAME TO ENGINE	3	7
C002	FRAME TO ENGINE	10	7
C003	FUEL SOLENOID	3	7
C004	ENGINE COOLANT TEMPERATURE	3	7
C005	SPEED SENSOR	3	7
C006	ALTERNATOR	2	7
C007	FRAME TO LH CONSOLE	8	5, 8, 12
C008	FRAME TO LH CONSOLE	10	5, 8, 11, 12
C009	RIGHT JOYSTICK	5	9
C010	BLADE JOYSTICK	6	9
C011	IGNITION	6	10
C012	REMOTE TOOL / ACD	7	6
C014	FUEL SENSOR	2	12
C016	AUX SOCKET	2	10
C017	WASHER BOTTLE	2	12
C018	FRAME TO BOOM LIGHT	2	11
C019	HEATER / HVAC SUPPLY	2	14
C020	FRAME TO MOTION ALARM	2	14
C022	LH TO WIPER	3	12
C024	FRAME TO LOAD MOMENT	2	8
C028	RFID	6	6
C029	KEYPAD	6	6
C031	FRONT ROD	2	9
C032	FRONT BASE	2	9
C033	WORKGROUP LOCKOUT	2	8
C034	2 SPEED	2	8
C035	OFFSET ROD	2	9
C036	OFFSET BASE	2	9
C040	AI ACTUATOR	6	13
C041	FRAME TO JUMPER	3	13
C042	THROTTLE CONTROL	6	13
C045	AI SENSE PRESSURE	3	13
C107	LEFT JOYSTICK	5	8
C108	CONSOLE SENSOR	3	8
C109	LOAD MOMENT SWITCH	6	5, 8
C110	BEACON SWITCH	6	5, 11
C111	WIPER SWITCH	6	12
C112	FRAME LIGHT	2	11
C114	2nd AUX SWITCH	6	8
C115	LH CONSOLE TO 2nd AUX	2	8
C120	2nd AUX SOL	2	8

CONNECTORS ASSIGNMENT

CONNECTOR	DESCRIPTION	PINS	SHEET
C150	FRAME TO MAIN VALVE	6	9
C218	CAB TO LIGHT REAR	2	11
C219	CAB TO BEACON / STROBE	2	11
C220	RADIO	6	12
C300	HYD TEMP SENSOR	2	9
C301	HYD FILTER SWITCH	2	9
C460	BOOM LIGHT TO FRAME	2	11
C463	LH CONSOLE TO CAB	2	5, 11
C464	WIPER TO LH CONSOLE	3	12
C466	CAB LIGHT	3	11
C468	BOOM LIGHT	2	11
C469	LH CONSOLE TO CAB	3	11, 12
C611	PANEL (BLACK)	12	6
C623	HVAC BOX TO CLUTCH	3	14
C625	LIGHT TO REAR LIGHT	2	11
C626	T FRONT LIGHT	2	11
C627	T FRONT LIGHT	2	11
C628	WIPER	3	12
C631	CLUTCH	2	14
C635	YER SWITCH	2	14
C705	CON / STROBE	2	11
C706	/ STROBE TO CAB	2	11
C707	REAR LIGHT	2	11
C708	LIGHT TO LIGHT	2	11
C709	R LIGHT TO CAB	2	11
C714	MA DISABLE SWITCH	6	14
P1	PRESSURE SWITCH	2	14
P3	LATCHING RELAY	4	14
P4	RELAY	5	14
T001	GLOW PLUGS	1	7
T002	ENGINE OIL SWITCH	1	7
T003	ALTERNATOR_B	1	7
T004	ALTERNATOR_GND	1	7
T005	STARTER_B	1	7
T006	STARTER_S	1	7
T008	ENGINE_GND	1	7
T009	BATTERY_POS	1	4
T010	BATTERY_NEG	1	4
T011	STARTER_GND	1	7

CONNECTORS ASSIGNMENT

CONNECTOR	DESCRIPTION	PINS	SHEET
T012	ENGINE BAY FRAME GND	1	7
T014	FRAME_GND	1	5
T017	BUZZER +	1	10
T018	BUZZER -	1	10
T019	DISCONNECT	1	5
T020	DISCONNECT	1	5
T100	HORN	1	10
T101	HORN	1	10
T203	LEFT SPEAKER	1	12
T204	LEFT SPEAKER	1	12
T205	RIGHT SPEAKER	1	12
T206	RIGHT SPEAKER	1	12
T301	HYD FILTER SWITCH	1	9
T302	HYD FILTER SWITCH	1	9
TM1	MOTION ALARM	1	14
TM2	MOTION ALARM	1	14
J1A	CONTROLLER PRIMARY	34	4, 7, 8, 9, 10, 11, 13, 14
J1B	CONTROLLER PRIMARY	26	6, 7, 8, 9, 10, 12, 13
P001	FUSE RELAY CENTER - FRC	56	4, 7, 11, 14

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J1 CONNECTOR ASSIGNMENTS (CONTROLLER PRIMARY)			
PIN	FUNCTION	PIN	FUNCTION
A-01	AUX ROD RETURN	B-01	LOAD SENSE PRESSURE SENSOR
A-02	OFFSET ROD RETURN	B-02	UNSWITCHED BATTERY P1
A-03	FUEL PULL RELAY	B-03	UNSWITCHED BATTERY P2
A-04	SWITCHED POWER OUT RELAY	B-04	FUEL SOL HOLD
A-05	LIGHT 1 RELAY	B-05	OFFSET ROD SOL
A-06	GLOW PLUG RELAY	B-06	2 SPEED SOL
A-07	STARTER RELAY	B-07	OFFSET BASE SOL
A-08	WARNING BUZZER	B-08	CAN_LO_1
A-09	HVAC RELAY - INHIBIT DURING CRANK	B-09	CAN_HI_1
A-10	OFFSET BASE RETURN	B-10	OFFSET POT INPUT
A-11	THROTTLE CONTROL INPUT (ONLY FOR AI)	B-11	CONSOLE POSITION SENSOR
A-12	AUX POT INPUT	B-12	FUEL LEVEL SENSOR
A-13	2 SPEED SWITCH INPUT	B-13	AUX ROD SOL
A-14	GLOW PLUG RELAY FDBK	B-14	CAN_HI_2
A-15	ENGINE SPEED SENSOR	B-15	GROUND P1
A-16	NOT USED ON SPHX	B-16	GROUND P2
A-17	NOT USED ON SPHX	B-17	SENSOR GROUND REFERENCE
A-18	AUX BASE RETURN	B-18	ENGINE COOLANT TEMP SENSOR
A-19	SPARE	B-19	AUX BASE SOL
A-20	LOAD MOMENT SENSOR	B-20	CAN_LO_2
A-21	SWITCHED POWER OUT RELAY FDBK	B-21	REMOTE KEY
A-22	STARTER RELAY FDBK	B-22	KEY RUN
A-23	NOT USED ONSPHX	B-23	SENSOR SUPPLY 1 (8 V
A-24	CRANK INPUT	B-24	SENSOR SUPPLY 1 (5 V
A-25	ENGINE OIL PRESSURE SWITCH	B-25	NOT USED ON SPH
A-26	WORK GROUP SOL RETURN	B-26	WORK GROUP SOL
A-27	NOT USED ON SPHX		
A-28	NOT USED ON SPHX		
A-29	AUX DETENT		
A-30	FUEL PULL RELAY FDBK		
A-31	SPARE		
A-32	HYD OIL TEMP SENSOR		
A-33	TRAVEL LEVER POS SWITCH/SENS		
A-34	HYD OIL FILTER BYPASS SWITCH		

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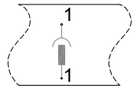
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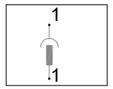
WIRE CATEGORIES FOR COLORS AND NUMBER RANGE			
GROUP DESCRIPTION	**GROUP NUMBER RANGE**	**WIRE COLOR**	**COLOR CODE**
BATT FEED, GENERAL	1000 THROUGH 1499	RED	RED
BATT FEED, FUSED	1000 THROUGH 1499	RED/WHITE	RED/WHT
BATT FEED, SWITCHED	1500 THROUGH 1999	ORANGE/WHITE	RNG/WHT
BATTERY GROUND	2000 THROUGH 2999	BLACK	BLK
CONTROLLER GROUND	2000 THROUGH 2999	BROWN	BRN
MONITORING	3000 THROUGH 3999	LIGHT BLUE	LBL
HYDRAULIC	4000 THROUGH 4999	LIGHT GREEN	LGN
CONTROLLER SUPLY (5V, 8V)	5000 THROUGH 5999	YELLOW	YEL
LIGHTS	6000 THROUGH 6999	PINK	PNK
OTHER FUNCTIONS	7000 THROUGH 7999	WHITE	WHT
ENGINE	8000 THROUGH 8999	TAN	TAN
COMMUNICATION CAN LO	90XX, 92XX, 94XX, 96XX, 98XX	PURPLE	PUR
COMMUNICATION CAN HI	91XX, 93XX, 95XX, 97XX, 99XX	PURPLE/WHITE	PUR/WHT

LEGEND

PARTIAL CONNECTOR



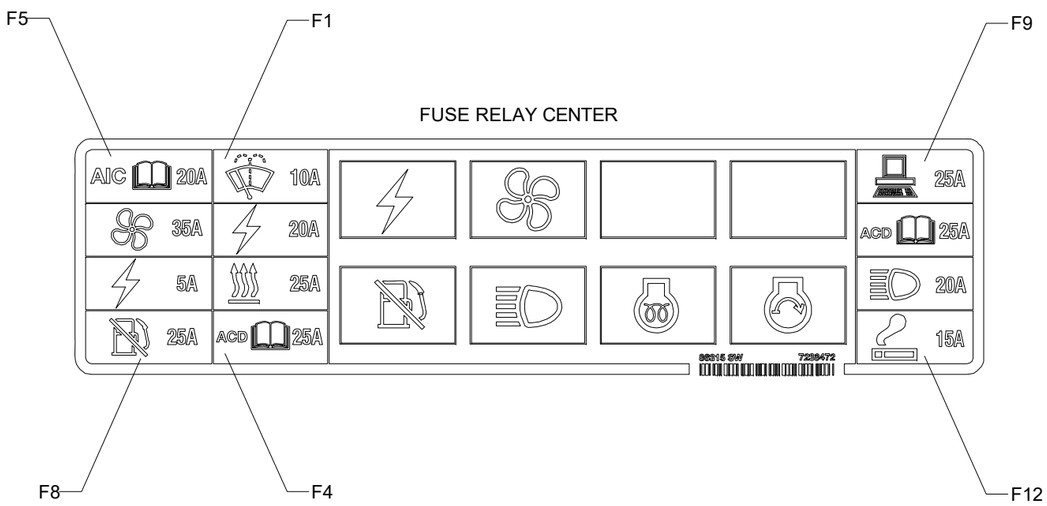
CONNECTOR



WIRE BREAK
(TWO WIRE BREAKS JOIN ONE WIRE)

SHEET #

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POWER	PAGE 4
GROUND	PAGE 5
CAN BUS	PAGE 6
ENGINE	PAGE 7
HYDRAULICS	PAGE 8, 9
FRAME	PAGE 10
LIGHTS, BEACON, STROBE	PAGE 11
RADIO, WIPER, FUEL	PAGE 12
AUTO IDLE	PAGE 13
HEATER, HVAC, MOTION ALARM	PAGE 14



HARNESSES PN# E25, E26	
HARNESS FRAME	7282021
HARNESS LH CONSOLE	7234503
HARNESS ENGINE EMEA / NA	7195838 / 7195839
HARNESS DIFF SWITCH	7198838
HARNESS MAIN VALVE	7234504
HARNESS BOOM LIGHT	7135895
HARNESS JUMPER (IF EQUIPTED)	7192507
HARNESS 2nd AUX (IF EQUIPTED)	7193481
HARNESS MOTION ALARM (IF EQUIPTED)	7246261
HARNESS CAB (IF EQUIPTED)	7225809
HARNESS WIPER (IF EQUIPTED)	7171777
HARNESS LIGHT (IF EQUIPTED)	7173482 / 7244464
HARNESS BEACON / STROBE (IF EQUIPTED)	7172972
HARNESS AC CLUTCH (IF EQUIPTED)	7168895

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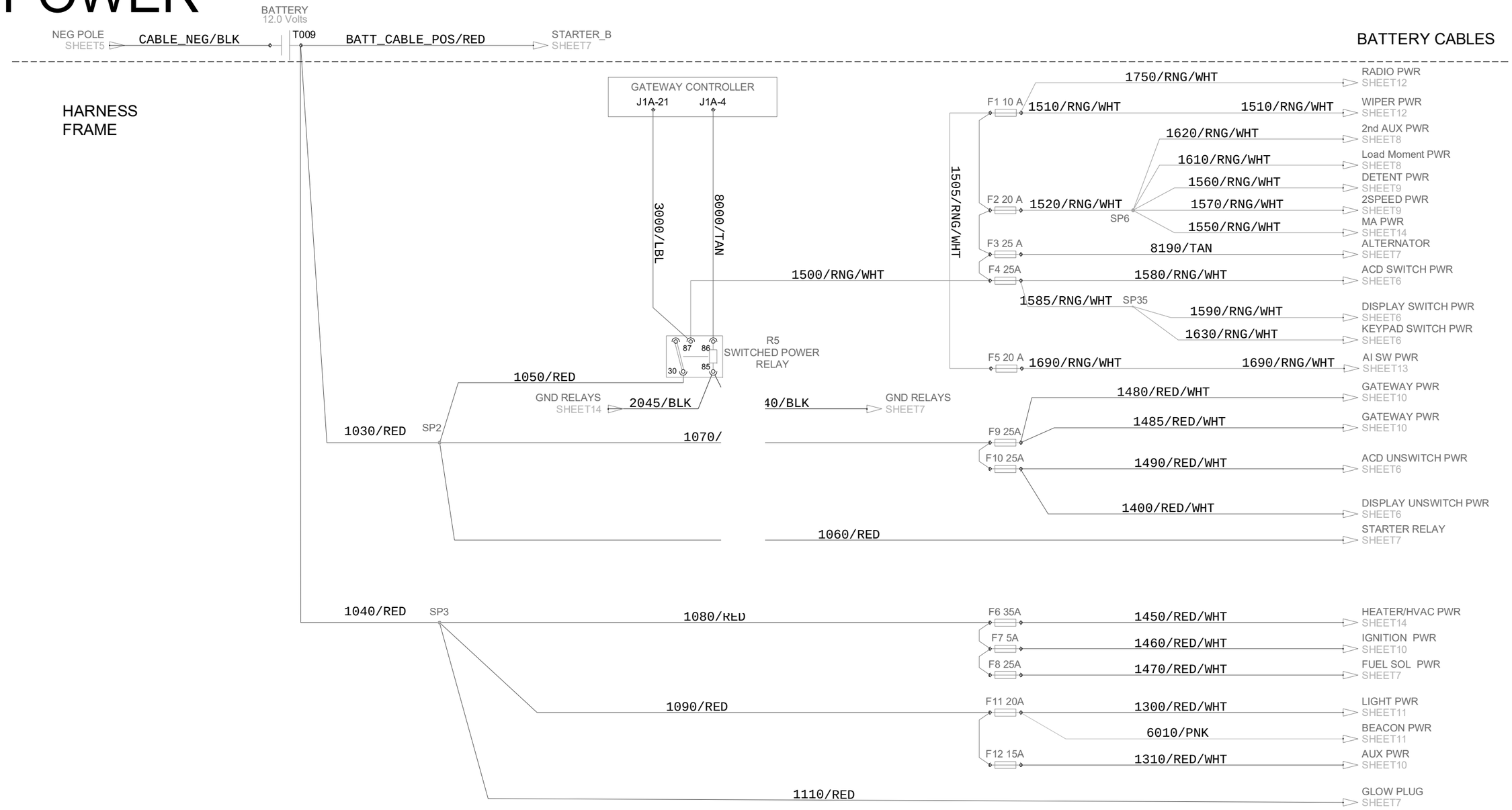
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POWER



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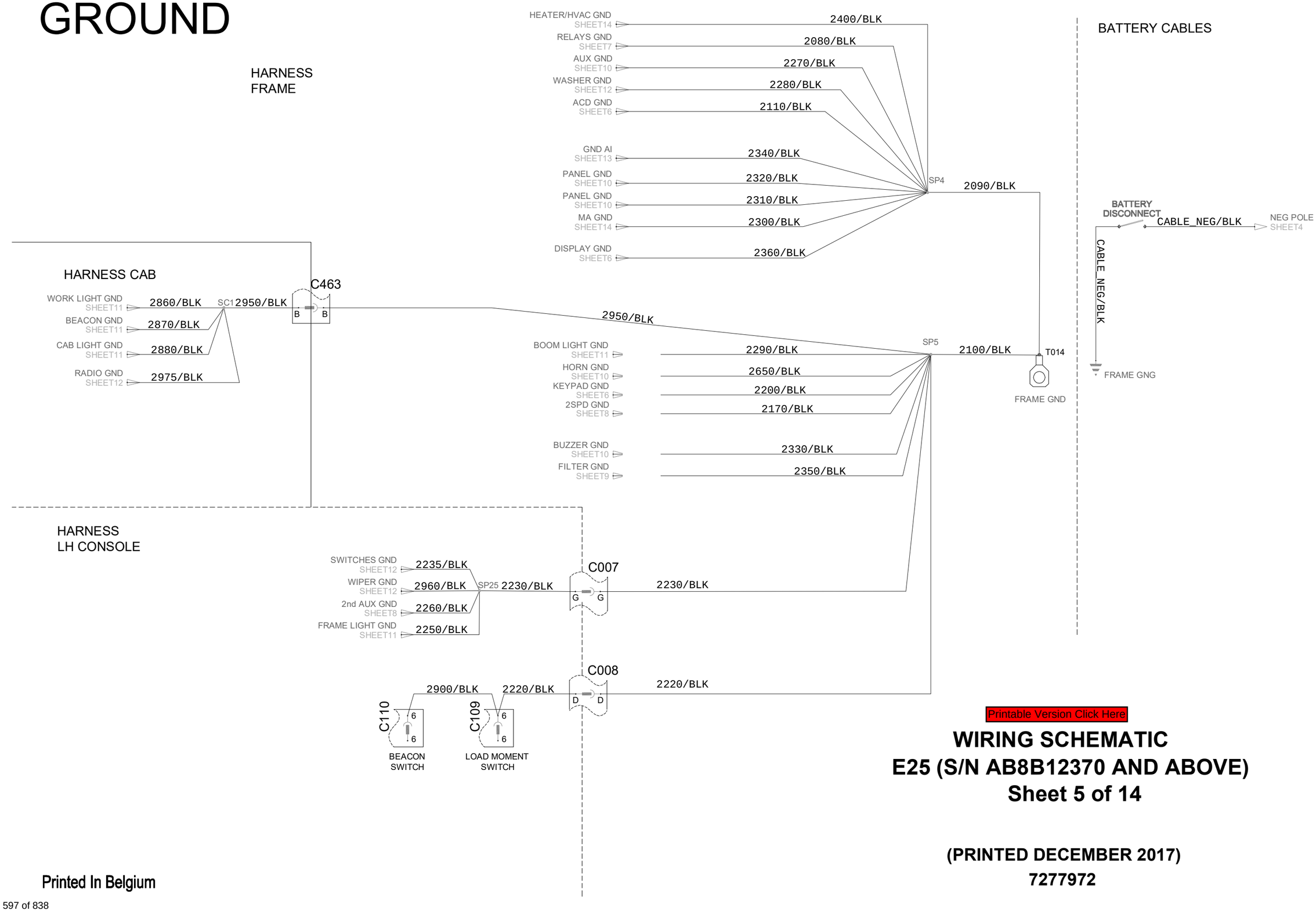
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GROUND



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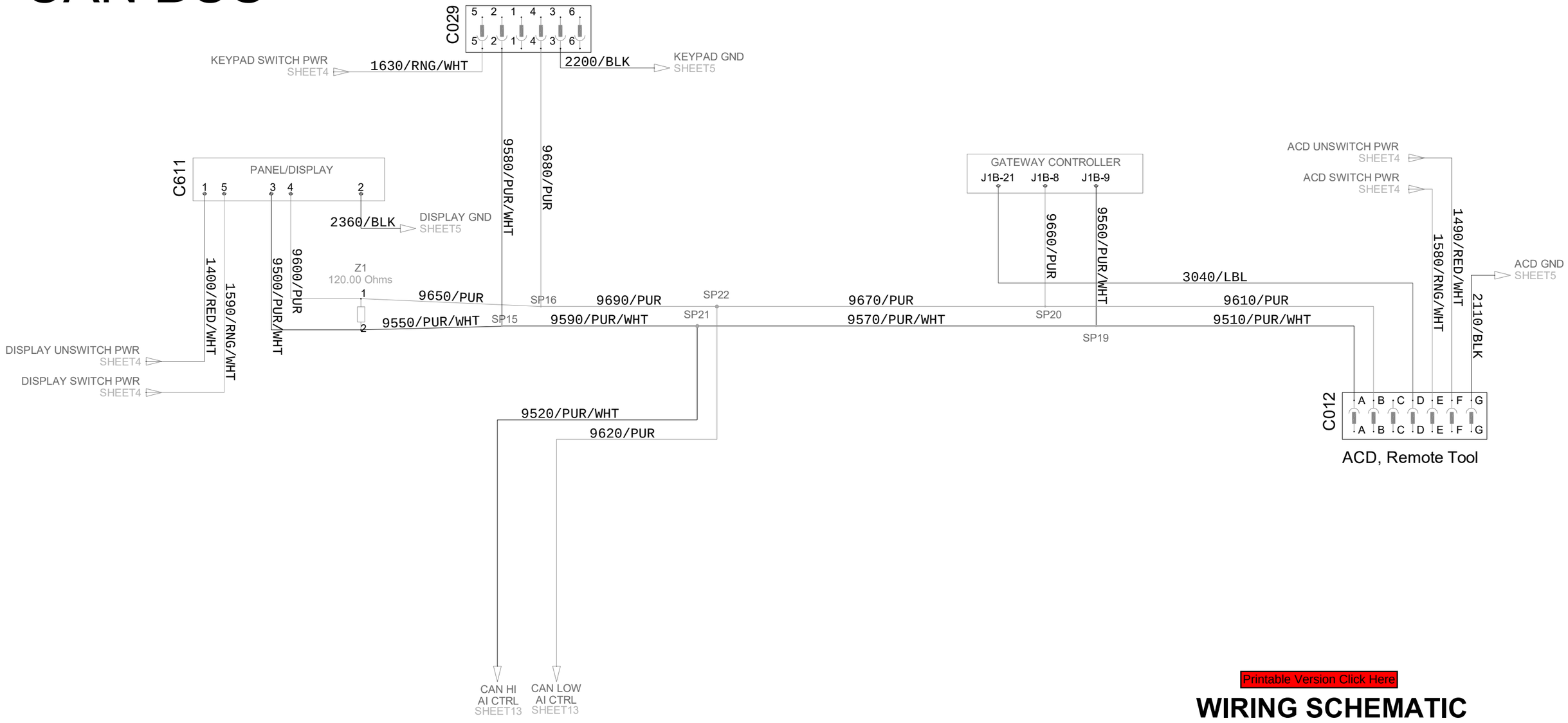
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CAN BUS



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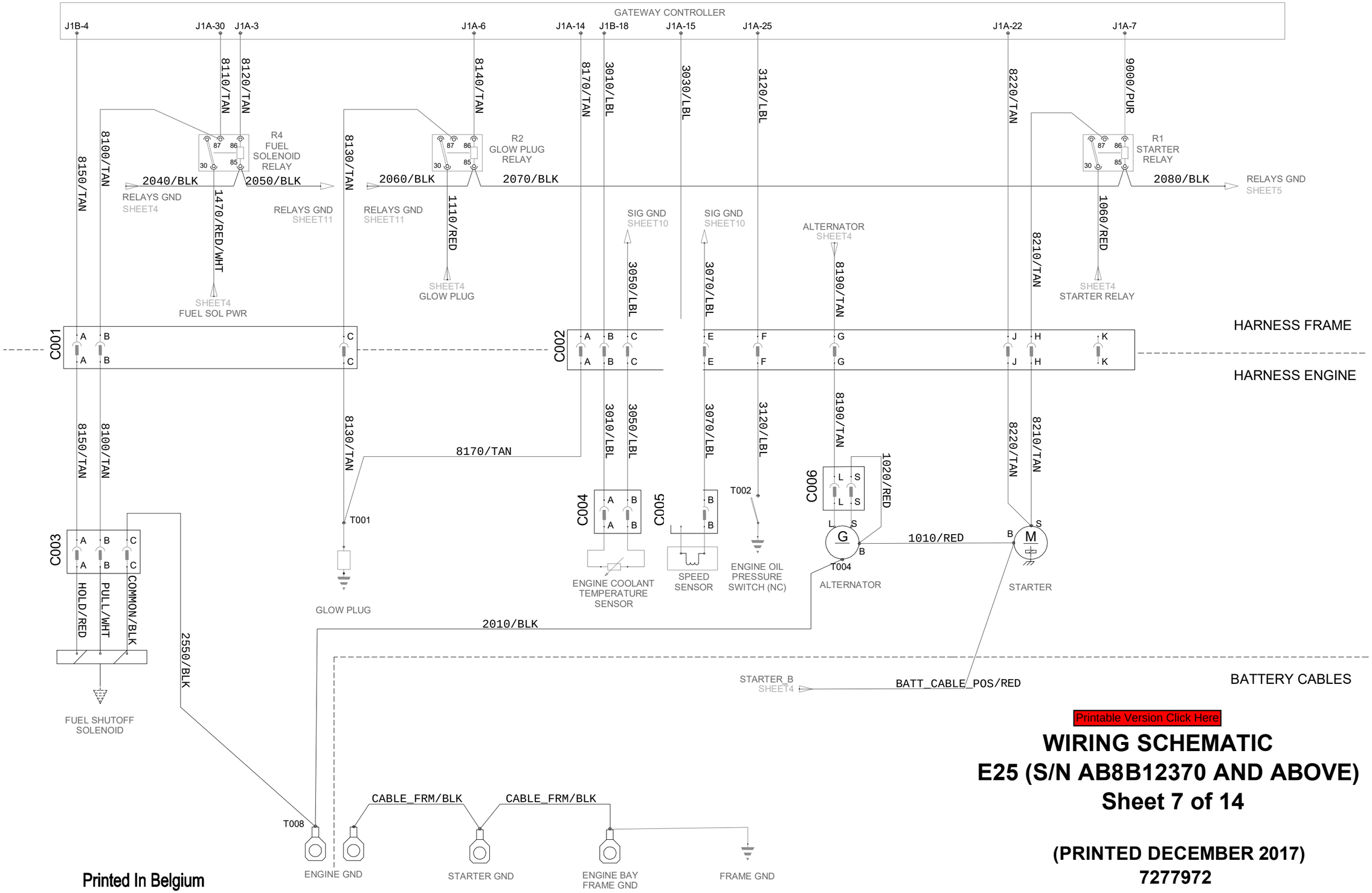
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ENGINE



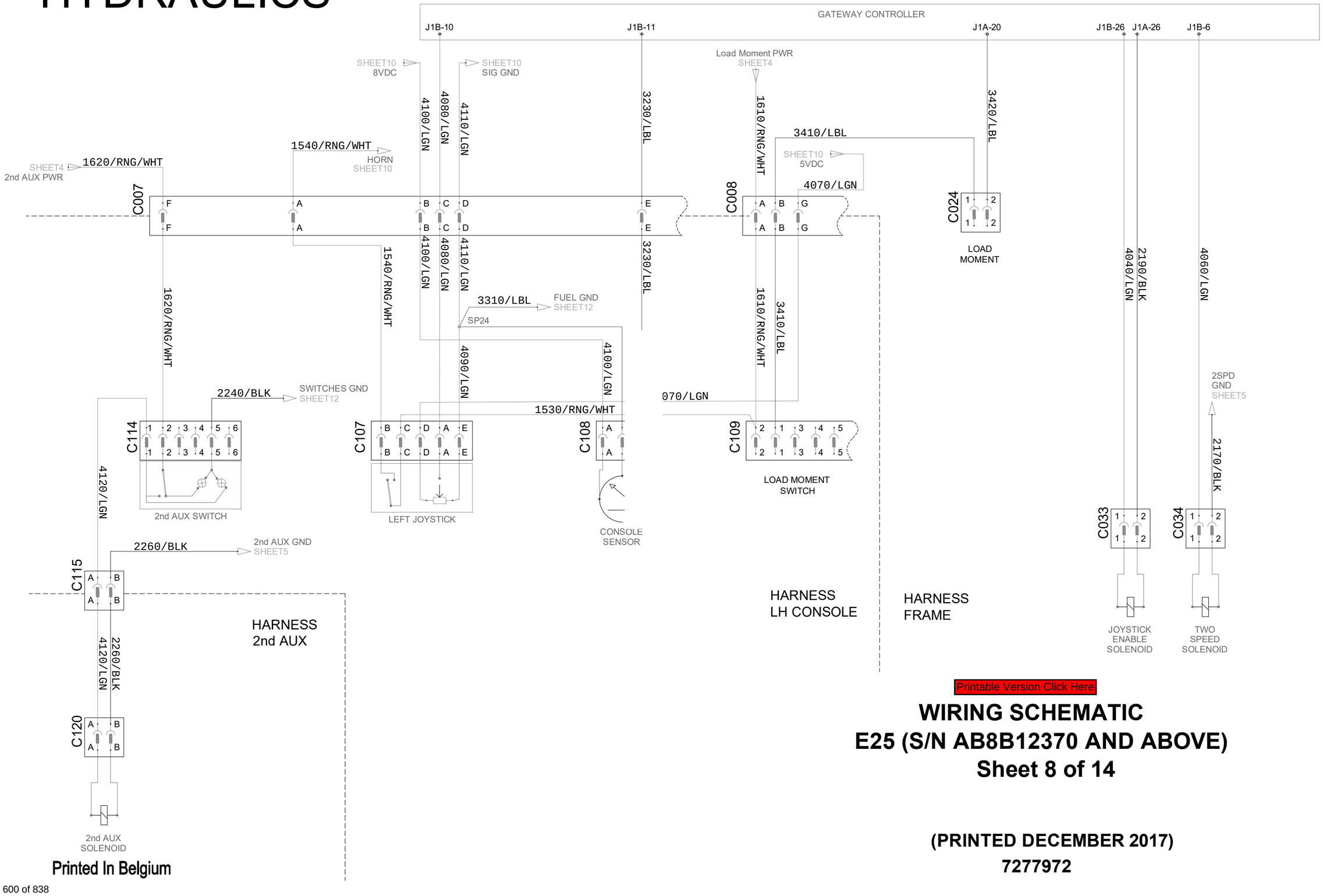
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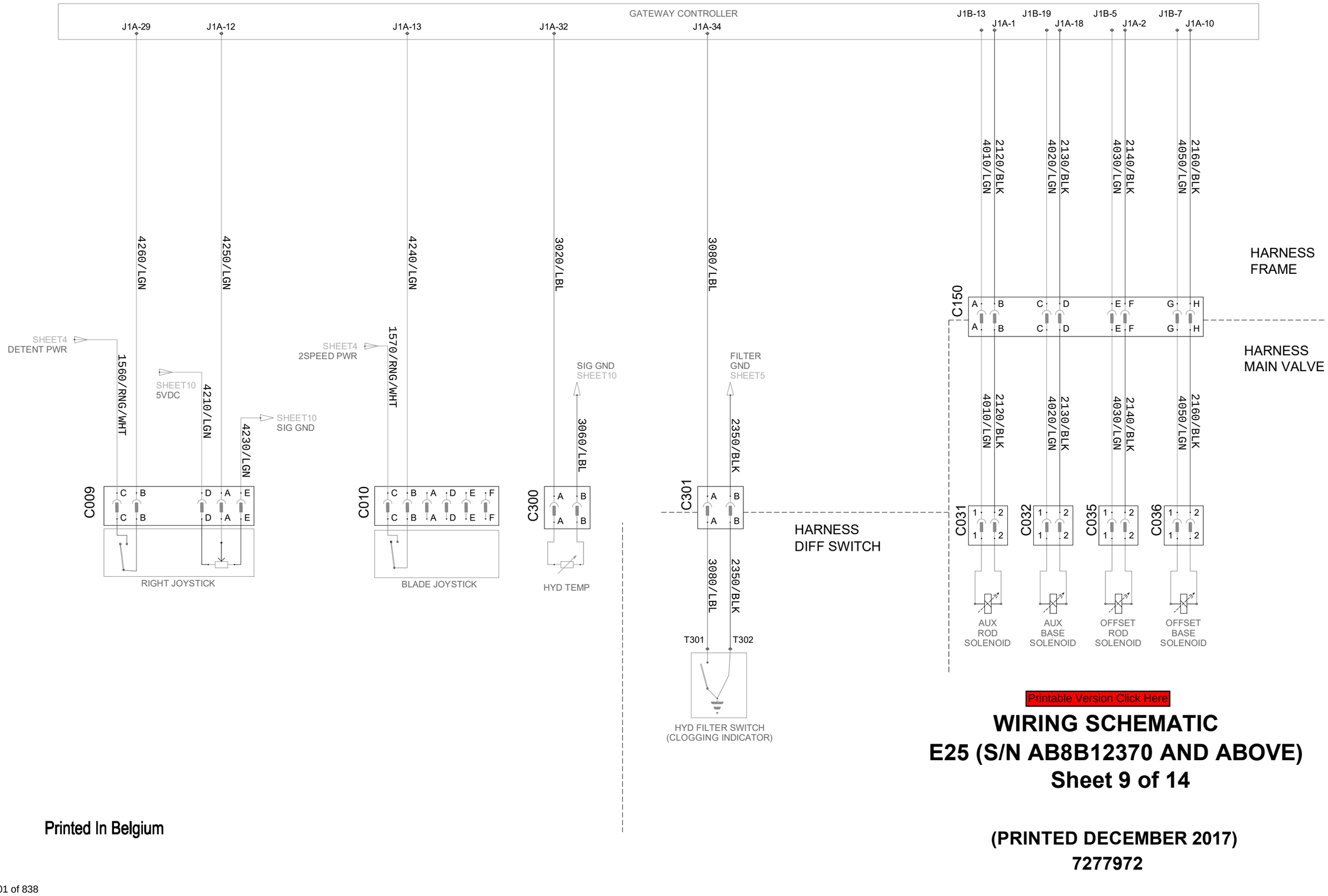
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HYDRAULICS



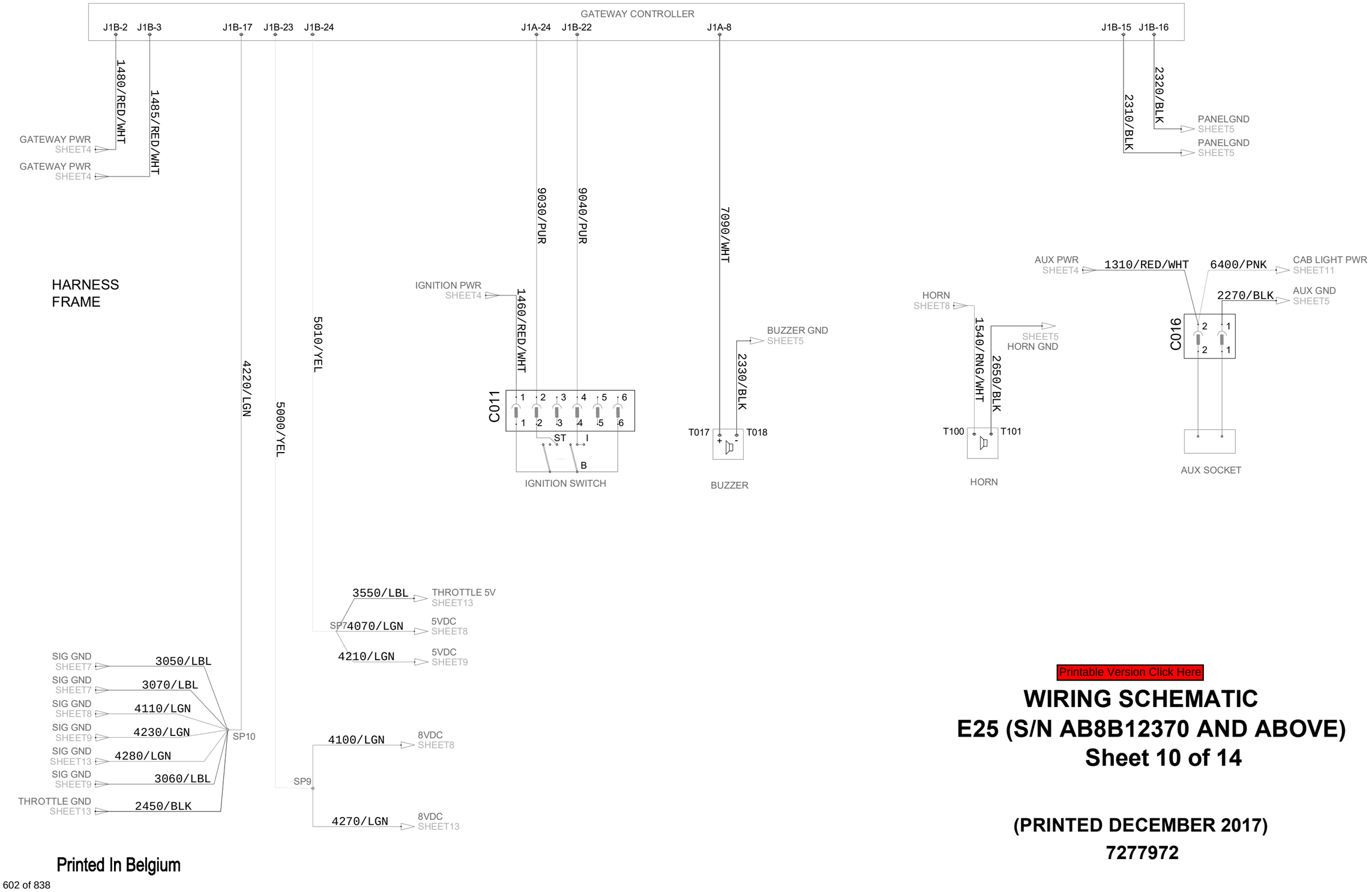
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FRAME



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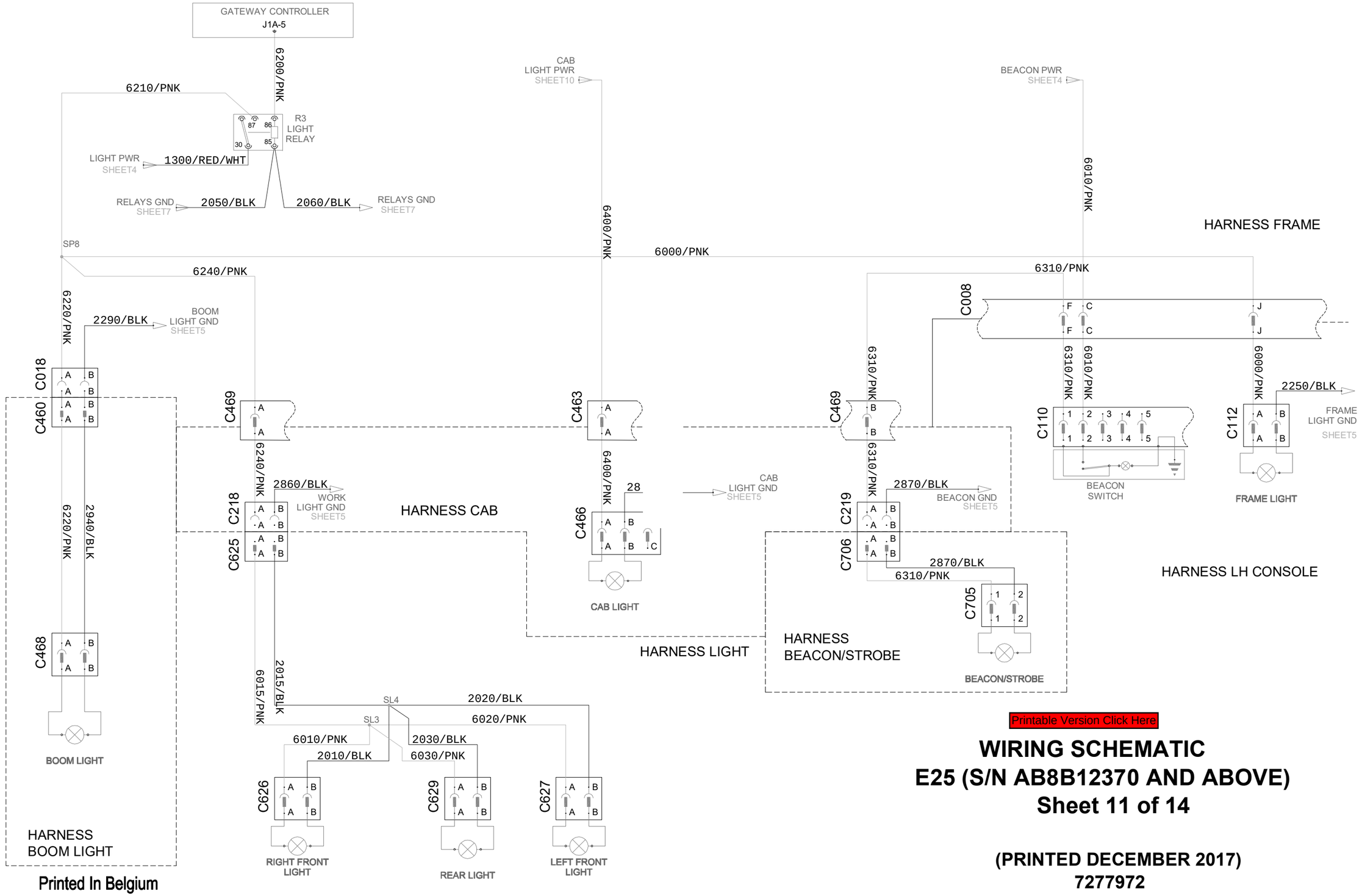
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LIGHTS / BEACON / STROBE



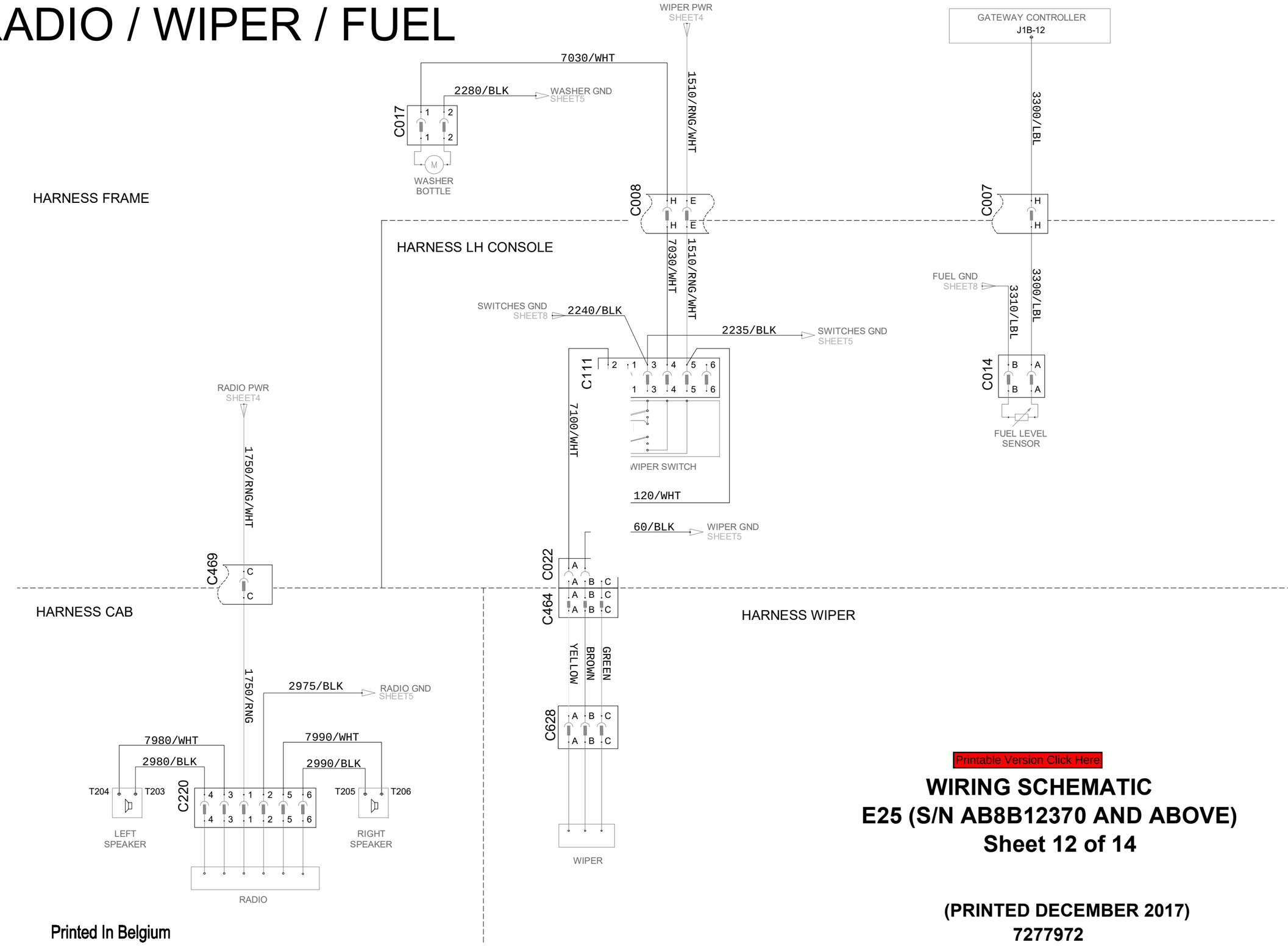
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RADIO / WIPER / FUEL



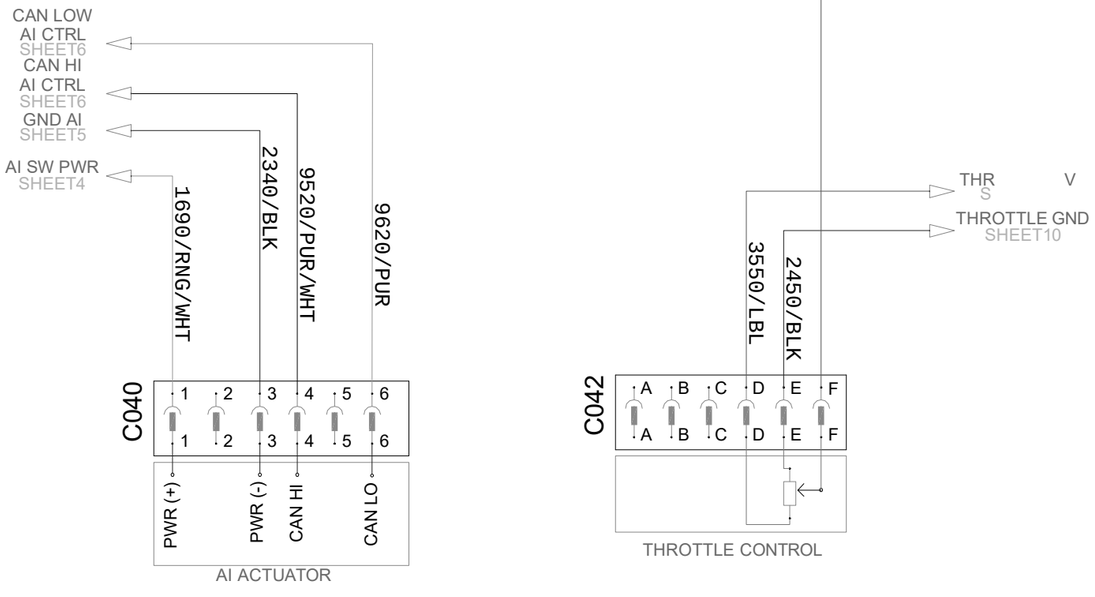
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AUTO -IDLE



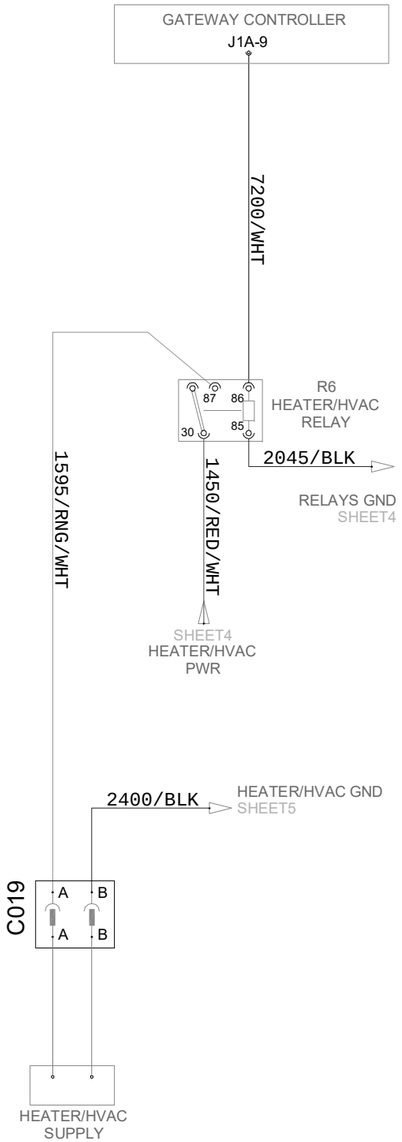
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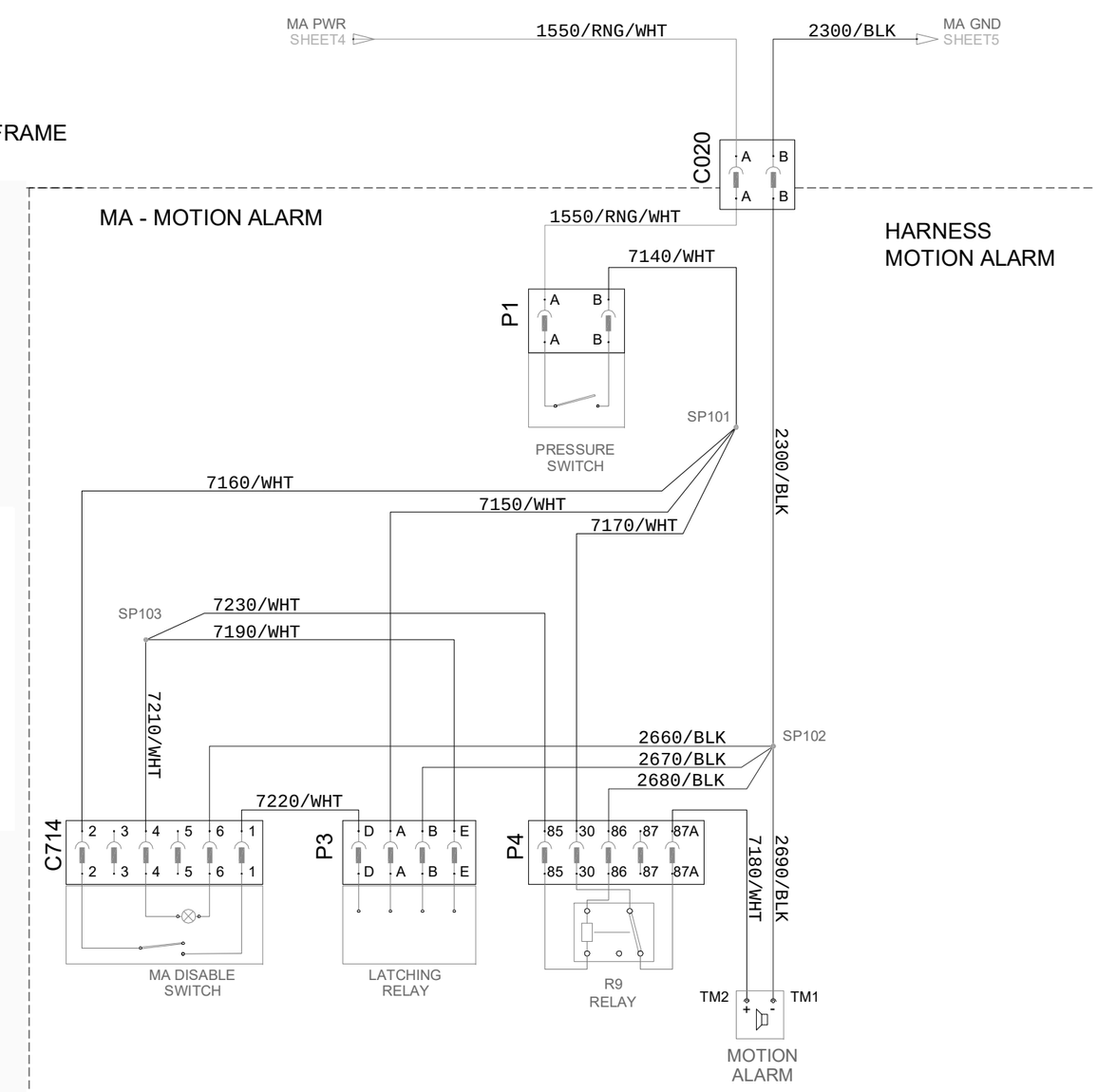
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HEATER / HVAC / MOTION ALARM



HARNESS FRAME



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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.

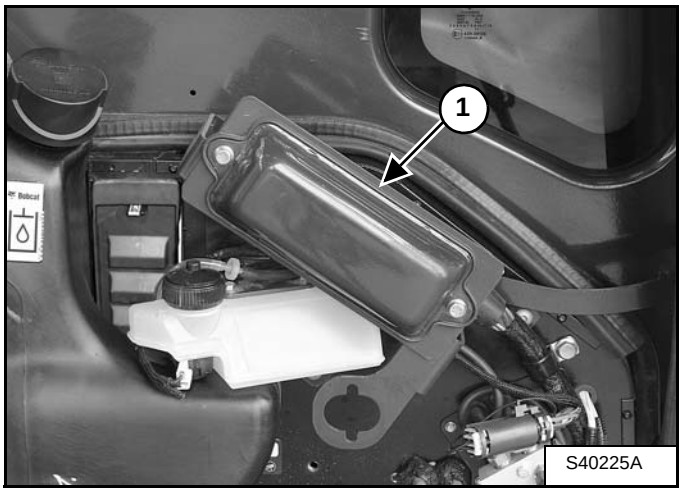
W-2003-0807

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.

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.

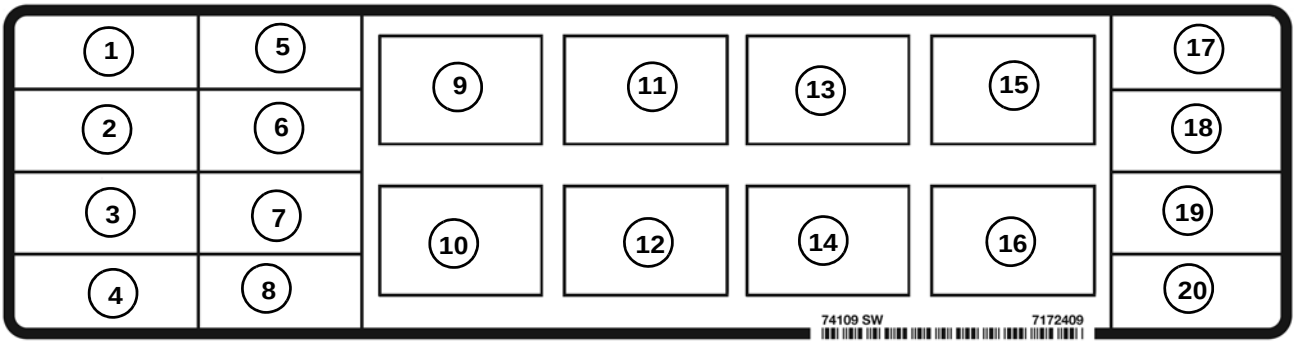
Remove the cover to check or replace the fuses and relays.

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.

Fuse And Relay Location / Identification (Cont'd)

Figure 50-10-2



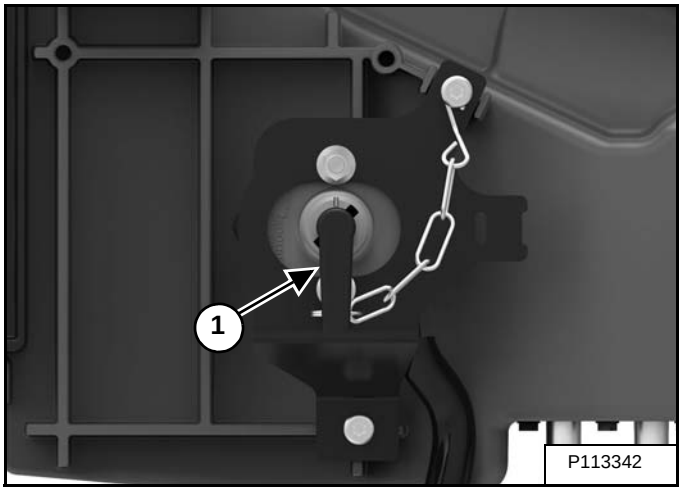
The location and amperage ratings are shown in the table below and on the decal **[Figure 50-10-2]**. Relays are identified by the letter "R" in the AMP column.

REF	ICON	DESCRIPTION	AMP	REF	ICON	DESCRIPTION	AMP	REF	ICON	DESCRIPTION	AMP
1		Auto Idle Controller (AIC)	20	**9**		Switched Power	R	**17**		Panel / Display Controller	25
2		Heater	25	**10**		Fuel Shutoff	R	**18**		ACD Unswitched Power	25
3		Start Key	5	**11**		Heater	R	**19**		LIGHTS	20
4		Fuel Shutoff	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 Switched Power	25	**16**		Starter	R				

Shut-Off Switch

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

Figure 50-10-3



The shut-off switch (Item 1) **[Figure 50-10-3]** is located under the right side cover below the fuse panel.

Rotate the switch (Item 1) counterclockwise to turn the switch to the OFF position, clockwise to turn to the ON position (shown in ON position).

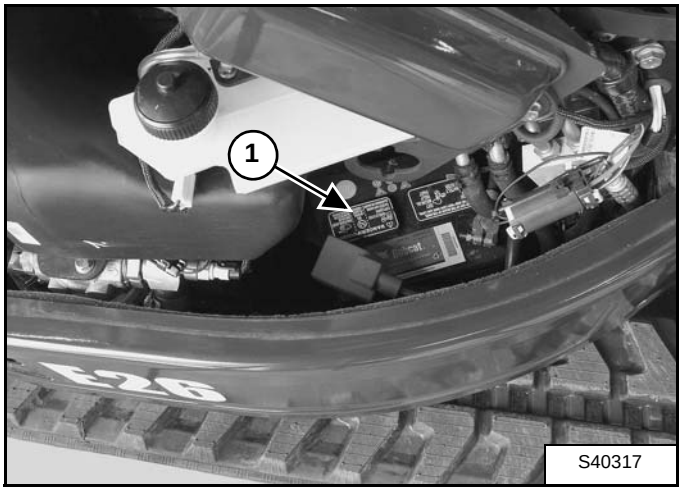
NOTE: In the OFF position the shut-off switch key can be removed from the switch. The key is secured to the switch mount with a chain.

BATTERY

Servicing

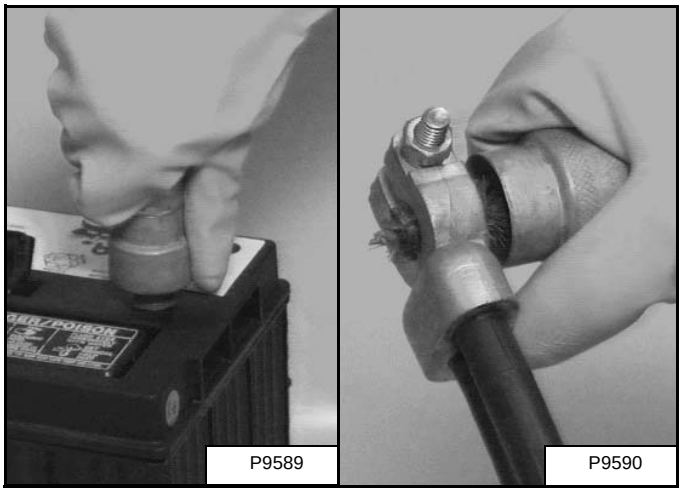
Open the right side cover. (See Opening And Closing on Page 10-60-1.)

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 to be removed for any reason disconnect the negative (-) cable first. When installing th battery cables, make the last connection the negative (- cable to the battery.

The original equipment battery is maintenance free. If replacement battery is installed, check the electrolyt level in the battery.

If the electrolyte level is lower than 13 mm (0.50 in) abov 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.

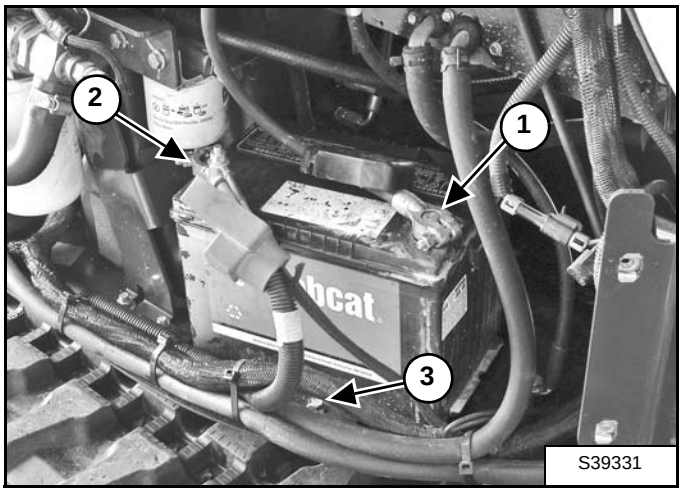
W-2065-0807

Removing And Installing The Battery

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

Remove the right side panel.

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.

Tighten the terminal clamp nuts to 7 N•m (5 ft-lb) torque.

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

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.

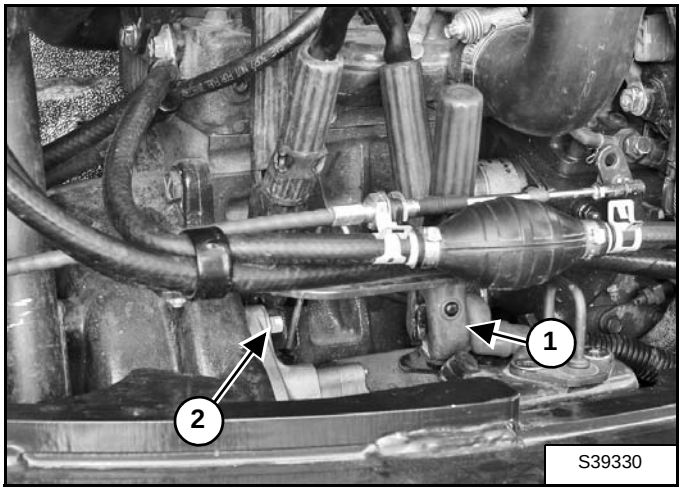
I-2060-0906

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 Opening And Closing 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 earth (-) 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 o contact. Wear goggles, protective clothing an rubber gloves to keep acid off body.

In case of acid contact, wash immediately with wate In case of eye contact get prompt medical attentio and wash eye with clean, cool water for at least 1 minutes.

If electrolyte is taken internally drink large quantitie of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807


Bobcat®

ALTERNATOR

Belt Adjustment

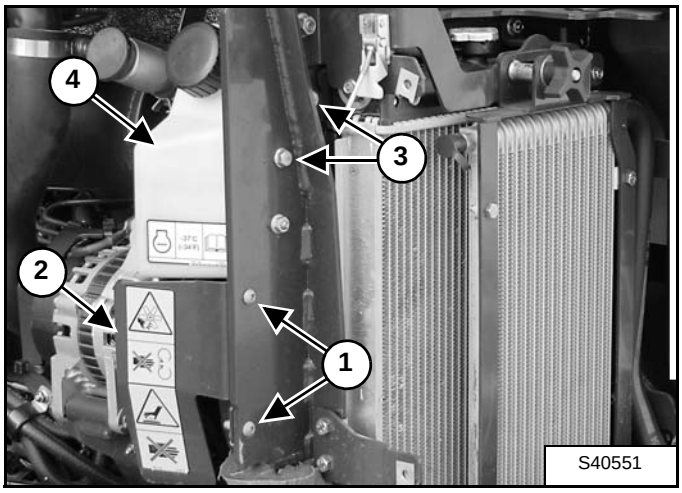
The alternator and fan belt is a special maintenance free type that is pretensioned over the pulleys. This belt eliminates the need for a tensioning procedure and does not require periodic adjustment.

Belt Replacement

Removal

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

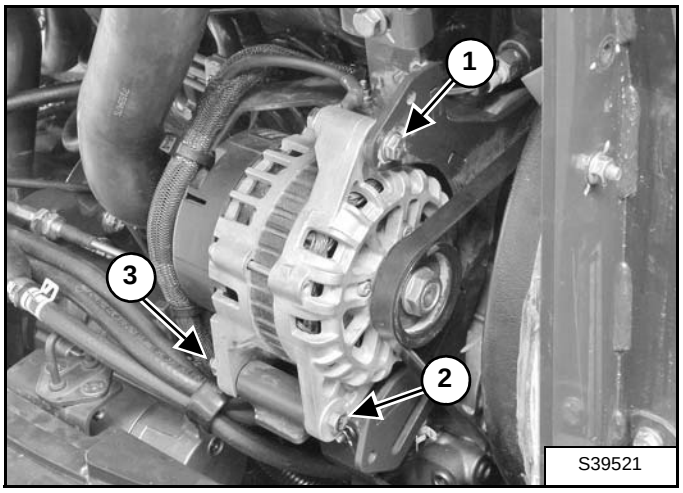
Figure 50-30-1



Remove belt shield mounting nuts and bolts (Item 1) and remove the belt shield (Item 2) **[Figure 50-30-1]**.

Remove the two bolts (Item 3) and the coolant recovery tank (Item 4) **[Figure 50-30-1]**.

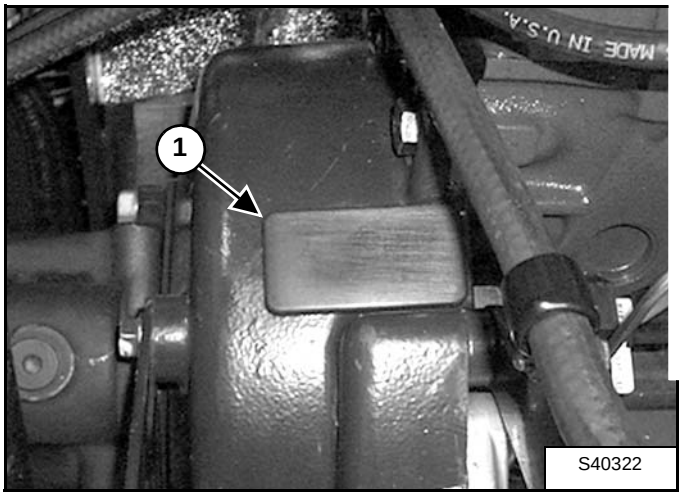
Figure 50-30-2



Loosen the bolt (Item 1) and the lower alternator mounting bolt (Item 2) and nut (Item 3) **[Figure 50-30-2]**.

Use a pry bar to take the pressure off of the bolt (Item 1) **[Figure 50-30-2]** and remove the top bolt.

Figure 50-30-3

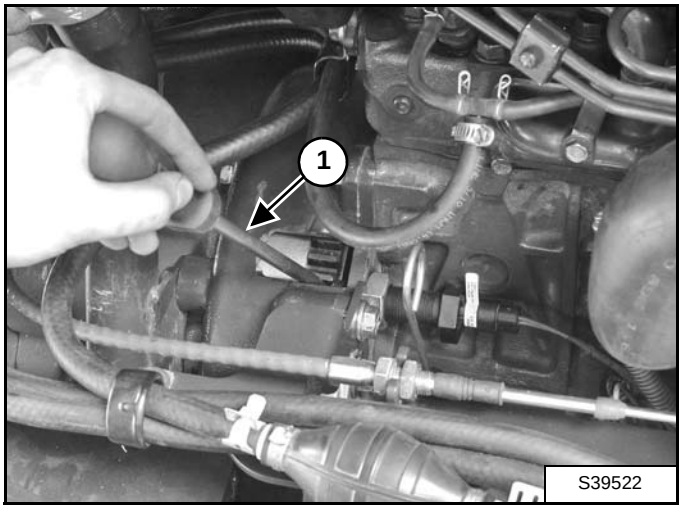


The flywheel will need to be rotated by hand to remove the belt. To access the flywheel, remove the plug (Item 1) **[Figure 50-30-3]** from the flywheel housing.

Belt Replacement (Cont'd)

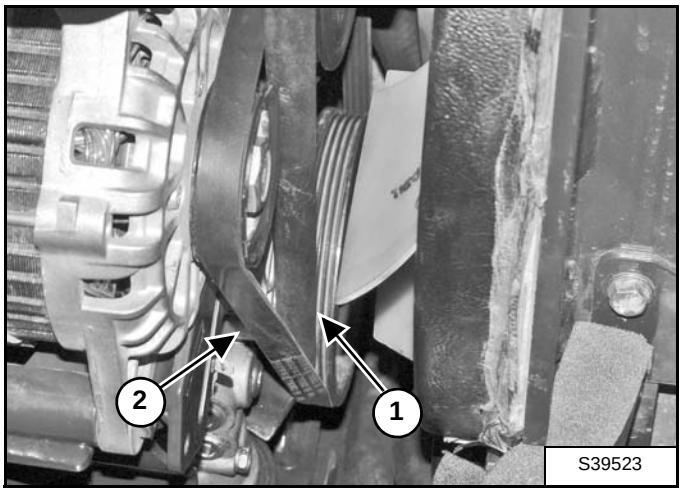
Removal (Cont'd)

Figure 50-30-4



Install a pry bar (Item 1) **[Figure 50-30-4]** to the flywheel teeth.

Figure 50-30-5



Install a second pry bar (Item 1) **[Figure 50-30-5]** or flat blade screw driver between the belt and the crankshaft pulley.

Using the pry bar (Item 1) **[Figure 50-30-4]** to rotate the flywheel, start to push the belt off of the pulley using the second pry bar (Item 1) **[Figure 50-30-5]**.

Continue to manually rotate the flywheel until the belt is off the pulley.

The belt (Item 2) **[Figure 50-30-5]** will need to be worked over the fan blades until it can be removed.

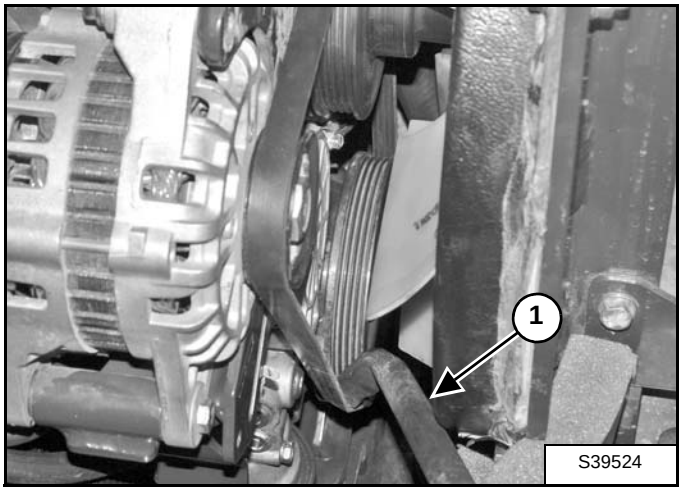
NOTE: Fan blades may be sharp, use care when moving the belt over the fan blades.

Belt Replacement (Cont'd)

Installation

Install the new alternator and fan belt.

Figure 50-30-6



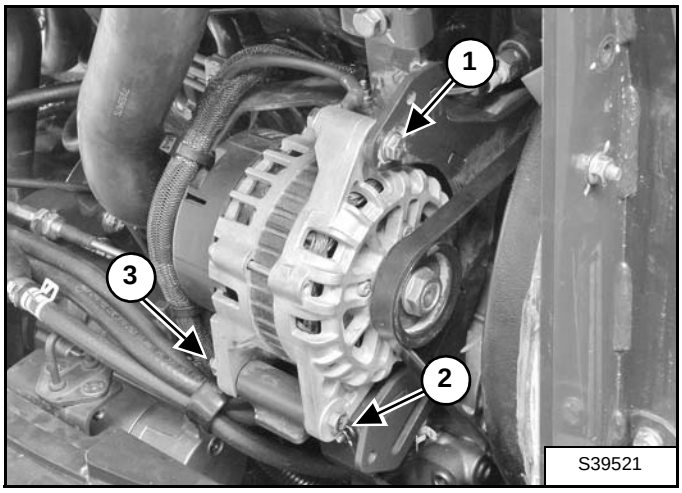
Position the belt over the crankshaft pulley and next to the engine block and align the upper part of the belt to the water pump pulley and alternator pulley.

Using the pry bar (Item 1) **[Figure 50-30-4]** to rotate the flywheel and push the belt on the pulley using the second pry bar (Item 1) **[Figure 50-30-6]**.

Continue rotating the flywheel until the belt is fully installed.

Install the flywheel plug (Item 1) **[Figure 50-30-3]**.

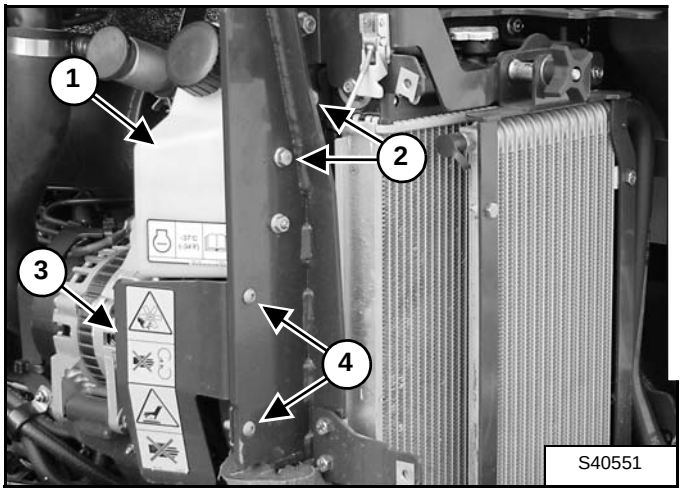
Figure 50-30-7



Use the pry bar to position the alternator and install the bolt (Item 1) **[Figure 50-30-7]**.

Tighten the alternator mounting bolt (Item 2) and nut (Item 3) **[Figure 50-30-7]**.

Figure 50-30-8



Install the coolant recovery tank (Item 1) with the two bolts (Item 2) **[Figure 50-30-8]**.

Install the belt shield (Item 3) with the two bolts (Item 4) **[Figure 50-30-8]** and nuts.

Close the tailgate.

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 (ground first, then positive). Inspect the cable clamps and battery posts for corrosion. Remove acid or corrosion from the battery and cables with a sodium bicarbonate and water solution. Put grease on the cable ends and battery terminals to prevent corrosion. Connect the cable to the positive terminal.

⚠ WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

⚠ WARNING

BATTERY GAS CAN EXPLODE AND CAUSE SERIOUS INJURY OR DEATH

Keep arcs, sparks, flames and lighted tobacco away from batteries. When *jumping* from booster battery make final connection (negative) at machine frame.

Do not jump start or charge a frozen or damaged battery. Warm battery to 16°C (60°F) before connecting to a charger. Unplug charger before connecting or disconnecting cables to battery. Never lean over battery while boosting, testing or charging.

W-2066-0910

Alternator Voltage Testing

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

Figure 50-30-9



Start the engine and run at low idle. With a voltmeter, check the voltage between the B+ terminal and ground at the starter **[Figure 50-30-9]**.

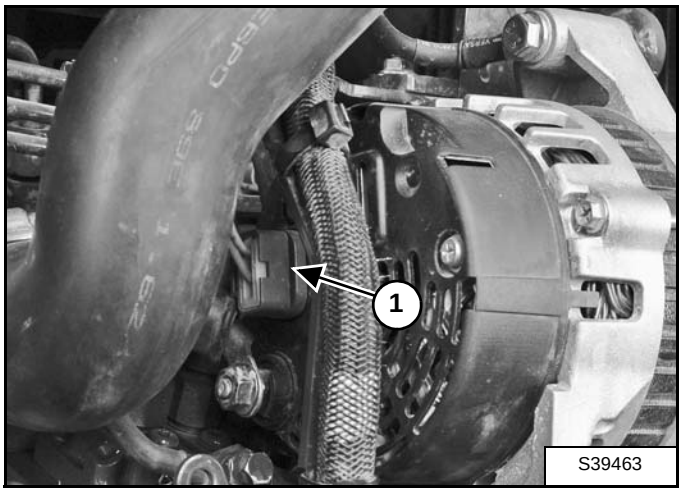
The voltage must be higher than 13.5 volt but lower than 14.7 volt at 21°C (70°F) (Alternator Temperature).

If the voltage is higher than 14.7 volt, proceed to the high voltage test.

If the voltage is lower than 13.5 volt, run the engine at high idle and recheck voltage. If voltage is still below 13.5 volt, proceed to the low voltage test.

Low Voltage Testing

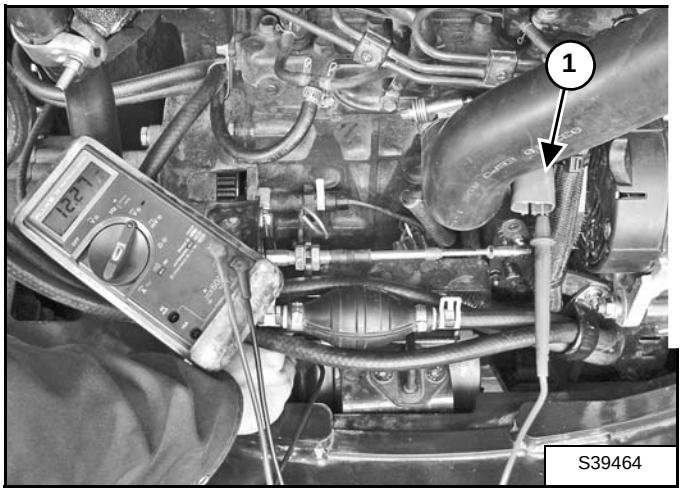
Figure 50-30-10



Turn engine OFF and remove the L and S terminal connector (Item 1) **[Figure 50-30-10]** from the alternator.

Turn the key switch to the ON position.

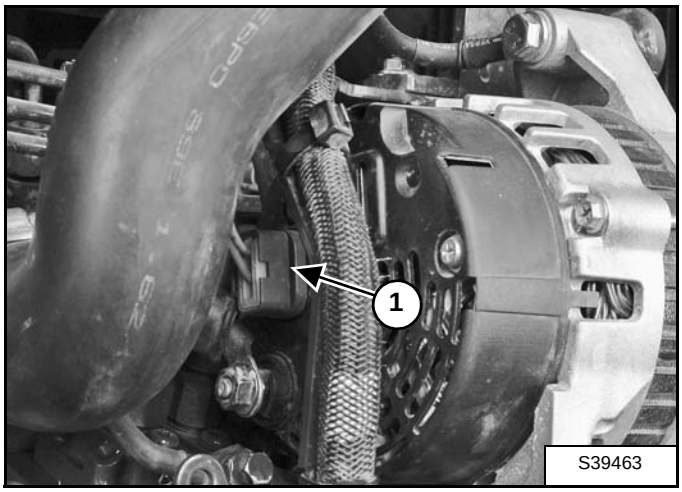
Figure 50-30-11



Check the voltage across the "L" terminal (Item 1) **[Figure 50-30-11]**. 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 alright, remove the alternator for replacement or repair.

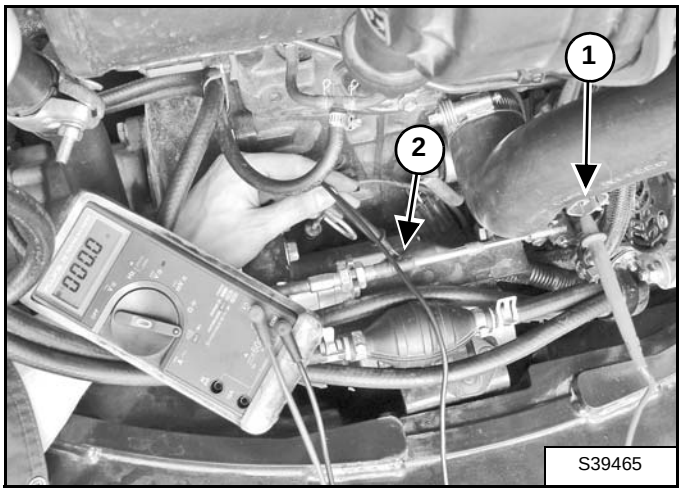
High Voltage Testing

Figure 50-30-12



Turn the engine OFF and remove the L and S Terminal connector (Item 1) **[Figure 50-30-12]** from the alternator.

Figure 50-30-13



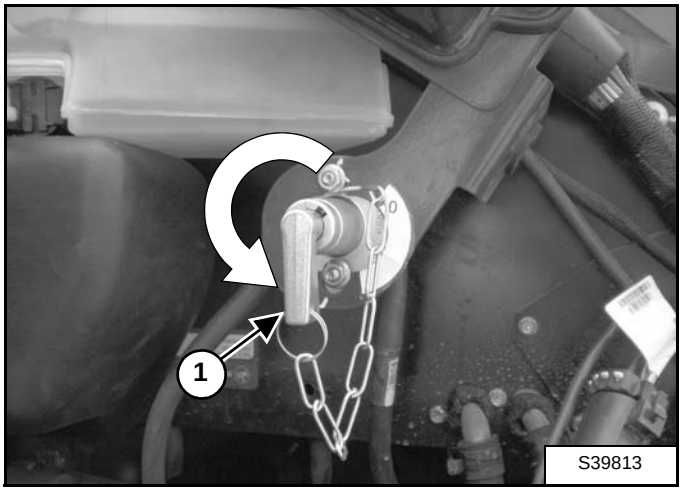
Check the continuity between the "S" terminal (Item 1) and the positive (+) terminal on the battery or starter terminal (Item 2) **[Figure 50-30-13]**. There should be continuity. If there is no continuity, replace the wire harness.

If the voltage is still above 14.7 at volt 21°C (70°F) (alternator temperature), then remove the alternator for replacement or repair.

Removal And Installation

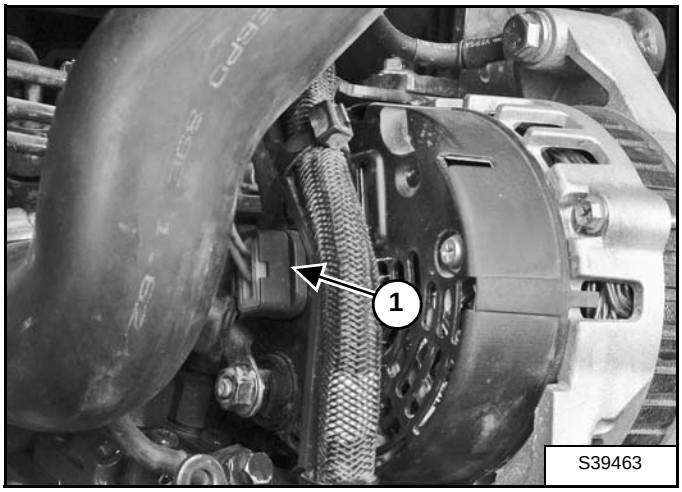
Open the tailgate. (See Opening And Closing on Page 10-50-1.)

Figure 50-30-14



Rotate the battery disconnect switch (Item 1) **[Figure 50-30-14]** counterclockwise to disconnect the ground terminal from the battery.

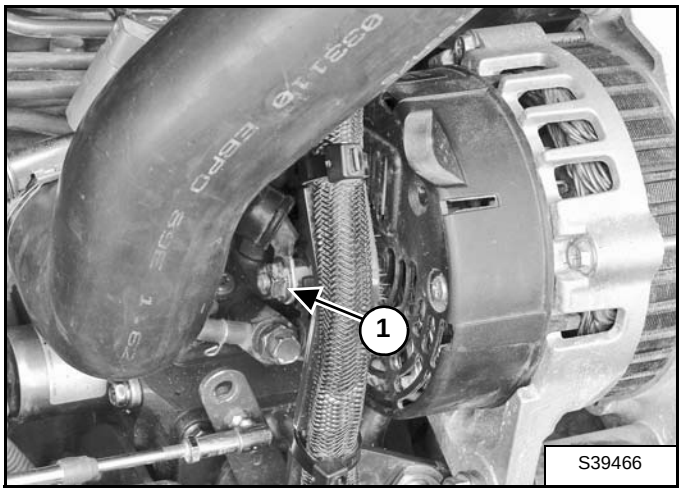
Figure 50-30-15



Disconnect the wire harness (Item 1) **[Figure 50-30-15]** from the alternator.

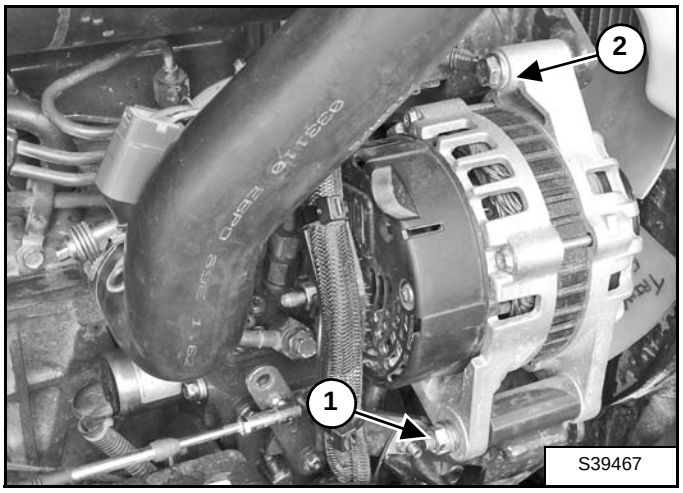
Removal And Installation (Cont'd)

Figure 50-30-16



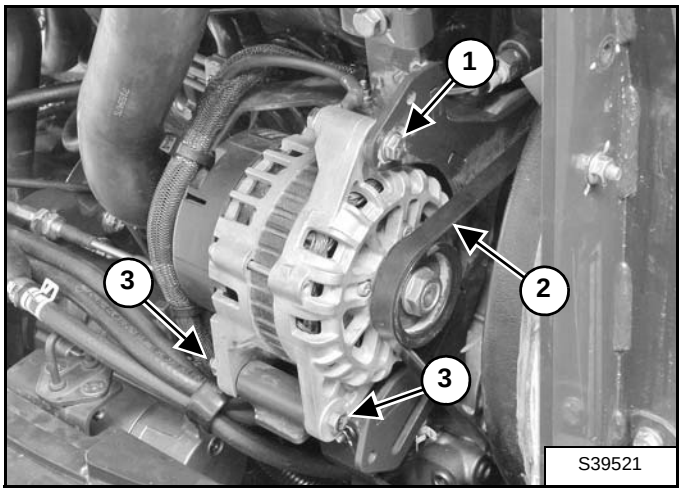
Remove the nut (Item 1) **[Figure 50-30-16]** and wire.

Figure 50-30-17



Remove the bolt (Item 1) and ground wire (Item 2) **[Figure 50-30-17]**.

Figure 50-30-18



Remove the bolt (Item 1) **[Figure 50-30-18]**.

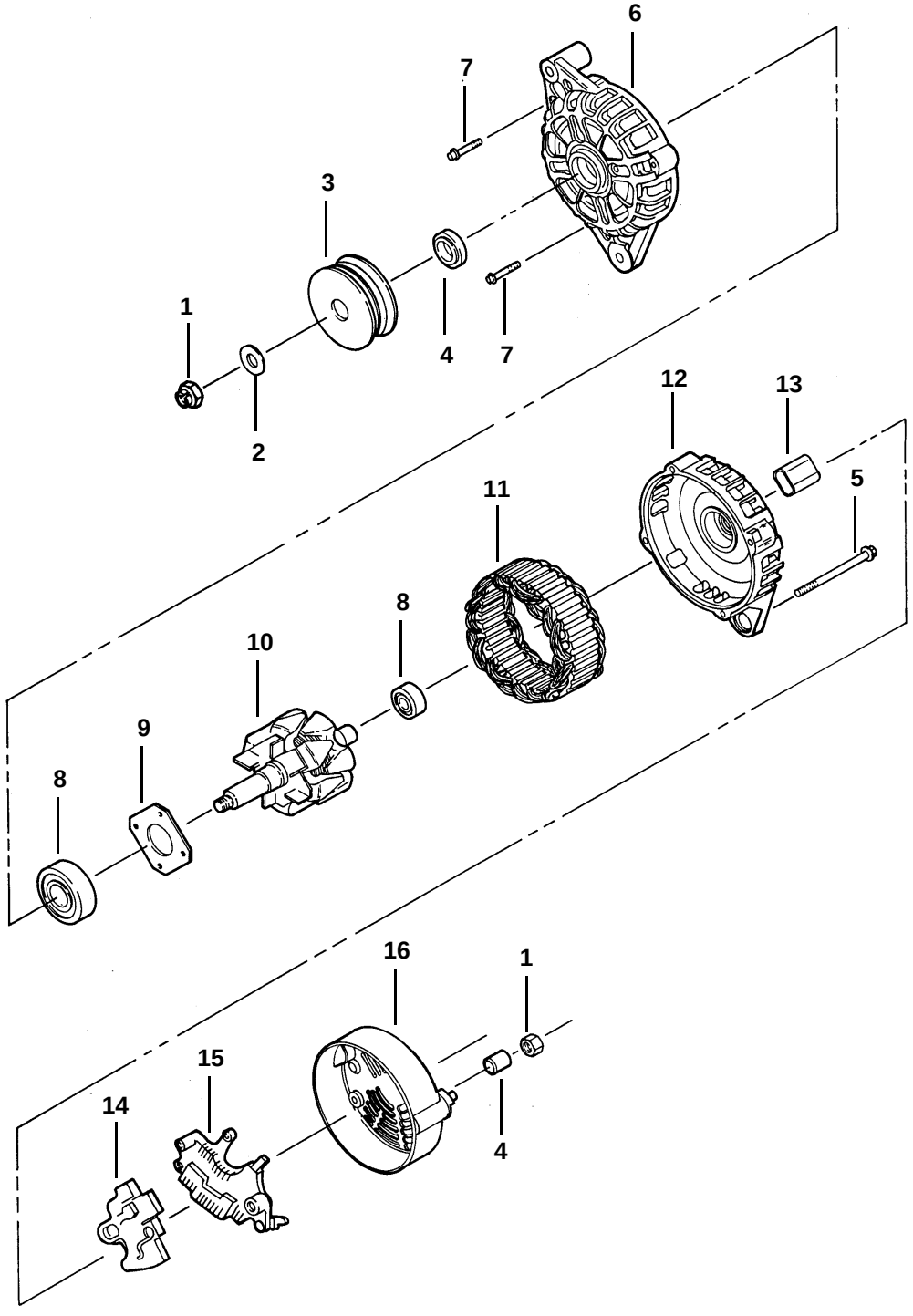
Remove the belt (Item 2) **[Figure 50-30-18]** from the engine. (See Belt Replacement on Page 50-30-1.)

Remove the nut and bolt (Item 3) **[Figure 50-30-18]**.

Remove the alternator.

Parts Identification

1. Nut
2. Washer
3. Pulley
4. Spacer
5. Bolt
6. Case Half
7. Bolt
8. Bearing
9. Retainer
10. Rotor
11. Stator
12. Case Half
13. Sleeve
14. Regulator
15. Rectifier
16. Cover

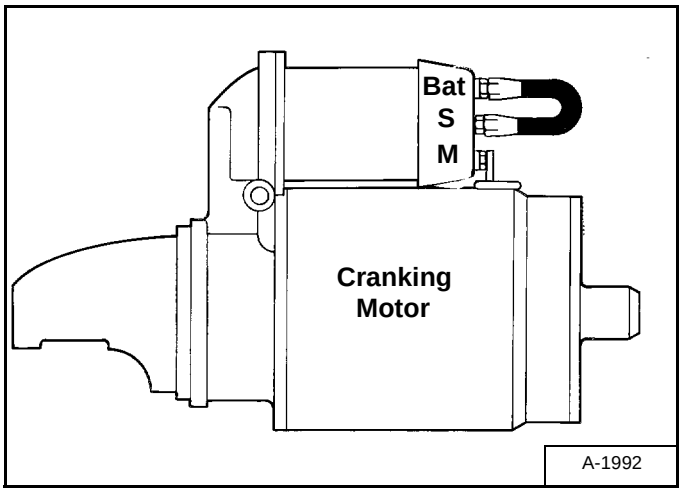


C-3529

STARTER

Testing

Figure 50-40-1



The key switch must be in the OFF position.

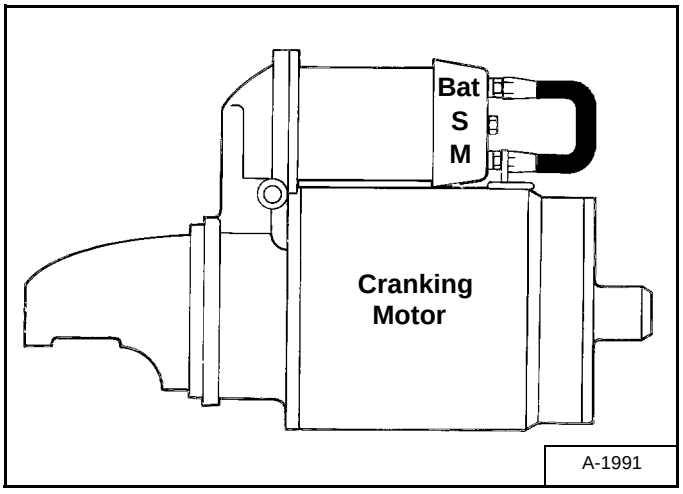
The battery must be at full charge.

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]**.

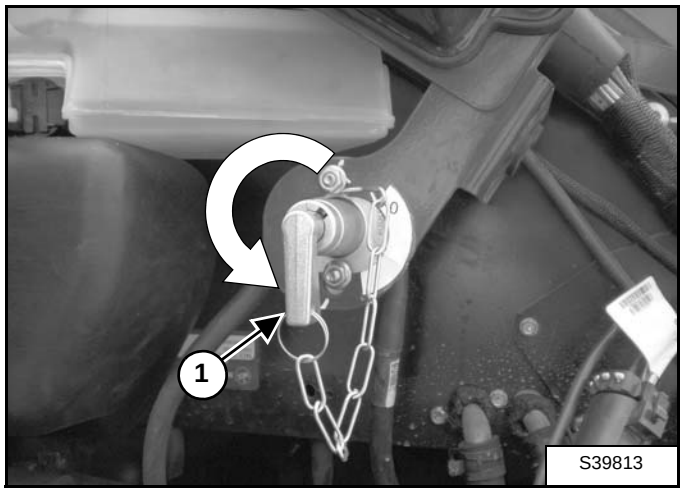
If the starter turns, the defect is in the solenoid.

If the starter does not turn, the starter is defective.

STARTER (CONT'D)

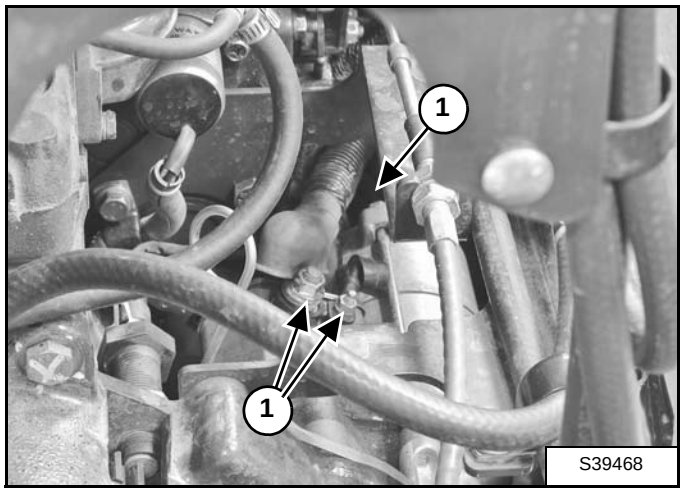
Removal And Installation

Figure 50-40-3



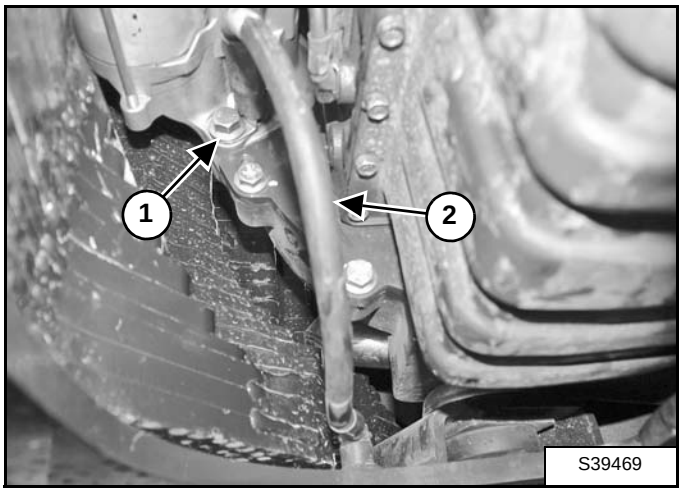
Rotate the battery disconnect switch (Item 1) **[Figure 50-40-3]** counterclockwise to disconnect the ground terminal from the battery.

Figure 50-40-4



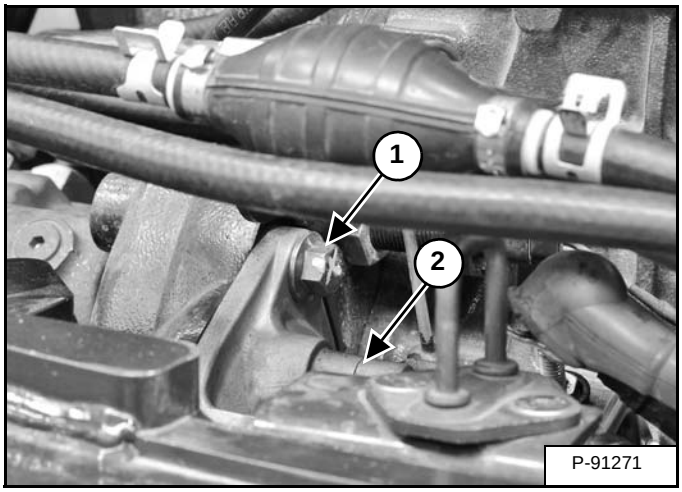
Disconnect the wires (Item 1) **[Figure 50-40-4]** from the starter.

Figure 50-40-5



Remove the bottom bolt (Item 1) and ground cable (Item 2) **[Figure 50-40-5]**.

Figure 50-40-6

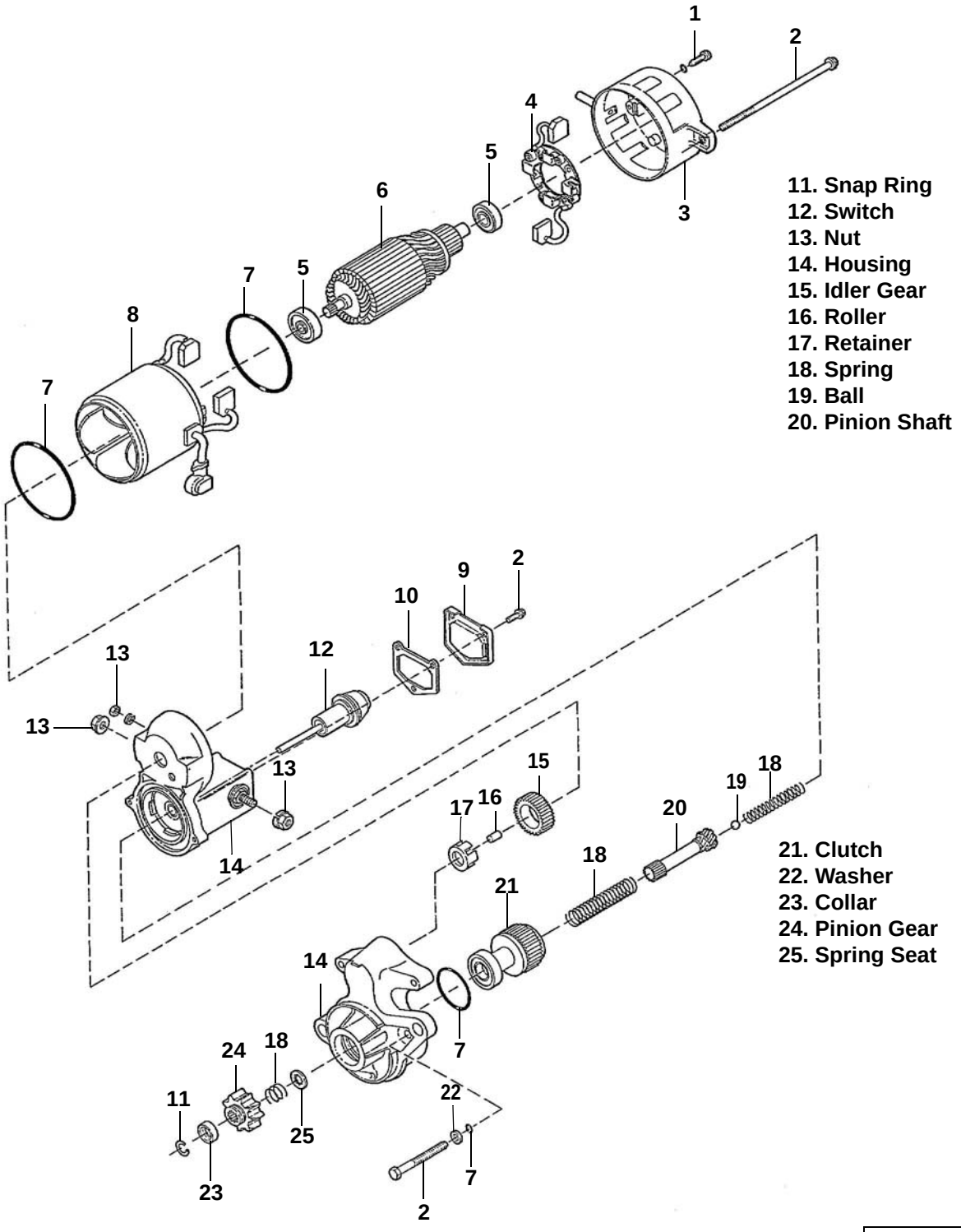


Remove the top bolt (Item 1) **[Figure 50-40-6]**.

Remove the starter (Item 2) **[Figure 50-40-6]**.

Parts Identification

1. Screw
2. Bolt
3. Brush Cover
4. Brush Holder
5. Bearing
6. Armature
7. O-ring
8. Frame
9. Cover
10. Gasket
11. Snap Ring
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. Collar
24. Pinion Gear
25. Spring Seat



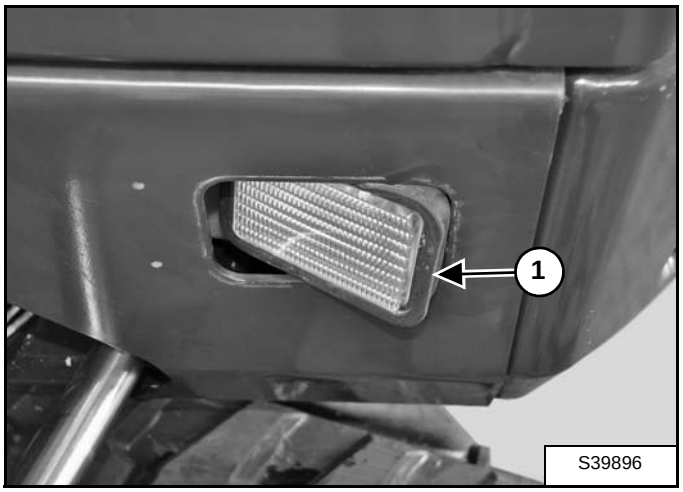
D-2396


Bobcat®

LIGHTS

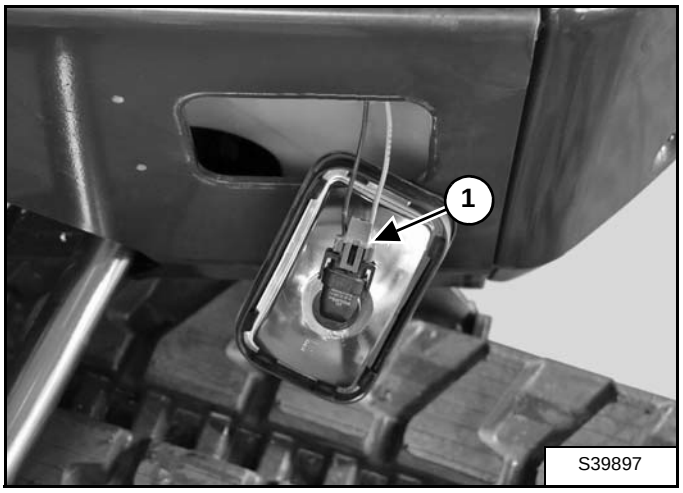
Removal And Installation

Figure 50-50-1



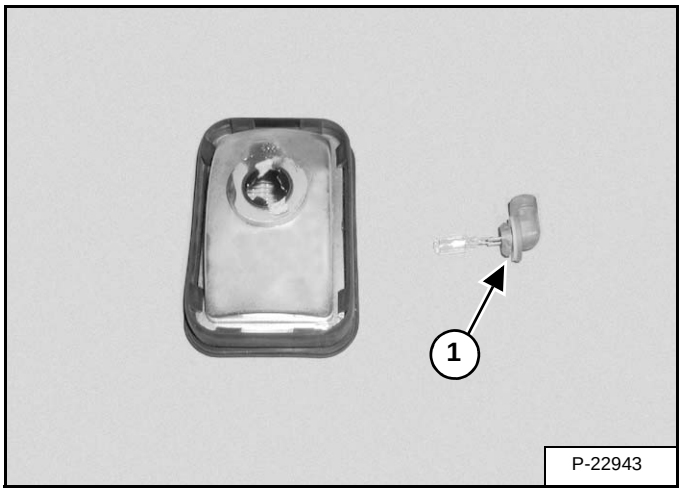
To remove the upperstructure light, pivot the light (Item 1) **[Figure 50-50-1]** back inside the frame.

Figure 50-50-2



Disconnect the wire harness (Item 1) **[Figure 50-50-2]**.

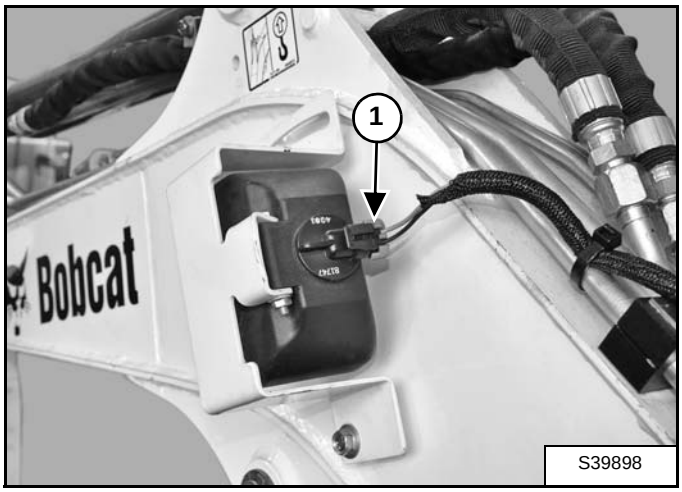
Figure 50-50-3



Remove the light bulb assembly (Item 1) **[Figure 50-50-3]** from the lens.

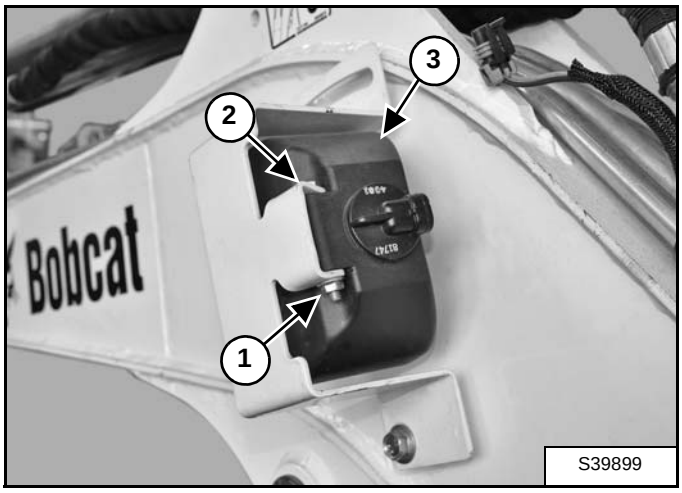
Boom Light Removal And Installation

Figure 50-50-4



Disconnect the wire harness (Item 1) **[Figure 50-50-4]**.

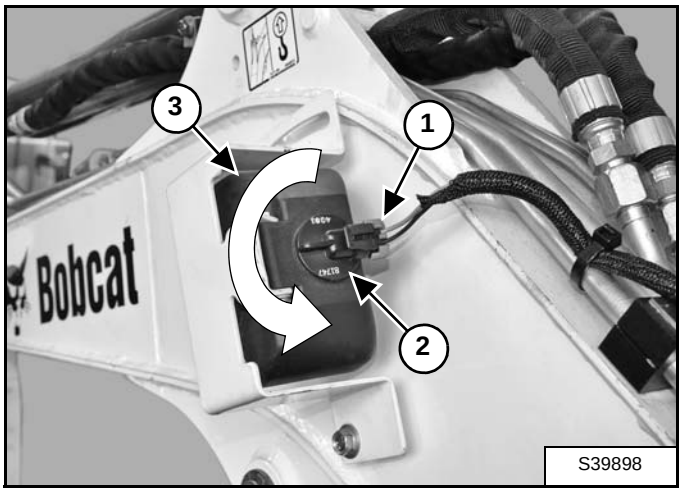
Figure 50-50-5



Remove the nut (Item 1) and bolt (Item 2). Remove the boom light (Item 3) **[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



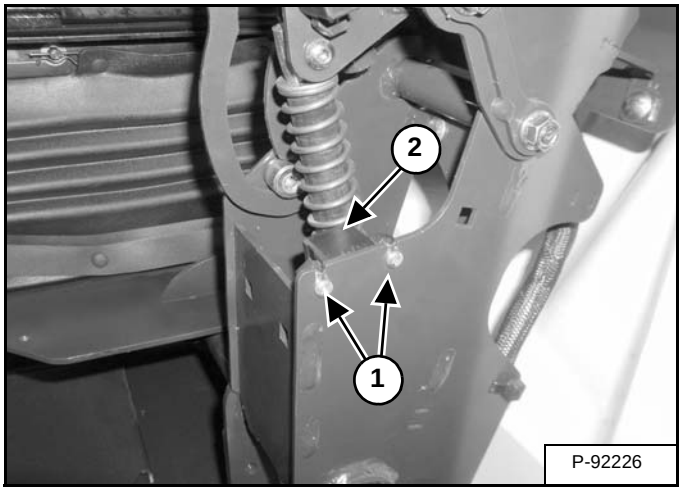
NOTE: Do not touch glass of halogen bulb with your fingers or allow bulb to come in contact with oils. If contaminated, the bulb should be cleaned with mild alcohol and a clean cloth [Figure 50-50-7].

MAGNETIC LOCKOUT SENSOR

Removal And Installation

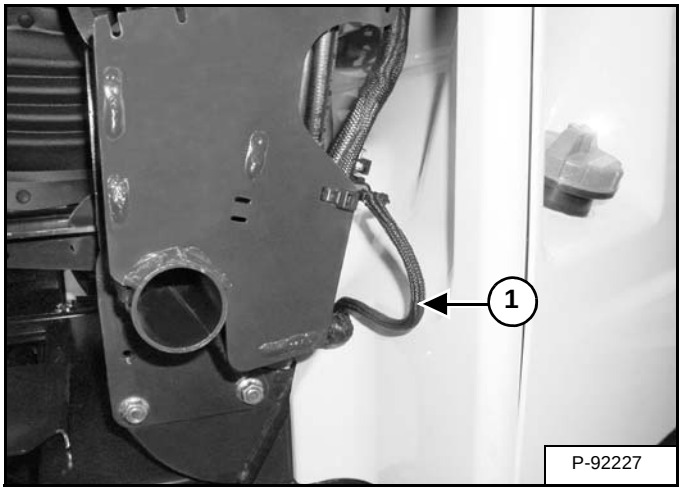
Remove the lower console cover. (See Lower Console Cover Removal And Installation on Page 40-60-1.)

Figure 50-60-1



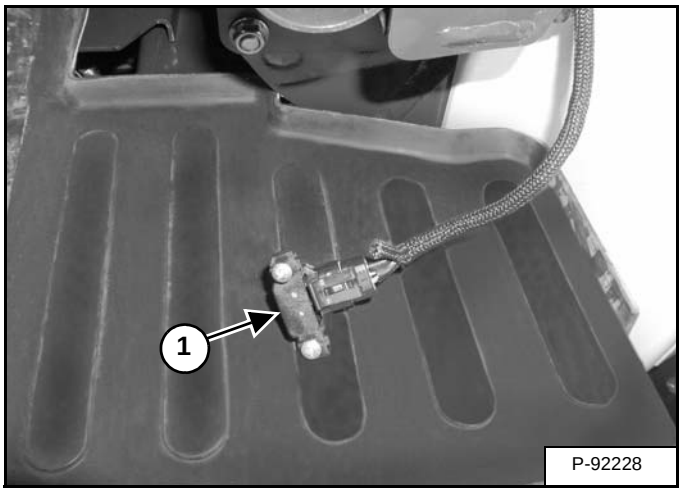
Loosen the screws (Item 1) and remove the switch (Item 2) **[Figure 50-60-1]**.

Figure 50-60-2



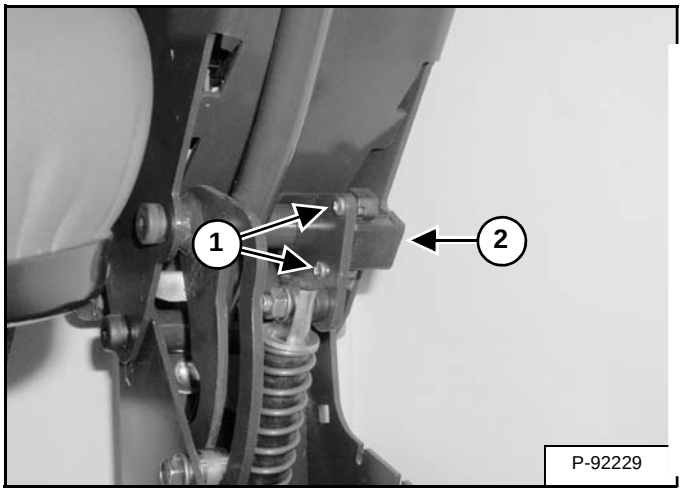
Route the switch and wire harness (Item 1) **[Figure 50-60-2]** out the back of the console.

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]**.

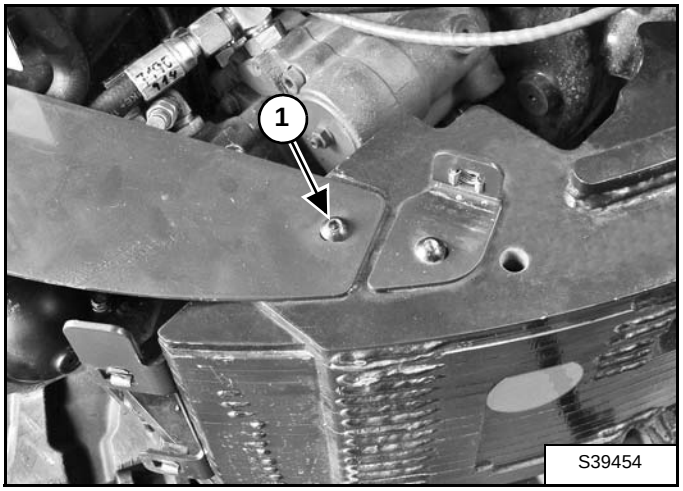

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FUEL LEVEL SENDER

Removal And Installation

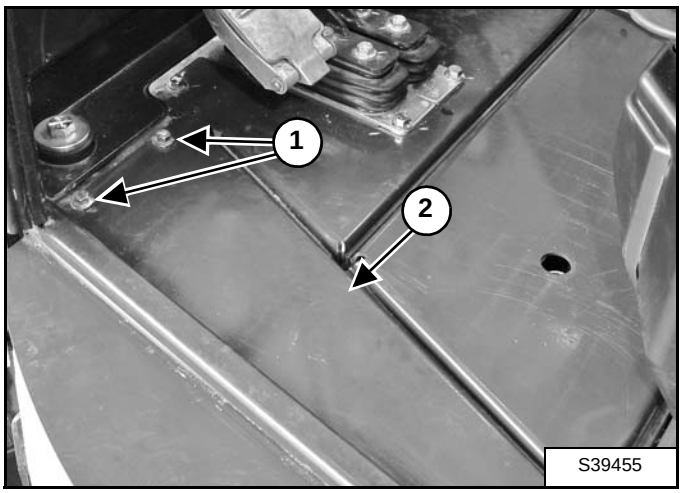
Remove the floor mat. (See Removal And Installation on Page 40-110-1.)

Figure 50-70-1



Remove the screw (Item 1) **[Figure 50-70-1]**.

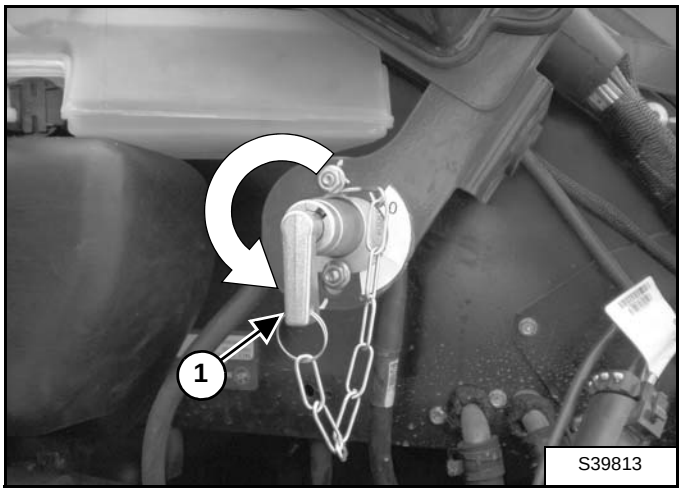
Figure 50-70-2



Remove the two bolts (Item 1) **[Figure 50-70-2]**.

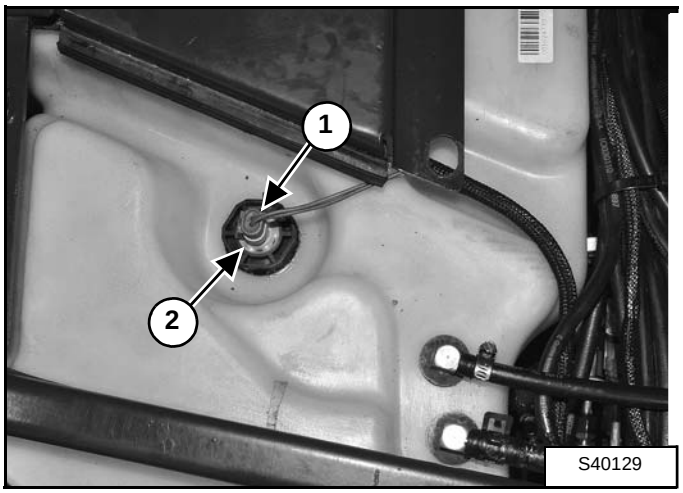
Remove the upperstructure cover (Item 2) **[Figure 50-70-2]**.

Figure 50-70-3



Rotate the battery disconnect switch (Item 1) **[Figure 50-70-3]** counterclockwise to disconnect the ground terminal from the battery.

Figure 50-70-4



Disconnect the harness connector (Item 1) **[Figure 50-70-4]** from the fuel sender.

Remove the fuel sender (Item 2) **[Figure 50-70-4]**. The sender threads into the tank, use a wrench to remove the sender.

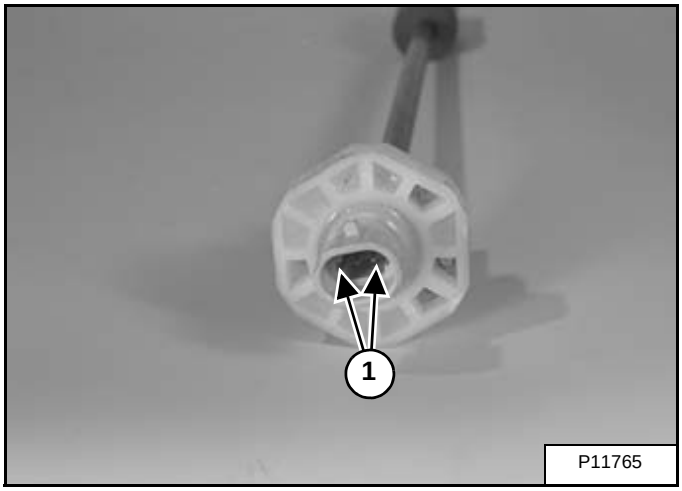
Installation: Tighten the fuel sender to 7 N•m (5 ft-lb) torque.

FUEL LEVEL SENDER (CONT'D)

Testing

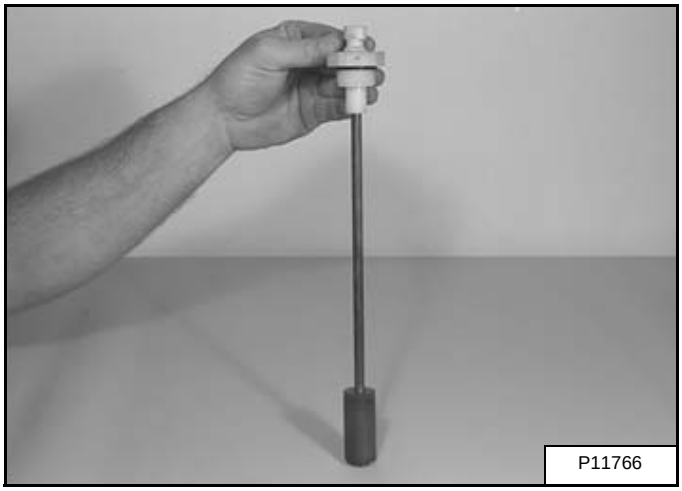
Use an ohmmeter to check the resistance of the fuel sender.

Figure 50-70-5



Insert one of the ohm tester leads into each of the fuel sender electrical connectors (Item 1) **[Figure 50-70-5]** in the end of the fuel sender.

Figure 50-70-6

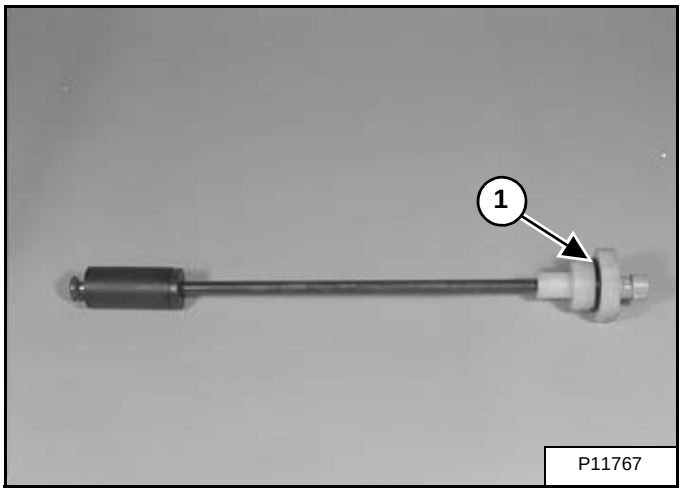


With the fuel sender in the position shown **[Figure 50-70-6]**, read the ohm in the empty position. Slide the float upwards and the ohm reading will decrease. See resistance chart below.

The resistance should read as follows:

FULL: 33 ohm
HALF: 142 ohm
EMPTY: 241 ohm

Figure 50-70-7



Inspect the O-ring (Item 1) **[Figure 50-70-7]** and replace as needed.

DIAGNOSTIC SERVICE CODES (S/N AB8B11001 - AB8B11999)

Service Codes List

CODE		CODE	
C0216	Hydraulic / hydrostatic filter not connected	C2102	Glow plugs error ON
C0217	Hydraulic / hydrostatic filter plugged	C2103	Glow plugs error OFF
C0309	Battery voltage low	C2202	Starter error ON
C0310	Battery voltage high	C2203	Starter error OFF
C0311	Battery voltage extremely high		
C0314	Battery voltage extremely low	C2305	Offset base solenoid short to battery
C0315	Battery voltage shutdown level	C2306	Offset base solenoid short to ground
C0322	Battery voltage out of range low	C2307	Offset base solenoid open circuit
C0414	Oil pressure extremely low	C2405	Offset rod solenoid short to battery
C0415	Oil pressure shutdown level	C2406	Offset rod solenoid short to ground
		C2407	Offset rod solenoid open circuit
C0610	Engine speed high		
C0611	Engine speed extremely high	C2505	Offset return short to battery
C0613	Engine speed no signal	C2506	Offset return short to ground
C0615	Engine speed shutdown level	C2507	Offset return open circuit
C0618	Engine speed out of range high		
		C2605	Auxiliary base solenoid short to battery
C0710	Hydraulic fluid temperature high	C2606	Auxiliary base solenoid short to ground
C0711	Hydraulic fluid temperature extremely high	C2607	Auxiliary base solenoid open circuit
C0715	Hydraulic fluid temperature shutdown level		
C0721	Hydraulic fluid temperature out of range high	C2705	Auxiliary rod solenoid short to battery
C0722	Hydraulic fluid temperature out of range low	C2706	Auxiliary rod solenoid short to ground
		C2707	Auxiliary rod solenoid open circuit
C0810	Engine coolant temperature high		
C0811	Engine coolant temperature extremely high	C2805	Hydraulic exchange error ON
C0815	Engine coolant temperature shutdown level	C2806	Hydraulic exchange error OFF
C0821	Engine coolant temperature out of range high		
C0822	Engine coolant temperature out of range low	C3028	Controller memory failure (Log only)
C0921	Fuel level out of range high	C3128	Interrupted power failure (Log only)
C0922	Fuel level out of range low		
		C3323	Main controller not programmed
C1221	Front auxiliary control out of range high		
C1222	Front auxiliary control out of range low	C3397	Main controller programmed (Log only)
C1223	Front auxiliary control not in neutral		
		C4321	Load sense pressure out of range high
C1305	Fuel shutoff hold solenoid short to battery	C4322	Load sense pressure out of range low
C1306	Fuel shutoff hold solenoid short to ground		
C1307	Fuel shutoff hold solenoid open circuit	C4516	Throttle controller not connected
C1402	Fuel pull solenoid short error on	C6021	Offset controller out of range high
C1403	Fuel pull solenoid short error off	C6022	Offset controller out of range low
		C6023	Offset controller not in neutral
C2005	Two speed solenoid error ON		
C2006	Two speed solenoid error OFF	C6204	Load moment in error

DIAGNOSTICS SERVICE CODE (S/N ACRA11001 - ACRA12177) (CONT'D)

Service Codes List (Cont'd)

CODE		CODE	
C6305	Console sensor short to battery	E0105	Throttle actuator short to battery
C6306	Console sensor short to ground	E0106	Throttle actuator short to ground
		E0107	Throttle actuator open circuit
C6405	Switched power relay short to battery		
C6406	Switched power relay short to ground	E0123	Throttle actuator not calibrated
C6407	Switched power relay open circuit		
		E0321	5 volt supply out of range high
C6505	Work group lockout short to battery	E0322	5 volt supply out of range low
C6506	Work group lockout short to ground		
C6507	Work group lockout open circuit	E0421	Throttle sensor out of range high
		E0422	Throttle sensor out of range low
		E0521	Throttle actuator feedback out of range high
		E0522	Throttle actuator feedback out of range low
		E3128	Interrupted power failure (Log only)
		E3297	Main controller programmed (Log only)

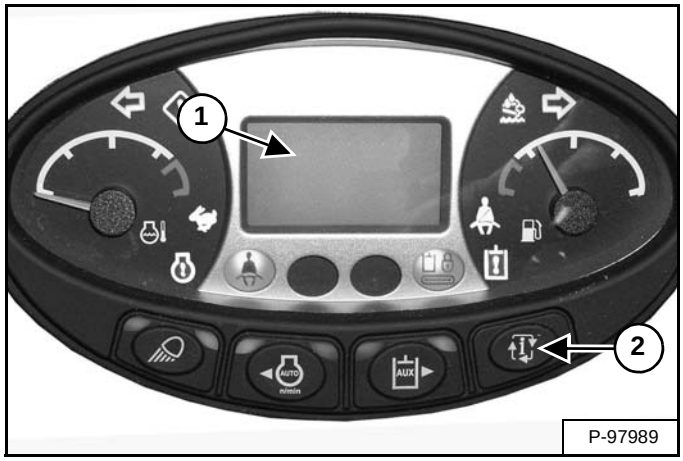
DIAGNOSTIC SERVICE CODES (S/N AB8B12001 & ABOVE)

Viewing Service Codes

The Service Codes will aid your dealer in diagnosing conditions that can damage your machine.

Standard Instrument Panel

Figure50-81-1



Press the Information button (Item 2) to cycle the data display (Item 1) **[Figure50-81-1]** until the service code screen is displayed. If more than one service code is present, the codes will scroll on the data display.

When no service code is present, **[NONE]** is displayed **[Figure50-81-1]**.

NOTE: Corroded or loose earth can cause multiple service codes and / or abnormal symptoms. All instrument panel lights flashing, alarm sounding, headlights and taillights flashing, can indicate a bad earth. The same symptoms can apply if the voltage is low, such as loose or corroded battery cables. If you observe these symptoms, check earths and positive leads first.

Deluxe Instrument Panel

The last 40 codes stored in history can also be viewed using the Deluxe Instrument Panel.

	Press a scroll button (Item 1) repeatedly until the Active Warnings screen icon (Inset) is highlighted.
	The ACTIVE WARNINGS screen displays active service codes. Press **[9]** to view the next service code if more than one is present. Press **[4]** to display a history of service codes.
	The WARNINGS HISTORY screen will lis the Service Code Numbe **(CODE)**, Hourmete reading when the erro occurred **(HOUR)**, and the User **(USER)** who was logged in to operate the machine when the erro occurred.
Press **[9]** to view the next eight service codes. A total of 40 codes can be stored. When more than 40 codes occur, the oldest code will disappear and the newest code will be in the number 1 position.	
	Press the list number next to the service code for more detail. Press the left scroll button to back up one screen.

DIAGNOSTIC SERVICE CODES (S/N AB8B12001 & ABOVE) (CONT'D)

Number Codes List

CODE		CODE	
E0105	Throttle actuator short to battery	M0710	Hydraulic Oil Temperature High
E0106	Throttle actuator short to ground	M0711	Hydraulic Oil Temperature Extremely High
E0107	Throttle actuator open circuit	M0715	Hydraulic Oil Temperature Shutdown
		M0721	Hydraulic Oil Temperature Out of Range High
E0123	Throttle actuator not calibrated	M0722	Hydraulic Oil Temperature Out of Range Low
E0321	5 volt supply out of range high	M0810	Engine Coolant Temperature High
E0322	5 volt supply out of range low	M0811	Engine Coolant Temperature Extremely High
		M0815	Engine Coolant Temperature Shutdown
E0421	Throttle sensor out of range high		
E0422	Throttle sensor out of range low	M0909	Fuel Level Low
		M0921	Fuel Level Out of Range High
E0421	Throttle actuator feedback out of range high	M0922	Fuel Level Out of Range Low
E0422	Throttle actuator feedback out of range low		
		M1121	Console Sensor Out of Range High
E3128	Interrupted power failure log only	M1122	Console Sensor Out of Range Low
		M1128	Console Sensor Failure
E3297	Controller programmed log only		
		M1705	Hydraulics Enable Solenoid Short to Battery
		M1706	Hydraulics Enable Solenoid Short to Ground
L0102	Lights Button Error On	M1707	Hydraulics Enable Solenoid Open Circuit
L0202	High Flow Button Error On	M1732	Hydraulics Enable Solenoid Overcurrent
L0302	Auxiliary Button Error On		
L0402	Information Button Error On	M2005	Two Speed Solenoid Short to Battery
		M2006	Two Speed Solenoid Short to Ground
L7404	Gateway Controller No Communication	M2007	Two Speed Solenoid Open Circuit
L7672	Display Panel programming Error		
		M2202	Starter Output Error On
M0116	Air Filter Not Connected	M2203	Starter Output Error Off
M0117	Air Filter Not Connected	M2207	Starter Output Open Circuit
		M2228	Starter Output Failure
M0216	Hydraulic Filter Not Connected		
M0217	Hydraulic Filter Plugged	M2302	Starter Relay Error On
		M2303	Starter Relay Error Off
M0309	Battery Voltage Low		
M0310	Battery Voltage High	M2521	Load Sense Sensor Out of Range High
M0311	Battery Voltage Extremely High	M2522	Load Sense Sensor Out of Range Low
M0314	Battery Voltage Extremely Low		
M0322	Battery Voltage Out of Range Low	M2721	Throttle Sensor Out of Range High
		M2722	Throttle Sensor Out of Range Low
M0610	Engine Speed High		
M0611	Engine Speed Extremely High	M3128	Interrupted Power Failure
M0613	Engine Speed No Signal		
M0615	Engine Speed Shutdown	M3304	Deluxe Panel No Communication
M0618	Engine Speed Out of Range		
M0634	Engine Speed Invalid Data from ECU		

DIAGNOSTICS SERVICE CODE (S/N AB8B12001 & ABOVE) (CONT'D)

Number Codes List (Cont'd)

CODE		CODE	
M3702	Hyd Exchange Output Error On	M6204	Load Moment Sensor In Error
M3703	Hyd Exchange Output Error Off		
		M6402	Switched Power Relay Error On
M4109	Alternator Low		
M4110	Alternator High	M6702	HVAC Output Error On
		M6703	HVAC Output Error Off
M4304	Keyless Start Panel No Communication		
		M7002	Switched Power Output Error On
M4404	Secondary Controller No Communication	M7003	Switched Power Output Error Off
		M7007	Switched Power Output Open Circuit
M4621	5V Sensor Supply Out of Range High	M7028	Switched Power Output Failure
M4622	5V Sensor Supply Out of Range Low		
M4721	8V Sensor Supply Out of Range High	M7423	Main Controller Not Programmed
M4722	8V Sensor Supply Out of Range Low	M7497	Main Controller Software Updated
M5002	Light Output Error On	M7604	Standard Display Panel No Communication
M5003	Light Output Error Off		
		M7748	Key Switch Multiple
M5205	Offset Base Solenoid Short to Battery		
M5206	Offset Base Solenoid Short to Ground	M7839	Hourmeter Changed
M5207	Offset Base Solenoid Open Circuit		
M5232	Offset Base Solenoid Overcurrent		
M5305	Offset Rod Solenoid Error On		
M5306	Offset Rod Solenoid Short to Ground	R7404	No Communication To Main Controller
M5307	Offset Rod Solenoid Open Circuit		
M5332	Offset Rod Solenoid Overcurrent		
M5421	Offset Control Switch Out of Range High		
M5422	Offset Control Switch Out of Range Low		
M5505	Auxiliary Base Solenoid Short to Battery		
M5506	Auxiliary Base Solenoid Short to Ground		
M5507	Auxiliary Base Solenoid Open Circuit		
M5532	Auxiliary Base Solenoid Overcurrent		
M5605	Auxiliary Rod Solenoid Short to Battery		
M5606	Auxiliary Rod Solenoid Short to Ground		
M5607	Auxiliary Rod Solenoid Open Circuit		
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		


Bobcat®

DELUXE INSTRUMENT PANEL SETUP (S/N AB8B11001 - AB8B11999)

Passwords

All new machines with Deluxe Instrumentation arrive at Bobcat Dealerships with the panel in locked mode. This means that a password must be used to start the engine.

For security purposes, your dealer can 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 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 display screen. If the password was entered correctly, there will be one long beep.

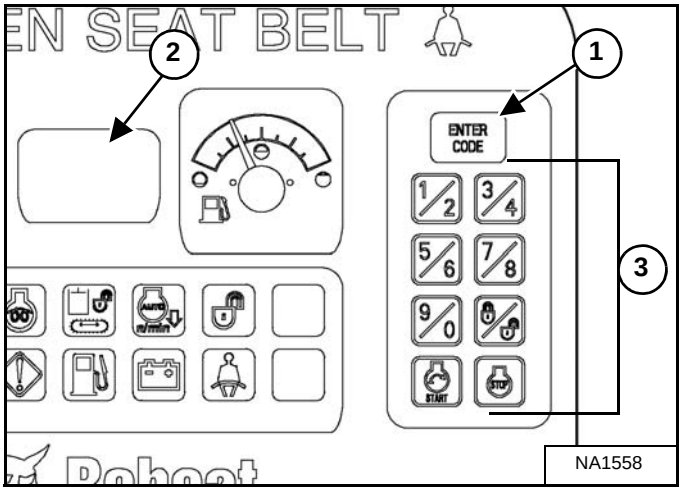
NOTE: If the password was incorrect there will be three short beeps and "ERROR" will appear on the display screen. Press the ENTER CODE button again and start over. After three failed attempts, you must wait three minutes to try again.

You are now ready to start and operate the machine.

If you will be changing passwords, do not start the engine. (See Changing The Operator Password on Page 50-90-1.)

Changing The Operator Password

Figure 50-90-1



Perform Password Entry at left, but do not start th engine.

Press and hold the ENTER CODE button (Item 1) fo three seconds. CodE 1 will appear on the display scree (Item 2) **[Figure 50-90-1]**.

Press the ENTER CODE button until the desired Cod (**CodE 0, CodE 1, CodE 2, CodE 3**) appears. CodE 0 i Owner Password. The other codes are Operato passwords. You now have 40 seconds to use the keypa (Item 3) **[Figure 50-90-1]** to enter each digit of a new fou 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 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 display screen will return to HOURMETER function.

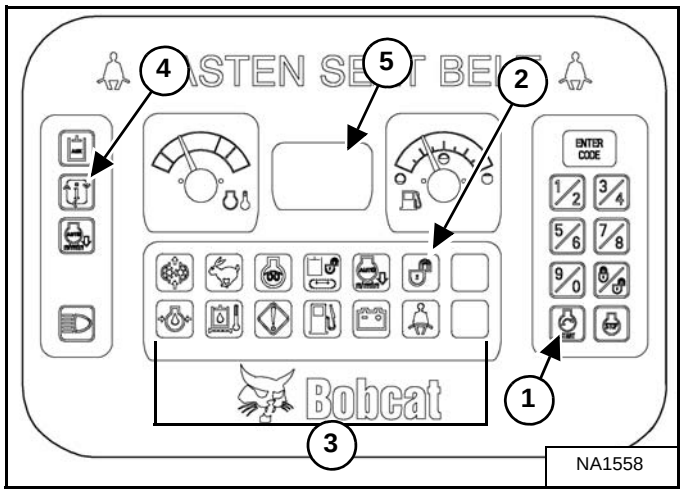
DELUXE INSTRUMENT PANEL SETUP (S/N AB8B11001 - AB8B11999) (CONT'D)

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). (See Password Entry (For Starting And Operating The Machine) on Page 50-90-1.)

Figure 50-90-2



Press the Lock / Unlock button (Item 1) **[Figure 50-90-2]**. The display screen will continuously alternate from **UnLoc** to **CodE** for 1 second periods.

Perform Password Entry again.

UnLoc will appear in the 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 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 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 HOURS / JOB / RPM button again or pressing the START button will return the display screen to HOURMETER function.

RPM

The 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 display screen (Item 5) **[Figure 50-90-2]**.

Engine rpm is now displayed in the display screen.

Press the information button (Item 4) **[Figure 50-90-2]** again the return to HOURMETER function.

CONTROL PANEL SETUP (S/N AB8B12001 & ABOVE)

Panel Setup (Deluxe Instrument Panel)

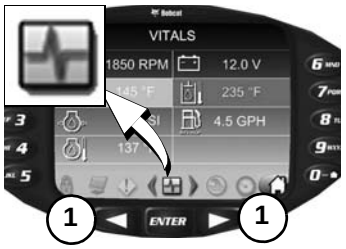
Icon Identification

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 t set your own preferences for operating / monitoring you Bobcat excavator.

CONTROL PANEL SETUP (S/N AB8B12001 & 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.

Panel Setup (Deluxe Instrument Panel) (Cont'd)

Auto Idle Time Delay

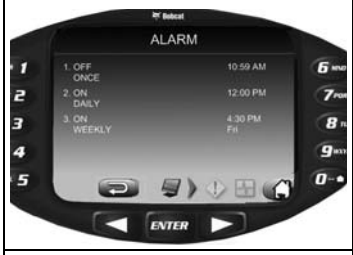
	Press a scroll button (Item 1) repeatedly until the Security screen icon (Inset) is highlighted.
	Select **[3. MACHINE PERFORMANCE]**.
	Select **[1. AUTO IDLE DELAY TIME]**.
	Use the keypad to enter the desired delay time between 4 and 250 seconds. Press **[ENTER]** to save and continue. Press left scroll 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.

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.

CONTROL PANEL SETUP (S/N AB8B12001 & 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

CONTROL PANEL SETUP (S/N AB8B12001 & 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.

CONTROL PANEL SETUP (S/N AB8B12001 & 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:

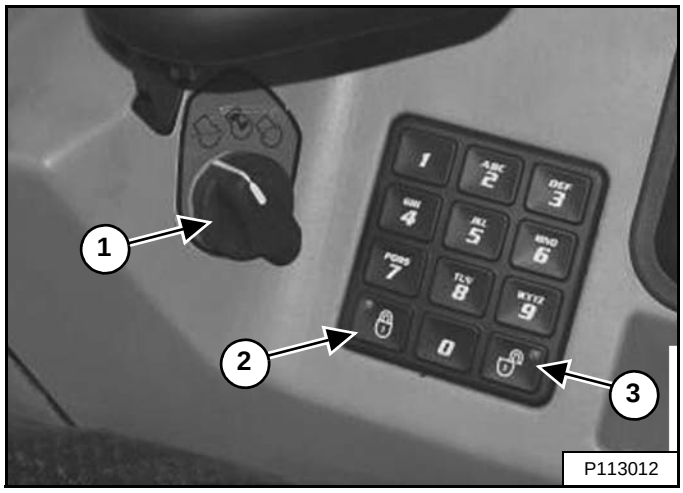
Allows for full use of the excavator. Must be used to change the owner password.

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.

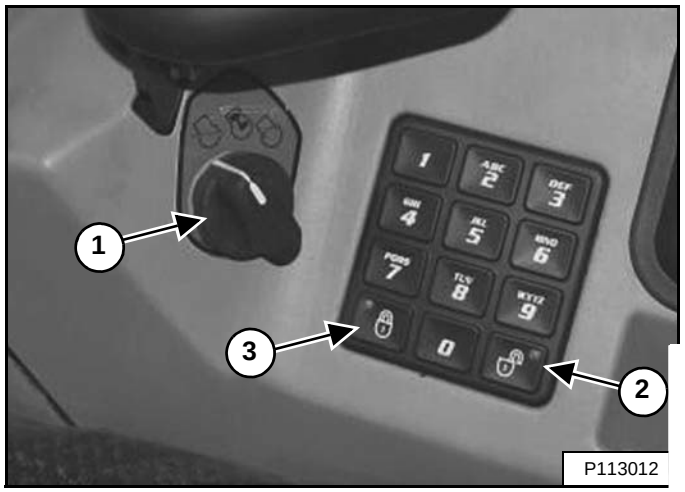
Password Lockout Feature

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 numbe 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.

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:

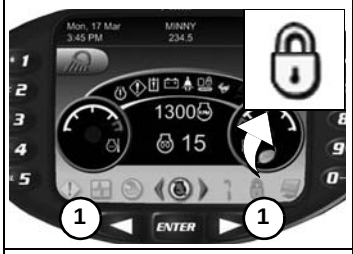
Allows for full use of the excavator and to set up the Deluxe Instrument Panel. There is only one owner password. The owner password must be used to change the owner or user passwords. Owner should change the password as soon as possible for security of the excavator.

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 Password on Page 50-91-9.)

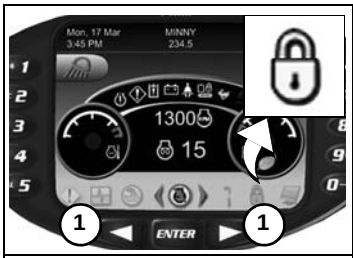
Changing The Owner Password

	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.

CONTROL PANEL SETUP (S/N AB8B12001 & ABOVE) (CONT'D)

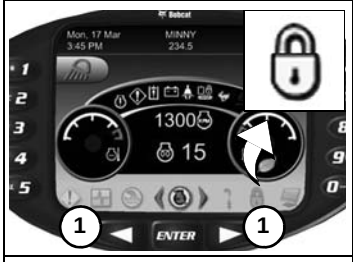
Password Setup (Deluxe Instrument Panel) (Cont'd)

Changing The User 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 user.
	Select **[2. CHANGE PASSWORD]**.
	Enter new user password and press **[ENTER]**.

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.

CONTROL PANEL SETUP (S/N AB8B12001 & ABOVE) (CONT'D)

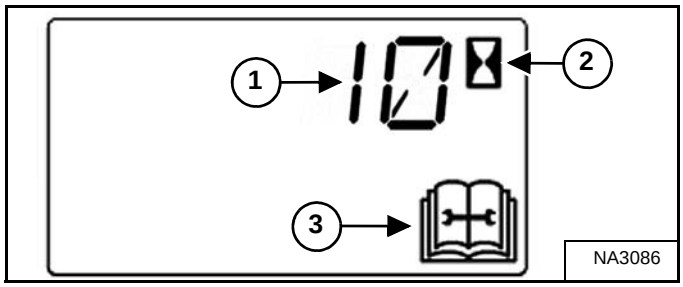
Maintenance Clock

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.

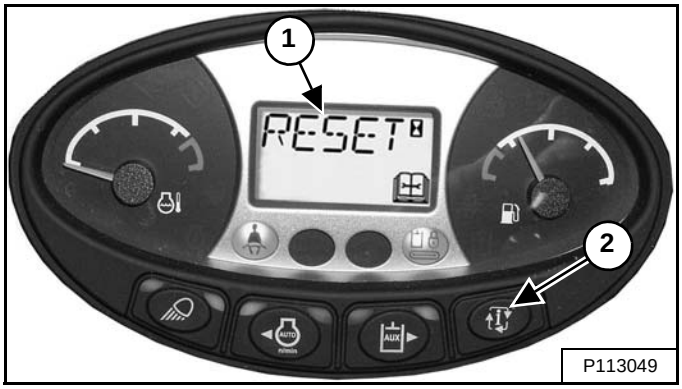
The display will revert to the previous display and will appear for 5 seconds every time the machine is started until the maintenance clock is reset.

Setup

See your Bobcat dealer about installation of this feature.

Reset

Figure 50-91-5

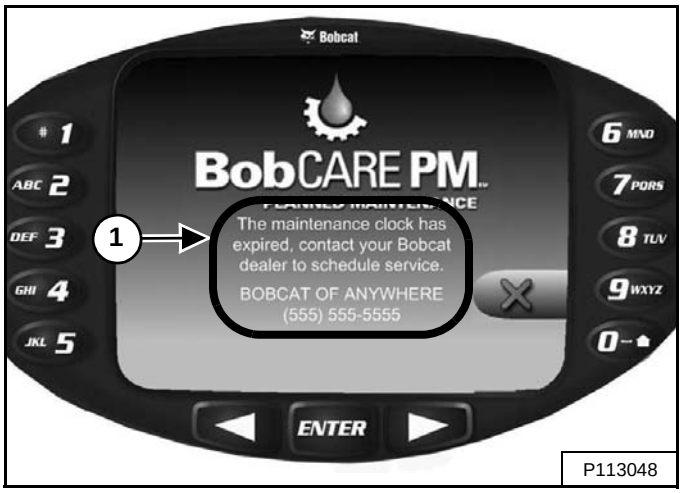


Press the Information button (Item 2) **[Figure 50-91-5]** until the display screen shows the maintenance clock.

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

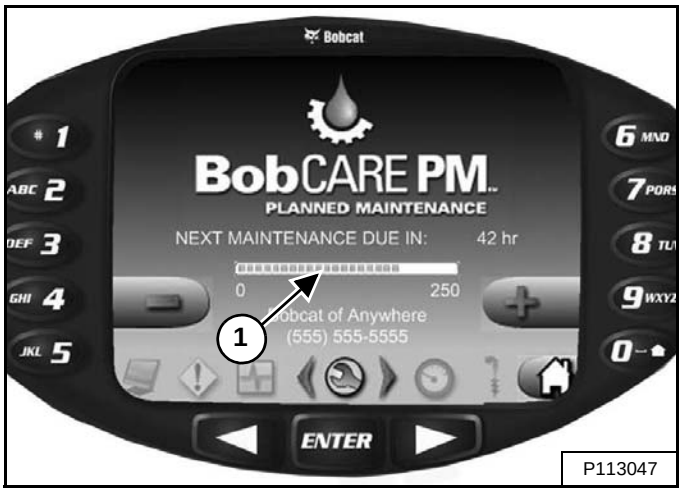


The Deluxe Instrument Panel (if equipped) will display a message (Item 1) **[Figure 50-91-6]** alerting the operator to service the machine.

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.

Maintenance Clock (Cont'd)

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]**.

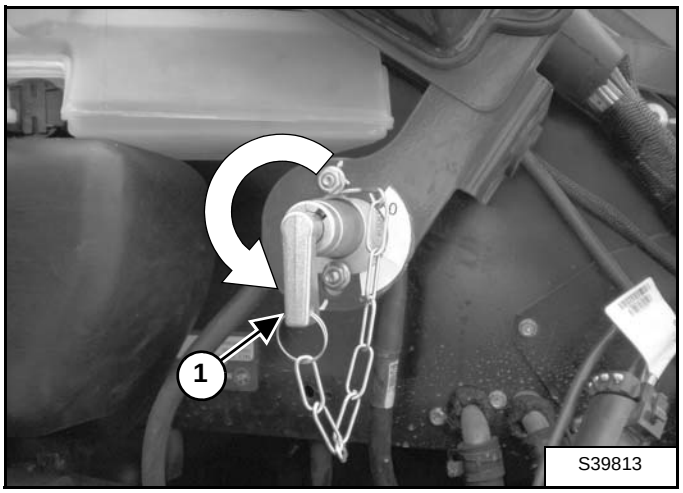

Bobcat®

INSTRUMENT PANEL / CONTROLLER (S/N AB8B11001 - AB8B11999)

Removal And Installation

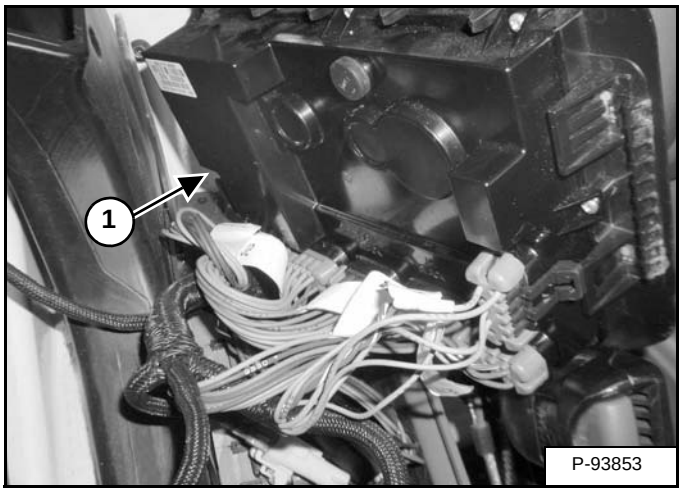
Remove the console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 50-100-1



Rotate the battery disconnect switch (Item 1) **[Figure 50-100-1]** counterclockwise to disconnect the ground terminal from the battery.

Figure 50-100-2



Mark and disconnect the wire harness from the controller (Item 1) **[Figure 50-100-2]**.

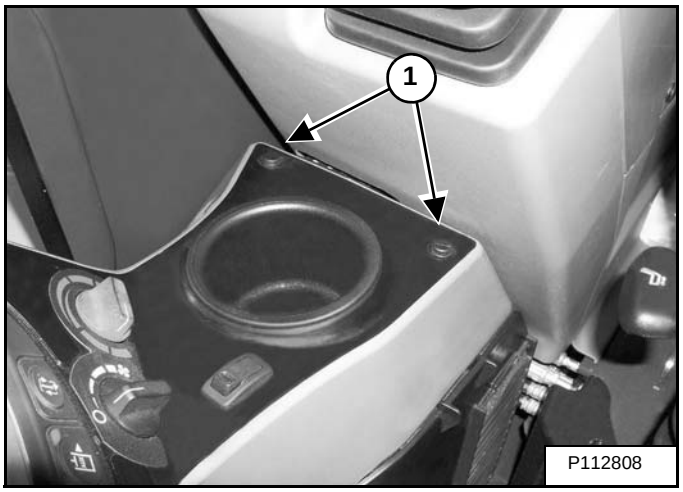
Remove the controller.


Bobcat®

INSTRUMENT PANEL (S/N AB8B12001 & ABOVE)

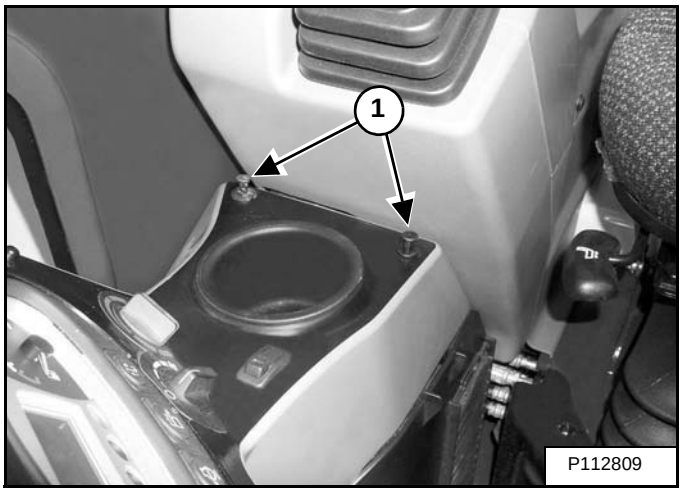
Removal And Installation

Figure 50-101-1



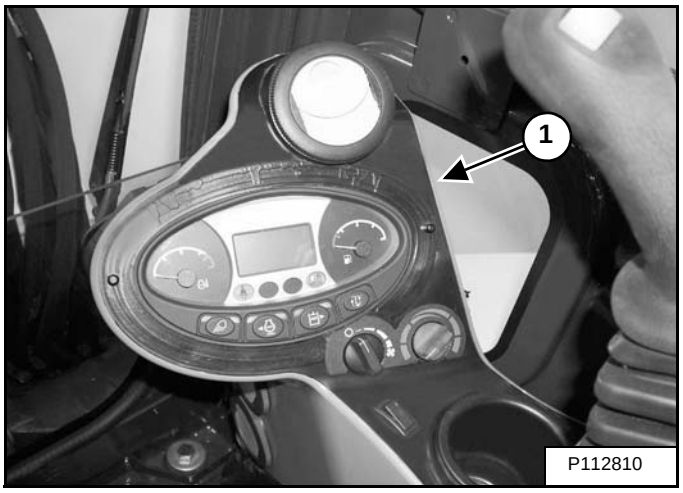
Pull up on the center pin (Item 1) **[Figure 50-101-1]**.

Figure 50-101-2



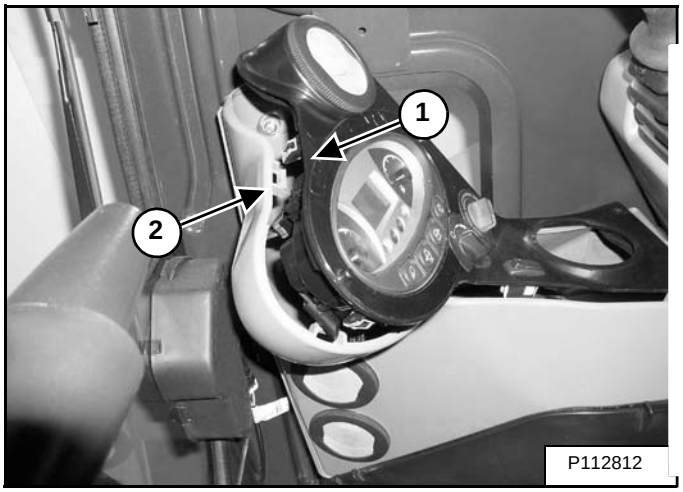
Remove the pin assembly (Item 1) **[Figure 50-101-2]**.

Figure 50-101-3



Pull up on the instrument panel (Item 1) **[Figure 50-101-3]**.

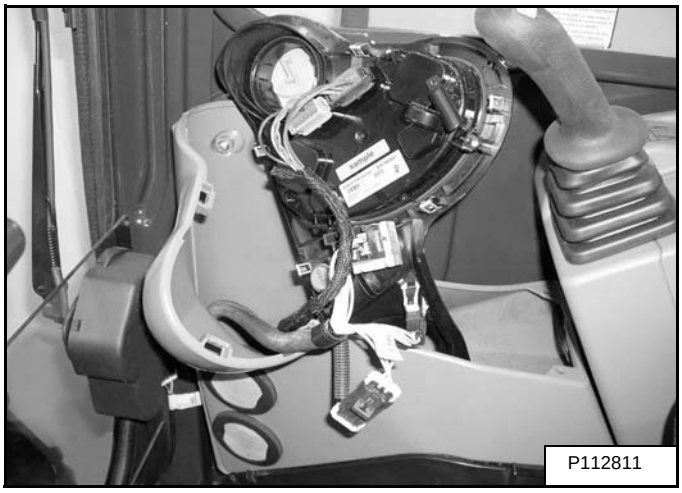
Figure 50-101-4



Installation: Install the tabs (Item 1) into the cover (Item 2) **[Figure 50-101-4]**.

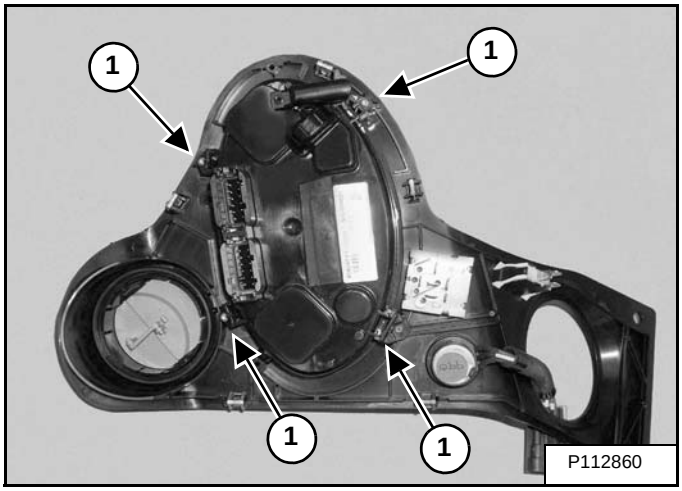
Removal And Installation (Cont'd)

Figure 50-101-5



Disconnect the wire harness from the instrument panel **[Figure 50-101-5]**.

Figure 50-101-6



Remove the screws (Item 1) **[Figure 50-101-6]** and remove the instrument panel.

CONTROLLER (S/N AB8B12001 & ABOVE) (GATEWAY AND AUXILIARY)

Description

The gateway controller is the main controller. It provides information to all other controllers.

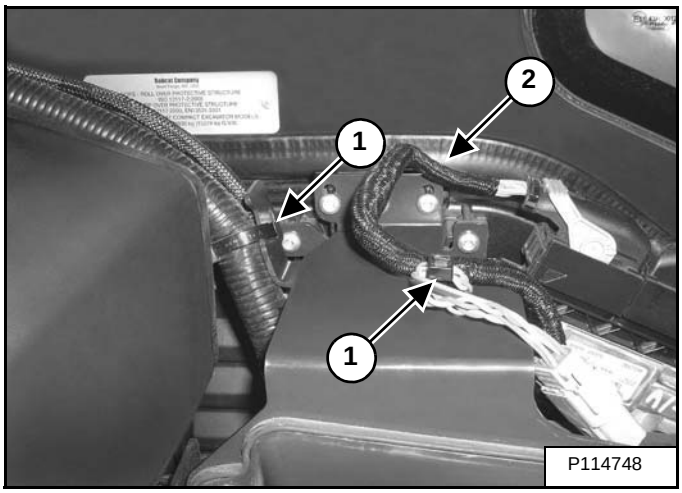
The gateway and auxiliary controllers are located under the right side cover.

CONTROLLER (S/N AB8B12001 & ABOVE) (GATEWAY AND AUXILIARY) (CONT'D)

Gateway Controller Removal And Installation

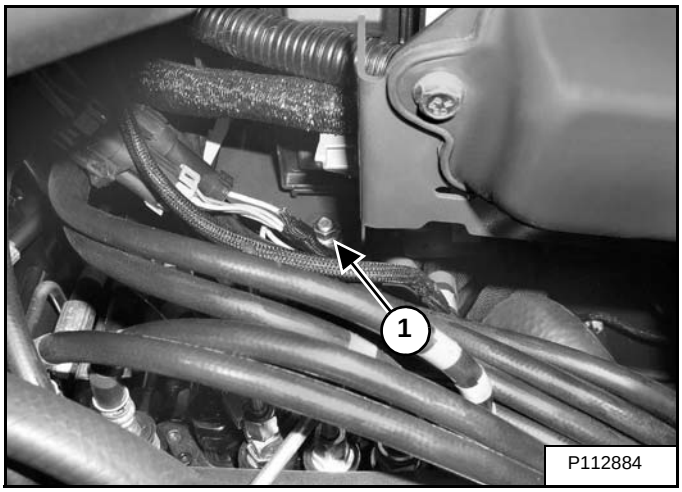
Open the right side cover. (See Opening And Closing on Page 10-60-1.)

Figure 50-102-1



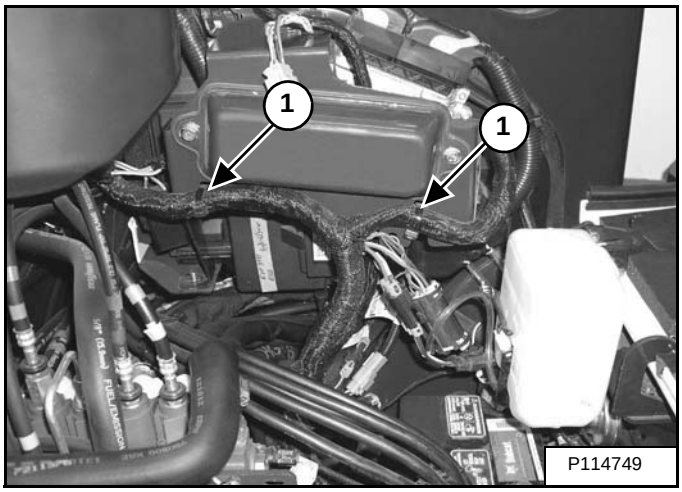
Cut and remove the cable ties (Item 1). Reposition the wire harness (Item 2) **[Figure 50-102-1]**.

Figure 50-102-2



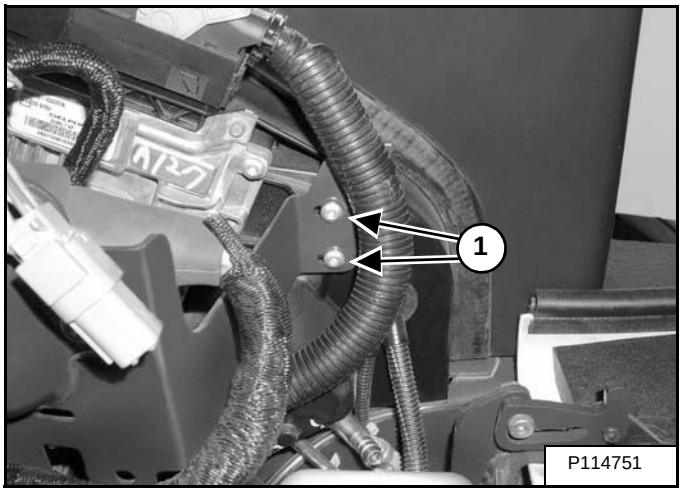
Remove the nut (Item 1) **[Figure 50-102-2]**.

Figure 50-102-3



Cut and remove the cable ties (Item 1) **[Figure 50-102-3]**.

Figure 50-102-4



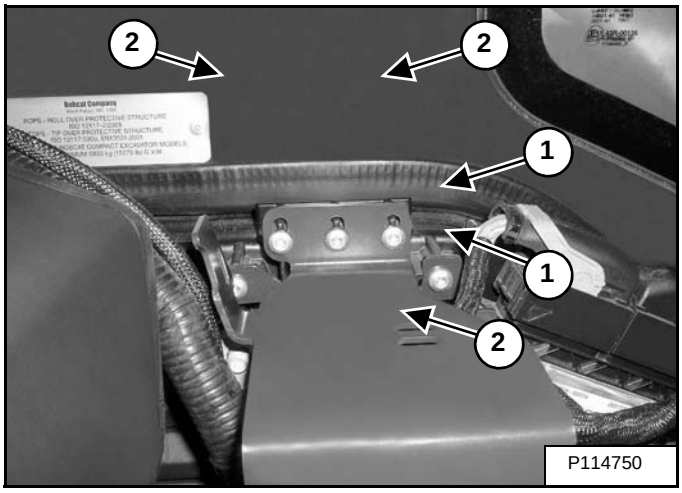
Remove the screws (Item 1) **[Figure 50-102-4]**. Reposition the fuse panel.

Installation: Tighten the screws to 7,9 N•m (5.8 ft-lb) torque.

CONTROLLER (S/N AB8B12001 & ABOVE) (GATEWAY AND AUXILIARY) (CONT'D)

Gateway Controller Removal And Installation (Cont'd)

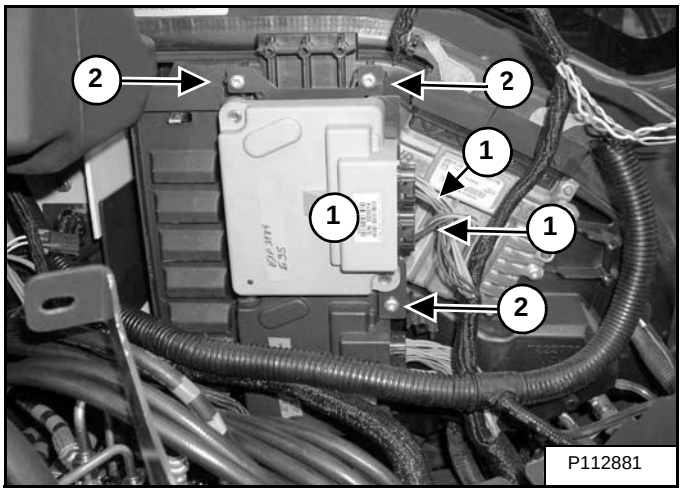
Figure 50-102-5



Remove the screws (Item 1) **[Figure 50-102-5]**. Reposition the fuse panel.

Installation: Tighten the screws to 7,9 N•m (5.8 ft-lb) torque.

Figure 50-102-6



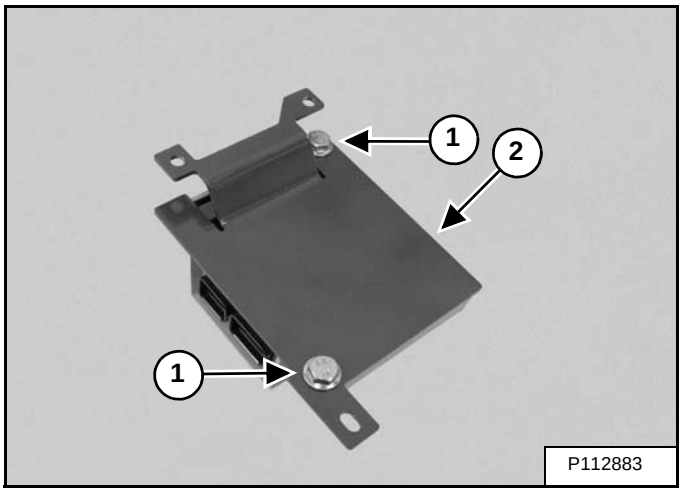
Disconnect the wire harness (Item 1) and remove the screws (Item 2) **[Figure 50-102-6]**.

Installation: Tighten the screws to 7,9 N•m (5.8 ft-lb) torque.

NOTE: The wire harness connectors are keyed and will only plug in one way.

Remove the gateway controller from the excavator.

Figure 50-102-7

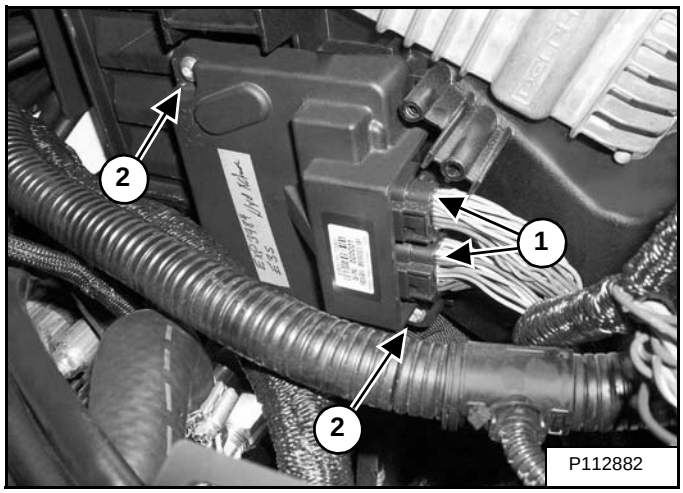


Remove the bolts (Item 1) and bracket (Item 2) **[Figure 50-102-7]**.

Auxiliary Controller Removal And Installation

Remove the gateway controller. (See Gateway Controller Removal And Installation on Page 50-102-2.)

Figure 50-102-8



Disconnect the wire harness (Item 1). Remove the bolts (Item 2) **[Figure 50-102-8]** and remove the auxiliary controller from the excavator.

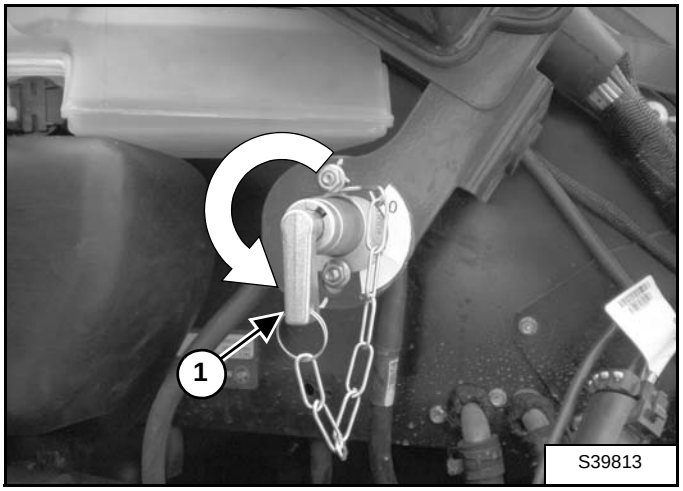
NOTE: The wire harness connectors are keyed and will only plug in one way.

KEY SWITCH

Removal And Installation

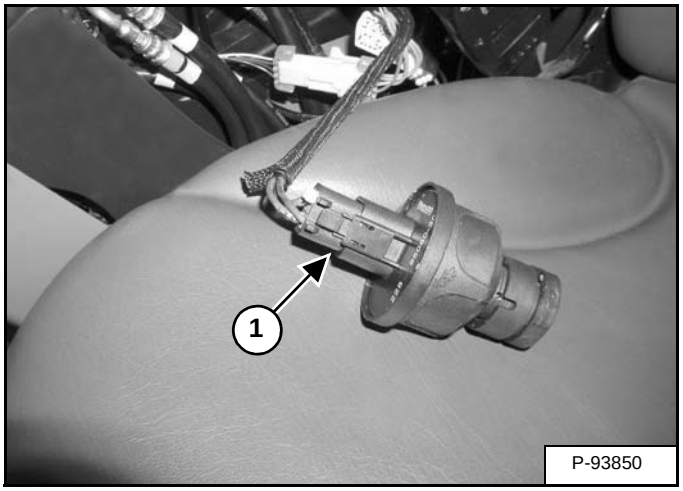
Remove the console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 50-110-1



Rotate the battery disconnect switch (Item 1) **[Figure 50-110-1]** counterclockwise to disconnect the ground terminal from the battery.

Figure 50-110-2



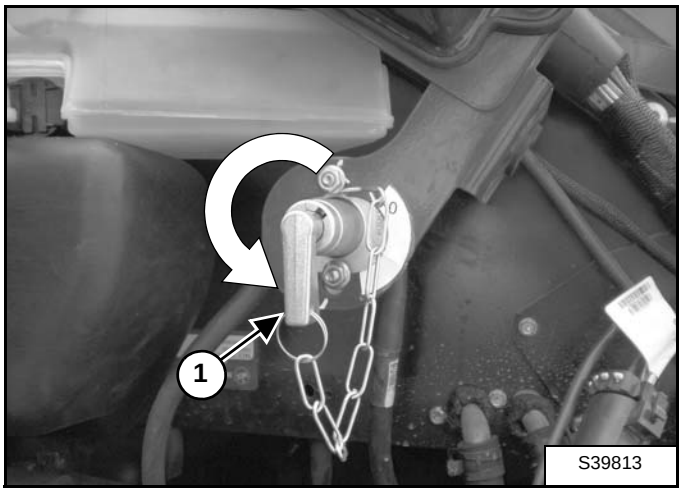
Disconnect the wire harness (Item 1) **[Figure 50-110-2]** from the switch. Remove the switch.


Bobcat®

WIPER MOTOR

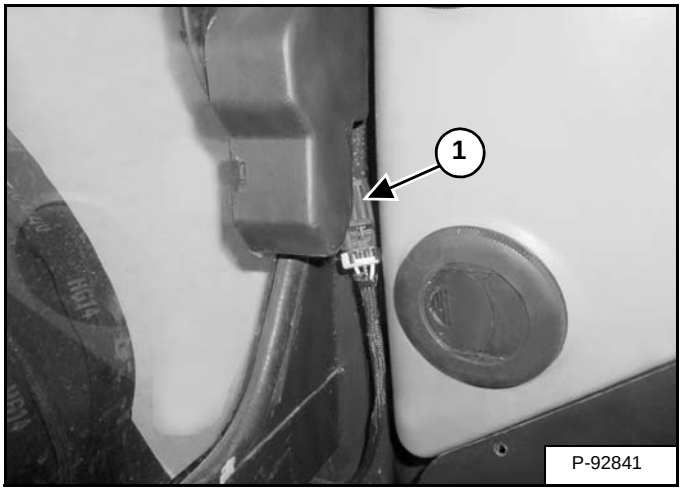
Removal And Installation

Figure 50-120-1



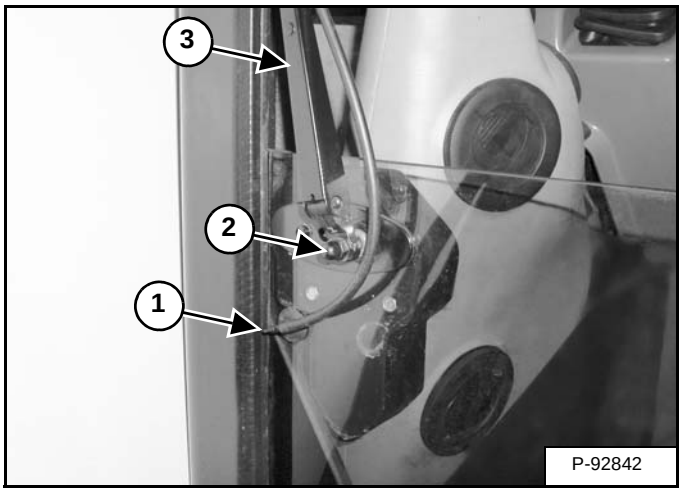
Rotate the battery disconnect switch (Item 1) **[Figure 50-120-1]** counterclockwise to disconnect the ground terminal from the battery.

Figure 50-120-2



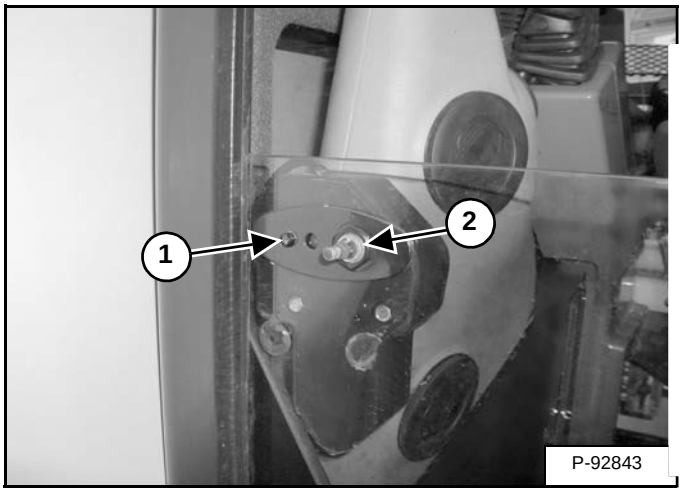
Disconnect the wire harness (Item 1) **[Figure 50-120-2]**.

Figure 50-120-3



Disconnect the washer hose (Item 1). Remove the nut (Item 2) and wiper arm (Item 3) **[Figure 50-120-3]**.

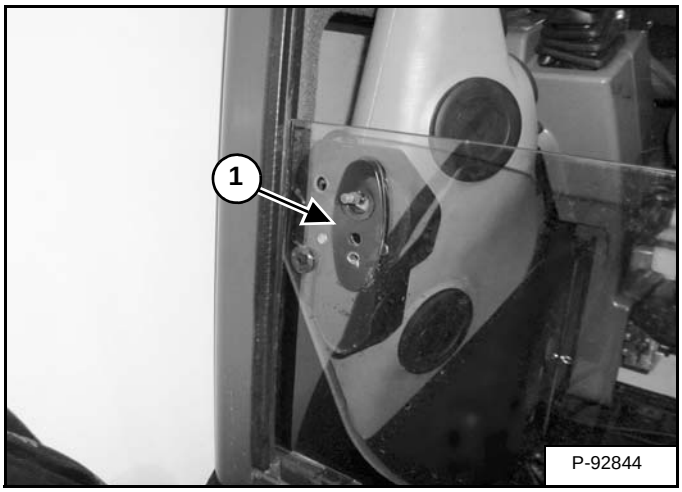
Figure 50-120-4



Remove the screw (Item 1). Remove the nut (Item 2) **[Figure 50-120-4]**.

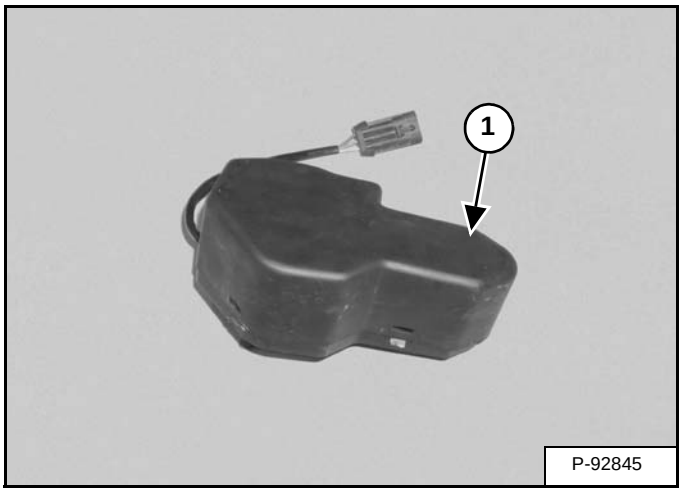
Removal And Installation (Cont'd)

Figure 50-120-5



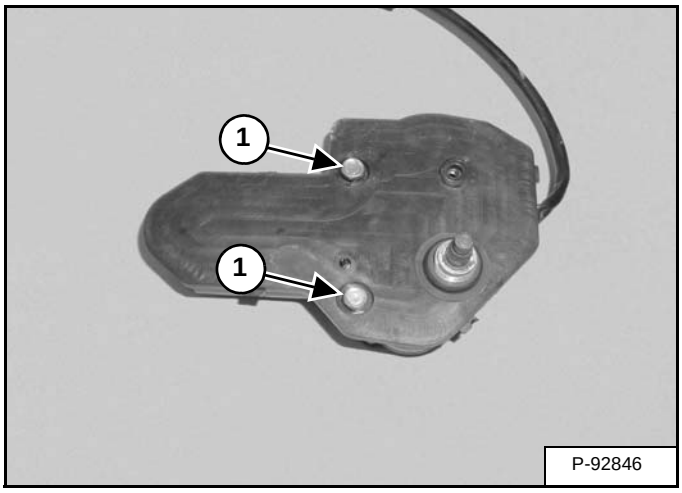
Remove the plate (Item 1) **[Figure 50-120-5]** and gasket.

Figure 50-120-6



Pry up on and remove the cover (Item 1) **[Figure 50-120-6]**.

Figure 50-120-7



Remove the bolts (Item 1) **[Figure 50-120-7]** and remove the wiper motor from the plate.

MOTION ALARM SYSTEM

Description

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

Inspecting

Figure 50-130-1

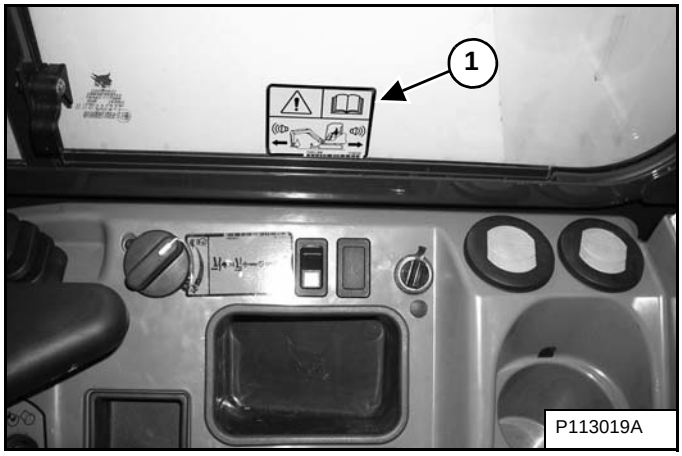
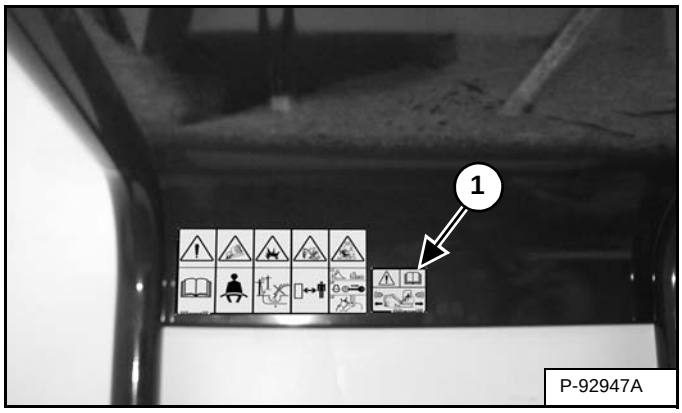


Figure 50-130-2



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

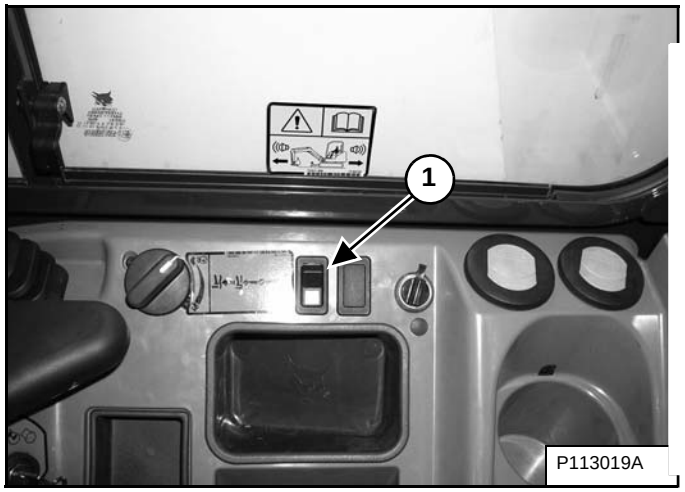
When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

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.

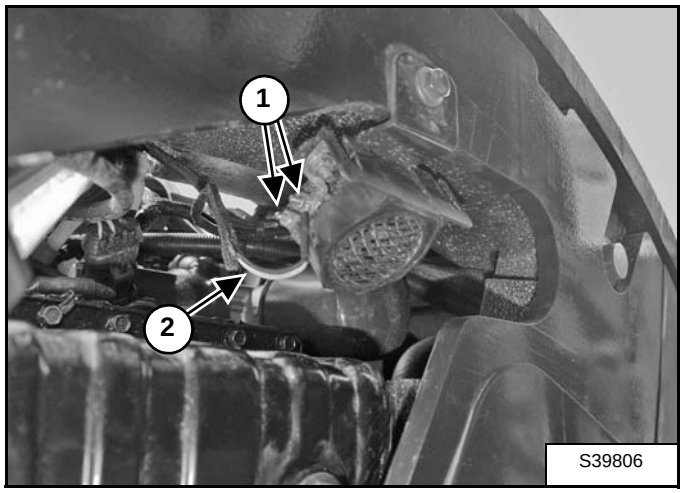
Slightly move both travel control levers in the reverse direction (until the machine is slowly moving backward) and then press the motion alarm cancel switch (Item 1) **[Figure 50-130-3]** (the switch icon will be illuminated when the motion alarm is deactivated). The motion alarm will shut off. With 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 switch to OFF position. Exit the excavator.

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), wire harness (Item 2) **[Figure 50-130-4]** and motion alarm switch (Item 2) **[Figure 50-130-6]** for tightness and damage. Repair or replace any damaged components.

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

⚠ 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

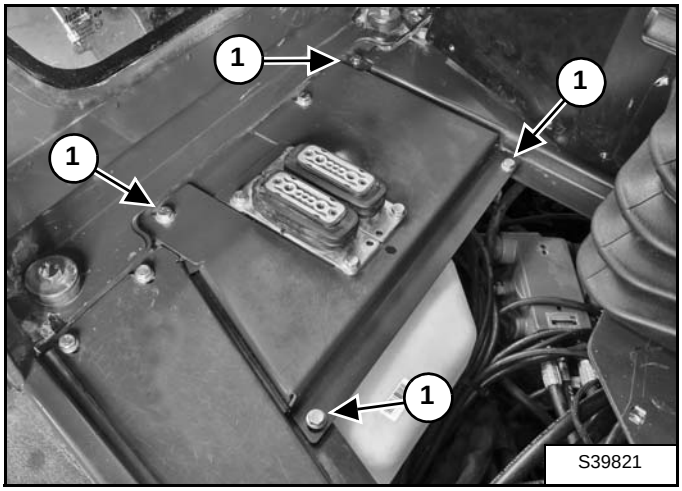
Adjusting Switch Position

The motion alarm switch (Item 2) **[Figure 50-130-6]** is located in the travel control valve located under the floorplate.

Remove the travel levers. (See Removal And Installation on Page 40-100-1.)

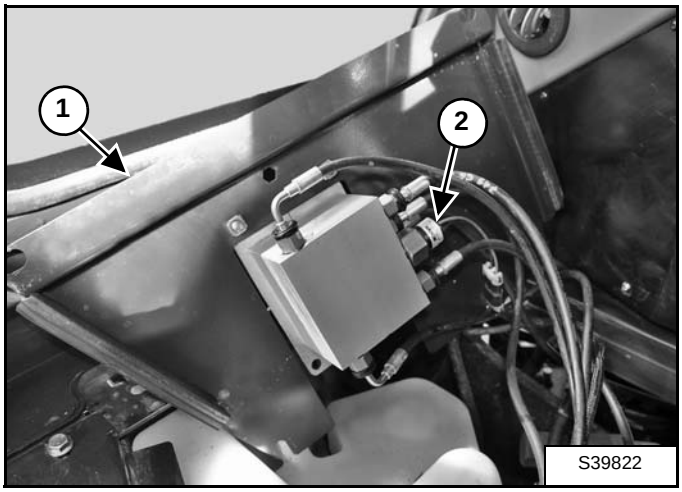
Remove the floor mat and center floorplate. (See Removal And Installation on Page 40-110-1.)

Figure 50-130-5



Remove the four bolts (Item 1) **[Figure 50-130-5]** from the front floorplate.

Figure 50-130-6



Tip the plate (Item 1) **[Figure 50-130-6]** towards the front window.

The switch (Item 2) **[Figure 50-130-6]** is non-adjustable. It must be fully installed into the travel control valve housing 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.

SERVICE PC (LAPTOP COMPUTER)

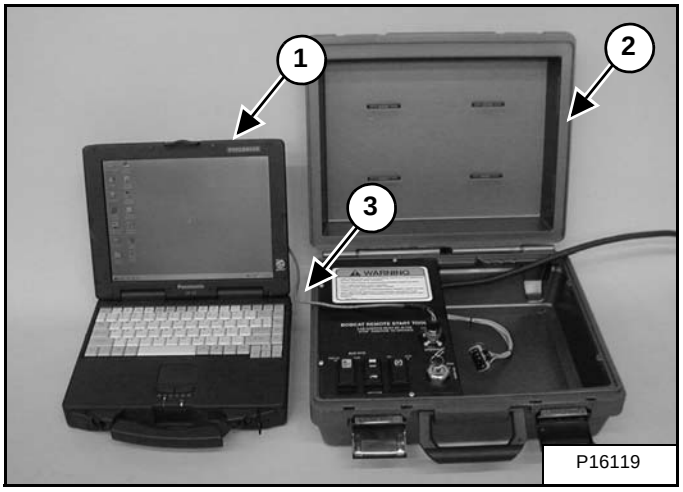
Connecting The Remote Start Tool

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 switch 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 15 feet. A serial cable longer than 15 feet 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.

NOTE: Refer to BobcatDealerNET.com for PC requirements and the latest Service Analyzer software.

Connecting Remote Start Tool (Service Tool)

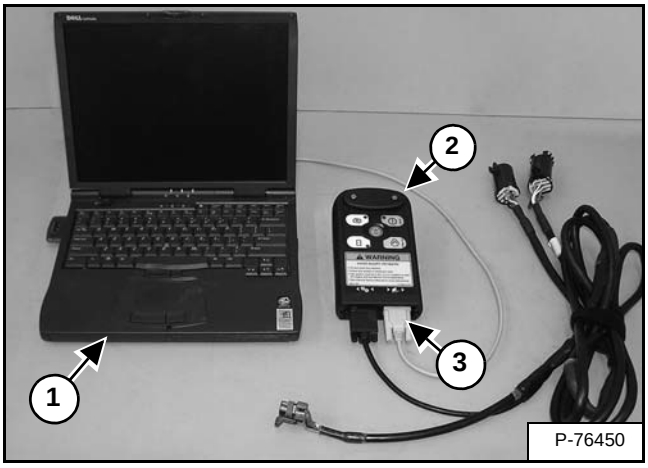
The tools listed will be needed to do the following procedure:

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

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

NOTE: Make all connections with the key switch in the OFF position.

Figure 50-140-2



When the Service PC (Item 1) and the Remote Start Too (Service Tool) (Item 2) **[Figure 50-140-2]**, are connecte to the excavator, the Service PC is used to monito 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 15 feet. A serial cable longer than 15 feet 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.

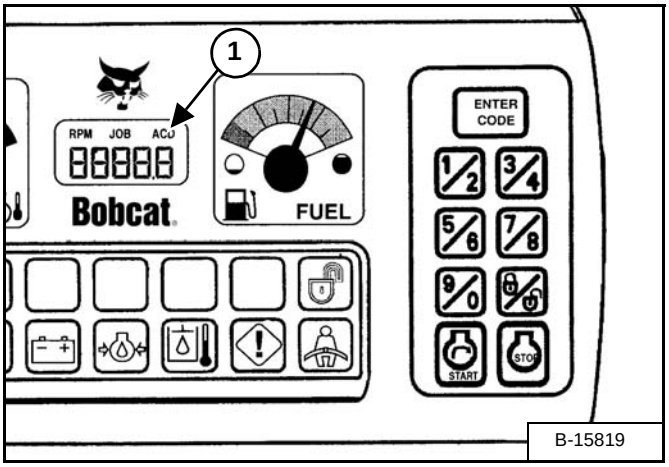
NOTE: Refer to BobcatDealerNET.com for PC requirements and the latest Service Analyzer software.

SERVICE PC (LAPTOP COMPUTER) (CONT'D)

Operation

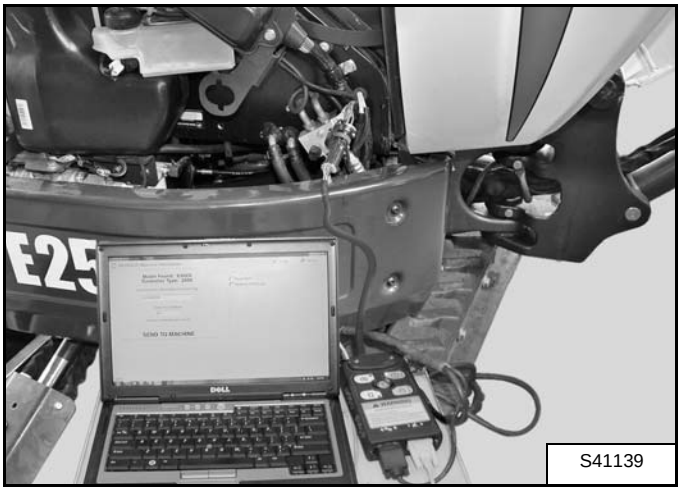
Turn the excavator key switch to the run position, or push the ENTER CODE button on the deluxe instrument panel.

Figure 50-140-3



If a new controller is locked, CODe will show in the display (Item 1) **[Figure 50-140-3]** 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]**.

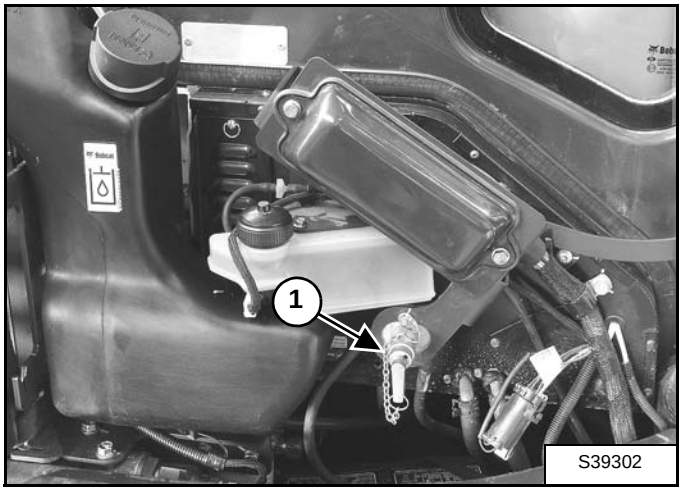
After successfully updating the new controller, change the password. (See Passwords on Page 50-90-1.)

BATTERY DISCONNECT SWITCH

Description

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

Figure 50-150-1



The battery disconnect switch (Item 1) **[Figure 50-150-1]** is located under the right side cover below the fuse panel.

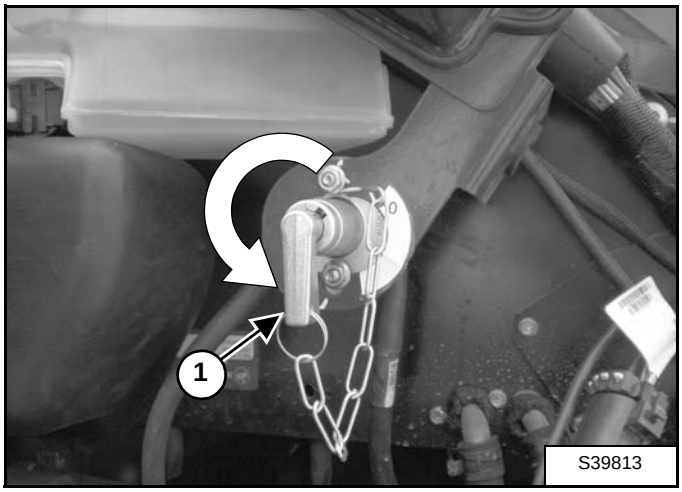
Rotate the switch (Item 1) counterclockwise to turn the switch to the OFF position, clockwise to turn to the ON position.

BATTERY DISCONNECT SWITCH (CONT'D)

Removal And Installation

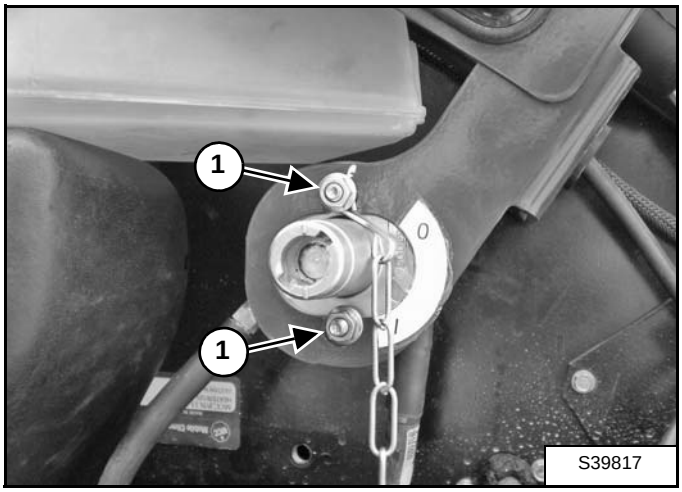
Disconnect the ground (-) cable from the battery. (See Removing And Installing The Battery on Page 50-20-2.)

Figure 50-150-2



Rotate the battery disconnect switch counterclockwise and remove the key (Item 1) **[Figure 50-150-2]**.

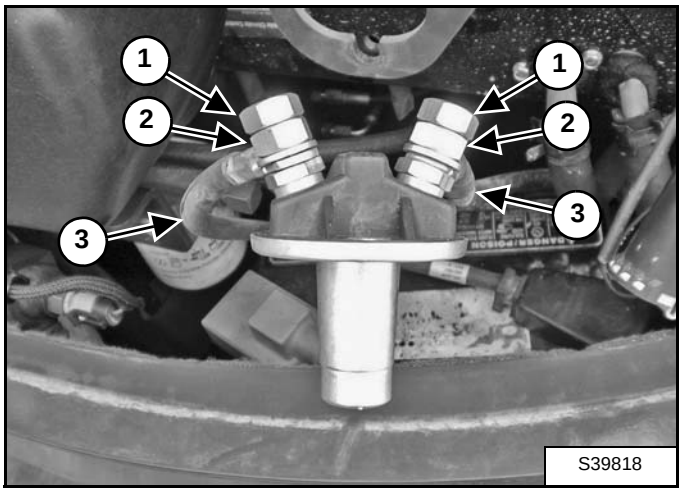
Figure 50-150-3



Remove the two nuts (Item 1) **[Figure 50-150-3]**.

Installation: Tighten the nuts to 9,6 - 14,4 N•m (85 - 127 in-lb) torque.

Figure 50-150-4



Tilt the switch down. Remove the locknut (Item 1) and nut (Item 2) from both switch terminals. Remove the cables (Item 3) **[Figure 50-150-4]** from the switch.

Installation: Tighten the nuts to 11 - 15 N•m (8.1 - 11.1 ft-lb) torque.

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ENGINE INFORMATION

Description

The E25 has a Kubota® D1105-E2B indirect injection diesel engine with a displacement of 1,123 L (68.53 in^3). The engine is rated at an SAE Gross 15,5 kW (20.8 hp) and has a closed breather system.

The engine has three cylinders and the rotation is counterclockwise (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 below the exhaust manifold, and also shown on labels fitted to 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.

Specifications

Fuel Injection Nozzles

Opening Pressure	13,73 - 14,70 MPa (137,3 - 147 bar) (1992 - 2133 psi)
Fuel Tightness Nozzle Seat	Dry Nozzle at 12,75 MPa (127,5 bar) (1849 psi)

Fuel Injection Pump

Fuel Tightness Plunger allowable limit	13,73 MPa (137,3 bar) (1991 psi)
Fuel Tightness of Delivery Valve	10 s: initial pressure drop 13,73 - 12,75 MPa (137,3 - 127,5 bar)(1991 - 1849 psi)
Allowable Limit	5 s: initial pressure drop 13,73 - 12,75 MPa (137,3 - 127,5 bar) (1991 - 1849 psi)
Maximum Bare Speed	2650 rpm
Minimum Bare Idling Speed	1225 rpm

Cylinder Head

Cylinder Head Surface Distortion	0,05 mm (0.002 in) over 100 mm (4 in) Maximum
Top Clearance (Piston to Head)	0,55 - 0,75 mm (0.022 - 0.029 in)
Compression	3,73 - 4,11 MPa (37,3 - 41,1 bar) (541 - 597 psi)
Allowable Limit	2,26 MPa (22,6 bar) (327 psi)
Allowable Difference Between Cylinders	10% or less
Head Bolt Torque	64 - 68 N•m (47 - 50 ft-lb)

Valves

Valve recessing	0,050 (protrusion) to 0,25 (recessing) mm 0.0020 (protrusion) to 0.0098 (recessing) in
Allowable limit (recessing)	0,40 mm (0.016 in)
Valve Seat Width (Intake and Exhaust)	2,12 mm (0.0835 in)
O.D. of Valve Stems	6,960 - 6,975 mm (0.2741 - 0.2746 in)
I.D. of Valve Guides	7,010 - 7,025 mm (0.2760 - 0.2765 in)
Clearance Between Valve Stem and Guide	0,035 - 0,065 mm (0.0014 - 0.0025 in)
Allowable Limit	0,10 mm (0.0039 in)
Valve Clearance (Cold)	0,145 - 0,185 mm (0.00571 - 0.00728 in)
Valve Seat Angle (Int.)	60 degrees
Valve Seat Angle (Exh.)	45 degrees

Specifications (Cont'd)

Valve Springs

Free Length	37,0 - 37,5 mm (1.46 - 1.47 in)
Allowable Limit	36,5 mm (1.44 in)
Fitted Length	31,0 mm (1.22 in)
Compress to Fitted Length	11,97 kgf (117,4 N) (26.39 lbf)
Allowable Limit	10,2 kgf (100 N) (22.48 lbf)
Inclination Allowable Limit	1,0 mm (0.039 in)

Rocker Arms

O.D. of Rocker Arm Shaft	11,973 - 11,984 mm (0.47138 - 0.47181 in)
I.D. of Rocker Arm Bushings	12,000 - 12,018 mm (0.47244 - 0.47314 in)
Clearance Between Rocker Arm and Bushing	0,016 - 0,045 mm (0.00063 - 0.0017 in)
Allowable Limit	0,10 mm (0.0039 in)

Camshaft

O.D. of Camshaft Bearing Journal	35,934 - 35,950 mm (1.4147- 1.4153 in)
I.D. of Camshaft Bearing	36,000 - 36,025 mm (1.4173 - 1.4183 in)
Oil Clearance of Camshaft Journal	0,050 - 0,091 mm (0.0020 - 0.0035 in)
Allowable Limit	0,15 mm (0.0059 in)
Side Clearance	0,070 - 0,22 mm (0.0028 - 0.0086 in)
Allowable Limit	0,30 mm (0.012 in)
Alignment Allowable Limit	0,01 mm (0.0004 in)
Cam Lobe Height (Intake)	28,80 mm (1.134 in)
(Exhaust)	29,00 mm (1.142 in)
Allowable Limit (Intake)	28,75 mm (1.132 in)
(Exhaust)	28,95 mm (1.140 in)

Specifications (Cont'd)

Tappet

Clearance Between Tappet and Guide	0,020 - 0,062 mm (0.00079 - 0.0024 in)
Allowable Limit	0,07 mm (0.003 in)
Tappet O.D.	19,959 - 19,980 mm (0.78579 - 0.78661 in)
Tappet Guide I.D.	20,000 - 20,021 mm (0.78740 - 0.78822 in)

Push Rod

Alignment	0,25 mm (0.0098 in)

Cylinders

Cylinder Bore I.D. (Standard)	78,000 - 78,019 mm (3.0709 - 3.0716 in)
Allowable Limit (Standard)	78,15 mm (3.077 in)
Cylinder Bore I.D. (Oversize)	78,500 - 78,519 mm (3.0906 - 3.0912 in)
Allowable Limit (Oversize)	78,65 mm (3.096 in)

Piston Rings

Ring Gap (Top and 2nd Ring)	0,30 - 0,45 mm (0.012 - 0.017 in)
Ring Gap (Oil Ring)	0,25 - 0,40 mm (0.0099 - 0.015 in)
Allowable Limit (All Rings)	1,25 mm (0.0492 in)
Side Clearance of Ring Groove:	
Top Ring	Cannot measure accurately
2nd Ring	0,0850 - 0,122 mm (0.00335 - 0.00440 in)
Allowable Limit (To and 2nd Ring)	0,20 mm (0.008 in)
Oil Ring	0,020 - 0,055 mm (0.00079 - 0.0021 in)
Allowable Limit	0,15 mm (0.0059 in)

Pistons

I.D. of Piston Bosses		22,00 - 22,013 mm (0.86615 - 0.86865 in)
Allowable Limit		22,03 mm (0.8673 in)
O.D. of Piston Pin		22,002 - 22,011 mm (0.86622 - 0.86657 in)
I.D. of Connecting Rod Bushing (Small End, Fitted)		22,025 - 22,040 mm (0.86713 - 0.86771 in)
Clearance Between Piston Pin and Small End Bushing	New Engine	0,014 - 0,038 mm (0.00055 - 0.0014 in)
	Service Parts	0,015 - 0,038 mm (0.00056 - 0.0014 in)
Allowable Limit		0,15 mm (0.0059 in)
Connecting Rod Alignment Allowable Limit		0,05 mm (0.002 in)
Oversize Piston		0,5 mm (0.020 in)

Specifications (Cont'd)

Oil Pump

Oil Pressure at Rated rpm	197 - 441 kPa (1,97 - 4,41 bar) (28.5 - 64.0 psi)
Allowable Limit	147 kPa (1,47 bar) (21.3 psi)
Oil Pressure at Idle Speed	more than 49 kPa (0.49 bar) (7.1 psi)
Clearance Between Inner Rotor and Outer Rotor	0,060 - 0,18 mm (0.0024 - 0.0071 in)
Clearance Between Outer Rotor and Pump Body	0,100 - 0,180 mm (0.00394 - 0.00708 in)
End Clearance Between Inner Rotor and Cover	0,025 - 0,075 mm (0.00099 - 0.0029 in)

Crankshaft

Crankshaft Alignment Allowable Limit	0,02 mm (0.0008 in)
Oil Clearance Between Crankshaft Journal and Crankshaft Bearing #1	0,0340 - 0,114 mm (0.00134 - 0.00448 in)
Allowable Limit	0,20 mm (0.0079 in)
Journal O.D. #1	47,934 - 47,950 mm (1.8872 - 1.8877 in)
Bearing I.D. #1	47,984 - 48,048 mm (1.8892 - 1.8916 in)
Oil Clearance Between Crankshaft Journal and Crankshaft Bearing #2	0,034 - 0,095 mm (0.0014 - 0.0037 in)
Allowable Limit	0,20 mm (0.0079 in)
Journal O.D. #2	47,934 - 47,950 mm (1.8872 - 1.8877 in)
Bearing I.D. #2	47,984 - 48,029 mm (1.8892- 1.8909 in)
Oil Clearance Between Crankshaft Journal and Crankshaft Bearing #3	0,034 - 0,098 mm (0.0013 - 0.0039 in)
Allowable Limit	0,20 mm (0.0079 in)
Journal O.D. (Flywheel side)	51,921 - 51,940 mm (2.0442 - 2.0448 in)
Bearing I.D. #3	51,974 - 52,019 mm (2.0463 - 2.0479 in)
Crankpin O.D.	39,959 - 39,975 mm (1.5732 - 1.5738 in)
Crankpin Bearing I.D.	40,040 - 40,050 mm (1.5764 - 1.5767 in)
Clearance Between Crankpin and Crankpin Bearing	0,029 - 0,091 mm (0.0012 - 0.0035 in)
Allowable Limit	0,20 mm (0.0079 in)
Crankshaft Side Clearance	0,15 - 0,31 mm (0.0059 - 0.012 in)
Allowable Limit	0,50 mm (0.020 in)

Specifications (Cont'd)

Timing Gear

Timing Gear Backlash	
Crank Gear - Idle Gear 1	0,0320 - 0,115 mm (0.00126 - 0.00452 in)
Idle Gear 1 - Cam Gear	0,0360 - 0,114 mm (0.00142 - 0.00448 in)
Idle Gear 1 - Injection Pump Gear	0,0340 - 0,116 mm (0.00134 - 0.00456 in)
Idle Gear 1 - Idle Gear 2 (if equipped)	0,0330 - 0,117 mm (0.00130 - 0.00460 in)
Allowable Limit	0,15 mm (0.0059 in)
Idle Gear Shaft O.D.	25,967 - 25,980 mm (1.0223 - 1.0228 in)
Idle Gear Bushing I.D.	26,000 - 26,021 mm (1.0237 - 1.0244 in)
Clearance Between Idle Gear Shaft and Idle Gear Bushing	0,020 - 0,054 mm (0.00079 - 0.0021 in)
Allowable Limit	0,10 mm (0.0039 in)
Idle Gear Side Clearance	0,20 - 0,51 mm (0.0079 - 0.020 in)
Allowable Limit	0,80 mm (0.031 in)

Governor Gear

Governor Gear Backlash	
Injection Pump Gear - Governor Gear	0,0300 - 0,117 mm (0.00119 - 0.00460 in)
Idle Gear 2 (if equipped) - Governor Gear	0,030 - 0,117 mm (0.0012 - 0.00460 in)
Allowable Limit	0,15 mm (0.0059 in)

Thermostat

Valve Opening Temperature (Starting)	69,5 - 72,5°C (157.1 - 162.5°F)
Valve Fully Open	85°C (185°F)

Specifications (Cont'd)

Engine Bolt Torque

Item	Size x Pitch	N•m	ft-lb
Cylinder head cover screw	M7 x 1.0	7 - 8	5 - 6
*Cylinder head screw	M10 x 1.25	64 - 68	47 - 50
*Main bearing case screw 1	M8 x 1.25	30 - 34	22 - 25
*Main bearing case screw 2	M9 x 1.25	49 - 53	37 - 39
*Flywheel screw	M10 x 1.25	54 - 58	40 - 43
*Connecting rod screw	M8 x 1.0	42 - 46	31 - 33
*Rocker arm bracket nut	M7 x 1.0	22 - 26	16 - 19
*Rocker arm bracket screw	M7 x 1.0	22 - 26	16 - 19
*Idle gear shaft screw	M6 x 1.0	9,81 - 11,2	7.24 - 8.31
*Fan drive pulley screw	M14 x 1.5	236 - 245	174 - 180
*Bearing case cover mounting screw	M6 x 1.0	9,81 - 11,2	7.24 - 8.31
Glow plug	M8 x 1.0	7,9 - 14	5.8 - 10
Nozzle holder assembly	M20 x 1.5	49 - 68	37 - 50
Oil pressure switch	PT 1/8	15 - 19	11 - 14
Injection pipe retaining nut	M12 x 1.5	25 - 34	18 - 25
Overflow pipe retaining nut	M12 x 1.5	20 - 24	15 - 18
Starter's B terminal nut	M8	6 - 11,6	4.42 - 8.58
Starter's S terminal nut	M8	2,6 - 4,6	1.92 - 3.4
Alternator's pulley nut	-	58,4 - 78,9	43.1 - 58.2
Drain plug with copper gasket	M12 x 1.25	33 - 37	24 - 27
Drain plug with rubber coated gasket	M22 x 1.5	45 - 53	33 - 39

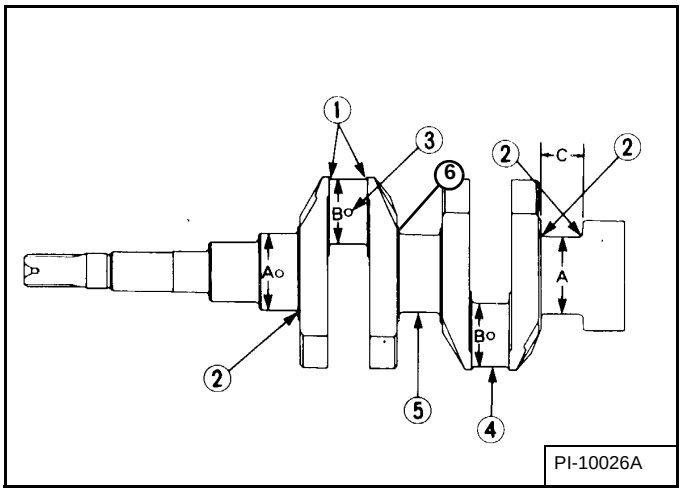
* Lightly Oiled Threads

Crankshaft Re-Grind Data

If the standard size bearing cannot be used due to excessive wear of the crankpin and crank journal use undersize or oversize bearings.

For undersize or oversize bearing use, follow the precautions noted below.

Figure 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. 2,8 - 3,2 mm (0.11 - 0.12 in) radius.
2. 2,3 - 2,7 mm (0.091 - 0.10 in) radius.
3. Chamfer the oil hole circumference to 1,0 - 1,5 mm (0.04 - 0.059 in) radius with an oil stone.
4. The crankpin must be fine finished to higher than (0.8S).
5. The crank journal must be fine-finished to higher than (0.8S).
6. The crank journal side surface must be fine-finished to higher than (0.8S).

SIZE	NAME OF BEARING	BEARING MARK	CRANKSHAFT PROCESSING DIM.	
-0,2 mm (0.0079 in)	Crankshaft Bearing 1 0,2 mm minus (0.0079 in minus)	020 US	A	47,734 - 47,750 mm (1.8793 - 1.8799 in)
-0,2 mm (0.0079 in)	Crankshaft Bearing 2 0,2 mm minus (0.0079 in minus)	020 US		
-0,4 mm (0.016 in)	Crankshaft Bearing 1 0,4 mm minus (0.016 in minus)	040 US	A	47,534 - 47.550 mm (1.8715 - 1.8720 in)
-0,4 mm (0.016 in)	Crankshaft Bearing 2 0,4 mm minus (0.016 in minus)	040 US		
-0,2 mm (0.0079 in)	Crank Pin Bearing 0,2 mm minus (0.0079 in minus)	020 US	B	39,759 - 39,775 mm (1.5654 - 1.5659 in)
-0,4 mm (0.016 in)	Crank Pin Bearing 0,4 mm minus (0.016 in minus)	040 US	B	39,559 - 39,575 mm (1.5575 - 1.5580 in)
+0,2 mm (+0.0079 in)	Thrust Bearing 1 - 0,2 mm plus (0.0079 in plus)	020 OS	C	28,20 - 28,25 mm (1.111 - 1.112 in)
	Thrust Bearing 2 - 0,2 mm plus (0.0079 in plus)			
+0,4 mm (+0.016 in)	Thrust Bearing 1 - 0,4 mm plus (0.016 in plus)	040 OS	C	28,4 - 28,45 mm (1.119 - 1.120 in)
	Thrust Bearing 2 - 0,4 mm plus (0.016 in plus)			

Torque For Kubota® Metric Bolts

Nominal Diameter	Grade	Standard Screw and Bolt 4			Special Screw and Bolt 7		
	Unit	N•m	kgf m	ft-lb	N•m	kgf m	ft-lb
M6		7,9 - 9,3	0,80 - 0,95	5.8 - 6.8	9,81 - 11,2	1,00 - 1,15	7.24 - 8.31
M8		18 - 20	1,8 - 2,1	13 - 15	24 - 27	2,4 - 2,8	18 - 20
M10		40 - 45	4,0 - 4,6	29 - 33	49 - 55	5,0 - 5,7	37 - 41
M12		63 - 72	6,4 - 7,4	47 - 53	78 - 90	7,9 - 9,2	58 - 66

Troubleshooting

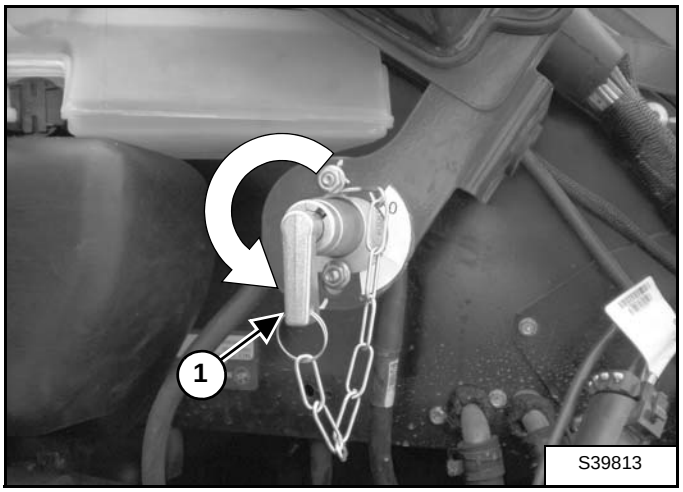
The following troubleshooting chart is provided for assistance in locating and correcting problems which are most common. Many of the recommended procedures must be done by authorized Bobcat Service personnel only.

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	

Engine Removal And Installation

Figure 60-10-2



Rotate the battery disconnect switch (Item 1) **[Figure 60-10-2]** counterclockwise to disconnect the ground terminal from the battery.

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-4.)

Drain the radiator. (See Removing And Replacing Coolant on Page 10-90-3.)

Remove the muffler. (See Removal on Page 60-30-1.)

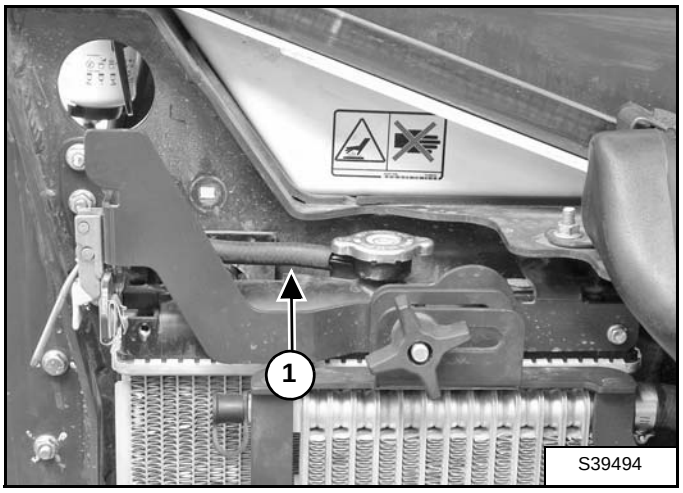
Remove the air cleaner. (See Removal And Installation on Page 60-40-1.)

Remove the tailgate. (See Removal And Installation on Page 40-190-1.)

Remove the counterweight. (See Removal And Installation on Page 40-90-1.)

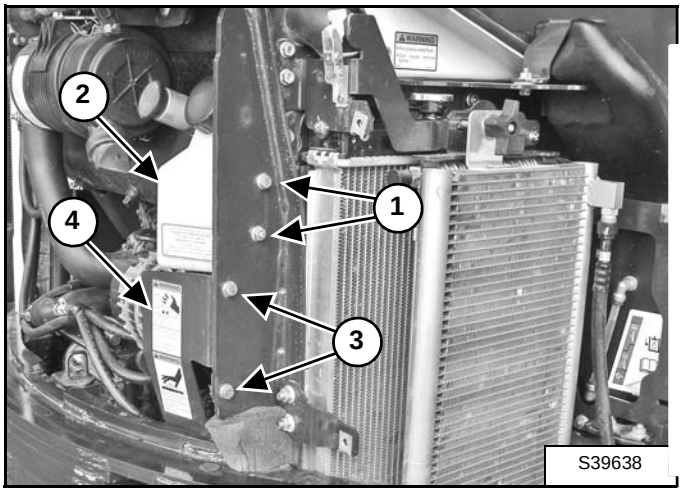
Remove the hydraulic pump. (See Removal And Installation on Page 20-50-11.)

Figure 60-10-3



Remove the radiator overflow hose (Item 1) **[Figure 60-10-3]**.

Figure 60-10-4



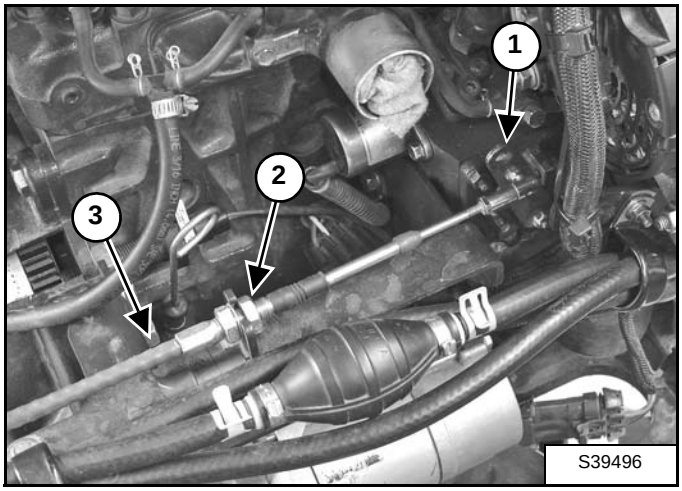
Remove the two bolts (Item 1) and the coolant reservoir (Item 2) **[Figure 60-10-4]**.

Remove the two bolts (Item 3) and the cover (Item 4) **[Figure 60-10-4]**.

Engine Removal And Installation (Cont'd)

Standard Engine Speed Control

Figure 60-10-5

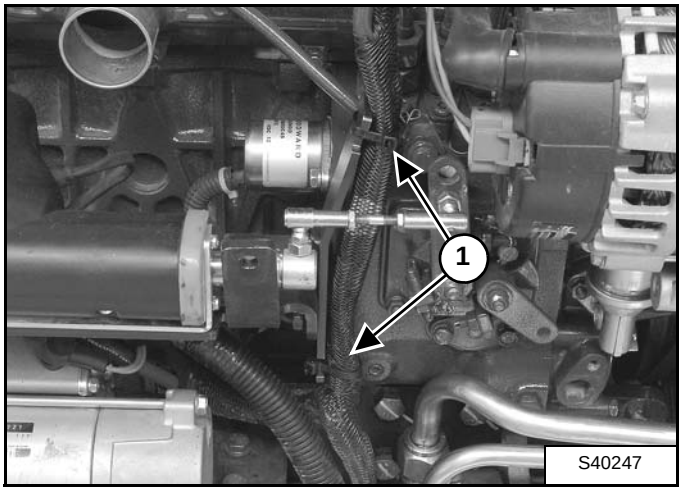


Remove two nuts (Item 1) and loosen nut (Item 2) **[Figure 60-10-5]**.

Remove the engine speed cable (Item 3) **[Figure 60-10-5]**.

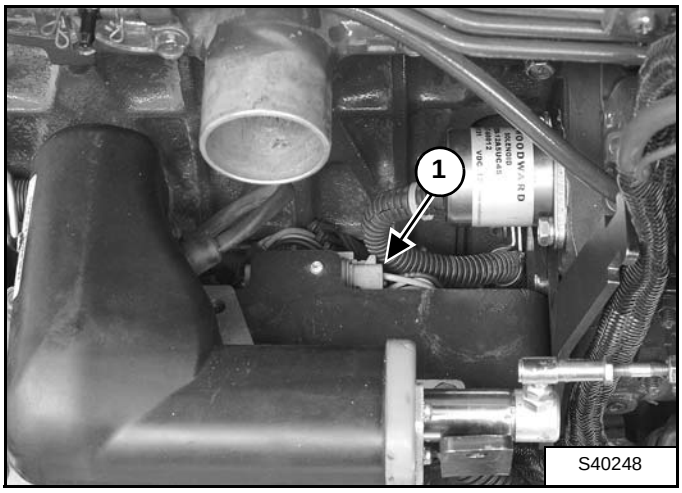
Optional Engine Speed Control (Auto-Idle)

Figure 60-10-6



Remove the tie-straps (Item 1) **[Figure 60-10-6]**.

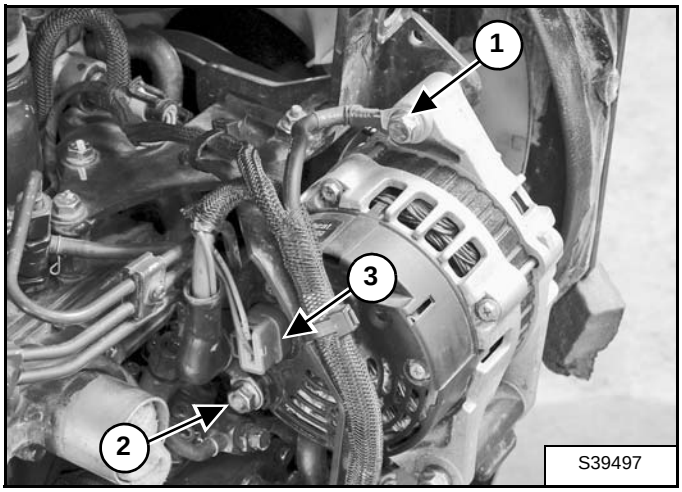
Figure 60-10-7



Disconnect the wire harness (Item 1) **[Figure 60-10-7]** from the speed control actuator.

All Machines

Figure 60-10-8



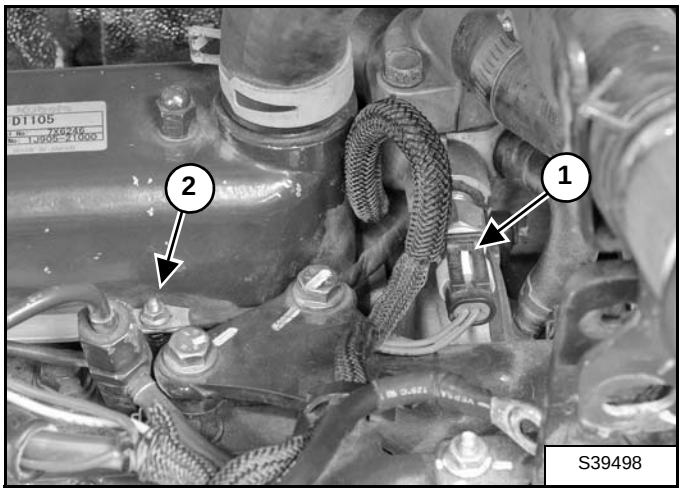
Remove the bolt and wire (Item 1) **[Figure 60-10-8]**.

Remove the nut and wire (Item 2) **[Figure 60-10-8]**.

Disconnect the wire harness (Item 3) **[Figure 60-10-8]** from the alternator.

Engine Removal And Installation (Cont'd)

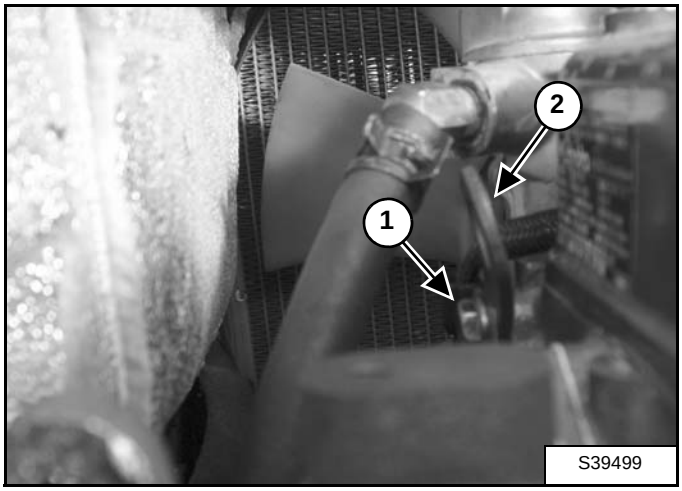
Figure 60-10-9



Disconnect the wire harness (Item 1) from the thermostat **[Figure 60-10-9]**.

Loosen the nut (Item 2) **[Figure 60-10-9]** and remove the wire harness.

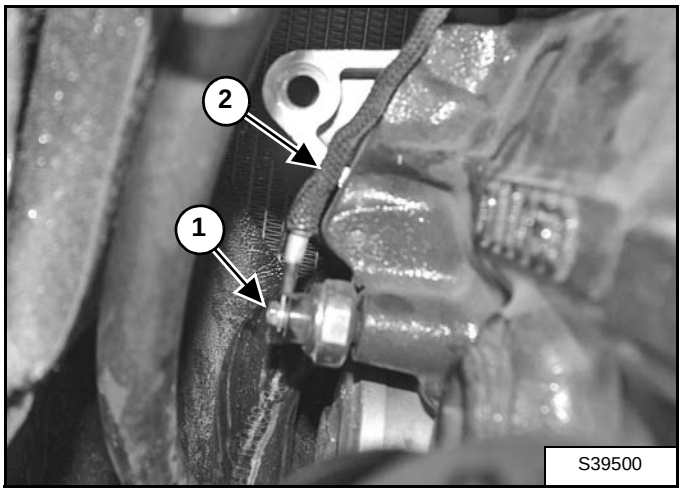
Figure 60-10-10



Remove the bolt and clamp (Item 1) **[Figure 60-10-10]**.

Install the lifting eye (Item 2) with the bolt (Item 1) **[Figure 60-10-10]**.

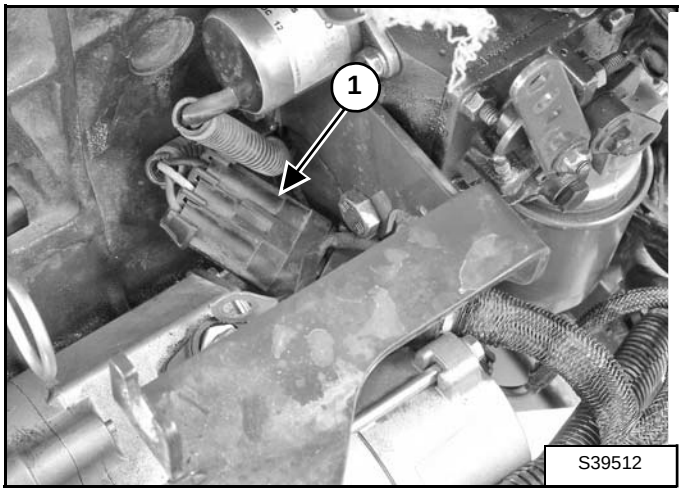
Figure 60-10-11



Remove the bolt and washer (Item 1) **[Figure 60-10-11]**.

Remove the wire (Item 2) **[Figure 60-10-11]**.

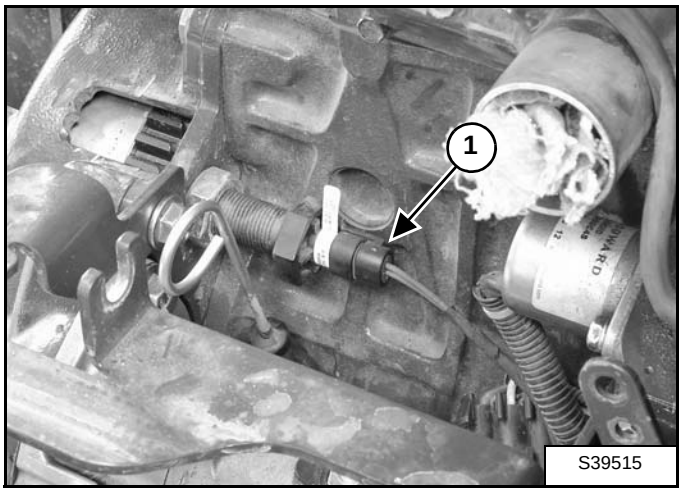
Figure 60-10-12



Disconnect the wire harness (Item 1) **[Figure 60-10-12]**.

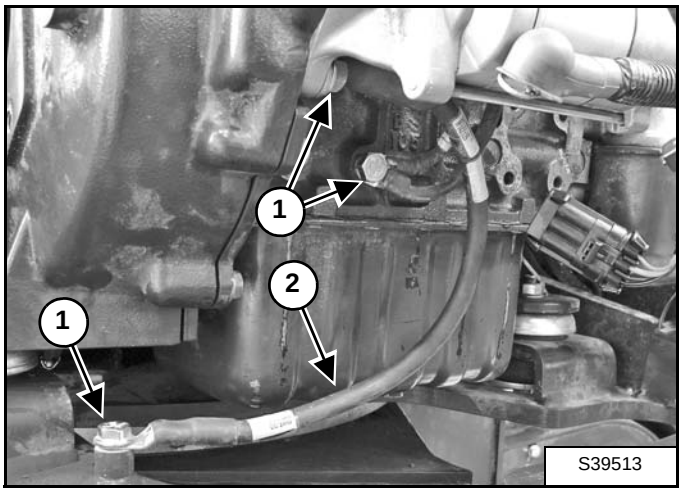
Engine Removal And Installation (Cont'd)

Figure 60-10-13



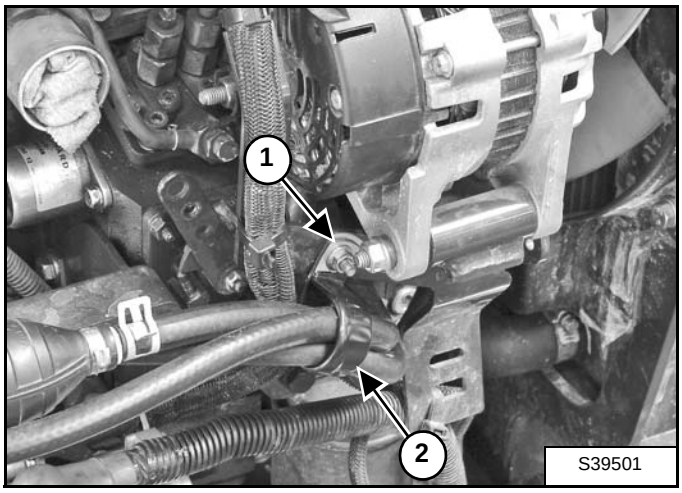
Disconnect the wire harness (Item 1) **[Figure 60-10-13]**.

Figure 60-10-14



Remove the bolts (Item 1) and the ground wire (Item 2) **[Figure 60-10-14]**.

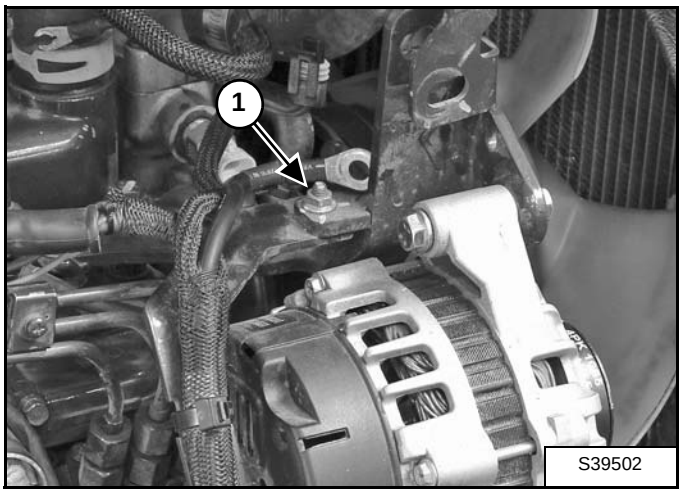
Figure 60-10-15



Remove the bolt and nut (Item 1) **[Figure 60-10-15]**.

Remove the clamp (Item 2) **[Figure 60-10-15]**.

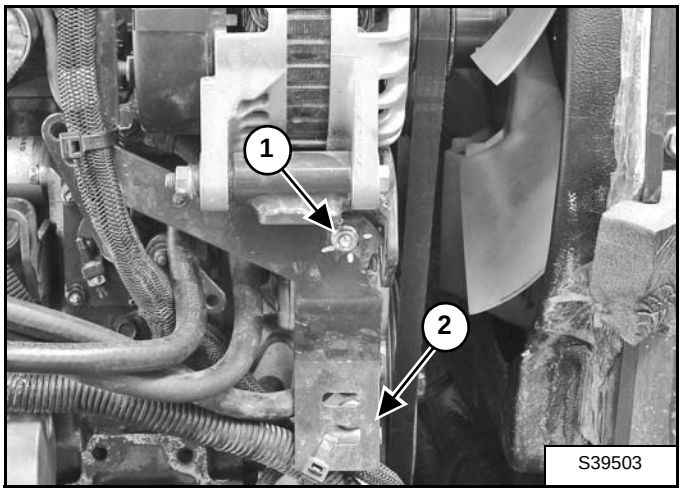
Figure 60-10-16



Remove the bolt and nut (Item 1) **[Figure 60-10-16]**.

Engine Removal And Installation (Cont'd)

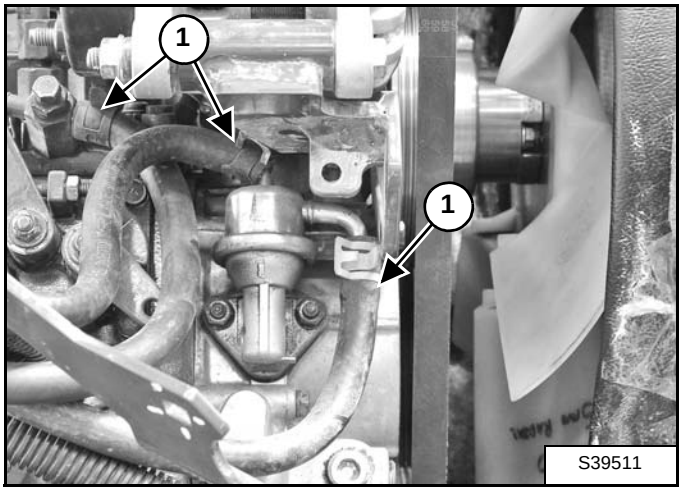
Figure 60-10-17



Remove the bolt and nut (Item 1) **[Figure 60-10-17]**.

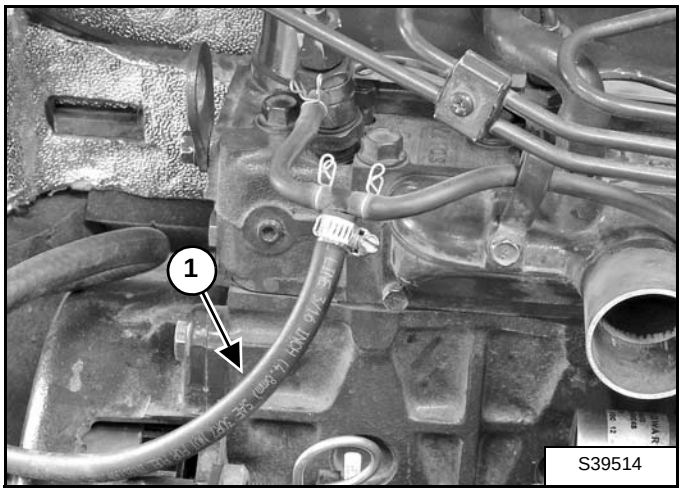
Remove the bracket (Item 2) **[Figure 60-10-17]**.

Figure 60-10-18



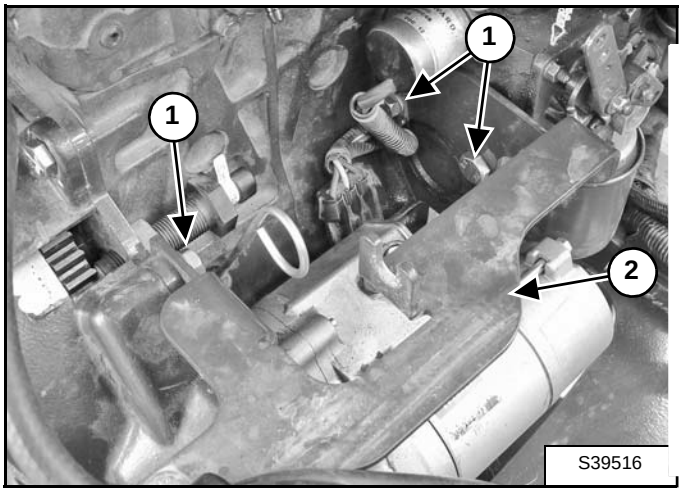
Remove the fuel lines (Item 1) **[Figure 60-10-18]** from the fuel pump and fuel injection pump.

Figure 60-10-19



Loosen the clamp and remove the fuel return line (Item 1) **[Figure 60-10-19]**.

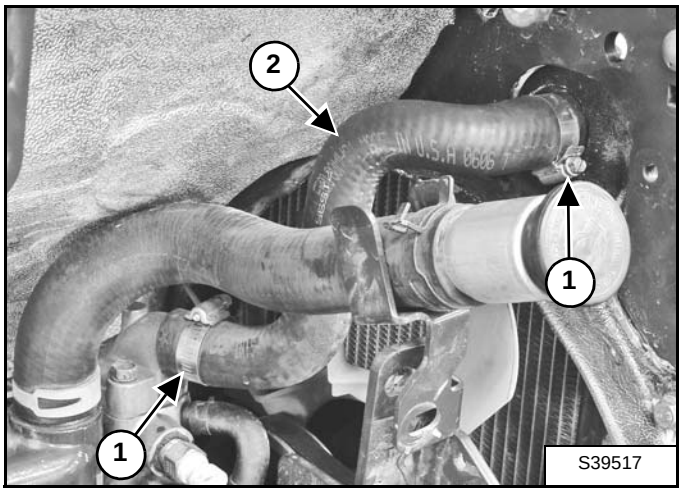
Figure 60-10-20



Remove the three bolts (Item 1) and the bracket (Item 2) **[Figure 60-10-20]**.

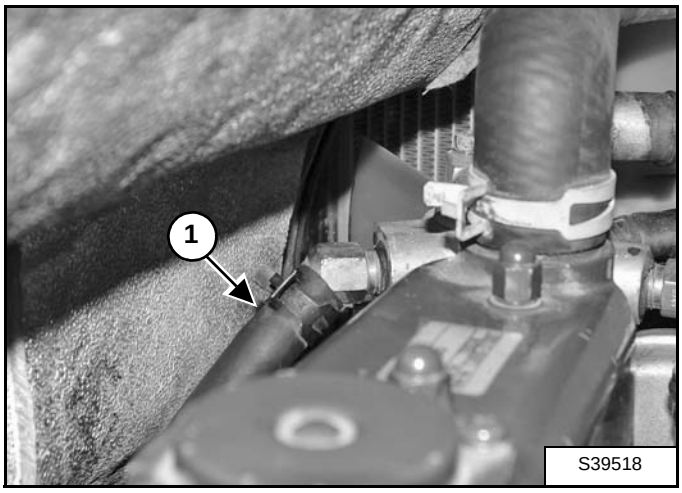
Engine Removal And Installation (Cont'd)

Figure 60-10-21



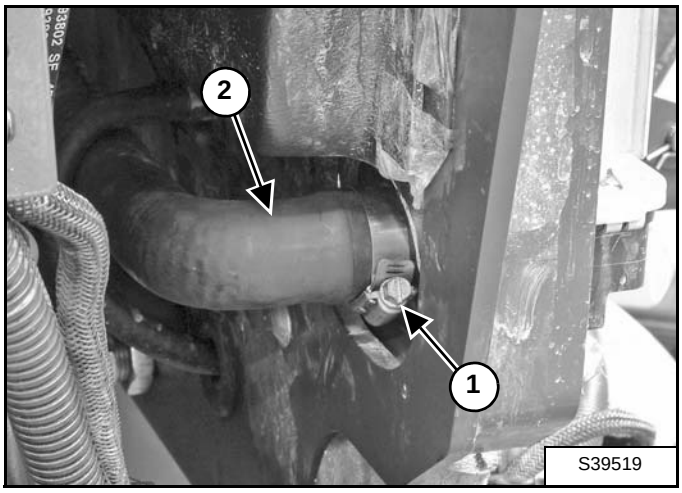
Loosen the two clamps (Item 1) and remove the hose (Item 2) **[Figure 60-10-21]**.

Figure 60-10-22



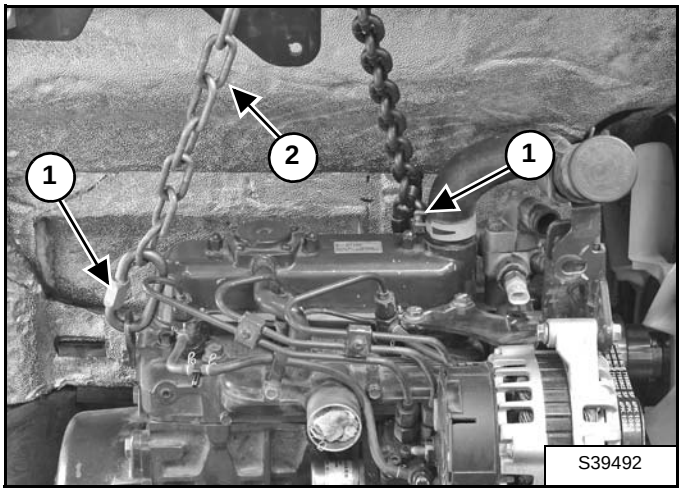
Loosen the clamps and remove the hose (Item 1) **[Figure 60-10-22]**.

Figure 60-10-23



Loosen the clamp (Item 1) and remove the lower radiator hose (Item 2) **[Figure 60-10-23]**.

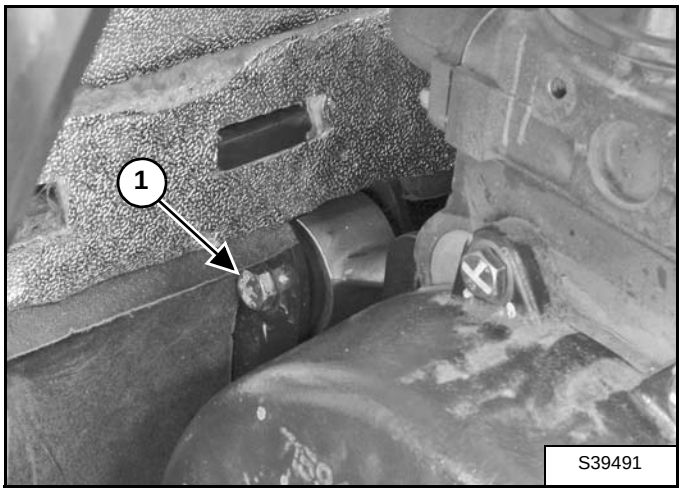
Figure 60-10-24



Attach lifting brackets (Item 1) and chain (Item 2) **[Figure 60-10-24]** to a hoist.

Engine Removal And Installation (Cont'd)

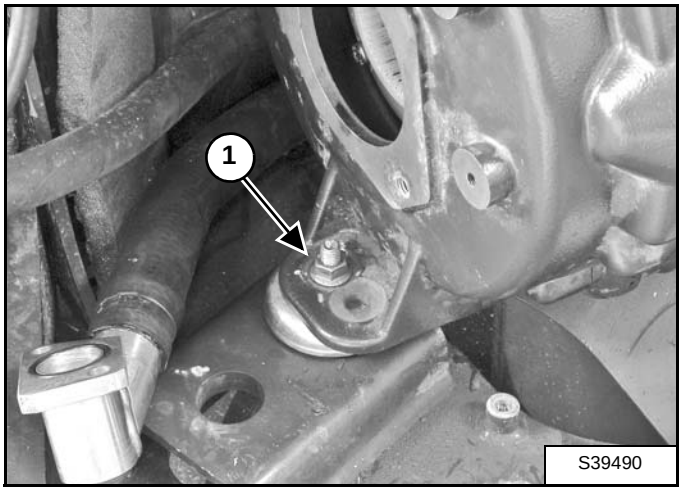
Figure 60-10-25



Remove the bolt (Item 1) **[Figure 60-10-25]** from the front motor mount.

Installation: Tighten the bolt to 105 - 115 N•m (78 - 85 ft-lb) torque.

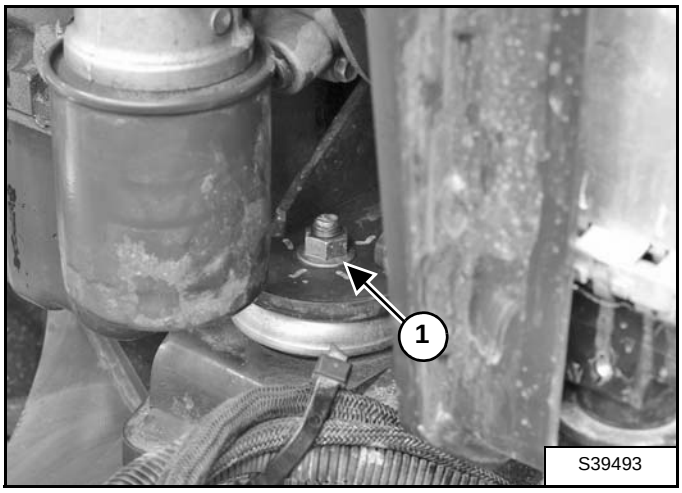
Figure 60-10-26



Remove the bolt and nut (Item 1) **[Figure 60-10-26]** from the left motor mount.

Installation: Tighten the bolt and nut to 105 - 115 N•m (78 - 85 ft-lb) torque.

Figure 60-10-27



Remove the bolt and nut (Item 1) **[Figure 60-10-27]** from the right motor mount.

Installation: Tighten the bolt to 105 - 115 N•m (78 - 85 ft-lb) torque.

Remove the engine.

Compression Checking

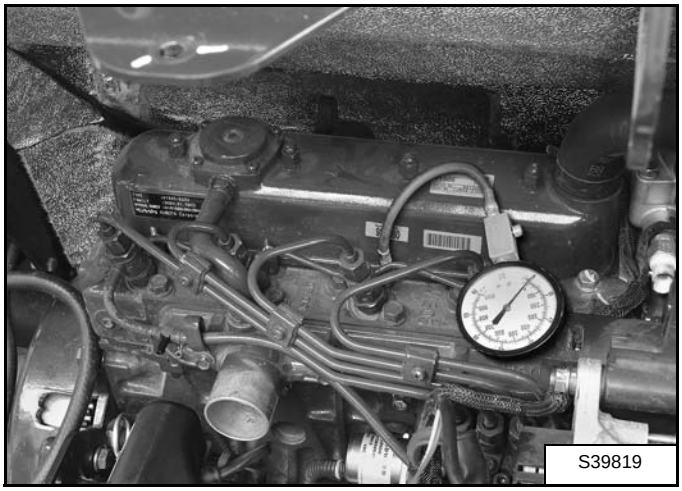
The tools listed will be needed to do the following procedure:

MEL10630 - Engine Compression Kit
MEL1352 - Compression Adapter

The engine must be at operating temperature.

Remove the glow plugs. (See Glow Plugs Removal And Installation on Page 60-80-1.)

Figure 60-10-28



Install the correct compression adapter into the cylinder head **[Figure 60-10-28]**.

Connect the compression gauge **[Figure 60-10-28]**.

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	3,73 - 4,11 MPa (37,3 - 41,1 bar) (541 - 597 psi)
Allowable Limit (minimum)	2,26 MPa (22,6 bar) (327 psi)

The compression must be no lower than the allowable limit, with no more than 10% variance among cylinders.

Connect the fuel stop solenoid.

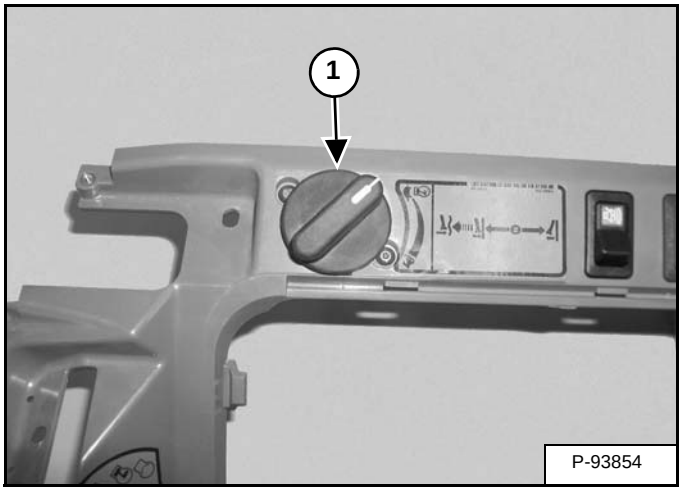
Install the glow plugs.

ENGINE SPEED CONTROL (DIAL GAUGE)

Removal And Installation

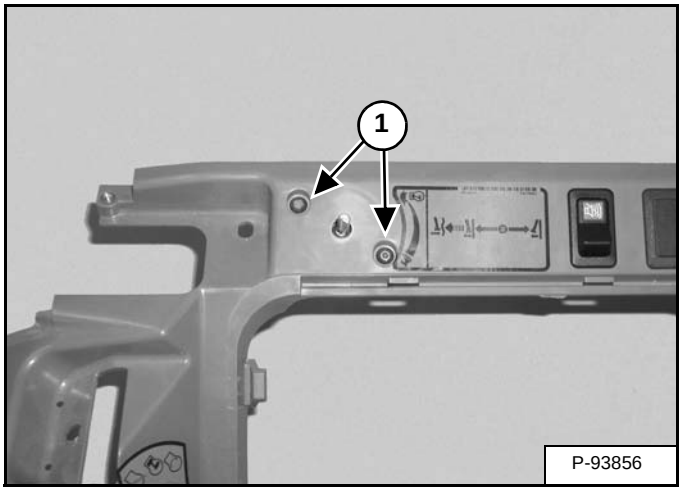
Remove the console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 60-20-1



Pull up on and remove the engine speed control knob (Item 1) **[Figure 60-20-1]**.

Figure 60-20-2

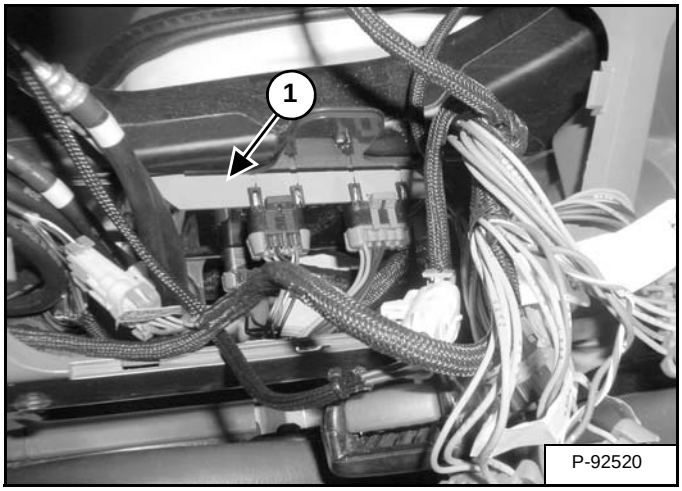


Remove the screws (Item 1) **[Figure 60-20-2]** and remove the speed control switch.

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

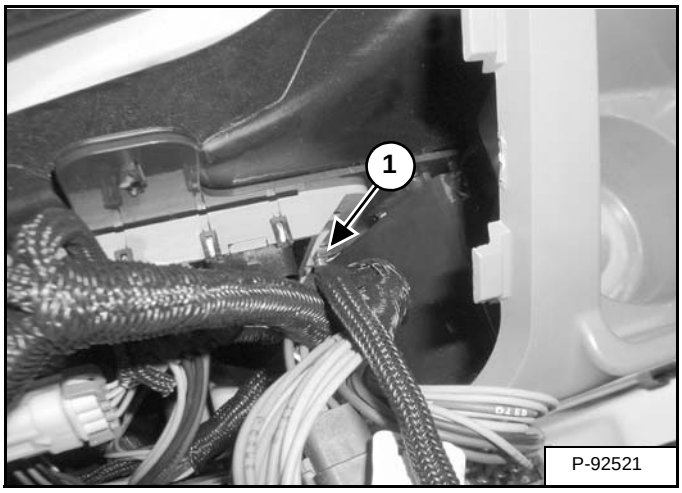
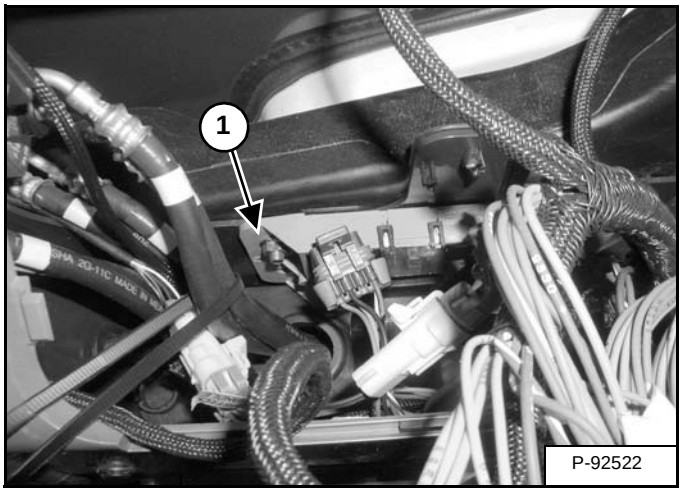


Figure 60-20-5



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.)

Calibration

Figure 60-20-6

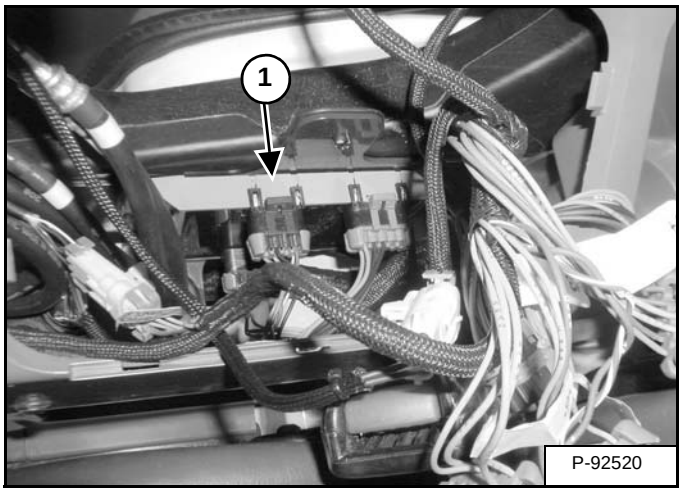
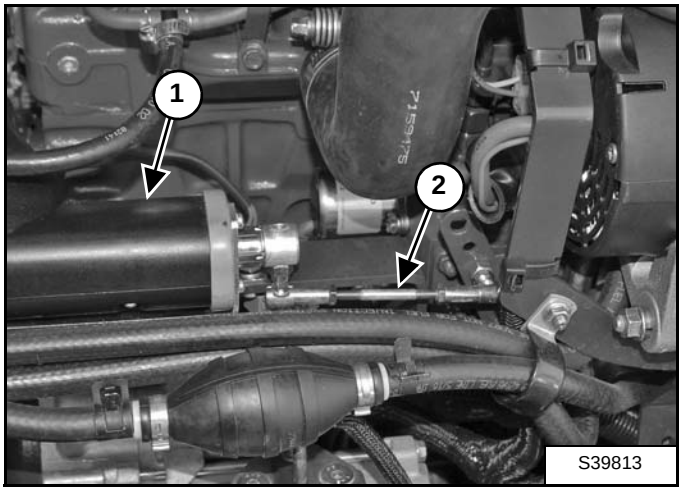
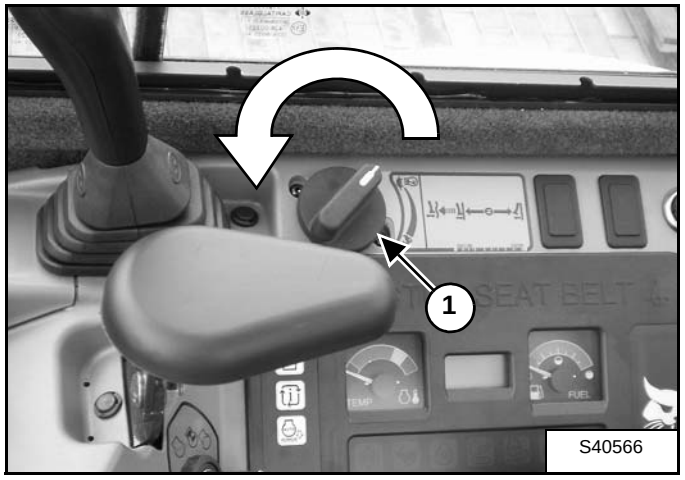


Figure 60-20-7



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.

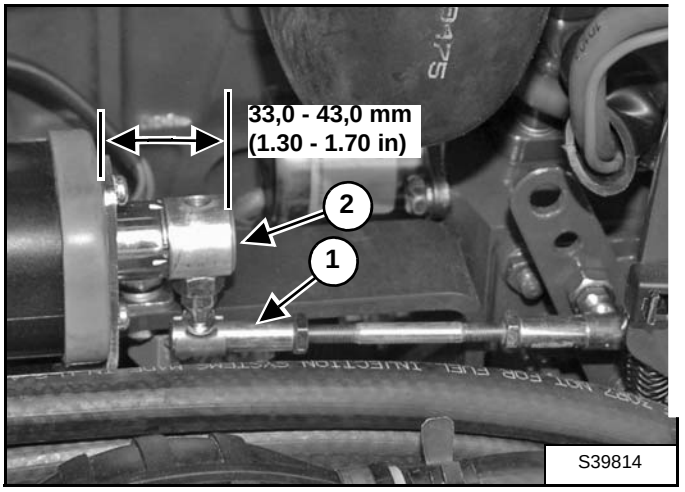
Figure 60-20-8



With the engine off, rotate the engine speed control dial (Item 1) **[Figure 60-20-8]** to the low speed position.

Turn the key switch to ON (Standard) or press ENTER CODE Button (Keyless).

Figure 60-20-9



Leave the engine speed control dial gauge at the low speed position and turn the key switch to the STOP position (Standard) or press STOP button (Keyless).

Measure from the face of the seal to the end of the actuator plunger. The plunger (Item 2) **[Figure 60-20-9]** must be between 33,0 - 43,0 mm (1.30 - 1.70 in).

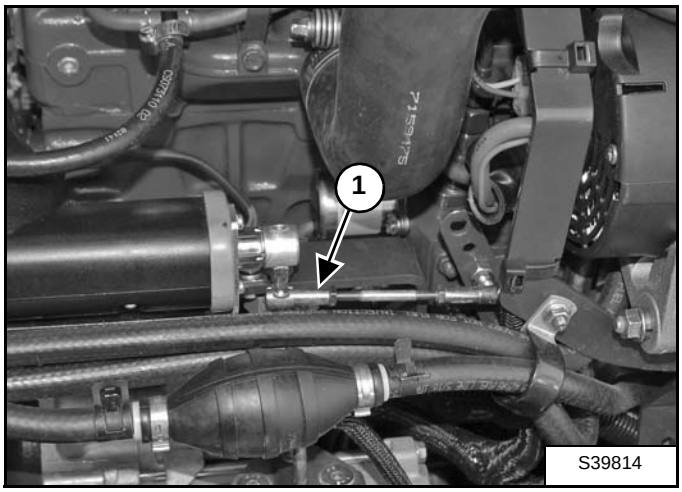
If the actuator plunger needs to be adjusted, pull down and disconnect the linkage (Item 1) **[Figure 60-20-9]**.

Manually pull or push the actuator plunger (Item 2) **[Figure 60-20-9]** to a point between 33,0 - 43,0 mm (1.30 - 1.70 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.

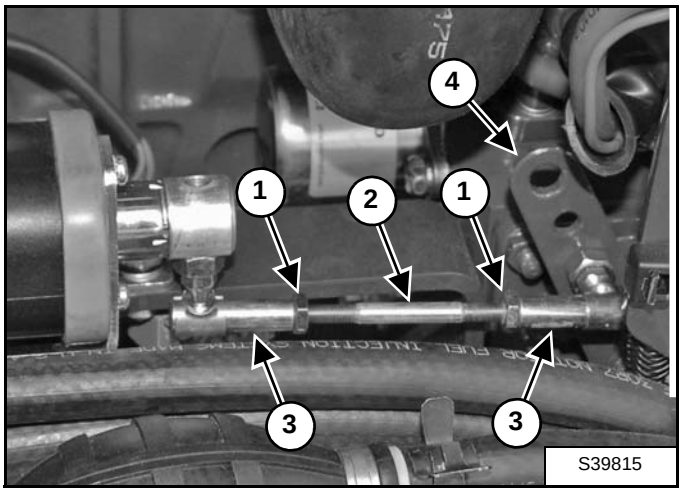
Calibration (Cont'd)

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) **[Figure 60-20-11]** a small amount and connect the linkage.

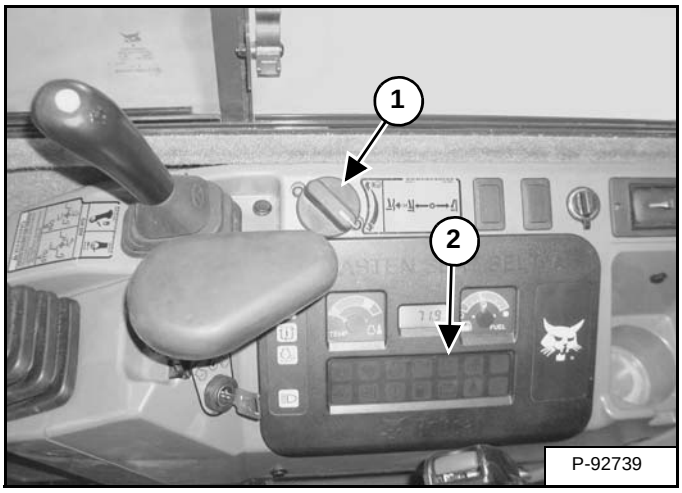
Repeat the procedure until the lever (Item 4) **[Figure 60-20-11]** fully contacts the end stop.

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 low speed position, turn the key switch to ON (Standard) or press ENTER CODE Button (Keyless).

Figure 60-20-12



Turn the engine speed control dial (Item 1) **[Figure 60-20-12]** from the low speed position to the high speed position four times:

Low Speed
High Speed
Low Speed
High Speed
Low Speed
High Speed
Low Speed
High Speed

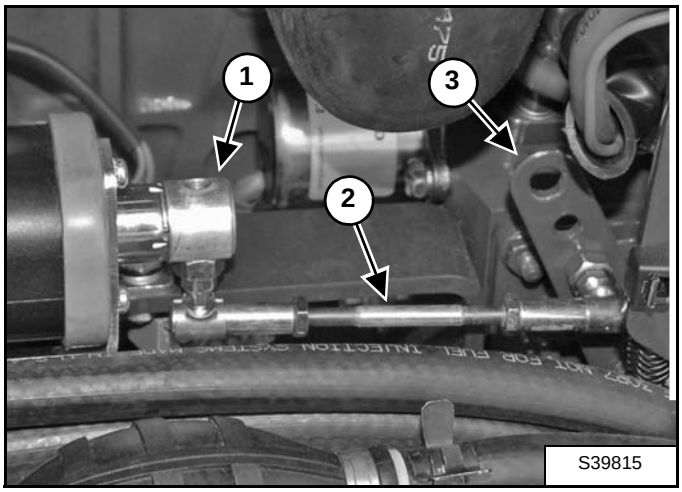
NOTE: The auto idle icon (Item 2) [Figure 60-20-12] will flash while the calibration procedure is in process.

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 switch to the STOP position (Standard) or press STOP button (Keyless).

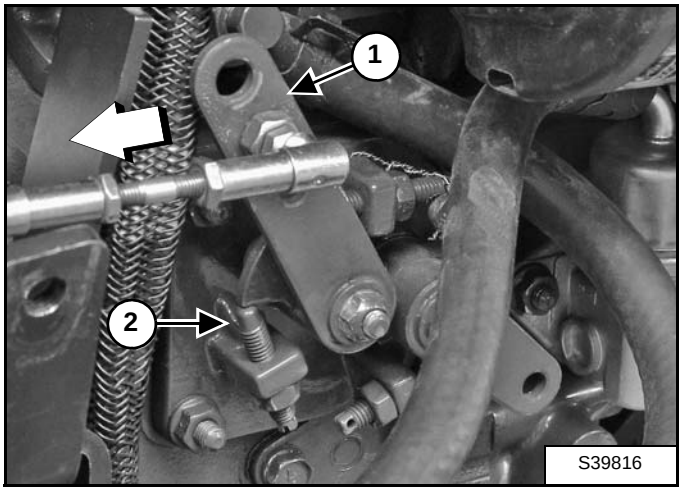
Calibration (Cont'd)

Figure 60-20-13



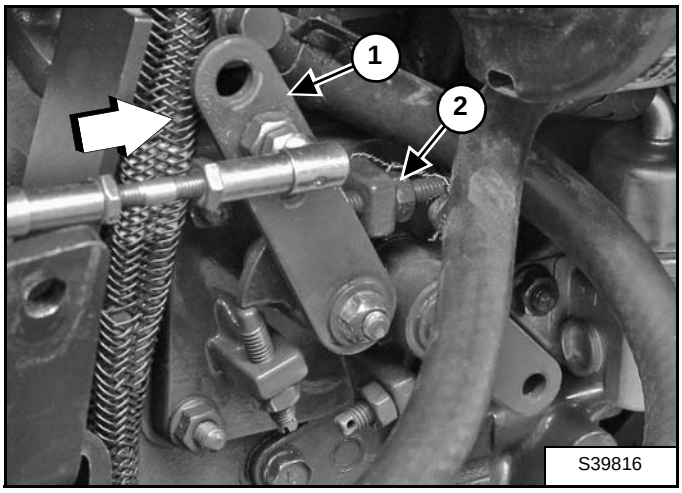
NOTE: The actuator plunger (Item 1), linkage (Item 2) and lever (Item 3) [Figure 60-20-13] will move several times during the calibration procedure. Keep all personnel, tools and rags away from all moving components while performing the calibration procedure

Figure 60-20-14



After the calibration procedure has been completed, with the engine off, Turn the key switch to ON (Standard) or press ENTER CODE Button (Keyless). Turn the engine speed control to the low speed position. The engine speed control lever (Item 1) must contact the stop (Item 2) **[Figure 60-20-14]**.

Figure 60-20-15

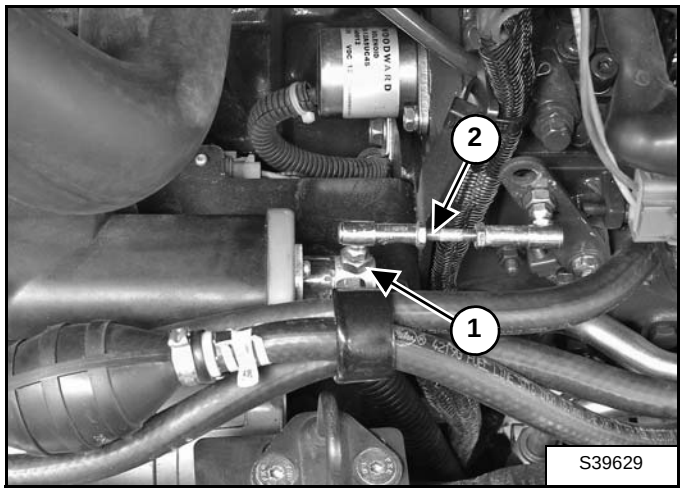


Turn the engine speed control to the high speed position. The engine speed control lever (Item 1) must contact the stop (Item 2) **[Figure 60-20-15]**.

If the control lever does not contact both stops, repeat the calibration procedure.

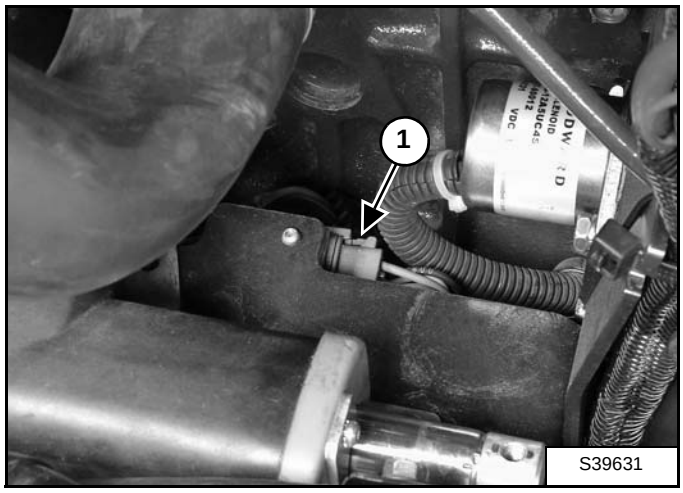
Actuator Removal And Installation

Figure 60-20-16



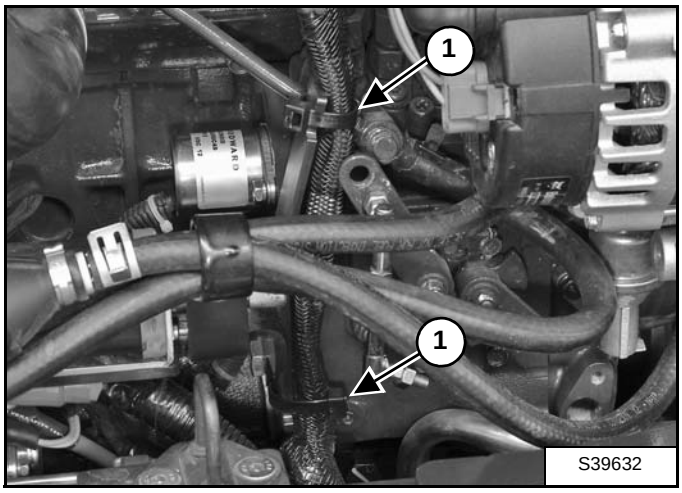
Loosen the nut (Item 1) and remove the linkage (Item 2) **[Figure 60-20-16]** from the actuator.

Figure 60-20-17



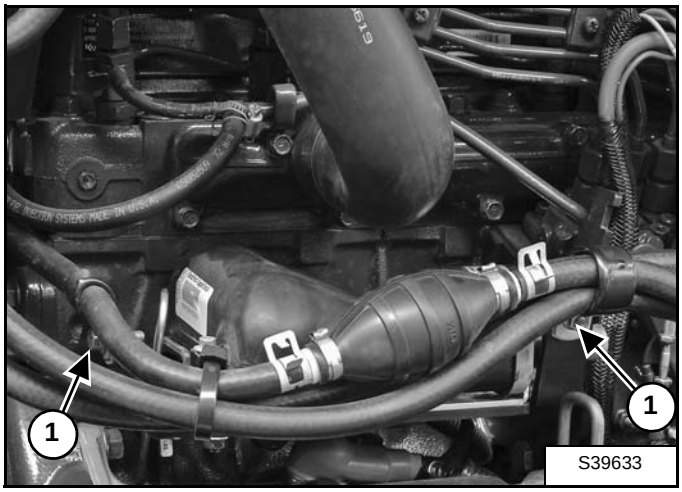
Remove the connector (Item 1) **[Figure 60-20-17]**.

Figure 60-20-18



Cut and remove the cable ties (Item 1) **[Figure 60-20-18]**.

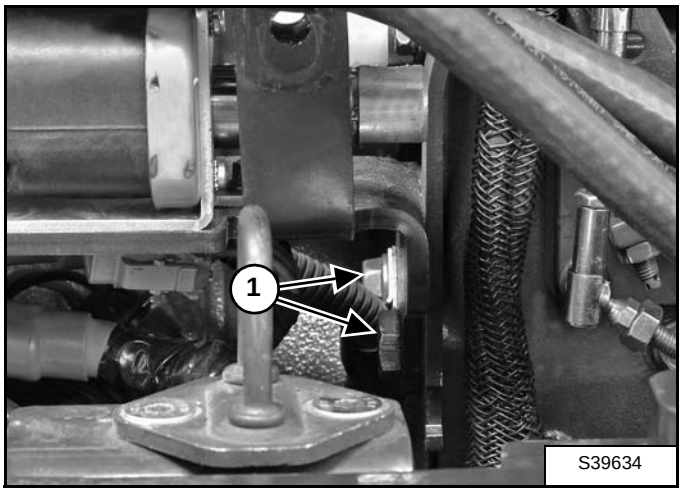
Figure 60-20-19



Remove the two bolts, nuts and clamps (Item 1) **[Figure 60-20-19]** and reposition the fuel line.

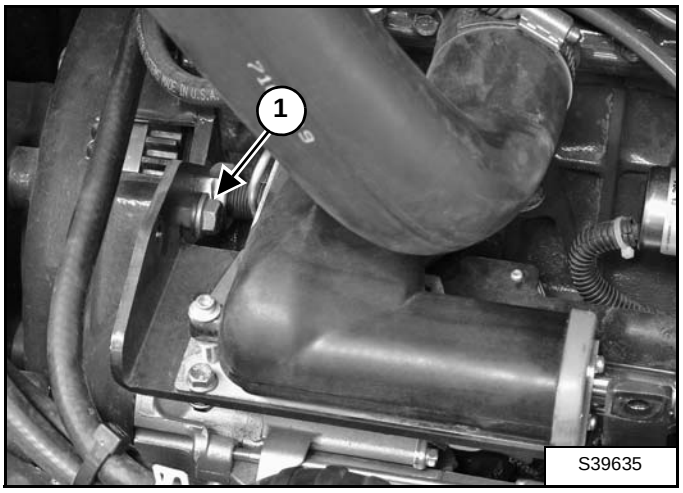
Actuator Removal And Installation (Cont'd)

Figure 60-20-20



Remove the two bolts (Item 1) **[Figure 60-20-20]**.

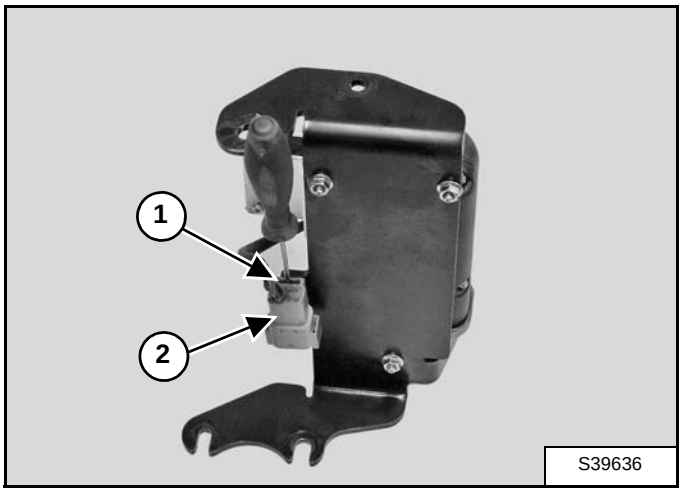
Figure 60-20-21



Remove the bolt (Item 1) **[Figure 60-20-21]**.

Remove the actuator / mount assembly from the excavator.

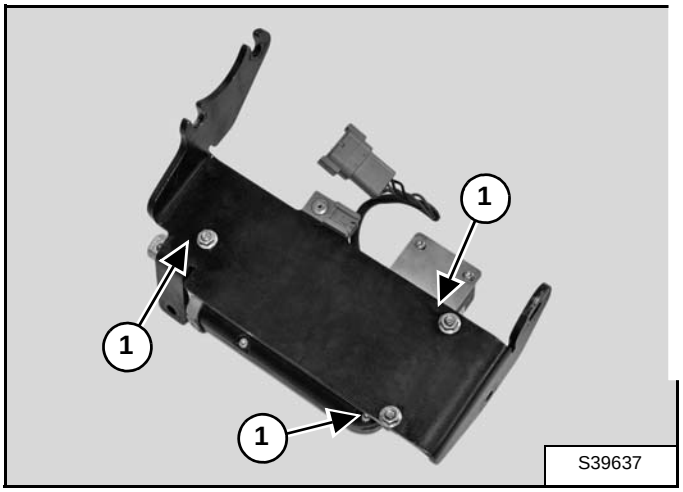
Figure 60-20-22



Install a flat bladed screw driver in the slot (Item 1) **[Figure 60-20-22]** of the wire harness connector.

Push down on the screw driver to remove the connector (Item 2) **[Figure 60-20-22]** from the mount.

Figure 60-20-23



Remove the three bolts and nuts (Item 1) **[Figure 60-20-23]**. 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.)


Bobcat®

ENGINE SPEED CONTROL (LEVER)

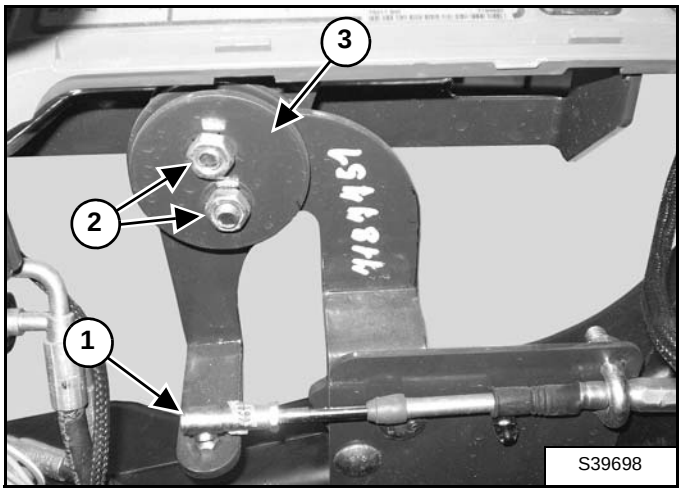
Removal And Installation

Figure 60-21-1



Pull out the controller (Item 1) **[Figure 60-21-1]**.

Figure 60-21-2



Remove the cable end (Item 1) **[Figure 60-21-2]** from the ball joint.

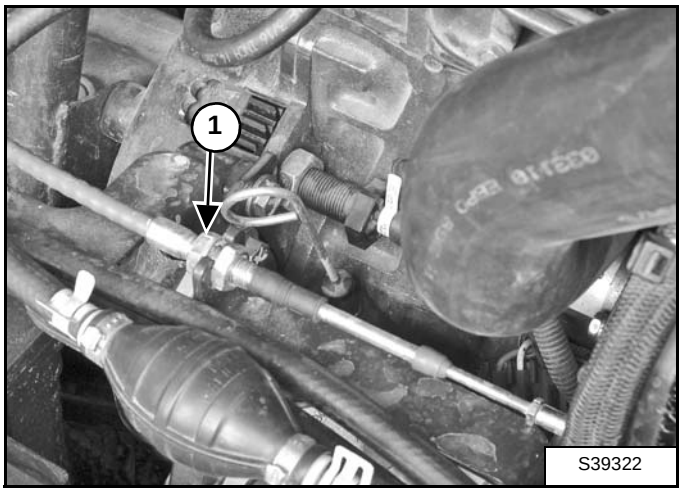
Remove the two bolts and nuts (Item 2) and washer (Item 3) **[Figure 60-21-2]**.

Remove the engine speed control lever.

Installation: Tighten the nuts (Item 2) **[Figure 60-21-2]** to minimize any play. The lever must be easily operable.

Calibration

Figure 60-21-3



Loosen the jam nuts (Item 1) **[Figure 60-21-3]**.

ENGINE SPEED CONTROL (LEVER) (CONT'D)

Calibration (Cont'd)

Figure 60-21-4

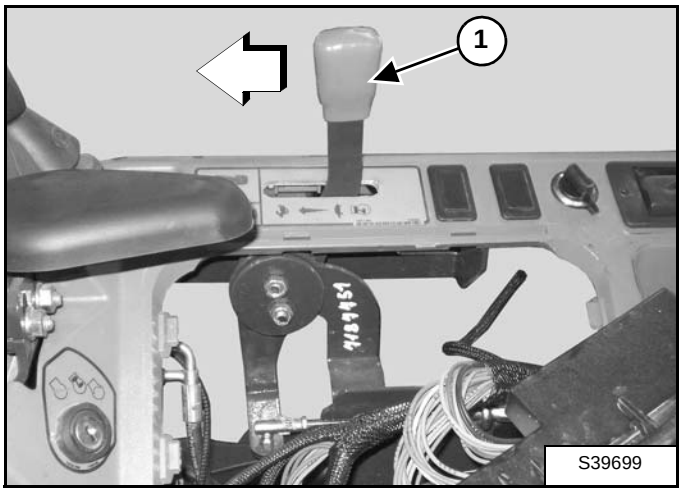
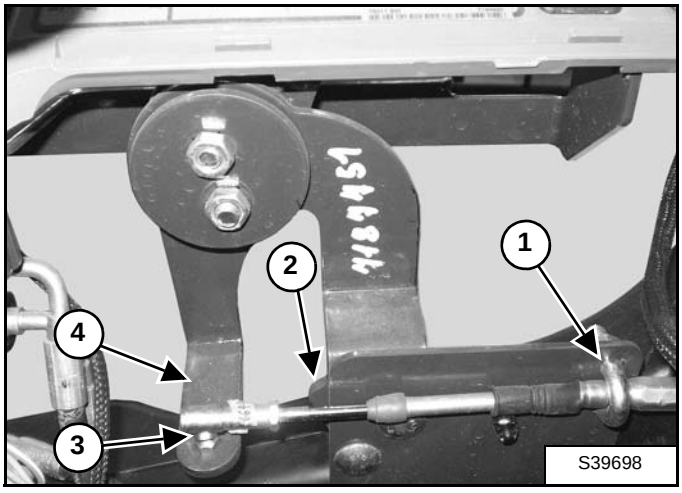


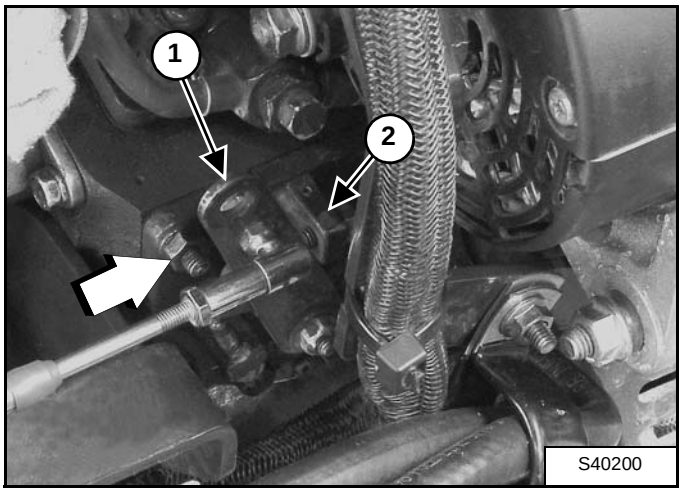
Figure 60-21-5



Secure the engine speed cable with the bracket (Item 1) **[Figure 60-21-5]**. Move the lever (Item 1) **[Figure 60-21-4]** forward until the bottom of the lever (Item 4) contacts the stop (Item 2) **[Figure 60-21-5]**.

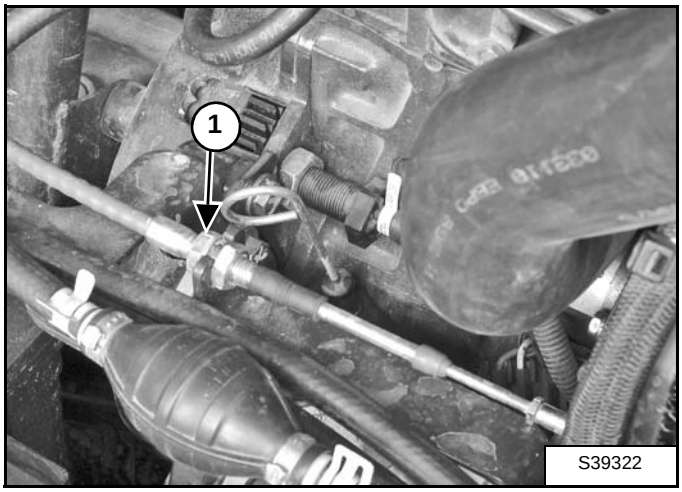
Tighten the ball joint with the nut (Item 3) **[Figure 60-21-5]**.

Figure 60-21-6



Move the engine throttle lever (Item 1) until it contacts the stop (Item 2) **[Figure 60-21-6]**.

Figure 60-21-7



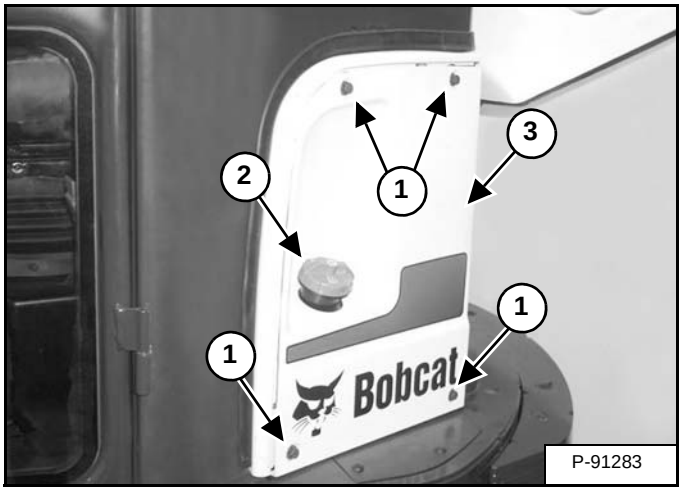
Tighten the jam nuts (Item 1) **[Figure 60-21-7]** to secure the position.

MUFFLER

Removal

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

Figure 60-30-1

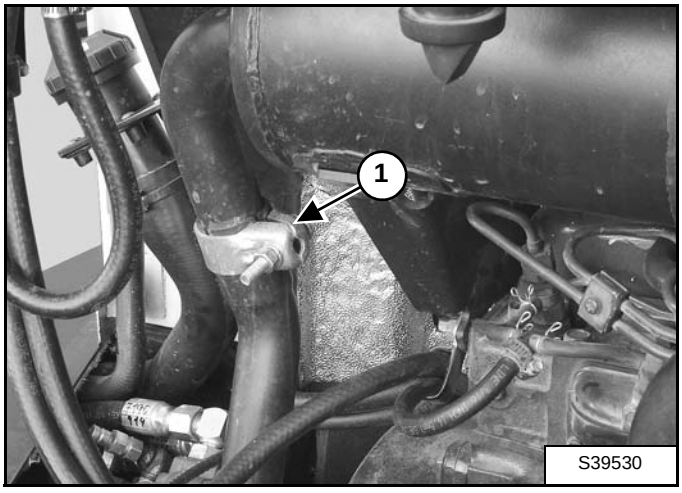


Remove the four bolts (Item 1), fuel cap (Item 2) and side cover (Item 3) **[Figure 60-30-1]**.

Reinstall the fuel cap (Item 2) **[Figure 60-30-1]**.

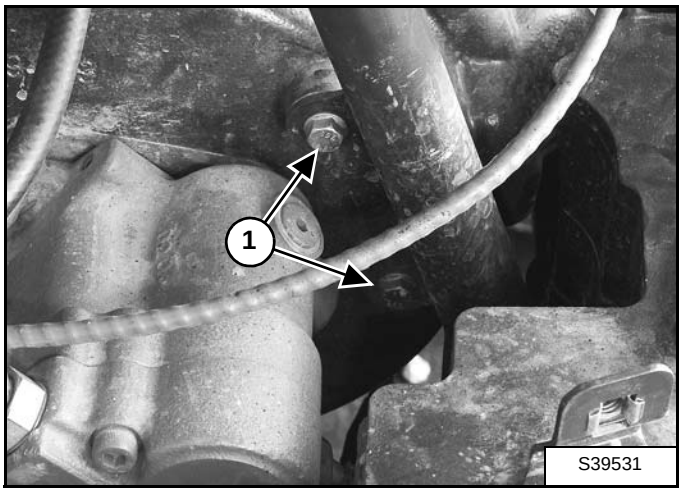
NOTE: Reinstall the fuel cap to prevent any contamination from entering the fuel tank.

Figure 60-30-2



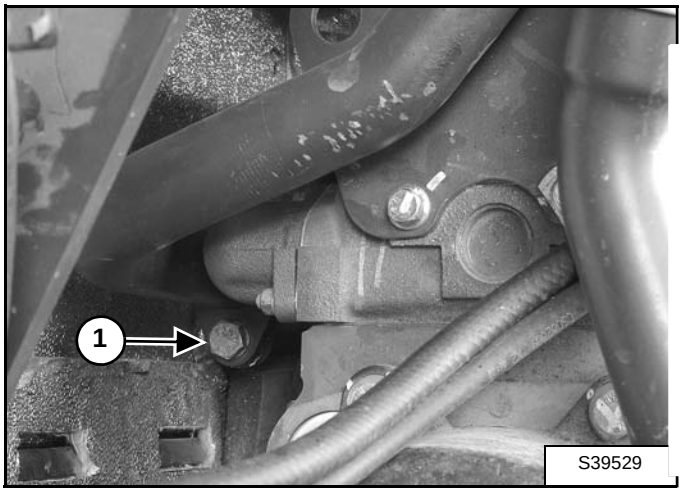
Remove the clamp (Item 1) **[Figure 60-30-2]**.

Figure 60-30-3



Remove the bolts (Item 1) **[Figure 60-30-3]** and remove the tail pipe.

Figure 60-30-4

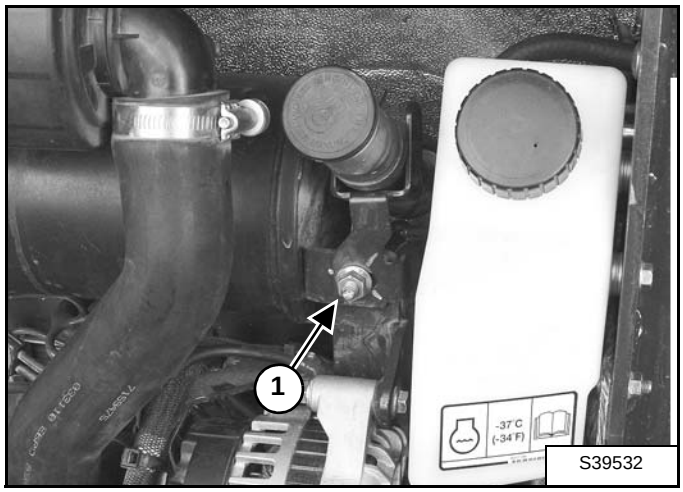


Remove the two bolts (Item 1) **[Figure 60-30-4]**, washers and nuts.

NOTE: One bolt is hidden in [Figure 60-30-4].

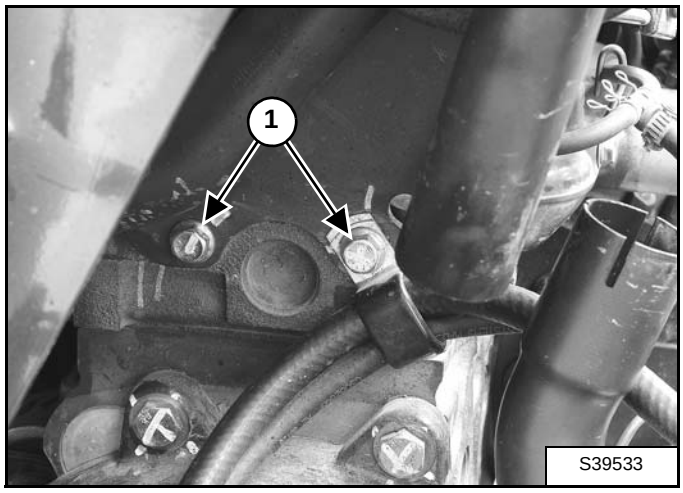
Removal (Cont'd)

Figure 60-30-5



Remove the bolt and nut (Item 1) **[Figure 60-30-5]**.

Figure 60-30-6



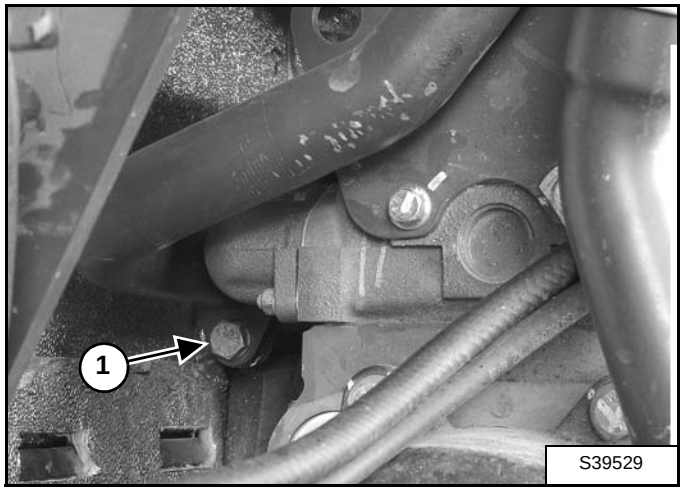
Remove the two bolts (Item 1) **[Figure 60-30-6]**.

Remove the muffler.

Installation

NOTE: It is important to follow the muffler mounting bolts torque sequence as described below.

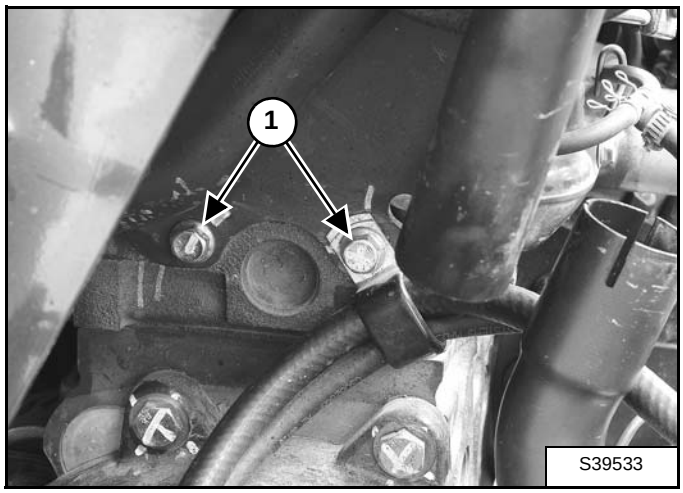
Figure 60-30-7



Install the two bolts (Item 1) **[Figure 60-30-7]**, washers and nuts. Do not yet tighten the bolts.

NOTE: One bolt is hidden in [Figure 60-30-7].

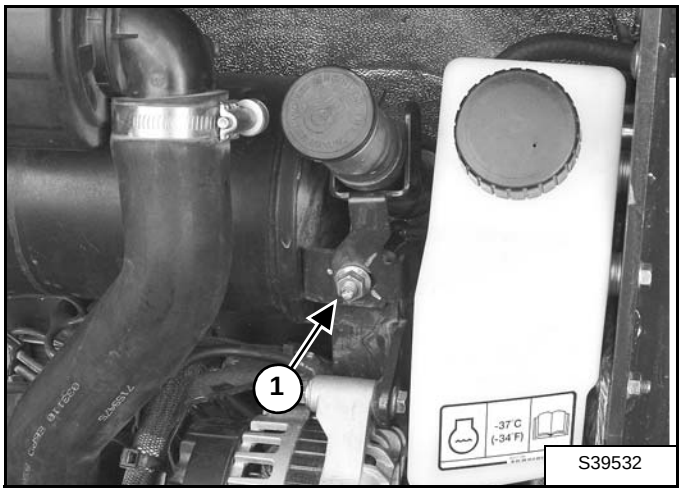
Figure 60-30-8



Install the two bolts (Item 1) **[Figure 60-30-8]**. Do not yet tighten the bolts.

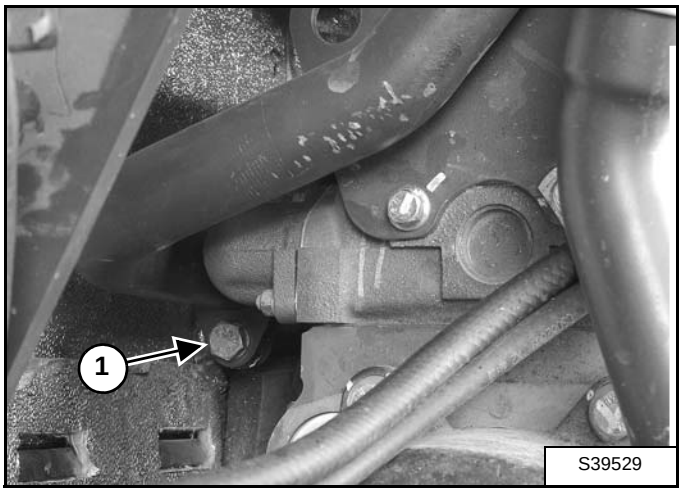
Installation (Cont'd)

Figure 60-30-9



Install the bolt and nut (Item 1) **[Figure 60-30-9]**. Do not yet tighten the bolt and nut.

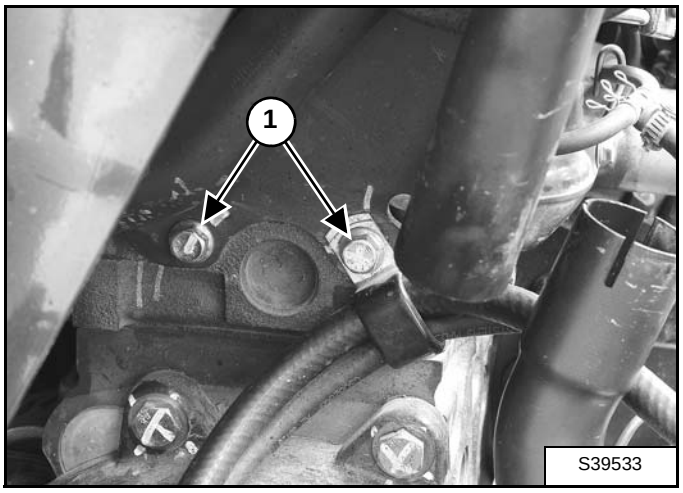
Figure 60-30-10



NOTE: One bolt is hidden in [Figure 60-30-10].

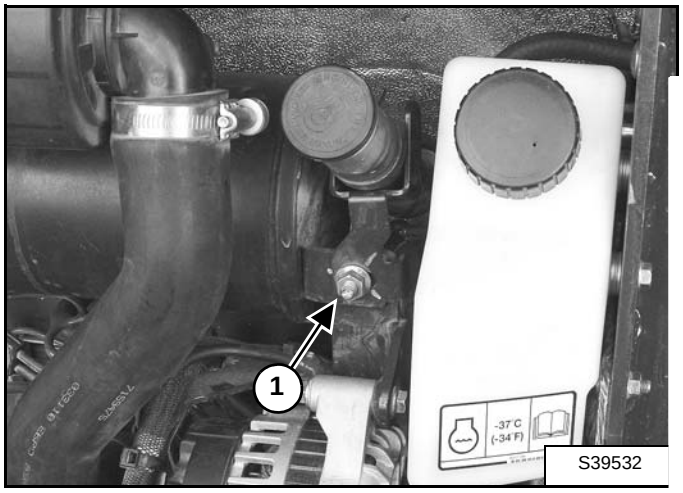
Tighten the two bolts (Item 1) **[Figure 60-30-10]** to 54 - 61 N•m (40 - 45 ft-lb) torque.

Figure 60-30-11



Tighten the two bolts (Item 1) **[Figure 60-30-11]**.

Figure 60-30-12

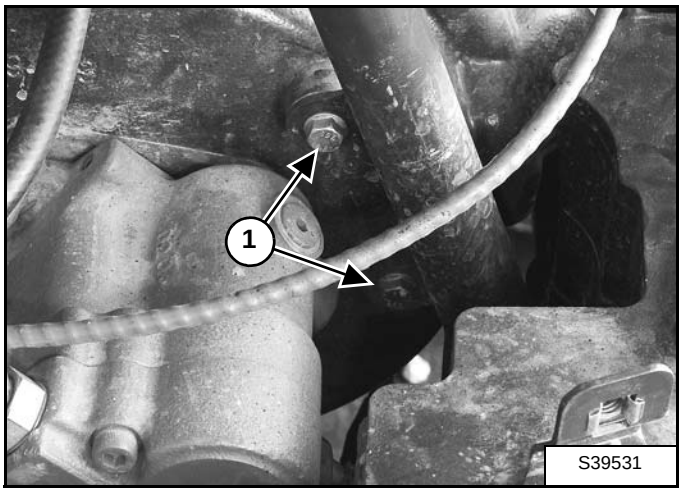


Tighten the bolt and nut (Item 1) **[Figure 60-30-12]**.

MUFFLER (CONT'D)

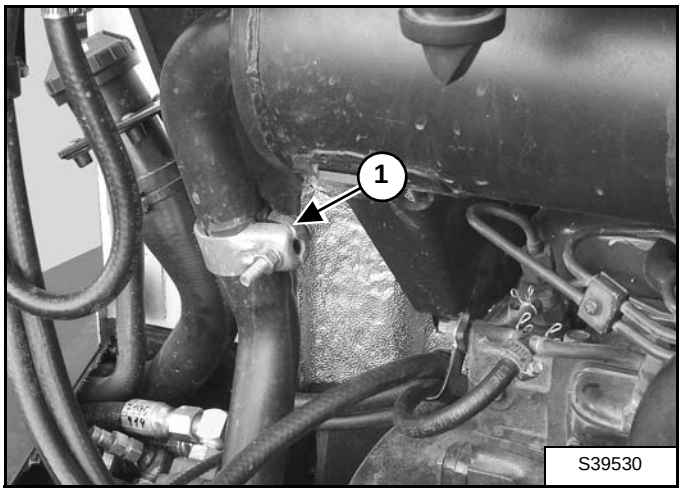
Installation (Cont'd)

Figure 60-30-13



Install the tail pipe with the two bolts (Item 1) **[Figure 60-30-13]**.

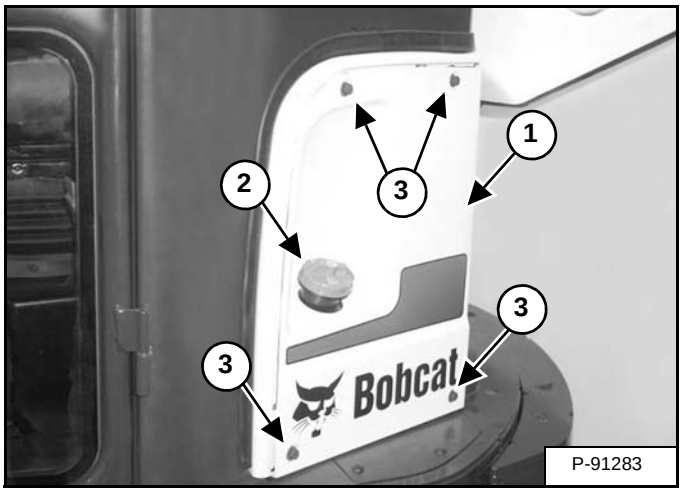
Figure 60-30-14



Install the clamp (Item 1) **[Figure 60-30-14]**.

Tighten the bolt and nut to 28 - 32 N•m (21 - 24 ft-lb) torque.

Figure 60-30-15



Remove the fuel cap which has been temporarily installed to prevent contamination.

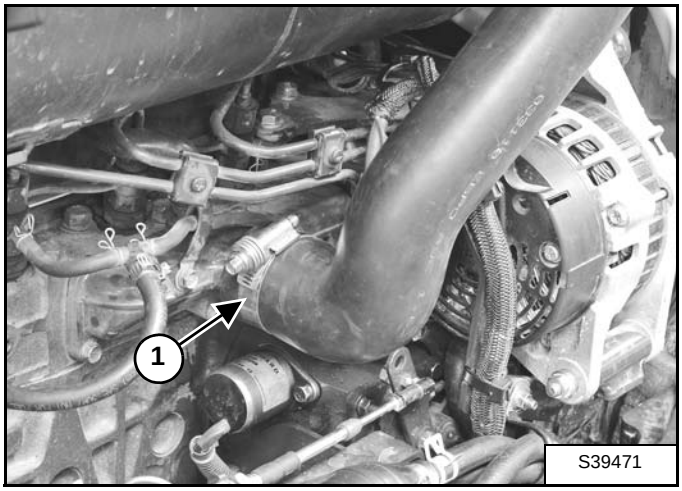
Install the side cover (Item 1), fuel cap (Item 2) and four bolts (Item 3) **[Figure 60-30-15]**.

AIR CLEANER

Removal And Installation

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

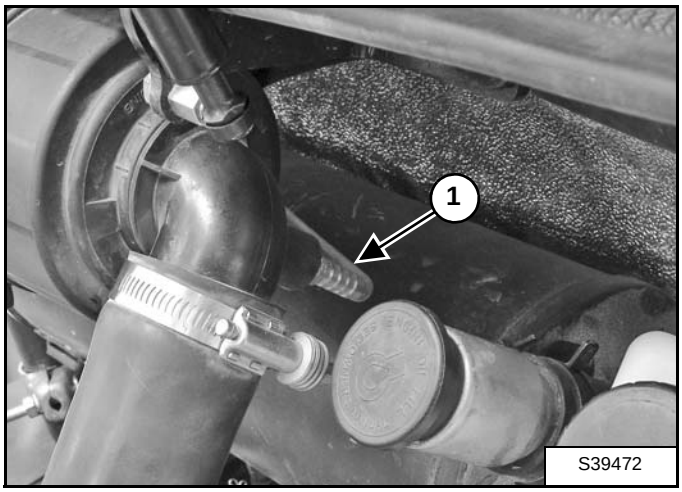
Figure 60-40-1



Loosen the clamp (Item 1) **[Figure 60-40-1]** and remove the hose from the intake manifold.

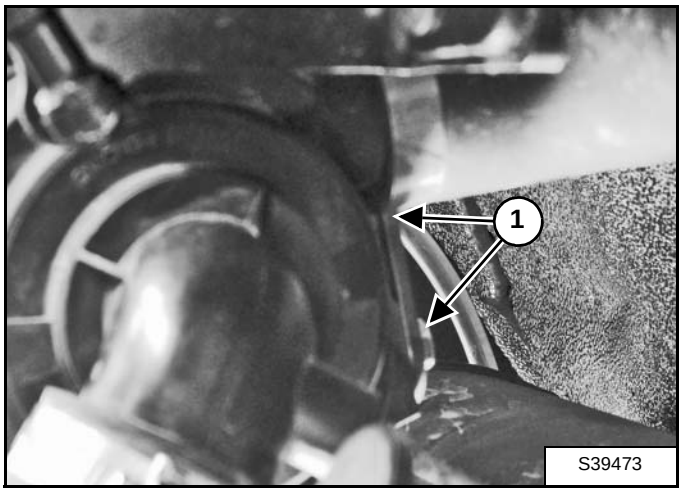
NOTE: Plug the intake manifold to prevent any contamination from entering the engine.

Figure 60-40-2



Lower the air cleaner assembly and remove the air filter indicator hose (Item 1) **[Figure 60-40-2]**.

Figure 60-40-3



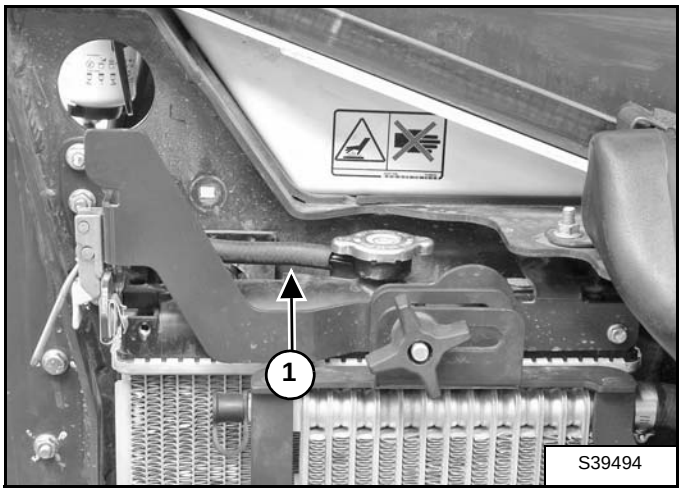
Remove the bolts (Item 1) **[Figure 60-40-3]** from the air cleaner.

Remove the air cleaner assembly from the excavator.


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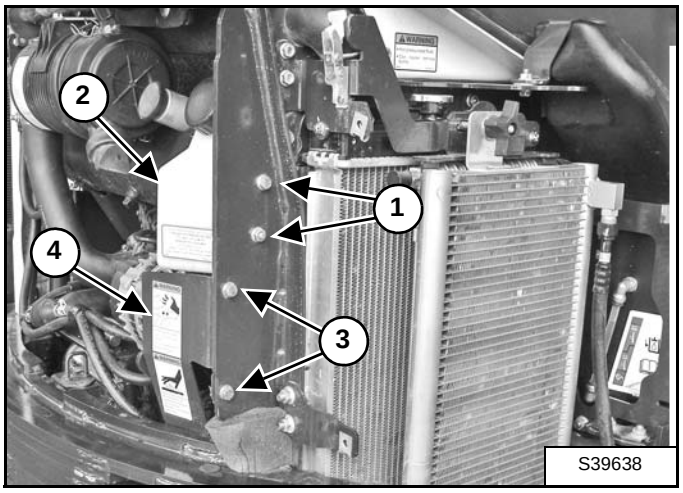
Radiator Removal And Installation

Figure 60-50-1



Remove the radiator overflow hose (Item 1) **[Figure 60-50-1]**.

Figure 60-50-2



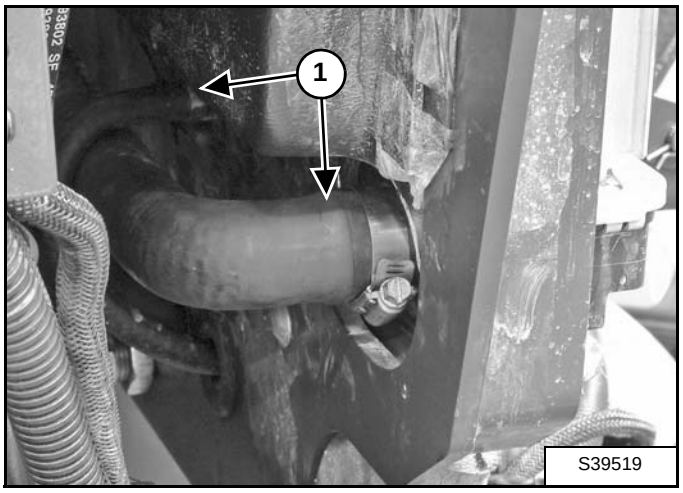
Remove the two bolts (Item 1) and the coolant reservoir (Item 2) **[Figure 60-50-2]**.

Remove the two bolts (Item 3) and the fan guard (Item 4) **[Figure 60-50-2]**.

Remove the oil cooler. (See Removal And Installation on Page 20-150-1.)

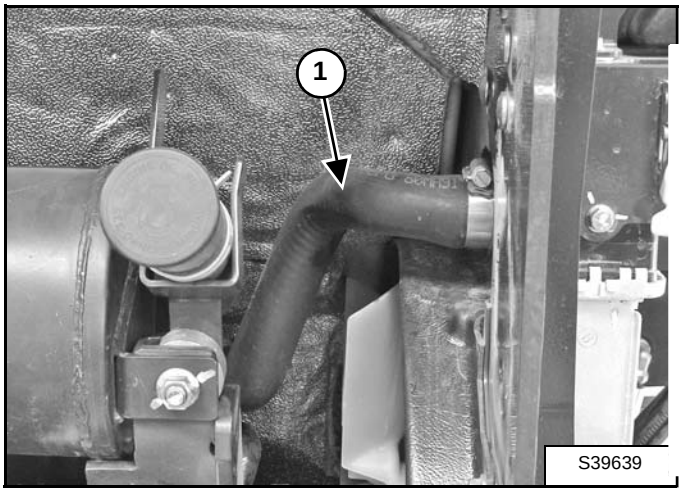
Drain the coolant. (See Removing And Replacing Coolant on Page 10-90-3.)

Figure 60-50-3



Remove the lower hoses (Item 1) **[Figure 60-50-3]** from the radiator.

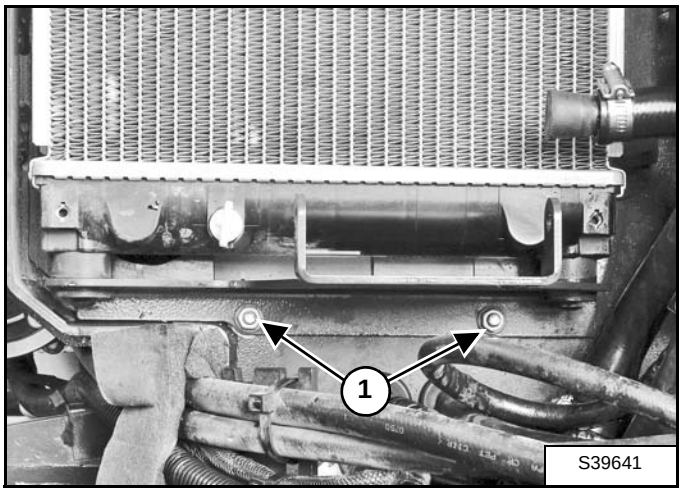
Figure 60-50-4



Remove the upper hose (Item 1) **[Figure 60-50-4]** from the radiator.

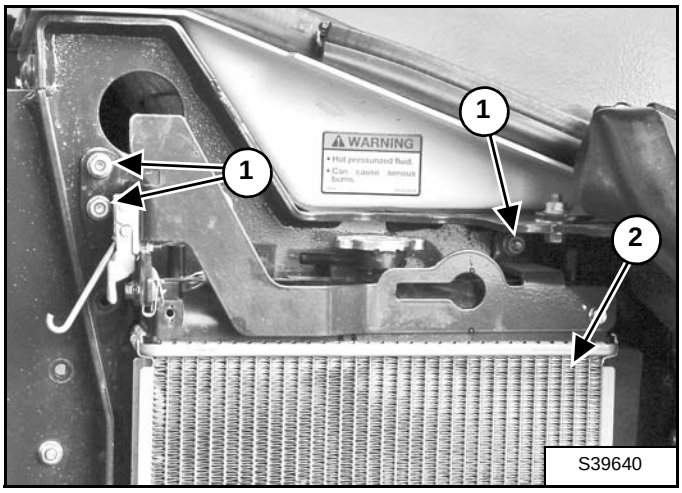
Radiator Removal And Installation (Cont'd)

Figure 60-50-5



Remove the nuts (Item 1) **[Figure 60-50-5]** from the bottom bracket of the radiator.

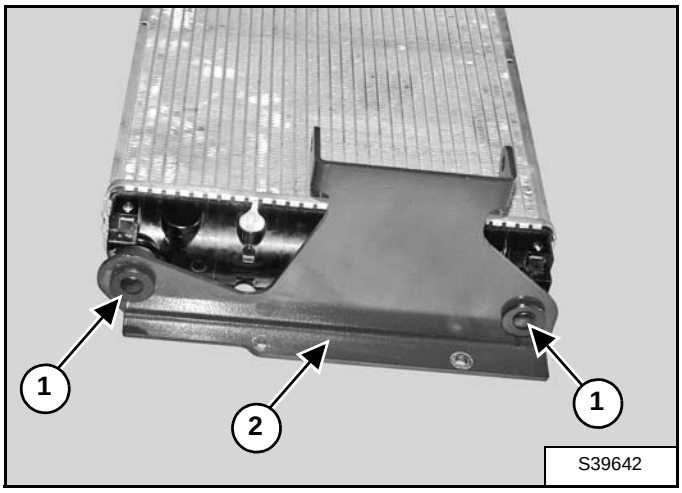
Figure 60-50-6



Remove the nuts (Item 1) **[Figure 60-50-6]** from the top of the radiator.

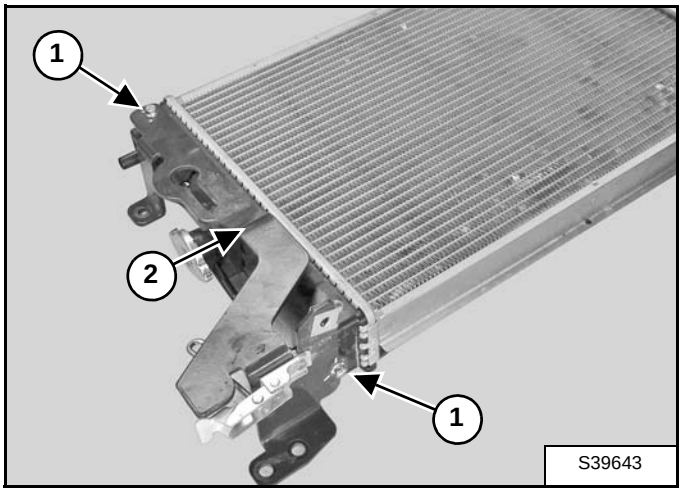
Remove the radiator (Item 2) **[Figure 60-50-6]**.

Figure 60-50-7



Remove the fasteners (Item 1). Remove the bottom bracket (Item 2) **[Figure 60-50-7]**.

Figure 60-50-8



Remove the bolts (Item 1) and remove the top bracket (Item 2) **[Figure 60-50-8]**.

Fan Removal And Installation

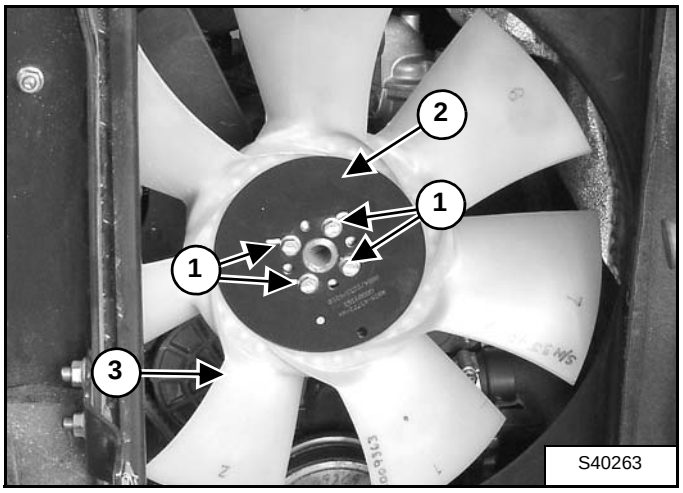
Open the tailgate. (See Opening And Closing on Page 10-50-1.)

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

Remove the oil cooler. (See Removal And Installation on Page 20-150-1.)

Remove the radiator. (See Radiator Removal And Installation on Page 60-50-1.)

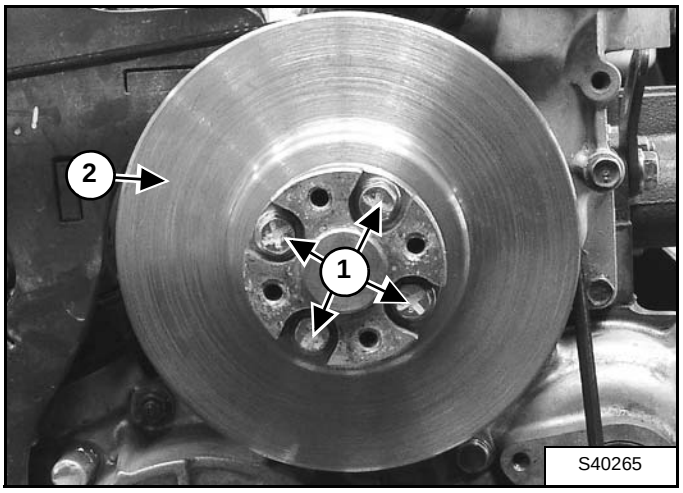
Figure 60-50-9



Remove the front four bolts (Item 1) from the front plate (Item 2) **[Figure 60-50-9]**.

The fan (Item 3) **[Figure 60-50-9]** can now be removed through the side of the frame.

Figure 60-50-10



The four bolts (Item 1) and the flange (Item 2) **[Figure 60-50-10]**.

Installation: Install new bolts with preapplied thread adhesive. Tighten the bolts to 16,3 - 20,3 N•m (12 - 15 ft-lb) torque.

Water Pump Removal And Installation

Drain the cooling system.

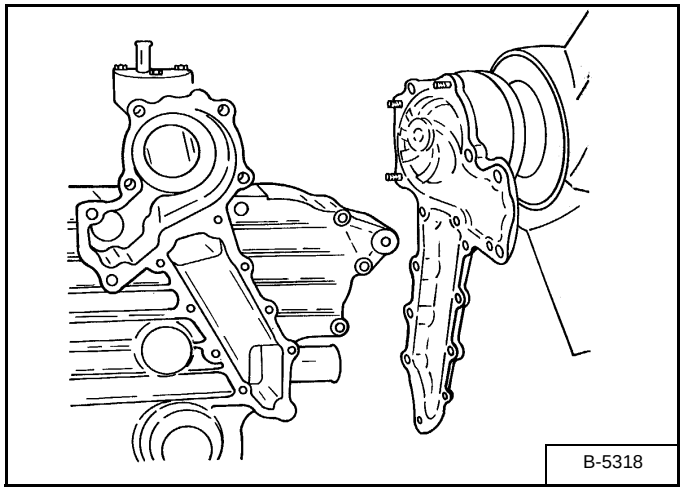
Remove the radiator. (See Radiator Removal And Installation on Page 60-50-1.)

Remove the alternator belt. (See Belt Replacement on Page 50-30-1.)

Remove the fan. (See Fan Removal And Installation on Page 60-50-3.)

Remove the water pump bolts. (See Water Pump Removal And Installation on Page 60-50-4.)

Figure 60-50-11

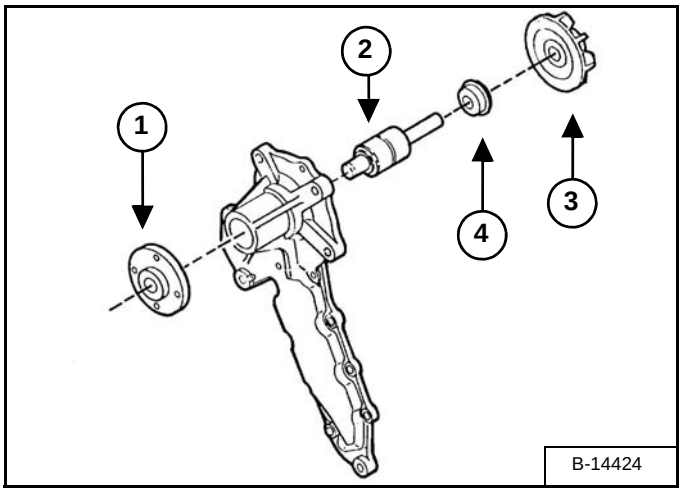


Remove the water pump **[Figure 60-50-11]**.

Installation: Always use a new gasket when installing the water pump.

Water Pump Disassembly And Assembly

Figure 60-50-12



Remove the flange (Item 1) **[Figure 60-50-12]**.

Press the shaft (Item 2) and impeller (Item 3) **[Figure 60-50-12]** out the impeller side of the water pump.

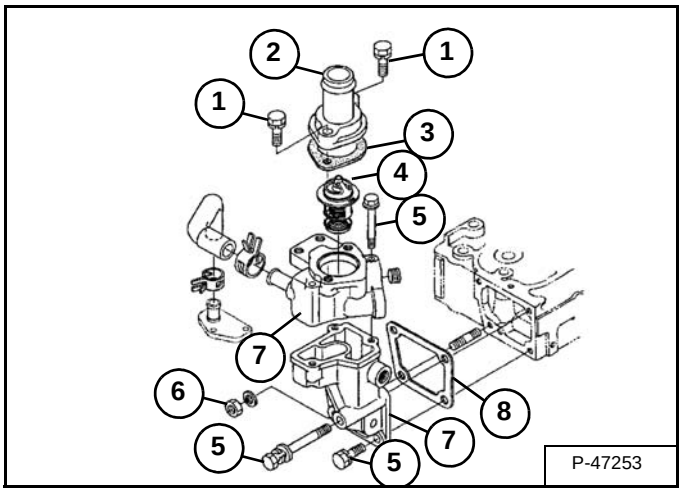
Remove the impeller (Item 3) **[Figure 60-50-12]** from the shaft.

Remove the seal (Item 4) **[Figure 60-50-12]**.

Install a new seal (Item 4) **[Figure 60-50-12]** when assembling the water pump.

Thermostat Housing Removal And Installation

Figure 60-50-13

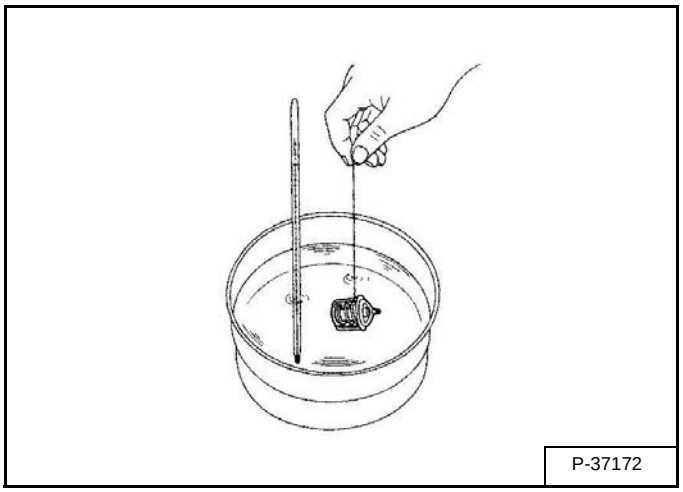


Remove the bolts (Item 1), housing (Item 2), gasket (Item 3) and thermostat (Item 4) **[Figure 60-50-13]**.

Remove bolts (Item 5), nut (Item 6), top and bottom housing (Item 7), and gasket (Item 8) from the cylinder head **[Figure 60-50-13]**.

Thermostat - Checking

Figure 60-50-14



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 14]**.

Hold the string to suspend the thermostat in the wate When the water temperature rises, the thermostat valv will open, allowing it to fall down from the string.

Continue heating the water and read the temperatur when the valve has risen by about 8 mm (0.315 in).

If the measurement is not acceptable, replace th thermostat.

Thermostat's valve opening temperature	Factory spec.	69,5 - 72,5°C (157.1 - 162.5°F)
Temperature at which thermostat completely opens	Factory spec.	85°C (185°F)


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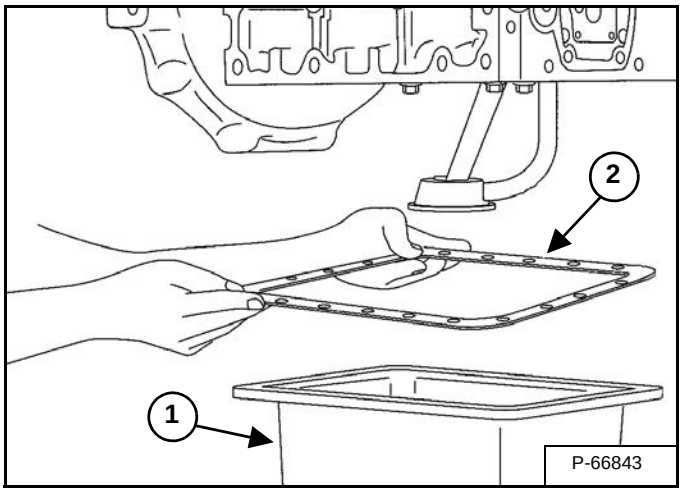
LUBRICATION SYSTEM

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.

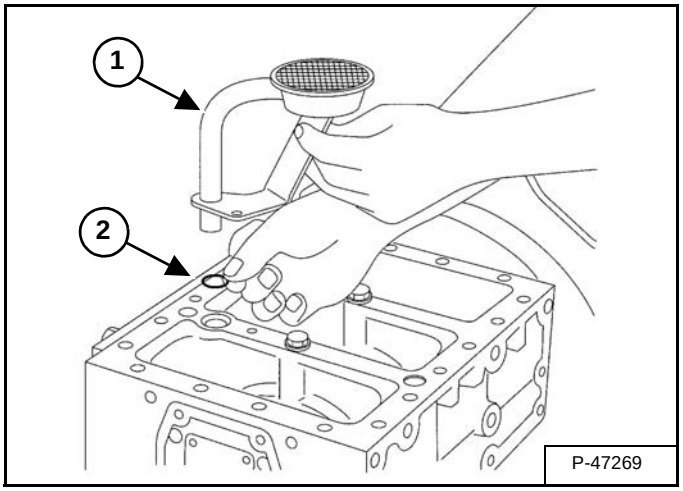
Figure 60-60-1



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 loose 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

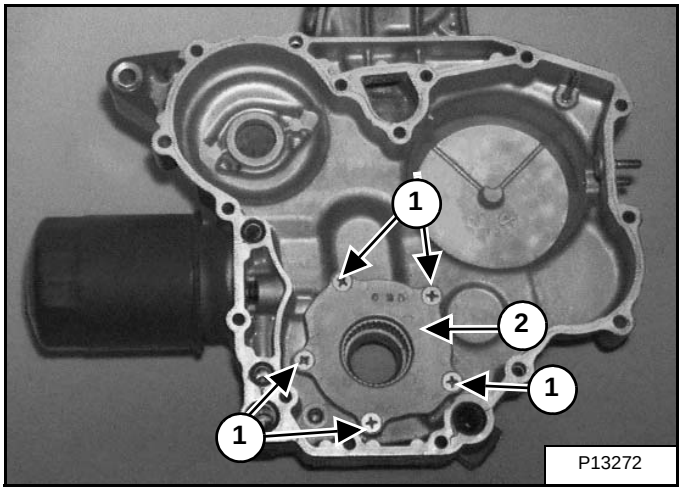


Remove the oil pump strainer (Item 1) and O-ring (Item 2) **[Figure 60-60-2]** by tapping the edge of the strainer with a soft faced hammer.

Oil Pump Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-100-1.)

Figure 60-60-3



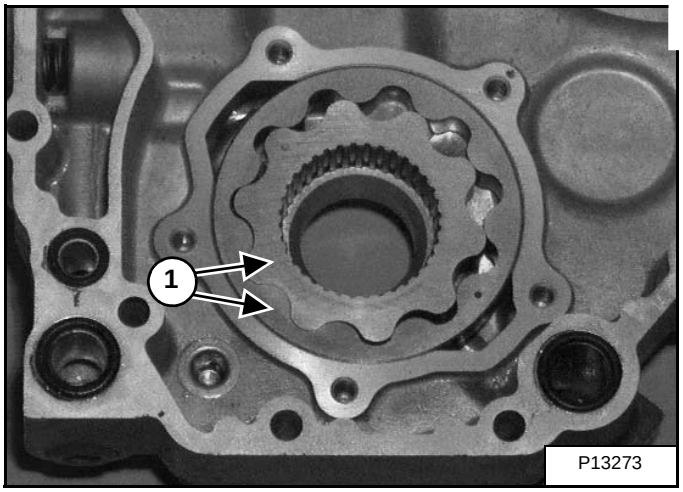
Remove the timing gearcase cover. See **[Figure 60-60 3]**.

Remove the mounting screws (Item 1) **[Figure 60-60-3]**.

Installation: Tighten the mounting screws to 7,9 - 12, N•m (70 - 113 in-lb) torque.

Remove the rear cover (Item 2) **[Figure 60-60-3]**.

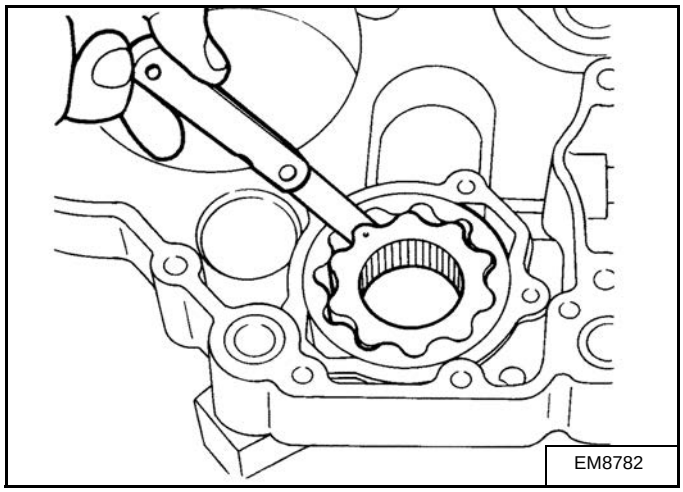
Figure 60-60-4



Remove the oil pump rotor assembly (Item 1) **[Figure 60-60-4]** and check for wear.

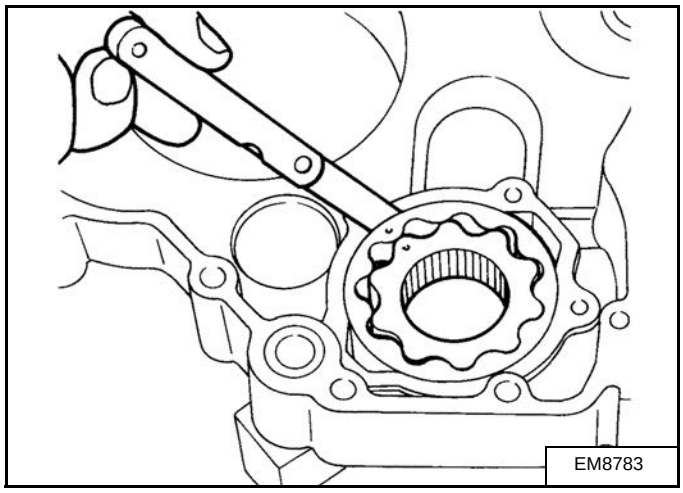
Oil Pump Inspection

Figure 60-60-5



Measure the clearance between the lobes of the inner rotor and outer rotor **[Figure 60-60-5]**.

Figure 60-60-6

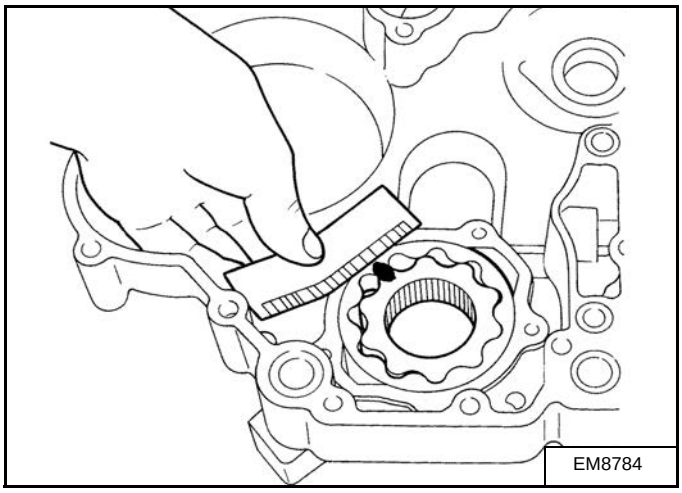


Measure the clearance between the outer rotor and pump body **[Figure 60-60-6]**.

If the clearance exceeds the allowable limit, replace the oil pump.

Clearance Between Inner and Outer Rotor	0,060 - 0,18 mm (0.0024 - 0.0071 in)
Allowable Limit	-
Clearance Between Outer Rotor and Body	0,100 - 0,180 mm (0.00394 - 0.00708 in)
Allowable Limit	-

Figure 60-60-7



Put a piece of press gauge on the rotor face **[Figure 60-60-7]**.

Install the cover and tighten the bolts.

Remove the cover carefully. Measure the width of the press gauge **[Figure 60-60-7]**.

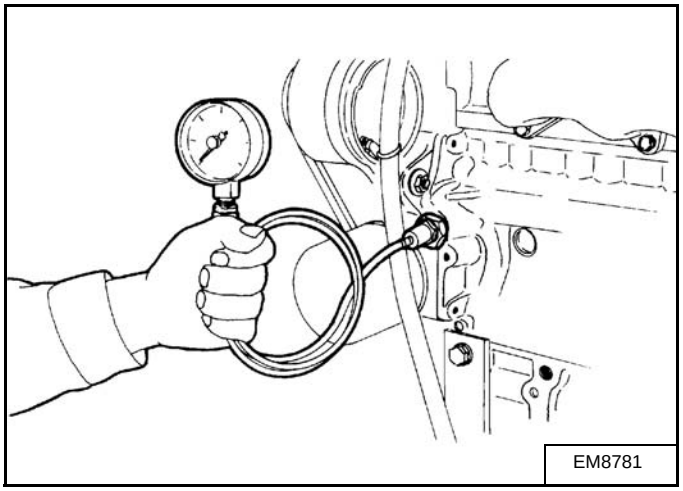
If the clearance exceeds the allowable limit replace the oil pump.

End Clearance	0,025 - 0,075 mm (0.00099 - 0.0029 in)
Allowable Limit	-

Engine Oil Pressure - Testing

Remove the oil pressure sender.

Figure 60-60-8



Install a pressure gauge **[Figure 60-60-8]**.

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

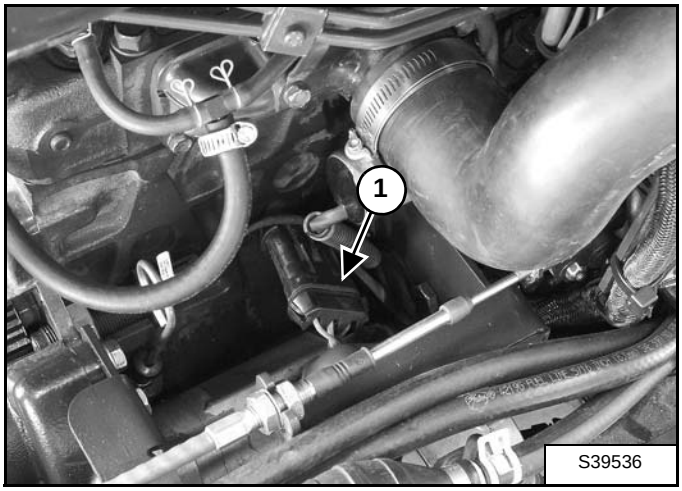
At Idle Speed Allowable Limit	49 kPa (0,49 bar) (7.1 psi)
At Rated Speed	197 - 441 kPa (1,97 - 4,41 bar) (28.5 - 64.0 psi)
Allowable Limit	147 kPa (1,47 bar) (21.3 psi)


Bobcat®

Fuel Shutoff Solenoid - Checking

Stop the engine and open the tailgate.

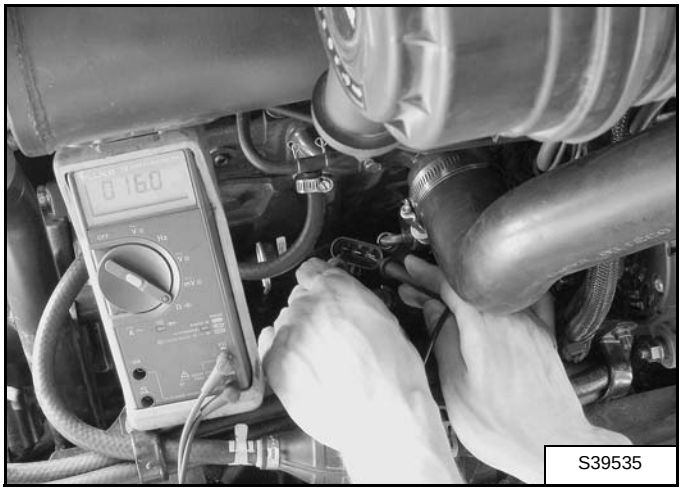
Figure 60-70-1



Disconnect the fuel shutoff solenoid wire harness (Item 1) **[Figure 60-70-1]**.

Use an ohmmeter to check the fuel shutoff solenoid.

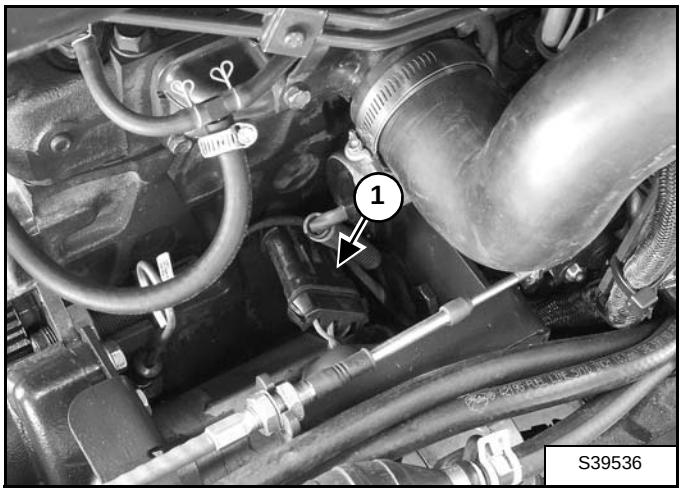
Figure 60-70-2



The reading between terminals A - B and A - C should be approximately 16 ohm. The reading between terminals B - C should be approximately 0.38 ohm **[Figure 60-70-2]**.

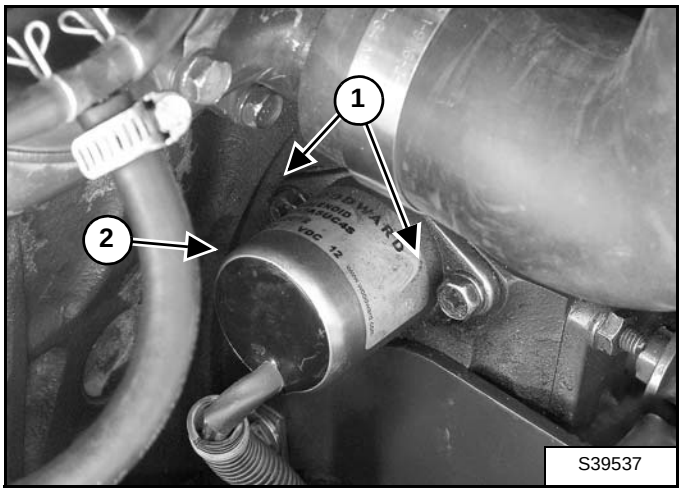
Fuel Shutoff Solenoid Removal And Installation

Figure 60-70-3



Disconnect the wire harness (Item 1) **[Figure 60-70-3]**.

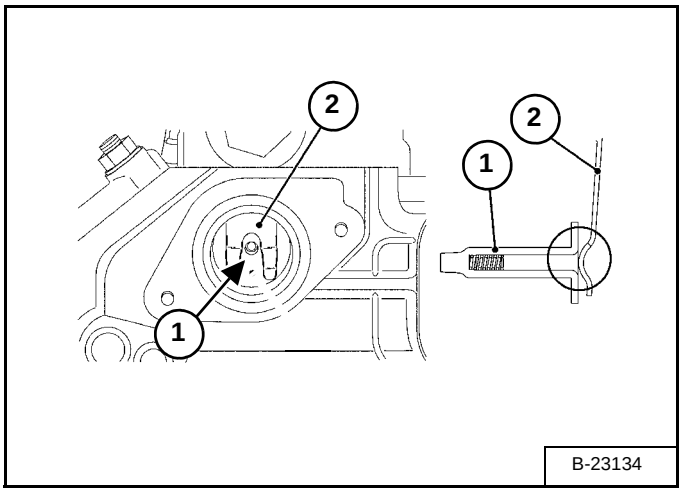
Figure 60-70-4



Remove the bolts (Item 1) **[Figure 60-70-4]**.

Remove the solenoid (Item 2) **[Figure 60-70-4]**.

Figure 60-70-5



Installation: The guide (Item 1) on the fuel shutoff solenoid must contact the boost lever (Item 2) **[Figure 60-70-5]**.

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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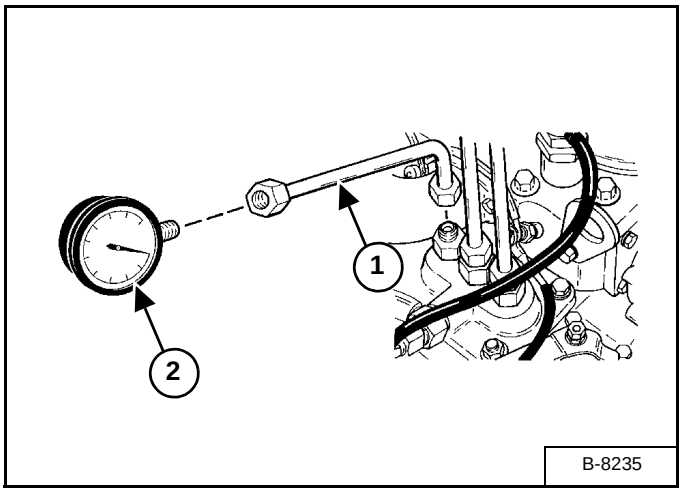
The tools listed will be needed to do the following procedure:

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 pressur can not reach the allowable limit, replace the injectio pump assembly.

Fuel Tightness of Pump Element Allowable Limit	13,73 MPa (137,5 bar) (1991 psi)

With the speed control lever at the low engine idl position, turn the flywheel until the pressure is at 13,7 MPa (137,3 bar) (1991 psi).

Turn the flywheel back approximately one-half turn. Kee the flywheel at this position, and measure the time it takes the pressure to decrease to 12,75 MPa (127,5 bar) (1849 psi).

Fuel Tightness of Delivery Valve Allowable Limit	5 seconds

Fuel Injection Pump Removal And Installation

IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

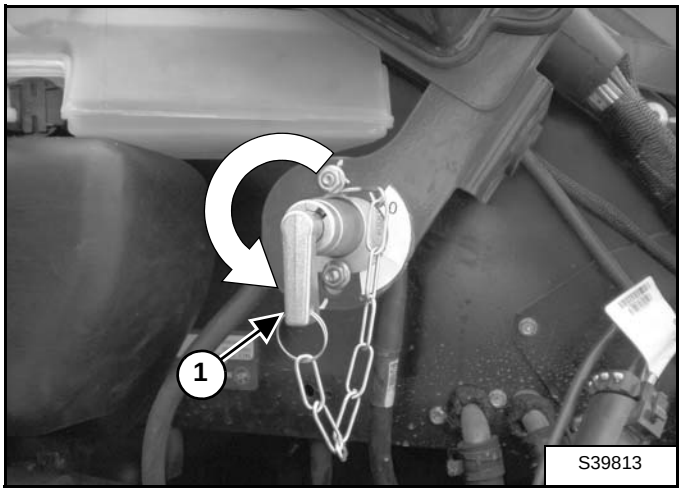
I-2029-0289

IMPORTANT

Do not attempt to maintain or adjust unless you are trained and have the correct equipment.

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Figure 60-70-7



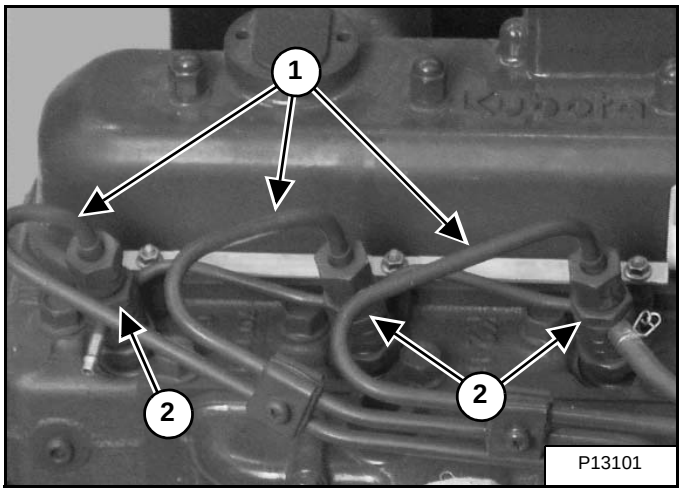
Rotate the battery disconnect switch (Item 1) **[Figure 60-70-7]** counterclockwise to disconnect the ground terminal from the battery.

Remove the air cleaner. (See Removal And Installation on Page 60-40-1.)

Remove the fuel shut-off solenoid. (See Fuel Shutoff Solenoid Removal And Installation on Page 60-70-2.)

Clean around the injection pump.

Figure 60-70-8



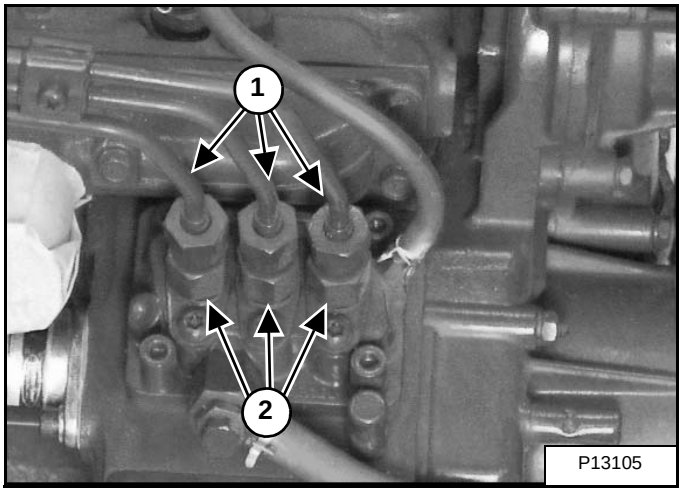
Remove the bolts (Item 1) and bracket (Item 2) **[Figure 60-70-8]**.

Disconnect the high pressure fuel lines (Item 1) **[Figure 60-70-8]** from the fuel injectors.

NOTE: Hold the banjo fitting nuts (Item 2) [Figure 60-70-8] when removing or tightening the high pressure fuel lines.

Installation: Tighten the high pressure fuel line nuts to 24 - 33 N•m (18 - 25 ft-lb).

Figure 60-70-9



Disconnect the high pressure fuel lines (Item 1) **[Figure 60-70-9]** from the delivery valves.

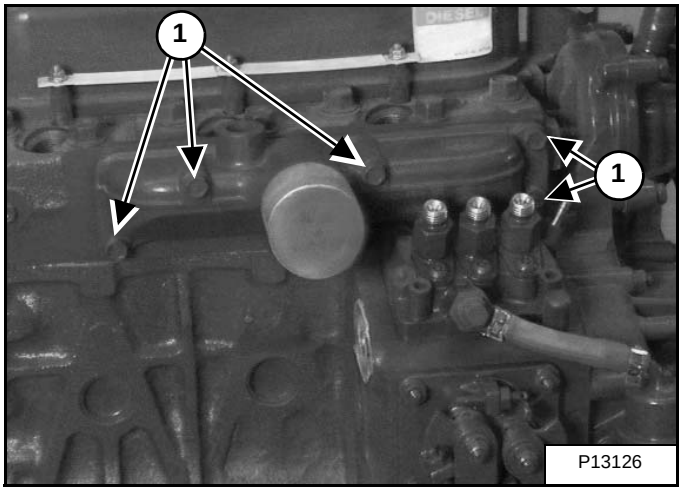
NOTE: Hold the delivery valve holder nuts (Item 2) [Figure 60-70-9] when removing or tightening the high pressure fuel lines.

Installation: Tighten the high pressure fuel line nuts to 24 - 33 N•m (18 - 25 ft-lb).

Remove the high pressure fuel lines from the engine.

Fuel Injection Pump Removal And Installation (Cont'd)

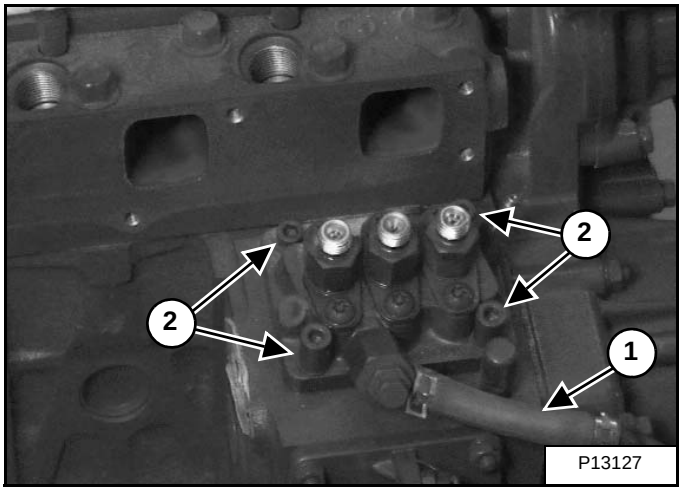
Figure 60-70-10



Remove the five mounting bolts (Item 1) **[Figure 60-70-10]** from the intake manifold. Remove the intake manifold from the engine.

Installation: Replace the manifold gasket. Tighten the mounting bolts to 22 - 27 N•m (16 - 20 ft-lb) torque.

Figure 60-70-11

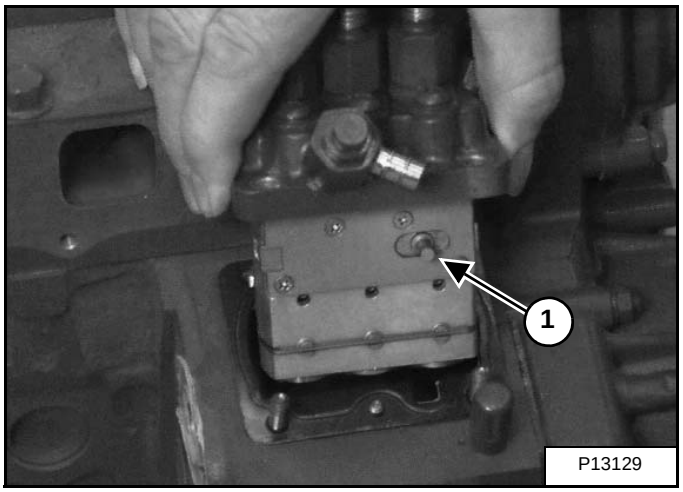


Disconnect the fuel inlet hose (Item 1) **[Figure 60-70-11]** from the injection pump.

Remove the four mounting bolts (Item 2) **[Figure 60-70-11]** from the top of the injection pump.

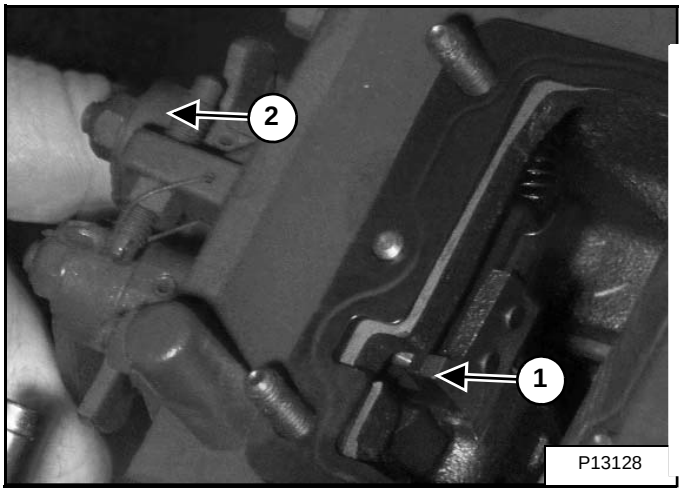
Installation: Tighten the mounting bolts to 22 - 27 N•m (16 - 20 ft-lb) torque.

Figure 60-70-12



Remove the injection pump (Item 1) **[Figure 60-70-12]** from the engine.

Figure 60-70-13

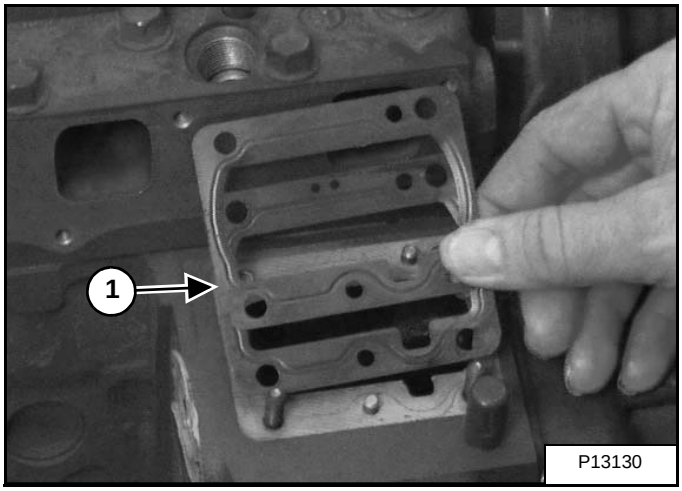


Installation: Align the rack pin (Item 1) **[Figure 60-70-12]** with the notch (Item 1) **[Figure 60-70-13]** located inside the injection pump chamber. Use the throttle lever (Item 2) **[Figure 60-70-13]** on the side of the injection pump chamber to align the notch.

If the rack pin is not installed correctly engine damage can result.

Fuel Injection Pump Removal And Installation (Cont'd)

Figure 60-70-14



Install the shim(s) (Item 1) **[Figure 60-70-14]** on the injection pump mounting surface. For information on number of shims used (See Fuel Injection Pump - Timing on Page 60-70-7.).

Fuel Injection Pump - Timing

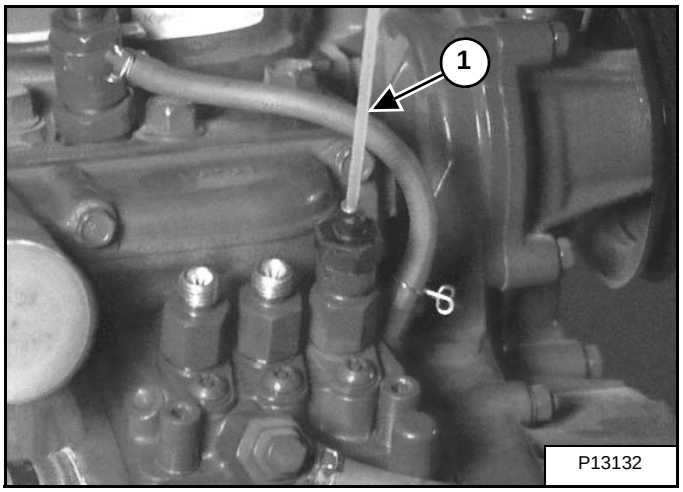
Timing the injection pump is done by changing the number of shims between the injection pump and engine block.

Disconnect the high pressure fuel lines from the injection pump and the injectors. (See Fuel Injection Pump Removal And Installation on Page 60-70-4.)

Remove the fuel injectors. (See Fuel Injector Removal And Installation on Page 60-70-10.)

Remove the fuel shut-off solenoid. (See Fuel Shutoff Solenoid Removal And Installation on Page 60-70-2.)

Figure 60-70-15



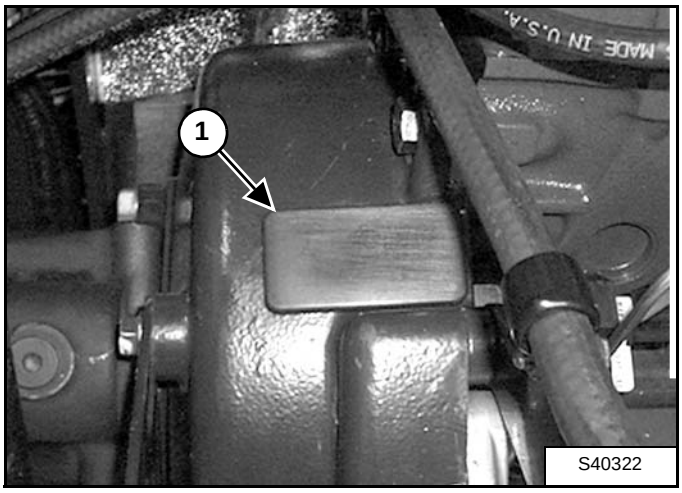
Turn the fuel supply lever to the ON position. Install a short plastic tube (Item 1) **[Figure 60-70-15]** in the fitting of the number one cylinder port. Point the tube up (vertical).

NOTE: The fuel must be in the tube before attempting timing.

Move the fuel lever on the injection pump to full fuel position (or full throttle).

Turn the flywheel counterclockwise (facing the flywheel) slowly until the start of fuel rise in the plastic tube (Item 1) **[Figure 60-70-15]**.

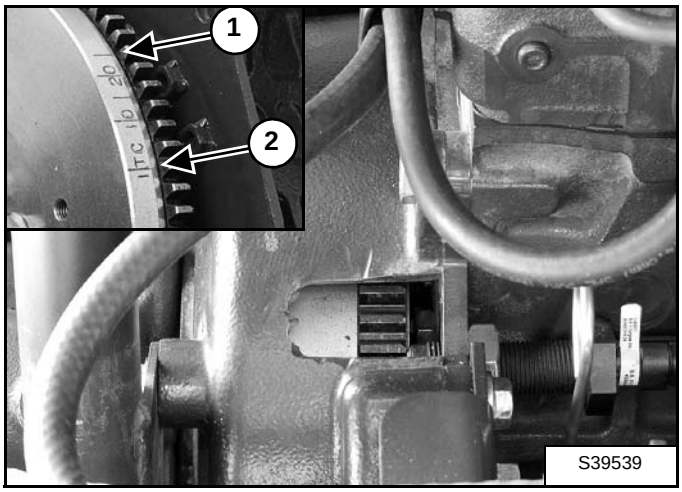
Figure 60-70-16



Remove the rubber plug (Item 1) **[Figure 60-70-16]**.

Fuel Injection Pump - Timing (Cont'd)

Figure 60-70-17



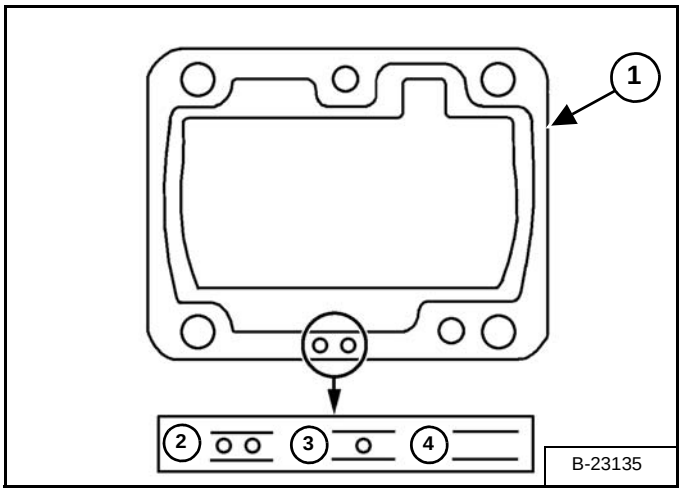
After the fuel fills up the hole of the delivery valve holder No. 1 cylinder, turn back (clockwise) the flywheel for approx. 90°.

Turn the flywheel counterclockwise to 25° before T.D.C. of the first cylinder. This 25° position is marked on the flywheel (Item 1) **[Figure 60-70-17]**.

Slowly turn the flywheel counterclockwise and stop turning when the fuel begins to come up, to get the actual injection timing.

Read the actual angle on the flywheel. The flywheel has marks in 5 degree steps until 25 degrees before the T.D.C. mark "1TC" (Item 2) **[Figure 60-70-17]** of the first cylinder.

Figure 60-70-18



The correct engine timing is 17,25 - 18,75° B.T.D.C. Add or subtract shims (Item 1) **[Figure 60-70-18]** to time the engine to 17,25 - 18,75° 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: The liquid gasket is not required for assembling.

NOTE: Shims (Item 1) are available in four thicknesses, shims with the two holes (Item 2) are 0,20 mm or 0,175 mm (0.0098 in or 0.0068 in) thick, shims with one hole (Item 3) are 0,25 mm (0.0098 in) thick and shims with no holes (Item 4) [Figure 60-70-18] are 0,30 mm (0.0118 in) thick.

NOTE: Increasing the thickness of the shim pack by 0,050 mm (0.00196 in) retards the injection timing by 0,5 degrees. Decreasing the shim pack by 0,050 mm (0.00196 in) advances the timing by 0,5 degrees.

NOTE: In disassembling and replacing the injection pump, use the same number of new shims with the same thickness.

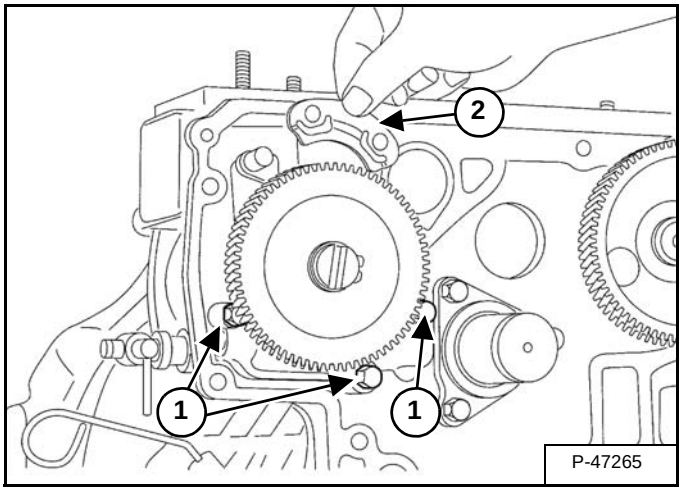
NOTE: The 0,175 mm (0.0068 in) thick shim is coated only on the lower face. Therefore, do not use the 0,175 mm (0.0068 in) thick shim as the top shim of the combination (injection pump side), because this can cause oil leakage.

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 Idler Gear And Shaft Removal And Installation on Page 60-100-3.)

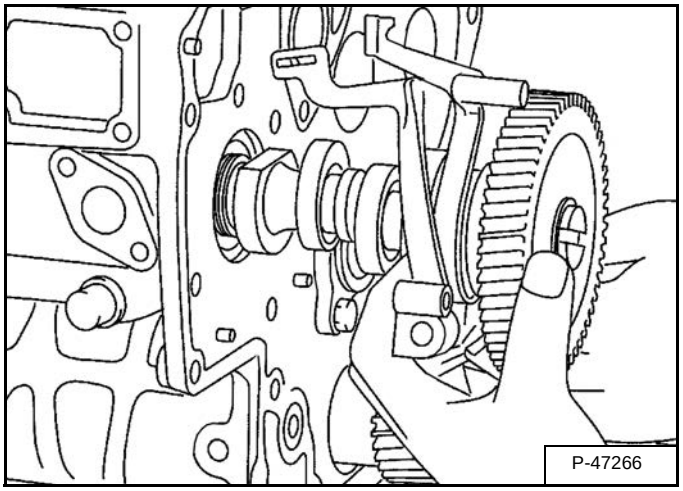
Figure 60-70-19



Remove the three bolts (Item 1) **[Figure 60-70-19]**.

Remove the two bolts and fuel camshaft retainer plate (Item 2) **[Figure 60-70-19]**.

Figure 60-70-20

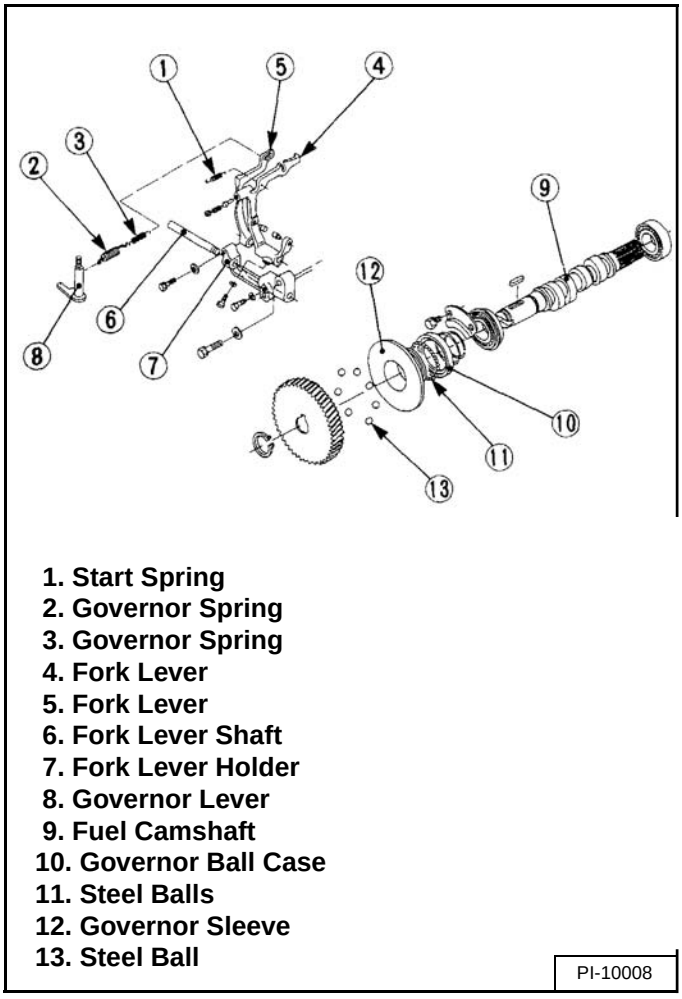


Remove the fuel camshaft and fork lever assembly at the same time **[Figure 60-70-20]**.

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 60-70-21



Disassemble and assemble the governor and fuel camshaft as shown in figure **[Figure 60-70-21]**.

Check all the parts for wear or damage and replace as needed.

Fuel Injector Removal And Installation

Remove the air cleaner. (See Removal And Installation on Page 60-40-1.)

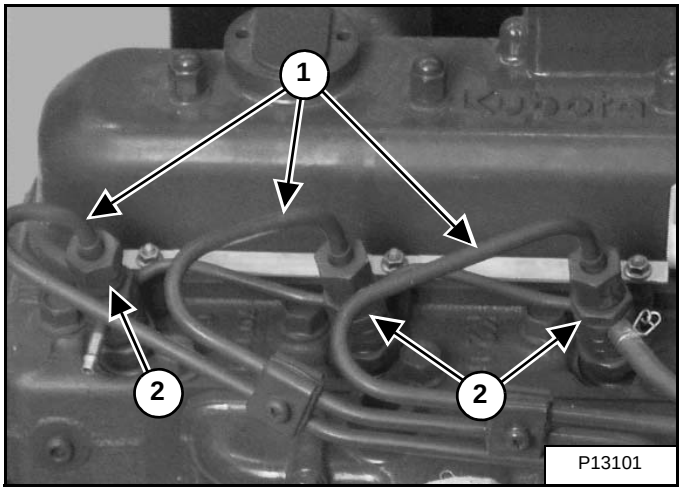
⚠ WARNING

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.

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Figure 60-70-22

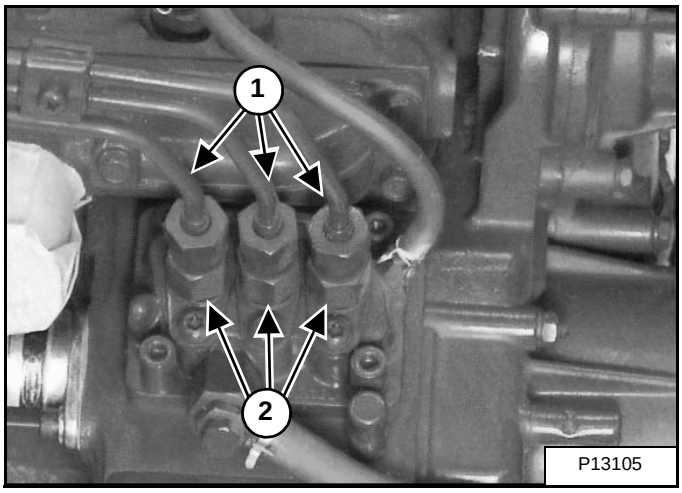


Disconnect the high pressure fuel lines (Item 1) **[Figure 60-70-22]** from the fuel injectors.

NOTE: Hold the banjo fitting nuts (Item 2) [Figure 60-70-22] when removing or tightening the high pressure fuel lines.

Installation: Tighten the high pressure fuel line nuts to 24 - 33 N•m (18 - 25 ft-lb).

Figure 60-70-23



Disconnect the high pressure fuel lines (Item 1) **[Figure 60-70-23]** from the delivery valves.

NOTE: Hold the delivery valve holder nuts (Item 2) [Figure 60-70-23] when removing or tightening the high pressure fuel lines.

Installation: Tighten the high pressure fuel line nuts to 24 - 33 N•m (18 - 25 ft-lb).

Remove the high pressure fuel lines from the engine.

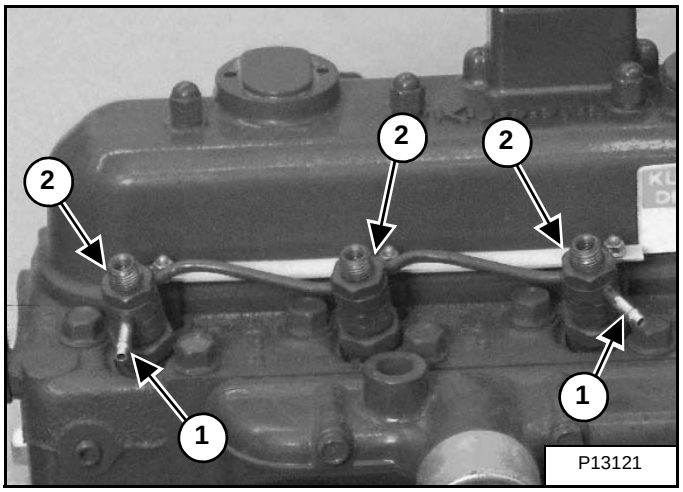
IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

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Fuel Injector Removal And Installation (Cont'd)

Figure 60-70-24

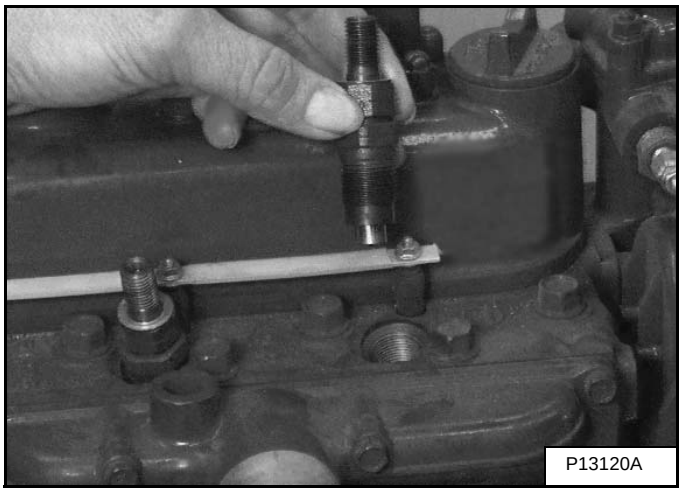


Remove the fuel line return hoses (Item 1) **[Figure 60-70-24]** from the banjo fittings.

Remove the three banjo fitting nuts (Item 2) **[Figure 60-70-24]** from the fuel injector nozzles.

Remove the banjo fittings from the fuel injectors.

Figure 60-70-25



Remove the fuel injector nozzles from the engine **[Figure 60-70-25]**.

Installation: Tighten the injectors to 29 - 49 N•m (22 - 36 ft-lb) torque.

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.

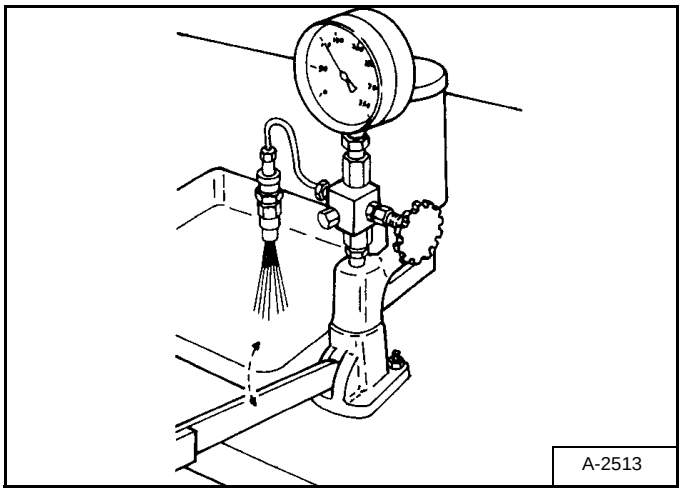
When temperatures are below -30°C (-20°F), the hydrostatic oil must be heated or kept warm. The hydrostatic system will not get enough oil at low temperatures. Park the machine in an area where the temperature will be above -18°C (0°F) if possible.

W-2027-0311

The tool listed will be needed to do the following procedure:

OEM 1064 - Injector Nozzle Tester

Figure 60-70-26



Connect the nozzle to the tester with the nozzle down **[Figure 60-70-26]**.

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	13,73 - 14,70 MPa (137,2 - 147 bar) (1992 - 2133 psi)

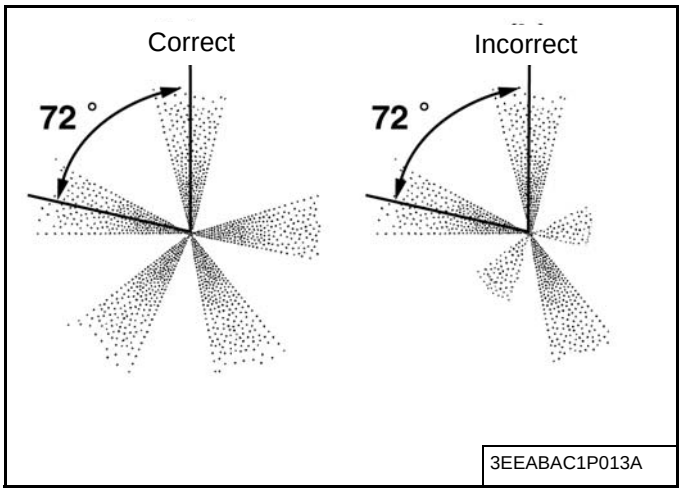
Check for inside leakage. Operate the hand lever until the pressure is 12,75 MPa (127,5 bar) (1849 psi). Keep the nozzle under this pressure for 10 seconds, check to see if fuel leaks from the nozzle. If fuel leaks, replace the nozzle.

Nozzle Spray Condition

The tool listed will be needed to do the following procedure:

OEM1064 - Injector Nozzle Tester

Figure 60-70-27



Set the injection nozzle to a nozzle tester, and check the nozzle spraying condition **[Figure 60-70-27]**.

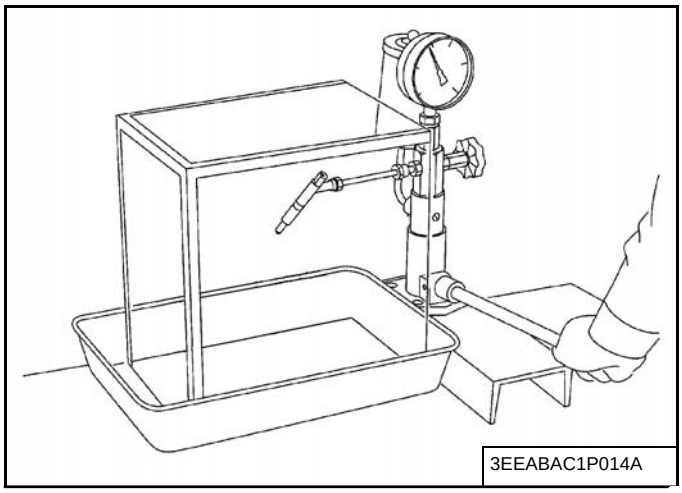
If the spraying condition is defective, replace the injection nozzle assembly.

Valve Seat Tightness

The tool listed will be needed to do the following procedure:

OEM1064 - Injector Nozzle Tester

Figure 60-70-28



Set the injection nozzle to a nozzle tester **[Figure 60-70 28]**.

Raise the fuel pressure, and keep at 12,75 MPa (127, bar) (1849 psi) for 10 seconds.

If any fuel leak is found, replace the injection nozzl assembly.

Valve seat tightness	Factory spec	No fuel leak at 12,75 MPa (127,5 bar) (1849 psi)

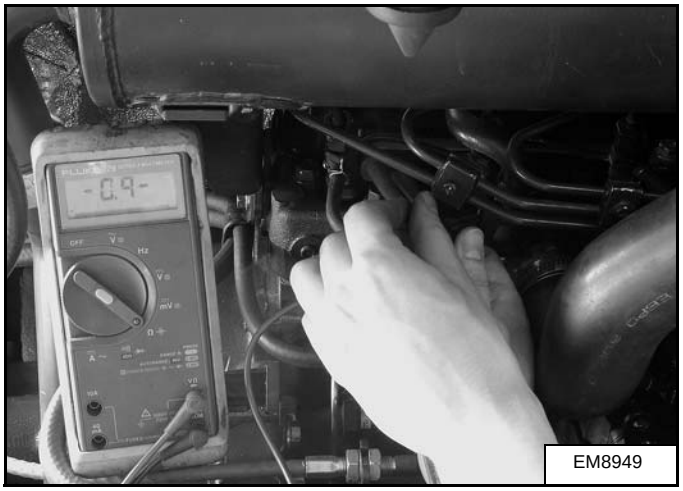

Bobcat®

CYLINDER HEAD

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.

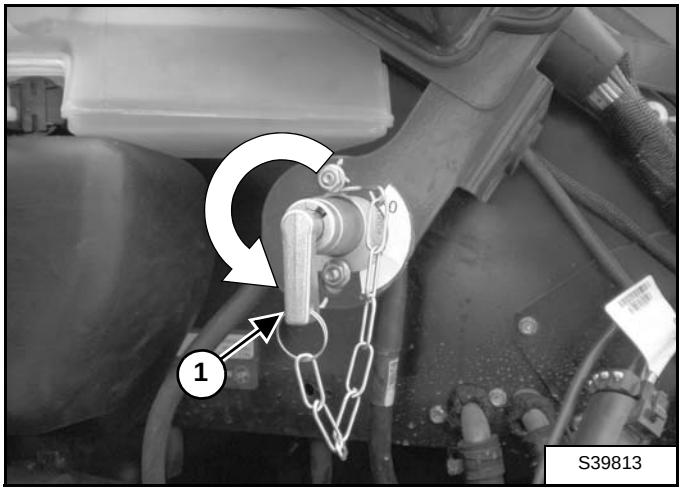
The reading should be approximately 0.9 ohm. If the resistance is infinite, the coil of the glow plug is broken. If the resistance is 0 the glow plug is short circuited.

Repeat the procedure for each glow plug.

Glow Plugs Removal And Installation

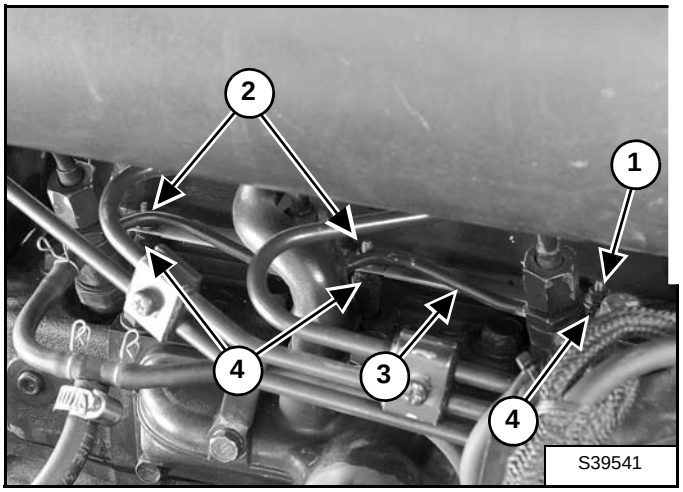
Remove the air cleaner. (See Removal And Installation on Page 60-40-1.)

Figure 60-80-2



Rotate the battery disconnect switch (Item 1) **[Figure 60-80-2]** counterclockwise to disconnect the ground termina from the battery.

Figure 60-80-3



Remove the nut and wire harness (Item 1) **[Figure 60-80-3]**.

Remove the nuts (Item 2) **[Figure 60-80-3]** from the two remaining glow plugs.

Remove the connecting strap (Item 3) **[Figure 60-80-3]** from the glow plugs.

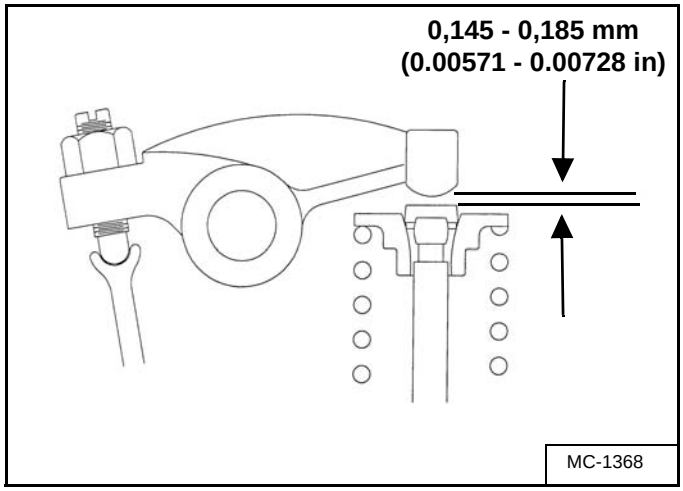
Remove the three glow plugs (Item 4) **[Figure 60-80-3]**.

Installation: Tighten the glow plugs to 15 - 20 N•m (11 - 15 ft-lb) torque.

Valve Clearance Adjustment

Adjust the valve clearance with the engine stopped and cold.

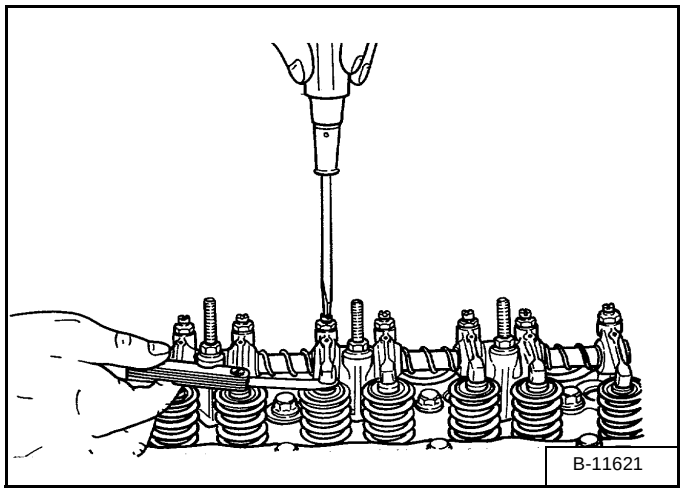
Figure 60-80-4



The correct valve clearance is 0,145 - 0,185 mm (0.00571 - 0.00728 in) **[Figure 60-80-4]**.

Make sure the piston is at T.D.C. when making the adjustment for the valves of the particular cylinder.

Figure 60-80-5

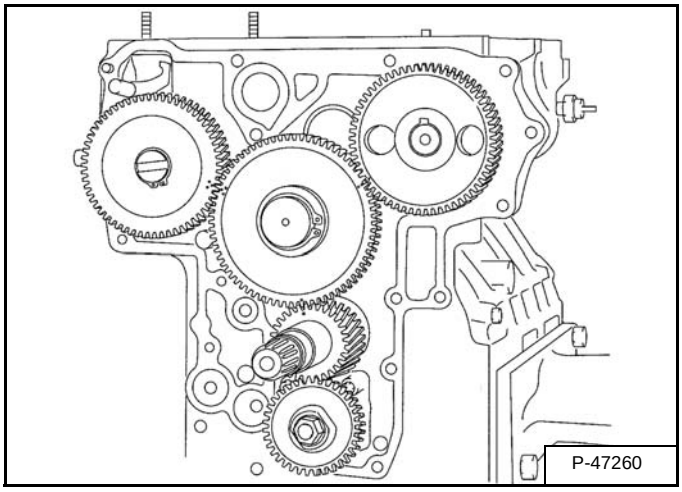


Put the correct size feeler gauge between the rocker arm and valve stem. Turn the adjustment bolt until the clearance is correct **[Figure 60-80-5]**.

Valve Timing - Checking

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-100-1.)

Figure 60-80-6

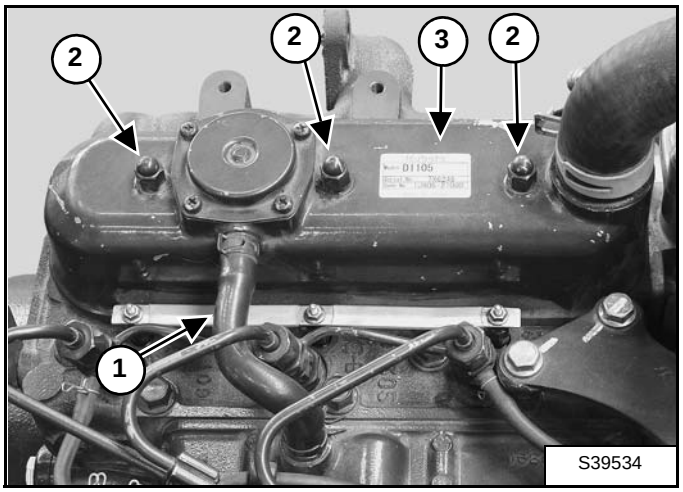


Make sure the timing marks are in correct alignment when installing the timing gears **[Figure 60-80-6]**.

CYLINDER HEAD (CONT'D)

Cylinder Head Removal And Installation

Figure 60-80-7

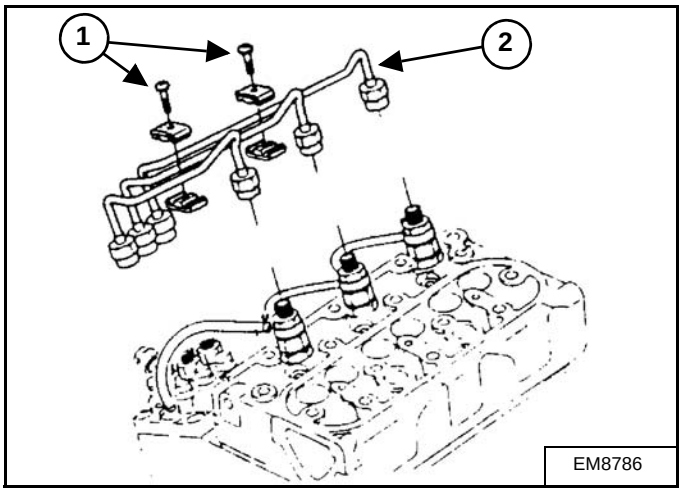


Remove the breather hose (Item 1) and valve cover bolts (Item 2) **[Figure 60-80-7]**.

Remove the valve cover (Item 3) **[Figure 60-80-7]** and gasket.

Installation: Tighten the valve cover bolts to 7 - 8 N•m (62 - 70.8 in-lb).

Figure 60-80-8



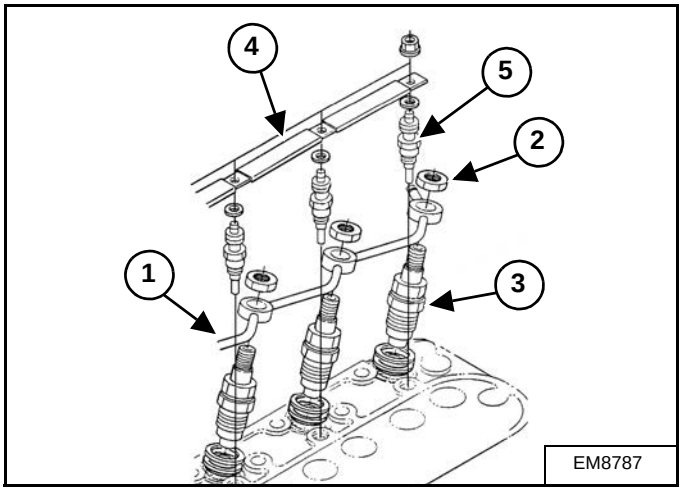
Remove the clamp screws (Item 1) **[Figure 60-80-8]** and clamps.

Remove the high pressure fuel lines (Item 2) **[Figure 60-80-8]** from the fuel injectors.

NOTE: Hold the banjo fitting nuts (Item 2) [Figure 60-80-8] when removing or tightening the high pressure fuel lines.

Installation: Tighten the high pressure fuel line nuts to 24 - 33 N•m (18 - 25 ft-lb).

Figure 60-80-9



Remove the overflow pipe (Item 1) **[Figure 60-80-9]**.

Installation: Tighten the overflow pipe nuts (Item 2) **[Figure 60-80-9]** to 20 - 24 N•m (15 - 18 ft-lb) torque.

Remove the three nozzle holder assemblies (Item 3 **[Figure 60-80-9]**.

Installation: Tighten the nozzle holder assemblies to 49 - 68 N•m (37 - 50 ft-lb) torque.

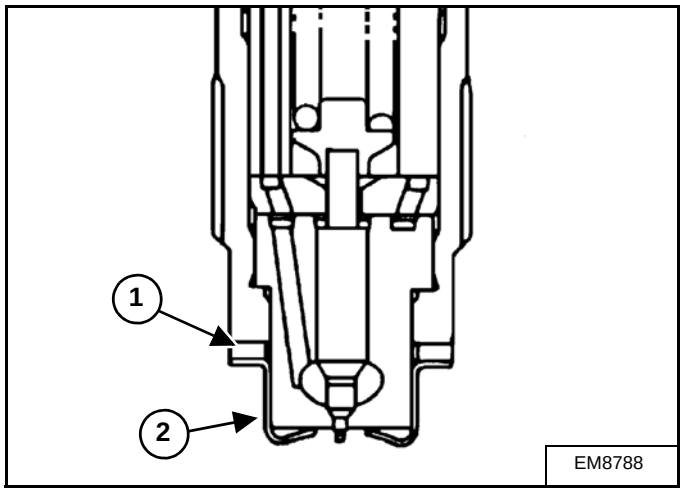
Remove the lead (Item 4) from the glow plugs (Item 5 **[Figure 60-80-9]**.

Remove the three glow plugs (Item 5) **[Figure 60-80-9]**.

Installation: Tighten the glow plugs to 7,9 - 14 N•m (5.8 - 10 ft-lb) torque.

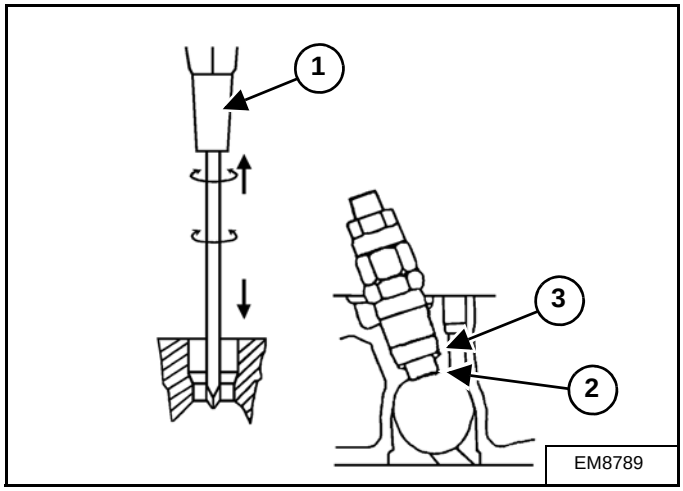
Cylinder Head Removal And Installation (Cont'd)

Figure 60-80-10



Installation: Replace the copper gasket (Item 1) and heat seal (Item 2) **[Figure 60-80-10]** on the nozzle holder assemblies.

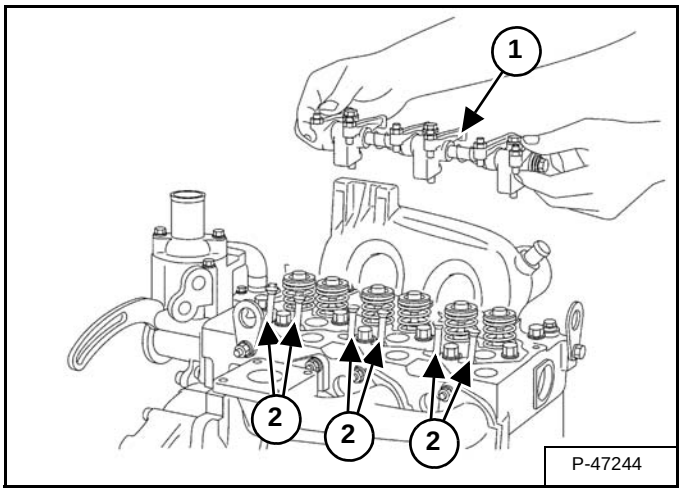
Figure 60-80-11



Installation: Drive a screw driver (Item 1) lightly into the heat seal hole. Turn the screwdriver three or four times each way. While turning the screwdriver, slowly pull the heat seal (Item 2) out together with the injection nozzle gasket (Item 3) **[Figure 60-80-11]**. If the heat seal drops, repeat above procedure.

NOTE: Use a plus (Phillips head) screw driver (Item 1) that has a diameter which is bigger than the heat seal hole (Approx. 6 mm [0.25 in]).

Figure 60-80-12



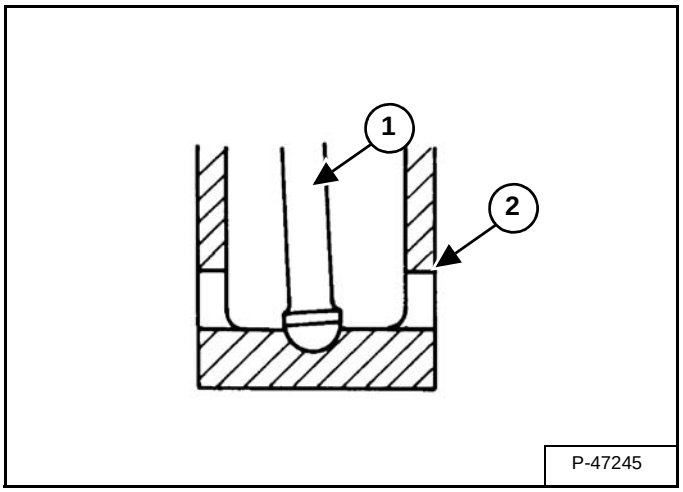
Remove the rocker arm bolts and remove the rocker arm assembly (Item 1) **[Figure 60-80-12]**.

Installation: Tighten the bolts to 24 - 27 N•m (18 - 20 ft-lb) torque.

Remove the push rods (Item 2) **[Figure 60-80-12]**.

Cylinder Head Removal And Installation (Cont'd)

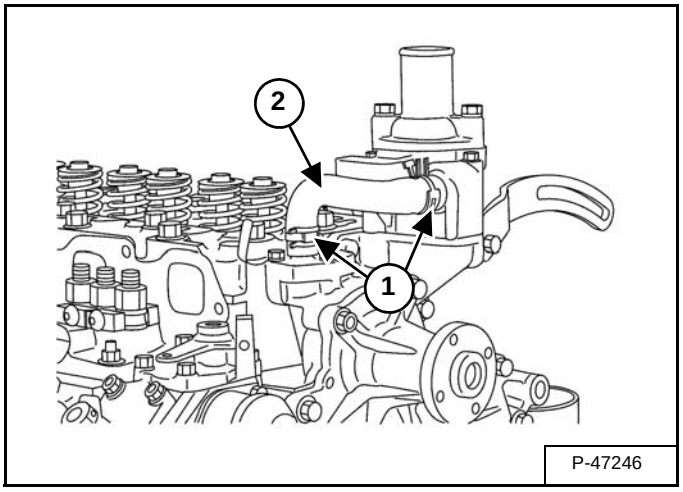
Figure 60-80-13



Installation: The push rod (Item 1) must be seated in the tappet (Item 2) **[Figure 60-80-13]** correctly or the push rods will be damaged.

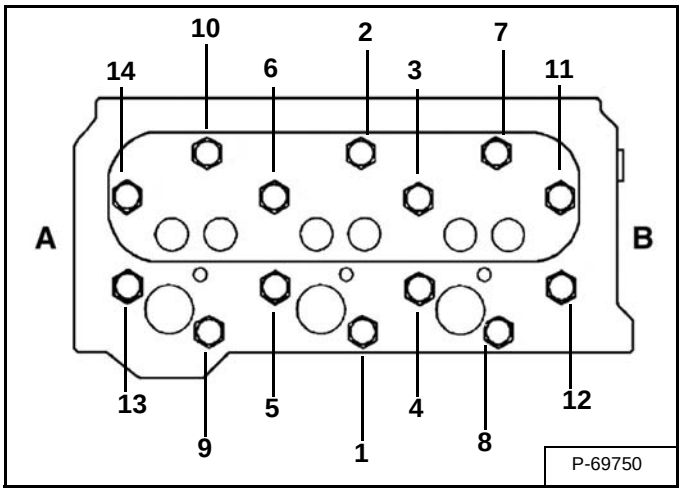
After installing the rocker arm assembly and push rods, the valve lash must be adjusted. (See Valve Clearance Adjustment on Page 60-80-2.)

Figure 60-80-14



Remove the clamps (Item 1) and remove the hose (Item 2) **[Figure 60-80-14]**.

Figure 60-80-15



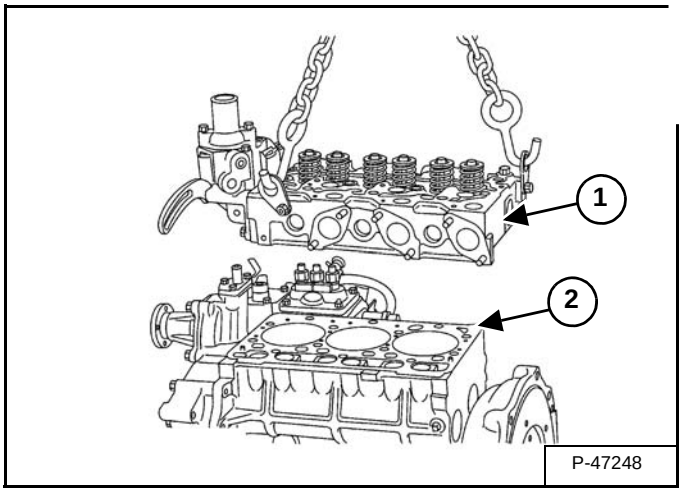
Remove the cylinder head bolts in order of #14 to #1 **[Figure 60-80-15]**.

NOTE: (A) is the gearcase side, (B) is the flywheel side.

Installation: Put oil on the bolt threads. Tighten the bolt in the correct sequence in order of #1 to #14 to 93 - 9 N•m (69 - 72 ft-lb) torque.

NOTE: Re-tighten the cylinder head bolts in th correct sequence after the engine has bee run for 30 minutes.

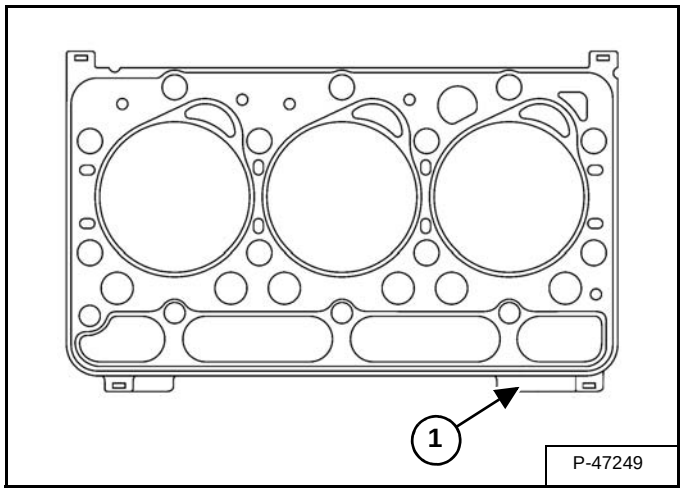
Figure 60-80-16



Remove the cylinder head (Item 1) and gasket (Item 2) **[Figure 60-80-16]**.

Cylinder Head Removal And Installation (Cont'd)

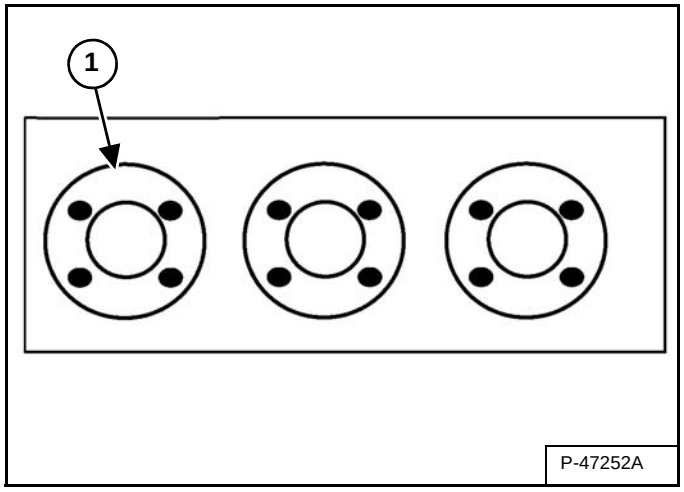
Figure 60-80-17



When replacing just the gasket, use a new gasket that has the same mark (Item 1) **[Figure 60-80-17]** 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 60-80-18



Measure and record the protrusion of each piston in the four places shown (Item 1) **[Figure 60-80-18]**. Find the average of each piston, then find the combined average of the three pistons.

Figure 60-80-19

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 60-80-19]**.

Find the measurement of the highest piston protrusion and the lowest piston protrusion (recorded earlier) for each piston.

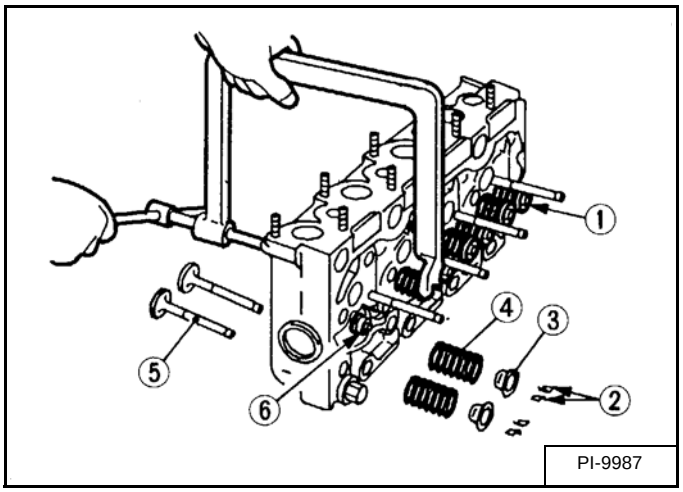
If the highest measurement exceeds the piston protrusion of the selected gasket, use the gasket which is one size larger. If the measurement exceeds gasket size 35, the engine must be disassembled, clearances checked, and reassembled.

If the measurement is two sizes smaller than the selected gasket or smaller than gasket size 15, the engine must be disassembled, clearances checked, and reassembled.

After the gasket and cylinder head have been installed, turn the crankshaft by hand to be sure there is no interference between the piston, cylinder, and valves.

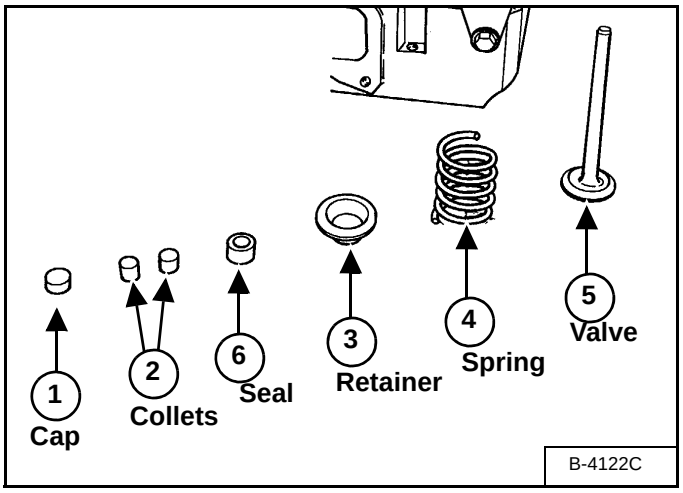
Cylinder Head Disassembly And Assembly

Figure 60-80-20



Use a valve spring compressor to compress the valve springs **[Figure 60-80-20]**.

Figure 60-80-21



Remove the valve cap (Item 1) and valve spring collet (Item 2) **[Figure 60-80-20]** and **[Figure 60-80-21]**.

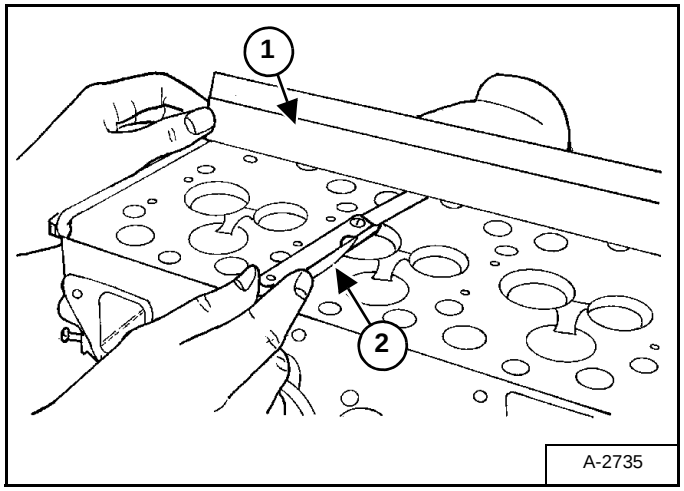
Remove the valve spring retainer (Item 3) and the spring (Item 4) **[Figure 60-80-20]** and **[Figure 60-80-21]**.

Remove the seal (Item 6) and the valve (Item 5) **[Figure 60-80-20]** and **[Figure 60-80-21]**.

Cylinder Head - Servicing

Clean the surface of the cylinder head.

Figure 60-80-22

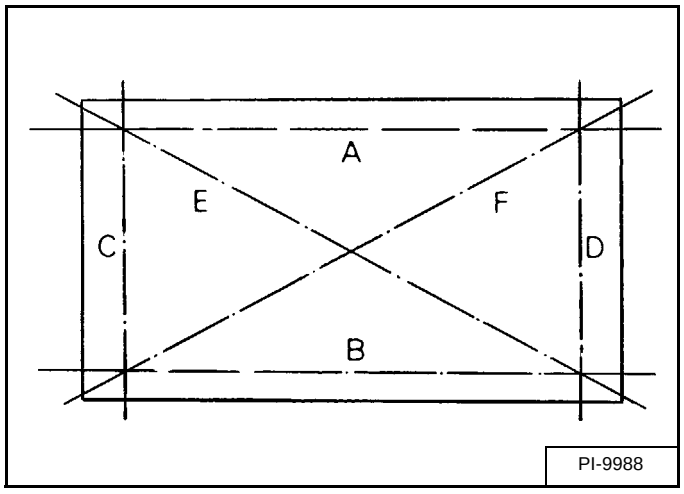


Put a straight edge (Item 1) **[Figure 60-80-22]** on the cylinder head.

NOTE: Do not put the straight edge across combustion chambers.

Put a feeler gauge (Item 2) **[Figure 60-80-22]** between the straight edge and the surface of the cylinder head.

Figure 60-80-23

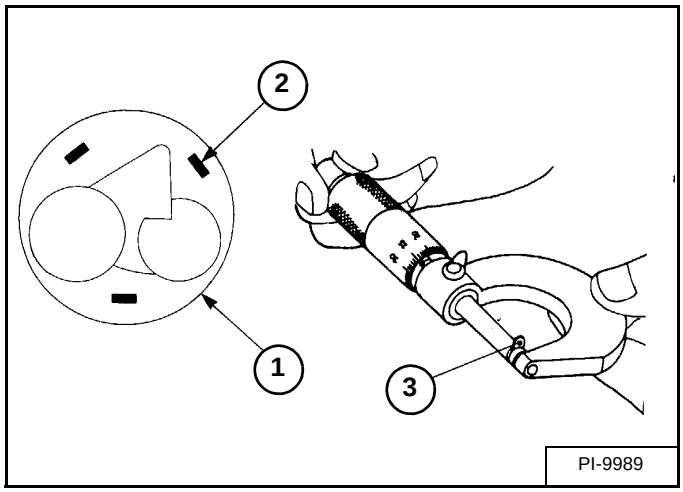


Put the straight edge on the cylinder head's four sides and two diagonal as shown in figure **[Figure 60-80-23]**.

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 60-80-24



Install the cylinder head gasket. Put the piston (Item 1) **[Figure 60-80-24]** being checked at T.D.C.

Put three pieces of 1,5 mm (0.06 in) diameter solder (Item 2) **[Figure 60-80-24]** 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 60-80-3.)

Turn the crankshaft until the piston exceeds T.D.C. Remove the cylinder head.

Remove the solder (Item 3) **[Figure 60-80-24]** and measure it.

If the measurement exceeds the specifications, check the oil clearance of the crank pin journal or the piston pin.

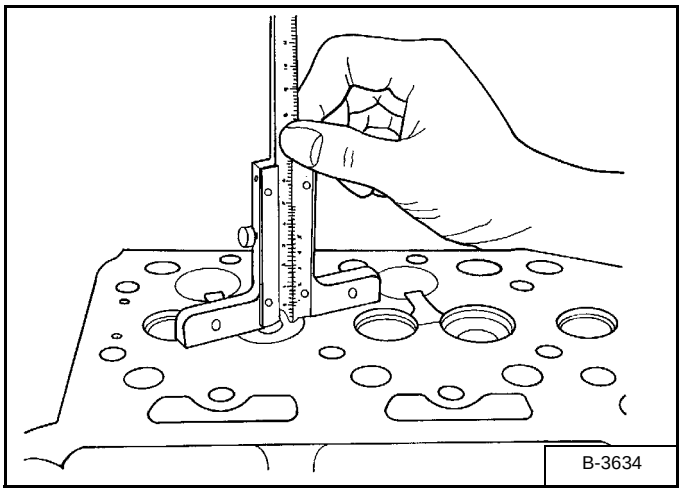
Top Clearance	0,55 - 0,75 mm (0.022 - 0.029 in)

Valve Guide - Checking

Remove the valve and spring from the cylinder head. (See Cylinder Head Disassembly And Assembly on Page 60-80-7.)

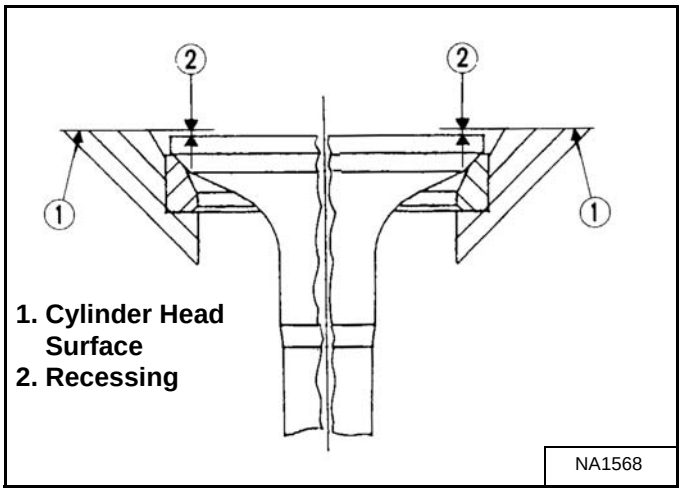
Clean the valve seat and combustion chamber.

Figure 60-80-25



Install the valve into the guide. Measure the valve recessing with a depth gauge **[Figure 60-80-25]**.

Figure 60-80-26

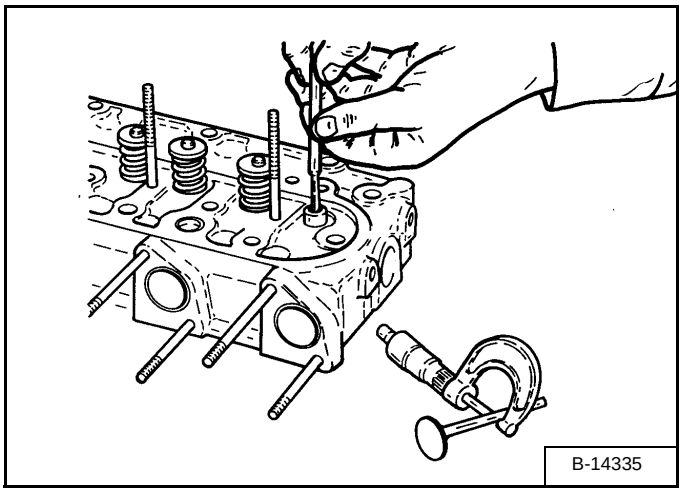


If the measurement exceeds the limit, replace the valve or cylinder head **[Figure 60-80-26]**.

Recessing	0,050 - 0,25 mm (0.0020 - 0.0098 in)
Allowable Limit	0,40 mm (0.016 in)

Remove the carbon from the valve guide.

Figure 60-80-27



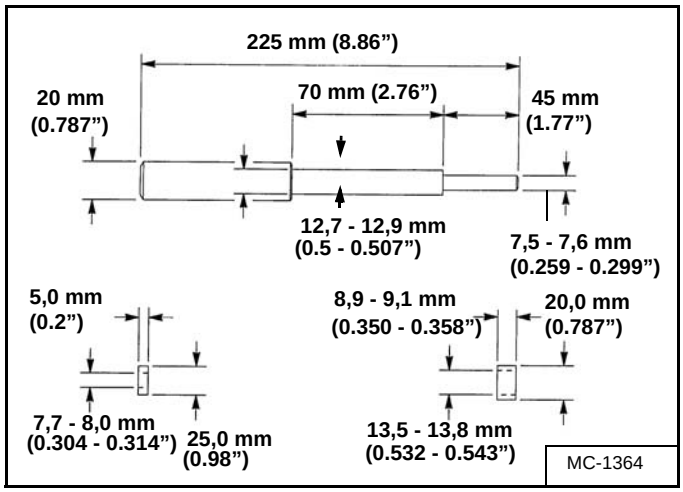
Measure the valve stem O.D. **[Figure 60-80-27]**.

Measure the valve guide I.D. **[Figure 60-80-27]**.

Calculate the clearance. If the clearance exceeds the allowable limit, replace the valve and / or valve guide.

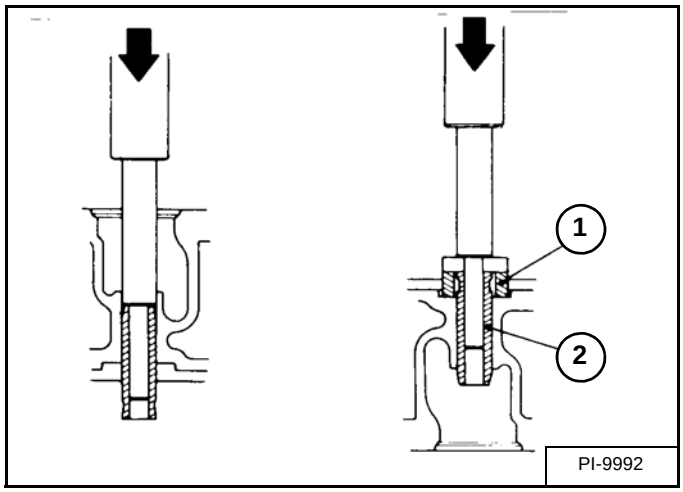
Valve Guide Removal And Installation

Figure 60-80-28



To remove and replace the valve guide, make the driver tool as shown in **[Figure 60-80-28]**.

Figure 60-80-29



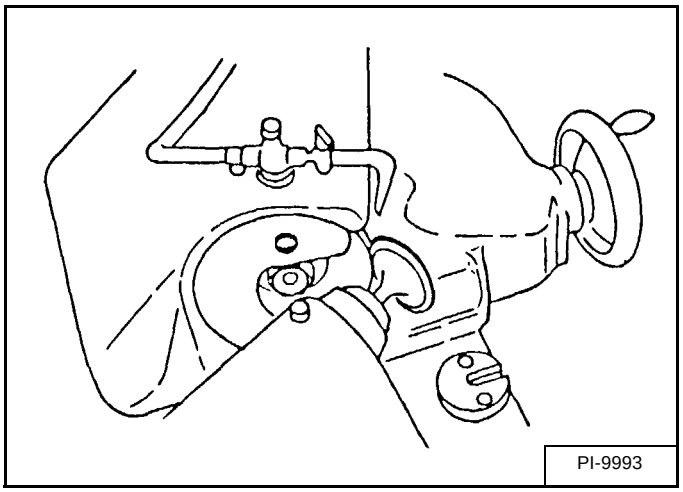
Press the used valve guide out of the cylinder head using the special driver tool **[Figure 60-80-29]**.

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 60-80-29]**, press the new guide until the tool contacts the cylinder head.

Ream the valve guide to the correct specifications.

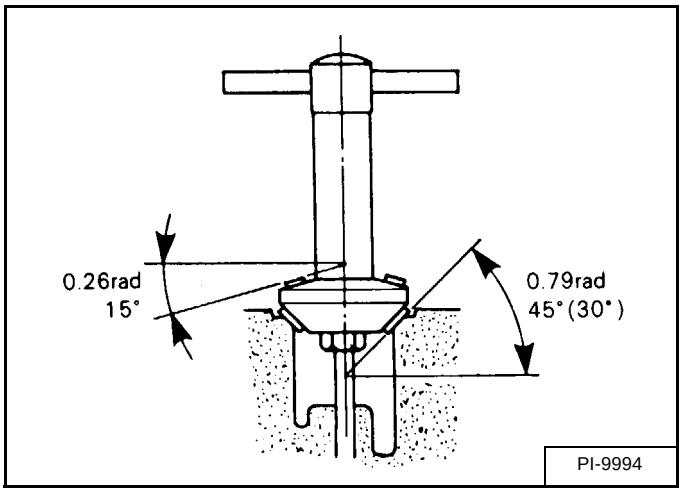
Reconditioning The Valve And Valve Seat

Figure 60-80-30



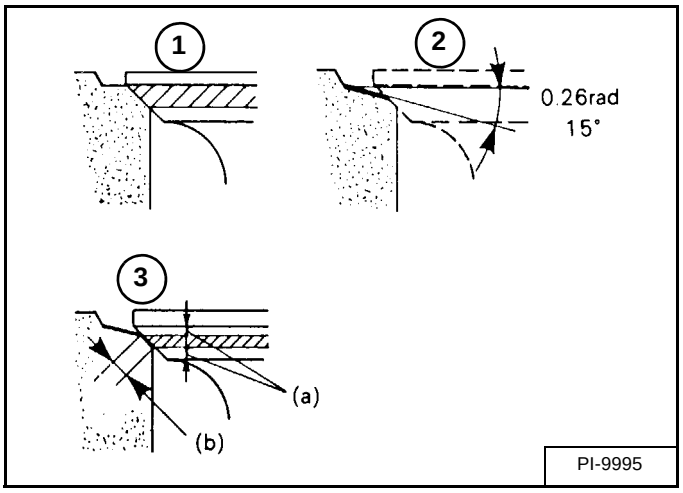
Grind the valve face to the correct angle using a valve refacer **[Figure 60-80-30]**.

Figure 60-80-31



Grind the valve seat surface in the cylinder head to the correct angle **[Figure 60-80-31]**.

Figure 60-80-32



Check the seat surface and valve face (Item 1) **[Figure 60-80-32]**.

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 60-80-32]**.

Valve Seat Width

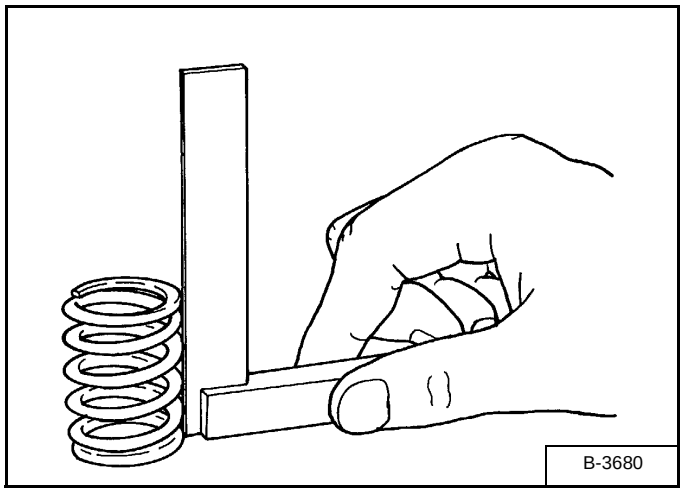
Intake	2,12 mm (0.0835 in)
Exhaust	2,12 mm (0.0835 in)

Valve Seat and Face Angle

Intake	60°
Exhaust	45°

Valve Spring

Figure 60-80-33



Measure the length of the valve spring. If the measurement is less than the allowable limit, replace the spring **[Figure 60-80-33]**.

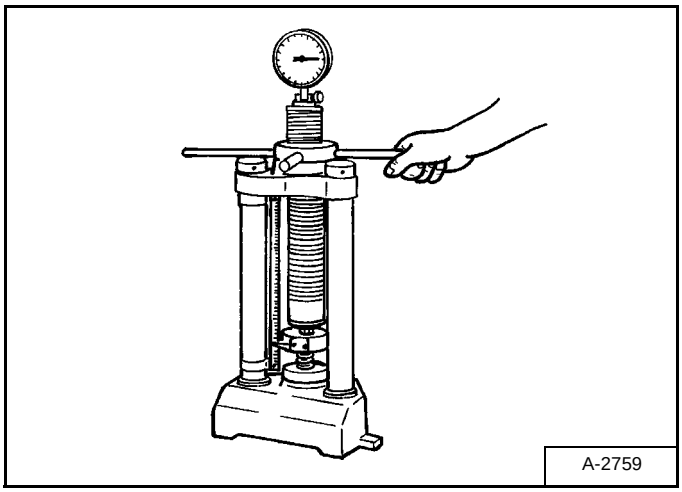
Free Length	37,0 - 37,5 mm (1.46 - 1.47 in)
Allowable Limit	36,5 mm (1.44 in)

Put the spring on a flat surface, place a square on the side of the spring **[Figure 60-80-33]**.

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 60-80-34



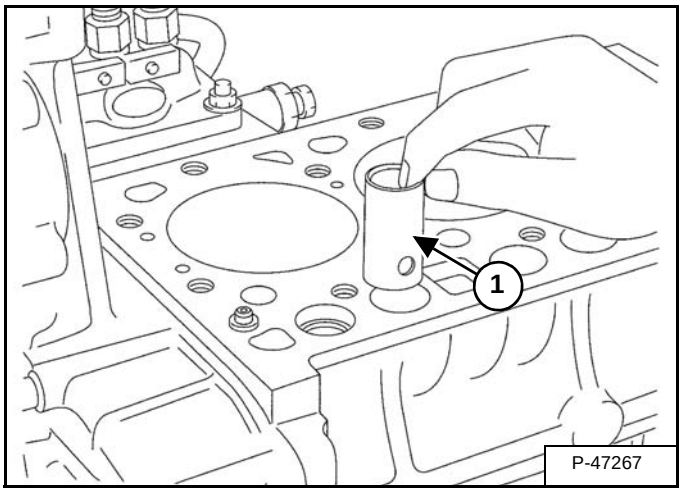
Put the spring on a tester and compress to specified length **[Figure 60-80-34]**.

Read the compressed load on the gauge. If the measurement exceeds the allowable limit, replace the spring.

Setting Length	31,0 mm (1.22 in)
Setting Load	117,6 N (26.39 lbf)
Allowable Limit	100,0 N (22.48 lbf)

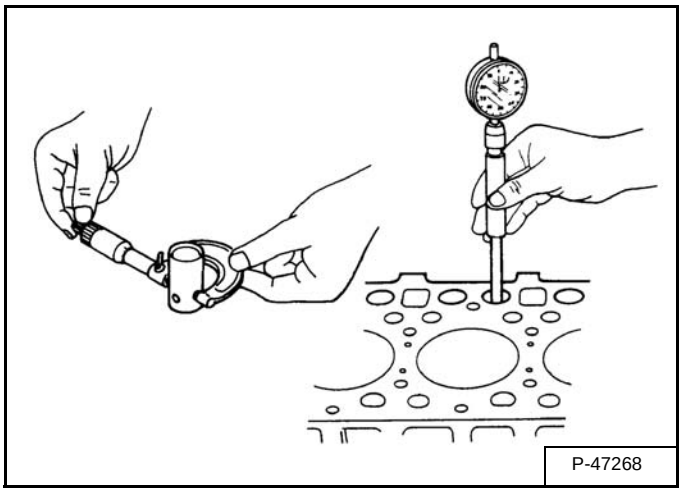
Valve Tappets

Figure 60-80-35



Remove the valve tappets (Item 1) **[Figure 60-80-35]**.

Figure 60-80-36



Measure the O.D. of the tappet **[Figure 60-80-36]**.

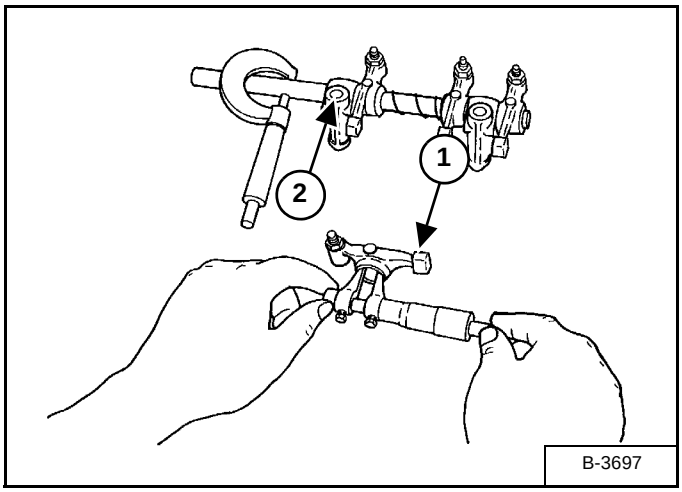
Measure the I.D. of the tappet guide **[Figure 60-80-36]**.

If the clearance exceeds the allowable limit, replace the tappets.

Tappet O.D.	19,959 - 19,980 mm (0.78579 - 0.78661 in)
Tappet Guide I.D.	20,000 - 20,021 mm (0.78740 - 0.78822 in)
Clearance Between Tappet and Tappet Guide	0,020 - 0,062 mm (0.00079 - 0.0024 in)
Allowable Limit	0,07 mm (0.003 in)

Rocker Arm And Shaft - Checking

Figure 60-80-37



Measure the rocker arm I.D. (Item 1) **[Figure 60-80-37]** with an inside micrometer.

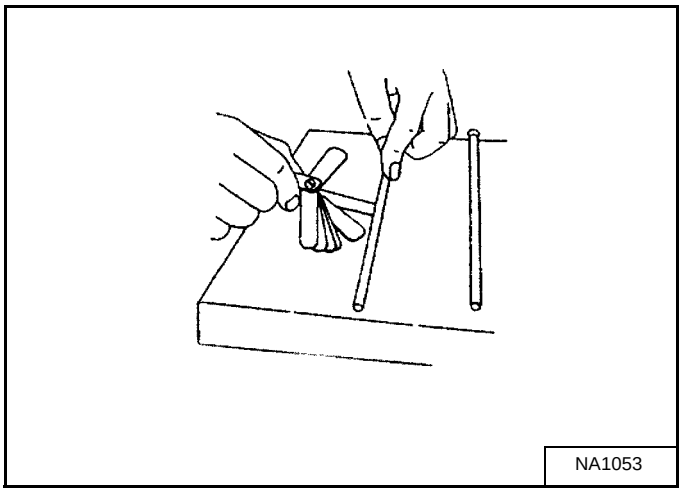
Measure the rocker arm shaft O.D. (Item 2) **[Figure 60-80-37]** with an outside micrometer.

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.

Push Rod Alignment - Checking

Figure 60-80-38



Place the push rod on an inspection block. Use a feeler gauge (Item 1) **[Figure 60-80-38]** to measure the gap.

Push Rod Alignment Allowable Limit	0,25 mm (0.0098 in)

Piston And Connecting Rod Removal And Installation

Remove the cylinder head. (See Cylinder Head Removal And Installation on Page 60-80-3.)

Remove the top edge from the cylinder bore with a ridge reamer.

Remove the oil pan.

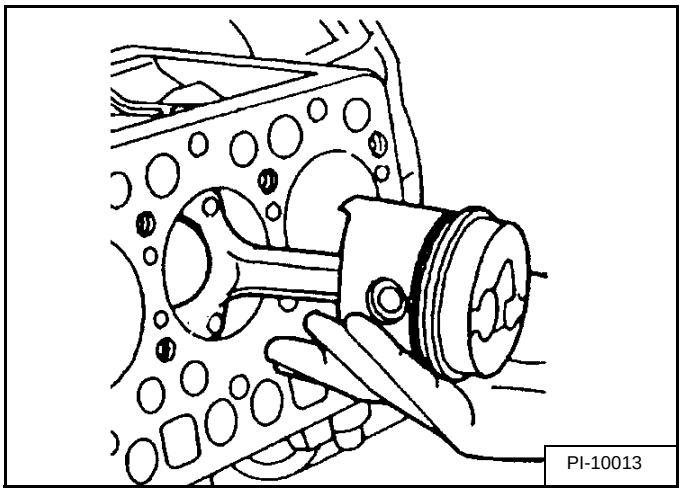
Turn the flywheel and put a pair of connecting rods at bottom dead center.

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.

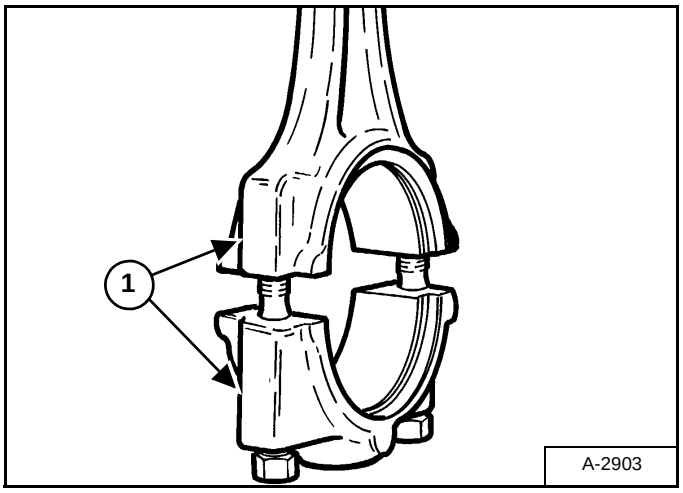
Figure 60-90-1



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.

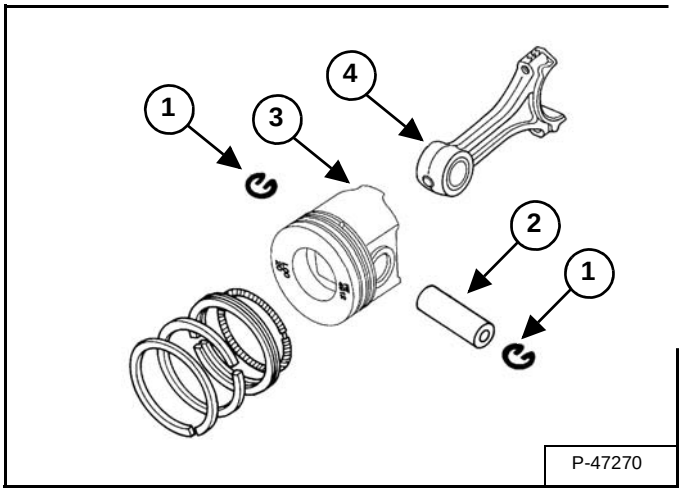
Figure 60-90-2



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



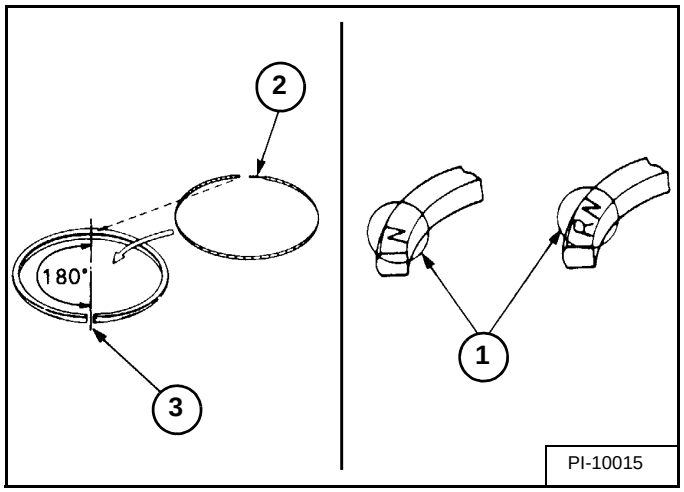
Remove the piston rings **[Figure 60-90-3]**.

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]**.

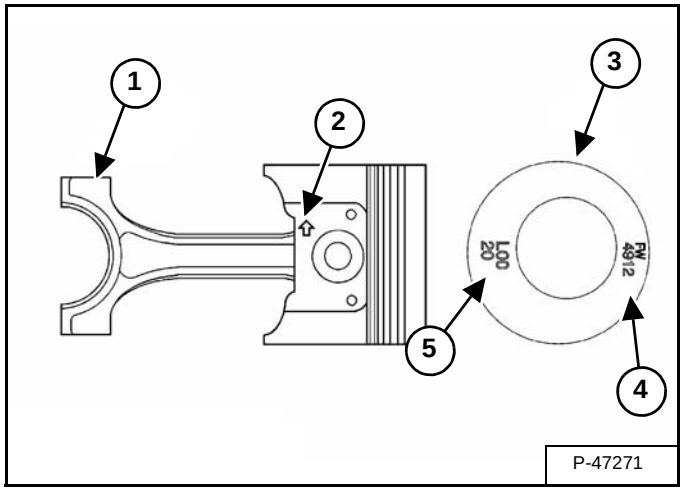
Piston And Connecting Rod Removal And Installation (Cont'd)

Figure 60-90-4



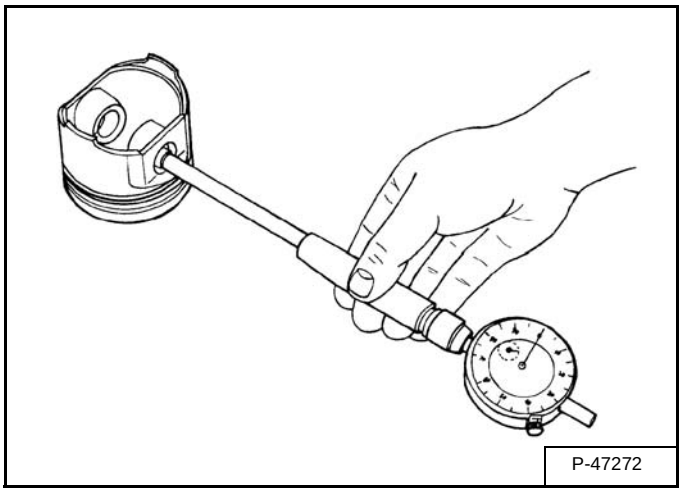
Installation: When installing new rings, assemble the ring so the mark (Item 1) near the gap faces the top of the piston. When installing the oil ring, place the expander joint (Item 2) on the opposite side of the oil ring gap (Item 3) **[Figure 60-90-4]**.

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



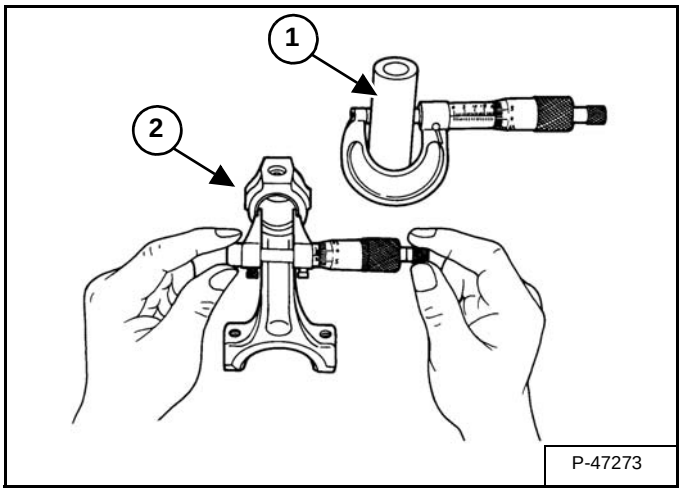
Measure the I.D. of the piston pin bore in both horizontal and vertical directions **[Figure 60-90-6]**.

If the measurement exceeds the allowable limit, replace the piston.

Piston Bore I.D.	22,000 - 22,013 mm (0.86615 - 0.86665 in)
Allowable Limit	22,03 mm (0.8673 in)

Piston And Connecting Rod - Servicing

Figure 60-90-7



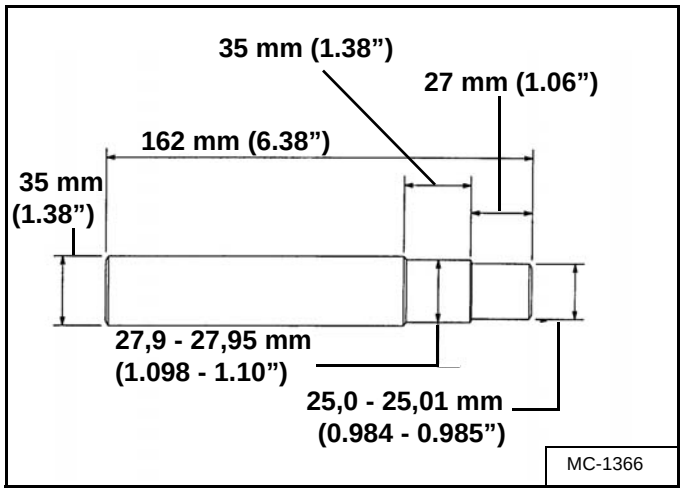
Measure the O.D. of the piston pin (Item 1) **[Figure 60-90-7]**.

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.

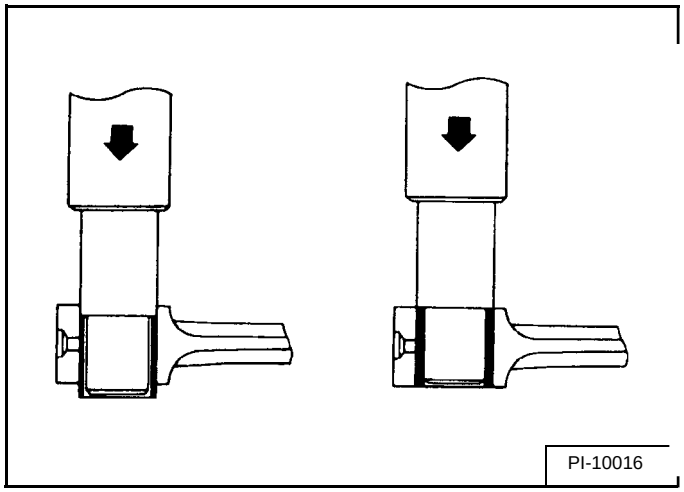
Piston Pin O.D.	22,002 - 22,011 mm (0.86622 - 0.86657 in)
Small End Bushing I.D.	22,025 - 22,040 mm (0.86713 - 0.86771 in)
Oil Clearance Between Piston Pin and Bushing	0,014 - 0,038 mm (0.00056 - 0.0014 in)
Allowable Limit	0,15 mm (0.0059 in)

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

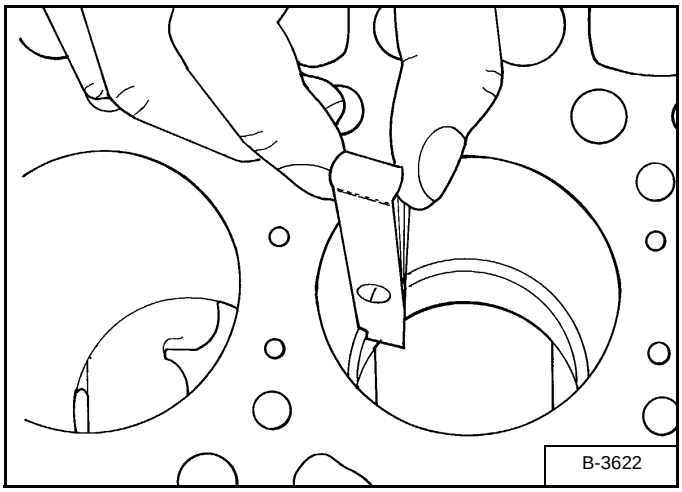


Use a press and special driver tool to remove the small end bushing **[Figure 60-90-9]**.

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]**.

Piston And Connecting Rod - Servicing (Cont'd)

Figure 60-90-10

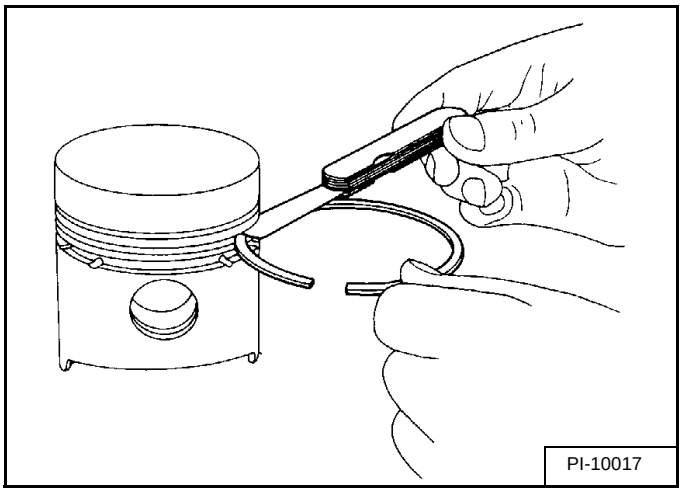


Install a piston ring into the lower part of the cylinder bore. Measure the ring gap with a feeler gauge **[Figure 60-90-10]**.

If the gap exceeds the allowable limit, replace the ring.

Top Ring and Second Ring Gap	0,30 - 0,45 mm (0.012 - 0.017 in)
Oil Ring Gap	0,25 - 0,40 mm (0.0098 - 0.015 in)
Allowable Limit	1,25 mm (0.0492 in)

Figure 60-90-11



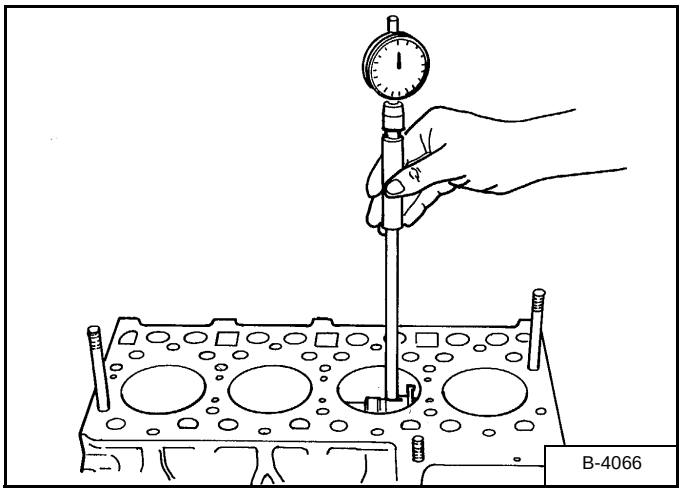
Remove the carbon from the ring grooves. Measure the clearance between the ring and groove with a feeler gauge **[Figure 60-90-11]**.

If the clearance exceeds the allowable limit, replace the ring. If the clearance still exceeds the allowable limit, replace the piston.

Top Ring Gap	Cannot be measured
Second Ring Gap	0,0850 - 0,112 mm (0.00335 - 0.00440 in)
Allowable Limit	0,20 mm (0.008 in)
Oil Ring	0,020 - 0,055 mm (0.00079 - 0.0021 in)
Allowable Limit	0,15 mm (0.0059 in)

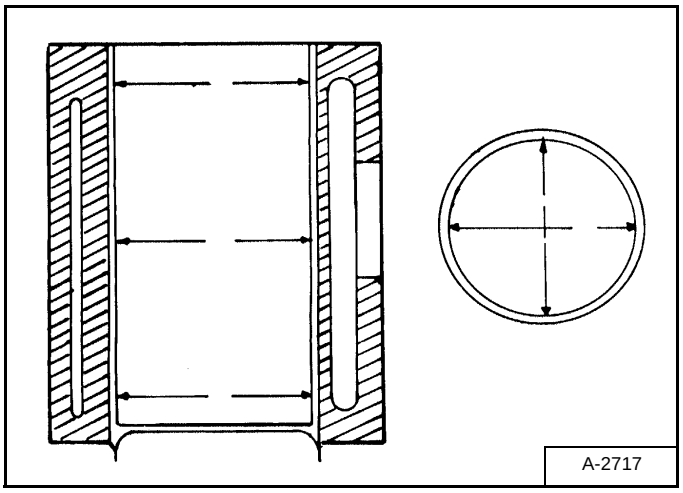
Cylinder Bore - Checking

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 78,000 - 78,019 mm (3.0709 - 3.0716 in). The wear limit is 78,15 mm (3.077 in).

If the cylinder bore is not within specifications, re-bore the cylinder for oversize piston.

Connecting Rod Alignment

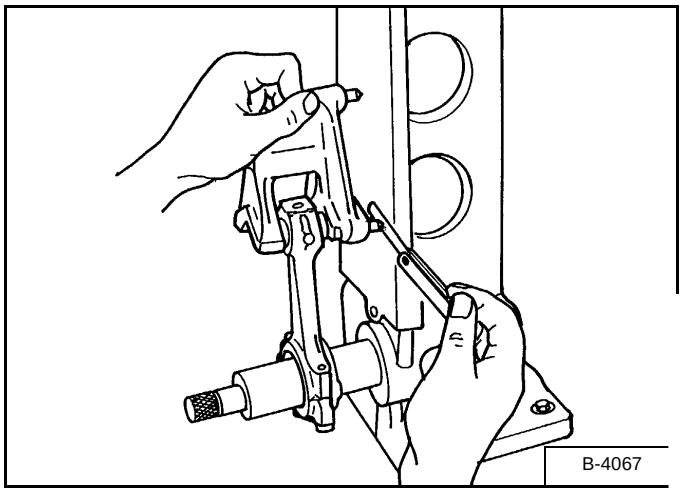
NOTE: The small end bushing is the basis of this check, check the bushing for wear before doing this check.

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 plat **[Figure 60-90-14]**.

If the measurement exceeds the allowable limit, replac the connecting rod.

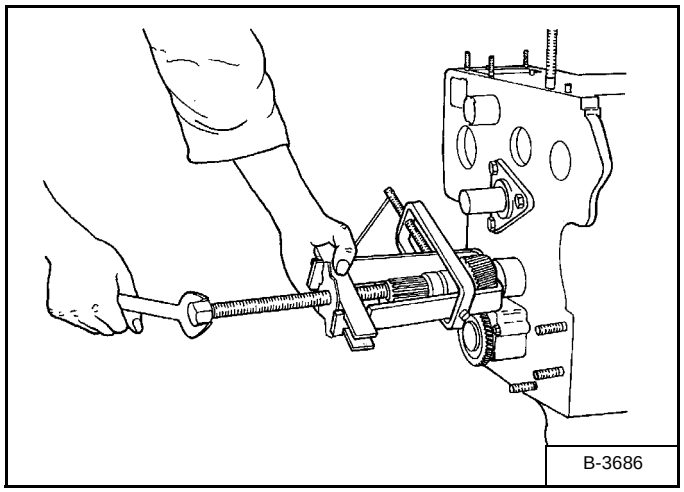
Rod Alignment	0,05 mm (0.002 in)

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 Idler Gear And Shaft Removal And Installation on Page 60-100-3.)

Figure 60-90-15



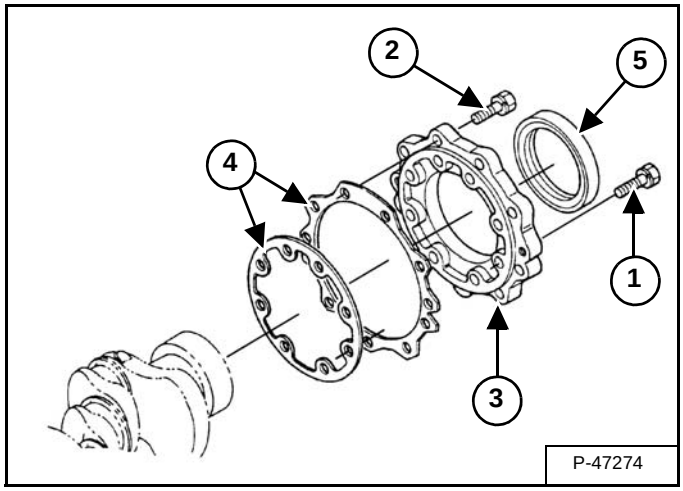
Remove the crankshaft gear with a puller **[Figure 60-90-15]**.

Remove the crankshaft key.

Crankshaft And Bearings Removal And Installation

Remove the piston and connecting rod assemblies. (See Piston And Connecting Rod Removal And Installation on Page 60-90-1.)

Figure 60-90-16



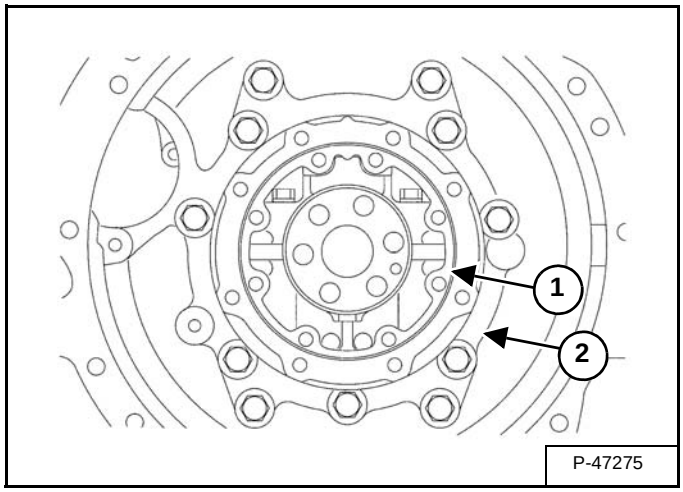
Mark and remove the inside screws (Item 1) first, then remove the outside screws (Item 2) **[Figure 60-90-16]**.

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.

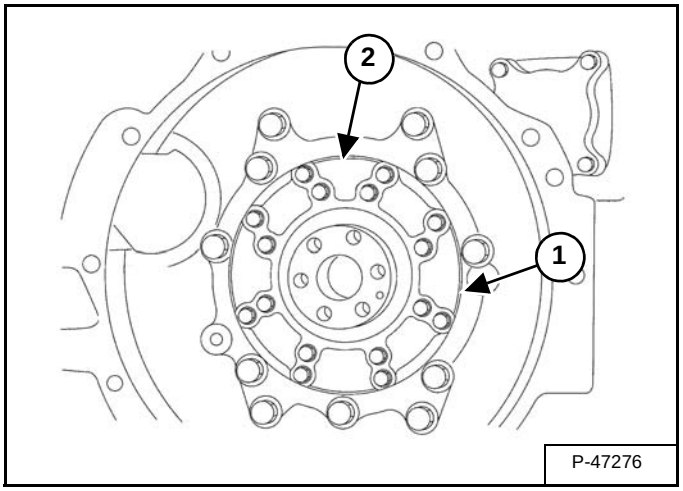
Figure 60-90-17



Installation: Install the gaskets (Item 1) and (Item 2) **[Figure 60-90-17]** as shown.

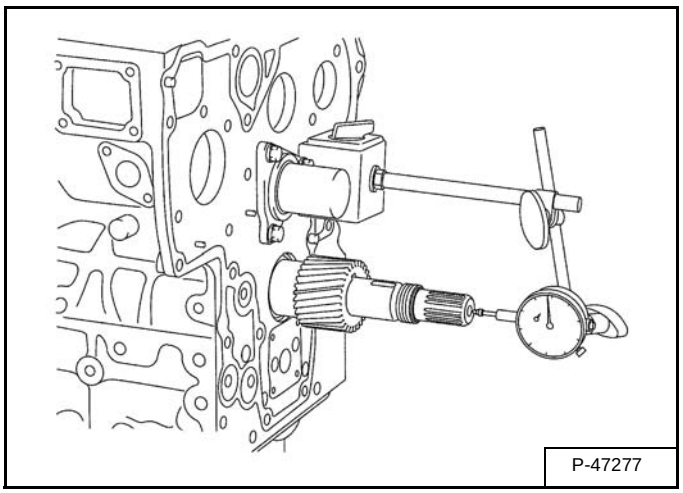
Crankshaft And Bearings Removal And Installation (Cont'd)

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

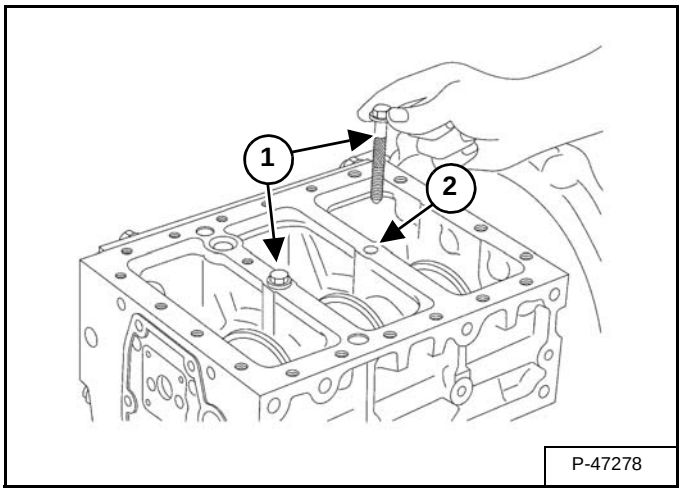


Before removing the crankshaft / main bearings, check the side clearance. Install a dial indicator. Move the crankshaft **[Figure 60-90-19]** to the flywheel side, zero the dial indicator. Measure the side clearance by pulling the crankshaft toward the gearcase side.

If the measurement exceeds the allowable limit, replace the thrust washers **[Figure 60-90-19]**.

Side Clearance	0,15 - 0,31 mm (0.0059 - 0.012 in)
Allowable Limit	0,50 mm (0.020 in)

Figure 60-90-20



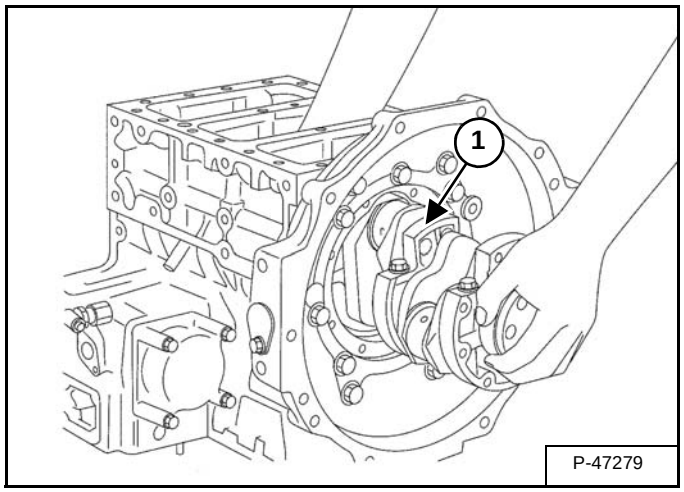
Remove the main bearing bolt (Item 1) **[Figure 60-90-20]**.

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° counterclockwise so the #2 crank pin i at BDC. Repeat the above procedure when the #1 cran pin is in the #3 cylinder.

Installation: Align the bearing case hole with the hole i the block (Item 2) **[Figure 60-90-20]**. Put oil on the bol threads and tighten to 69 - 74 N•m (51 - 54 ft-lb) torque.

Crankshaft And Bearings Removal And Installation (Cont'd)

Figure 60-90-21

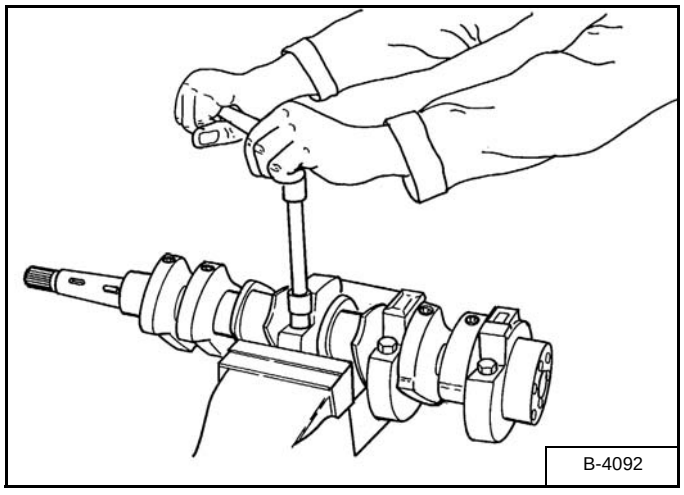


Remove the crankshaft / main bearing assembly from the engine block **[Figure 60-90-21]**.

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

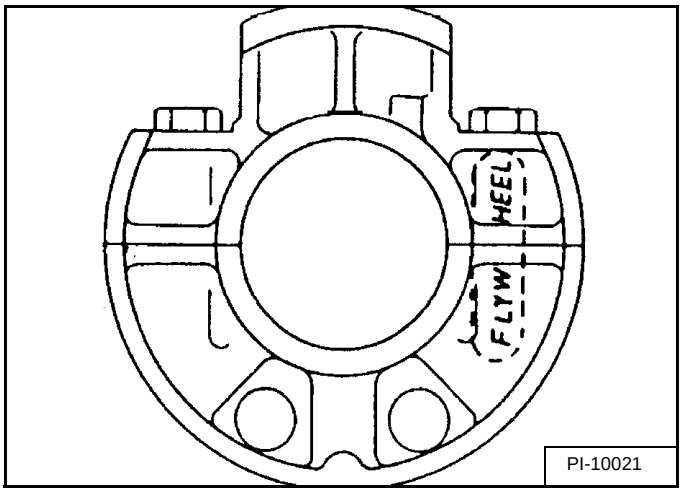


Remove the two bearing case bolts **[Figure 60-90-22]**.

Remove the bearing case and bearing.

Installation: Tighten the bearing case bolts to 46 - 51 N•m (34 - 38 ft-lb) torque.

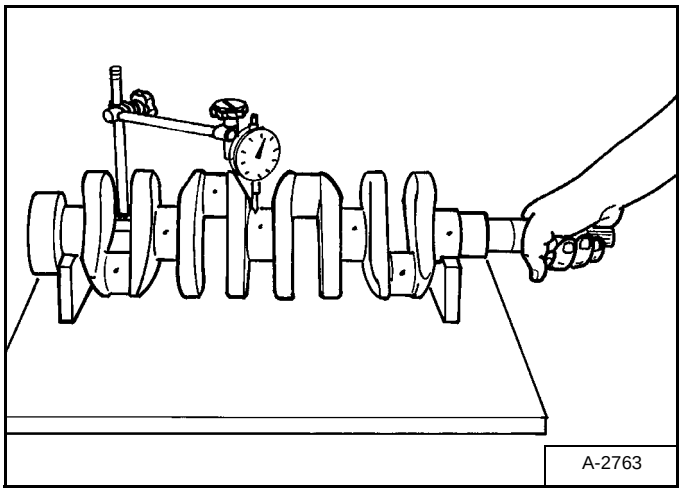
Figure 60-90-23



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.

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]**.

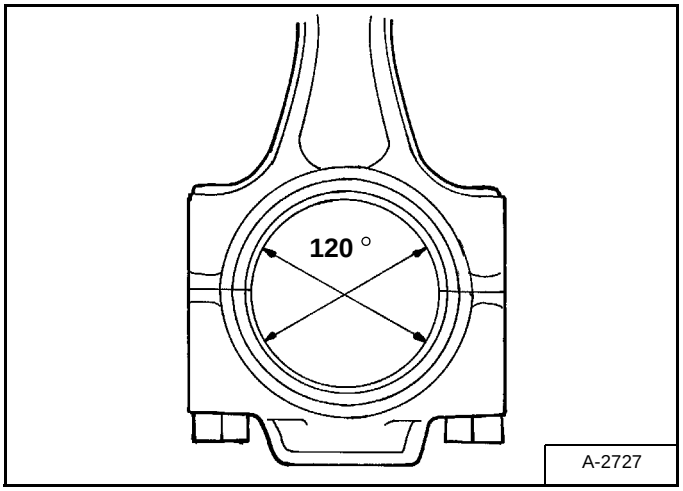
Turn the crankshaft at a slow rate to obtain the misalignment (one half of the alignment measurement).

If the misalignment exceeds the allowable limit, replace the crankshaft.

Alignment	0,02 mm (0.0008 in)

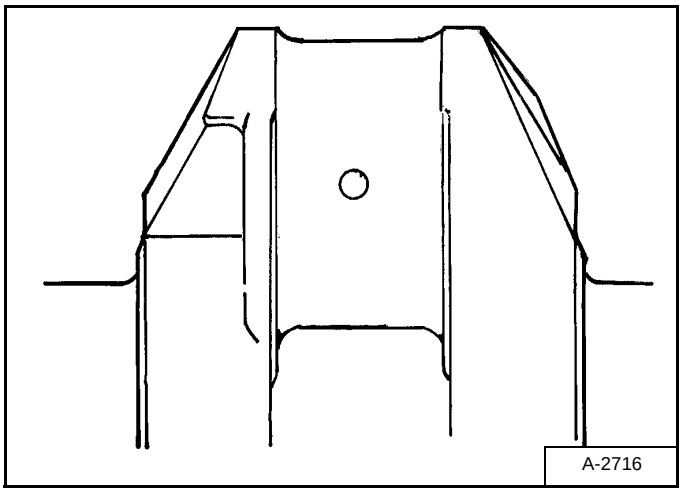
Tighten the connecting rod bolts to 44 - 49 N•m (33 - 36 ft-lb) torque.

Figure 60-90-25



Measure the crankpin bearing I.D. **[Figure 60-90-25]**.

Figure 60-90-26



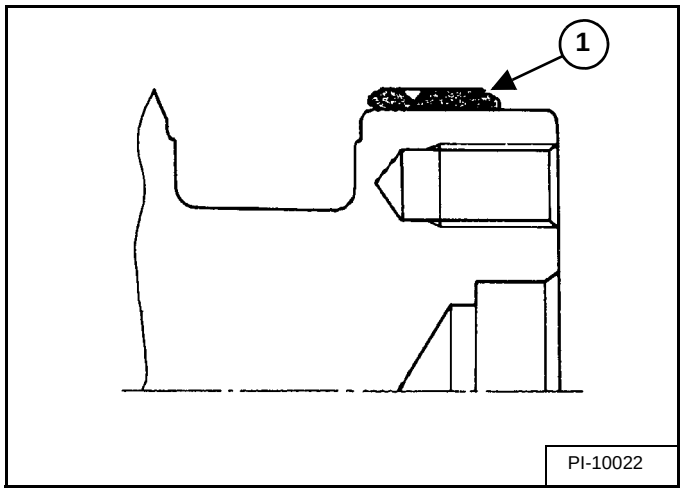
Measure the crankpin O.D. **[Figure 60-90-26]**.

Calculate the oil clearance.

Crankpin Bearing I.D.	40,040 - 40,050 mm (1.5764 - 1.5767 in)
Crankpin O.D.	39,959 - 39,975 mm (1.5732 - 1.5738 in)
Oil Clearance	0,029 - 0,091 mm (0.0012 - 0.0035 in)
Allowable Limit	0,2 mm (0.0079 in)

Crankshaft And Bearings - Servicing (Cont'd)

Figure 60-90-27



Check the wear on the crankshaft sleeve (Item 1) **[Figure 60-90-27]**.

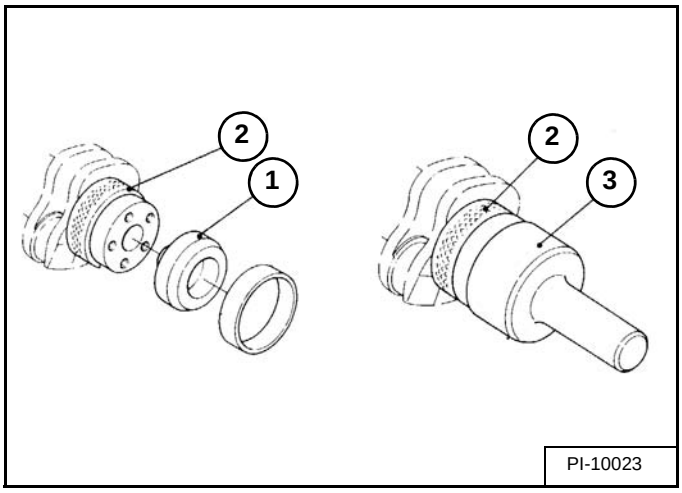
If the wear exceeds the allowable limit or the seal leaks oil, replace the sleeve.

Wear of Sleeve	0,1 mm (0.0004 in)

The special tool set will be needed to replace the crankshaft sleeve.

Remove the sleeve.

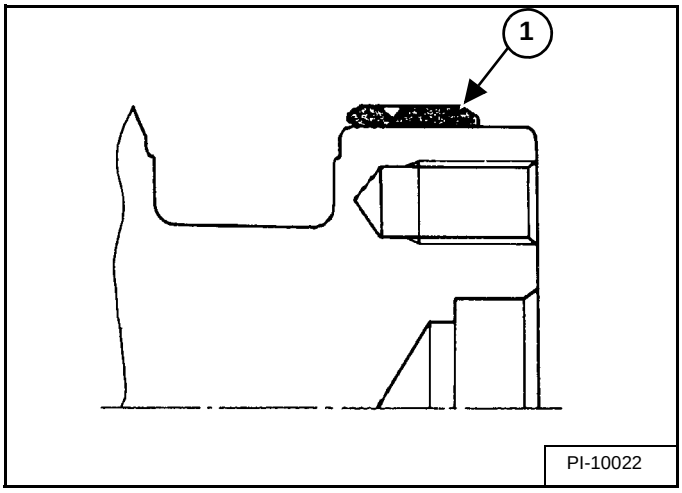
Figure 60-90-28



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]**.

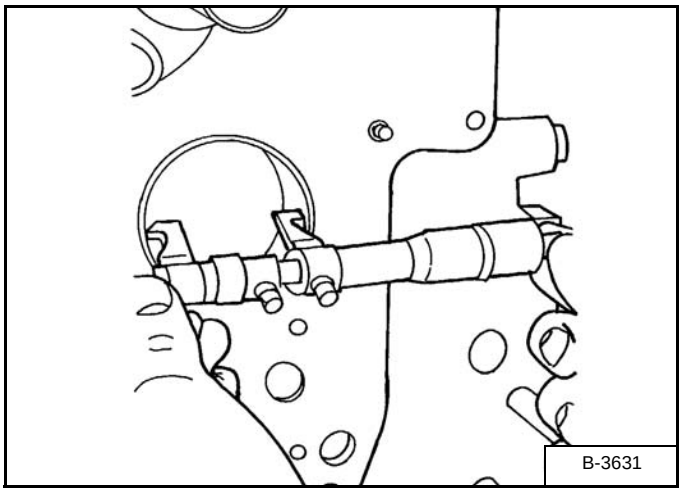
Figure 60-90-29



NOTE: The sleeve is installed with the larger chamfered surface to the front of the crankshaft (Item 1) [Figure 60-90-29].

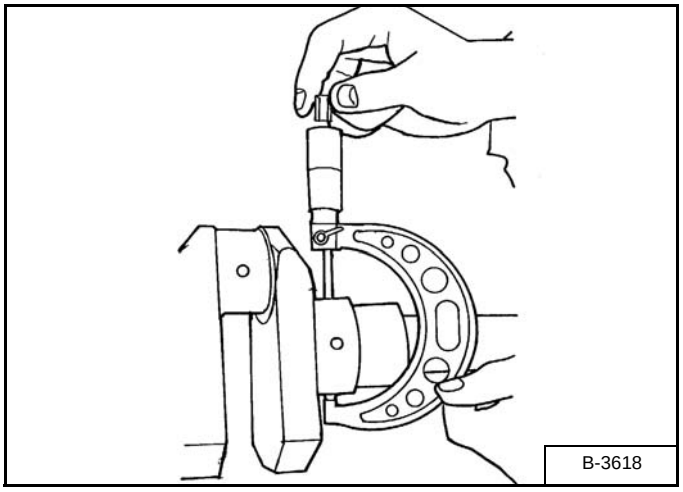
Crankshaft And Bearings - Servicing (Cont'd)

Figure 60-90-30



Measure the I.D. of the No. 1 crankshaft bearing **[Figure 60-90-30]**.

Figure 60-90-31



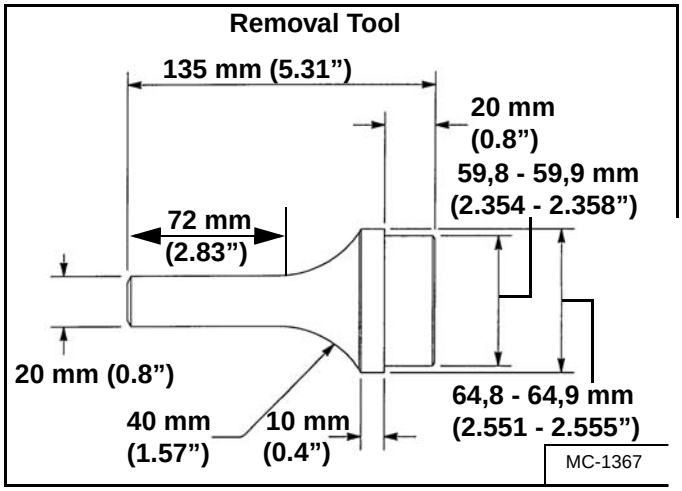
Measure the O.D. of the crankshaft journal **[Figure 60-90-31]**.

Calculate the oil clearance.

If the clearance exceeds the allowable limit, replace the crankshaft bearing.

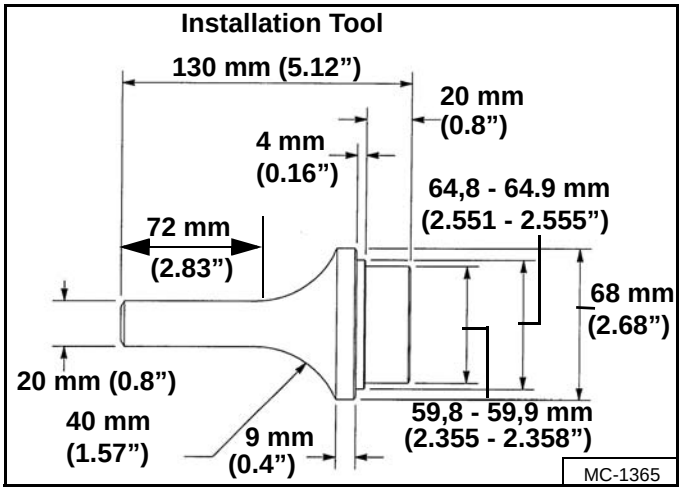
Bearing #1 I.D.	47,984 - 48,048 mm (1.8892 - 1.8916 in)
Crankshaft Journal #1 O.D.	47,934 - 47,950 mm (1.8872 - 1.8877 in)
Oil Clearance	0,04 - 0,118 mm (0.0016 - 0.0046 in)
Allowable Limit	0,20 mm (0.0079 in)

Figure 60-90-32



To remove the front bearing make the tool as shown i **[Figure 60-90-32]**.

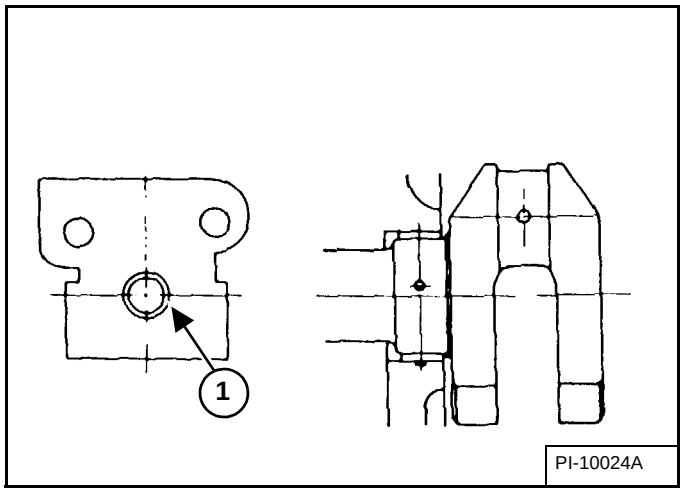
Figure 60-90-33



To install the front bearing make the tool as shown in **[Figure 60-90-33]**.

Crankshaft And Bearings - Servicing (Cont'd)

Figure 60-90-34



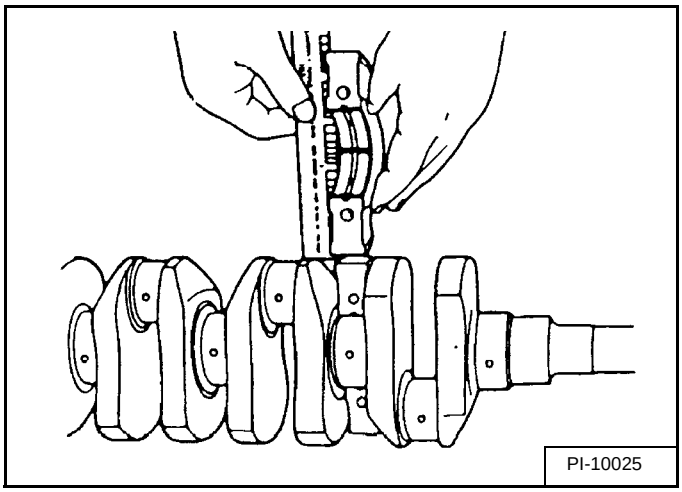
Remove the front bearing with the special removal tool **[Figure 60-90-34]**.

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 #2 O.D.	47,934 - 47,950 mm (2.3591 - 2.3598 in)
Crankshaft Journal #3 O.D.	51,921 - 51,940 mm (2.0442 - 2.0448 in)
Bearing #2 I.D.	47,984 - 48,029 mm (1.8872 - 1.8877 in)
Bearing #3 I.D.	51,974 - 52,019 mm (2.0463 - 2.0479 in)
Oil Clearance Crankshaft to Bearing #2	0,034 - 0,095 mm (0.0014 - 0.0037 in)
Oil Clearance Crankshaft to Bearing #3	0,034 - 0,098 mm (0.0014 - 0.0038 in)
Allowable Limit	0,20 mm (0.0079 in)

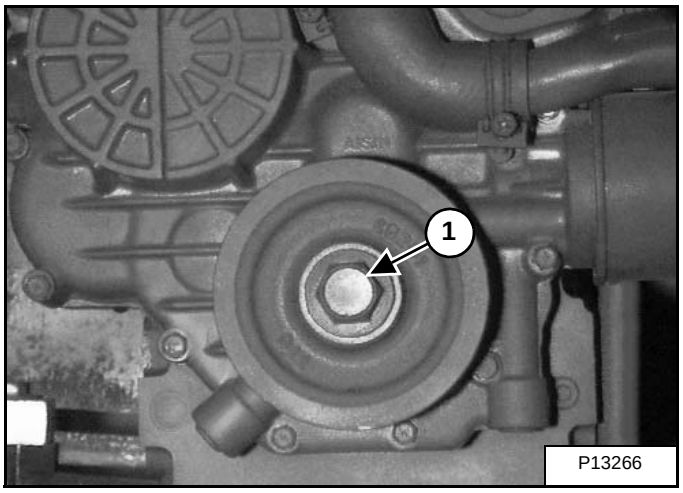
CAMSHAFT AND TIMING GEARS

Timing Gearcase Cover Removal And Installation

Remove the fuel injection pump. (See Fuel Injection Pump Removal And Installation on Page 60-70-4.)

Remove the governor fork lever.

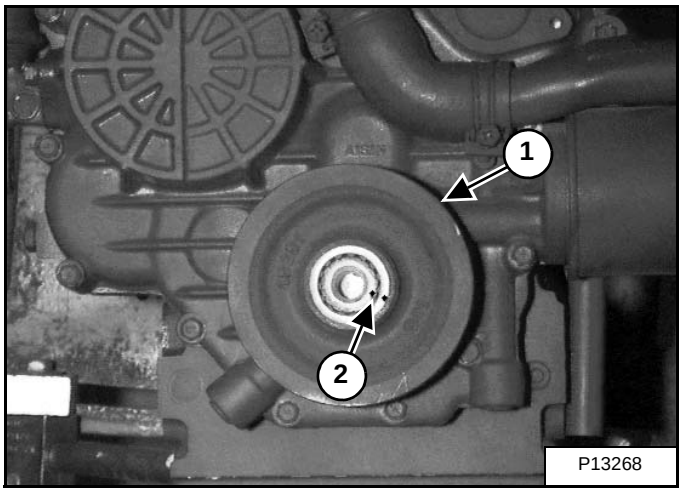
Figure 60-100-1



Remove the crankshaft pulley bolt (Item 1) **[Figure 60-100-1]**.

Installation: Apply Loctite® 243 and tighten crankshaft pulley bolt to 236 - 245 N•m (174 - 180 ft-lb) torque.

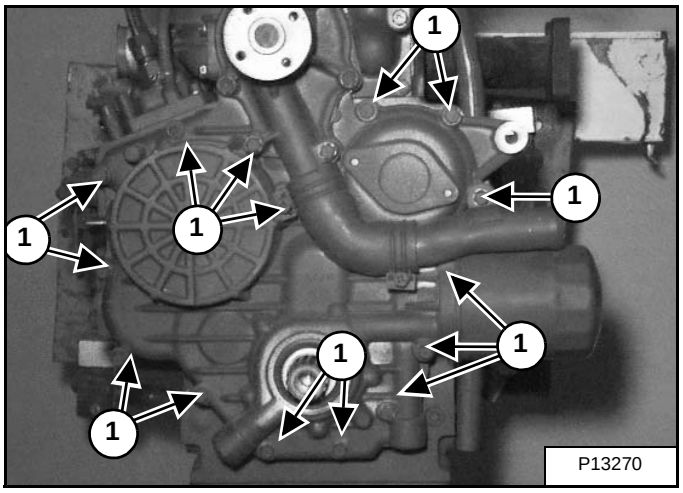
Figure 60-100-2



Remove the crankshaft pulley (Item 1) **[Figure 60-100-2]** from the crankshaft.

Installation: When installing the crankshaft pulley on the crankshaft, align the timing marks (Item 2) **[Figure 60-100-2]**.

Figure 60-100-3



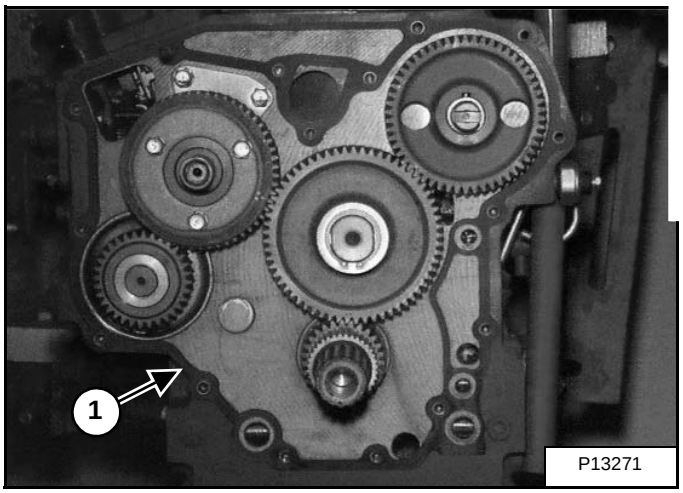
NOTE: The bolts may vary in length. Keep the bolts in their original location

Remove the mounting bolts (Item 1) **[Figure 60-100-3]** from the timing gearcase cover, and remove the cover.

Installation: Tighten the mounting bolts to 10 - 11 N• (7.37 - 8.11 ft-lb) torque.

Clean the gasket surface of timing cover.

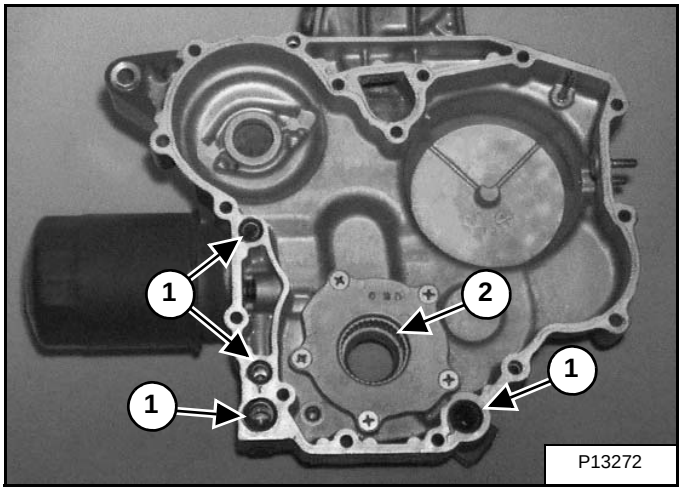
Figure 60-100-4



Remove the timing cover gasket (Item 1) **[Figure 60-100-4]**.

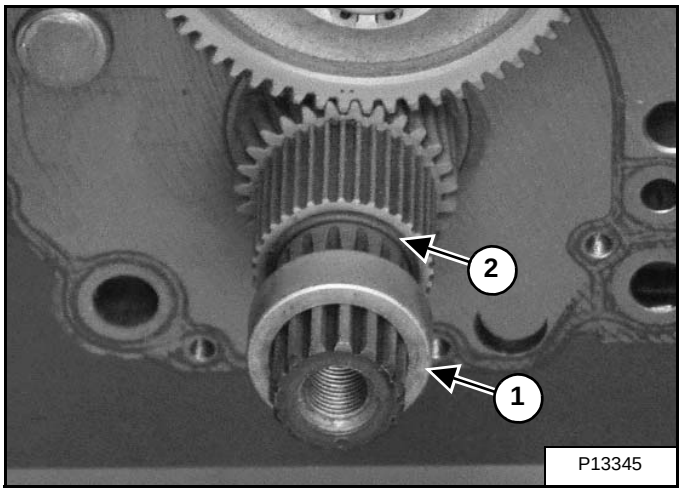
Timing Gearcase Cover Removal And Installation (Cont'd)

Figure 60-100-5



Installation: Install four new O-rings (Item 1) and the oil seal (Item 2) **[Figure 60-100-5]** into the timing gearcase cover

Figure 60-100-6

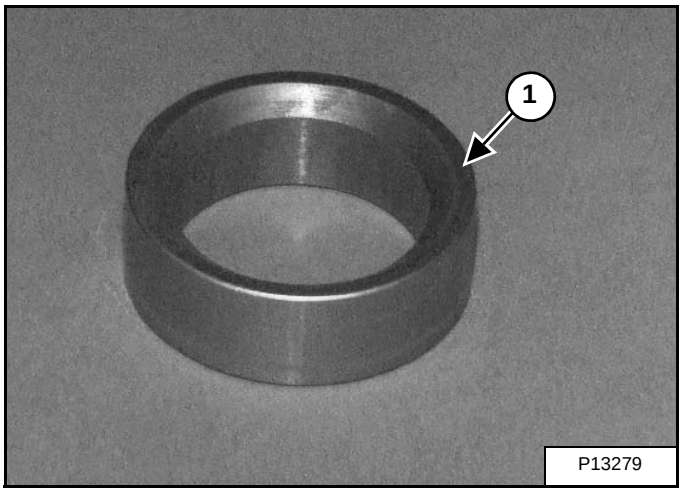


Remove the crankshaft collar (Item 1) **[Figure 60-100-6]** from the crankshaft.

NOTE: The collar may stay in the gearcase cover, when the cover is removed.

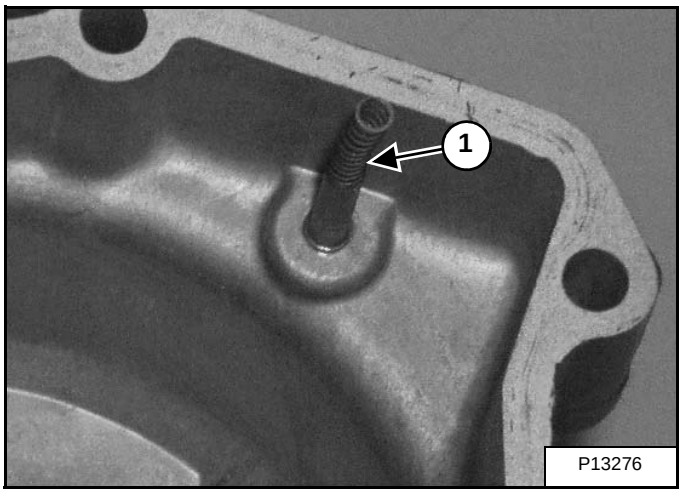
Remove the O-ring (Item 2) **[Figure 60-100-6]** from the crankshaft and replace with a new O-ring.

Figure 60-100-7



Installation: Install the timing gearcase cover, then install the crankshaft collar with the tapered side (Item 1) **[Figure 60-100-7]** toward the O-ring.

Figure 60-100-8

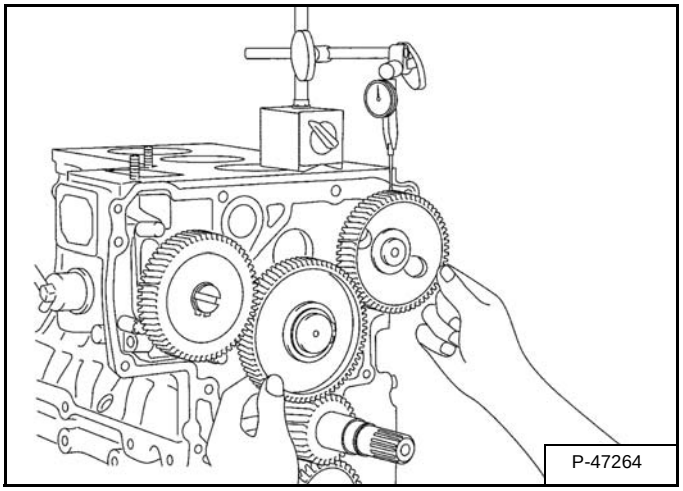


NOTE: The idle adjustment spring (Item 1) [Figure 60-100-8] is located inside the timing case cover. Be careful not to damage.

Timing Gears Backlash - Checking

When the gears are installed, check the backlash of the gears.

Figure 60-100-9



Install a dial indicator **[Figure 60-100-9]**.

Hold one gear while turning the other gear **[Figure 60-100-9]**.

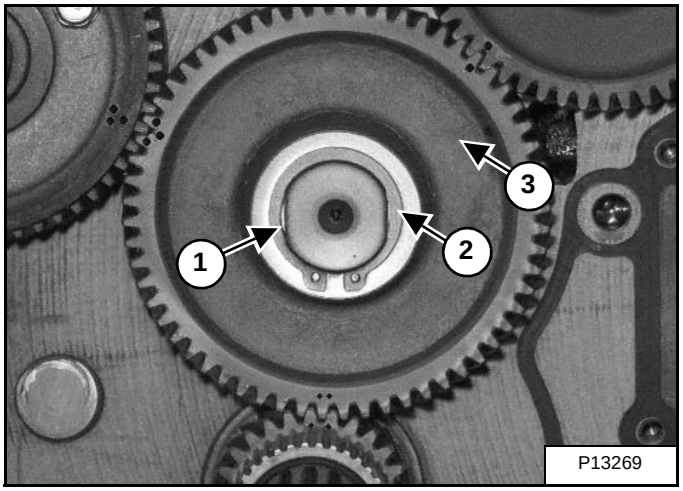
If the backlash exceeds the allowable limit, check the oil clearance of the shaft and gear. If the oil clearance is correct, replace the gear.

Crank Gear and Idle Gear 1	0,032 - 0,115 mm (0.00126 - 0.00452 in)
Allowable Limit	0,15 mm (0.0059 in)
Cam Gear and Idle Gear 1	0,0360 - 0,114 mm (0.00142 - 0.00448 in)
Allowable Limit	0,15 mm (0.0059 in)
Injection Pump Gear and Idle Gear 1	0,0340 - 0,116 mm (0.00134 - 0.00456 in)
Allowable Limit	0,15 mm (0.0059 in)
Injection Pump Gear and Governor Gear	0,0300 - 0,117 mm (0.00119 - 0.00460 in)
Allowable Limit	0,15 mm (0.0059 in)

Idler Gear And Shaft Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-100-1.)

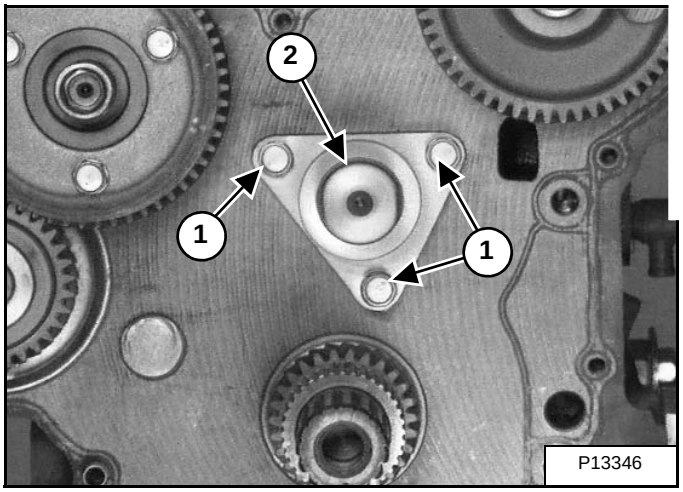
Figure 60-100-10



Remove the snap ring (Item 1) and flat washer (Item 2 from the idler gear shaft **[Figure 60-100-10]**.

Remove the idler gear (Item 3) **[Figure 60-100-10]**.

Figure 60-100-11



Remove the mounting bolts (Item 1) **[Figure 60-100-11]** from the idler shaft.

Remove the idler shaft (Item 2) **[Figure 60-100-11]**.

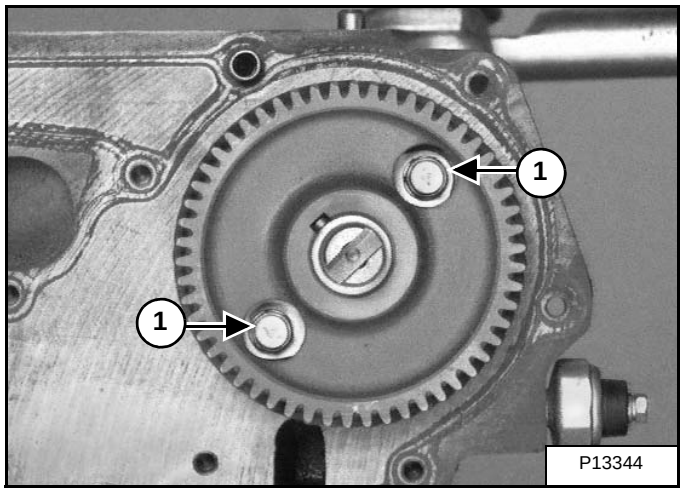
Installation: Tighten the camshaft retainer bolts to 18 - 21 N•m (14 - 15 ft-lb) torque.

Camshaft - Servicing

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-100-1.)

Remove the cylinder head. (See Cylinder Head Removal And Installation on Page 60-80-3.)

Figure 60-100-12



Remove the tappets from the block.

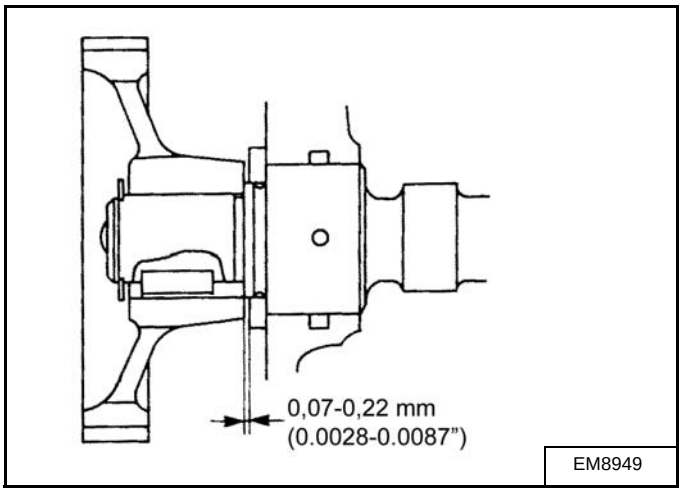
Align the holes (Item 1) **[Figure 60-100-12]** in the gear on the camshaft with the mounting plate bolts.

Remove the mounting bolts from the camshaft mounting plate.

Installation: Tighten the mounting bolts to 9,8 - 11,3 N•m (89 - 100 in-lb) torque.

Remove the camshaft.

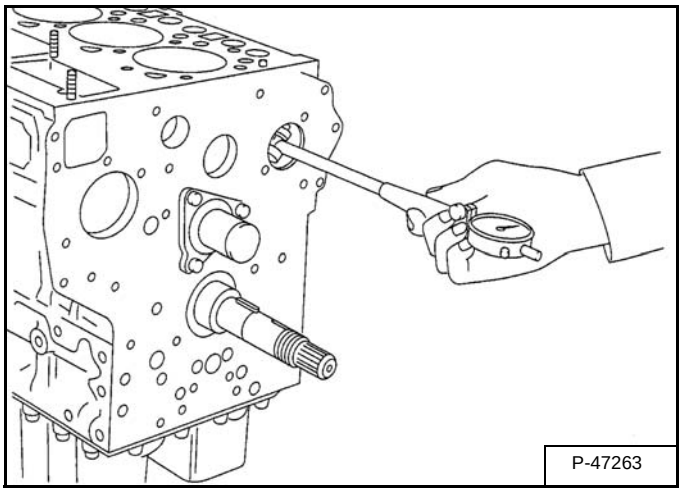
Figure 60-100-13



Installation: Check the camshaft side clearance. If clearance exceeds the allowable limit, replace the camshaft retainer plate **[Figure 60-100-13]**.

Camshaft Side Clearance	0,070 - 0,22 mm (0.0028 - 0.0086 in)
Allowable Limit	0,30 mm (0.012 in)

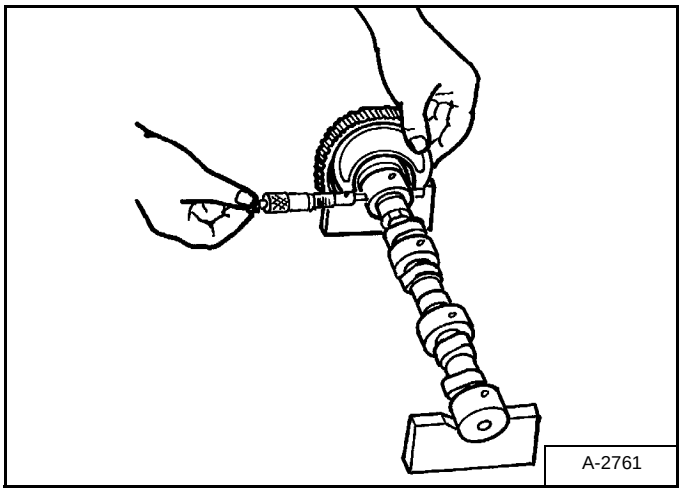
Figure 60-100-14



Measure the cylinder block bore in the engine block **[Figure 60-100-14]**.

Camshaft - Servicing (Cont'd)

Figure 60-100-15

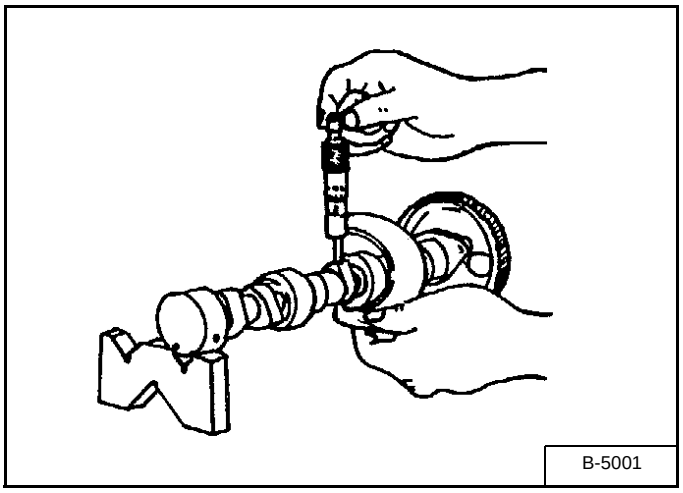


Measure the camshaft journal.

Calculate the oil clearance. If the clearance exceeds the allowable limit, replace the camshaft.

Cylinder Block Bore I.D.	36,000 - 36,025 mm (1.4173 - 1.4183 in)
Journal O.D.	35,934 - 35,950 mm (1.4147 - 1.4153 in)
Oil Clearance of Camshaft Journal	0,050 - 0,091 mm (0.0020 - 0.0035 in)
Allowable Limit	0,15 mm (0.0059 in)

Figure 60-100-16

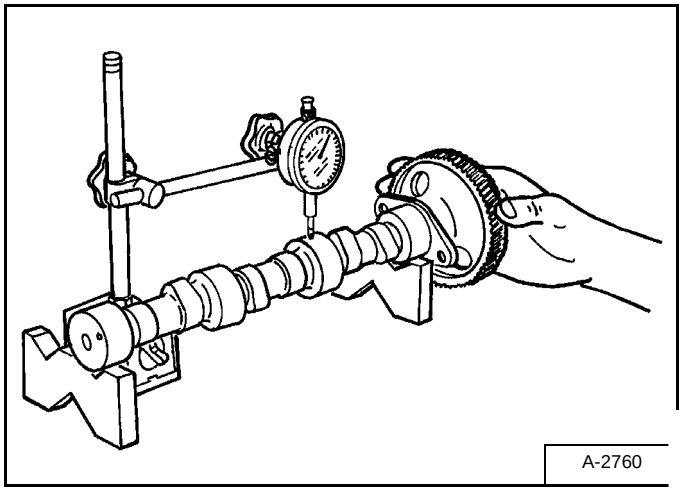


Measure the cam lobes at their highest point **[Figure 60-100-16]**.

If the measurement is less than the allowable limit, replace the camshaft.

Cam Height of Intake	28,80 mm (1.134 in)
Allowable Limit	28,75 mm (1.132 in)
Cam Height of Exhaust	29,00 mm (1.142 in)
Allowable Limit	28,95 mm (1.140 in)

Figure 60-100-17



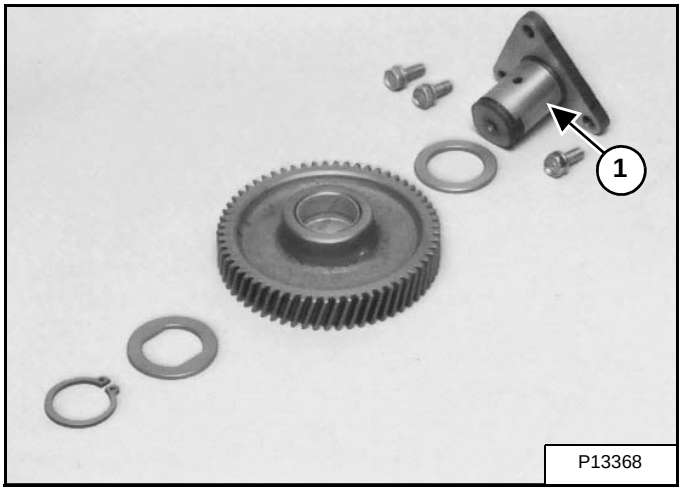
Put the camshaft in V-blocks. Install a dial indicato **[Figure 60-100-17]**.

Turn the camshaft at a slow rate. If the misalignmen exceeds the allowable limit, replace the camshaft.

Camshaft Alignment Allowable Limit	0,01 mm (0.0004 in)

Idler Gear And Shaft Servicing

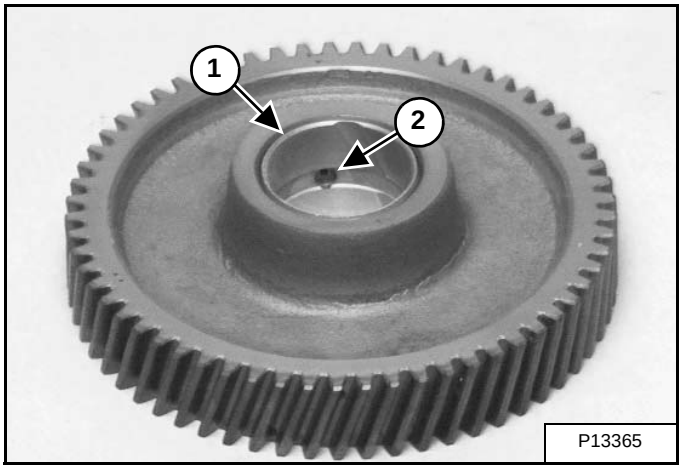
Figure 60-100-18



Measure the outside diameter of the idler gear shaft (Item 1) **[Figure 60-100-18]**.

Idler Gear Shaft O.D.	25,967 - 25,980 mm (1.0223 - 1.0228 in)

Figure 60-100-19



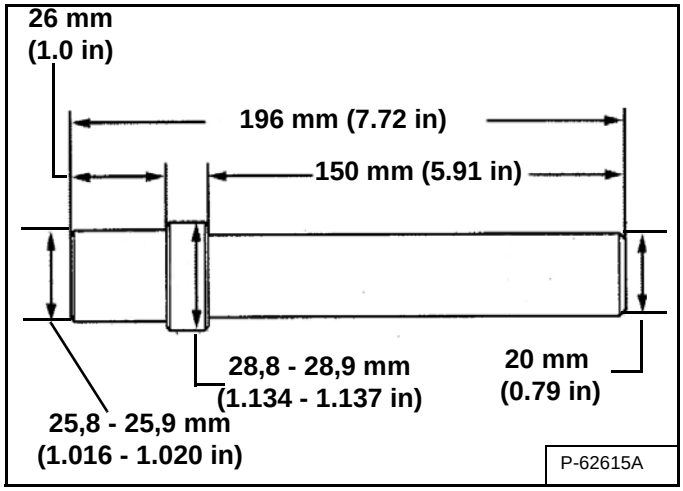
Check the inside diameter of the idler gear bushing (Item 1) **[Figure 60-100-19]**.

Idler Gear Bushing I.D.	26,000 - 26,021 mm (1.0237 - 1.0244 in)
Oil Clearance Between Idle Gear and Bushing	0,020 - 0,054 mm (0.00079 - 0.0021 in)
Allowable limit	0,10 mm (0.0039 in)

If the clearance exceeds the allowable limit, replace the bushing.

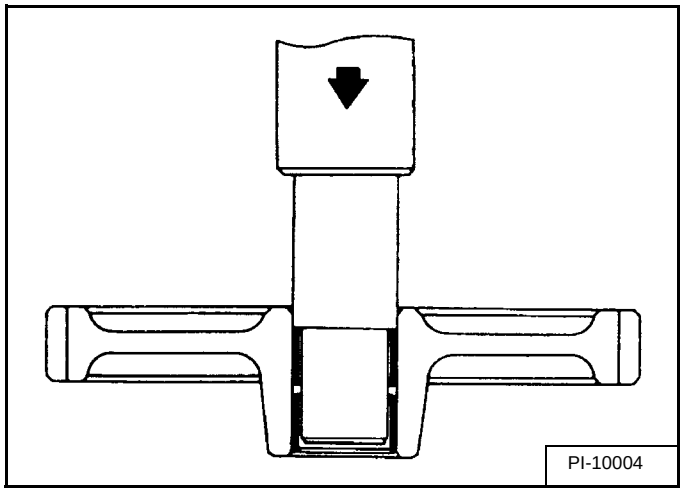
Align the oil hole in the bushing (Item 2) **[Figure 60-100-19]** with oil hole in the gear, when installing the new bushing.

Figure 60-100-20



To replace the idler gear bushing, make a driver tool as shown in figure **[Figure 60-100-20]**.

Figure 60-100-21



Use a press and the driver tool, to remove the old bushing and install the new bushing **[Figure 60-100-21]**.

Hydraulic Pump Coupler Removal And Installation

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

Remove the counterweight. (See Removal And Installation on Page 40-90-1.)

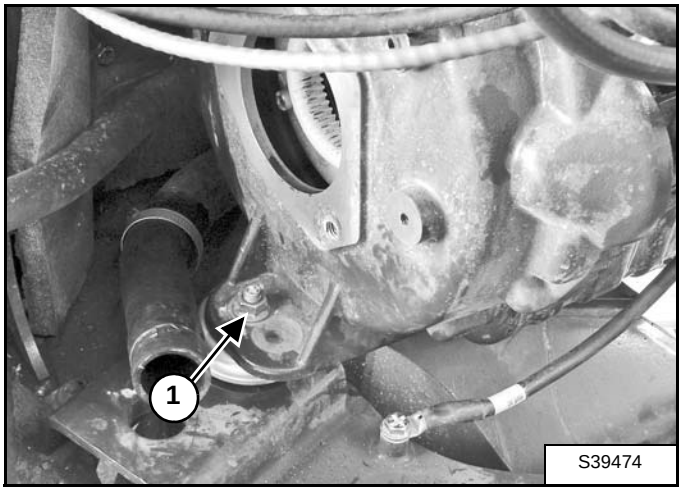
Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-4.)

Remove the muffler. (See Removal 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.)

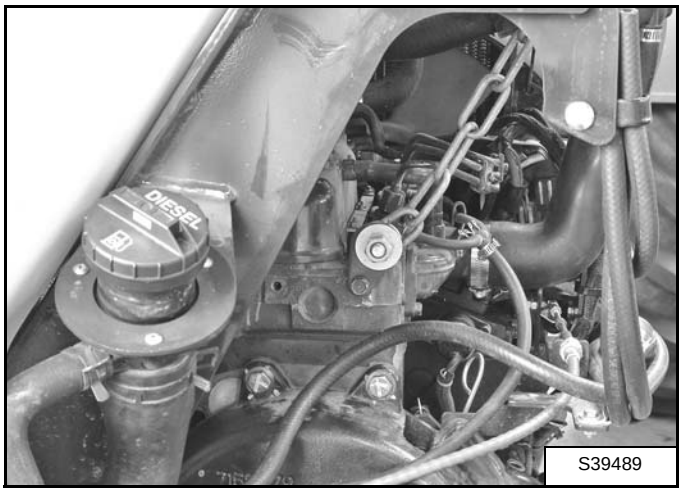
Figure 60-110-1



Remove the nut (Item 1) **[Figure 60-110-1]** and bolt from the engine mount.

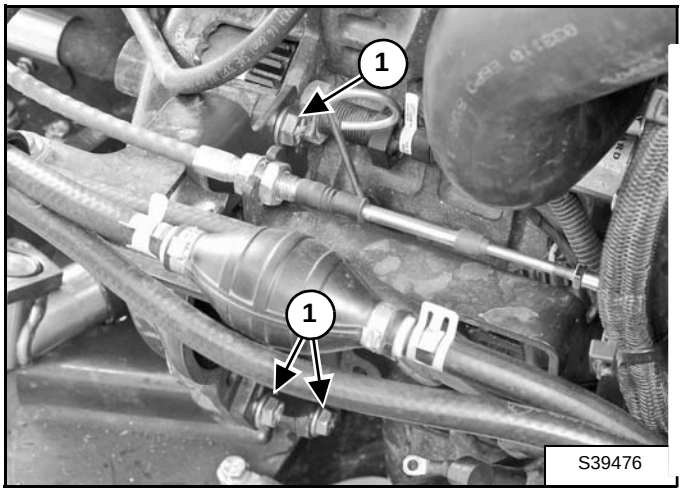
Installation: Tighten the bolt to 105 - 115 N•m (78 - 85 ft-lb) torque.

Figure 60-110-2



Slightly raise the flywheel end of the engine, and place a support under the oil pan **[Figure 60-110-2]**.

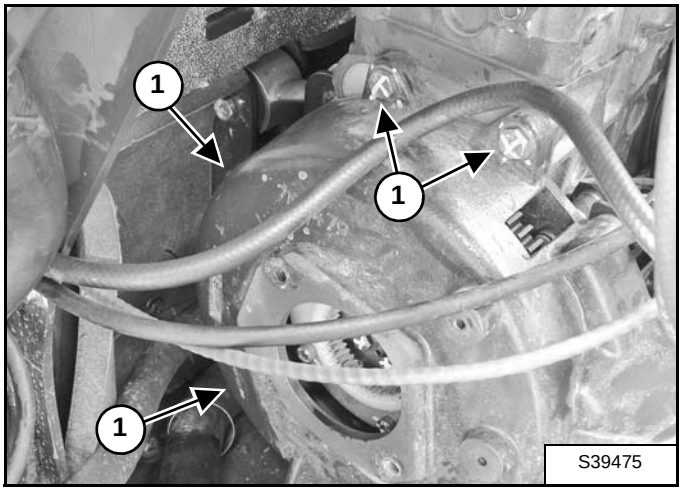
Figure 60-110-3



Remove the three flywheel housing bolts (Item 1) **[Figure 60-110-3]**.

Hydraulic Pump Coupler Removal And Installation (Cont'd)

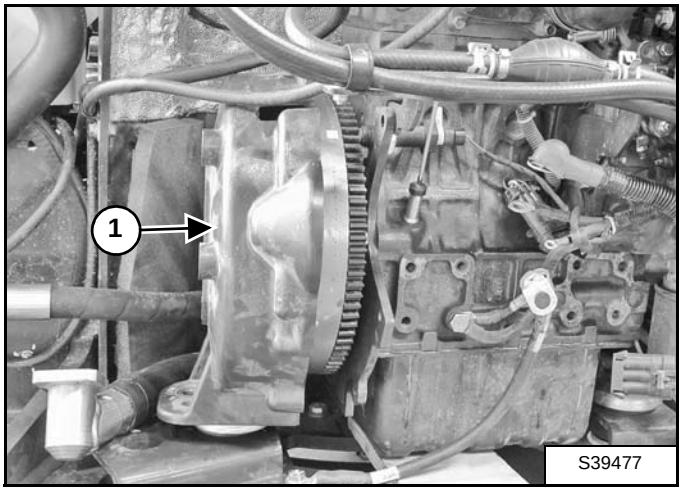
Figure 60-110-4



Remove the two flywheel housing bolts (Item 1) **[Figure 60-110-4]** from the front side of the engine.

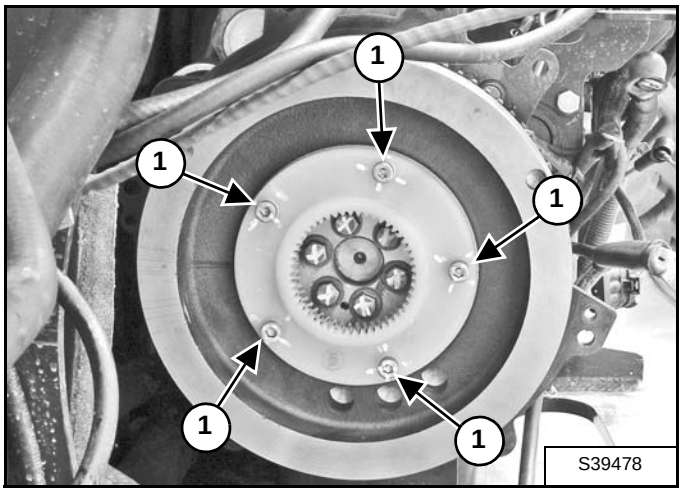
Installation: Position the housing over the alignment pins and tighten the bolts to 43 - 47 N•m (32 - 35 ft-lb) torque.

Figure 60-110-5



Remove the flywheel housing (Item 1) **[Figure 60-110-5]** from the engine.

Figure 60-110-6



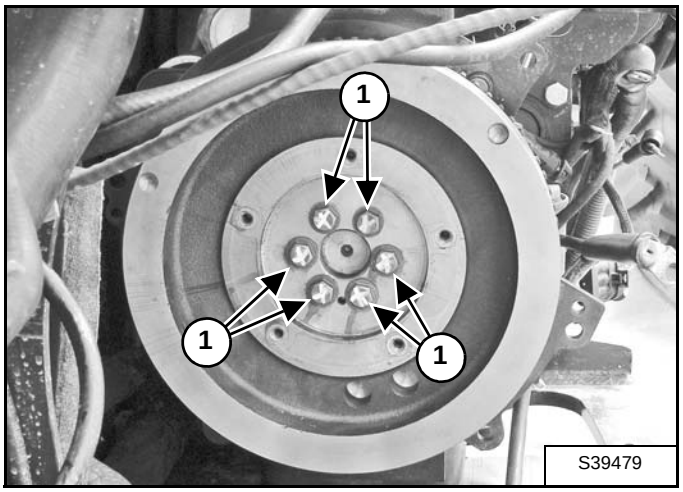
Remove the bolts (Item 1) **[Figure 60-110-6]** from the hydraulic pump coupler.

Installation: Apply Loctite® 243 to the bolts. Tighten the bolts to 35 - 39 N•m (25 - 28 ft-lb) torque.

Remove the hydraulic pump coupler.

Flywheel Removal And Installation

Figure 60-110-7



Remove the five bolts (Item 1) **[Figure 60-110-7]** from the flywheel.

Installation: Apply Loctite® 243 to the bolts. Tighten the bolts to 54 - 58 N•m (40 - 43 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 o 232 - 260°C (450 - 500°F).

Fit the ring gear over the flywheel. Make sure the gear i seated correctly.


Bobcat®

HEATING, VENTILATION AND AIR

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Cab Filters 70-10-1

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Removal And Installation 70-71-1


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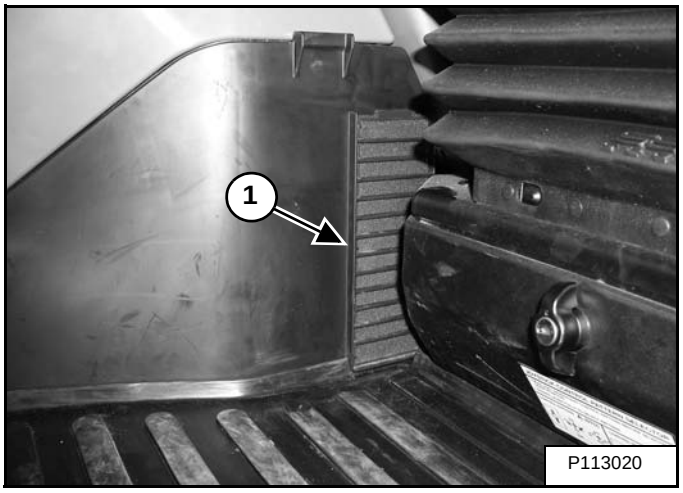
REGULAR MAINTENANCE (S/N AB8B110001 - AB8B11999)

Cab Filters

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

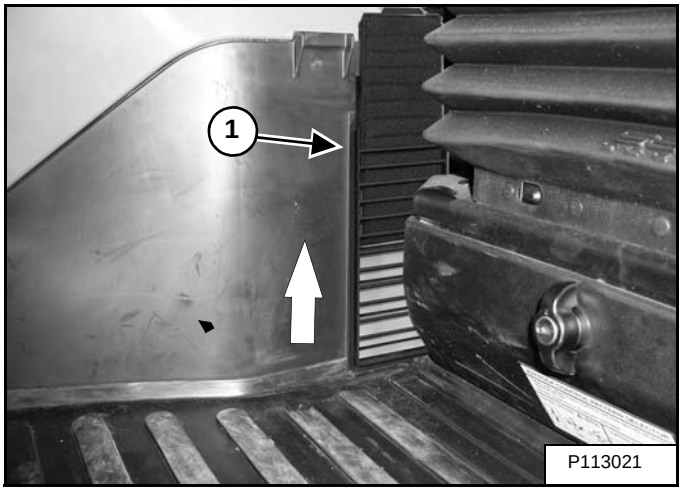
Recirculation Filter

Figure 70-10-1



The recirculation filter (Item 1) **[Figure 70-10-1]** is located to the right of the operator's seat.

Figure 70-10-2



Pull up on the filter (Item 1) **[Figure 70-10-2]** 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.

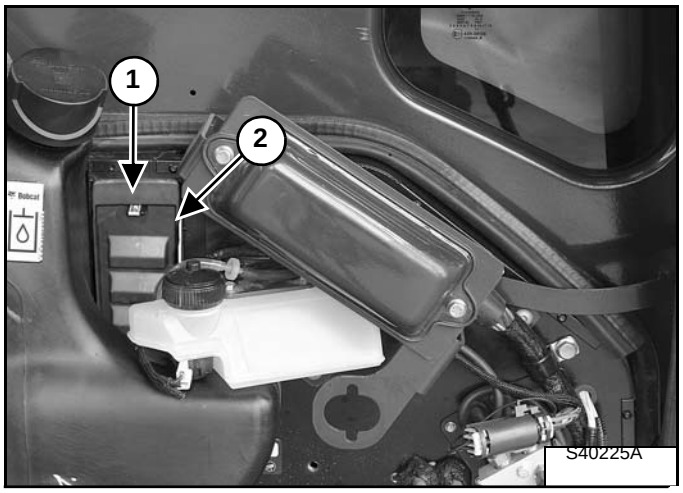
Installation: Position the bottom of the filter (Item 1) **[Figure 70-10-2]** into the housing and slowly push the filter down fully.

Fresh Air Filter

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

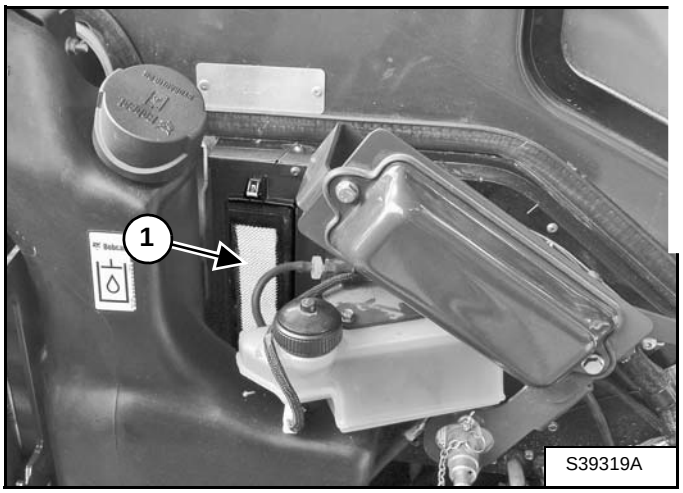
Open the right side cover. (See RIGHT SIDE COVER on Page 10-60-1.)

Figure 70-10-3



Pull out on the tab (Item 1) and remove the cover (Item 2 **[Figure 70-10-3]**.

Figure 70-10-4



Pull the filter (Item 1) **[Figure 70-10-4]** 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 70-10-4]** 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 70-10-3]** locks to the frame.


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REGULAR MAINTENANCE (S/N AB8B12001 & ABOVE)

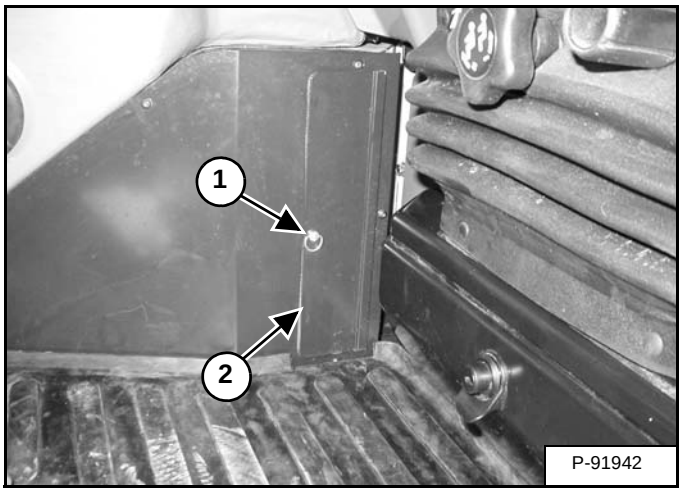
Cab Filters

The recirculation filter and the fresh air filter must be cleaned regularly. (See Maintenance Intervals 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.

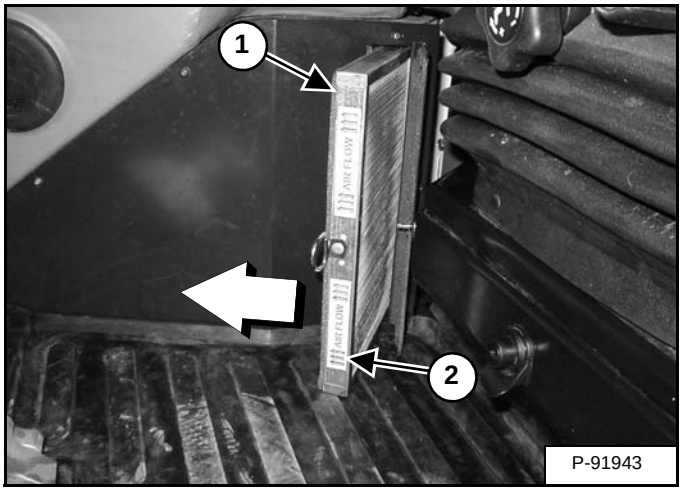
Recirculation Filter

Figure70-11-5



Turn the fastener (Item 1) 90° turn and remove the cover (Item 2) **[Figure70-11-5]**.

Figure 70-11-6



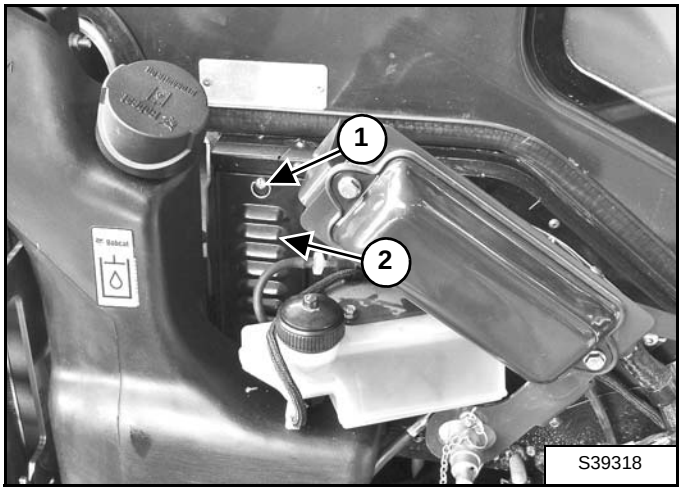
Pull the filter (Item 1) **[Figure 70-11-6]** out of the heater housing.

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 70-11-6]** pointing towards the heater housing.

Fresh Air Filter

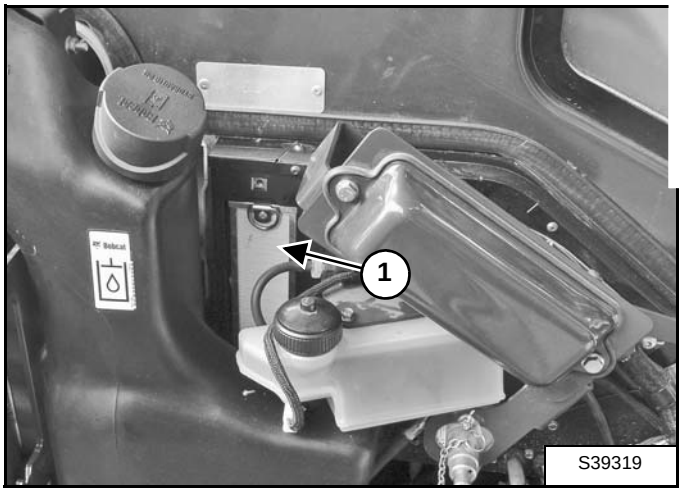
Figure 70-11-7



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

Turn the fastener (Item 1) 90° turn and remove the cove (Item 2) **[Figure 70-11-7]**.

Figure 70-11-8



Pull the filter (Item 1) **[Figure 70-11-8]** out of the housing.

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


Bobcat®

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

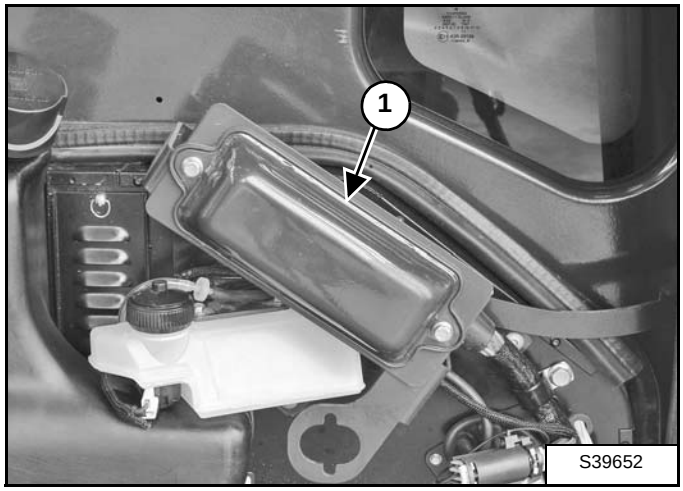
Blower Motor Operates Normally, But Air Flow Is Insufficient

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. Heater inlet obstruction	Check heater for plugging	Remove the obstruction and clean heater fins with air or water
2. Air leak	Check to make sure air hoses are properly hooked to Louvers and air ducts	Repair or adjust
3. Plugged cab filters	Check cab recirculation and fresh air filters	Clean or replace filters

Electrical System

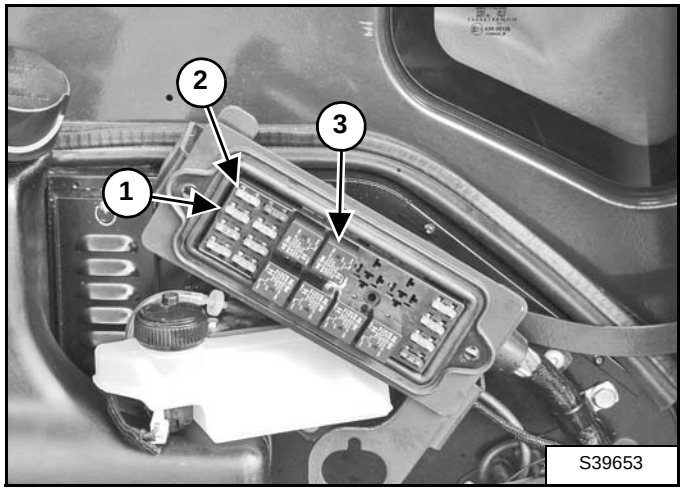
If the excavator heating / ventilation system shows no blower motor function, do the following check:

Figure 70-20-1



Remove the two bolts and fuse / relay cover (Item 1) **[Figure 70-20-1]**.

Figure 70-20-2

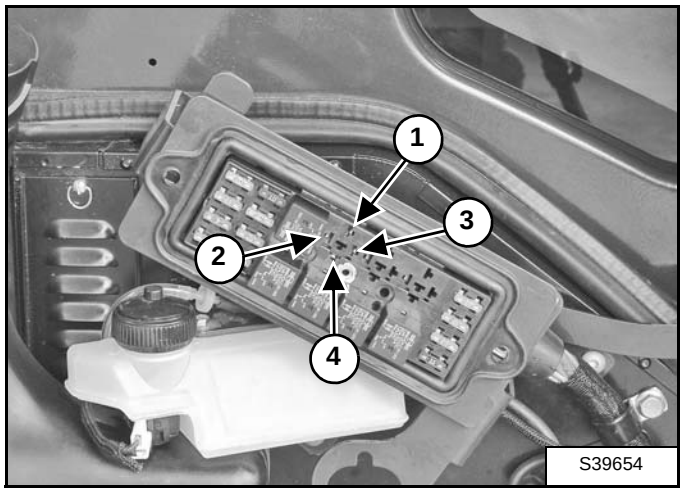


Check the heating / ventilation fuse (Item 1) and controller fuse (Item 2) **[Figure 70-20-2]**.

Replace the fuse if burned out. If the fuses are good, remove the relay (Item 3) **[Figure 70-20-2]**.

Using a multimeter, check the voltage at the following relay terminals:

Figure 70-20-3



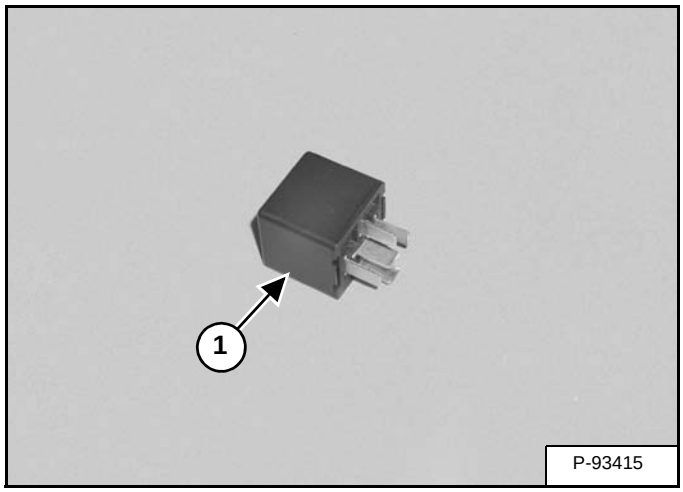
Voltage at pin 30 (Item 1) **[Figure 70-20-3]** is 12 volts at all times.

Voltage at pin 86 (Item 2) **[Figure 70-20-3]** is 12 volts when the key switch is in the on position.

Pin 85 (Item 3) **[Figure 70-20-3]** is ground. Check for continuity to the ground.

With the key switch in the ON position, A/C switch ON, turn the fan switch ON pin 87 (Item 4) **[Figure 70-20-3]** is ground. Turn the fan switch OFF, and there is no continuity.

Figure 70-20-4



If the voltages and continuity checks are OK but the problem still persists, replace the heating / ventilation relay (Item 1) **[Figure 70-20-4]**.

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.

HEATING / VENTILATION UNIT

Removal And Installation

Remove the cab. (See Removal And Installation on Page 40-30-1.)

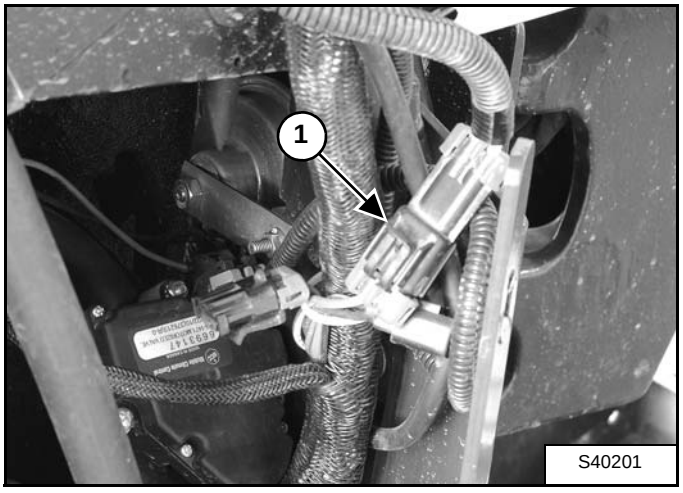
Remove the engine coolant. (See Removing And Replacing Coolant on Page 10-90-3.)

Remove the right upperstructure cover. (See Removal And Installation on Page 40-80-1.)

Remove the tool box. (See Removal And Installation on Page 40-220-1.)

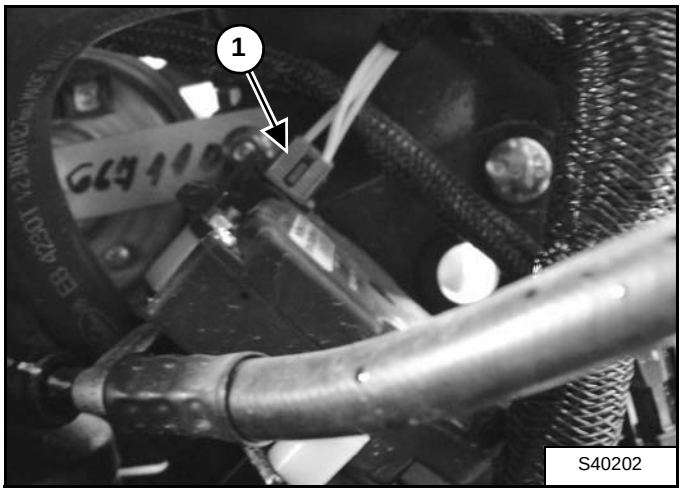
Remove the battery disconnect switch (if equipped). (See BATTERY DISCONNECT SWITCH on Page 50-150-1.)

Figure 70-30-1



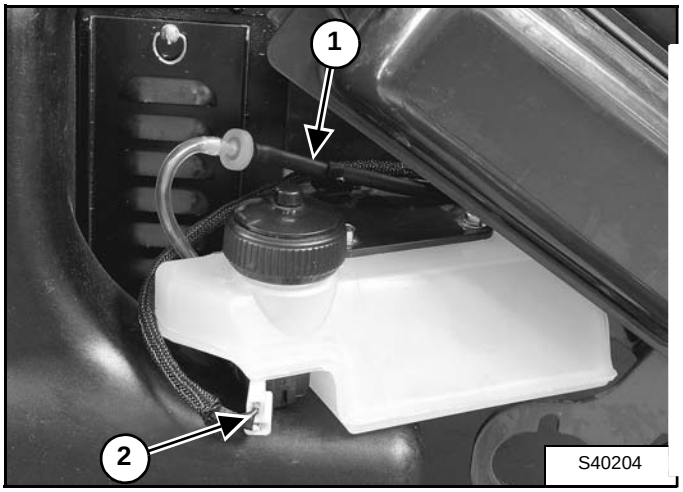
Disconnect the wire harness (Item 1) **[Figure 70-30-1]**.

Figure 70-30-2



Disconnect the wire harness (Item 1) **[Figure 70-30-2]** from the heater valve.

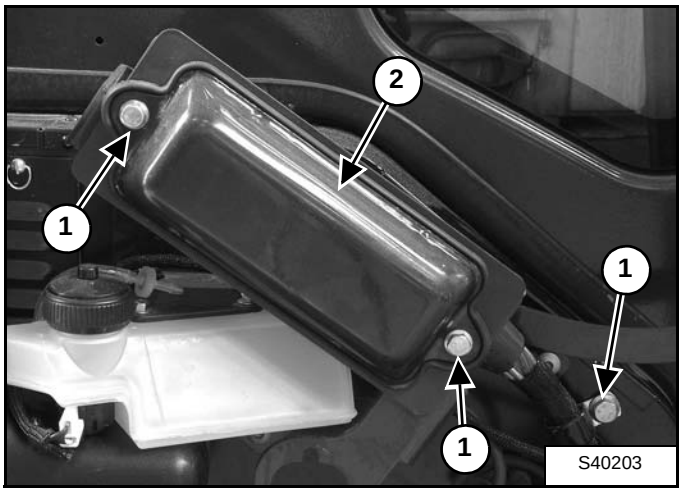
Figure 70-30-3



Remove the hose (Item 1) and the wire harness (Item 2) **[Figure 70-30-3]**.

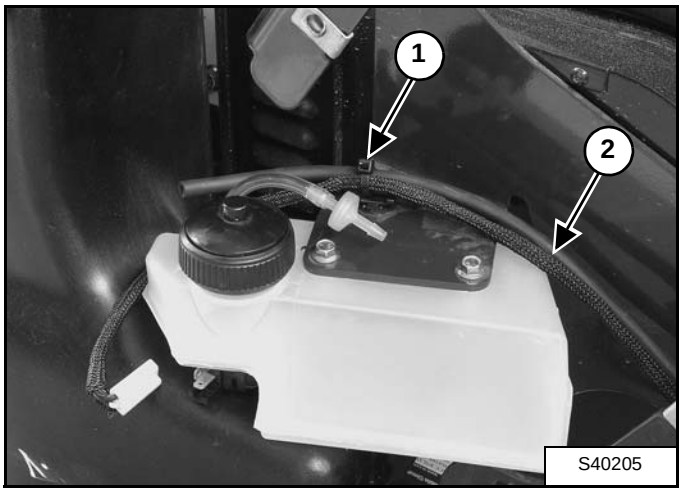
Removal And Installation (Cont'd)

Figure 70-30-4



Remove the bolts (Item 1) and reposition the fuse box (Item 2) **[Figure 70-30-4]**.

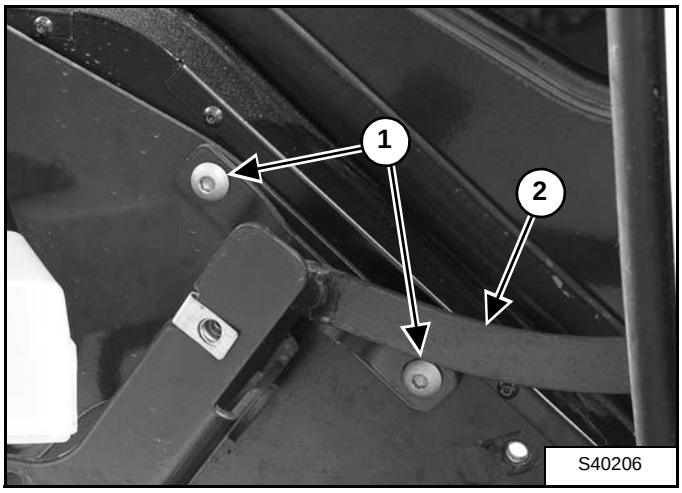
Figure 70-30-5



Remove the tie-strap (Item 1) **[Figure 70-30-5]**.

Remove the wire harness and hose (Item 2) **[Figure 70-30-5]**.

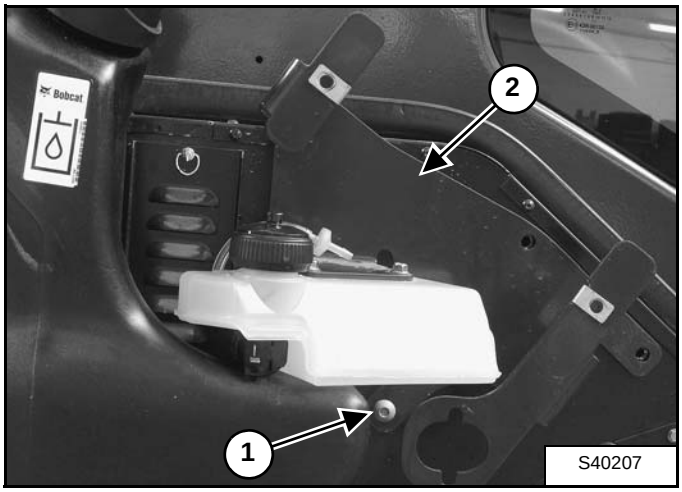
Figure 70-30-6



Support the left side cover and remove the bolts (Item 1) **[Figure 70-30-6]**.

Reposition the bracket (Item 2) **[Figure 70-30-6]**.

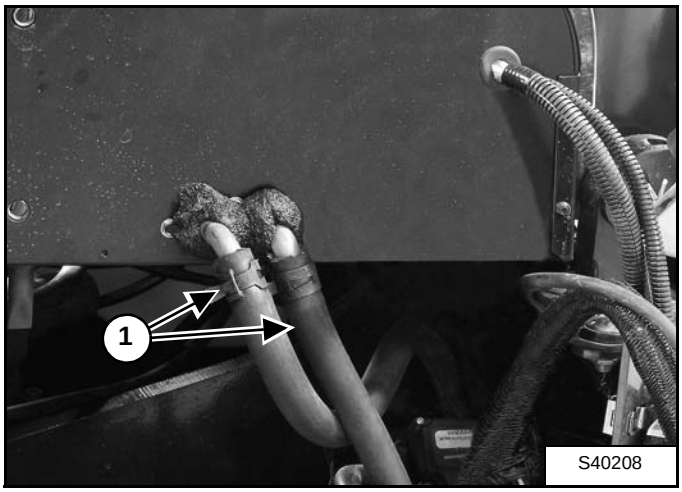
Figure 70-30-7



Remove the bolt (Item 1) and bracket (Item 2) **[Figure 70-30-7]**.

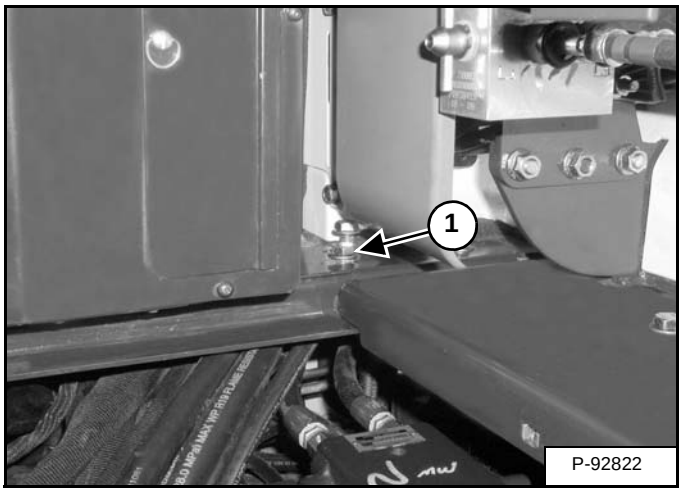
Removal And Installation (Cont'd)

Figure 70-30-8



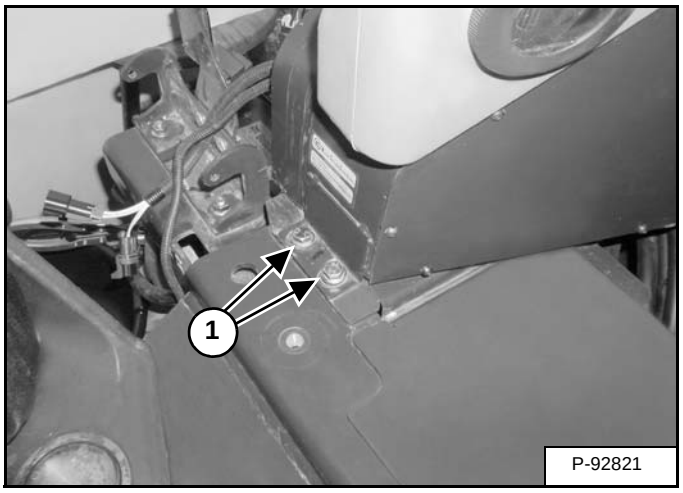
Mark and remove the heater hoses (Item 1) **[Figure 70-30-8]**.

Figure 70-30-9



Remove the bolt (Item 1) **[Figure 70-30-9]**.

Figure 70-30-10



Remove the two bolts (Item 1) **[Figure 70-30-10]**.

Remove the heating / ventilation unit.


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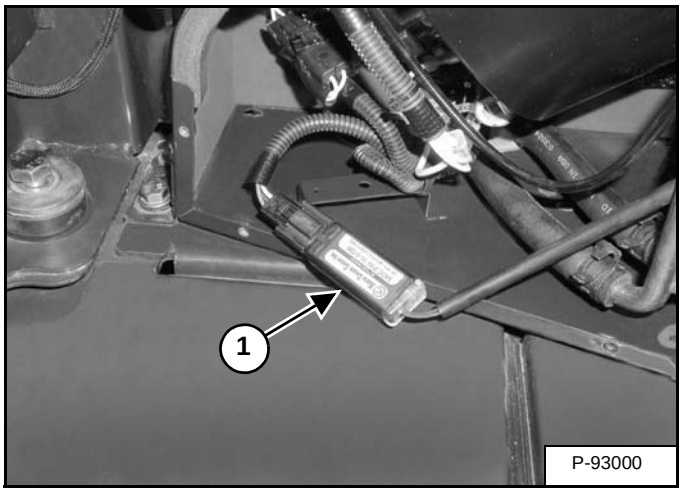
HEATER COIL (S/N AB8B11001 - AB8B11999)

Removal And Installation

Remove the engine coolant. (See Removing And Replacing Coolant on Page 10-90-3.)

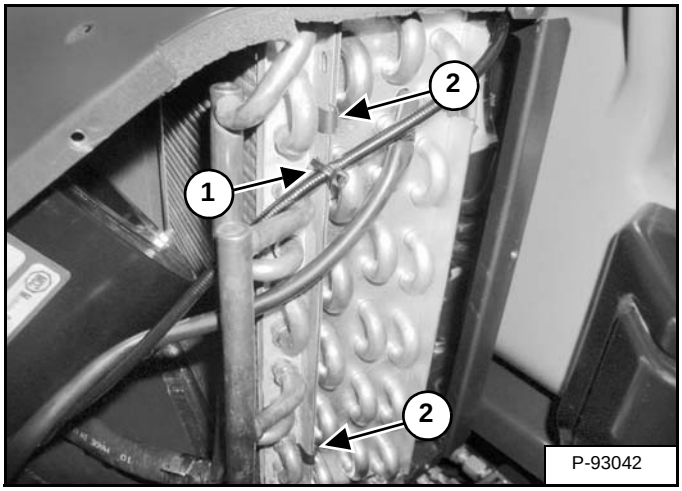
Remove the heating / ventilation duct. (See Removal And Installation on Page 70-70-1.)

Figure 70-40-1



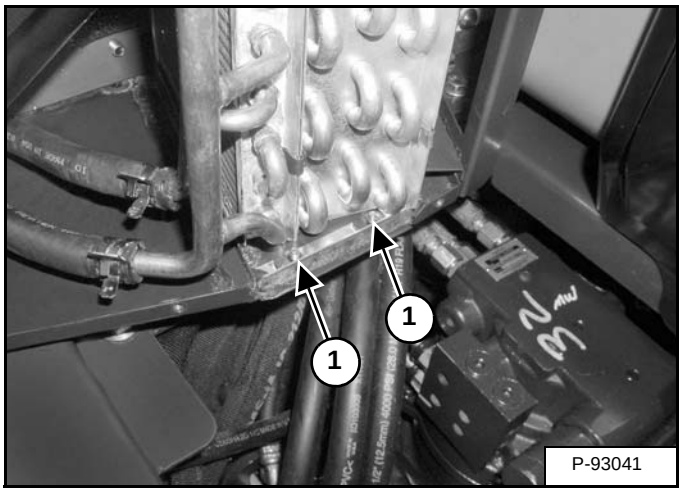
Disconnect the wire harness (Item 1) **[Figure 70-40-1]**.

Figure 70-40-2



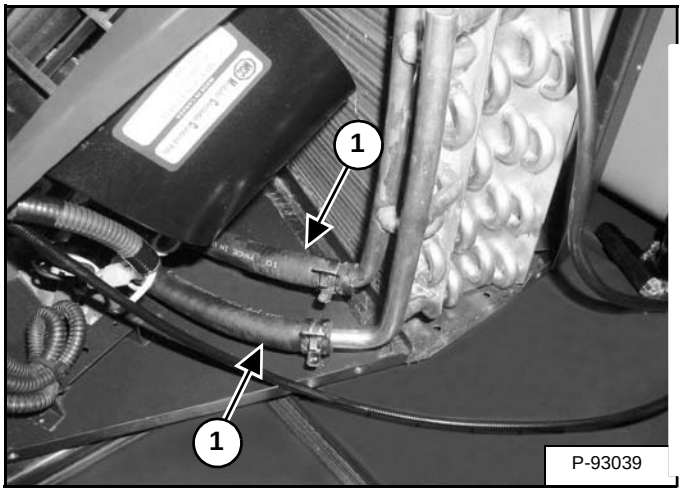
Cut and remove the cable tie (Item 1). Remove the clips (Item 2) **[Figure 70-40-2]**.

Figure 70-40-3



Remove the center floor panel. Remove the two screws and remove the bracket (Item 1) **[Figure 70-40-3]**.

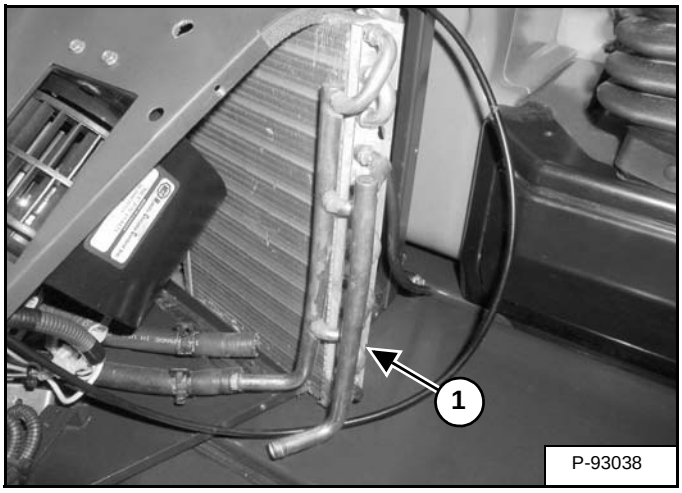
Figure 70-40-4



Disconnect the heater hoses (Item 1) **[Figure 70-40-4]**.

Removal And Installation (Cont'd)

Figure 70-40-5



Remove the coil (Item 1) **[Figure 70-40-5]**.

HEATER COIL (S/N AB8B12001 & ABOVE)

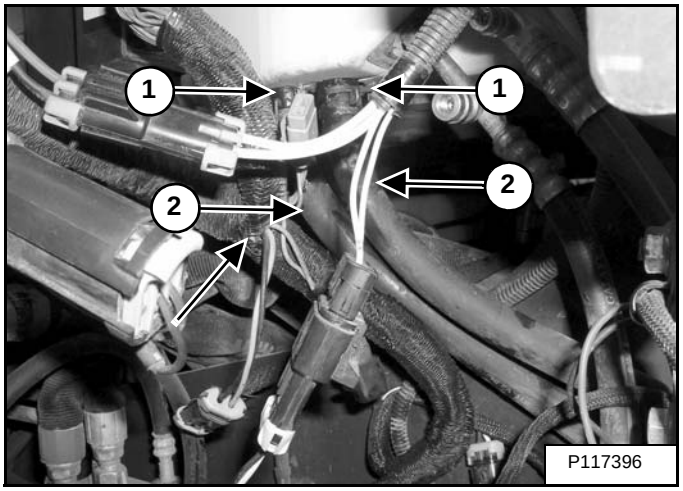
Removal And Installation

Remove the engine coolant. (See Removing And Replacing Coolant on Page 10-90-3.)

Remove the HVAC Duct. (See Removal And Installation on Page 70-71-1.)

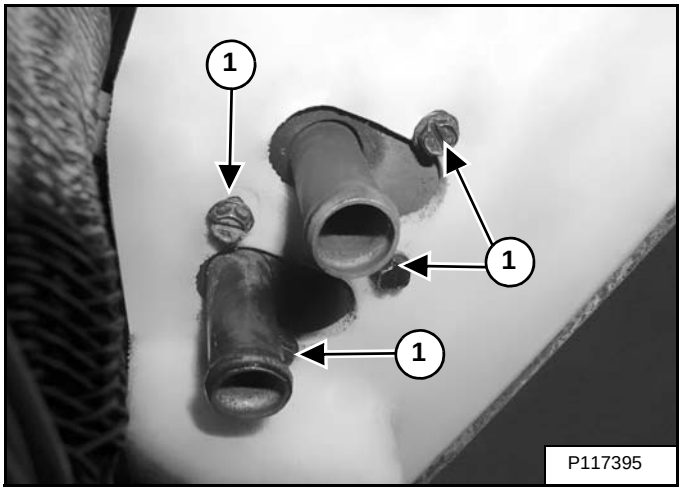
Remove the blower fan. (See Removal And Installation on Page 70-50-1.)

Figure 70-41-1



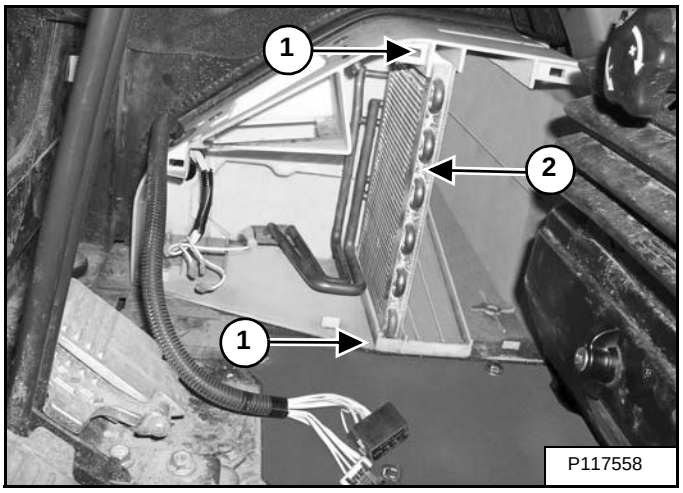
Loosen the clamps (Item 1) and remove the heater hoses (Item 2) **[Figure 70-41-1]**.

Figure 70-41-2



Remove the four screws (Item 1) **[Figure 70-41-2]** from the bottom of the HVAC box.

Figure 70-41-3



Remove the two screws (Item 1) and the heater coil (Item 2) **[Figure 70-41-3]**.

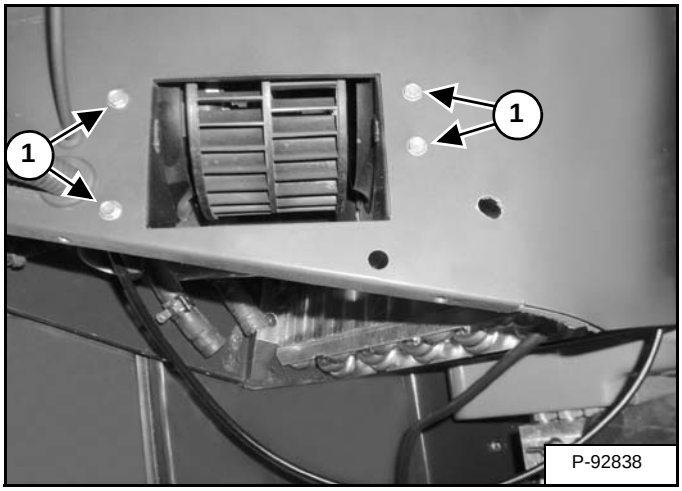

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BLOWER FAN (S/N AB8B11001 - AB8B11999)

Removal And Installation

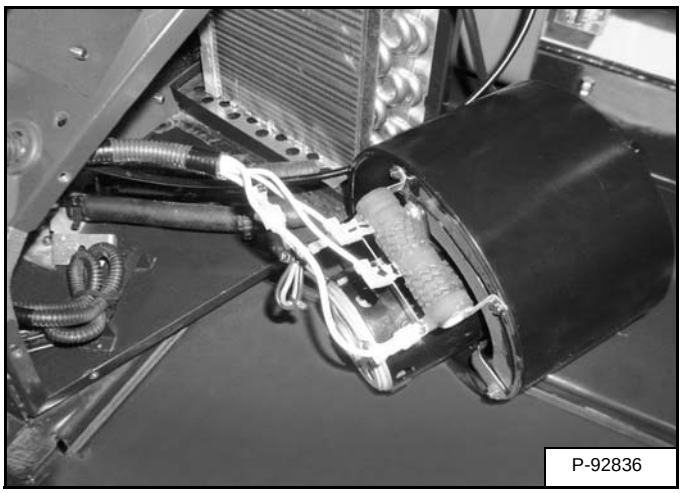
Remove the heater coil. (See Removal And Installation on Page 70-40-1.)

Figure 70-50-1



Remove the four bolts (Item 1) **[Figure 70-50-1]**.

Figure 70-50-2



Mark and remove the wire connectors from the motor **[Figure 70-50-2]**. Remove the motor.


Bobcat®

BLOWER FAN (S/N AB8B12001 & ABOVE)

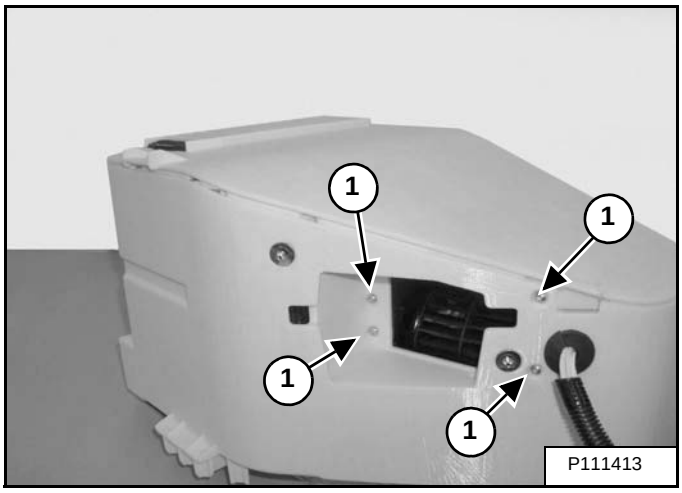
Removal And Installation

Figure 70-51-1



Mark and remove the wire connectors from the motor **[Figure 70-51-1]**.

Figure 70-51-2



Remove the two bolts (Item 1) **[Figure 70-51-2]**.

Remove the motor.


Bobcat®

HEATER VALVE

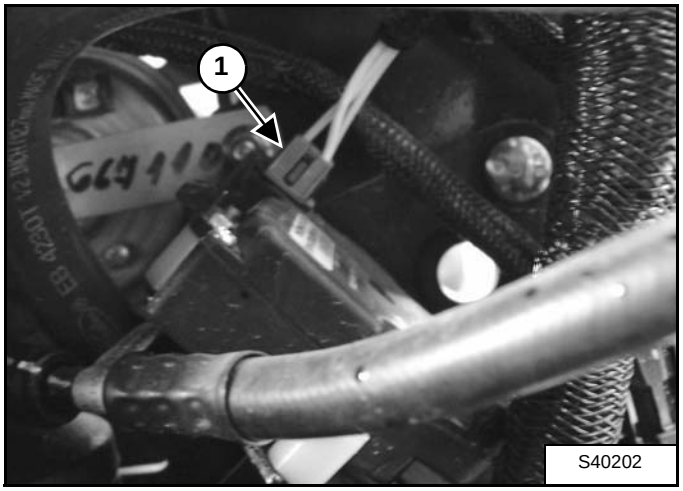
Removal And Installation

Drain the radiator. (See Removing And Replacing Coolant on Page 10-90-3.)

Remove the right upperstructure cover. (See Removal And Installation on Page 40-80-1.)

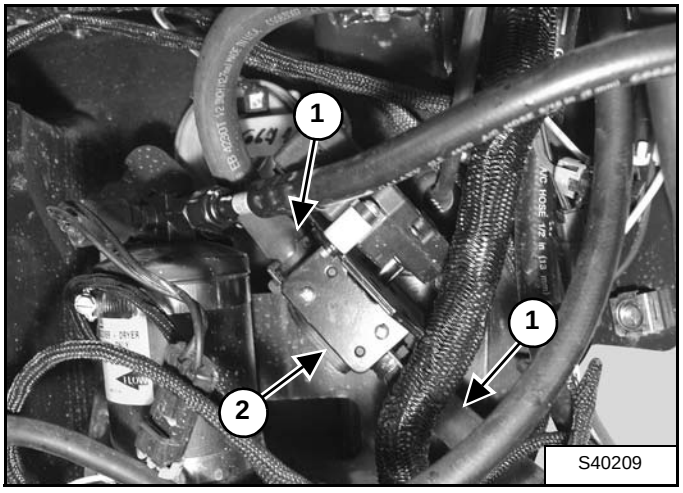
Remove the battery. (See Removing And Installing The Battery on Page 50-20-2.)

Figure 70-60-1



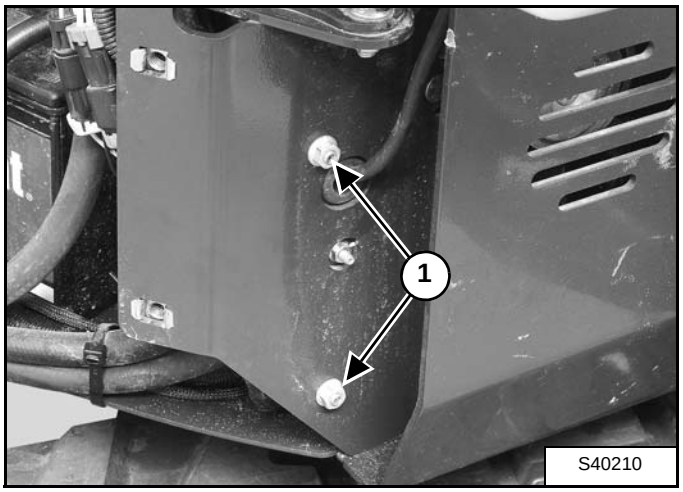
Disconnect the wire harness (Item 1) **[Figure 70-60-1]**.

Figure 70-60-2



Mark and remove the hoses (Item 1) from the heater valve (Item 2) **[Figure 70-60-2]**.

Figure 70-60-3



Remove the bolts and nuts (Item 1) **[Figure 70-60-3]**.

Remove the heater valve (Item 2) **[Figure 70-60-2]**.

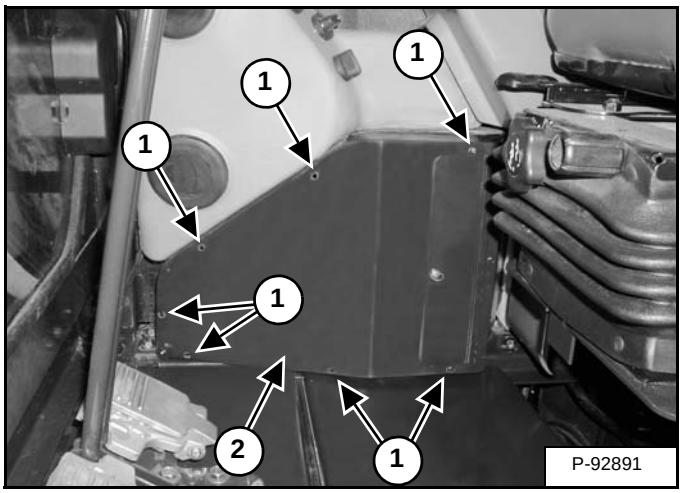

Bobcat®

HEATING / VENTILATION DUCT (S/N AB8B110001 - AB8B11999)

Removal And Installation

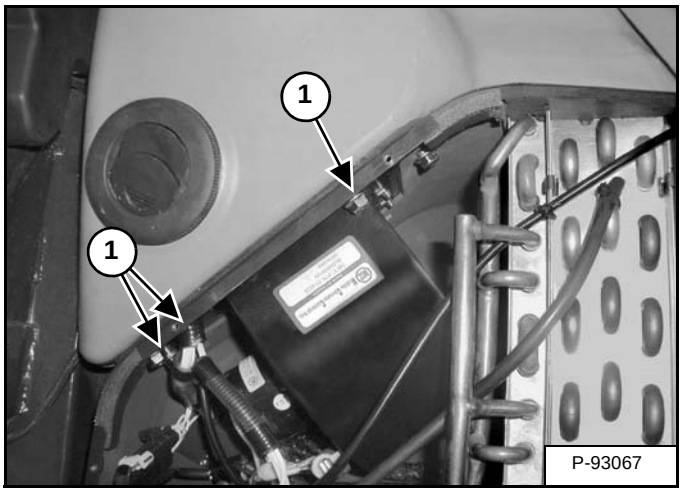
Remove the floor mat. (See Removal And Installation on Page 40-110-1.)

Figure 70-70-1



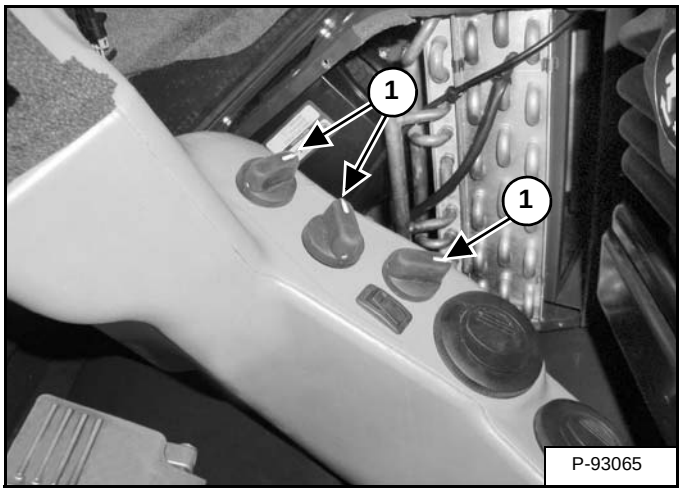
Remove the eight screws (Item 1) and cover (Item 2) **[Figure 70-70-1]**.

Figure 70-70-2



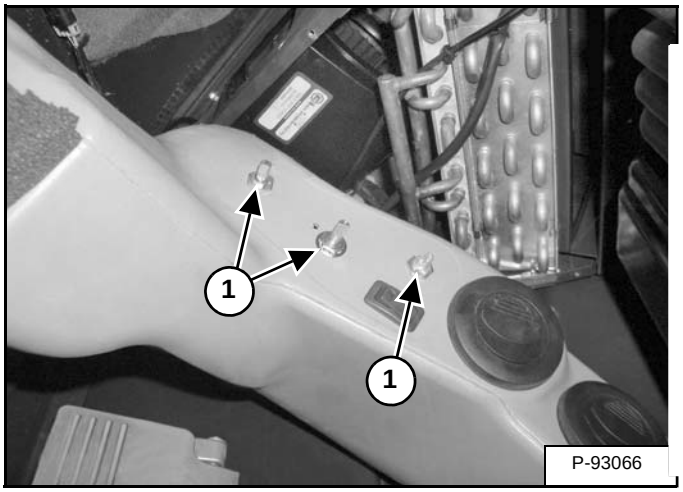
Remove the four bolts (Item 1) **[Figure 70-70-2]**.

Figure 70-70-3



Loosen the set screws (Item 1) **[Figure 70-70-3]** and remove the control knobs.

Figure 70-70-4



Remove the nuts (Item 1) **[Figure 70-70-4]** and push the controls into the duct.

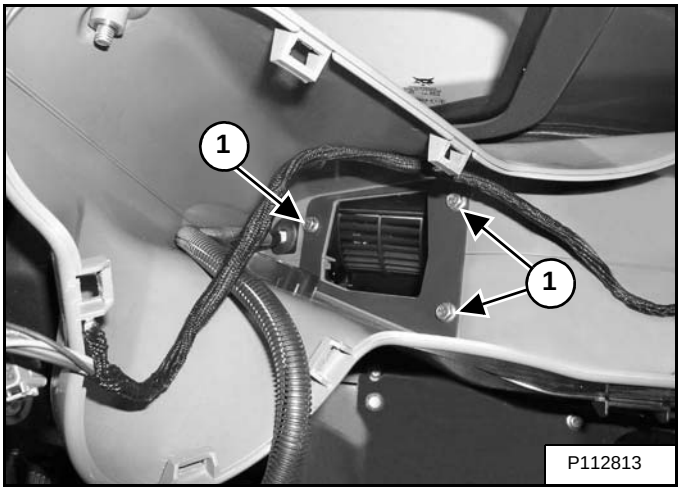

Bobcat®

HVAC DUCT (S/N AB8B12001 & ABOVE)

Removal And Installation

Remove the instrument panel. (See Removal And Installation on Page 70-71-1.)

Figure 70-71-1



Remove the bolts (Item 1) **[Figure 70-71-1]**. Remove the plate and duct.


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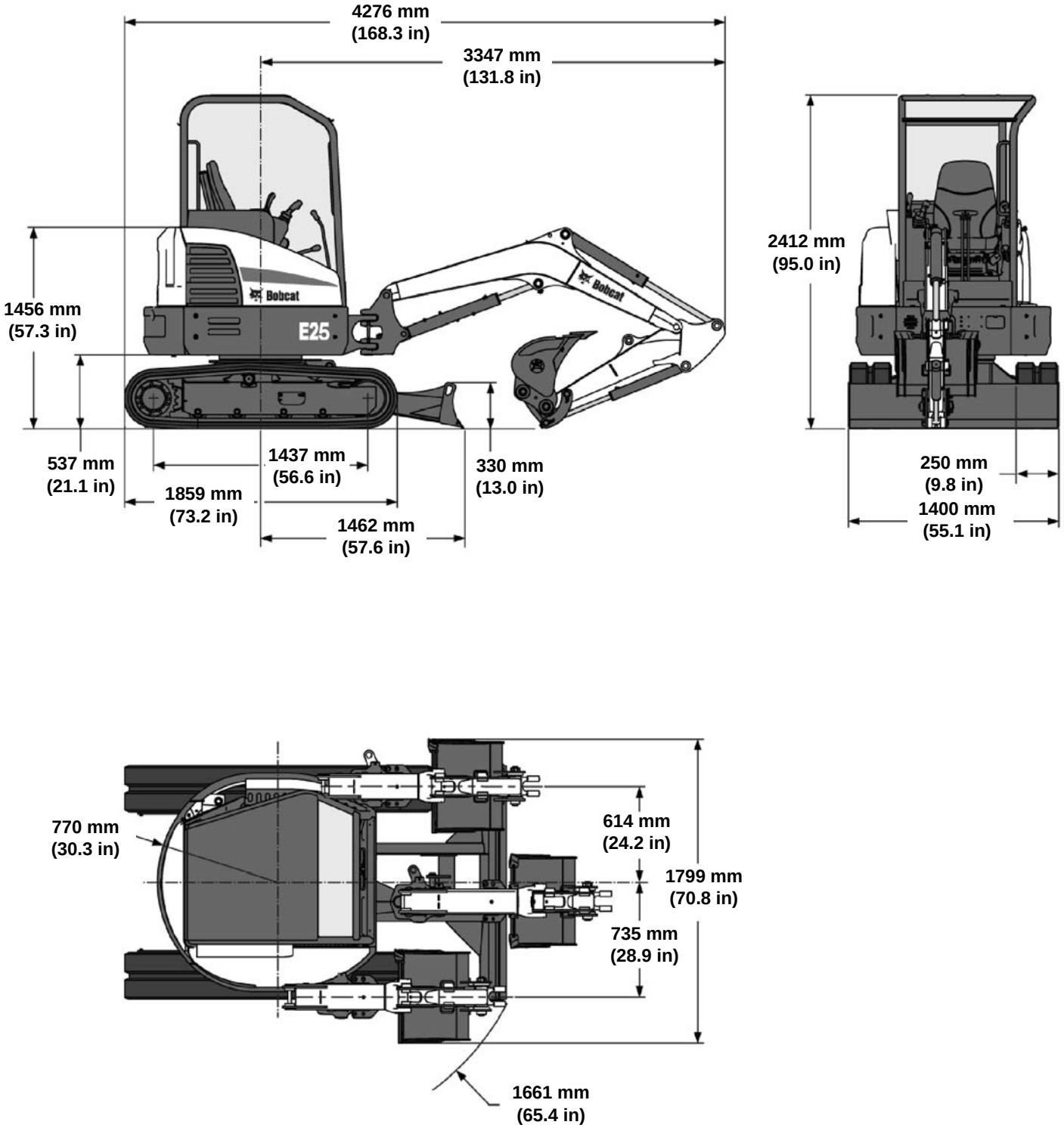
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Certain specification(s) are based on engineering calculations and are not actual measurements. Specification(s) are provided for comparison purposes only and are subject to change without notice. Specification(s) for your individual Bobcat equipment will vary based on normal variations in design, manufacturing, operating conditions, and other factors.

EXCAVATOR SPECIFICATIONS

Machine Dimensions (Standard Arm)

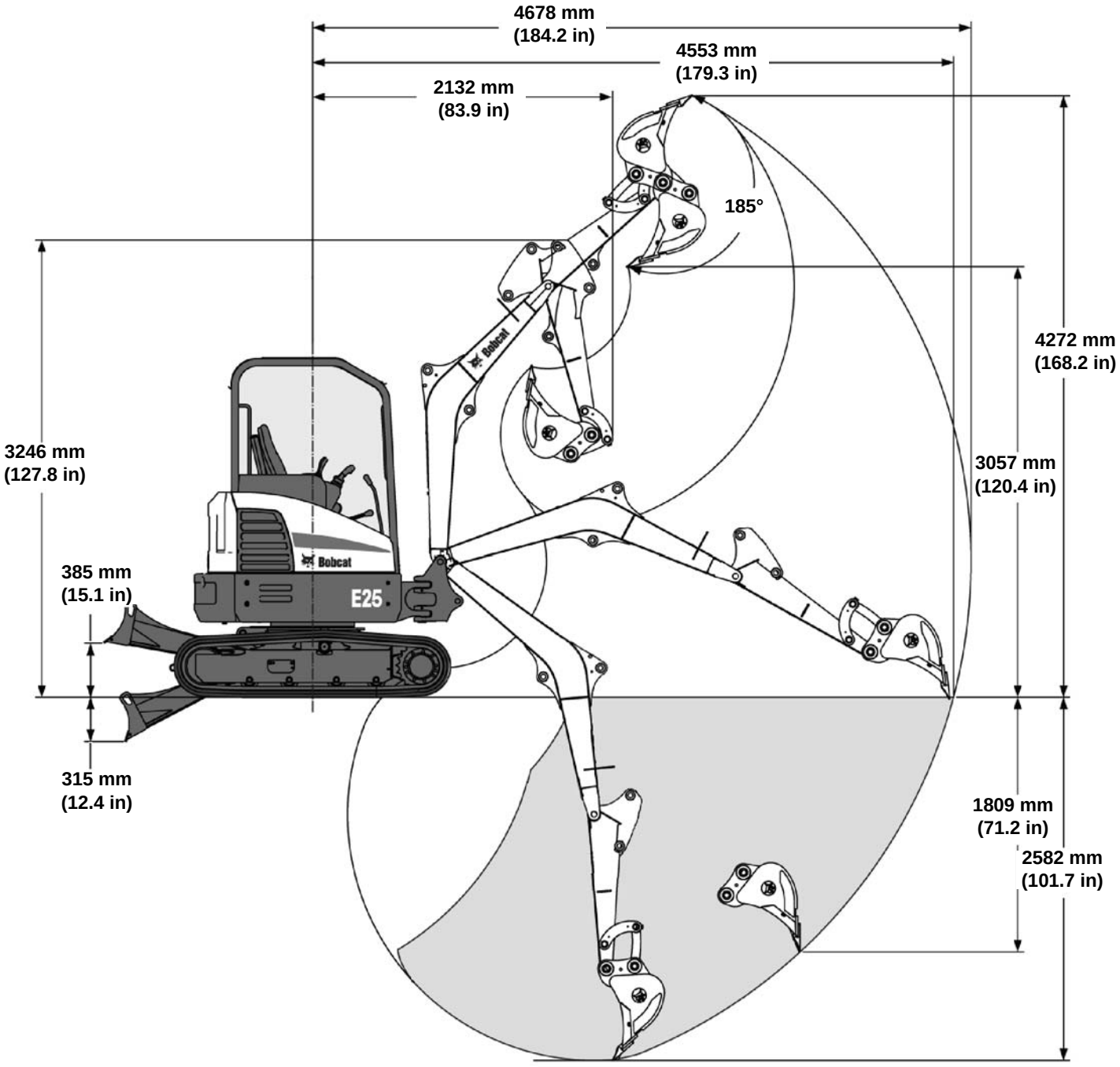
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



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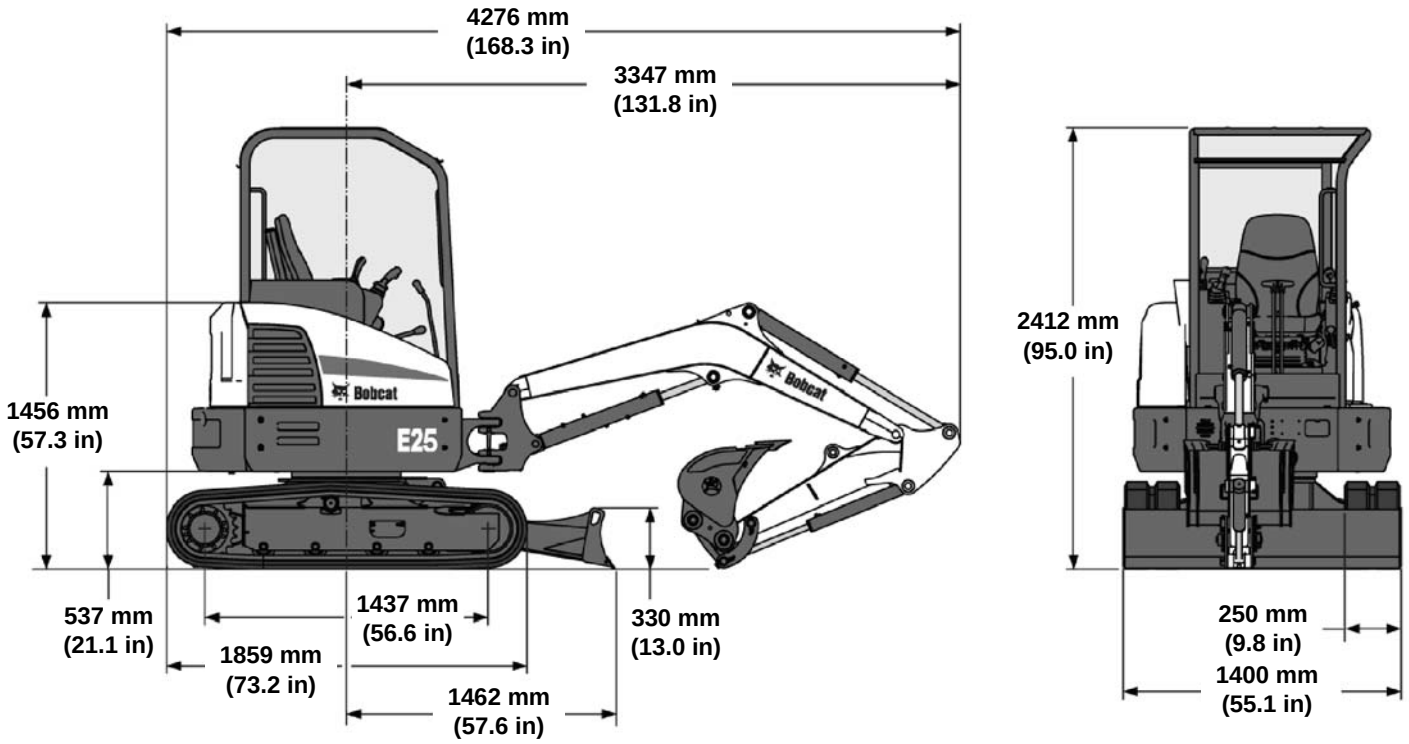
Machine Dimensions (Standard Arm) (Cont'd)

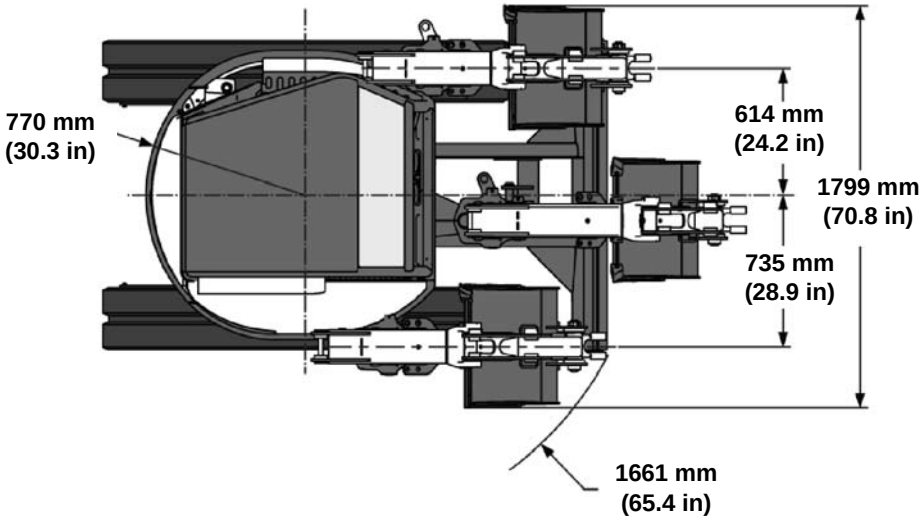
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



Machine Dimensions (Long Arm)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.

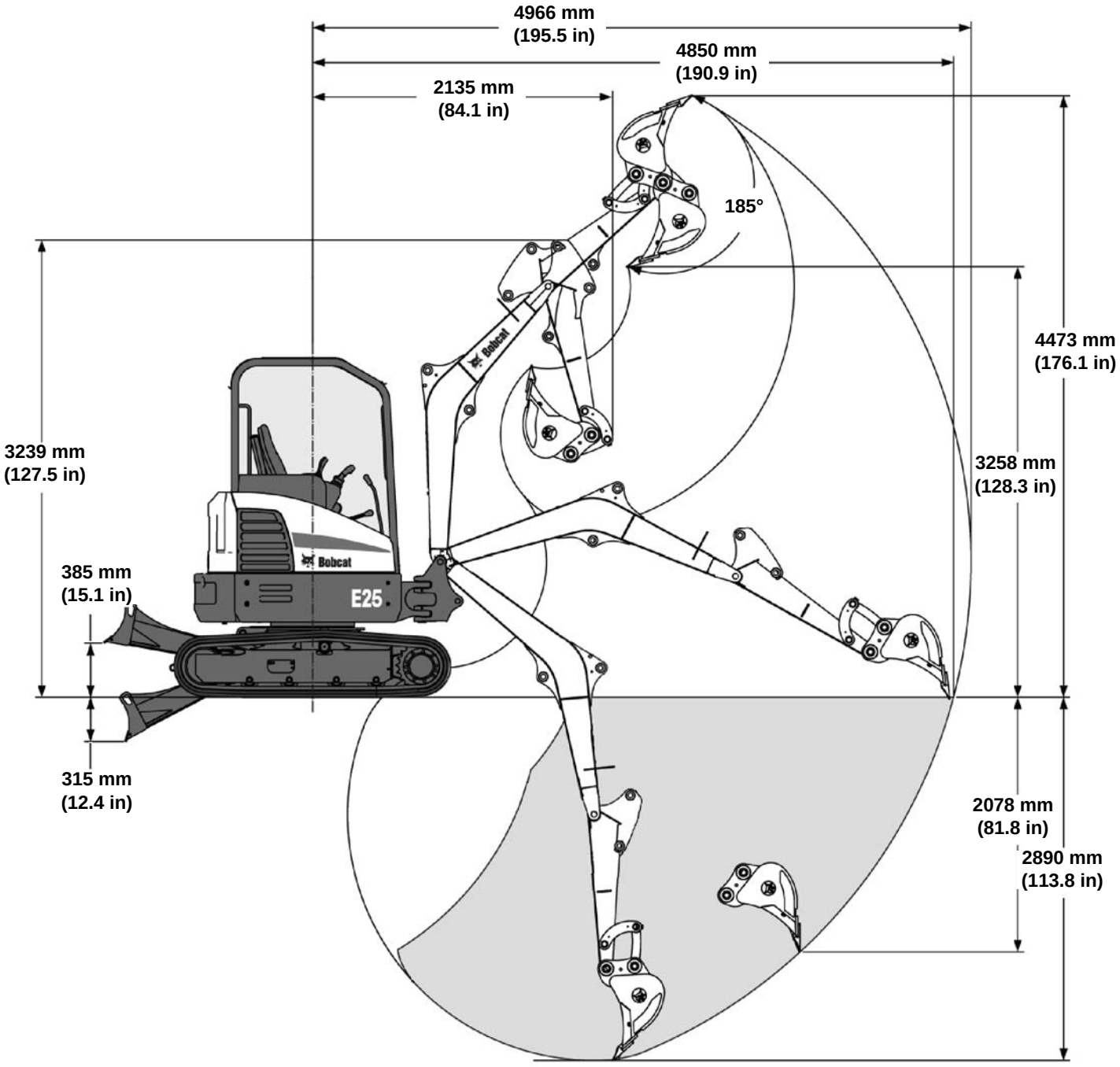




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Machine Dimensions (Long Arm) (Cont'd)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



Rated Lift Capacity - With Standard Arm

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.

A	B				B				B			
	2000 mm	3000 mm	4000 mm	kg @ max. B	2000 mm	3000 mm	4000 mm	kg @ max. B	2000 mm	3000 mm	4000 mm	kg @ max. B
3000 mm		*504 kg		*558 kg @ 3230 mm		431 kg		377 kg @ 3230 mm		355 kg		310 kg @ 3230 mm
2000 mm		*576 kg		*565 kg @ 3840 mm		423 kg		267 kg @ 3840 mm		347 kg		214 kg @ 3840 mm
1000 mm		*797 kg	*595 kg	*590 kg @ 4030 mm		392 kg	242 kg	238 kg @ 4030 mm		319 kg	193 kg	189 kg @ 4030 mm
Ground	*1255 kg	*934 kg		*642 kg @ 3880 mm	709 kg	369 kg		246 kg @ 3880 mm	555 kg	294 kg		198 kg @ 3880 mm
-1000 mm	*1595 kg	*840 kg		*693 kg @ 3320 mm	727 kg	365 kg		316 kg @ 3320 mm	572 kg	297 kg		253 kg @ 3320 mm
-2000 mm												

EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Standard Arm With Counterweight

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.

A	B				B				B			
	2000 mm	3000 mm	4000 mm	kg @ max. B	2000 mm	3000 mm	4000 mm	kg @ max. B	2000 mm	3000 mm	4000 mm	kg @ max. B
3000 mm		*520 kg		*562 kg @ 3230 mm		*526 kg		463 kg @ 3230 mm		432 kg		366 kg @ 3230 mm
2000 mm		*585 kg		*569 kg @ 3840 mm		534 kg		339 kg @ 3840 mm		417 kg		272 kg @ 3840 mm
1000 mm		*799 kg	*604 kg	*598 kg @ 4030 mm		494 kg	312 kg	302 kg @ 4030 mm		388 kg	247 kg	240 kg @ 4030 mm
Ground	*1286 kg	*944 kg		*637 kg @ 3880 mm	897 kg	462 kg		312 kg @ 3880 mm	678 kg	369 kg		252 kg @ 3880 mm
-1000 mm	*1571 kg	*854 kg		*682 kg @ 3320 mm	930 kg	470 kg		400 kg @ 3320 mm	717 kg	372 kg		322 kg @ 3320 mm
-2000 mm												

Rated Lift Capacity - With Long Arm

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.

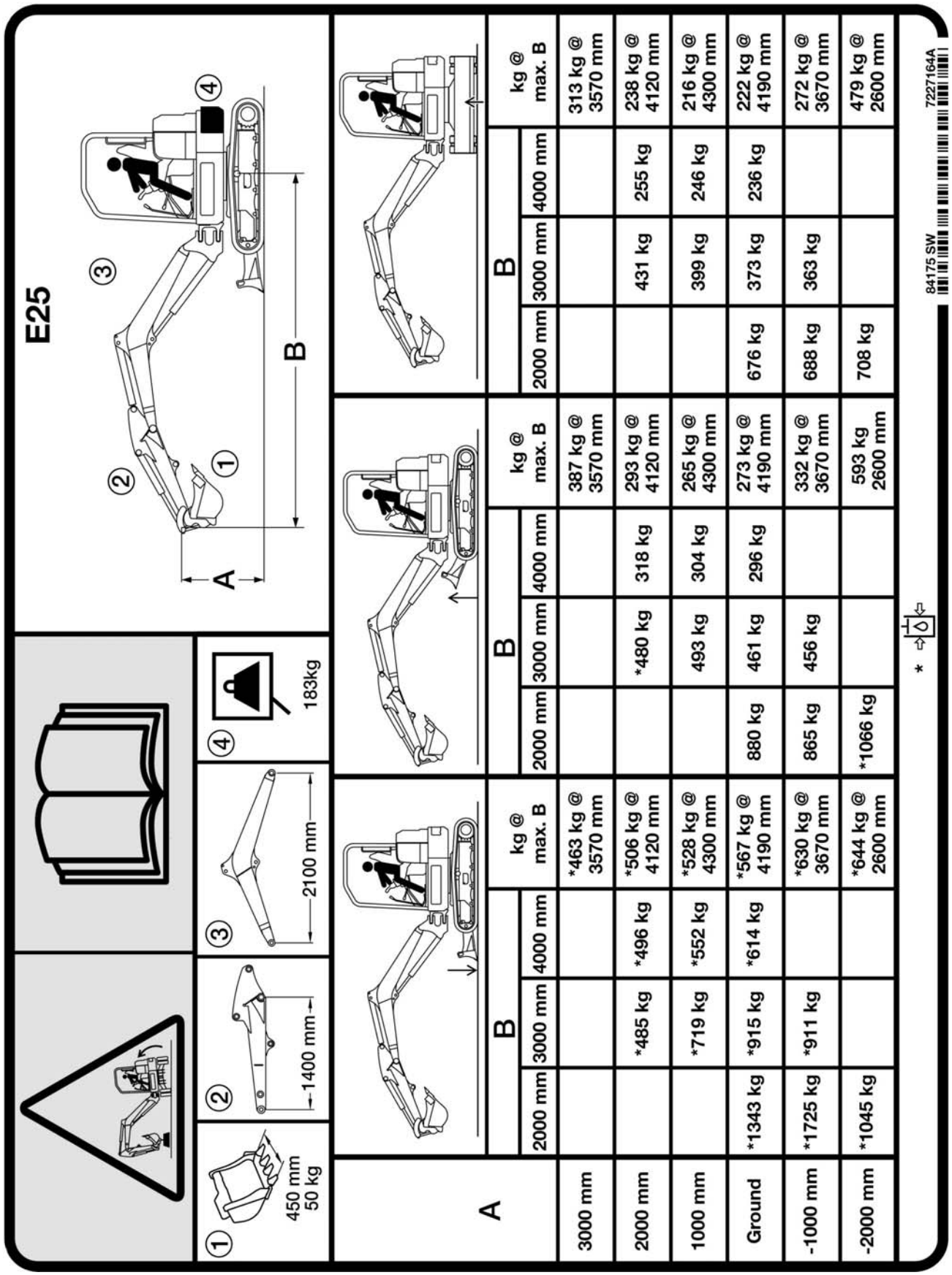
A	B				B				B			
	2000 mm	3000 mm	4000 mm	kg @ max. B	2000 mm	3000 mm	4000 mm	kg @ max. B	2000 mm	3000 mm	4000 mm	kg @ max. B
3000 mm				*460 kg @ 3570 mm				307 kg @ 3570 mm				256 kg @ 3570 mm
2000 mm		*474 kg	*481 kg	*488 kg @ 4120 mm		422 kg	244 kg	228 kg @ 4120 mm		353 kg	202 kg	189 kg @ 4120 mm
1000 mm		*710 kg	*544 kg	*523 kg @ 4300 mm		391 kg	235 kg	204 kg @ 4300 mm		323 kg	194 kg	167 kg @ 4300 mm
Ground	*1324 kg	*900 kg	*601 kg	*561 kg @ 4190 mm	710 kg	365 kg	226 kg	209 kg @ 4190 mm	567 kg	299 kg	185 kg	171 kg @ 4190 mm
-1000 mm	*1713 kg	*900 kg		*624 kg @ 3670 mm	712 kg	361 kg		263 kg @ 3670 mm	570 kg	296 kg		217 kg @ 3670 mm
-2000 mm	*1053 kg			*636 kg @ 2600 mm	745 kg			482 kg @ 2600 mm	600 kg			399 kg @ 2600 mm

*

EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Long Arm With Counterweight

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



A	B											
	2000 mm	3000 mm	4000 mm	kg @ max. B	2000 mm	3000 mm	4000 mm	kg @ max. B	2000 mm	3000 mm	4000 mm	kg @ max. B
3000 mm				*463 kg @ 3570 mm				387 kg @ 3570 mm				313 kg @ 3570 mm
2000 mm		*485 kg	*496 kg	*506 kg @ 4120 mm		*480 kg	318 kg	293 kg @ 4120 mm		431 kg	255 kg	238 kg @ 4120 mm
1000 mm		*719 kg	*552 kg	*528 kg @ 4300 mm		493 kg	304 kg	265 kg @ 4300 mm		399 kg	246 kg	216 kg @ 4300 mm
Ground	*1343 kg	*915 kg	*614 kg	*567 kg @ 4190 mm	880 kg	461 kg	296 kg	273 kg @ 4190 mm	676 kg	373 kg	236 kg	222 kg @ 4190 mm
-1000 mm	*1725 kg	*911 kg		*630 kg @ 3670 mm	865 kg	456 kg		332 kg @ 3670 mm	688 kg	363 kg		272 kg @ 3670 mm
-2000 mm	*1045 kg			*644 kg @ 2600 mm	*1066 kg			593 kg 2600 mm	708 kg			479 kg @ 2600 mm

Performance

Operating weight (canopy w/ rubber tracks, counterweight and standard bucket)	2441 kg (5381 lb)
If equipped with the following, add:	Cab w/ Heater, add 130 kg (287 lb); Long Arm, add 10 kg (22 lb) Additional Counterweight, add 183 kg (403 lb)
Travel Speed (Low / High)	2,2 km/h / 4,3 km/h (1.4 mph / 2.7 mph)
Digging Force (per ISO 6015)	
With Standard Arm	Arm - 15800 N (3552 lb) Bucket - 22200 N (4991 lb)
With Long Arm	Arm - 13200 N (2967 lb) Bucket - 22200 N (4991 lb)

Controls

Steering	Two hand levers (optional foot pedals)
Hydraulics	Two hand operated levers (joysticks) control boom, bucket, arm and upperstructure slew
Blade	Hand lever
Two Speed	Switch on blade lever
Boom Swing	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 and Parking Slew Service Holding	 Hydraulic lock in motor circuit Hydraulic lock on motor Spring applied - hydraulic release

EXCAVATOR SPECIFICATIONS (CONT'D)

Engine

Make / Model	Kubota® V1105-E2B-BCZ-2
Fuel / Cooling	Diesel / Liquid
Horsepower (SAE Net) @ 2400 rpm	15,5 kW (20.8 hp)
Torque @ 2100 rpm (SAE)	71,2 N•m (52.5 ft-lb)
Number Of Cylinders	3
Displacement	1,123 L (68.53 in^3)
Bore / Stroke	78 x 78,4 mm (3.07 x 3.09 in)
Lubrication	Pressure System with Filter
Crankcase Ventilation	Closed breathing
Air Cleaner	Dual dry replacement paper cartridge with safety element
Ignition	Diesel - Compression
Low Idle Speed	1150 ± 50 rpm
High Idle Speed	2400 max rpm
Engine Coolant	Propylene Glycol / water mixture (53% PG / 47% water)

Hydraulic System

Pump Type	Engine driven, dual outlet, variable displacement, load sensing, torque limited, piston pump with gear pumps
Pump Capacity Piston Pump Gear Pump - 1 Gear Pump - 2	 2 x 28,8 L/min (2 x 7.6 U.S. gpm) 19,2 L/min (5.1 U.S. gpm) 6,5 L/min (1.7 U.S. gpm)
Auxiliary Flow	48,0 L/min (12.7 U.S. gpm)
Hydraulic Filter	Full flow replaceable, 3 micron synthetic media element
Control Valve	10 spool, parallel series type, open centre.
System Relief Pressure Slew relief pressure Blade, Boom Swing Boom, Arm, Bucket, Travel Joystick Control Pressure	 19098 kPa (191 bar) (2770 psi) 20595 kPa (206 bar) (2987 psi) 23994 kPa (240 bar) (3480 psi) 3199 kPa (32 bar) (464 psi)
Auxiliary Relief	17995 kPa (180 bar) (2610 psi)
Arm Port Relief Base And Rod End	28992 kPa (290 bar) (4205 psi)
Boom Port Relief Base And Rod End	28992 kPa (290 bar) (4205 psi)
Bucket Port Relief Base And Rod End	25993 kPa (260 bar) (3770 psi)
Blade Port Relief Base End	26993 kPa (270 bar) (3915 psi)
Main Hydraulic Filter Bypass	345 kPa (3,4 bar) (50 psi)
Case Drain	124 - 159 kPa (1,2 - 1,6 bar) (18 - 23 psi)

EXCAVATOR SPECIFICATIONS (CONT'D)

Hydraulic Cylinders

Cylinder	Bore	Rod	Stroke
Boom (cushion up)	69,9 mm (2.75 in)	41,3 mm (1.63 in)	546,1 mm (21.5 in)
Arm (cushion retract / extend)	69,9 mm (2.75 in)	41,3 mm (1.63 in)	492,3 mm (19.4 in)
Bucket	57,2 mm (2.25 in)	31,8 mm (1.25 in)	445,0 mm (17.52 in)
Boom Swing	69,9 mm (2.75 in)	38,1 mm (1.50 in)	385,3 mm (15.17 in)
Blade	82.6 mm (3.25 in)	44,5 mm (1.75 in)	145,0 mm (5.71 in)

Hydraulic Cycle Times

Bucket Curl	2.35 seconds
Bucket Dump	1.59 seconds
Arm Retract	2.44 seconds
Arm Extend	1.70 seconds
Boom Raise	3.45 seconds
Boom Lower	4.15 seconds
Boom Swing Left (60°)	3.24 seconds
Boom Swing Right (60°)	4.61 seconds
Blade Raise	1.72 seconds
Blade Lower	2.43 seconds

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)
Instrumentation	Fuel gauge, audible alarm, visual warning for engine functions and hourmeter
Lights	37.5 watt (2)

Drive System

Final Drive	Each track is driven by hydrostatic axial piston motor
Drive Reduction	41,9:1 two stage planetary
Gradeability	30*
Brakes	Hydraulic lock on motor

Slew System

Slew Drive	Axial piston connected to a planetary drive
Slew Circle	Single row shear type ball bearings with internal gear
Gear Reduction	21.5:1
Brake	Spring applied, pressure released
Slew Speed	8,7 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	1400 mm (55.1 in)

Capacities

Fuel Tank	34,6 L (9.14 U.S. gal)
Hydraulic Reservoir Only (centre of Sight Glass)	Tank Cap. 14,7 L (3.88 U.S. gal)
Hydraulic System (with Reservoir)	25,0 L (6.60 U.S. gal)
Cooling System	4,6L (1.22 U.S. gal)
Engine Oil and Filter:	
S/N AB8B12001 - AB8B12089	5,4 L (5.70 qt)
S/N AB8B12090 And Above	3,6 L (3.80 qt)
Final Drive (each)	0,6 L (0.63 qt)

Tracks

Type	Rubber
Width	250 mm (9.8 in)
Number Of Shoes	Single Assembly
Number of Track Rollers (per side)	4

Ground Pressure

Type	Rubber
Standard Arm	30,2 kPa (0,302 bar) (4.38 psi)
Long Arm	32,6 kPa (0,326 bar) (4.73 psi)
With CTW	32,8 kPa (0,328 bar) (4.75 psi)

Environmental

DECLARED SINGLE-NUMBER NOISE EMISSION VALUES In accordance with ISO 4871	
Noise level per Directive 2000/14/EC - L_{wA}	93 dB
Operator noise level per Directive 2006/42/EC — L_{pA}	77 dB

DECLARED VIBRATION EMISSION VALUES Ina accordance with EN 12096		
	Value	Uncertainty
Whole-body vibration per ISO 2631-1	0,40 m/s^2	-------
Hand-arm vibration per ISO 5349-1	1,57 m/s^2	-------

Temperature Range

Operation and storage	-17° - +43°C (-1.3° - +109.4°F)


Bobcat®

TECHNICAL SERVICE GUIDE SPECIFICATIONS

Engine

Engine Oil Pressure at Low Idle	50 kPa (0,50 bar) (7 psi)
Engine Oil Pressure at High Idle	193 - 441 kPa (1,9 - 4,4 bar) (28 - 64 psi)
Firing Order	1-2-3
Location of Number 1 Cylinder	Closest to water pump
Injection Timing	18° BTDC
Crankshaft Rotation (Facing Crankshaft Pulley)	Clockwise
Compression at Cranking Speed	10% variance between pistons. 3716 - 4109 kPa (37 - 41 bar) (539 - 596 psi)
Valve Clearance (Cold) Intake	0,145 - 0,185 mm (0.00571 - 0.00728 in)
Valve Clearance (Cold) Exhaust	0,145 - 0,185 mm (0.00571 - 0.00728 in)

NOTE: For additional engine specifications, (See Specifications on Page 60-10-2.)

Engine Torques

Engine Oil Drain Cap	33 - 37 N•m (24 - 27 ft-lb)
Fuel Injection Tubeline Nuts	25 - 34 N•m (18 - 25 ft-lb)
Glow Plugs	14,6 N•m (10.8 ft-lb)
Injection Pump Mounting Bolts/Nuts	22 - 27 N•m (16 - 20 ft-lb)
Valve Cover Bolts	6,9 - 8,8 N•m (5.1 - 6.5 ft-lb)
Head Bolts	63,7 - 68,6 N•m (47 - 50.6 ft-lb)

NOTE: For additional engine torques, (See Engine Removal And Installation on Page 60-10-11.)

Excavator Torques

Drive Motor To Frame Bolt	105 - 115 N•m (78 - 85 ft-lb)
Sprocket To Drive Motor	108 N•m (80 ft-lb)
Swing Bearing To Frame Bolt	105 - 115 N•m (78 - 85 ft-lb)
Swing Bearing To Upperstructure Bolt	105 - 155 N•m (78 - 85 ft-lb)
Swing Motor Drive Carrier	270 - 300 N•m (199 - 221 ft-lb)
Swing Motor Mounting Bolts	35 - 39 N•m (25.5 - 28.5 ft-lb)
Swivel Joint Mounting Bolts	94 - 118 N•m (69 - 87 ft-lb)

NOTE: Additional excavator torques can be found in the relevant section of this manual.

Cooling System

Coolant Type and Mix	47% Water and 53% Propylene Glycol
Radiator Cap Pressure	89,6 kPa (0,9 bar) (13 psi)
Thermostat	Fully Open at 85°C (185°F)

NOTE: For additional cooling system information, (See ENGINE COOLING SYSTEM on Page 60-50-1.)

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 (in-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)	7450 - 8300 (5500 - 6100)
	2.000	5150 - 5700 (3800 - 4200)	8800 - 9800 (6500 - 7200)

TORQUE SPECIFICATION FOR BOLTS

Torque For General Metric Bolts

THREAD SIZE (DIA. X PITCH)	MATERIAL		
	HEAD MARK 4	HEAD MARK 7	HEAD MARK 10
M 5 x 0.8		4 - 5 N•m (3 - 4 ft-lb)	
M 6 x 1.0		8 - 9 N•m (6 - 7 ft-lb)	8 - 12 N•m (6 - 9 ft-lb)
M 8 x 1.25	8 - 12 N•m (6 - 9 ft-lb)	15 - 22 N•m (11 - 16 ft-lb)	24 - 34 N•m (18 - 25 ft-lb)
M 10 x 1.25	18 - 24 N•m (13 - 18 ft-lb)	30 - 41 N•m (22 - 30 ft-lb)	49 - 68 N•m (36 - 50 ft-lb)
M 12 x 1.25	30 - 41 N•m (22 - 30 ft-lb)	54 - 73 N•m (40 - 54 ft-lb)	94 - 118 N•m (69 - 87 ft-lb)
M 14 x 1.25	49 - 68 N•m (36 - 50 ft-lb)	79 - 108 N•m (58 - 80 ft-lb)	157 - 186 N•m (116 - 137 ft-lb)

HYDRAULIC CONNECTION SPECIFICATIONS

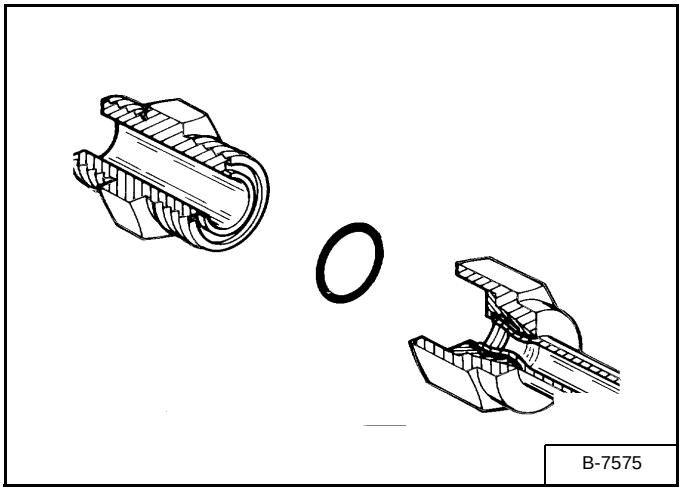
O-ring Face Seal Connection

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.

I-2003-0888

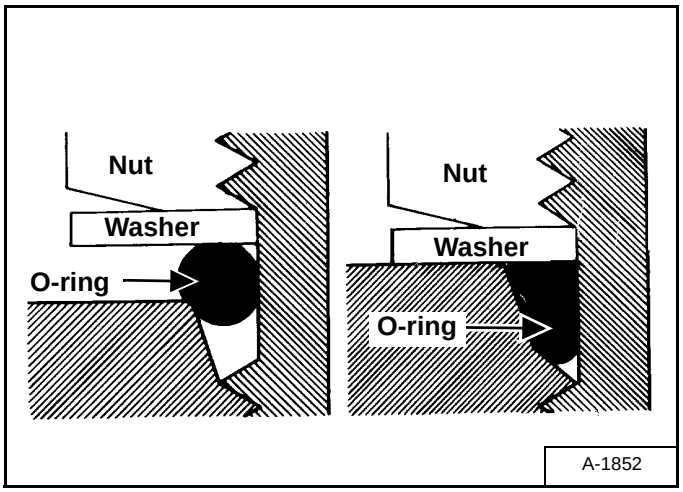
Figure SPEC-40-1



Use petroleum jelly to hold the O-ring in position until the fittings are assembled. To eliminate leakage do not under or over tighten **[Figure SPEC-40-1]**.

Straight Thread O-ring Fitting

Figure SPEC-40-2



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-40-2]**.

Tubelines And Hoses

Replace any tubelines that are bent or flattened. They will restrict flow, which will slow hydraulic action and cause heat.

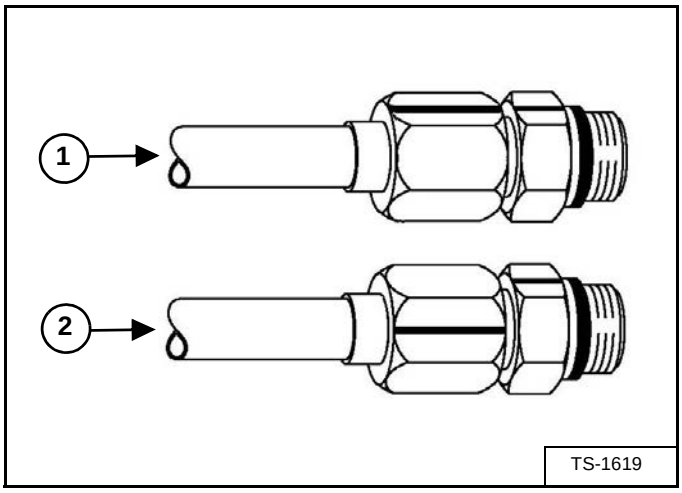
Replace hoses which show signs of wear, damage or weather cracked rubber.

Always use two wrenches when loosening and tightening hose or tubeline fittings.

Flare Fitting

Use the following procedure to tighten the flare fitting:

Figure SPEC-40-3



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-40-3]**.

Use the chart below to find the correct tightness needed (Item 2) **[Figure SPEC-40-3]**. If the fitting leaks after tightening, disconnect it and inspect the seat area for damage.

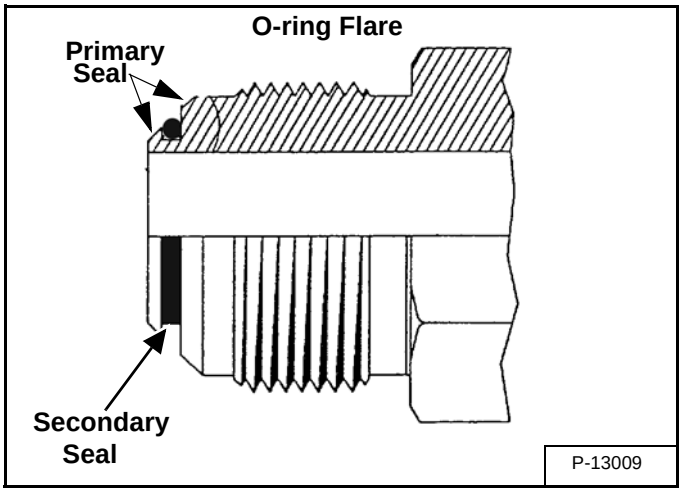
FLARE FITTING TIGHTENING TORQUE

Wrench Size	Tubeline Outside Diameter	Thread Size	TORQUE N•m (ft-lb)	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

HYDRAULIC CONNECTION SPECIFICATIONS (CONT'D)

O-ring Flare Fitting

Figure SPEC-40-4

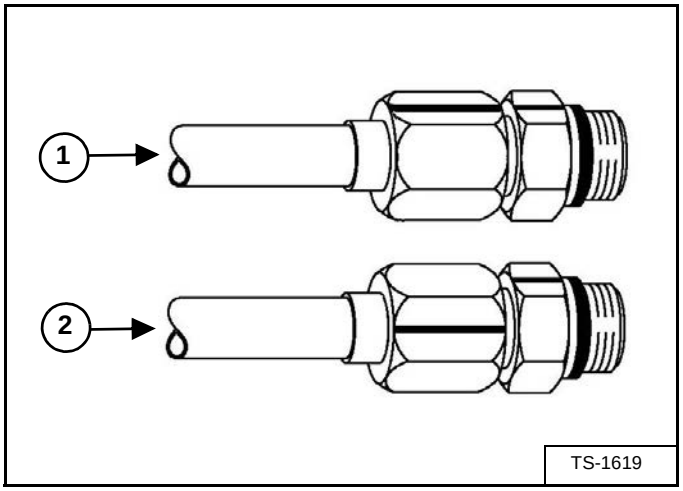


The flare is the primary seal, the O-ring is the secondary seal and helps absorb vibration and pressure pulses at the connection **[Figure SPEC-40-4]**.

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-40-5



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-40-5]**.

Use the chart below to find the correct tightness neede (Item 2) **[Figure SPEC-40-5]**. If the fitting leaks afte tightening, disconnect it and inspect the seat area fo

O-RING FLARE FITTING TIGHTENING TORQUE					
			*	**	***
Wrench Size	Tubeline Outside Diameter	Thread Size	TORQUE N•m (ft-lb)	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 / tubeline.

**If using the hex flat tightening method to tighten a new fitting to a used hose / tubeline.

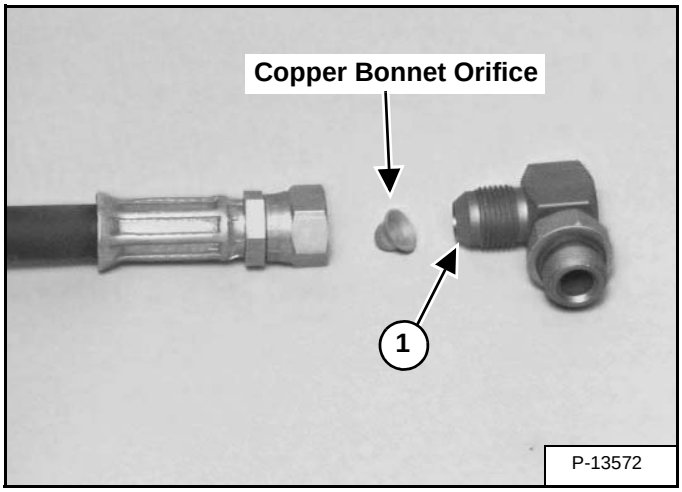
***If using the hex flat tightening method to tighten a used fitting to a new hose / tubeline.

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.

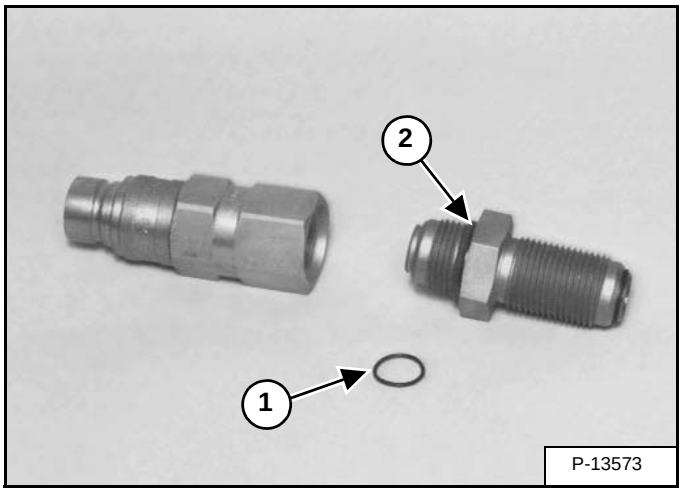
Do not use an O-ring flare fitting when a copper bonnet orifice is used. When tightened the connection at the bonnet may distort the flare face and prevent it from sealing.

Figure SPEC-40-6



Use a standard flare fitting (Item 1) **[Figure SPEC-40-6]** as shown.

Figure SPEC-40-7



When an 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.

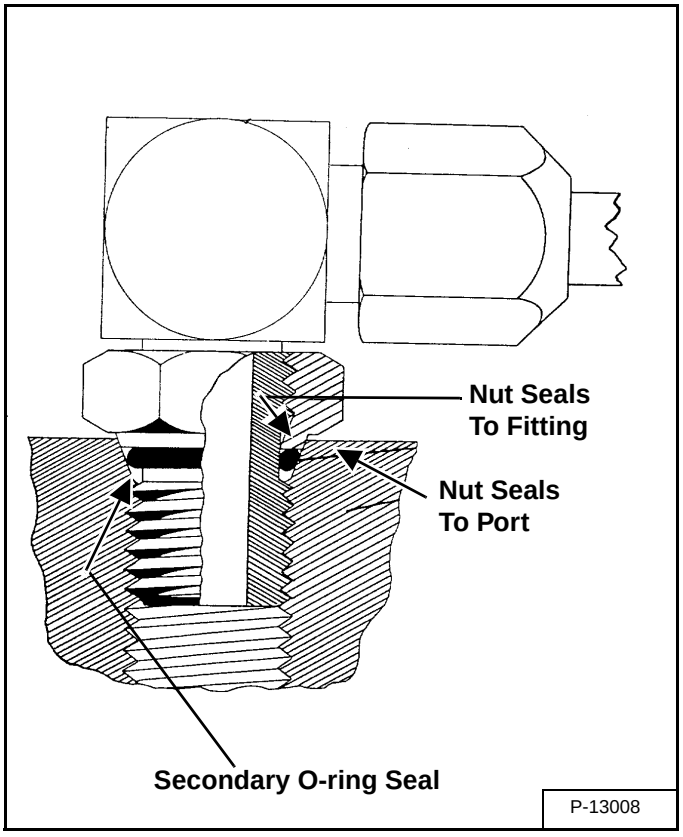
Always remove the O-ring (Item 1) **[Figure SPEC-40-7]** from the flare face as shown.

An O-ring (Item 2) **[Figure SPEC-40-7]** is added to the flat boss of the fitting to seal the connection in this application.

HYDRAULIC CONNECTION SPECIFICATIONS (Cont'd)

Port Seal Fitting

Figure SPEC-40-8



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-40-8]**.

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.

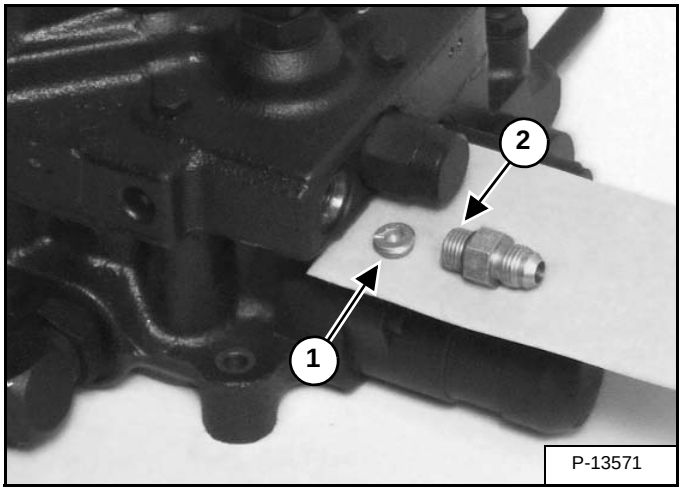
Tighten the nut until it just makes metal to metal contact, you can feel the resistance. Tighten the nut with a wrench no more than one hex flat maximum.

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-40-9



Do not use port seal fittings when a thread in orifice (Item 1) **[Figure SPEC-40-9]** 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-40-9** as shown.

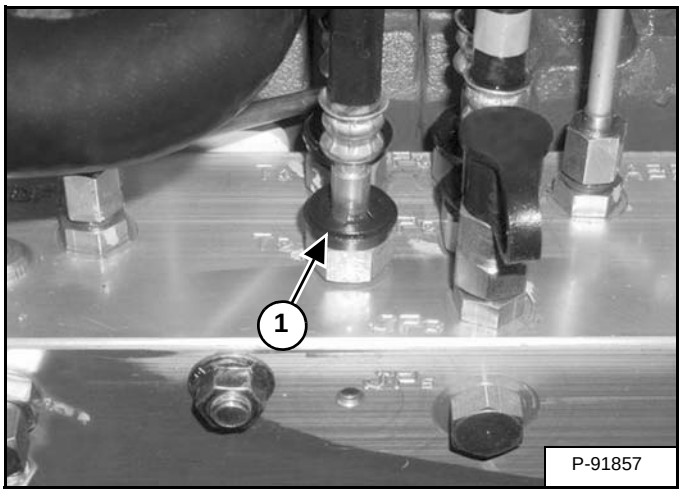
PORT SEAL AND O-RING BOSS TIGHTENING TORQUE

Fitting Nut Wrench Size	Thread Size	TORQUE N•m (ft-lb)
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”	160 (118)

Push To Connect Fittings

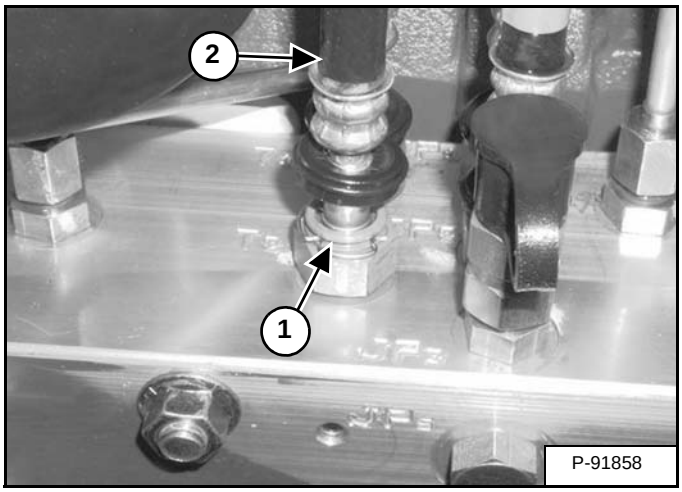
The push to connect fittings provide a leak free seal that also acts as a swivel fitting.

Figure SPEC-40-10



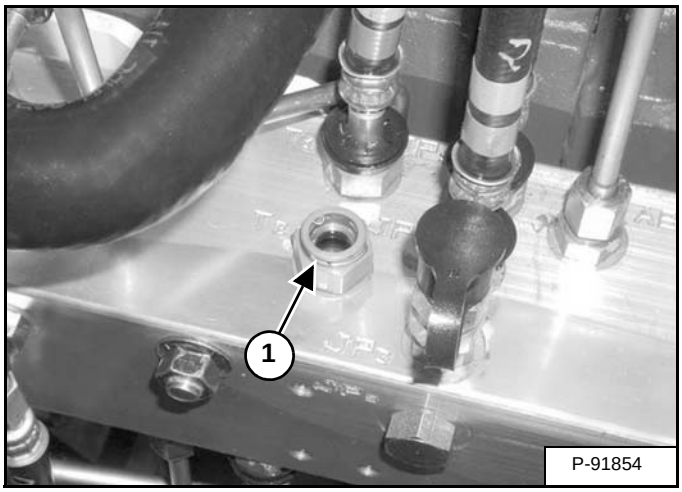
To disconnect the hose, pull up on the grommet (Item 1) **[Figure SPEC-40-10]**.

Figure SPEC-40-11



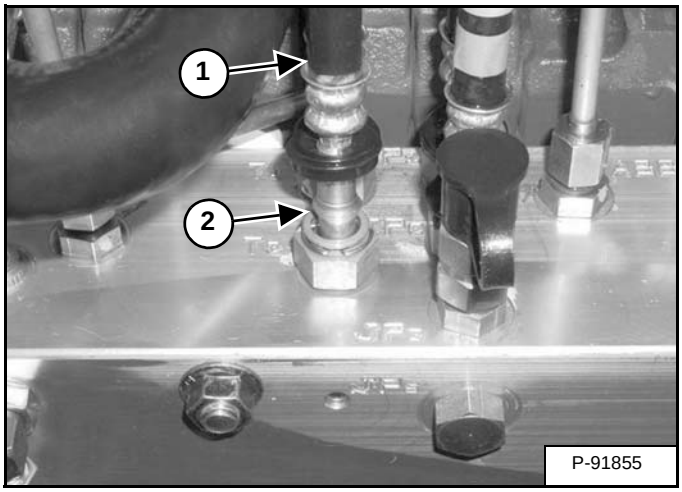
Use an O-ring pick to remove the retainer clip (Item 1). Pull up on the hose (Item 2) **[Figure SPEC-40-11]** and remove the hose from the fitting.

Figure SPEC-40-12



To install the hose, install the retainer clip (Item 1) **[Figure SPEC-40-12]** in the fitting.

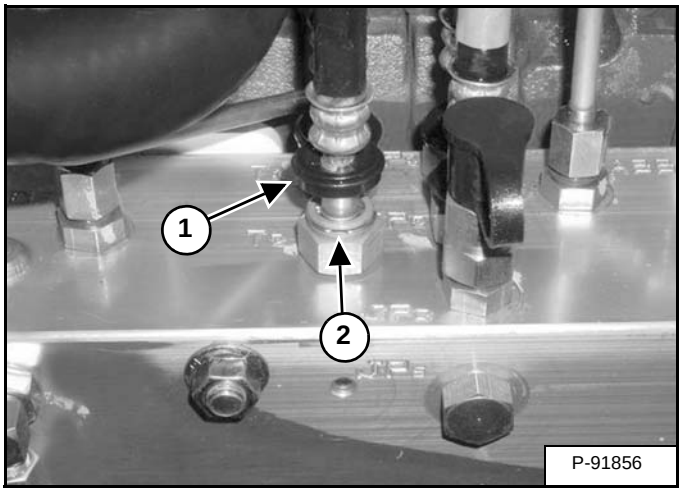
Figure SPEC-40-13



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-40-13]**.

Push To Connect Fittings (Cont'd)

Figure SPEC-40-14



Push the grommet (Item 1) down and over the top of the fitting (Item 2) **[Figure SPEC-40-14]**.


Bobcat®

HYDRAULIC FLUID SPECIFICATIONS

Specifications

Use only Bobcat hydraulic fluid.

DO NOT use automatic transmission fluids in the excavator or permanent damage to the hydraulic system will result.

Bobcat hydraulic fluid is available in:

- 9,5 L (2.5 U.S. gal) qty 2 (P/N 6903117)
- 18,9 L (5 U.S. gal) (P/N 6903118)
- 208 L (55 U.S. gal) (P/N 6903119)

WARNING

AVOID INJURY OR DEATH

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

W-2072-0807

When temperatures below -18°C (0°F) are common, the excavator must be kept in a warm building. Extra warm-up time must be used each time the excavator is started during cold temperature conditions. Cold fluid will not flow easily and it makes action of the hydraulic function slower. Loss of fluid flow to the hydraulic system (Indicated by hydraulic temp / pressure lights on) can cause system damage in less than 60 seconds.

WARNING

During cold weather (0°C [32°F] and below), do not operate machine until the engine has run for at least 5 minutes at less than half throttle. This warm-up period is necessary for foot pedal operation and safe stopping. Do not operate controls during warm-up period.

When temperatures are below -30°C (-20°F), the hydrostatic oil must be heated or kept warm. The hydrostatic system will not get enough oil at low temperatures. Park the machine in an area where the temperature will be above -18°C (0°F) if possible.

W-2027-0311


Bobcat®

CONVERSIONS

Decimal And Millimeter Equivalent Chart

FRACTIONS	DECIMALS	MM
1/64	0.015625	0.397
1/32	0.03125	0.794
3/64	0.046875	1.191
1/16	0.0625	1.588
5/64	0.078125	1.984
3/32	0.09375	2.381
7/64	0.109375	2.778
1/8	0.1250	3.175
9/64	0.140625	3.572
5/32	0.15625	3.969
11/64	0.171875	4.366
3/16	0.1876	4.762
13/64	0.203125	5.159
7/32	0.21875	5.556
15/64	0.234375	5.953
1/4	0.2500	6.350
17/64	0.265625	6.747
9/32	0.28125	7.144
19/64	0.296875	7.541
5/16	0.3125	7.938
21/64	0.328125	8.334
11/32	0.34375	8.731
23/64	0.359375	9.128
3/8	0.3750	9.525
25/64	0.390625	9.922
13/32	0.40625	10.319
27/64	0.421875	10.716
7/16	0.4375	11.112
29/64	0.453125	11.509
15/32	0.46875	11.906
31/64	0.484375	12.303
1/2	0.5000	12.700
33/64	0.515625	13.097
17/32	0.53125	13.494
35/64	0.546875	13.891
9/16	0.5625	14.288
37/64	0.578125	14.684
19/32	0.59375	15.081
39/64	0.609375	15.478
5/8	0.6250	15.875
41/64	0.640625	16.272
21/32	0.65625	16.669
43/64	0.671875	17.066
11/16	0.6875	17.462
45/64	0.703125	17.859
23/32	0.71875	18.256
47/64	0.734375	18.653
3/4	0.7500	19.050
49/64	0.765625	19.447
25/32	0.78125	19.844
51/64	0.796875	20.241
13/16	0.8125	20.638
53/64	0.828125	21.034
27/32	0.84375	21.431
55/64	0.859375	21.828
7/8	0.8750	22.225
57/64	0.890625	22.622
29/32	0.90625	23.019
59/64	0.921875	23.416
15/16	0.9375	23.812
61/64	0.953125	24.209
31/32	0.96875	24.606
63/64	0.984375	25.003
1	1.000	25.400

1 mm = 0.03937”

0.001 = 0.0254 mm

CONVERSIONS (CONT'D)

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

SERVICE TOOLS REQUIRED

The following is a list of service tools required for servicing excavators.

Remote Start Tools

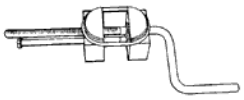
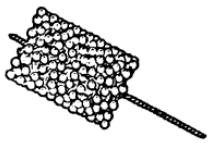
TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1563	Remote Start Tool	E20 - E55	This tool has been replaced by the new remote start tool 7003031, see below. MEL1563 includes: MEL1565 and MEL1566.	
MEL1565	Service Tool Harness		Used with MEL1563 to connect remote start tool to machine	
MEL1566	Service Tool Harness Communicator		Used with MEL1563 to connect remote start tool to PC	
7217666 (Was 7003031) (Was 6689779)	Remote Start Tool Kit	E20 - E55	This tool replaced the original remote start tool kit MEL1563 and 7003031. Kit 7217666 includes: 7022042, 6689747, 6689746 and 6689745.	
7022042 (Was 7003030) (Was 6689778)	Remote Start Tool		This tool replaces remote start tool 6689778 and 7003030.	
6689747	Remote Start Tool Harness		Used with 7003030 to connect remote start tool to excavator.	
6689746	Remote Start Tool Harness		Used with 7003030 to connect Service PC to remote start tool.	

See BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

ST EXC-0118

SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools

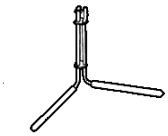
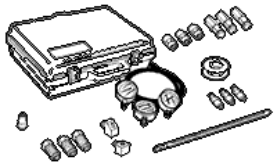
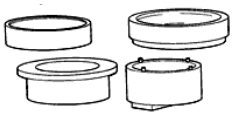
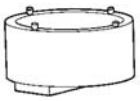
TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1744	Hydraulic Tester (Flow Meter)	E08 - E85	Hydraulic tester MEL1744, MEL10003 or TWX-RFIK200-S-6 can be used for hydraulic testing.	
MEL10003	Hydraulic Tester (Flow Meter)		MEL10003 and TWX-RFIK22-S-6 are no longer available, order MEL1744.	
TWX-RFIK200-S-6	Hydraulic Tester (Flow Meter)			
MEL1074	O-Ring Seal Hook			
MEL1075	Adjustable Gland Nut Wrench		Includes MEL1075-1 and MEL1075-2	
MEL1075-1	Standard Pins		These are replaceable pins that insert into MEL1075-1 for disassembling various cylinders	No Image Available
MEL1075-2	Offset Pins		These are replaceable pins that insert into MEL1075-1 for disassembling various cylinders	No Image Available
MEL1396-1	Universal Seal Expander		MEL1396 includes: MEL1396-1 and MEL1396-2	
MEL1396-2	Piston Ring Compressor			
MEL1418	Cylinder Hone = 2.00 in			
OEM6275	Cylinder Hone = 2.75 - 3.00 in			
OEM6270	Cylinder Hone = 3.00 - 3.50 in			
OEM6271	Cylinder Hone = 3.50 - 4.00 in			

See BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

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SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools (Cont'd)

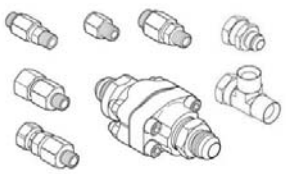
TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1033	Rod Seal Installation Tool	E08 - E85		
MEL1355	Hydraulic Test Kit		This test kit includes various gauges, adapters, couplers and hoses that are used when testing hydraulic functions. MEL1355 Includes: MEL1355-1 thru MEL1355-12	
MEL1355-2	1000 psi gauge			
MEL1355-3	5000 psi gauge			
MEL1355-12	Coupler			
MEL1412	Seal Installation Tool	E32, E35	Used for installing Travel Motor Seal	
MEL1413	Seal Installation Tool	E26	Used for installing Travel Motor Seal	
MEL1553	Travel Motor Tool Kit	E42 - E55	MEL1553 Includes: MEL1553-1 thru MEL1553-4	
MEL1553-1	Motor Seal Installation Tool		Included with MEL1553	
MEL1553-2	Motor Seal Installation Tool		Included with MEL1553	
MEL1553-3	Motor Seal Installation Tool		Included with MEL1553	
MEL1553-4	Motor Seal Installation Tool		Included with MEL1553	
6675936 (MEL1560)	Bleed Tool	E08 - E55	Machines with two track tension fittings.	

See BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

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SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools (Cont'd)

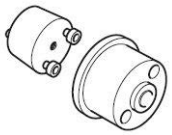
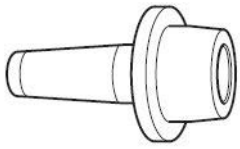
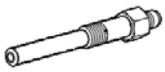
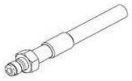
TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
7277225	Bleed Tool	E08 - E85	Machines with one track tension fitting.	
MEL1713	Hydraulic Fitting Kit	E60, E63, E80, E85	This test kit includes various adapters and couplers that are used when testing hydraulic functions. MEL1713 Includes: MEL1713-1 thru MEL1713-12	
MEL1727	Spanner Wrench	E60, E63	Used for removing and installing bearing nut used in the Travel Motor	
MEL1728	Seal Installation Tool	E60, E63	Used for installing Travel Motor Seal	
7323185	Spanner Wrench	E32, E32i, E35 & E35i	Used for removing and installing bearing nut used in the Travel Motor	
7335495	Hydraulic Fitting Kit	E85	This test kit includes various adapters and couplers that are used when testing hydraulic functions. 7335495 Includes: 7335499 thru 7335505	

See BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

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SERVICE TOOLS REQUIRED (CONT'D)

Engine Tools

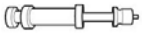
TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
7009358	Bobcat Diagnostic Interface Box	E63, E85	Interface for using Yanmar SA-D SmartAssist-Direct diagnostic service software.	No Image Available
7031222	Bobcat Engine Analyzer Diagnostic Tool Kit	T4 Bobcat Engine Applications	Includes: Diagnostic Service Tool (7031223), Vehicle Cable 6 pin (7031398), Vehicle Cable 14 pin (7031356), USB Cable (7031357)	
7031370	Rear Main Seal Installer	T4 Bobcat Engine Applications	Used for installing rear main seal	
7031369	Front Seal Installer	T4 Bobcat Engine Applications	Used for installing front seal	
7031371	Valve Spring Compressor	T4 Bobcat Engine Applications	Used for compressing valve springs	
MEL10630	Engine Compression Test Kit	E08 - E55	Includes: MEL1352, MEL1433, MEL1489, MEL1546, MEL1551, MEL1594, MEL1594, MEL10630-1 - MEL10630-11 and MEL10630-14	
MEL1352	Compression Adapter	E26, E42 - E55	Used in glow plug port for testing compression - Included with MEL10630	
MEL1631	Compression Adapter	E32, E35	Used in glow plug port for testing compression, NOT included with MEL10630	
MEL1743	Compression Adapter	E63, E85	Used in glow plug port for testing compression, NOT included with MEL10630	

See BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

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SERVICE TOOLS REQUIRED (CONT'D)

Engine Tools (Cont'd)

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1237	Fuel Line Adapter	E25 - E55	Adapter used to test delivery valve at the injection pump (Used with pressure gauge MEL1173-1)	
MEL1173-1	Pressure Gauge 10000 psi			
4200	Injector Nozzle Tester			
7268212	Valve Lash Adjusting Wrench	All Bobcat Engine Models		
7255632	Valve Stem Seal Tool			
7313843	Glow Plug Compression Tool	1.8L & 2.4L Bobcat Engine Models	Used in glow plug port for testing compression.	
7299831	Injector Compression Tool	All Bobcat Engine Models	Used in injector port for testing compression.	
7332314	Turbo and Oil Sensor Block Adapter Kit	All Bobcat Engine Models	7332314 includes: 7332313 - Oil Sensor Block Adapter and 7332298 - Turbo Oil Adapter.	

See BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

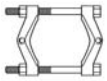
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SERVICE TOOLS REQUIRED (CONT'D)

Electrical Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
7313846 Was 7292829	Injector Signal Tester	Excavators equipped with Bobcat engines	Used to test injector signal on Bobcat 1.8L and 2.4L engines.	
MEL1712	Push Button Starter Switch	E17 - E55		

HVAC Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1581	HVAC Recover, Recycling, Recharging Machine	E25 - E85	MEL1581 is no longer available, order MEL1735 or MEL1736	
MEL1735	Deluxe HVAC Recover, Recycling, Recharging Machine			
MEL1736	Standard HVAC Recover, Recycling, Recharging Machine			
MEL1592	HVAC Refrigerant Identification Tool			
MEL1595	AC Compressor Pulley Puller			

See BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

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Bobcat®

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