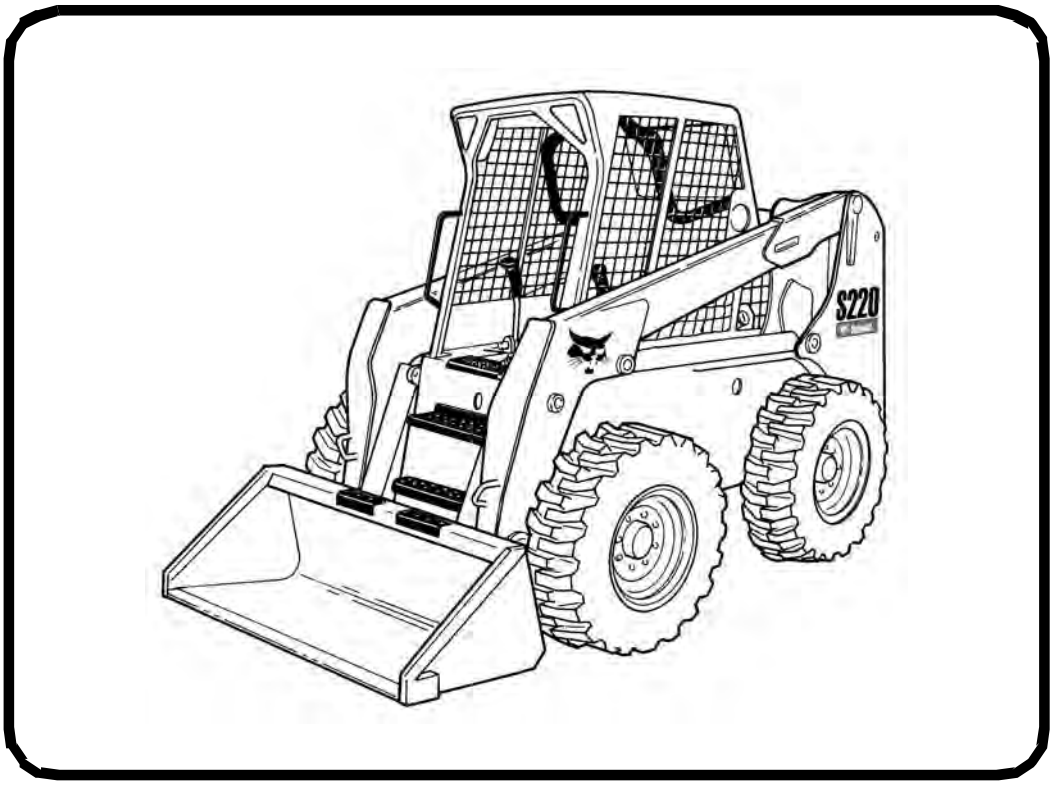
Bobcat®

Service Manual
S220 Skid-Steer Loader

S/N 530711001 & Above
S/N 530811001 & Above



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EQUIPPED WITH
BOBCAT INTERLOCK
CONTROL SYSTEM (BICS™)

6904154 (3-09)

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MAINTENANCE SAFETY

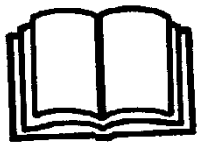
WARNING

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-2003-0903

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

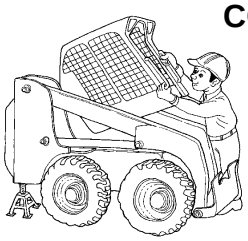
CORRECT



B-10731a

Never service the Bobcat Skid-Steer Loader without instructions.

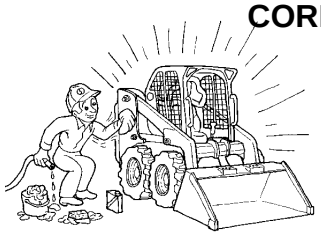
CORRECT



B-15590

Use the correct procedure to lift or lower operator cab.

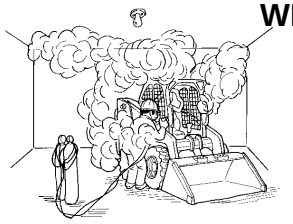
CORRECT



B-15591

Cleaning and maintenance are required daily.

WRONG



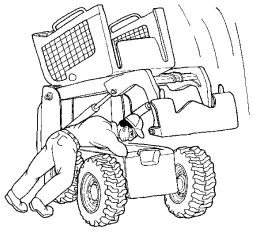
B-15592

Have good ventilation when welding or grinding painted parts.

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

Avoid exhaust fume leaks which can kill without warning. Exhaust system must be tightly sealed.

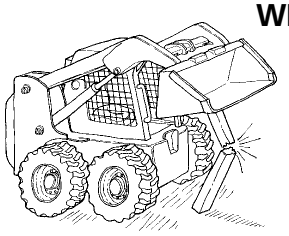
WRONG



B-15593

Disconnecting or loosening any hydraulic tubeline, hose, fitting, component or a part failure can cause lift arms to drop. Do not go under lift arms when raised unless supported by an approved lift arm support device. Replace it if damaged.

WRONG

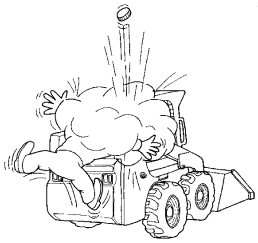


B-15599

Never work on loader with lift arms up unless lift arms are held by an approved lift arm support device. Replace if damaged.

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

WRONG



B-15600

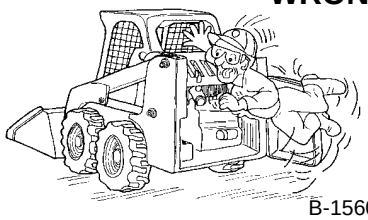
Stop, cool and clean engine of flammable materials before checking fluids.

Never service or adjust loader 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-15601

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 protection approved for type of welding.

Keep rear door closed except for service. Close and latch door before operating the loader.

WRONG



B-6589

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.

MSW08-0805

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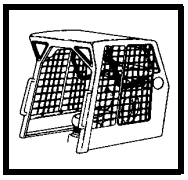
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FOREWORD

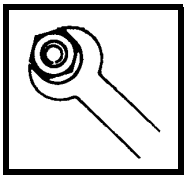
This manual is for the Bobcat loader mechanic. It provides necessary servicing and adjustment procedures for the Bobcat loader and its component parts and systems. Refer to the Operation & Maintenance Manual for operating instructions, starting procedure, daily checks, etc.

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

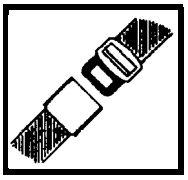
1. Check that the ROPS/FOPS (Including side screens) is in good condition and is not modified.



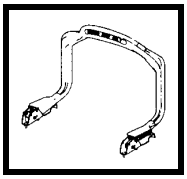
2. Check that ROPS mounting hardware is tightened and is Bobcat approved.



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



4. The seat bar must be correctly adjusted, clean and lubricated.



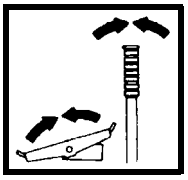
5. Check lift arm support device, replace if damaged.



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



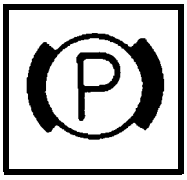
7. Steering levers, hand controls and foot pedals must return to neutral (as applicable).



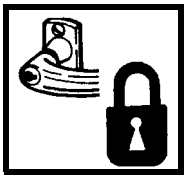
8. Check for correct function of the work lights.



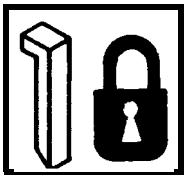
9. The parking brake must function correctly.



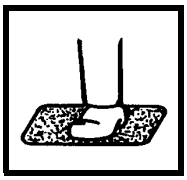
10. Enclosure door latches must open and close freely.



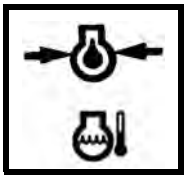
11. Bob-Tach wedges and linkages must function correctly and be in good condition.



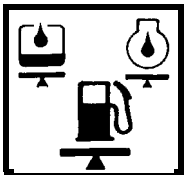
12. Safety treads must be in good condition.



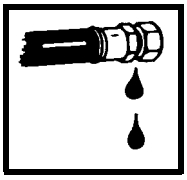
13. Check for correct function of indicator lamps.



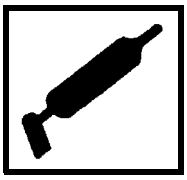
14. Check hydraulic fluid level, engine oil level and fuel supply.



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



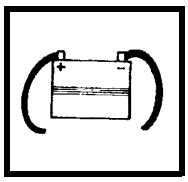
16. Lubricate the loader.



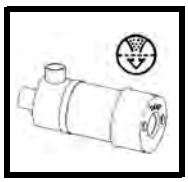
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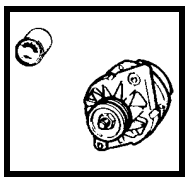
17. Check the condition of the battery and cables.



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



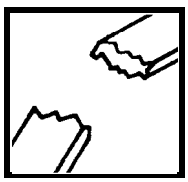
19. Check the electrical charging system.



20. Check tires for wear and pressure. Check tracks for wear and tension. Use only approved tires or tracks.



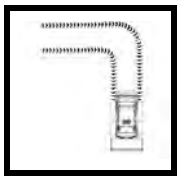
21. Inspect for loose or broken parts or connections.



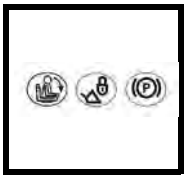
22. Check for any field modification not completed.



23. Operate the machine and check all functions.



24. Check for correct function of the Bobcat Interlock Control System (BICS™) before the machine is returned to the customer.



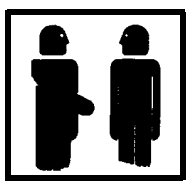
25. Check for proper function of front horn and back-up alarm (if equipped).



26. Check function or condition of all equipped options and accessories (examples: fire extinguisher, rotating beacon, lift kits, etc.).



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



CALIFORNIA
PROPOSITION 65 WARNING

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

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SAFETY INSTRUCTIONS

Safety Alert Symbol

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

WARNING

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-2003-0903

IMPORTANT

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

I-2019-0284

DANGER

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

D-1002-1107

WARNING

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

W-2044-1107

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

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

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



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

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



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

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FIRE PREVENTION



Maintenance

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

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

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

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

Operation

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

Electrical



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

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

Hydraulic System

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

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

Fueling



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

Starting

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

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

Spark Arrestor Exhaust System

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

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FIRE PREVENTION (CONT'D)

Welding And Grinding

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

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

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

Fire Extinguishers



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

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SERIAL NUMBER LOCATIONS

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

Loader Serial Number

Figure 1



The loader serial number plate is located on the outside of the loader frame **[Figure 1]**.

Explanation of loader Serial Number:

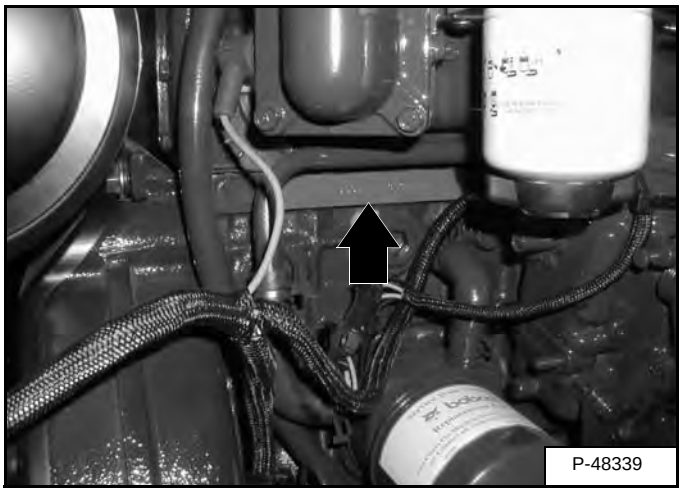
XXXX	XXXXX
Model 1.-Model/ Engine Combination	Model 2.-Production Sequence (Series)

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 loader is produced.

Engine Serial Number

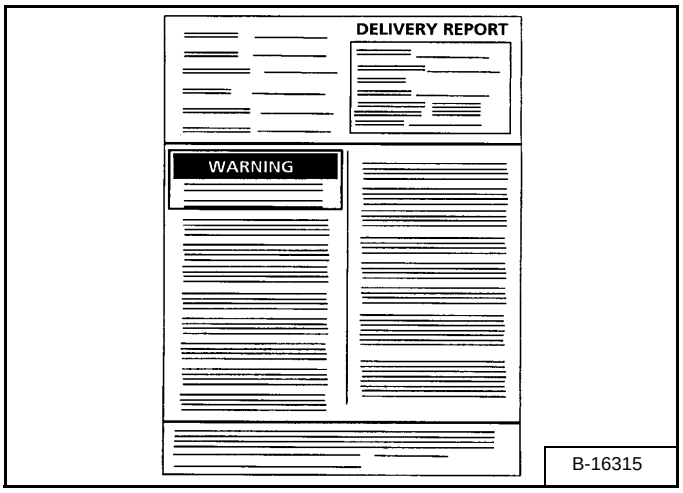
Figure 2



The engine serial number is located on the engine block **[Figure 2]**.

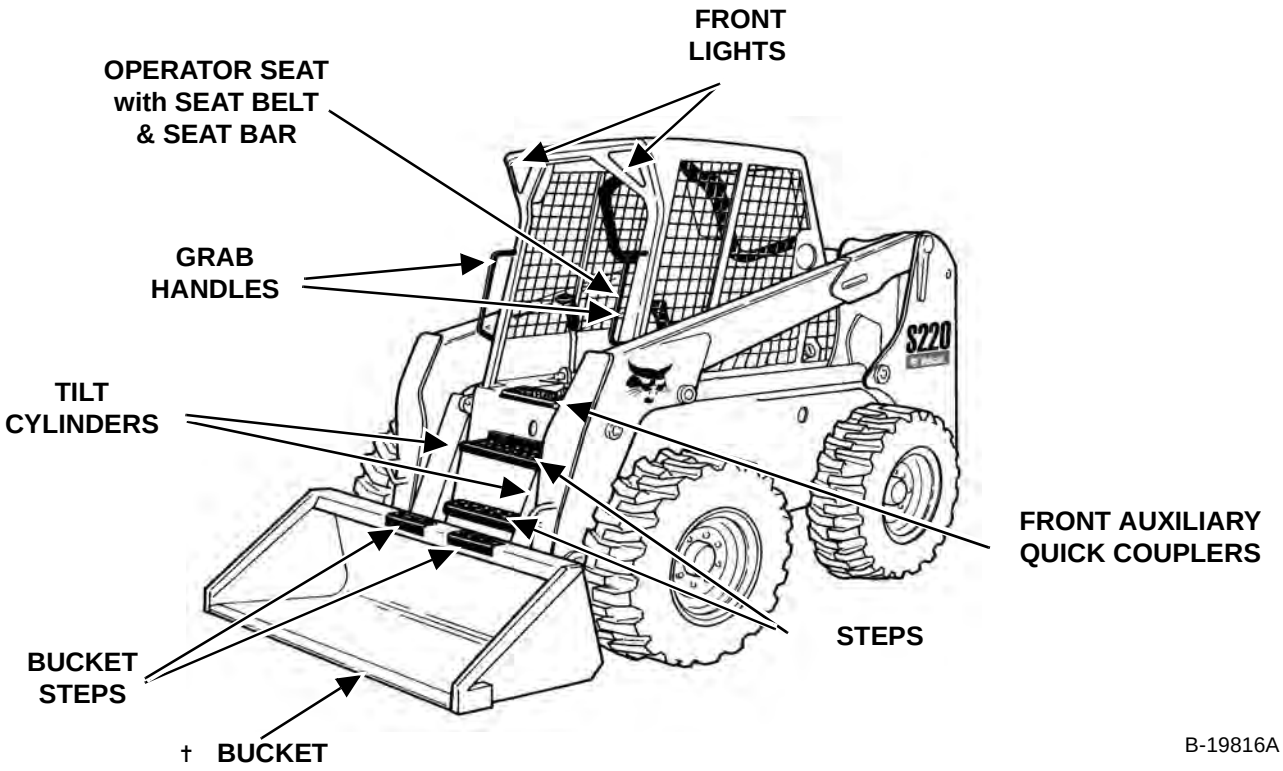
DELIVERY REPORT

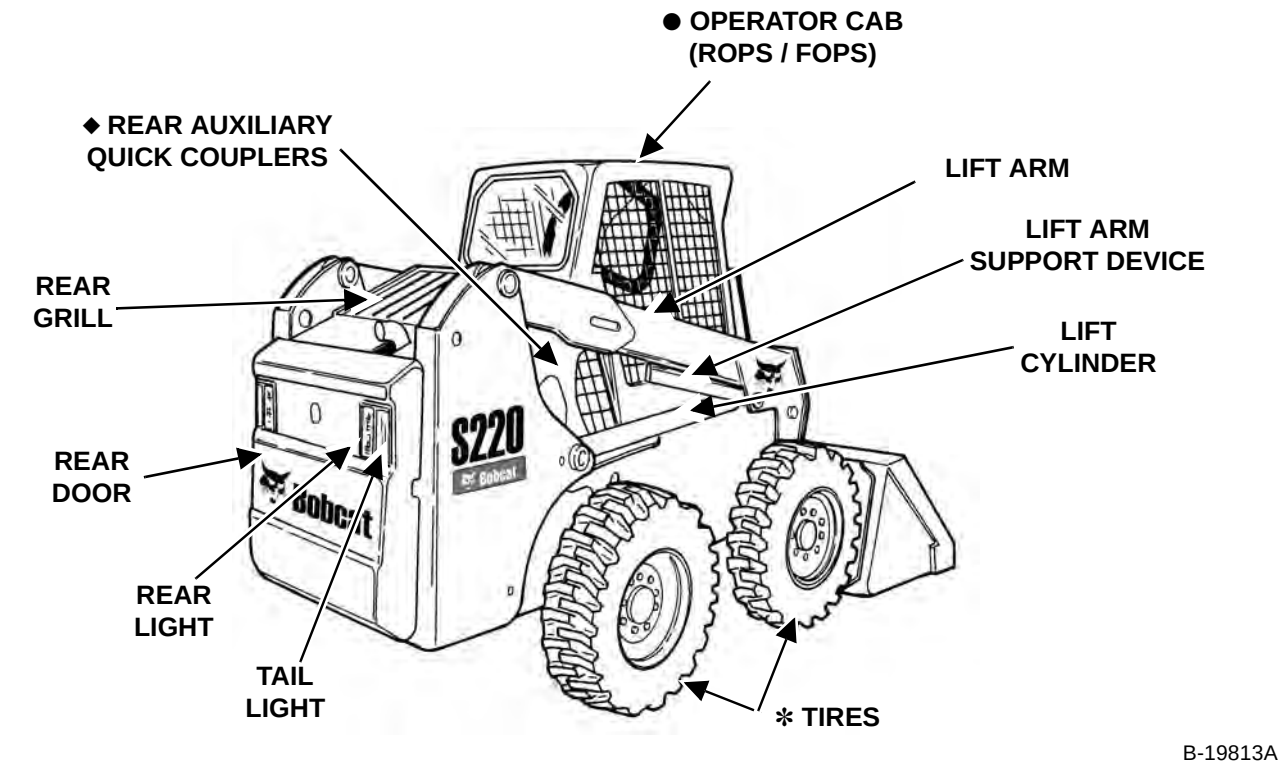
Figure 3



The Delivery Report must be filled out by the dealer and signed by the owner or operator when the Bobcat loader is delivered. An explanation of the form must be given to the owner. Make sure it is filled out completely **[Figure 3]**.

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◆ Optional or Field Accessory (Not Standard Equipment)

✻ TIRES - Tires shown may not be standard. The machine is factory equipped with standard tires. Other tires are available.

† Bucket - Several different buckets and other attachments are available for this machine.

● ROPS, FOPS - Roll Over Protective Structure, per SAE J1040 and ISO 3471, and Falling Object Protective Structure per SAE J1043 and ISO 3449, Level I. Level II is available.

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TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.

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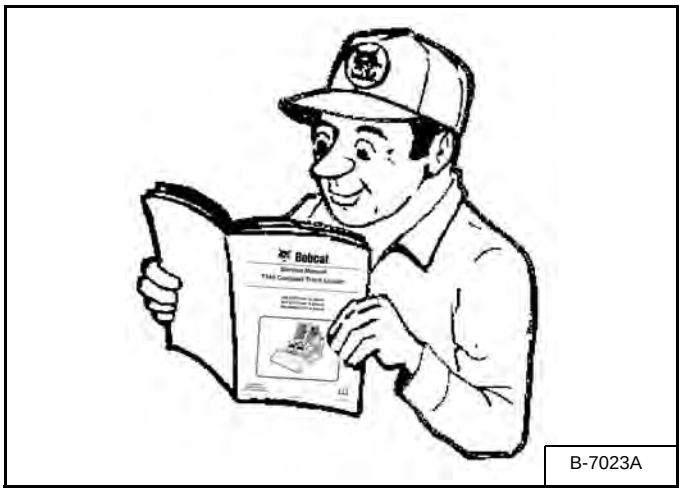


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LIFTING AND BLOCKING THE LOADER

Procedure

Figure 10-10-4



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

Read the Removal & Installation, Disassembly & Assembly, etc. completely to become familiar with the procedure before beginning **[Figure 10-10-4]**.

Always park the loader on a level surface.

WARNING

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

W-2017-0286

Figure 10-10-5



Lift the rear of the loader and install jackstands **[Figure 10-10-5]**.

Figure 10-10-6



Lift the front of the loader and put jackstands under the axle tubes **[Figure 10-10-6]**.

NOTE: Make sure the jackstands do not touch the tires.

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LIFT ARM SUPPORT DEVICE

Installing

WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

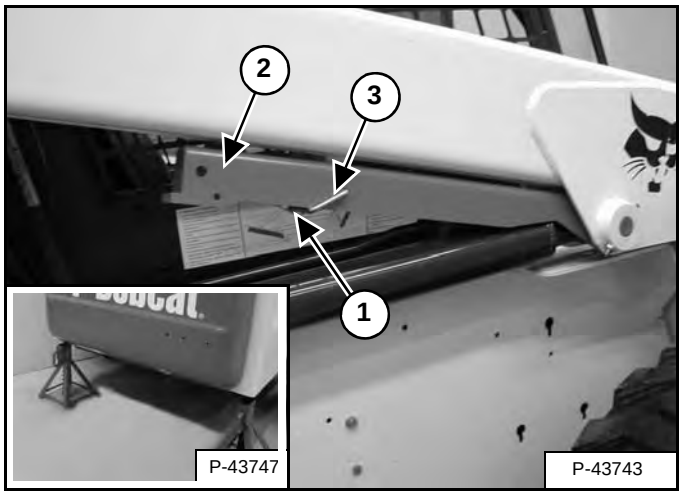
Service lift arm support device if damaged or if parts are missing. Using a damaged lift arm support or with missing parts can cause lift arms to drop causing injury or death.

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Remove attachment from the loader.

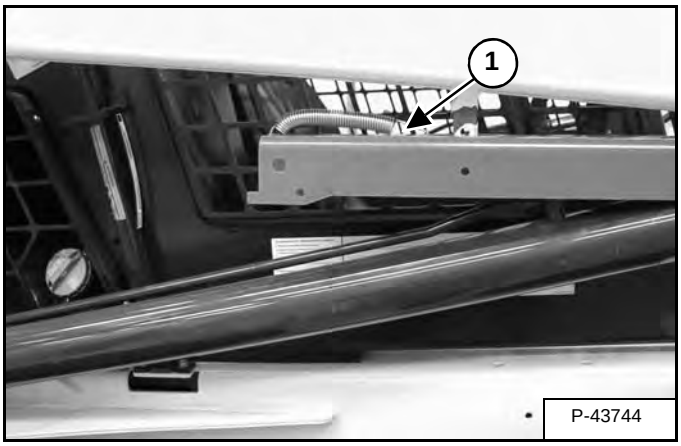
Figure 10-20-1



Put jackstands under the rear corners of the loader frame (Inset) **[Figure 10-20-1]**.

Disconnect the spring from the lift arm support device retaining pin (Item 1) **[Figure 10-20-1]**. Support the lift arm support device (Item 2) **[Figure 10-20-1]** with your hand and remove the retaining pin (Item 3) **[Figure 10-20-1]**.

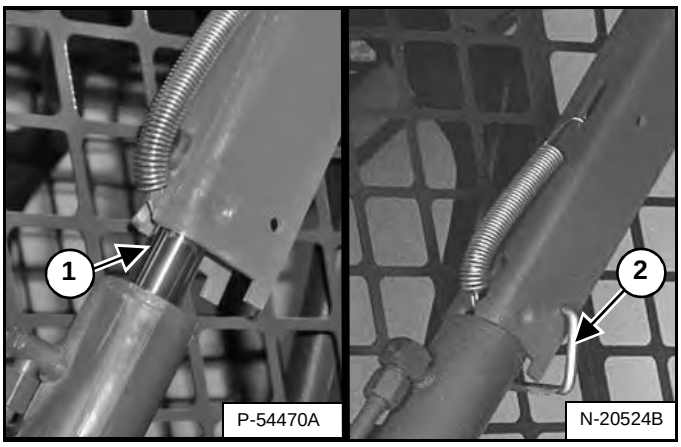
Figure 10-20-2



Lower the lift arm support device to the top of the lift cylinder. Hook the free end of the spring (Item 1) **[Figure 10-20-2]** to the lift arm support device so there will be no interference with the support device engagement.

Sit in the operator's seat, fasten the seat belt and lower the seat bar. Start the engine.

Figure 10-20-3



Raise the lift arms until the lift arm support device drops onto the lift cylinder rod (Item 1) **[Figure 10-20-3]**

Lower the lift arms slowly until the support device is held between the lift arm and the lift cylinder. Stop the engine. Raise the seat bar and move both pedals until both pedals lock.

Install pin (Item 2) **[Figure 10-20-3]** into the rear of the lift arm support device below the cylinder rod.

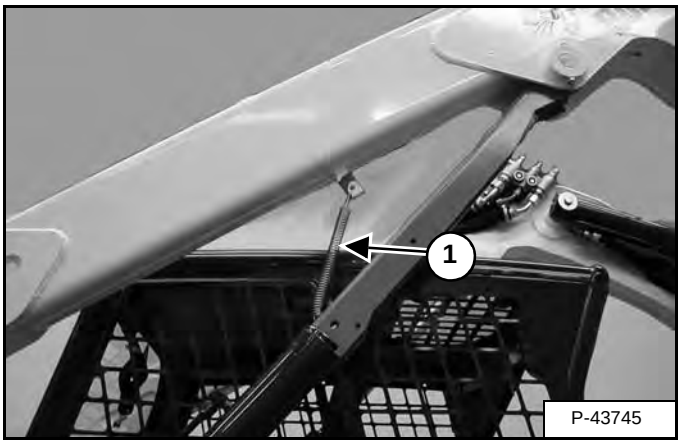
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LIFT ARM SUPPORT DEVICE (CONT'D)

Removing

Remove the pin from the lift arm support device.

Figure 10-20-4



Connect the spring (Item 1) **[Figure 10-20-4]** from the lift arm support device to the bracket below the lift arms.

Sit in the operator's seat fasten the seat belt and lower the seat bar. Start the engine.

Figure 10-20-5



Raise the lift arms a small amount. The spring will lift the support device off the lift cylinder rod **[Figure 10-20-5]**. Lower the lift arms. Stop the engine.

Raise the seat bar, disconnect the seat belt, move pedals until both pedals lock and exit the cab.

Disconnect the spring from the bracket.

Raise the support device into storage position and insert pin through lift arm support device and bracket. (See LIFT ARM SUPPORT DEVICE on Page PM-1) Hook the spring to the lift arm support device retaining pin.

Remove the jackstands.

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OPERATOR CAB

Description

The Bobcat Loader has an operator cab (ROPS and FOPS) as standard equipment to protect the operator from rollover and falling objects. Check with your dealer if the operator cab has been damaged. The seat belt must be worn for rollover protection.

ROPS / FOPS - Roll Over protective Structure per ISO 3471, and Falling Object Protective Structure per SAE J1043 and ISO 3449, Level I. Level II is available.

Level I

Protection from falling bricks, small concrete blocks, and hand tools encountered in operations such as highway maintenance, landscaping, and other construction sites.

Level II

Protection from falling trees, rocks: for machines involved in site clearing, overhead demolition or forestry.

⚠ 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.

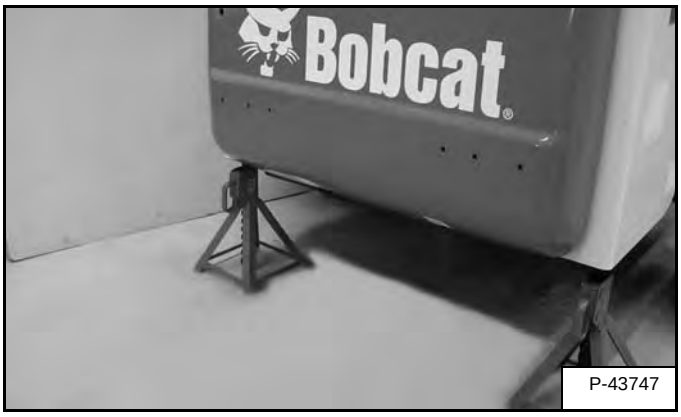
W-2069-0200

Raising

Always stop the engine before raising or lowering the cab.

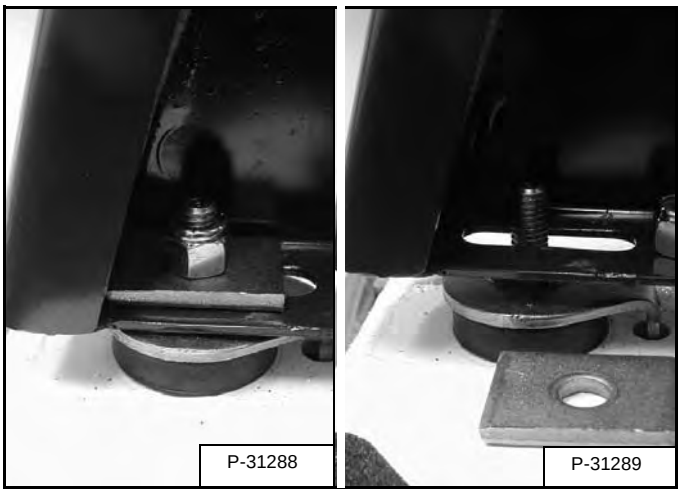
Stop the loader on a level surface. Lower the lift arms. If the lift arms must be up while raising the operator cab, install the lift arm support device. (See LIFT ARM SUPPORT DEVICE on Page 10-20-1.)

Figure 10-30-1



Install jackstands under the rear of the loader frame **[Figure 10-30-1]**.

Figure 10-30-2



Remove the nuts and plates **[Figure 10-30-2]** (both sides) at the front corners of the cab.



NOTE: On Advanced Control System (ACS) equipped machines, the steering levers could contact the cab frame while raising or lowering the operator cab. The engine MUST be stopped before raising or lowering the cab.

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Raising (Cont'd)

Figure 10-30-3



Lift on the grab handles and bottom of the operator cab **[Figure 10-30-3]** slowly until the cab is all the way up and the latching mechanism engages.

Lowering

Always stop the engine before raising or lowering the cab.

NOTE: Always use the grab handles to lower the cab.

Figure 10-30-4



Pull down on the bottom of the operator cab until it stops at the latching mechanism **[Figure 10-30-4]**.

NOTE: The weight of the cab increases when equipped with options and accessories such as cab door, heater, air conditioning, etc. In these cases, the cab may need to be raised slightly from the latch to be able to release the latch.



NOTE: On Advanced Control System (ACS) equipped machines, the steering levers could contact the cab frame while raising or lowering the operator cab. The engine MUST be stopped before raising or lowering the cab.

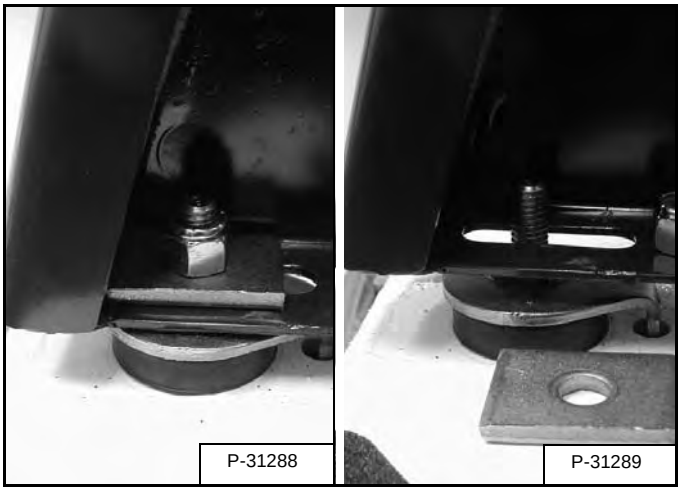
Support the cab and release the latching mechanism (Inset) **[Figure 10-30-4]**. Remove your hand from the latch mechanism when the cab is past the latch stop. Use both hands to lower the cab all the way down.

WARNING

PINCH POINT CAN CAUSE INJURY
Remove your hand from the latching mechanism when the cab is past the latch stop.

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Figure 10-30-5



[Figure 10-30-5] Install the plates and nuts (both sides).

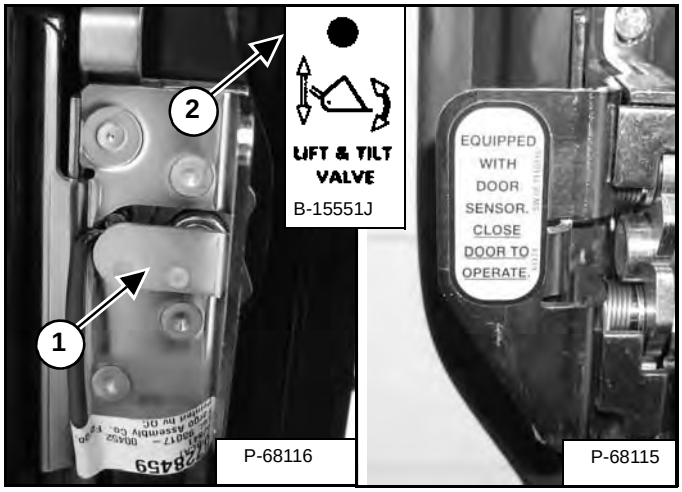
Tighten the nuts to 40-45 ft.-lb. (54-61 N•m) torque.

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Cab Door Sensor

This machine may be equipped with a Cab Door Sensor.

Figure 10-30-6



The cab door (option) has a sensor (Item 1) **[Figure 10-30-6]** installed which deactivates the lift and tilt valves when the door is open.

CLOSE DOOR TO OPERATE lift and tilt valves.

The LIFT & TILT VALVE light (Item 2) **[Figure 10-30-6]** will be ON when the door is closed and the PRESS TO OPERATE LOADER Button is pressed.

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TRANSPORTING LOADER ON A TRAILER

Loading And Unloading

⚠ 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

Be sure the transport and towing vehicles are of adequate size and capacity. (See Capacities on Page SPEC-10-4.)

Figure 10-40-1

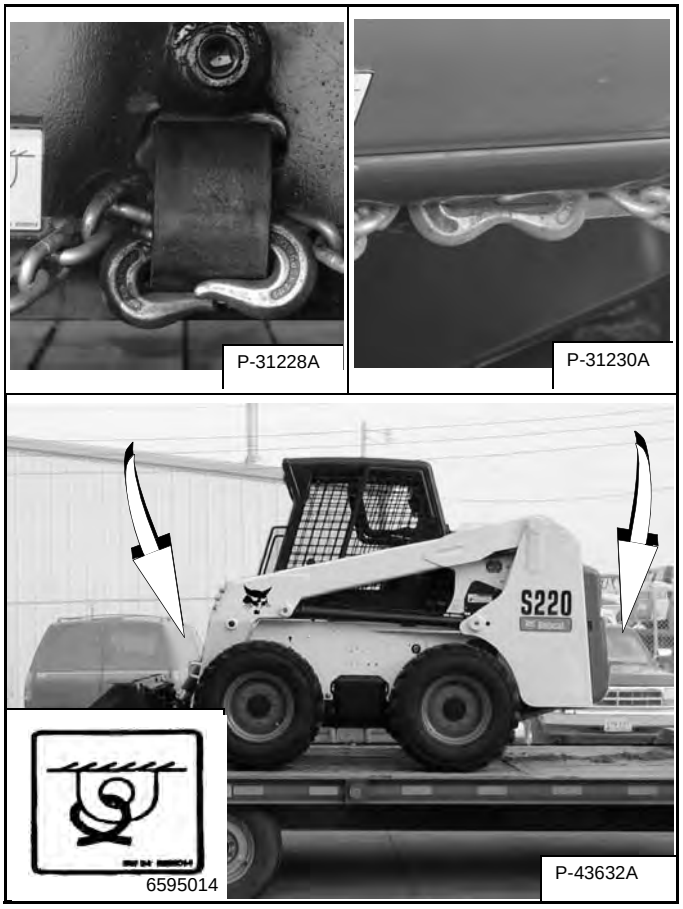


A loader with an empty bucket or no attachment must be loaded backward onto the transport vehicle **[Figure 10-40-1]**.

The rear of the trailer must be blocked or supported (Item 1) **[Figure 10-40-1]** when loading or unloading the loader to prevent the front end of the trailer from raising up.

Fastening

Figure 10-40-2



Use the following procedure to fasten the Bobcat loader to the transport vehicle to prevent the loader from moving during sudden stops or when going up or down slopes **[Figure 10-40-2]**.

- Lower the bucket or attachment to the floor.
- Stop the engine.
- Engage the parking brake.
- Fasten each end of the chain to the transport vehicle.
- Install chains at the front and rear loader tie down positions (Inset) **[Figure 10-40-2]**.

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TOWING THE LOADER

Procedure

Because of the design of the loader, there is not a recommended towing procedure.

- The loader can be lifted onto a transport vehicle.

- The loader can be skidded a short distance to move for service (EXAMPLE: Move onto a transport vehicle.) without damage to the hydrostatic system. (The tires/tracks will not turn.) There might be slight wear to the tires/tracks when the loader is skidded.

  The towing chain (or cable) must be rated at 1 & 1/2 times the weight of the loader (See Performance on Page SPEC-10-2.)

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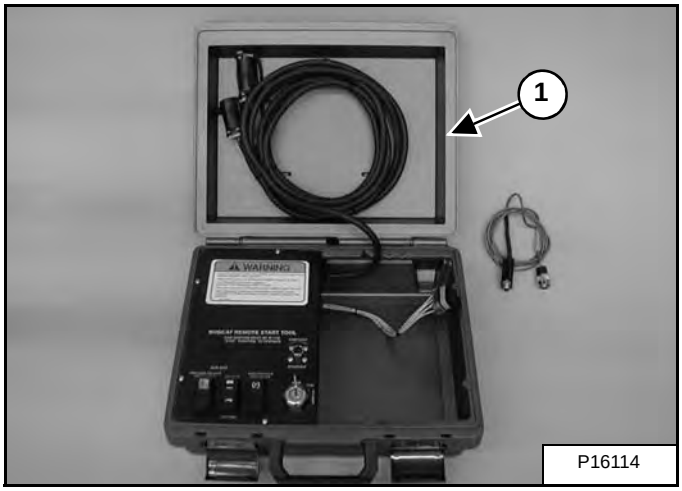
REMOTE START TOOL KIT-MEL1563

Remote Start Tool - MEL1563

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

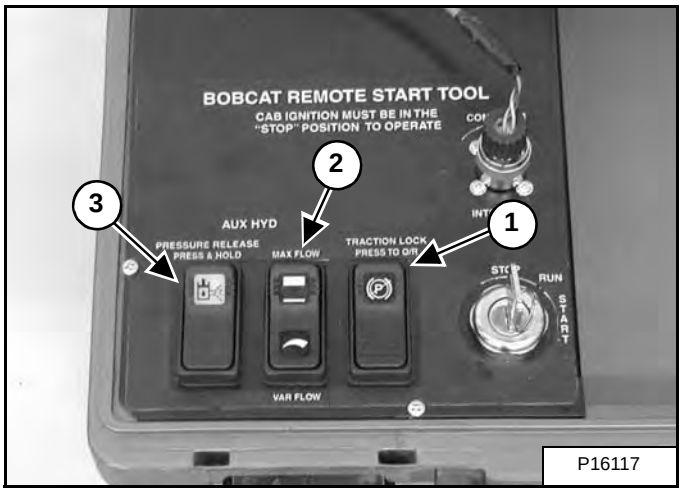
MEL1563 - Remote Start Tool
MEL1565 - Service Tool Harness Control
MEL1566 - Service Tool Harness Communicator (Computer Interface)

Figure 10-60-1



The remote start tool (Item 1) **[Figure 10-60-1]** is required when the service technician is checking the hydraulic/hydrostatic system or adjusting the steering linkage.

Figure 10-60-2



The traction lock switch (Item 1) **[Figure 10-60-2]** is used to turn traction lock ON or OFF. Push the switch to the override position. The switch will illuminate to indicate traction lock OVERRIDE, in this position the wheels are able to turn.

The maximum flow/variable flow switch (Item 2) **[Figure 10-60-2]** is used to activate the auxiliary hydraulics. Pressing the switch once will activate maximum flow. Pressing the switch again will activate variable flow. The switch will illuminate to indicate which flow rate is active. Pressing the switch a third time will turn the flow OFF. The switch is used when checking pressures and flow rate.

The auxiliary pressure release (Item 3) **[Figure 10-60-2]** is used to release hydraulic pressure to the front and/or rear auxiliary couplers. To release pressure; push and hold the switch for a few seconds.

NOTE: With the engine running; pushing and holding the pressure release switch will cause the engine to stop. To relieve the pressure; press the switch until the engine stops.

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Remote Start Tool - MEL1563 (Cont'd)

Figure 10-60-3



Figure 10-60-4



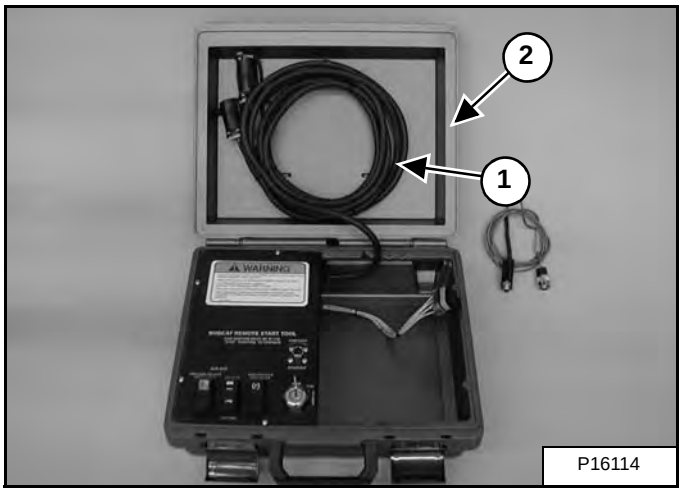
The 10-pin rectangular connector (Item 1) **[Figure 10-60-3]** is used to update software in the Deluxe Instrumentation Panel (Item 1) **[Figure 10-60-4]**.

NOTE: The Service PC must be connected to the remote start tool to update the deluxe panel software.

The panel must be removed from inside the operator cab and plugged into this connector **[Figure 10-60-3]**.

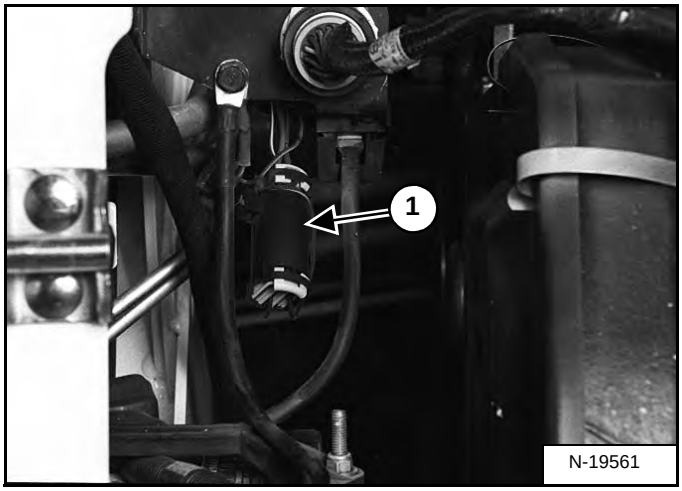
Service Tool Harness Control - MEL1565

Figure 10-60-5



The service tool harness control (Item 1) **[Figure 10-60-5]** is used to connect the remote start tool (Item 2) **[Figure 10-60-5]** to the electrical system on the loader.

Figure 10-60-6



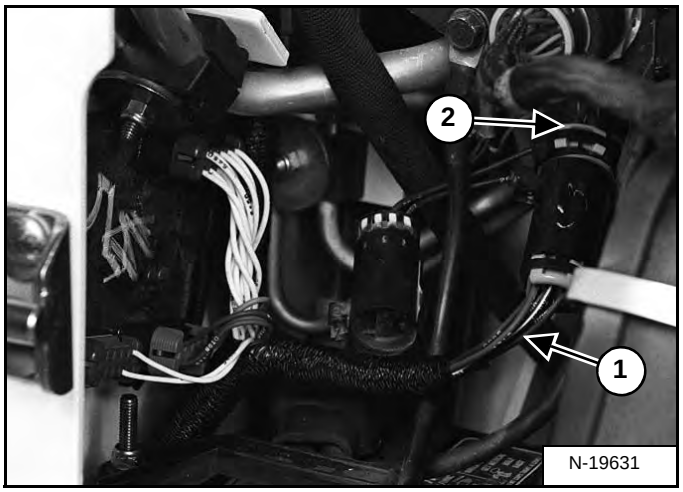
Remove the plug (Item 1) **[Figure 10-60-6]** from the loader harness connector.

Connect the service tool harness control to the loader harness connector.

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Service Tool Harness Control - MEL1565 (Cont'd)

Figure 10-60-7



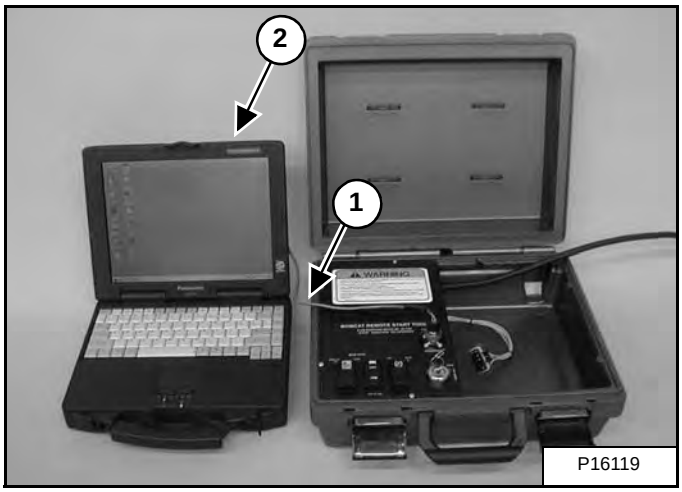
Loaders equipped with an attachment harness (Item 1) **[Figure 10-60-7]** must disconnect the attachment harness from the loader harness (Item 2) **[Figure 10-60-7]**.

Connect the service tool harness to the ACD connector and the loader harness connector.

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

Service Tool Harness Communicator - MEL1566

Figure 10-60-8



The service tool harness communicator (Item 1) **[Figure 10-60-8]** is required to connect remote start tool to the Service PC (Item 2) **[Figure 10-60-8]**.

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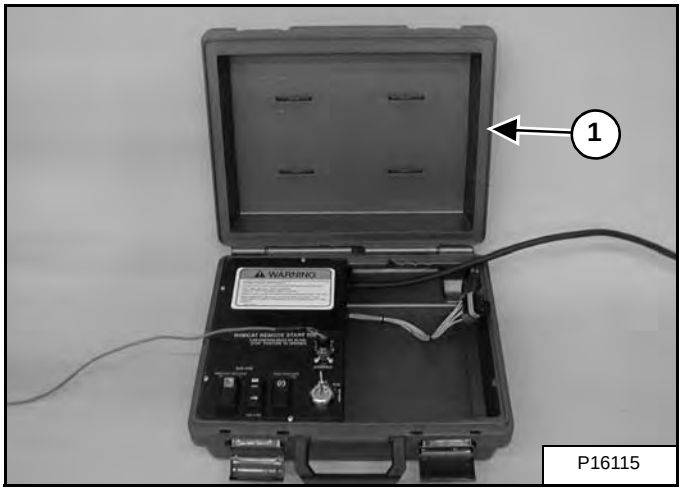
REMOTE START TOOL KIT-MEL1563 (CONT'D)

Remote Start Procedure

The tool listed will be needed to do the following procedure:

MEL1563: Remote Start Tool Kit

Figure 10-60-9



The remote start tool (Item 1) **[Figure 10-60-9]** is required when the operator cab is in the raised position for service and the service technician needs to turn the key switch on or start the engine. Example: adjusting the steering linkage.

Lift and block the loader.

Raise the lift arms (if required by the procedure) and install an approved lift arm support device.

Raise the operator cab (if required by the procedure).

Open the rear door of the loader.

Figure 10-60-10

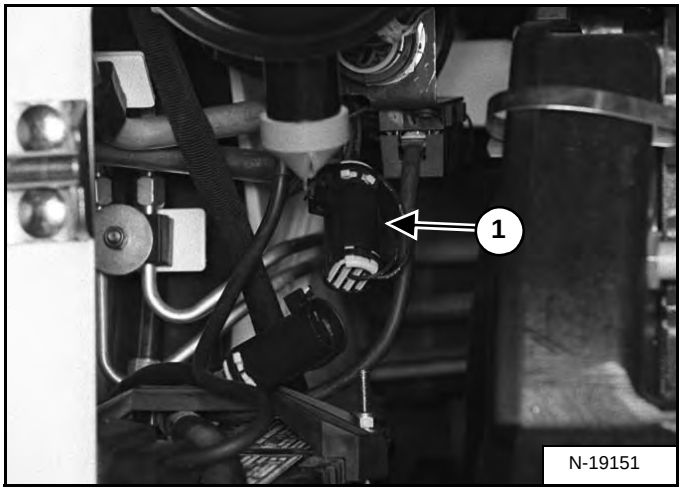
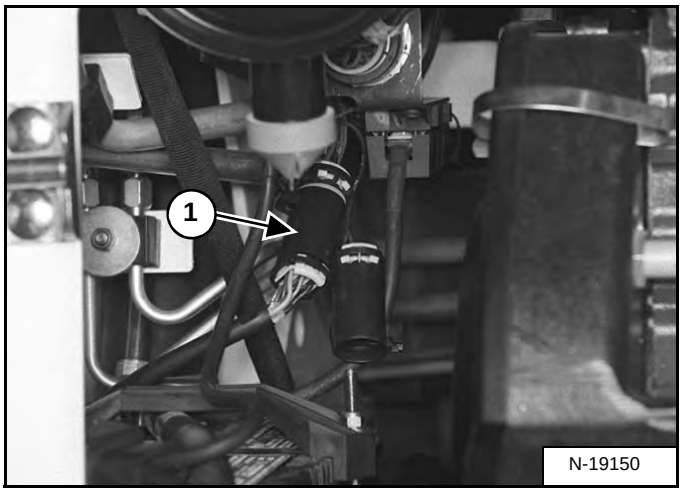
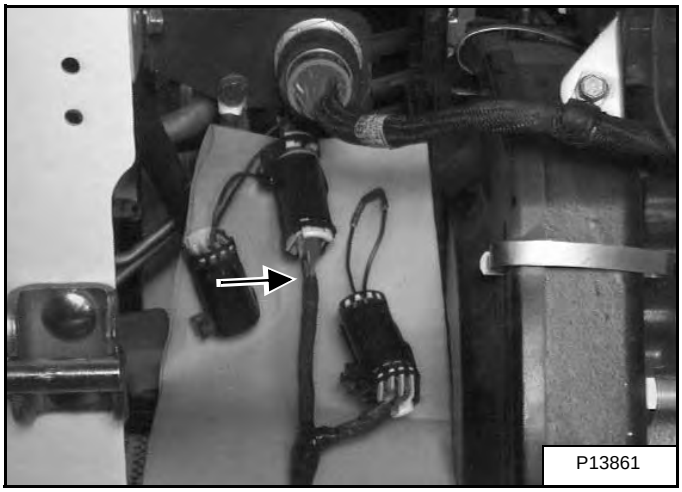


Figure 10-60-11



Remove the plug (Item 1) **[Figure 10-60-10]** or disconnect the attachment control harness (Item 1) **[Figure 10-60-11]** if connected.

Figure 10-60-12



Connect the remote start tool to the engine harness connector **[Figure 10-60-12]**.

NOTE: The key switch on the right-hand side operator panel must be in the off position or the Remote Start Kit will not operate.

WARNING

AVOID INJURY OR DEATH

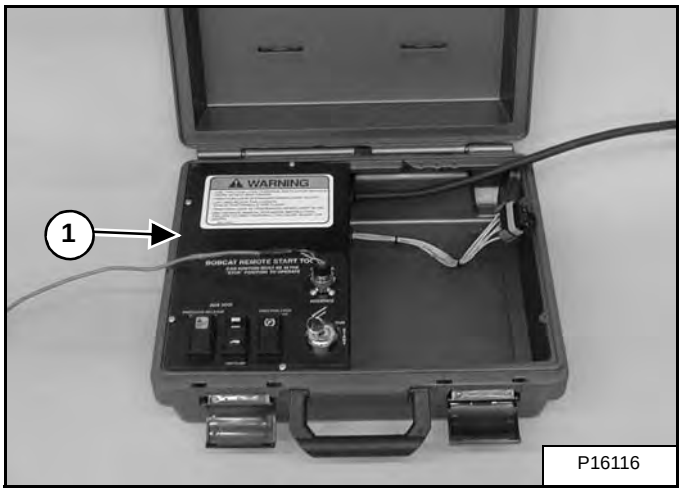
With the 7-pin connector plugged into the loader and Remote Start Key Switch in the OFF position, the loader can still be started from the operator panel inside the cab. Placing the key switch of the remote start tool in the run position disconnects the operator panel key switch from the start circuit. If the service technician will be working the engine area it is important to remove the operator panel keys.

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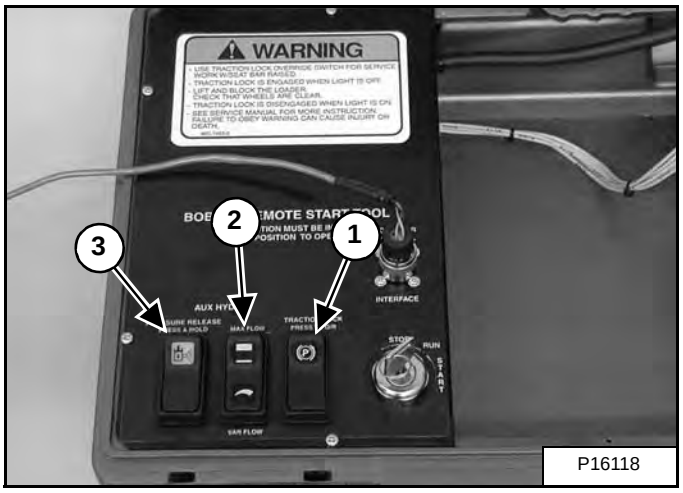
Remote Start Procedure (Cont'd)

Figure 10-60-13



The remote start tool (Item 1) **[Figure 10-60-13]** has three rocker switches.

Figure 10-60-14

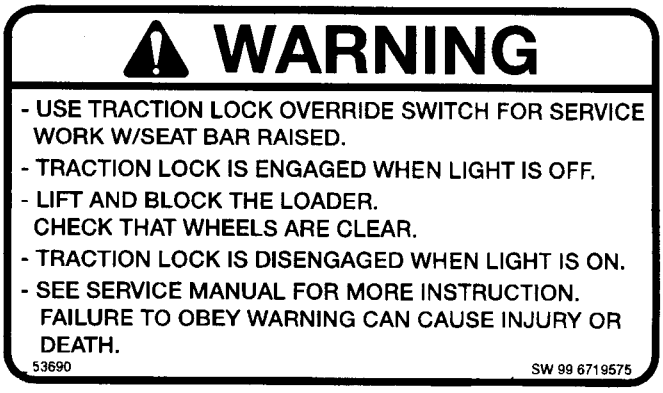


The traction lock switch (Item 1) **[Figure 10-60-14]** is used to turn traction lock on or off. Push the switch to the override position. The switch will illuminate to indicate traction lock OVERRIDE, in this position the wheels are able to turn.

The maximum flow/variable flow switch (Item 2) **[Figure 10-60-14]** is used to activate the auxiliary hydraulics. Pressing the switch once will activate variable flow. Pressing the switch again will activate maximum flow. The switch will illuminate to indicate which flow rate is active. Pressing the switch a third time will turn the flow OFF. The switch is used when checking pressures and flow rate.

The auxiliary pressure release (Item 3) **[Figure 10-60-14]** is used to release hydraulic pressure to the front and/or rear auxiliary couplers. To release pressure; push and hold the switch for three seconds.

NOTE: With the engine running; pushing and holding the pressure release switch will cause the engine to stop in three seconds. To relieve the pressure; continue to press the switch after the engine has stopped.



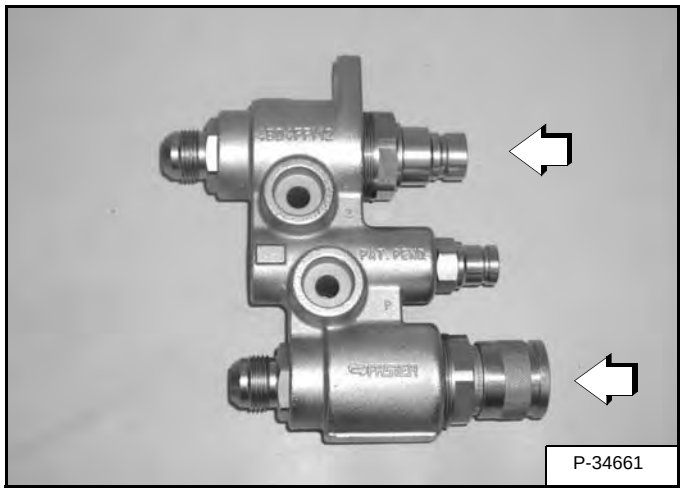
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REMOTE START TOOL KIT-MEL1563 (CONT'D)

Remote Start Procedure (Cont'd)

NOTE: With the engine running; pushing and holding the pressure release switch will cause the engine to stop in three seconds. To relieve the pressure at the rear or right hand auxiliary, (If so equipped.) continue to hold the switch for three seconds after the engine has stopped.

Figure 10-60-15



Push the couplers on the front auxiliary block toward the block and hold for five seconds to release the front auxiliary pressure **[Figure 10-60-15]**.

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REMOTE START TOOL (SERVICE TOOL) KIT - 6689779

Description

The Remote Start Tool (Service Tool) Kit is a replacement tool for MEL 1563 Remote Start Tool and MEL 1400B - BOSS® Diagnostic Tool.

The Remote Start Tool (Service Tool) Kit, P/N 6689779, can be used to service older loaders with the BOSS® system using the supplied BOSS® Service Tool Harness P/N 6689745.

The Remote Start Tool (Service Tool) Kit, P/N 6689779, can be used to service newer loaders 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 loader harness.

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

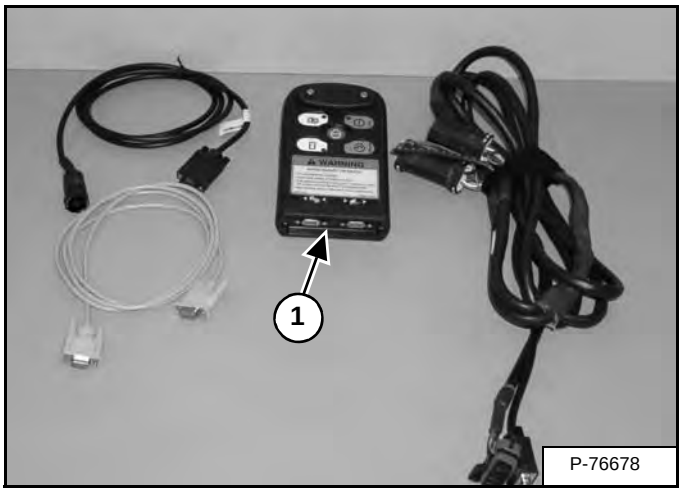
Remote Start Tool (Service Tool) - 6689778

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

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

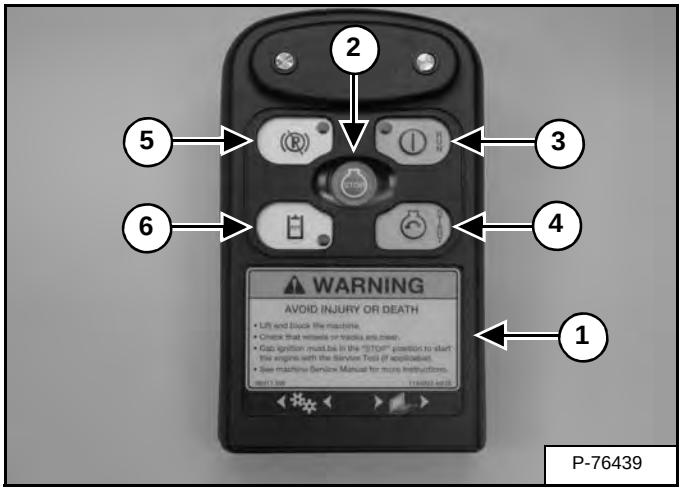
Kit Includes:
6689778 - Remote Start Tool (Service Tool)
6689747 - Loader Service Tool Harness
6689746 - Computer Service Tool Harness
6689745 - BOSS® Service Tool Harness

Figure 10-61-16



The remote start tool (Item 1) **[Figure 10-61-16]** is required when the service technician is checking the hydraulic / hydrostatic system or adjusting the steering linkage.

Figure 10-61-17



The Remote Start Tool (Service Tool) (Item 1) **[Figure 10-61-17]** has five buttons.

The STOP button (Item 2) **[Figure 10-61-17]** is used to stop the Remote Start Tool (Service Tool) from communicating and stop the loader engine.

The RUN button (Item 3) **[Figure 10-61-17]** is used to turn the Remote Start Tool (Service Tool) on and activates the loader ignition power. The button will illuminate to indicate the service tool is active.

The START button (Item 4) **[Figure 10-61-17]** is used to start the loader engine.

The traction lock button (Item 5) **[Figure 10-61-17]** is used to turn traction lock ON or OFF. Push the button and the button will illuminate indicating the traction lock is disabled in which the wheels or tracks are able to turn.

Loader S/N: xxxx60000 & Below

The auxiliary button (Item 6) **[Figure 10-61-17]** is used to activate the auxiliary hydraulics. The button will illuminate to indicate the auxiliary hydraulics are active. Pressing the button once will activate maximum flow. Pressing the button again will activate variable flow. Pressing the button a third time will turn the flow OFF. The button is used when checking pressures and flow rate.

Loader S/N: xxxx60001 & Above

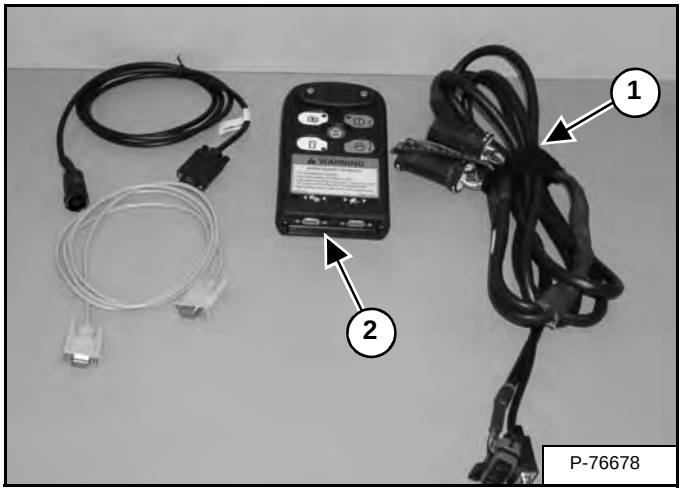
The auxiliary button (Item 6) **[Figure 10-61-17]** is used to activate the auxiliary hydraulics. The button will illuminate to indicate the auxiliary hydraulics are active. Pressing the button a second time will turn the flow OFF. The button is used when checking pressures and flow rate.

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

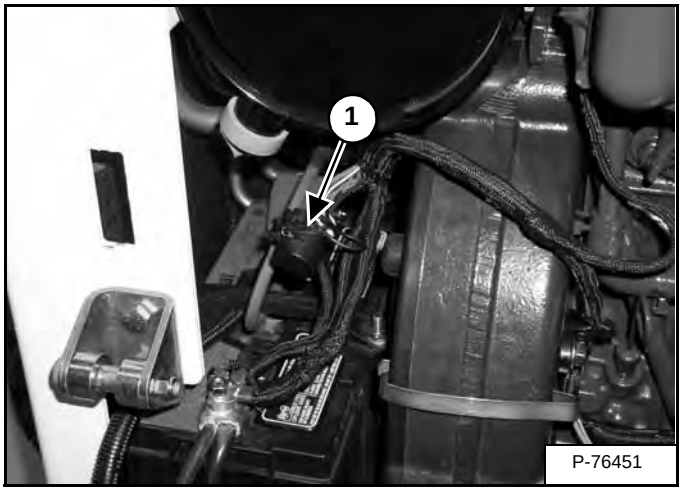
Loader Service Tool Harness - 6689747

Figure 10-61-18



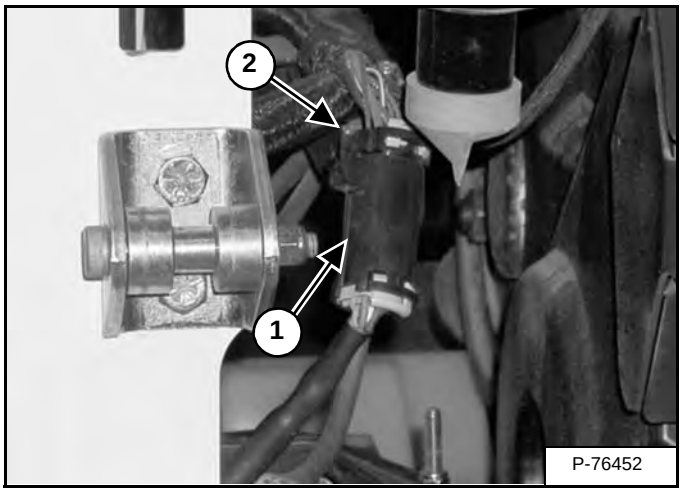
The loader service tool harness (Item 1) **[Figure 10-61-18]** is used to connect the remote start tool (service tool) (Item 2) **[Figure 10-61-18]** to the electrical system on the loader.

Figure 10-61-19



Loaders without an attachment control harness, remove the loader harness cap (Item 1) **[Figure 10-61-19]** and connect the Loader Service Tool Harness from the Remote Start Tool (Service Tool).

Figure 10-61-20



Loaders with an attachment control harness (7 pin or 14 pin), the attachment harness (Item 1) must be disconnected from the loader harness (Item 2) **[Figure 10-61-20]**.

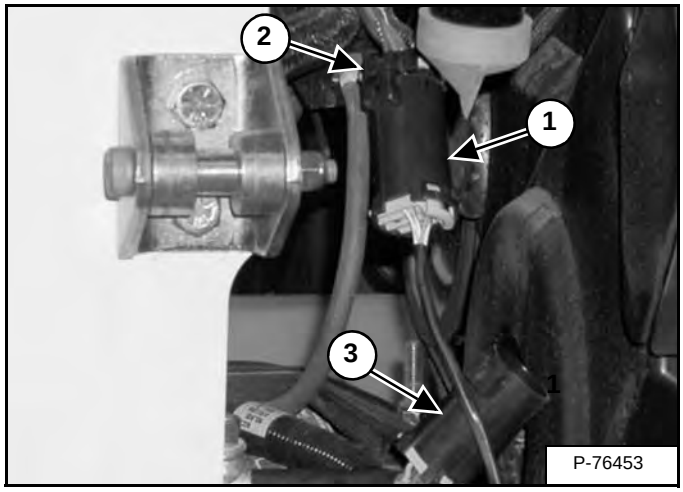
When the remote start procedure is completed, replace the loader connector cap (Item 1) **[Figure 10-61-19]** or reconnect the attachment control harness to the loader harness **[Figure 10-61-20]**.

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

Loader Service Tool Harness - 6689747 (Cont'd)

Figure 10-61-21



NOTE: The Remote Start Tool (Service Tool) connection harness has two connectors (Item 1) and (Item 3). The main connector (Item 1) [Figure 10-61-21] is always used for connection to the loader harness.

The second connector (Item 3) [Figure 10-61-21] is used for attachment ACD upgrades or attachment operational diagnostics only. This connector has a cap attached to it to prevent damage or corrosion when not in use.

Connect the Remote Start Tool (Service Tool) connector (Item 1) to the loader harness connector (Item 2) and the other Remote Start Tool (Service Tool) connector to the ACD harness connector (Item 3) **[Figure 10-61-21]**.

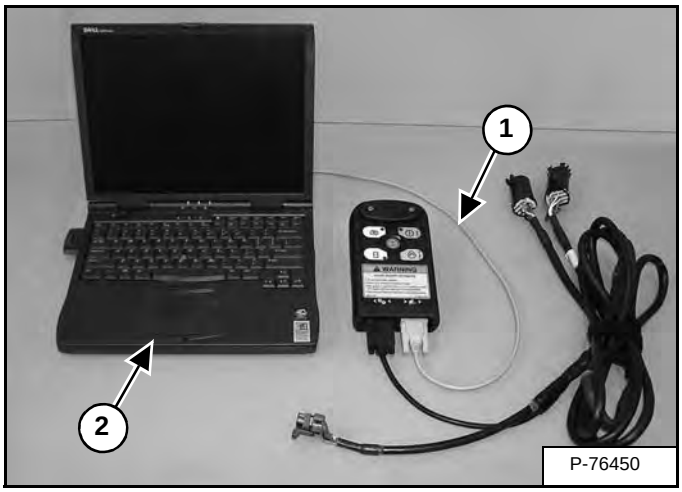
NOTE: The right instrument panel (Key Switch or Keyless) must be in the off position or the Remote Start Tool (Service Tool) will not operate.



P-76454

Computer Service Tool Harness - 6689746

Figure 10-61-22



The computer service tool harness (Item 1) **[Figure 10-61-22]** is required to connect remote start tool (service tool) to the Service PC (Item 2) **[Figure 10-61-22]**.

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

Remote Start Procedure

⚠ WARNING

AVOID INJURY OR DEATH

With the 7-pin connector plugged into the loader and Remote Start Tool RUN button is not illuminated, the loader can still be started from the operator panel inside the cab.

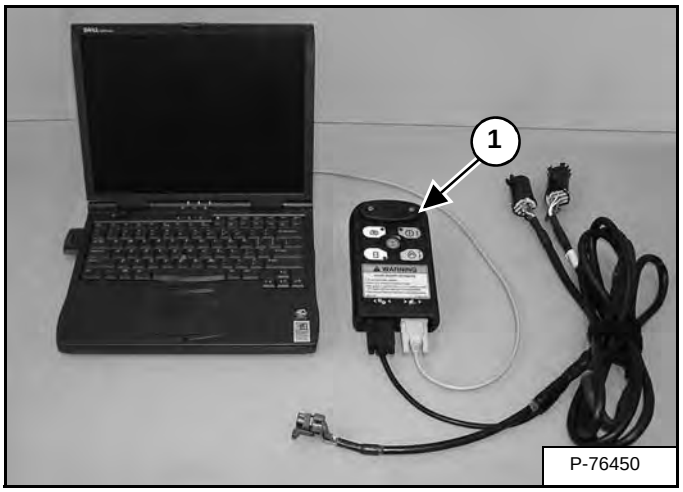
Pressing the RUN button on the Remote Start Tool disconnects the operator panel from the start circuit. If the service technician will be working in the engine area it is important to remove the operator panel key or lock the keypad with a unique password.

W-2647-0707

The tool listed will be needed to do the following procedure:

6689779: Remote Start Tool (Service Tool) Kit

Figure 10-61-23



The Remote Start Tool (Service Tool) (Item 1) **[Figure 10-61-23]** is required when the operator cab is in the raised position for service and the service technician needs to turn on the loader or start the engine. Example: adjusting the steering linkage.

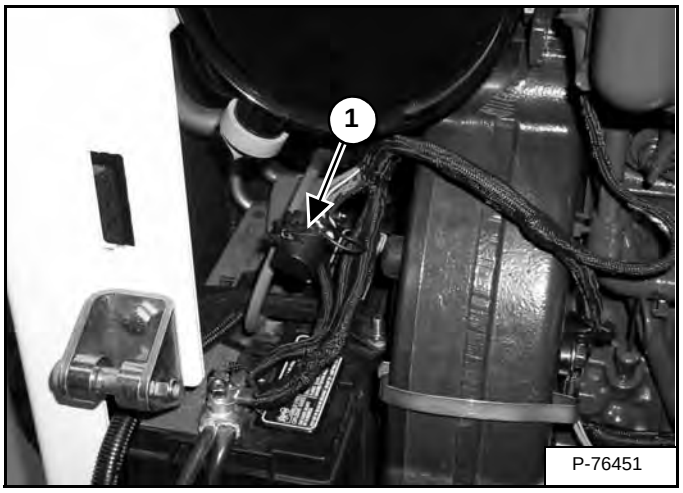
Lift and block the loader.

Raise the lift arms (if required by the procedure) and install an approved lift arm support device.

Raise the operator cab (if required by the procedure).

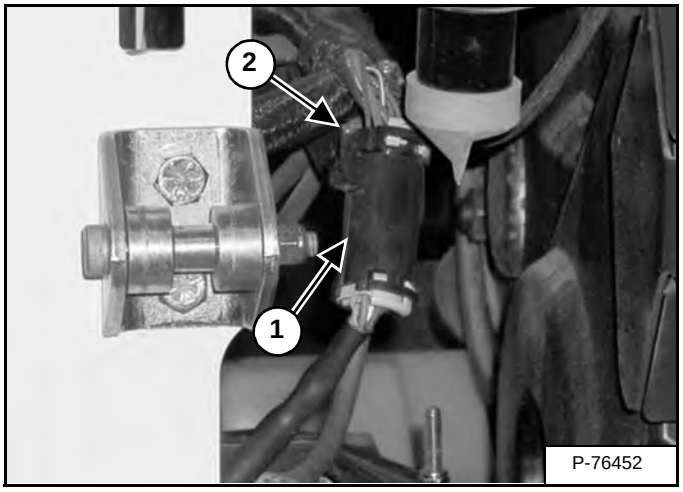
Open the rear door of the loader.

Figure 10-61-24



Loaders without an attachment control harness, remove the loader harness cap (Item 1) **[Figure 10-61-24]** and connect the Loader Service Tool Harness from the Remote Start Tool (Service Tool).

Figure 10-61-25



Loaders with an attachment control harness (7 pin or 14 pin), the attachment harness (Item 1) must be disconnected from the loader harness (Item 2) **[Figure 10-61-25]**.

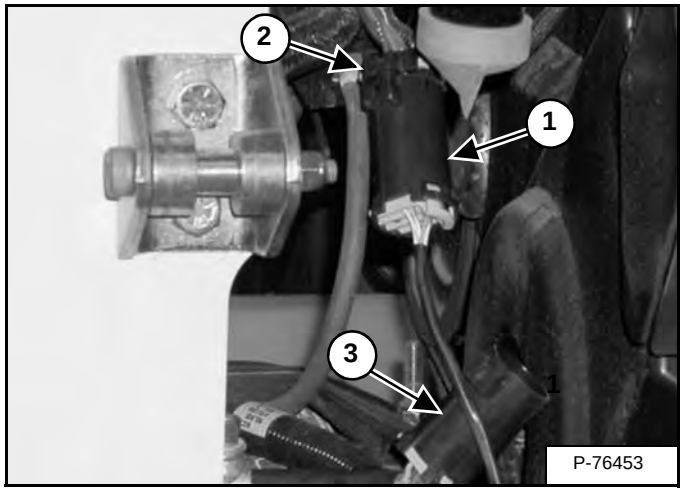
When the remote start procedure is completed, replace the loader connector cap (Item 1) **[Figure 10-61-25]** or reconnect the attachment control harness to the loader harness **[Figure 10-61-25]**.

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

Remote Start Procedure (Cont'd)

Figure 10-61-26



NOTE: The Remote Start Tool (Service Tool) connection harness has two connectors (Item 1) and (Item 3). The main connector (Item 1) [Figure 10-61-26] is always used for connection to the loader harness.

The second connector (Item 3) [Figure 10-61-26] is used for attachment ACD upgrades or attachment operational diagnostics only. This connector has a cap attached to it to prevent damage or corrosion when not in use.

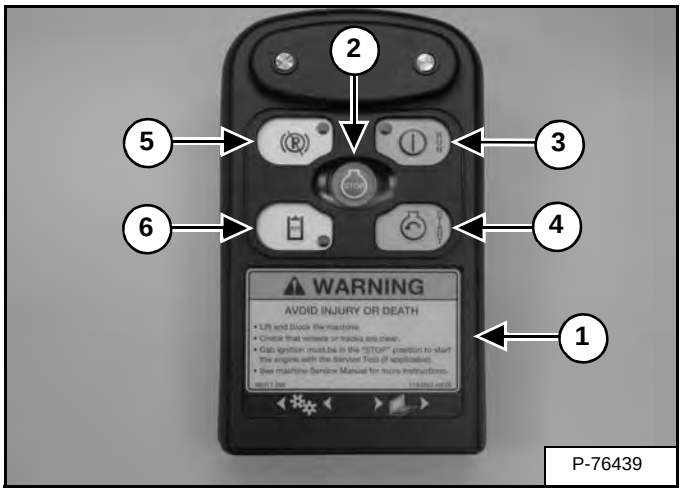
Connect the Remote Start Tool (Service Tool) connector (Item 1) to the loader harness connector (Item 2) and the other Remote Start Tool (Service Tool) connector to the ACD harness connector (Item 3) **[Figure 10-61-26]**.

NOTE: The right instrument panel (Key Switch or Keyless) must be in the off position or the Remote Start Tool (Service Tool) will not operate.



P-76454

Figure 10-61-27



The Remote Start Tool (Service Tool) (Item 1) **[Figure 10-61-27]** has five buttons.

The STOP button (Item 2) **[Figure 10-61-27]** is used to stop the Remote Start Tool (Service Tool) from communicating and stop the loader engine.

The RUN button (Item 3) **[Figure 10-61-27]** is used to turn the Remote Start Tool (Service Tool) on and activates the loader ignition power. The button will illuminate to indicate the service tool is active.

The START button (Item 4) **[Figure 10-61-27]** is used to start the loader engine.

The traction lock button (Item 5) **[Figure 10-61-27]** is used to turn traction lock ON or OFF. Push the button and the button will illuminate indicating the traction lock is disabled in which the wheels or tracks are able to turn.

Loader S/N: xxxx60000 & Below

The auxiliary button (Item 6) **[Figure 10-61-27]** is used to activate the auxiliary hydraulics. The button will illuminate to indicate the auxiliary hydraulics are active. Pressing the button once will activate maximum flow. Pressing the button again will activate variable flow. Pressing the button a third time will turn the flow OFF. The button is used when checking pressures and flow rate.

Loader S/N: xxxx60001 & Above

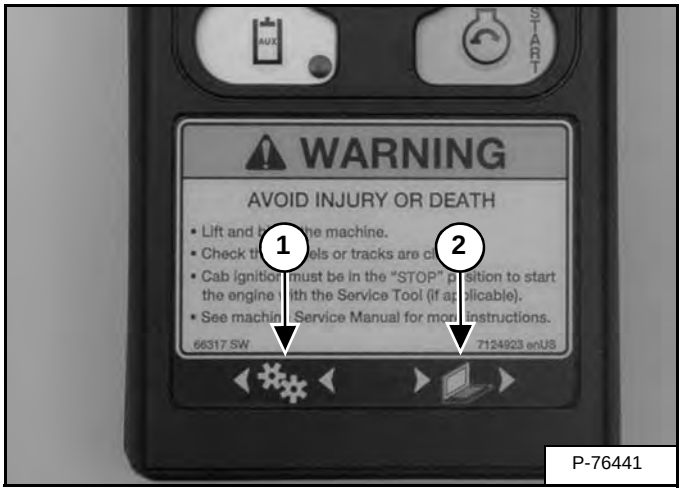
The auxiliary button (Item 6) **[Figure 10-61-27]** is used to activate the auxiliary hydraulics. The button will illuminate to indicate the auxiliary hydraulics are active. Pressing the button a second time will turn the flow OFF. The button is used when checking pressures and flow rate.

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

Remote Start Procedure (Cont'd)

Figure 10-61-28



The gear icon with the left facing arrows (Item 1) **[Figure 10-61-28]** will illuminate and blink when the RUN key is pressed and the loader is communicating with the service tool.

The computer icon with the right facing arrows (Item 2) **[Figure 10-61-28]** will illuminate and blink when the Remote Start Tool (Service Tool) is transmitting data to and from the computer.

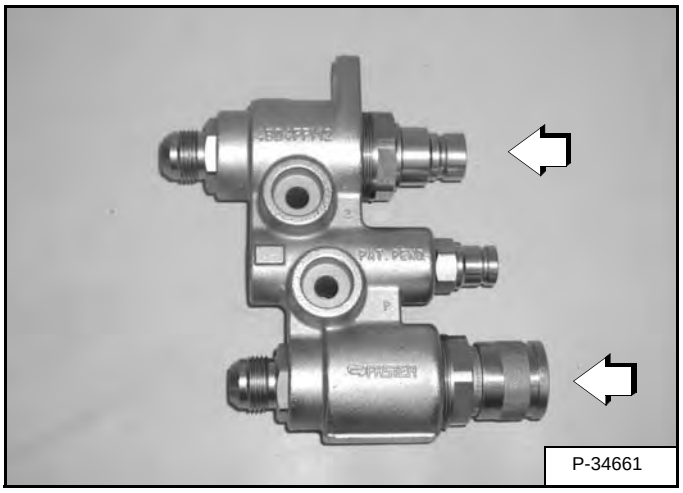
Loader S/N: xxxx60000 & Below

NOTE: To relieve the pressure at the rear or secondary front auxiliary, (if equipped) press and hold the AUXILIARY PRESSURE RELEASE button on the left instrument panel for three seconds after the engine has stopped.

Loader S/N: xxxx60001 & Above

NOTE: To relieve the pressure at the rear or secondary front auxiliary, (if equipped) press the RUN button on the remote start tool. Then press the auxiliary (AUX) hydraulics button on the remote start tool and move the AUXILIARY Hydraulic Switch on the to the right and left several times.

Figure 10-61-29



Push the couplers on the front auxiliary block toward the block and hold for five seconds to release the front auxiliary pressure **[Figure 10-61-29]**.

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SERVICE SCHEDULE

Chart

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

⚠ 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-2003-0903

SERVICE SCHEDULE		HOURS					
ITEM	SERVICE REQUIRED	8-10	50	100	■ 250	■ 500	■ 1000
Engine Oil	Check the oil level and add as needed. Do not overfill.						
Engine Air Filter and Air System	Check display panel. Service only when required. Check for leaks and damaged components.						
Engine Cooling System	Clean debris from oil cooler, radiator and grill. Check coolant level COLD and add premixed coolant as needed.						
Fuel Filter	Remove the trapped water.						
Lift Arms, Cylinders, Bob-Tach Pivot Pins and Wedges	Lubricate with multi-purpose lithium based grease.						
Tires	Check for damaged tires and correct air pressure. Inflate to MAXIMUM pressure shown on the sidewall of the tire.						
Seat Bar, Control Interlocks, Seat Belt, Seat Belt Retractors	Check the condition of seat belt. Clean or replace seat belt retractors as needed. Check the seat bar and control interlocks for correct operation. Clean dirt and debris from moving parts.						
Bobcat Interlock Control Systems (BICS)	Check for correct function. Lift and Tilt functions MUST NOT operate with seat bar raised. See details in this Manual.						
Safety Signs and Safety Treads	Check for damaged signs (decals) and safety treads. Replace any signs or safety treads that are damaged or worn.						
Operator Cab	Check the fastening bolts, washers and nuts. Check the condition of the cab.						
Indicators and Lights	Check for correct operation of all indicators and lights.						
Heater and A/C Filters (If Equipped)	Clean or replace filters as needed.						
Hydraulic Fluid, Hoses and Tubelines	Check fluid level and add as needed. Check for damage and leaks. Repair or replace as needed.						
Final Drive Trans. (Chaincase),	Check fluid level and add as needed.						
Parking Brake, Foot Pedals, Hand Controls and Steering Levers or Joysticks	Check for correct operation. Repair or adjust as needed.						
Wheel Nuts	Check for loose wheel nuts and tighten to correct torque. (See TIRE MAINTENANCE in this manual.)	❑					
Spark Arrestor Muffler	Clean the spark chamber.						
Battery	Check cables, connections and electrolyte level. Add distilled water as needed.						
Steering Lever Pivots	Grease fittings.						
Fuel Filter	Replace filter element.						
Engine / Hydro. Drive Belt	Check for wear or damage. Check idler arm stop.		▲				
Drive Belts (Alternator, air conditioner, water pump)	Check condition and tension. Adjust or replace as needed.						
Bobcat Interlock Control System (BICS)	Check the function of the lift arm bypass control.						
Hydraulic / Hydrostatic Filter, Charge Filter, Reservoir Breather	Replace the hydraulic / hydrostatic filter, charge filter, and the reservoir breather.		●				
Engine Oil and Filter	Replace oil and filter.		▲		✶		
Final Drive Trans. (Chaincase)	Replace the fluid.						
Hydraulic Reservoir	Replace the fluid.						
Case Drain Filters	Replace the filters.		▲				
Engine Valves	Adjust the engine valves.					❍	
Coolant	Replace the coolant	Every 2 years					

■ **Or every 12 months.**

▲ **Perform at first 50 hours, then as scheduled.**

❑ **Check every 8 - 10 hours for the first 24 hours, then at 50 hour intervals.**

● **Replace the hydraulic / hydrostatic filter element after the first 50 hours, then when the transmission warning light comes ON while operating or as scheduled.**

✶ **Change oil and filter every 250 hours when operating under severe conditions.**

❍ **Perform at first 500 hours, then as scheduled.**

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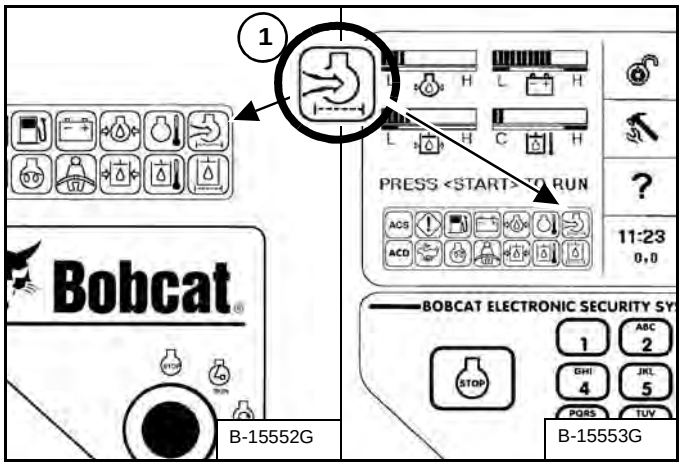


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AIR CLEANER SERVICE

Replacing Filter Elements

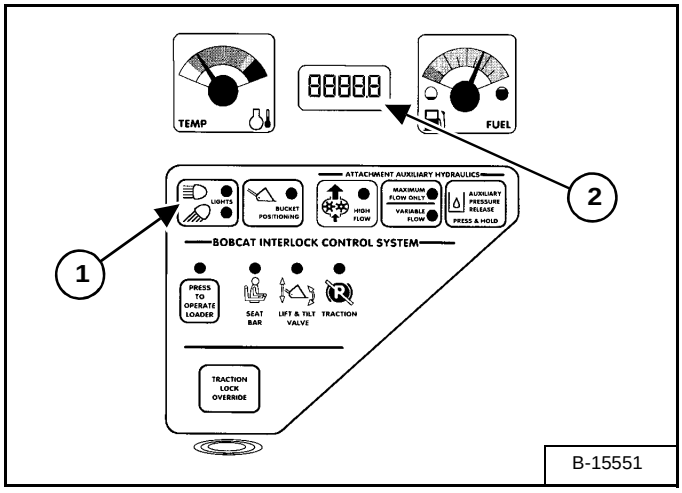
Figure 10-80-1



It is important to change the air filter element only when the Air Cleaner Icon in the right panel is ON (Item 1) **[Figure 10-80-1]** and you hear three beeps from the alarm.

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

Figure 10-80-2

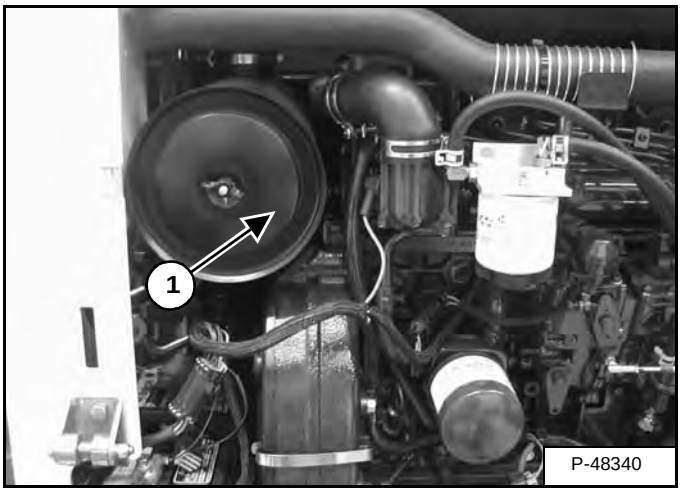


Press and hold the LIGHT Button (Item 1) **[Figure 10-80-2]** for two seconds.

If the filter element needs replacement, the CODE [01-17] (Air Filter Plugged) will show in the HOURMETER / CODE DISPLAY (Item 2) **[Figure 10-80-2]**.

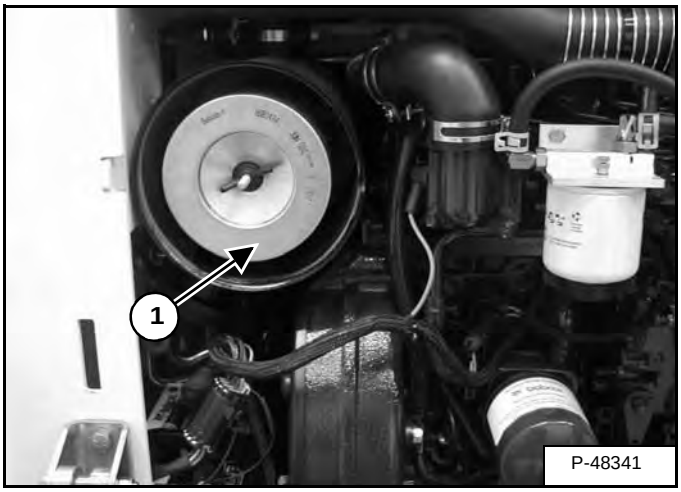
Outer Filter

Figure 10-80-3



Remove the wing nut and remove the dust cover (Item 1) **[Figure 10-80-3]**.

Figure 10-80-4



Remove the wing nut and pull the outer filter element (Item 1) **[Figure 10-80-4]** out and discard.

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

Install new filter. Push all the way in until it contacts the base of the housing. Install wing nut.

Install the dust cover and the wing nut **[Figure 10-80-3]**.

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

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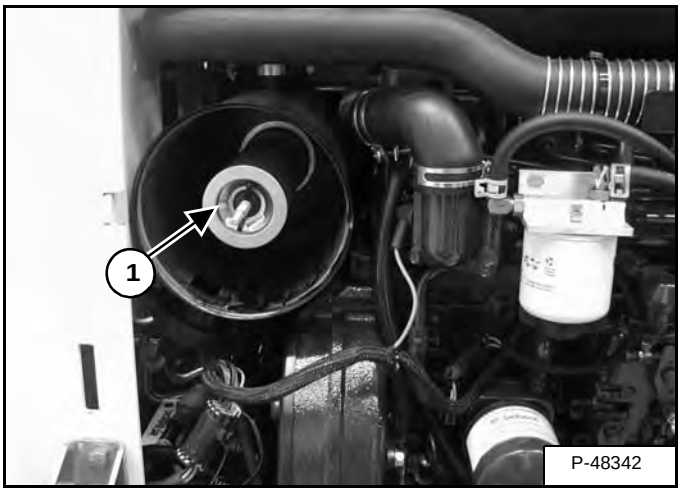
Replacing Filter Elements (Cont'd)

Inner Filter

Only replace the inner filter element under the following conditions:

- Replace the inner filter element every *third* time the outer filter is replaced.
- After the outer element has been replaced, start the engine and run at full RPM. If the HOURMETER / CODE DISPLAY shows [01-17] (Air Filter Plugged), replace the inner filter element.

Figure 10-80-5



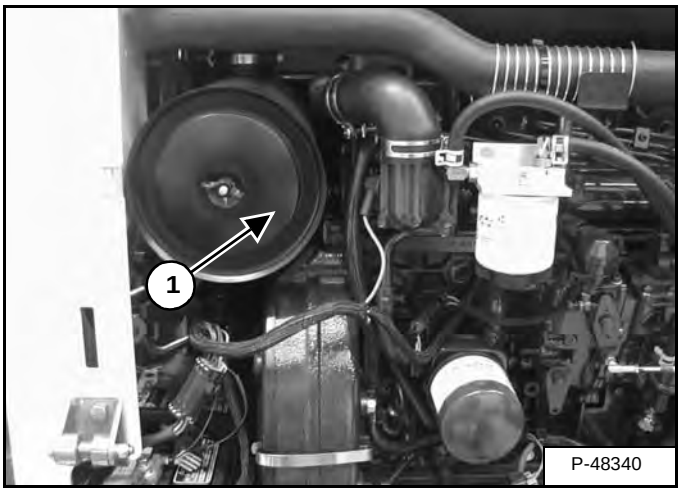
Remove the inner filter element (Item 1) **[Figure 10-80-5]**.

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

Install the new inner element **[Figure 10-80-5]**.

Install the outer element.

Figure 10-80-6



Install the dust cover and the wing nut **[Figure 10-80-6]** (Be sure the evacuator is down).

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ENGINE COOLING SYSTEM

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

⚠ 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.**

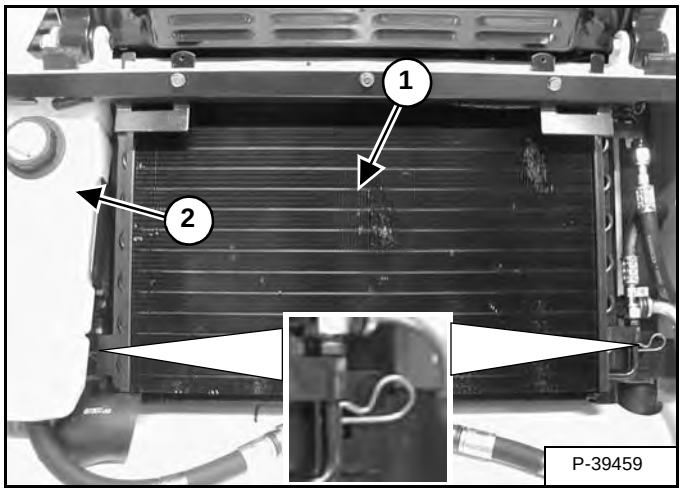
W-2019-0907

Cleaning

Open the rear door.

Remove the rear grill.

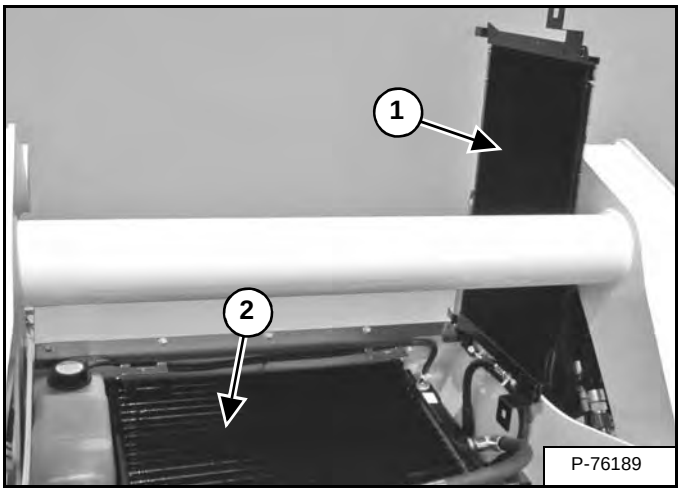
Figure 10-90-1



Use low air pressure or water pressure to clean the top of the air conditioning condenser (Item 1) **[Figure 10-90-1]**, if equipped.

Raise the overflow tank (Item 2) slightly and remove the two fasteners (Inset) **[Figure 10-90-1]**.

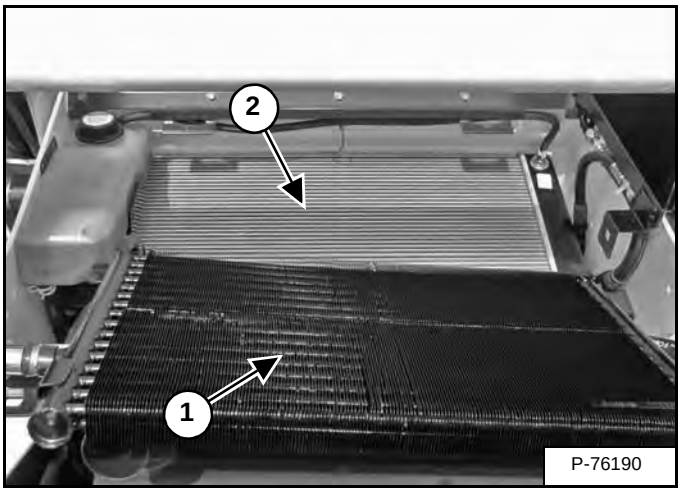
Figure 10-90-2



NOTE: Be careful when raising and lowering the air conditioning condenser so that the air conditioning condenser does not fall on the oil cooler and damage the fins.

Raise the air conditioning condenser (Item 1) and use low air pressure or water pressure to clean the top of the oil cooler (Item 2) **[Figure 10-90-2]**.

Figure 10-90-3



NOTE: Be careful when raising and lowering the oil cooler so that the oil cooler does not fall on the radiator and damage the fins.

Raise the oil cooler (Item 1) and use low air pressure or water pressure to clean the top of the radiator (Item 2) **[Figure 10-90-3]**.

Lower the oil cooler.

Lower the air conditioning condenser, if equipped.

Install the fasteners and lower the overflow tank. Check the cooling system for leaks.

Install the rear grill and close the rear door.

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Checking Level

Remove the rear grill.

Remove the coolant fill cap (Item 1) **[Figure 10-90-5]**. Check coolant level. The level markers are on the tank. Coolant must be at the bottom marker when the engine is cold; top marker when hot.

Install the rear grill and close the rear door.

IMPORTANT

AVOID ENGINE DAMAGE

Always use the correct ratio of water to antifreeze.

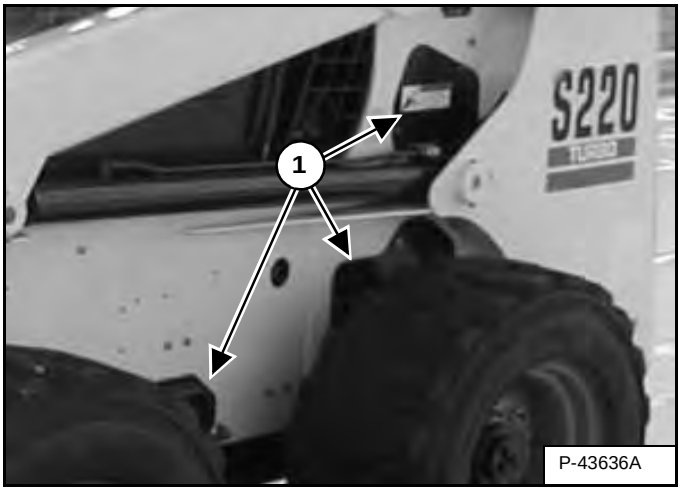
Too much antifreeze reduces cooling system efficiency and may cause serious premature engine damage.

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

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

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Figure 10-90-4

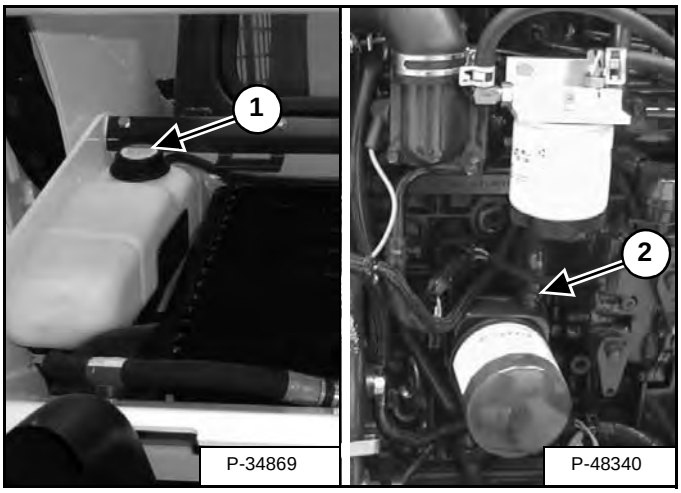


NOTE: All access covers (Item 1) [Figure 10-90-4] (both sides) must be in place to ensure correct air flow through the oil cooler which will ensure proper cooling for the engine and hydraulic systems.

Removing And Replacing Coolant

Remove the rear grill.

Figure 10-90-5



Remove the coolant fill cap (Item 1) **[Figure 10-90-5]**.

Disconnect the hose from the engine block to the oil filter cooler (Item 2) **[Figure 10-90-5]**. Drain the coolant into a container. Recycle or dispose of coolant in an environmentally safe manner.

Mix new coolant in a separate container. (See Capacities on Page SPEC-10-4.)

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

Add premixed coolant, 47% water and 53% propylene glycol to the recovery tank. (See Checking Level on Page PM-2.)

One gallon and one pint (4,3 L) of propylene glycol mixed with one gallon (3,8 L) of water is the correct mixture of coolant to provide a -34°F (-37°C) freeze protection.

Fill the tank until it is at the lower marker on the tank.

Use a refractometer to check the condition of propylene glycol in your cooling system and replace the coolant fill cap.

NOTE: When installing the coolant fill cap, the cap must be tightened until it clicks.

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

Install the rear grill and close the rear door.

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FUEL SYSTEM

Fuel Specifications

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

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

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

The following fuels may be used in this machine:

- Low Sulfur (500 ppm sulfur) Diesel Fuel.
- Ultra Low Sulfur (15 ppm sulfur) Diesel Fuel.
- 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

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

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Biodiesel Blend Fuel

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

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

Apply the following guidelines if biodiesel blend fuel is used:

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

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

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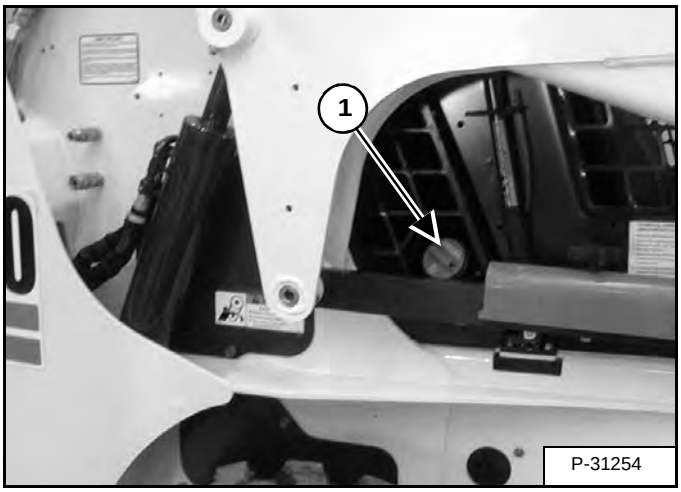
Filling The Fuel Tank

WARNING

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

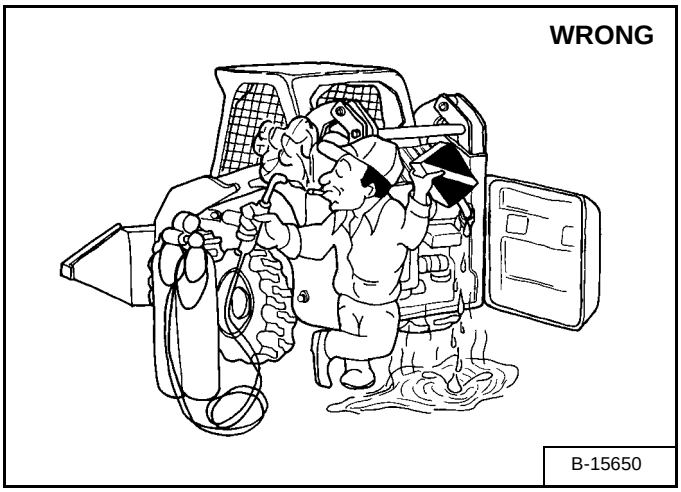
W-2063-0807

Figure 10-100-1



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

Figure 10-100-2



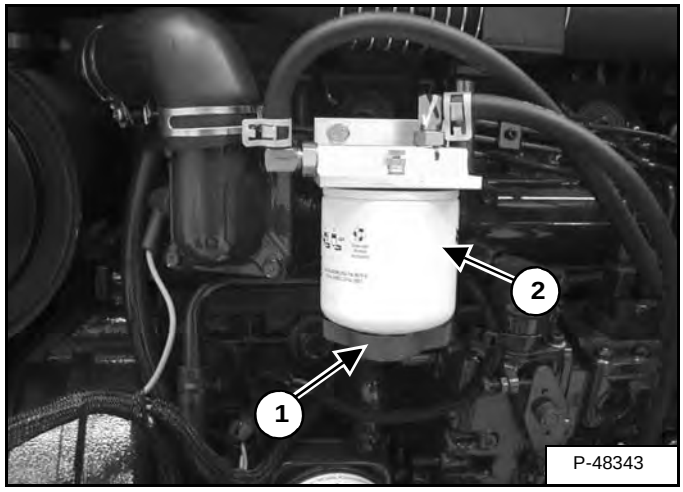
Use a clean, approved safety container to add fuel of the correct specification. Add fuel only in an area that has free movement of air and no open flames or sparks *NO SMOKING* **[Figure 10-100-2]**.

Install and tighten the fuel cap (Item 1) **[Figure 10-100-1]**.

Fuel Filter

For the service interval for removing water from, or replacing the fuel filter (See SERVICE SCHEDULE on Page 10-70-1.)

Figure 10-100-3



Loosen the drain (Item 1) **[Figure 10-100-3]** at the bottom of the filter element to remove water from the filter.

Remove the filter element (Item 2) **[Figure 10-100-3]**.

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

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

WARNING

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

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Removing Air From The Fuel System

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

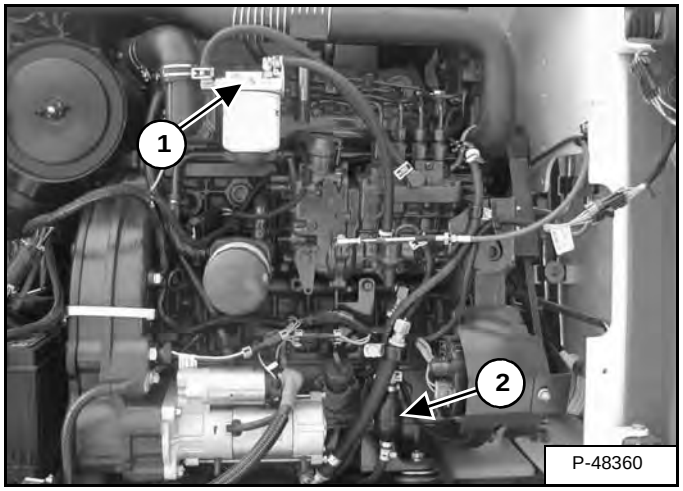
⚠ WARNING

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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Figure 10-100-4



Open the vent (Item 1) **[Figure 10-100-4]** on the fuel filter housing.

Squeeze the hand pump (priming bulb) (Item 2) **[Figure 10-100-4]** until fuel flows from the vent with no air bubbles.

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

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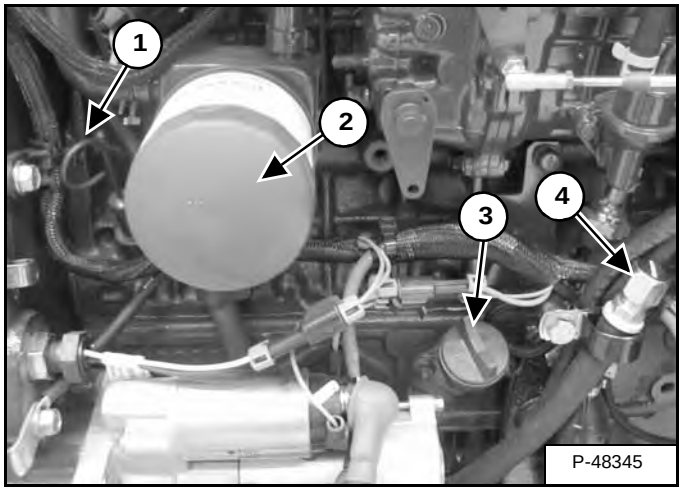
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ENGINE LUBRICATION SYSTEM

Checking And Adding Engine Oil

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

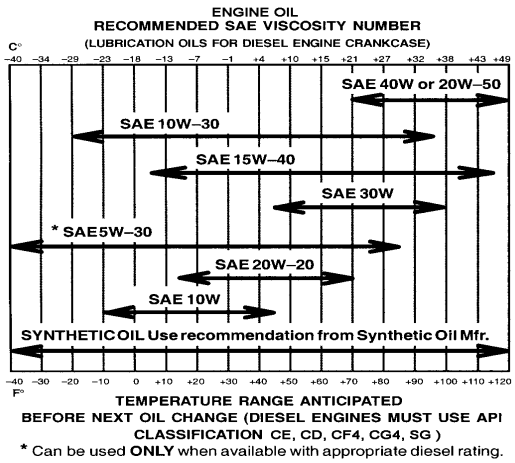
Figure 10-110-1



Park the machine on level ground. Open the rear door and remove the dipstick (Item 1) **[Figure 10-110-1]**.

Keep the oil level between the marks on the dipstick. Do not overfill.

Engine Oil Chart



Use good quality motor oil that meets API Service Classification of CD or better (See Oil Chart, above).

Install the dipstick and close the rear door.

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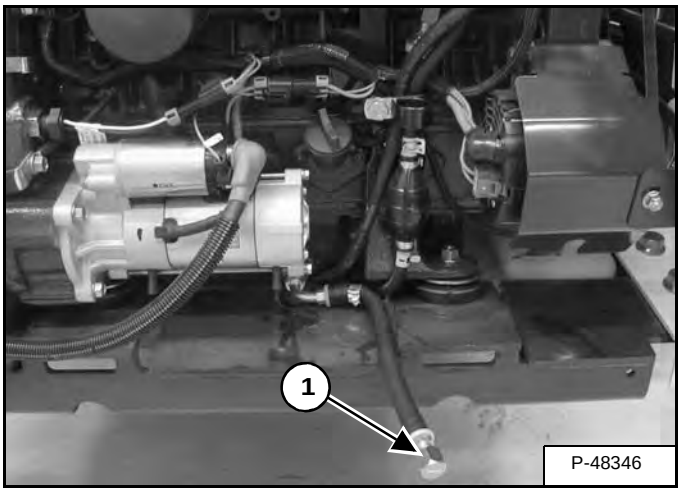
Removing And Replacing Oil And Filter

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

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

Open the rear door and remove the drain hose from its storage position (Item 4) **[Figure 10-110-1]**.

Figure 10-110-2



Remove the drain plug (Item 1) **[Figure 10-110-2]** and drain the oil into a container and recycle or dispose of used oil in an environmentally safe manner.

Remove the oil filter (Item 2) **[Figure 10-110-1]** and clean the filter housing surface.

Put oil on the new filter gasket, install the filter and hand tighten.

Install and tighten the drain plug.

Remove the fill cap (Item 3) **[Figure 10-110-1]**.

Put oil in the engine. (See Capacities on Page SPEC-10-4), for the correct quantity. Do not overfill.

Start the engine and let it run for several minutes. Stop the engine and check for leaks at the filter.

Remove the dipstick (Item 1) **[Figure 10-110-1]** and check the oil level.

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

Install the dipstick and close the rear door.

⚠ WARNING

AVOID INJURY OR DEATH

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

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HYDRAULIC / HYDROSTATIC SYSTEM

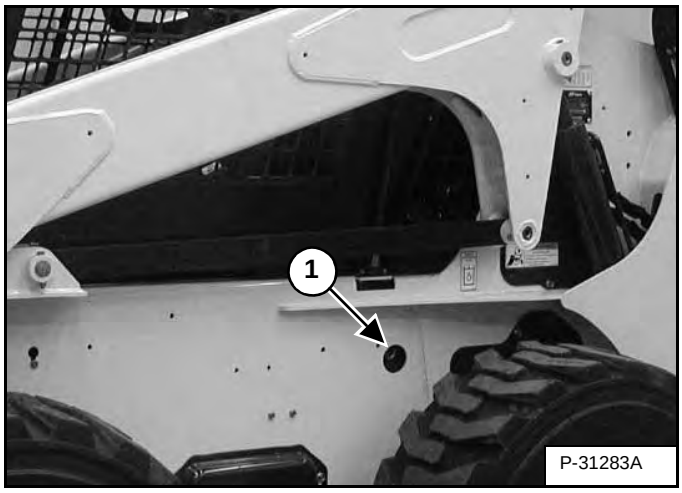
Checking And Adding Fluid

Use only recommended fluid in the hydraulic system. (See Specifications on Page SPEC-40-1.) and **[Figure 10-120-3]**.

Put the loader on a level surface, lower the lift arms and tilt the Bob-Tach fully back.

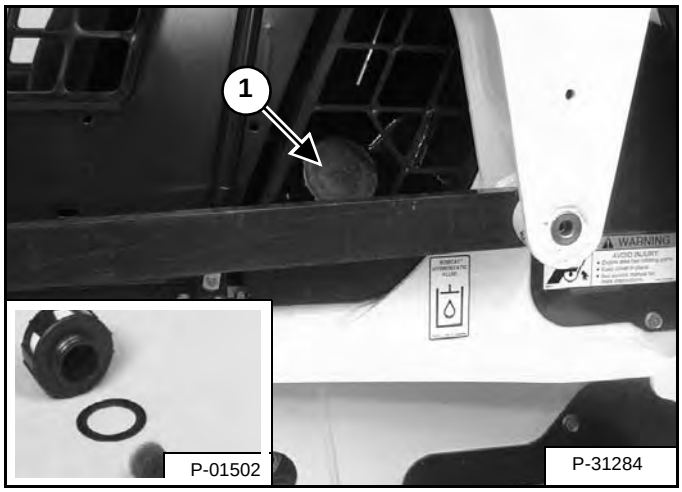
Stop the engine.

Figure 10-120-1



Check the fluid level in the sight gauge (Item 1) **[Figure 10-120-1]**.

Figure 10-120-2



Remove the fill cap (Item 1) **[Figure 10-120-2]**.

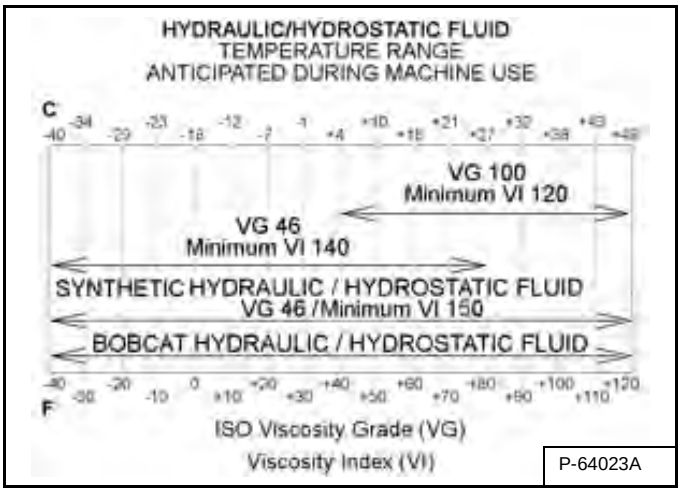
Add fluid as needed to bring the level to the center of the sight gauge.

NOTE: Before installing the fill cap, make sure the rubber gasket is installed on fill cap (Inset) [Figure 10-120-2].

Install the fill cap **[Figure 10-120-2]**.

Hydraulic / Hydrostatic Fluid Chart

Figure 10-120-3



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Removing And Replacing Hydraulic Fluid

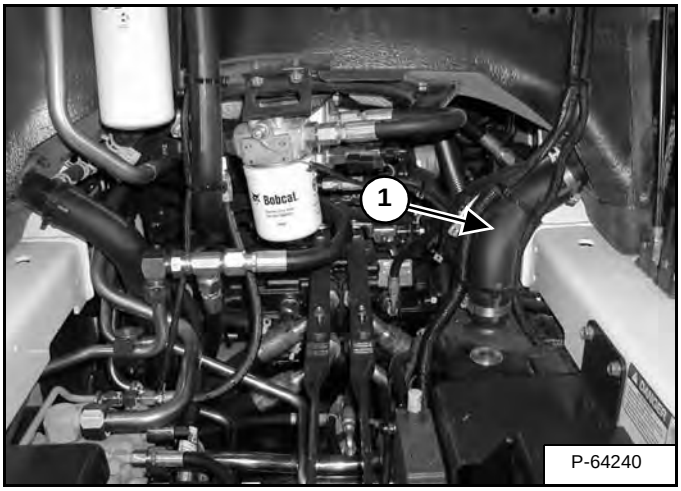
See your SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-70-1.)

Replace the fluid if it becomes contaminated or after major repair.

Always replace the hydraulic / hydrostatic filter, the case drain filters and the hydraulic charge filter whenever the hydraulic fluid is replaced. (See Removing And Replacing Hydraulic / Hydrostatic Filter on Page 10-120-3.)

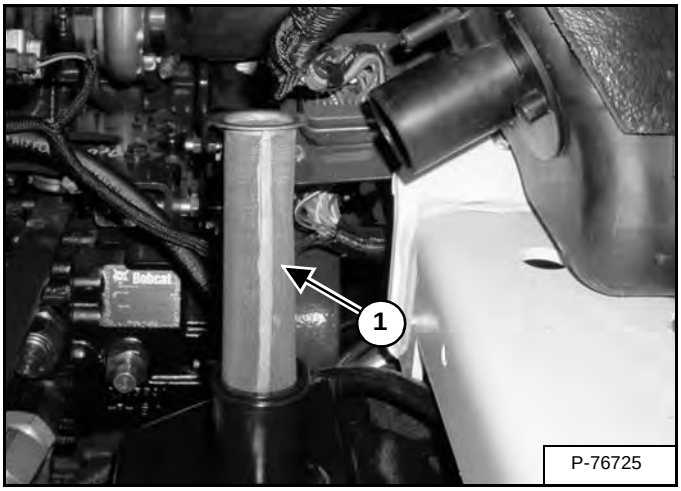
Remove the fill cap and raise the operator cab. (See Raising on Page 10-30-1.)

Figure 10-120-4



Remove the two hose clamps and remove the hose (Item 1) **[Figure 10-120-4]**.

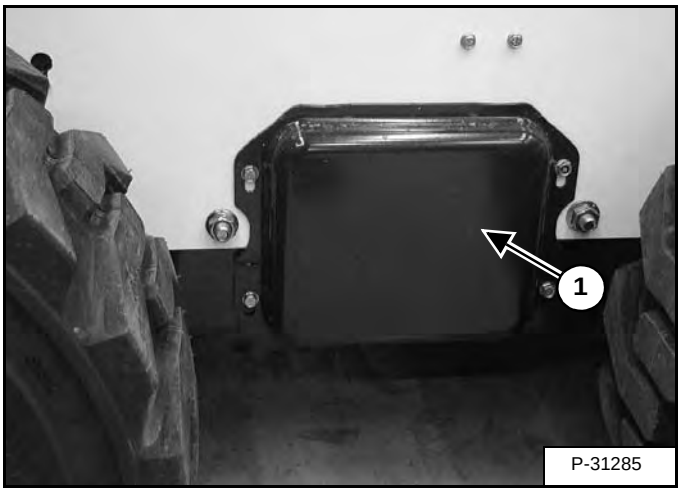
Figure 10-120-5



Remove and clean the hydraulic fill screen (Item 1) **[Figure 10-120-5]**. Use low air pressure to dry the screen.

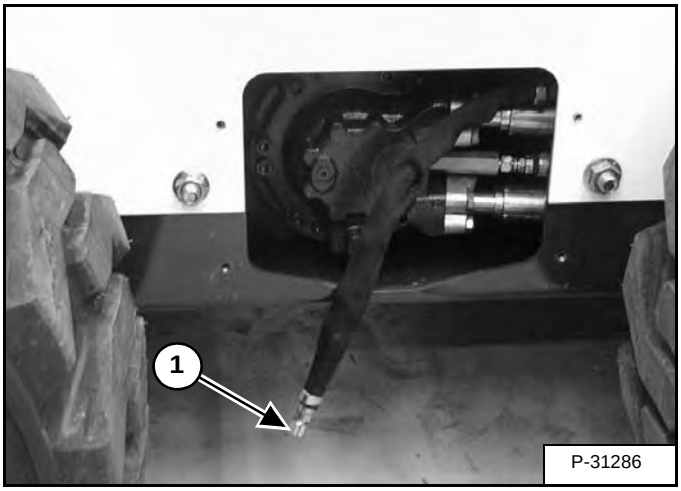
Install screen, hose and hose clamps.

Figure 10-120-6



Remove the hydrostatic motor cover (Item 1) **[Figure 10-120-6]**. (Left Side)

Figure 10-120-7



Pull the reservoir drain hose out the left motor cover hole. Remove the plug (Item 1) **[Figure 10-120-7]** and drain the fluid into a container.

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

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Removing And Replacing Hydraulic Fluid (Cont'd)

WARNING

AVOID INJURY OR DEATH

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

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Install the plug in the reservoir drain hose and tighten. Install the motor cover.

Lower the operator cab. (See Lowering on Page 10-30-2.)

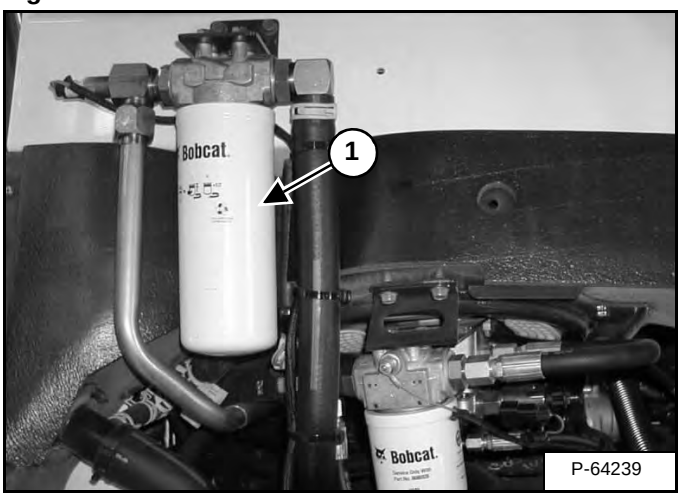
Add the correct fluid to the reservoir until the fluid level is at the center of the sight gauge. (See Checking And Adding Fluid on Page 10-120-1.)

Removing And Replacing Hydraulic / Hydrostatic Filter

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

Raise the operator cab. (See Raising on Page 10-30-1.)

Figure 10-120-8



Remove the filter (Item 1) **[Figure 10-120-8]**.

Clean the surface of the filter housing where the filter seal contacts the housing.

Put clean oil on the seal of the new filter element. Install and hand tighten the filter element.

WARNING

AVOID INJURY OR DEATH

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

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Lower the operator cab. (See Lowering on Page 10-30-2.)

Start the engine and operate the loader hydraulic controls.

Stop the engine and check for leaks at the filter.

Check the fluid level in the reservoir and add as needed. (See Checking And Adding Fluid on Page 10-120-1.)

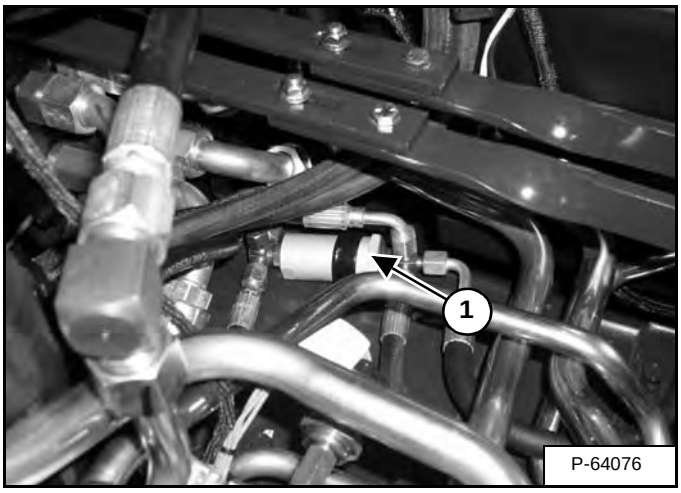
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Removing And Replacing Case Drain Filters

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

Raise the operator cab. (See Raising on Page 10-30-1.)

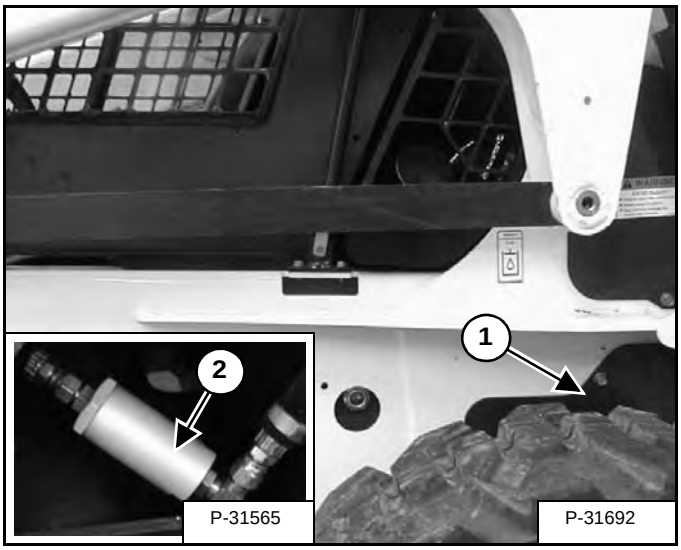
Figure 10-120-9



Disconnect the hoses and fittings from the hydrostatic motor case drain filter (Item 1) **[Figure 10-120-9]**. Remove the mounting clamp and discard the filter.

Install fittings on new filter, install new filter, install the mounting clamp, connect and tighten the hoses.

Figure 10-120-10



Remove the left lower side cover (Item 1) **[Figure 10-120-10]**.

Disconnect the hoses and fittings from the attachment case drain filter (Item 2) **[Figure 10-120-10]**. Remove and discard the filter.

Install fittings on new filter, install new filter, connect and tighten the hoses and install the left lower side cover.

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

Lower the operator cab. (See Lowering on Page 10-30-2.)

Start the engine and operate the loader hydraulic controls.

Stop the engine and check for leaks at the filters.

Check the fluid level in the reservoir and add as needed. (See Checking And Adding Fluid on Page 10-120-1.)

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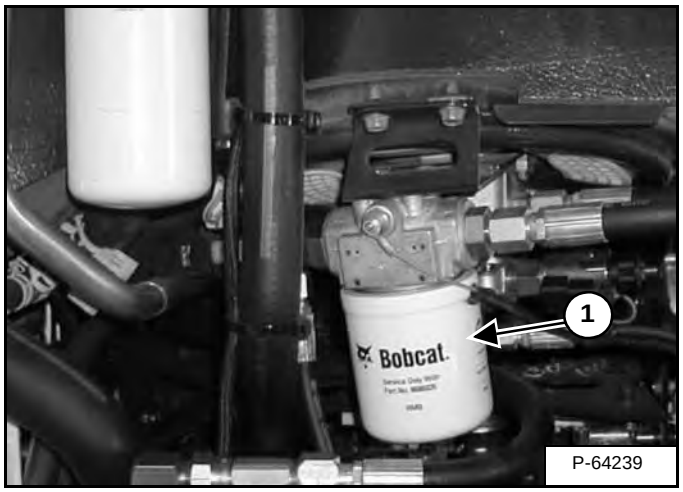
Removing And Replacing Hydraulic Charge Filter

The hydraulic charge filter is located under the cab. For the correct service interval (See SERVICE SCHEDULE on Page 10-70-1.)

Raise the cab. (See Raising on Page 10-30-1.)

Earlier Models

Figure 10-120-11



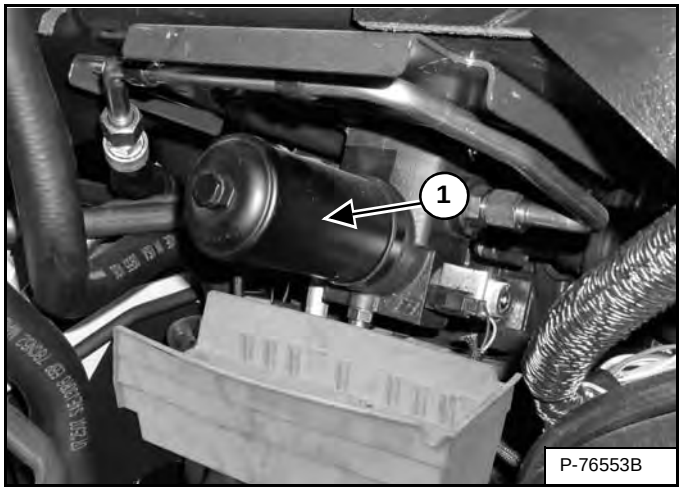
Remove the filter (Item 1) **[Figure 10-120-11]**.

Clean the surface of the filter housing where the filter seal contacts the housing.

Put clean oil on the seal of the new filter. Install and hand tighten the new filter.

Later Models

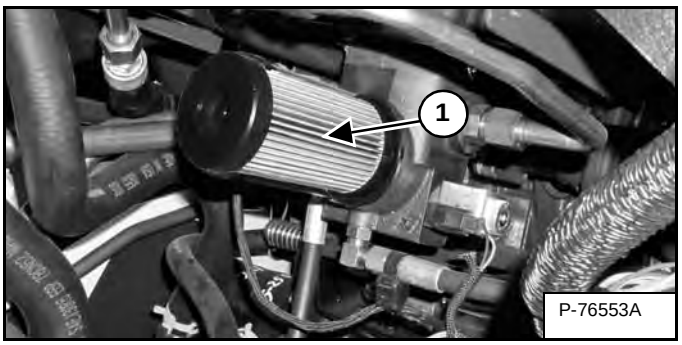
Figure 10-120-12



Place a suitable container below the filter housing and remove the filter housing (Item 1) **[Figure 10-120-12]**.

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

Figure 10-120-13



Remove and discard the filter element (Item 1) **[Figure 10-120-13]**.

Clean the surface of the filter housing and the filter base where they contact the filter element seal.

Put clean oil on the seal of the new filter element. Install the element on the filter base. Install and tighten the filter housing to 35-40 ft.-lb. (47-54 N•m) torque.

All Models

WARNING

AVOID INJURY OR DEATH

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

W-2103-0508

WARNING

AVOID INJURY OR DEATH

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

Lower the cab. (See Lowering on Page 10-30-2.)

Start the engine and operate the loader hydraulic controls.

Stop the engine and check for leaks at the filter.

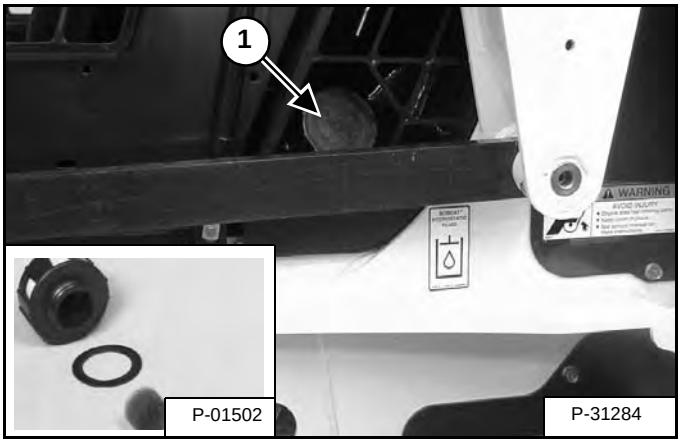
Check the fluid level in the reservoir and add as needed. (See Checking And Adding Fluid on Page 10-120-1.)

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Breather Cap

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

Figure 10-120-14



Remove the breather cap (Item 1) **[Figure 10-120-14]** and discard.

Install new breather cap.

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2072-0807

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FINAL DRIVE TRANSMISSION (CHAINCASE)

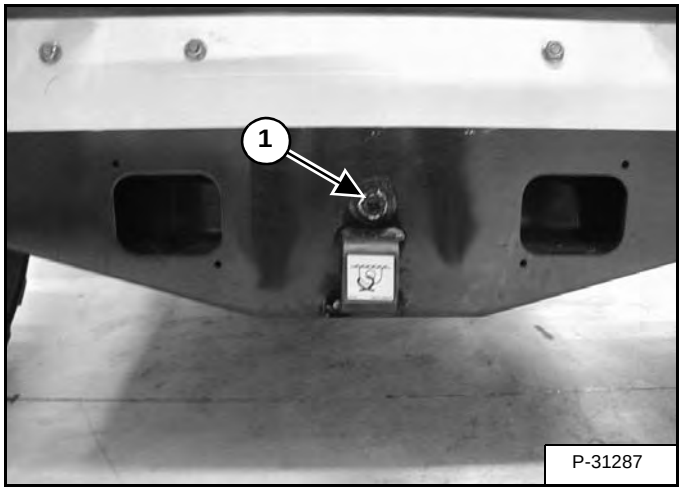
Checking And Adding Oil

The chaincase contains the final drive sprockets and chains and uses the same type of oil as the hydraulic/ hydrostatic system. (See Hydraulic System on Page SPEC-10-3.)

Stop the loader on a level surface.

Stop the engine.

Figure 10-130-1



Remove the drain plug (Item 1) **[Figure 10-130-1]** from the front of the chaincase housing.

If oil can be reached with the tip of your finger through the hole, the oil level is correct.

If the level is low, add oil through the check plug hole until the oil flows from the hole.

Install and tighten the plug.

Removing And Replacing Oil

Remove the check plug (Item 1) **[Figure 10-130-1]** from the front of the chaincase housing.

Figure 10-130-2



Use a pump to suction the oil from the chaincase **[Figure 10-130-2]**

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

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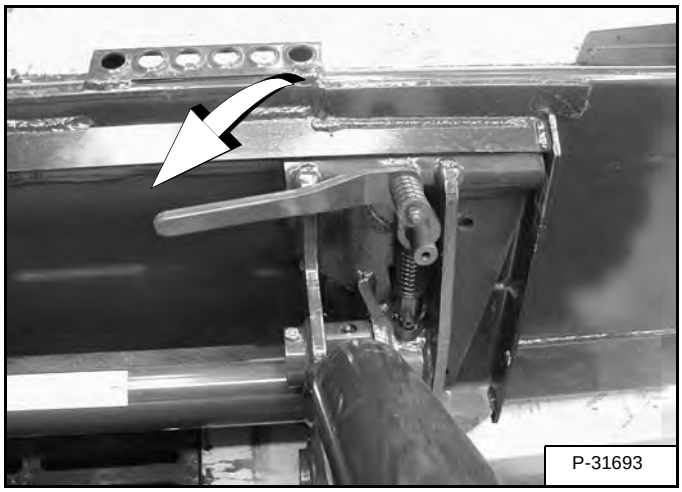


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BOB-TACH (HAND LEVER)

Inspection And Maintenance

Figure 10-140-1



Move the Bob-Tach levers down to engage the wedges **[Figure 10-140-1]**.

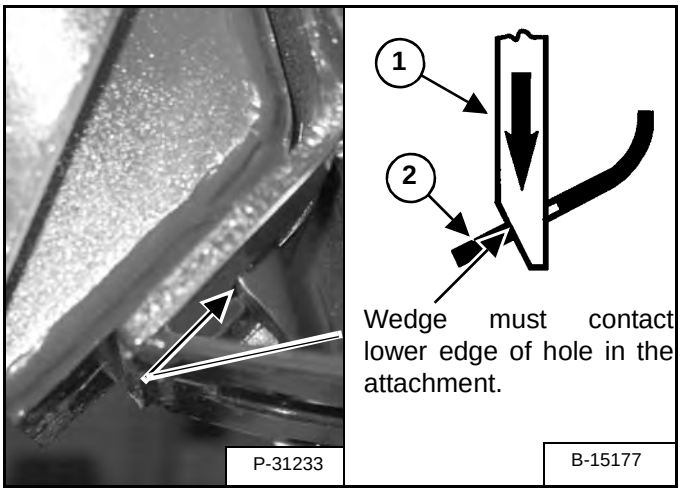
The levers and wedges must move freely.

⚠ WARNING

Bob-Tach wedges must extend through the holes in attachment. Lever(s) must be fully down and locked. Failure to secure wedges can allow attachment to come off and cause injury or death.

W-2102-0497

Figure 10-140-2

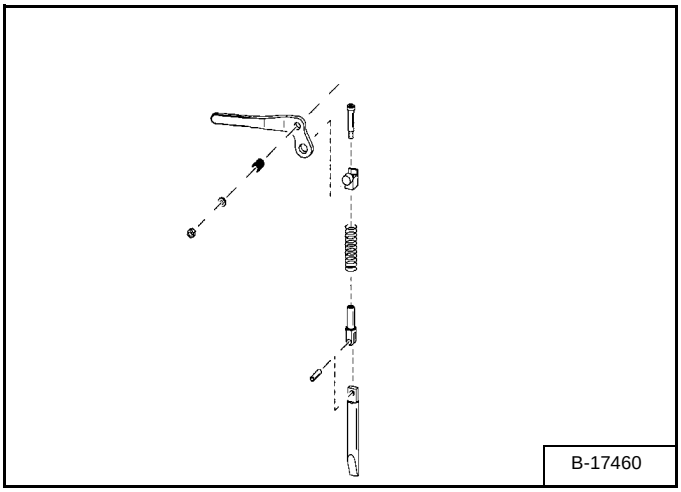


The wedges (Item 1) **[Figure 10-140-2]** must extend through the holes in the attachment mounting frame.

The spring loaded wedge (Item 1) must contact the lower edge of the hole in the attachment (Item 2) **[Figure 10-140-2]**.

If the wedge does not contact the lower edge of the hole **[Figure 10-140-2]**, the attachment will be loose and can come off the Bob-Tach.

Figure 10-140-3



Inspect the mounting frame on the attachment and Bob-Tach, linkages and wedges for excessive wear or damage **[Figure 10-140-3]**. Replace any parts that are damaged, bent or missing. Keep all fasteners tight.

Look for cracked welds. Contact your Bobcat dealer for repair or replacement parts.

Lubricate the wedges. (See SERVICE SCHEDULE on Page 10-70-1) and (See Lubrication Locations on Page 10-150-1.)

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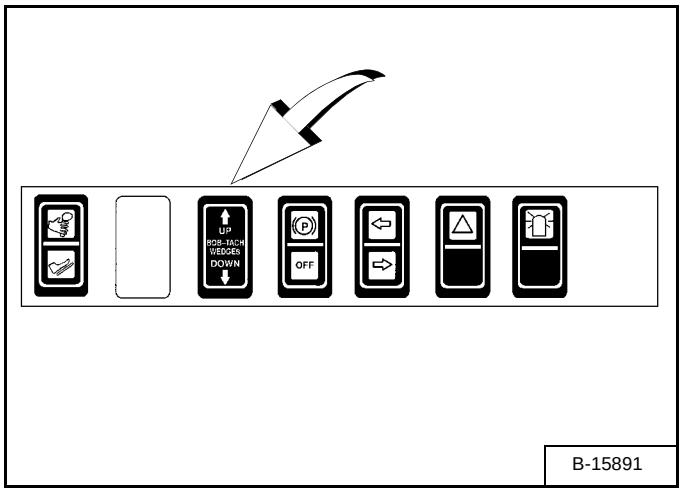
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BOB-TACH (POWER - OPTION)

Inspection And Maintenance

This machine may be equipped with a Power Bob-Tach.

Figure 10-141-1



Push and hold the BOB-TACH “WEDGES UP” switch **[Figure 10-141-1]** until wedges are fully raised. Push and hold the BOB-TACH “WEDGES DOWN” switch **[Figure 10-141-1]** until the wedges are fully down.

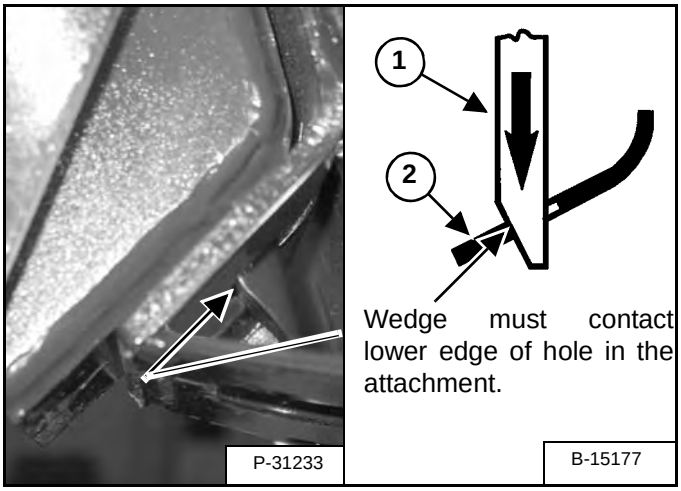
The levers and wedges must move freely.

⚠ WARNING

Bob-Tach wedges must extend through the holes in attachment. Lever(s) must be fully down and locked. Failure to secure wedges can allow attachment to come off and cause injury or death.

W-2102-0497

Figure 10-141-2

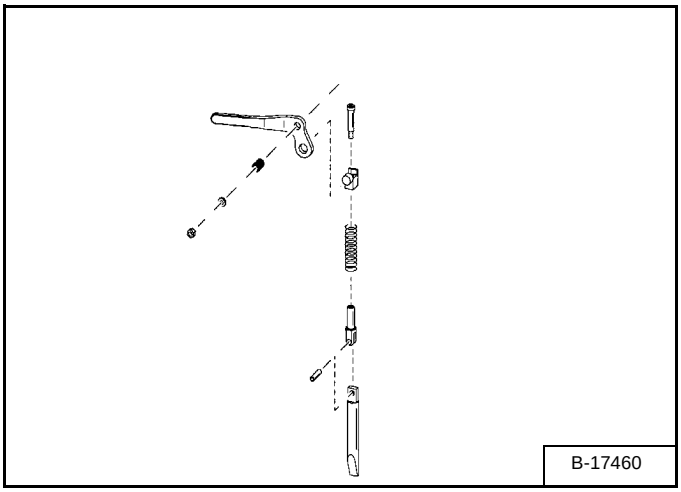


The wedges must extend through the holes in the attachment mounting frame (Item 1) **[Figure 10-141-2]**.

The spring loaded wedge (Item 1) must contact the lower edge of the hole in the attachment (Item 2) **[Figure 10-141-2]**.

If the wedge does not contact the lower edge of the hole **[Figure 10-141-2]**, the attachment will be loose and can come off the Bob-Tach.

Figure 10-141-3



Inspect the mounting frame on the attachment and the Bob-Tach, linkages and wedges for excessive wear or damage **[Figure 10-141-3]**. Replace any parts that are damaged, bent, or missing. Keep all fasteners tight.

Look for cracked welds. Contact your Bobcat dealer for repair or replacement parts.

Lubricate the wedges. (See SERVICE SCHEDULE on Page 10-70-1.) and (See Lubrication Locations on Page 10-150-1.)

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LUBRICATING THE LOADER

Lubrication Locations

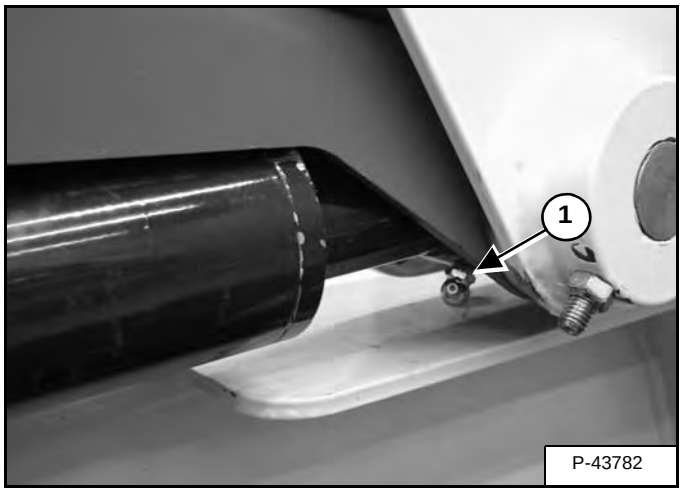
Lubricate the loader as specified for the best performance of the loader. (See SERVICE SCHEDULE on Page 10-70-1.)

Record the operating hours each time you lubricate the Bobcat loader.

Always use a good quality lithium based multi-purpose grease when you lubricate the loader. Apply the lubricant until extra grease shows.

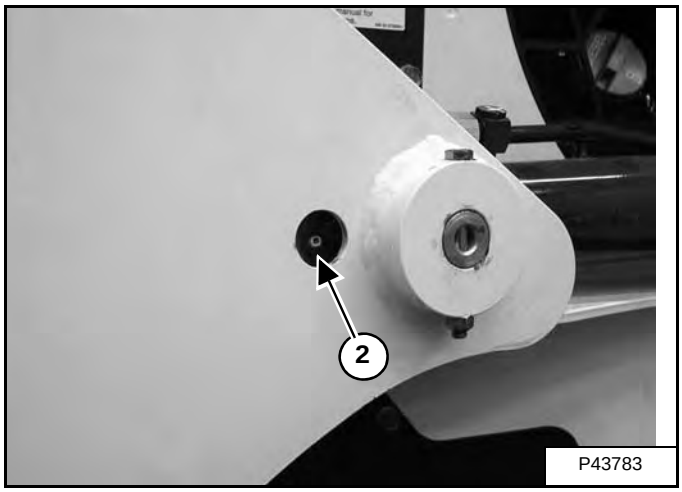
Lubricate the following:

Figure 10-150-1



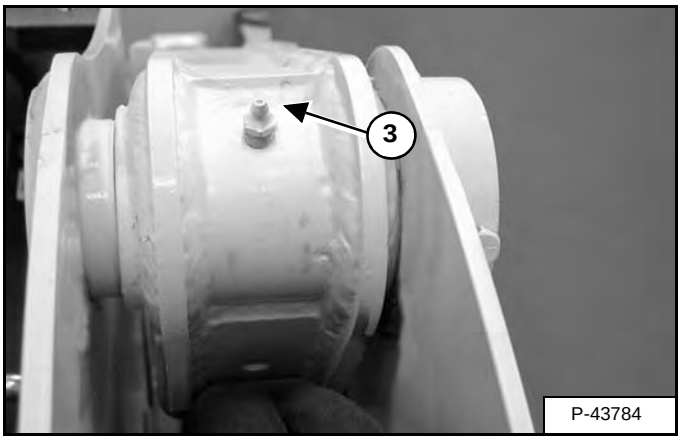
1. Rod End Lift Cylinder (Both Sides) **[Figure 10-150-1]**.

Figure 10-150-2



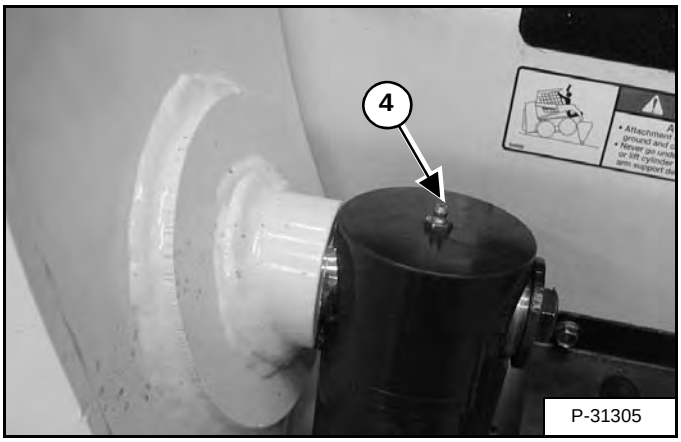
2. Base End Lift Cylinder (Both Sides) **[Figure 10-150-2]**.

Figure 10-150-3



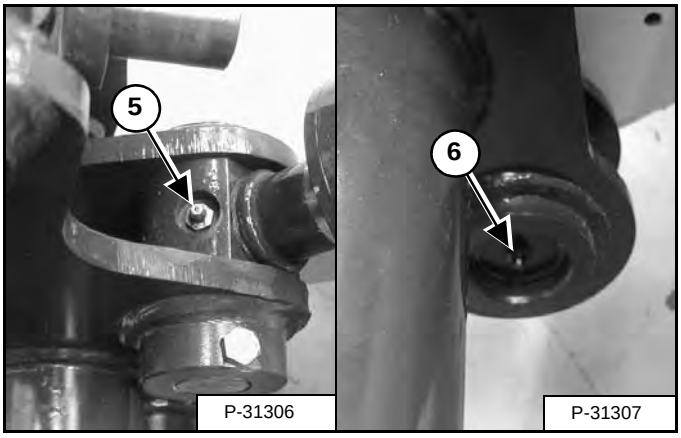
3. Lift Arm Pivot Pin (Both Sides) **[Figure 10-150-3]**.

Figure 10-150-4



4. Base End Tilt Cylinder (Both Sides) **[Figure 10-150-4]**.

Figure 10-150-5

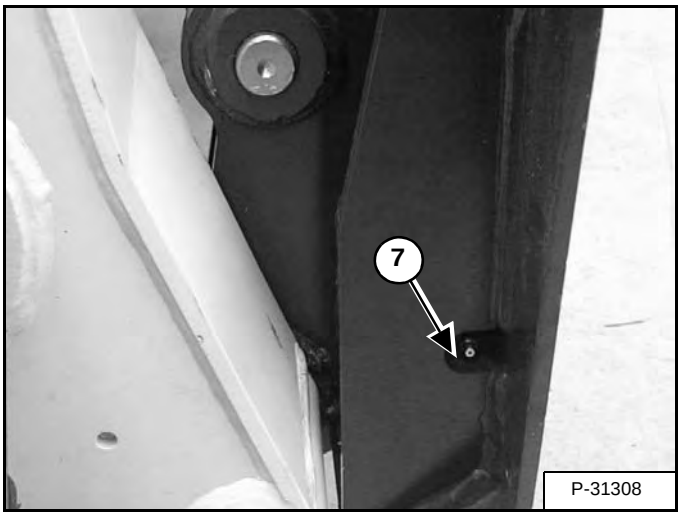


5. Rod End Tilt Cylinder (Both Sides) **[Figure 10-150-5]**.
6. Bob-Tach Pivot Pin (Both Sides) **[Figure 10-150-5]**.

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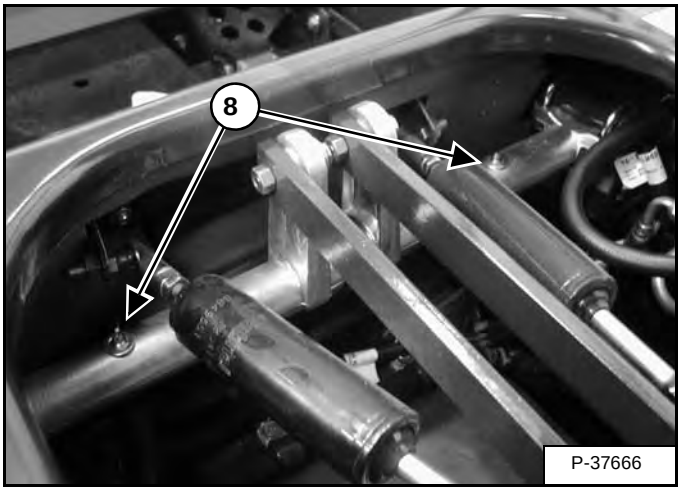
Lubrication Locations (Cont'd)

Figure 10-150-6



7. Bob-Tach Wedge (Both Sides) **[Figure 10-150-6]**.

Figure 10-150-7



8. 250 Hours: Steering Lever Shaft (2) **[Figure 10-150-7]**.

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TIRE MAINTENANCE

Wheel Nuts

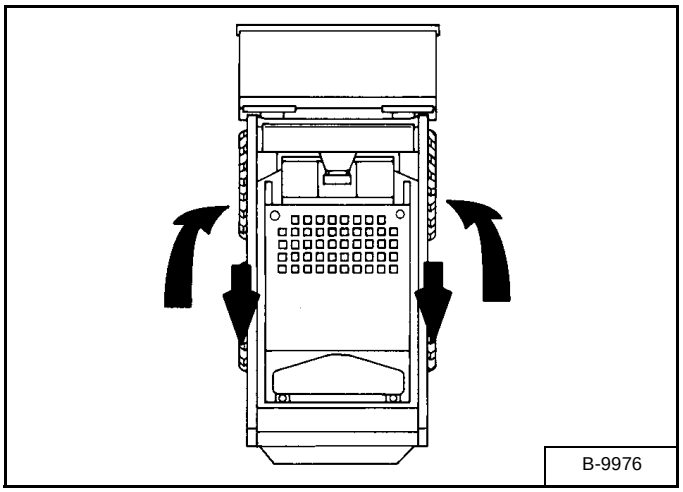
Figure 10-160-1



For the service interval to check the wheel nuts **[Figure 10-160-1]** (See SERVICE SCHEDULE on Page 10-70-1.) The correct torque is 105-115 ft.-lb. (142-156 N•m) torque.

Rotating

Figure 10-160-2



Check the tires regularly for wear, damage and pressure. (See Tires on Page SPEC-10-4.)

Rear tires usually wear faster than front tires. To keep tire wear even, move the front tires to the rear and rear tires to the front **[Figure 10-160-2]**.

It is important to keep the same size tires on each side of the loader. If different sizes are used, each tire will be turning at a different rate and cause excessive wear. The tread bars of all the tires must face the same direction.

Recommended tire pressure must be maintained to avoid excessive tire wear and loss of stability and handling capability. Check for the correct pressure before operating the loader.

⚠ WARNING

AVOID INJURY OR DEATH

Do not inflate tires above specified pressure. Failure to use correct tire mounting procedure can cause an explosion which can result in injury or death.

W-2078-1007

IMPORTANT

Inflate tires to the MAXIMUM pressure shown on the sidewall of the tire. DO NOT mix brands of tires used on the same loader.

I-2057-0794

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Mounting

Tires are to be repaired only by an authorized person using the proper procedures and safety equipment. Tires and rims must always be checked for correct size before mounting. Check rim and tire bead for damage.

The rim flange must be cleaned and free of rust. The tire bead and rim flange must be lubricated with a rubber lubricant before mounting the tire, avoid excessive pressure which can rupture the tire and cause serious injury or death. During inflation of the tire, check the tire pressure frequently to avoid over inflation.

⚠ WARNING

AVOID INJURY OR DEATH

Do not inflate tires above specified pressure. Failure to use correct tire mounting procedure can cause an explosion which can result in injury or death.

W-2078-1007

IMPORTANT

Inflate tires to the MAXIMUM pressure shown on the sidewall of the tire. DO NOT mix brands of tires used on the same loader.

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SPARK ARRESTOR MUFFLER

Cleaning Procedure

Use the correct service interval for cleaning the spark arrestor muffler. (See SERVICE SCHEDULE on Page 10-70-1.)

Do not operate the loader with a defective exhaust system.

IMPORTANT

This loader is factory equipped with a U.S.D.A. Forestry Service approved spark arrestor muffler. It is necessary to do maintenance on this spark arrestor muffler to keep it in working condition. The spark arrestor muffler must be serviced by dumping the spark chamber every 100 hours of operation.

If this machine is operated on flammable forest, brush or grass covered land, it must be equipped with a spark arrestor attached to the exhaust system and maintained in working order. Failure to do so will be in violation of California State Law, Section 4442 PRC.

Consult local laws and regulations for spark arrestor requirements

I-2022-0807

⚠ WARNING

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

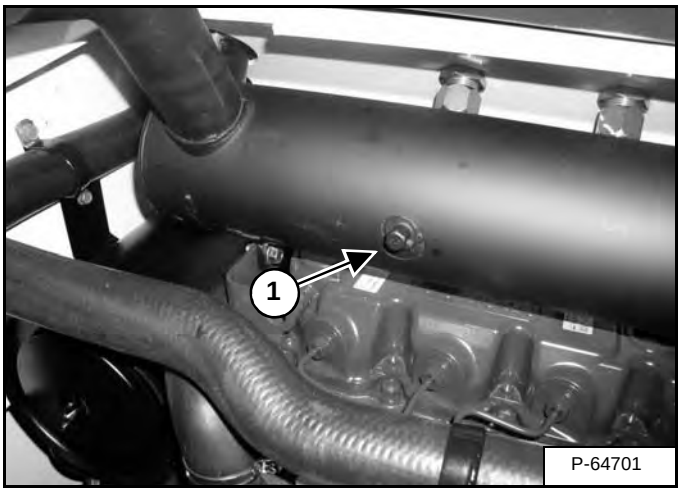
W-2011-1285

⚠ WARNING

When the engine is running during service, the steering levers must be in neutral and the parking brake engaged. Failure to do so can cause injury or death.

W-2006-0284

Figure 10-170-1



Stop the engine. Open the rear door.

Remove the plug (Item 1) **[Figure 10-170-1]** from the muffler.

Start the engine and run for about ten seconds while a second person, wearing safety glasses, holds a piece of wood over the outlet of the muffler.

This will force contaminants out through the cleanout hole.

Stop the engine.

Install and tighten the plug.

Close the rear door.

⚠ WARNING

AVOID INJURY OR DEATH

When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W-2050-0807

⚠ WARNING

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

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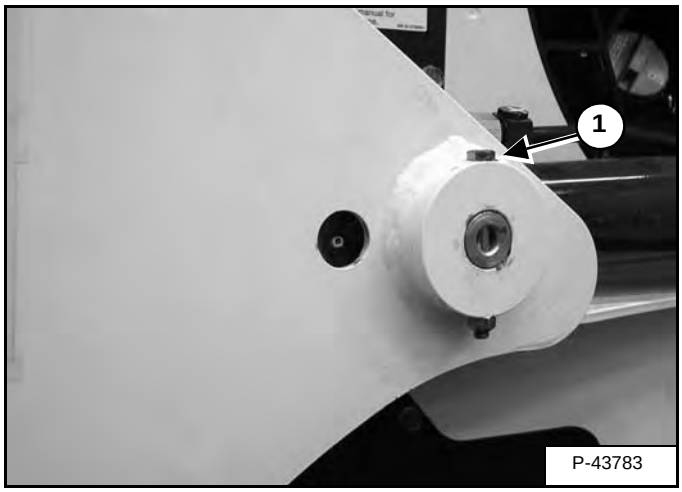


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PIVOT PINS

Inspection And Maintenance

Figure 10-180-1



All lift arm and cylinder pivots have a large pin held in position with a retainer bolt and lock nut (Item 1) **[Figure 10-180-1]**.

Check that the lock nuts are tightened to 35-40 ft.-lb. (48-54 N•m) torque.

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LOADER STORAGE AND RETURN TO SERVICE

Storage

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

- Thoroughly clean the loader including the engine compartment.
- Lubricate the loader.
- Replace worn or damaged parts.
- Park the loader in a dry protected shelter.
- Lower the lift arms all the way and put the bucket flat on the ground.
- Put blocks under the frame to remove weight from the tires.
- Put grease on any exposed cylinder rods.
- Put fuel stabilizer in the fuel tank and run the engine a few minutes to circulate the stabilizer to the pump and fuel injectors.
- Drain and flush the cooling system. Refill with premixed coolant.
- Replace all fluids and filters (engine, hyd. / hydro.).
- Replace air cleaner, heater and air conditioning filters.
- Put all controls in neutral position.
- Remove the battery. Be sure the electrolyte level is correct then charge the battery. Store it in a cool dry place above freezing temperatures and charge it periodically during storage.
- Cover the exhaust pipe opening.
- Tag the machine to indicate that it is in storage condition.

Return to Service

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

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

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STOPPING THE ENGINE AND LEAVING THE LOADER

Procedure

Figure 10-200-1

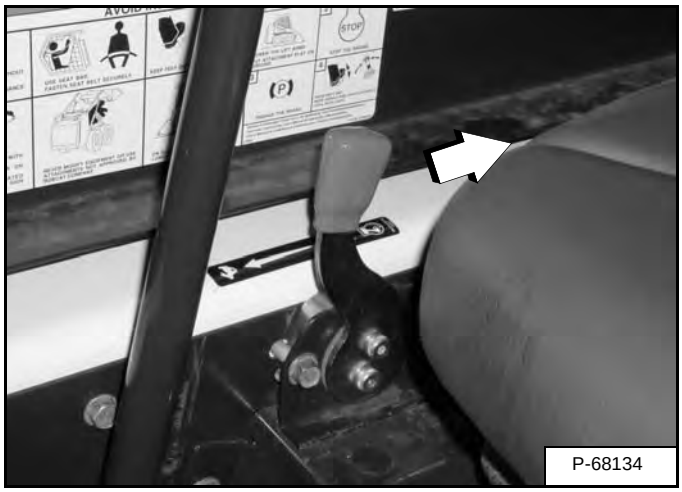


Stop the Bobcat Loader on level ground.

Lower the lift arms fully and put the attachment flat on the ground **[Figure 10-200-1]**.

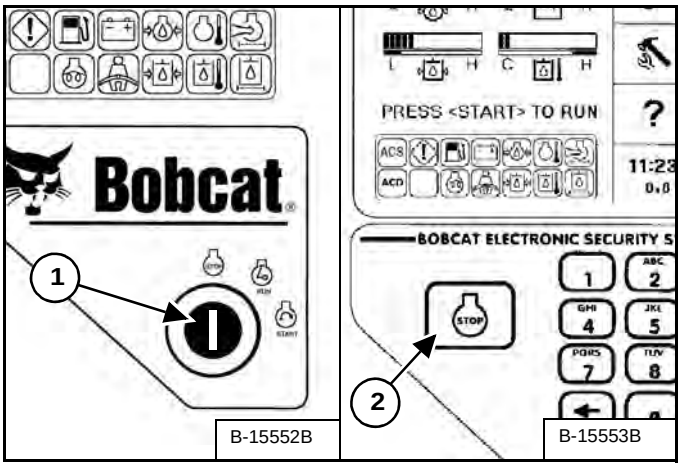
Exit the loader **[Figure 10-200-1]**.

Figure 10-200-2



Pull the engine speed control fully backward **[Figure 10-200-2]** to decrease the engine speed.

Figure 10-200-3



Engage the parking brake.

Turn the key switch (Item 1) to the STOP position (*Key Switch Panel*) *or* press the STOP Button (Item 2) **[Figure 10-200-3]** (*Keyless Panel*).

Lift the seat bar and make sure the lift and tilt functions are deactivated.

Unbuckle the seat belt.

Remove the key from the switch (*Key Switch*) to prevent operation of the loader by unauthorized personnel.

⚠ WARNING

Before you leave the operator's seat:

- **Lower the lift arms, put the attachment flat on the ground.**
- **Stop the engine.**
- **Engage the parking brake.**
- **Raise seat bar.**
- **(Foot Pedal Controls) Move pedals until both lock.**
- **(Advanced Control System-ACS) Move the hydraulic controls to the NEUTRAL POSITION to make sure that both lift and tilt functions are deactivated.**
  The seat bar system must deactivate the lift and tilt control functions when the seat bar is up. Service the system if hand controls do not deactivate.
- **(Selectable Joystick Controls-SJC) Move the joysticks to the NEUTRAL POSITION to make sure that travel and hydraulic functions are deactivated.**
  The seat bar system must deactivate these functions when the seat bar is up. Service the system if controls do not deactivate.

W-2463-0603

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STOPPING THE ENGINE AND LEAVING THE LOADER (CONT'D)

Emergency Exit

The front opening on the operator cab and rear window provide exits.

Rear Window (If Equipped)

Figure 10-200-4



Pull on the tag on the top of the rear window to remove the rubber cord **[Figure 10-200-4]**.

Push the rear window out of the rear of the operator cab.

Figure 10-200-5



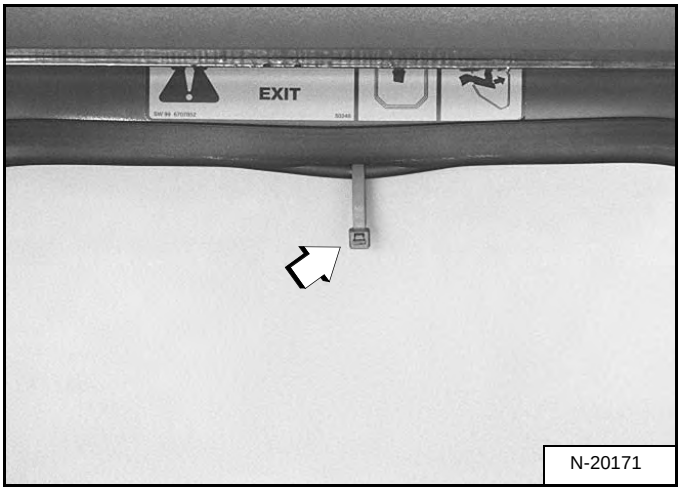
Exit through the rear of the operator cab **[Figure 10-200-5]**.

Front Door (If Equipped)

NOTE: When an Operator Cab Enclosure Kit is installed, the window of the front door can be used as an emergency exit. [Figure 10-200-6]

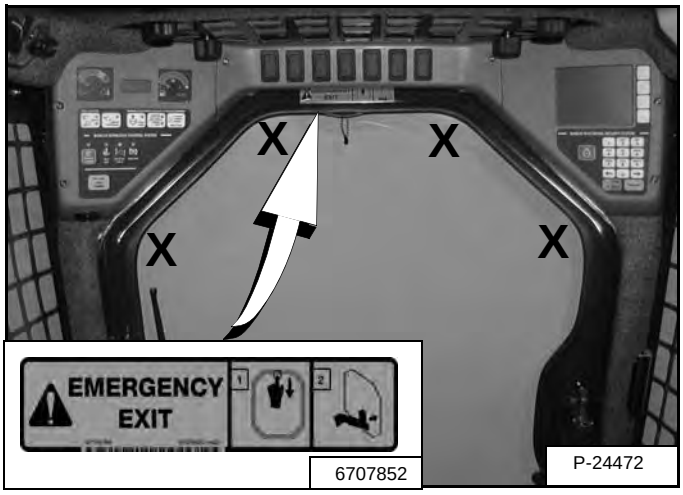
NOTE: If the loader has a Special Application Door Kit installed, the window of the front door is NOT an emergency exit.

Figure 10-200-6



Pull the plastic loop at the top of the window in the front door to remove the rubber cord **[Figure 10-200-6]**.

Figure 10-200-7



Push the window out with your foot **[Figure 10-200-7]** at any corner of the window.

Exit through the front door.

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HYDRAULIC SYSTEM

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- Description 20-71-1
- Direct Pump Test (Charge Section) 20-71-5
- Direct Pump Test (High Flow Section) 20-71-9
- Direct Pump Test (Standard Section) 20-71-3
- Disassembly And Assembly 20-71-21
- High Flow Relief Valve Adjustment 20-71-11
- High Flow Relief Valve Removal And Installation 20-71-14
- Hydraulic Pump Start Up 20-71-18
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TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.

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S220 (S/N 530711001 - 530740000)
(S/N 530811001 - 530840000)

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LEGEND

1. RESERVOIR:
   Capacity . . . . . 18.8 qt. (17,8 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   440 PSI (30,3 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   20.7 GPM (78,4 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    4000 PSI (276 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.031 inch (0,8 mm)
29. RELIEF VALVE: 3300 PSI (228 bar)
30. CHARGE PRESSURE SENSOR
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    200 PSI (13,8 bar)
38. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR
51. ANTICAVITATION VALVE
52. PROPORTIONAL RELIEF VALVE – (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)
53. CHARGE PUMP -
    13.6 GPM (51,5 L/min) at High Engine Idle
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice

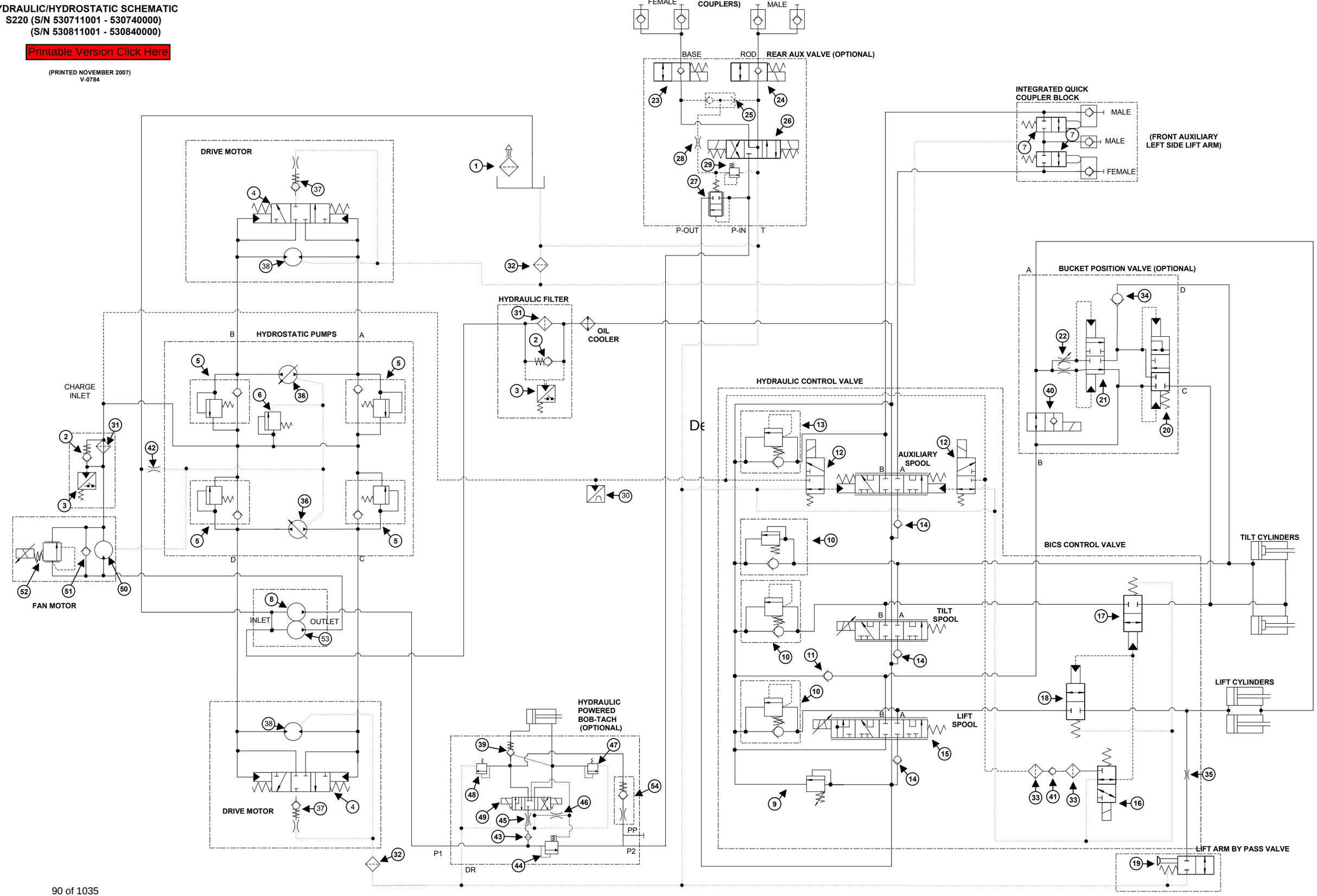
NOTE: Unless otherwise specified, springs have NO significant pressure value.

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(S/N 530811001 - 530840000)

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LEGEND

1. RESERVOIR:
   Capacity . . . . . 18.8 qt. (17,8 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   440 PSI (30,3 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   20.7 GPM (78,4 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    4000 PSI (276 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.031 inch (0,8 mm)
29. RELIEF VALVE: 3300 PSI (228 bar)
30. HYDRAULIC BRAKE - SPRING APPLIED - PRESSURE RELEASE
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    200 PSI (13,8 bar)
38. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. CHECK VALVE
51. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BRAKE
52. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR – 2 SPEED
53. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice
55. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED
56. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – MAKE-UP
57. FILTER - BRAKE
58. CHARGE PRESSURE SENSOR
59. CHARGE PUMP -
    13.6 GPM (51,5 L/min) at High Engine Idle
60. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR
61. ANTICAVITATION VALVE
62. PROPORTIONAL RELIEF VALVE –
    (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)

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

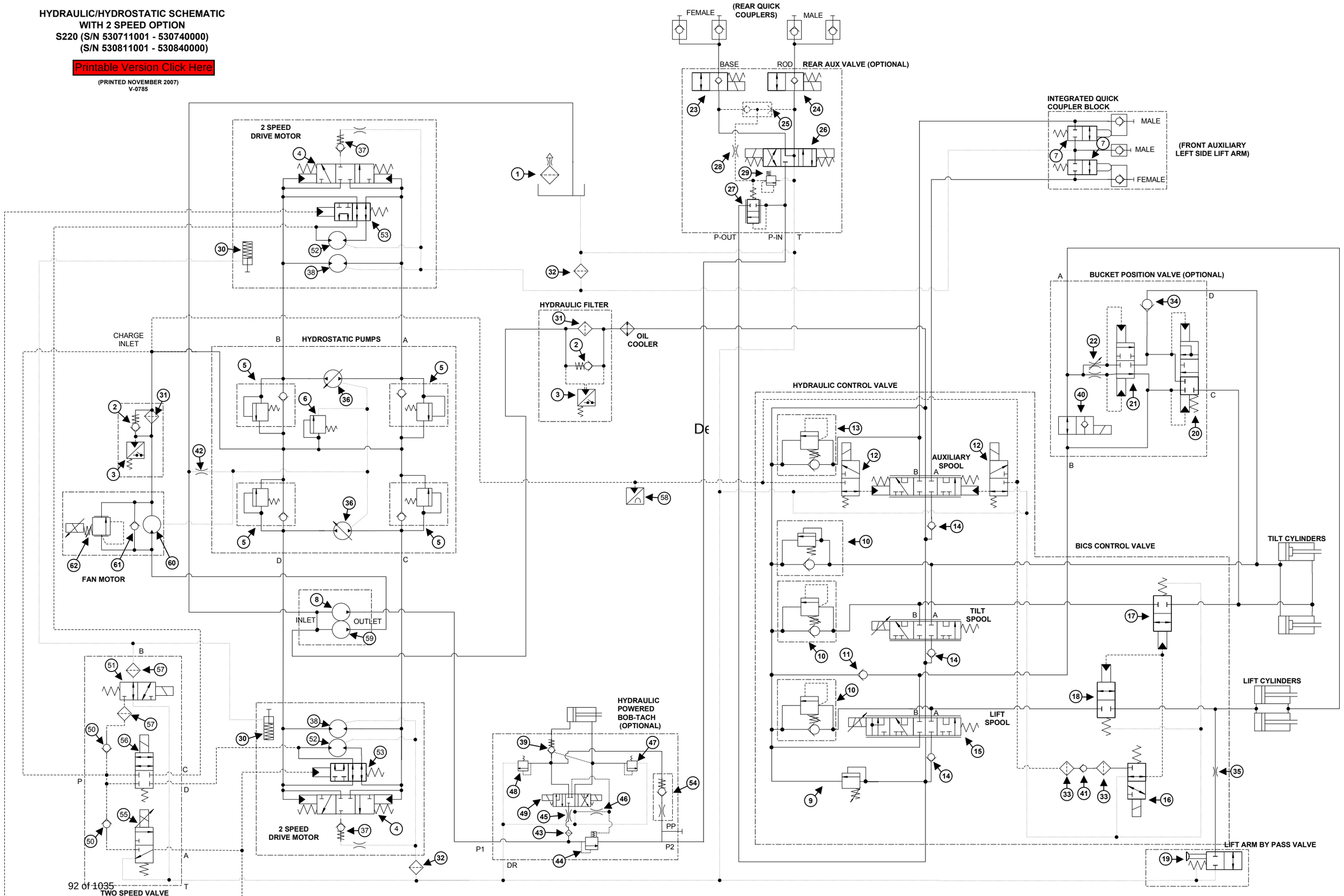
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LEGEND

1. RESERVOIR:
   Capacity . . . . . 18.8 qt. (17,8 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   440 PSI (30,3 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   20.7 GPM (78,4 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    4000 PSI (276 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.031 inch (0,8 mm)
29. RELIEF VALVE: 3300 PSI (228 bar)
30. CHARGE PRESSURE SENSOR
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    200 PSI (13,8 bar)
38. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. RELIEF VALVE - 3300 PSI (228 bar)
51. DUMP VALVE - (ON/OFF)
52. CHECK VALVE
53. AUXILIARY HYDRAULIC PUMP - 16.0 GPM (60,5 L/min) at High Engine Idle
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice
55. CHARGE PUMP - 13.6 GPM (51,5 L/min) at High Engine Idle
56. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR
57. ANTICAVITATION VALVE
58. PROPORTIONAL RELIEF VALVE – (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)

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

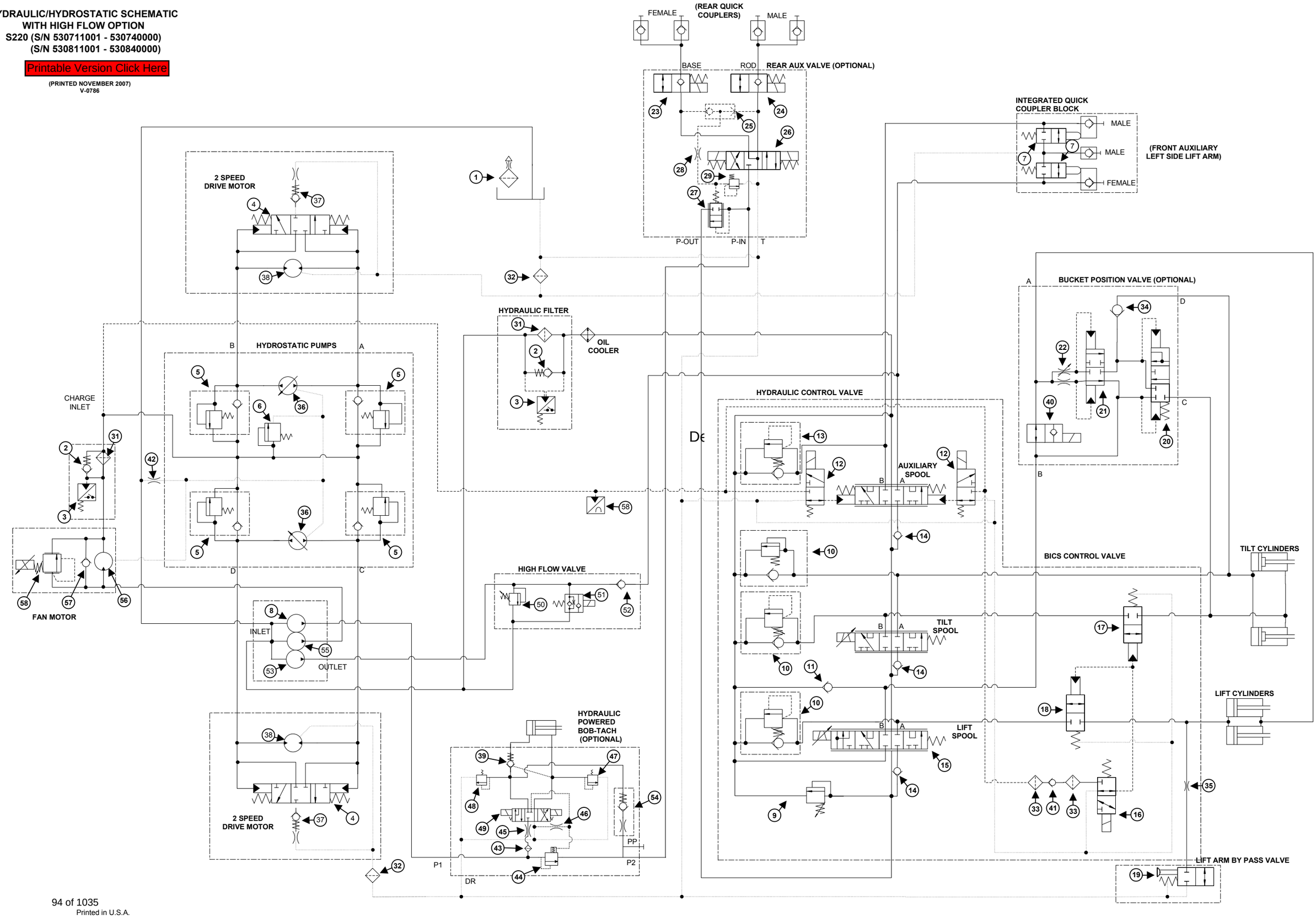
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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH 2 SPEED AND HIGH FLOW OPTION
S220 (S/N 530711001 - 530740000)
(S/N 530811001 - 530840000)

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LEGEND

1. RESERVOIR:
   Capacity . . . . . 18.8 qt. (17,8 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   440 PSI (30,3 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   20.7 GPM (78,4 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    4000 PSI (276 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.031 inch (0,8 mm)
29. RELIEF VALVE: 3300 PSI (228 bar)
30. HYDRAULIC BRAKE - SPRING APPLIED - PRESSURE RELEASE
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    200 PSI (13,8 bar)
38. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. RELIEF VALVE - 3300 PSI (228 bar)
51. DUMP VALVE - (ON/OFF)
52. CHECK VALVE
53. AUXILIARY HYDRAULIC PUMP -
    16.0 GPM (60,5 L/min) at High Engine Idle
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice
55. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED
56. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – MAKE-UP
57. FILTER - BRAKE
58. CHARGE PRESSURE SENSOR
59. CHARGE PUMP -
    13.6 GPM (51,5 L/min) at High Engine Idle
60. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR
61. ANTICAVITATION VALVE
62. PROPORTIONAL RELIEF VALVE – (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)
63. CHECK VALVE
64. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BRAKE
65. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR – 2 SPEED
66. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED

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

V-0787legend (11-12-07)

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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH 2 SPEED AND HIGH FLOW OPTION
S220 (S/N 530711001 - 530740000)
(S/N 530811001 - 530840000)

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FEMALE
(REAR QUICK COUPLERS)
MALE
BASE
ROD
REAR AUX VALVE (OPTIONAL)
P-OUT
P-IN
T
INTEGRATED QUICK COUPLER BLOCK
MALE
MALE
FEMALE
(FRONT AUXILIARY LEFT SIDE LIFT ARM)
2 SPEED DRIVE MOTOR
HYDRAULIC FILTER
OIL COOLER
CHARGE INLET
HYDROSTATIC PUMPS
HYDRAULIC CONTROL VALVE
BUCKET POSITION VALVE (OPTIONAL)
AUXILIARY SPOOL
FAN MOTOR
HIGH FLOW VALVE
INLET
OUTLET
BICS CONTROL VALVE
TILT CYLINDERS
TILT SPOOL
LIFT SPOOL
LIFT CYLINDERS
HYDRAULIC POWERED BOB-TACH (OPTIONAL)
2 SPEED DRIVE MOTOR
TWO SPEED VALVE
LIFT ARM BY PASS VALVE
P1
P2
DR
PP

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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC OPTION
S220 (S/N 530711001 - 530740000)
(S/N 530811001 - 530840000)

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(PRINTED NOVEMBER 2007)
V-0788legend

LEGEND

1. RESERVOIR:
   Capacity . . . . . 18.8 qt. (17,8 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   360 PSI (24,8 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   20.7 GPM (78,4 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    4000 PSI (276 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.031 inch (0,8 mm)
29. RELIEF VALVE: 3300 PSI (228 bar)
30. CHARGE PRESSURE SENSOR
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    200 PSI (13,8 bar)
38. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR
51. ANTICAVITATION VALVE
52. PROPORTIONAL RELIEF VALVE – (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)
53. CHARGE PUMP -
    13.6 GPM (51,5 L/min) at High Engine Idle
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice
55. SOLENOID ACTIVATED CONTROL VALVE - FORWARD/REVERSE
56. SERVO PISTON -Swash Plate
57. POSITION SENSOR -Swash Plate

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

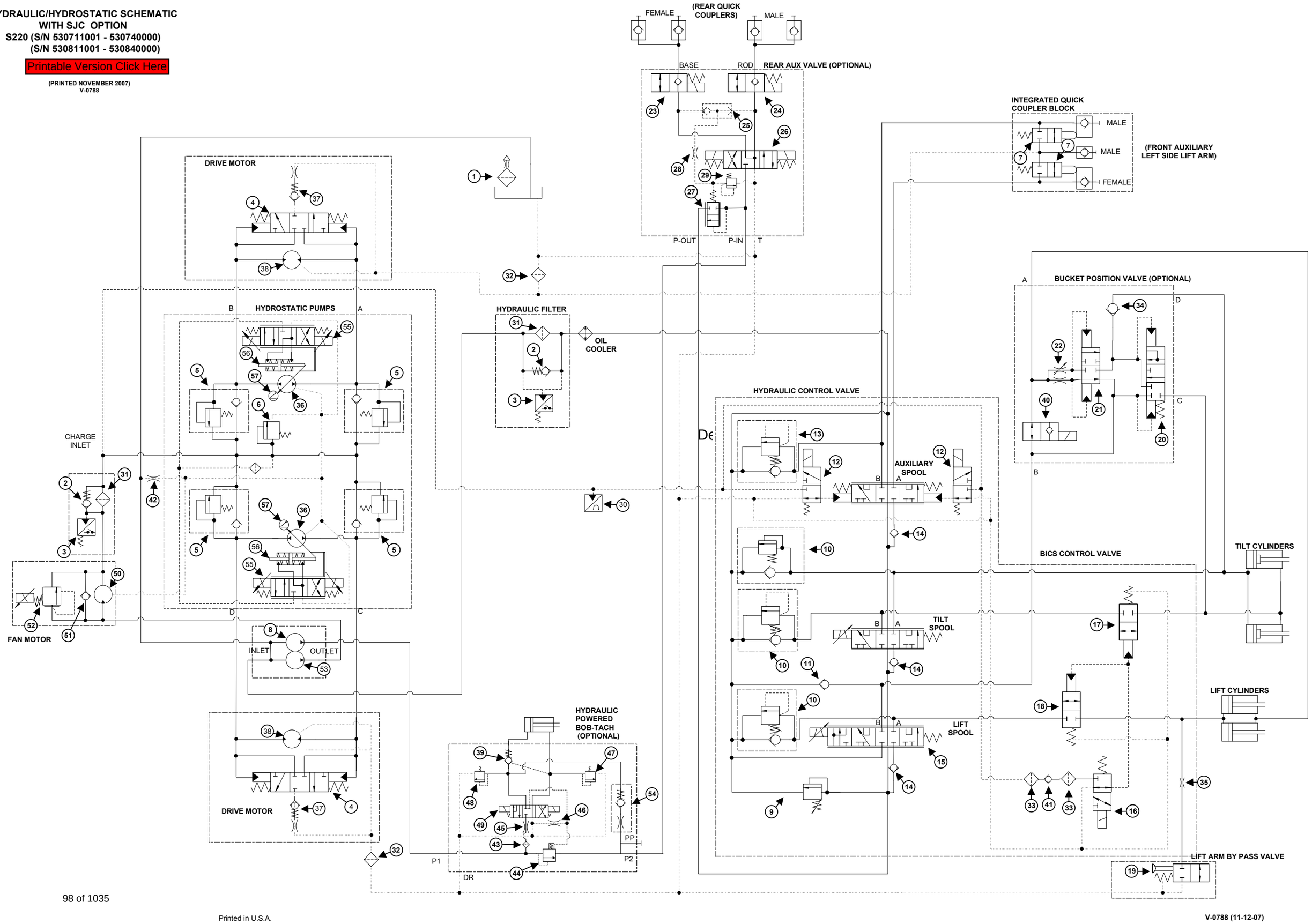
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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC OPTION
S220 (S/N 530711001 - 530740000)
(S/N 530811001 - 530840000)

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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC AND 2 SPEED OPTION
S220 (S/N 530711001 - 530740000)
(S/N 530811001 - 530840000)

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(PRINTED NOVEMBER 2007)
V-0789legend

LEGEND

1. RESERVOIR:
   Capacity . . . . . 18.8 qt. (17,8 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   360 PSI (24,8 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   20.7 GPM (78,4 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    4000 PSI (276 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.031 inch (0,8 mm)
29. RELIEF VALVE: 3300 PSI (228 bar)
30. HYDRAULIC BRAKE - SPRING APPLIED - PRESSURE RELEASE
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    200 PSI (13,8 bar)
38. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED
51. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED
52. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – MAKE-UP
53. FILTER - BRAKE
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice
55. SOLENOID ACTIVATED CONTROL VALVE - FORWARD/REVERSE
56. SERVO PISTON -Swash Plate
57. POSITION SENSOR -Swash Plate
58. CHARGE PRESSURE SENSOR
59. CHARGE PUMP -
    13.6 GPM (51,5 L/min) at High Engine Idle
60. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR
61. ANTICAVITATION VALVE
62. PROPORTIONAL RELIEF VALVE –
    (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)
63. CHECK VALVE
64. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BRAKE
65. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR – 2 SPEED

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

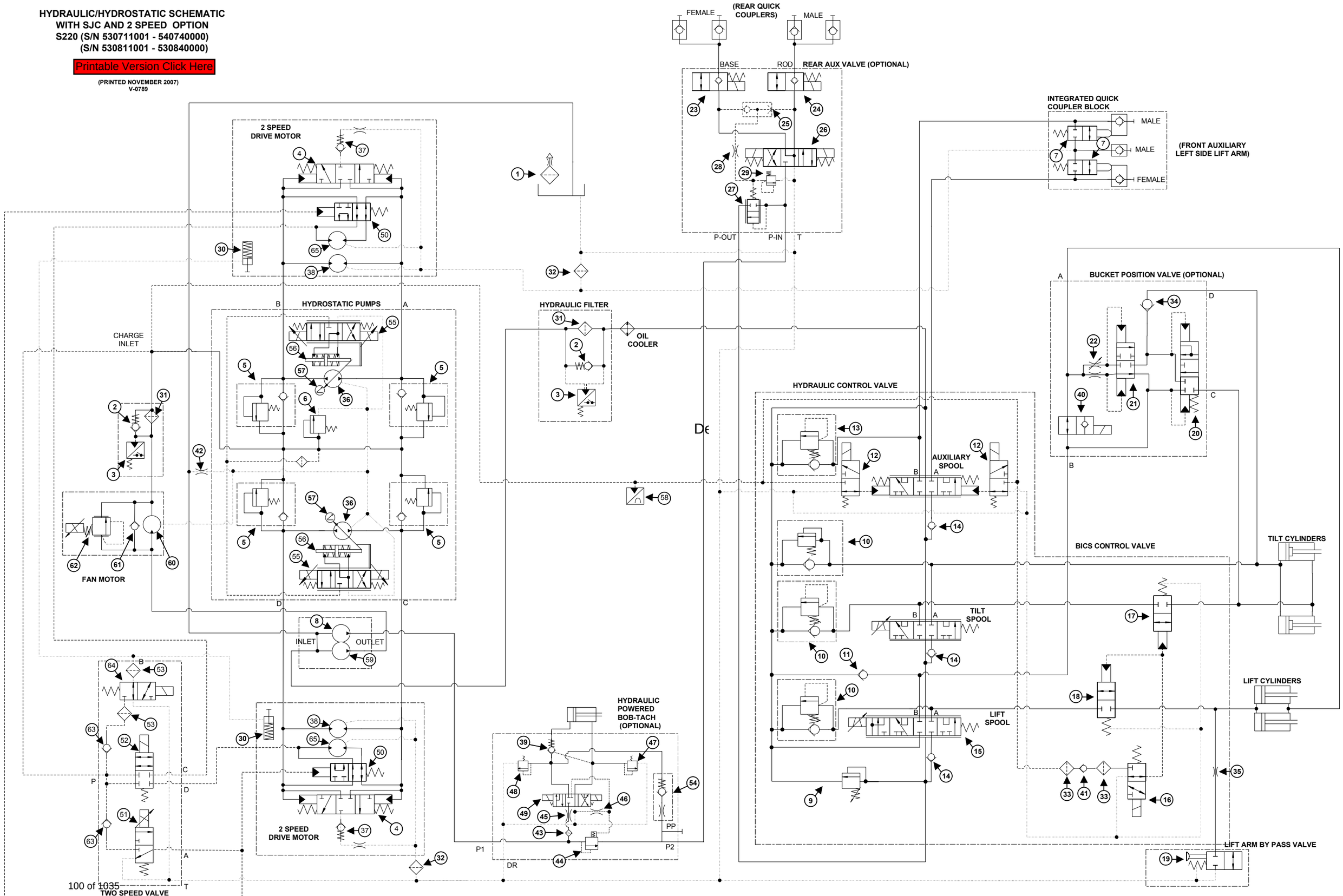
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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC AND 2 SPEED OPTION
S220 (S/N 530711001 - 540740000)
(S/N 530811001 - 530840000)

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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC AND HIGH FLOW OPTION
S220 (S/N 530711001 - 530740000)
(S/N 530811001 - 530840000)

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V-0790legend

LEGEND

1. RESERVOIR:
   Capacity . . . . . 18.8 qt. (17,8 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   360 PSI (24,8 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   20.7 GPM (78,4 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    4000 PSI (276 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.031 inch (0,8 mm)
29. RELIEF VALVE: 3300 PSI (228 bar)
30. PROPORTIONAL RELIEF VALVE – (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    200 PSI (13,8 bar)
38. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. RELIEF VALVE - 3300 PSI (228 bar)
51. DUMP VALVE - (ON/OFF)
52. CHECK VALVE
53. AUXILIARY HYDRAULIC PUMP - 16.0 GPM (60,5 L/min) at High Engine Idle
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice
55. SOLENOID ACTIVATED CONTROL VALVE - FORWARD/REVERSE
56. SERVO PISTON -Swash Plate
57. POSITION SENSOR -Swash Plate
58. CHARGE PRESSURE SENSOR
59. CHARGE PUMP - 13.6 GPM (51,5 L/min) at High Engine Idle
60. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR
61. ANTICAVITATION VALVE

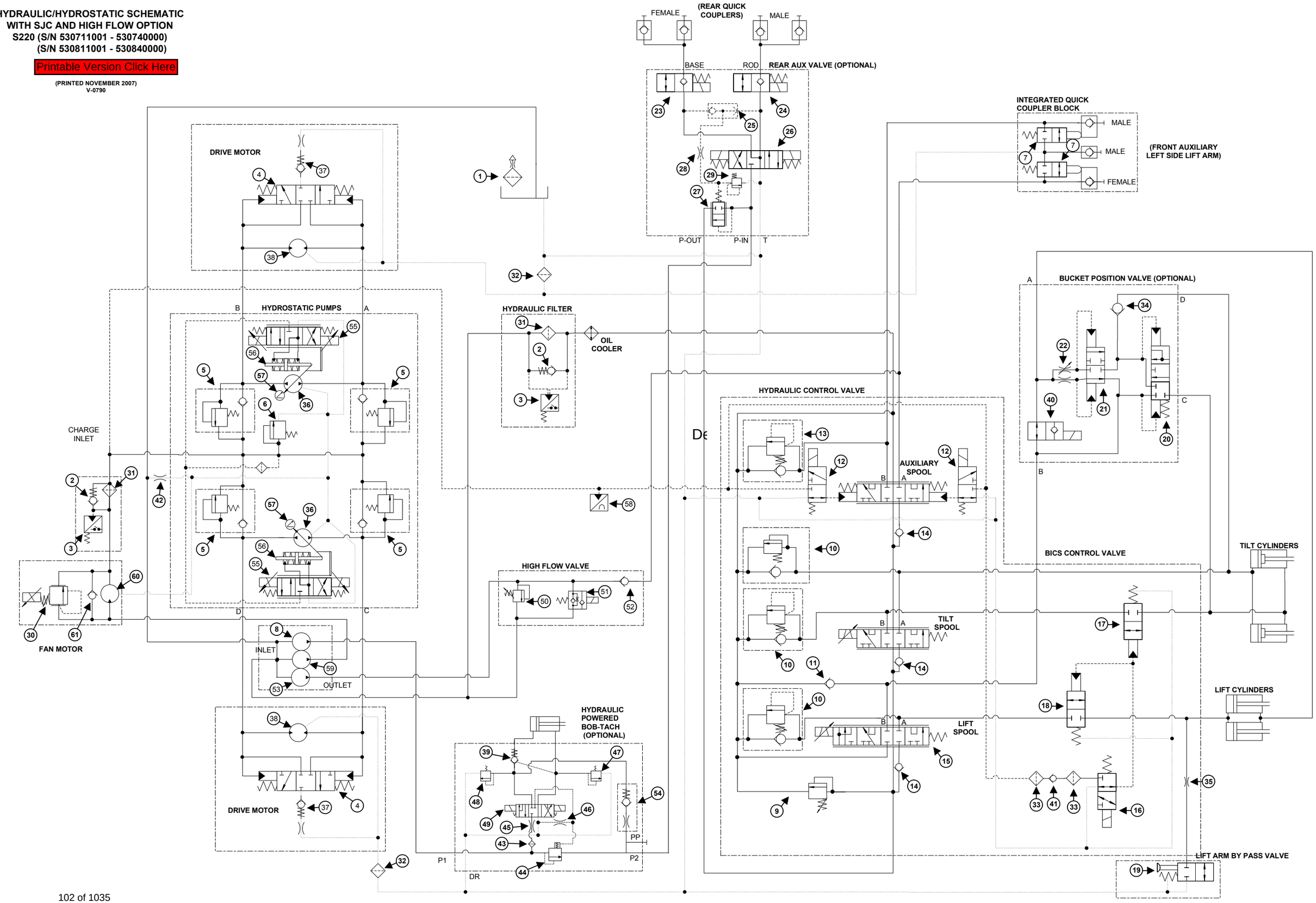
NOTE: Unless otherwise specified, springs have NO significant pressure value.

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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC AND HIGH FLOW OPTION
S220 (S/N 530711001 - 530740000)
(S/N 530811001 - 530840000)

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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC, 2 SPEED AND HIGH FLOW OPTION
S220 (S/N 530711001 - 530740000)
(S/N 530811001 - 530840000)

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(PRINTED NOVEMBER 2007)
V-0791legend

LEGEND

1. RESERVOIR:
   Capacity . . . . . 18.8 qt. (17,8 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   360 PSI (24,8 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   20.7 GPM (78,4 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    4000 PSI (276 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.031 inch (0,8 mm)
29. RELIEF VALVE: 3300 PSI (228 bar)
30. HYDRAULIC BRAKE - SPRING APPLIED - PRESSURE RELEASE
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    200 PSI (13,8 bar)
38. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. RELIEF VALVE - 3300 PSI (228 bar)
51. DUMP VALVE - (ON/OFF)
52. CHECK VALVE
53. AUXILIARY HYDRAULIC PUMP - 16.0 GPM (60,5 L/min) at High Engine Idle
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice
55. SOLENOID ACTIVATED CONTROL VALVE - FORWARD/REVERSE
56. SERVO PISTON -Swash Plate
57. POSITION SENSOR -Swash Plate
58. CHARGE PRESSURE SENSOR
59. CHARGE PUMP - 13.6 GPM (51,5 L/min) at High Engine Idle
60. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR
61. ANTICAVITATION VALVE
62. PROPORTIONAL RELIEF VALVE – (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)
63. CHECK VALVE
64. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BRAKE
65. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR – 2 SPEED
66. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED
67. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED
68. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – MAKE-UP
69. FILTER - BRAKE

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

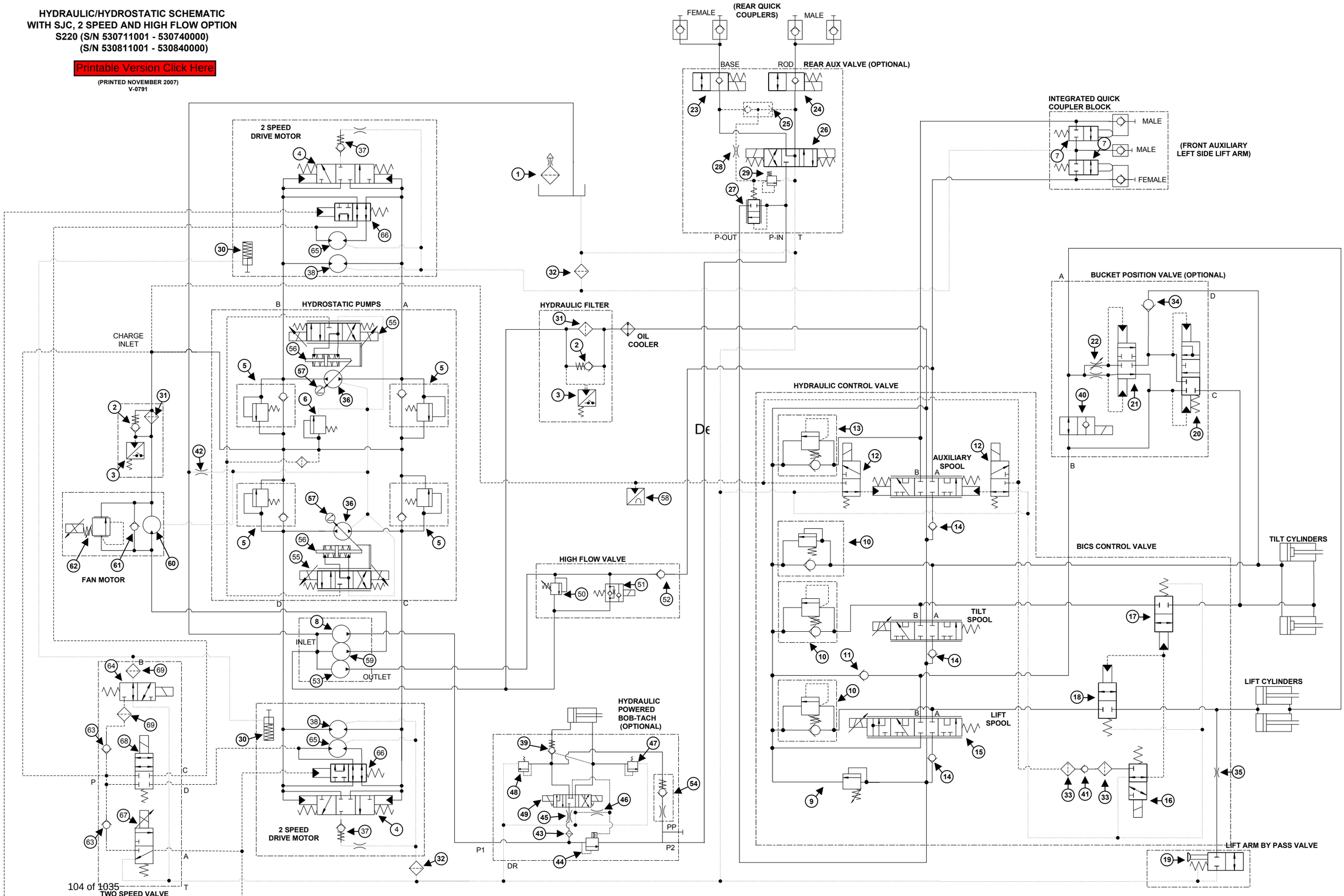
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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC, 2 SPEED AND HIGH FLOW OPTION
S220 (S/N 530711001 - 530740000)
(S/N 530811001 - 530840000)

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HYDRAULIC/HYDROSTATIC SCHEMATIC
S220 (S/N 530740001 & ABOVE)
(S/N 530840001 & ABOVE)

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V-0929legend

LEGEND

1. RESERVOIR:
   Capacity . . . . . 18.8 qt. (17,8 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   440 PSI (30,3 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   20.7 GPM (78,4 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    4000 PSI (276 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.031 inch (0,8 mm)
29. RELIEF VALVE: 3300 PSI (228 bar)
30. CHARGE PRESSURE SENSOR
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    200 PSI (13,8 bar)
38. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR
51. ANTICAVITATION VALVE
52. PROPORTIONAL RELIEF VALVE –
    (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)
53. CHARGE PUMP -
    13.6 GPM (51,5 L/min) at High Engine Idle
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice
55. FILTER - HYDRAULIC
56. SPRING LOADED FILTER BY-PASS VALVE: 75-83 PSI (5,2-5,7 bar)

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

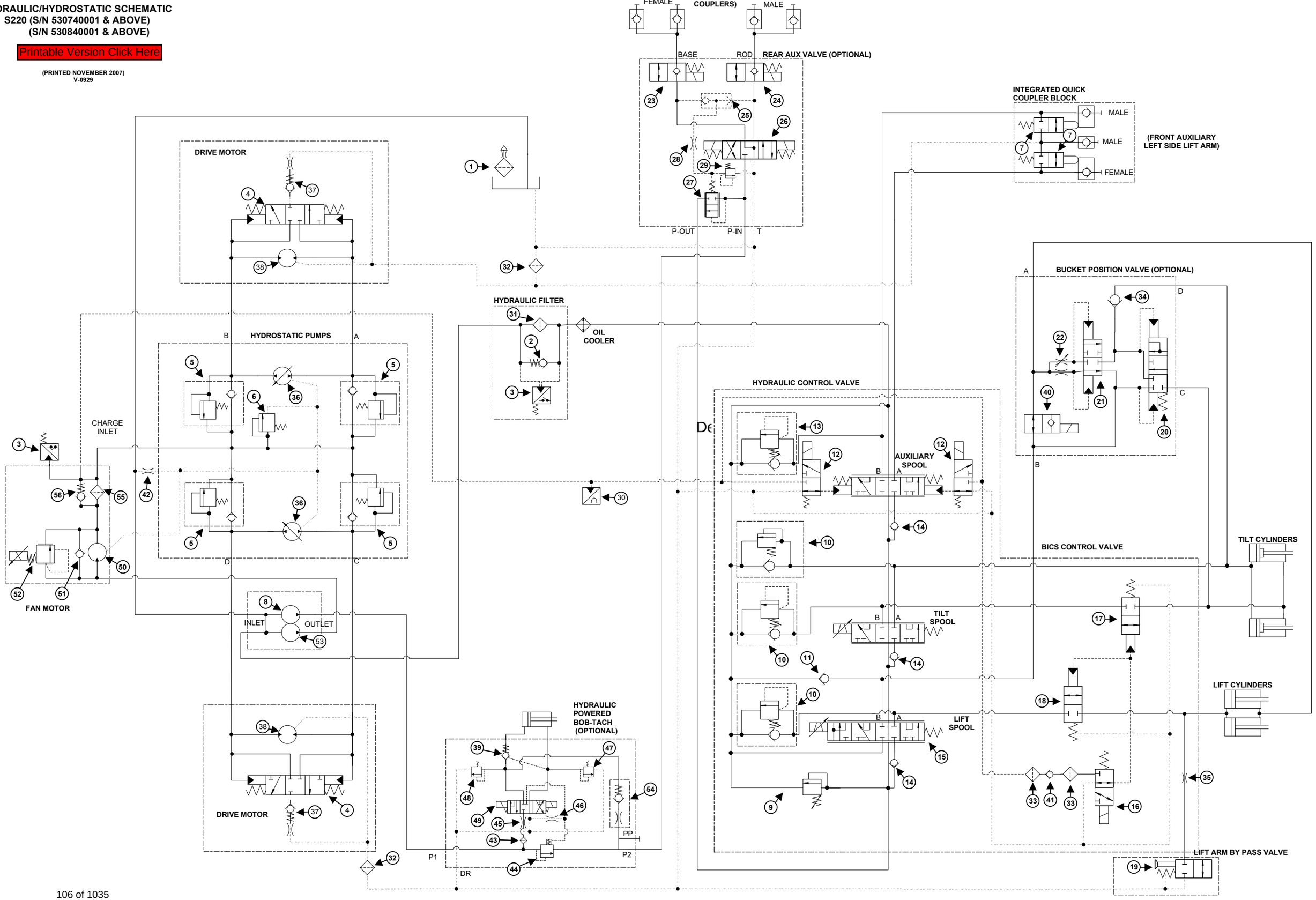
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HYDRAULIC/HYDROSTATIC SCHEMATIC
S220 (S/N 530740001 & ABOVE)
(S/N 530840001 & ABOVE)

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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH 2 SPEED OPTION
S220 (S/N 530740001 & ABOVE)
(S/N 530840001 & ABOVE)

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V-0930legend

LEGEND

1. RESERVOIR:
   Capacity . . . . . 18.8 qt. (17,8 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   440 PSI (30,3 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   20.7 GPM (78,4 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    4000 PSI (276 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.031 inch (0,8 mm)
29. RELIEF VALVE: 3300 PSI (228 bar)
30. HYDRAULIC BRAKE - SPRING APPLIED - PRESSURE RELEASE
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    200 PSI (13,8 bar)
38. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. CHECK VALVE
51. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BRAKE
52. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR – 2 SPEED
53. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice
55. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED
56. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – MAKE-UP
57. FILTER - BRAKE
58. CHARGE PRESSURE SENSOR
59. CHARGE PUMP -
    13.6 GPM (51,5 L/min) at High Engine Idle
60. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR
61. ANTICAVITATION VALVE
62. PROPORTIONAL RELIEF VALVE – (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)
63. FILTER - HYDRAULIC
64. DIFFERENTIAL PRESSURE SWITCH:
    75-83 PSI (5,2-5,7 bar)
    Normally Closed

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

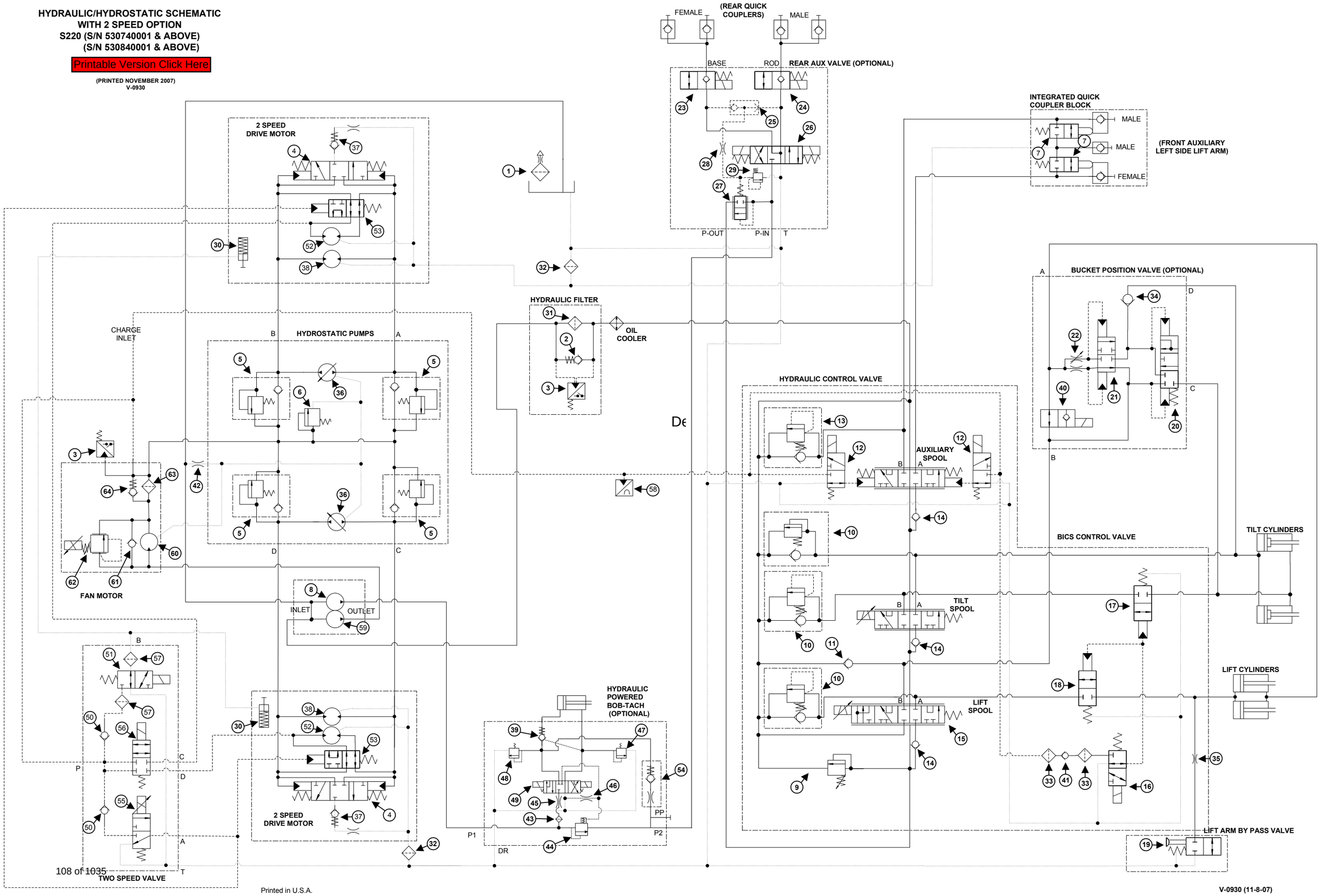
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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH 2 SPEED OPTION
S220 (S/N 530740001 & ABOVE)
(S/N 530840001 & ABOVE)

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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH HIGH FLOW OPTION
S220 (S/N 530740001 & ABOVE)
(S/N 530840001 & ABOVE)

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V-0931legend

LEGEND

1. RESERVOIR:
   Capacity . . . . . 18.8 qt. (17,8 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   440 PSI (30,3 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   20.7 GPM (78,4 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    4000 PSI (276 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.031 inch (0,8 mm)
29. RELIEF VALVE: 3300 PSI (228 bar)
30. CHARGE PRESSURE SENSOR
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    200 PSI (13,8 bar)
38. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. RELIEF VALVE - 3300 PSI (228 bar)
51. DUMP VALVE - (ON/OFF)
52. CHECK VALVE
53. AUXILIARY HYDRAULIC PUMP - 16.0 GPM (60,5 L/min) at High Engine Idle
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice
55. CHARGE PUMP - 13.6 GPM (51,5 L/min) at High Engine Idle
56. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR
57. ANTICAVITATION VALVE
58. PROPORTIONAL RELIEF VALVE – (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)
59. FILTER - HYDRAULIC
60. SPRING LOADED FILTER BY-PASS VALVE: 75-83 PSI (5,2-5,7 bar)

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

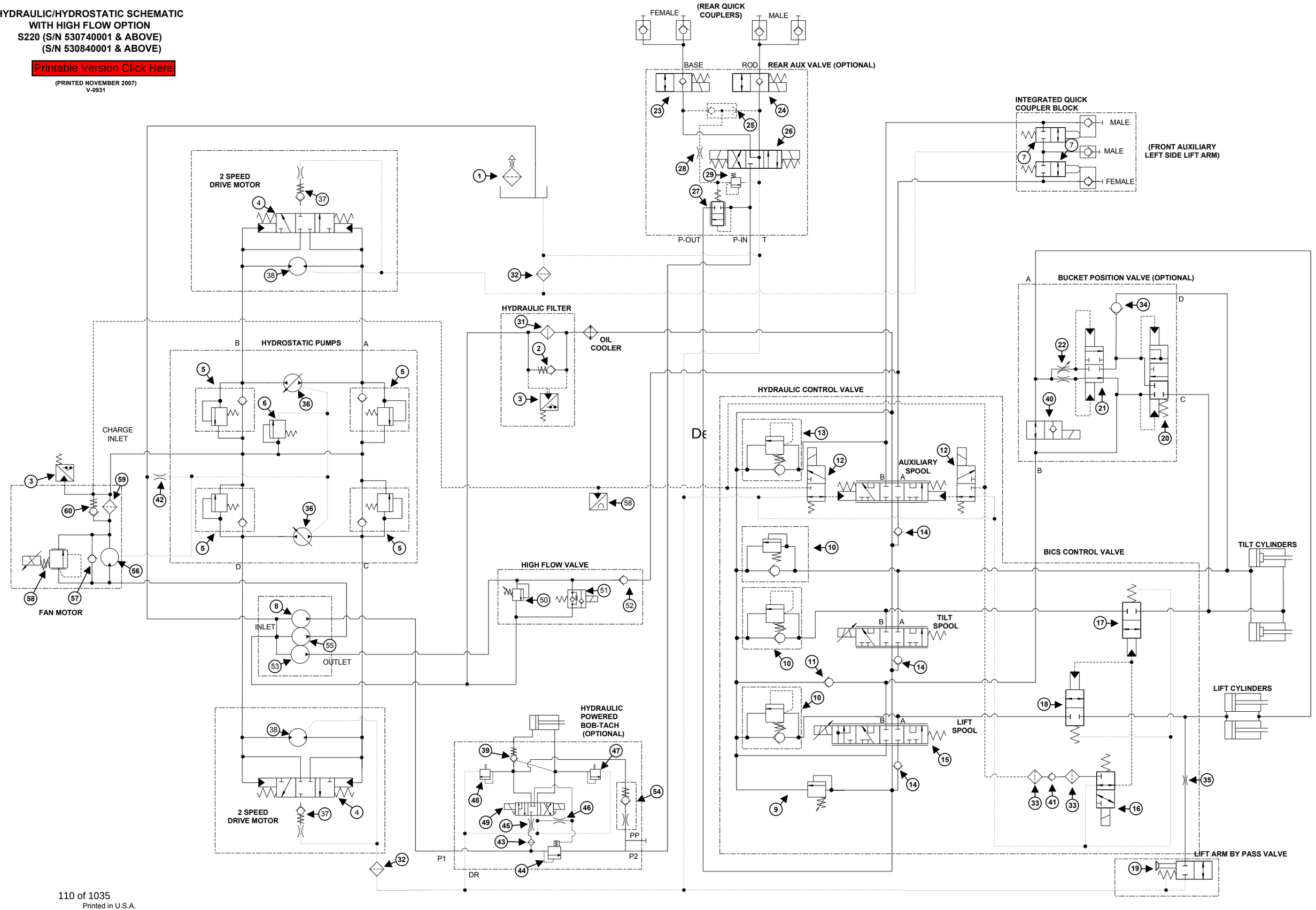
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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH HIGH FLOW OPTION
S220 (S/N 530740001 & ABOVE)
(S/N 530840001 & ABOVE)

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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH 2 SPEED AND HIGH FLOW OPTION
S220 (S/N 530740001 & ABOVE)
(S/N 5530840001 & ABOVE)

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V-0932legend

LEGEND

1. RESERVOIR:
   Capacity . . . . . 18.8 qt. (17,8 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   440 PSI (30,3 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   20.7 GPM (78,4 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    4000 PSI (276 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.031 inch (0,8 mm)
29. RELIEF VALVE: 3300 PSI (228 bar)
30. HYDRAULIC BRAKE - SPRING APPLIED - PRESSURE RELEASE
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    200 PSI (13,8 bar)
38. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. RELIEF VALVE - 3300 PSI (228 bar)
51. DUMP VALVE - (ON/OFF)
52. CHECK VALVE
53. AUXILIARY HYDRAULIC PUMP -
    16.0 GPM (60,5 L/min) at High Engine Idle
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice
55. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED
56. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – MAKE-UP
57. FILTER - BRAKE
58. CHARGE PRESSURE SENSOR
59. CHARGE PUMP -
    13.6 GPM (51,5 L/min) at High Engine Idle
60. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR
61. ANTICAVITATION VALVE
62. PROPORTIONAL RELIEF VALVE – (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)
63. CHECK VALVE
64. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BRAKE
65. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR – 2 SPEED
66. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED
67. FILTER - HYDRAULIC
68. SPRING LOADED FILTER BY-PASS VALVE: 75-83 PSI (5,2-5,7 bar)

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

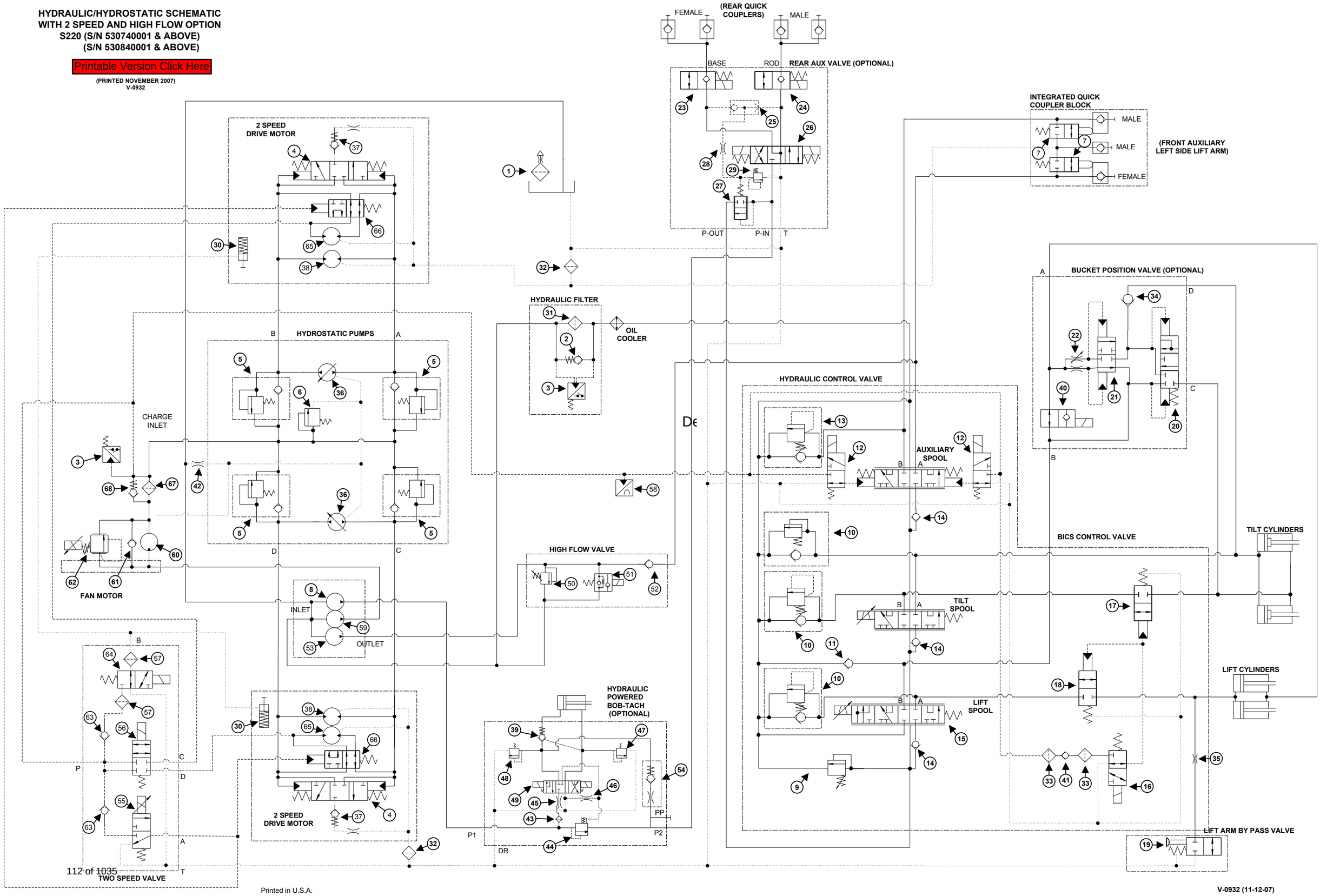
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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH 2 SPEED AND HIGH FLOW OPTION
S220 (S/N 530740001 & ABOVE)
(S/N 530840001 & ABOVE)

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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC OPTION
S220 (S/N 530740001 & ABOVE)
(S/N 530840001 & ABOVE)

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V-0933legend

LEGEND

1. RESERVOIR:
   Capacity . . . . . 18.8 qt. (17,8 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   360 PSI (24,8 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   20.7 GPM (78,4 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    4000 PSI (276 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.031 inch (0,8 mm)
29. RELIEF VALVE: 3300 PSI (228 bar)
30. CHARGE PRESSURE SENSOR
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    200 PSI (13,8 bar)
38. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR
51. ANTICAVITATION VALVE
52. PROPORTIONAL RELIEF VALVE –
    (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)
53. CHARGE PUMP -
    13.6 GPM (51,5 L/min) at High Engine Idle
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice
55. SOLENOID ACTIVATED CONTROL VALVE - FORWARD/REVERSE
56. SERVO PISTON -Swash Plate
57. POSITION SENSOR -Swash Plate
58. FILTER - HYDRAULIC
59. SPRING LOADED FILTER BY-PASS VALVE: 75-83 PSI (5,2-5,7 bar)

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

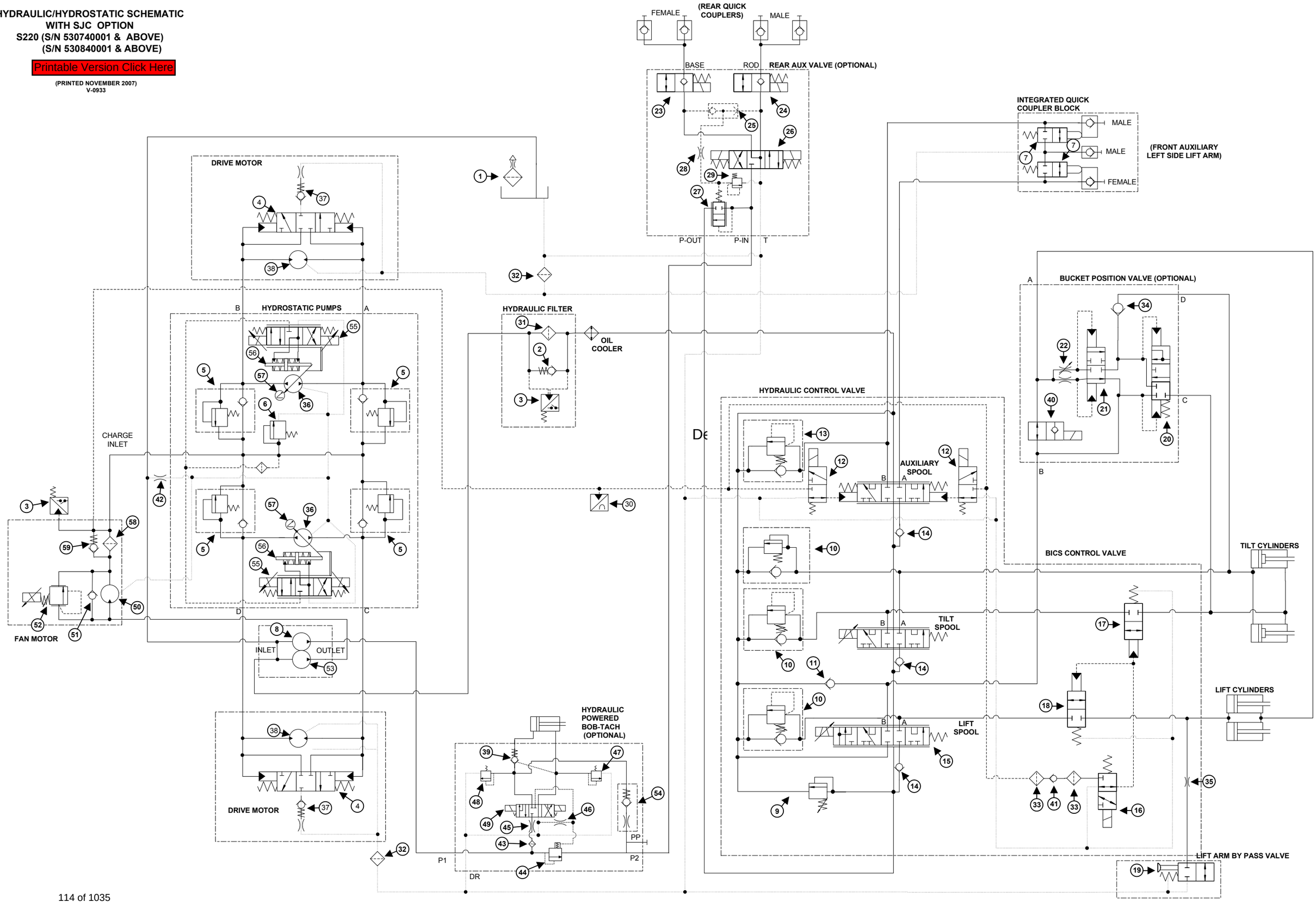
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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC OPTION
S220 (S/N 530740001 & ABOVE)
(S/N 530840001 & ABOVE)

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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC AND 2 SPEED OPTION
S220 (S/N 530740001 & ABOVE)
(S/N 530840001 & ABOVE)

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(PRINTED NOVEMBER 2007)
V-0934legend

LEGEND

1. RESERVOIR:
   Capacity . . . . . 18.8 qt. (17,8 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   360 PSI (24,8 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   20.7 GPM (78,4 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    4000 PSI (276 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.031 inch (0,8 mm)
29. RELIEF VALVE: 3300 PSI (228 bar)
30. HYDRAULIC BRAKE - SPRING APPLIED - PRESSURE RELEASE
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    200 PSI (13,8 bar)
38. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED
51. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED
52. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – MAKE-UP
53. FILTER - BRAKE
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice
55. SOLENOID ACTIVATED CONTROL VALVE - FORWARD/REVERSE
56. SERVO PISTON -Swash Plate
57. POSITION SENSOR -Swash Plate
58. CHARGE PRESSURE SENSOR
59. CHARGE PUMP -
    13.6 GPM (51,5 L/min) at High Engine Idle
60. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR
61. ANTICAVITATION VALVE
62. PROPORTIONAL RELIEF VALVE –
    (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)
63. CHECK VALVE
64. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BRAKE
65. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR – 2 SPEED
66. FILTER - HYDRAULIC
67. SPRING LOADED FILTER BY-PASS VALVE: 75-83 PSI (5,2-5,7 bar)

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

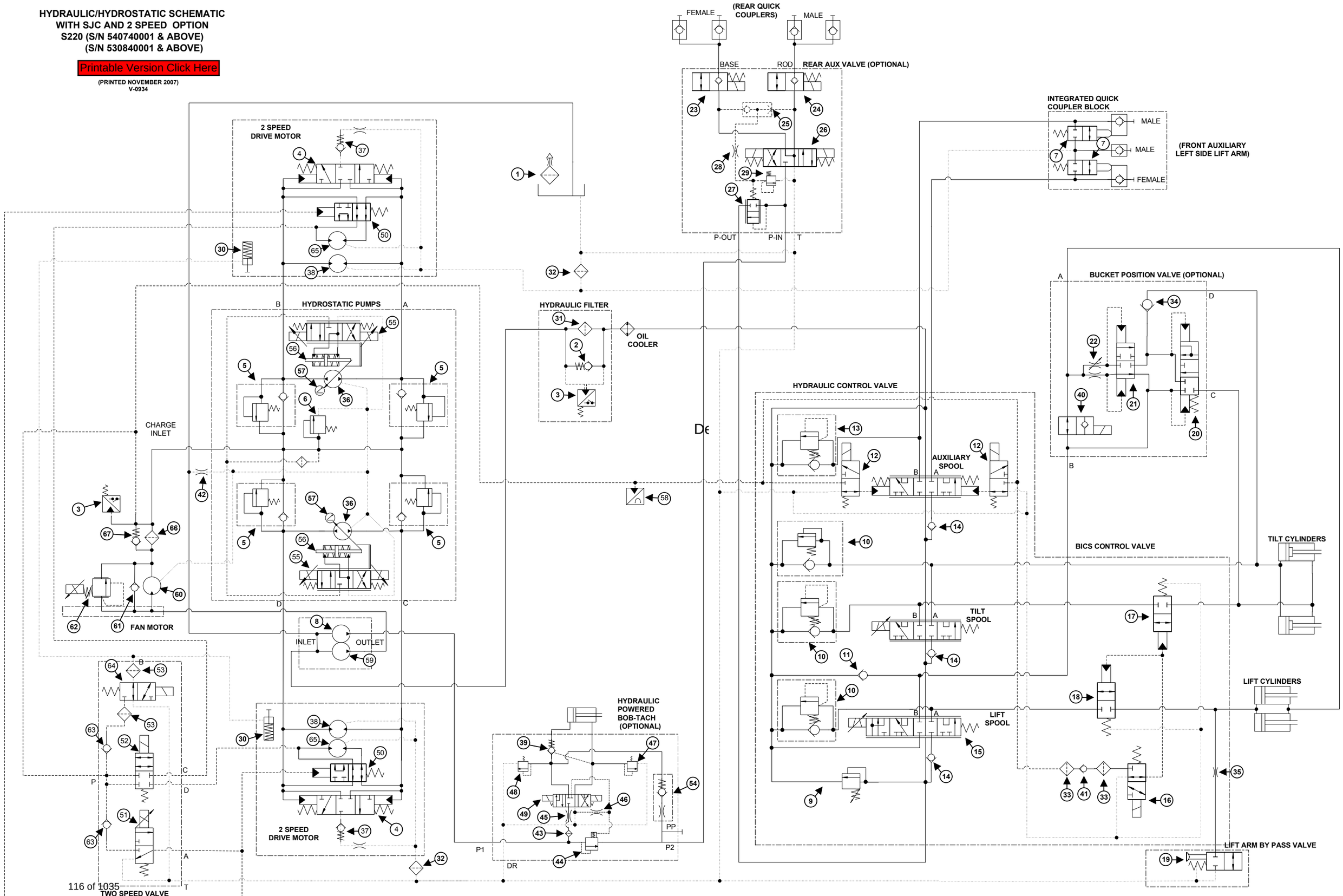
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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC AND 2 SPEED OPTION
S220 (S/N 540740001 & ABOVE)
(S/N 530840001 & ABOVE)

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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC AND HIGH FLOW OPTION
S220 (S/N 530740001 & ABOVE)
(S/N 530840001 & ABOVE)

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V-0935legend

LEGEND

1. RESERVOIR:
   Capacity . . . . . 18.8 qt. (17,8 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   360 PSI (24,8 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   20.7 GPM (78,4 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    4000 PSI (276 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.031 inch (0,8 mm)
29. RELIEF VALVE: 3300 PSI (228 bar)
30. PROPORTIONAL RELIEF VALVE – (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    200 PSI (13,8 bar)
38. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. RELIEF VALVE - 3300 PSI (228 bar)
51. DUMP VALVE - (ON/OFF)
52. CHECK VALVE
53. AUXILIARY HYDRAULIC PUMP - 16.0 GPM (60,5 L/min) at High Engine Idle
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice
55. SOLENOID ACTIVATED CONTROL VALVE - FORWARD/REVERSE
56. SERVO PISTON -Swash Plate
57. POSITION SENSOR -Swash Plate
58. CHARGE PRESSURE SENSOR
59. CHARGE PUMP - 13.6 GPM (51,5 L/min) at High Engine Idle
60. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR
61. ANTICAVITATION VALVE
62. FILTER - HYDRAULIC
63. SPRING LOADED FILTER BY-PASS VALVE: 75-83 PSI (5,2-5,7 bar)

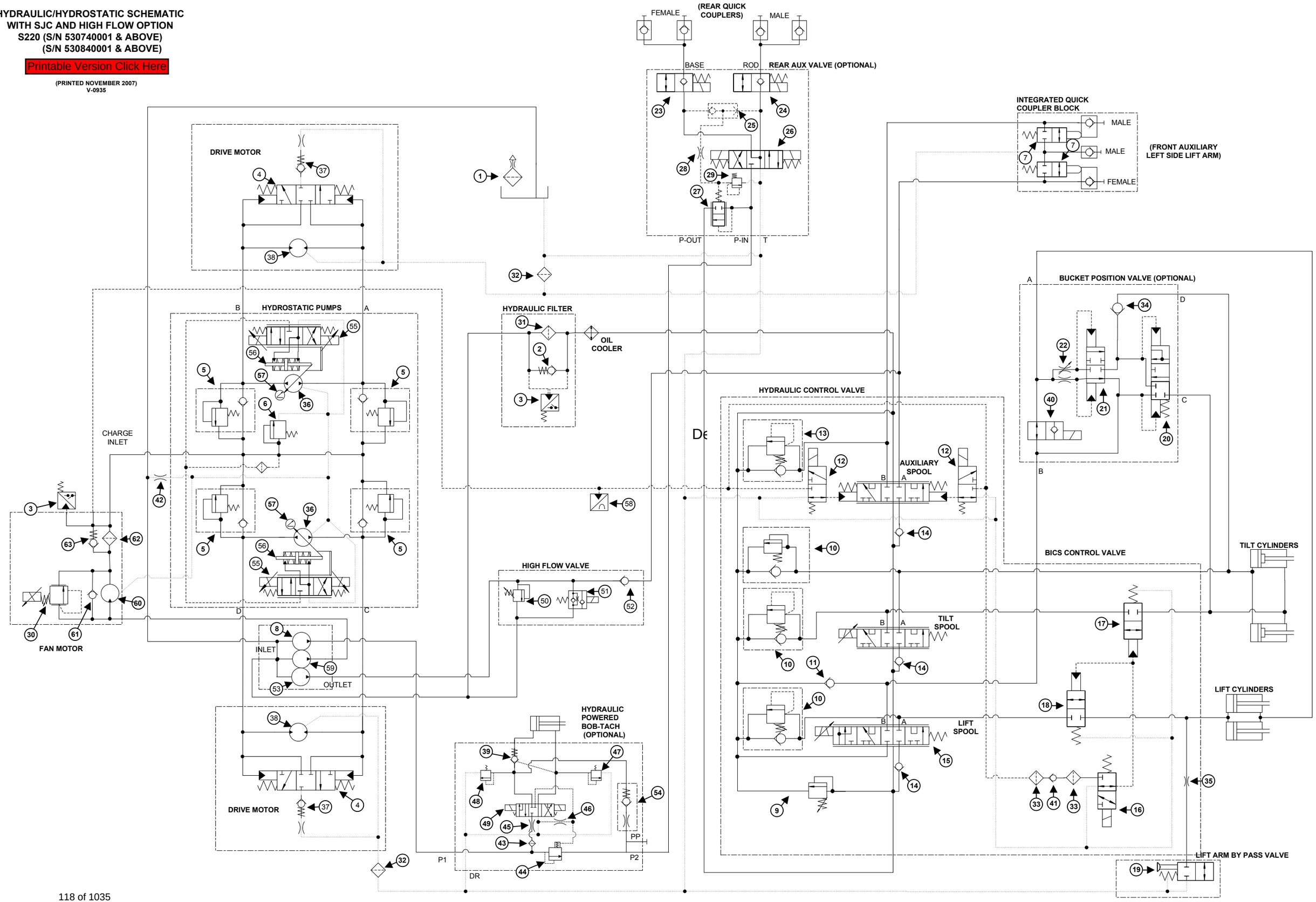
NOTE: Unless otherwise specified, springs have NO significant pressure value.

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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC AND HIGH FLOW OPTION
S220 (S/N 530740001 & ABOVE)
(S/N 530840001 & ABOVE)

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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC, 2 SPEED AND HIGH FLOW OPTION
S220 (S/N 530740001 & ABOVE)
(S/N 530840001 & ABOVE)

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(PRINTED NOVEMBER 2007)
V-0936legend

LEGEND

1. RESERVOIR:
   Capacity . . . . . 18.8 qt. (17,8 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   360 PSI (24,8 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   20.7 GPM (78,4 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    4000 PSI (276 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.031 inch (0,8 mm)
29. RELIEF VALVE: 3300 PSI (228 bar)
30. HYDRAULIC BRAKE - SPRING APPLIED - PRESSURE RELEASE
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    200 PSI (13,8 bar)
38. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. RELIEF VALVE - 3300 PSI (228 bar)
51. DUMP VALVE - (ON/OFF)
52. CHECK VALVE
53. AUXILIARY HYDRAULIC PUMP - 16.0 GPM (60,5 L/min) at High Engine Idle
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice
55. SOLENOID ACTIVATED CONTROL VALVE - FORWARD/REVERSE
56. SERVO PISTON -Swash Plate
57. POSITION SENSOR -Swash Plate
58. CHARGE PRESSURE SENSOR
59. CHARGE PUMP - 13.6 GPM (51,5 L/min) at High Engine Idle
60. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR
61. ANTICAVITATION VALVE
62. PROPORTIONAL RELIEF VALVE – (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)
63. CHECK VALVE
64. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BRAKE
65. FIXED CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC MOTOR – 2 SPEED
66. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED
67. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED
68. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – MAKE-UP
69. FILTER - BRAKE
70. FILTER - HYDRAULIC
71. SPRING LOADED FILTER BY-PASS VALVE: 75-83 PSI (5,2-5,7 bar)

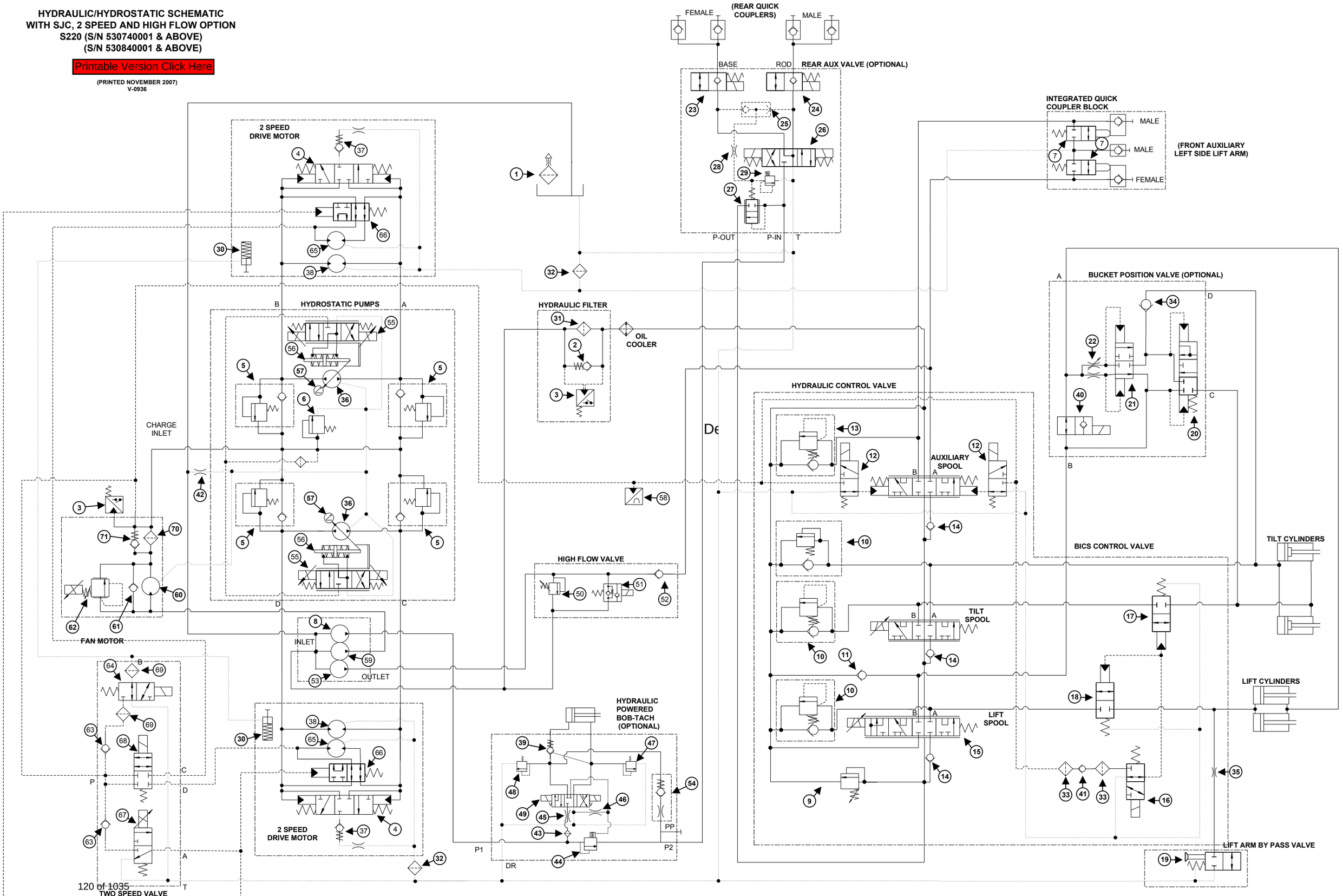
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HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC, 2 SPEED AND HIGH FLOW OPTION
S220 (S/N 530740001 & ABOVE)
(S/N 530840001 & ABOVE)

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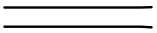
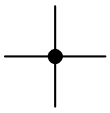
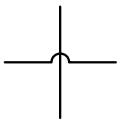
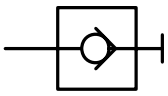


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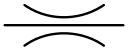
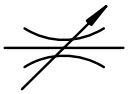
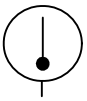
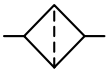
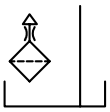
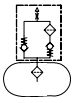
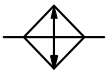
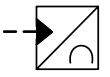
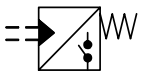
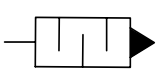
V-0936 (11-12-07)

Glossary Of Hydraulic / Hydrostatic Symbols

FLOW LINES and CONNECTIONS

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

BASIC and MISCELLANEOUS SYMBOLS

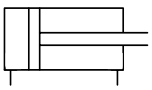
SYMBOL	DESCRIPTION
	RESTRICTION - Line with Fixed Restriction - Affected by Viscosity (property of resistance to flowing fluid).
	VARIABLE ADJUSTMENT RESTRICTION - Regulated or Variable Restriction.
	TEMPERATURE CONTROL - (Indication of temperature).
	TEMPERATURE INDICATOR - (temperature measurement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

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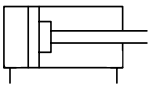
Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

SYMBOL DESCRIPTION

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

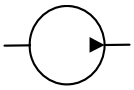


DOUBLE ACTING HYDRAULIC CYLINDER, UNEQUAL DISPLACEMENT - With single piston rod.

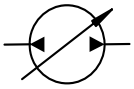


DOUBLE ACTING HYDRAULIC CYLINDER, UNEQUAL DISPLACEMENT and CUSHION ON ONE END - With single piston rod.

PUMP: To convert mechanical energy into hydraulic energy.

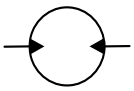


FIXED CAPACITY DISPLACEMENT HYDRAULIC PUMP - With one direction of flow.



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

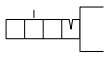
MOTOR: To convert hydraulic energy into rotary mechanical energy.



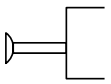
FIXED CAPACITY DISPLACEMENT BIDIRECTIONAL HYDRAULIC MOTOR - With two directions of flow (bidirectional.

SYMBOL DESCRIPTION

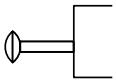
CONTROL MECHANISMS



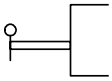
CONTROL VALVE WITH DETENT (Holds Valve in Position) - device for maintaining a given position (mechanical).



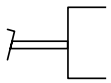
CONTROL VALVE ACTIVATED BY A PULL BUTTON (manual).



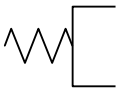
CONTROL VALVE ACTIVATED BY A PUSH-PULL BUTTON (manual).



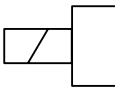
CONTROL VALVE ACTIVATED BY A LEVER (manual).



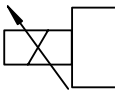
CONTROL VALVE ACTIVATED BY A PEDAL (manual).



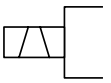
CONTROL VALVE WITH SPRING RETURN (mechanical).



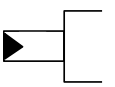
CONTROL VALVE ACTIVATED BY AN ELECTRIC SOLENOID (electrical).



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



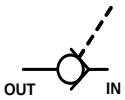
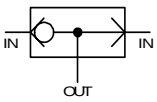
CONTROL VALVE ACTIVATED BY DUAL ELECTRICAL SOLENOID (electrical).

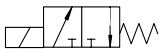
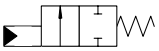
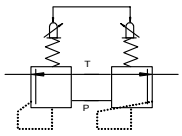
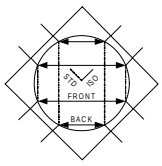
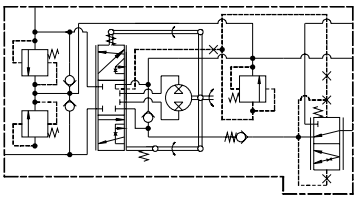
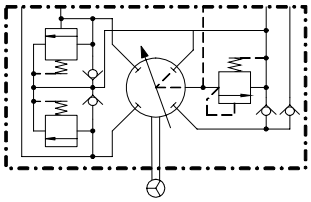
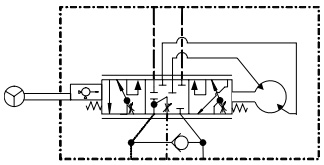


CONTROL VALVE ACTIVATED BY PILOT PRESSURE (indirect control, pilot actuated by application of pressure).

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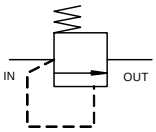
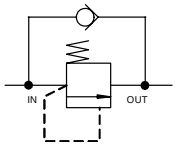
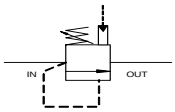
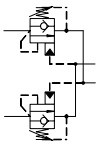
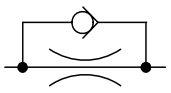
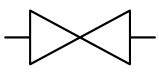
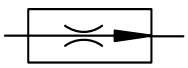
Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

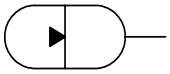
SYMBOL	DESCRIPTION
NON-RETURN VALVE, SHUTTLE VALVE: Valve which allows free flow in one direction only.	
	NON-RETURN VALVE (Check Valve) - Used as Replenishing Valve, Lock Check Valve or Anticavitation Valve - Opens if the Inlet pressure is higher than the Outlet pressure. Often contains internal spring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

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

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Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

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

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

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Troubleshooting

The 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.

If the service code appears in the left instrument panel, refer to the Electrical Service Manual for the probable cause.

WARNING

Check for correct function after adjustments, repairs or service. Failure to make correct repairs or adjustments can cause injury or death.

W-2004-1285

PROBLEM	CAUSE
The hydraulic system will not operate.	1, 2, 3, 5, 8
Slow hydraulic system action.	1, 3, 4, 6, 8
Hydraulic action is not smooth.	1, 4, 5, 6, 7
Lift arms go up slowly at full engine RPM.	1, 3, 4, 6, 7, 8, 9
The lift arms or Bob-Tach will move when the pedal is in neutral position.	4
The lift arms come down with the pedal in the neutral position.	4, 9, 10, 11
Bypass valve stuck.	12
Bypass valve stem bent or broke.	13

KEY TO CORRECT THE CAUSE
1. The fluid level is not correct.
2. The pedal linkage is disconnected.
3. The hydraulic pump has damage.
4. The pedal linkage is not adjusted correctly.
5. Relief valve is not at the correct pressure.
6. Suction leak on the inlet side of the hydraulic pump.
7. Fluid is cold. Wrong viscosity fluid. (See Section SPEC-01.)
8. Using the loader for more than its rated capacity.
9. Internal leak in the lift cylinder(s).
10. External leak from the lift cylinder(s).
11. Damaged lift spool.
12. Rotate shaft.
13. Replace manual spool cartridge.

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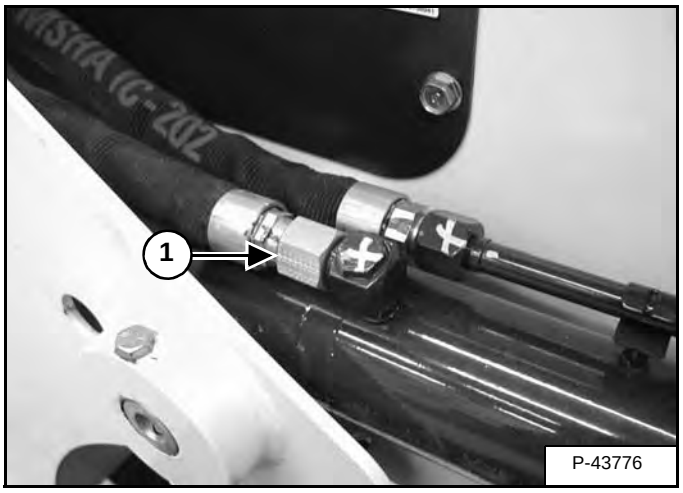


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CYLINDER (LIFT)

Testing

Figure 20-20-1



Lower the lift arms. Stop the engine. Raise the seat bar.

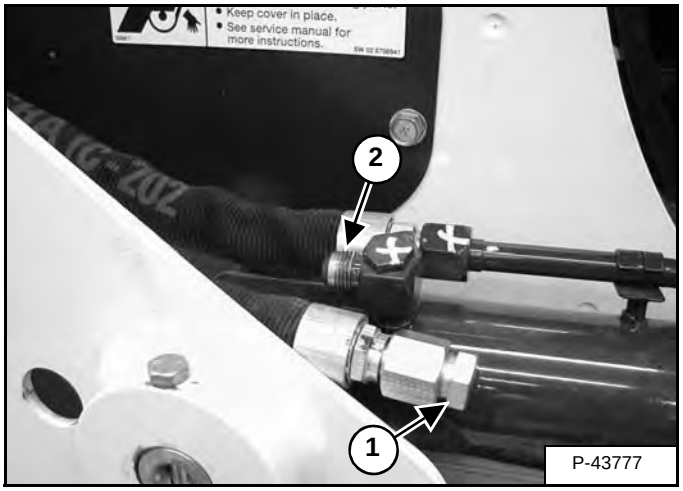
⚠ WARNING

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

Check only one cylinder at a time. Disconnect the hose (Item 1) **[Figure 20-20-1]** which goes to the base end of the lift cylinder.

Figure 20-20-2



Install a cap (Item 1) **[Figure 20-20-2]** in the hose and tighten.

Engage the parking brake. Lower the seat bar. Start the engine and push the top (toe) of the lift pedal.

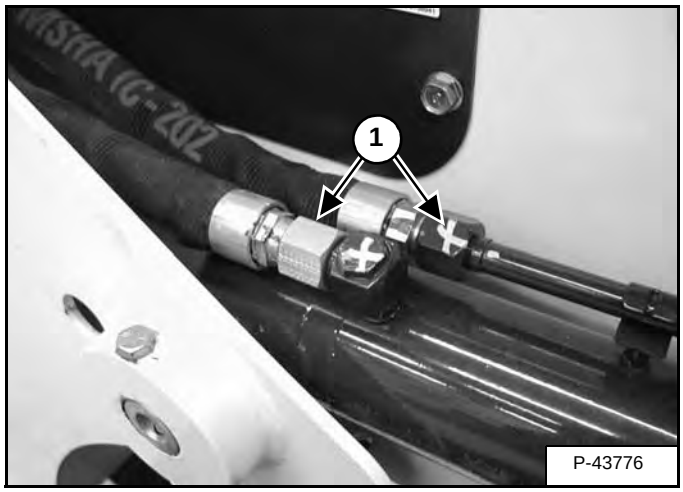
If there is any leakage from the fitting on the cylinder (Item 2) **[Figure 20-20-2]**. Remove the lift cylinder for repair. Repeat the procedure to check the other lift cylinder.

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CYLINDER (LIFT) (CONT'D)

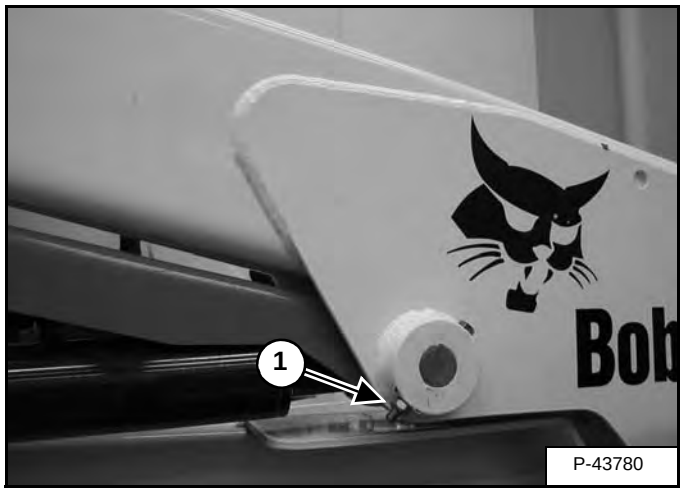
Removal And Installation

Figure 20-20-3



Disconnect both hydraulic hoses from the cylinder (Item 1) **[Figure 20-20-3]**. Cap and plug the fittings and hoses.

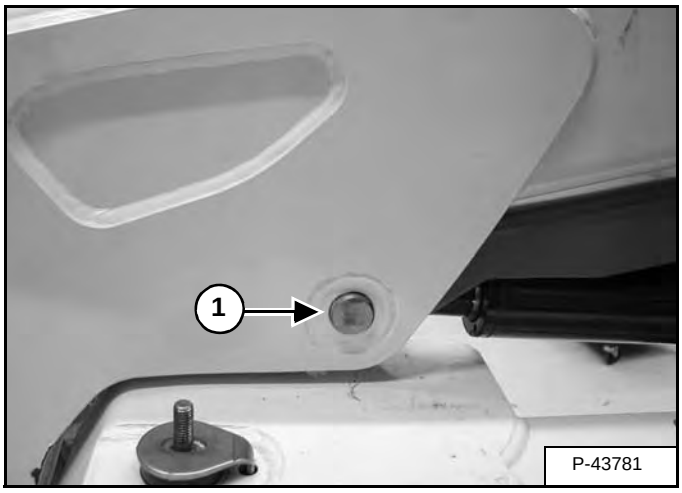
Figure 20-20-4



Remove the retaining bolt and nut (Item 1) **[Figure 20-20-4]** from the pin on the rod end of the lift cylinder.

Installation: Tighten the retainer bolt and nut to 25-28 ft.-lb. (34-38 N•m) torque.

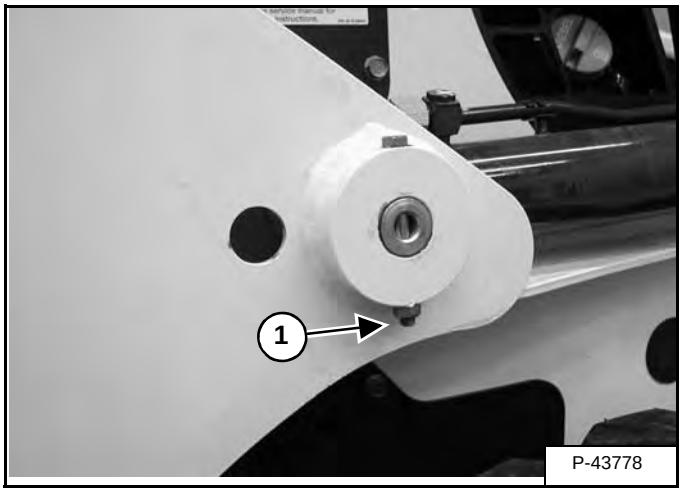
Figure 20-20-5



Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the pin (Item 1) **[Figure 20-20-5]** from the rod end of the lift cylinder.

Figure 20-20-6



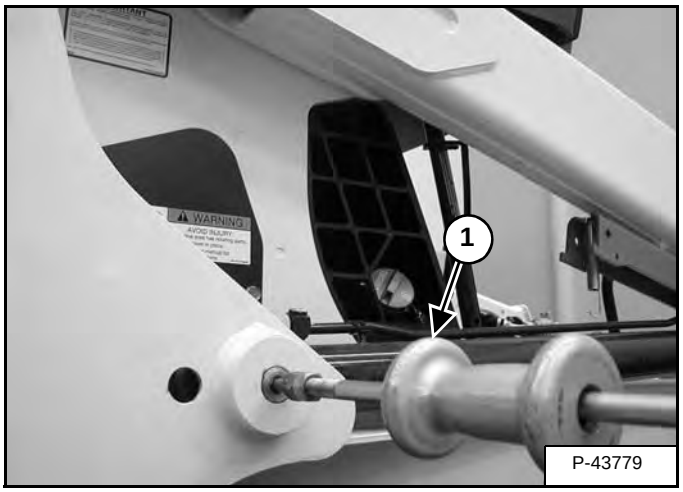
Remove the retaining bolt and nut (Item 1) **[Figure 20-20-6]** from the pivot pin at the base end of the lift cylinder.

Installation: Tighten the retainer bolt and nut to 25-28 ft.-lb. (34-38 N•m) torque.

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Removal And Installation (Cont'd)

Figure 20-20-7



Install a slide hammer (Item 1) **[Figure 20-20-7]** and remove the base end pivot pin.

Remove the lift cylinder.

⚠ WARNING

AVOID INJURY OR DEATH

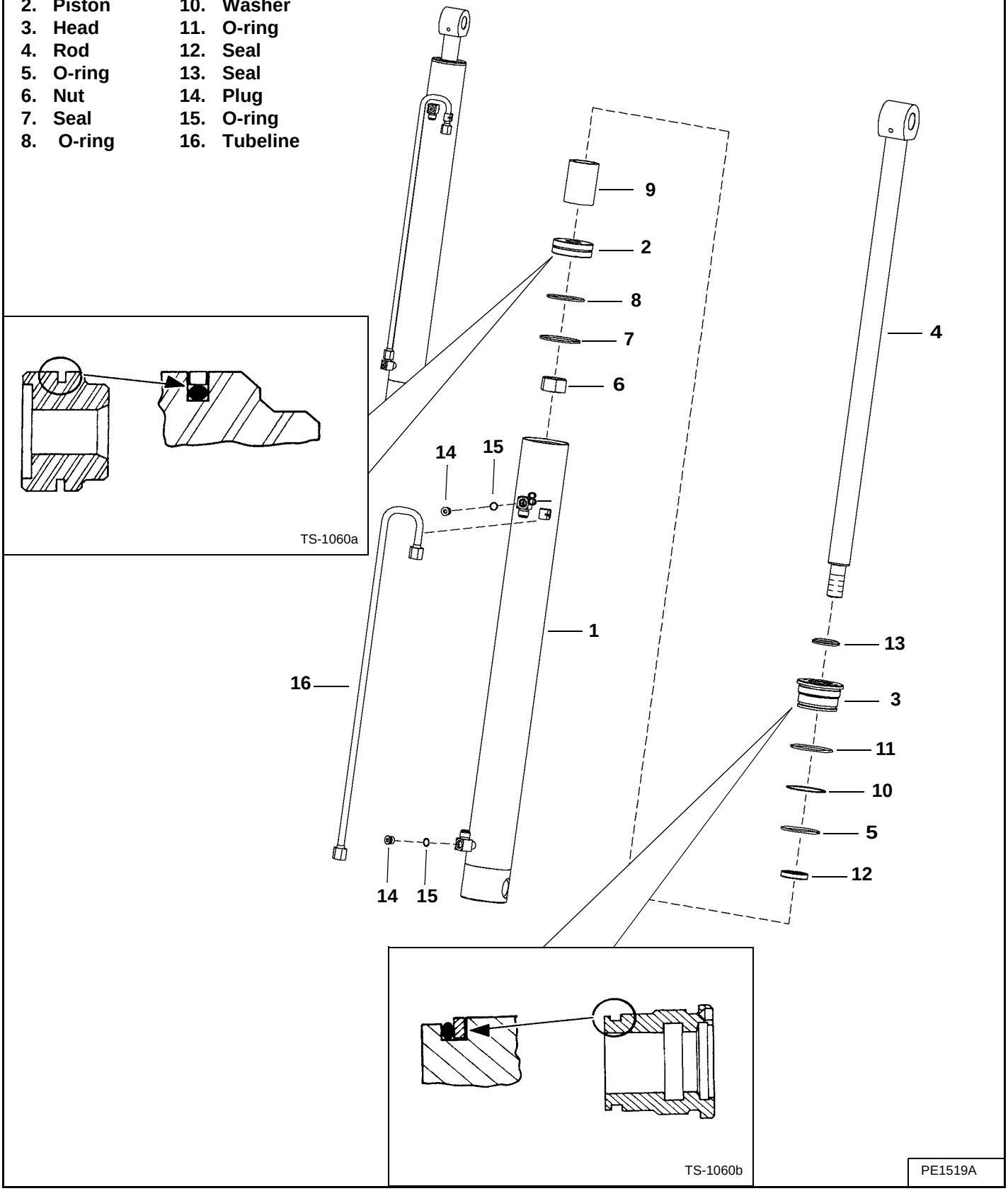
Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

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Parts Identification

1. Case
2. Piston
3. Head
4. Rod
5. O-ring
6. Nut
7. Seal
8. O-ring
9. Spacer
10. Washer
11. O-ring
12. Seal
13. Seal
14. Plug
15. O-ring
16. Tubeline



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Disassembly

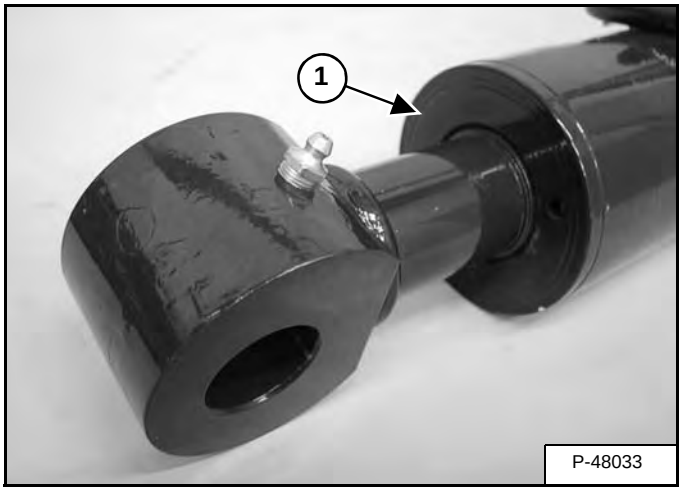
Use the following tools to disassemble the cylinder:

MEL1074 - O-ring Seal Hook
Spanner Wrench

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

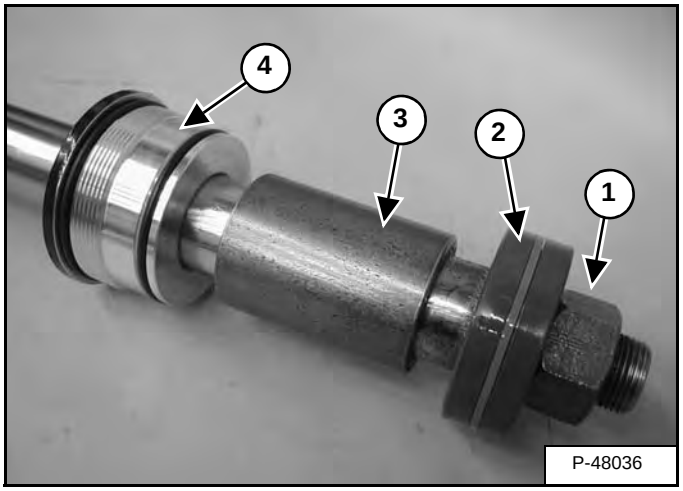
Put the base end of the cylinder in a vise.

Figure 20-20-8



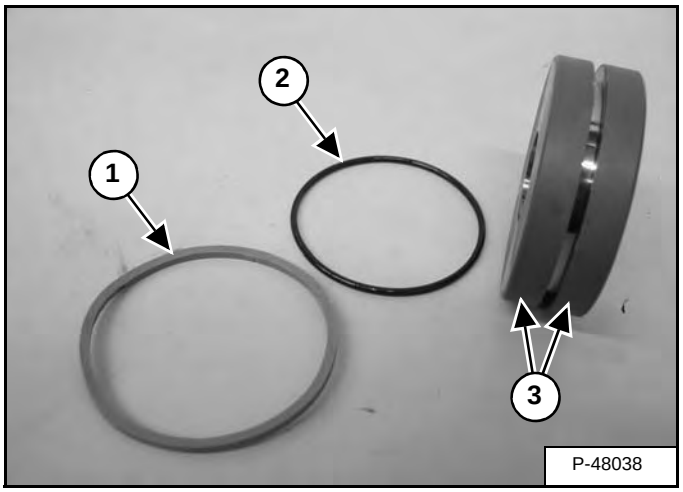
Use a spanner wrench to loosen the head (Item 1) **[Figure 20-20-8]** from the cylinder case.

Figure 20-20-9



Remove the nut (Item 1), piston (Item 2), spacer (Item 3) and head (Item 4) **[Figure 20-20-9]**.

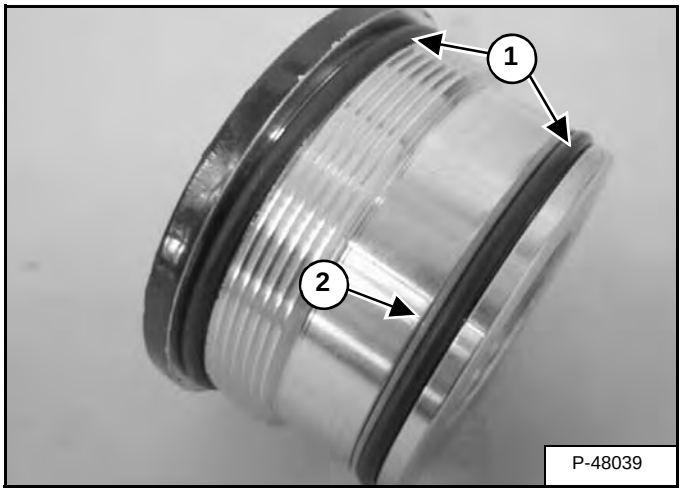
Figure 20-20-10



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

NOTE: If the fiber surface (Item 3) [Figure 20-20-10] on the piston head, becomes damaged, the complete piston head must be replaced.

Figure 20-20-11

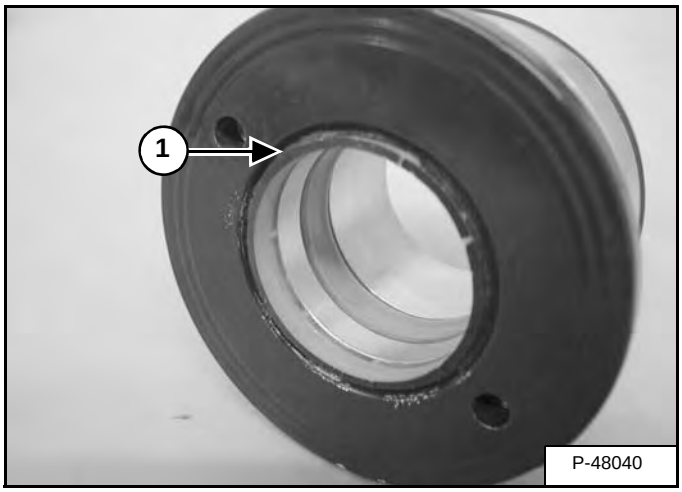


Remove the two O-rings (Item 1) and the back-up washer (Item 2) **[Figure 20-20-11]** from the cylinder head.

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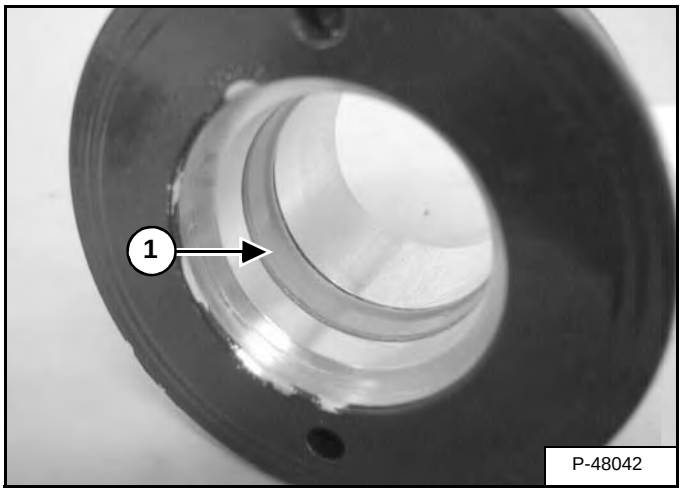
Disassembly (Cont'd)

Figure 20-20-12



Remove the wiper seal (Item 1) **[Figure 20-20-12]** from the cylinder head.

Figure 20-20-13



Remove the rod seal (Item 1) **[Figure 20-20-13]** from the cylinder head.

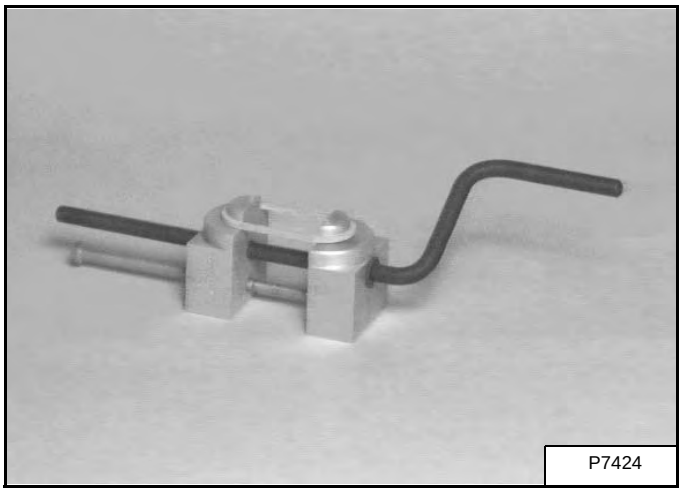
Dealer Copy -- Not for Resale

Assembly

Use the following tools to assemble the cylinder:

MEL1396 - Seal Installation Tool
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
Spanner Wrench

Figure 20-20-14



Wash the cylinder parts in solvent and air dry them.

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

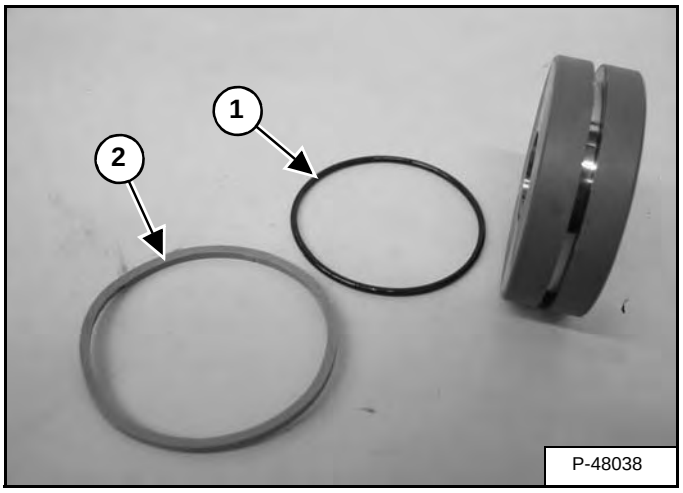
Always install new O-rings and seals during assembly.

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

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

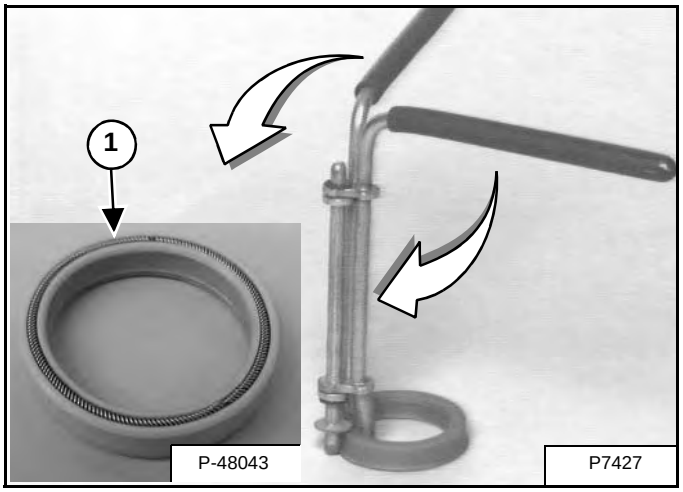
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-20-15



Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-20-15]** on the cylinder piston.

Figure 20-20-16



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

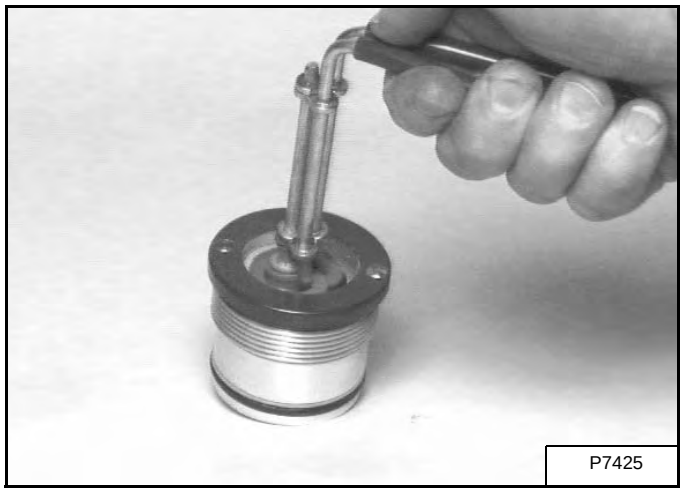
NOTE: During installation the spring side of the seal (Item 1) [Figure 20-20-16] must be installed toward the inside of the cylinder.

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

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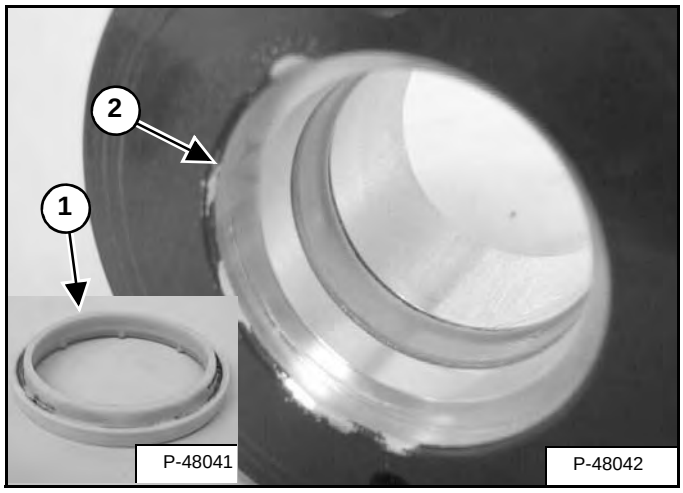
Assembly (Cont'd)

Figure 20-20-17



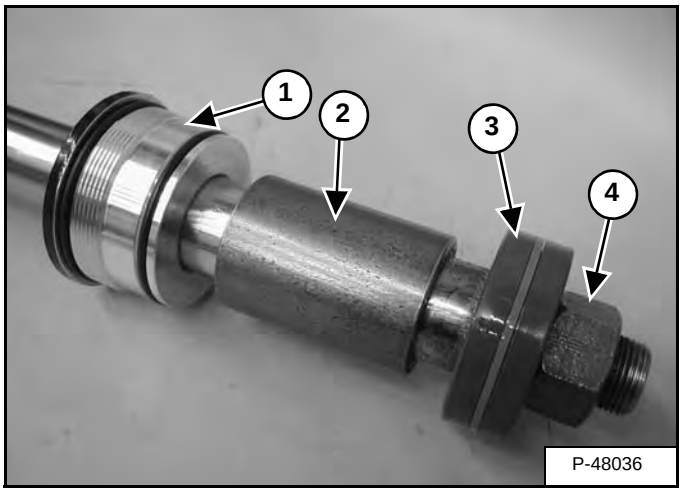
Install the rod seal in the head **[Figure 20-20-17]**.

Figure 20-20-18



Install the wiper seal, with the wiper side of the seal (Item 1) toward the outside of the head (Item 2) **[Figure 20-20-18]**.

Figure 20-20-19

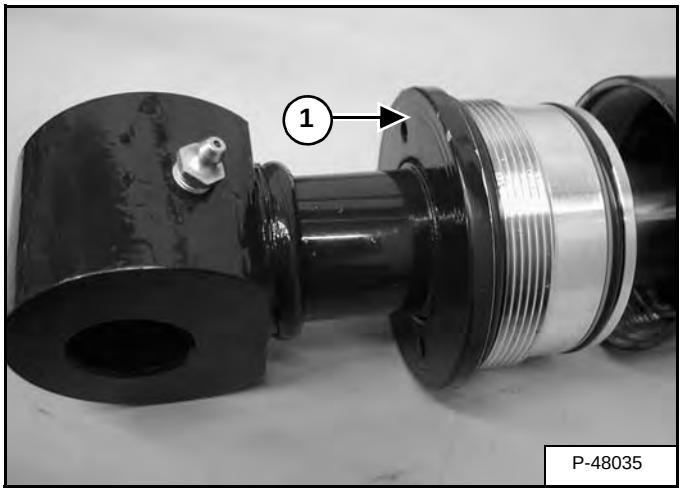


NOTE: Clean and dry the threads before installing the nut. Install the new nut from the kit.

Install the head (Item 1), spacer (Item 2) piston (Item 3), and nut (Item 4) **[Figure 20-20-19]**.

Tighten the nut (Item 4) **[Figure 20-20-19]** to 600 ft.-lb. (814 N•m) torque.

Figure 20-20-20



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

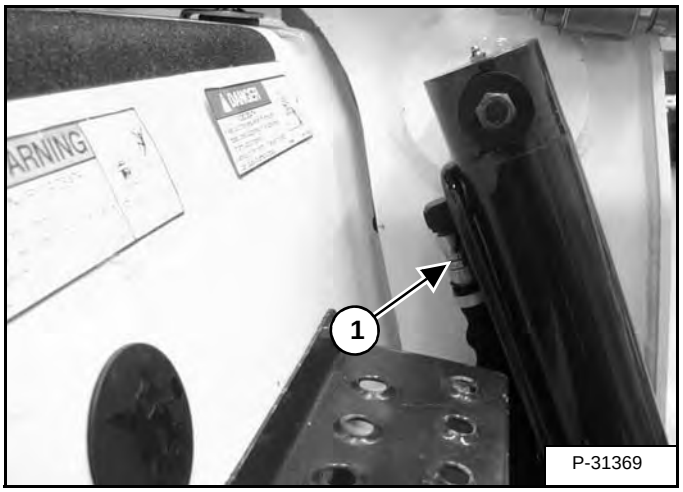
Using a spanner wrench, tighten the head (Item 1) **[Figure 20-20-20]** until the head is flush with the end of the cylinder tube assembly.

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CYLINDER (TILT)

Testing

Figure 20-21-1



Remove the attachment. Roll the Bob-Tach fully back. Stop the engine. Raise the seat bar.

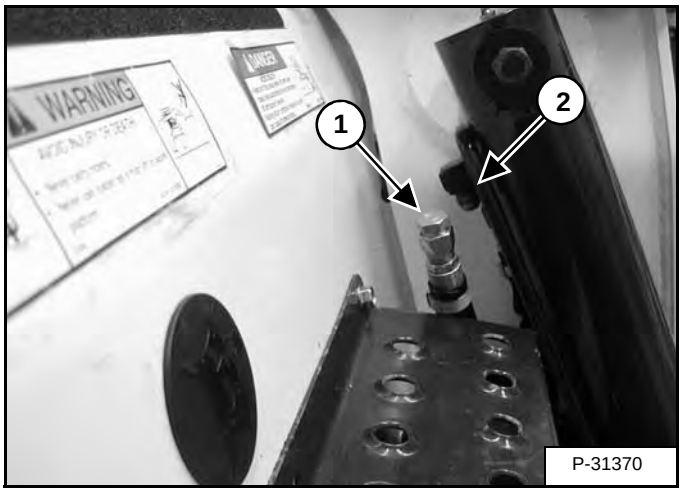
⚠ WARNING

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

Disconnect the hose (Item 1) **[Figure 20-21-1]** which goes to the base end of the tilt cylinder.

Figure 20-21-2



Install a cap (Item 1) **[Figure 20-21-2]** in the hydraulic hose and tighten.

Engage the parking brake. Lower the seat bar. Start the engine and push the bottom (heel) of the tilt pedal. If there is leakage from the open port on the cylinder (Item 2) **[Figure 20-21-2]**, remove the tilt cylinder for repair.

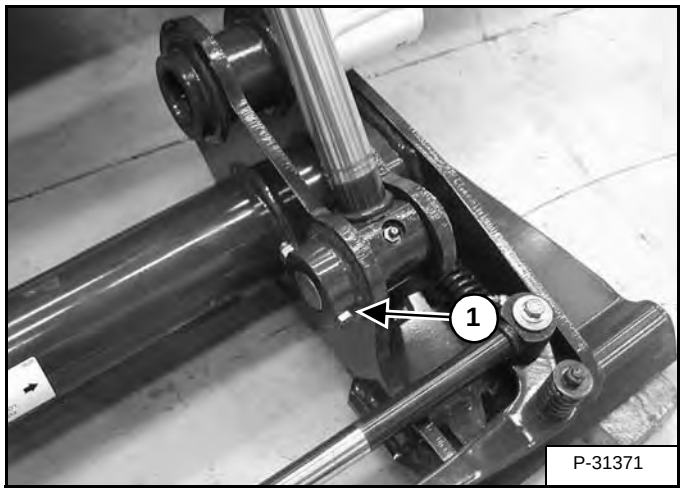
Repeat procedure to check the other tilt cylinder.

Dealer Copy -- Not for Resale

CYLINDER (TILT) (CONT'D)

Removal And Installation

Figure 20-21-3



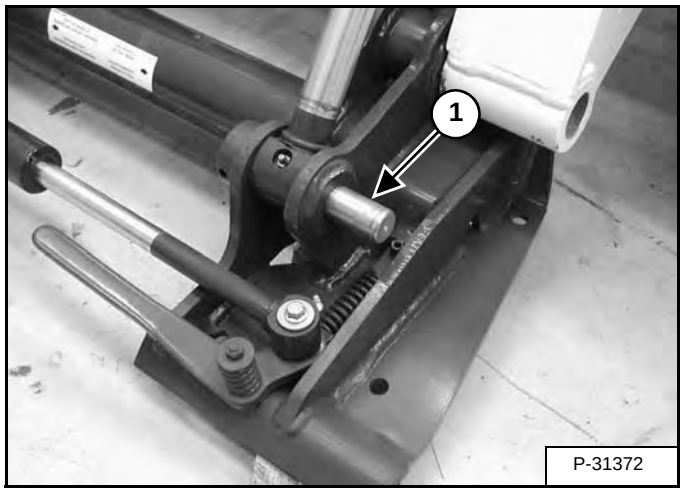
Remove the attachment from the Bob-Tach. Roll the Bob-Tach forward

Stop the engine. Raise the seat bar.

Remove the retainer bolt and nut (Item 1) **[Figure 20-21-3]** from the rod end pivot pin.

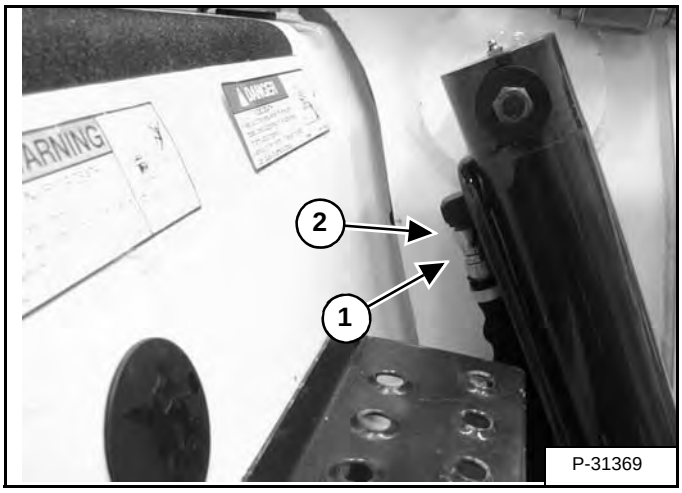
Installation: Tighten the retainer nut to 18-20 ft.-lb. (24-27 N•m) torque.

Figure 20-21-4



Remove the rod end pivot pin (Item 1) **[Figure 20-21-4]**.

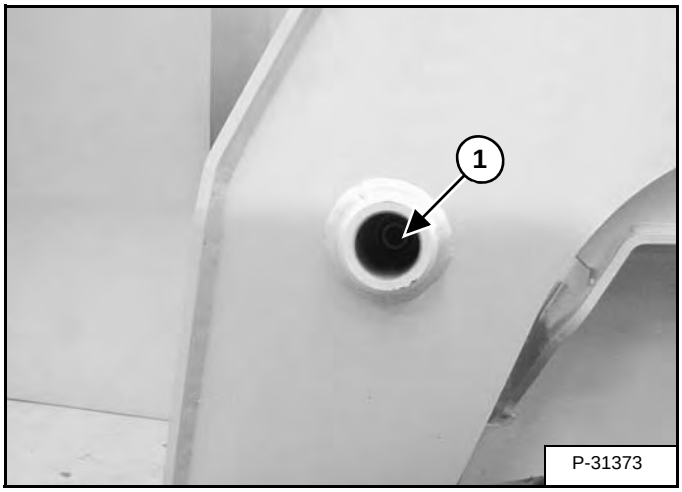
Figure 20-21-5



Disconnect the two hydraulic hoses (Items 1 & 2) **[Figure 20-21-5]** from the tilt cylinder.

Cap the hoses and plug the fittings on the cylinder.

Figure 20-21-6



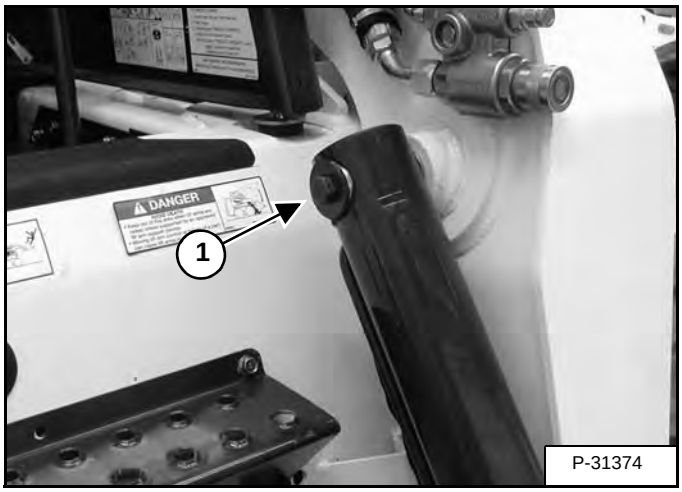
Remove the retainer nut (Item 1) **[Figure 20-21-6]** from the base end pivot pin.

Installation: Tighten the retainer nut to 190 ft.-lb. (257,6 N•m) torque.

Dealer Copy -- Not for Resale

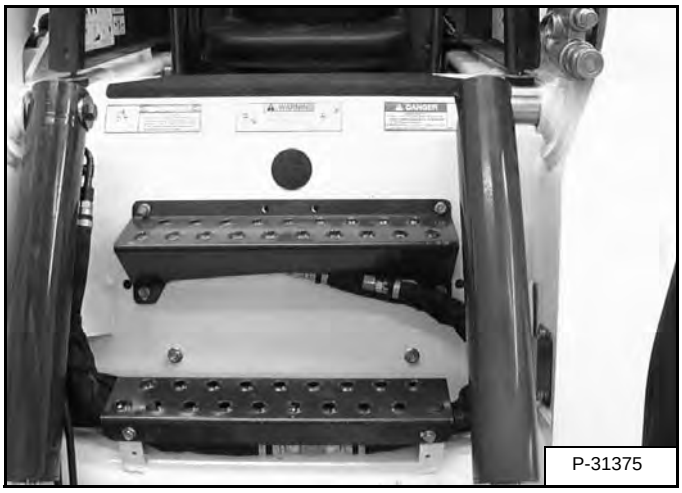
Removal And Installation (Cont'd)

Figure 20-21-7



Remove the base end pivot bolt and washer (Item 1) **[Figure 20-21-7]**.

Figure 20-21-8

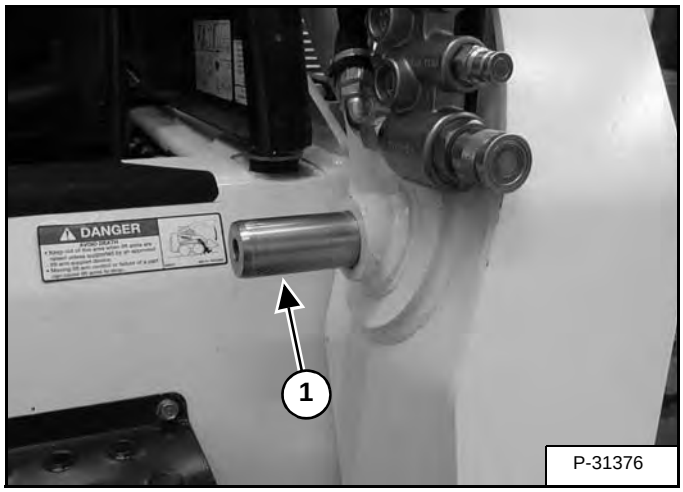


Slide the cylinder from the base pin and remove the tilt cylinder from the loader **[Figure 20-21-8]**.

Dealer Copy -- Not for Resale

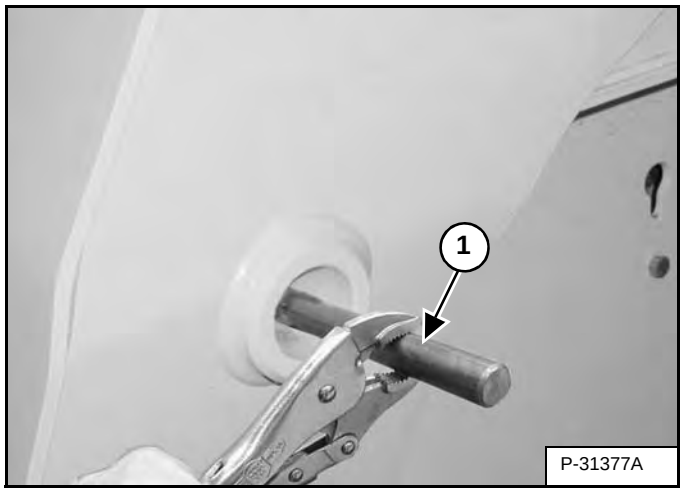
Base End Pivot Pin Removal And Installation

Figure 20-21-9



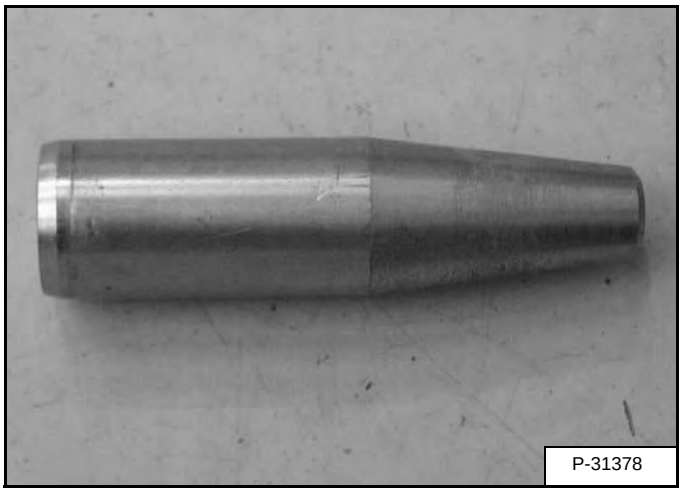
Remove the tilt cylinder from the cylinder base pin (Item 1) **[Figure 20-21-9]**. (See Removal And Installation on Page 20-21-2.)

Figure 20-21-10



Use a 7/8" (.875 mm) shaft (Item 1) **[Figure 20-21-10]** and a hammer to remove the tilt cylinder base pin from the lift arms.

Figure 20-21-11

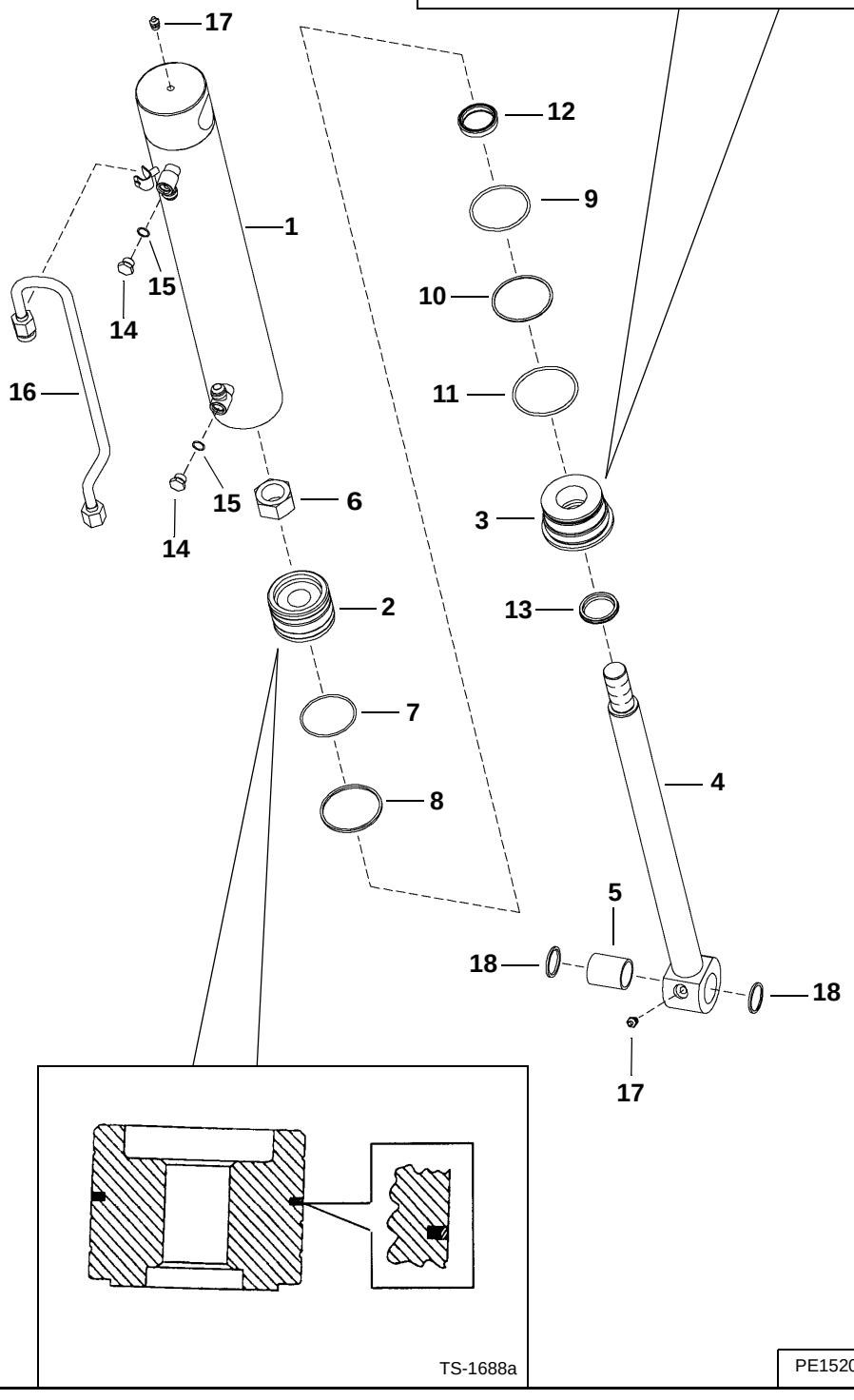


Check pivot pin and replace as needed **[Figure 20-21-11]**.

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Parts Identification

1. Case
2. Piston
3. Head
4. Rod
5. Bushing
6. Nut
7. O-ring
8. Seal
9. O-ring
10. Washer
11. O-ring
12. Seal
13. Seal
14. Plug
15. O-ring
16. Tubeline
17. Grease Fitting
18. Oil Seal



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Disassembly

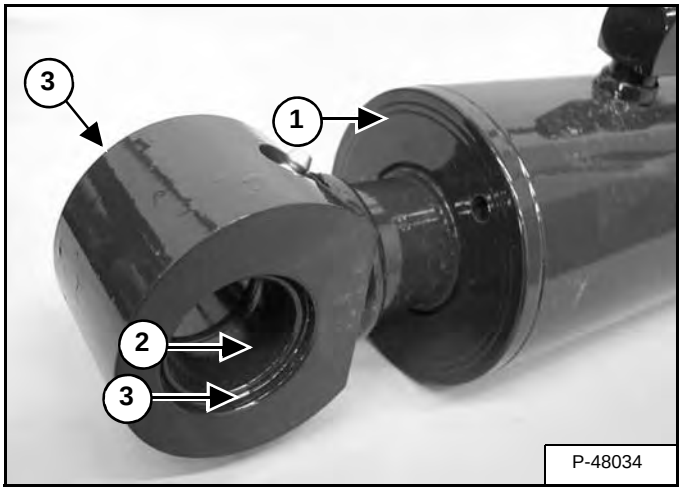
Use the following tools to disassemble the cylinder:

MEL1074 - O-ring Seal Hook
Spanner Wrench

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 20-21-12

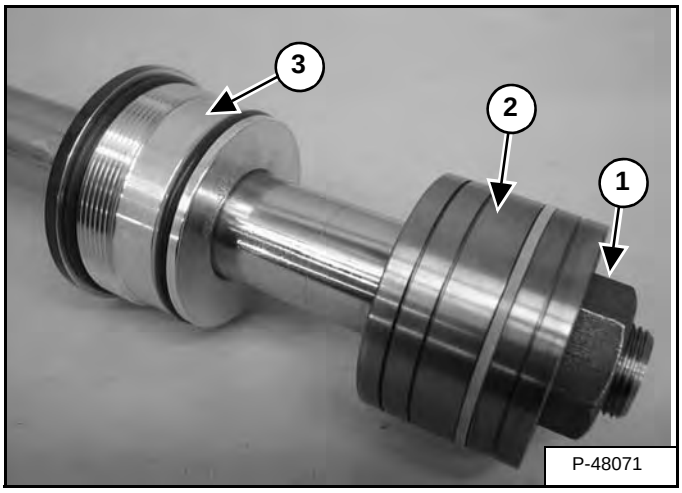


Use a seal pick to remove the seals (Item 3) **[Figure 20-21-12]** on both sides of the pivot bushing.

Remove and replace bushing (Item 2) with a driver tool and hammer **[Figure 20-21-12]**.

Use a spanner wrench to loosen the head (Item 1) **[Figure 20-21-12]** from the cylinder case.

Figure 20-21-13

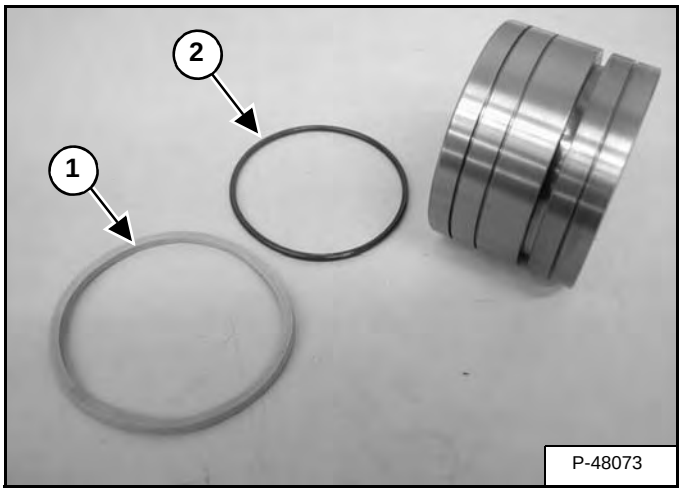


Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-21-13]**.

Dealer Copy -- Not for Resale

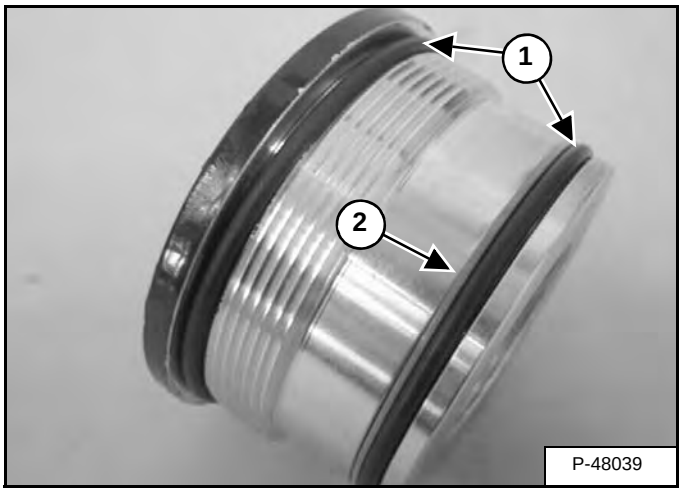
Disassembly (Cont'd)

Figure 20-21-14



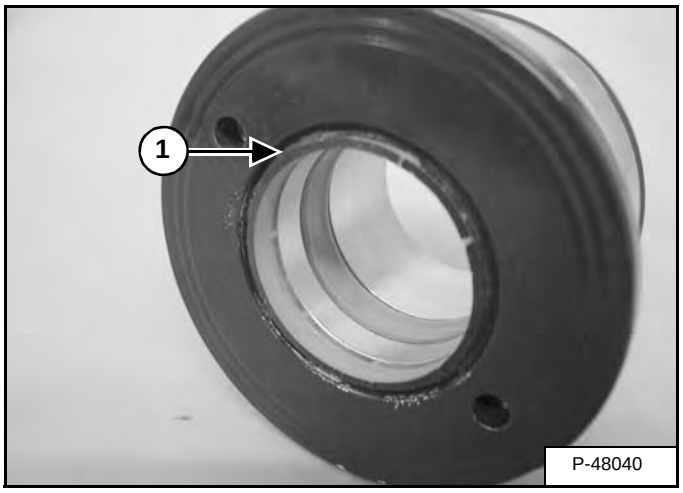
Remove the seal (Item 1), and O-ring (Item 2) **[Figure 20-21-14]** from the piston.

Figure 20-21-15



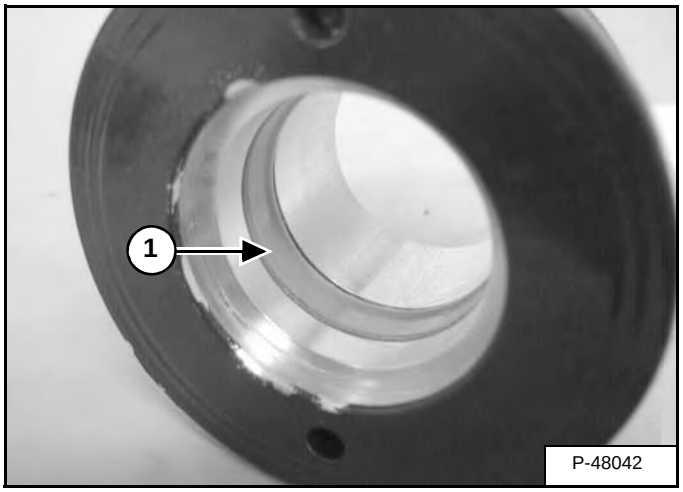
Remove the two O-rings (Item 1) and the back-up washer (Item 2) **[Figure 20-21-15]** from the cylinder head.

Figure 20-21-16



Remove the wiper seal (Item 1) **[Figure 20-21-16]** from the cylinder head.

Figure 20-21-17



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

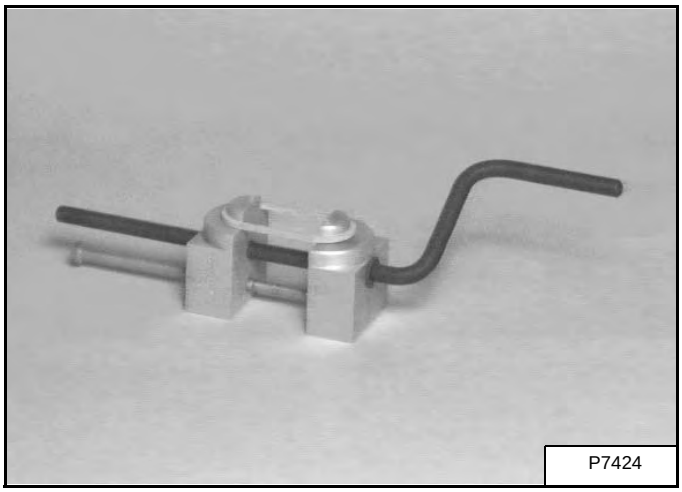
Dealer Copy -- Not for Resale

Assembly

Use the following tools to assemble the cylinder:

MEL1396 - Seal Installation Tool
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
Spanner Wrench

Figure 20-21-18



Wash the cylinder parts in solvent and air dry them.

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

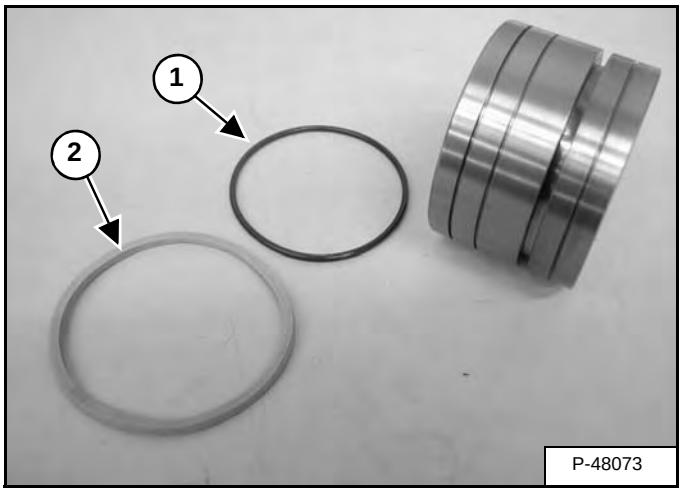
Always install new O-rings and seals during assembly.

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

Install the new seal on the tool and slowly stretch it until it fits the piston **[Figure 20-21-18]**.

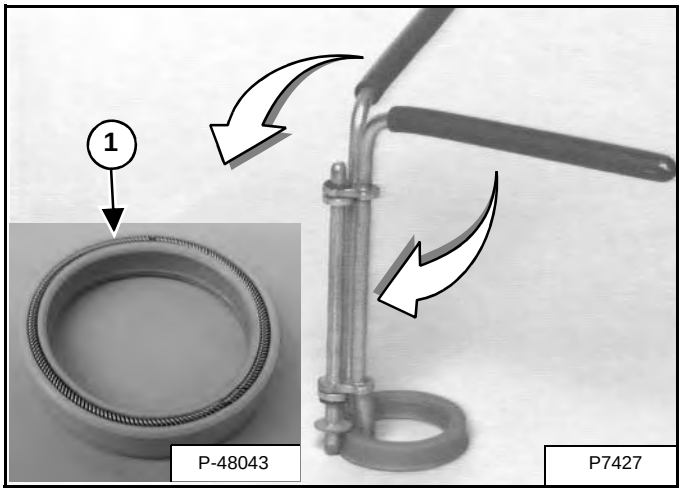
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-21-19



Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-21-19]** on the cylinder piston.

Figure 20-21-20



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

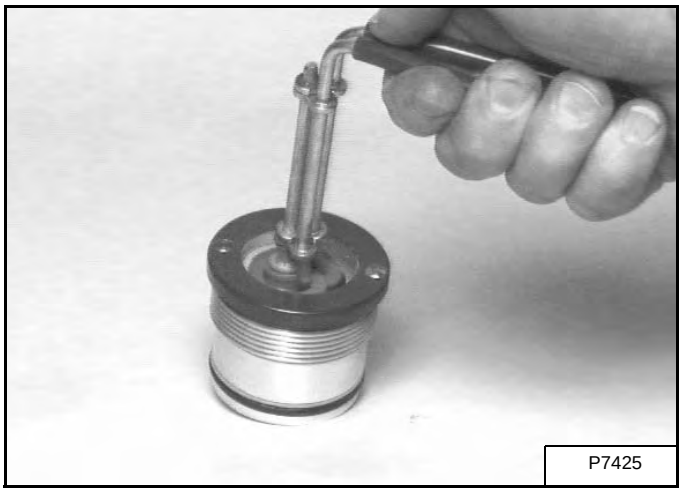
NOTE: During installation the spring side of the seal (Item 1) [Figure 20-21-20] must be installed toward the inside of the cylinder.

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

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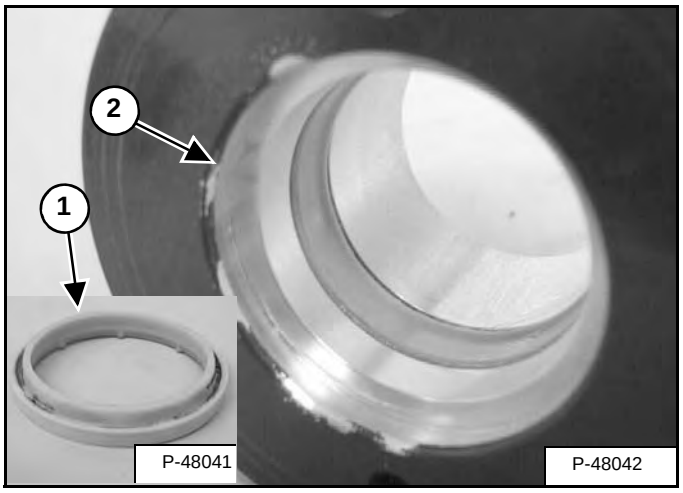
Assembly (Cont'd)

Figure 20-21-21



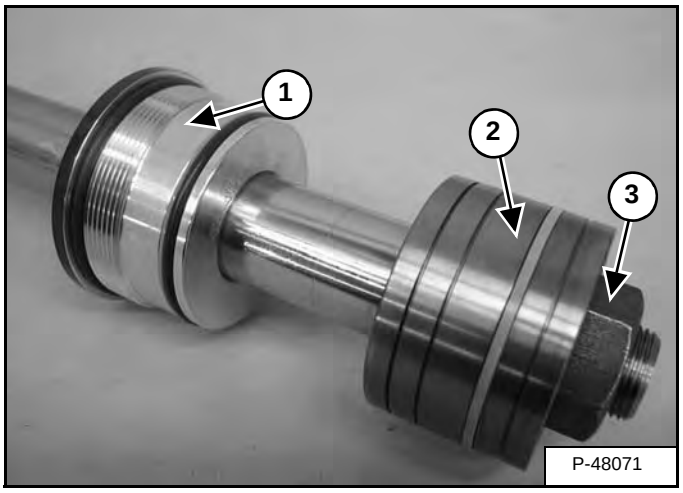
Install the rod seal in the head **[Figure 20-21-21]**.

Figure 20-21-22



Install the wiper seal, with the wiper side of the seal (Item 1) toward the outside of the head (Item 2) **[Figure 20-21-22]**.

Figure 20-21-23

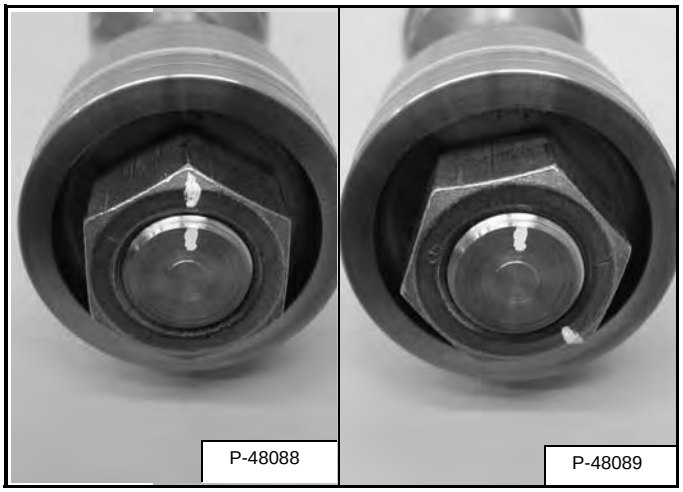


NOTE: Clean and dry the threads before installing the nut. Install the new nut from the kit.

Install the head (Item 1), piston (Item 2) and nut (Item 3) **[Figure 20-21-23]**.

Tighten the nut (Item 3) **[Figure 20-21-23]** to 100 ft.-lb. (136 N•m) torque.

Figure 20-21-24

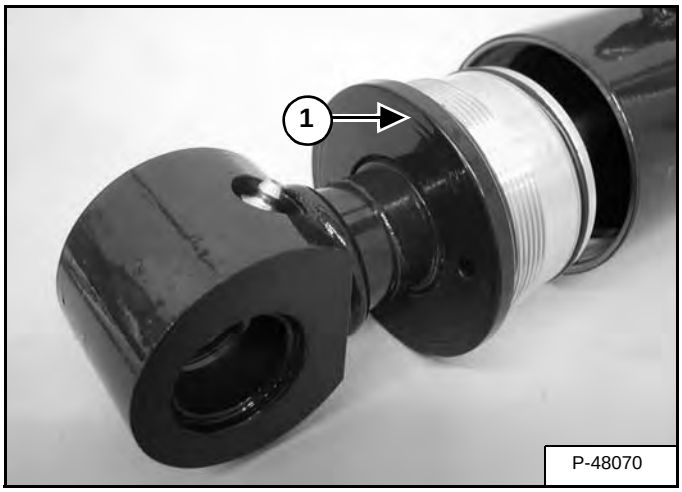


Mark the end of the shaft and nut **[Figure 20-21-24]**. Tighten the nut an additional 135 degrees or 2-1/4 flats **[Figure 20-21-24]**.

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Assembly (Cont'd)

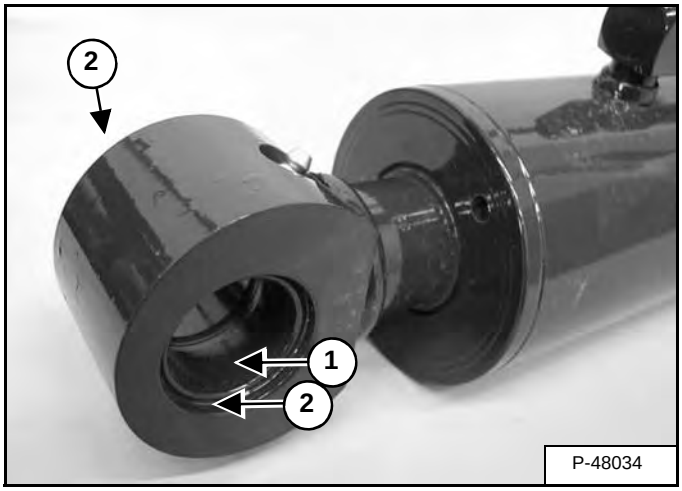
Figure 20-21-25



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

Using a spanner wrench, tighten the head (Item 1) **[Figure 20-21-25]** until the head is flush with the end of the cylinder tube assembly.

Figure 20-21-26



Install the bushing (Item 1) and seals (Item 2) using a driver tool and hammer **[Figure 20-21-26]**.

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CYLINDER (BOB-TACH)

Testing

⚠ 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

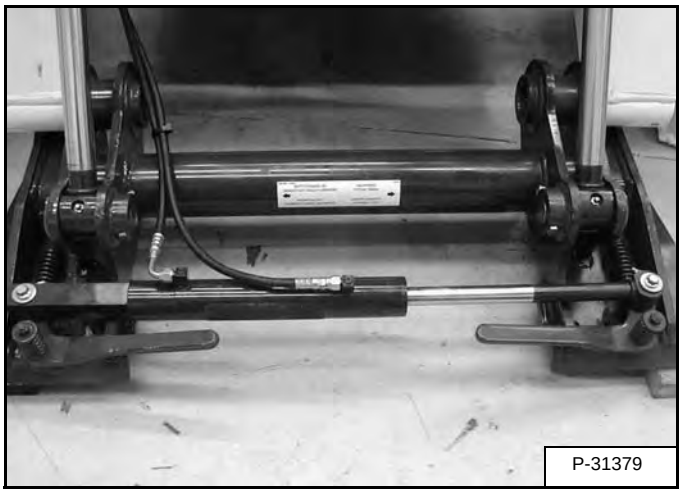
⚠ WARNING

AVOID INJURY OR DEATH

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

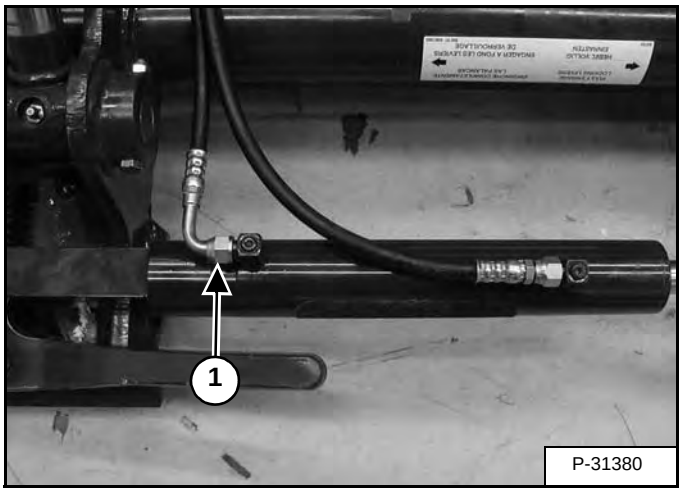
W-2103-0508

Figure 20-22-1



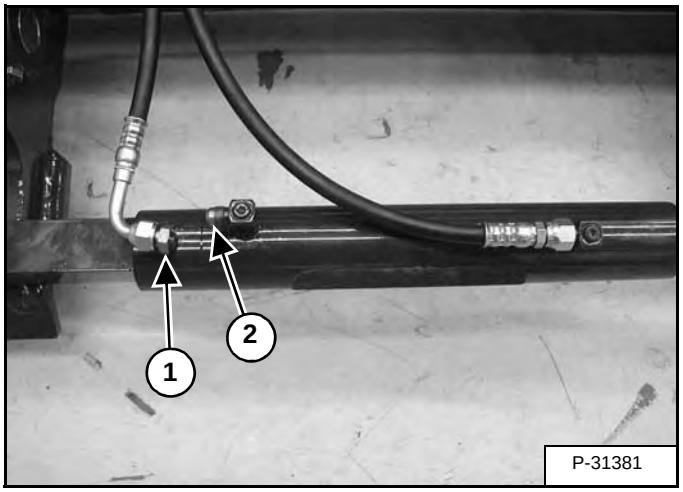
Tilt the Bob-Tach forward, so it is parallel to the floor **[Figure 20-22-1]**.

Figure 20-22-2



Disconnect the hose (Item 1) **[Figure 20-22-2]** from the power Bob-Tach cylinder base end port.

Figure 20-22-3



Install a plug in the hose (Item 1) **[Figure 20-22-3]** and tighten.

Engage the parking brake. Lower the seat bar. Start the engine.

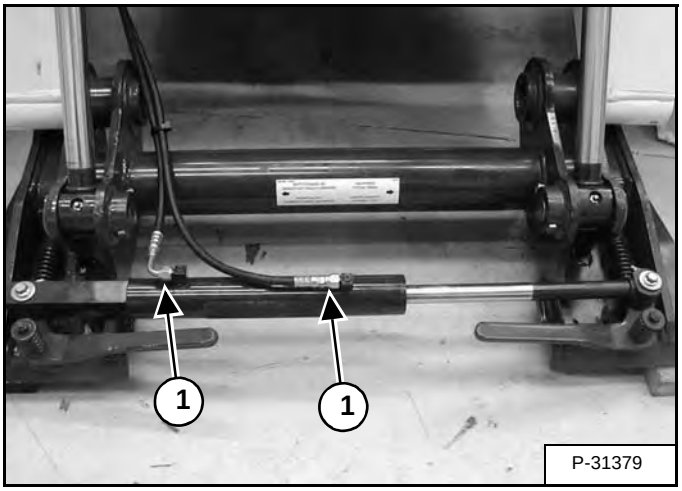
Push and hold the BOB-TACH “WEDGES UP” Switch (Front Accessory Panel).

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

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Removal And Installation

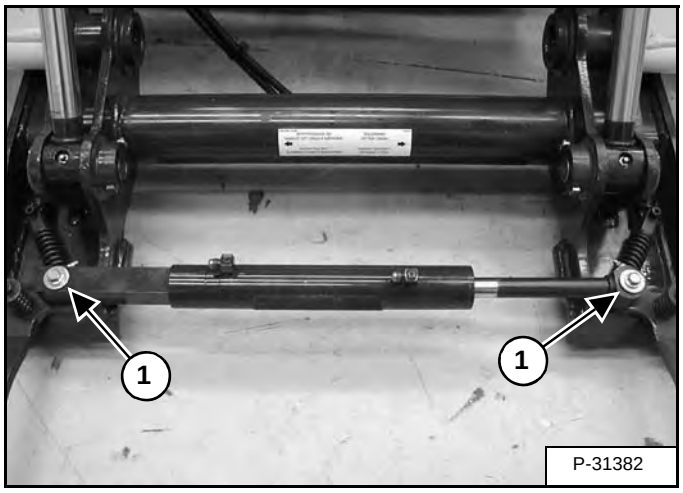
Figure 20-22-4



Disconnect the hoses from the rod and base end cylinder fitting (Item 1) **[Figure 20-22-4]**.

Install plugs in the hoses and cap on fittings.

Figure 20-22-5



Remove the bolts and washers (Item 1) **[Figure 20-22-5]**.

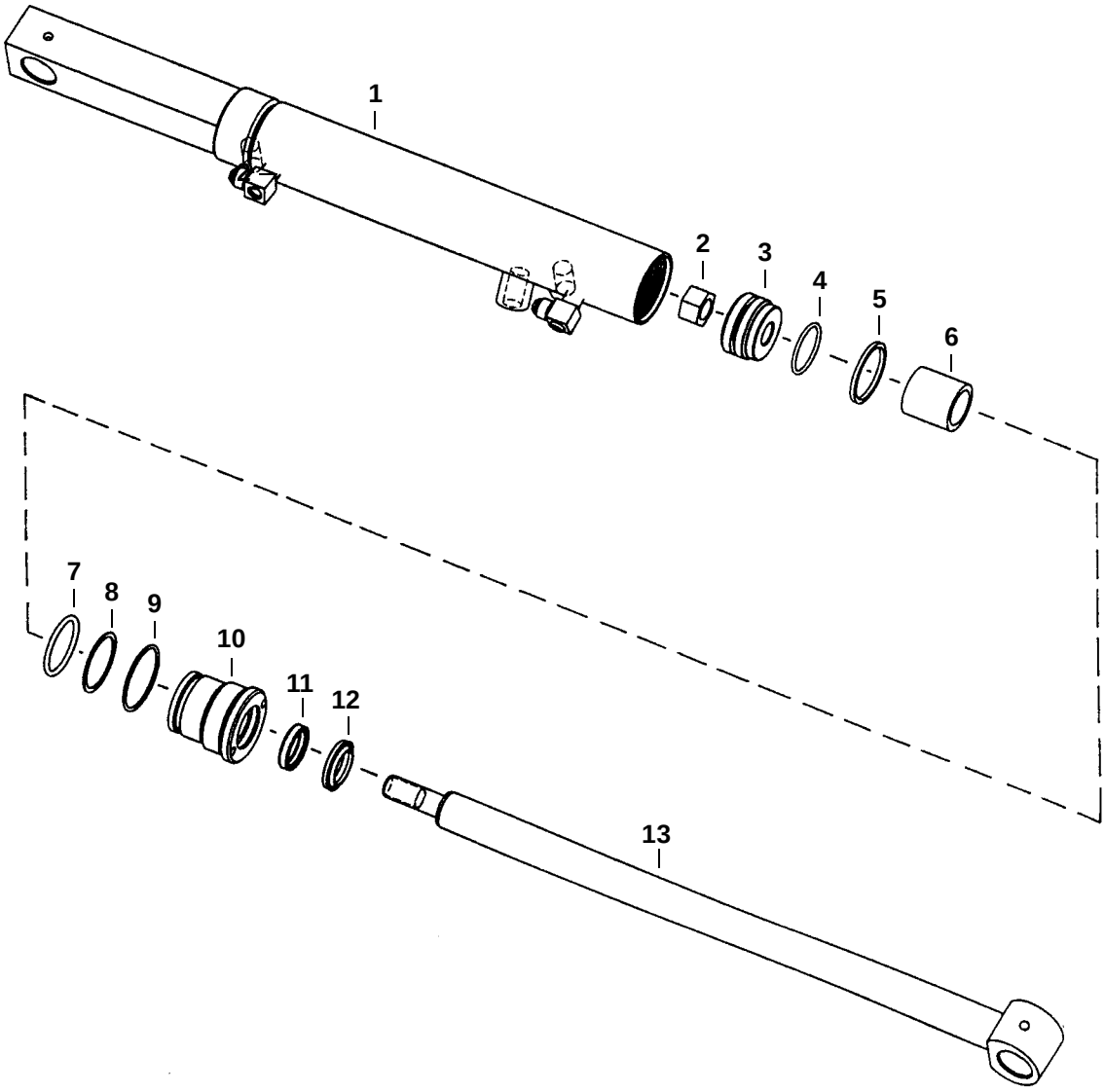
Installation: Tighten the bolts to 25-28 ft.-lb. (34-38 N•m) torque.

Remove the cylinder from the lever pivots.

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Parts Identification

1. Cylinder
2. Nut
3. Piston
4. O-ring
5. Ring
6. Spacer
7. O-ring
8. Ring
9. O-ring
10. Head
11. Seal
12. Seal
13. Rod



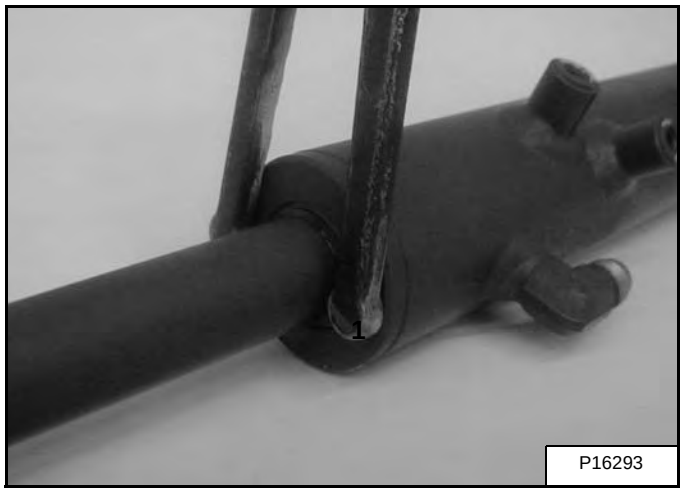
B-16207

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CYLINDER (BOB-TACH) (CONT'D)

Disassembly

Figure 20-22-6



Use the following tools to disassemble the cylinder:

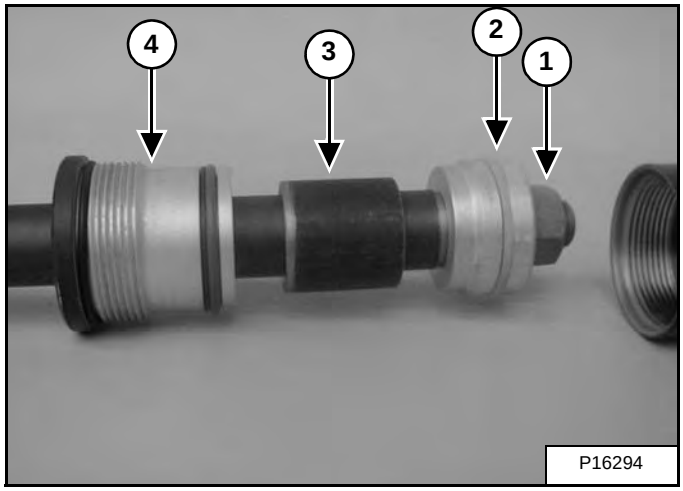
MEL1074 - O-ring Seal Hook
Spanner Wrench

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.

Use a spanner wrench to loosen the head **[Figure 20-22-6]**.

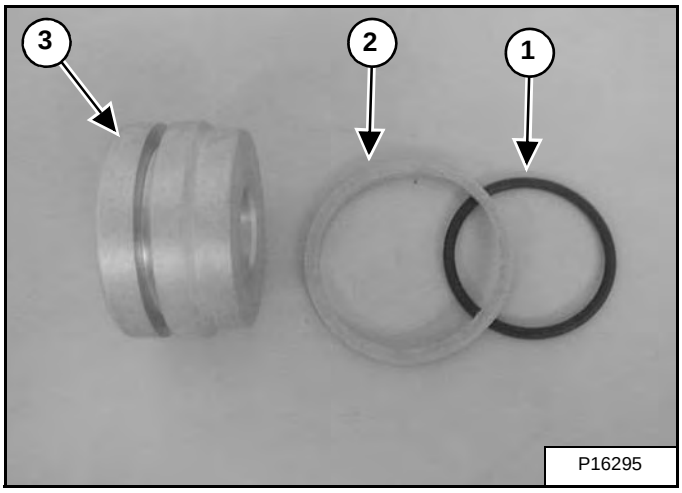
Figure 20-22-7



Remove the head and rod assembly from the cylinder **[Figure 20-22-7]**. Put the rod end in a vise.

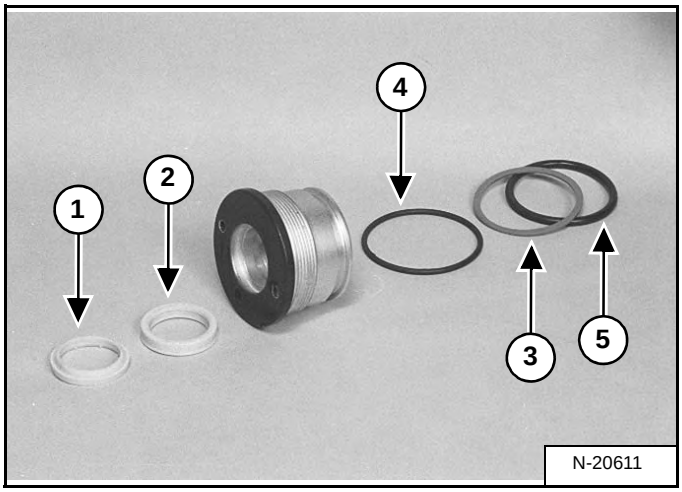
Remove the nut (Item 1), piston (Item 2), spacer (Item 3), and head (Item 4) **[Figure 20-22-7]** from the rod.

Figure 20-22-8



Piston: Remove the O-ring (Item 1), and seal (Item 2) from the piston (Item 3) **[Figure 20-22-8]**.

Figure 20-22-9

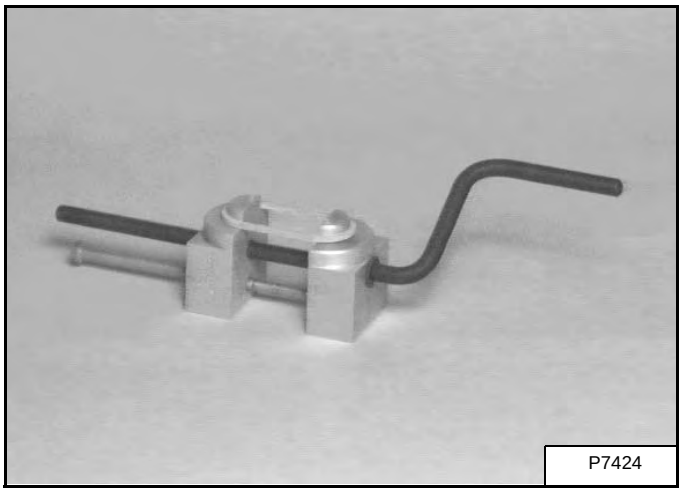


Remove the wiper seal (Item 1), and rod seal (Item 2), the back-up washer (Item 3), the thin O-ring (Item 4), and the thick O-ring (Item 5) **[Figure 20-22-9]** from the head.

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Assembly

Figure 20-22-10



Use the following tools to assembly the cylinder:

MEL1396 - Seal Installation Tool
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
Spanner Wrench

Wash the cylinder parts in solvent and air dry them.

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

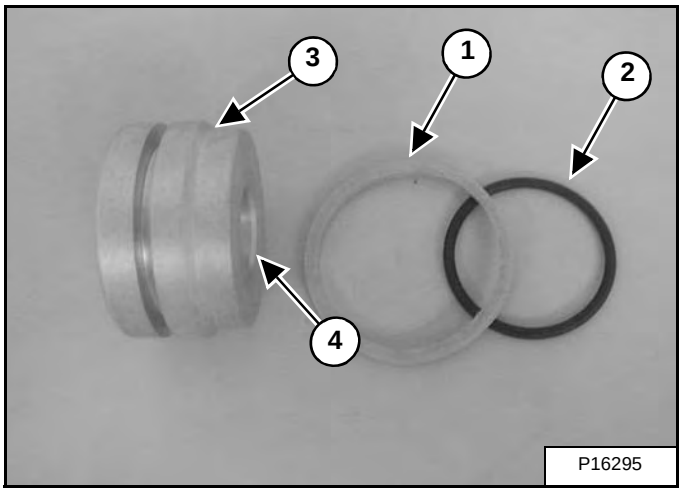
Always install new O-rings and seals during assembly.

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

Install the new seal on the tool and slowly stretch it until it fits the piston **[Figure 20-22-10]**.

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

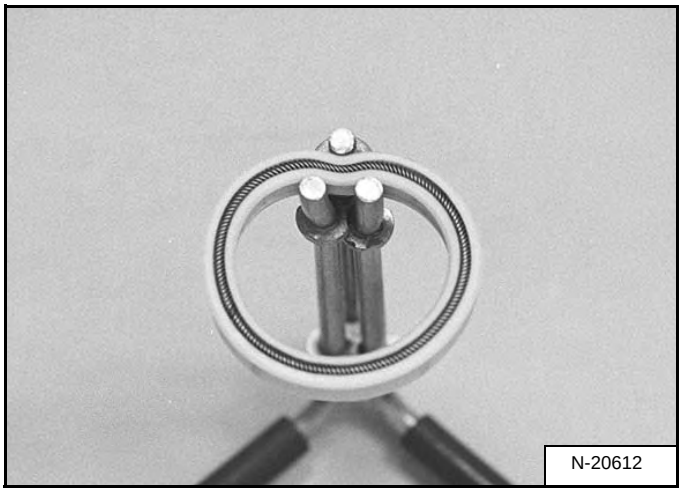
Figure 20-22-11



Piston: Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-22-11]**.

NOTE: The piston center hole (Item 4) [Figure 20-22-11] has a bevel on one end. The bevel goes toward the rod.

Figure 20-22-12



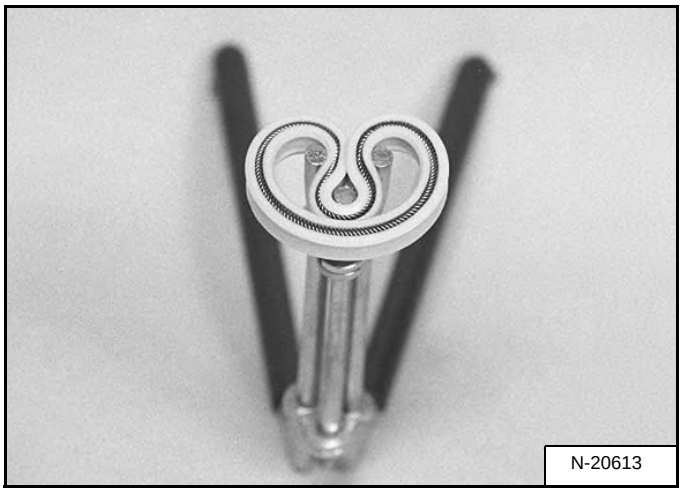
Install the rod seal on the rod seal tool **[Figure 20-22-12]**.

NOTE: During installation the O-ring side of the seal must be toward the inside of the cylinder.

Dealer Copy -- Not for Resale

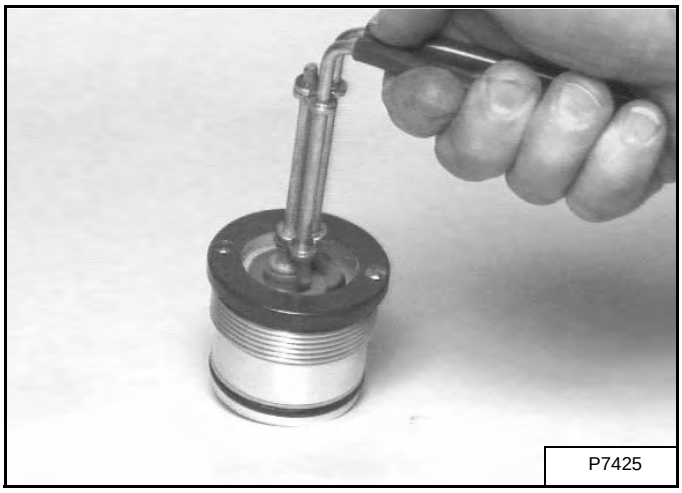
Assembly (Cont'd)

Figure 20-22-13



Rotate the handles to collapse the rod seal **[Figure 20-22-13]**.

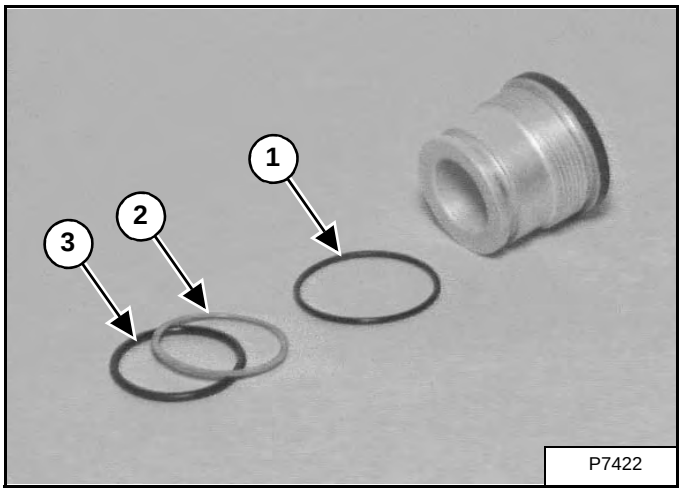
Figure 20-22-14



Install the rod seal in the head **[Figure 20-22-14]**.

Install the wiper seal with the wiper toward the outside of the head.

Figure 20-22-15

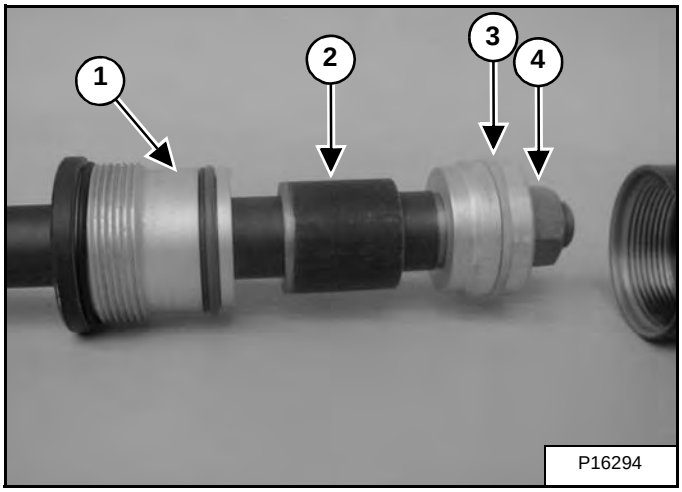


Install the thin O-ring (Item 1) **[Figure 20-22-15]**.

Install the back-up washer (Item 2) and thick O-ring (Item 3) **[Figure 20-22-15]** into the groove on the head.

NOTE: Clean and dry the threads before installing the nut. Install the new nut from the seal kit.

Figure 20-22-16



Install the head (Item 1), and spacer (Item 2) **[Figure 20-22-16]**.

Install the piston (Item 3) **[Figure 20-22-16]**.

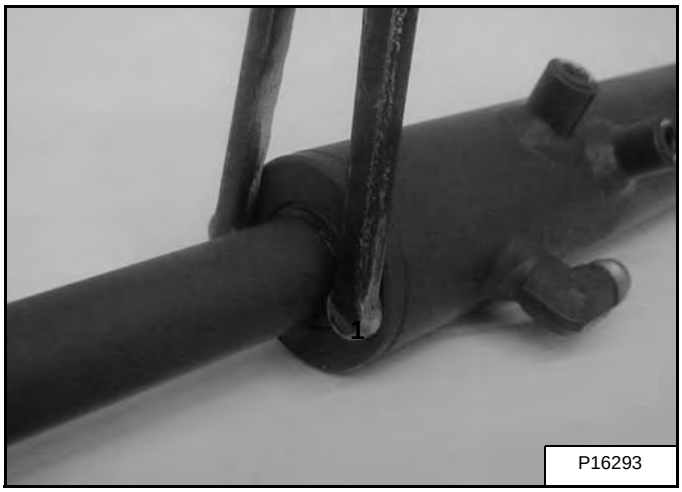
Grease the piston where the nut contacts the piston. do not get grease on the threads. Install the new nut (Item 4) **[Figure 20-22-16]**.

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

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Assembly (Cont'd)

Figure 20-22-17



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

Tighten the head using a spanner wrench **[Figure 20-22-17]**.

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MAIN RELIEF VALVE

Description

The main relief valve limits the hydraulic system pressure by opening at a certain pressure and allowing the hydraulic oil to flow back to the hydraulic reservoir. (See Hydraulic System on Page SPEC-10-3.)

The main relief valve is adjustable and is located on the hydraulic control valve near the bottom, facing the front of the loader.

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Testing

IMPORTANT

The hydraulic tester must be in the fully open position before you start the engine.

I-2024-0284

⚠ WARNING

When the engine is running during service, the steering levers must be in neutral and the parking brake engaged. Failure to do so can cause injury or death.

W-2006-0284

⚠ WARNING

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

W-2017-0286

The tools listed will be needed to do the following procedure:

MEL10003 - Hydraulic Tester
MEL10006 - Hydraulic Test Kit

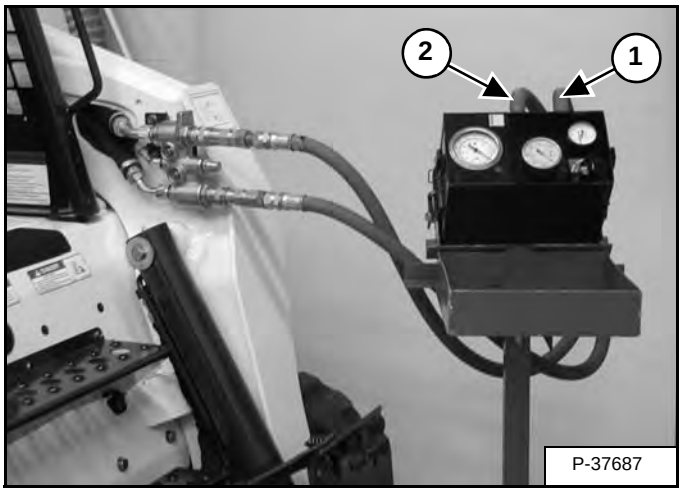
Turn the key switch to the OFF position.

NOTE: This procedure is for standard loaders, loaders equipped with ACS option and loaders equipped with SJC option. The main relief valve is located in the same place on all of the loaders.

To release the hydraulic pressure at the front auxiliary quick couplers push the couplers into the coupler block and hold for three seconds.

Lift and block the loader. (See Procedure on Page 10-10-1.)

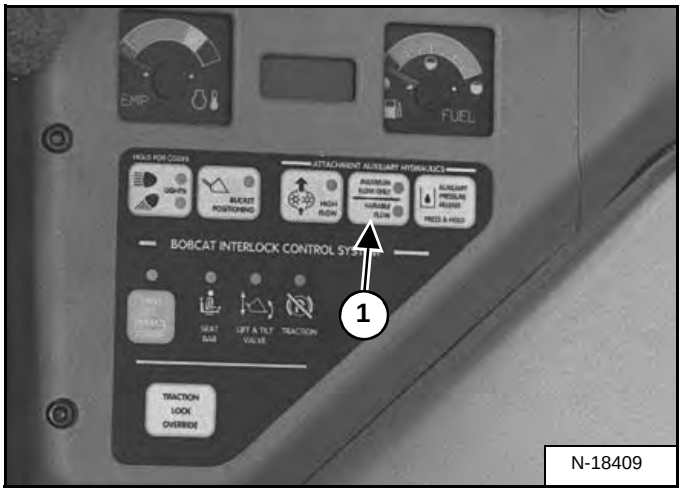
Figure 20-30-1



Connect the IN port (Item 1) **[Figure 20-30-1]** of the hydraulic tester to the bottom (female) quick coupler on the loader.

Connect the OUT port (Item 2) **[Figure 20-30-1]** of the hydraulic tester to the top (male) quick coupler on the loader.

Figure 20-30-2



Start the engine and run at low idle.

- Press the AUXILIARY HYDRAULICS Button (Item 1) **[Figure 20-30-2]** twice and the light beside Maximum Flow comes on.

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MAIN RELIEF VALVE (CONT'D)

Testing (Cont'd)

Figure 20-30-3

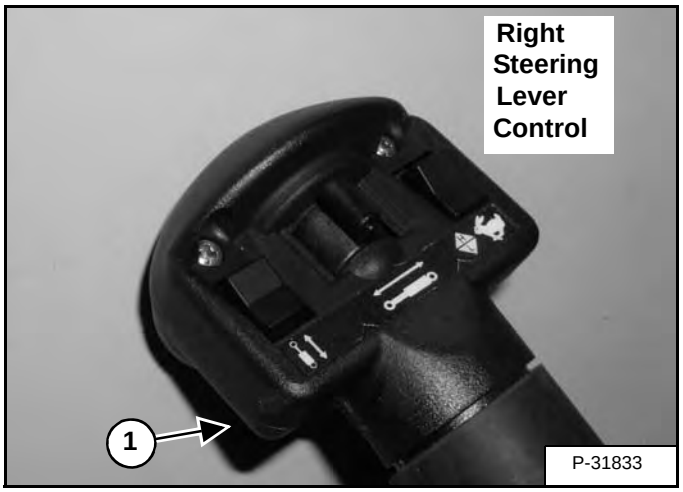
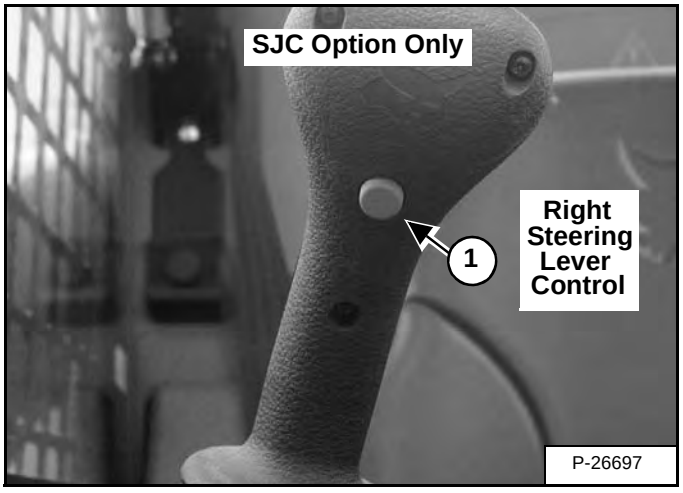


Figure 20-30-4



- Push the front switch (Item 1) **[Figure 20-30-3]** & **[Figure 20-30-4]** to give the **front** quick couplers a constant flow of fluid.

- To release from continuous operation, press the front switch (Item 1) **[Figure 20-30-3]** & **[Figure 20-30-4]** a second time.

Watch the flow meter on the hydraulic tester to make sure the flow is correct. Increase the engine speed to full RPM.

Refer to (See Hydraulic System on Page SPEC-10-3.) for both flow and pressure specifications of the hydraulic system.

Check the free flow specification.

Turn the restrictor control, on the tester, until the main relief valve opens. Check the relief pressure.

If the relief pressure is not correct, stop the engine and adjust the main relief valve.

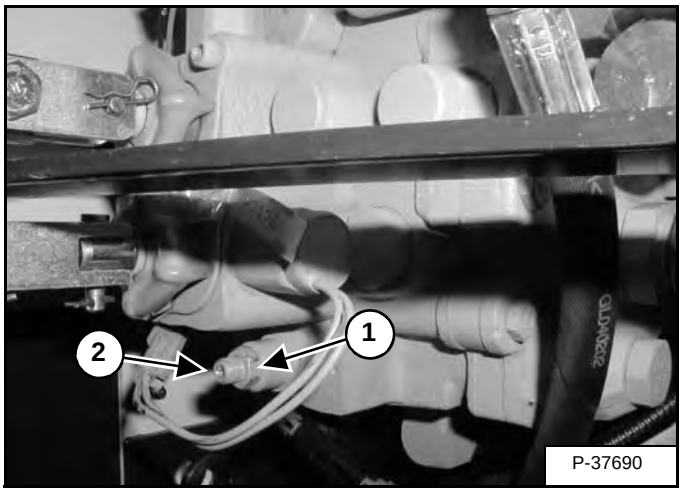
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MAIN RELIEF VALVE (CONT'D)

Adjusting

NOTE: This procedure is for standard loaders, loaders equipped with ACS option and loaders equipped with SJC option. The main relief valve is located in the same place on all of the loaders.

Figure 20-30-5



If the pressure is not correct, adjust the main relief valve. Loosen the lock nut (Item 1) **[Figure 20-30-5]**.

Turn the adjusting screw (Item 2) **[Figure 20-30-5]** in or out until the pressure is correct. Turning screw in will increase pressure.

NOTE: If the correct pressure can not be reached, replace the main relief valve. Check the pressure setting of the new relief valve.

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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.

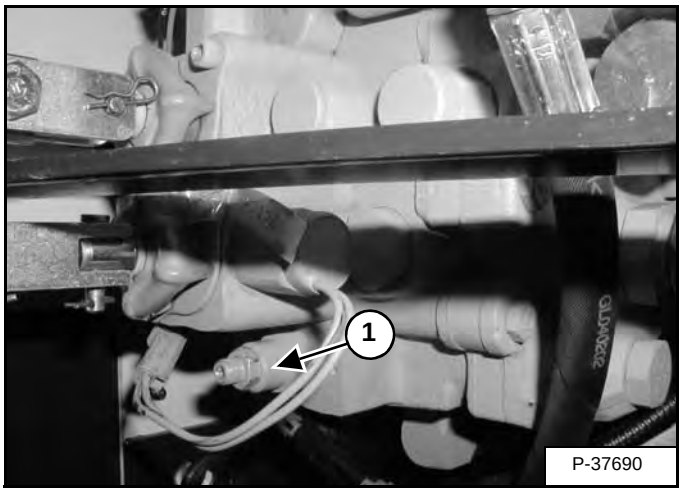
I-2003-0888

Raise the operator cab. (See Raising on Page 10-30-1.)

Clean the area around the control valve.

NOTE: This procedure is for standard loaders, loaders equipped with ACS option and loaders equipped with SJC option. The main relief valve is located in the same place on all of the loaders.

Figure 20-30-6



NOTE: The right side motor cover if removed may provide better access to the main relief valve on some machines.

The main relief valve (Item 1) **[Figure 20-30-6]** is located at the lower front of the control valve below the lift and tilt spool connections.

Loosen and remove the main relief valve (Item 1) **[Figure 20-30-6]**.

Figure 20-30-7



Remove the O-rings and back-up washers from the main relief valve **[Figure 20-30-7]**.

Clean the main relief valve in clean solvent. Use air pressure to dry the valve.

Install new O-rings and back-up washers. Install the main relief valve and tighten **[Figure 20-30-7]**.

Installation: Tighten the main relief valve to 35-40 ft.-lb. (47-54 N•m) torque.

Check the pressure again. (See Testing on Page 20-30-2.)

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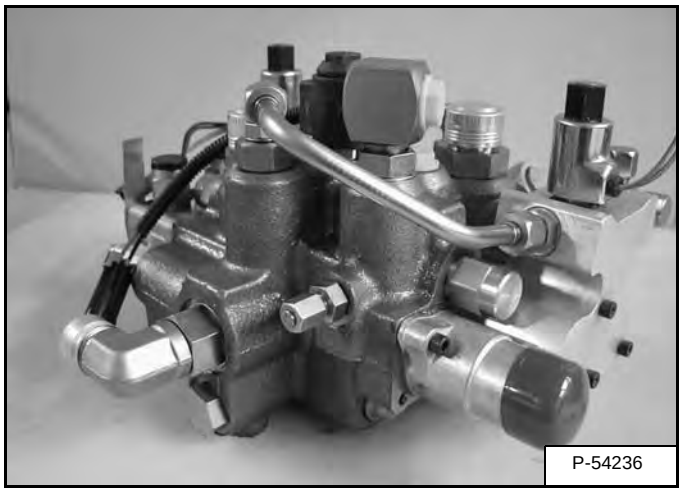


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HYDRAULIC CONTROL VALVE (STANDARD)

Description

Figure 20-40-1



The hydraulic control valve is located inside the main frame on the right hand side, below the operators cab.

The hydraulic control valve **[Figure 20-40-1]** is the hydraulic component that uses spools to direct the flow of hydraulic fluid to the lift, tilt and auxiliary functions.

The lift and tilt functions are operated using mechanical linkages to connect the foot pedals to the lift and tilt spools.

The auxiliary function is operated by pilot pressure. There is one solenoid located by each side of the spool. Only one solenoid at a time is activated by the switch on the right side control handle/lever. The activated solenoid sends pilot pressure oil to one side of the spool and forces the spool to shift.

The hydraulic control valve contains a main relief valve which is adjustable.

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HYDRAULIC CONTROL VALVE (STANDARD) (CONT'D)

Removal And Installation



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

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IMPORTANT

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

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Raise the lift arms and install an approved lift arm support device.

Stop the engine. Raise the seat bar.

Raise the operator cab. (See Raising on Page 10-30-1.)

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-2.)

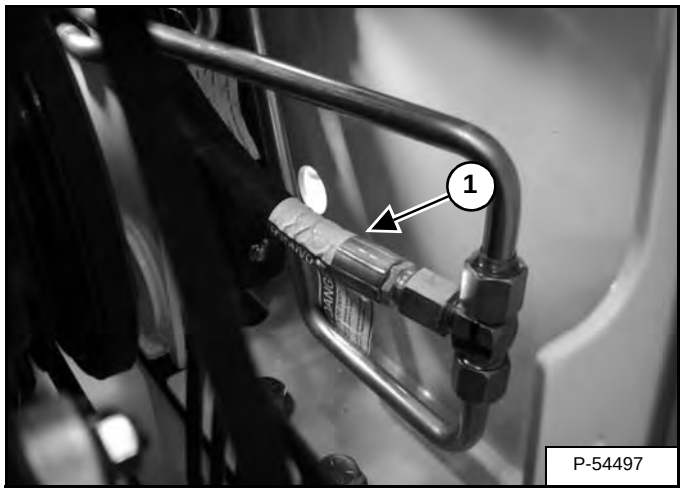
Remove the control panel. (See Removal And Installation on Page 50-100-2.)

Remove the lift arm bypass valve and mount from the loader. (See Removal And Installation on Page 20-50-2.)

Clean area around control valve.

Open rear door.

Figure 20-40-2

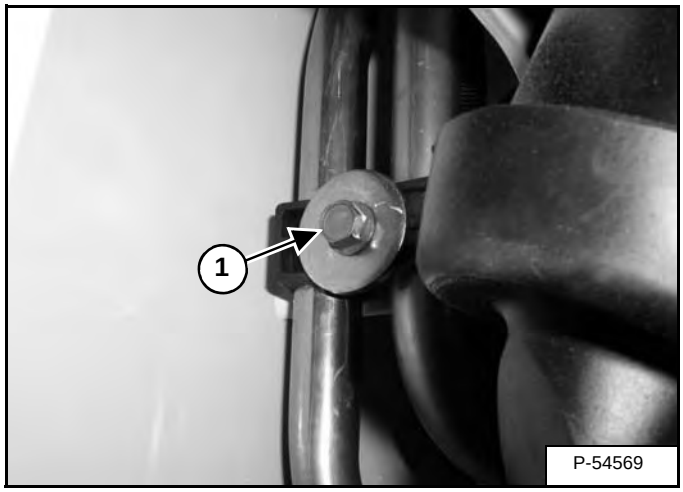


The fixed end main valve hose assembly (Item 1) **[Figure 20-40-2]** is connected to a fixed end fitting on the control valve. The hose is routed to the upright where the hose is connected to a fitting that feeds the base end of both lift cylinders. The hose can only be removed by first removing it from the tee fitting located at the rear of the loader.

Mark all hydraulic hoses and tubelines to aid in assembly.

Cap and plug the hose and fitting.

Figure 20-40-3



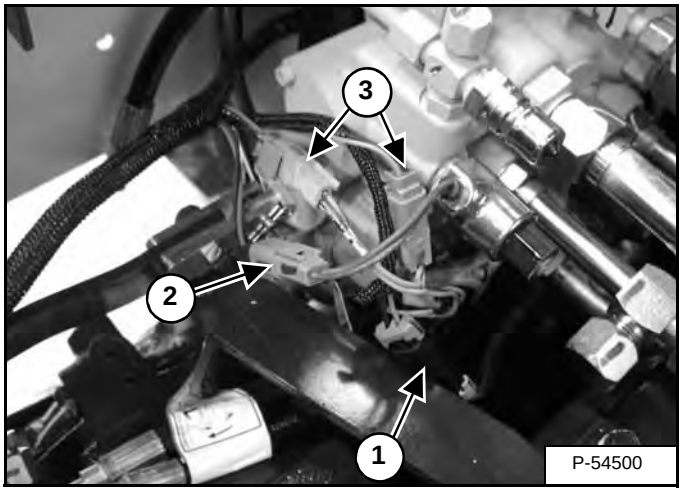
Remove the tubeline clamp (Item 1) **[Figure 20-40-3]** located on the inside of the left upright.

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HYDRAULIC CONTROL VALVE (STANDARD) (CONT'D)

Removal And Installation (Cont'd)

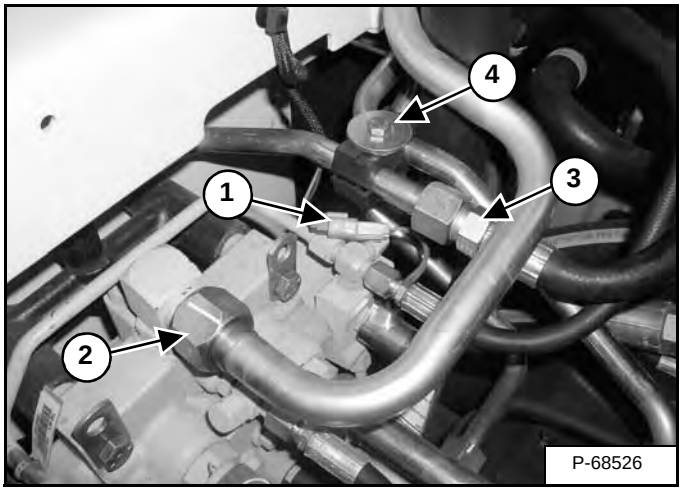
Figure 20-40-4



Mark the four wire connectors for proper installation.

Disconnect the wire harness connectors (Item 1) from the BICS valve solenoid, (Item 2) from auxiliary valve solenoid and (Item 3) from the lift and tilt lock solenoids **[Figure 20-40-4]**.

Figure 20-40-5



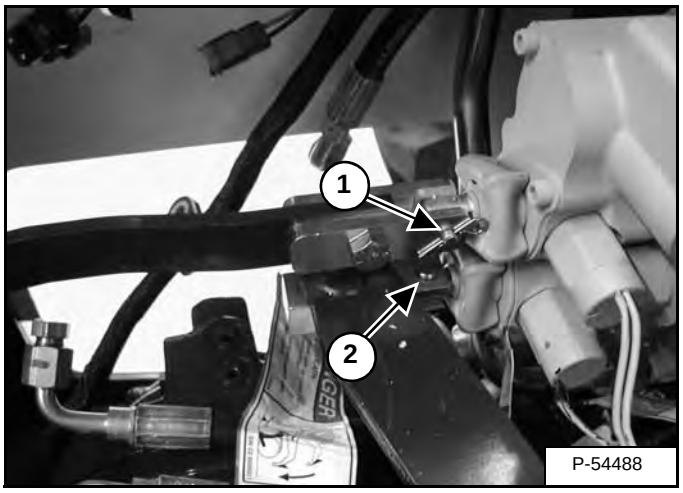
Disconnect the harness connector (Item 1) **[Figure 20-40-5]** from the auxiliary valve solenoid.

Disconnect the tubeline (Item 2) **[Figure 20-40-5]** that goes from the control valve to the hydraulic cooler.

Disconnect the hose (Item 3) **[Figure 20-40-5]** that goes from the gearpump to the control valve.

Remove the tubeline clamp (Item 4) **[Figure 20-40-5]**.

Figure 20-40-6

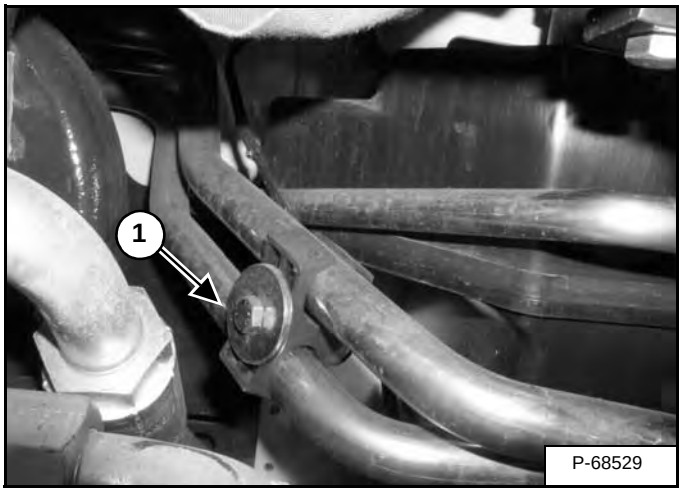


Disconnect foot control linkage (Item 1) **[Figure 20-40-6]** from the tilt spool on the control valve.

Disconnect foot control linkage (Item 2) **[Figure 20-40-6]** from the lift spool on the control valve.

Move the control linkages to allow clearance for the control valve removal.

Figure 20-40-7



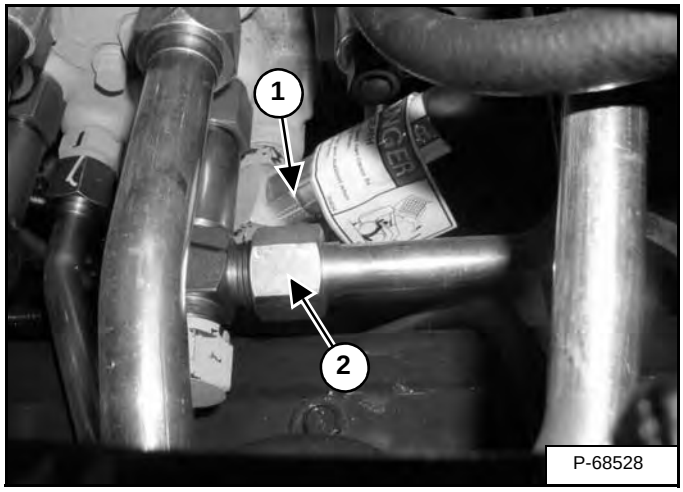
Remove the tubeline clamp (Item 1) **[Figure 20-40-7]** located on the auxiliary tubelines between the hydraulic reservoir and the hydrostatic pump.

Removing this clamp will allow more movement in the auxiliary tubelines for removing the control valve from the loader.

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Removal And Installation (Cont'd)

Figure 20-40-8



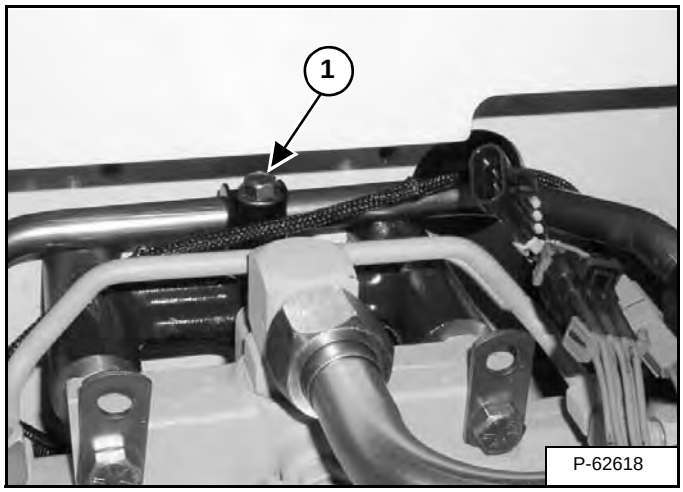
Loosen the fixed end main valve hose assembly (Item 1) **[Figure 20-40-8]** from the control valve.

The hose can be removed from the control valve by rotating the hose assembly.

Disconnect the tilt tubeline (Item 2) **[Figure 20-40-8]** from the control valve.

Cap and plug the hose, tubeline and the fittings.

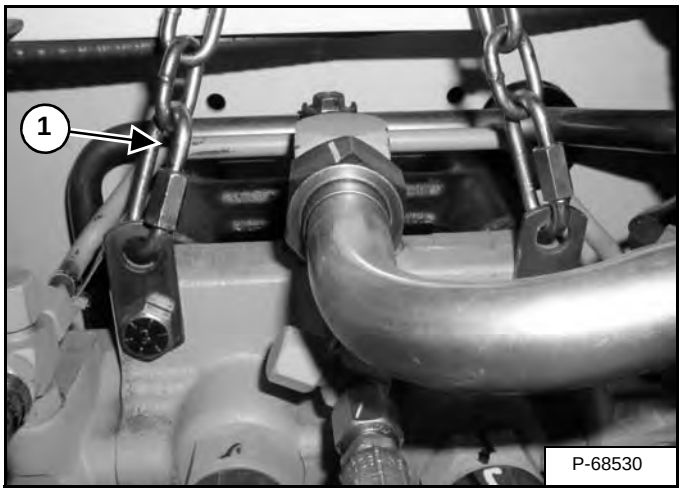
Figure 20-40-9



Remove the tubeline clamp mount bolt and clamp (Item 1) **[Figure 20-40-9]**.

NOTE: Removing the tubeline clamp will help provide added clearance for removing the valve.

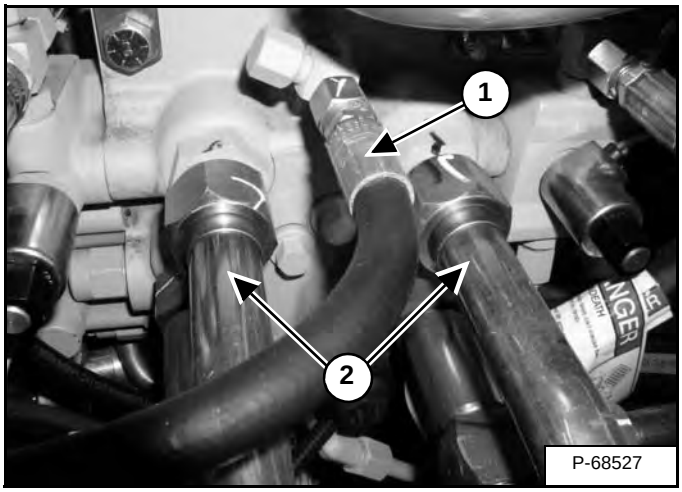
Figure 20-40-10



Install a chain hoist (Item 1) **[Figure 20-40-10]** to the control valve, and support the control valve.

Loosen all the tubeline fittings connected to the control valve.

Figure 20-40-11



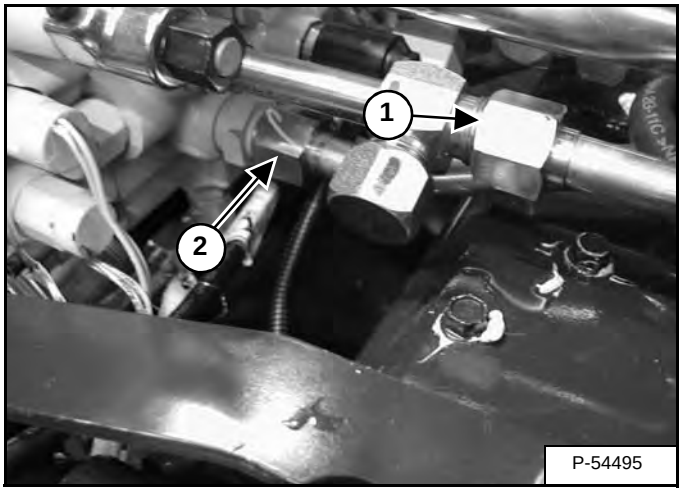
Disconnect the two auxiliary tubelines (Item 2) **[Figure 20-40-11]** from the control valve.

Disconnect the lift arm bypass drain hose (Item 1) **[Figure 20-40-11]** from the control valve.

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Removal And Installation (Cont'd)

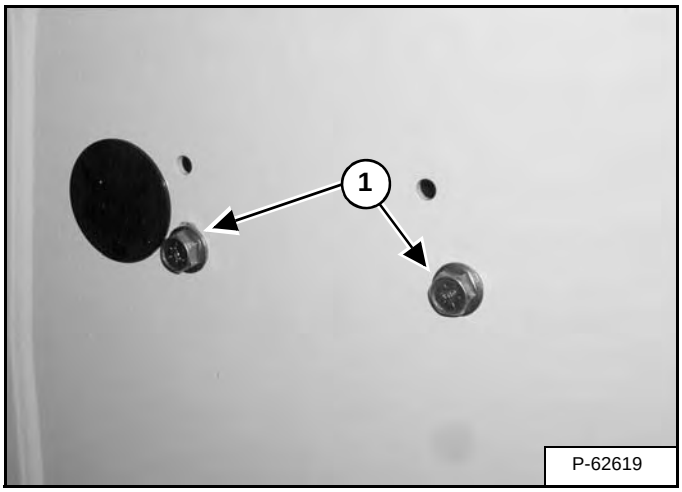
Figure 20-40-12



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

Disconnect the lift tubeline (Item 2) **[Figure 20-40-12]** from the control valve.

Figure 20-40-13



Remove the two control valve mount bolts (Item 1) **[Figure 20-40-13]** located on the outside of the frame.

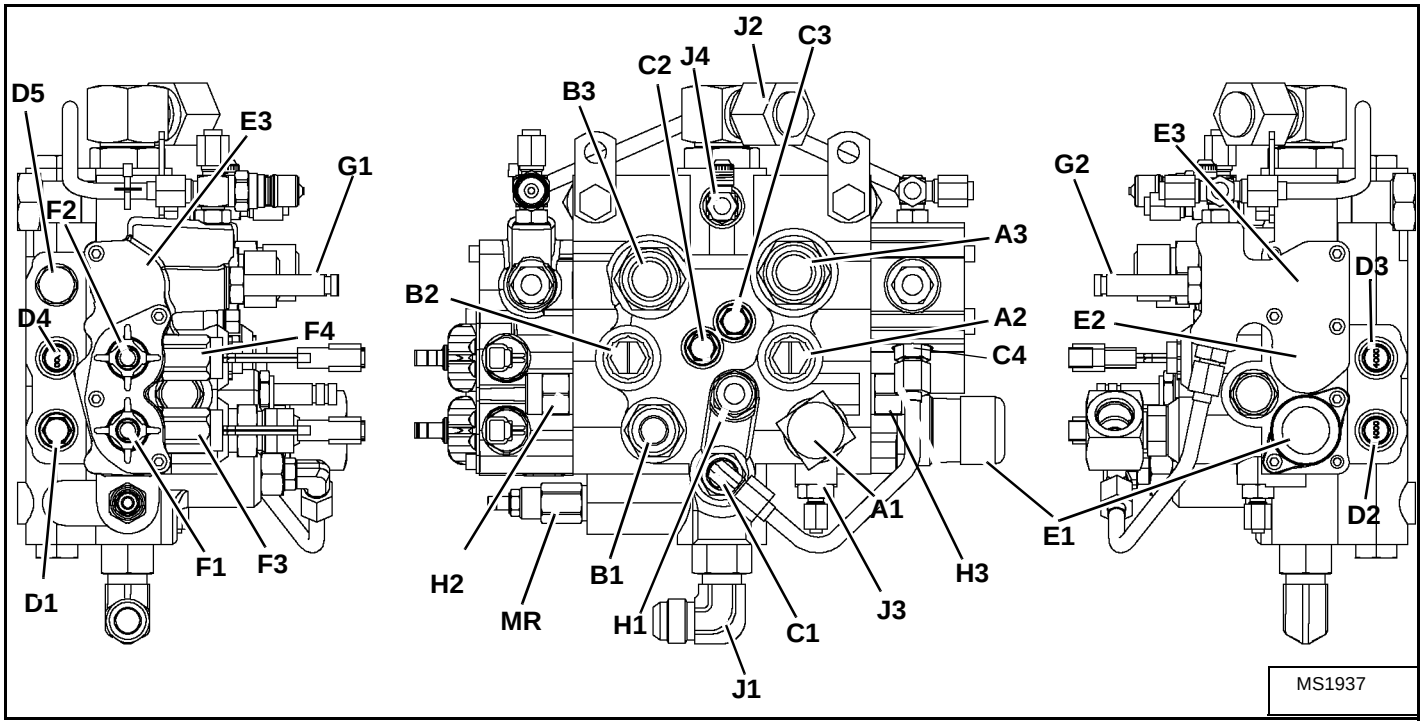
Installation: Torque the bolts (Item 1) **[Figure 20-40-13]** to 90-100 ft.-lb. (123-135 N•m).

Remove the control valve from the loader.

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Identification Chart

Figure 20-40-14



ITEM	S220 LOADER
A1	Lift Cylinder Base End
A2	Tilt Cylinder Base End
A3	Auxiliary Hydraulic Rod End
B1	Lift Cylinder Rod End
B2	Tilt Cylinder Rod End
B3	Auxiliary Hydraulics Base End
C1	Lift Load Check
C2	Load Check Valve Tilt Function
C3	Load Check Valve Auxiliary Function
C4	Check Valve
D1	Anti-Cavitation Valve Lift (Rod End)
D2	Port Relief/Anti-Cavitation Valve – 4000 PSI Lift (Base End)
D3	Port Relief/Anti-Cavitation Valve – 4000 PSI Tilt (Base End)
D4	Port Relief/Anti-Cavitation Valve – 4000 PSI Tilt (Rod End)
D5	Port Relief/Anti-Cavitation Valve (Auxiliary) 3500 PSI (Optional)

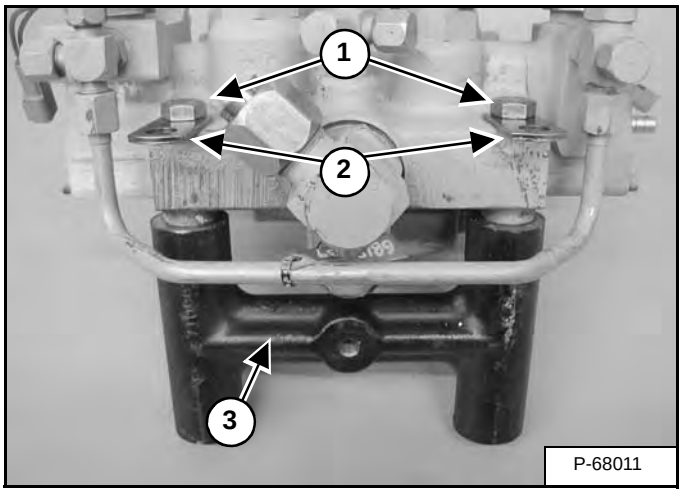
ITEM	S220 LOADER
E1	Lift Spool Detent
E2	Tilt Spool Centering Spring
E3	Auxiliary Spool/Centering Springs
F1	LIft Spool
F2	Tilt Spool
F3	Lift Spool Lock Solenoid
F4	Tilt Spool Lock Solenoid
G1	Auxiliary Solenoid Stem
G2	Auxiliary Solenoid Stem
H1	BICS Solenoid
H2	BICS Lock Valve (Tilt)
H3	BICS Lock Valve (Lift)
J1	Inlet Fluid Flow (From Pump)
J2	Outlet Fluid Flow (Return to Tank)
J3	Lift Arm Bypass Orifice
J4	Drain (Case)
MR	Main Relief Valve – 3300 PSI

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Mount Bracket Removal And Installation

Remove the control valve and mount bracket from the loader.

Figure 20-40-15

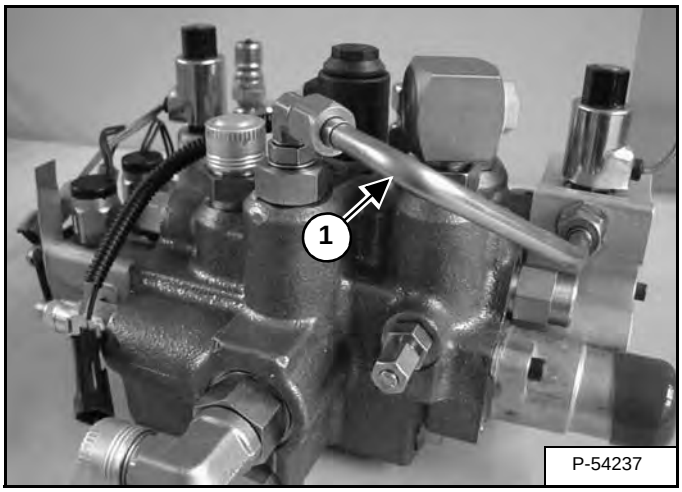


Remove the two mount bolts (Item 1) **[Figure 20-40-15]** and lift eyes (Item 2) from the hydraulic control valve.

Remove the mount bracket (Item 3) from the hydraulic control valve.

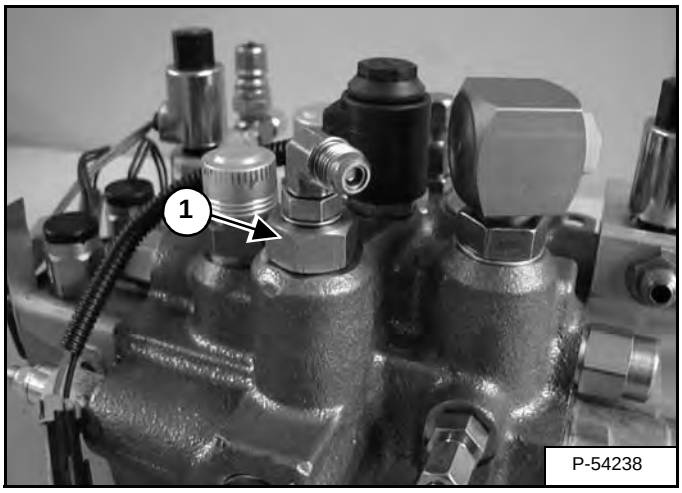
Lift Load Check Valve Removal And Installation

Figure 20-40-16



Remove the charge tubeline (Item 1) **[Figure 20-40-16]** from the BICS valve fitting on the top of the lift load check valve.

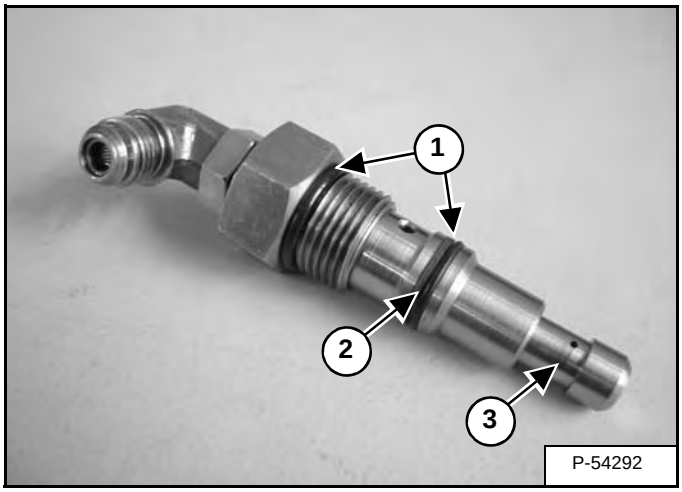
Figure 20-40-17



Remove the lift load check valve (Item 1) **[Figure 20-40-17]** and fitting from the top of the control valve.

Installation: Lubricate the O-ring and threads and tighten to 55-65 ft.-lb. (75-88 N•m) torque.

Figure 20-40-18



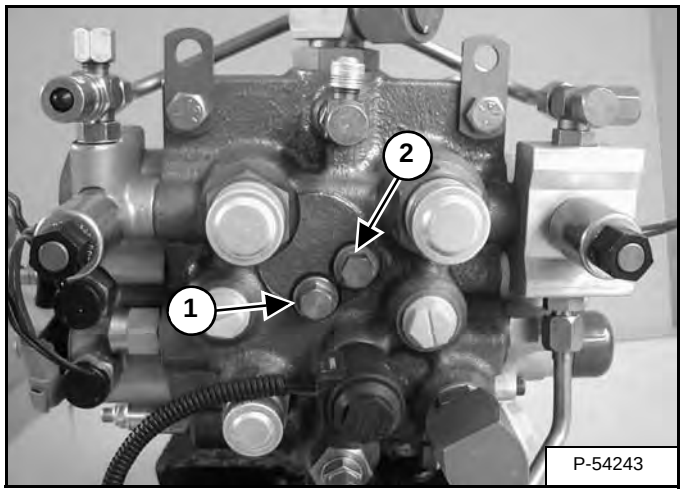
Remove and install new O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-18]**.

Check the free movement load check valve (Item 3) **[Figure 20-40-18]**.

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Load Check Valve Removal And Installation (Tilt & Auxiliary)

Figure 20-40-19

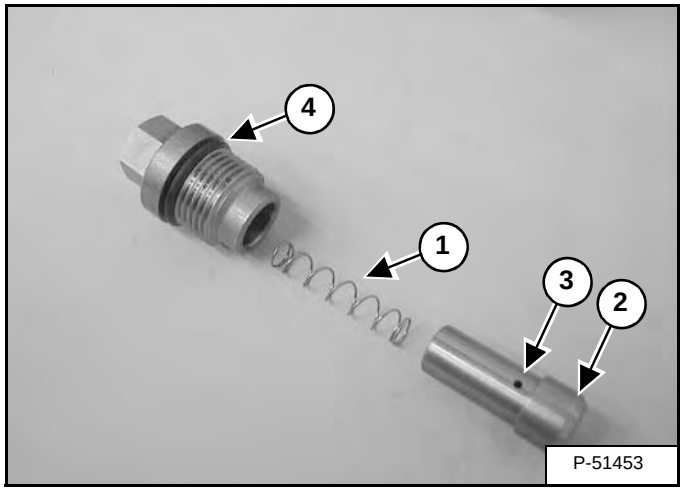


At the front side of the control valve locate the tilt section load check valve (Item 1) **[Figure 20-40-19]**.

At the front side of the control valve locate the auxiliary section load check valve (Item 2) **[Figure 20-40-19]**.

NOTE: The tilt and auxiliary load check valves are interchangeable.

Figure 20-40-20



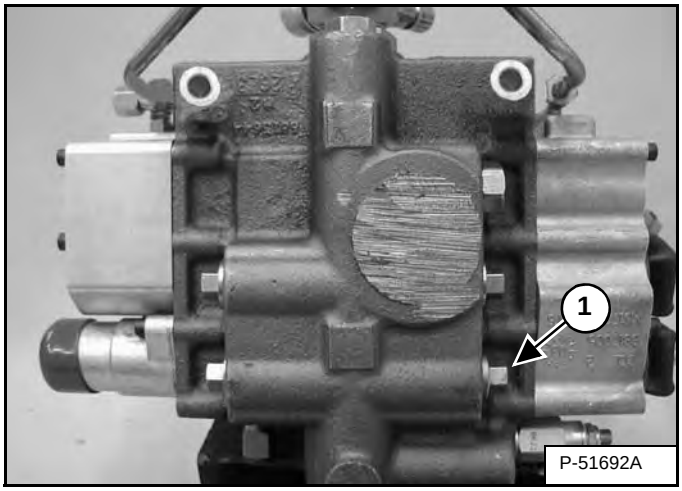
Remove the spring (Item 1) and poppet (Item 2) **[Figure 20-40-20]**.

Check the orifice (Item 3) **[Figure 20-40-20]** in the poppet to be sure it is not plugged.

Installation: Install a new O-ring (Item 4) **[Figure 20-40-20]** on the plug and lightly lubricate with oil before installing. Tighten the plug to 38-45 ft.-lb. (52-61 N•m) torque.

Anti-Cavitation Valve Removal And Installation (Lift, Rod End)

Figure 20-40-21



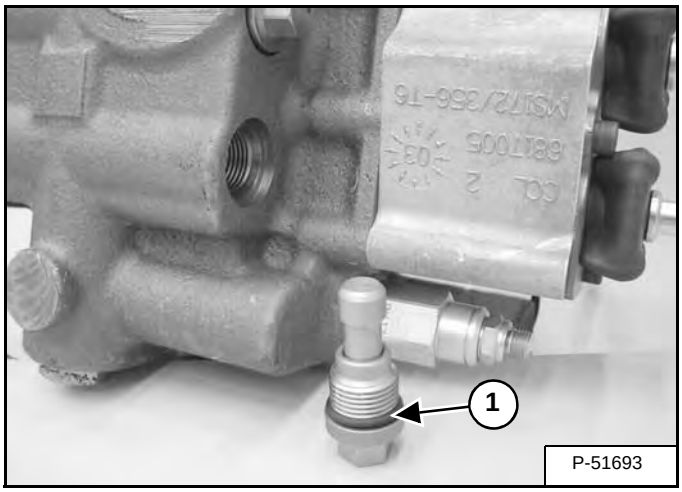
At the back side of the control valve, remove the lift section anti-cavitation valve (Item 1) **[Figure 20-40-21]**.

IMPORTANT

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

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Figure 20-40-22

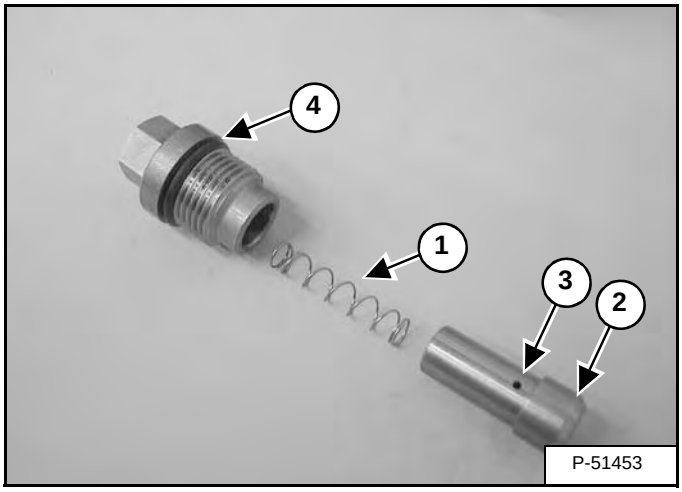


Installation: Always use new O-ring (Item 1) **[Figure 20-40-22]** on the anti-cavitation valve plug. Tighten the plug to 38-45 ft.-lb. (52-61 N•m) torque.

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Anti-Cavitation Valve Removal And Installation (Lift, Rod End) (Cont'd)

Figure 20-40-23



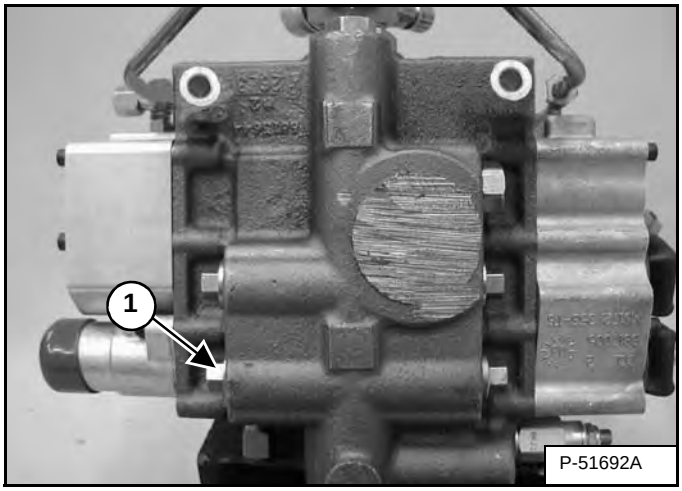
Remove the spring (Item 1) and poppet (Item 2) **[Figure 20-40-23]**.

Check the orifice (Item 3) **[Figure 20-40-23]** in the poppet to be sure it is not plugged.

Installation: Install a new O-ring (Item 4) **[Figure 20-40-23]** on the plug and lightly lubricate with oil before installing. Tighten the plug to 38-45 ft.-lb. (52-61 N•m) torque.

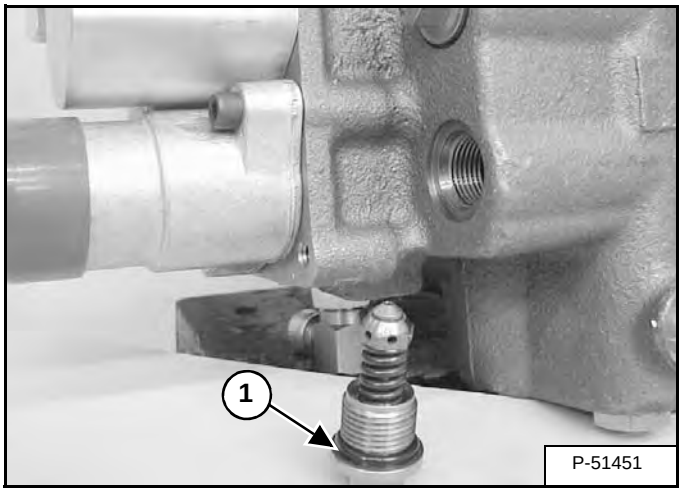
Port Relief / Anti-Cavitation Valve Removal And Installation (Lift, Base End)

Figure 20-40-24



Loosen the lift circuit port relief/anti cavitation valve (Item 1) **[Figure 20-40-24]**.

Figure 20-40-25



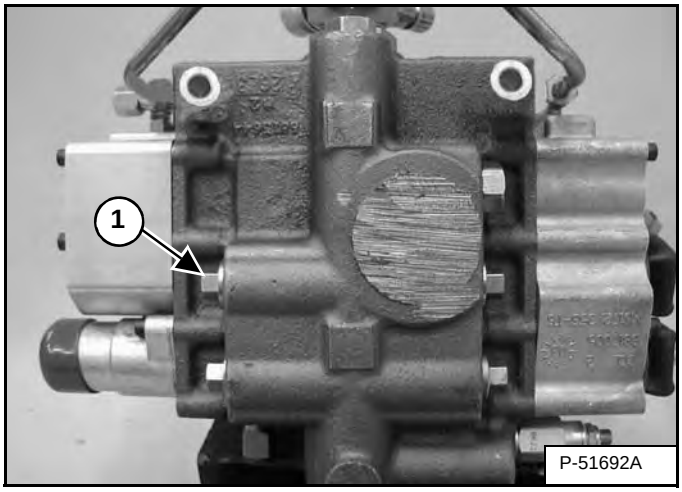
Replace the O-ring (Item 1) **[Figure 20-40-25]** before installation.

Installation: Tighten to 38-45 ft.-lb. (52-61 N•m) torque.

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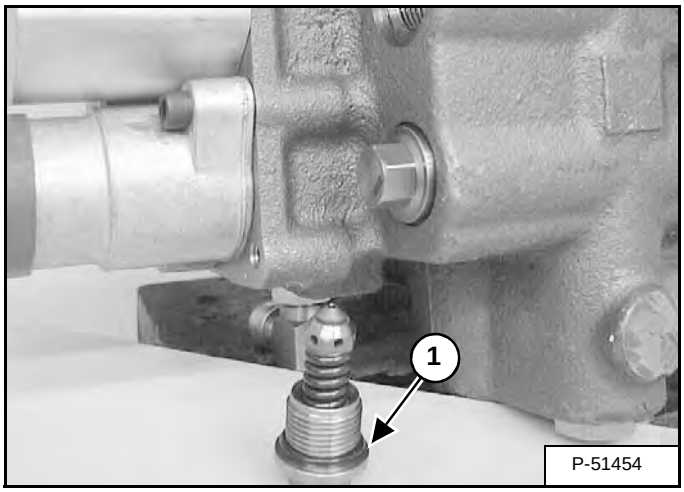
Port Relief / Anti-Cavitation Valve Removal And Installation (Tilt, Base End)

Figure 20-40-26



Remove the tilt port relief/anti cavitation valve (Item 1) **[Figure 20-40-26]** from the base end of the tilt section.

Figure 20-40-27

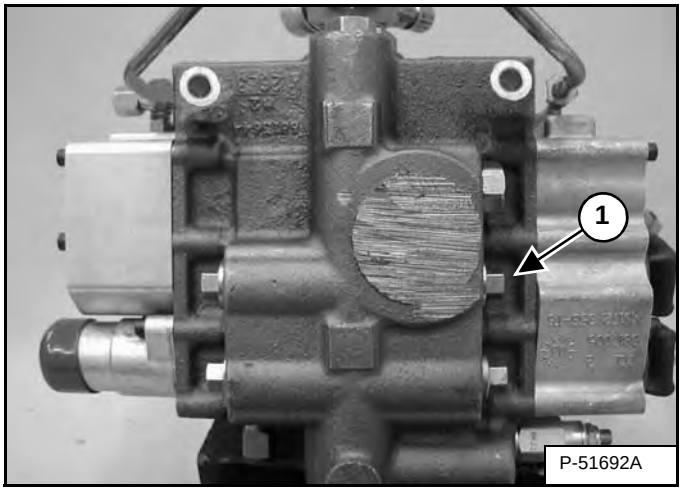


Replace the O-ring (Item 1) **[Figure 20-40-27]** before installation.

Installation: Tighten to 38-45 ft.-lb. (52-61 N•m) torque.

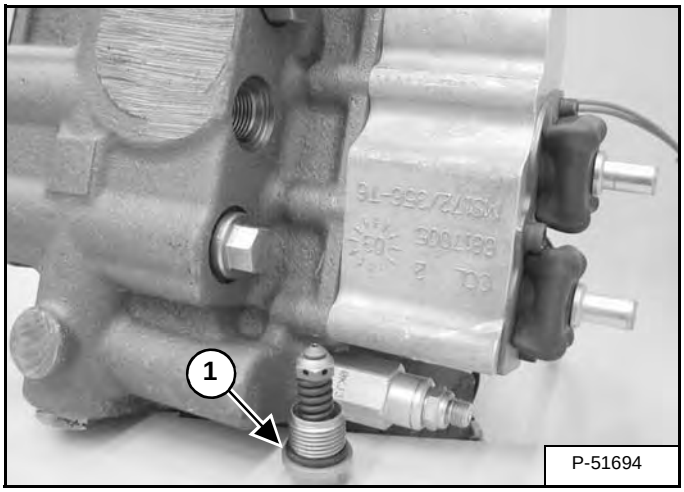
Port Relief / Anti-Cavitation Valve Removal And Installation (Tilt, Rod End)

Figure 20-40-28



Remove the tilt port relief/anti cavitation valve (Item 1) **[Figure 20-40-28]** from the rod end of the tilt section.

Figure 20-40-29



Replace the O-ring (Item 1) **[Figure 20-40-29]** before installation.

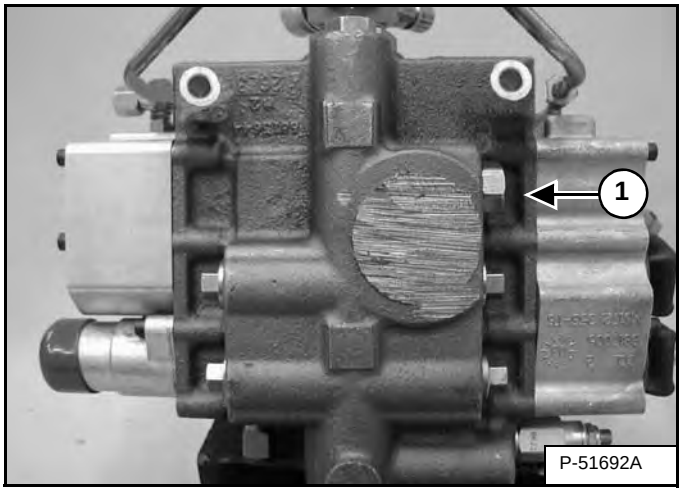
Installation: Tighten to 38-45 ft.-lb. (52-61 N•m) torque.

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HYDRAULIC CONTROL VALVE (STANDARD) (CONT'D)

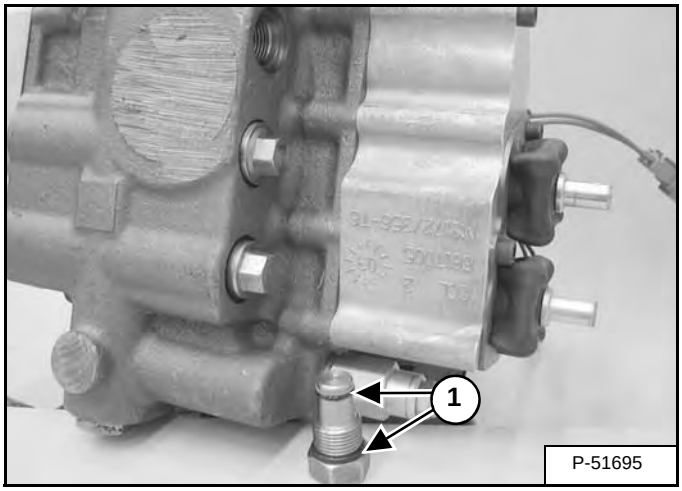
Port Relief Valve Removal And Installation

Figure 20-40-30



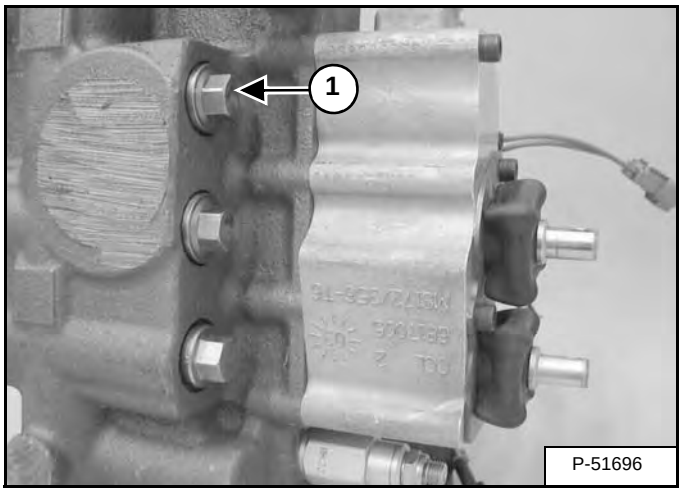
Remove the port relief plug (Item 1) **[Figure 20-40-30]** from the auxiliary circuit of the control valve.

Figure 20-40-31



Installation: Always use new O-rings (Item 1) **[Figure 20-40-31]**. Tighten to 38-45 ft.-lb. (52-61 N•m) torque.

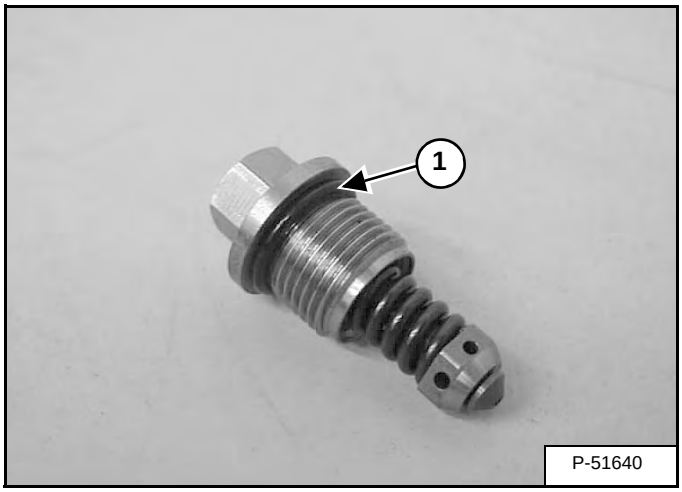
Figure 20-40-32



The control valve may be equipped with an optional auxiliary port relief valve (Item 1) **[Figure 20-40-32]**.

Remove the auxiliary port relief valve.

Figure 20-40-33

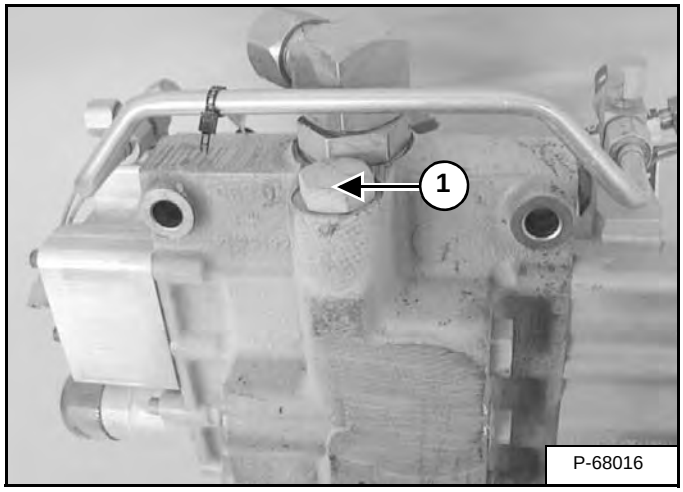


Installation: Always use new O-rings (Item 1) **[Figure 20-40-33]**. Tighten to 38-45 ft.-lb. (52-61 N•m) torque.

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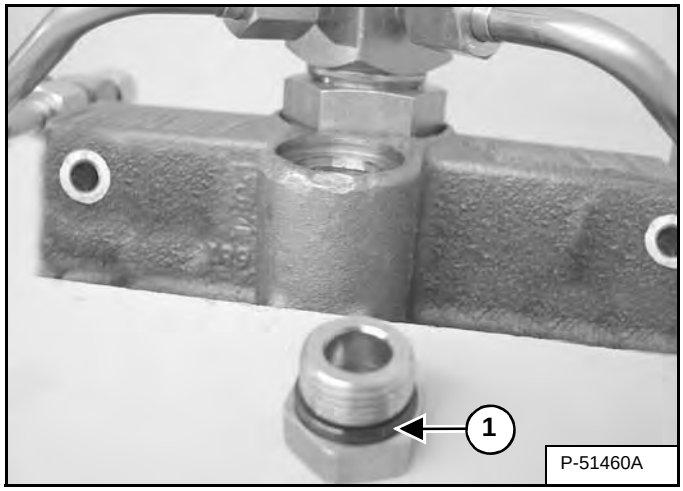
Plug Removal And Installation

Figure 20-40-34



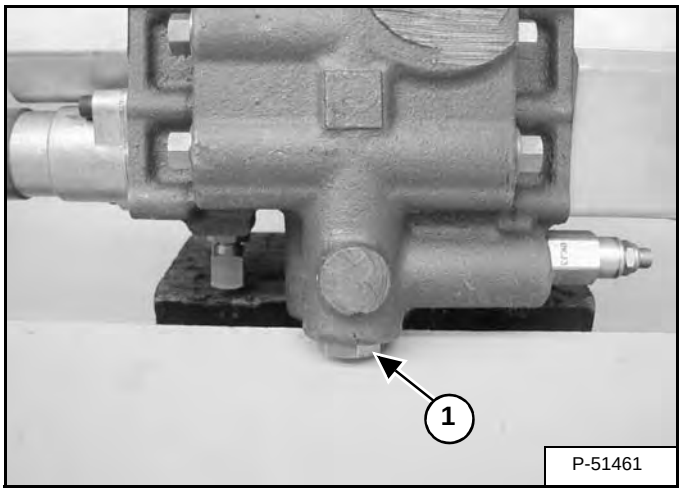
At the top side of the control valve, remove the plug (Item 1) **[Figure 20-40-34]**.

Figure 20-40-35



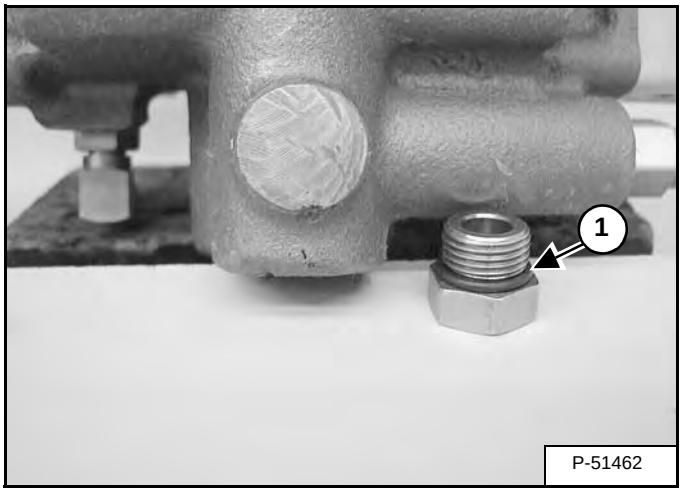
Installation: Always use new O-rings (Item 1) **[Figure 20-40-35]**. Tighten to 40 ft.-lb. (54 N•m) torque.

Figure 20-40-36



At the bottom side of the control valve remove the plug (Item 1) **[Figure 20-40-36]**.

Figure 20-40-37

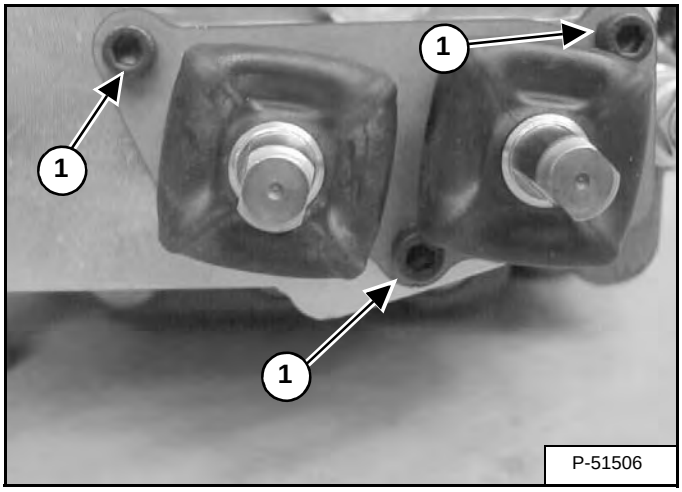


Installation: Always use new O-rings (Item 1) **[Figure 20-40-37]**. Tighten to 40 ft.-lb. (54 N•m) torque.

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Rubber Boot Removal and Installation

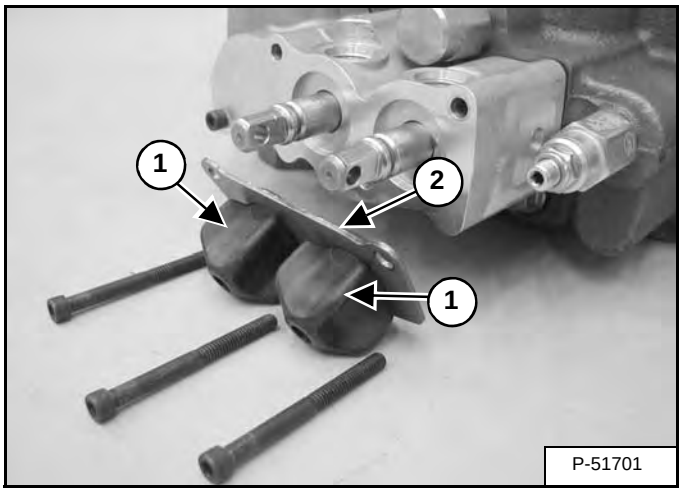
Figure 20-40-38



Remove the three screws (Item 1) **[Figure 20-40-38]** on the rubber boot retainer plate.

Installation: Tighten the screws to 90-100 in.-lb. (10-11,3 N•m) torque.

Figure 20-40-39

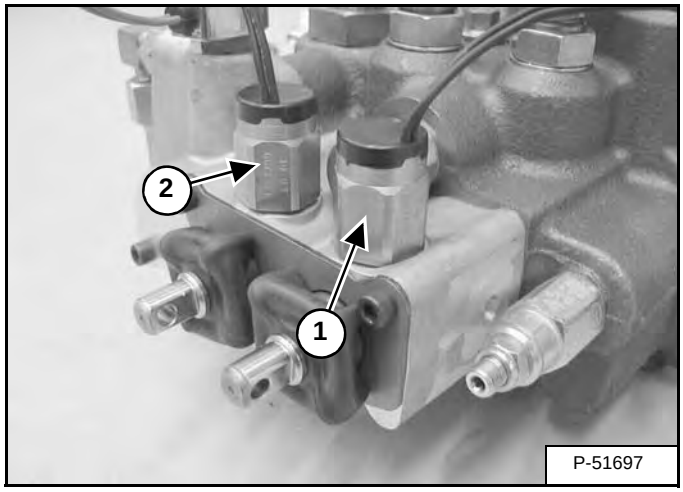


Remove the rubber boots (Item 1) from the retainer plate (Item 2) **[Figure 20-40-39]**.

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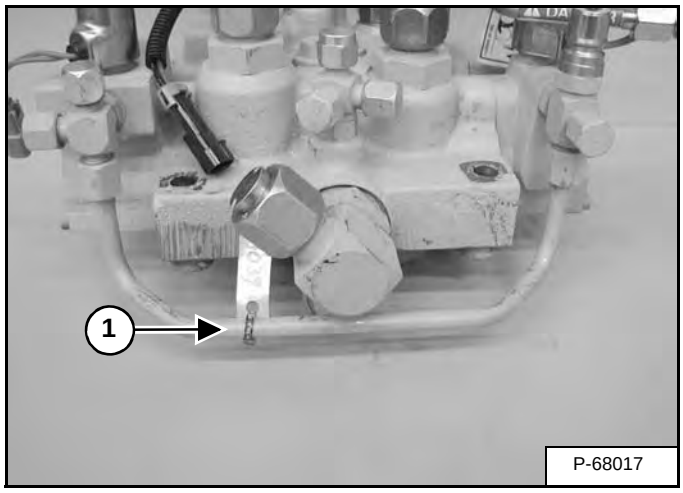
End Cap Block Removal and Installation

Figure 20-40-40



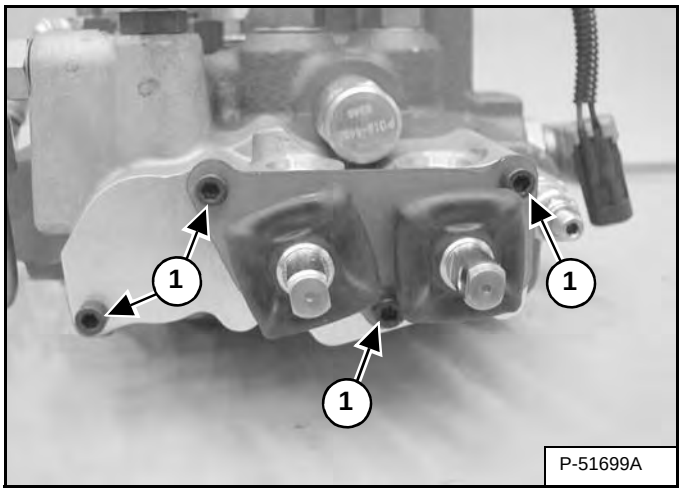
Remove the lift spool lock solenoid (Item 1) and the tilt spool lock solenoid (Item 2) **[Figure 20-40-40]** from the end cap/spool lock block.

Figure 20-40-41



Disconnect the tube line (Item 1) **[Figure 20-40-41]** from the end cap/spool lock block.

Figure 20-40-42

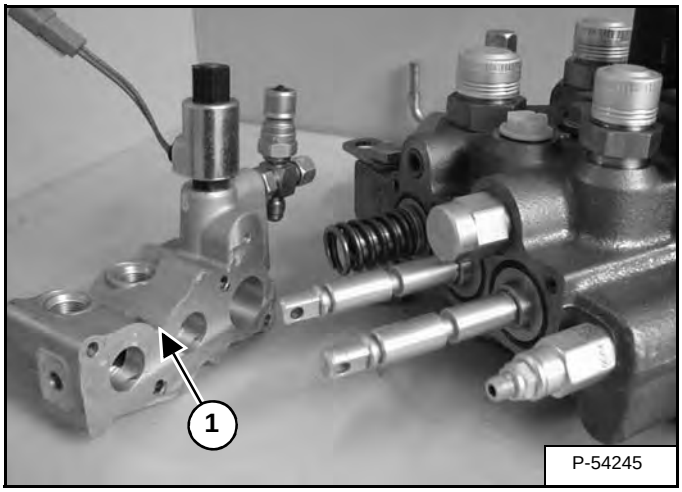


Remove the four end cap/spool lock block mount screws (Item 1) **[Figure 20-40-42]**.

Installation: Tighten the screws to 90-100 in.-lb. (10-11,3 N•m) torque.

Remove the rubber boots and retainer plate from the lift and tilt spools.

Figure 20-40-43



Remove the end cap/spool lock block (Item 1) **[Figure 20-40-43]** from the control valve.

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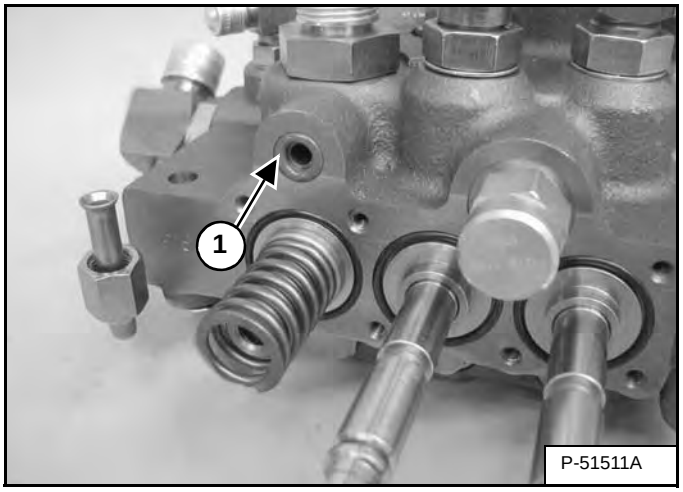
Lift Spool And Detent Removal And Installation

The tool listed will be needed to do the following procedure:

MEL1278 - Detent Tool
MEL1285 - Detent Spring Tool

Remove the end cap/spool lock block from the control valve.

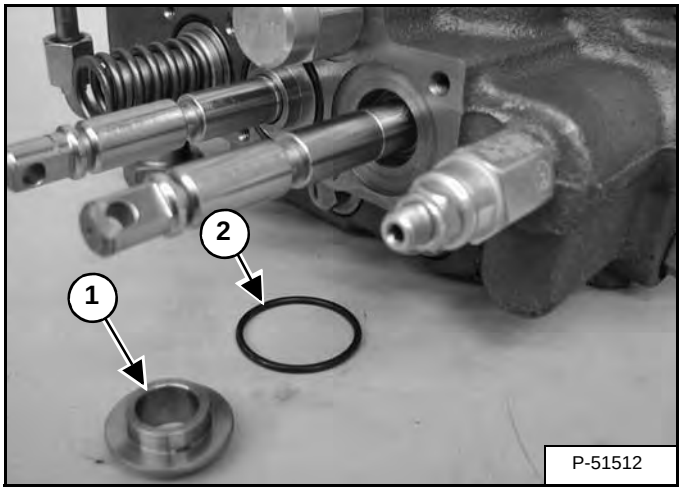
Figure 20-40-44



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

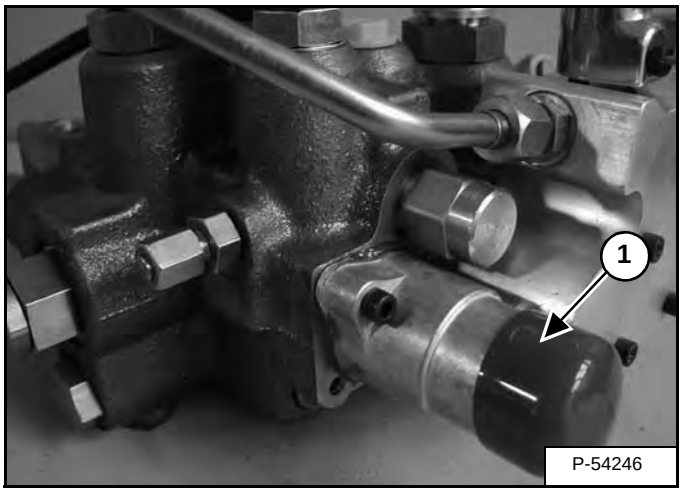
Installation: Replace the O-ring, and lubricate the O-ring lightly with grease or oil before installation of the end cap/ spool lock block.

Figure 20-40-45



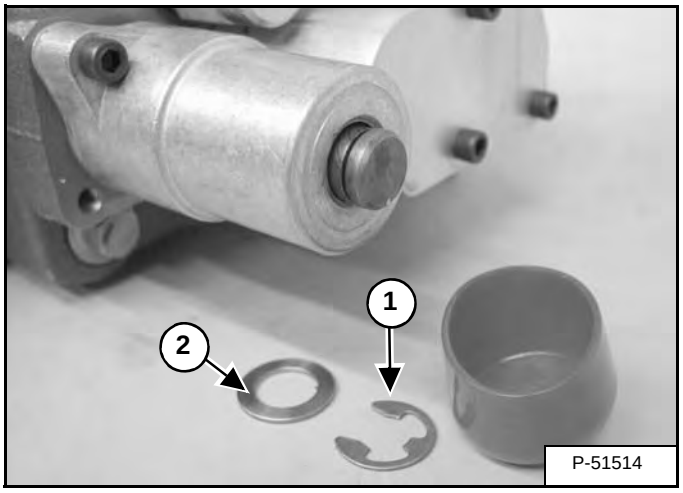
Remove the spacer (Item 1) and O-ring (Item 2) **[Figure 20-40-45]** from the lift spool.

Figure 20-40-46



Remove the end cap (Item 1) **[Figure 20-40-46]**.

Figure 20-40-47



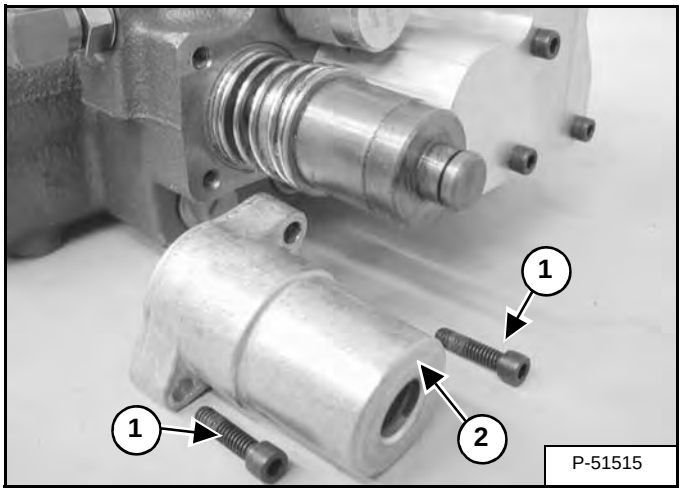
Use a screwdriver to remove the snap ring (Item 1) **[Figure 20-40-47]**.

Remove the washer (Item 2) **[Figure 20-40-47]**.

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Lift Spool And Detent Removal And Installation (Cont'd)

Figure 20-40-48



Remove the screws (Item 1) **[Figure 20-40-48]** from the detent bonnet.

Remove the detent bonnet (Item 2) **[Figure 20-40-48]**.

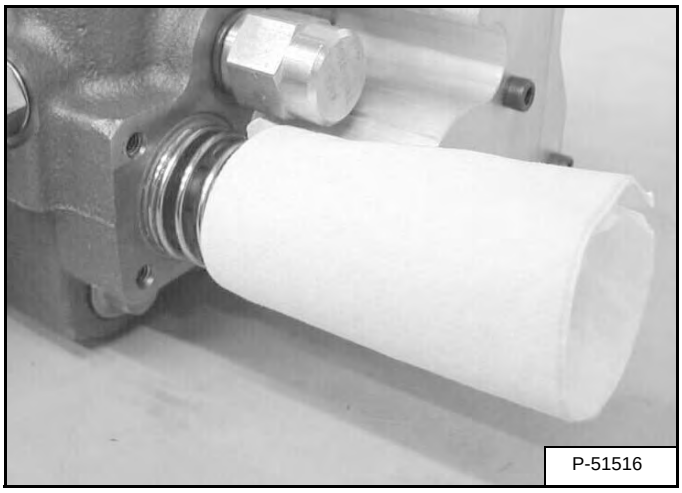
Installation: Lubricate the screws and tighten to 90-100 in.-lb. (10-11,3 N•m) torque.

IMPORTANT

The detent assembly has small springs and balls. Do not lose these parts during disassembly and assembly.

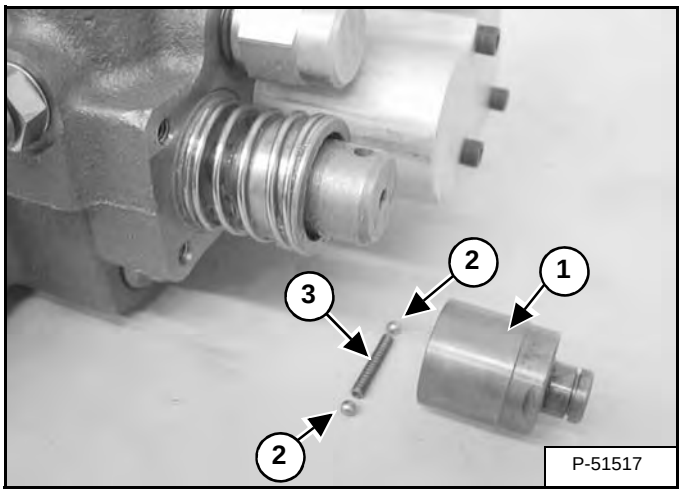
I-2012-0284

Figure 20-40-49



Put a rag around the detent assembly **[Figure 20-40-49]**. This will prevent the detent balls and spring from being lost when the detent sleeve is removed.

Figure 20-40-50

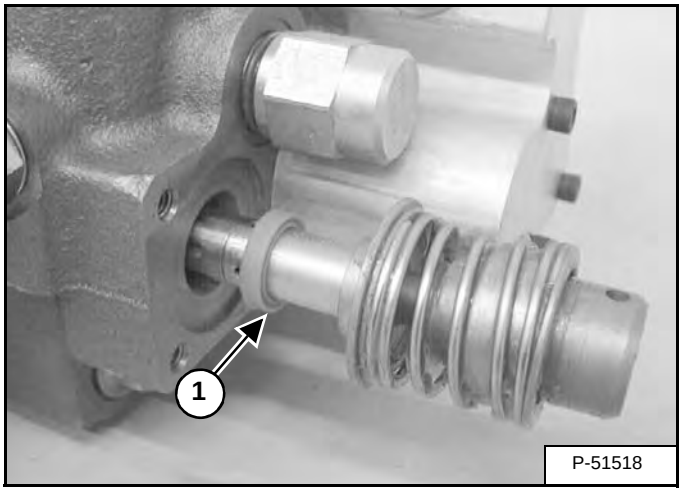


Remove the detent sleeve (Item 1), detent balls (Item 2) and spring (Item 3) **[Figure 20-40-50]**.

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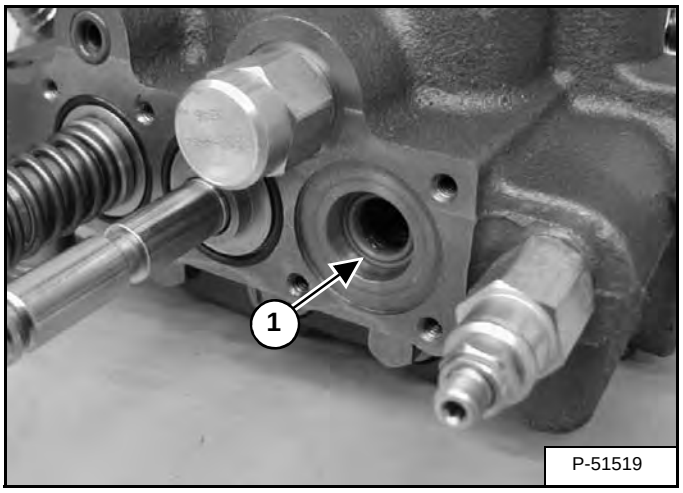
Lift Spool And Detent Removal And Installation (Cont'd)

Figure 20-40-51



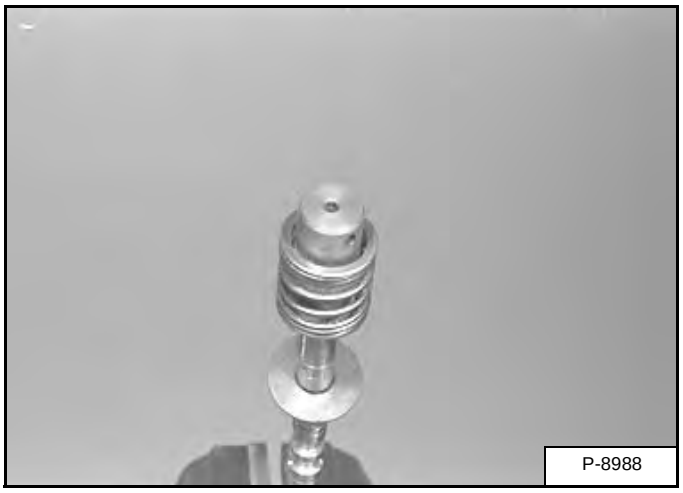
Remove the lift spool assembly and seal (Item 1) **[Figure 20-40-51]** from the control valve.

Figure 20-40-52



Remove the lift spool seal (Item 1) **[Figure 20-40-52]** from the linkage end of the valve.

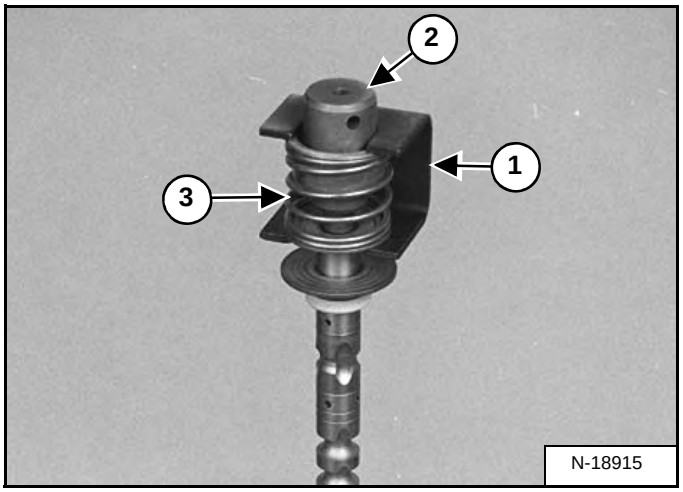
Figure 20-40-53



Clamp the linkage end of the spool in a vise **[Figure 20-40-53]**.

NOTE: Protect spool before clamping in vise.

Figure 20-40-54



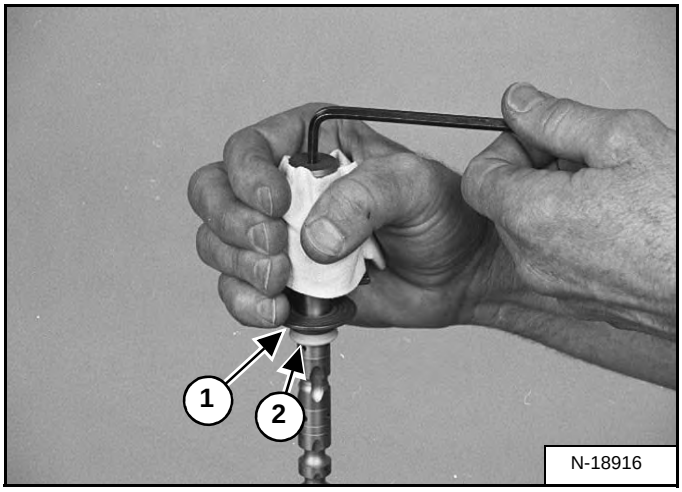
Install the spring tool (Item 1) **[Figure 20-40-54]** over the centering spring.

NOTE: Be careful when removing the detent adapter (Item 2) [Figure 20-40-54] from the centering spring, as it is under spring pressure.

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Lift Spool And Detent Removal And Installation (Cont'd)

Figure 20-40-55

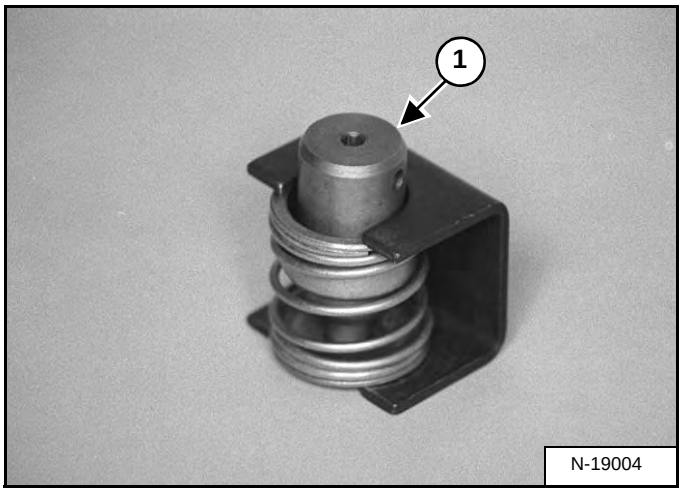


Put a rag around the detent assembly **[Figure 20-40-55]**. This will prevent the detent balls and spring from being lost when the detent adapter is removed.

Remove the detent adapter with an Alan wrench.

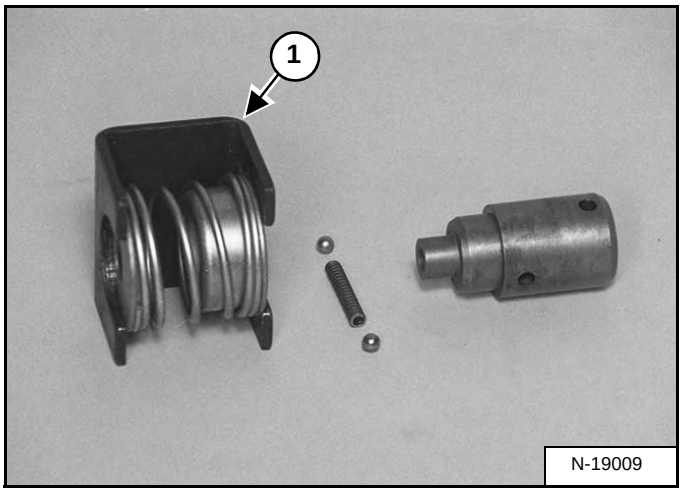
Remove the back-up washer (Item 1) and spool seal (Item 2) **[Figure 20-40-55]**.

Figure 20-40-56



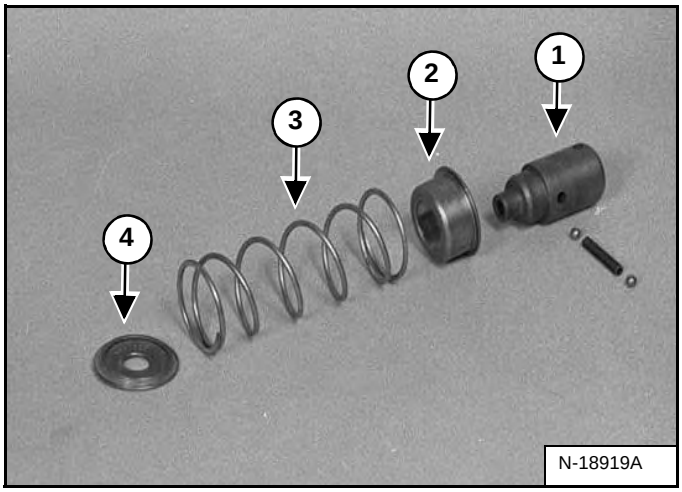
Remove the detent adapter (Item 1) **[Figure 20-40-56]** from the spring assembly.

Figure 20-40-57



Remove spring tool (Item 1) **[Figure 20-40-57]** from the spring assembly.

Figure 20-40-58

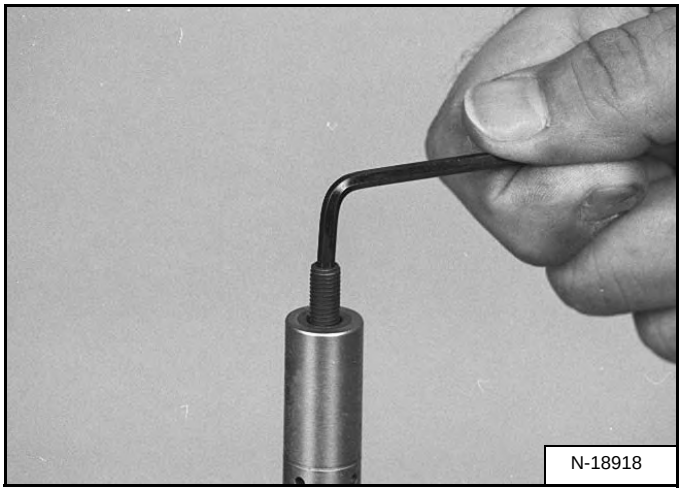


Inspect the adapter (Item 1), collar (Item 2), spring (Item 3) and washer (Item 4) **[Figure 20-40-58]**.

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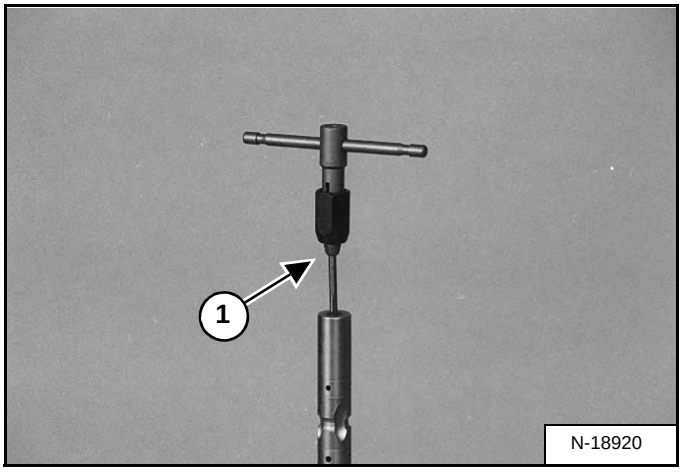
Lift Spool And Detent Removal And Installation (Cont'd)

Figure 20-40-59



Remove the stud from the end of the spool **[Figure 20-40-59]**.

Figure 20-40-60



Removal of the plastic plug:

Make a center point in the plug using a 1/16 in. drill.

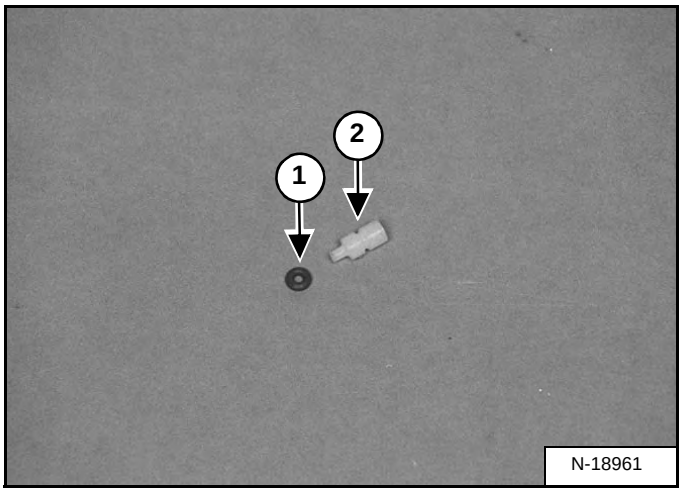
Drill a hole all the way through the plug using a 7/64 in. tap drill

Turn a 6-32 tap (Item 1) **[Figure 20-40-60]** into the plug. Pull the tap and plug out of the spool. Be careful, do not break the tap.

Clean all the debris from inside the spool bore.

NOTE: DO NOT USE Loctite® ON THE STUD THREADS.

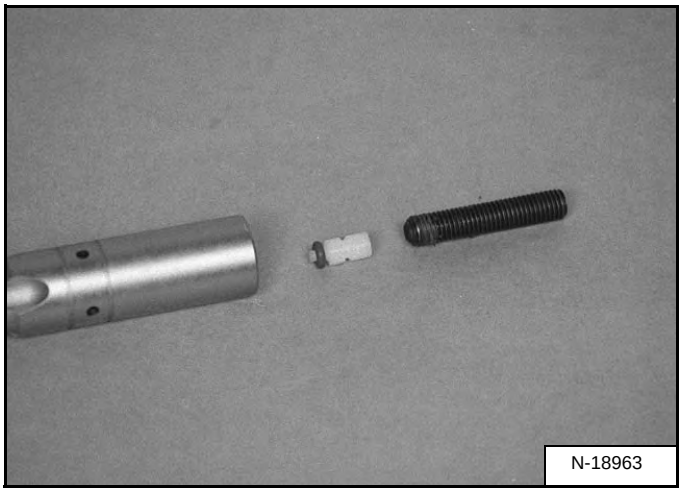
Figure 20-40-61



Install the O-ring (Item 1) over the nipple on the plastic plug (Item 2) **[Figure 20-40-61]**.

NOTE: Check the o-ring for damage. The lift spool will have an internal leak if there is damage to this o-ring. Always replace the o-ring and recheck the lift spool before the control valve is replaced.

Figure 20-40-62

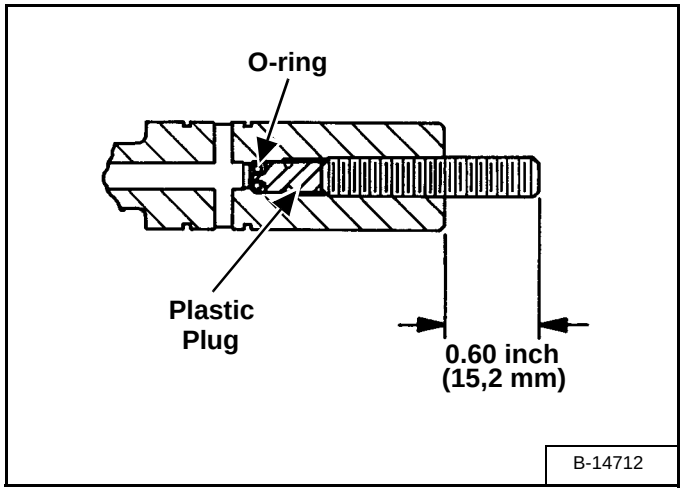


Install the plastic plug and O-ring in the spool **[Figure 20-40-62]**.

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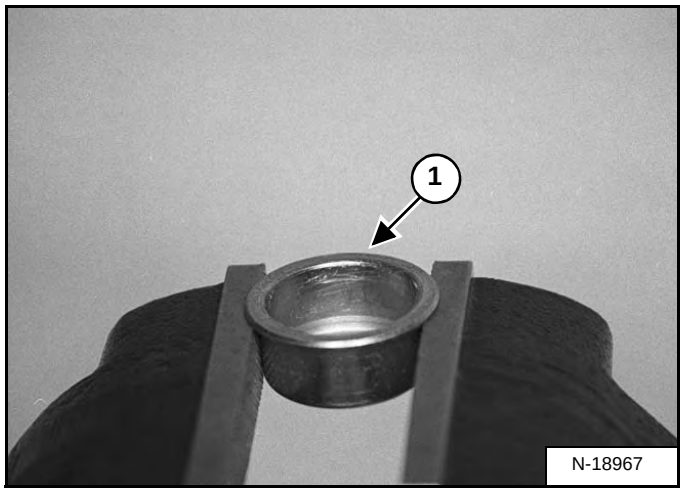
Lift Spool And Detent Removal And Installation (Cont'd)

Figure 20-40-63



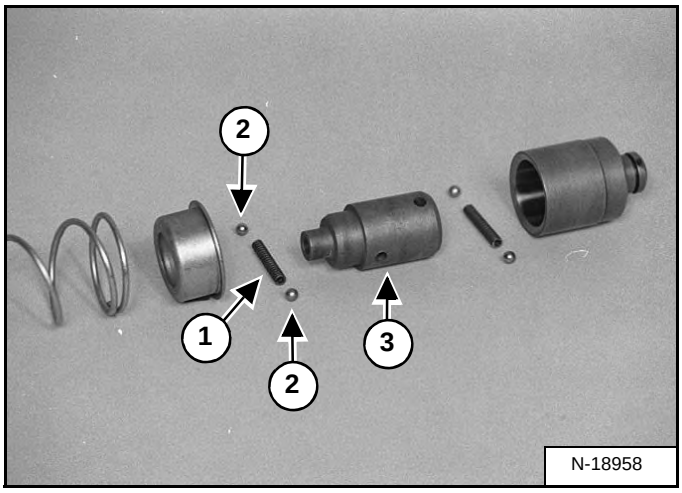
Install the stud and tighten until the other end of the stud is out about 0.600 in. (15,2 mm) from the spool **[Figure 20-40-63]**.

Figure 20-40-64



Clamp the collar (Item 1) **[Figure 20-40-64]** in a vice.

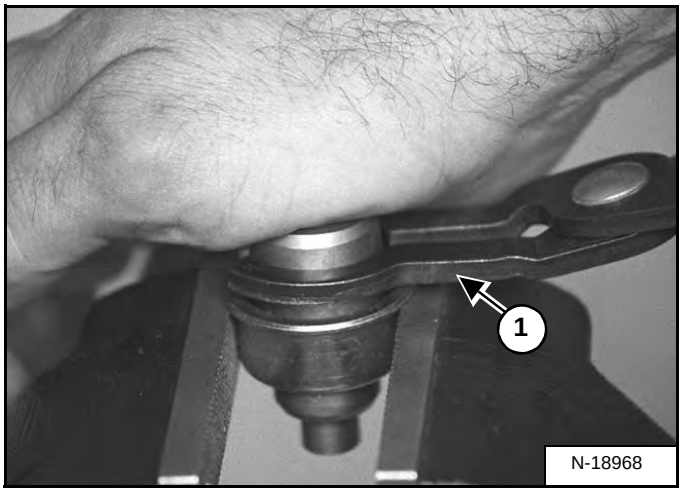
Figure 20-40-65



Apply grease on all the detent component surfaces before assembly **[Figure 20-40-65]**.

Install the spring (Item 1) **[Figure 20-40-65]** and detent balls (Item 2) **[Figure 20-40-65]** into the adapter (Item 3) **[Figure 20-40-65]** and compress with the detent pliers (Item 1) **[Figure 20-40-66]**.

Figure 20-40-66



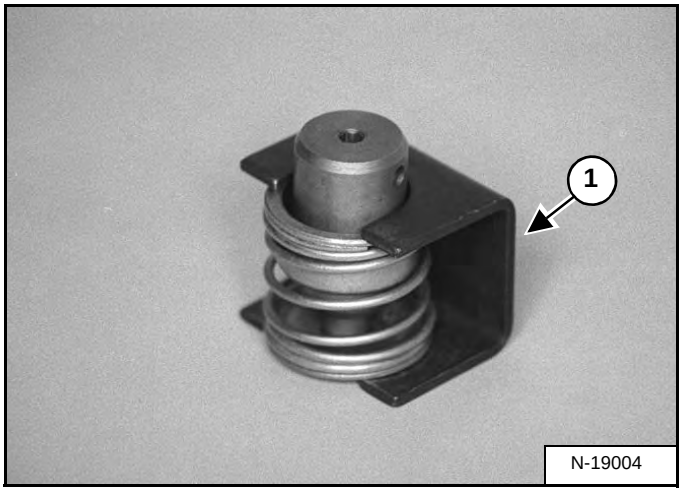
Install the detent adapter to the collar **[Figure 20-40-66]**.

NOTE: The collar and the detent adapter are held together by spring pressure when assembled to the lift spool not the detent balls. Hold the detent adapter and collar together to prevent the detent balls and spring from falling out.

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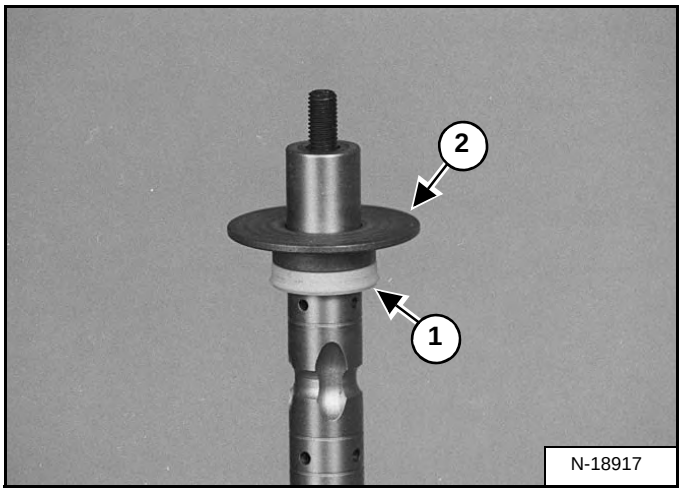
Lift Spool And Detent Removal And Installation (Cont'd)

Figure 20-40-67



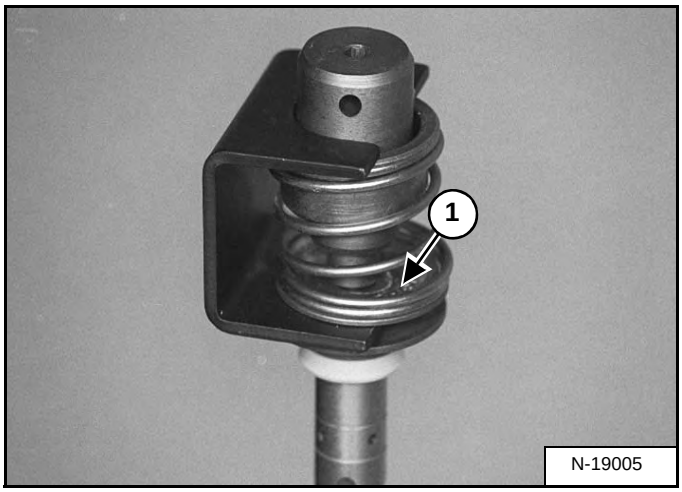
Install the spring tool (Item 1) **[Figure 20-40-67]** over the washer, spring, collar and detent adapter.

Figure 20-40-68



Install the spool seal (Item 1) and back-up washer (Item 2) **[Figure 20-40-68]**.

Figure 20-40-69



Install the spring assembly to the lift spool hand tight **[Figure 20-40-69]**.

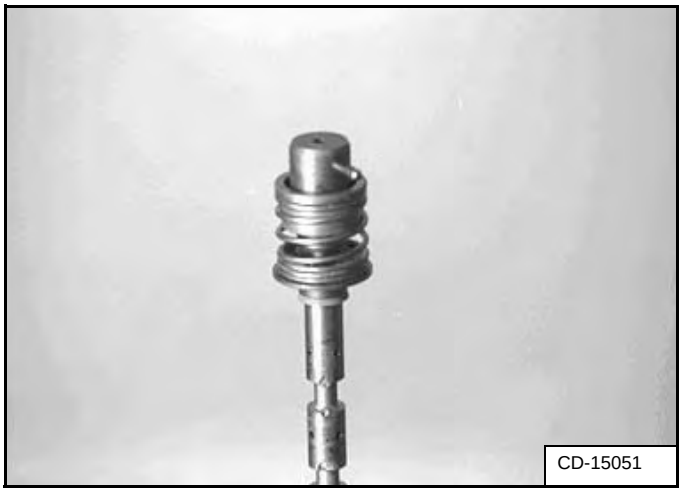
Remove the spring tool.

Check the alignment of the detent adapter and the washer.

Tighten the adapter to 90-100 in.-lb. (10,2-11,3 N•m).

NOTE: The adapter must fit in the center of the washer (Item 1) [Figure 20-40-69].

Figure 20-40-70

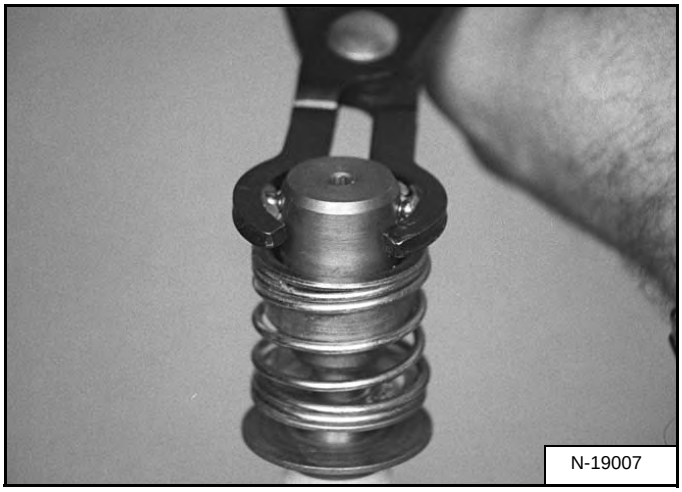


Install the detent balls and spring **[Figure 20-40-70]**.

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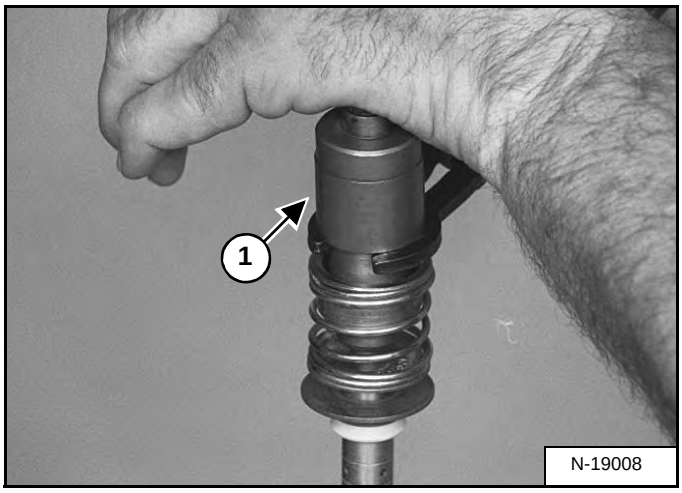
Lift Spool And Detent Removal And Installation (Cont'd)

Figure 20-40-71



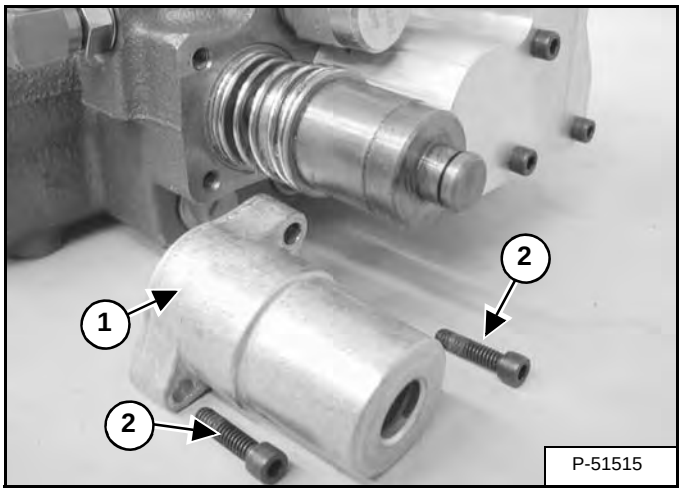
Hold the detent balls in place with the detent pliers **[Figure 20-40-71]**.

Figure 20-40-72



Install the detent sleeve (Item 1) **[Figure 20-40-72]** to the detent adapter.

Figure 20-40-73



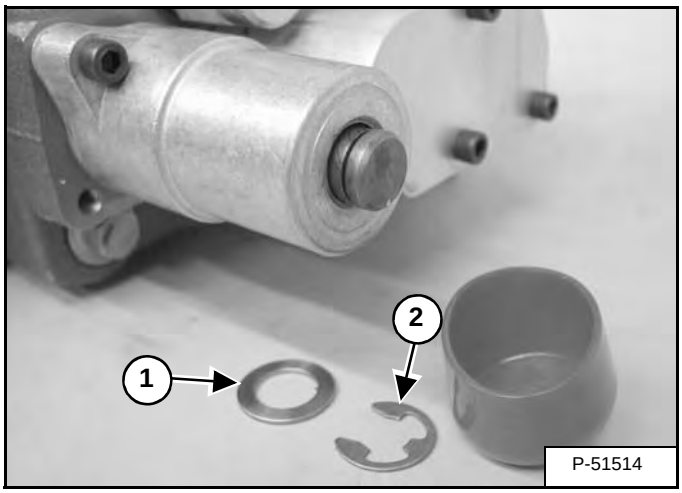
Install the lift spool assembly in the spool bore **[Figure 20-40-73]**.

Install the detent bonnet (Item 1) **[Figure 20-40-73]**.

Install the mounting screws (Item 2) **[Figure 20-40-73]**.

Installation: Lubricate the screws and tighten to 90-100 in.-lb. (10-11,3 N•m) torque.

Figure 20-40-74

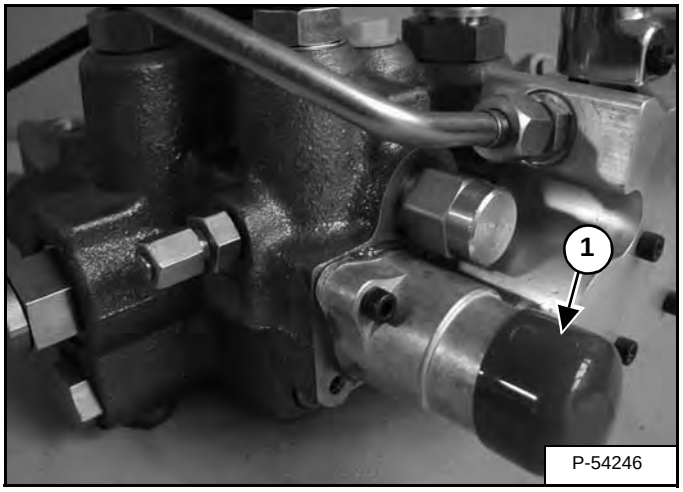


Install the washer (Item 1) and snap ring (Item 2) **[Figure 20-40-74]**.

Dealer Copy -- Not for Resale

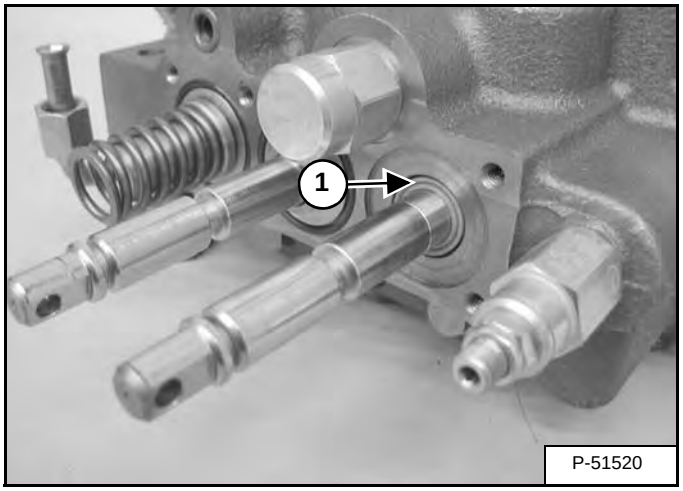
Lift Spool And Detent Removal And Installation (Cont'd)

Figure 20-40-75



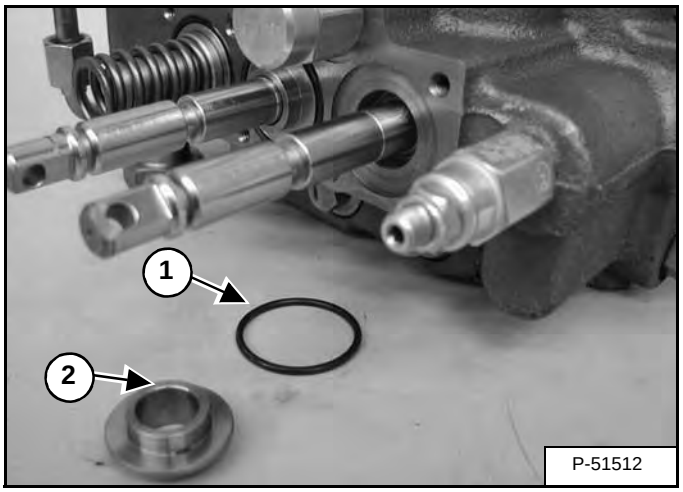
Install the end cap (Item 1) **[Figure 20-40-75]**.

Figure 20-40-76



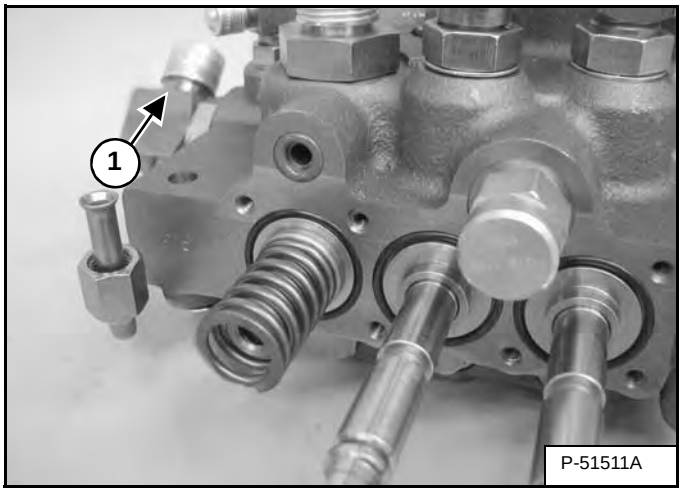
Install the spool seal (Item 1) **[Figure 20-40-76]** on the linkage end of the valve.

Figure 20-40-77



Install the O-ring (Item 1) and bushing (Item 2) **[Figure 20-40-77]** on the lift spool.

Figure 20-40-78

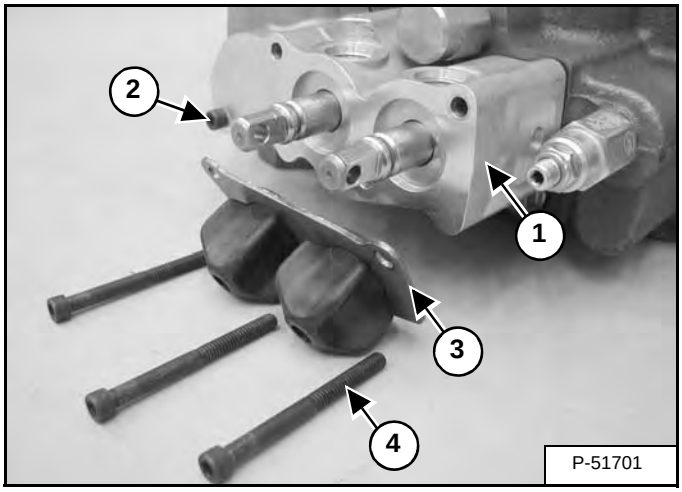


Install the O-ring (Item 1) **[Figure 20-40-78]** on the control valve.

Dealer Copy -- Not for Resale

Lift Spool And Detent Removal And Installation (Cont'd)

Figure 20-40-79

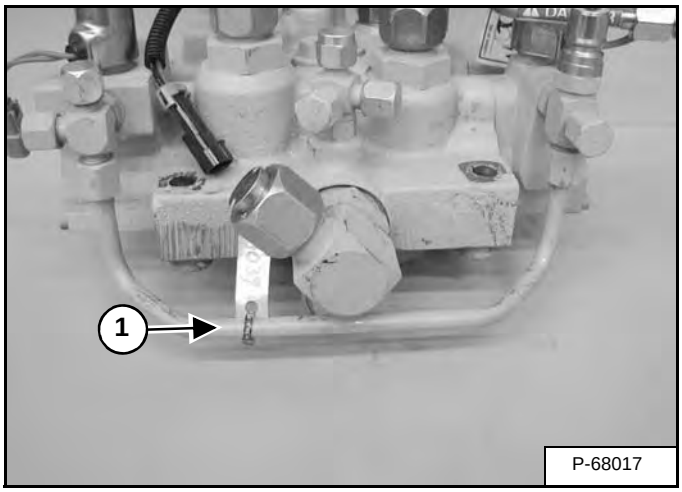


Install the end cap/spool lock block (Item 1) and the mount bolt (Item 2) **[Figure 20-40-79]**.

Install the lift and tilt spool rubber boots and mount plate (Item 3) and install the three mounting screws (Item 4) **[Figure 20-40-79]**.

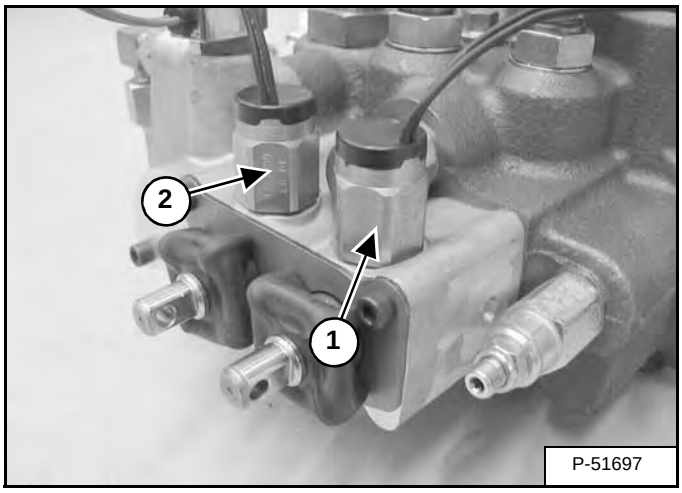
Installation: Tighten the screws to 90-100 in.-lb. (10-11,3 N•m) torque.

Figure 20-40-80



Connect the tubeline (Item 1) **[Figure 20-40-80]**.

Figure 20-40-81



Use an Ohm meter to measure the lock solenoid coils resistance.

The correct resistance for the coil is **5.5 ±.28 Ohms**.

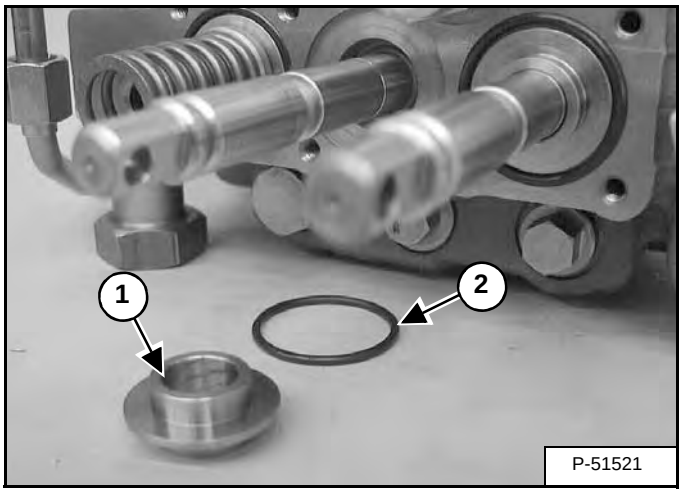
Installation: Install the lift spool (Item 1) and tilt spool (Item 2) lock solenoids and tighten to 38-45 ft.-lb. (52-61 N•m) torque **[Figure 20-40-81]**.

Dealer Copy -- Not for Resale

Tilt Spool Removal And Installation

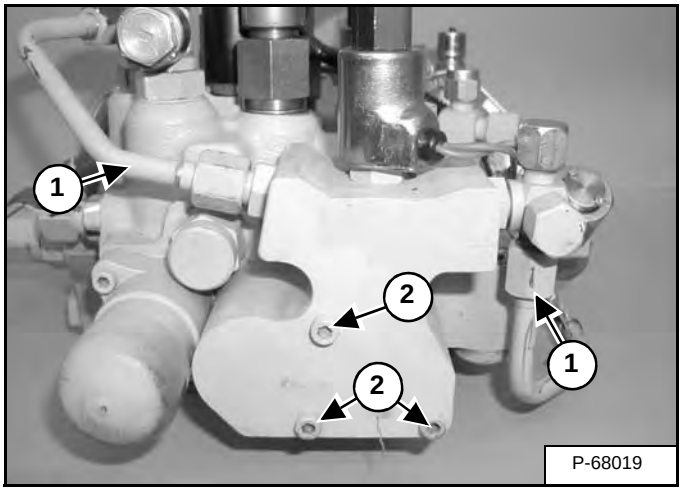
Remove the lift and tilt end cap/spool lock block. (See End Cap Block Removal and Installation on Page 20-40-14.)

Figure 20-40-82



Remove the spacer (Item 1) and O-ring (Item 2) **[Figure 20-40-82]** from the tilt spool.

Figure 20-40-83

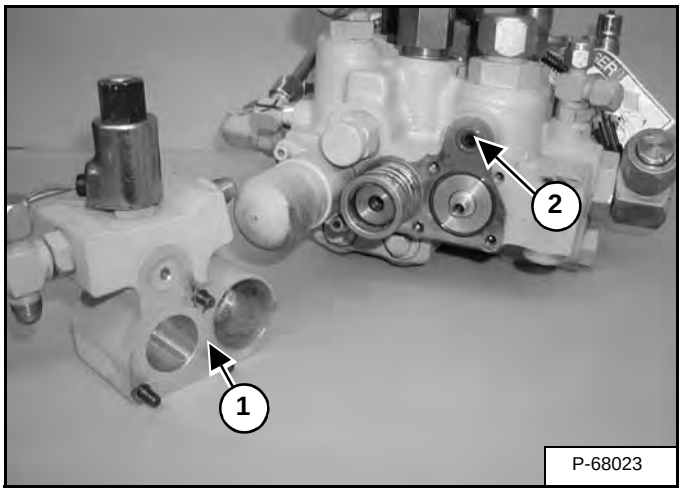


Disconnect the two tubelines (Item 1) **[Figure 20-40-83]** from the spool centering block.

Remove the three screws (Item 2) **[Figure 20-40-83]** from the spool centering block.

Installation: Tighten the bolt to 90-100 in.-lb. (10-11,3 N•m) torque.

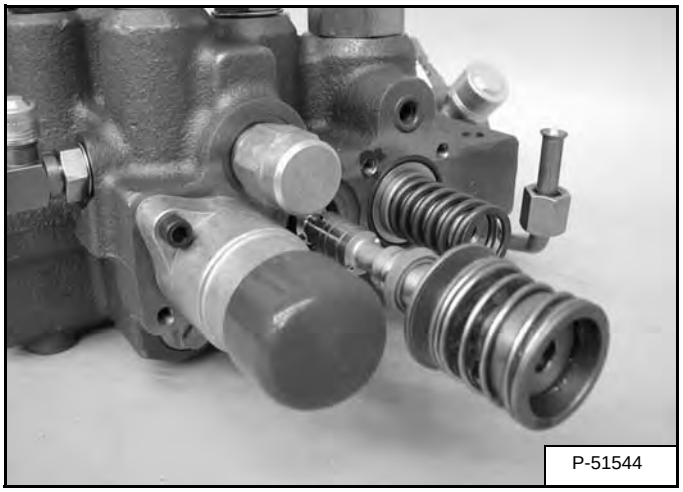
Figure 20-40-84



Remove the spool centering block (Item 1) **[Figure 20-40-84]** from the control valve.

Installation: Replace the O-ring (Item 2) **[Figure 20-40-84]** and lubricate the O-ring lightly with grease or oil before installation of the end cap/spool lock block.

Figure 20-40-85



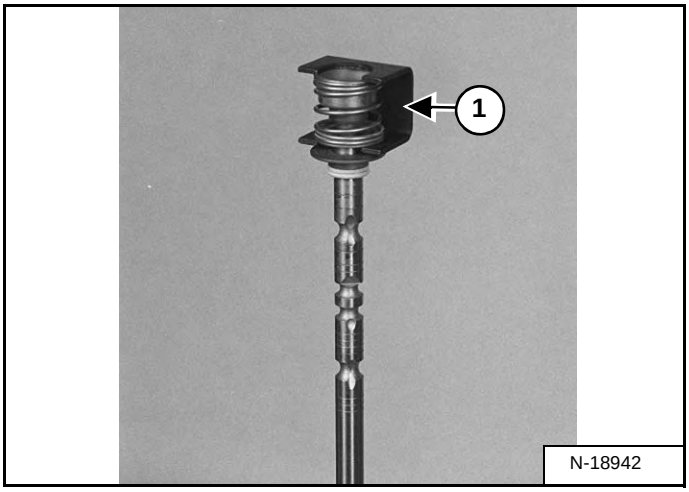
Remove the tilt spool, centering spring, back-up washer and spool seal **[Figure 20-40-85]**.

Assembly: Always use a new spool seal.

Dealer Copy -- Not for Resale

Tilt Spool Removal And Installation (Cont'd)

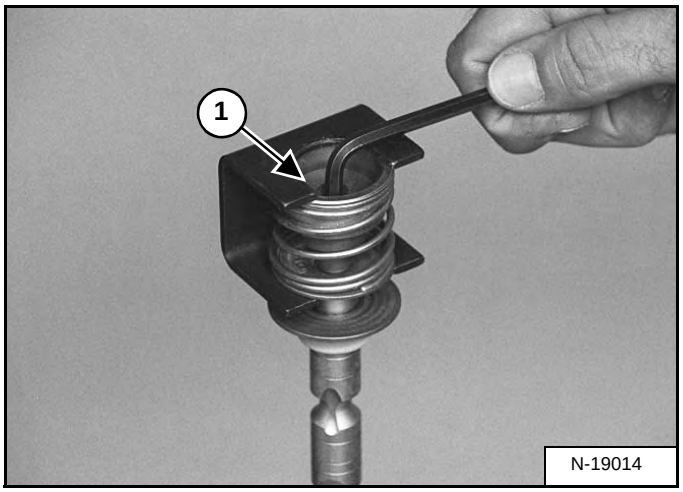
Figure 20-40-86



Put the linkage end of the spool in the vice **[Figure 20-40-86]**.

Install the spool tool (Item 1) **[Figure 20-40-86]** over the centering spring.

Figure 20-40-87

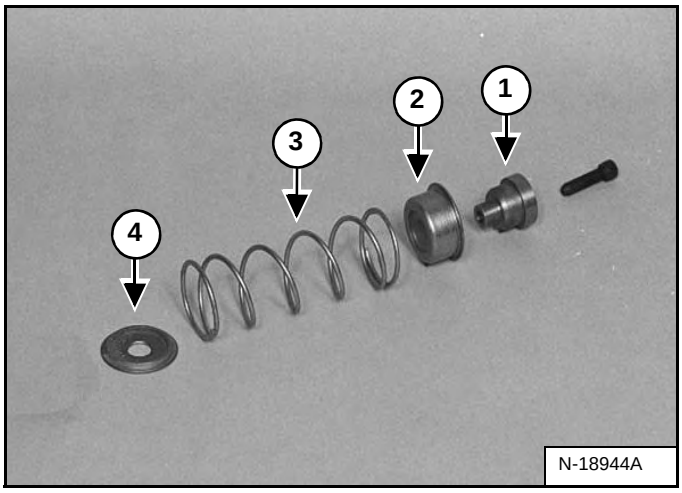


Remove the bolt (Item 1) **[Figure 20-40-87]** holding the centering spring to the spool.

Installation: Tighten the bolt to 90-100 in.-lb. (10,2-11,3 N•m) torque.

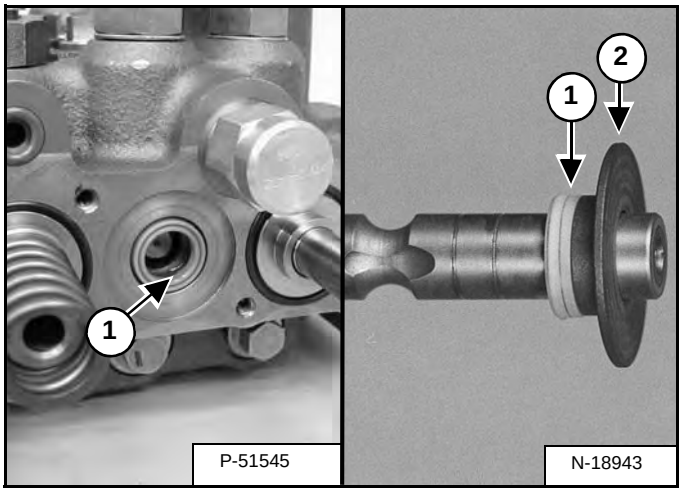
Remove spring tool from the spring assembly.

Figure 20-40-88



Inspect the adapter (Item 1), collar (Item 2), spring (Item 3) and washer (Item 4) **[Figure 20-40-88]**.

Figure 20-40-89



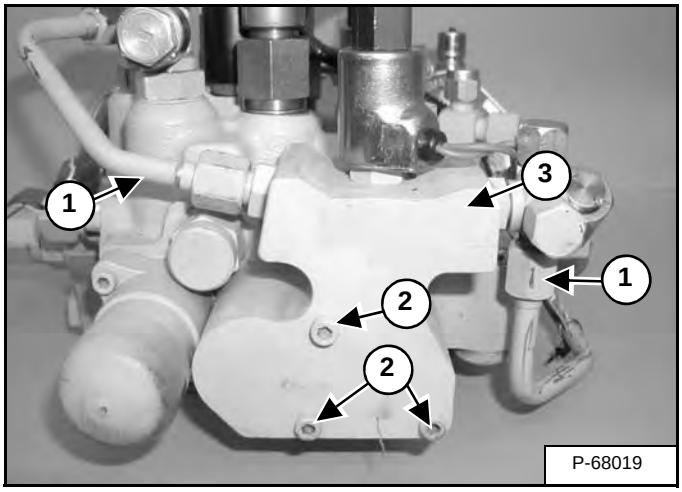
Remove the spool seal(s) (Item 1) and the back-up washer (Item 2) **[Figure 20-40-89]**.

Assembly: Always use a new spool seal.

Dealer Copy -- Not for Resale

Auxiliary Spool Removal And Installation

Figure 20-40-90



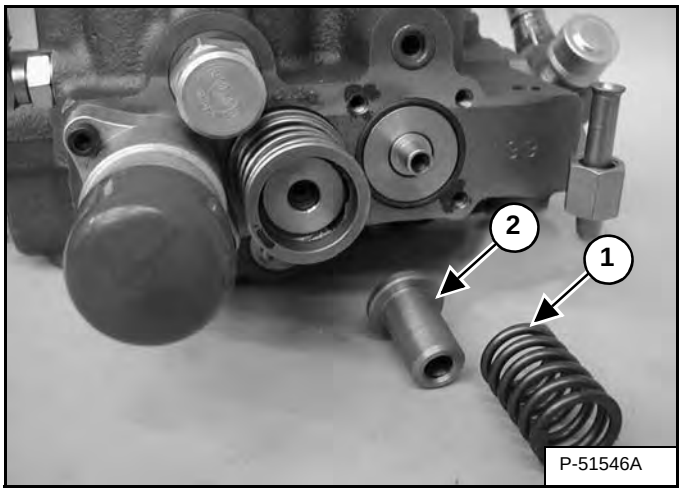
Remove the two tubelines (Item 1) **[Figure 20-40-90]** from the spool centering block.

Remove the three screws (Item 2) **[Figure 20-40-90]** from the spool centering block.

Installation: Tighten the bolt to 90-100 in.-lb. (10-11,3 N•m) torque.

Remove the spool centering block (Item 2) **[Figure 20-40-90]** from the control valve.

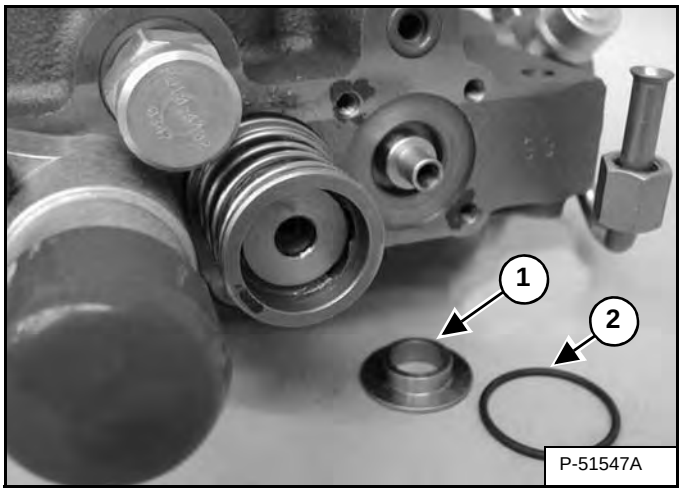
Figure 20-40-91



Remove the spring (Item 1) and center spring retainer (Item 2) **[Figure 20-40-91]** from the auxiliary spool.

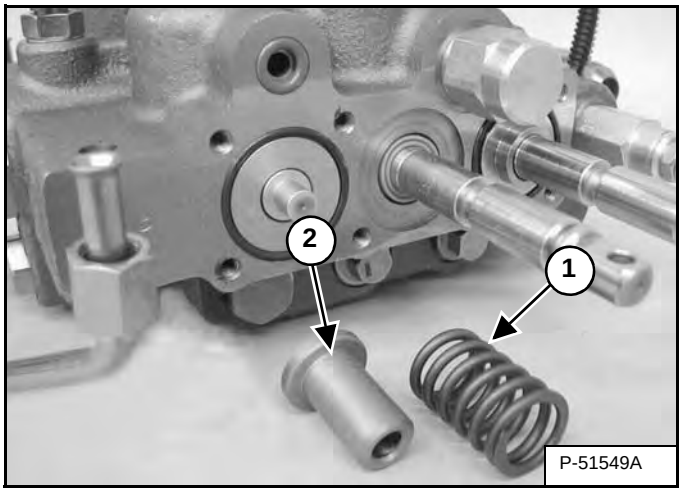
Note: If the centering spring retainer (Item 2) [Figure 20-40-91] must be replaced, replace the retainer on the opposite end also.

Figure 20-40-92



Remove the spacer (Item 1) and O-ring (Item 2) **[Figure 20-40-92]** from the auxiliary spool.

Figure 20-40-93



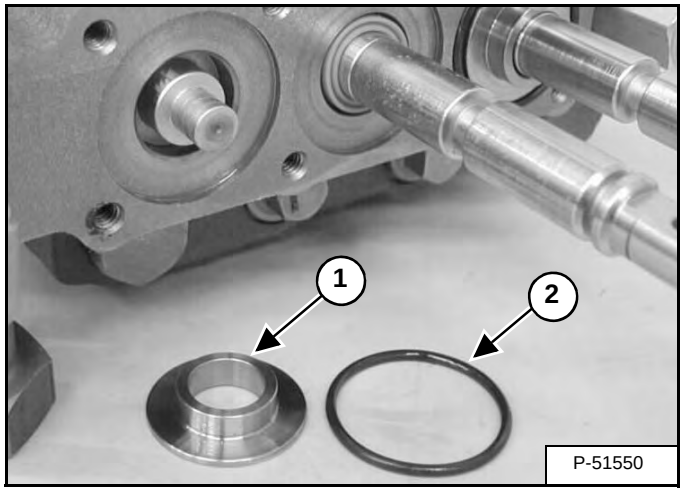
Remove the spring (Item 1) and center spring retainer (Item 2) **[Figure 20-40-93]** from the auxiliary spool.

NOTE: If the centering spring retainer (Item 2) [Figure 20-40-93] must be replaced, replace the retainer on the opposite end also.

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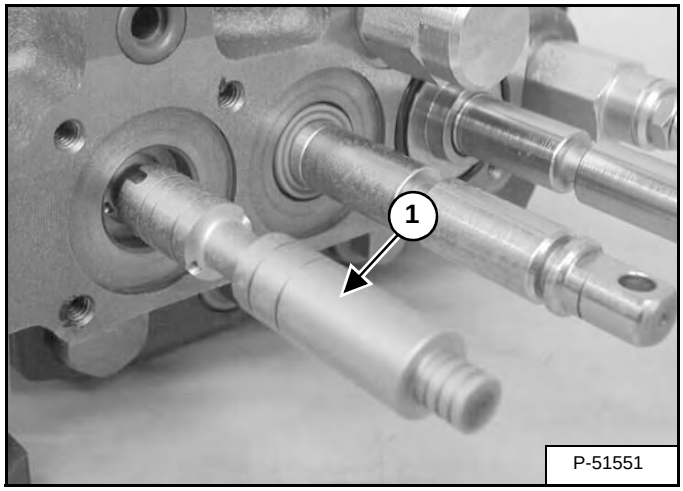
Auxiliary Spool Removal And Installation (Cont'd)

Figure 20-40-94



Remove the spacer (Item 1) and O-ring (Item 2) **[Figure 20-40-94]** from the auxiliary spool.

Figure 20-40-95

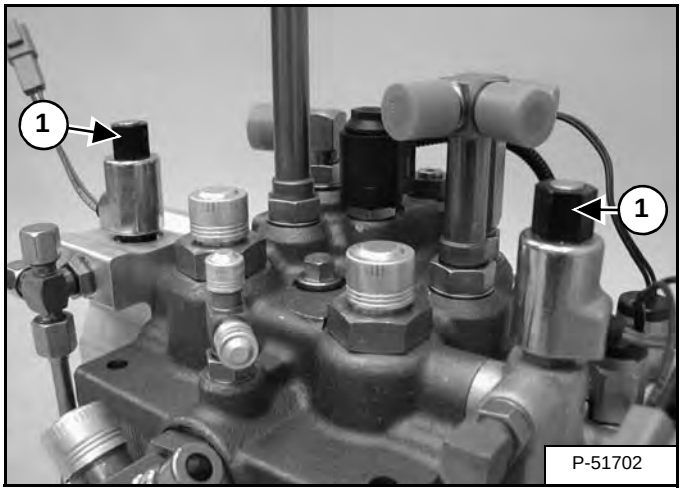


Remove the spool (Item 1) **[Figure 20-40-95]**.

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Auxiliary Solenoid Removal And Installation

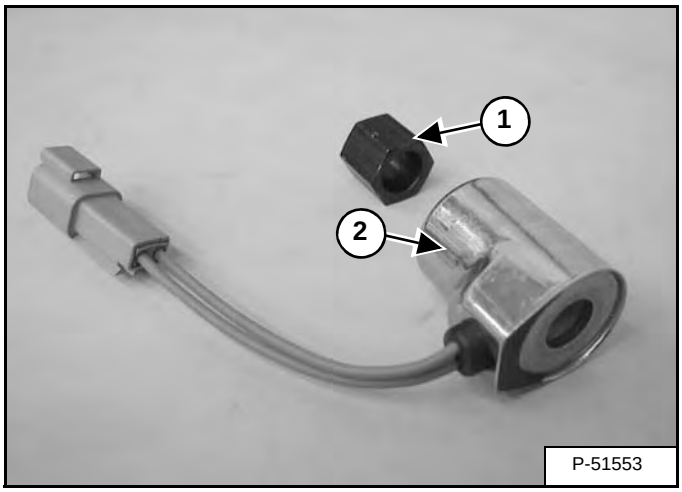
Figure 20-40-96



Remove the nut (Item 1) **[Figure 20-40-96]** from both solenoids.

Installation: Tighten the nut to 48-72 in.-lb. (5-8 N•m) torque.

Figure 20-40-97

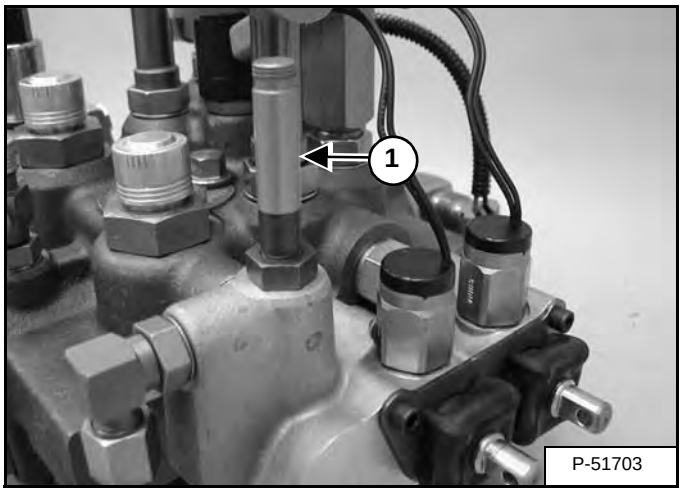


Remove the nut (Item 1) and solenoid coil (Item 2) **[Figure 20-40-97]**.

Use an ohmmeter to measure the solenoid coil resistance.

The correct resistance for the coil is **4.9 ±.25 Ohms**.

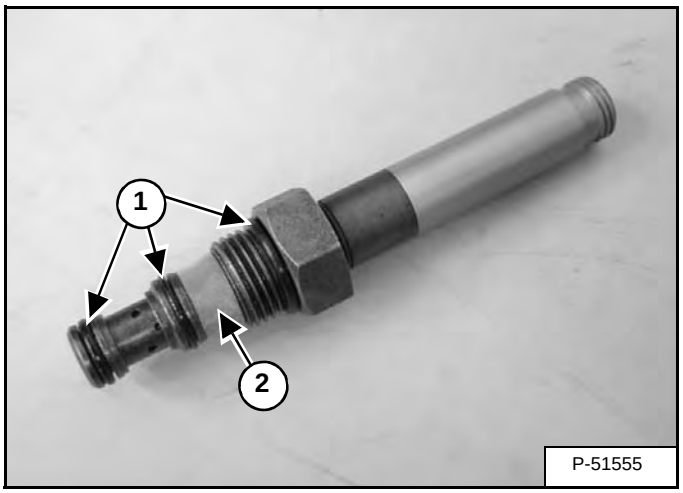
Figure 20-40-98



Remove the solenoid stem (Item 1) **[Figure 20-40-98]**.

Installation: Tighten the stem to 10-14 ft.-lb. (14-19 N•m) torque.

Figure 20-40-99



Remove the O-rings (Item 1) **[Figure 20-40-99]** from the solenoid stem.

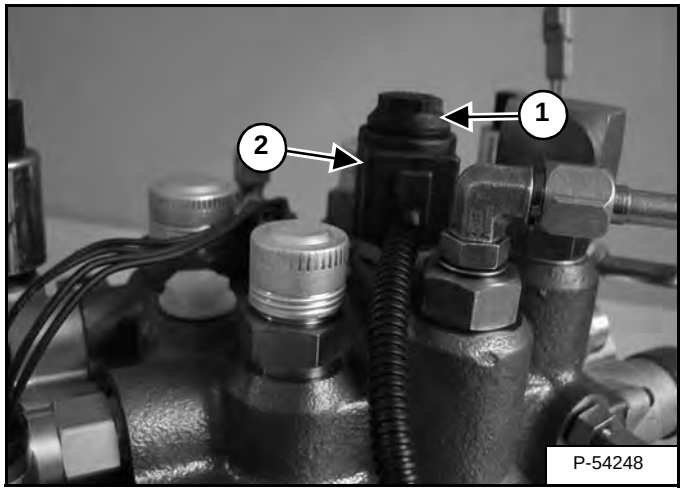
Check and clean the screen (Item 2) **[Figure 20-40-99]**.

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HYDRAULIC CONTROL VALVE (STANDARD) (CONT'D)

Solenoid Removal And Installation

Figure 20-40-100

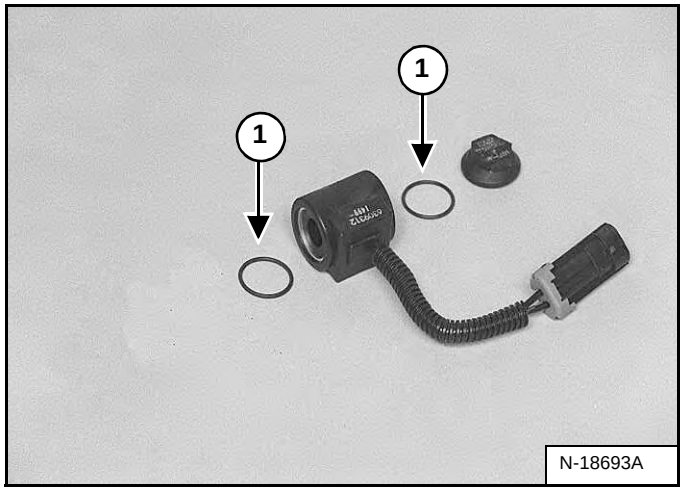


Remove the nut (Item 1) **[Figure 20-40-100]** from the solenoid stem.

Installation: Tighten the nut to 53 in.-lb. (6 N•m) torque.

Remove the solenoid coil (Item 2) **[Figure 20-40-100]**.

Figure 20-40-101

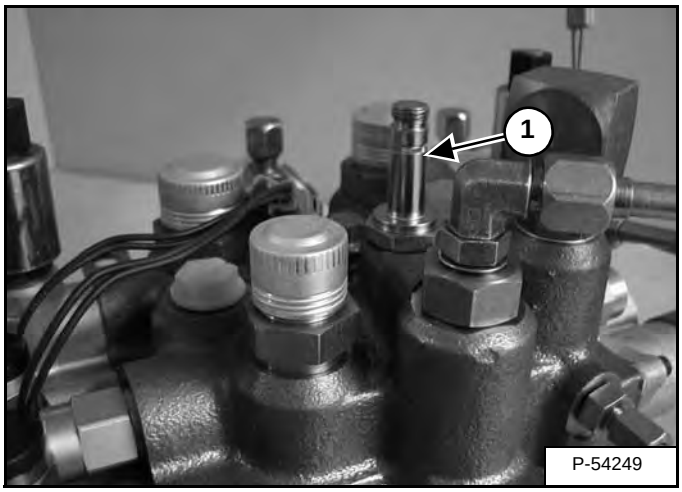


Remove the O-rings (Item 1) **[Figure 20-40-101]** from both ends of the solenoid coil.

Use an ohmmeter to measure the solenoid coil resistance.

The correct resistance for the coil is **9.79 ±.29 Ohms**.

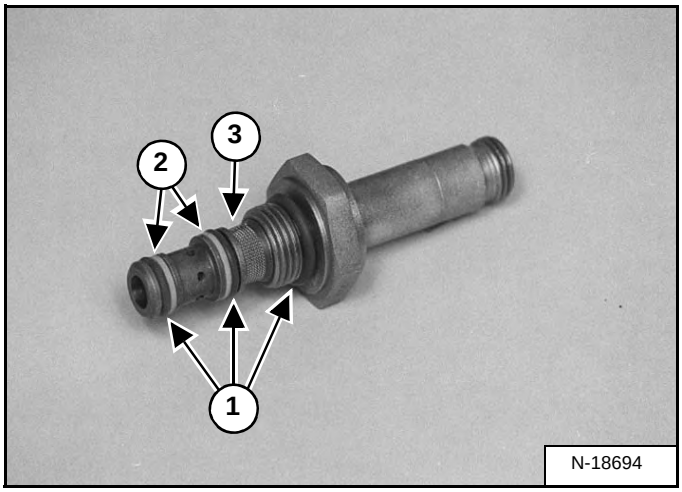
Figure 20-40-102



Remove the solenoid stem (Item 1) **[Figure 20-40-102]**.

Installation: Lubricate the O-rings and tighten the stem to 20-24 ft.-lb. (27-33 N•m) torque.

Figure 20-40-103



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-40-103]** from the stem.

Clean all parts in solvent and dry with compressed air.

Inspect all parts for wear and replace any showing excessive wear.

NOTE: The screen (Item 3) [Figure 20-40-103] may be cleaned with solvent. If it is torn or worn it needs to be replaced.

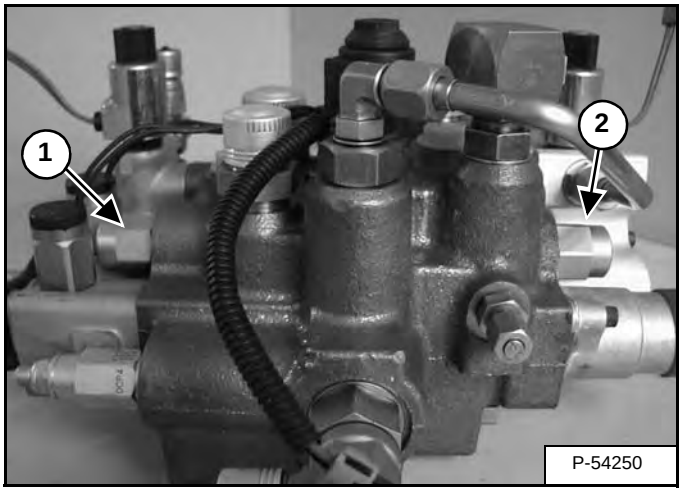
Use only new O-rings and apply oil to all O-rings and back-up rings before installation.

Install new O-rings (Item 1) **[Figure 20-40-101]** & **[Figure 20-40-103]** and new back-up rings (Item 2) **[Figure 20-40-103]** on the solenoid stem.

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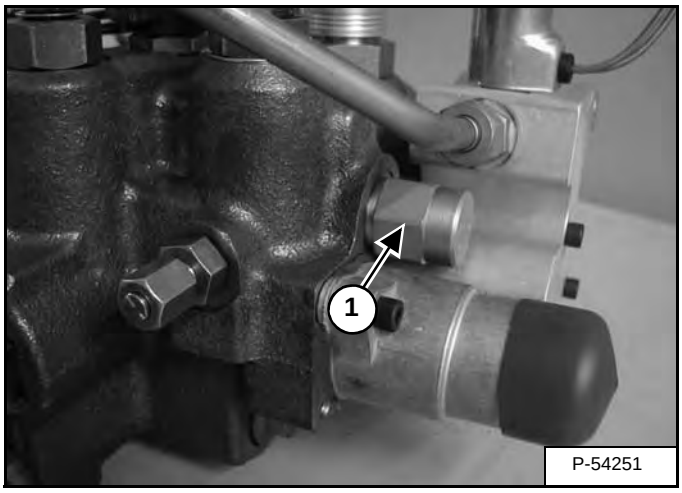
Lock Valve Removal And Installation

Figure 20-40-104



Locate the two BICS lock valves, (Item 1) is for the tilt circuit and (Item 2) **[Figure 20-40-104]** is for the lift circuit.

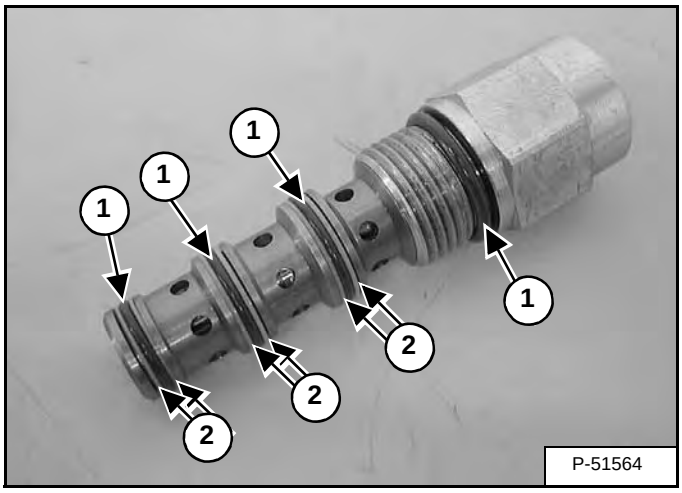
Figure 20-40-105



Remove the lift lock valve (Item 1) **[Figure 20-40-105]** from the back of the control valve.

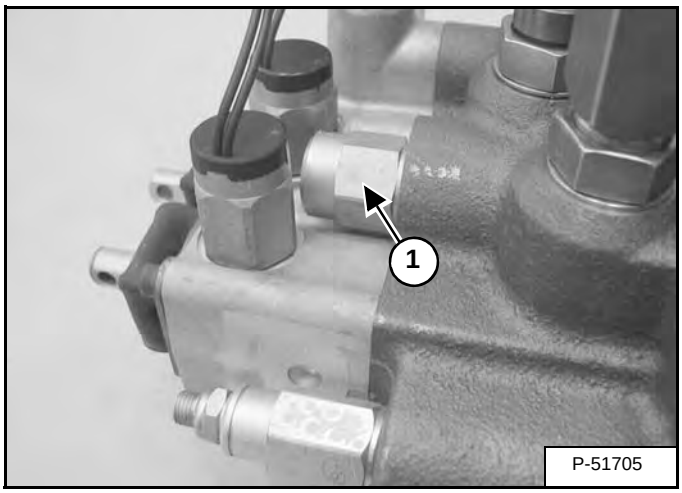
Installation: Lightly lubricate the lock valve O-rings and tighten to 20-24 ft.-lb. (27-33 N•m) torque.

Figure 20-40-106



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-40-106]** from the lift lock valve, and replace with new.

Figure 20-40-107

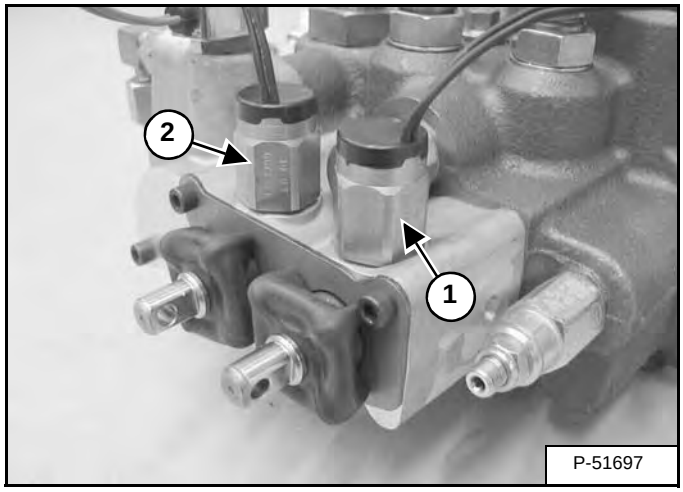


Locate the tilt circuit lock valve (Item 1) **[Figure 20-40-107]**.

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Lock Valve Removal And Installation (Cont'd)

Figure 20-40-108

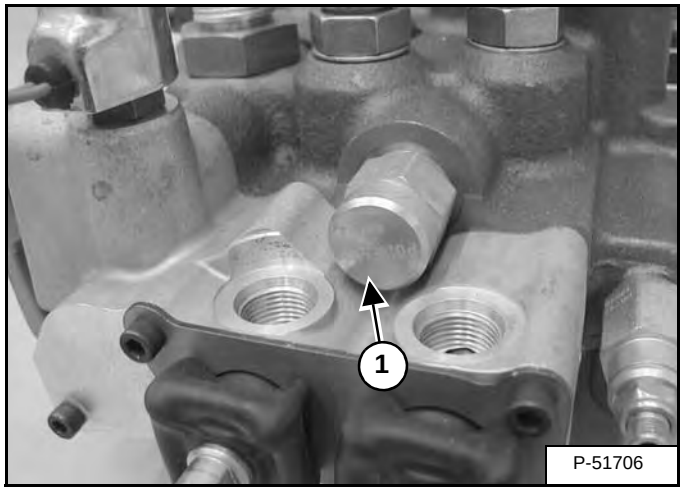


Remove the lift spool lock solenoid (Item 1) **[Figure 20-40-108]**.

Remove the tilt spool lock solenoid (Item 2) **[Figure 20-40-108]**.

Installation: Lubricate the O-rings and tighten the spool lock solenoids to 38-45 ft.-lb. (52-61 N•m) torque.

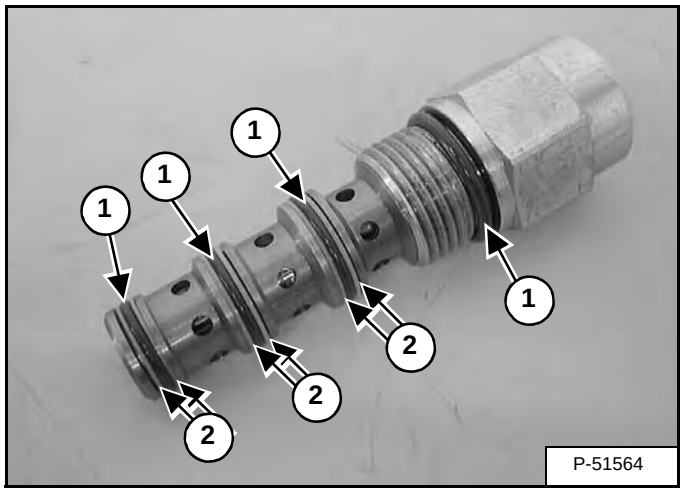
Figure 20-40-109



Remove the tilt lock valve (Item 1) **[Figure 20-40-109]** from the front of the control valve.

Installation: Lightly lubricate the lock valve O-rings and tighten to 20-24 ft.-lb. (27-33 N•m) torque.

Figure 20-40-110

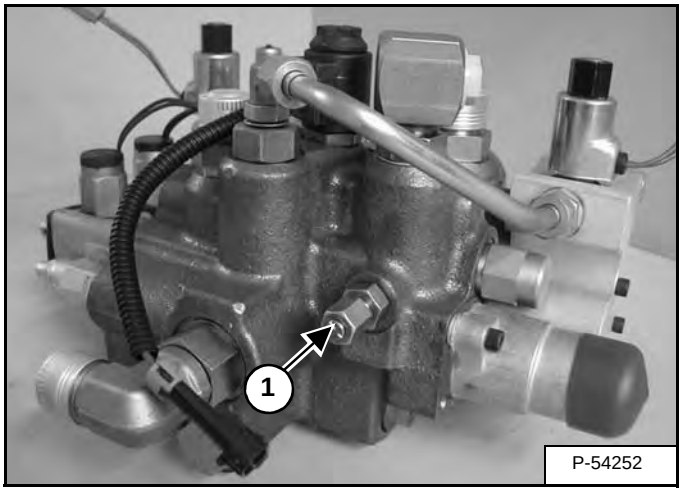


Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-40-110]** from the tilt lock valve, and replace with new.

Dealer Copy -- Not for Resale

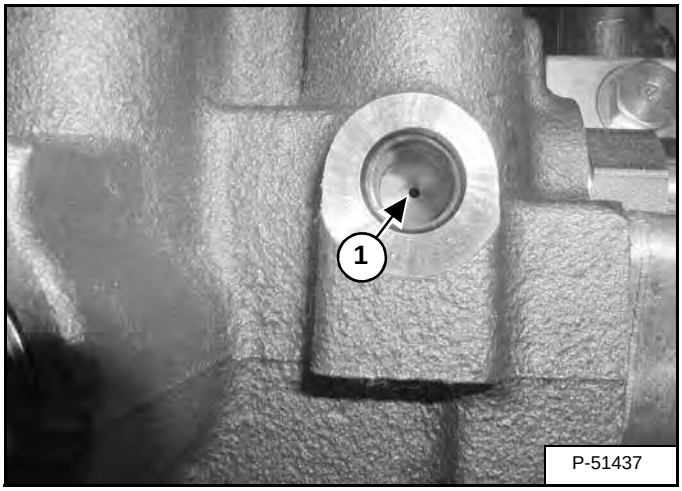
Lift Arm Bypass Orifice Removal And Installation

Figure 20-40-111



Remove the fitting (Item 1) **[Figure 20-40-111]** from the valve.

Figure 20-40-112

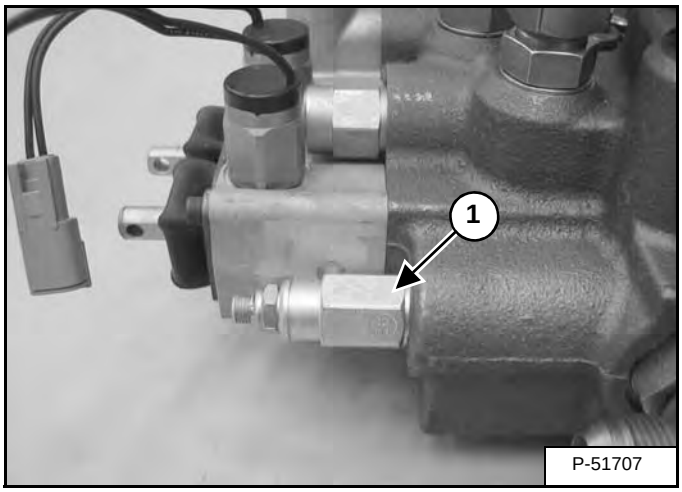


Check the lift arm bypass orifice (Item 1) **[Figure 20-40-112]**.

NOTE: This orifice is not removable from the valve casting.

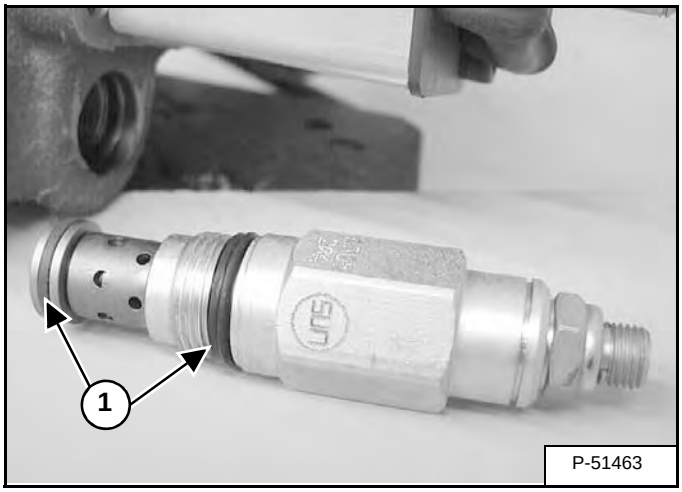
Main Relief Valve Removal And Installation

Figure 20-40-113



Remove the main relief valve (Item 1) **[Figure 20-40-113]**.

Figure 20-40-114



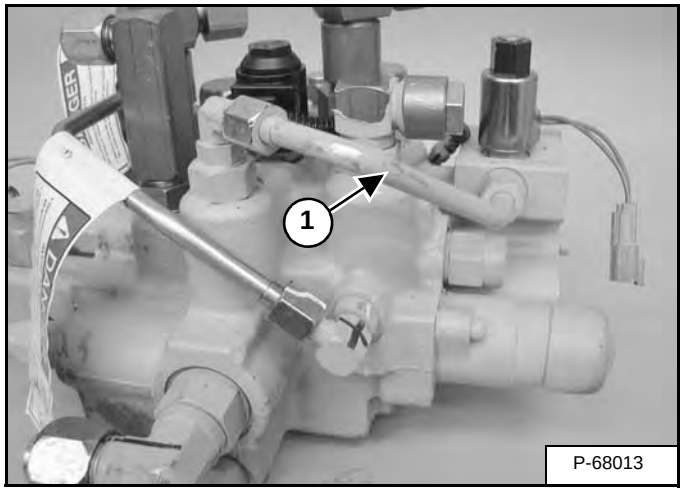
Remove the O-rings from the main relief valve (Item 1) **[Figure 20-40-114]**.

Installation: Always use new O-rings. Tighten to 38-45 ft.-lb. (52-61 N•m) torque.

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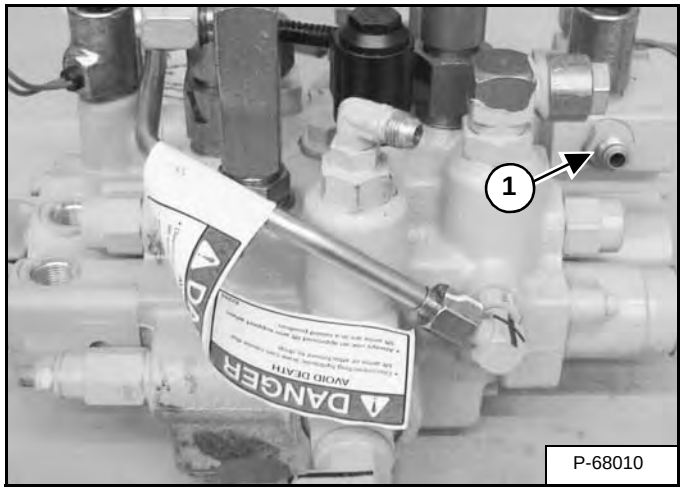
Check Valve Removal And Installation

Figure 20-40-115



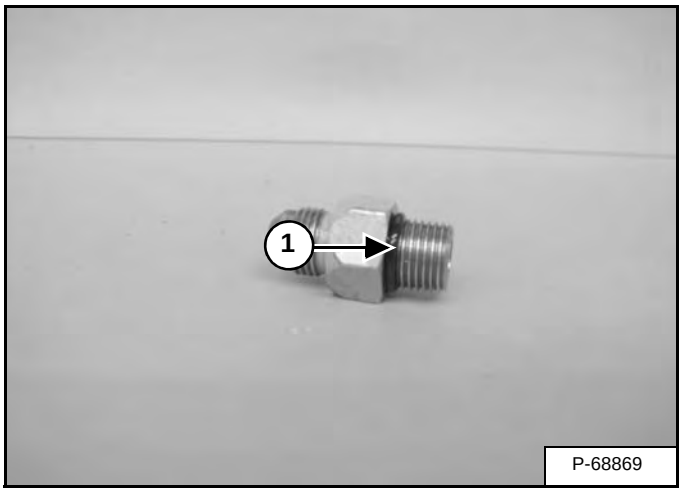
Remove the tubeline (Item 1) **[Figure 20-40-115]**.

Figure 20-40-116



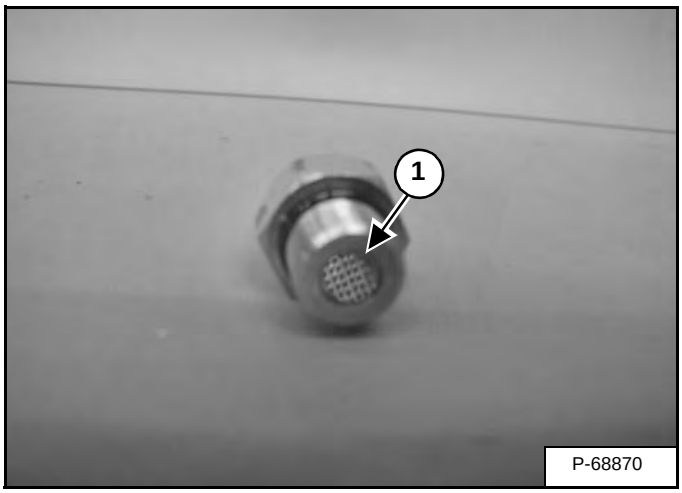
Remove the check valve fitting (Item 1) **[Figure 20-40-116]** from the hydraulic control valve.

Figure 20-40-117



Installation: Lubricate the O-ring (Item 1) **[Figure 20-40-117]** and tighten the fitting to 20-24 ft.-lb. (27-33 N•m) torque.

Figure 20-40-118



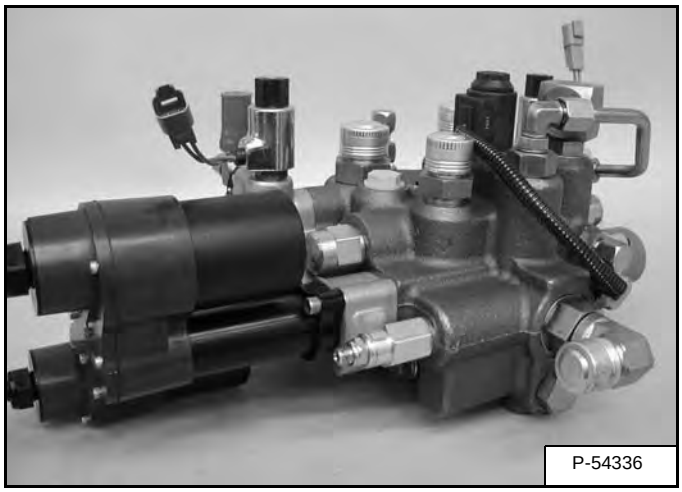
Inspect the screen (Item 1) **[Figure 20-40-118]**.

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HYDRAULIC CONTROL VALVE (ACS) OR (SJC)

Description

Figure 20-41-1



The hydraulic control valve is located inside the main frame on the right hand side, below the operators cab.

The hydraulic control valve **[Figure 20-41-1]** is the hydraulic component that uses spools to direct the flow of hydraulic fluid to the lift, tilt and auxiliary functions.

The lift and tilt functions in the ACS or the SJC hydraulic control valve are operated using electronic control handle/levers or foot pedals that send an electronic signal to the electronic actuators to move the lift and tilt spools in the control valve.

The auxiliary function is operated by pilot pressure. There is one solenoid located by each side of the spool. Only one solenoid at a time is activated by the switch on the right side control handle/lever. The activated solenoid sends pilot pressure oil to one side of the spool and forces the spool to shift.

The hydraulic control valve also contains a main relief valve which is adjustable.

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Removal And Installation



⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

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

Raise the lift arms and install an approved lift arm support device.

Stop the engine. Raise the seat bar.

Raise the operator cab. (See Raising on Page 10-30-1.)

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-2.)

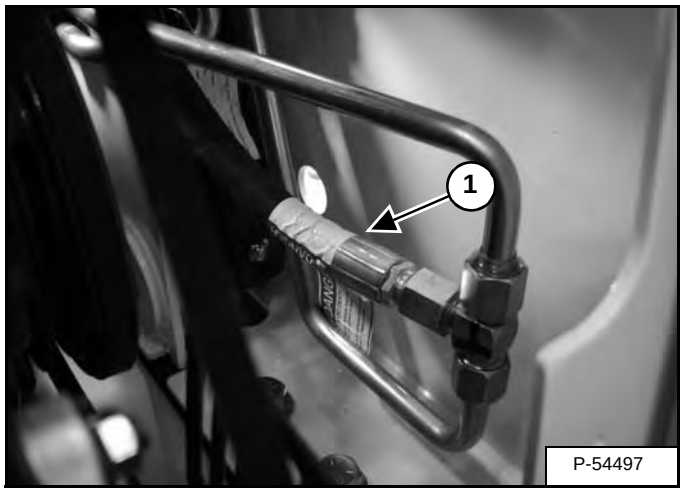
Remove the control panel. (See Removal And Installation on Page 50-101-2.)

Clean area around control valve.

Remove the lift arm bypass valve. (See Removal And Installation on Page 20-50-2.)

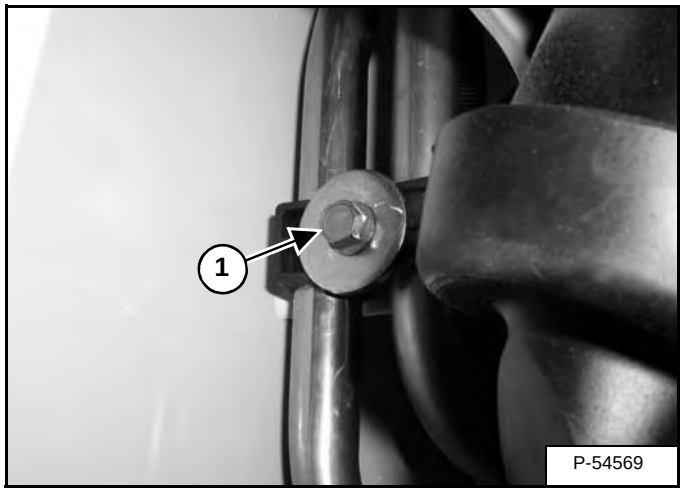
Open rear door.

Figure 20-41-2



The fixed end main valve hose assembly (Item 1) **[Figure 20-41-2]** is connected to a fixed end fitting on the control valve. The hose is routed to the upright where the hose is connected to a fitting that feeds the base end of both lift cylinders. The hose can only be removed by first removing it from the tee fitting located at the rear of the loader.

Figure 20-41-3

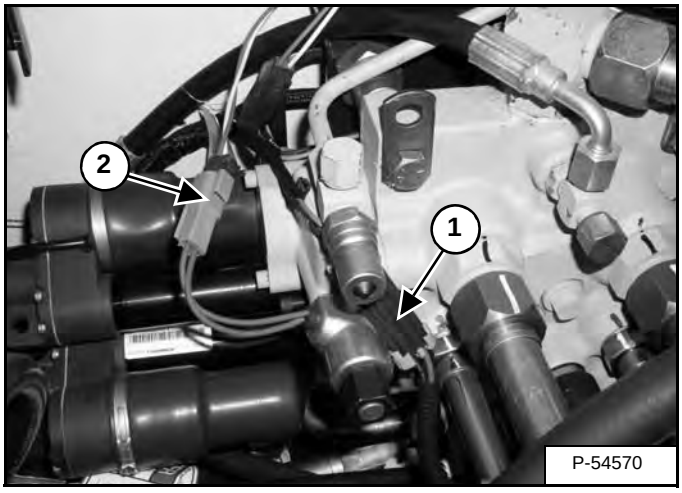


Remove the tubeline clamp (Item 1) **[Figure 20-41-3]** located on the inside of the left upright.

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Removal And Installation (Cont'd)

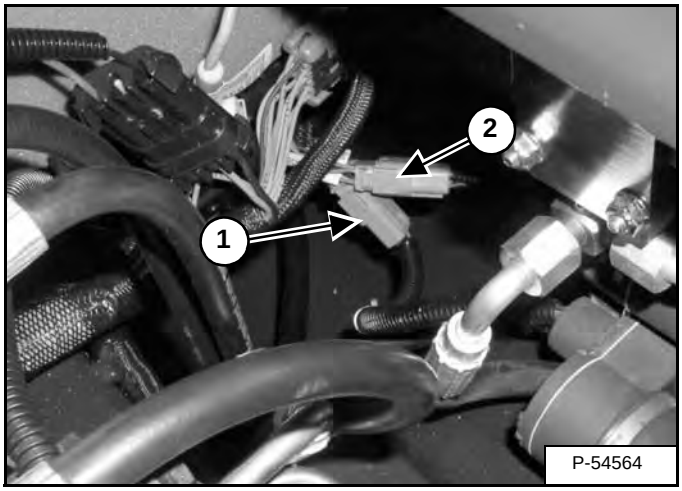
Figure 20-41-4



Mark the two wire connectors for proper installation.

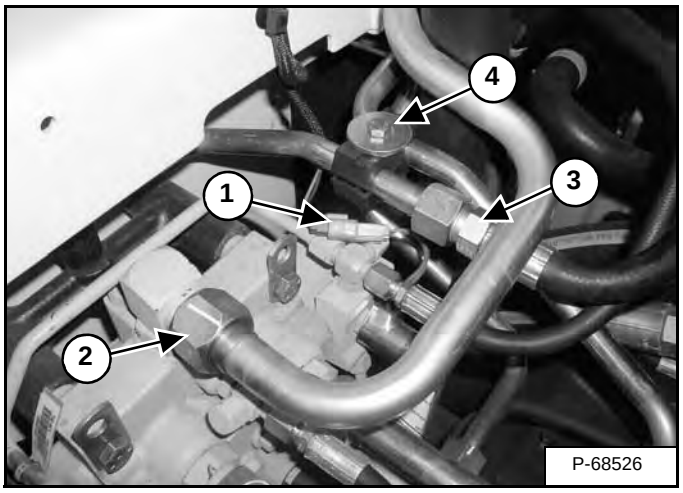
Disconnect the wire harness connector (Item 1) from the BICS valve solenoid and (Item 2) from auxiliary valve solenoid **[Figure 20-41-4]**.

Figure 20-41-5



Disconnect the lift and tilt actuator electrical connectors (Item 1) and (Item 2) **[Figure 20-41-5]** from the control valve.

Figure 20-41-6



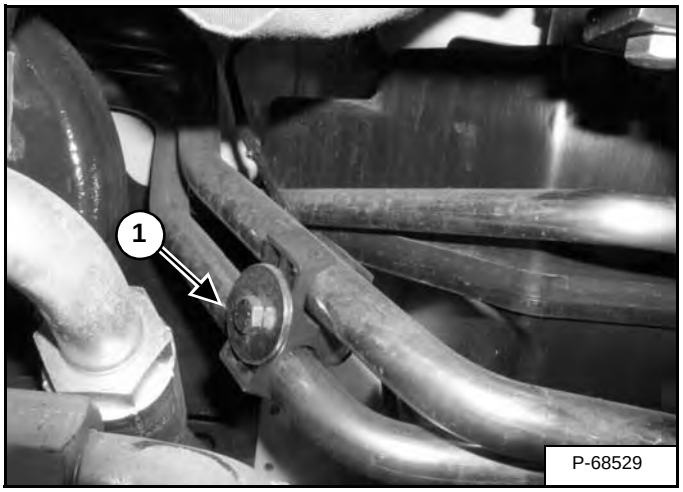
Disconnect the harness connector (Item 1) **[Figure 20-41-6]** from the auxiliary valve solenoid.

Disconnect the tubeline (Item 2) **[Figure 20-41-6]** that goes from the control valve to the hydraulic cooler.

Disconnect the hose (Item 3) **[Figure 20-41-6]** that goes from the gearpump to the control valve.

Remove the tubeline clamp (Item 4) **[Figure 20-41-6]**.

Figure 20-41-7



Remove the tubeline clamp (Item 1) **[Figure 20-41-7]** located on the auxiliary tubelines between the hydraulic reservoir and the hydrostatic pump.

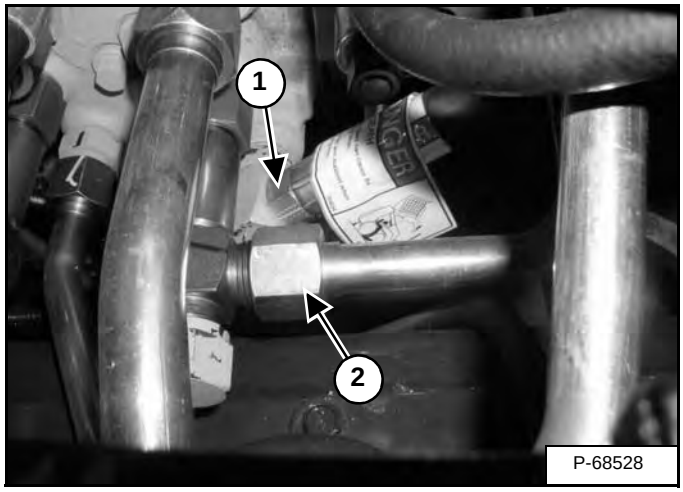
Removing this clamp will allow more movement in the auxiliary tubelines for removing the control valve from the loader.

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HYDRAULIC CONTROL VALVE (ACS) OR (SJC) (CONT'D)

Removal And Installation (Cont'd)

Figure 20-41-8



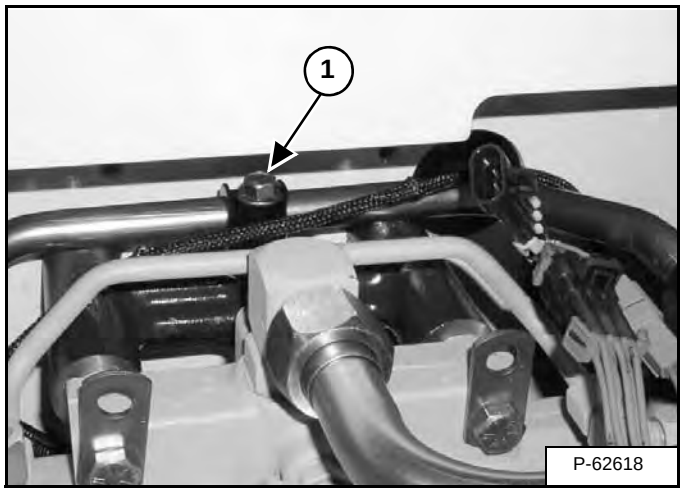
Loosen the fixed end main valve hose assembly (Item 1) **[Figure 20-41-8]** from the control valve.

The hose can be removed from the control valve by rotating the hose assembly.

Disconnect the tilt tubeline (Item 2) **[Figure 20-41-8]** from the control valve.

Cap and plug the hose, tubeline and the fittings.

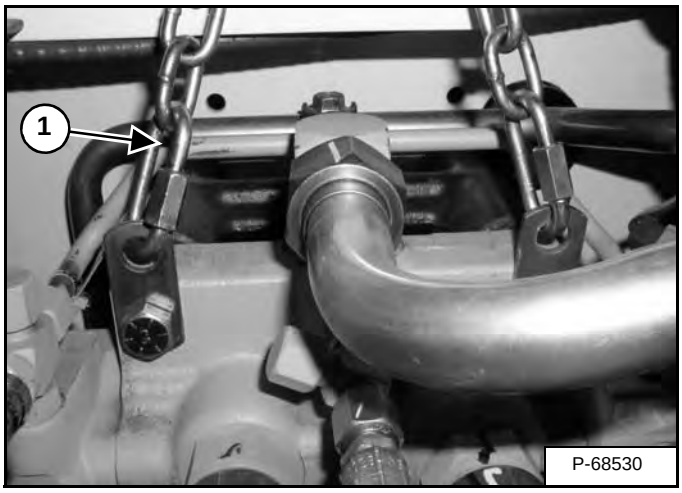
Figure 20-41-9



Remove the tubeline clamp mount bolt and clamp (Item 1) **[Figure 20-41-9]**.

NOTE: Removing the tubeline clamp will help provide added clearance for removing the valve.

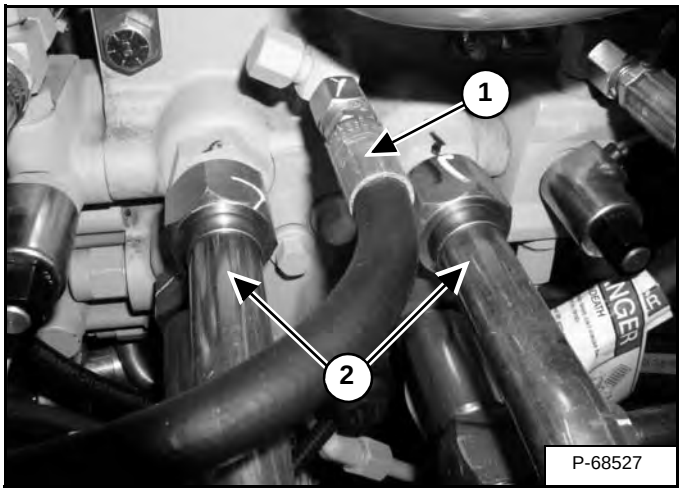
Figure 20-41-10



Install a chain hoist (Item 1) **[Figure 20-41-10]** to the control valve, and support the control valve.

Loosen all the tubeline fittings connected to the control valve.

Figure 20-41-11



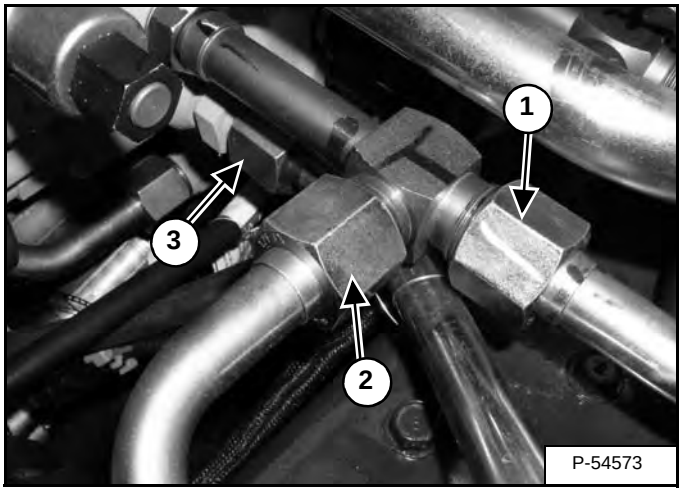
Disconnect the lift arm bypass drain hose (Item 1) **[Figure 20-41-11]** from the control valve.

Disconnect the two auxiliary tubelines (Item 2) **[Figure 20-41-11]** from the control valve.

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Removal And Installation (Cont'd)

Figure 20-41-12

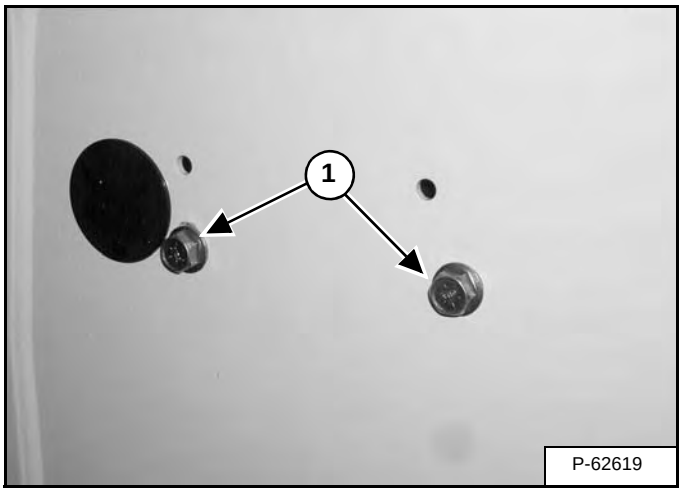


Disconnect the tilt tubeline (Item 1) **[Figure 20-41-12]** from the control valve.

Disconnect the tilt tubeline (Item 2) **[Figure 20-41-12]** from the control valve. (If equipped with Bucket Positioning Valve.)

Disconnect the lift tubeline (Item 3) **[Figure 20-41-12]** from the control valve.

Figure 20-41-13



Remove the two control valve mount bolts (Item 1) **[Figure 20-41-13]** located on the outside of the frame.

Installation: Torque the bolts (Item 1) **[Figure 20-41-13]** to 90-100 ft.-lb. (123-135 N•m).

Remove the control valve from the loader.

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Actuator Removal And Installation (In Loader)

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

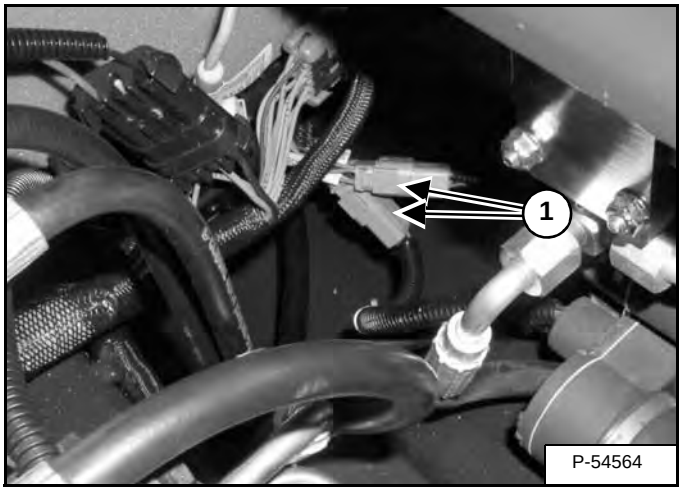
W-2059-0598

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Stop the engine. Raise the seat bar.

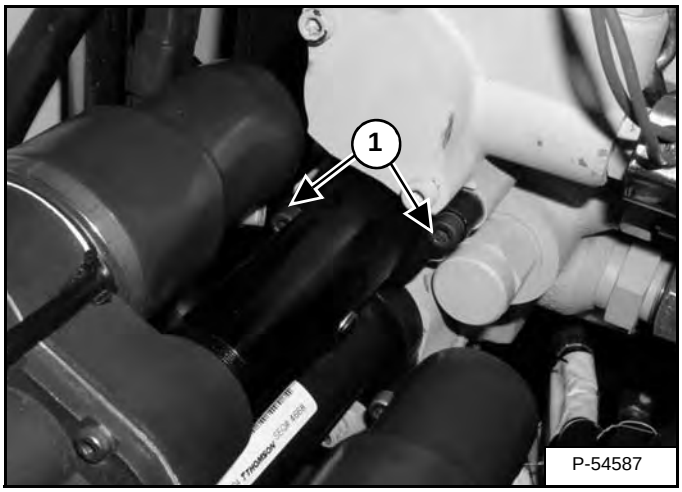
Mark the actuator wiring harness connectors for proper installation.

Figure 20-41-14



Unplug the actuator connectors (Item 1) **[Figure 20-41-14]** from the loader harness.

Figure 20-41-15



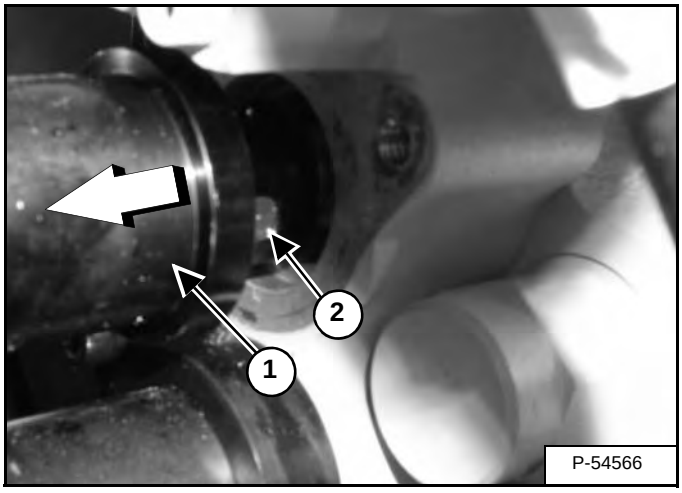
Remove the two screws (Item 1) **[Figure 20-41-15]** from the actuator retainer.

Installation: Tighten the bolts to 90-100 in.-lb. (10,2-11,3 N•m) torque.

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Actuator Removal And Installation (In Loader) (Cont'd)

Figure 20-41-16



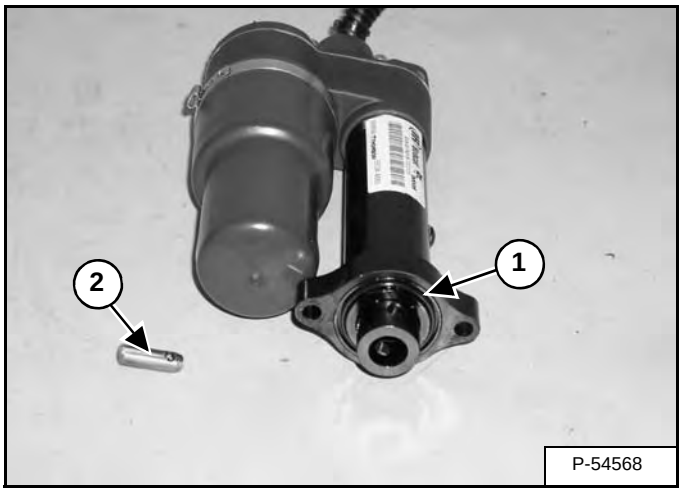
Pull the actuator (Item 1) **[Figure 20-41-16]** away from the control valve.

Use a punch to remove the actuator pin (Item 2) **[Figure 20-41-16]** from the actuator and spool.

Remove the actuator from the hydraulic control valve.

NOTE: The calibration procedure must be followed when replacing a lift or tilt actuator. (See Lift And Tilt Calibration (SJC) on Page 60-160-5.)

Figure 20-41-17



Inspect the O-ring (Item 1) **[Figure 20-41-17]** on the face of the actuator, and replace as needed.

Check the linkage pin (Item 2) **[Figure 20-41-17]** and replace as needed.

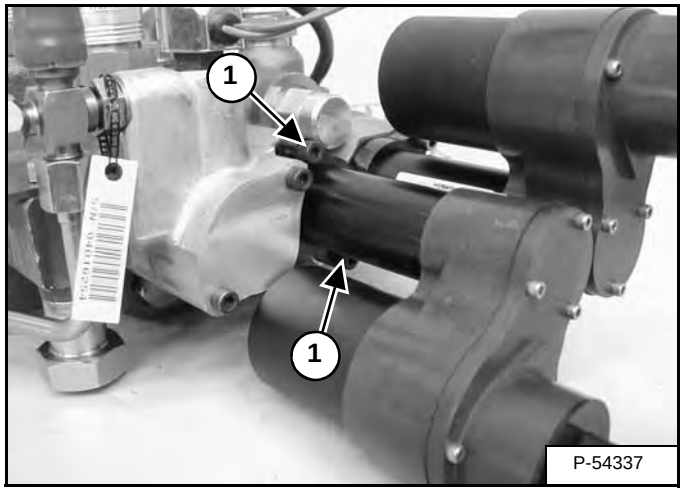
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HYDRAULIC CONTROL VALVE (ACS) OR (SJC) (CONT'D)

Actuator Removal And Installation (Out Of Loader)

Remove the control valve from the loader.

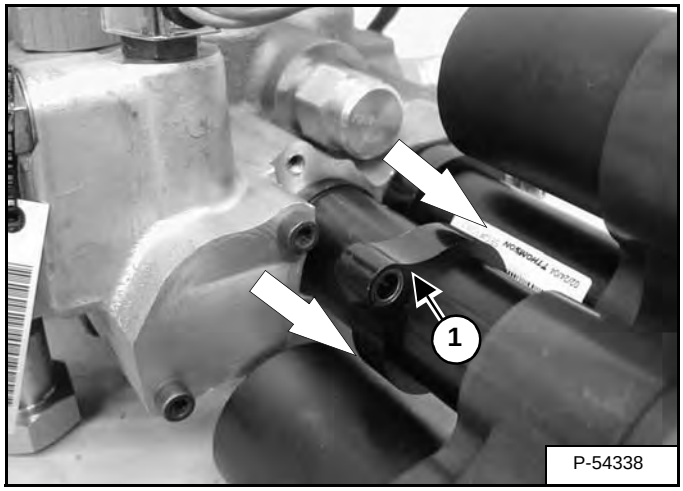
Figure 20-41-18



Remove the two mount bolts (Item 1) **[Figure 20-41-18]** from the tilt actuator.

Installation: Tighten the mounting bolts to 90-100 in.-lb. (10,2-11,3 N•m) torque.

Figure 20-41-19



Slide the actuator mount bracket (Item 1) **[Figure 20-41-19]** away from the control valve.

Pull the actuator away from the control valve **[Figure 20-41-19]**.

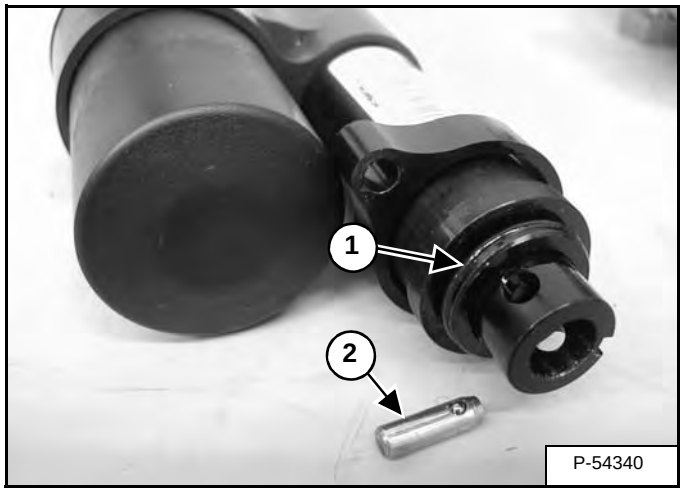
Figure 20-41-20



Using a drift pin and a hammer, remove the actuator linkage pin (Item 1) **[Figure 20-41-20]** from the actuator and the tilt spool.

Remove the actuator and linkage pin from the valve.

Figure 20-41-21



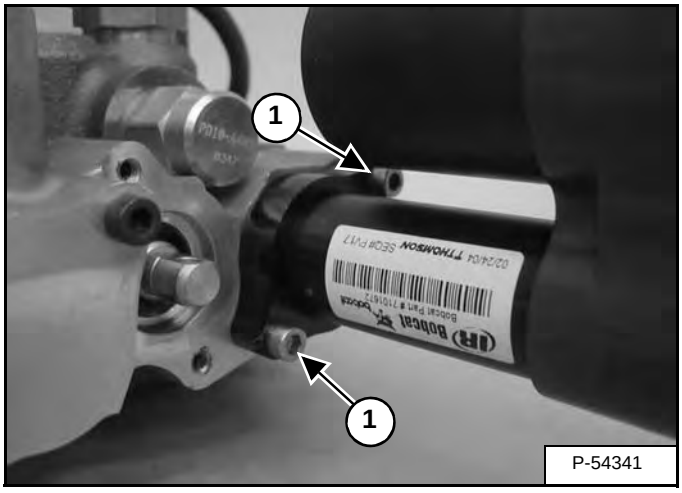
Inspect the O-ring (Item 1) **[Figure 20-41-21]** on the face of the actuator, and replace as needed.

Check the linkage pin (Item 2) **[Figure 20-41-21]** and replace as needed.

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Actuator Removal And Installation (Out Of Loader) (Cont'd)

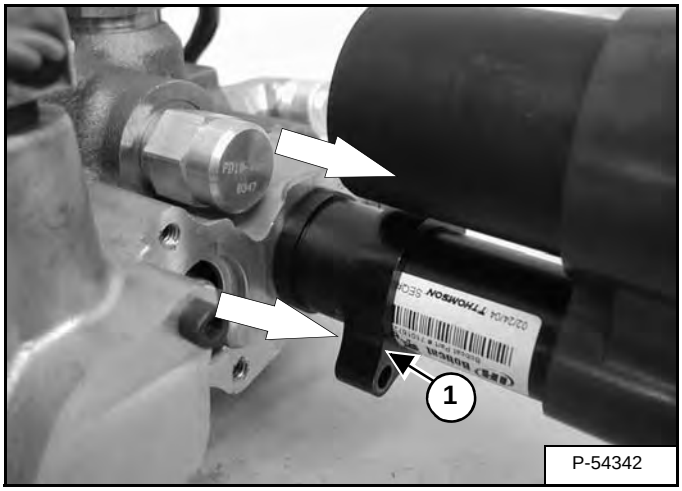
Figure 20-41-22



Remove the two mount bolts (Item 1) **[Figure 20-41-22]** from the lift actuator.

Installation: Tighten the mounting bolts to 90-100 in.-lb. (10,2-11,3 N•m) torque.

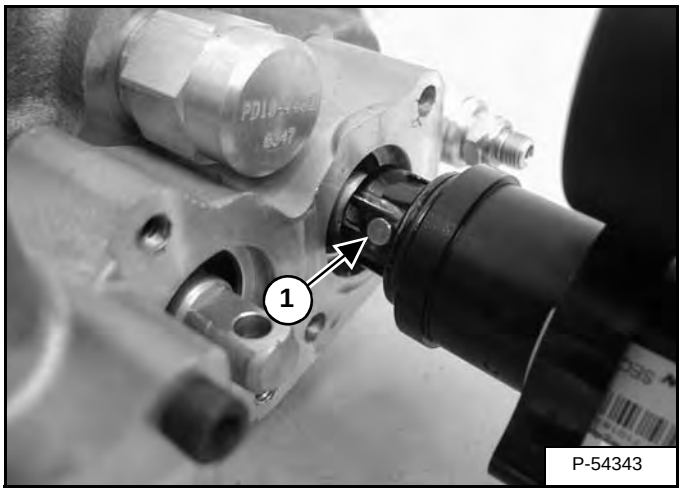
Figure 20-41-23



Slide the actuator mount bracket (Item 1) **[Figure 20-41-23]** away from the control valve.

Pull the actuator away from the control valve **[Figure 20-41-23]**.

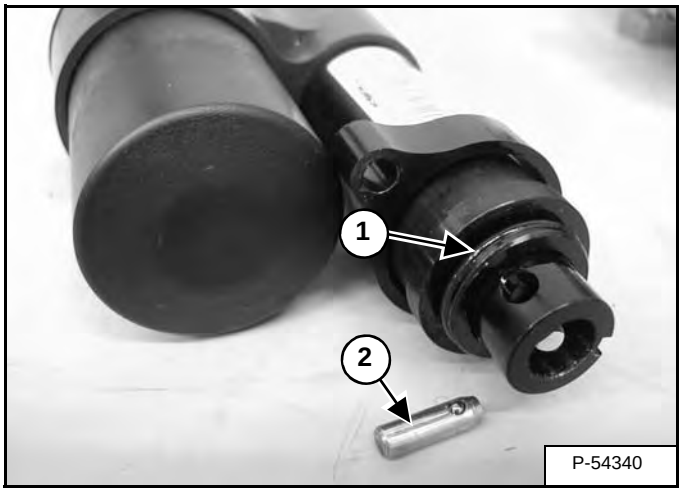
Figure 20-41-24



Using a drift pin and a hammer, remove the actuator linkage pin (Item 1) **[Figure 20-41-24]** from the actuator and the tilt spool.

Remove the actuator and linkage pin from the valve.

Figure 20-41-25



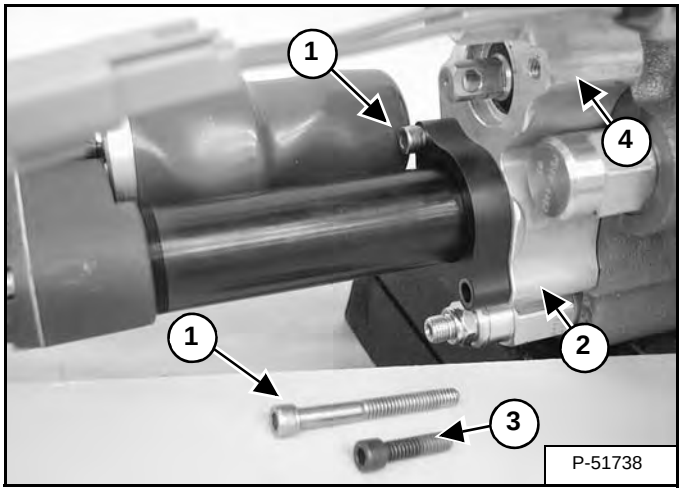
Inspect the O-ring (Item 1) **[Figure 20-41-25]** on the face of the actuator, and replace as needed.

Check the linkage pin (Item 2) **[Figure 20-41-25]** and replace as needed.

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Actuator Removal And Installation (Out Of Loader) (Cont'd)

Figure 20-41-26



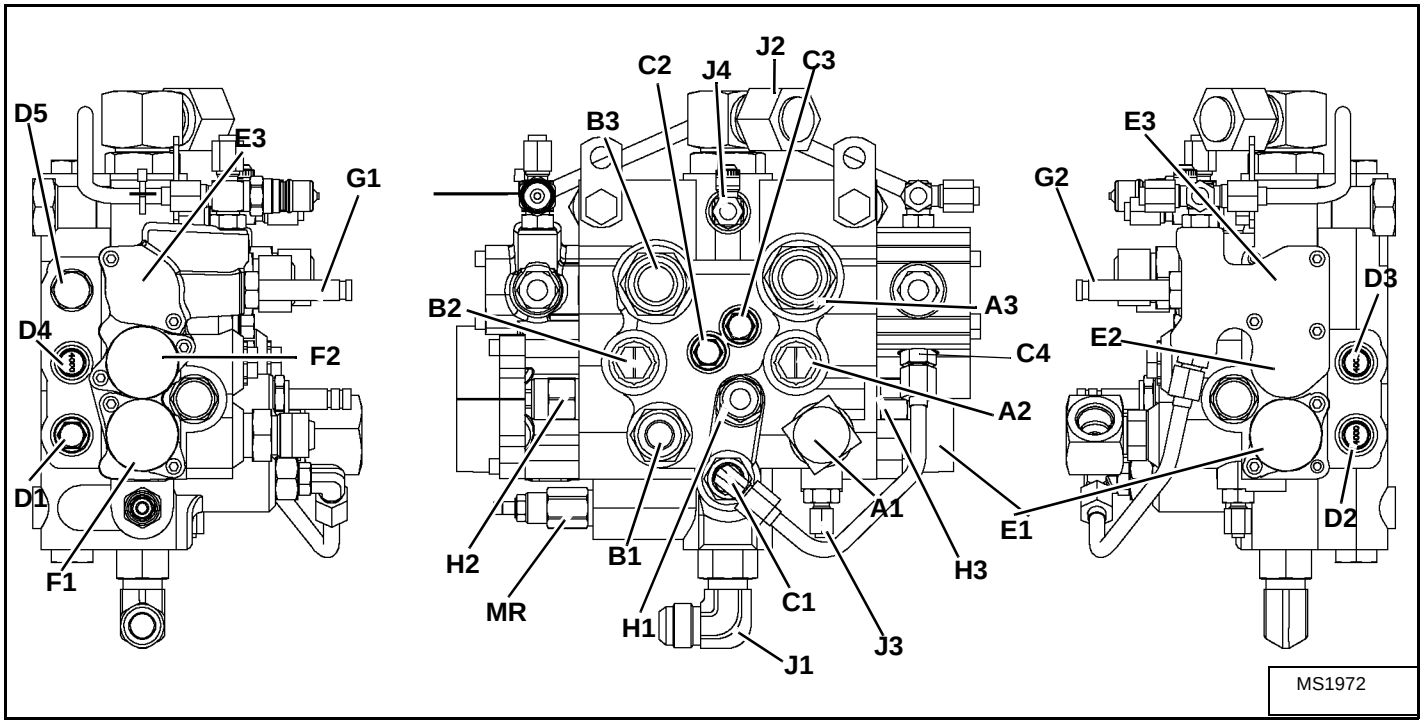
NOTE: The two longer bolts (Item 1) are used to mount the lift actuator and end cap (Item 2) [Figure 20-41-26] to the control valve.
The two shorter mount bolts (Item 3) are used to mount the tilt actuator to the end cap (Item 4) [Figure 20-41-26].

Installation: Tighten the mounting bolts to 90-100 in.-lb. (10,2-11,3 N•m) torque (Item 1) **[Figure 20-41-26]**

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Identification Chart

Figure 20-41-27



ITEM	S220 LOADER
A1	Lift Cylinder Base End
A2	Tilt Cylinder Base End
A3	Auxiliary Hydraulic Rod End
B1	Lift Cylinder Rod End
B2	Tilt Cylinder Rod End
B3	Auxiliary Hydraulics Base End
C1	Lift Load Check
C2	Load Check Valve Tilt Function
C3	Load Check Valve Auxiliary Function
C4	Check Valve
D1	Anti-Cavitation Valve Lift (Rod End)
D2	Port Relief/Anti-Cavitation Valve – 4000 PSI Lift (Base End)
D3	Port Relief/Anti-Cavitation Valve – 4000 PSI Tilt (Base End)
D4	Port Relief/Anti-Cavitation Valve – 4000 PSI Tilt (Rod End)
D5	Port Relief/Anti-Cavitation Valve (Auxiliary) 3500 PSI (Optional)

ITEM	S220 LOADER
E1	Lift Spool Centering Spring
E2	Tilt Spool Centering Spring
E3	Auxiliary Spool/Centering Springs
F1	LIft Spool
F2	Tilt Spool
G1	Auxiliary Solenoid Stem
G2	Auxiliary Solenoid Stem
H1	BICS Valve Solenoid
H2	BICS Lock Valve (Tilt)
H3	BICS Lock Valve (Lift)
J1	Inlet Fluid Flow (From Pump)
J2	Outlet Fluid Flow (Return to Tank)
J3	Lift Arm Bypass Orifice
J4	Drain (Case)
MR	Main Relief Valve – 3300 PSI

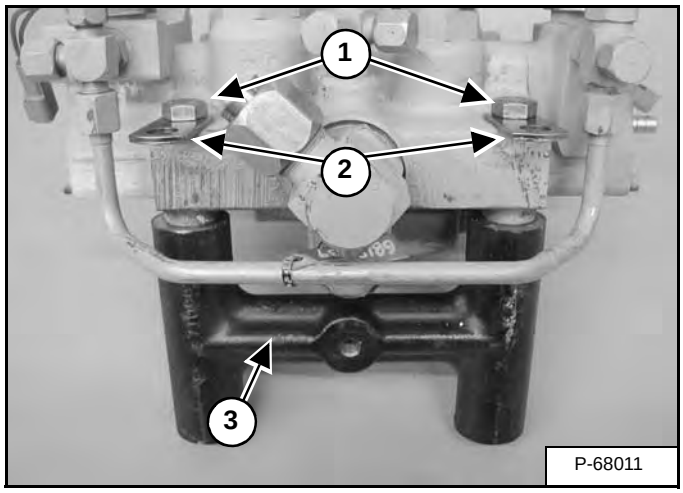
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HYDRAULIC CONTROL VALVE (ACS) OR (SJC) (CONT'D)

Mount Bracket Removal And Installation

Remove the control valve and mount bracket from the loader.

Figure 20-41-28

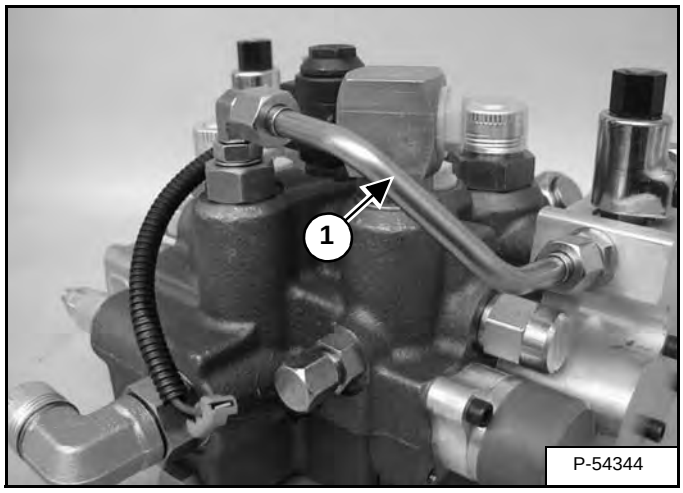


Remove the two mount bolts (Item 1) **[Figure 20-41-28]** and lift eyes (Item 2) from the hydraulic control valve.

Remove the mount bracket (Item 3) **[Figure 20-41-28]** from the hydraulic control valve.

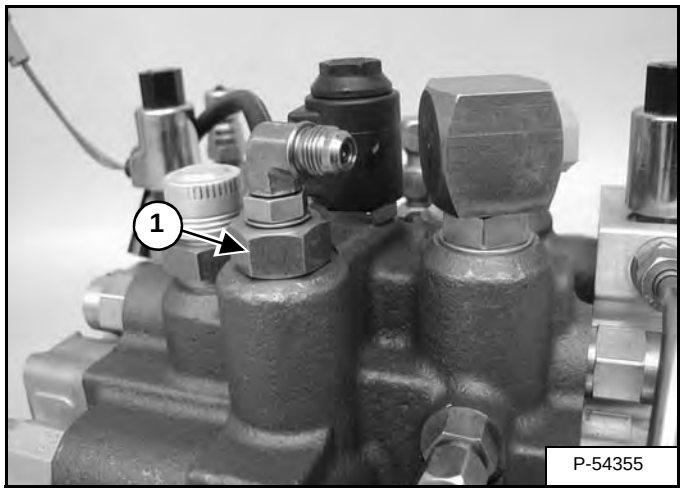
Lift Load Check Valve Removal And Installation

Figure 20-41-29



Remove the charge tubeline (Item 1) **[Figure 20-41-29]** from the BICS valve fitting on the top of the lift load check valve.

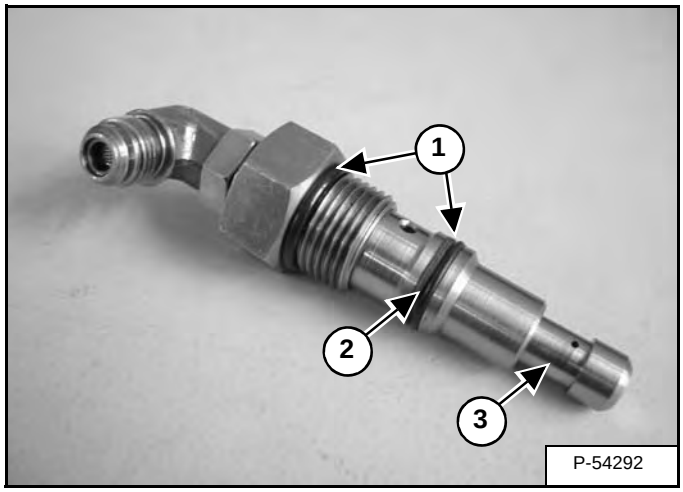
Figure 20-41-30



Remove the lift load check valve (Item 1) **[Figure 20-41-30]** and fitting from the top of the control valve.

Installation: Lubricate the O-ring and threads and tighten to 55-65 ft.-lb. (75-88 N•m) torque.

Figure 20-41-31



Remove and install new O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-41-31]**.

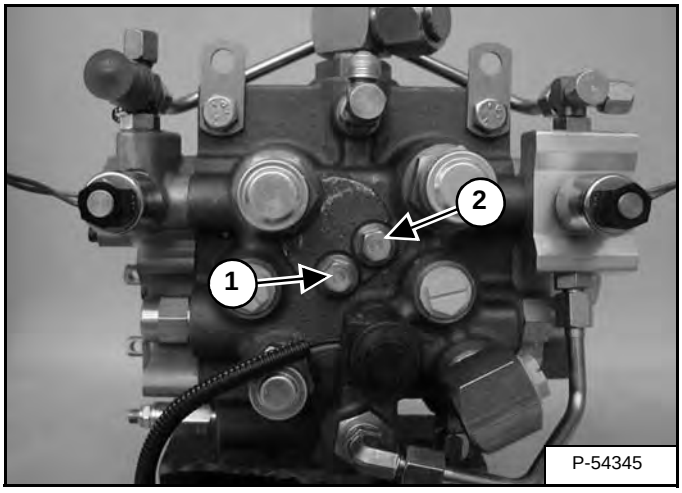
Check the load check valve (Item 3) **[Figure 20-41-31]**.

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HYDRAULIC CONTROL VALVE (ACS) OR (SJC) (CONT'D)

Load Check Valve Removal And Installation (Tilt & Auxiliary)

Figure 20-41-32

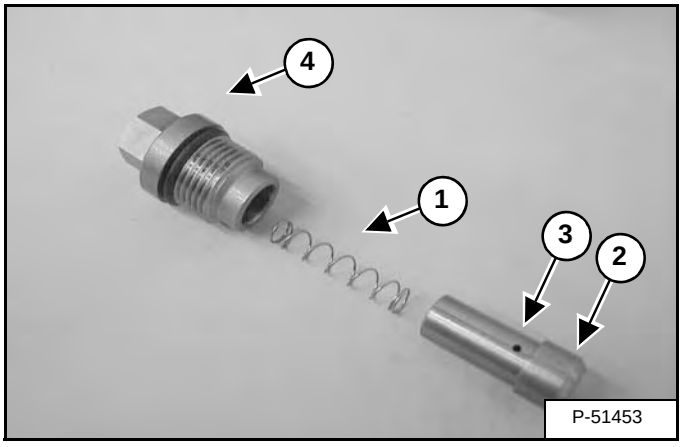


At the front side of the control valve locate the tilt section load check valve (Item 1) **[Figure 20-41-32]**.

At the front side of the control valve locate the auxiliary section load check valve (Item 2) **[Figure 20-41-32]**.

NOTE: The tilt and auxiliary load check valves are interchangeable.

Figure 20-41-33



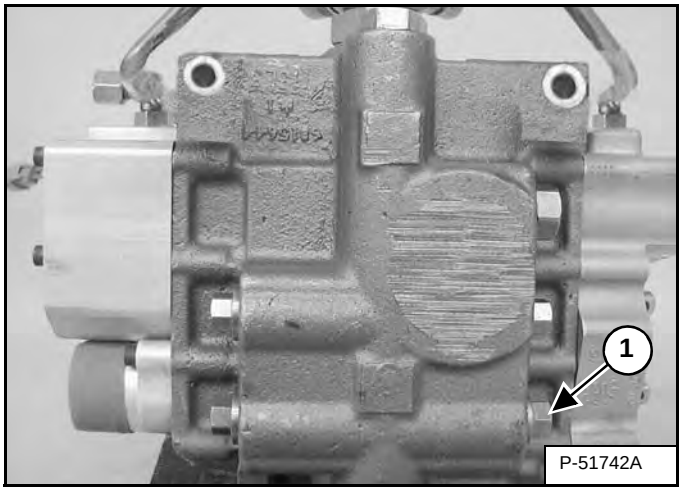
Remove the spring (Item 1) and poppet (Item 2) **[Figure 20-41-33]**.

Check the orifice (Item 3) **[Figure 20-41-33]** in the poppet to be sure it is not plugged.

Installation: Install a new O-ring (Item 4) **[Figure 20-41-33]** on the plug and lightly lubricate with oil before installing. Tighten the plug to 38-45 ft.-lb. (52-61 N•m) torque.

Anti-Cavitation Valve Removal And Installation (Lift, Rod End)

Figure 20-41-34



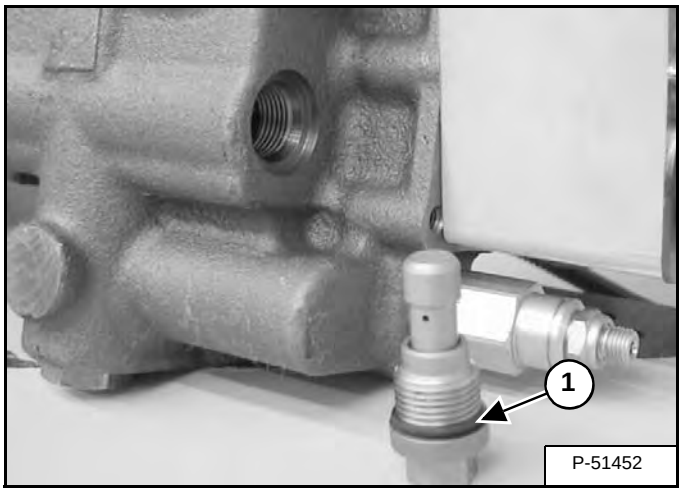
At the back side of the control valve, remove the lift section anti-cavitation valve (Item 1) **[Figure 20-41-34]**.

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 20-41-35

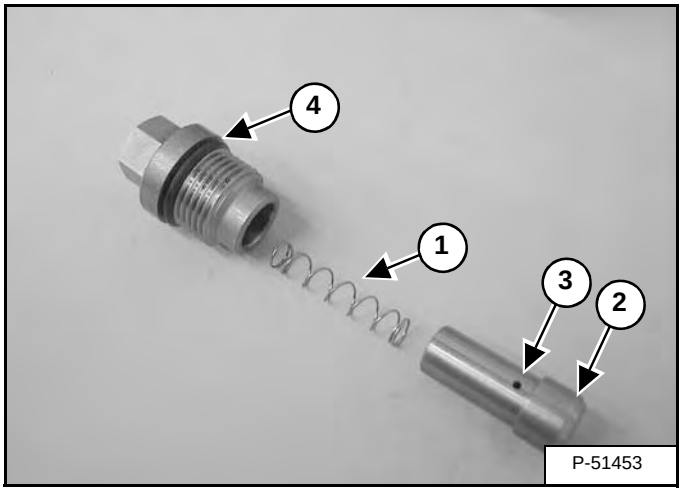


Always use new O-ring (Item 1) **[Figure 20-41-35]** on the anti-cavitation valve plug.

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Anti-Cavitation Valve Removal And Installation (Lift, Rod End) (Cont'd)

Figure 20-41-36



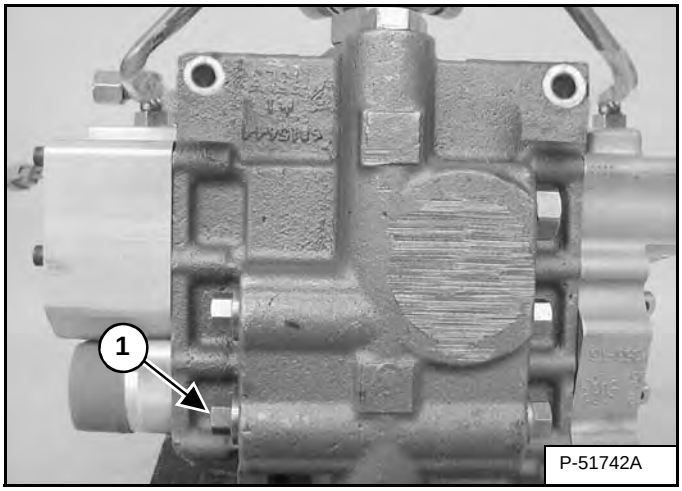
Remove the spring (Item 1) and poppet (Item 2) **[Figure 20-41-36]**.

Check the orifice (Item 3) **[Figure 20-41-36]** in the poppet to be sure it is not plugged.

Installation: Install a new O-ring (Item 4) **[Figure 20-41-36]** on the plug and lightly lubricate with oil before installing. Tighten the plug to 38-45 ft.-lb. (52-61 N•m) torque.

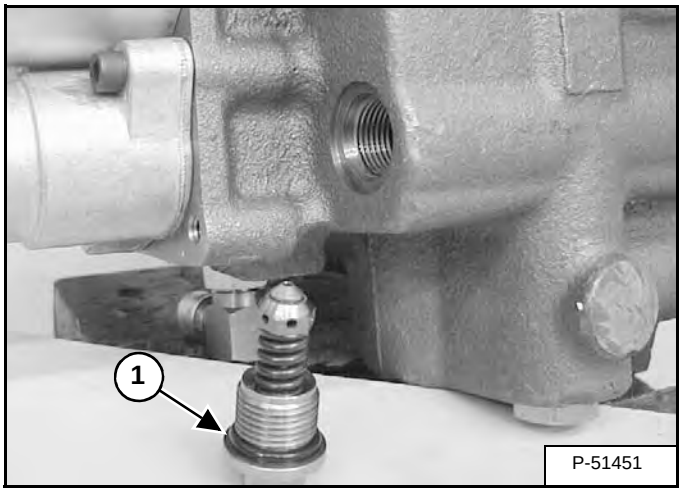
Port Relief / Anti-Cavitation Valve Removal And Installation (Lift, Base End)

Figure 20-41-37



Loosen the lift circuit port relief/anti-cavitation valve (Item 1) **[Figure 20-41-37]**.

Figure 20-41-38



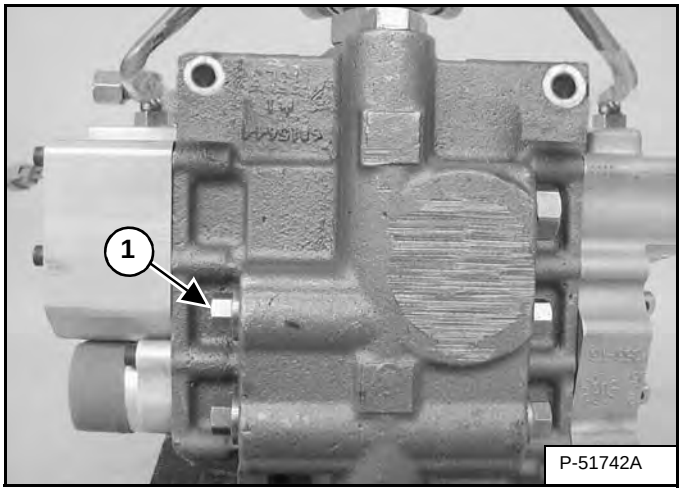
Replace the O-ring (Item 1) **[Figure 20-41-38]** before installation.

Installation: Lightly lubricate with oil and tighten to 38-45 ft.-lb. (52-61 N•m) torque.

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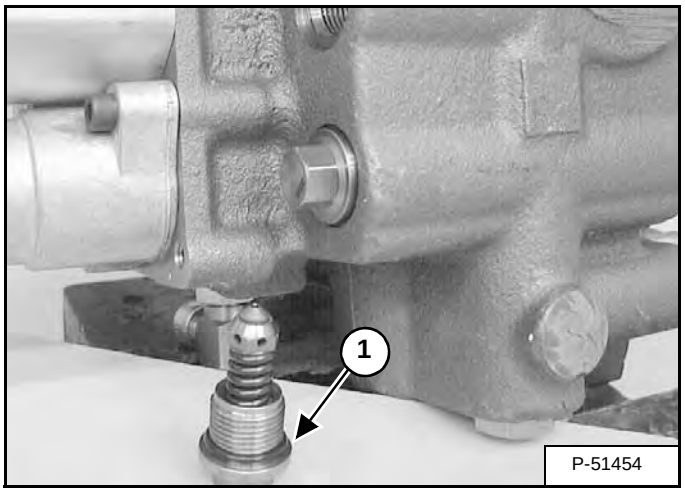
Port Relief / Anti-Cavitation Valve Removal And Installation (Tilt, Base End)

Figure 20-41-39



Remove the tilt port relief/anti cavitation valve (Item 1) **[Figure 20-41-39]** from the base end of the tilt section.

Figure 20-41-40

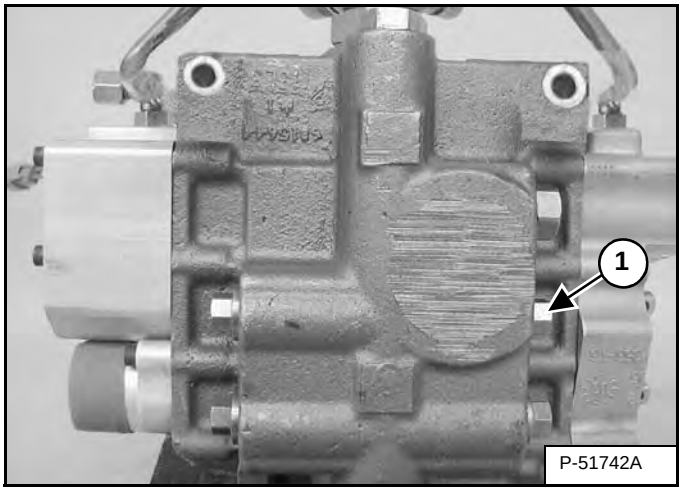


Replace the O-ring (Item 1) **[Figure 20-41-40]** before installation.

Installation: Lightly lubricate with oil and tighten to 38-45 ft.-lb. (52-61 N•m) torque.

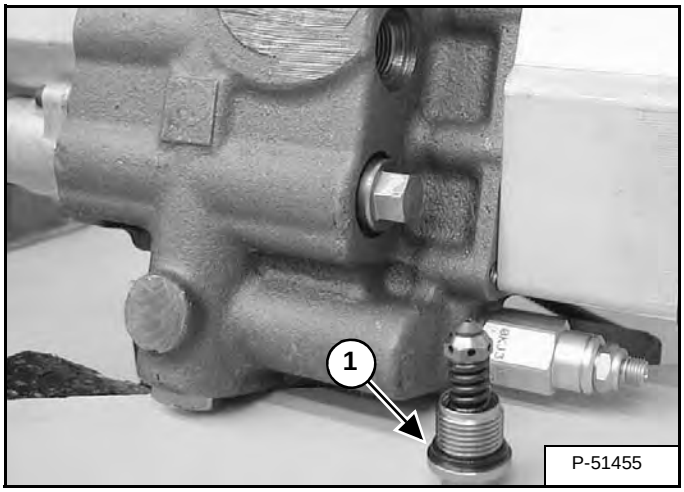
Port Relief / Anti-Cavitation Valve Removal And Installation (Tilt, Rod End)

Figure 20-41-41



Remove the tilt port relief/anti cavitation valve (Item 1) **[Figure 20-41-41]** from the rod end of the tilt section.

Figure 20-41-42



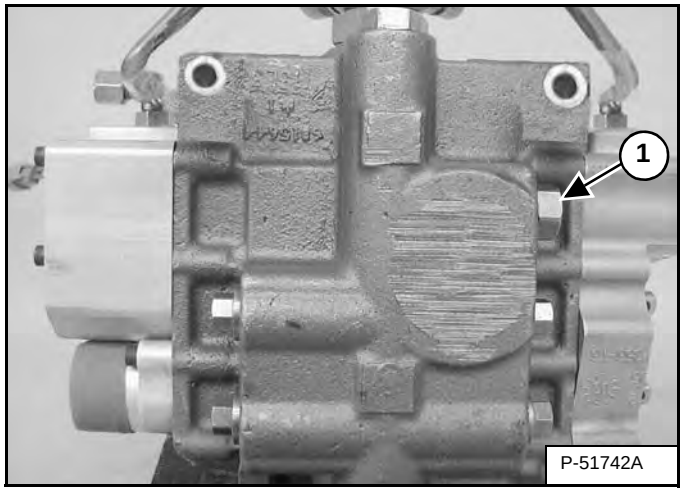
Replace the O-ring (Item 1) **[Figure 20-41-42]** before installation.

Installation: Lightly lubricate with oil and tighten to 38-45 ft.-lb. (52-61 N•m) torque.

Dealer Copy -- Not for Resale

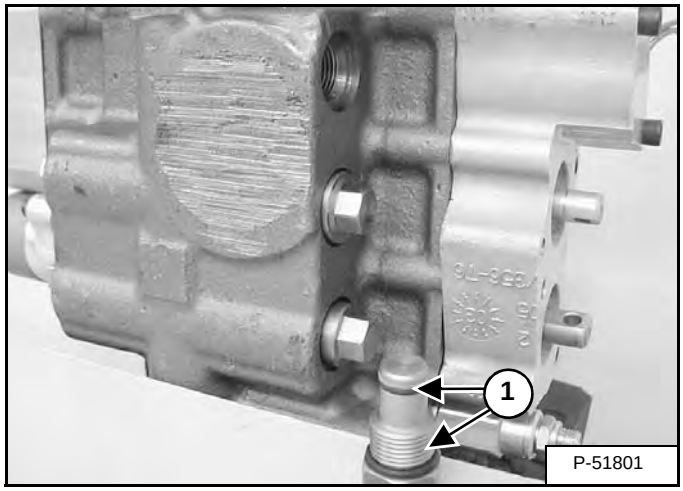
Port Relief Valve Removal And Installation

Figure 20-41-43



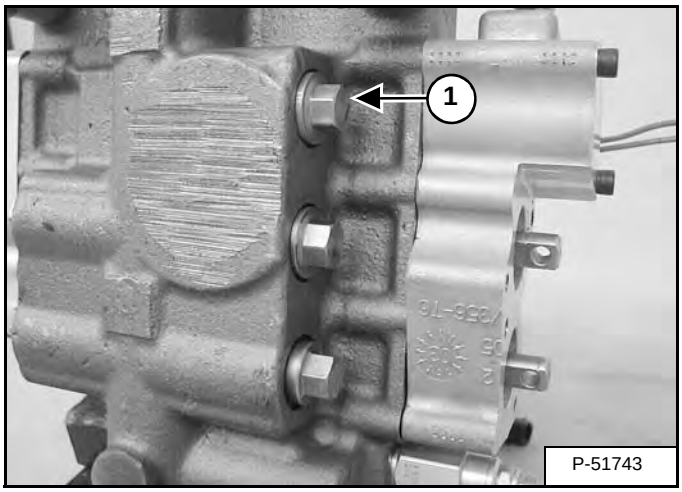
Remove the port relief plug (Item 1) **[Figure 20-41-43]** from the auxiliary circuit of the control valve.

Figure 20-41-44



Installation: Always use new O-rings (Item 1) **[Figure 20-41-44]**. Lightly lubricate with oil and tighten to 38-45 ft.-lb. (52-61 N•m) torque.

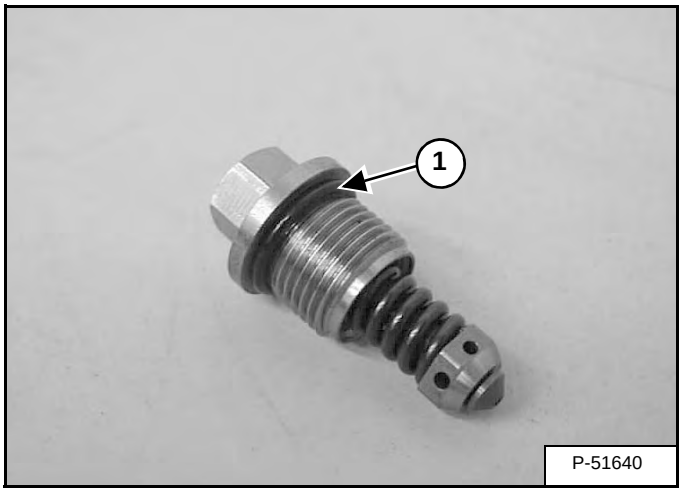
Figure 20-41-45



The control valve may be equipped with an optional auxiliary port relief valve (Item 1) **[Figure 20-41-45]**.

Remove the auxiliary port relief valve.

Figure 20-41-46

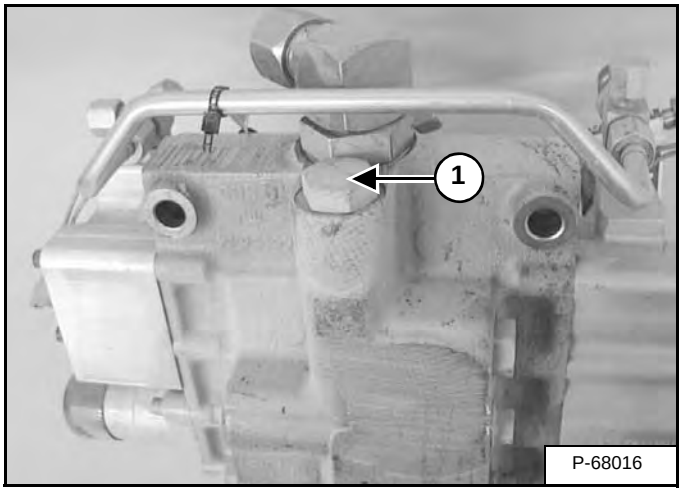


Installation: Always use new O-rings (Item 1) **[Figure 20-41-46]**. Lightly lubricate with oil and tighten to 38-45 ft.-lb. (52-61 N•m) torque.

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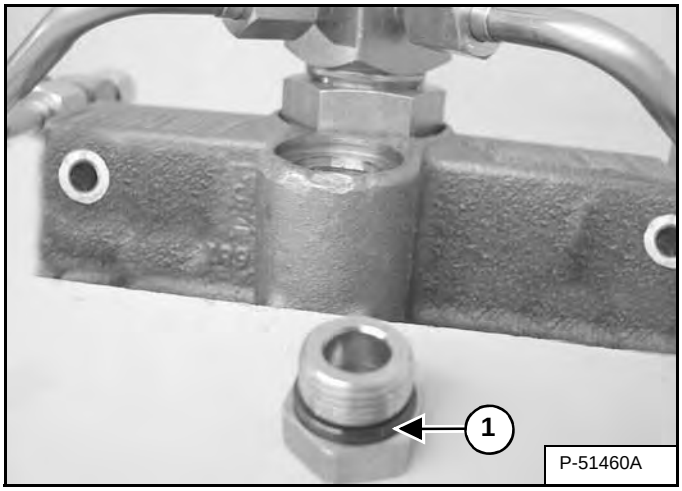
Plug Removal And Installation

Figure 20-41-47



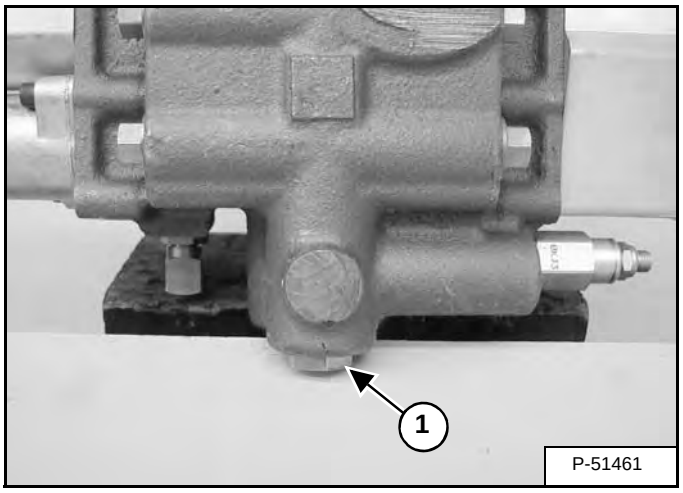
At the top side of the control valve, remove the plug (Item 1) **[Figure 20-41-47]**.

Figure 20-41-48



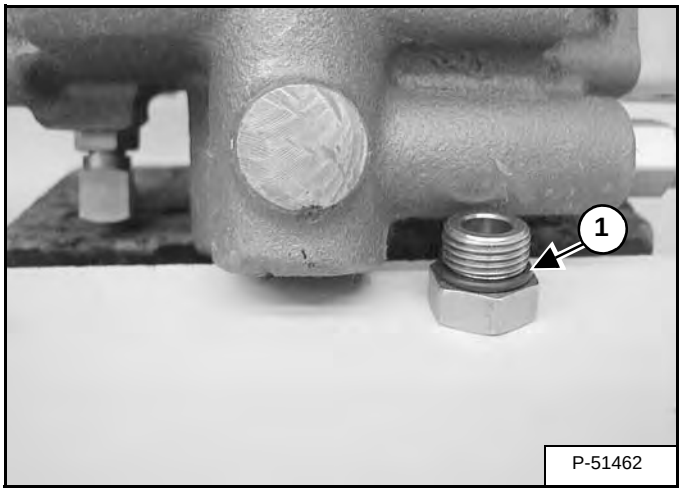
Installation: Always use new O-rings (Item 1) **[Figure 20-41-48]**. Tighten to 60 ft.-lb. (81,3 N•m) torque.

Figure 20-41-49



At the bottom side of the control valve remove the plug (Item 1) **[Figure 20-41-49]**.

Figure 20-41-50



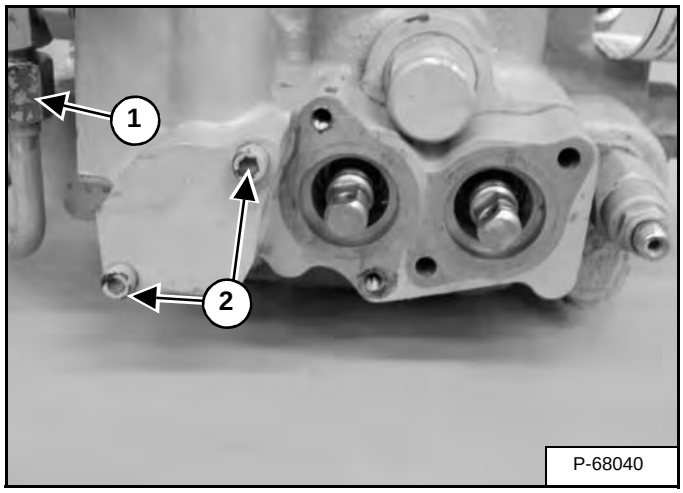
Installation: Always use new O-rings (Item 1) **[Figure 20-41-50]**. Tighten to 60 ft.-lb. (81,3 N•m) torque.

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End Cap Block Removal And Installation

Remove the lift and tilt actuators from the control valve. (See Actuator Removal And Installation (In Loader) on Page 20-41-6.)

Figure 20-41-51

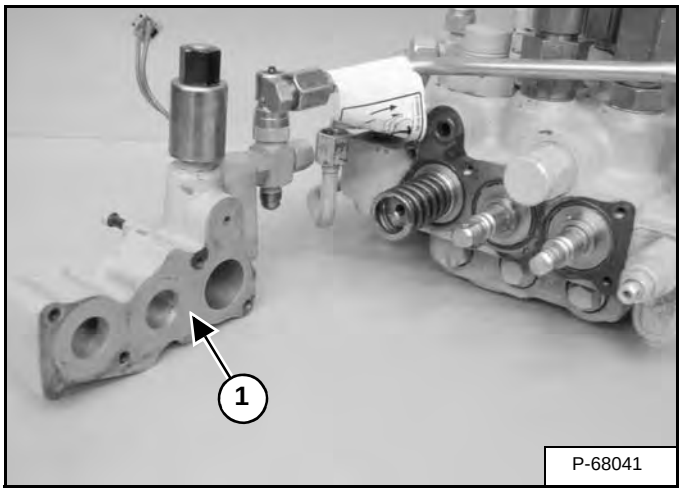


Disconnect the tube line (Item 1) **[Figure 20-41-51]** from the end cap block.

Remove the two end cap block mount screws (Item 1) **[Figure 20-41-51]**.

Installation: Tighten the screws to 90-100 in.-lb. (10,2-11,3 N•m) torque.

Figure 20-41-52



Remove the end cap block (Item 1) **[Figure 20-41-52]** from the control valve.

Dealer Copy -- Not for Resale

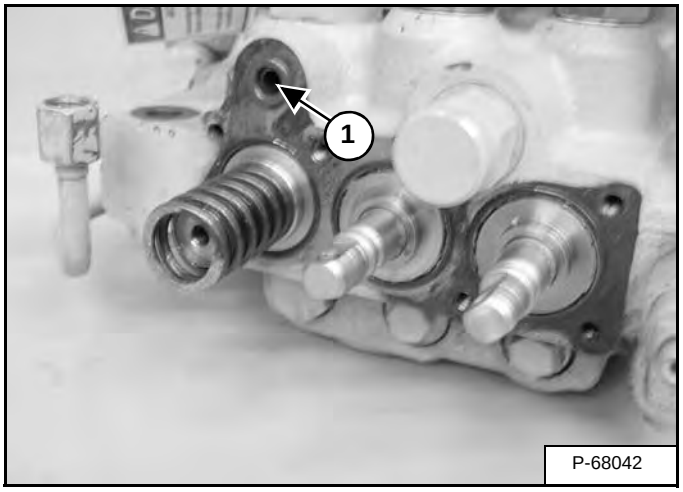
Lift Spool And Detent Removal And Installation

The tool listed will be needed to do the following procedure:

MEL 1285 - Spring Tool

Remove the end cap block from the control valve.

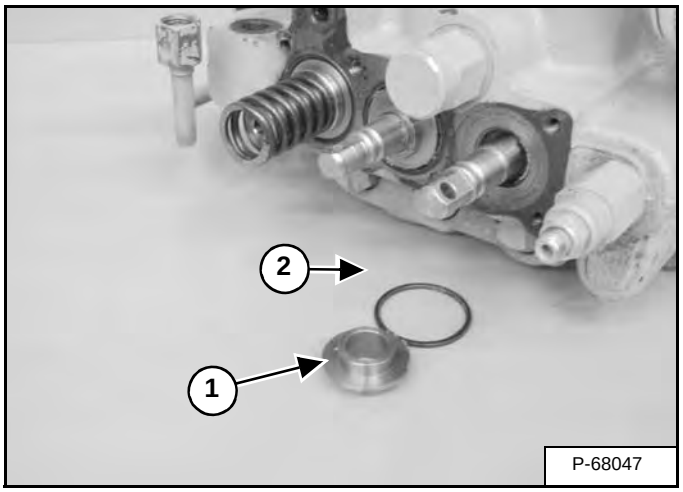
Figure 20-41-53



Remove the O-ring (Item 1) **[Figure 20-41-53]**.

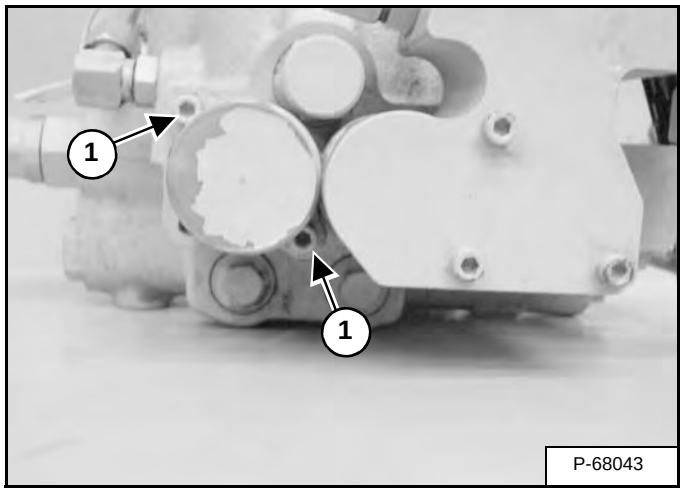
Installation: Replace the O-ring, and lubricate lightly with oil before installation of the end cap block.

Figure 20-41-54



Remove the spacer (Item 1) and O-ring (Item 2) **[Figure 20-41-54]** from the lift spool.

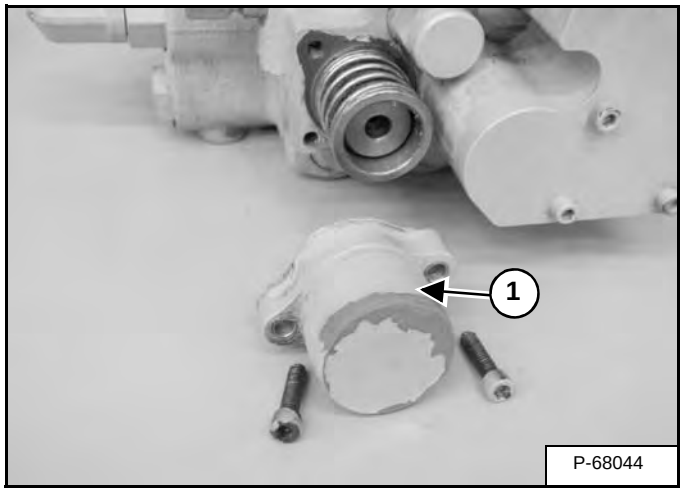
Figure 20-41-55



Remove the two screws (Item 1) **[Figure 20-41-55]** from the lift spool end cap.

Installation: Lubricate the screws and tighten to 90-100 in.-lb. (10,2-11,3 N•m) torque.

Figure 20-41-56

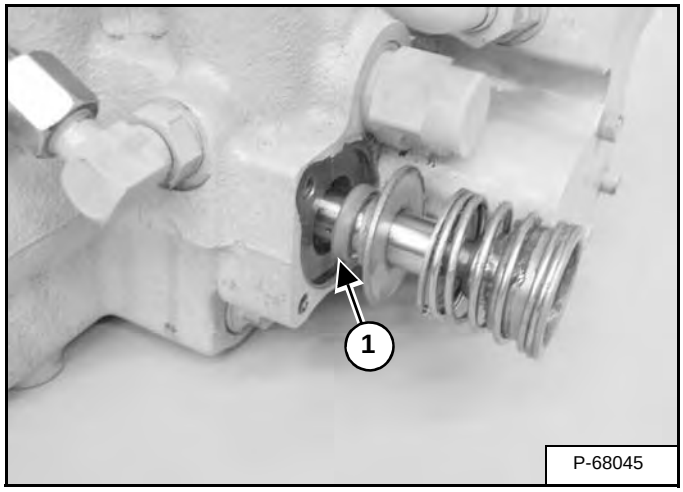


Remove the lift spool end cap (Item 1) **[Figure 20-41-56]** from the control valve.

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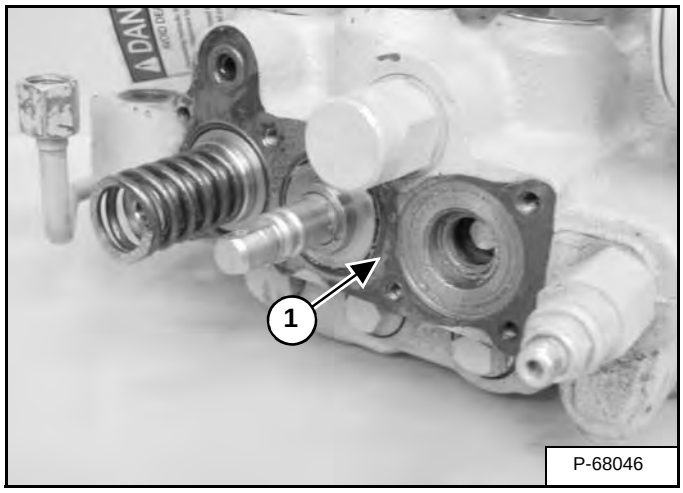
Lift Spool And Detent Removal And Installation (Cont'd)

Figure 20-41-57



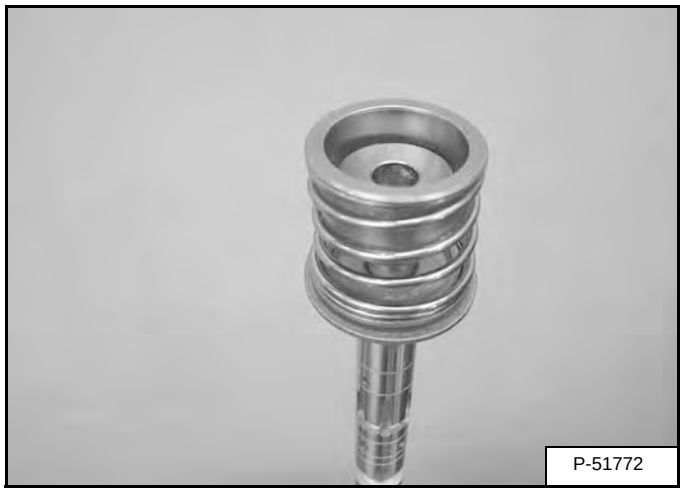
Remove the lift spool assembly and seal (Item 1) **[Figure 20-41-57]** from the control valve.

Figure 20-41-58



Remove the lift spool seal (Item 1) **[Figure 20-41-58]** from the linkage end of the valve.

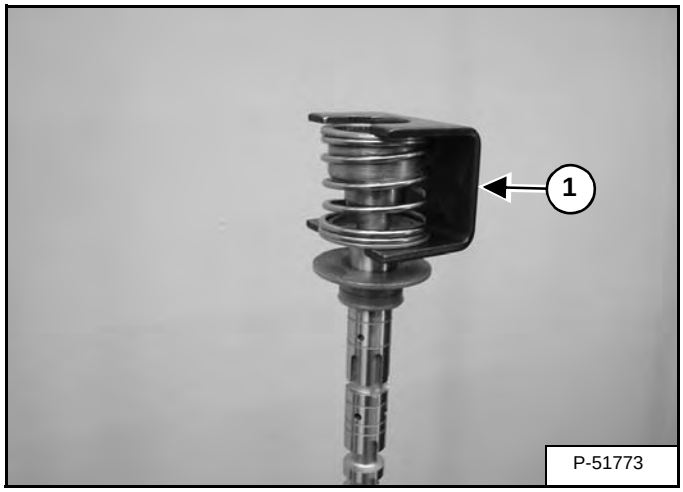
Figure 20-41-59



Clamp the linkage end of the spool in a vise **[Figure 20-41-59]**.

NOTE: Protect spool before clamping in vise.

Figure 20-41-60

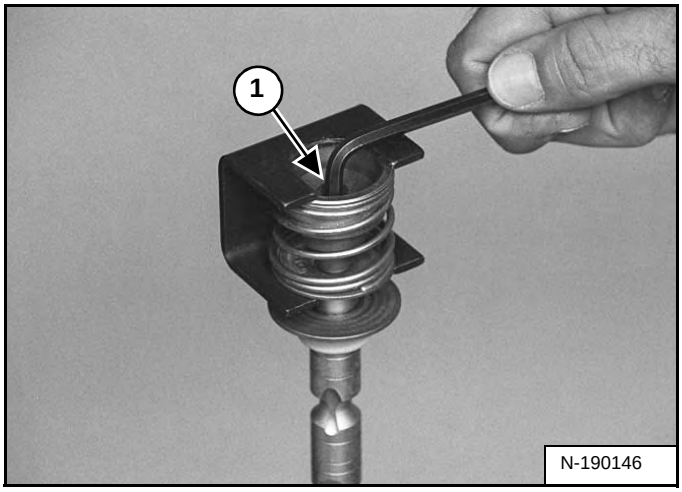


Install the spring tool (Item 1) **[Figure 20-41-60]** over the centering spring.

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Lift Spool And Detent Removal And Installation (Cont'd)

Figure 20-41-61

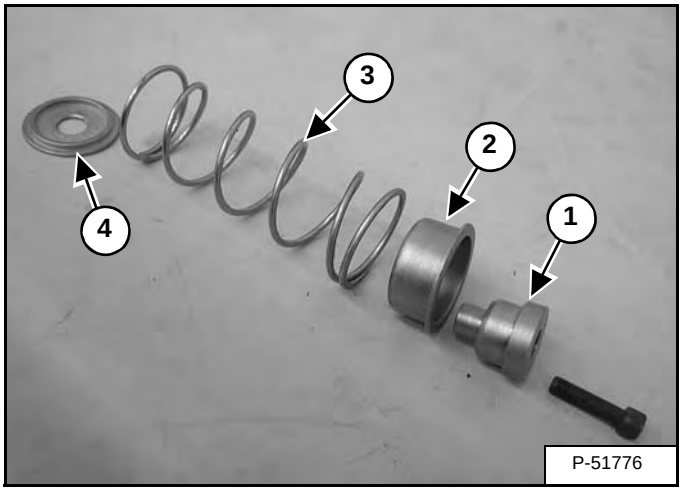


Remove the bolt (Item 1) **[Figure 20-41-61]** holding the centering spring to the spool.

Installation: Tighten the bolt to 90-100 in.-lb. (10,2-11,3 N•m) torque.

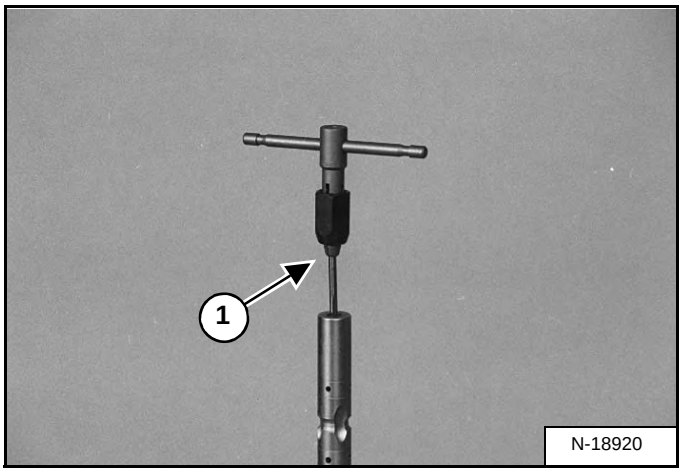
Remove spring tool from the spring assembly.

Figure 20-41-62



Inspect the adapter (Item 1), collar (Item 2), spring (Item 3) and washer (Item 4) **[Figure 20-41-62]**.

Figure 20-41-63



Removal of the plastic plug:

Make a center point in the plug using a 1/16 in. drill.

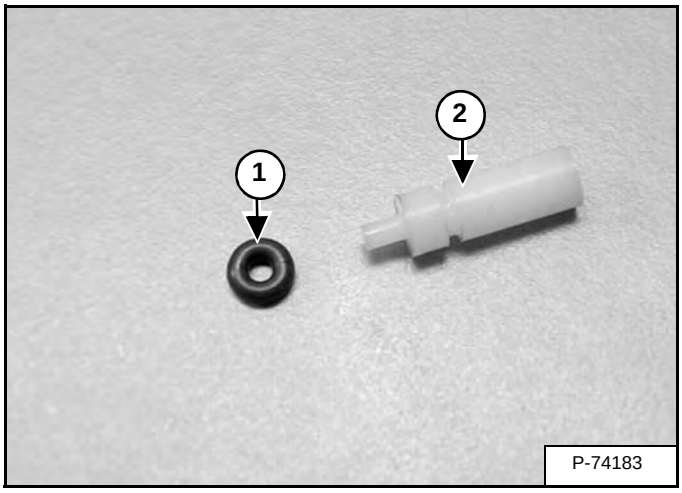
Drill a hole all the way through the plug using a 7/64 in. tap drill

Turn a 6-32 tap (Item 1) **[Figure 20-41-63]** into the plug. Pull the tap and plug out of the spool. Be careful, do not break the tap.

Clean all the debris from inside the spool bore.

NOTE: DO NOT USE Loctite® ON THE STUD THREADS.

Figure 20-41-64



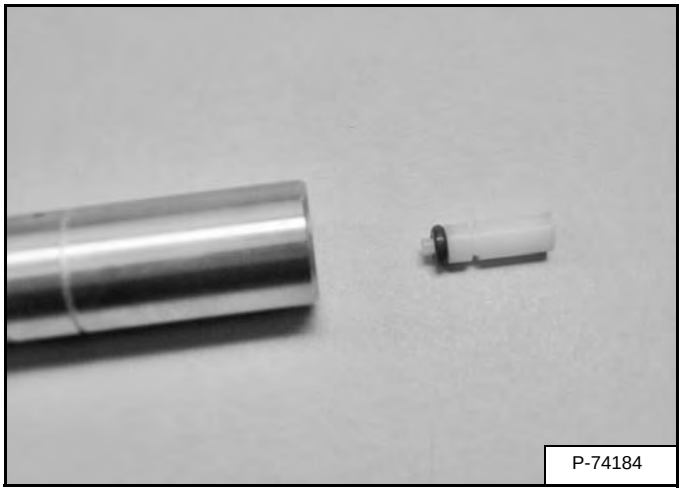
Install the O-ring (Item 1) over the nipple on the plastic plug (Item 2) **[Figure 20-41-64]**.

NOTE: Check the O-ring for damage. The lift spool will have an internal leak if there is damage to this O-ring. Always replace the O-ring and recheck the lift spool before the control valve is replaced.

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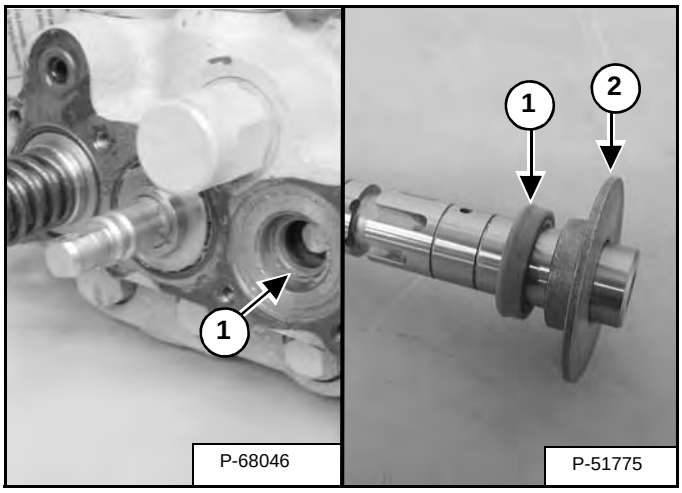
Lift Spool And Detent Removal And Installation (Cont'd)

Figure 20-41-65



Install the plastic plug and O-ring in the spool **[Figure 20-41-65]**.

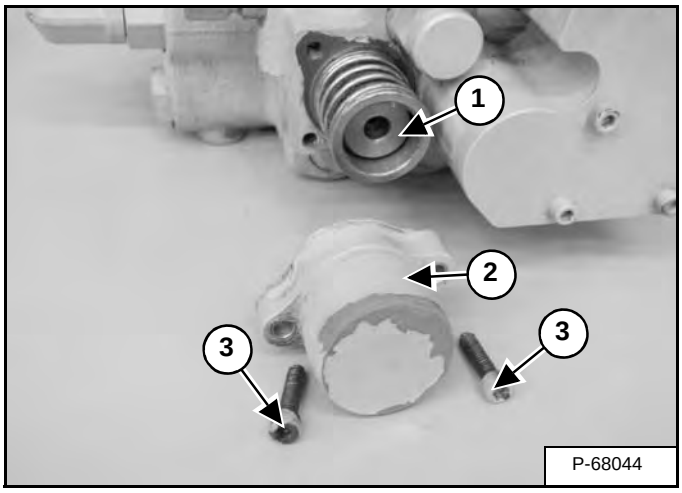
Figure 20-41-66



Remove the spool seal(s) (Item 1) and the back-up washer (Item 2) **[Figure 20-41-66]**.

Assembly: Always use a new spool seal.

Figure 20-41-67



Install the lift spool assembly (Item 1) **[Figure 20-41-67]** in the spool bore.

Install the end cap (Item 2) **[Figure 20-41-67]**.

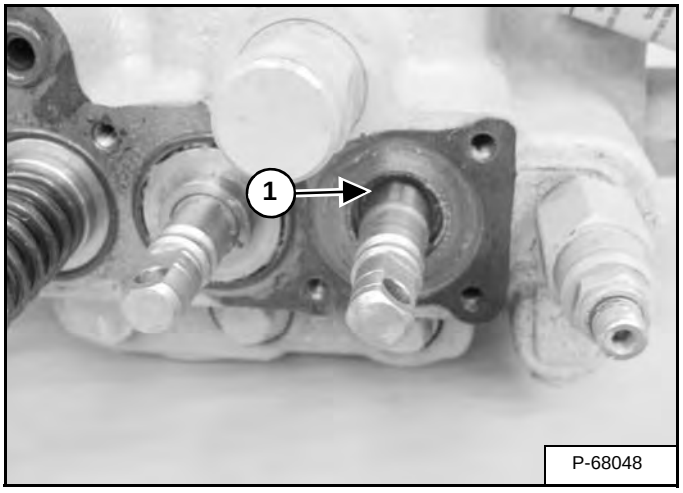
Install the mounting screws (Item 3) **[Figure 20-41-67]**.

Installation: Lubricate the screws and tighten to 90-100 in.-lb. (10,2-11,3 N•m) torque.

Dealer Copy -- Not for Resale

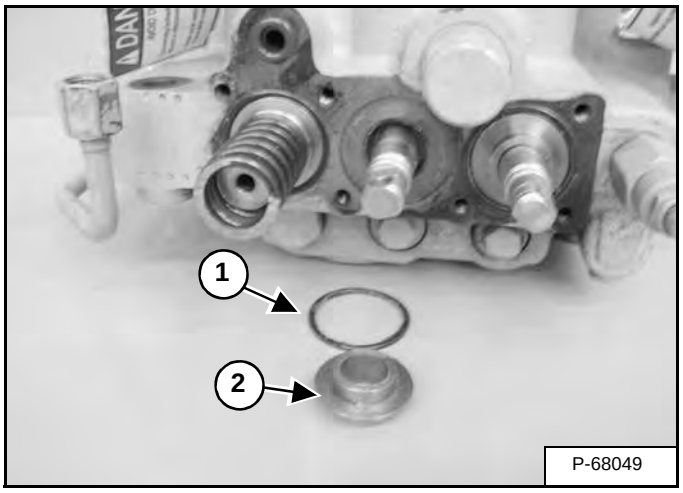
Lift Spool And Detent Removal And Installation (Cont'd)

Figure 20-41-68



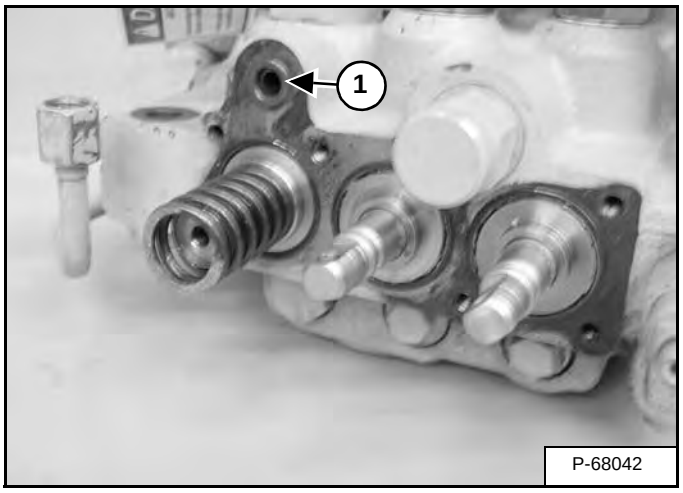
Install the spool seal (Item 1) **[Figure 20-41-68]** on the linkage end of the valve.

Figure 20-41-69



Install the O-ring (Item 1) and bushing (Item 2) **[Figure 20-41-69]** on the lift spool.

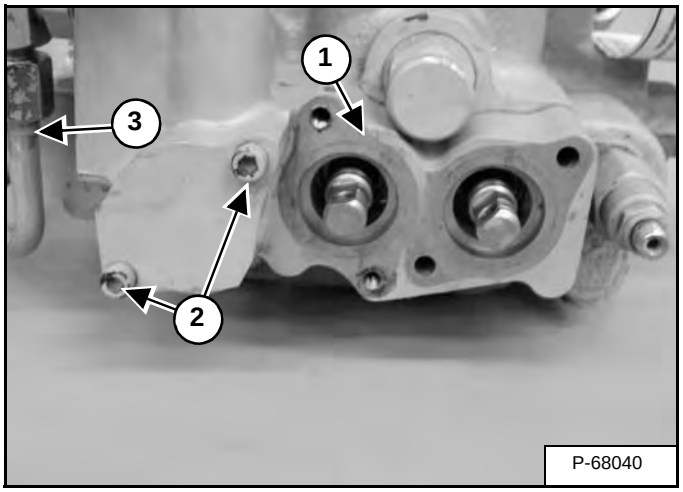
Figure 20-41-70



Install the O-ring (Item 1) **[Figure 20-41-70]** on the control valve.

Installation: Replace the O-ring, lubricate lightly with oil or grease before installation of the end cap block.

Figure 20-41-71



Install the end cap block (Item 1) and the two mount bolts (Item 2) **[Figure 20-41-71]**.

Installation: Tighten the screws to 90-100 in.-lb. (10,2-11,3 N•m) torque.

Connect the tubeline (Item 1) **[Figure 20-41-71]** to the end cap block.

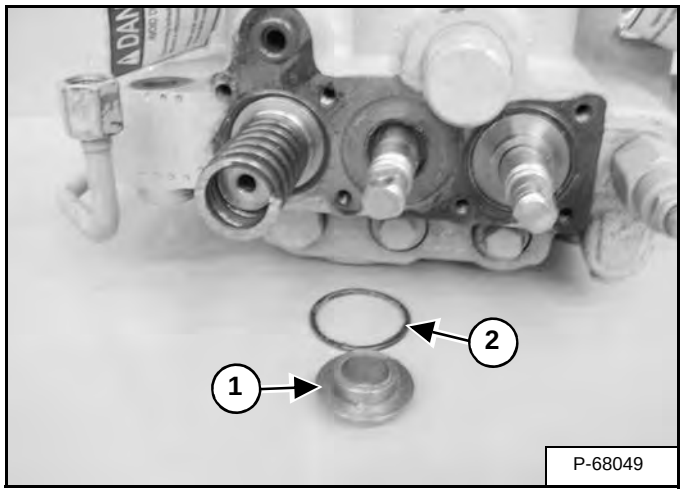
Install the lift and tilt actuators to the control valve.

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Tilt Spool Removal And Installation

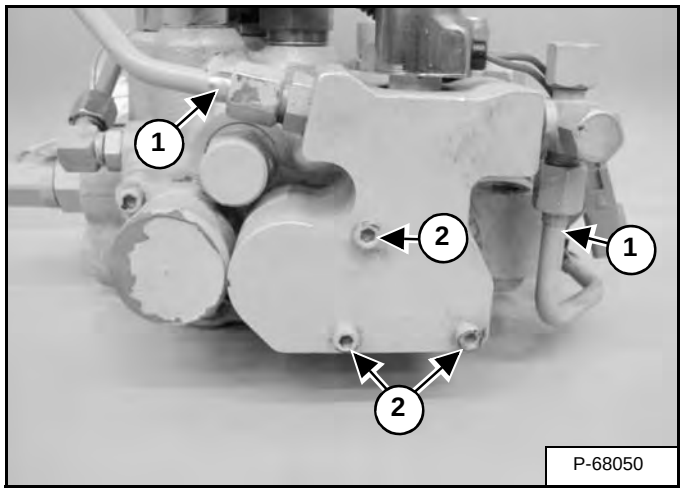
Remove the end cap block. (See End Cap Block Removal And Installation on Page 20-41-18.)

Figure 20-41-72



Remove the spacer (Item 1) and O-ring (Item 2) **[Figure 20-41-72]** from the tilt spool.

Figure 20-41-73

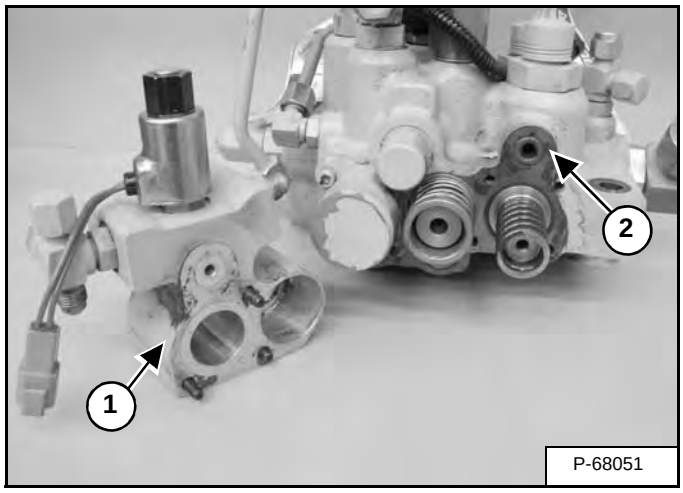


Disconnect the two tubelines (Item 1) **[Figure 20-41-73]**.

Remove the three screws (Item 2) **[Figure 20-41-73]** from the spool centering block.

Installation: Tighten the bolt to 90-100 in.-lb. (10,2-11,3 N•m) torque.

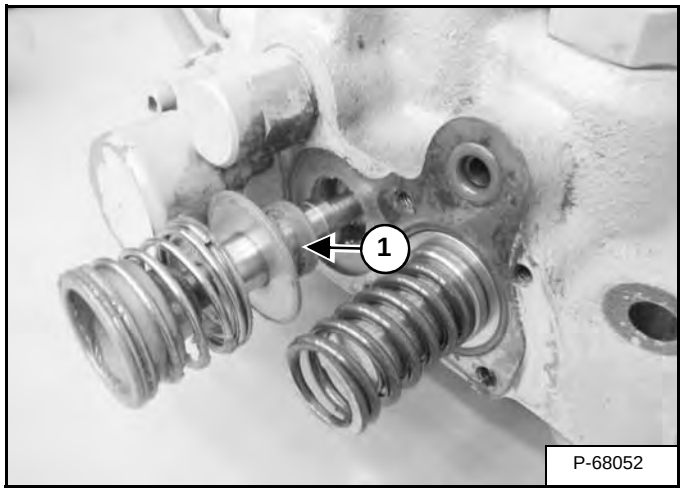
Figure 20-41-74



Remove the spool centering block (Item 1) **[Figure 20-41-74]** from the control valve.

Installation: Replace the O-ring (Item 2) **[Figure 20-41-74]** and lubricate lightly with oil/grease before installation of the end cap block.

Figure 20-41-75



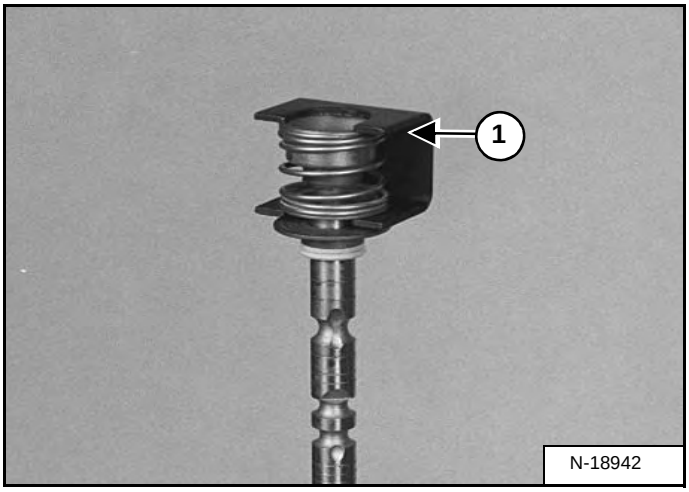
Remove the tilt spool, centering spring, back-up washer and spool seal (Item 1) **[Figure 20-41-75]**.

Assembly: Always use a new spool seal.

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Tilt Spool Removal And Installation (Cont'd)

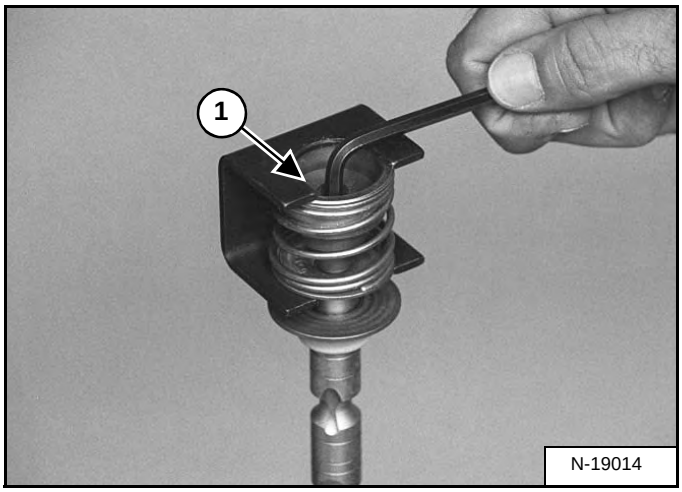
Figure 20-41-76



Put the linkage end of the spool in the vice **[Figure 20-41-76]**.

Install the spring tool (Item 1) **[Figure 20-41-76]** over the centering spring.

Figure 20-41-77

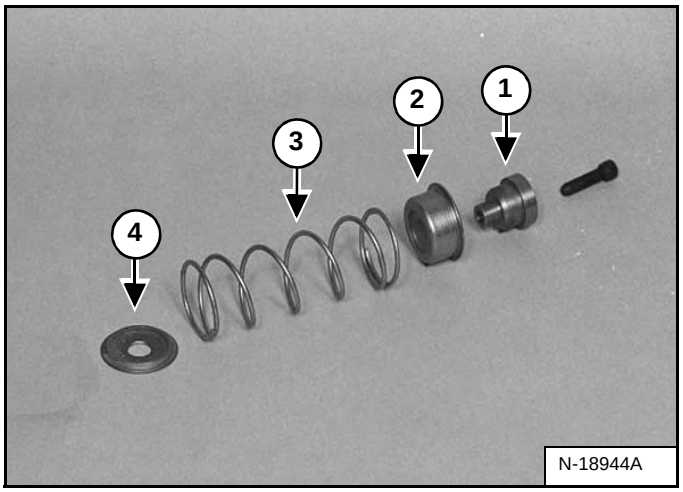


Remove the bolt (Item 1) **[Figure 20-41-77]** holding the centering spring to the spool.

Installation: Tighten the bolt to 90-100 in.-lb. (10,2-11,3 N•m) torque.

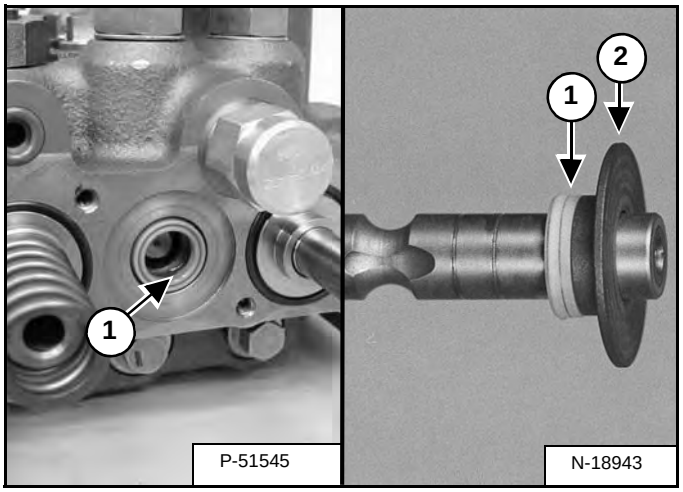
Remove spring tool from the spring assembly.

Figure 20-41-78



Inspect the adapter (Item 1), collar (Item 2), spring (Item 3) and washer (Item 4) **[Figure 20-41-78]**.

Figure 20-41-79



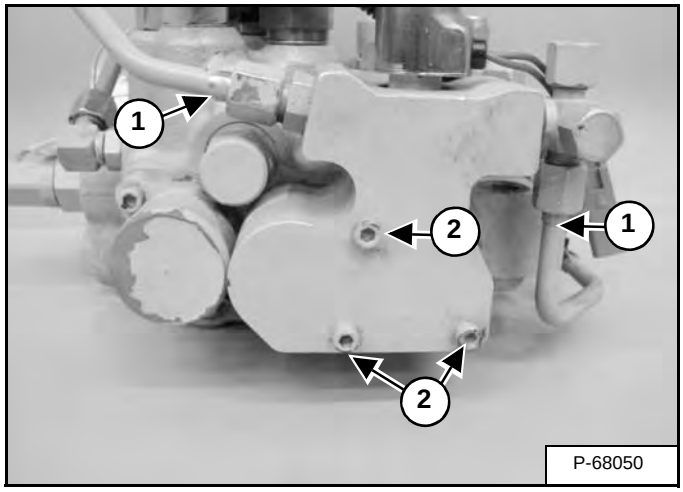
Remove the spool seal(s) (Item 1) and the back-up washer (Item 2) **[Figure 20-41-79]**.

Assembly: Always use a new spool seal.

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Auxiliary Spool Removal And Installation

Figure 20-41-80



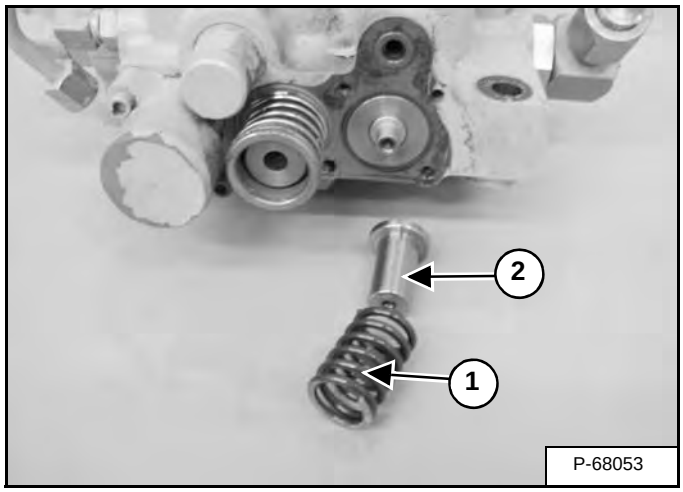
Disconnect the two tubelines (Item 1) **[Figure 20-41-80]** from the spool centering block.

Remove the three screws (Item 2) **[Figure 20-41-80]** from the spool centering block.

Installation: Tighten the bolt to 90-100 in.-lb. (10,2-11,3 N•m) torque.

Remove the spool centering block from the control valve.

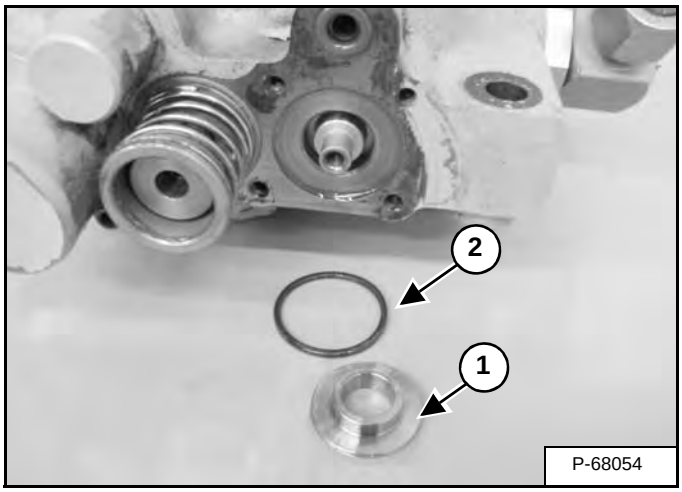
Figure 20-41-81



Remove the spring (Item 1) and center spring retainer (Item 2) **[Figure 20-41-81]** from the auxiliary spool.

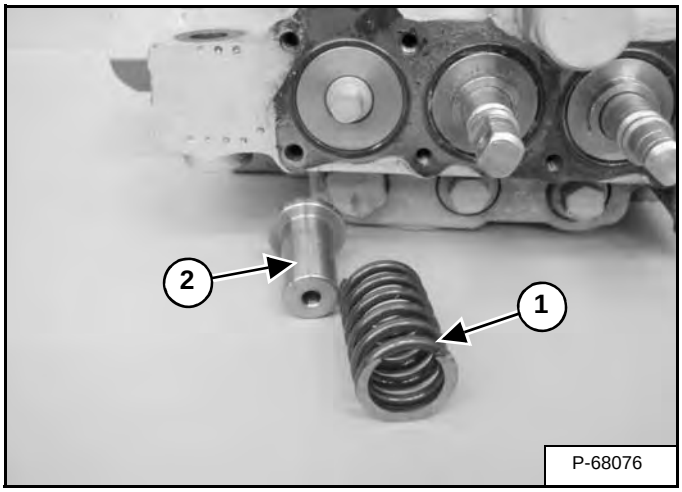
NOTE: If the centering spring retainer (Item 2) [Figure 20-41-81] must be replaced, replace the retainer on the opposite end also.

Figure 20-41-82



Remove the spacer (Item 1) and O-ring (Item 2) **[Figure 20-41-82]** from the auxiliary spool.

Figure 20-41-83



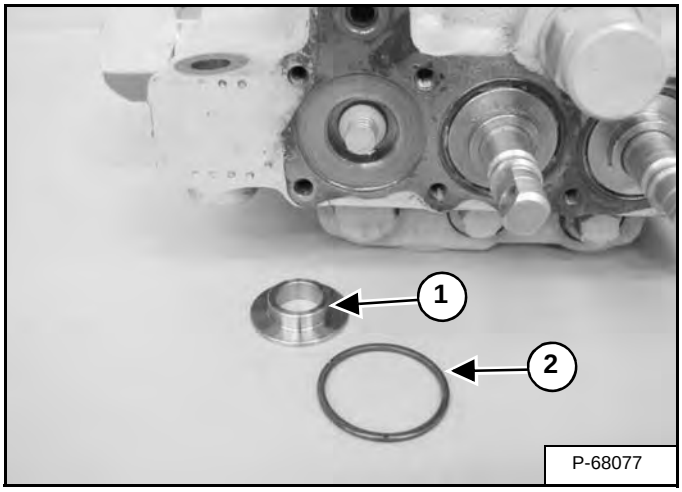
Remove the spring (Item 1) and center spring retainer (Item 2) **[Figure 20-41-83]** from the auxiliary spool.

NOTE: If the centering spring retainer (Item 2) [Figure 20-41-83] must be replaced, replace the retainer on the opposite end also.

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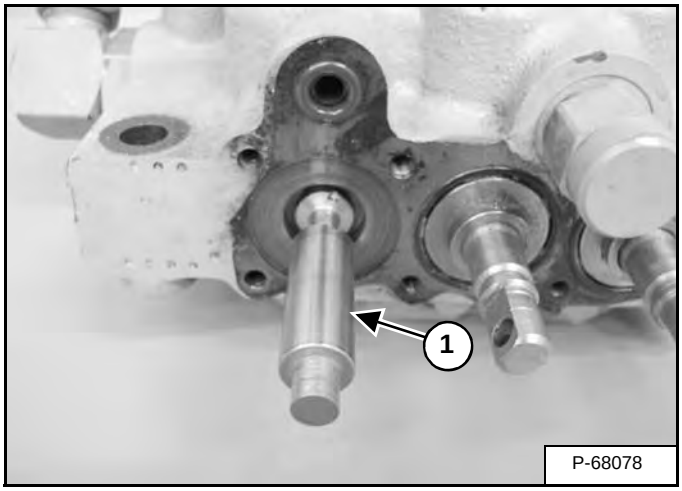
Auxiliary Spool Removal And Installation (Cont'd)

Figure 20-41-84



Remove the spacer (Item 1) and O-ring (Item 2) **[Figure 20-41-84]** from the auxiliary spool.

Figure 20-41-85

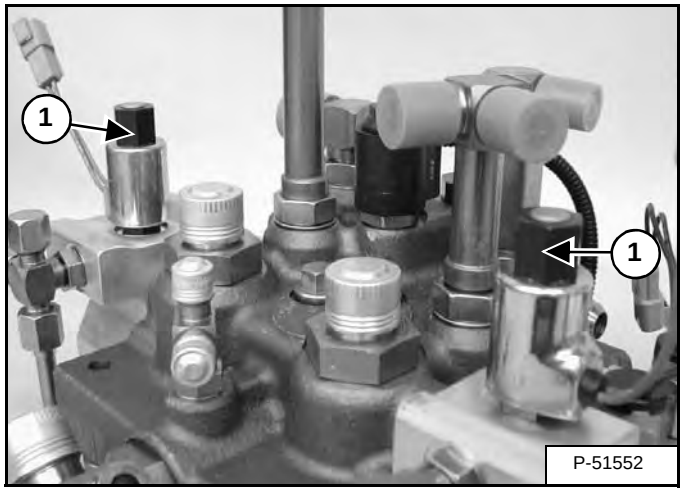


Remove the auxiliary spool (Item 1) **[Figure 20-41-85]**.

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Auxiliary Solenoid Removal And Installation

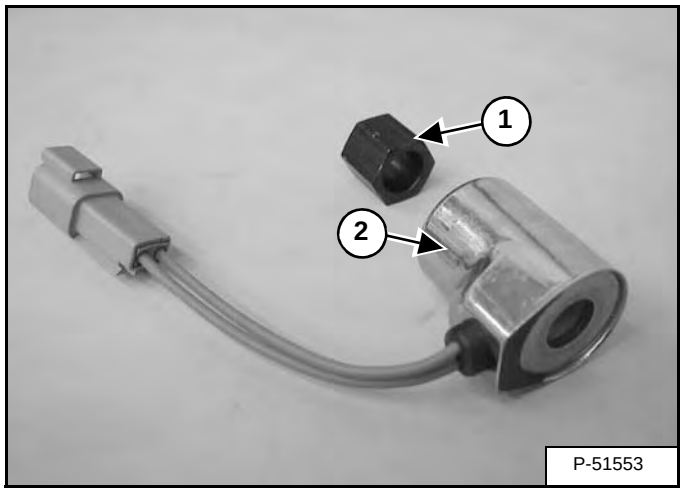
Figure 20-41-86



Remove the nut (Item 1) **[Figure 20-41-86]** from both solenoids.

Installation: Tighten the nut to 48-72 in.-lb. (5-8 N•m) torque.

Figure 20-41-87

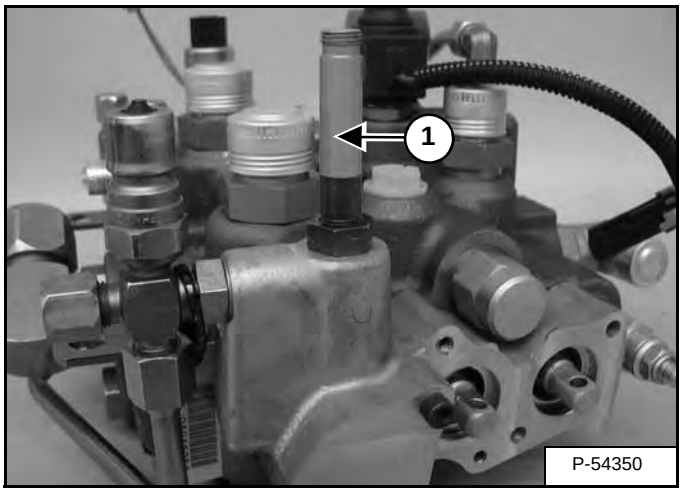


Remove the nut (Item 1) and solenoid coil (Item 2) **[Figure 20-41-87]**.

Use an Ohmmeter to measure the solenoid coil resistance.

The correct resistance for the coil is **4.9 ± 0.25 Ohms**.

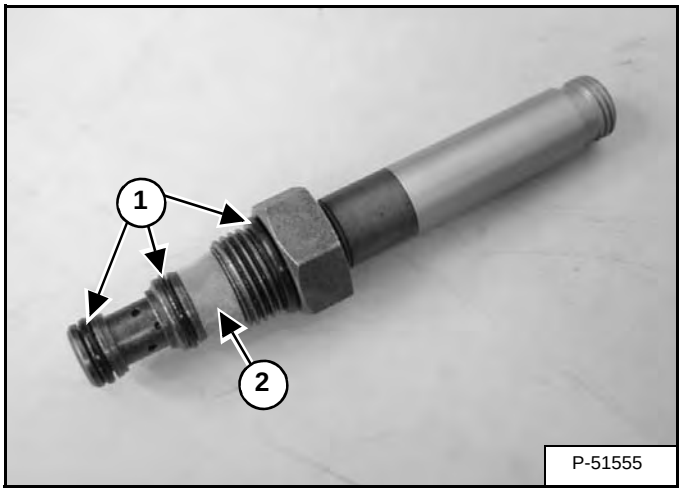
Figure 20-41-88



Remove the solenoid stem (Item 1) **[Figure 20-41-88]**.

Installation: Tighten the stem to 10-14 ft.-lb. (14-19 N•m) torque.

Figure 20-41-89



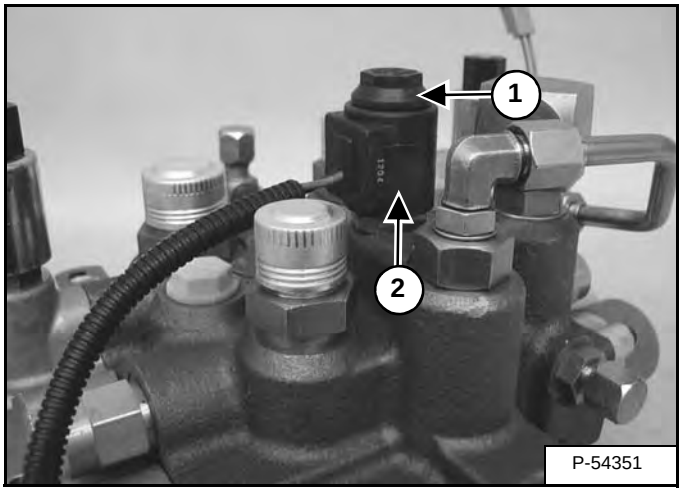
Remove the O-rings (Item 1) **[Figure 20-41-89]** from the solenoid stem.

Check and clean the screen (Item 2) **[Figure 20-41-89]**.

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Solenoid Removal And Installation

Figure 20-41-90

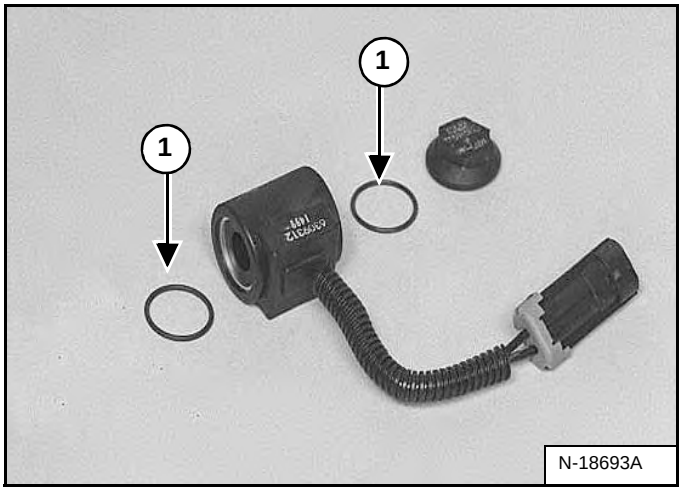


Remove the nut (Item 1) **[Figure 20-41-90]** from the solenoid stem.

Installation: Tighten the nut to 53 in.-lb. (6 N•m) torque.

Remove the solenoid coil (Item 2) **[Figure 20-41-90]**.

Figure 20-41-91

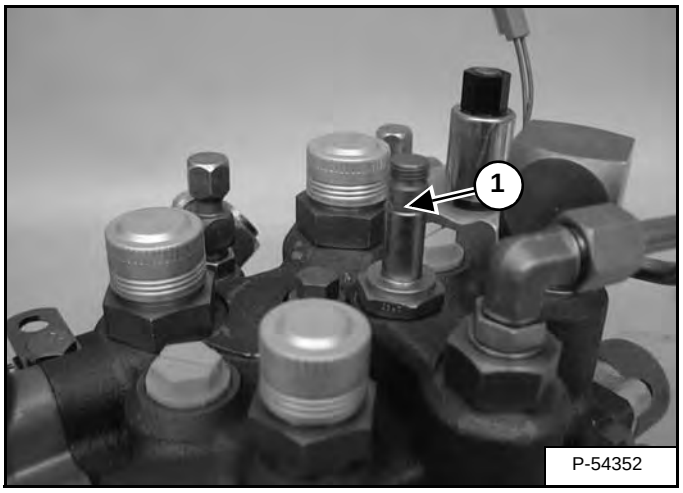


Remove the O-rings (Item 1) **[Figure 20-41-91]** from both ends of the solenoid coil.

Use an Ohmmeter to measure the solenoid coil resistance.

The correct resistance for the coil is **9.79 ± 0.29 Ohms**.

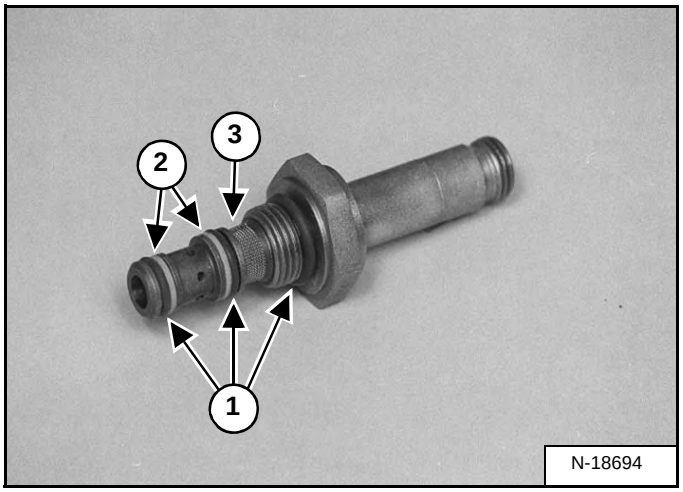
Figure 20-41-92



Remove the solenoid stem (Item 1) **[Figure 20-41-92]**.

Installation: Lubricate the O-rings and tighten the stem to 20 - 24 ft.-lb. (27-33 N•m) torque.

Figure 20-41-93



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-41-93]** from the stem.

Clean all parts in solvent and dry with compressed air.

Inspect all parts for wear and replace any showing excessive wear.

NOTE: The screen (Item 3) [Figure 20-41-93] may be cleaned with solvent. If it is torn or worn it needs to be replaced.

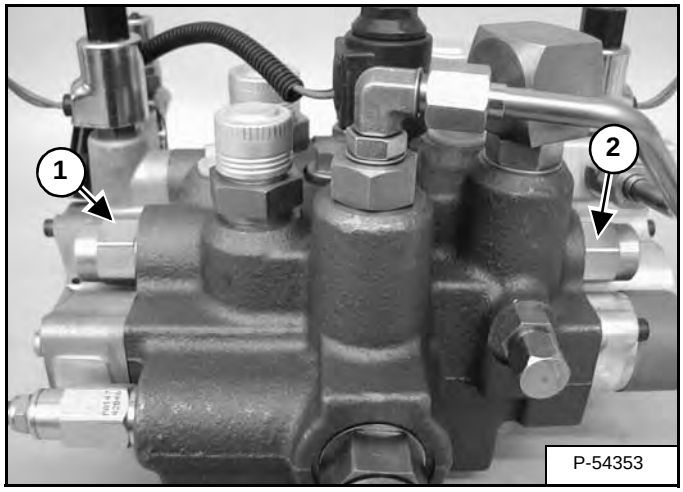
Use only new O-rings and apply oil to all O-rings and back-up rings before installation.

Install new O-rings (Item 1) **[Figure 20-41-91]** & **[Figure 20-41-93]** and new back-up rings (Item 2) **[Figure 20-41-93]** on the solenoid stem.

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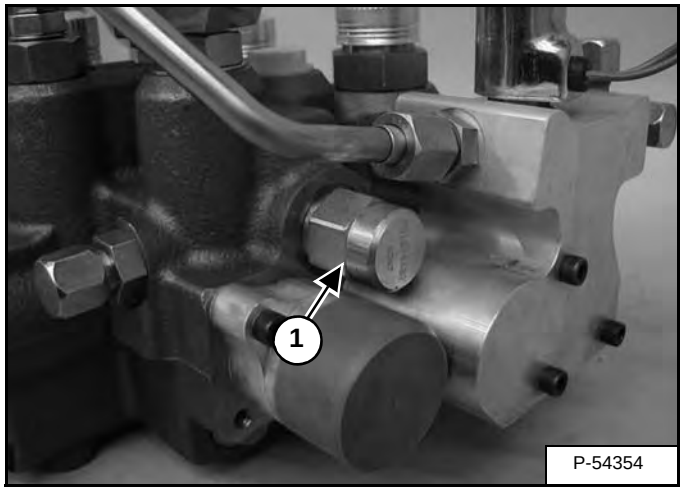
Lock Valve Removal And Installation

Figure 20-41-94



Locate the two BICS lock valves, (Item 1) is for the tilt circuit and (Item 2) **[Figure 20-41-94]** is for the lift circuit.

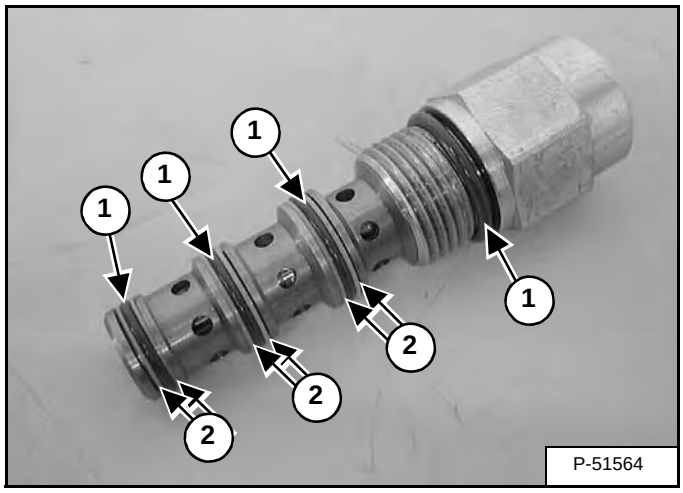
Figure 20-41-95



Remove the lift lock valve (Item 1) **[Figure 20-41-95]** from the back of the control valve.

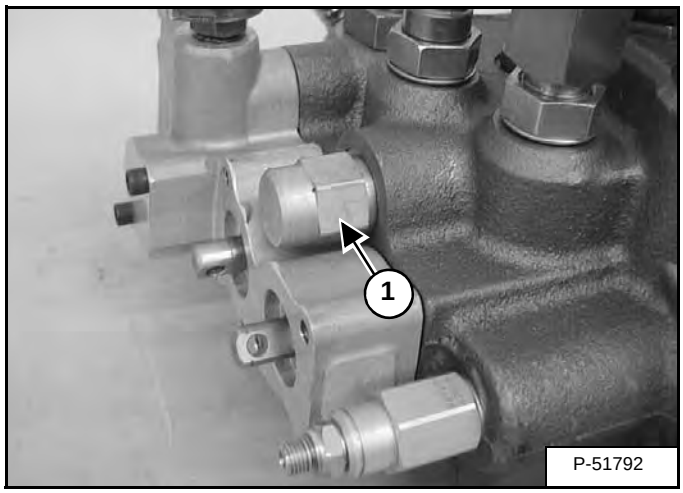
Installation: Lightly lubricate the lock valve O-rings and tighten to 20-24 ft.-lb. (27-33 N•m) torque.

Figure 20-41-96



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-41-96]** from the lift lock valve, and replace with new.

Figure 20-41-97



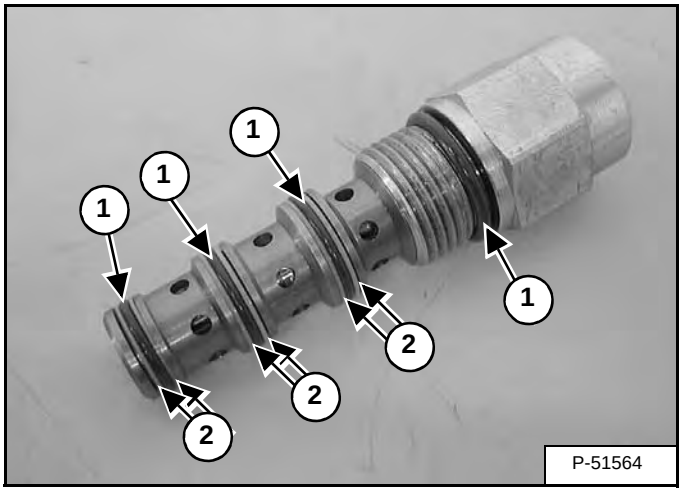
Remove the tilt lock valve (Item 1) **[Figure 20-41-97]** from the back of the control valve.

Installation: Lightly lubricate the lock valve O-rings and tighten to 20-24 ft.-lb. (27-33 N•m) torque.

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Lock Valve Removal And Installation (Cont'd)

Figure 20-41-98

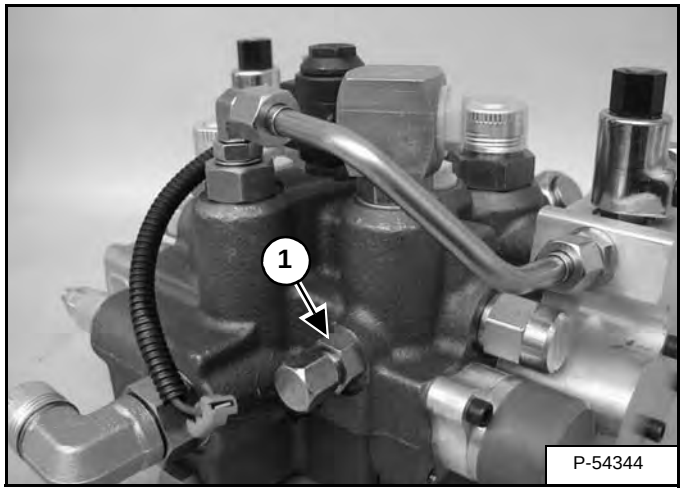


Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-41-98]** from the tilt lock valve, and replace with new.

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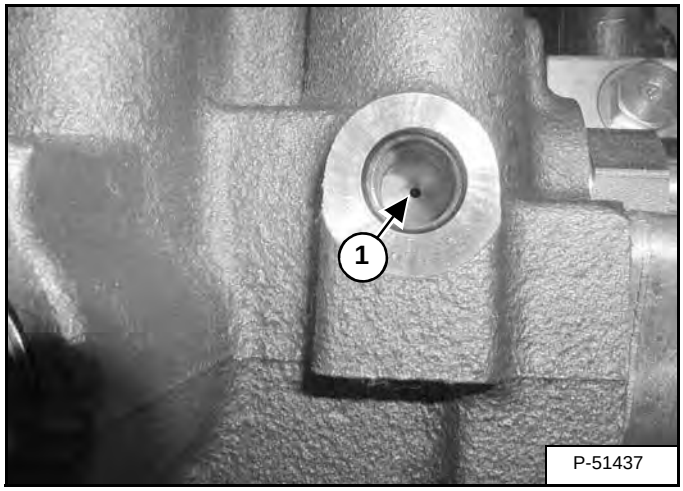
Lift Arm Bypass Orifice Removal And Installation

Figure 20-41-99



Remove the fitting (Item 1) **[Figure 20-41-99]** from the valve.

Figure 20-41-100

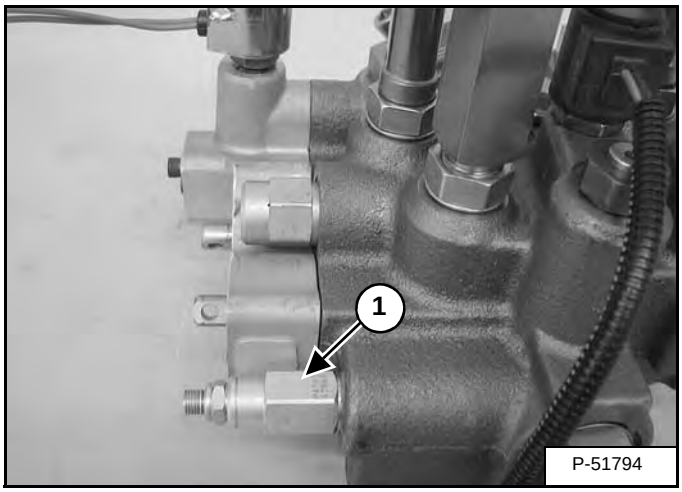


Check the lift arm bypass orifice (Item 1) **[Figure 20-41-100]**.

NOTE: This orifice is not removable from the valve casting.

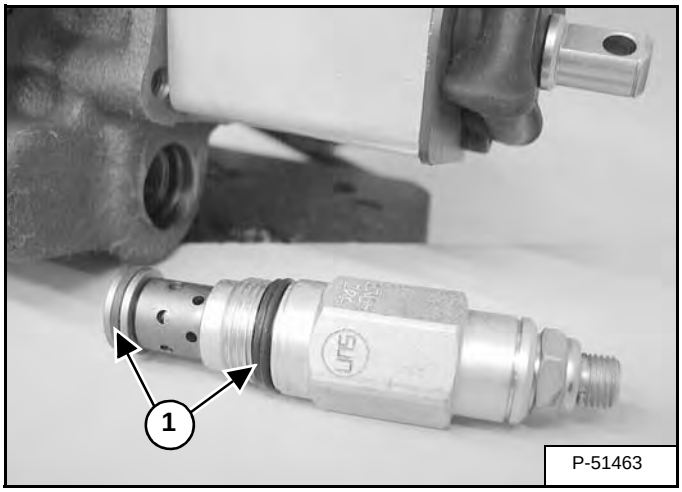
Main Relief Valve Removal And Installation

Figure 20-41-101



Remove the main relief valve (Item 1) **[Figure 20-41-101]**.

Figure 20-41-102



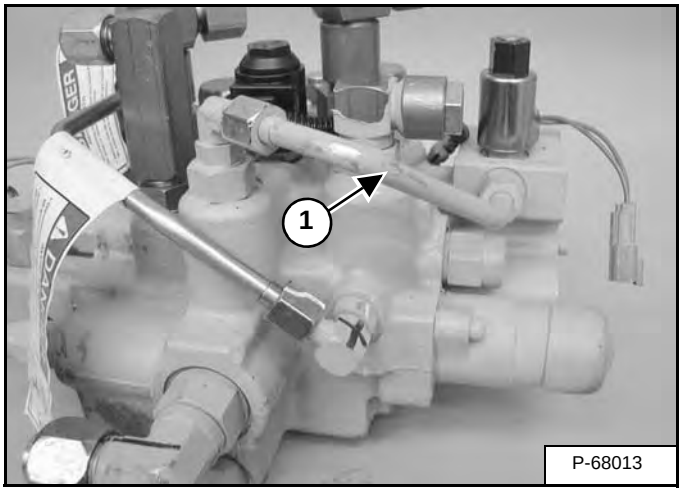
Remove the O-rings from the main relief valve (Item 1) **[Figure 20-41-102]**.

Installation: Always use new O-rings. Tighten to 38-45 ft.-lb. (52-61 N•m) torque.

Dealer Copy -- Not for Resale

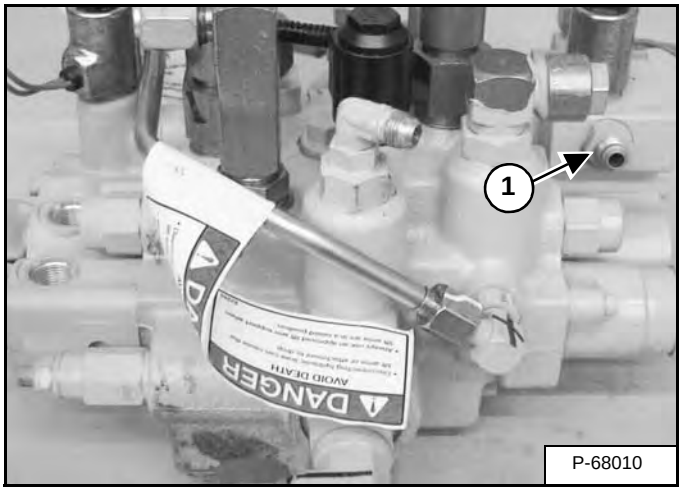
Check Valve Removal And Installation

Figure 20-41-103



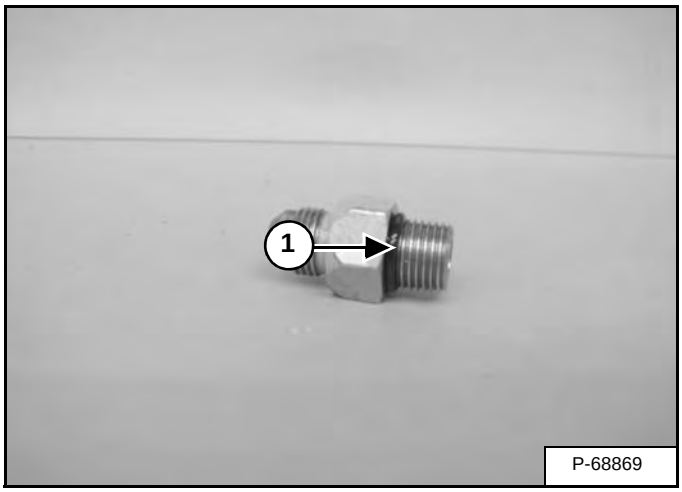
Remove the tubeline (Item 1) **[Figure 20-41-103]**.

Figure 20-41-104



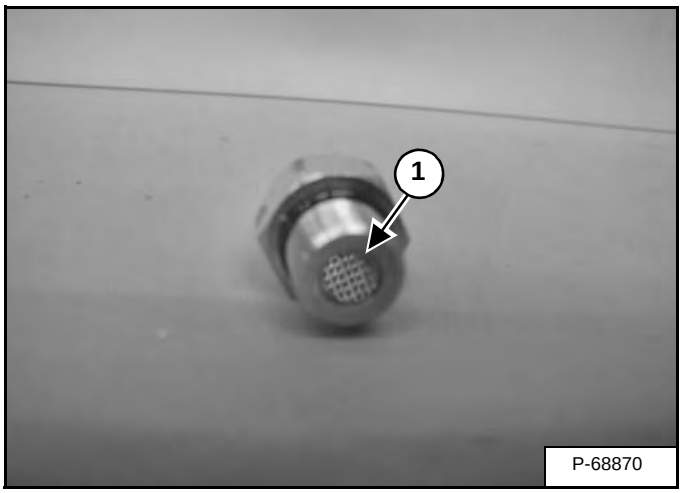
Remove the check valve fitting (Item 1) **[Figure 20-41-104]** from the hydraulic control valve.

Figure 20-41-105



Installation: Lubricate the O-ring (Item 1) **[Figure 20-41-105]** and tighten the fitting to 20-24 ft.-lb. (27-33 N•m) torque.

Figure 20-41-106



Inspect the screen (Item 1) **[Figure 20-41-106]**.

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LIFT ARM BYPASS CONTROL VALVE

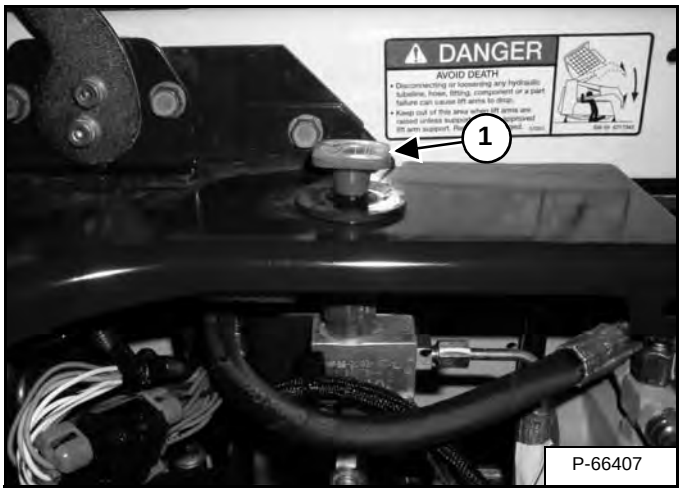
Description

The lift arm bypass control valve is located on the right side of the machine close to the engine speed control.

The lift arm bypass control valve is manually operated by pulling on the valve (Item 1) **[Figure 20-50-1]** and turning the knob clockwise a 1/4 turn. The valve releases the hydraulic fluid from the base end of the lift cylinder(s) which allows the lift arm to slowly come down to the transport position.

Testing

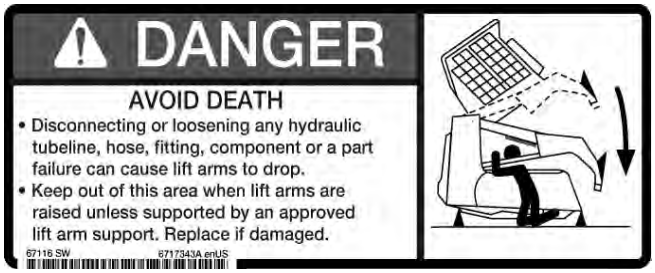
Figure 20-50-1



Raise the lift arms 6 feet (2 m) off the ground. Stop the engine. Turn the Lift Arm Bypass Control Knob clockwise 1/4 turn. Then pull up and hold the Lift Arm Bypass Control Knob until the lift arms slowly lower.

Dealer Copy -- Not for Resale

Removal And Installation



WARNING

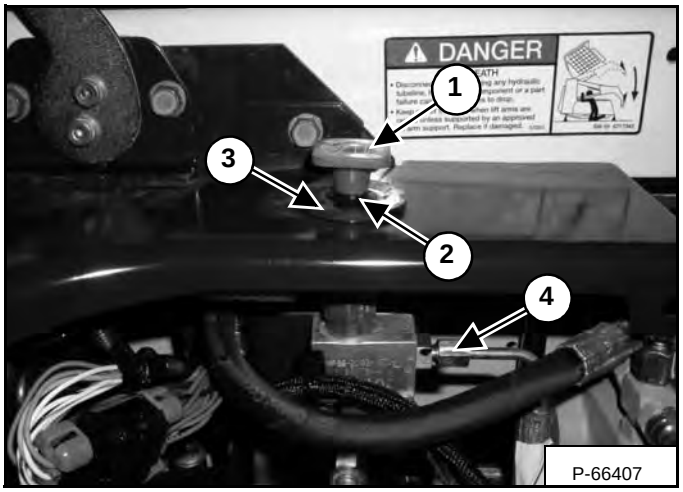
Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

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Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Figure 20-50-2



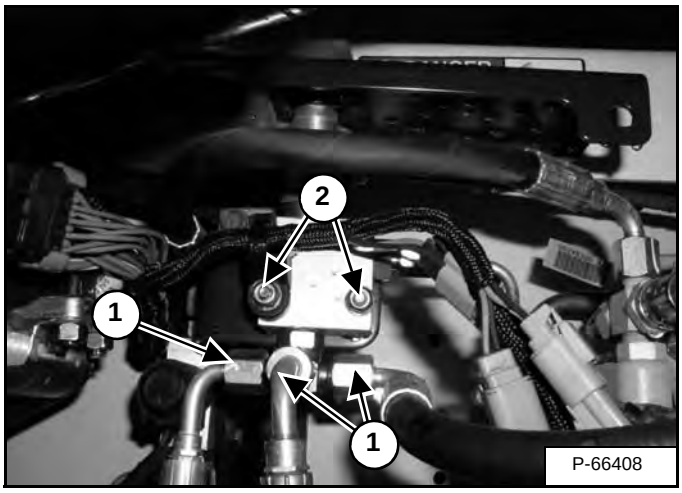
Hold the bypass control knob (Item 1) **[Figure 20-50-2]** and loosen the jam nut on the bypass valve shaft.

Remove the bypass control knob (Item 1). Remove the jam nut (Item 2) from the valve shaft **[Figure 20-50-2]**.

Remove the rubber washer (Item 3) **[Figure 20-50-2]**.

Disconnect the hydraulic hose (Item 4) **[Figure 20-50-2]**. Cap and plug the hose.

Figure 20-50-3



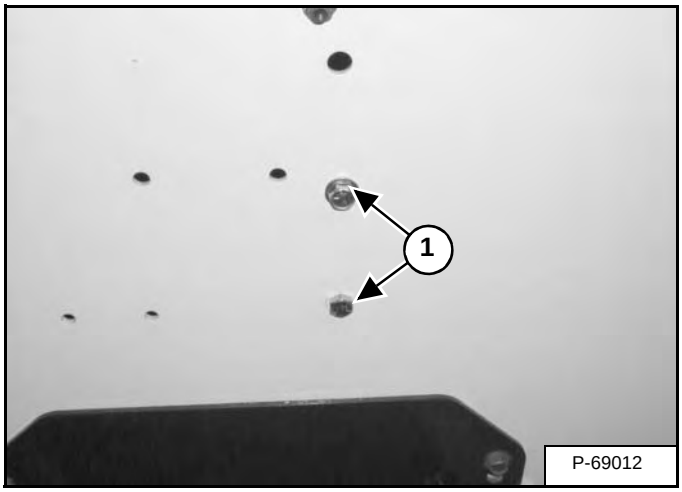
Disconnect the three hydraulic tubelines (Item 1) **[Figure 20-50-3]** and cap and plug the lines.

Remove the two mounting bolts (Item 2) **[Figure 20-50-3]**.

Installation: Tighten the mounting bolts to 180-200 in.-lb. (21-23 N•m) torque.

Remove the lift arm bypass valve.

Figure 20-50-4



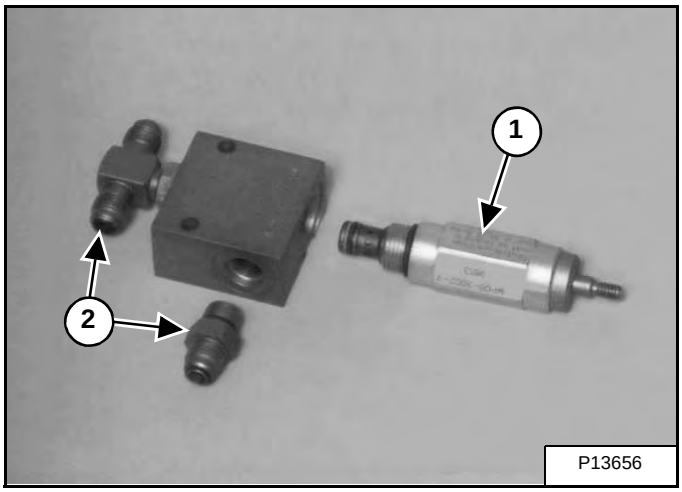
Remove the two bolts (Item 1) **[Figure 20-50-4]** to replace the bypass valve mounting bracket if necessary.

Reverse the removal procedure to install the lift arm bypass valve in the loader.

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Disassembly And Assembly

Figure 20-50-5



Remove the bypass valve (Item 1) **[Figure 20-50-5]** from the valve block. Inspect the bypass valve for damage and replace if necessary.

Installation: Tighten the valve to 33-37 ft.-lb. (45-50 N•m) torque.

Inspect the hydraulic fittings (Item 2) **[Figure 20-50-5]** on the valve block for damage and replace if necessary.

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HYDRAULIC PUMP (STANDARD)

Description

The hydraulic gear pump is attached to the end of the hydrostatic pumps and are located on the right side of the loader between the hydraulic control valve and the engine.

The hydraulic gear pump is a combination of gear pumps that provide hydraulic flow to several hydraulic systems.

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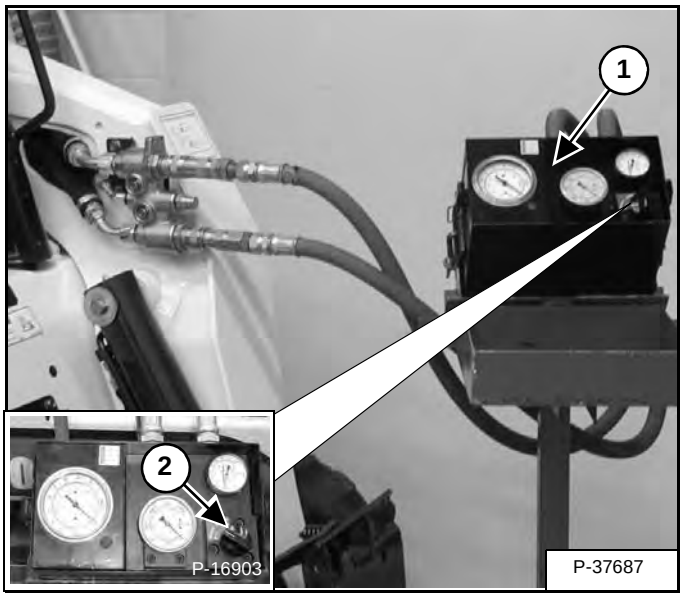
HYDRAULIC PUMP (STANDARD) (CONT'D)

Pump Test at Quick Couplers

The tools listed will be needed to do the following procedure:

MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit

Figure 20-60-1



NOTE: When testing the hydraulic flow of a machine hoses must be at least 3/4 inch in diameter and connected directly to the hydraulic tester without using any type of "quick coupler" on the connection to the tester. Also make sure your hydraulic tester is capable of at least 50 GPM.

Install a hydraulic tester (Item 1) **[Figure 20-60-1]** onto the front auxiliary quick couplers.

This procedure will require a operator in the cab and one operator running the tester.

Start the engine and run at low idle RPM. Press the Front Auxiliary button. Engage the front auxiliary with the trigger on the right handle. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control clockwise on the tester so it reads about a 1000 PSI (69 bar).

NOTE: *DO NOT EXCEED 3300 PSI.*

Turn the restrictor control (Item 2) **[Figure 20-60-1]** on the tester counterclockwise to obtain free flow, the flow should be approximately 21 GPM. Start turning the restrictor clockwise, causing more restriction on the flow. The GPM should drop off slightly until the pressure reaches approximately 2800 PSI. At approximately 2800 PSI the flow should start decreasing rapidly until the pressure reaches 3250-3300 PSI. At 3250-3300 PSI the flow should be at 0 GPM. Turn the restrictor (Item 2) **[Figure 20-60-1]** counterclockwise to free flow. Shut the front auxiliary hydraulics off.

If flow and pressure specs are not obtained, go to Direct Pump Testing. (See Direct Pump Test (Standard Section) on Page 20-60-3.)

*Refer to (See Hydraulic System on Page SPEC-10-3.) for system relief pressure and full RPM.

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Direct Pump Test (Standard Section)

The tools listed will be needed to do the following procedure:

MEL1563 or 6689779 - Remote Start Tool
MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit

⚠ WARNING

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

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Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

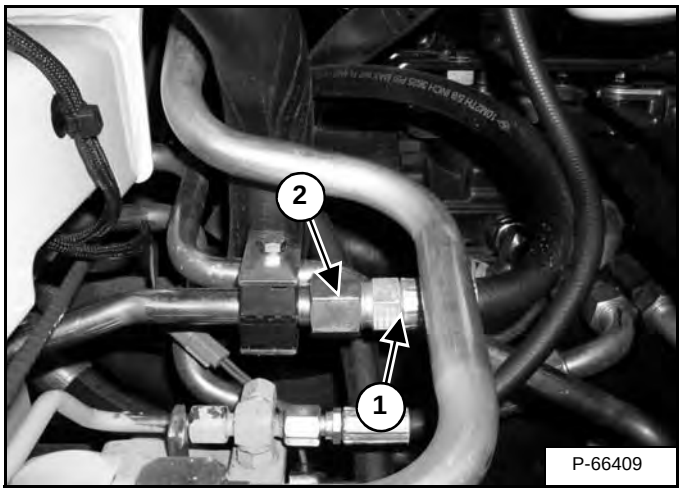
W-2059-0598

Raise the operator cab. (See Raising on Page 10-30-1.)

Open the rear door of the loader.

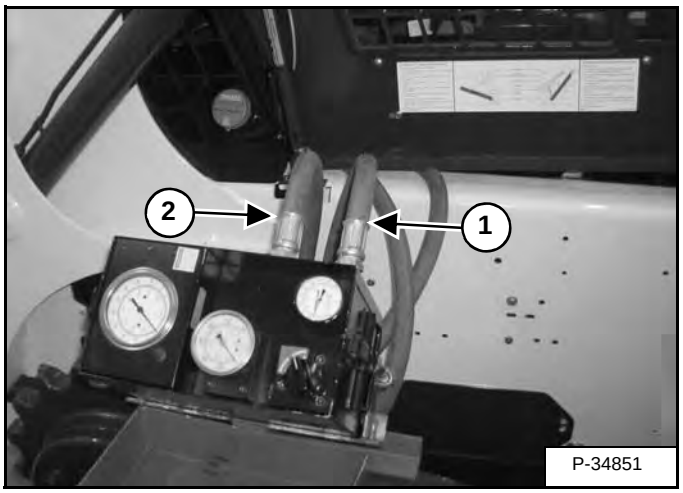
Connect the remote start tool. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.)

Figure 20-60-2



Disconnect the OUTLET hose (Item 1) **[Figure 20-60-2]** that comes from the gear pump, and connects to the tubeline on the control valve.

Figure 20-60-3



Connect the INLET hose (Item 1) **[Figure 20-60-3]** from the tester to the OUTLET hose (Item 1) **[Figure 20-60-2]** of the pump. Connect the OUTLET hose (Item 2) **[Figure 20-60-3]** from the tester to the tubeline (Item 2) **[Figure 20-60-2]** on the control valve.

IMPORTANT

The hydraulic tester must be in the fully open position before you start the engine.

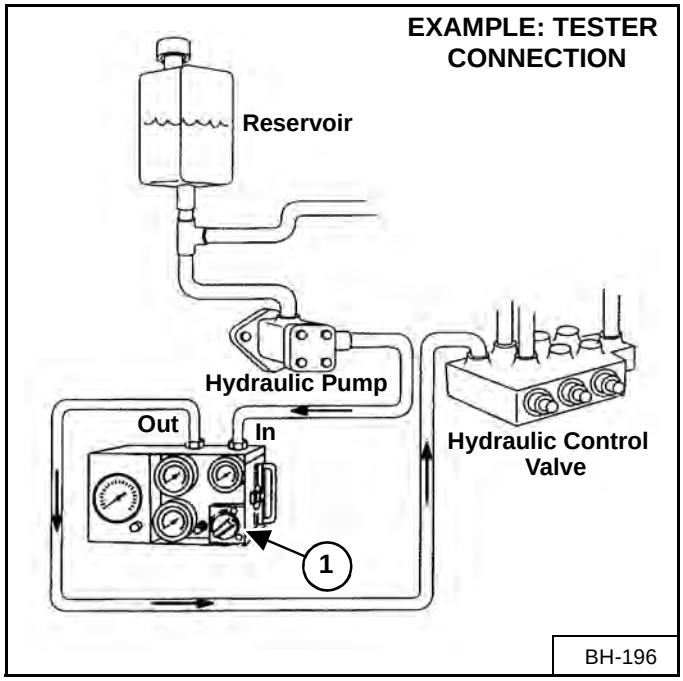
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HYDRAULIC PUMP (STANDARD) (CONT'D)

Direct Pump Test (Standard Section) (Cont'd)

Figure 20-60-4



Sample tester connection shown **[Figure 20-60-4]**.

Start the engine and run at low idle RPM. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control (Item 1) **[Figure 20-60-4]** on the tester to about 1000 PSI (6895 kPa). DO NOT exceed system relief pressure. Open the restrictor control and record the free flow (GPM) at full RPM.

Push the maximum/variable flow switch (on the remote start tool) to engage the front auxiliary hydraulics, the light will come ON. Push the button (on the right control lever) for fluid flow to the quick coupler (fluid pressure will go over main relief). Record the highest pressure (PSI) and flow (GPM). The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \times 100$$

A low percentage may indicate a failed pump.

*Refer to (See Hydraulic System on Page SPEC-10-3.) for system relief pressure and full RPM.

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Direct Pump Test (Charge Section)

The tools listed will be needed to do the following procedure:

MEL1563 or 6689779 - Remote Start Tool
MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit
6661247 - Filter Assembly
17 KB 1212 - Elbow Fitting
15 KB 1212 - Straight Fitting
15 KB 0812 - Reducer Fitting

⚠ WARNING

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

W-2017-0286

Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

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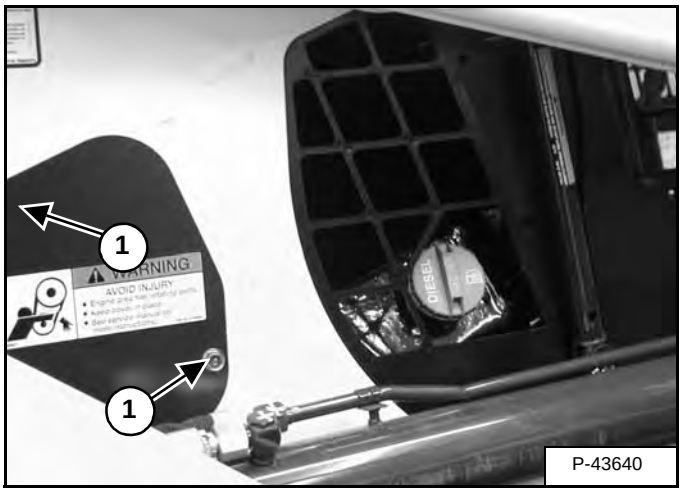
NOTE: The fluid from the charge pump must be filtered after it passes through the Hydraulic Tester, to prevent any contamination to the Hydrostatic Pumps.

Raise the operator cab. (See Raising on Page 10-30-1.)

Open the rear door of the loader.

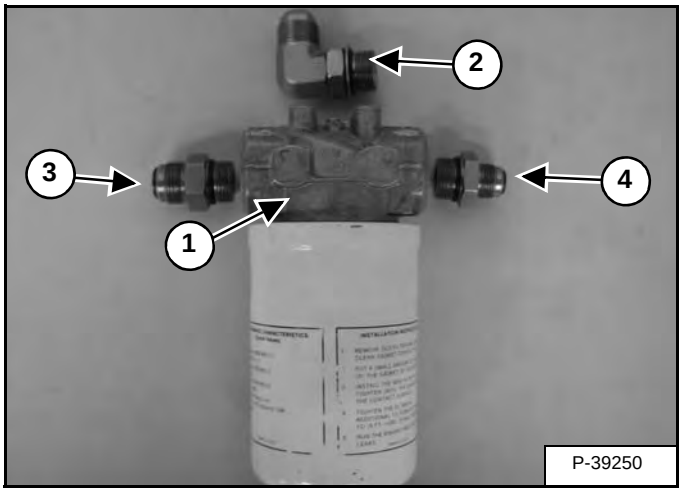
Connect the remote start tool. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.)

Figure 20-60-5



Remove the mount bolts (Item 1) **[Figure 20-60-5]** from the right side access panel. Remove the panel.

Figure 20-60-6

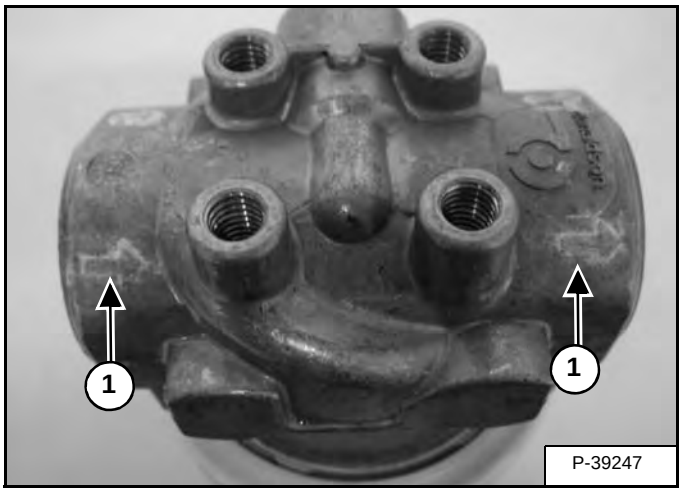


Assemble the filter assembly (Item 1), elbow fitting (Item 2), straight fitting (Item 3) and the reducer fitting (Item 4) **[Figure 20-60-6]**.

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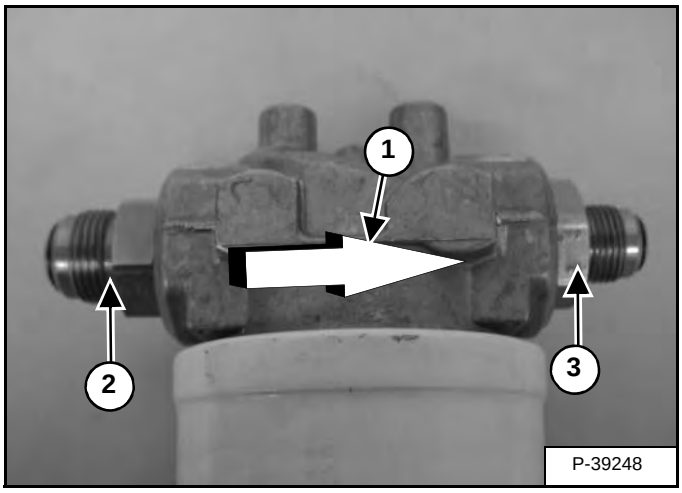
Direct Pump Test (Charge Section) (Cont'd)

Figure 20-60-7



Determine the proper direction of oil flow through the filter housing (Item 1) **[Figure 20-60-7]** and **[Figure 20-60-8]**.

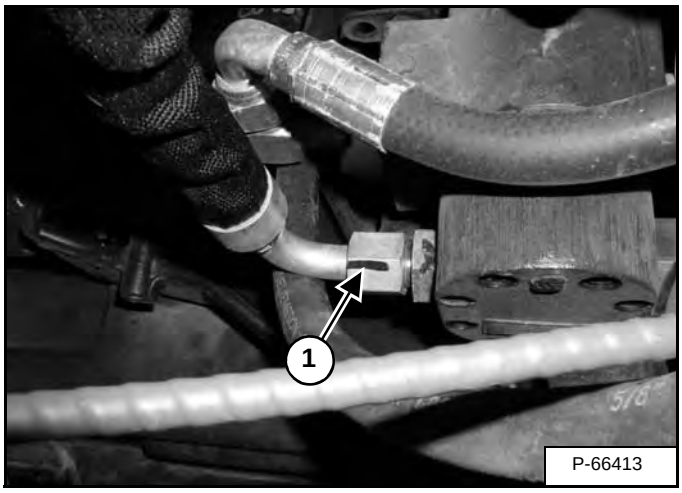
Figure 20-60-8



Install the fitting (15KB 1212-Straight Fitting) (Item 2) **[Figure 20-60-8]** in the filter housing inlet.

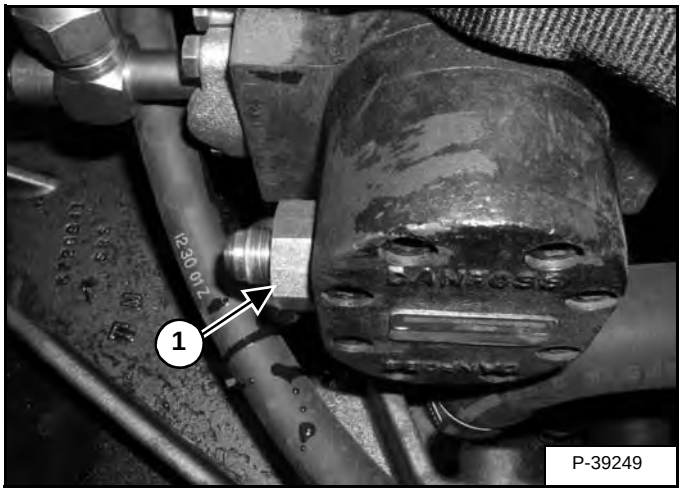
Install the fitting (15KB 0812-Reducer Fitting) (Item 3) **[Figure 20-60-8]** in the filter housing outlet.

Figure 20-60-9



Disconnect the OUTLET hose (Item 1) **[Figure 20-60-9]**.

Figure 20-60-10

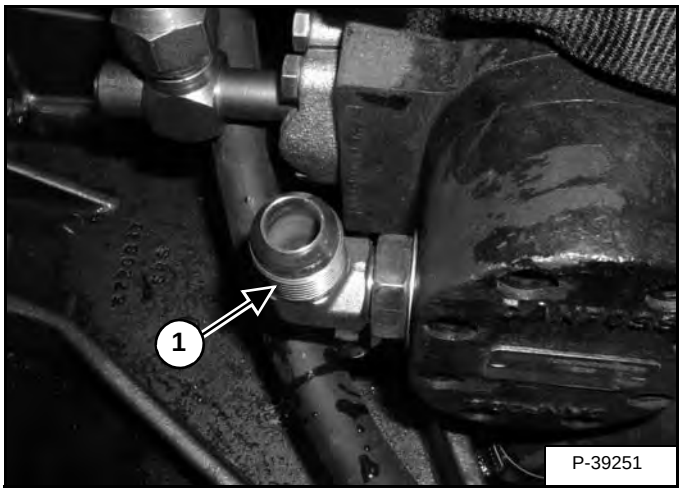


Remove the OUTLET fitting (Item 1) **[Figure 20-60-10]** from the charge pump.

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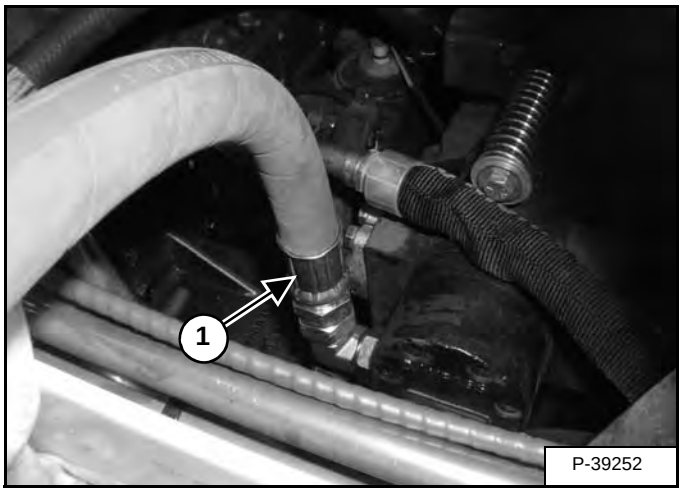
Direct Pump Test (Charge Section) (Cont'd)

Figure 20-60-11



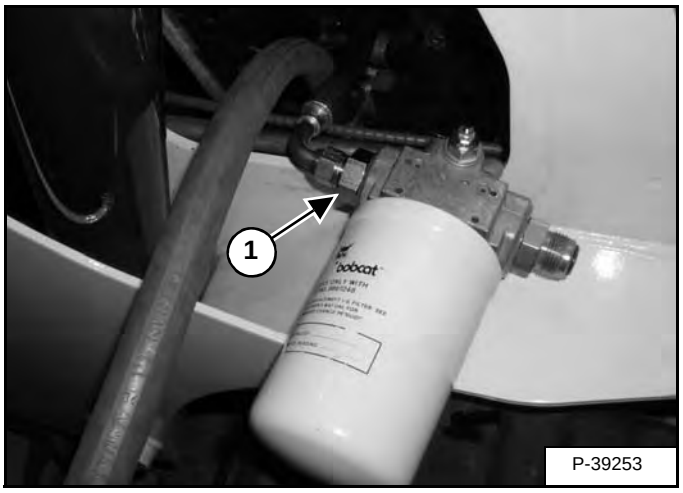
Install the elbow fitting 17KB 1212 (Item 1) **[Figure 20-60-11]** into the OUTLET of the charge pump.

Figure 20-60-12



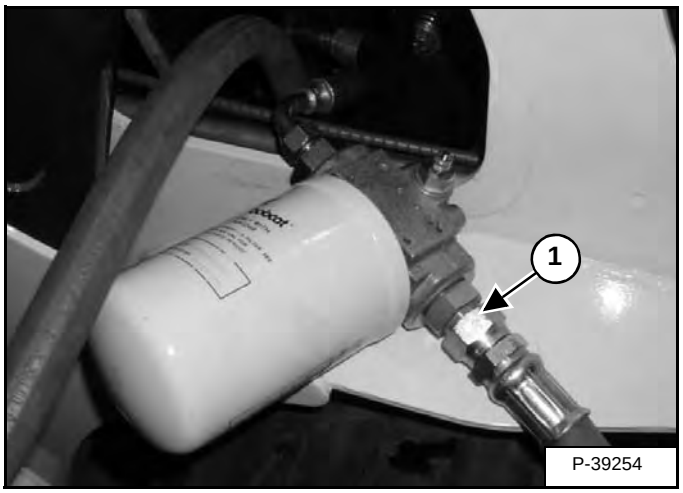
Connect the Inlet hose from the hydraulic tester (Item 1) **[Figure 20-60-12]** to the OUTLET fitting of the charge pump.

Figure 20-60-13



Connect the outlet fitting on the hydraulic filter (Item 1) **[Figure 20-60-13]** to the hose that was remove from the charge pump and routes to the back side of the hydrostatic pump.

Figure 20-60-14



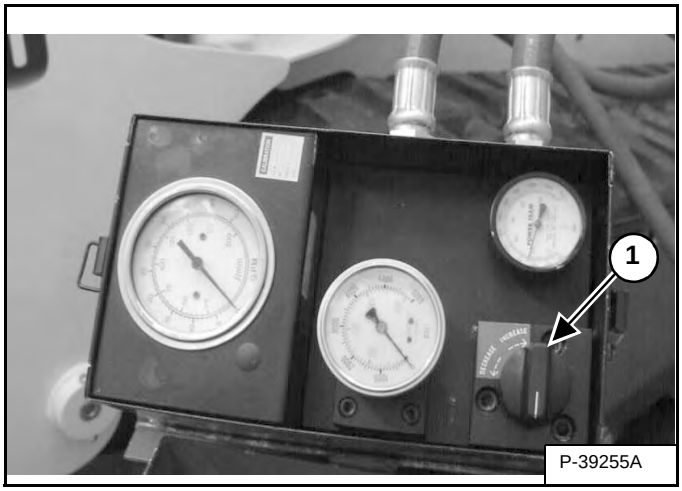
Connect the outlet hose on the hydraulic tester (Item 1) **[Figure 20-60-14]** to the inlet fitting on the hydraulic filter assembly.

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HYDRAULIC PUMP (STANDARD) (CONT'D)

Direct Pump Test (Charge Section) (Cont'd)

Figure 20-60-15



Be sure all connections are tight and that the hoses are not touching any moving parts before starting the loader **[Figure 20-60-15]**.

IMPORTANT

The hydraulic tester must be in the fully open position before you start the engine.

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Start the engine and run at low idle RPM. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control (Item 1) on the tester to about 1000 PSI (6895 kPa). DO NOT exceed system relief pressure. Open the restrictor control and record the free flow (GPM) at full RPM.

Turn the restrictor down to system operating pressure. **DO NOT EXCEED SYSTEM RELIEF PRESSURE**. Refer to Hydraulic Schematics for pressure. The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \times 100$$

A low percentage may indicate a failed pump.

*Refer to (See Hydraulic System on Page SPEC-10-3.) for system relief pressure and full RPM.

*Refer to the Hydraulic Schematics for pump flow and RPM.

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Removal And Installation



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Stop the engine. Raise the seat bar.

Lift and block the loader. (See Procedure on Page 10-10-1.)

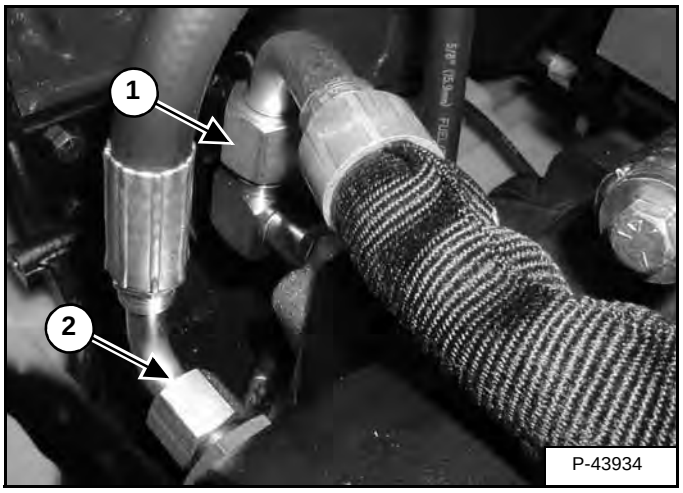
Raise the operator cab. (See Raising on Page 10-30-1.)

Drain the hydraulic fluid from the reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-2.)

Open the rear door of the loader.

Remove the Power Bob-Tach block if equipped. (See Removal And Installation on Page 20-130-1.)

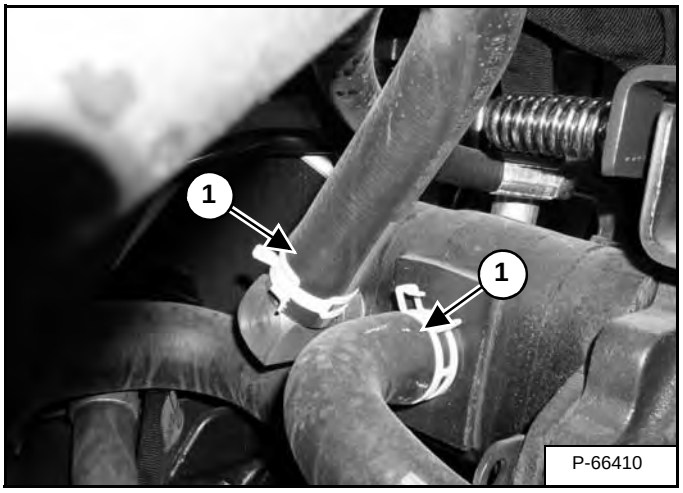
Figure 20-60-16



Disconnect and cap the hose from the outlet fitting (Item 1) **[Figure 20-60-16]** of the hydraulic pump.

Disconnect and cap the hose from the outlet fitting (Item 2) **[Figure 20-60-16]** of the hydraulic charge pump.

Figure 20-60-17

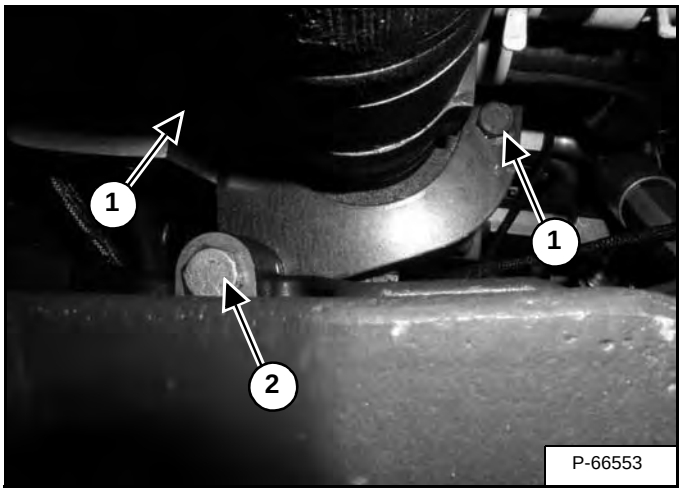


Disconnect the two inlet hoses (Item 1) **[Figure 20-60-17]** from the front of the hydraulic pump.

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Removal And Installation (Cont'd)

Figure 20-60-18



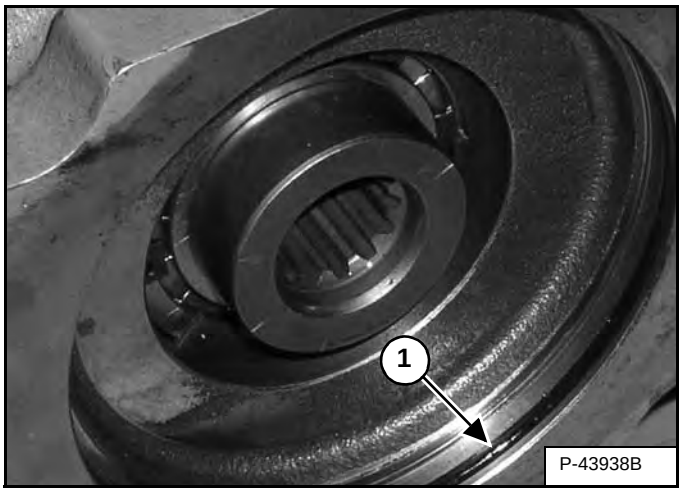
Remove the two mounting bolts (Item 1) **[Figure 20-60-18]** from the hydraulic pump.

Installation: Tighten the mounting bolts to 65-70 ft.-lb. (88-95 N•m) torque.

At the bottom side of the gear pump, remove the pump bolt (Item 2) **[Figure 20-60-18]** from pump support bracket.

Installation: Tighten the pump support bracket bolt to 175-190 ft.-lb. (237-257 N•m) torque.

Figure 20-60-19



Remove the hydraulic pump from the hydrostatic pump **[Figure 20-60-19]**.

Remove the O-ring (Item 1) **[Figure 20-60-19]**.

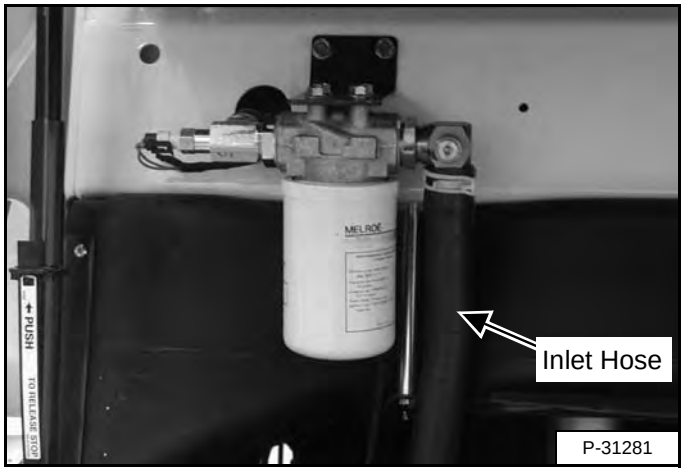
Installation: Use a new O-ring when installing the hydraulic pump.

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Hydraulic Pump Start Up

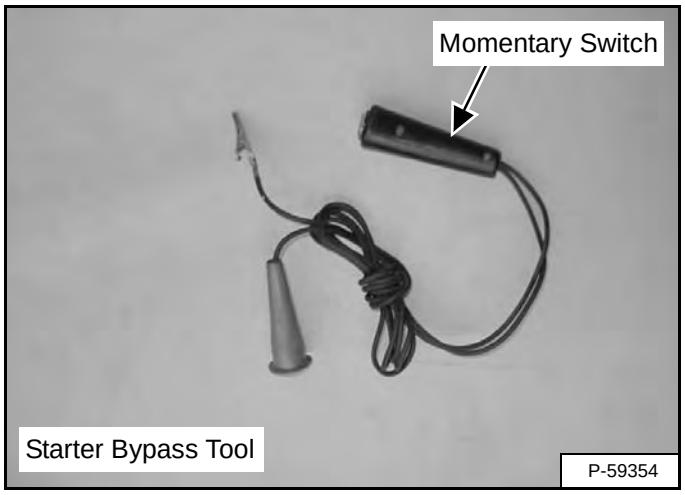
NOTE: This procedure to prevent a dry start up of the hydraulic pump.

Figure 20-60-20



Disconnect the pump inlet hose connection at the filter head. Fill the pump inlet and hose completely with hydraulic fluid. Reconnect the hose **[Figure 20-60-20]**.

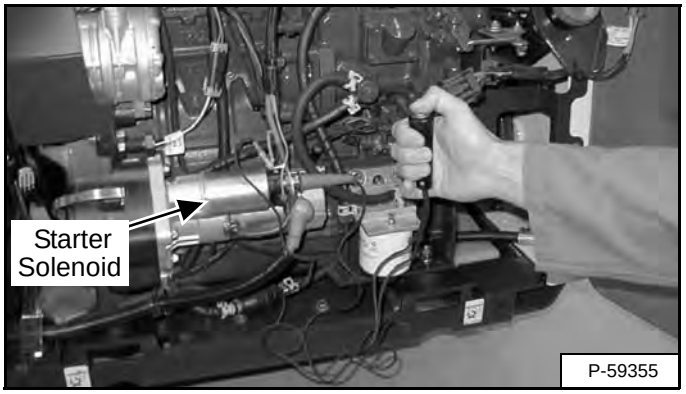
Figure 20-60-21

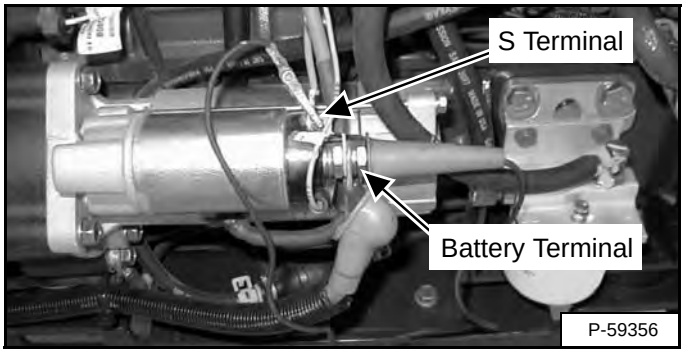


[Figure 20-60-21] To crank the engine without starting, the machine key switch can be bypassed. Obtain a starter bypass tool from a local source which can be used as a universal connection to remotely crank the engine without starting.

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 20-60-22





Connect the starter bypass tool to the starter solenoid battery terminal and S terminal. Crank the engine for 15 seconds, then stop for at least 30 seconds. Again, crank the engine for 15 seconds. Remove the starter bypass tool **[Figure 20-60-22]**.

Start the loader from the operators cab and run the engine at low idle for 1 - 2 minutes without operating the hydraulics.

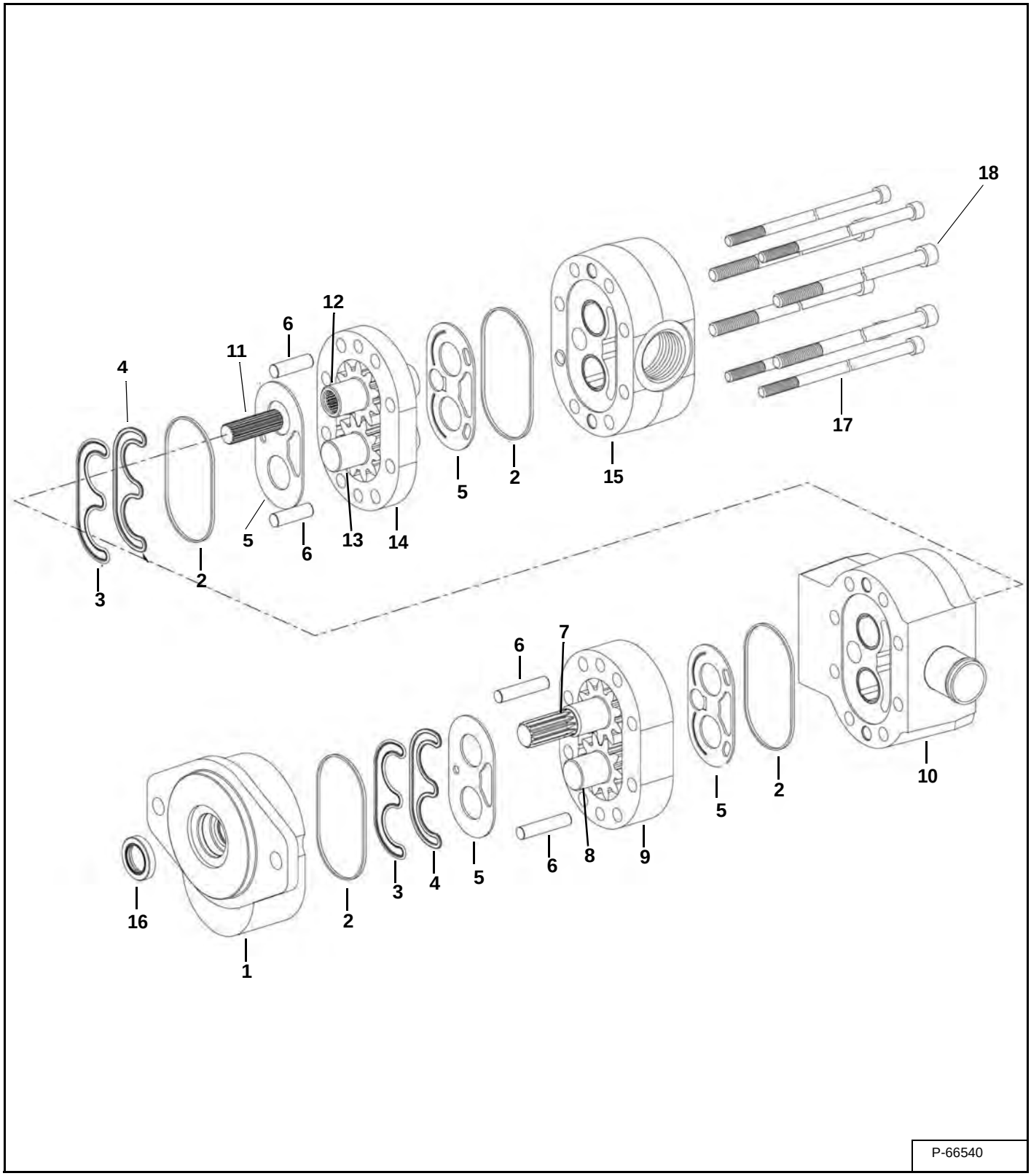
After operating the engine at low idle, Remove the lift arm support device and fully raise and lower the loader lift arms several times or until air is purged from the system. ***Avoid running over the relief valve setting at the end of cylinder stroke.***

With the loader parked on a level surface and lift arms down, check and fill the hydraulic reservoir as required. Check for hydraulic leaks.

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Parts Identification

Figure 20-60-23



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Parts Identification (Cont'd)

The items listed below refer to Page 20-60-12 **[Figure 20-60-23]**.

1. Auxiliary Pump End Section
2. Section Seal
3. Pre-Load Seal
4. Load Seal
5. Wear Plate
6. Alignment Pins
7. Drive Gear (Auxiliary Pump)
8. Idler Gear (Auxiliary Pump)
9. Auxiliary Pump Center Section
10. Auxiliary Pump End Section
11. Spline Shaft
12. Drive Gear (Charge Pump)
13. Idler Gear (Charge Pump)
14. Charge Pump Center Section
15. Charge Pump End Section
16. Shaft Seal
17. Bolts (4)
18. Bolts (4)

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

Mark the pump sections for correct assembly.

To disassemble and assemble the hydraulic pump, follow the Parts Identification page **[Figure 20-60-23]** for proper placement of components along with the information below.

NOTE: A seal kit is available through Bobcat Service Parts.

Assembly: Tighten the eight pump housing bolts (Item 19) **[Figure 20-60-23]** to 37 ft.-lb. (50 N•m) torque.

NOTE: Position the wear plate (Item 5) and (Item 10) [Figure 20-60-23] inlets and traps as shown with the bronze side toward the gears on all wear plates.

NOTE: Inspect all gears, shafts and pump end sections. If any of these components have excessive wear or damage is visible, the complete pump must be replaced.

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HYDRAULIC PUMP (STANDARD) (HIGH FLOW)

Description

The hydraulic gear pump is attached to the end of the hydrostatic pumps and are located on the right side of the loader between the hydraulic control valve and the engine.

The hydraulic gear pump is a combination of gear pumps that provide hydraulic flow to several hydraulic systems.

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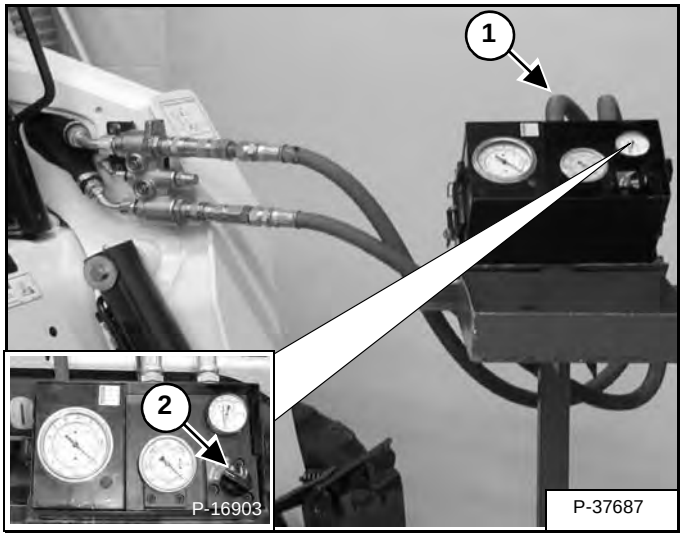
HYDRAULIC PUMP (STANDARD) (HIGH FLOW) (CONT'D)

Pump Test At Quick Couplers

The tools listed will be needed to do the following procedure:

MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit

Figure 20-61-1



NOTE: When testing the hydraulic flow of a machine hoses must be at least 3/4 inch in diameter and connected directly to the hydraulic tester without using any type of "quick coupler" on the connection to the tester. Also make sure your hydraulic tester is capable of at least 50 GPM.

Install a hydraulic tester (Item 1) **[Figure 20-61-1]** onto the front auxiliary quick couplers.

This procedure will require a operator in the cab and one operator running the tester.

Start the engine and run at low idle RPM. Press the Front Auxiliary button. Engage the front auxiliary with the trigger on the right handle. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control clockwise on the tester so it reads about a 1000 PSI (69 bar).

NOTE: *DO NOT EXCEED 3300 PSI.*

Turn the restrictor control (Item 2) **[Figure 20-61-1]** on the tester counterclockwise to obtain free flow, the flow should be approximately 21 GPM. Start turning the restrictor clockwise, causing more restriction on the flow. The GPM should drop off slightly until the pressure reaches approximately 2800 PSI. At approximately 2800 PSI the flow should start decreasing rapidly until the pressure reaches 3250-3300 PSI. At 3250-3300 PSI the flow should be at 0 GPM. Turn the restrictor (Item 2) **[Figure 20-61-1]** counterclockwise to free flow. Shut the front auxiliary hydraulics off.

If flow and pressure specs are not obtained, go to the Direct Pump Testing (Standard Section). (See Direct Pump Test (Standard Section) on Page 20-61-3.) If flow and pressure specs are obtained continue on to the next paragraph.

With the engine running at low idle RPM. Press the Front Auxiliary button. Engage the front auxiliary with the trigger on the right handle. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control on the tester to about 1000 PSI (69 bar).

NOTE: *DO NOT EXCEED 3300 PSI.*

Turn the restrictor control (Item 2) **[Figure 20-61-1]** on the tester counterclockwise, to obtain free flow, the flow should be approximately 21 GPM. Press the High Flow button. The flow should increase approximately 37 GPM. Start turning the restrictor clockwise, causing more restriction on the flow. The GPM should drop off slightly until the pressure reaches approximately 3100 PSI. At approximately 3100 PSI the flow should start decreasing rapidly until the pressure reaches 3250-3350 PSI. At 3250-3350 PSI the flow should be at 0 GPM. Turn the restrictor control (Item 2) **[Figure 20-61-1]** counterclockwise to free flow. Shut the front auxiliary hydraulics off.

If the specs from above are reached, the high flow hydraulic pump is OK.

If the flow and pressure were not obtained, go to the Direct Pump Testing (High Flow Section) (See Direct Pump Test (High Flow Section) on Page 20-61-9.)

*Refer to Hydraulic Schematics for system relief pressure and full RPM.

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HYDRAULIC PUMP (STANDARD) (HIGH FLOW) (CONT'D)

Direct Pump Test (Standard Section)

The tools listed will be needed to do the following procedure:

MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit

⚠ WARNING

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

W-2017-0286

Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

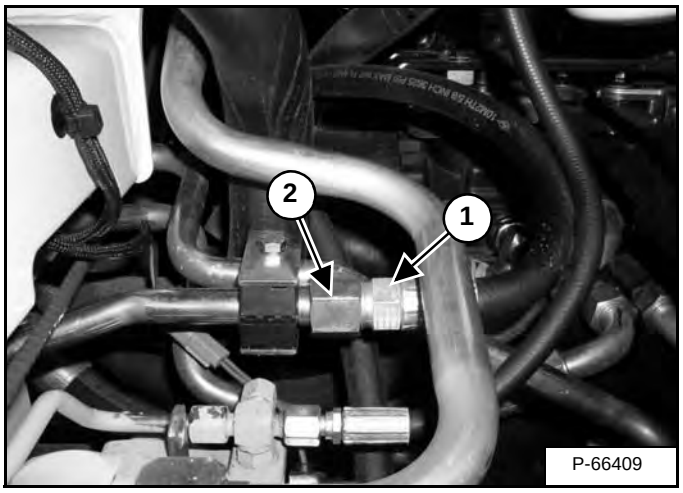
⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

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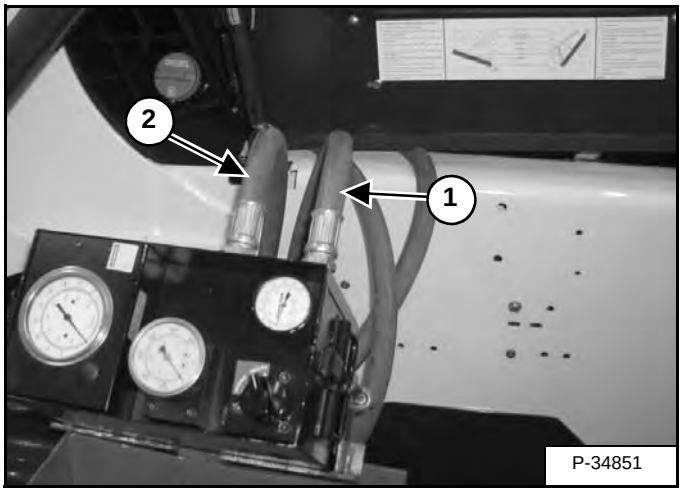
Raise the operator cab. (See Raising on Page 10-30-1.)

Figure 20-61-2



At the control valve, disconnect the standard (auxiliary) pump OUTLET hose (Item 1) **[Figure 20-61-2]** from the tube line.

Figure 20-61-3



NOTE: When testing the hydraulic flow of a machine hoses must be at least 3/4 inch in diameter and connected directly to the hydraulic tester without using any type of "quick coupler" on the connection to the tester. Also make sure your hydraulic tester is capable of at least 50 GPM.

Connect the INLET hose (Item 1) **[Figure 20-61-3]** from the tester to the OUTLET hose (Item 1) **[Figure 20-61-2]** of the pump. Connect the OUTLET hose (Item 2) **[Figure 20-61-3]** from the tester to the tube line (Item 2) **[Figure 20-61-2]** which goes to the control valve.

Lower the cab down.

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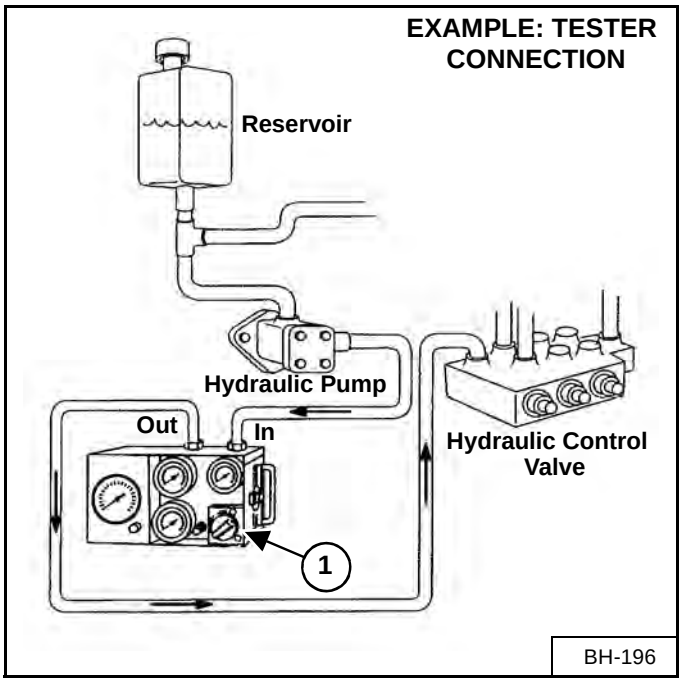
Direct Pump Test (Standard Section) (Cont'd)

IMPORTANT

The hydraulic tester must be in the fully open position before you start the engine.

I-2024-0284

Figure 20-61-4



Sample tester connection shown **[Figure 20-61-4]**.

This procedure will require a operator in the cab and one operator running the tester.

Start the engine and run at low idle RPM. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control (Item 1) **[Figure 20-61-4]** on the tester clockwise to about 1000 PSI (69 bar).

NOTE: *DO NOT EXCEED 3300 PSI*.

Open the restrictor control and record the free flow (GPM) at full RPM.

Record the flow (GPM) at 2700 PSI, this is the high pressure flow. The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \times 100$$

A low percentage may indicate a failed pump.

*Refer to (See Hydraulic System on Page SPEC-10-3.) for system relief pressure and full RPM.

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HYDRAULIC PUMP (STANDARD) (HIGH FLOW) (CONT'D)

Direct Pump Test (Charge Section)

The tools listed will be needed to do the following procedure:

MEL1563 or 6689779 - Remote Start Tool
MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit
6661247 - Filter Assembly
17 KB 1212 - Elbow Fitting
15 KB 1212 - Straight Fitting
15 KB 0812 - Reducer Fitting

⚠ WARNING

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

W-2017-0286

Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

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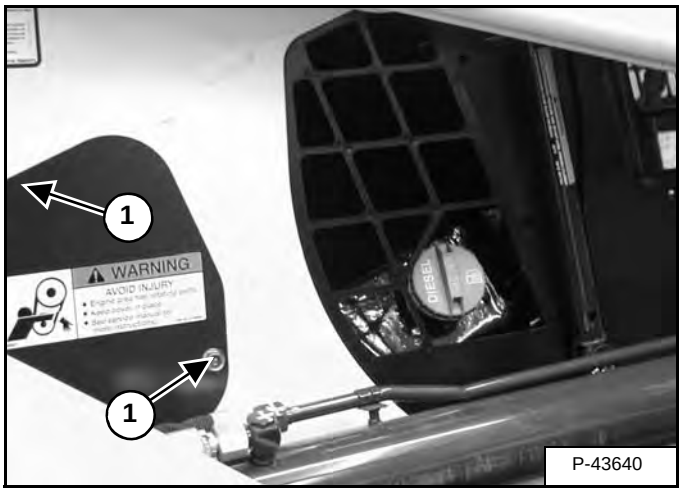
NOTE: The fluid from the charge pump must be filtered after it passes through the Hydraulic Tester, to prevent any contamination to the Hydrostatic Pumps.

Raise the operator cab. (See Raising on Page 10-30-1.)

Open the rear door of the loader.

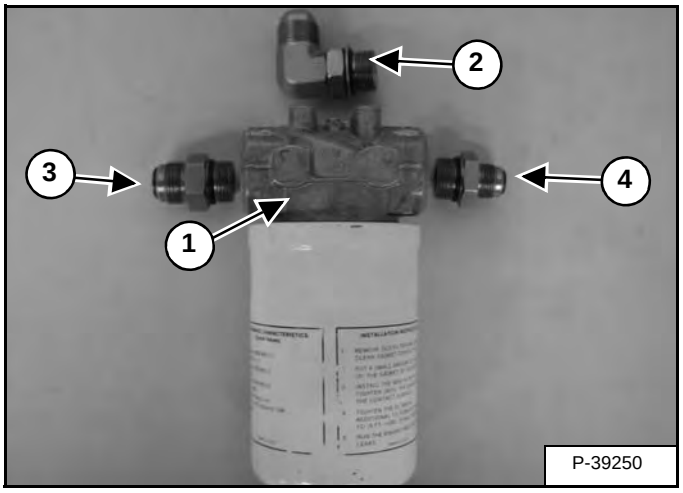
Connect the remote start tool. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.)

Figure 20-61-5



Remove the mount bolts (Item 1) **[Figure 20-61-5]** from the right side access panel. Remove the panel.

Figure 20-61-6

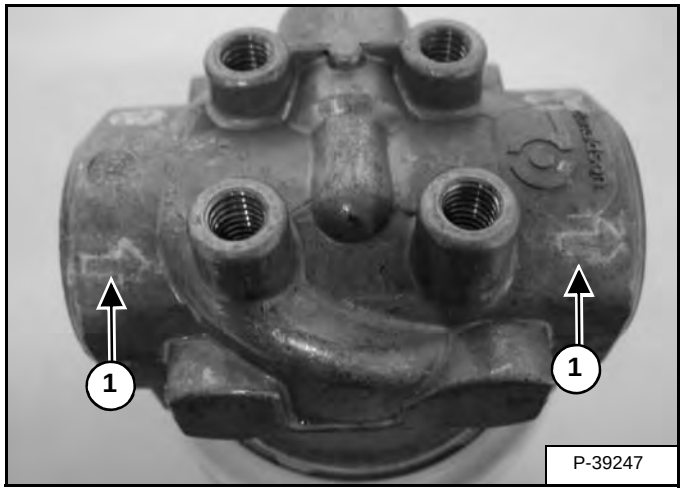


Assemble the filter assembly (Item 1), elbow fitting (Item 2), straight fitting (Item 3) and the reducer fitting (Item 4) **[Figure 20-61-6]**.

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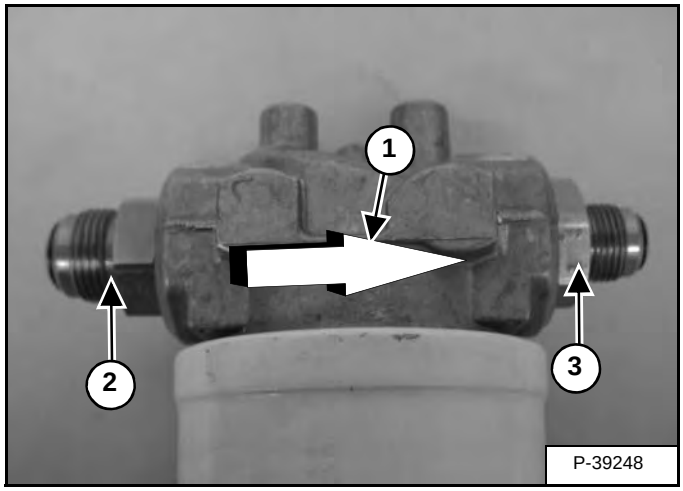
Direct Pump Test (Charge Section) (Cont'd)

Figure 20-61-7



Determine the proper direction of oil flow through the filter housing (Item 1) **[Figure 20-61-7]** and **[Figure 20-61-8]**.

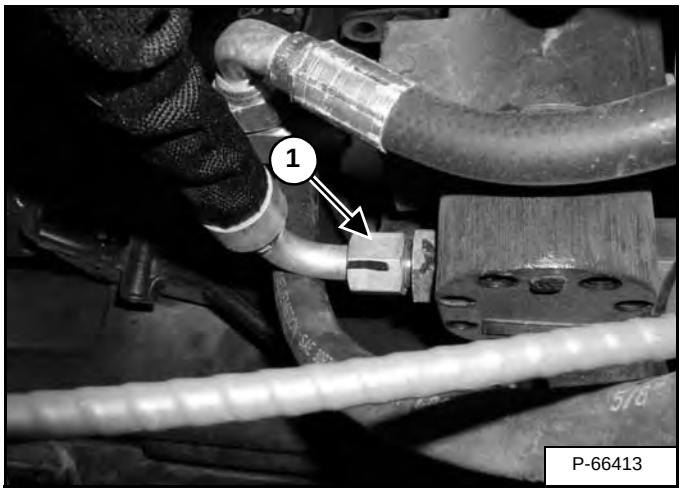
Figure 20-61-8



Install the fitting (15KB 1212-Straight Fitting) (Item 2) **[Figure 20-61-8]** in the filter housing inlet.

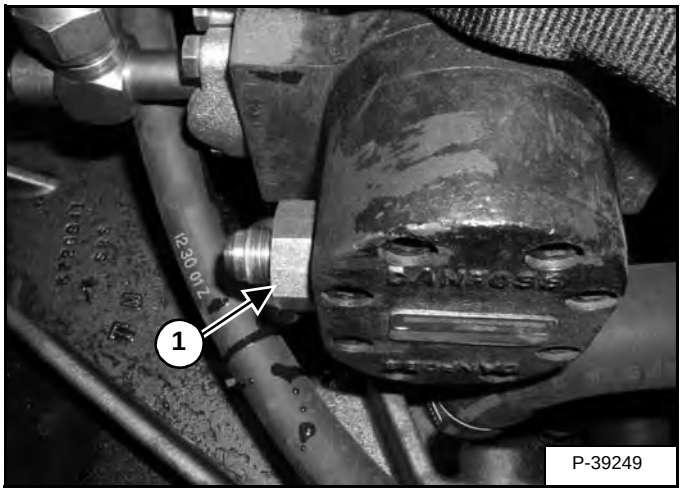
Install the fitting (15KB 0812-Reducer Fitting) (Item 3) **[Figure 20-61-8]** in the filter housing outlet.

Figure 20-61-9



Disconnect the charge pump OUTLET hose (Item 1) **[Figure 20-61-9]**.

Figure 20-61-10

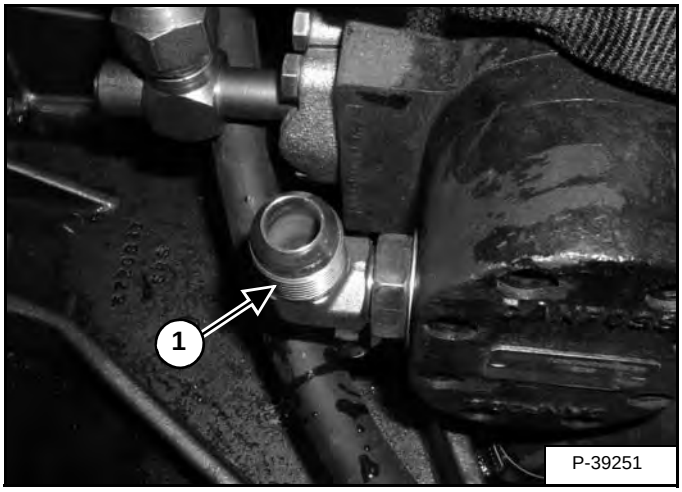


Remove the OUTLET fitting (Item 1) **[Figure 20-61-10]** from the charge pump.

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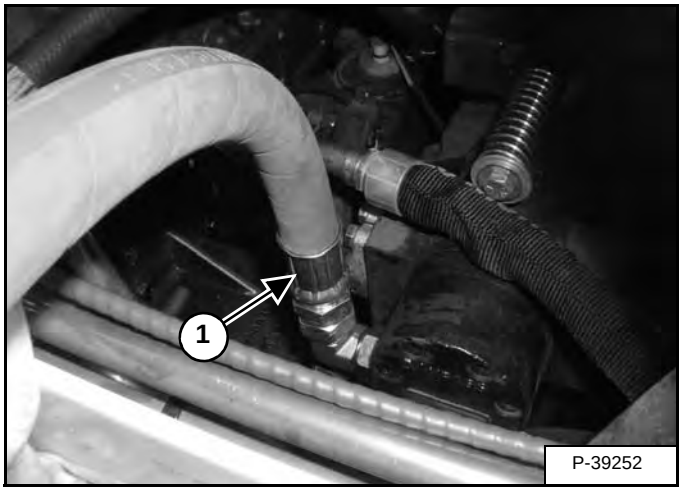
Direct Pump Test (Charge Section) (Cont'd)

Figure 20-61-11



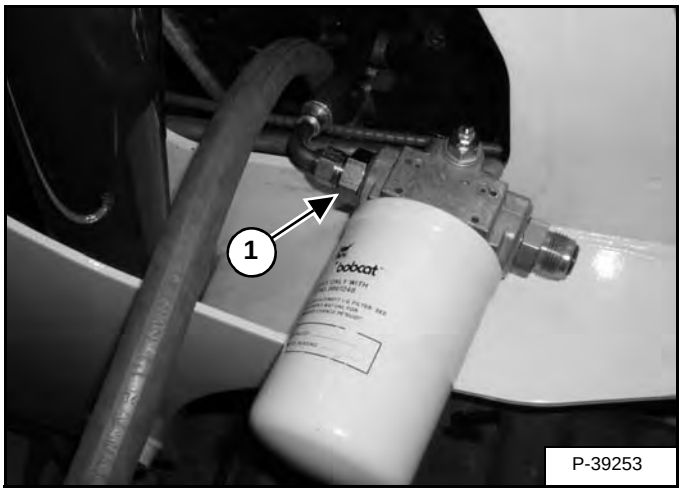
Install the elbow fitting 17KB 1212 (Item 1) **[Figure 20-61-11]** into the OUTLET of the charge pump.

Figure 20-61-12



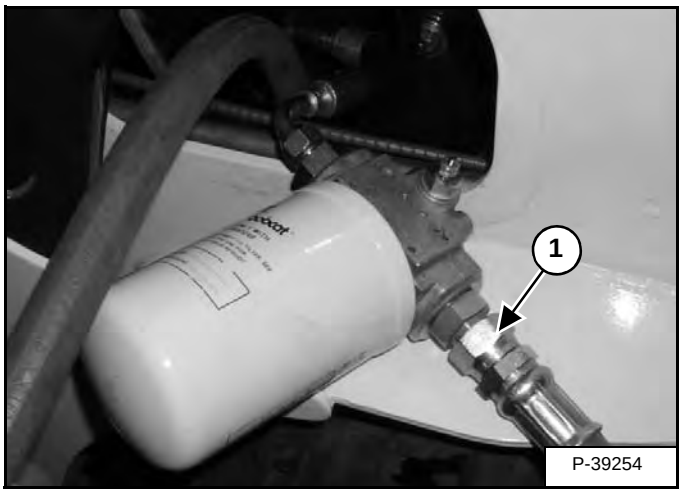
Connect the Inlet hose from the hydraulic tester (Item 1) **[Figure 20-61-12]** to the OUTLET fitting of the charge pump.

Figure 20-61-13



Connect the outlet fitting on the hydraulic filter (Item 1) **[Figure 20-61-13]** to the hose that was remove from the charge pump and routes to the back side of the hydrostatic pump.

Figure 20-61-14



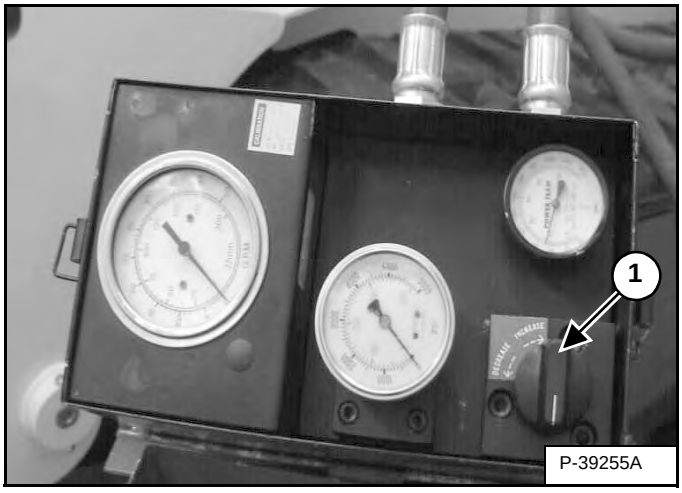
Connect the outlet hose on the hydraulic tester (Item 1) **[Figure 20-61-14]** to the inlet fitting on the hydraulic filter assembly.

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HYDRAULIC PUMP (STANDARD) (HIGH FLOW) (CONT'D)

Direct Pump Test (Charge Section) (Cont'd)

Figure 20-61-15



Be sure all connections are tight and that the hoses are not touching any moving parts before starting the loader **[Figure 20-61-15]**.

IMPORTANT

The hydraulic tester must be in the fully open position before you start the engine.

I-2024-0284

Start the engine and run at low idle RPM. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control (Item 1) on the tester to about 1000 PSI (6895 kPa). DO NOT exceed system relief pressure. Open the restrictor control and record the free flow (GPM) at full RPM.

Turn the restrictor down to system operating pressure. **DO NOT EXCEED SYSTEM RELIEF PRESSURE**. Refer to Hydraulic Schematics for pressure. The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \times 100$$

A low percentage may indicate a failed pump.

*Refer to (See Hydraulic System on Page SPEC-10-3.) for system relief pressure and full RPM.

*Refer to the Hydraulic Schematics for pump flow and RPM.

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HYDRAULIC PUMP (STANDARD) (HIGH FLOW) (CONT'D)

Direct Pump Test (High Flow Section)

The tools listed will be needed to do the following procedure:

MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit

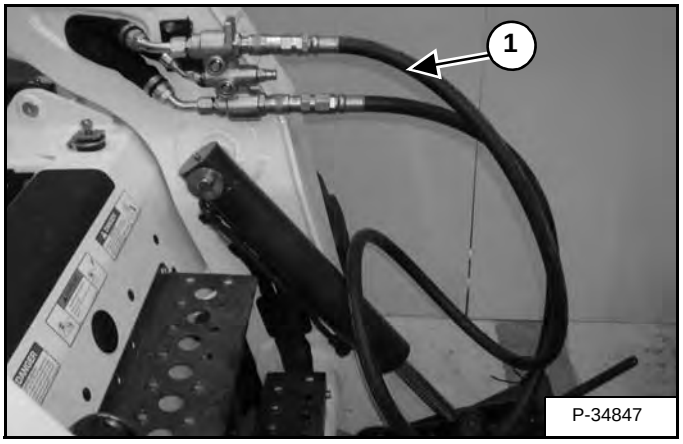
⚠ WARNING

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

W-2017-0286

Lift and block the loader. (See Procedure on Page 10-10-1.)

Figure 20-61-16



Install a jumper hose (Item 1) **[Figure 20-61-16]** onto the front auxiliary quick couplers.

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

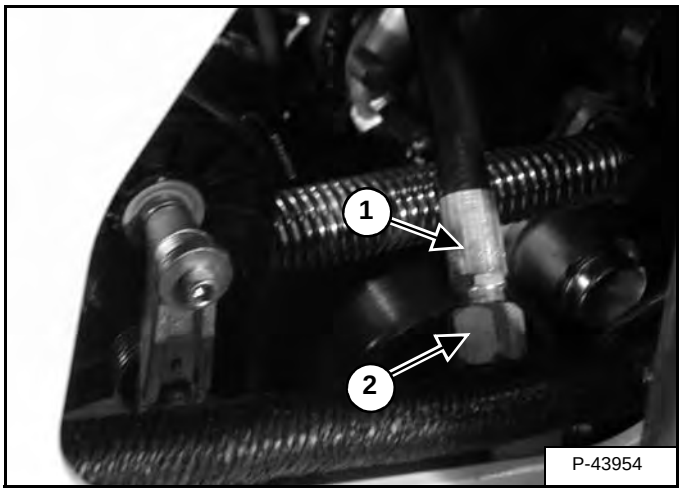
⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Raise the operator cab. (See Raising on Page 10-30-1.)

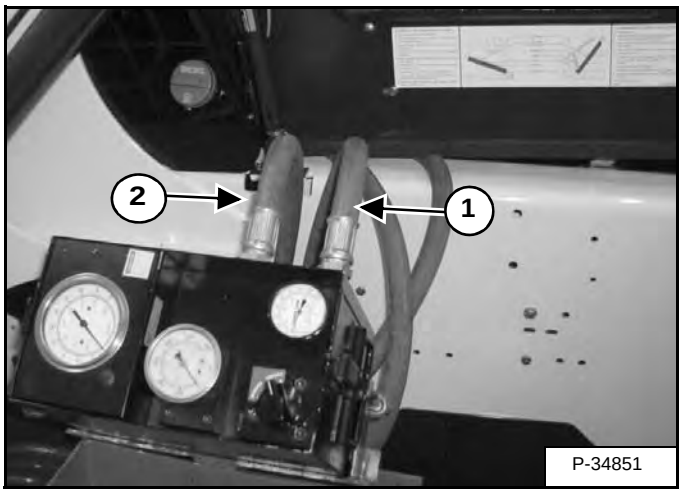
Figure 20-61-17



Remove the left side access cover.

Disconnect the high flow pump OUTLET hose (Item 1) from the fitting (Item 2) **[Figure 20-61-17]** on the tube line.

Figure 20-61-18



NOTE: When testing the hydraulic flow of a machine hoses must be at least 3/4 inch in diameter and connected directly to the hydraulic tester without using any type of "quick coupler" on the connection to the tester. Also make sure your hydraulic tester is capable of at least 50 GPM.

Connect the INLET hose (Item 1) **[Figure 20-61-18]** from the tester to the OUTLET hose (Item 1) **[Figure 20-61-17]** of the pump. Connect the OUTLET hose (Item 2) **[Figure 20-61-18]** from the tester to the fitting (Item 2) **[Figure 20-61-17]** on the tube line.

Lower the cab down.

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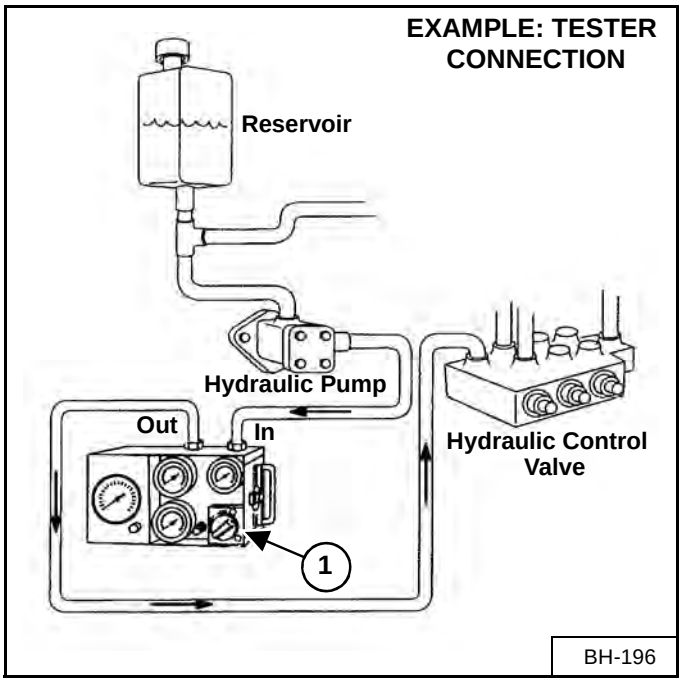
Direct Pump Test (High Flow Section) (Cont'd)

IMPORTANT

The hydraulic tester must be in the fully open position before you start the engine.

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Figure 20-61-19



Sample tester connection shown **[Figure 20-61-19]**.

This procedure will require a operator in the cab and one operator running the tester.

Start the engine and run at low idle RPM. Press the Front Auxiliary button. Press the High Flow button. Engage the front auxiliary with the trigger on the right handle. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control (Item 1) **[Figure 20-61-19]** clockwise on the tester to about 1000 PSI (69 bar).

NOTE: ***DO NOT EXCEED 3300 PSI.***

Turn the restrictor control clockwise on the tester to 3300 PSI and the flow should go to zero GPM. If the pressure readings are not obtained. (See High Flow Relief Valve Adjustment on Page 20-61-11.). If the pressure readings are correct, continue on to the next paragraph.

Open the restrictor control and record the free flow (GPM) at full RPM.

Record the flow (GPM) at 2500 PSI, this is the high pressure flow. The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \times 100$$

A low percentage may indicate a failed pump.

*Refer to (See Hydraulic System on Page SPEC-10-3.) for system relief pressure and full RPM.

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HYDRAULIC PUMP (STANDARD) (HIGH FLOW) (CONT'D)

High Flow Relief Valve Adjustment

The tools listed will be needed to do the following procedure:

MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit

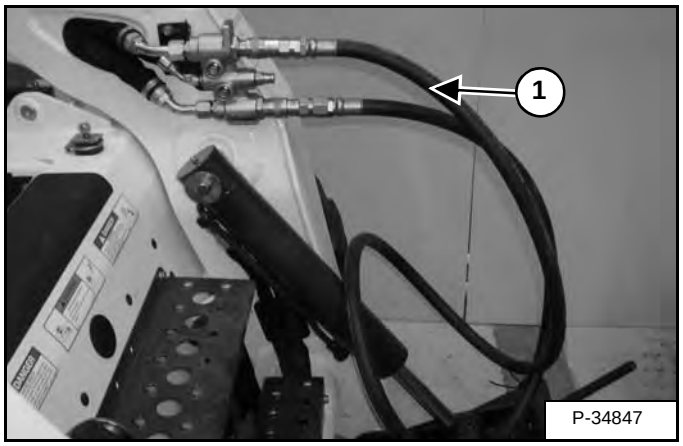
⚠ WARNING

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

W-2017-0286

Lift and block the loader. (See Procedure on Page 10-10-1.)

Figure 20-61-20



Install a jumper hose (Item 1) **[Figure 20-61-20]** onto the front auxiliary quick couplers.

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

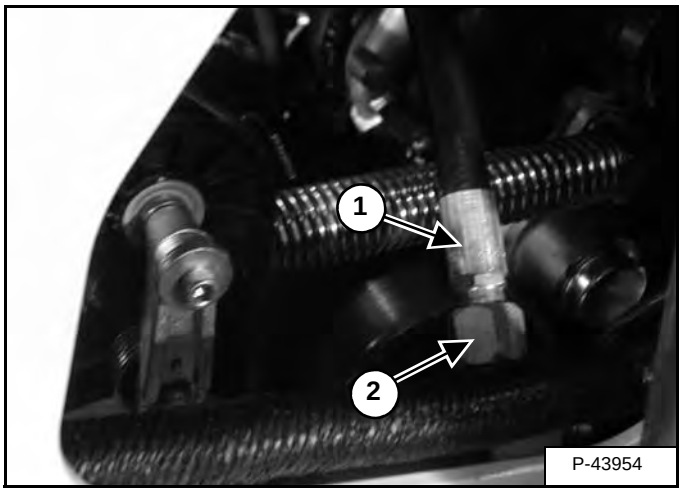
⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Raise the operator cab. (See Raising on Page 10-30-1.)

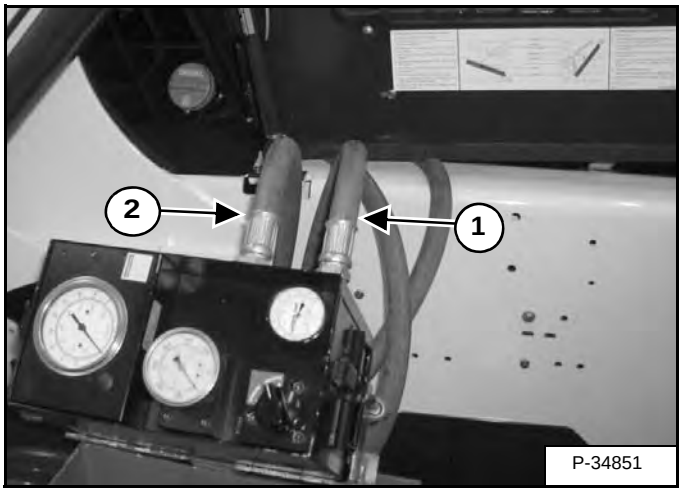
Figure 20-61-21



Remove the left side access cover.

Disconnect the high flow pump OUTLET hose (Item 1) **[Figure 20-61-21]** from the fitting (Item 2) **[Figure 20-61-21]** on the tube line.

Figure 20-61-22



NOTE: When testing the hydraulic flow of a machine hoses must be at least 3/4 inch in diameter and connected directly to the hydraulic tester without using any type of "quick coupler" on the connection to the tester. Also make sure your hydraulic tester is capable of at least 50 GPM.

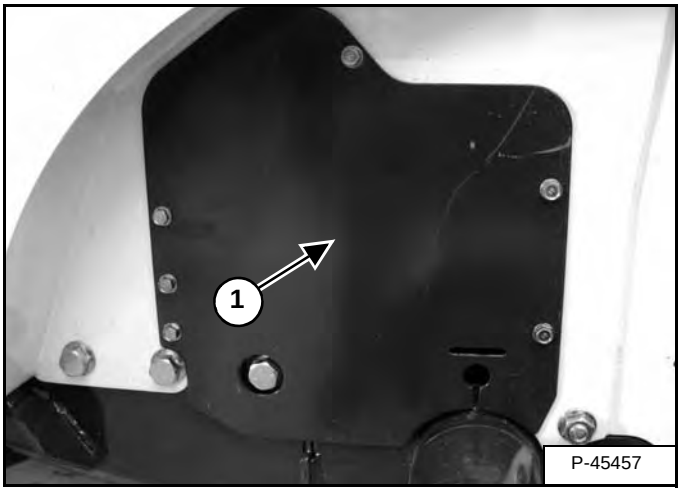
Connect the INLET hose (Item 1) **[Figure 20-61-22]** from the tester to the OUTLET hose (Item 1) **[Figure 20-61-21]** of the pump. Connect the OUTLET hose (Item 2) **[Figure 20-61-22]** from the tester to the tube line (Item 2) **[Figure 20-61-21]**.

Lower the cab down.

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High Flow Relief Valve Adjustment (Cont'd)

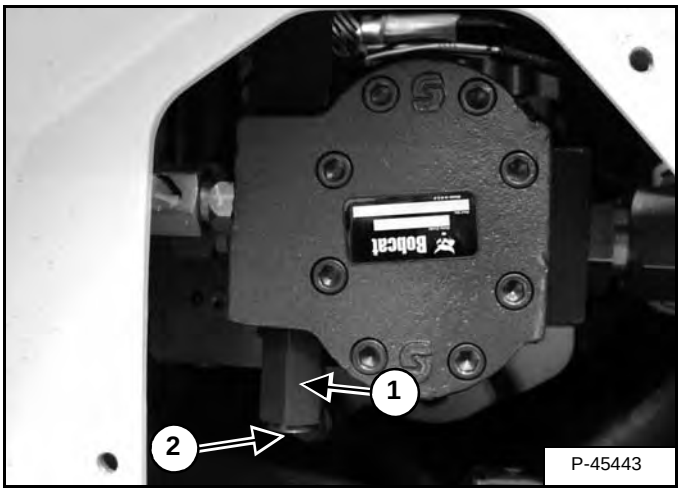
Figure 20-61-23



Remove the right rear tire. (See tire maintenance page 10-50-1).

Remove the gear pump access cover (Item 1) **[Figure 20-61-23]**.

Figure 20-61-24



Locate the high flow relief valve (Item 1) **[Figure 20-61-24]**.

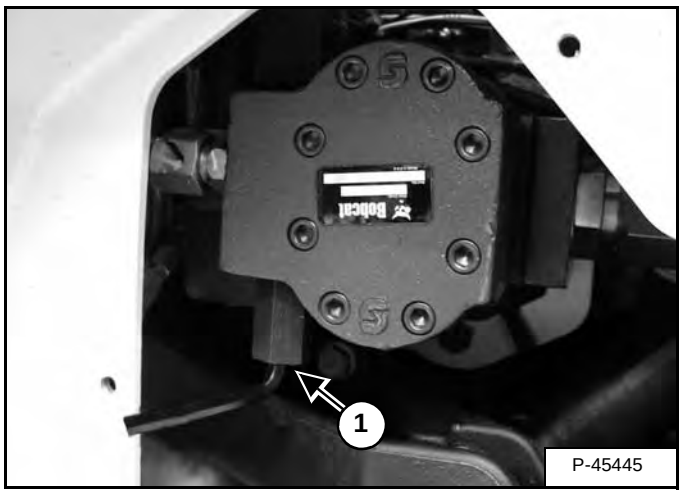
Remove the plug (Item 2) **[Figure 20-61-24]** located on the bottom of the high flow relief valve.

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HYDRAULIC PUMP (STANDARD) (HIGH FLOW) (CONT'D)

High Flow Relief Valve Adjustment (Cont'd)

Figure 20-61-25



Start the engine and run at low idle RPM. Press the Front Auxiliary button. Press the High Flow button. Engage the front auxiliary with the trigger on the right handle. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control clockwise on the tester to about 1000 PSI (69 bar).

NOTE: ***DO NOT EXCEED 3300 PSI.***

Turn the restrictor control clockwise on the tester to causing more restriction on the flow. The GPM should drop off slightly until the pressure reaches approximately 3100 PSI. At approximately 3100 PSI the flow should start decreasing rapidly until the pressure reaches 3250-3350 PSI. At 3250-3350 PSI the flow should be at 0 GPM. Turn the restrictor counterclockwise to free flow. Shut the front auxiliary hydraulics off.

If the specs from above are reached, the pump is OK.

If the pump is unable to reach 3300 PSI stop the engine. The relief screw (Item 1) **[Figure 20-61-25]** will need to be turned clockwise a 1/4 turn and retested with the procedure above. (1/4 turn equals approximately 200 PSI.)

NOTE: If the relief screw has been turned in 1/4 turn and the pressure remains the same, go to the high flow relief valve removal and installation section. (See High Flow Relief Valve Removal And Installation on Page 20-61-14.) If relief valve has been checked and is OK, go to the high flow pump disassembly and assembly section. (See Disassembly And Assembly on Page 20-61-21.)

If the pump reaches 3300 PSI and there is flow stop the engine. The relief screw must be turned counterclockwise 1/4 turn and retested with the procedure above.

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High Flow Relief Valve Removal And Installation

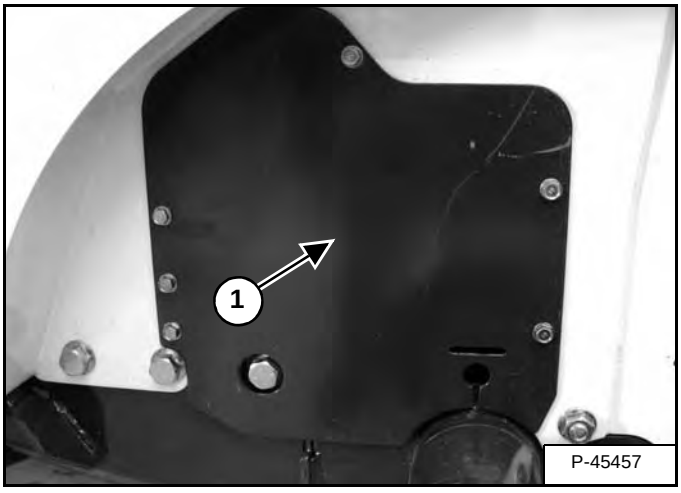
⚠ WARNING

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

W-2017-0286

Lift and block the loader. (See Procedure on Page 10-10-1.)

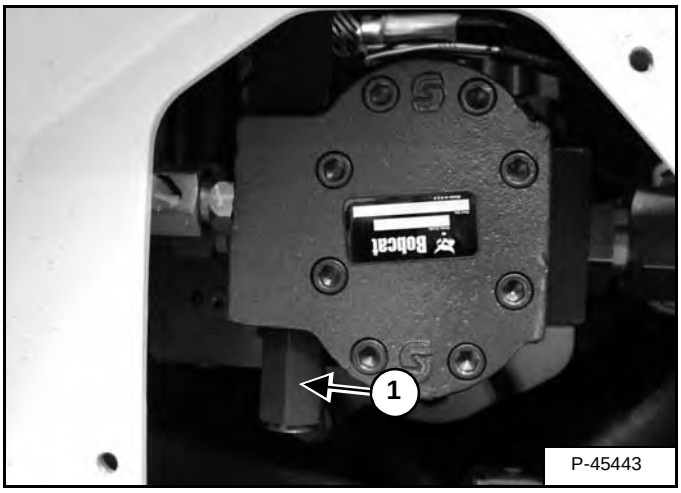
Figure 20-61-26



Remove the right rear tire. (See Mounting on Page 10-160-2.).

Remove the gear pump access cover (Item 1) **[Figure 20-61-26]**.

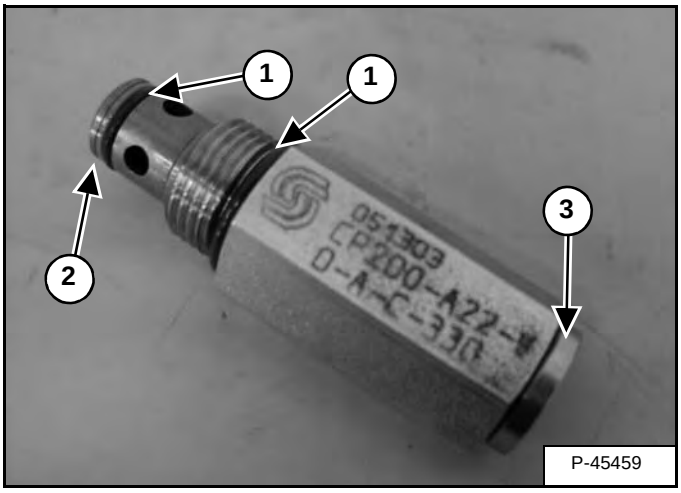
Figure 20-61-27



Remove the relief valve (Item 1) **[Figure 20-61-27]** from the pump.

Installation: Tighten the relief valve to 30-35 ft.-lb. (41-47 N•m) torque.

Figure 20-61-28



Inspect the relief valve and replace the two O-rings (Item 1) and washer (Item 2) **[Figure 20-61-28]**.

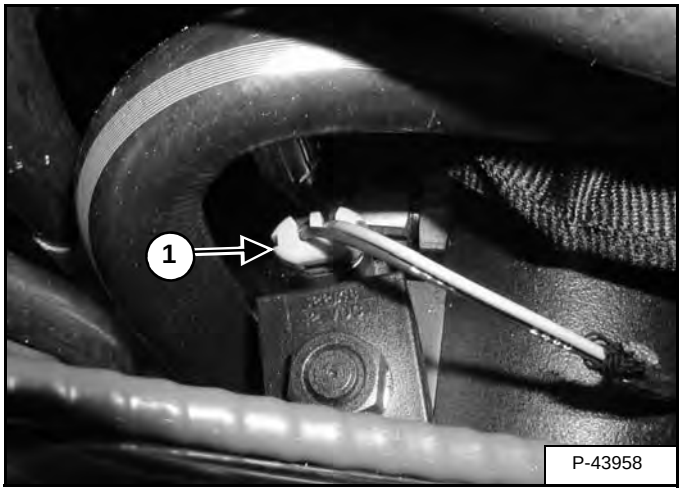
If the relief valve is bad, it must be replaced as a complete unit.

Remove the plug (Item 3) and inspect the O-ring **[Figure 20-61-28]** damage and replace as needed.

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Solenoid Removal And Installation

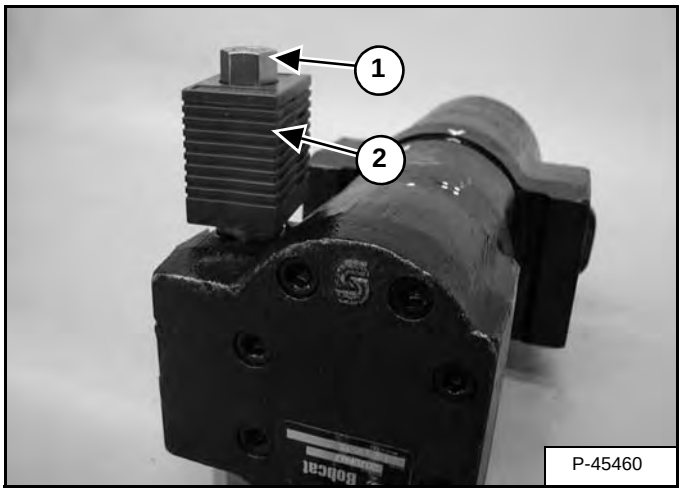
Figure 20-61-29



Remove right side access cover beside the lift cylinder.

At the right side access hole, disconnect the electrical connector (Item 1) **[Figure 20-61-29]** from the high flow pump solenoid.

Figure 20-61-30

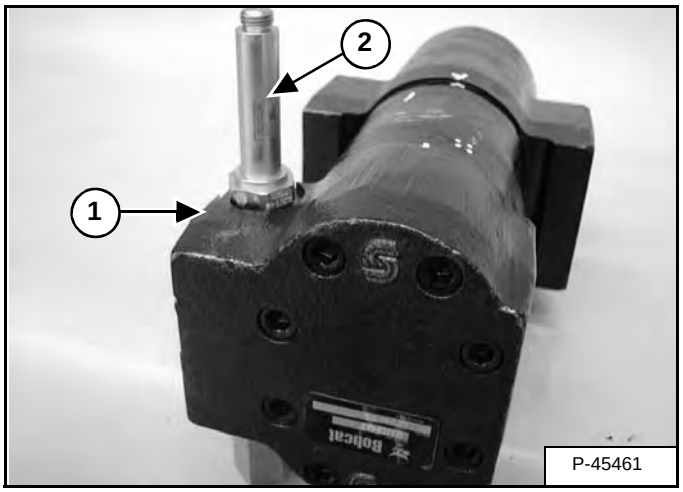


Remove the solenoid nut (Item 1) **[Figure 20-61-30]**.

Remove the solenoid (Item 2) **[Figure 20-61-30]**.

Installation: Tighten the solenoid nut to 48-72 in - lb. (5-8 N•m)

Figure 20-61-31

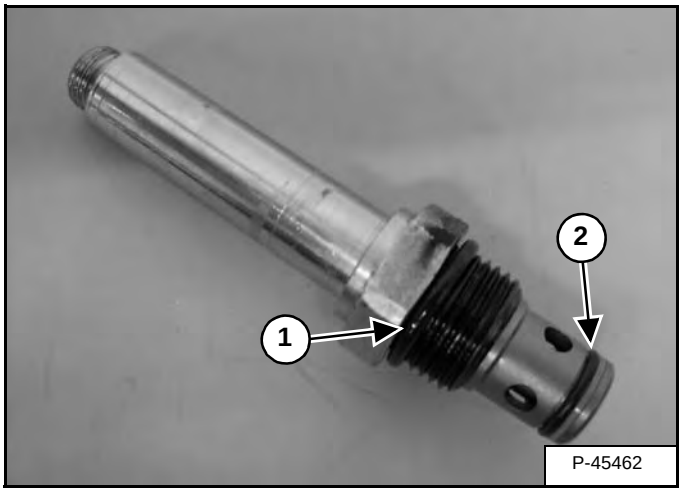


NOTE: Mark the pump housing (Item 1) [Figure 20-61-31] for proper installation of the solenoid valve cartridge.

Remove the valve cartridge (Item 1) **[Figure 20-61-31]**.

Installation: Tighten the solenoid valve to 35-40 ft.-lb. (47-54 N•m).

Figure 20-61-32



Inspect the O-ring (Item 1) **[Figure 20-61-32]** and replace as needed.

Inspect the O-ring and back-up washer (Item 2) **[Figure 20-61-32]** and replace as needed.

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Removal And Installation



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

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Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Stop the engine. Raise the seat bar.

Lift and block the rear of the loader. (See Procedure on Page 10-10-1.)

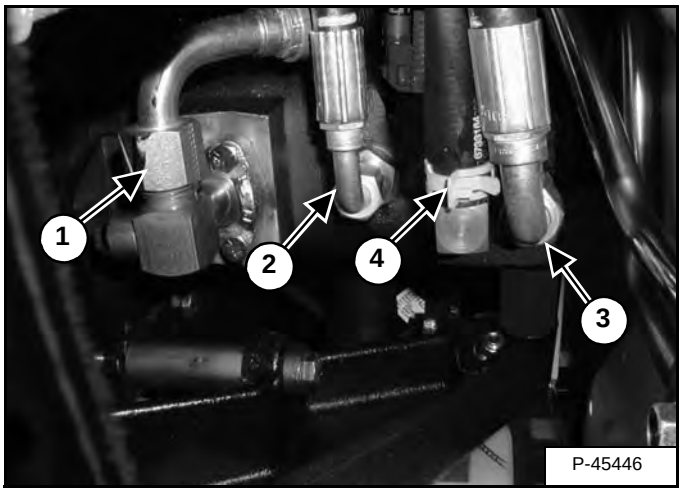
Raise the operator cab. (See Raising on Page 10-30-1.)

Drain the hydraulic fluid from the reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-2.)

Open the rear door of the loader.

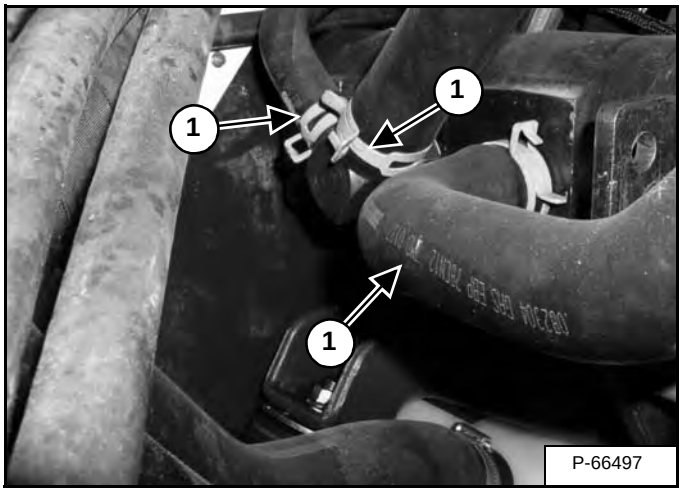
Remove the hoses from the Power Bob-Tach block. (If so equipped.) (See Removal And Installation on Page 20-130-1.)

Figure 20-61-33



At the back side of the gear pump, disconnect and cap the hose from the outlet fitting (Item 1) of the standard flow pump. Disconnect and cap the hose (Item 2) from the charge pump. Disconnect and cap the hoses from the High Flow pump outlet fitting (Item 3) and the low pressure hose (Item 4) **[Figure 20-61-33]**.

Figure 20-61-34



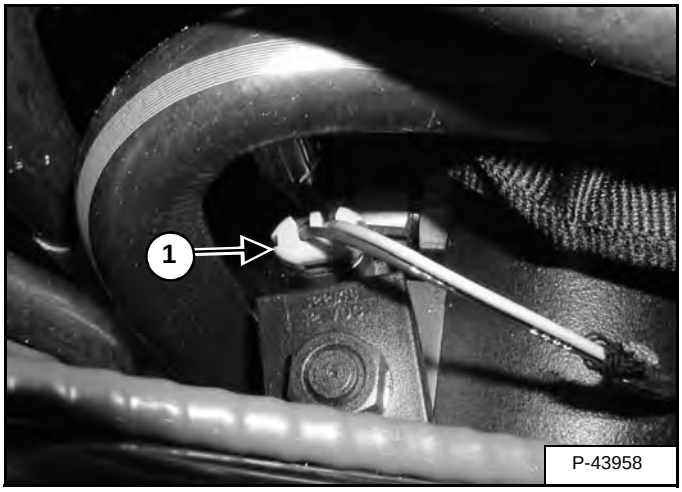
At the front side of the gear pump, disconnect and cap the three hoses (Item 1) from the inlet side of the hydraulic pump **[Figure 20-61-34]**.

Disconnect the inlet hose (Item 3) from the second inlet fitting (Item 4) **[Figure 20-61-34]**.

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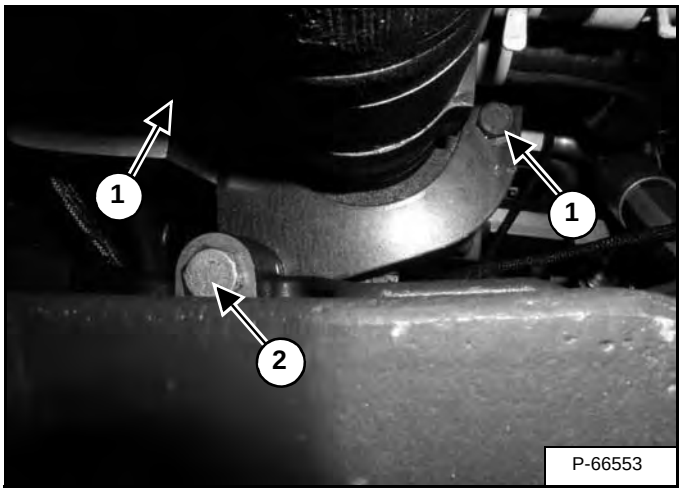
Removal And Installation (Cont'd)

Figure 20-61-35



At the right side access hole, disconnect the electrical connector (Item 1) **[Figure 20-61-35]** from the high flow pump solenoid.

Figure 20-61-36



Remove the two mounting bolts (Item 1) **[Figure 20-61-36]** from the hydraulic pump.

Installation: Tighten the mounting bolts to 65-70 ft.-lb. (88-95 N•m) torque.

At the bottom side of the gear pump, remove the pump support bracket bolt (Item 2) **[Figure 20-61-36]** from pump support bracket.

Installation: Tighten the pump support bracket bolt to 175-190 ft.-lb. (237-257 N•m) torque.

Remove the hydraulic pump from the hydrostatic pump.

Remove the O-ring from the hydrostatic pump.

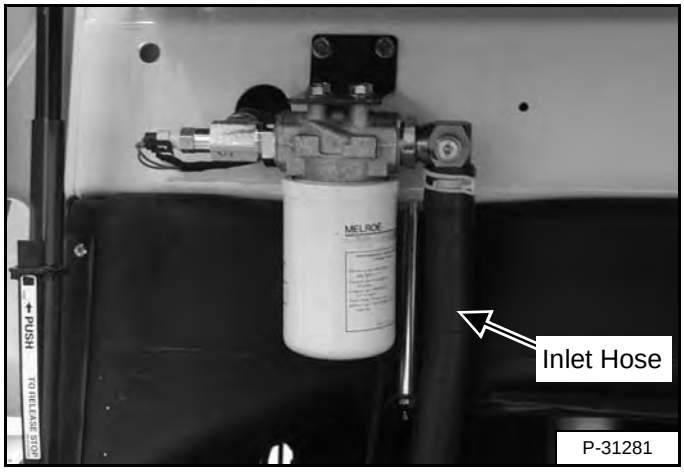
Installation: Use a new O-ring when installing the hydraulic pump.

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Hydraulic Pump Start Up

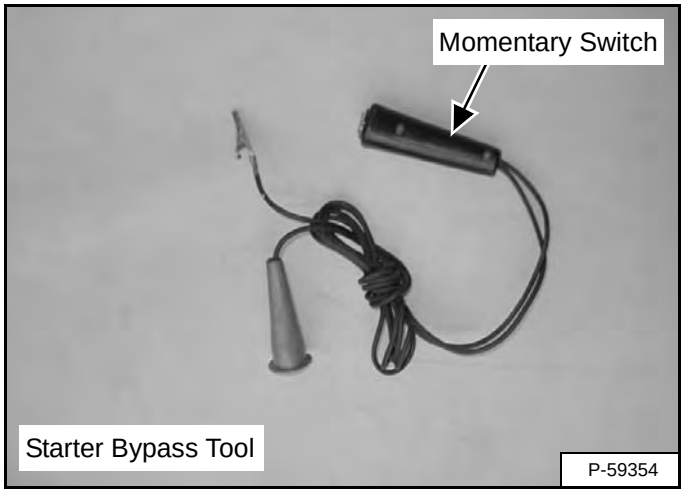
NOTE: This procedure to prevent a dry start up of the hydraulic pump.

Figure 20-61-37



Disconnect the pump inlet hose connection at the filter head. Fill the pump inlet and hose completely with hydraulic fluid. Reconnect the hose **[Figure 20-61-37]**.

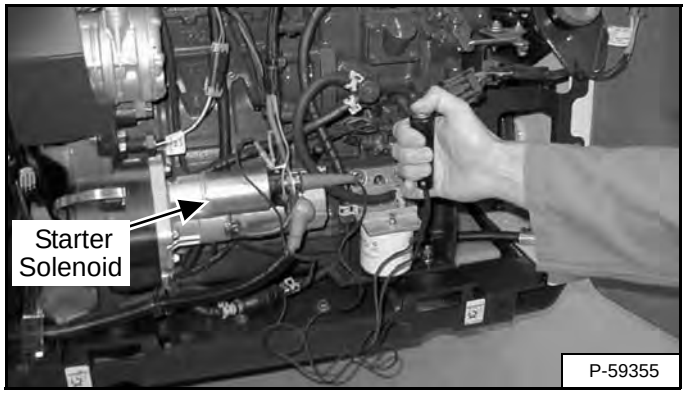
Figure 20-61-38

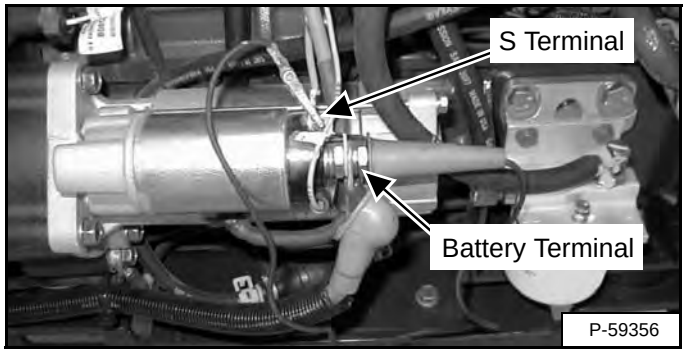


[Figure 20-61-38] To crank the engine without starting, the machine key switch can be bypassed. Obtain a starter bypass tool from a local source which can be used as a universal connection to remotely crank the engine without starting.

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 20-61-39





Connect the starter bypass tool to the starter solenoid battery terminal and S terminal. Crank the engine for 15 seconds, then stop for at least 30 seconds. Again, crank the engine for 15 seconds. Remove the starter bypass tool **[Figure 20-61-39]**.

Start the loader from the operators cab and run the engine at low idle for 1 - 2 minutes without operating the hydraulics.

After operating the engine at low idle, Remove the lift arm support device and fully raise and lower the loader lift arms 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 loader parked on a level surface and lift arms down, check and fill the hydraulic reservoir as required. Check for hydraulic leaks.

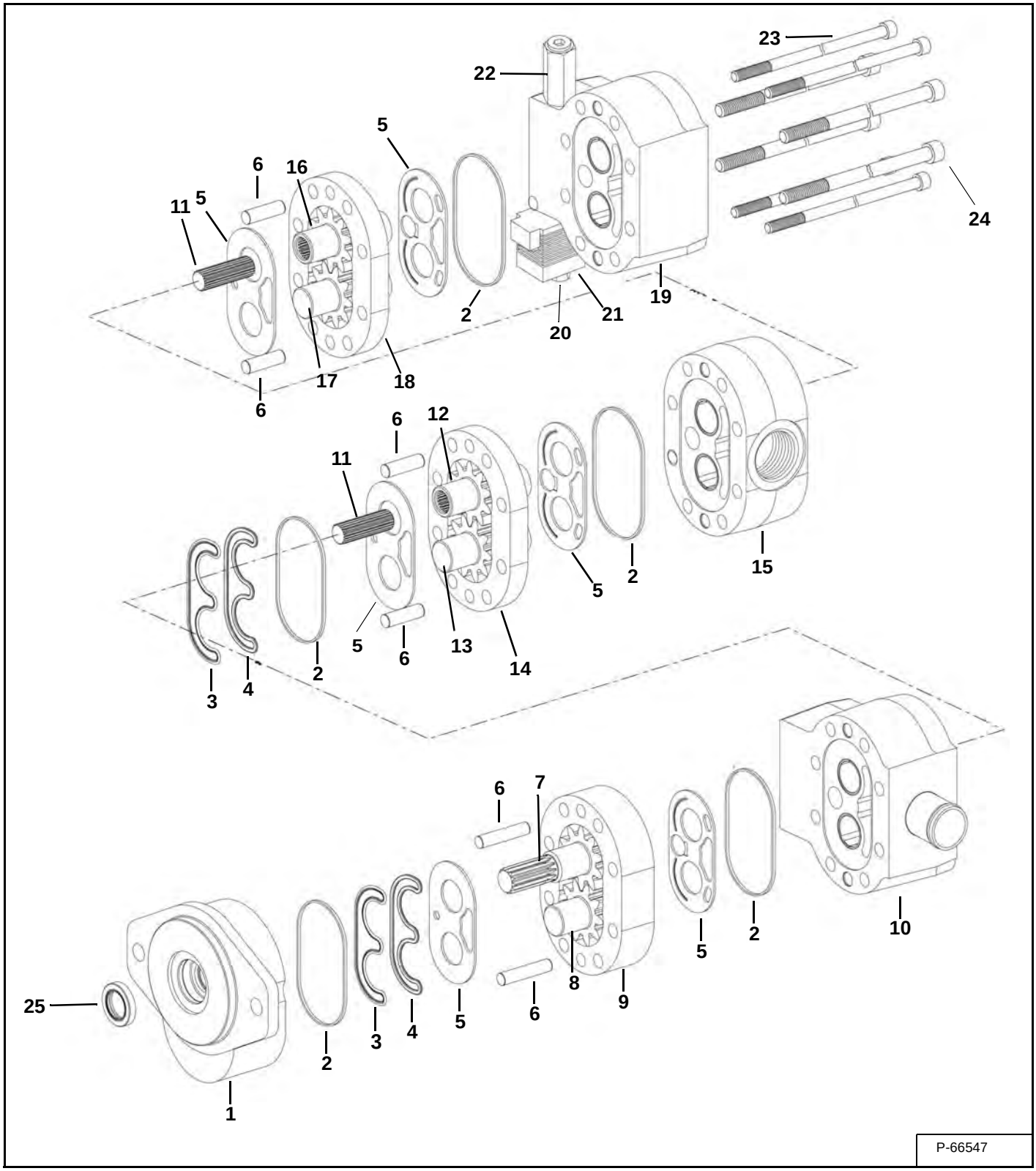
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Parts Identification

Figure 20-61-40



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Parts Identification (Cont'd)

The items listed below refer to Page 20-61-20 **[Figure 20-61-40]**.

1. Pump End Section (Auxiliary Pump)
2. Section Seal
3. Pre-Load Seal
4. Load Seal
5. Wear Plate
6. Alignment Pins
7. Drive Gear (Auxiliary Pump)
8. Idler Gear (Auxiliary Pump)
9. Pump Center Section (Auxiliary Pump)
10. Pump End Section (Auxiliary Pump)
11. Spline Shaft
12. Drive Gear (Charge Pump)
13. Idler Gear (Charge Pump)
14. Pump Center Section (Charge Pump)
15. Pump End Section (Charge Pump)
16. Drive Gear (High Flow Pump)
17. Idler Gear (High Flow Pump)
18. Pump Center Section (High Flow Pump)
19. Pump End Section (High Flow Pump)
20. High Flow Solenoid Nut
21. High Flow Solenoid
22. High Flow Relief Valve
23. Bolts (4)
24. Bolts (4)
25. Shaft Seal

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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Mark the pump sections for correct assembly.

To disassemble and assemble the hydraulic pump, follow the Parts Identification page **[Figure 20-61-40]** for proper placement of components along with the information below.

NOTE: A seal kit is available through Bobcat Service Parts.

Assembly: Tighten the eight pump housing bolts (Item 23) and (Item 24) **[Figure 20-61-40]** to 37 ft.-lb. (50 N•m) torque.

NOTE: Position the wear plate (Item 5) and (Item 10) [Figure 20-61-40] inlets and traps as shown with the bronze side toward the gears on all wear plates.

NOTE: Inspect all gears, shafts and pump end sections. If any of these components have excessive wear or damage is visible, the complete pump must be replaced.

NOTE: The relief valve and the solenoid can be replaced along with the o-rings and backup washers.

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HYDRAULIC PUMP (SJC)

Description

The hydraulic gear pump is attached to the end of the hydrostatic pumps and are located on the right side of the loader between the hydraulic control valve and the engine.

The hydraulic gear pump is a combination of gear pumps that provide hydraulic flow to several hydraulic systems.

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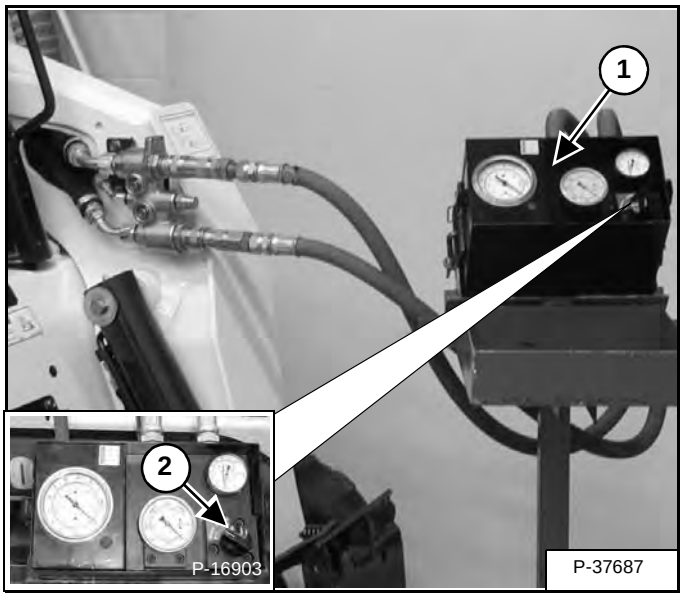
HYDRAULIC PUMP (SJC) (CONT'D)

Pump Test At Quick Couplers

The tools listed will be needed to do the following procedure:

MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit

Figure 20-70-41



NOTE: When testing the hydraulic flow of a machine hoses must be at least 3/4 inch in diameter and connected directly to the hydraulic tester without using any type of "quick coupler" on the connection to the tester. Also make sure your hydraulic tester is capable of at least 50 GPM.

Install a hydraulic tester (Item 1) **[Figure 20-70-41]** onto the front auxiliary quick couplers.

This procedure will require a operator in the cab and one operator running the tester.

Start the engine and run at low idle RPM. Press the Front Auxiliary button. Engage the front auxiliary with the trigger on the right handle. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control clockwise on the tester so it reads about a 1000 PSI (69 bar).

NOTE: *DO NOT EXCEED 3300 PSI.*

Turn the restrictor control (Item 2) **[Figure 20-70-41]** on the tester counterclockwise to obtain free flow, the flow should be approximately 20 GPM. Start turning the restrictor clockwise, causing more restriction on the flow. The GPM should drop off slightly until the pressure reaches approximately 2800 PSI. At approximately 2800 PSI the flow should start decreasing rapidly until the pressure reaches 3250-3300 PSI. At 3250-3300 PSI the flow should be at 0 GPM. Turn the restrictor (Item 2) **[Figure 20-70-41]** counterclockwise to free flow. Shut the front auxiliary hydraulics off.

If flow and pressure specs are not obtained, go to Direct Pump Testing. (See Direct Pump Test (Standard Section) on Page 20-70-3.)

*Refer to (See Hydraulic System on Page SPEC-10-3.) for system relief pressure and full RPM.

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Direct Pump Test (Standard Section)

The tools listed will be needed to do the following procedure:

MEL1563 or 6689779 - Remote Start Tool
MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit

⚠ WARNING

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

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Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

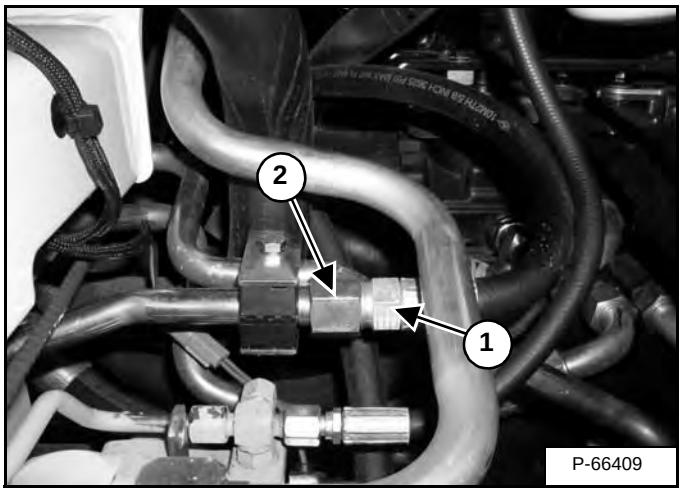
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Raise the operator cab. (See Raising on Page 10-30-1.)

Open the rear door of the loader.

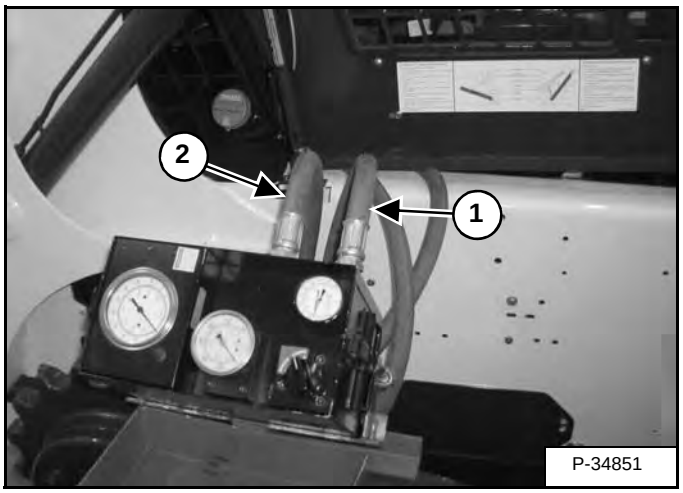
Connect the remote start tool. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.)

Figure 20-70-42



Disconnect the OUTLET hose (Item 1) **[Figure 20-70-42]** that comes from the gear pump, and connects to the tubeline on the top of the control valve.

Figure 20-70-43



Connect the INLET hose (Item 1) **[Figure 20-70-43]** from the tester to the OUTLET hose (Item 1) **[Figure 20-70-42]** of the pump. Connect the OUTLET hose (Item 2) **[Figure 20-70-43]** from the tester to the tubeline (Item 2) **[Figure 20-70-42]** on the top of the control valve.

IMPORTANT

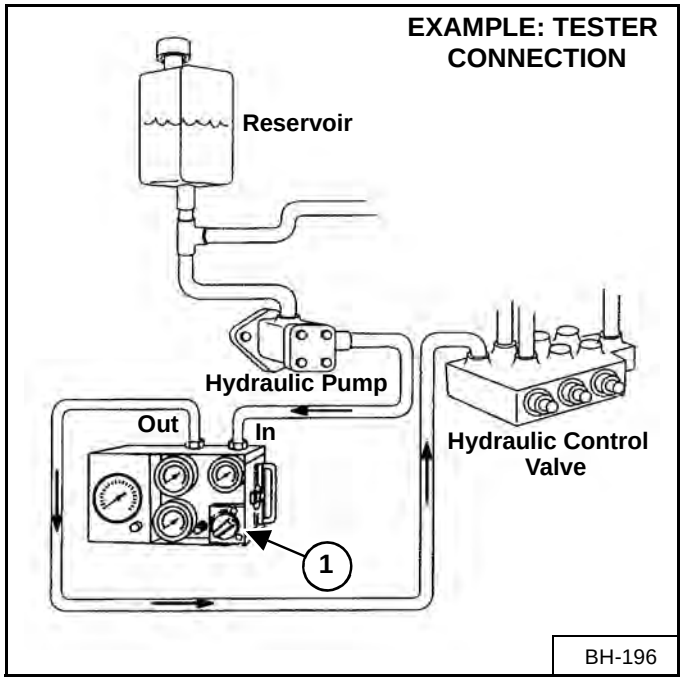
The hydraulic tester must be in the fully open position before you start the engine.

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Direct Pump Test (Standard Section) (Cont'd)

Figure 20-70-44



Sample tester connection shown **[Figure 20-70-44]**.

Start the engine and run at low idle RPM. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control (Item 1) **[Figure 20-70-44]** on the tester to about 1000 PSI (6895 kPa). DO NOT exceed system relief pressure. Open the restrictor control and record the free flow (GPM) at full RPM.

Push the maximum/variable flow switch (on the remote start tool) to engage the front auxiliary hydraulics, the light will come ON. Push the button (on the right control lever) for fluid flow to the quick coupler (fluid pressure will go over main relief). Record the highest pressure (PSI) and flow (GPM). The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \times 100$$

A low percentage may indicate a failed pump.

*Refer to (See Hydraulic System on Page SPEC-10-3.) for system relief pressure and full RPM.

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Direct Pump Test (Charge Section)

The tools listed will be needed to do the following procedure:

MEL1563 or 6689779 - Remote Start Tool
MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit
6661247 - Filter Assembly
17 KB 1212 - Elbow Fitting
15 KB 1212 - Straight Fitting
15 KB 0812 - Reducer Fitting

⚠ WARNING

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

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Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

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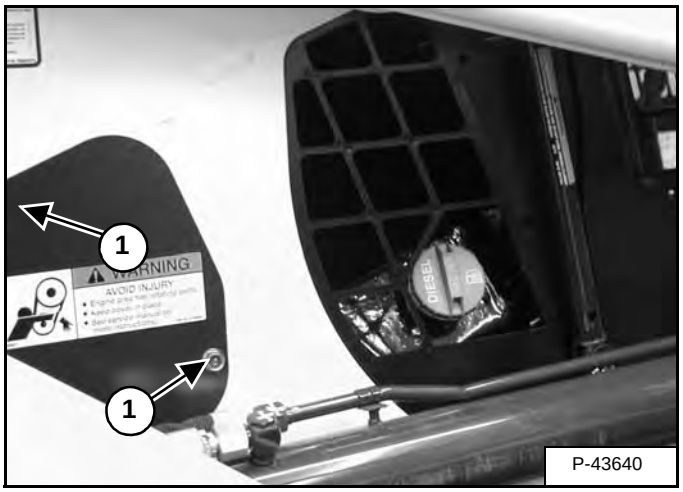
NOTE: The fluid from the charge pump must be filtered after it passes through the Hydraulic Tester, to prevent any contamination to the Hydrostatic Pumps.

Raise the operator cab. (See Raising on Page 10-30-1.)

Open the rear door of the loader.

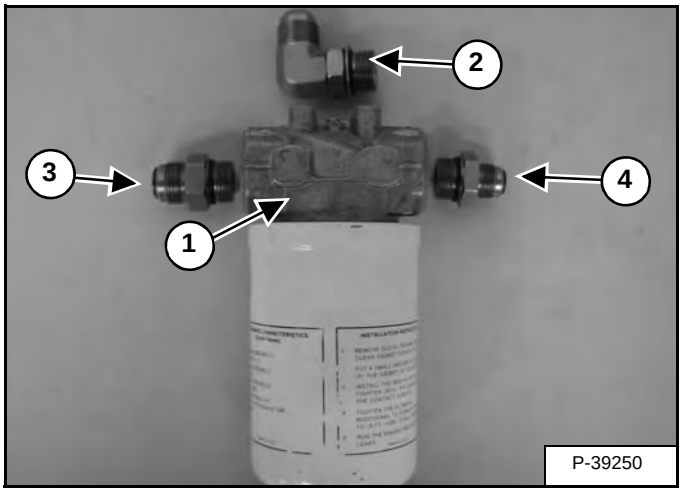
Connect the remote start tool. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.)

Figure 20-70-45



Remove the mount bolts (Item 1) **[Figure 20-70-45]** from the right side access panel. Remove the panel.

Figure 20-70-46

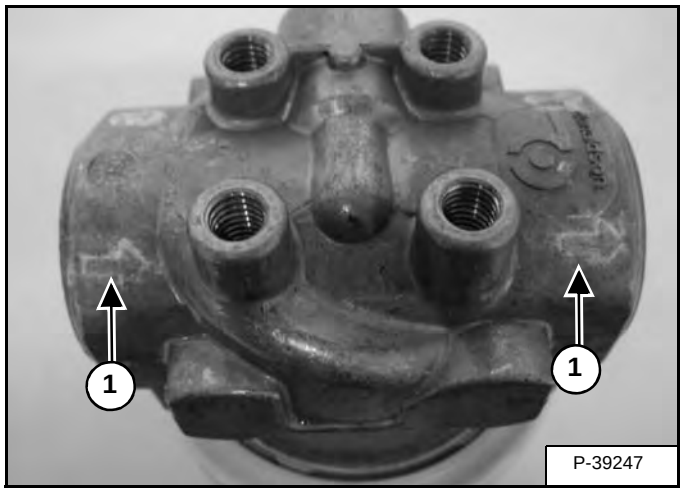


Assemble the filter assembly (Item 1), elbow fitting (Item 2), straight fitting (Item 3) and the reducer fitting (Item 4) **[Figure 20-70-46]**.

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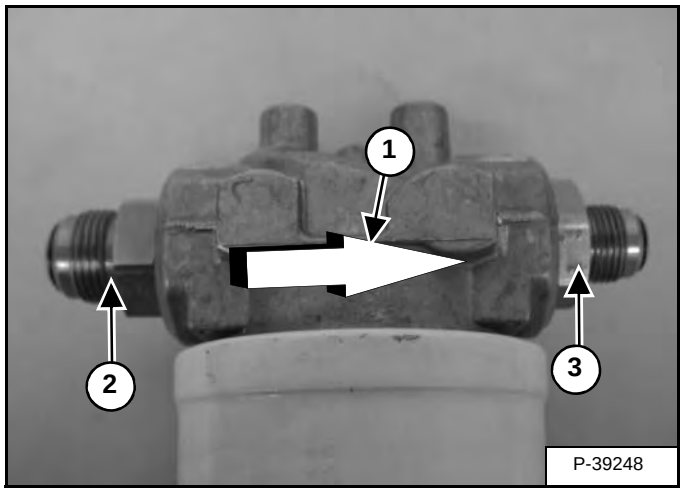
Direct Pump Test (Charge Section) (Cont'd)

Figure 20-70-47



Determine the proper direction of oil flow through the filter housing (Item 1) **[Figure 20-70-47]** and **[Figure 20-70-48]**.

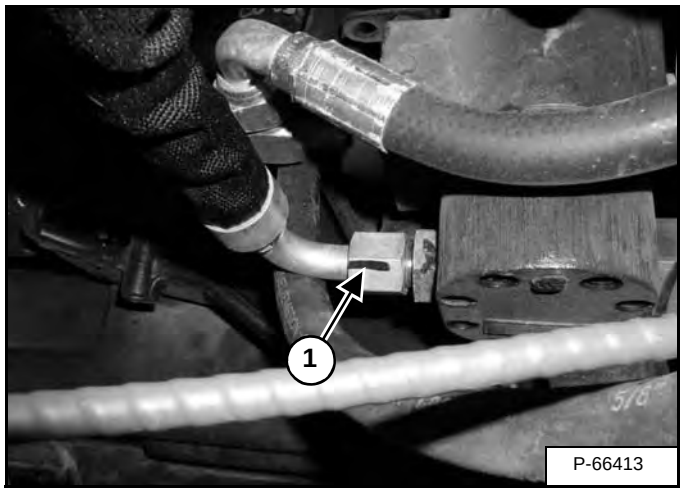
Figure 20-70-48



Install the fitting (15KB 1212-Straight Fitting) (Item 2) **[Figure 20-70-48]** in the filter housing inlet.

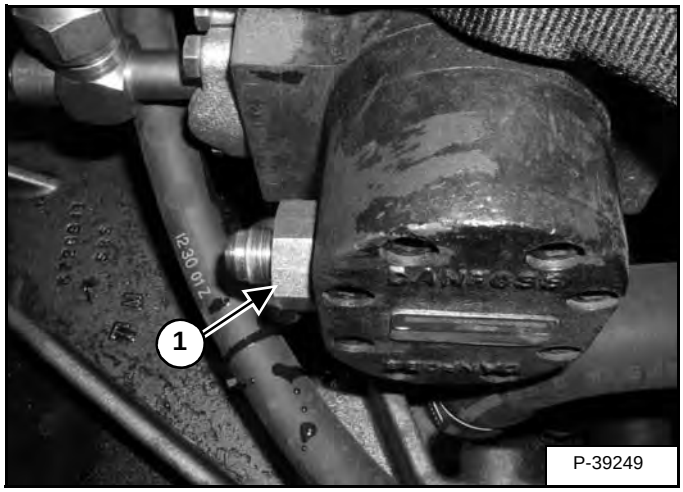
Install the fitting (15KB 0812-Reducer Fitting) (Item 3) **[Figure 20-70-48]** in the filter housing outlet.

Figure 20-70-49



Disconnect the OUTLET hose (Item 1) **[Figure 20-70-49]**.

Figure 20-70-50

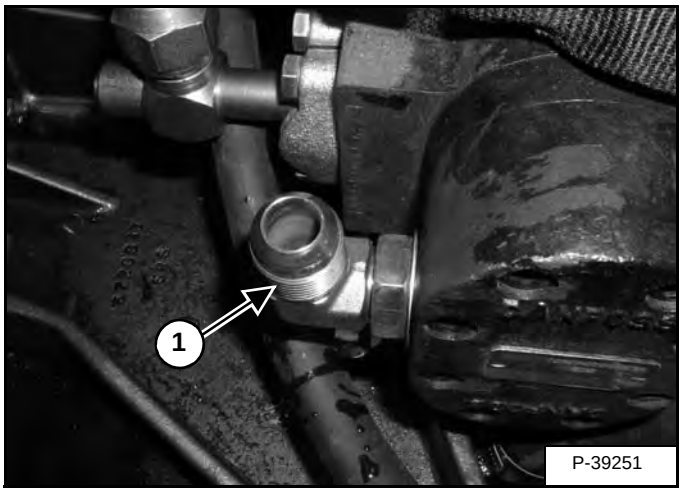


Remove the OUTLET fitting (Item 1) **[Figure 20-70-50]** from the charge pump.

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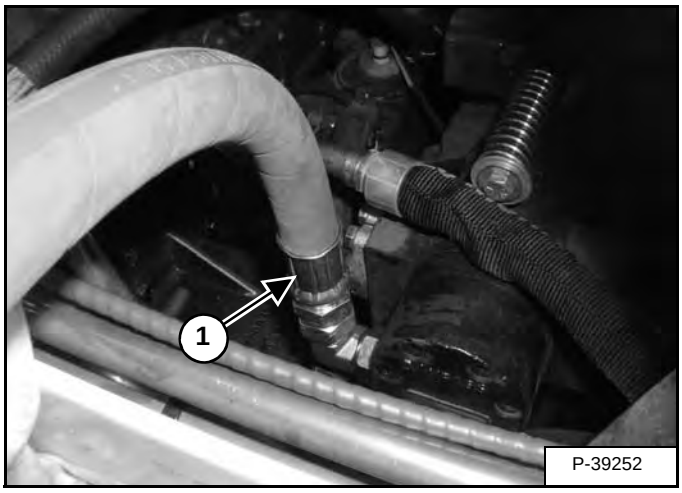
Direct Pump Test (Charge Section) (Cont'd)

Figure 20-70-51



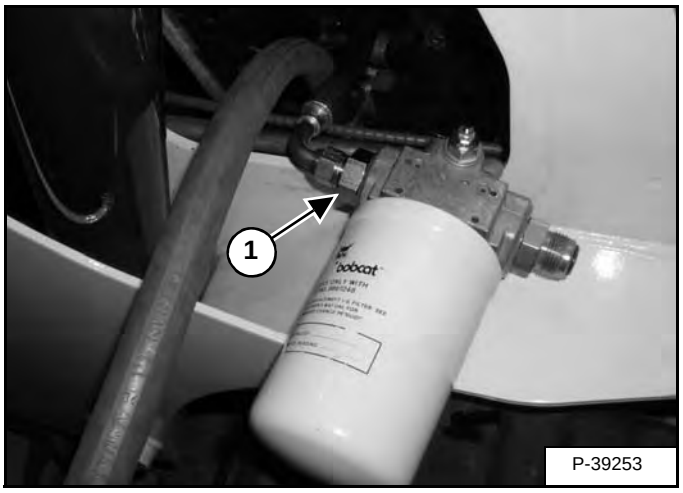
Install the elbow fitting 17KB 1212 (Item 1) **[Figure 20-70-51]** into the OUTLET of the charge pump.

Figure 20-70-52



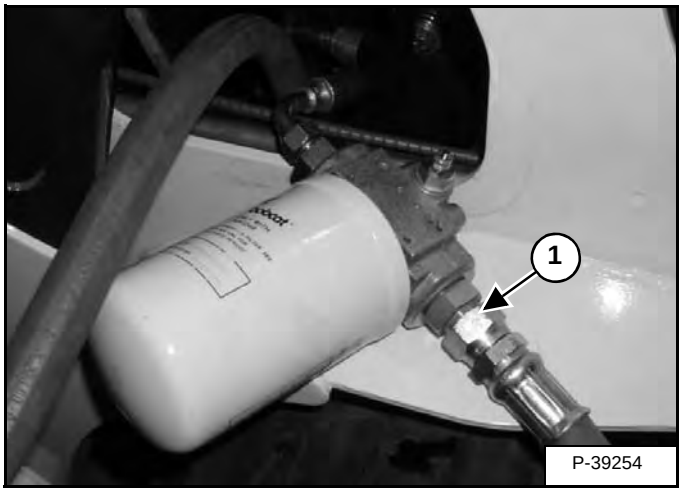
Connect the Inlet hose from the hydraulic tester (Item 1) **[Figure 20-70-52]** to the OUTLET fitting of the charge pump.

Figure 20-70-53



Connect the outlet fitting on the hydraulic filter (Item 1) **[Figure 20-70-53]** to the hose that was remove from the charge pump and routes to the back side of the hydrostatic pump.

Figure 20-70-54

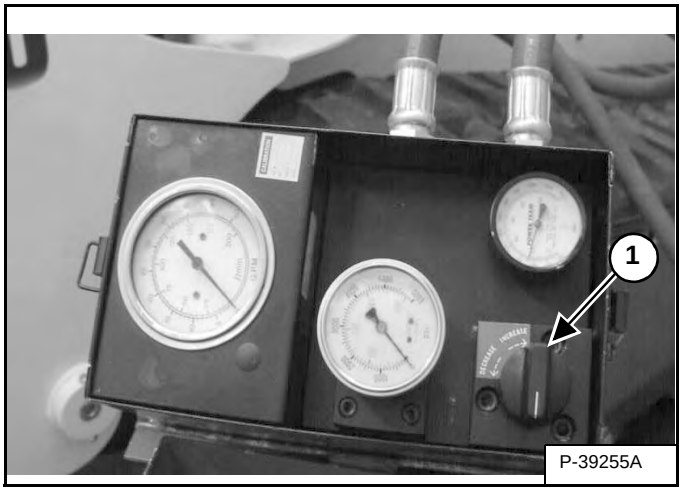


Connect the outlet hose on the hydraulic tester (Item 1) **[Figure 20-70-54]** to the inlet fitting on the hydraulic filter assembly.

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Direct Pump Test (Charge Section) (Cont'd)

Figure 20-70-55



Be sure all connections are tight and that the hoses are not touching any moving parts before starting the loader **[Figure 20-70-55]**.

IMPORTANT

The hydraulic tester must be in the fully open position before you start the engine.

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Start the engine and run at low idle RPM. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control (Item 1) on the tester to about 1000 PSI (6895 kPa). DO NOT exceed system relief pressure. Open the restrictor control and record the free flow (GPM) at full RPM.

Turn the restrictor down to system operating pressure. **DO NOT EXCEED SYSTEM RELIEF PRESSURE**. Refer to Hydraulic Schematics for pressure. The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \times 100$$

A low percentage may indicate a failed pump.

*Refer to (See Hydraulic System on Page SPEC-10-3.) for system relief pressure and full RPM.

*Refer to the Hydraulic Schematics for pump flow and RPM.

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Removal And Installation



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Stop the engine. Raise the seat bar.

Lift and block the rear of the loader. (See Procedure on Page 10-10-1.)

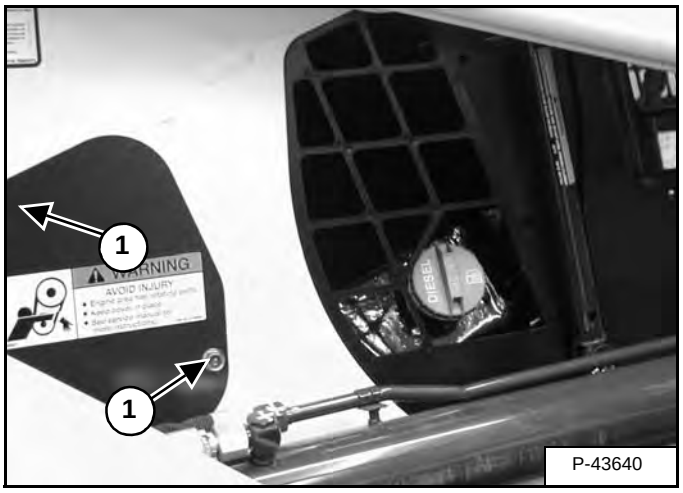
Raise the operator cab. (See Raising on Page 10-30-1.)

Drain the hydraulic fluid from the reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-2.)

Open the rear door of the loader.

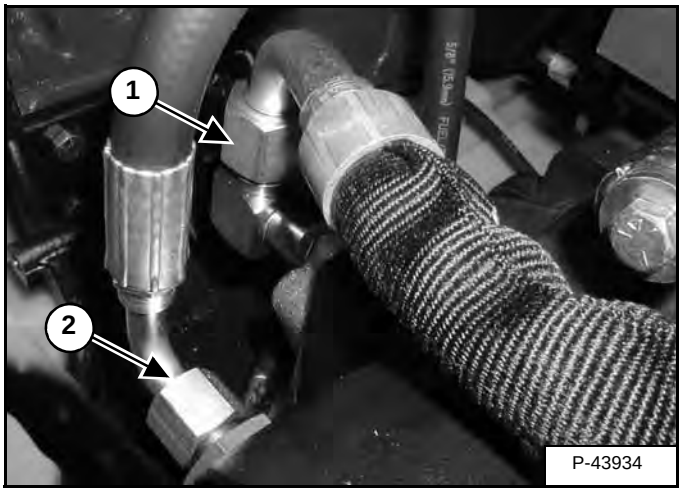
Remove the Power Bob-Tach block if equipped. (See Removal And Installation on Page 20-130-1.)

Figure 20-70-56



Remove the mount bolts (Item 1) **[Figure 20-70-56]** from the right side access panel. Remove the panel.

Figure 20-70-57



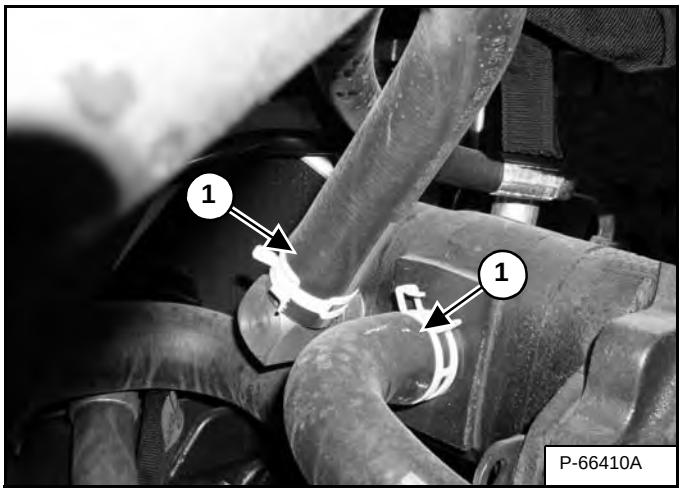
Disconnect and cap the hose from the outlet fitting (Item 1) **[Figure 20-70-57]** of the hydraulic pump.

Disconnect and cap the hose from the outlet fitting (Item 2) **[Figure 20-70-57]** of the hydraulic charge pump.

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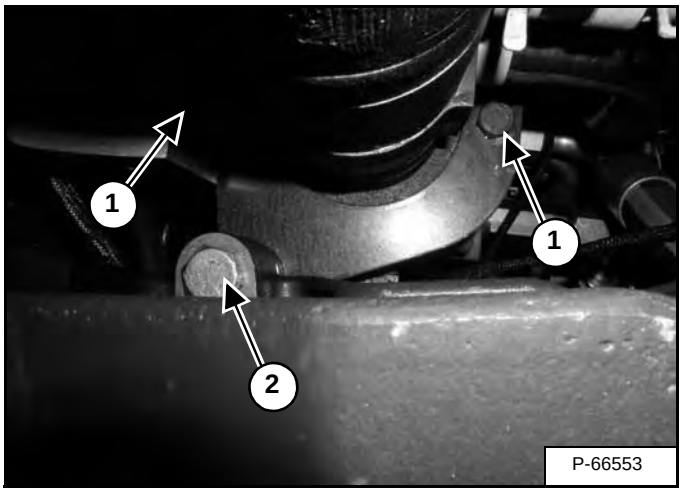
Removal And Installation (Cont'd)

Figure 20-70-58



Disconnect the two inlet hoses (Item 1) **[Figure 20-70-58]** from the front of the hydraulic pump.

Figure 20-70-59



Remove the two pump mounting bolts (Item 1) **[Figure 20-70-59]** from the hydraulic pump.

Installation: Tighten the mounting bolts to 65-70 ft.-lb. (88-95 N•m) torque.

At the bottom side of the gear pump, remove the pump bolt (Item 2) **[Figure 20-70-59]** from pump support bracket.

Installation: Tighten the pump support bracket bolt to 175-190 ft.-lb. (237-257 N•m) torque.

Remove the hydraulic pump from the hydrostatic pump **[Figure 20-70-59]**.

Remove the O-ring from the hydrostatic pump.

Installation: Use a new O-ring when installing the hydraulic pump.

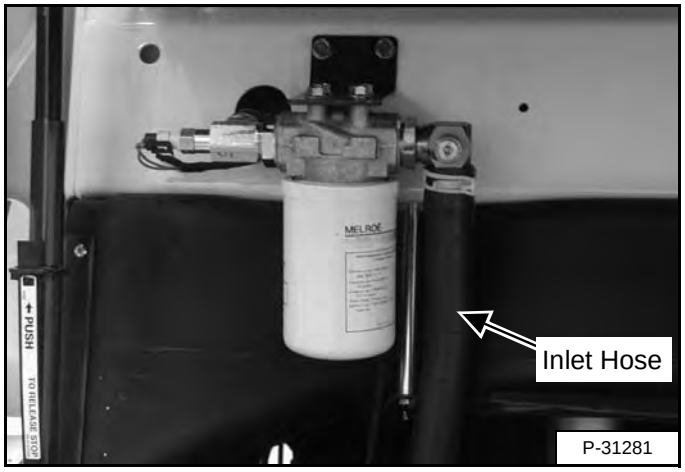
For the proper Hydraulic Pump Disassembly And Assembly procedure. (See Disassembly And Assembly on Page 20-70-13.)

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Hydraulic Pump Start Up

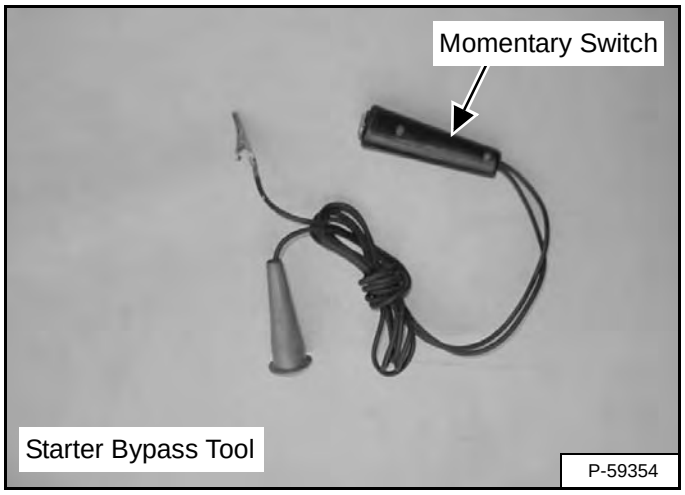
NOTE: This procedure to prevent a dry start up of the hydraulic pump.

Figure 20-70-60



Disconnect the pump inlet hose connection at the filter head. Fill the pump inlet and hose completely with hydraulic fluid. Reconnect the hose **[Figure 20-70-60]**.

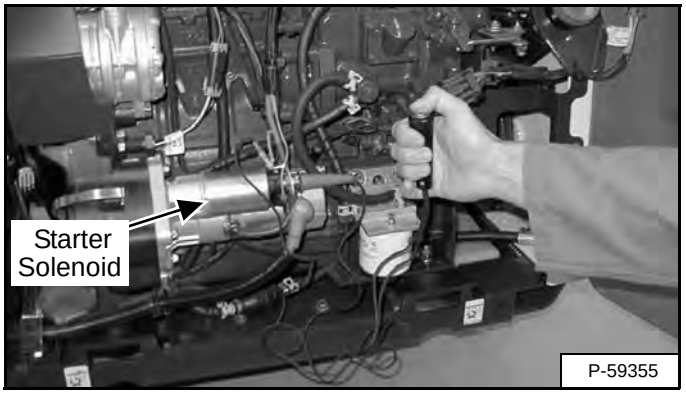
Figure 20-70-61

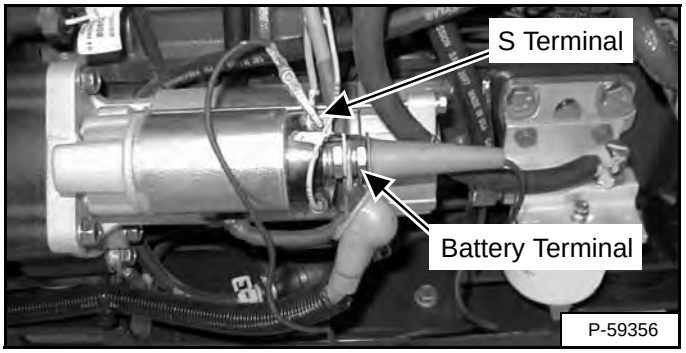


[Figure 20-70-61] To crank the engine without starting, the machine key switch can be bypassed. Obtain a starter bypass tool from a local source which can be used as a universal connection to remotely crank the engine without starting.

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 20-70-62





Connect the starter bypass tool to the starter solenoid battery terminal and S terminal. Crank the engine for 15 seconds, then stop for at least 30 seconds. Again, crank the engine for 15 seconds. Remove the starter bypass tool **[Figure 20-70-62]**.

Start the loader from the operators cab and run the engine at low idle for 1 - 2 minutes without operating the hydraulics.

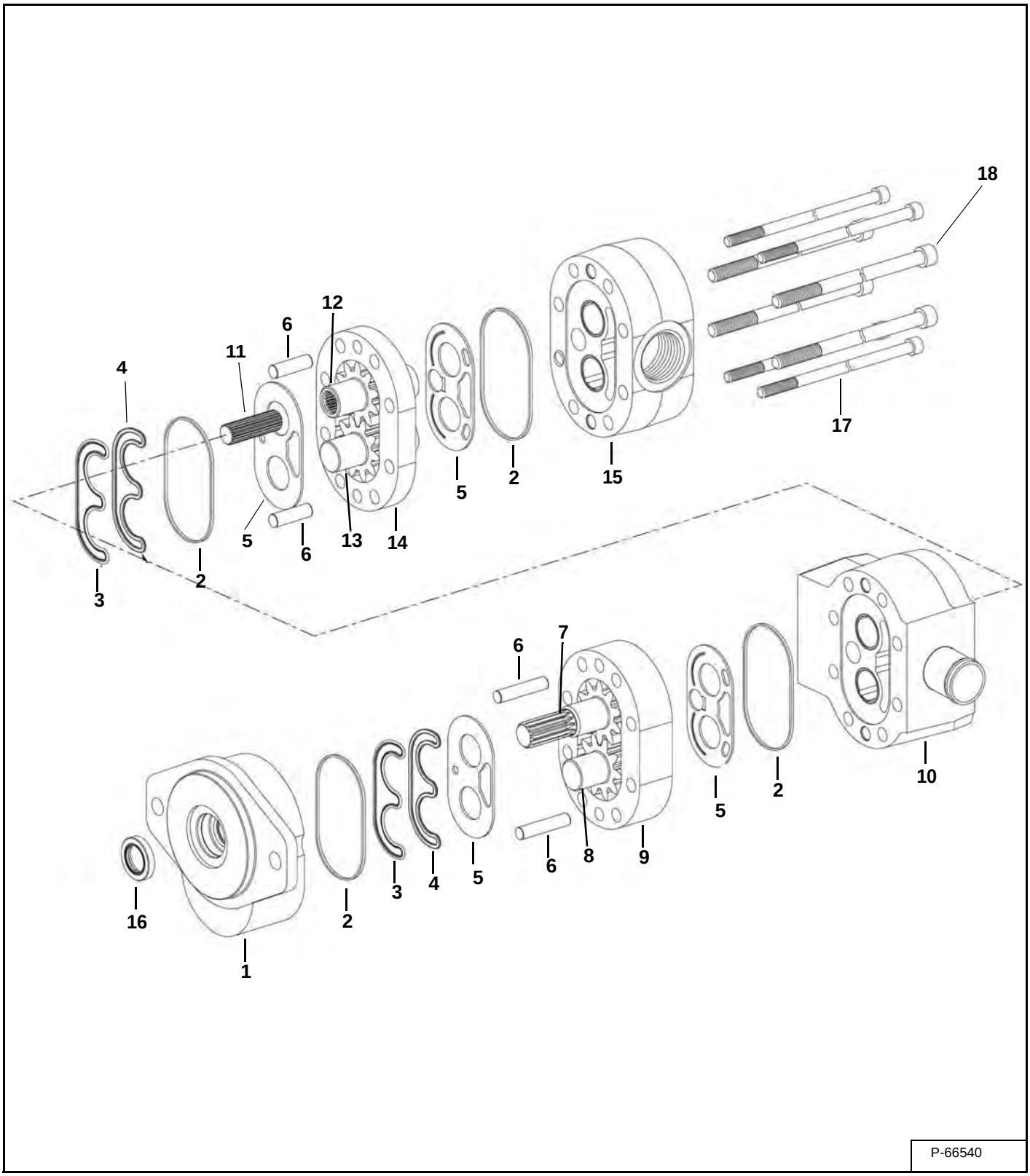
After operating the engine at low idle, Remove the lift arm support device and fully raise and lower the loader lift arms several times or until air is purged from the system. ***Avoid running over the relief valve setting at the end of cylinder stroke.***

With the loader parked on a level surface and lift arms down, check and fill the hydraulic reservoir as required. Check for hydraulic leaks.

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Parts Identification

Figure 20-70-63



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Parts Identification (Cont'd)

The items listed below refer to Page 20-70-12 **[Figure 20-70-63]**.

1. Pump End Section (Auxiliary Pump)
2. Section Seal
3. Pre-Load Seal
4. Load Seal
5. Wear Plate
6. Alignment Pins
7. Drive Gear (Auxiliary Pump)
8. Idler Gear (Auxiliary Pump)
9. Pump Center Section (Auxiliary Pump)
10. Pump End Section (Auxiliary Pump)
11. Spline Shaft
12. Drive Gear (Charge Pump)
13. Idler Gear (Charge Pump)
14. Pump Center Section (Charge Pump)
15. Pump End Section (Charge Pump)
16. Shaft Seal
17. Bolts (4)
18. Bolts (4)

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

Mark the pump sections for correct assembly.

To disassemble and assemble the hydraulic pump, follow the Parts Identification page **[Figure 20-70-63]** for proper placement of components along with the information below.

NOTE: A seal kit is available through Bobcat Service Parts.

Assembly: Tighten the eight pump housing bolts (Item 19) **[Figure 20-70-63]** to 37 ft.-lb. (50 N•m) torque.

NOTE: Position the wear plate (Item 5) and (Item 10) [Figure 20-70-63] inlets and traps as shown with the bronze side toward the gears on all wear plates.

NOTE: Inspect all gears, shafts and pump end sections. If any of these components have excessive wear or damage is visible, the complete pump must be replaced.

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HYDRAULIC PUMP (SJC) (HIGH FLOW)

Description

The hydraulic gear pump is attached to the end of the hydrostatic pumps and are located on the right side of the loader between the hydraulic control valve and the engine.

The hydraulic gear pump is a combination of gear pumps that provide hydraulic flow to several hydraulic systems.

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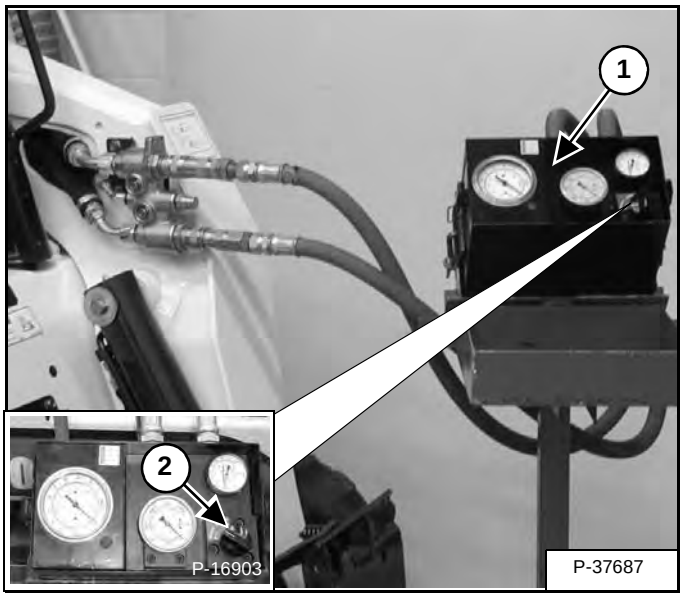
HYDRAULIC PUMP (SJC) (HIGH FLOW) (CONT'D)

Pump Test At Quick Couplers

The tools listed will be needed to do the following procedure:

MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit

Figure 20-71-64



NOTE: When testing the hydraulic flow of a machine hoses must be at least 3/4 inch in diameter and connected directly to the hydraulic tester without using any type of "quick coupler" on the connection to the tester. Also make sure your hydraulic tester is capable of at least 50 GPM.

Install a hydraulic tester (Item 1) **[Figure 20-71-64]** onto the front auxiliary quick couplers.

This procedure will require a operator in the cab and one operator running the tester.

Start the engine and run at low idle RPM. Press the Front Auxiliary button. Engage the front auxiliary with the trigger on the right handle. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control clockwise on the tester so it reads about a 1000 PSI (69 bar).

NOTE: ***DO NOT EXCEED 3300 PSI.***

Turn the restrictor control (Item 2) **[Figure 20-71-64]** on the tester counterclockwise to obtain free flow, the flow should be approximately 20 GPM. Start turning the restrictor clockwise, causing more restriction on the flow. The GPM should drop off slightly until the pressure reaches approximately 2800 PSI. At approximately 2800 PSI the flow should start decreasing rapidly until the pressure reaches 3250-3300 PSI. At 3250-3300 PSI the flow should be at 0 GPM. Turn the restrictor (Item 2) **[Figure 20-71-64]** counterclockwise to free flow. Shut the front auxiliary hydraulics off.

If flow and pressure specs are not obtained, go to the Direct Pump Testing (Standard Section). If flow and pressure specs are obtained continue on to the next paragraph.

With the engine running at low idle RPM. Press the Front Auxiliary button. Engage the front auxiliary with the trigger on the right handle. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control on the tester to about 1000 PSI (69 bar).

NOTE: ***DO NOT EXCEED 3300 PSI.***

Turn the restrictor control (Item 2) **[Figure 20-71-64]** on the tester counterclockwise, to obtain free flow, the flow should be approximately 20 GPM. Press the High Flow button. The flow should increase to 37 GPM. Start turning the restrictor clockwise, causing more restriction on the flow. The GPM should drop off slightly until the pressure reaches approximately 3100 PSI. At approximately 3100 PSI the flow should start decreasing rapidly until the pressure reaches 3250-3350 PSI. At 3250-3350 PSI the flow should be at 0 GPM. Turn the restrictor control (Item 2) **[Figure 20-71-64]** counterclockwise to free flow. Shut the front auxiliary hydraulics off.

If the specs from above are reached, the high flow hydraulic pump is OK.

If the flow and pressure were not obtained, go to the Direct Pump Testing (High Flow Section) (See Direct Pump Test (High Flow Section) on Page 20-71-9.)

*Refer to (See Hydraulic System on Page SPEC-10-3.) for system relief pressure and full RPM.

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Direct Pump Test (Standard Section)

The tools listed will be needed to do the following procedure:

MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit

⚠ WARNING

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

W-2017-0286

Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

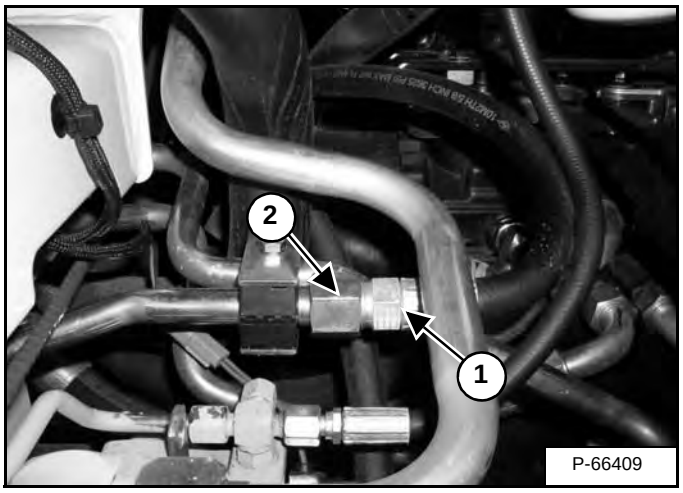
⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

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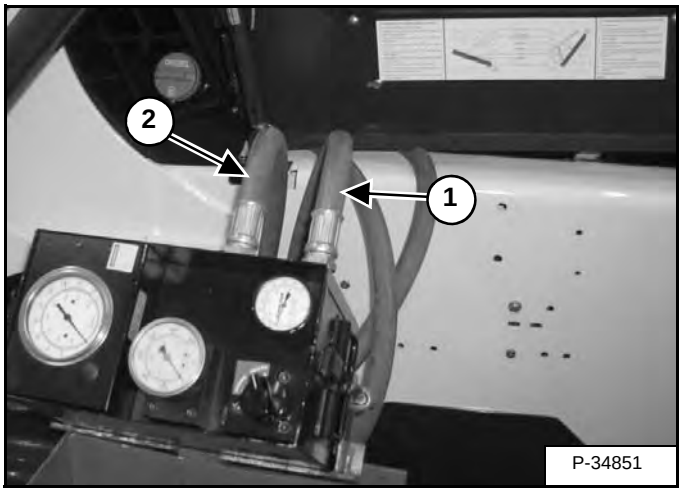
Raise the operator cab. (See Raising on Page 10-30-1.)

Figure 20-71-65



At the control valve, disconnect the standard (auxiliary) pump OUTLET hose (Item 1) **[Figure 20-71-65]** from the tubeline.

Figure 20-71-66



NOTE: When testing the hydraulic flow of a machine hoses must be at least 3/4 inch in diameter and connected directly to the hydraulic tester without using any type of "quick coupler" on the connection to the tester. Also make sure your hydraulic tester is capable of at least 50 GPM.

Connect the INLET hose (Item 1) **[Figure 20-71-66]** from the tester to the OUTLET hose (Item 1) **[Figure 20-71-65]** of the pump. Connect the OUTLET hose (Item 2) **[Figure 20-71-66]** from the tester to the tubeline (Item 2) **[Figure 20-71-65]** which goes to the control valve.

Lower the cab down.

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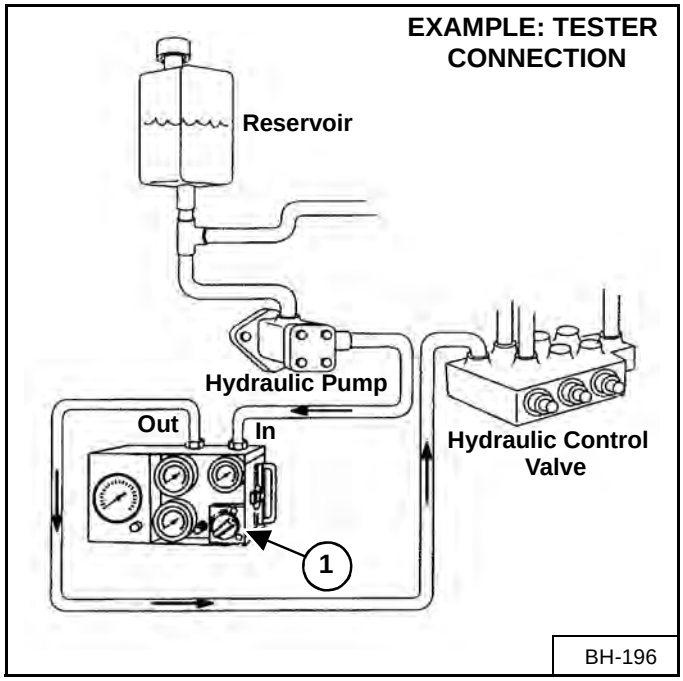
Direct Pump Test (Standard Section) (Cont'd)

IMPORTANT

The hydraulic tester must be in the fully open position before you start the engine.

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Figure 20-71-67



Sample tester connection shown **[Figure 20-71-67]**.

This procedure will require a operator in the cab and one operator running the tester.

Start the engine and run at low idle RPM. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control (Item 1) **[Figure 20-71-67]** on the tester clockwise to about 1000 PSI (69 bar).

NOTE: *DO NOT EXCEED 3300 PSI*.

Open the restrictor control and record the free flow (GPM) at full RPM.

Record the flow (GPM) at 2700 PSI, this is the high pressure flow. The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \times 100$$

A low percentage may indicate a failed pump.

*Refer to (See Hydraulic System on Page SPEC-10-3.) for system relief pressure and full RPM.

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Direct Pump Test (Charge Section)

The tools listed will be needed to do the following procedure:

MEL1563 or 6689779 - Remote Start Tool
MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit
6661247 - Filter Assembly
17 KB 1212 - Elbow Fitting
15 KB 1212 - Straight Fitting
15 KB 0812 - Reducer Fitting

⚠ WARNING

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

W-2017-0286

Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device.(See Installing on Page 10-20-1.)

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

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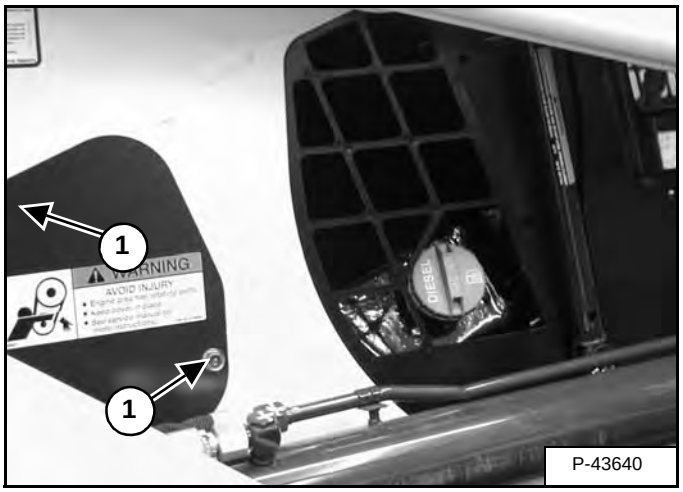
NOTE: The fluid from the charge pump must be filtered after it passes through the Hydraulic Tester, to prevent any contamination to the Hydrostatic Pumps.

Raise the operator cab. (See Raising on Page 10-30-1.)

Open the rear door of the loader.

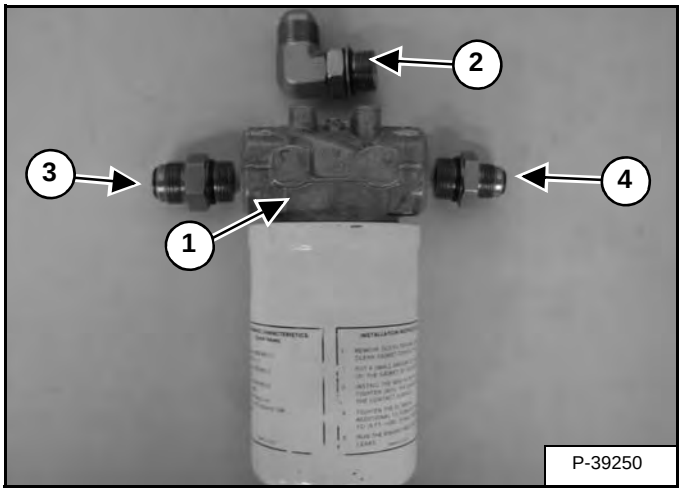
Connect the remote start tool. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.)

Figure 20-71-68



Remove the mount bolts (Item 1) **[Figure 20-71-68]** from the right side access panel. Remove the panel.

Figure 20-71-69

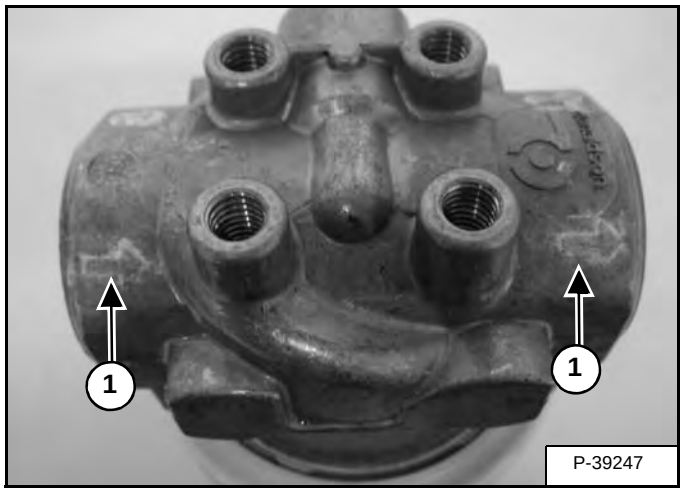


Assemble the filter assembly (Item 1), elbow fitting (Item 2), straight fitting (Item 3) and the reducer fitting (Item 4) **[Figure 20-71-69]**.

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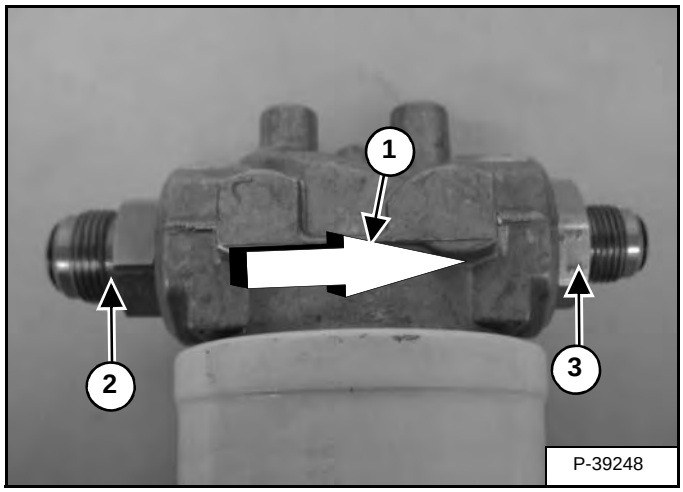
Direct Pump Test (Charge Section) (Cont'd)

Figure 20-71-70



Determine the proper direction of oil flow through the filter housing (Item 1) **[Figure 20-71-70]** and **[Figure 20-71-71]**.

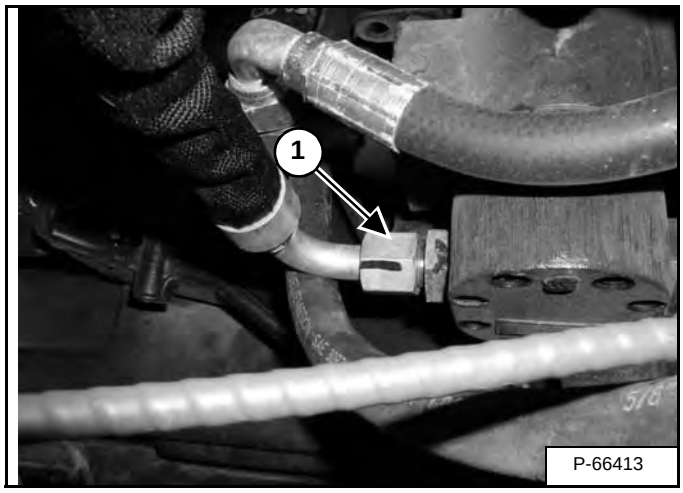
Figure 20-71-71



Install the fitting (15KB 1212-Straight Fitting) (Item 2) **[Figure 20-71-71]** in the filter housing inlet.

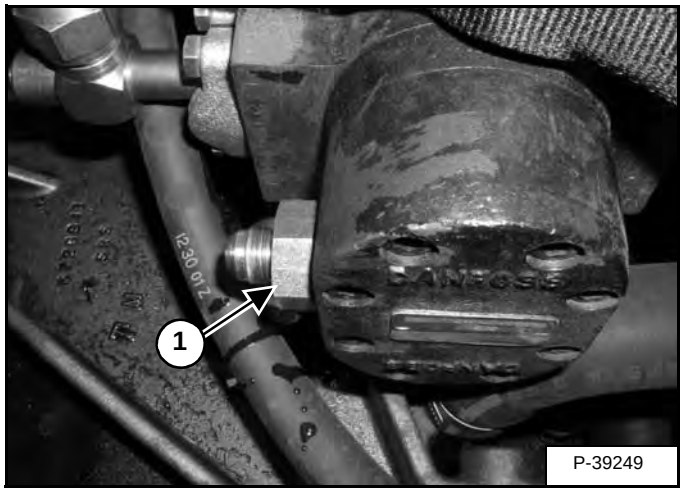
Install the fitting (15KB 0812-Reducer Fitting) (Item 3) **[Figure 20-71-71]** in the filter housing outlet.

Figure 20-71-72



Disconnect the charge pump OUTLET hose (Item 1) **[Figure 20-71-72]**.

Figure 20-71-73

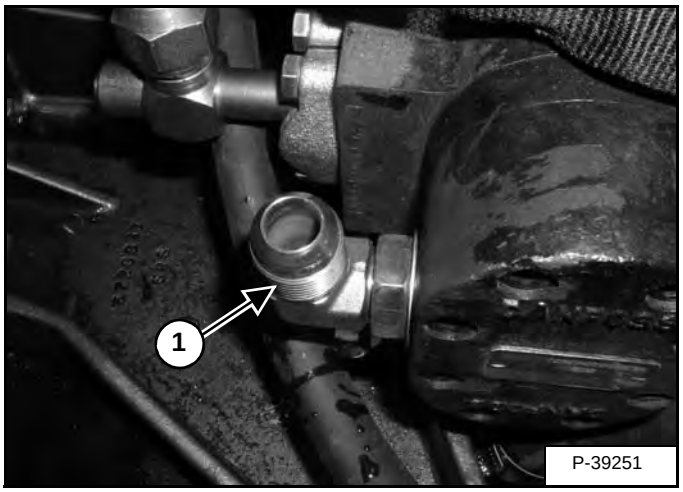


Remove the OUTLET fitting (Item 1) **[Figure 20-71-73]** from the charge pump.

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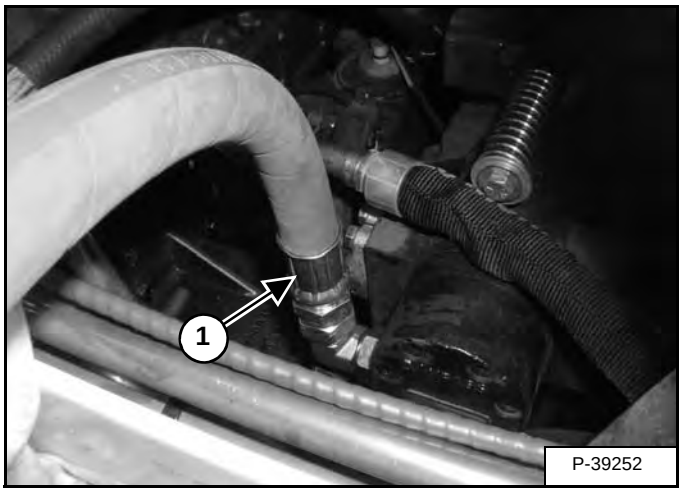
Direct Pump Test (Charge Section) (Cont'd)

Figure 20-71-74



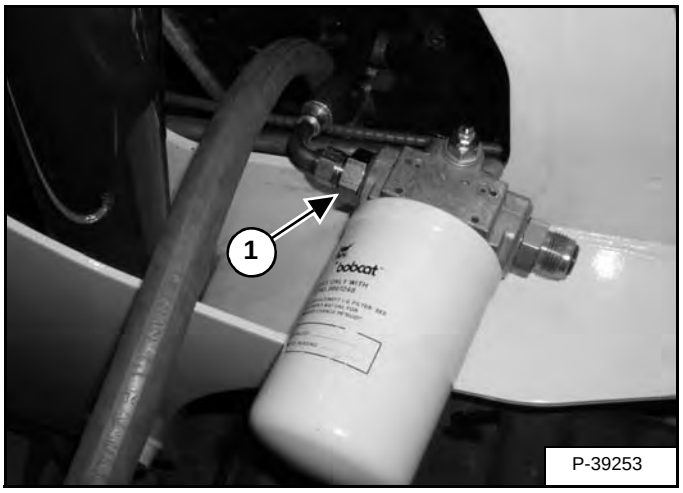
Install the elbow fitting 17KB 1212 (Item 1) **[Figure 20-71-74]** into the OUTLET of the charge pump.

Figure 20-71-75



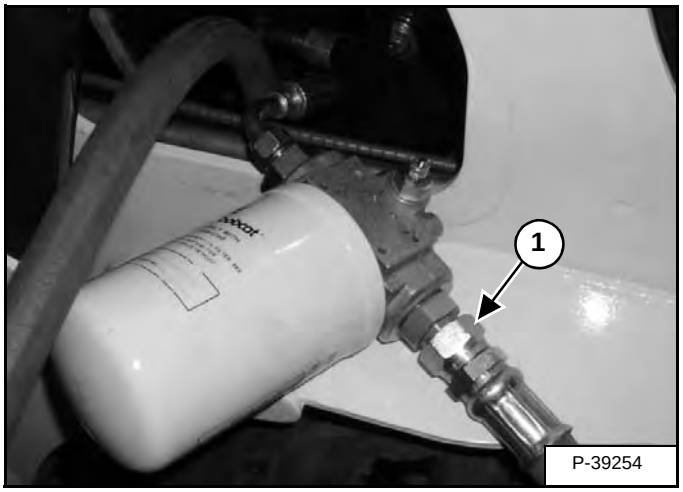
Connect the Inlet hose from the hydraulic tester (Item 1) **[Figure 20-71-75]** to the OUTLET fitting of the charge pump.

Figure 20-71-76



Connect the outlet fitting on the hydraulic filter (Item 1) **[Figure 20-71-76]** to the hose that was remove from the charge pump and routes to the back side of the hydrostatic pump.

Figure 20-71-77



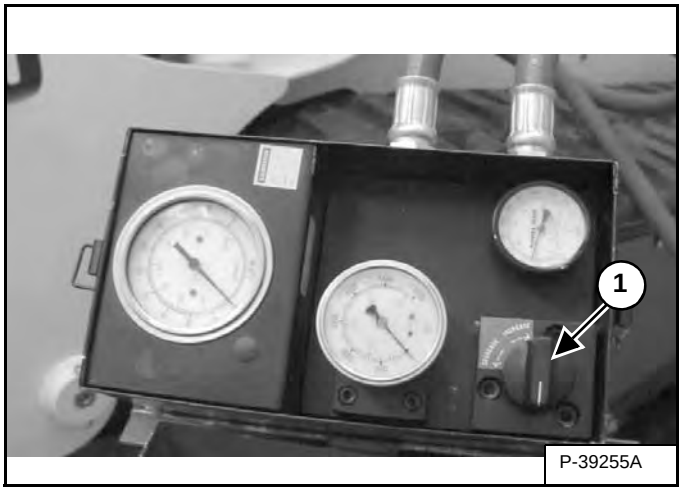
Connect the outlet hose on the hydraulic tester (Item 1) **[Figure 20-71-77]** to the inlet fitting on the hydraulic filter assembly.

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HYDRAULIC PUMP (SJC) (HIGH FLOW) (CONT'D)

Direct Pump Test (Charge Section) (Cont'd)

Figure 20-71-78



Be sure all connections are tight and that the hoses are not touching any moving parts before starting the loader **[Figure 20-71-78]**.

IMPORTANT

The hydraulic tester must be in the fully open position before you start the engine.

I-2024-0284

Start the engine and run at low idle RPM. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control (Item 1) on the tester to about 1000 PSI (6895 kPa). DO NOT exceed system relief pressure. Open the restrictor control and record the free flow (GPM) at full RPM.

Turn the restrictor down to system operating pressure. **DO NOT EXCEED SYSTEM RELIEF PRESSURE**. Refer to Hydraulic Schematics for pressure. The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \times 100$$

A low percentage may indicate a failed pump.

*Refer to (See Hydraulic System on Page SPEC-10-3.) for system relief pressure and full RPM.

*Refer to the Hydraulic Schematics for pump flow and RPM.

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Direct Pump Test (High Flow Section)

The tools listed will be needed to do the following procedure:

MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit

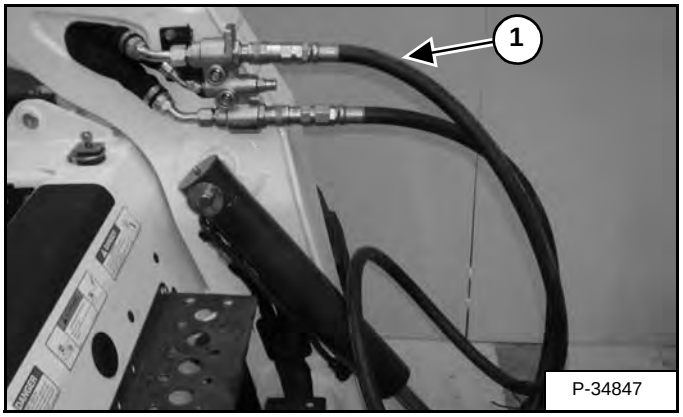
⚠ WARNING

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

W-2017-0286

Lift and block the loader. (See Procedure on Page 10-10-1.)

Figure 20-71-79



Install a jumper hose (Item 1) **[Figure 20-71-79]** onto the front auxiliary quick couplers.

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

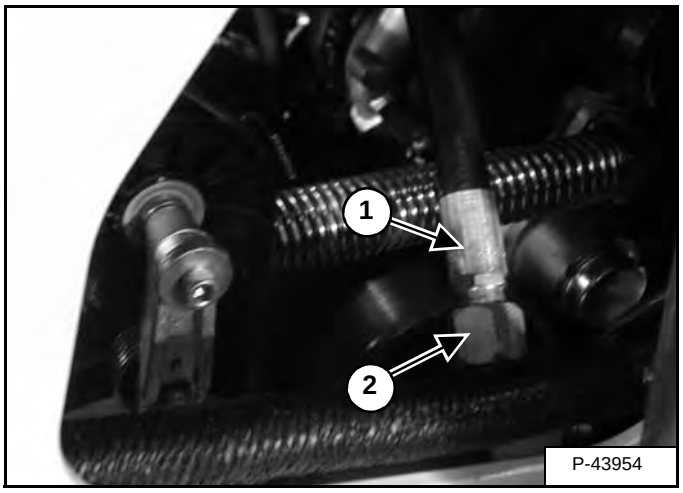
⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Raise the operator cab. (See Raising on Page 10-30-1.)

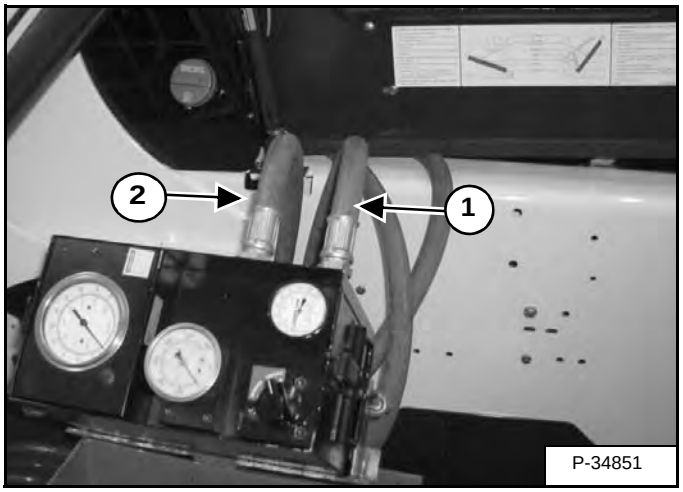
Figure 20-71-80



Remove the left side access cover.

Disconnect the high flow pump OUTLET hose (Item 1) from the fitting (Item 2) on the tubeline **[Figure 20-71-80]**.

Figure 20-71-81



NOTE: When testing the hydraulic flow of a machine hoses must be at least 3/4 inch in diameter and connected directly to the hydraulic tester without using any type of "quick coupler" on the connection to the tester. Also make sure your hydraulic tester is capable of at least 50 GPM.

Connect the INLET hose (Item 1) **[Figure 20-71-81]** from the tester to the OUTLET hose (Item 1) **[Figure 20-71-80]** of the pump. Connect the OUTLET hose (Item 2) **[Figure 20-71-81]** from the tester to the fitting (Item 2) **[Figure 20-71-80]** on the tubeline.

Lower the cab down.

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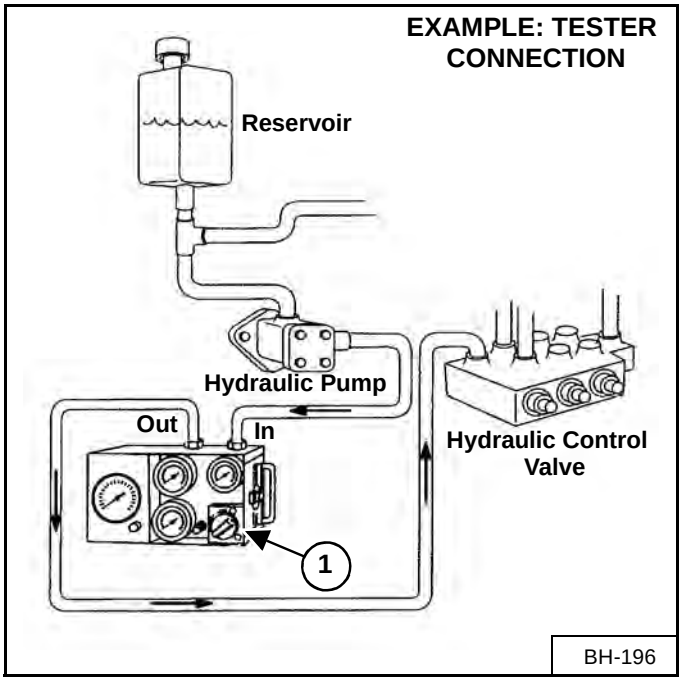
Direct Pump Test (High Flow Section) (Cont'd)

IMPORTANT

The hydraulic tester must be in the fully open position before you start the engine.

I-2024-0284

Figure 20-71-82



Sample tester connection shown **[Figure 20-71-82]**.

This procedure will require a operator in the cab and one operator running the tester.

Start the engine and run at low idle RPM. Press the Front Auxiliary button. Press the High Flow button. Engage the front auxiliary with the trigger on the right handle. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control (Item 1) **[Figure 20-71-82]** clockwise on the tester to about 1000 PSI (6895 kPa).

NOTE: ***DO NOT EXCEED 3300 PSI.***

Turn the restrictor control clockwise on the tester to 3300 PSI and the flow should go to zero GPM. If the pressure readings are not obtained. (See High Flow Relief Valve Adjustment on Page 20-71-11.). If the pressure readings are correct, continue on to the next paragraph.

Open the restrictor control and record the free flow (GPM) at full RPM.

Record the flow (GPM) at 2500 PSI, this is the high pressure flow. The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \times 100$$

A low percentage may indicate a failed pump.

*Refer to (See Hydraulic System on Page SPEC-10-3.) for system relief pressure and full RPM.

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High Flow Relief Valve Adjustment

The tools listed will be needed to do the following procedure:

MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit

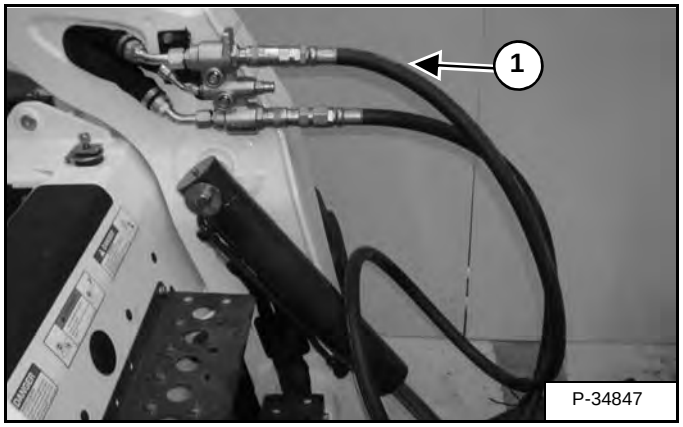
⚠ WARNING

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

W-2017-0286

Lift and block the loader. (See Procedure on Page 10-10-1.)

Figure 20-71-83



Install a jumper hose (Item 1) **[Figure 20-71-83]** onto the front auxiliary quick couplers.

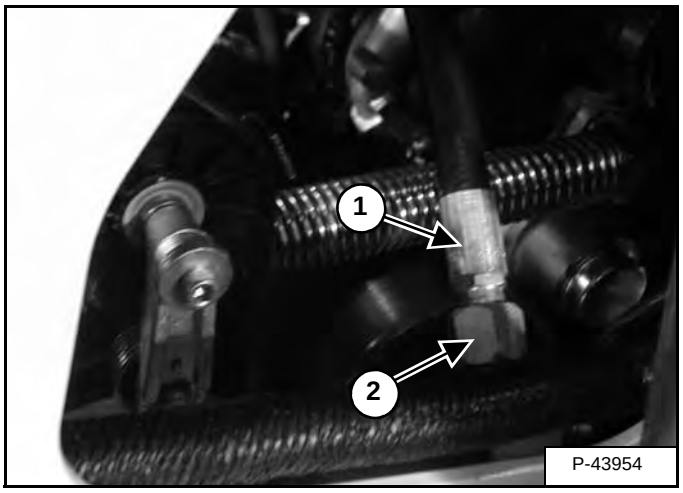
Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

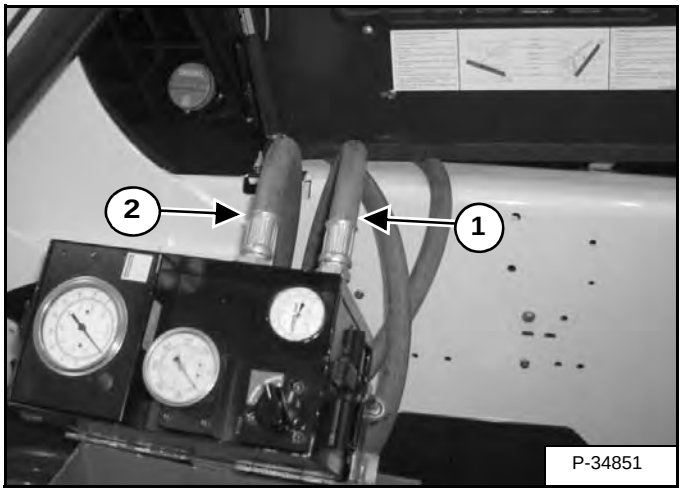
Figure 20-71-84



Remove the left side access cover.

Disconnect the high flow pump OUTLET hose (Item 1) from the fitting (Item 2) on the tubeline **[Figure 20-71-84]**.

Figure 20-71-85



NOTE: When testing the hydraulic flow of a machine hoses must be at least 3/4 inch in diameter and connected directly to the hydraulic tester without using any type of "quick coupler" on the connection to the tester. Also make sure your hydraulic tester is capable of at least 50 GPM.

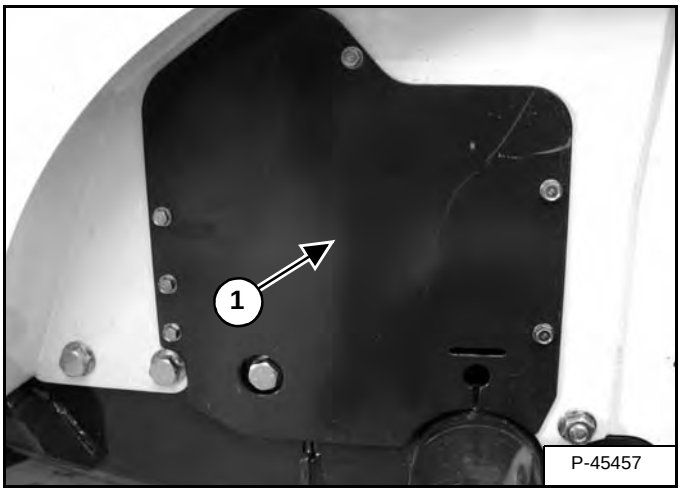
Connect the INLET hose (Item 1) **[Figure 20-71-85]** from the tester to the OUTLET hose (Item 1) **[Figure 20-71-84]** of the pump. Connect the OUTLET hose (Item 2) **[Figure 20-71-85]** from the tester to the tubeline (Item 2) **[Figure 20-71-84]** at the control valve.

Lower the cab down.

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High Flow Relief Valve Adjustment (Cont'd)

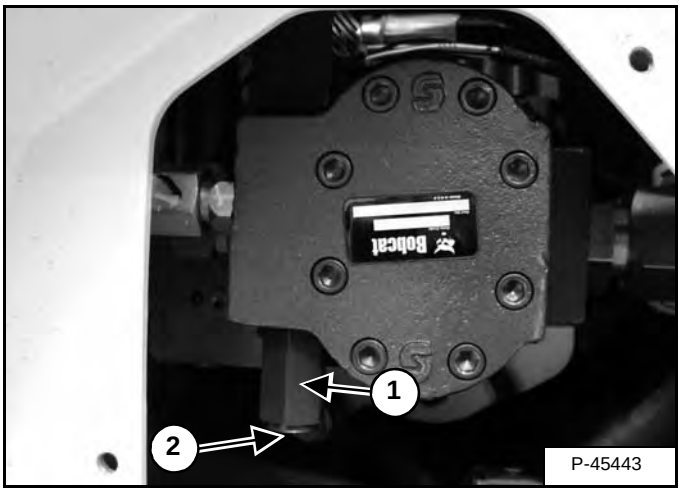
Figure 20-71-86



Remove the right rear tire. (See Mounting on Page 10-160-2.)

Remove the gear pump access cover (Item 1) **[Figure 20-71-86]**.

Figure 20-71-87



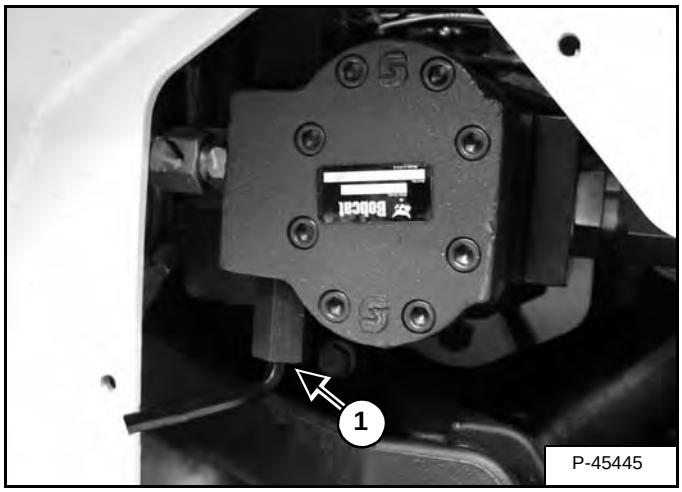
Locate the high flow relief valve (Item 1) **[Figure 20-71-87]**.

Remove the plug (Item 2) **[Figure 20-71-87]** located on the bottom of the high flow relief valve.

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High Flow Relief Valve Adjustment (Cont'd)

Figure 20-71-88



Start the engine and run at low idle RPM. Press the Front Auxiliary button. Press the High Flow button. Engage the front auxiliary with the trigger on the right handle. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

Warm the fluid to 140°F. (60°C.) by turning the restrictor control clockwise on the tester to about 1000 PSI (69 bar).

NOTE: ***DO NOT EXCEED 3300 PSI.***

Turn the restrictor control clockwise on the tester to causing more restriction on the flow. The GPM should drop off slightly until the pressure reaches approximately 3100 PSI. At approximately 3100 PSI the flow should start decreasing rapidly until the pressure reaches 3250-3350 PSI. At 3250-3350 PSI the flow should be at 0 GPM. Turn the restrictor counterclockwise to free flow. Shut the front auxiliary hydraulics off.

If the specs from above are reached, the pump is OK.

If the pump is unable to reach 3300 PSI stop the engine. The relief screw (Item 1) **[Figure 20-71-88]** will need to be turned clockwise a 1/4 turn and retested with the procedure above. (1/4 turn equals approximately 200 PSI.)

NOTE: If the relief screw has been turned in 1/4 turn and the pressure remains the same, go to the high flow relief valve removal and installation section. (See High Flow Relief Valve Removal And Installation on Page 20-71-14.) If relief valve has been checked and is OK, go to the high flow pump disassembly and assembly section. (See Disassembly And Assembly on Page 20-71-21.)

If the pump reaches 3300 PSI and there is flow stop the engine. The relief screw must be turned counterclockwise 1/4 turn and retested with the procedure above.

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High Flow Relief Valve Removal And Installation

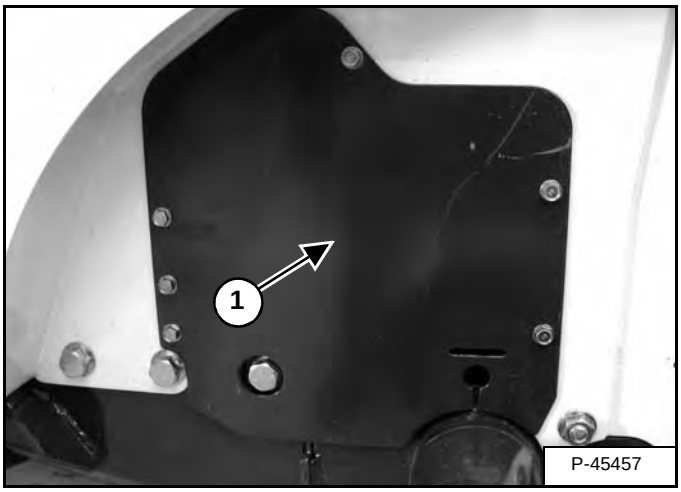
⚠ WARNING

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

W-2017-0286

Lift and block the loader. (See Procedure on Page 10-10-1.)

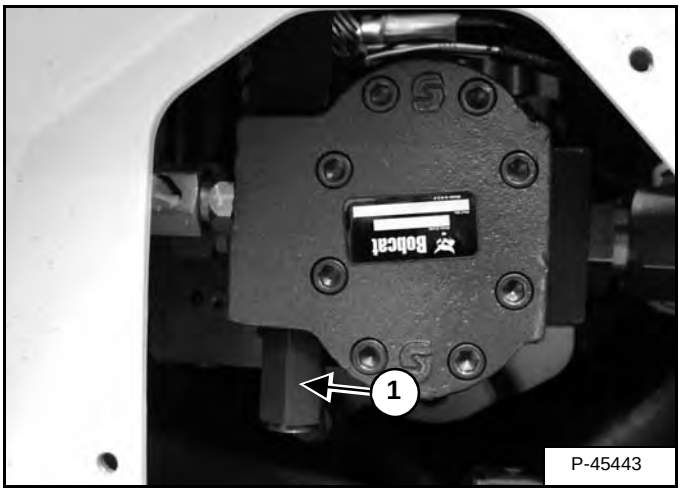
Figure 20-71-89



Remove the right rear tire. (See Mounting on Page 10-160-2.)

Remove the gear pump access cover (Item 1) **[Figure 20-71-89]**.

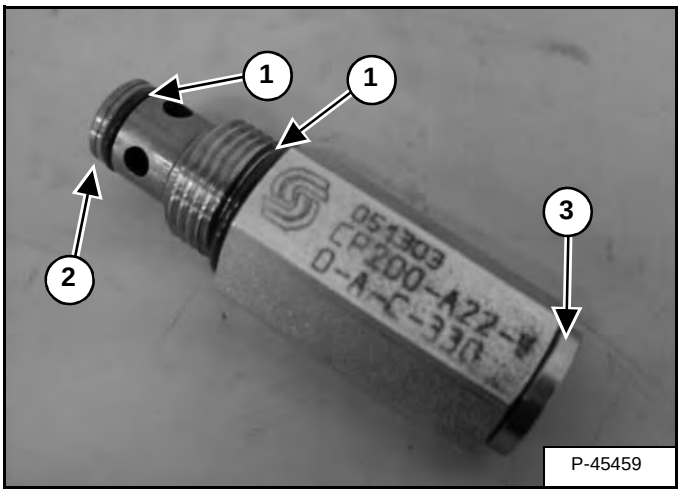
Figure 20-71-90



Remove the relief valve (Item 1) **[Figure 20-71-90]** from the pump.

Installation: Tighten the relief valve to 30-35 ft.-lb. (41-47 N•m) torque.

Figure 20-71-91



Inspect the relief valve and replace the two O-rings (Item 1) and washer (Item 2) **[Figure 20-71-91]**.

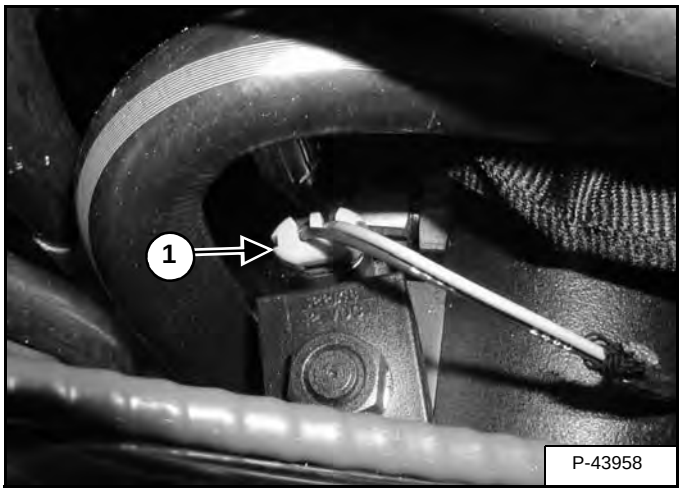
If the relief valve is bad, it must be replaced as a complete unit.

Remove the plug (Item 3) and inspect the O-ring **[Figure 20-71-91]** damage and replace as needed.

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Solenoid Removal And Installation

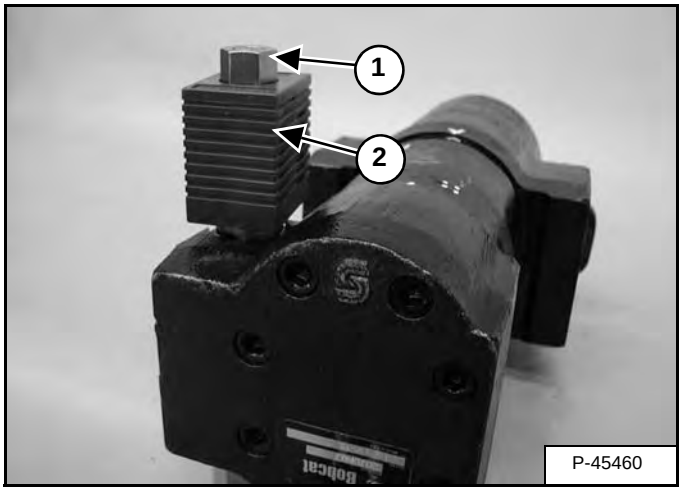
Figure 20-71-92



Remove right side access cover beside the lift cylinder.

At the right side access hole, disconnect the electrical connector (Item 1) **[Figure 20-71-92]** from the high flow pump solenoid.

Figure 20-71-93

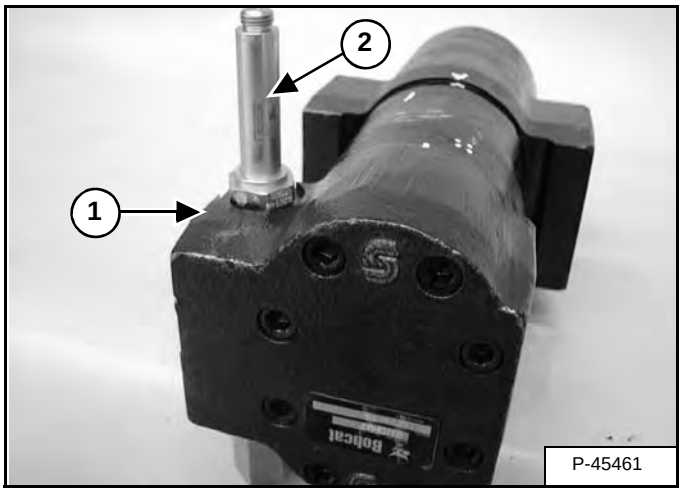


Remove the solenoid nut (Item 1) **[Figure 20-71-93]**.

Remove the solenoid (Item 2) **[Figure 20-71-93]**.

Installation: Tighten the solenoid nut to 48-72 in lb. (5-8 N•m)

Figure 20-71-94

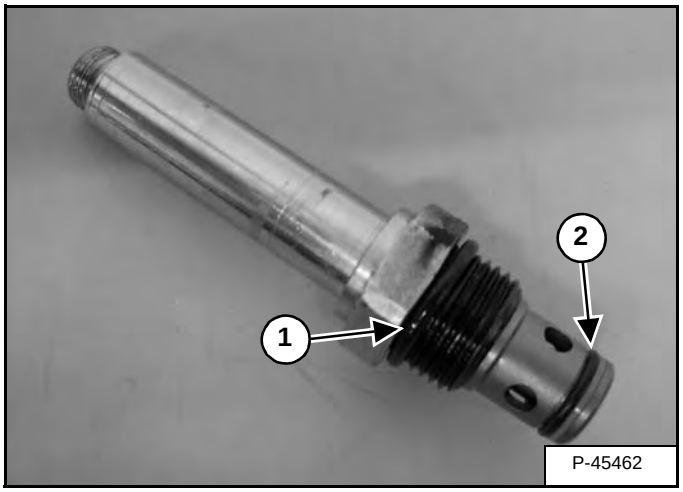


NOTE: Mark the pump housing (Item 1) [Figure 20-71-94] for proper installation of the solenoid valve cartridge.

Remove the valve cartridge (Item 1) **[Figure 20-71-94]**.

Installation: Tighten the solenoid valve to 35-40 ft.-lb. (47-54 N•m).

Figure 20-71-95



Inspect the O-ring (Item 1) **[Figure 20-71-95]** and replace as needed.

Inspect the O-ring and back-up washer (Item 2) **[Figure 20-71-95]** and replace as needed.

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Removal And Installation



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Stop the engine. Raise the seat bar.

Lift and block the rear of the loader. (See Procedure on Page 10-10-1.)

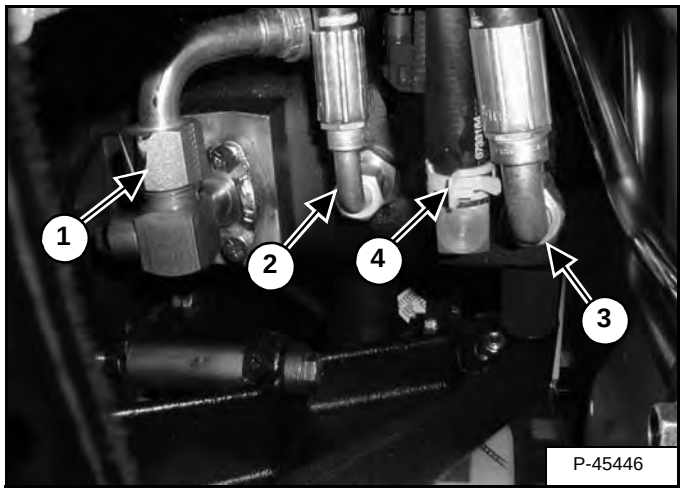
Raise the operator cab. (See Raising on Page 10-30-1.)

Drain the hydraulic fluid from the reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-2.)

Open the rear door of the loader.

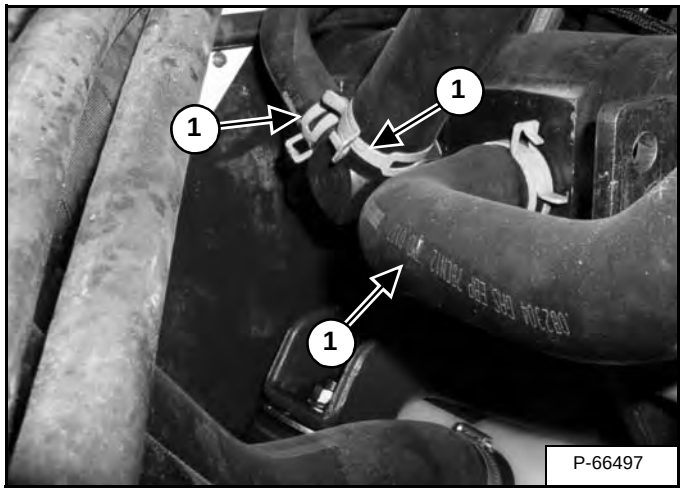
Remove the hoses from the Power Bob-Tach block. (If so equipped.) (See Removal And Installation on Page 20-130-1.)

Figure 20-71-96



At the back side of the gear pump, disconnect and cap the hose from the outlet fitting (Item 1) of the standard flow pump. Disconnect and cap the hose (Item 2) from the charge pump. Disconnect and cap the hoses from the High Flow pump outlet fitting (Item 3) and the low pressure hose (Item 4) **[Figure 20-71-96]**.

Figure 20-71-97

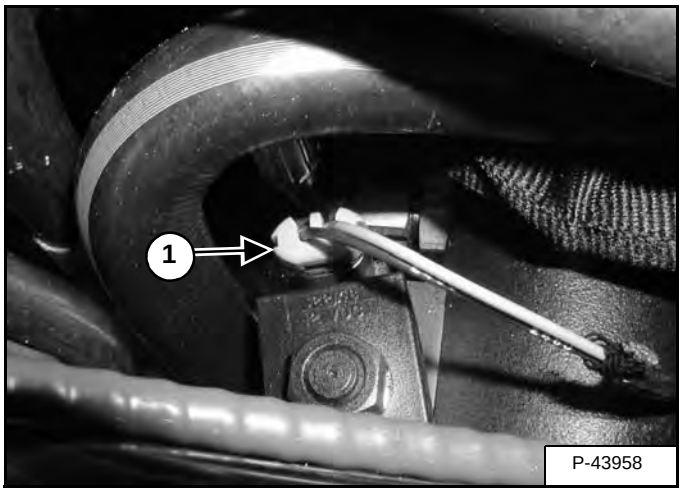


At the front side of the gear pump, disconnect and cap the three hoses (Item 1) from the inlet side of the hydraulic pump **[Figure 20-71-97]**.

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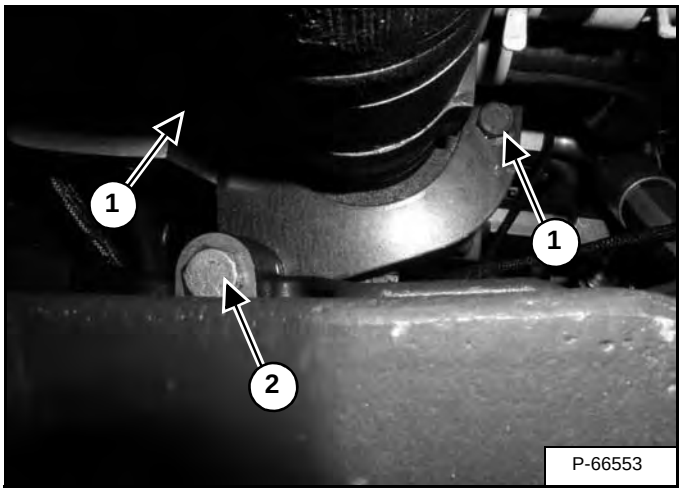
Removal And Installation (Cont'd)

Figure 20-71-98



At the right side access hole, disconnect the electrical connector (Item 1) **[Figure 20-71-98]** from the high flow pump solenoid.

Figure 20-71-99



Remove the two mounting bolts (Item 1) **[Figure 20-71-99]** from the hydraulic pump.

Installation: Tighten the mounting bolts to 65-70 ft.-lb. (88-95 N•m) torque.

At the bottom side of the gear pump, remove the pump bolt (Item 2) **[Figure 20-71-99]** from pump support bracket.

Installation: Tighten the pump support bracket bolt to 175-190 ft.-lb. (237-257 N•m) torque.

Remove the pump support bracket (Item 2) **[Figure 20-71-99]** from the loader.

Remove the hydraulic pump from the hydrostatic pump.

Remove the O-ring from the hydrostatic pump.

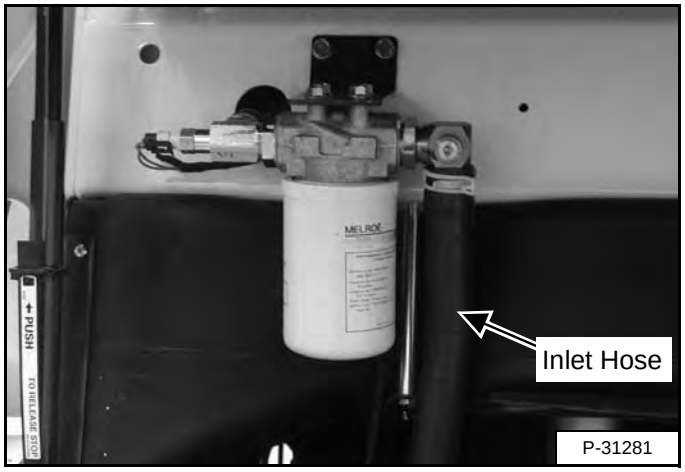
Installation: Use a new O-ring when installing the hydraulic pump.

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Hydraulic Pump Start Up

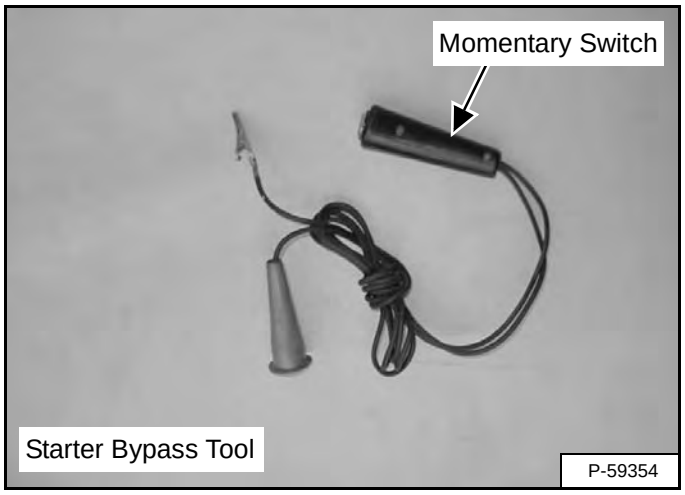
NOTE: This procedure to prevent a dry start up of the hydraulic pump.

Figure 20-71-100



Disconnect the pump inlet hose connection at the filter head. Fill the pump inlet and hose completely with hydraulic fluid. Reconnect the hose **[Figure 20-71-100]**.

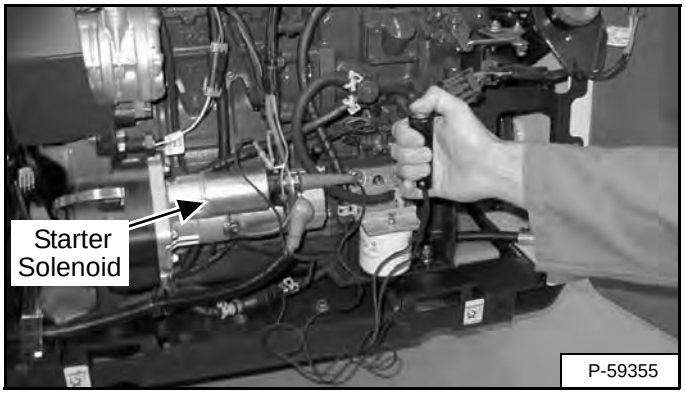
Figure 20-71-101

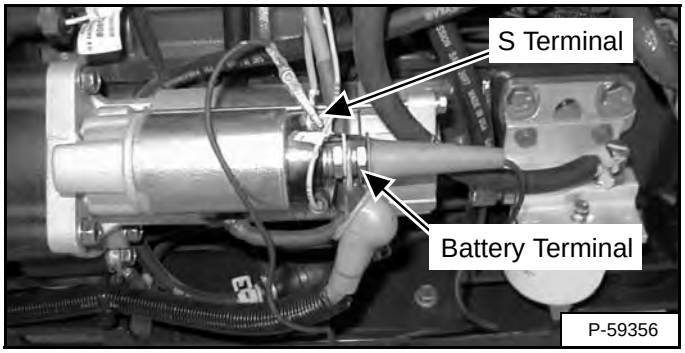


[Figure 20-71-101] To crank the engine without starting, the machine key switch can be bypassed. Obtain a starter bypass tool from a local source which can be used as a universal connection to remotely crank the engine without starting.

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 20-71-102





Connect the starter bypass tool to the starter solenoid battery terminal and S terminal. Crank the engine for 15 seconds, then stop for at least 30 seconds. Again, crank the engine for 15 seconds. Remove the starter bypass tool **[Figure 20-71-102]**.

Start the loader from the operators cab and run the engine at low idle for 1 - 2 minutes without operating the hydraulics.

After operating the engine at low idle, Remove the lift arm support device and fully raise and lower the loader lift arms 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 loader parked on a level surface and lift arms down, check and fill the hydraulic reservoir as required. Check for hydraulic leaks.

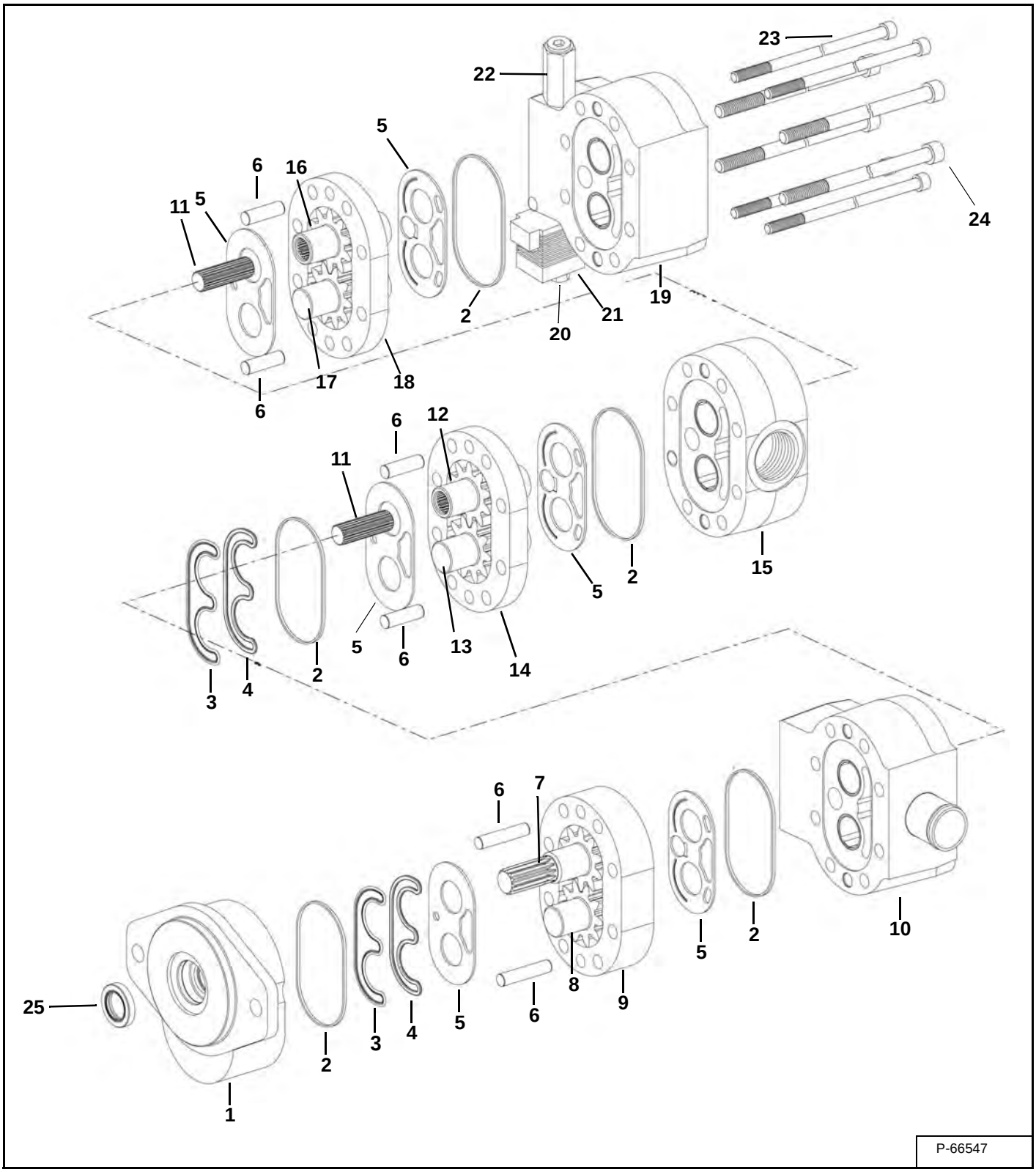
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Parts Identification

Figure 20-71-103



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Parts Identification (Cont'd)

The items listed below refer to Page 20-71-20 **[Figure 20-71-103]**.

1. Pump End Section (Auxiliary Pump)
2. Section Seal
3. Pre-Load Seal
4. Load Seal
5. Wear Plate
6. Alignment Pins
7. Drive Gear (Auxiliary Pump)
8. Idler Gear (Auxiliary Pump)
9. Pump Center Section (Auxiliary Pump)
10. Pump End Section (Auxiliary Pump)
11. Spline Shaft
12. Drive Gear (Charge Pump)
13. Idler Gear (Charge Pump)
14. Pump Center Section (Charge Pump)
15. Pump End Section (Charge Pump)
16. Drive Gear (High Flow Pump)
17. Idler Gear (High Flow Pump)
18. Pump Center Section (High Flow Pump)
19. Pump End Section (High Flow Pump)
20. High Flow Solenoid Nut
21. High Flow Solenoid
22. High Flow Relief Valve
23. Bolts (4)
24. Bolts (4)
25. Shaft Seal

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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Mark the pump sections for correct assembly.

To disassemble and assemble the hydraulic pump, follow the Parts Identification page **[Figure 20-71-103]** for proper placement of components along with the information below.

NOTE: A seal kit is available through Bobcat Service Parts.

Assembly: Tighten the eight pump housing bolts (Item 23) and (Item 24) **[Figure 20-71-103]** to 37 ft.-lb. (50 N•m) torque.

NOTE: Position the wear plate (Item 5) and (Item 10) [Figure 20-71-103] inlets and traps as shown with the bronze side toward the gears on all wear plates.

NOTE: Inspect all gears, shafts and pump end sections. If any of these components have excessive wear or damage is visible, the complete pump must be replaced.

NOTE: The relief valve and the solenoid can be replaced along with the O-rings and backup washers.

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HYDRAULIC/HYDROSTATIC FILTERS

Description

The hydraulic/hydrostatic filters help to remove contaminants from the fluid when the hydraulic/ hydrostatic systems are operating.

The hydraulic/hydrostatic filter system consists of one main filter and one charge filter.

The main filter removes contaminants after the oil cooler.

The charge pressure filter removes contaminants after the fan motor before the oil enters the hydrostatic pumps.

Housing Removal And Installation

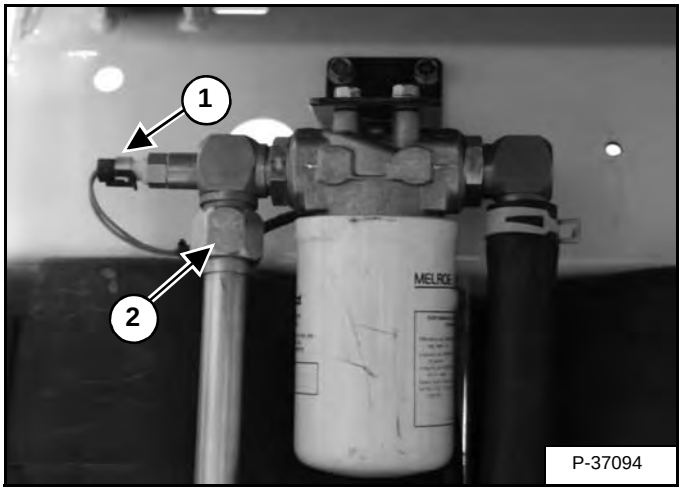


WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

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Figure 20-80-1



Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Disconnect the electrical connector (Item 1) **[Figure 20-80-1]** from the filter sender.

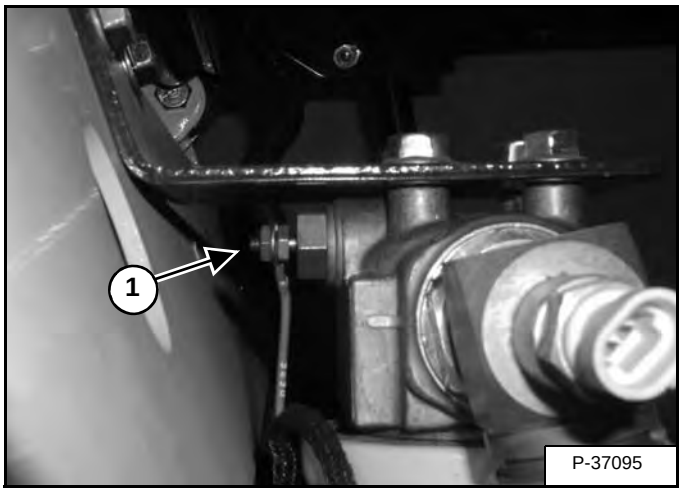
Loosen the nut (Item 2) **[Figure 20-80-1]** and disconnect the tubeline from the filter block.

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HYDRAULIC/HYDROSTATIC FILTER (CONT'D)

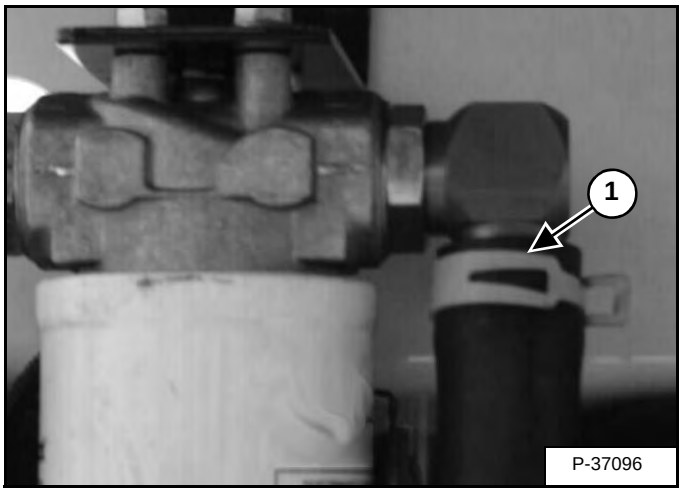
Housing Removal And Installation (Cont'd)

Figure 20-80-2



Loosen the nut (Item 1) **[Figure 20-80-2]**, and remove the electrical wire from the filter housing.

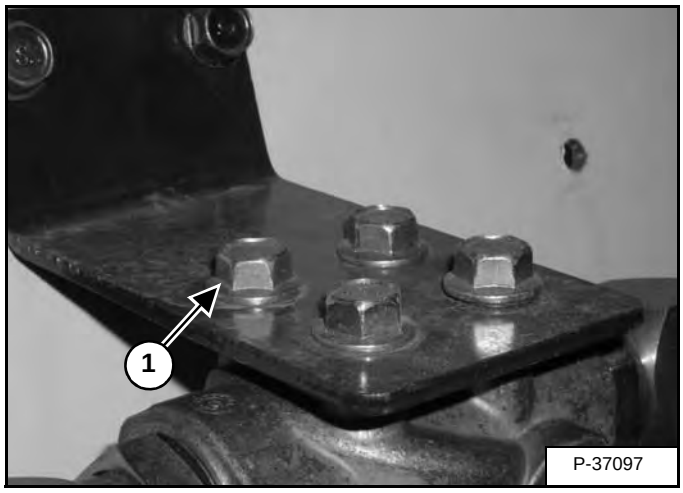
Figure 20-80-3



Remove the hose clamp (Item 1) **[Figure 20-80-3]**.

Remove the hose from the filter housing fitting.

Figure 20-80-4

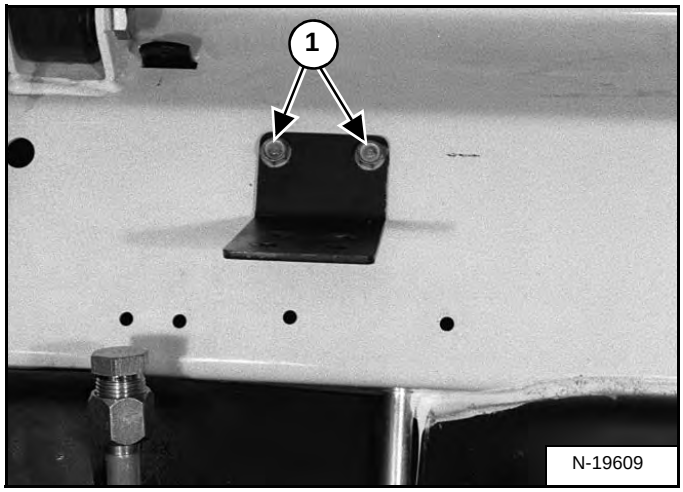


Remove the four mounting bolts (Item 1) **[Figure 20-80-4]**.

Installation; Tighten the mount bolts to 25 ft.-lb. (34 N•m) torque.

Remove the filter assembly from the loader.

Figure 20-80-5



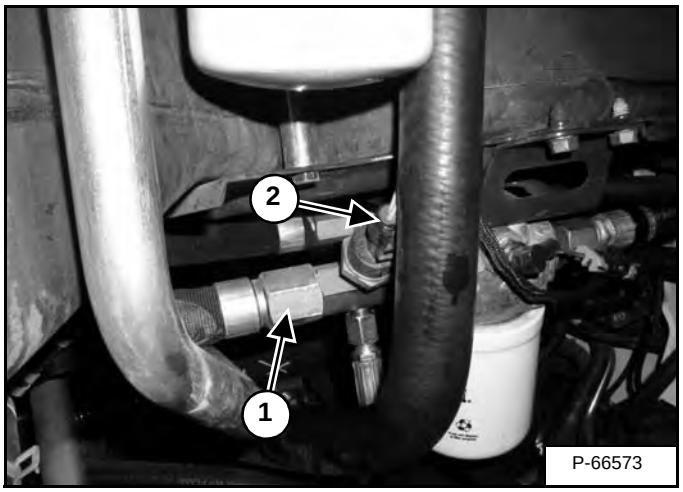
Remove the two filter bracket mount bolts (Item 1) **[Figure 20-80-5]**.

Remove the bracket from the loader.

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Charge Filter Housing Removal And Installation

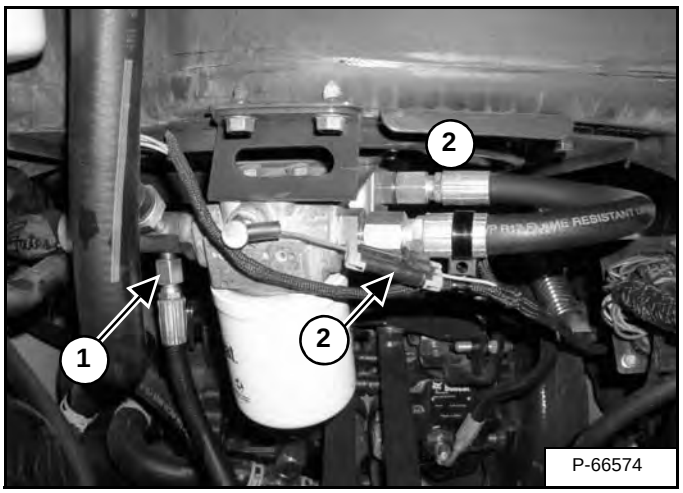
Figure 20-80-6



Remove filter outlet hose (Item 1) **[Figure 20-80-6]**.

Disconnect the electrical connector (Item 2) **[Figure 20-80-6]** from the charge pressure sender.

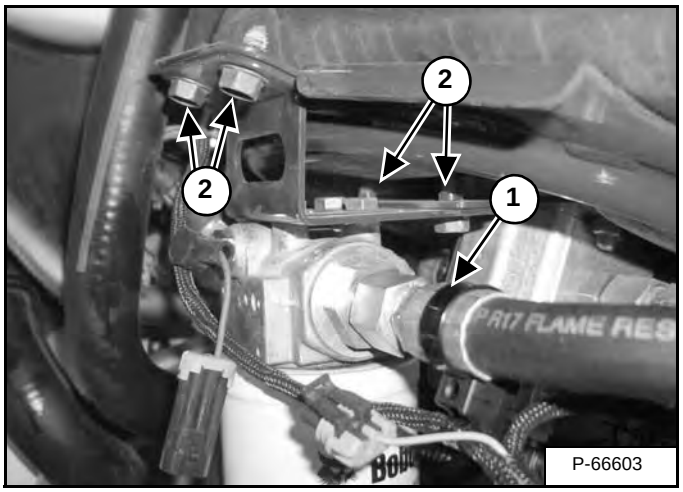
Figure 20-80-7



Disconnect the charge pressure hose (Item 1) **[Figure 20-80-7]** that connects to the control valve.

Disconnect the electrical connector from the filter sensor (Item 2) **[Figure 20-80-7]**.

Figure 20-80-8

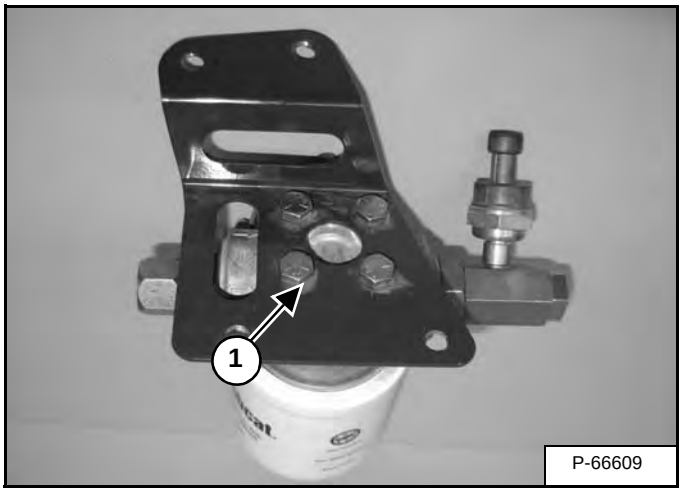


Remove filter inlet hose (Item 1) **[Figure 20-80-8]**.

Remove the four mounting bolts (Item 2) **[Figure 20-80-8]**.

Remove filter assembly from the loader.

Figure 20-80-9



Remove the four mounting bolts (Item 1) **[Figure 20-80-9]**.

Installation; Tighten the mount bolts to 25 ft.-lb. (34 N•m) torque.

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HYDRAULIC FLUID RESERVOIR

Description

The hydraulic fluid reservoir is a storage container for the loaders hydraulic/hydrostatic fluid. The reservoir contains a vented fill cap with a fluid screen to prevent contaminants from entering the reservoir while adding fluid.

The hydraulic fluid reservoir is located below the operators cab on the left side of the loader.

Removal And Installation

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

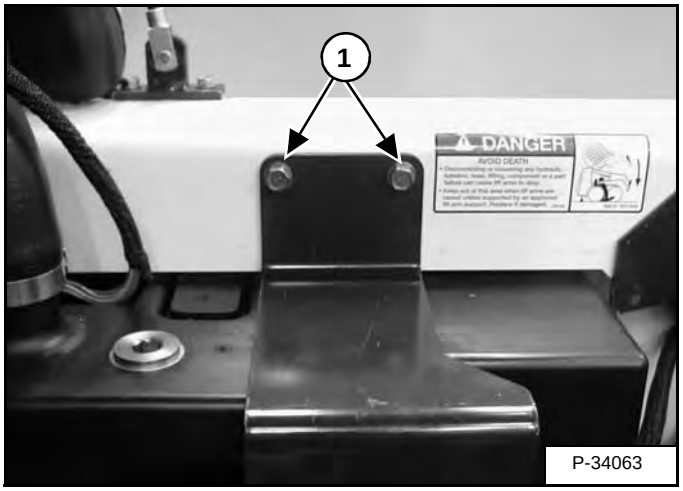
Remove the fluid from the reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-2.)

Remove the control panel. (See Removal And Installation on Page 50-100-2.)

Remove the crossbar linkage. (See Pedal Removal And Installation on Page 50-90-2.)

Remove bucket position valve. (If so equipped.) (See Removal And Installation on Page 20-110-3.)

Figure 20-90-1



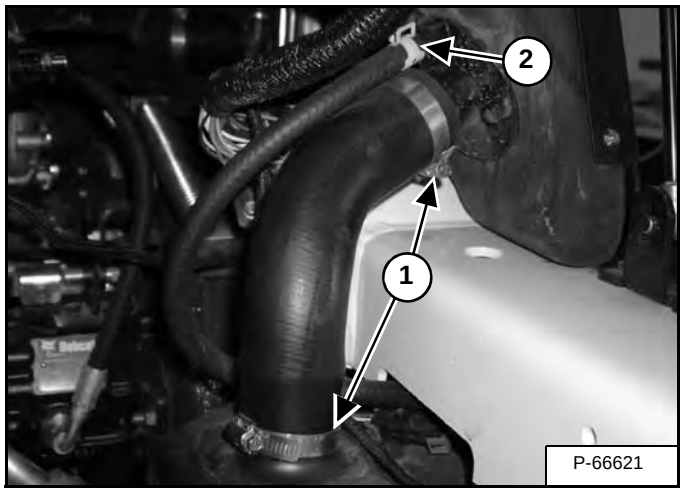
Remove the two mount bolts (Item 1) **[Figure 20-90-1]** from the bucket position valve mount plate. (If so equipped.)

Remove the mount plate from the loader. (If so equipped.)

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Removal And Installation (Cont'd)

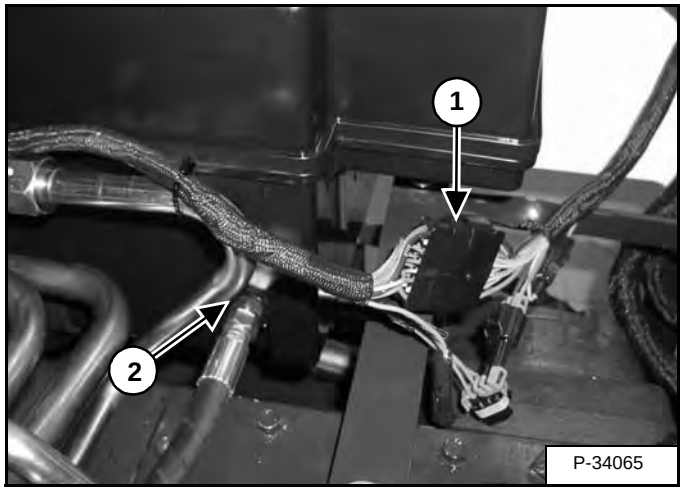
Figure 20-90-2



Loosen the two hose clamps (Item 1) **[Figure 20-90-2]** and remove the reservoir fill hose.

Remove the hose clamp (Item 2) **[Figure 20-90-2]** and remove the hydraulic vent hose.

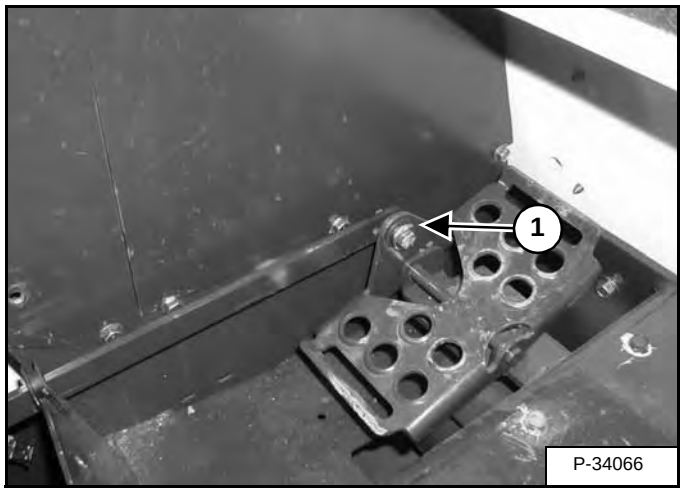
Figure 20-90-3



Disconnect the wiring harness connector (Item 1) **[Figure 20-90-3]**

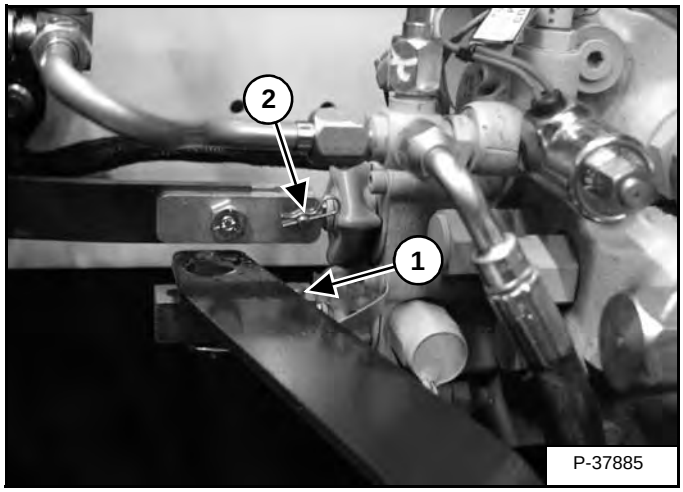
Disconnect the hydraulic hose (Item 2) **[Figure 20-90-3]** from the reservoir. Cap the hose and plug the fitting on the reservoir.

Figure 20-90-4



Remove the lift pedal linkage mount bolt (Item 1) **[Figure 20-90-4]**.

Figure 20-90-5



Remove the linkage pin (Item 1) **[Figure 20-90-5]** from the tilt linkage bar, and remove the linkage bar from the control valve lift spool.

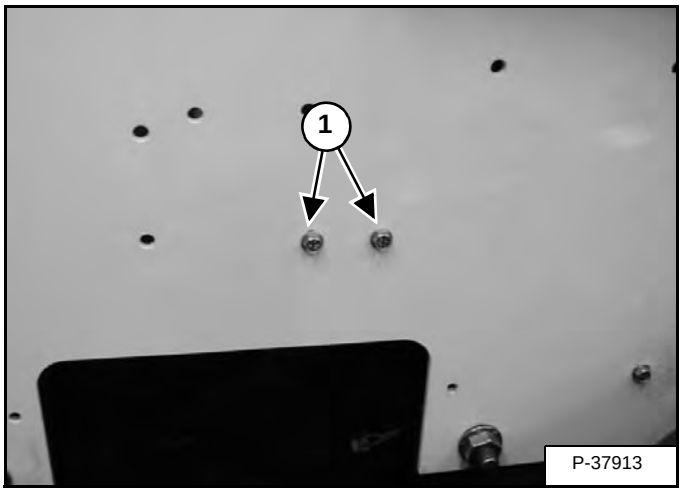
Remove the hairpin clip from the crossmember pin.

Remove the crossmember and lift linkage bar from the pivot, and the loader.

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Removal And Installation (Cont'd)

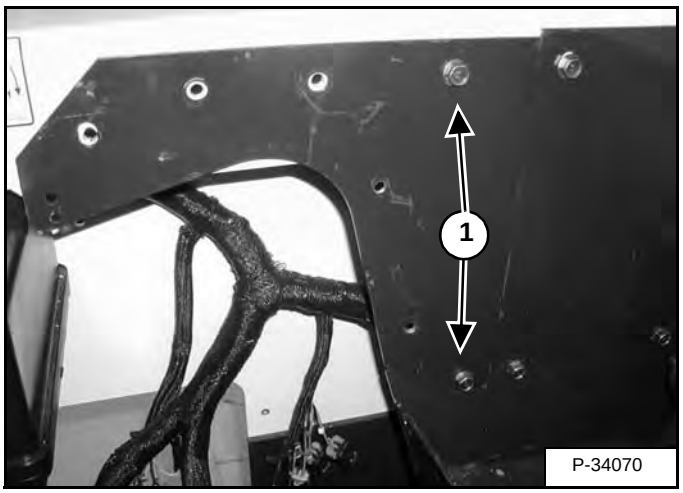
Figure 20-90-6



At the left fender, remove the two mount bolts (Item 1) **[Figure 20-90-6]** from the front reservoir mount bracket.

Remove the mount bracket from the loader.

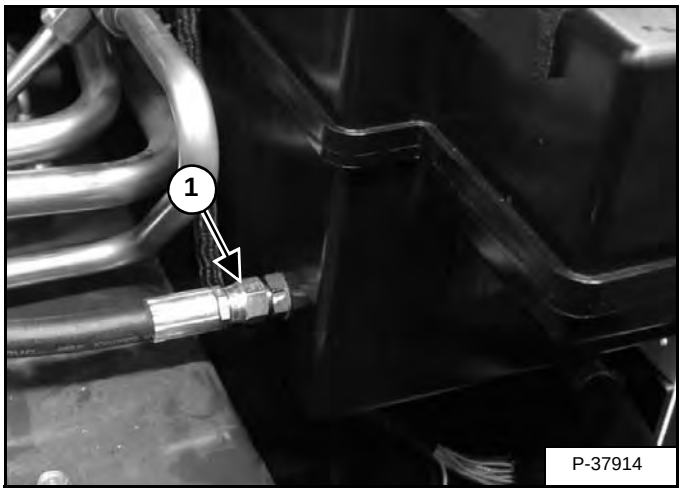
Figure 20-90-7



Remove the two mount bolts (Item 1) **[Figure 20-90-7]** from the side panel.

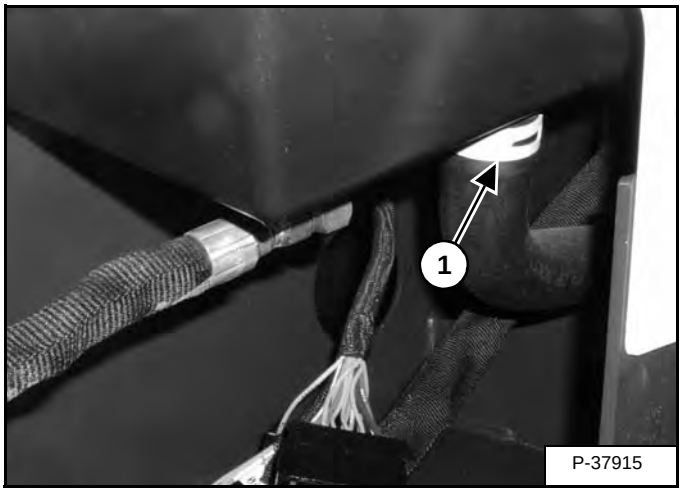
Remove the side panel from the loader.

Figure 20-90-8



Disconnect the hose (Item 1) **[Figure 20-90-8]** from the reservoir.

Figure 20-90-9



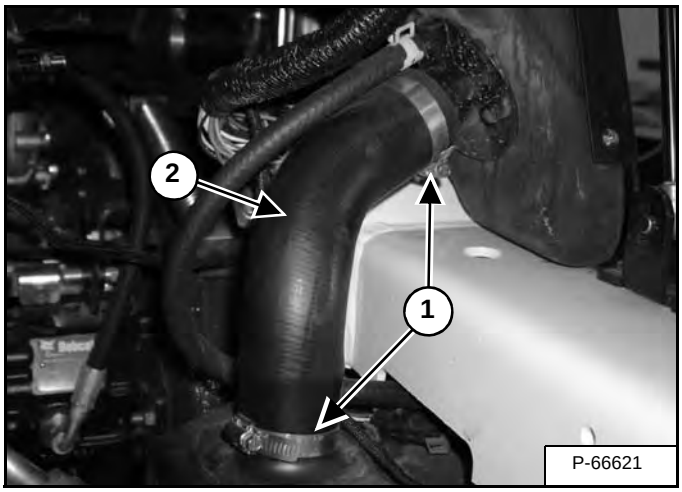
Slide the reservoir ahead. At the left motor access hole remove the hose clamp and hose (Item 1) **[Figure 20-90-9]** from the bottom of the reservoir.

Remove the hydraulic reservoir from the loader.

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Hydraulic Fluid Screen

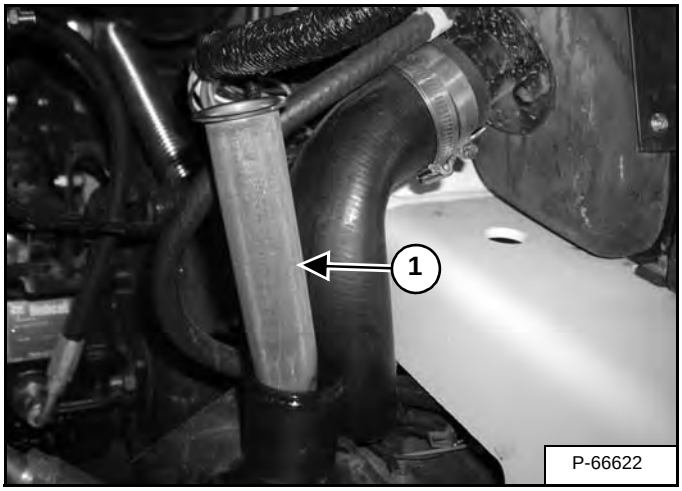
Figure 20-90-10



Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the two hose clamps (Item 1) and remove the hydraulic fill hose (Item 2) **[Figure 20-90-10]** from the hydraulic reservoir.

Figure 20-90-11



Remove the hydraulic fluid screen (Item 1) **[Figure 20-90-11]** from the reservoir.

Wash the screen in clean solvent and air dry, before replacing.

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OIL COOLER

Description

The oil cooler is used to cool the loaders hydraulic and hydrostatic oil. Oil passages are coiled into a heat exchanger. Air is forced around the passages cooling the oil.

The oil cooler is located underneath the rear grill between the A/C condenser (if so equipped) and the radiator.

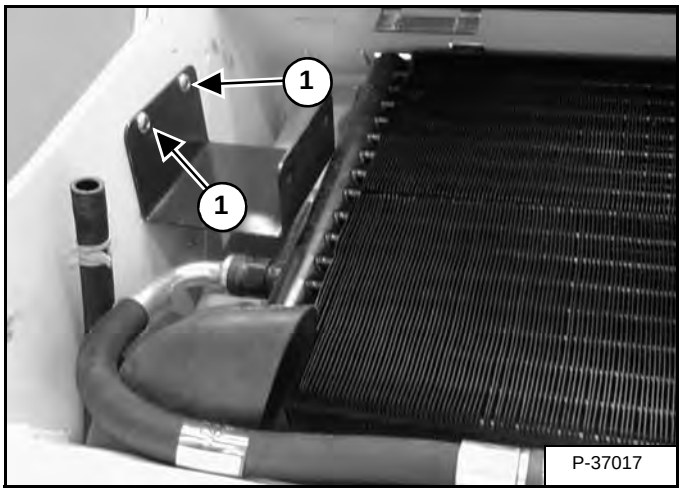
Removal And Installation

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.

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Figure 20-100-1



Open the rear door of the loader.

Raise and remove the rear grill.

Drain the coolant from the radiator and remove the radiator coolant tank. (See Removing And Replacing Coolant on Page 10-90-2.)

Remove the two radiator coolant tank mount bolts (Item 1) **[Figure 20-100-1]**.

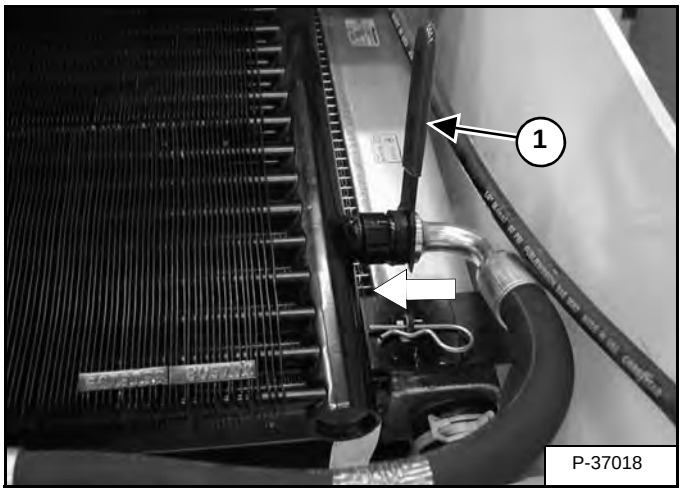
Remove the mount from the loader.

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OIL COOLER (CONT'D)

Removal And Installation (Cont'd)

Figure 20-100-2

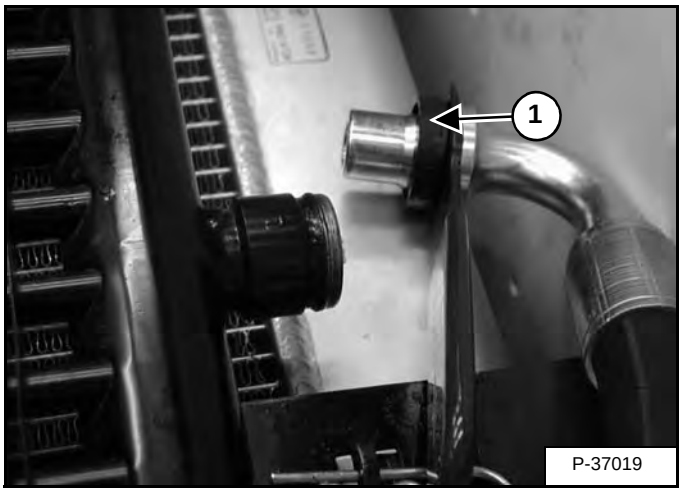


Install tool MEL1613 or MEL1640 (Item 1) **[Figure 20-100-2]** to the outside of the rubber sleeve.

NOTE: MEL1613 is used on standard machines. MEL 1640 is used on machines equipped with the high flow option or machines equipped with the SJC option.

Slide the rubber sleeve in toward the radiator.

Figure 20-100-3

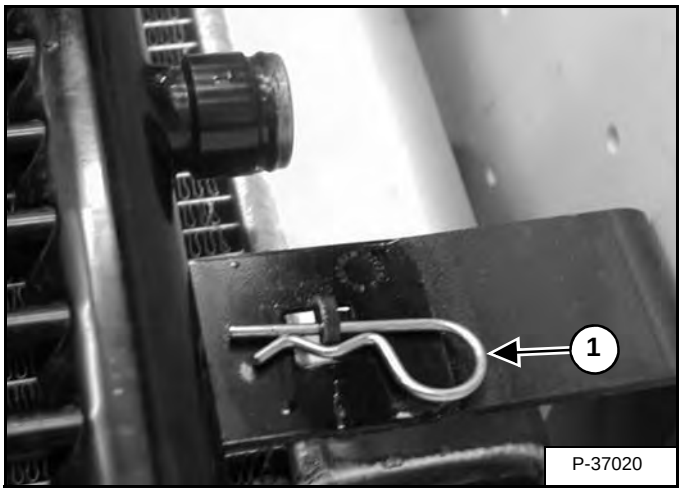


The connector will release from the radiator **[Figure 20-100-3]**.

Repeat the procedure for the other hose and fitting on the cooler.

NOTE: When installing the cooler hoses, the fittings should make a clicking sound when pushed together.

Figure 20-100-4



Remove the clip (Item 1) **[Figure 20-100-4]**. (Both sides.)

Lift the oil cooler from the mount and remove it from the loader.

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BUCKET POSITION VALVE

Description

The Bucket Position Valve is an option that allows the loader to meter the lift and tilt circuits. The metering of the lift and tilt circuits allows the operator to hold the attachment at the same angle from the ground to maximum lift height without using the tilt function.

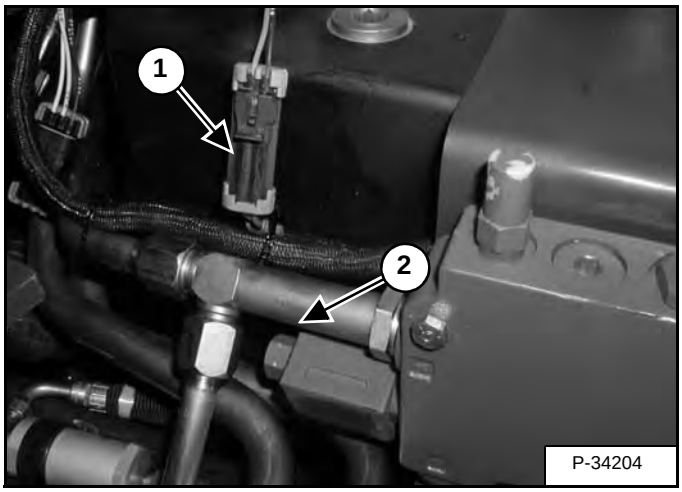
The bucket position valve is located below the operators cab on the right side of the hydraulic fluid reservoir.

See Hydraulic Schematic for more circuit information.

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Solenoid Removal And Installation

Figure 20-110-1

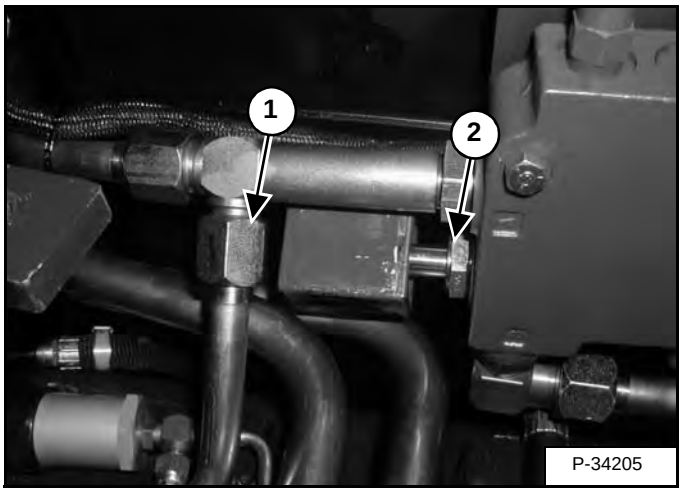


Disconnect the wire harness connector (Item 1) **[Figure 20-110-1]** from the bucket position solenoid.

Remove the solenoid nut (Item 2) **[Figure 20-110-1]**.

Installation: Tighten the solenoid nut to 60 in.-lb. (6,78 N•m) torque.

Figure 20-110-2

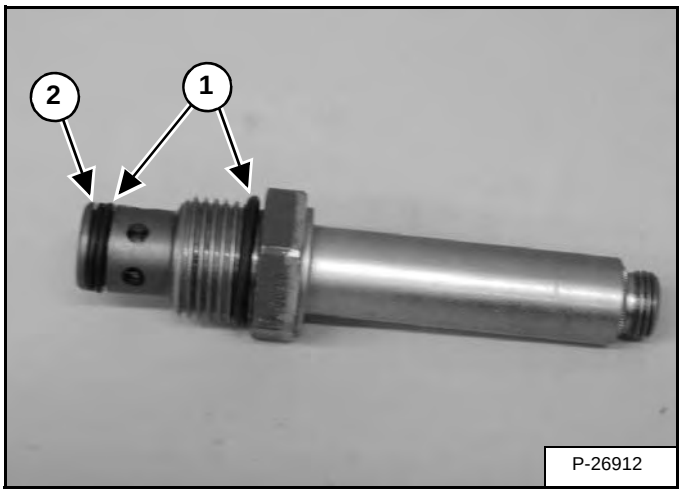


Move the solenoid until it touches the tubeline (Item 1) **[Figure 20-110-2]**.

Remove the solenoid stem and solenoid (Item 2) **[Figure 20-110-2]** from the bucket position valve.

Installation: Put oil on O-rings and back-up washers and tighten the solenoid stem to 30-35 ft.-lb. (40,8-47,6 N•m) torque.

Figure 20-110-3



Inspect the solenoid stem and replace the O-rings (Item 1) and the back-up washer (Item 2) **[Figure 20-110-3]**.

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Solenoid Testing

Figure 20-110-4

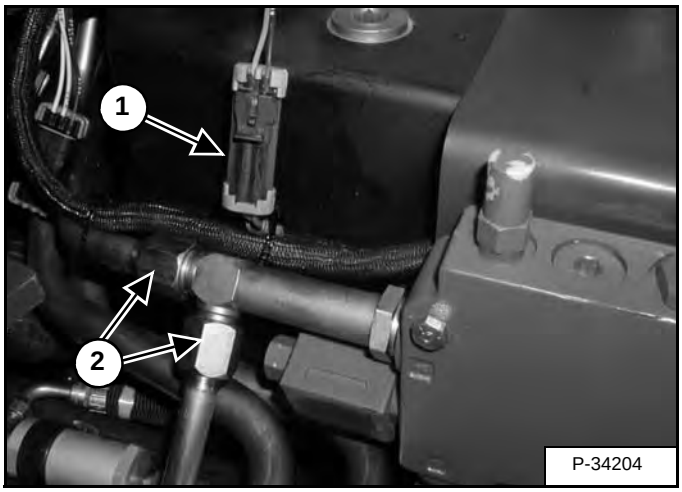


Use a test meter to measure coil resistance **[Figure 20-110-4]**. Coil wires do not have polarity. Correct resistance for the pressure relief (small) coil is 7-10 ohm and the other coils 5-8 ohms.

Replace the test meter with 12 volt power. You can see and hear the spool shift.

Removal And Installation

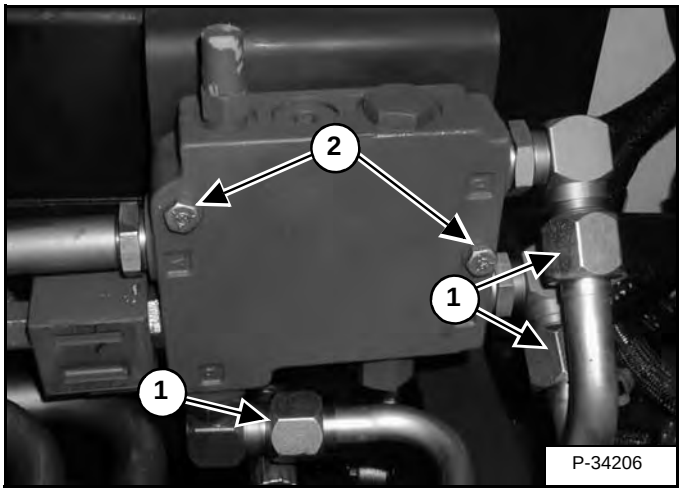
Figure 20-110-5



Disconnect the electrical harness (Item 1) **[Figure 20-110-5]**.

Disconnect the two tubelines (Item 2) **[Figure 20-110-5]**.

Figure 20-110-6



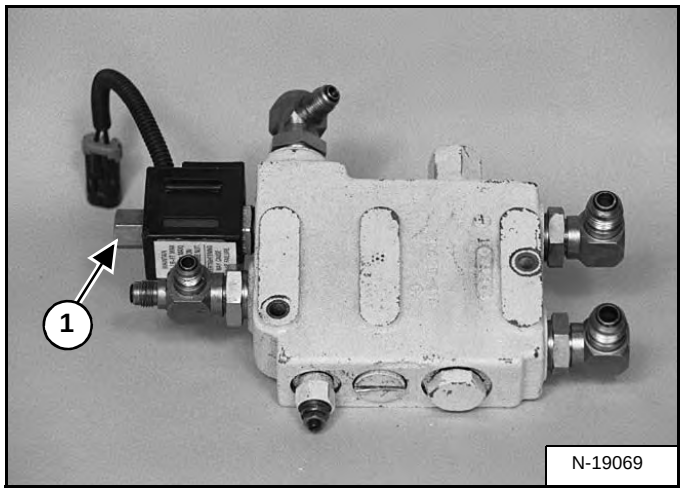
Disconnect the three tubelines (Item 1) **[Figure 20-110-6]** from the long tee fitting.

Remove the mounting bolts (Item 2) **[Figure 20-110-6]** from the bucket position valve.

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Disassembly And Assembly

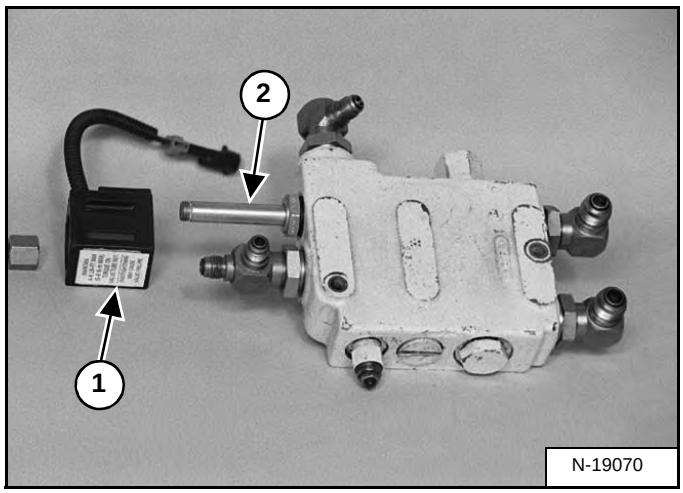
Figure 20-110-7



Remove the solenoid nut (Item 1) **[Figure 20-110-7]**.

Installation: Tighten the nut to 60 in.-lb. (6,78 N•m) torque.

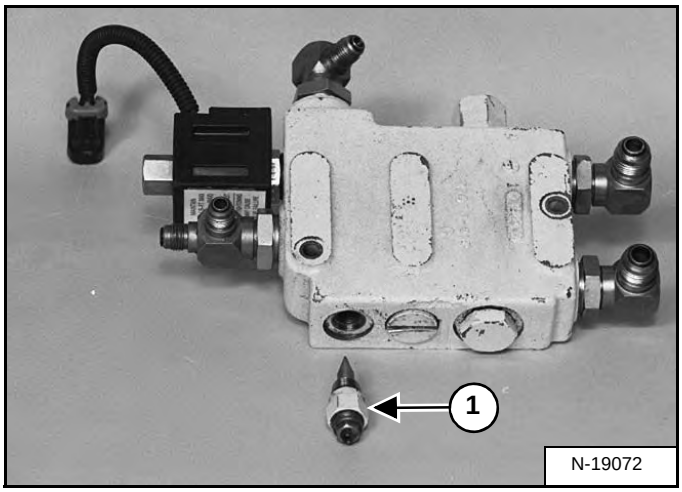
Figure 20-110-8



Remove the solenoid (Item 1) and the solenoid stem (Item 2) **[Figure 20-110-8]**.

Installation: Tighten the solenoid stem to 30-35 ft.-lb. (40,8-47,6 N•m) torque.

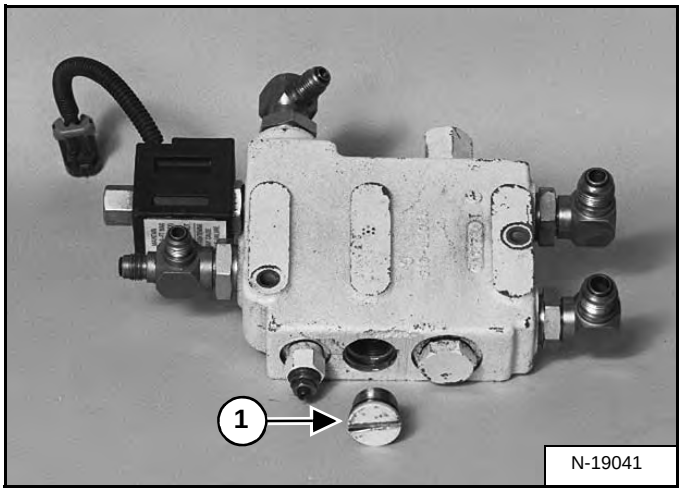
Figure 20-110-9



Remove the flow adjustment valve and O-ring (Item 1) **[Figure 20-110-9]**

NOTE: Always install new O-rings before any parts are installed into the valve. Check the parts for wear or damage and replace as needed.

Figure 20-110-10



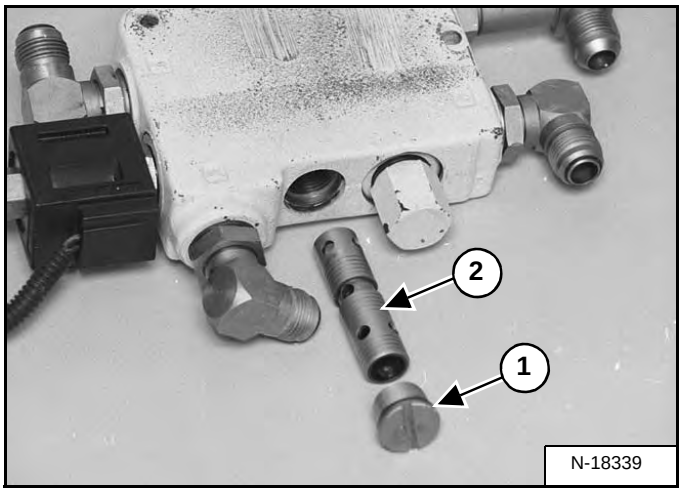
Remove the plug (Item 1) **[Figure 20-110-10]**.

Installation: Tighten the plug to 56-64 ft.-lb. (76-86,7 N•m) torque.

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Disassembly And Assembly (Cont'd)

Figure 20-110-11

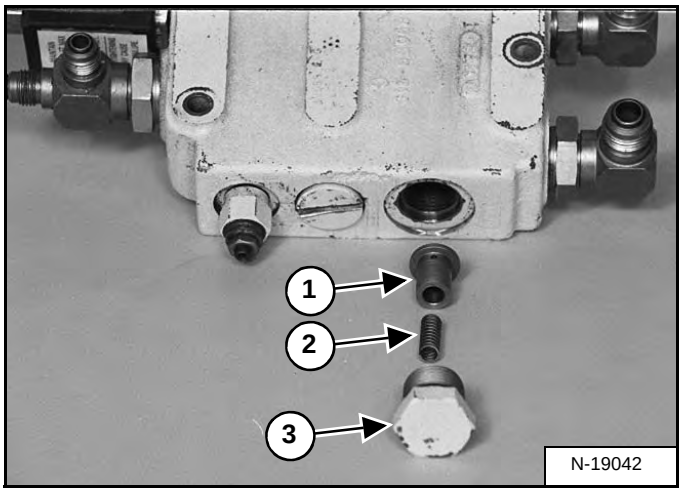


Remove the plug (Item 1), and flow control spool (Item 2) **[Figure 20-110-11]**.

Check the flow control spool for wear, check the O-ring on the plug and replace as needed.

Installation: Tighten the plug to 56-64 ft.-lb. (76-86,7 N•m) torque.

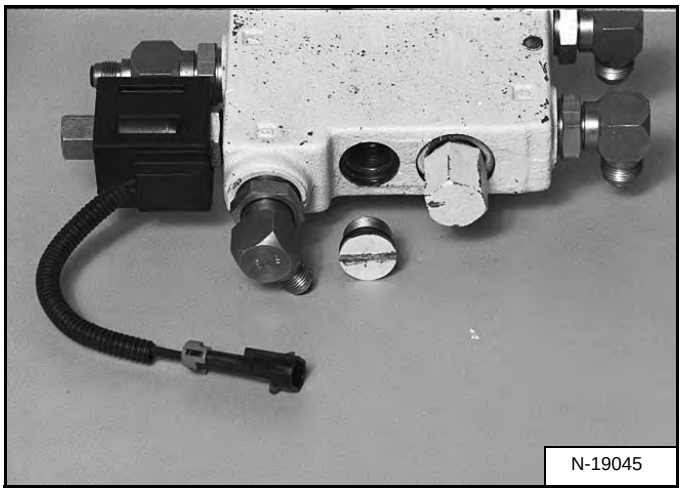
Figure 20-110-12



Remove the tilt cylinder check valve (Item 1) spring (Item 2) and plug (Item 3) **[Figure 20-110-12]**. Check for wear, check the O-ring and replace as needed.

Installation: Tighten the plug to 56-64 ft.-lb. (76-86,7 N•m) torque.

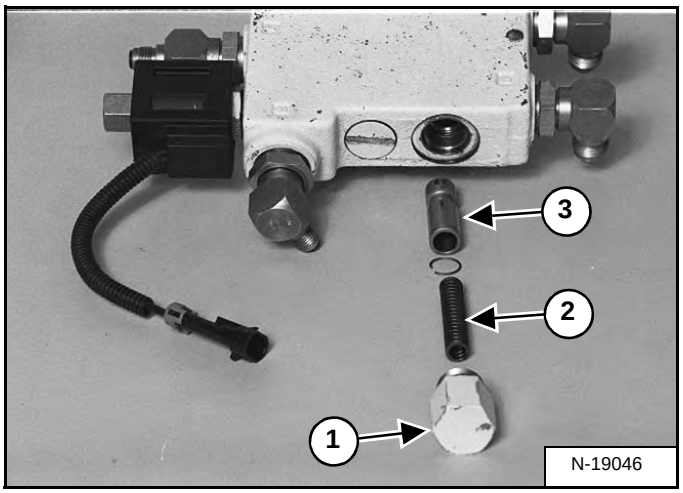
Figure 20-110-13



Remove the plug **[Figure 20-110-13]**.

Installation: Tighten the plug to 56-64 ft.-lb. (76-86,7 N•m) torque.

Figure 20-110-14



Remove the plug (Item 1), spring (Item 2) and unloading spool (Item 3) **[Figure 20-110-14]**.

Check all parts and replace as needed. Install a new O-ring on the plug before installing.

Installation: Tighten the plug to 56-64 ft.-lb. (76-86,7 N•m) torque.

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REAR AUXILIARY DIVERTER VALVE

Description

The rear auxiliary diverter valve is an optional valve that diverts oil from the front auxiliary circuit to two sets of rear auxiliary couplers or the right side auxiliaries. The couplers are used for rear mounted attachments.The right side auxiliaries are used for older attachments.

The rear couplers are located, one set on each side of the rear frame uprights.

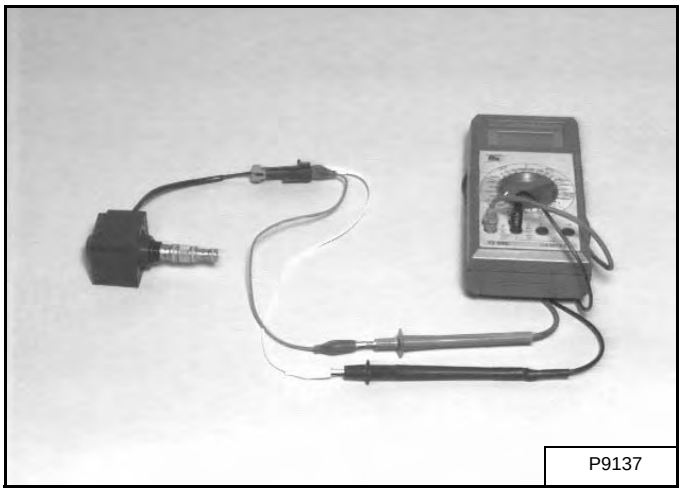
The right side auxiliaries are located on the inside of the right side lift arm at the front of the machine.

The rear auxiliary valve is located on the right side of the machine behind the blower housing. The valve is accessed by removing a panel on the right side of the machine.

See Hydraulic Schematic for more circuit information.

Solenoid Testing

Figure 20-120-1



Use a test meter to measure coil resistance **[Figure 20-120-1]**. Coil wires do not have polarity. Correct resistance is 8.6-9.5 ohms.

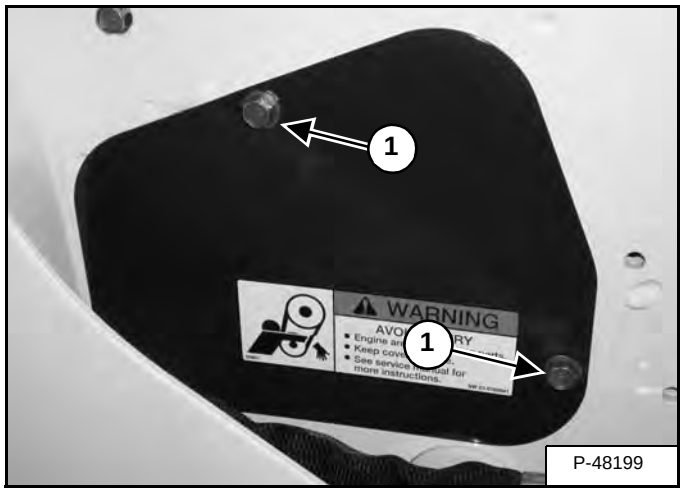
Replace the test meter with 12 volt power. You can see and hear the spool shift.

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REAR AUXILIARY DIVERTER VALVE (CONT'D)

Removal And Installation

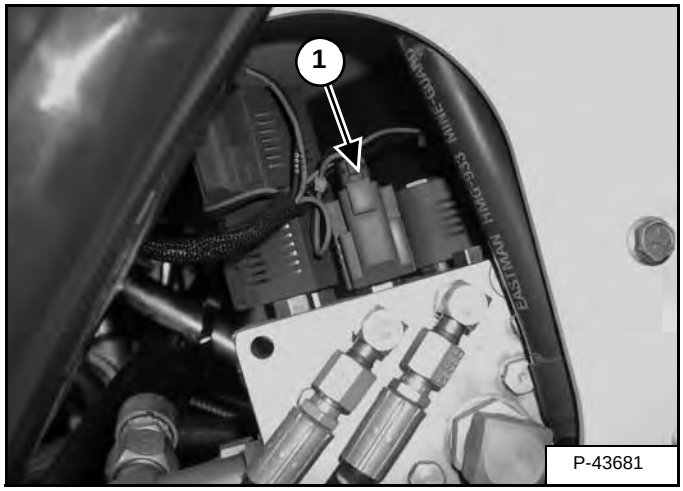
Figure 20-120-2



Remove the two access cover mount bolts (Item 1) **[Figure 20-120-2]** from the right side access cover. Remove the access cover.

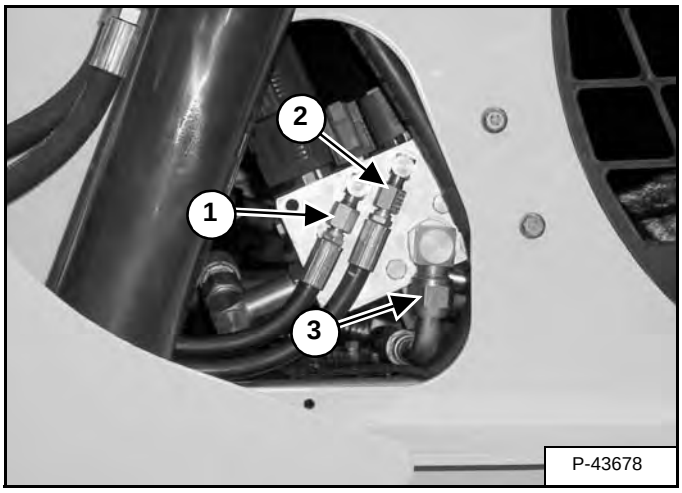
Mark all wires and hoses for proper installation.

Figure 20-120-3



Disconnect the four electrical connectors (Item 1) **[Figure 20-120-3]** from the diverter solenoids.

Figure 20-120-4



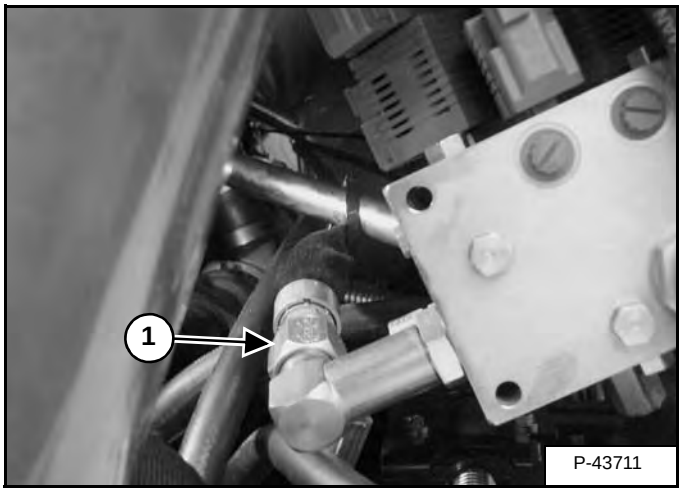
Disconnect the hose (Item 1) **[Figure 20-120-4]** from the base end fitting.

Disconnect the hose (Item 2) **[Figure 20-120-4]** from the rod end fitting.

Disconnect the hose (Item 3) **[Figure 20-120-4]** from the pressure outlet fitting.

Cap and plug all fittings and hoses.

Figure 20-120-5

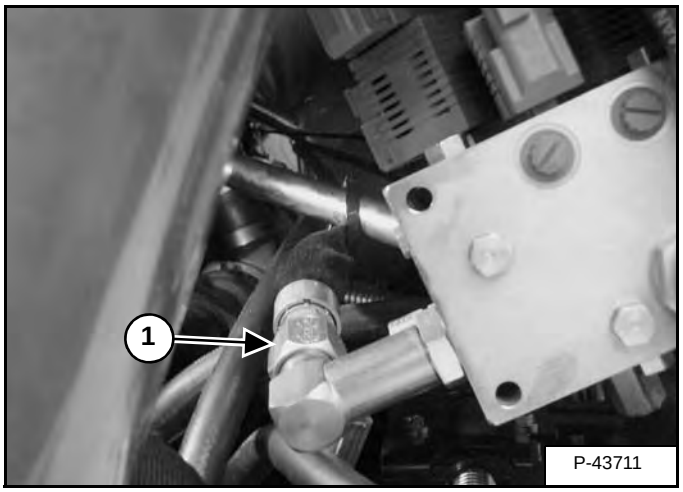


Disconnect the hose (Item 1) **[Figure 20-120-5]** from the pressure inlet fitting.

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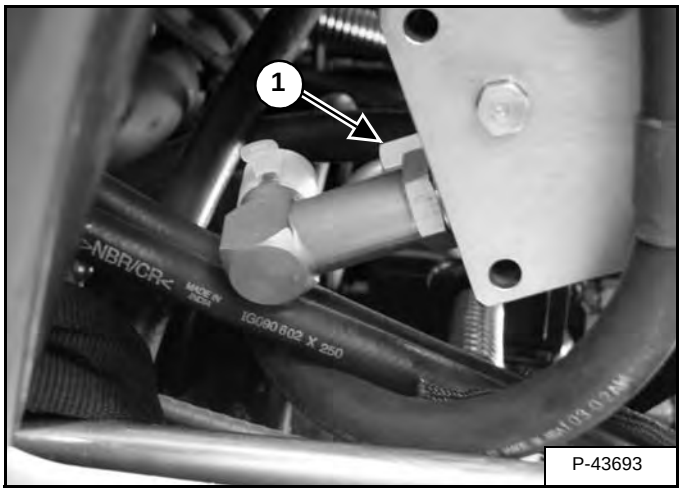
Removal And Installation (Cont'd)

Figure 20-120-6



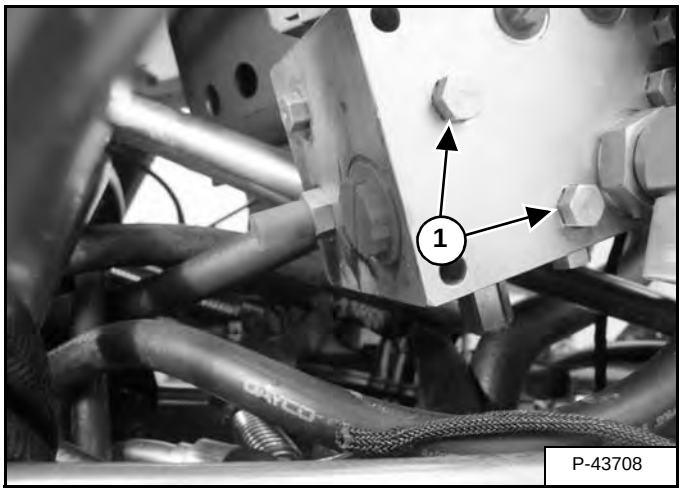
Disconnect the hose (Item 1) **[Figure 20-120-6]** from the pressure in fitting.

Figure 20-120-7



Disconnect the hose (Item 1) **[Figure 20-120-7]** from the fitting that goes to tank.

Figure 20-120-8



Remove the two mount bolts (Item 1) **[Figure 20-120-8]** from the block.

Remove the diverter valve from the loader.

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Disassembly And Assembly

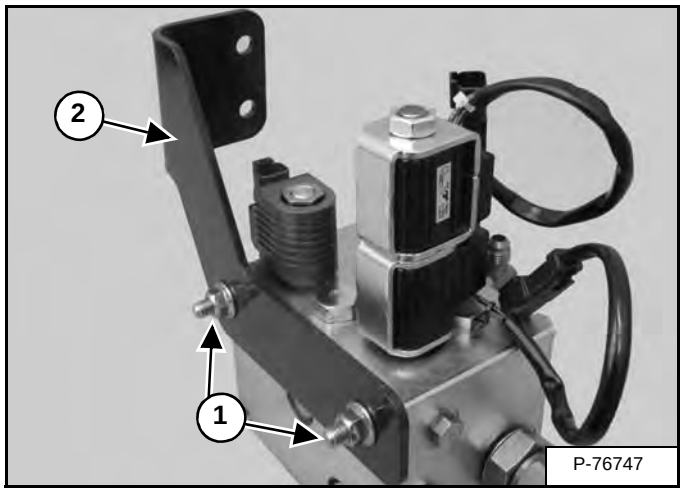
IMPORTANT

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

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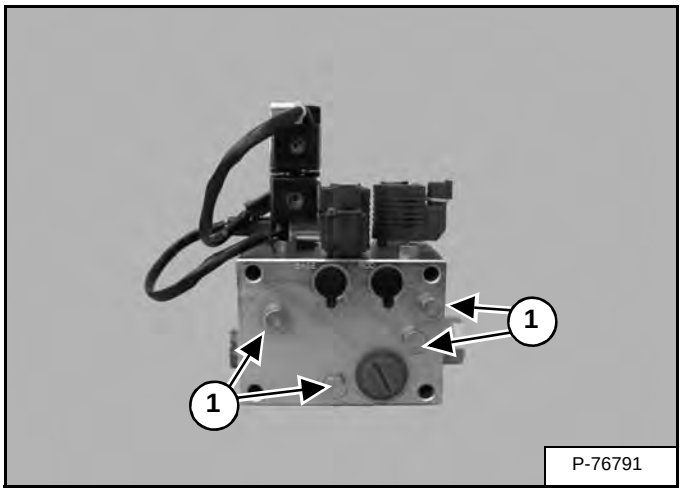
Clean the diverter valve to remove dirt before disassembly. Valve ports are labeled for correct assembly.

Figure 20-120-9



Remove the two mount bolts (Item 1) from the diverter valve mount plate (Item 2) **[Figure 20-120-9]** and remove the mount plate.

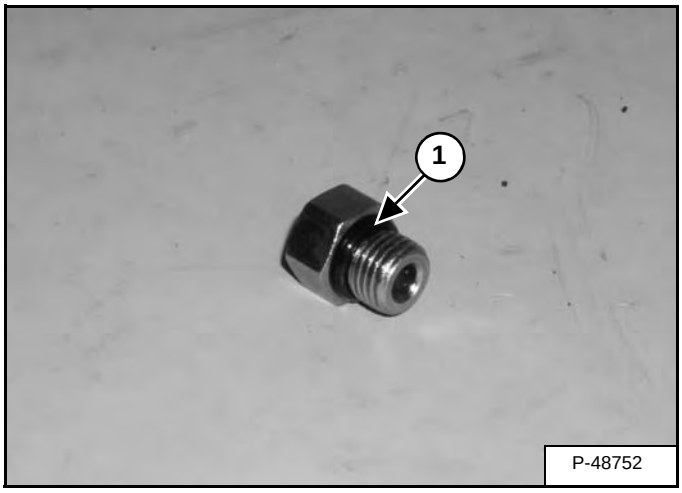
Figure 20-120-10



There are 11 #4 SAE hex head plugs (Item 1) **[Figure 20-120-10]** located on all sides of the diverter valve and can be removed for clean out purposes.

Assembly: Put oil on O-rings. Tighten to 10 ft.-lb. (13,6 N•m) torque.

Figure 20-120-11



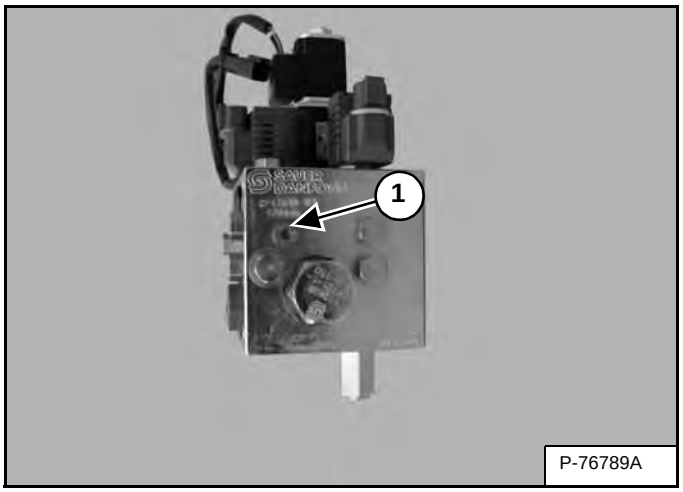
Inspect O-ring (Item 1) **[Figure 20-120-11]**.

Assembly: Put oil on O-ring.

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Disassembly And Assembly (Cont'd)

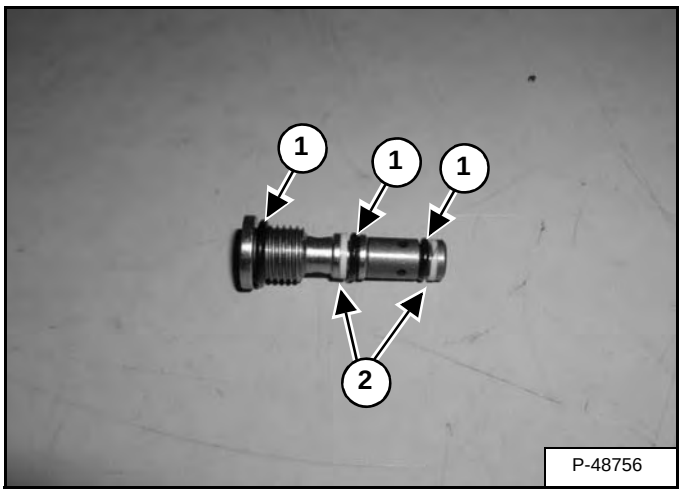
Figure 20-120-12



Remove the shuttle valve (Item 1) **[Figure 20-120-12]**.

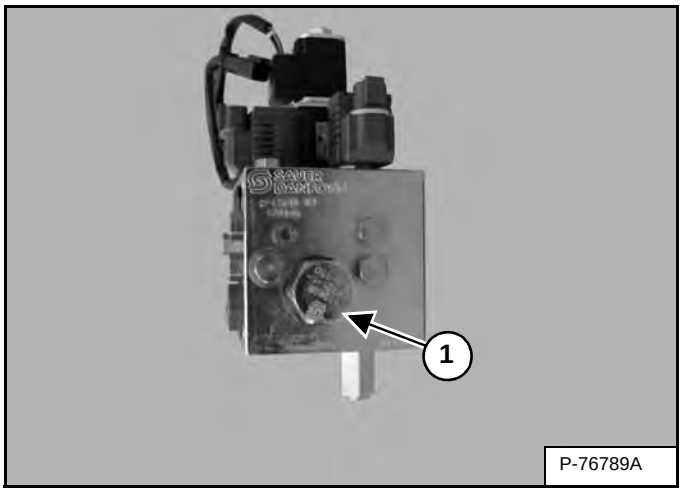
Assembly: Put oil on the O-rings and back-up washers. Tighten to 8 ft.-lb. (10,8 N•m) torque.

Figure 20-120-13



Inspect the O-rings (Item 1) and back-up washers (Item 2) **[Figure 20-120-13]** for damage.

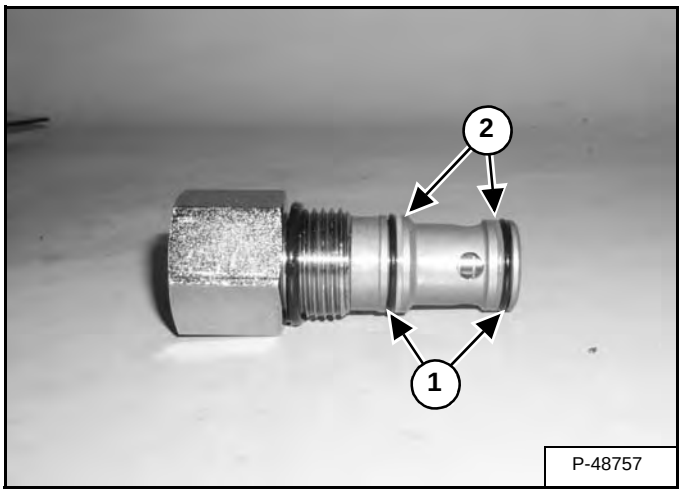
Figure 20-120-14



Remove the differential sensing valve (Item 1) **[Figure 20-120-14]**.

Assembly: Put oil on O-rings and back-up washers. Tighten to 85 ft.-lb. (115,25 N•m) torque.

Figure 20-120-15

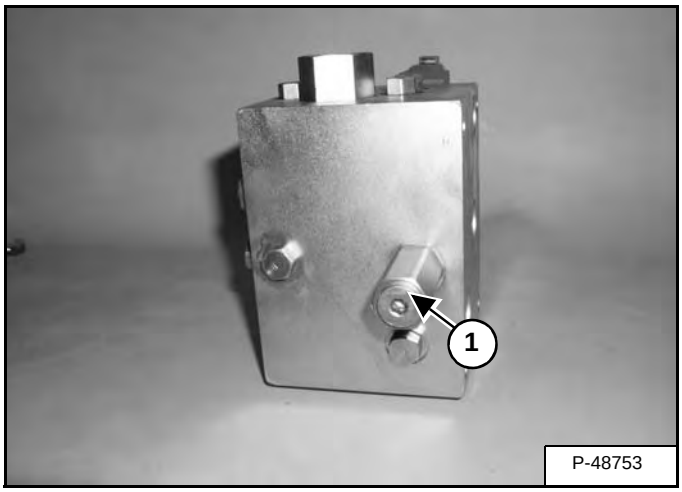


Inspect the O-rings (Item 1) and back-up washers (Item 2) **[Figure 20-120-15]** for damage.

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Disassembly And Assembly (Cont'd)

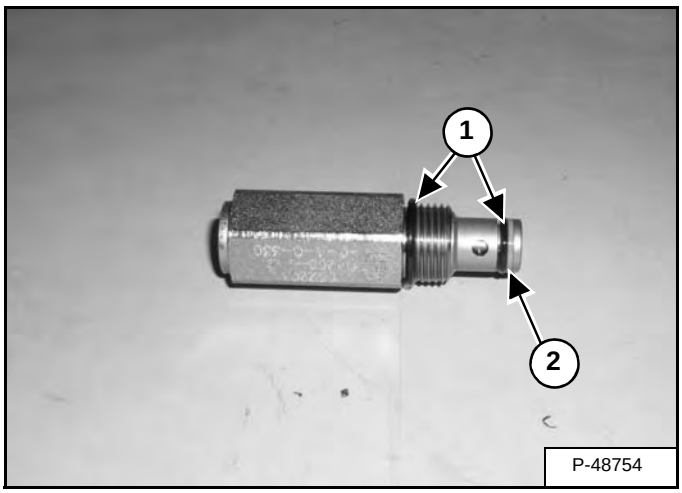
Figure 20-120-16



Remove the relief valve (Item 1) **[Figure 20-120-16]**.

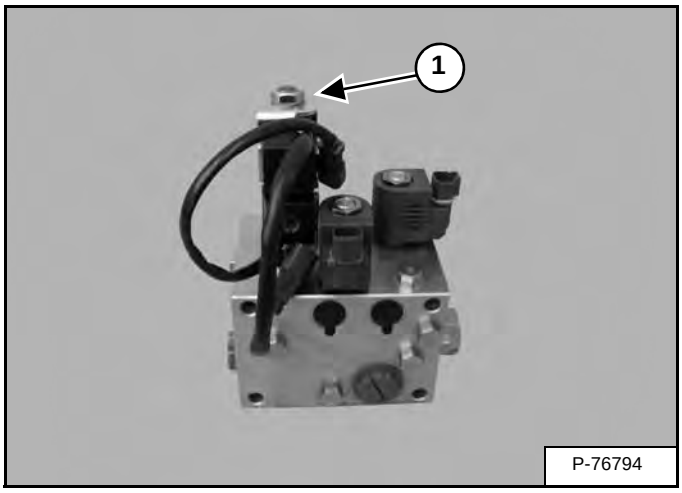
Assembly: Put oil on O-rings and back-up washers. Tighten to 25 ft.-lb. (34 N•m) torque.

Figure 20-120-17



Inspect the O-rings (Item 1) and back-up washer (Item 2) **[Figure 20-120-17]** for damage.

Figure 20-120-18

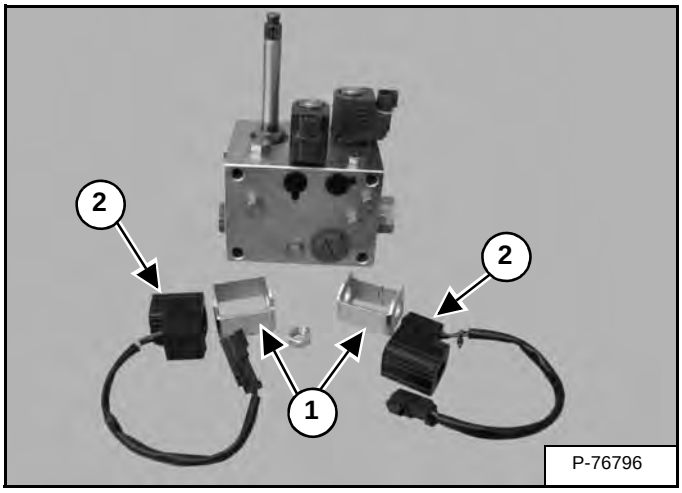


NOTE: Before removing the solenoid coils, mark the coils for proper alignment.

Remove the nut (Item 1) **[Figure 20-120-18]** from the solenoid valve stem.

Assembly: Tighten the nut to 4-6 ft.-lb. (5-8 N•m) torque.

Figure 20-120-19

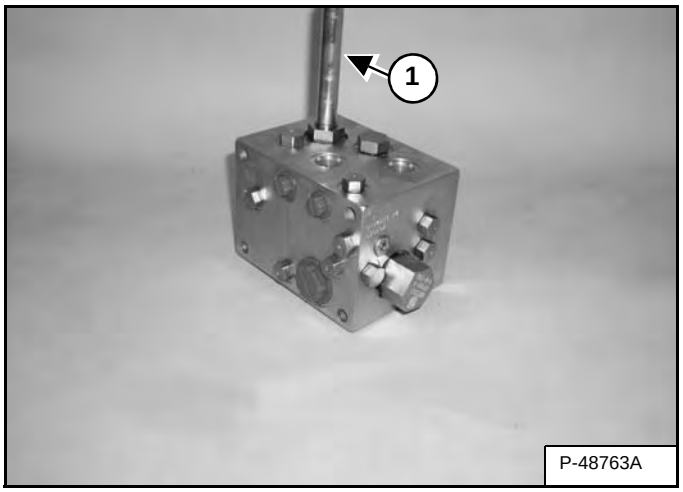


Remove the metal shields (Item 1) and solenoid valve coils (Item 2) **[Figure 20-120-19]**.

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Disassembly And Assembly (Cont'd)

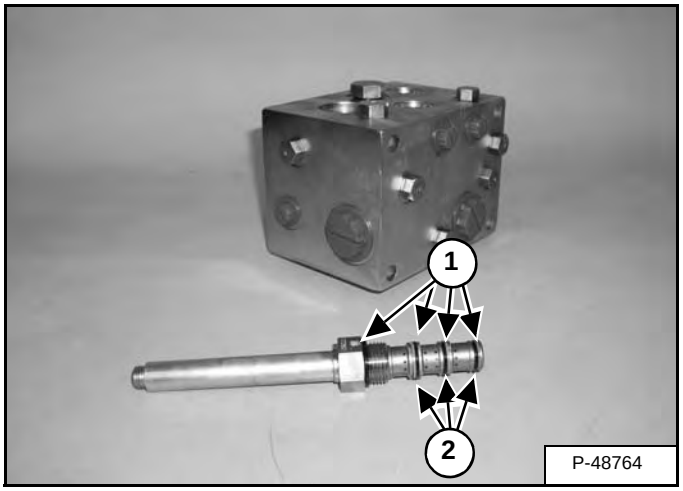
Figure 20-120-20



Remove the solenoid valve stem (Item 1) **[Figure 20-120-20]**

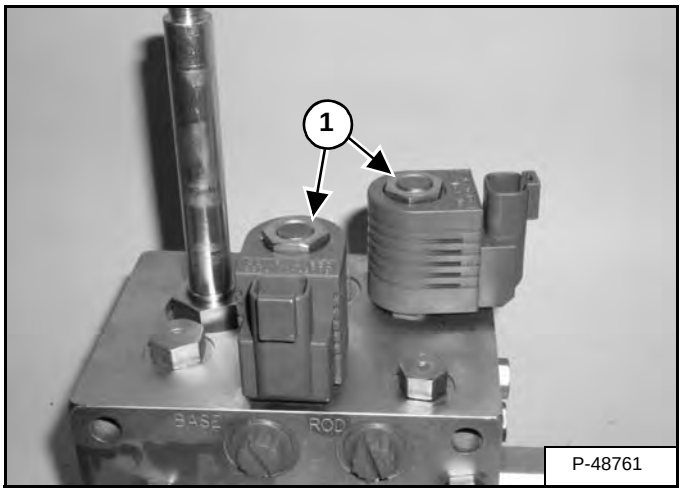
Assembly: Put oil on the O-rings and back-up washers. Tighten to 25 ft.-lb. (34 N•m) torque.

Figure 20-120-21



Inspect the O-rings (Item 1) and back-up washers (Item 2) **[Figure 20-120-21]** for damage.

Figure 20-120-22

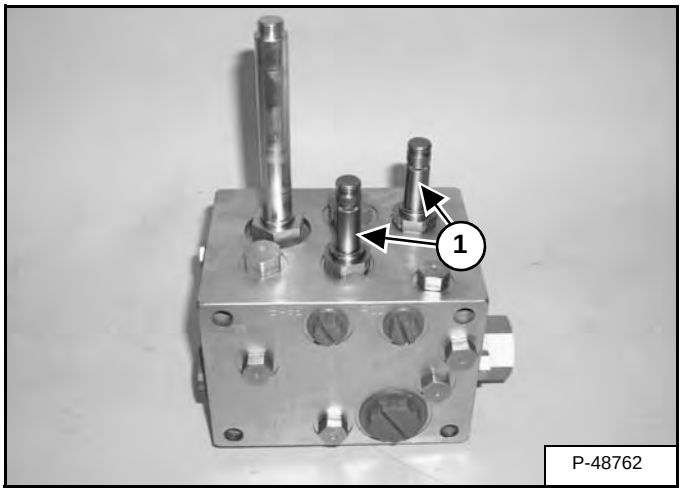


NOTE: Before removing the solenoid coils, mark the coils for proper alignment.

Remove the nuts (Item 1) **[Figure 20-120-22]** from the solenoid valve stems.

Assembly: Tighten the nut to 4-6 ft.-lb. (5-8 N•m) torque.

Figure 20-120-23



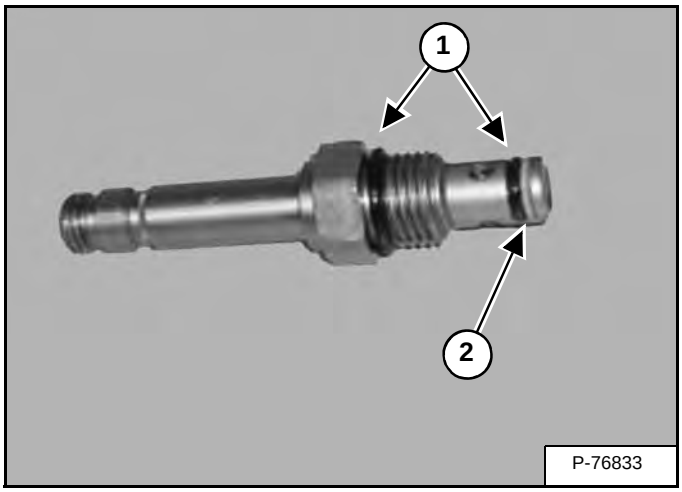
Remove the solenoid valve stems (Item 1) **[Figure 20-120-23]**.

Assembly: Put oil on the O-rings and back-up washers. Tighten to 25 ft.-lb. (34 N•m) torque.

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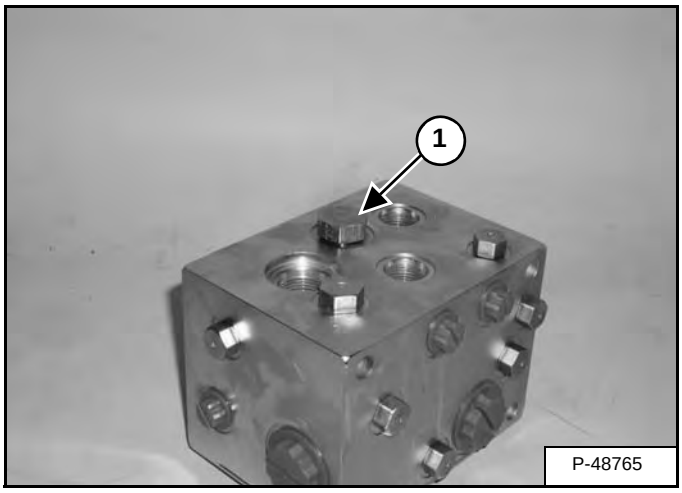
Disassembly And Assembly (Cont'd)

Figure 20-120-24



Inspect the O-rings (Item 1) and back-up washer (Item 2) **[Figure 20-120-24]**.

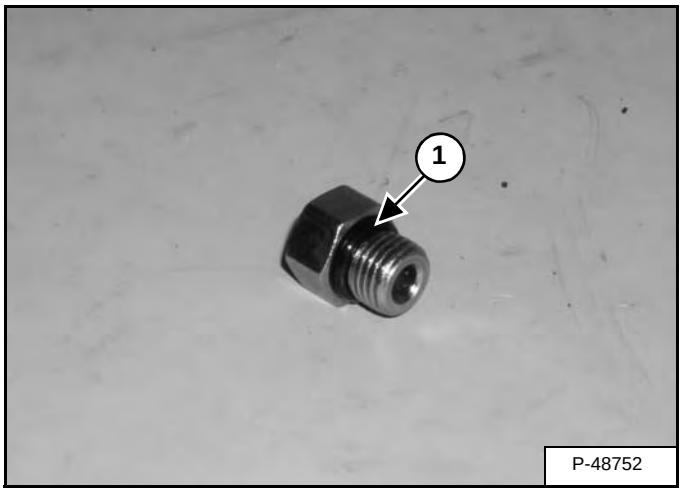
Figure 20-120-25



Remove the #8 SAE hex head plug (Item 1) **[Figure 20-120-25]**.

Assembly: Tighten the plug to 38 ft.-lb. (51,5 N•m) torque.

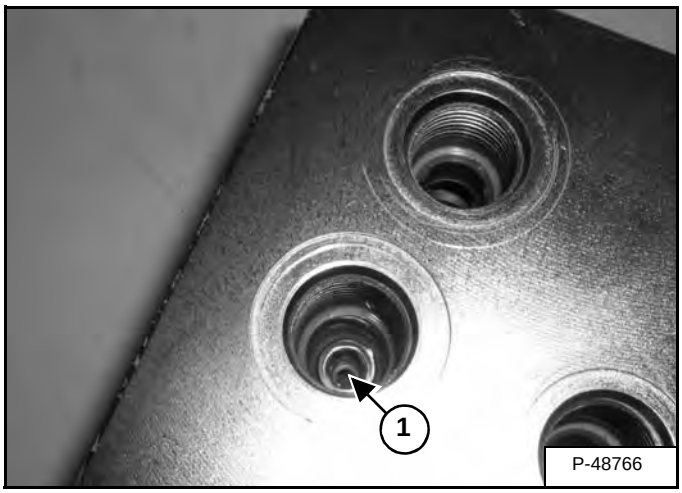
Figure 20-120-26



Inspect O-ring (Item 1) **[Figure 20-120-26]**.

Assembly: Put oil on O-ring.

Figure 20-120-27



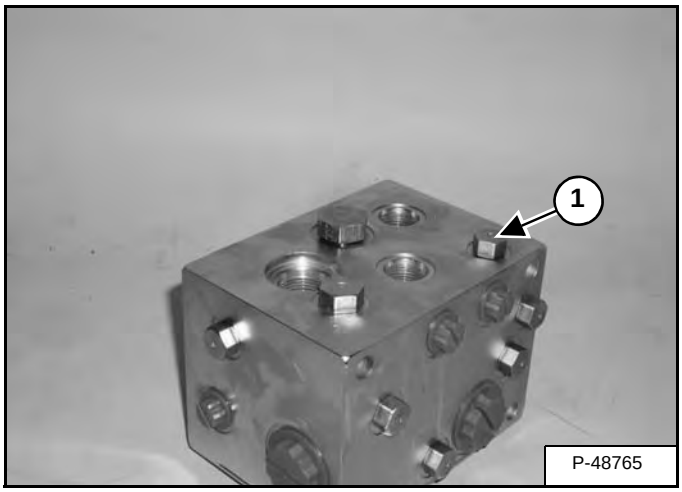
Remove and inspect the orifice (Item 1) **[Figure 20-120-27]** for dirt and debris.

Assembly: Tighten the orifice to 22 ft.-lb. (29,8 N•m) torque.

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Disassembly And Assembly (Cont'd)

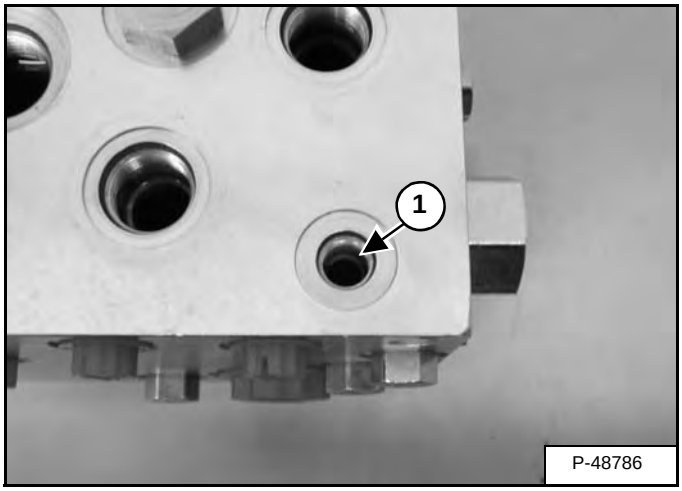
Figure 20-120-28



Remove the #4 SAE hex head plug (Item 1) **[Figure 20-120-28]**.

Assembly: Tighten the plug to 10 ft.-lb. (13,6 N•m) torque.

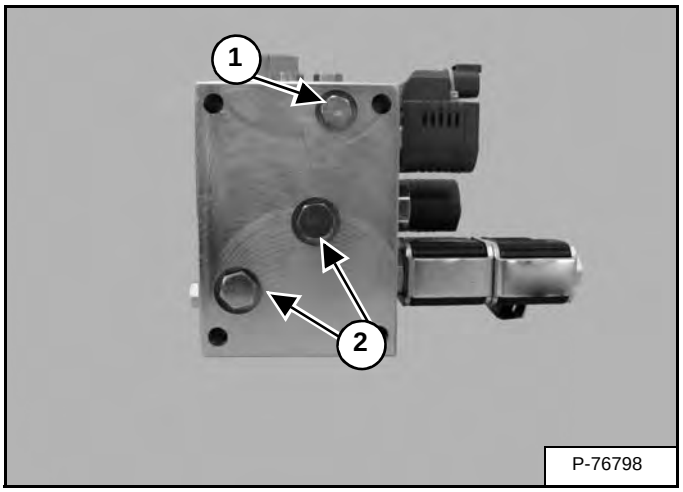
Figure 20-120-29



Remove the orifice (Item 1) **[Figure 20-120-29]** and inspect for dirt and debris.

Assembly: Tighten the orifice to 3.3 ft.-lb. (4,5 N•m) torque.

Figure 20-120-30

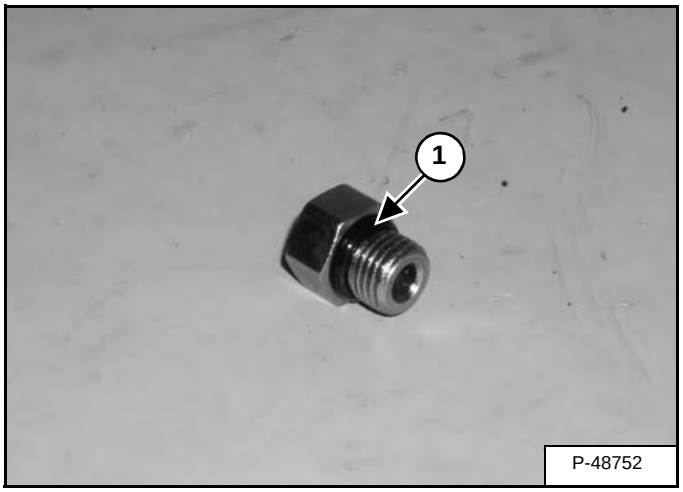


Remove the #4 SAE hex head plug (Item 1) and the #6 SAE hex head plugs (Item 2) **[Figure 20-120-30]**.

Assembly: Tighten the #4 SAE hex head plug to 10 ft.-lb. (13,6 N•m) torque.

Assembly: Tighten the #6 SAE hex head plugs to 14 ft.-lb. (19 N•m) torque.

Figure 20-120-31



Inspect O-ring (Item 1) **[Figure 20-120-31]**.

Assembly: Put oil on O-ring.

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BOB-TACH (POWER) BLOCK

Description

The power Bob-Tach block is an option that allows the operator to hydraulically control the Bob-Tach levers for mounting and dismounting the attachments.

The power Bob-Tach is operated by a switch on the front console.

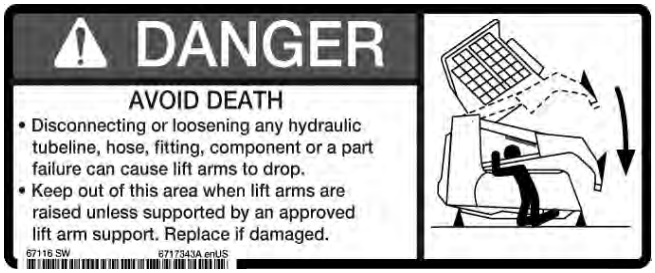
The power Bob-Tach block is mounted on the right side of the machine in front of the engine on the backside of the hydraulic pump.

Removal And Installation

WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

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IMPORTANT

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

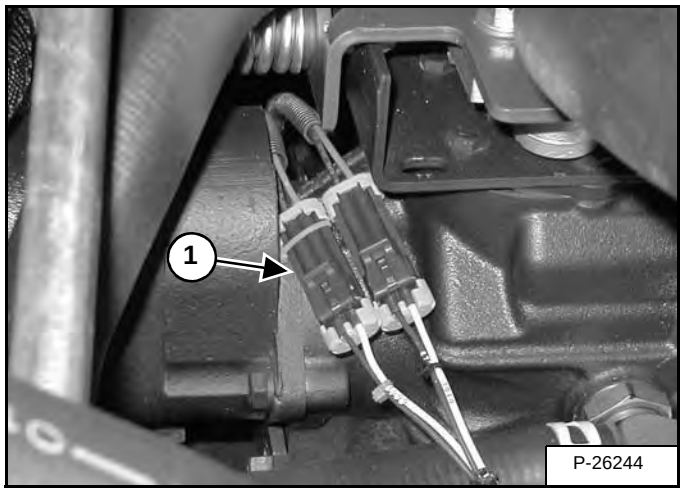
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BOB-TACH (POWER) BLOCK (CONT'D)

Removal And Installation (Cont'd)

Figure 20-130-1



Lift and block the loader. (See Procedure on Page 10-10-1.)

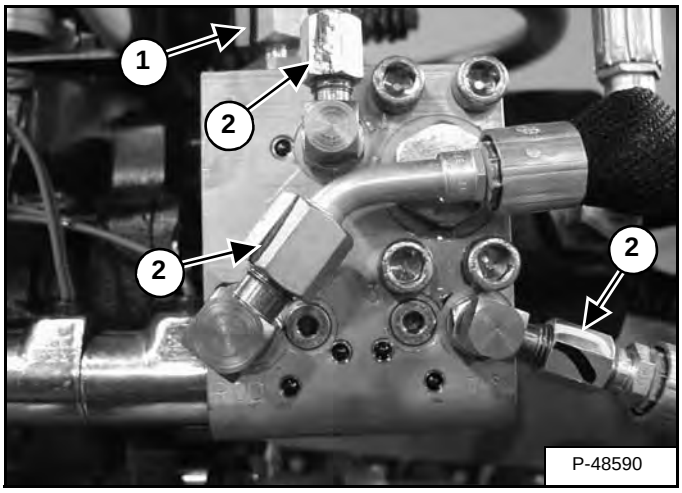
Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-2.)

Disconnect and cap the two electrical solenoid connectors (Item 1) **[Figure 20-130-1]** from the loader electrical harness.

Figure 20-130-2

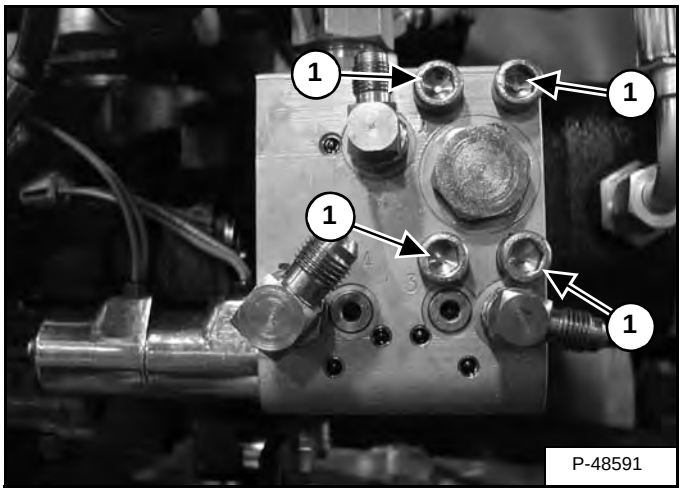


Disconnect and cap the outlet hose (Item 1) **[Figure 20-130-2]** from block.

Mark the hydraulic hoses for proper installation.

Disconnect and cap the hose (Item 2) **[Figure 20-130-2]** from block.

Figure 20-130-3



Remove the four mounting bolts (Item 1) **[Figure 20-130-3]**.

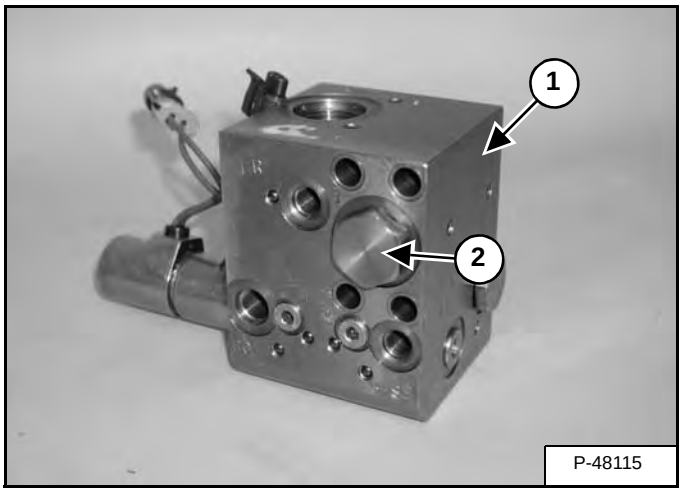
Installation: Tighten the mounting bolts to 25-28 ft.-lb. (34-38 N•m) torque.

Remove the power Bob-Tach block.

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Disassembly And Assembly

Figure 20-130-4



Clean the block (Item 1) **[Figure 20-130-4]** to remove dirt before disassembly. Block ports are labeled for correct assembly.

Remove the plug (Item 2) **[Figure 20-130-4]**.

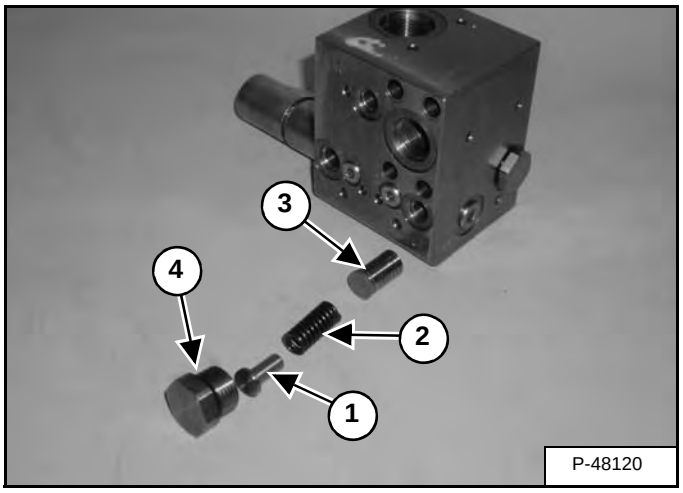
Installation: Tighten the plug to 25-30 ft.-lb. (34-40,6 N•m) torque.

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

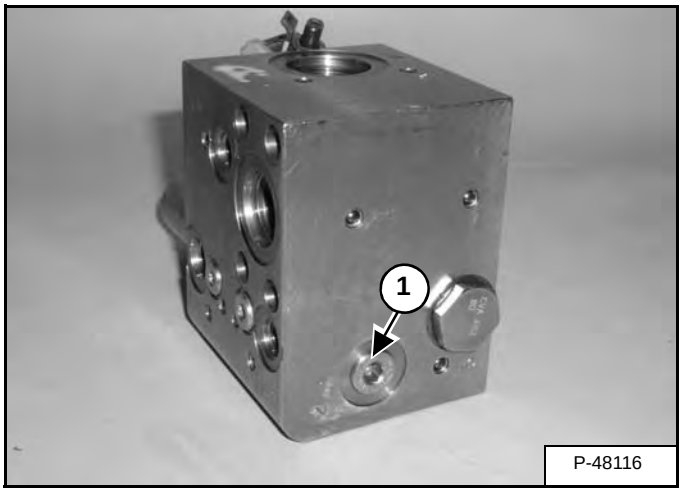
Figure 20-130-5



Remove the spring guide (Item 1), spring (Item 2) and the spool (Item 3) **[Figure 20-130-5]**.

Check the O-ring (Item 4) **[Figure 20-130-5]** on the plug and replace as needed.

Figure 20-130-6



NOTE: This plug is a zero leak plug and should not be removed. If removed damage may occur and the plug and O-ring must be replaced.

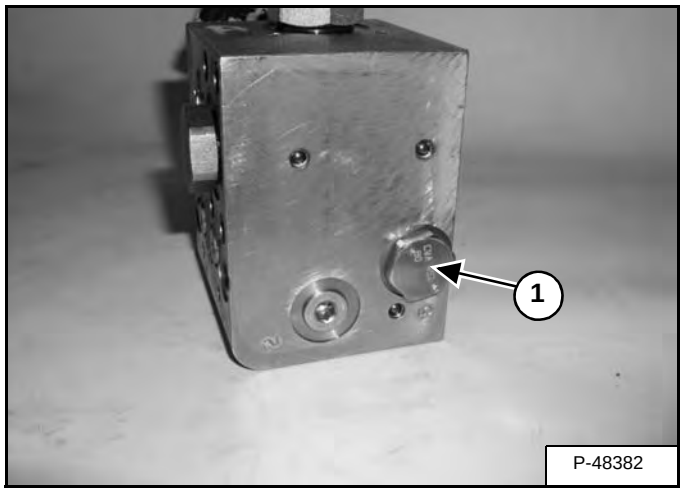
Do not remove the plug (Item 1) **[Figure 20-130-6]**.

Installation: Tighten the plug to 12-14 ft.-lb. (16,3-19 N•m) torque.

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Disassembly And Assembly (Cont'd)

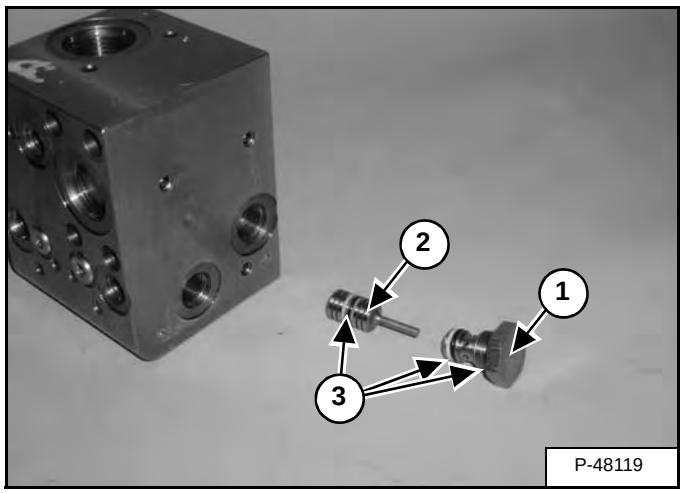
Figure 20-130-7



Remove the check valve (Item 1) **[Figure 20-130-7]**.

Installation: Oil the check valve and O-rings and tighten the check valve to 20-25 ft.-lb. (27,1-34 N•m) torque.

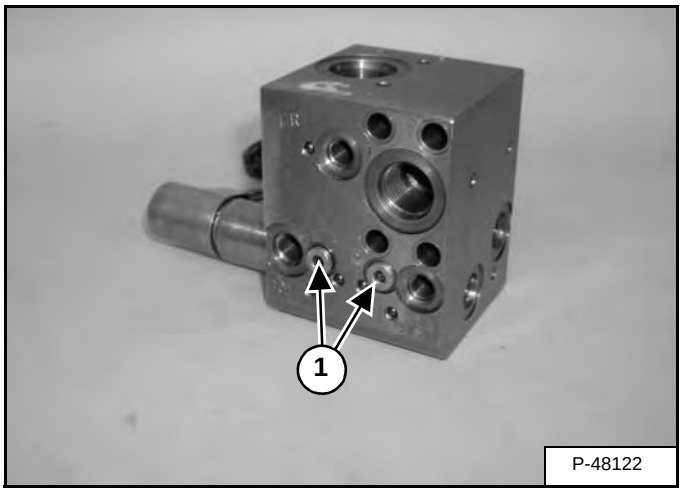
Figure 20-130-8



Inspect the check valve (Item 1) and piston assembly (Item 2) **[Figure 20-130-8]**.

Check the O-rings and back-up washers (Item 3) **[Figure 20-130-8]** on the check valve and piston assembly and replace as needed.

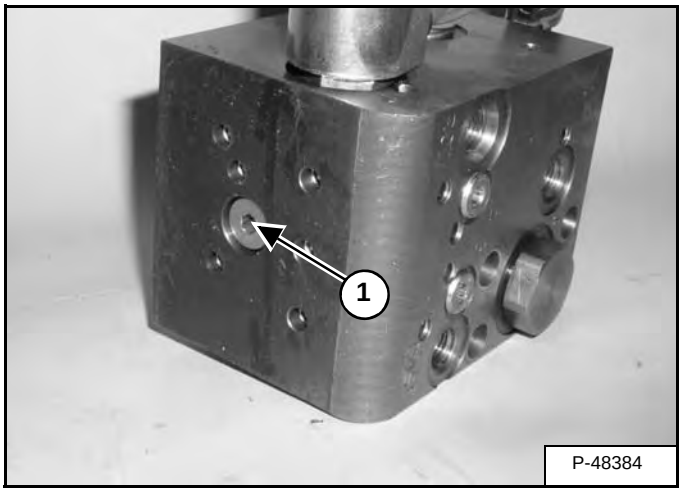
Figure 20-130-9



Do not remove the plugs (Item 1) **[Figure 20-130-9]**.

NOTE: Do not remove plugs. If the plugs are removed the internal pressure relieving spring setting will be altered.

Figure 20-130-10



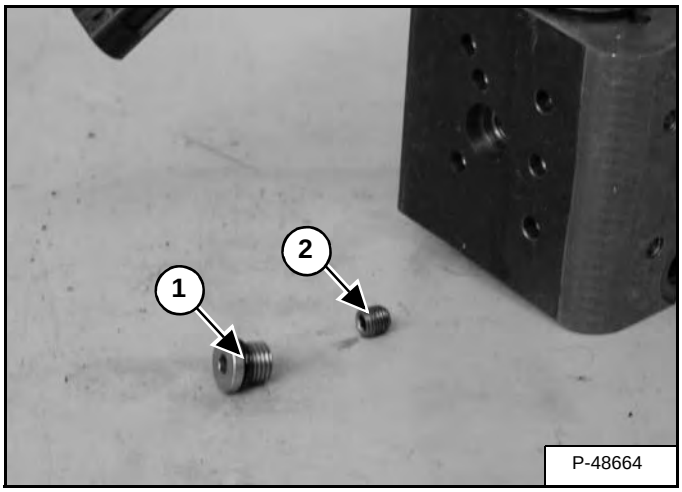
Remove the plug (Item 1) **[Figure 20-130-10]**, inspect the O-ring and replace as needed.

Installation: Tighten the plug (Item 1) **[Figure 20-130-10]** to 12-14 ft.-lb. (16,3-19 N•m) torque.

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Disassembly And Assembly (Cont'd)

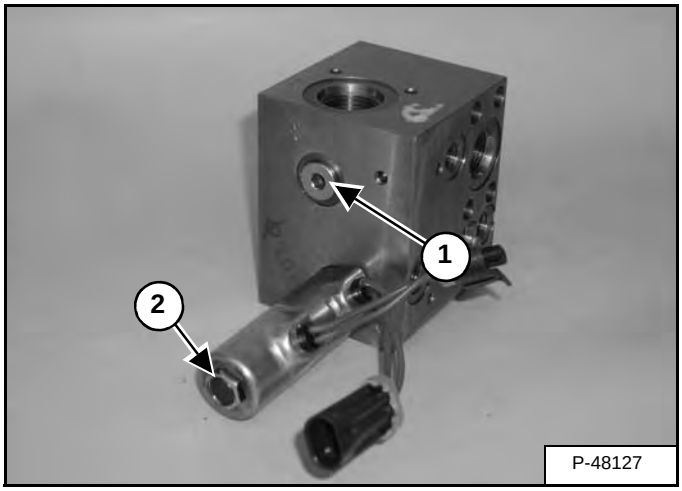
Figure 20-130-11



Remove the orifice screw (Item 2) located behind the plug (Item 1) **[Figure 20-130-11]**.

Installation: Tighten the orifice screw (Item 2) **[Figure 20-130-11]** to 6-8 ft.-lb. (8,1-10,8 N•m) torque.

Figure 20-130-12



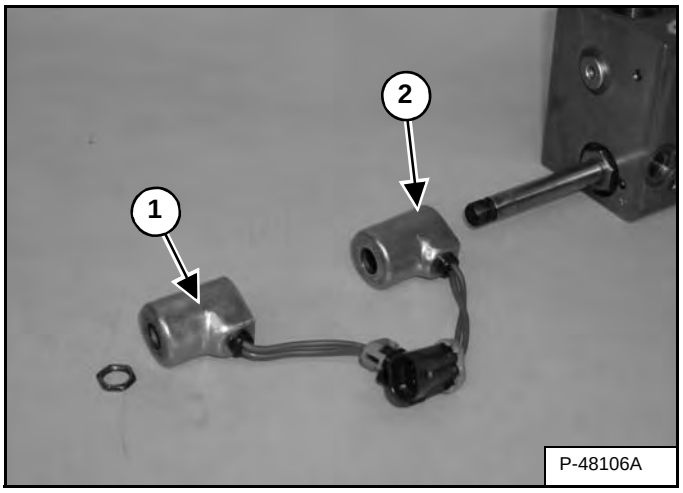
NOTE: This plug is a zero leak plug and should not be removed. If removed damage may occur and the plug and O-ring must be replaced.

Do not remove the plug (Item 1) **[Figure 20-130-12]**.

Remove the solenoid nut (Item 2) **[Figure 20-130-12]**.

Installation: Tighten the solenoid valve stem nut to 15-45 in.-lb. (1,7-5,1 N•m) torque.

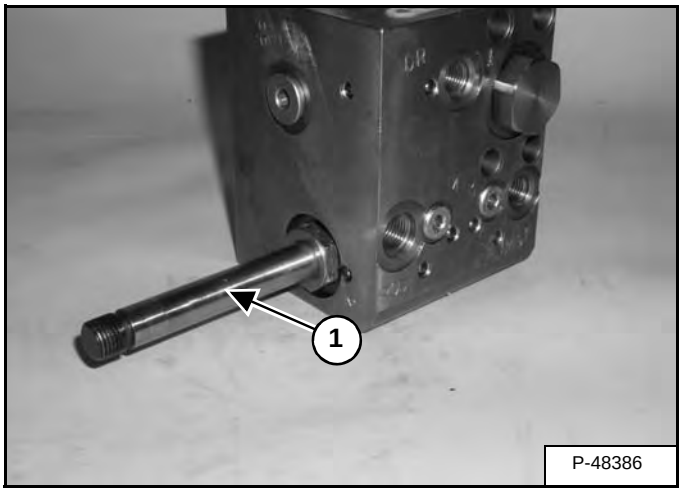
Figure 20-130-13



Remove the first solenoid coil (Item 1) and the second solenoid coil (Item 2) **[Figure 20-130-13]**.

NOTE: Remember the solenoid coil orientation for ease of installation.

Figure 20-130-14



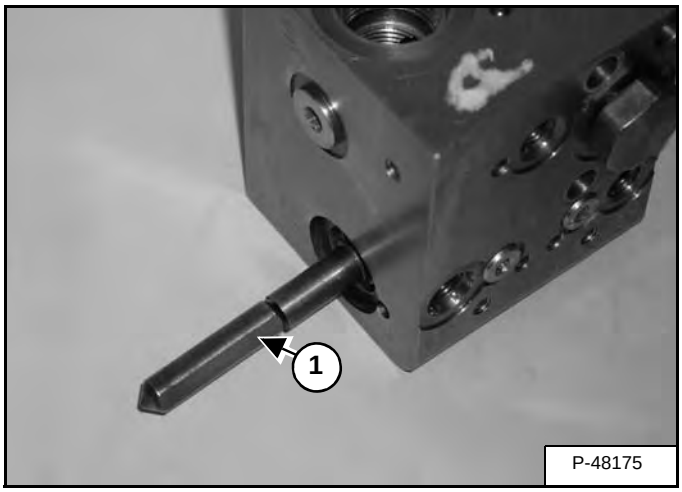
Remove the solenoid stem (Item 1) **[Figure 20-130-14]**.

Installation: Tighten the solenoid stem to 20-25 ft.-lb. (27,1-34 N•m) torque.

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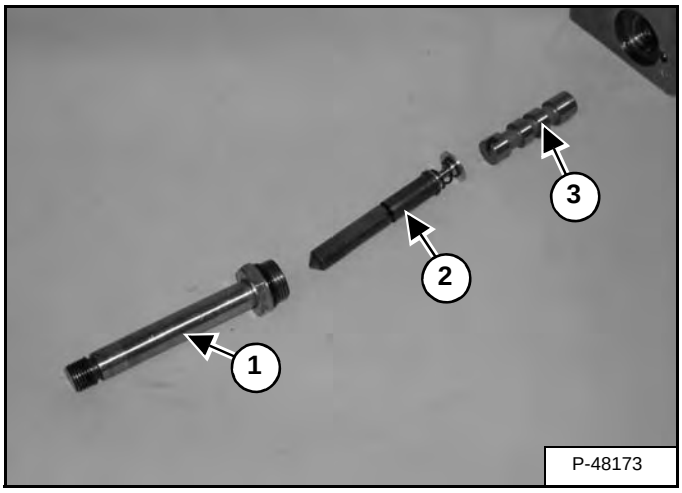
Disassembly And Assembly (Cont'd)

Figure 20-130-15



Remove the armature rod assembly (Item 1) **[Figure 20-130-15]**.

Figure 20-130-16

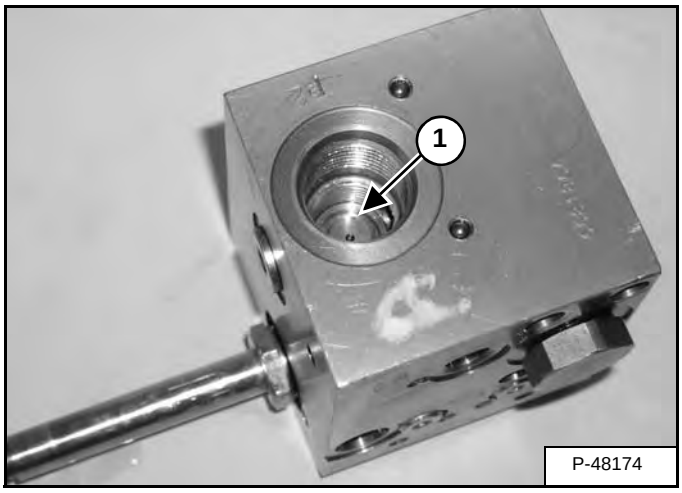


Inspect the solenoid stem (Item 1), armature assembly (Item 2) and the spool (Item 3) for damage **[Figure 20-130-16]**.

NOTE: If the solenoid stem is damaged (Item 1) check the armature assembly (Item 2) for damage.

The armature assembly (Item 2) and spool (Item 3) are non-serviceable parts. If they are damaged, order a new power Bob-Tach block assembly from Bobcat parts [Figure 20-130-16].

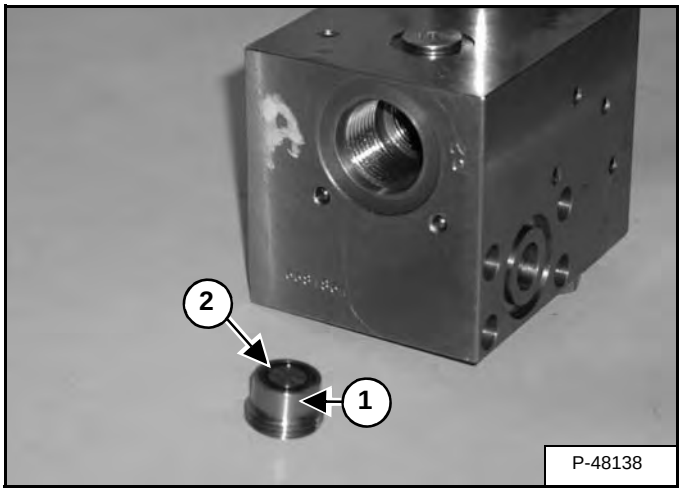
Figure 20-130-17



Remove the screened orifice plug (Item 1) **[Figure 20-130-17]**.

Installation: Tighten the screened orifice plug to 11-12 ft.-lb. (14,9-16,3 N•m) torque.

Figure 20-130-18



Inspect the screened orifice plug (Item 1) **[Figure 20-130-18]** for damage replace as needed. If the screened orifice plug is blocked replace with a new plug.

Check the O-ring (Item 2) **[Figure 20-130-18]** and replace as needed.

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FRONT AUXILIARY HYDRAULIC COUPLER BLOCK

Description

The front auxiliary hydraulic coupler block is the connection block that houses the two main auxiliary couplers along with a case drain coupler. These couplers are for suppling hydraulic flow for various attachments.

The front auxiliary coupler block is located at the front of the left side lift arm.

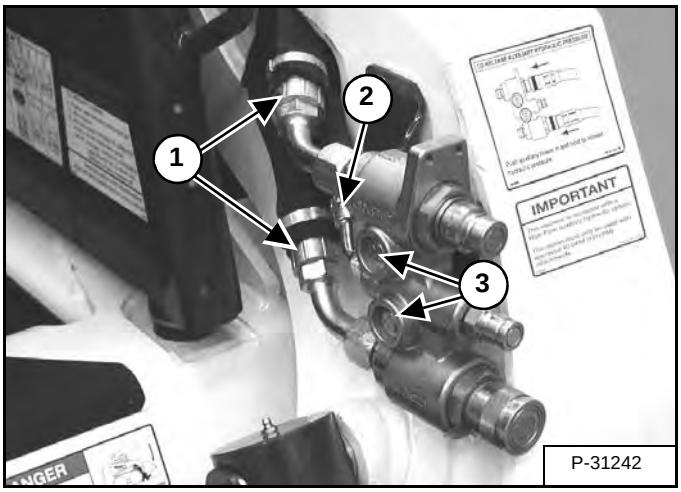
Removal and Installation

IMPORTANT

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

I-2003-0888

Figure 20-140-1



Disconnect the auxiliary hoses (Item 1) and drain hose (Item 2) **[Figure 20-140-1]** from the coupler block.

Remove the two mounting bolts (Item 3) **[Figure 20-140-1]**.

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FRONT AUXILIARY HYDRAULIC COUPLER BLOCK (CONT'D)

Disassembly And Assembly

Figure 20-140-2

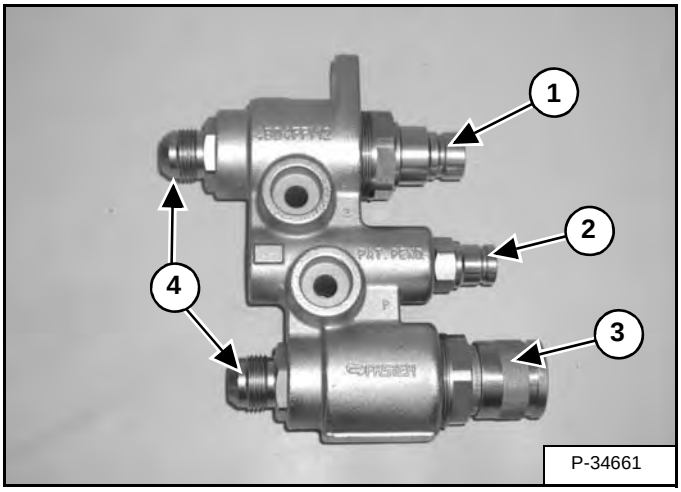
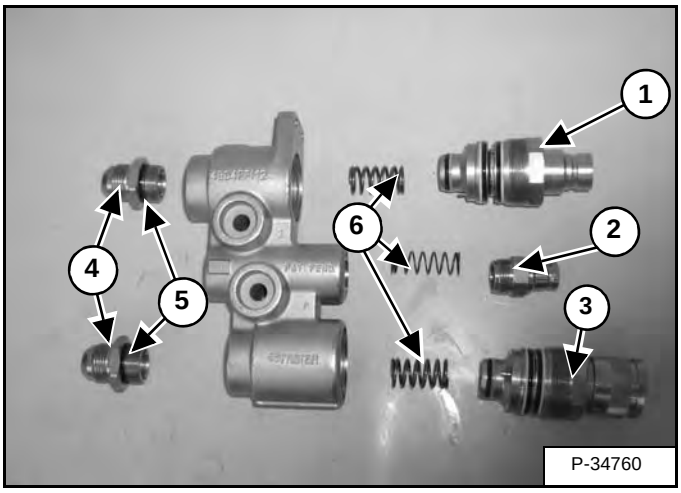


Figure 20-140-3



Remove the male coupler (Item 1) **[Figure 20-140-2]** & **[Figure 20-140-3].**

Installation: Tighten the male coupler (Item 1) **[Figure 20-140-2]** & **[Figure 20-140-3]** to 59 ft.-lb. (80 N•m)

Remove the drain coupler (Item 2) **[Figure 20-140-2]** & **[Figure 20-140-3].**

Installation: Tighten the drain coupler (Item 2) **[Figure 20-140-2]** & **[Figure 20-140-3]** to 37 ft.-lb. (50 N•m)

Remove the female coupler (Item 3) **[Figure 20-140-2]** & **[Figure 20-140-3].**

Installation: Tighten the female coupler (Item 3) **[Figure 20-140-2]** & **[Figure 20-140-3]** to 59 ft.-lb. (80 N•m)

Remove the fittings (Item 4) **[Figure 20-140-2]** & **[Figure 20-140-3]** check the O-rings (Item 5) **[Figure 20-140-3]** and replace as needed.

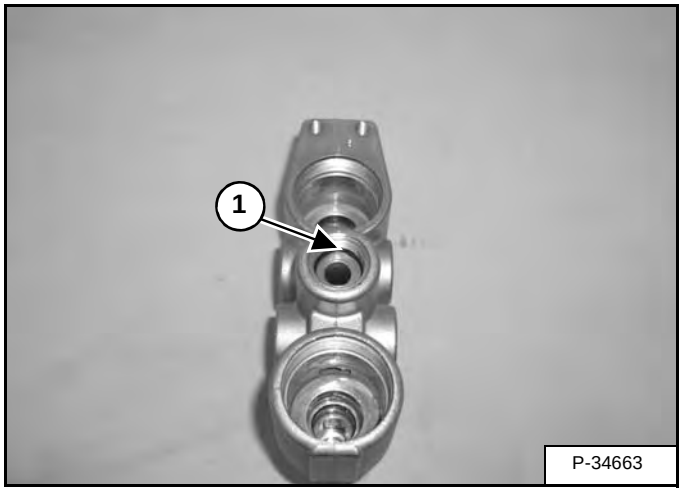
Remove the springs (Item 6) **[Figure 20-140-3].**

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FRONT AUXILIARY HYDRAULIC COUPLER BLOCK (CONT'D)

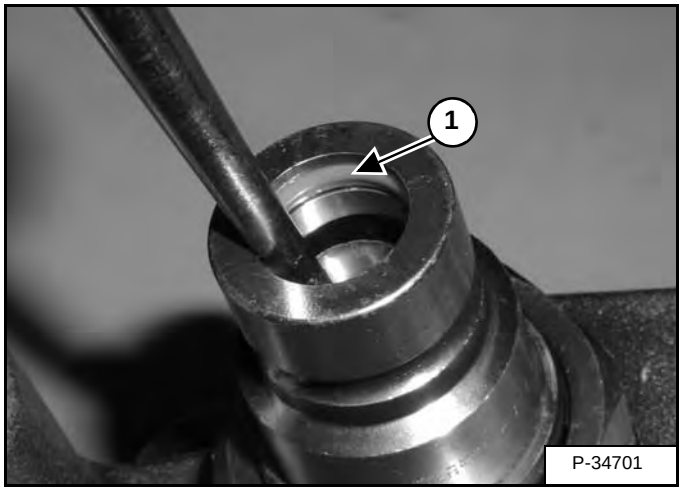
Disassembly And Assembly (Cont'd)

Figure 20-140-4



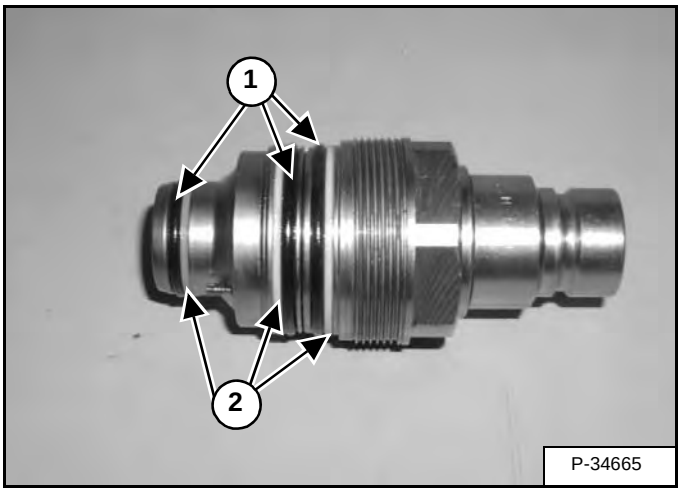
Check the O-ring (Item 1) **[Figure 20-140-4]** for damage and replace as needed.

Figure 20-140-5



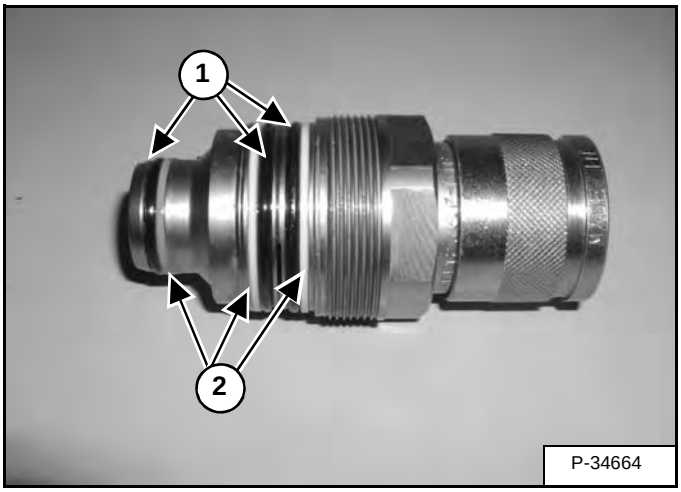
Press center of male couplers down and check the O-ring (Item 1) **[Figure 20-140-5]** for damage and replace as needed.

Figure 20-140-6



Check the O-rings (Item 1) back-up O-rings (Item 2) **[Figure 20-140-6]** for damage and replace as needed.

Figure 20-140-7



Check the O-rings (Item 1) back-up O-rings (Item 2) **[Figure 20-140-7]** for damage and replace as needed.

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HYDROSTATIC SYSTEM

CASE DRAIN FILTER 30-70-1
Description 30-70-1
Disassembly And Assembly 30-70-1

CHARGE PRESSURE 30-40-1
Adjusting 30-40-5
Description 30-40-1
Sender Removal And Installation 30-40-4
Testing 30-40-2

DRIVE BELT 30-60-1
Adjusting 30-60-2
Belt Removal And Installation 30-60-2
Description 30-60-1
Drive Belt Shield Removal And Installation 30-60-1
Tensioner Pulley Removal And Installation 30-60-3
Tensioner Pulley Tension Spring Removal And Installation 30-60-5

HYDROSTATIC MOTOR 30-20-1
Description 30-20-1
Disassembly And Assembly 30-20-5
Parts Identification 30-20-4
Removal And Installation 30-20-2

HYDROSTATIC MOTOR CARRIER 30-30-1
Assembly 30-30-5
Description 30-30-1
Disassembly 30-30-4
Parts Identification 30-30-3
Removal and Installation 30-30-2

HYDROSTATIC MOTOR CARRIER (SJC) 30-31-1
Assembly 30-31-6
Description 30-31-1
Disassembly 30-31-4
Parts Identification 30-31-3
Removal and Installation 30-31-2

HYDROSTATIC MOTOR (TWO-SPEED) 30-21-1
Assembly 30-21-13
Description 30-21-1
Disassembly 30-21-7
Parts Identification 30-21-5
Removal And Installation 30-21-2

Continued On Next Page

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HYDROSTATIC SYSTEM (CONT'D)

HYDROSTATIC PUMP 30-50-1
- Assembly 30-50-15
- Description 30-50-1
- Disassembly 30-50-8
- Hydrostatic Pump Start Up 30-50-4
- Parts Identification (Left Half) 30-50-6
- Parts Identification (Right Half) 30-50-7
- Removal And Installation 30-50-2
- Replenishing / High Pressure Relief Valve Removal And Installation 30-50-5

HYDROSTATIC PUMP (SJC) 30-51-1
- Charge Relief Valve 30-51-9
- Description 30-51-1
- Disassembly And Assembly 30-51-10
- High Pressure Relief And ByPass Valve 30-51-8
- Hydraulic Controller Neutral Adjustment 30-51-30
- Hydraulic Controller Removal And Installation 30-51-2
- Hydrostatic Pump Start Up 30-51-6
- Mechanical Neutral Adjustment 30-51-27
- Parts Identification 30-51-7
- Removal And Installation 30-51-4

HYDROSTATIC SYSTEM INFORMATION 30-10-1
- Description 30-10-2
- Troubleshooting 30-10-1

TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.

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HYDROSTATIC SYSTEM INFORMATION

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.

If the service code appears in the left instrument panel, refer to the Electrical Service Manual for the probable cause.

WARNING

Check for correct function after adjustments, repairs or service. Failure to make correct repairs or adjustments can cause injury or death.

W-2004-1285

PROBLEM	CAUSE
No drive on one side, in one direction.	1, 2
No drive on one side in both directions.	2, 3, 4, 5
The loader does not move in a straight line.	2, 3, 5, 6, 7, 10
The hydrostatic system is overheating.	8, 9

KEY TO CORRECT THE CAUSE
1. The hydrostatic pump relief / replenishing valves not seating.
2. The steering linkage needs adjustment.
3. The hydrostatic pump has damage.
4. The final drive chains are broken.
5. The hydrostatic motor has damage.
6. The tires do not have the correct tire pressure.
7. The tires are not the same size.
8. The hydrostatic fluid is not at the correct level.
9. The oil cooler has a restriction.
10. The hydrostatic pump is not properly calibrated, and/or incorrect steering drift compensation setting.

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HYDROSTATIC SYSTEM INFORMATION (CONT'D)

Description

The hydrostatic system consists of a tandem hydrostatic pump and two hydrostatic motors. The hydrostatic system allows forward and reverse motion of the loader.

The hydrostatic pump is connected to the engine by a drive belt and provides fluid to the hydrostatic motors. The charge pressure system assists in replenishing the fluid that is lost due to internal leakage in the components of the hydrostatic system.

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HYDROSTATIC MOTOR

Description

The hydrostatic motors are driven by high pressure from the hydrostatic pumps.

In this system there is a case drain filter for filtering the excess low pressure oil before the oil enters the hydraulic reservoir.

The hydrostatic motors do not have an internal brake.

Inside the endcap of the hydrostatic motor, there is a shuttle valve. The shuttle valve helps to keep the motor cool by mixing case drain oil with cooled low pressure oil from the charge circuit. The shuttle valve is shifted by the high pressure oil coming from the hydrostatic pumps. If the shuttle valve sticks, a delay or lack of drive may or may not be felt in the controls and/or an overheated hydrostatic motor will result.

There are two hydrostatic motors mounted to motor carriers. The motor carriers are mounted to the transmission chaincase which houses the drive chains.

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Removal And Installation



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

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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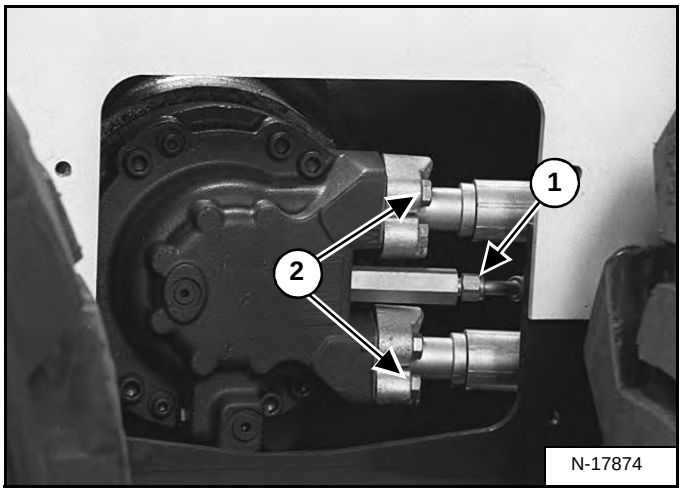
Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Drain the hydraulic reservoir. (See Removal And Installation on Page 20-90-1.)

Figure 30-20-1



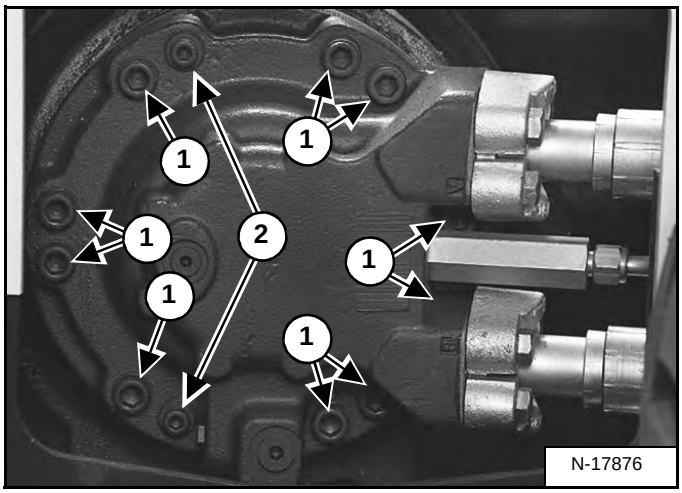
Remove the motor cover.

Mark the hoses for correct installation.

Disconnect the case drain hose (Item 1) **[Figure 30-20-1]**.

Disconnect the high pressure hoses (Item 2) **[Figure 30-20-1]**.

Figure 30-20-2



Remove the ten mounting bolts (Item 1) **[Figure 30-20-2]**.

Installation: Tighten the mounting bolts to 110 ft.-lb. (149,2 N•m) torque.

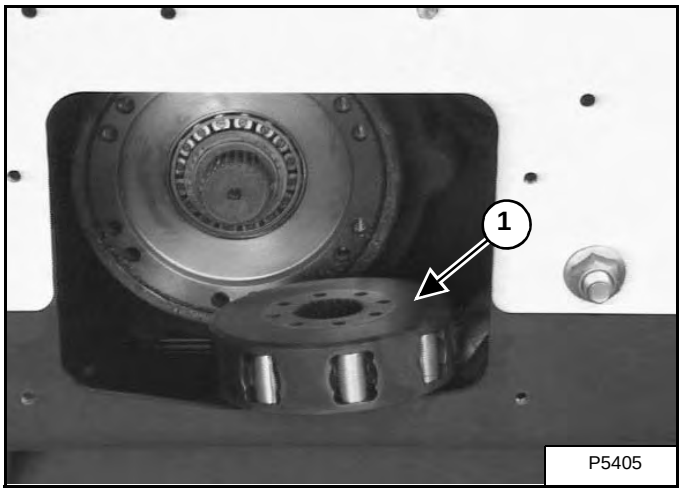
NOTE: The two bolts (Item 2) [Figure 30-20-2] mount the cam ring to the motor, and do not have to be removed, to remove the motor from the loader.

Remove the motor/cam ring section from the loader.

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Removal And Installation (Cont'd)

Figure 30-20-3



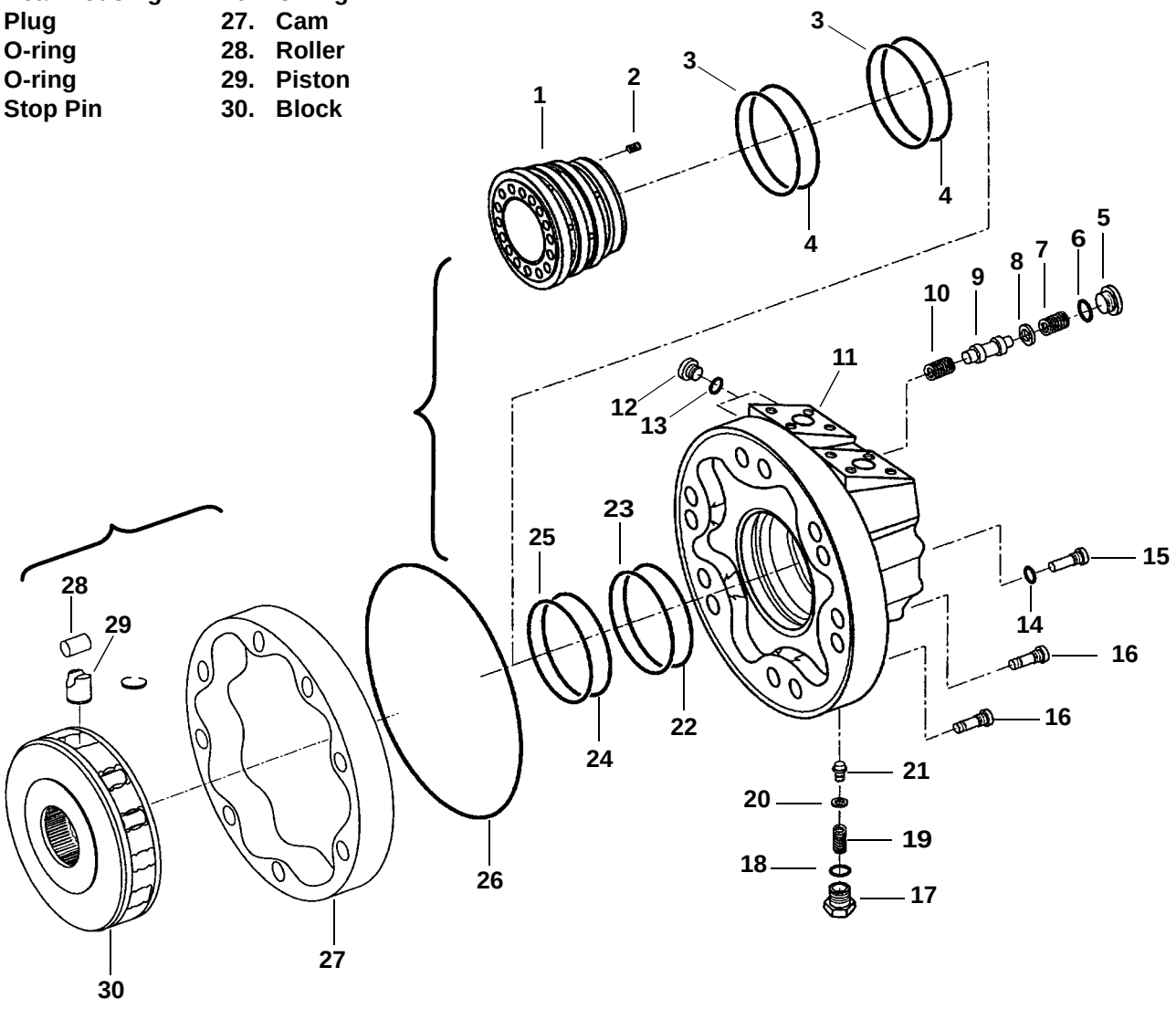
Remove the piston/roller section (Item 1) **[Figure 30-20-3]** from the loader, if it was not removed with the motor/cam ring.

To remove the motor carrier. (See Removal and Installation on Page 30-30-2.)

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Parts Identification

1. Distributor
2. Spring
3. Seal
4. O-ring
5. Plug
6. O-ring
7. Spring
8. Washer
9. Spool
10. Spring
11. Rear Housing
12. Plug
13. O-ring
14. O-ring
15. Stop Pin
16. Bolt
17. Plug
18. O-ring
19. Spring
20. Shim
21. Poppet
22. O-ring
23. Seal
24. O-ring
25. Seal
26. O-ring
27. Cam
28. Roller
29. Piston
30. Block



B-17125

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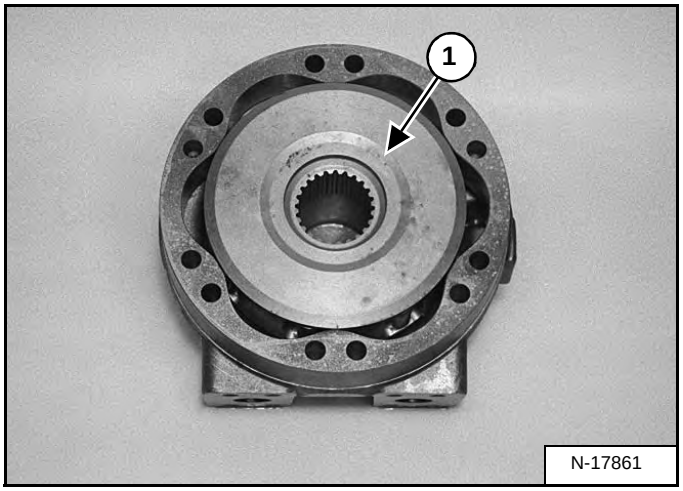
Disassembly And Assembly

IMPORTANT

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

I-2003-0888

Figure 30-20-4

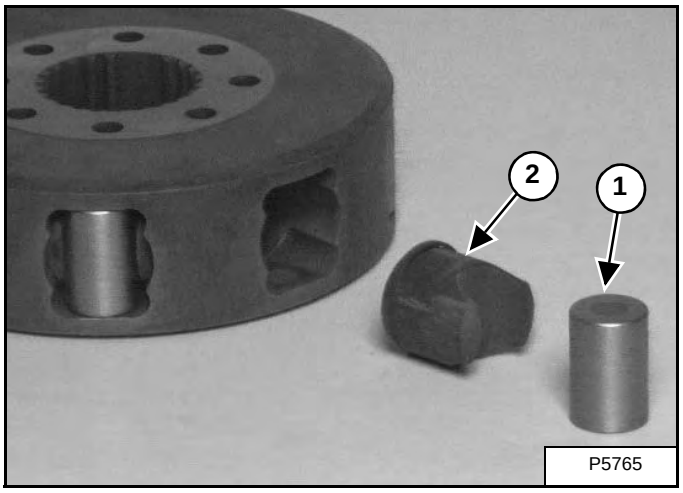


Remove the piston/roller section (Item 1) **[Figure 30-20-4]** from the motor.

Assembly: Install the motor on the loader and tighten the mount bolts to 110 ft.-lb. (149,2 N•m) torque.

NOTE: Before operating the hydrostatic motor, make sure it is full of oil. There are several methods to fill the motor with oil; (1) with the case drain hose disconnected, fill the motor with oil through the case drain port; (2) with the case drain hose disconnected, BICS] brake locked, engine running, stroke the steering lever until oil comes out of the case drain port.

Figure 30-20-5



Apply low air pressure to each port in the cylinder block to remove the roller (Item 1) and piston/ring assembly (Item 2) **[Figure 30-20-5]**.

Inspect the cylinder block surface and the roller/piston assemblies for scratches or wear.

NOTE: Put all the roller/piston assembly back in their original position.

Assembly: Install the roller (Item 1) in the piston (Item 2) **[Figure 30-20-5]**.

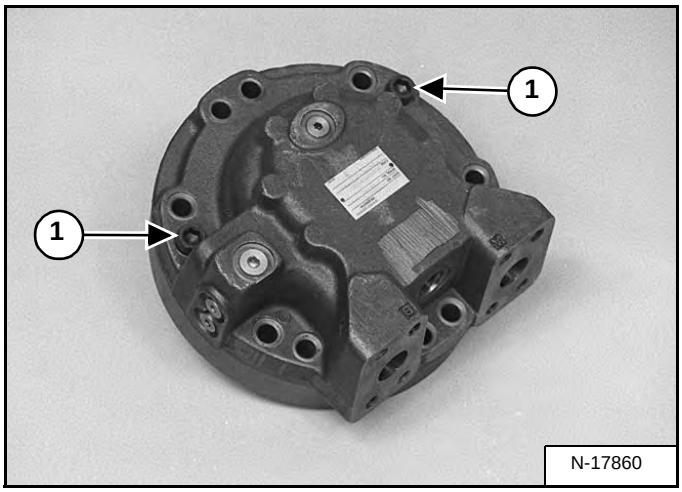
Assembly: Dip the roller/piston assembly into oil and install into the bore in the cylinder.

Repeat for each roller/piston assembly.

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Disassembly And Assembly (Cont'd)

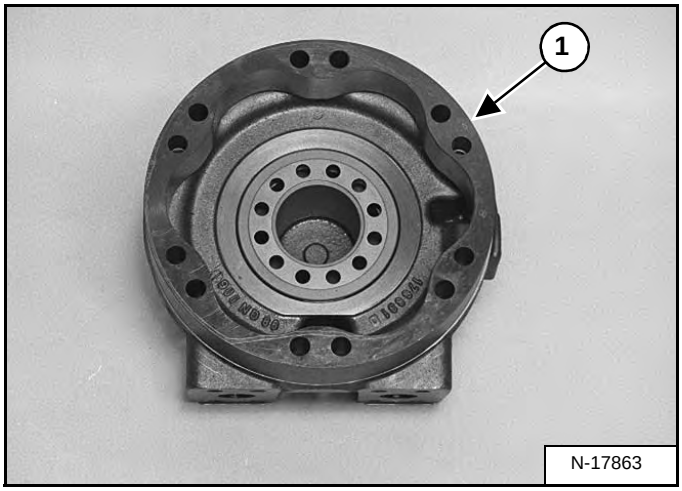
Figure 30-20-6



Remove the two cam ring mounting bolts (Item 1) **[Figure 30-20-6]**.

Assembly: Install the two cam ring mounting bolts (Item 1) **[Figure 30-20-6]** and tighten to 50 ft.-lb. (67,8 N•m) torque.

Figure 30-20-7

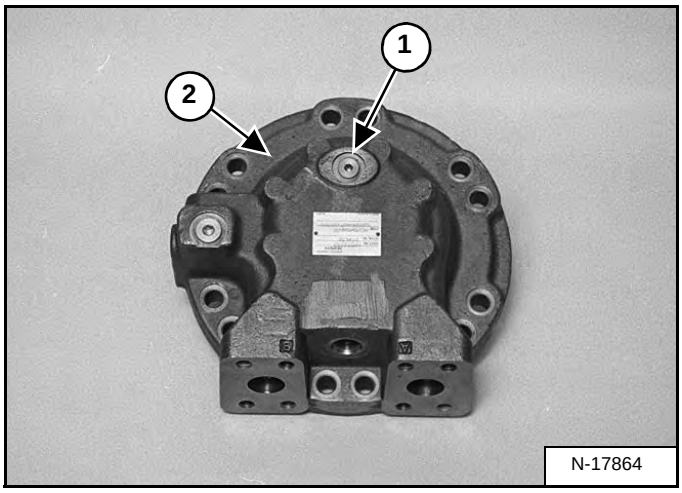


Remove the cam ring (Item 1) **[Figure 30-20-7]** from the motor housing.

Inspect the cam ring for surface scratches or wear.

Assembly: Install the cam ring (Item 1) **[Figure 30-20-7]** and align the mounting bolt holes.

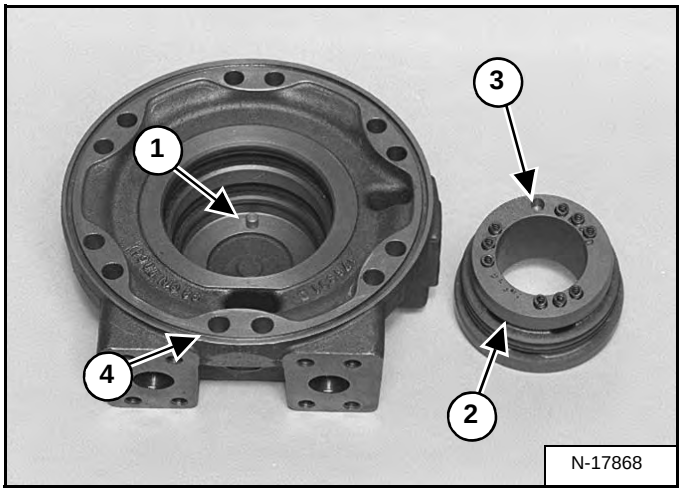
Figure 30-20-8



Remove the stop pin (Item 1) **[Figure 30-20-8]** from the rear motor housing.

Assembly: Install the stop pin (Item 1) **[Figure 30-20-8]** and tighten to 7-9 ft.-lb. (10-12 N•m) torque.

Figure 30-20-9



NOTE: The distributor removal, is best accomplished by lifting the housing (Item 2) [Figure 30-20-8] 2-3 inches above a wooden surface, and dropping the housing.

Assembly: Install the stop pin (Item 1) **[Figure 30-20-8]** and tighten to 7-9 ft.-lb. (10-12 N•m) torque.

Assembly: Install the distributor (Item 2) **[Figure 30-20-9]** into the housing.

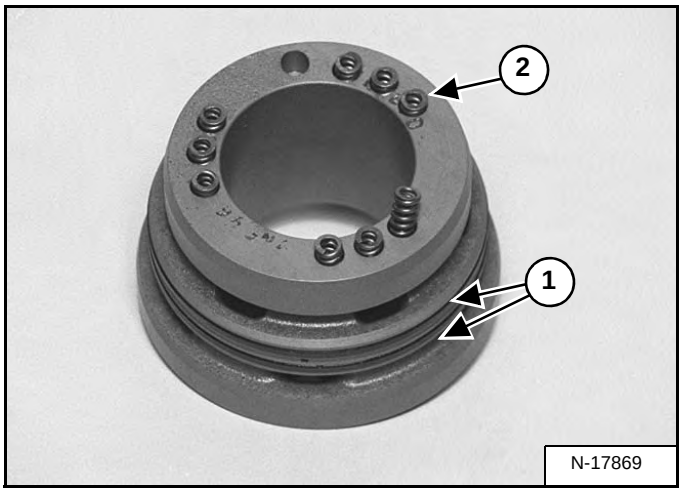
Assembly: Align the distributor hole (Item 3) **[Figure 30-20-9]** with the stop pin. When aligned correctly, the distributor can be depressed slightly.

Assembly: Install and lightly smear grease on the O-ring (Item 4) **[Figure 30-20-9]**.

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Disassembly And Assembly (Cont'd)

Figure 30-20-10



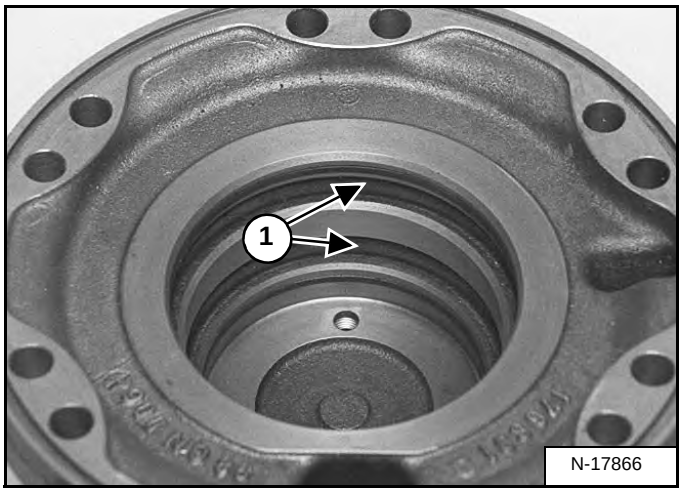
Remove and replace the two seals and back-up O-rings (Item 1) **[Figure 30-20-10]** on the distributor.

Inspect the distributor and springs (Item 2) **[Figure 30-20-10]** for damage or surface scratches.

Assembly: Put grease on the springs to hold them in place.

Assembly: Install the springs into the distributor.

Figure 30-20-11

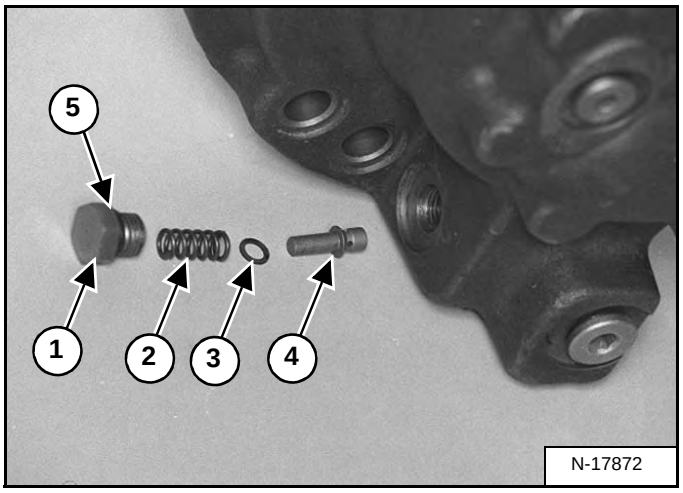


Remove the two seals (Item 1) **[Figure 30-20-11]** from the housing and replace with new seals.

Remove the two O-rings and replace with new O-rings. The O-rings are located under the seals.

Assembly: Lightly smear grease over the seals.

Figure 30-20-12

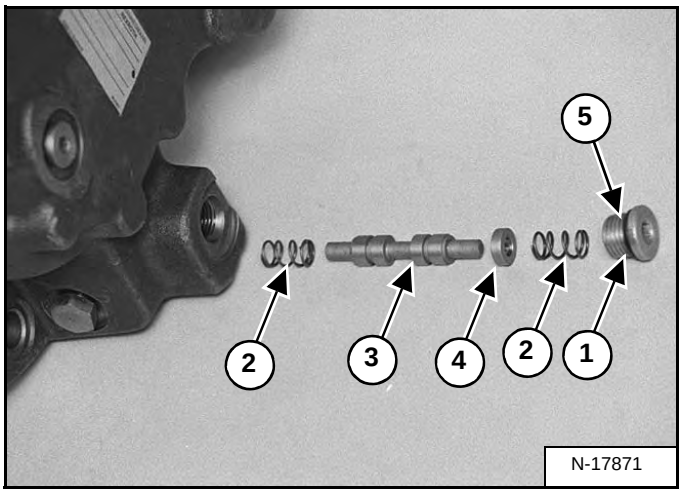


Remove, inspect and install the plug (Item 1), spring (Item 2), shim (Item 3) and poppet (Item 4) **[Figure 30-20-12]**.

Assembly: Remove and replace the O-ring (Item 5) **[Figure 30-20-12]**.

Assembly: Tighten the plug to 9-11 ft.-lb. (12-15 N•m) torque.

Figure 30-20-13



Remove, inspect and install the plug (Item 1), springs (Item 2), spool (Item 3) and washer (Item 4) **[Figure 30-20-13]**.

Assembly: Remove and replace the O-ring (Item 5) **[Figure 30-20-13]**.

Assembly: Tighten the plug to 18-22 ft.-lb. (25-30 N•m) torque.

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HYDROSTATIC MOTOR (TWO-SPEED)

Description

The hydrostatic motors are driven by high pressure from the hydrostatic pumps.

In this system there is a case drain filter for filtering the excess low pressure oil before the oil enters the hydraulic reservoir.

This hydrostatic motor contains a spring applied pressure release braking system to stop the loader. This braking system is located on the end of the hydrostatic motor.

The hydrostatic motor contains a shuttle valve. The shuttle valve helps to keep the motor cool by mixing case drain oil with cooled low pressure oil from the charge circuit. The shuttle valve is shifted by the high pressure oil coming from the hydrostatic pumps. If the shuttle valve sticks, a delay or lack of drive may or may not be felt in the controls and/or an overheated hydrostatic motor will result.

There are two hydrostatic motors mounted to motor carriers. The motor carriers are mounted to the transmission chaincase which houses the drive chains.

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Removal And Installation



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

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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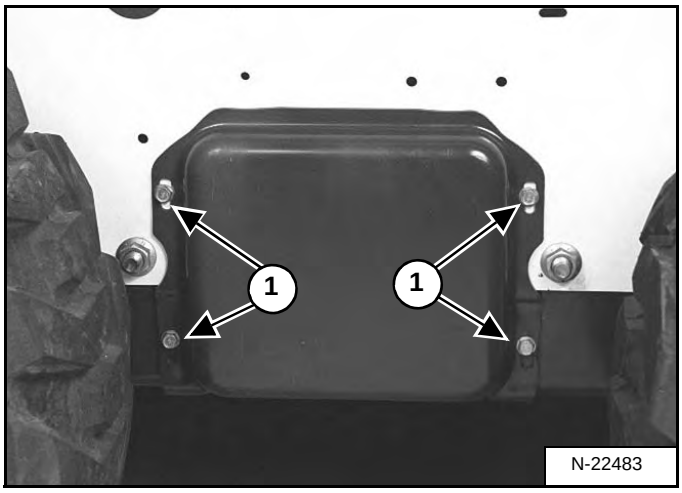
Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Drain the hydraulic reservoir. (See Removal And Installation on Page 20-90-1.)

Figure 30-21-1

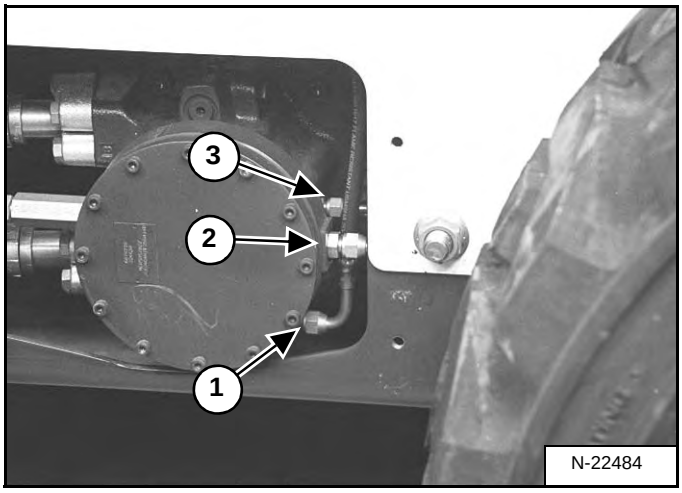


Remove the motor cover mount bolts (Item 1) **[Figure 30-21-1].**

Remove the motor cover from the loader.

Mark the hoses for correct installation.

Figure 30-21-2



Disconnect the hydraulic hose (Item 1) **[Figure 30-21-2]** that goes to the two-speed port on the two-speed/brake block.

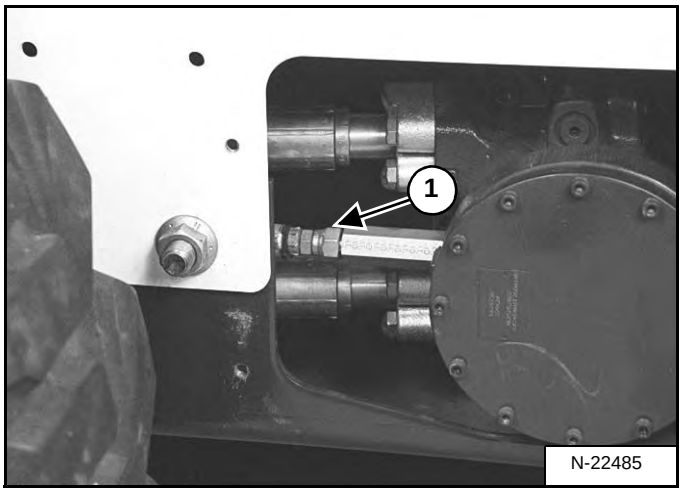
Disconnect the hydraulic hose (Item 2) **[Figure 30-21-2]** that goes to the brake port on the two-speed/brake block.

Disconnect the hydraulic hose (Item 3) **[Figure 30-21-2]** that goes to the make-up port on the two-speed/brake block.

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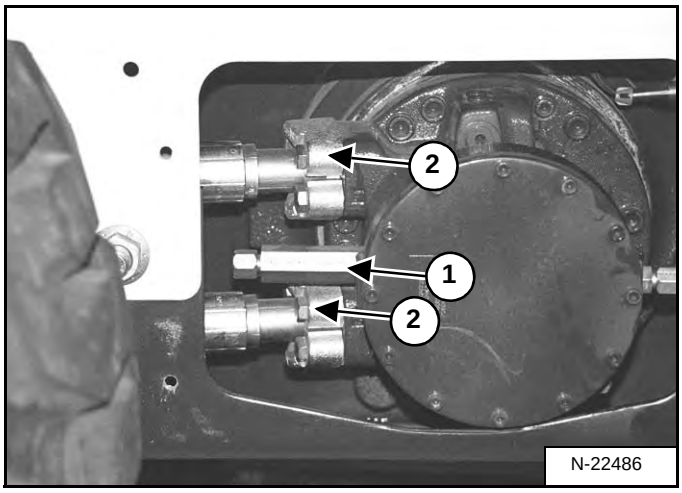
Removal And Installation (Cont'd)

Figure 30-21-3



Disconnect the hydraulic hose (Item 1) **[Figure 30-21-3]** that goes to the case drain filter.

Figure 30-21-4

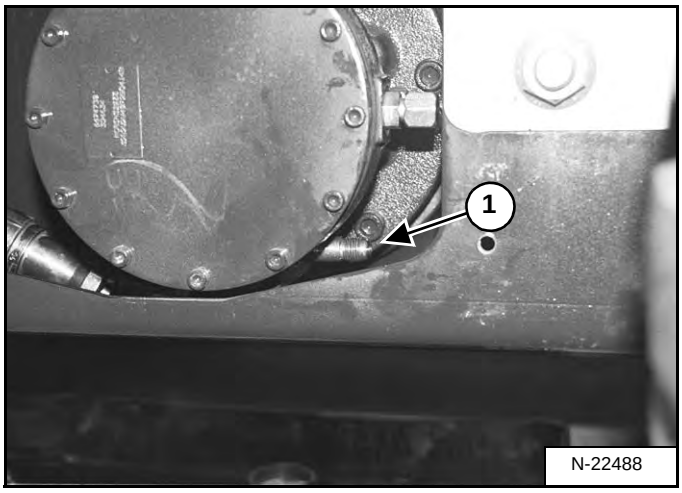


Remove the hydraulic fitting (Item 1) **[Figure 30-21-4]** from the motor.

Remove the eight flange bolts (Item 2) **[Figure 30-21-4]** from the high pressure hoses on the motor.

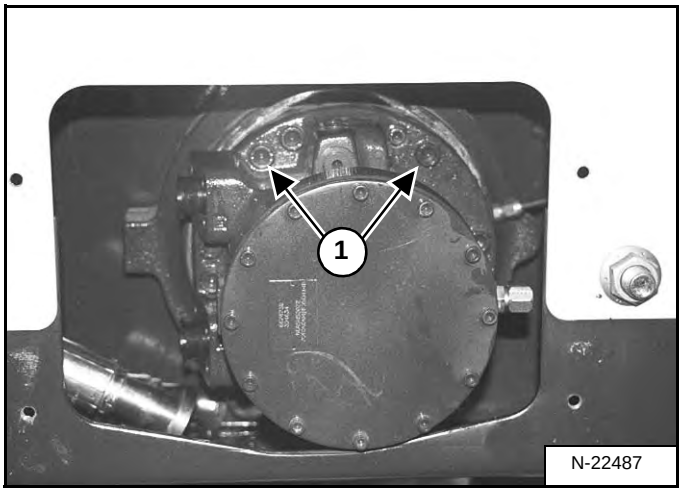
Installation: Install the lower collar to the motor and connect the high pressure hoses behind the collar, then install the upper collar and tighten the bolts to 25 ft.-lb. (34 N•m) torque.

Figure 30-21-5



Remove the hydraulic fitting (Item 1) **[Figure 30-21-5]** from the motor.

Figure 30-21-6



Remove the 10 (12 mm) mount bolts (Item 1) **[Figure 30-21-6]** from the motor.

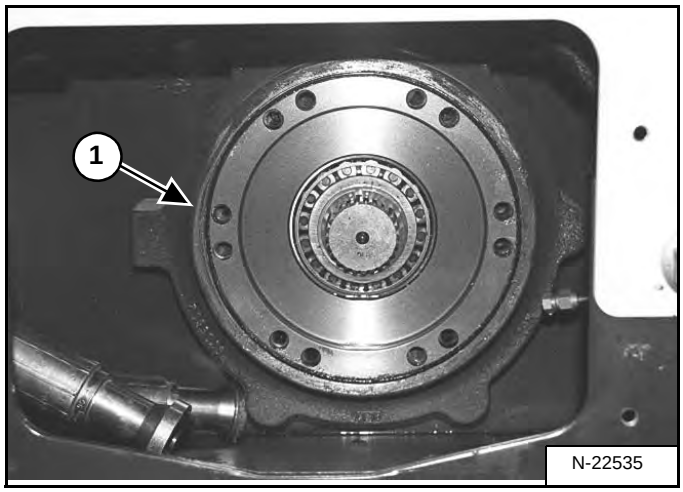
NOTE: The two smaller diameter bolts (8 mm), hold the cam ring to the motor and do not have to be remove for motor removal.

Remove the motor from the loader.

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Removal And Installation (Cont'd)

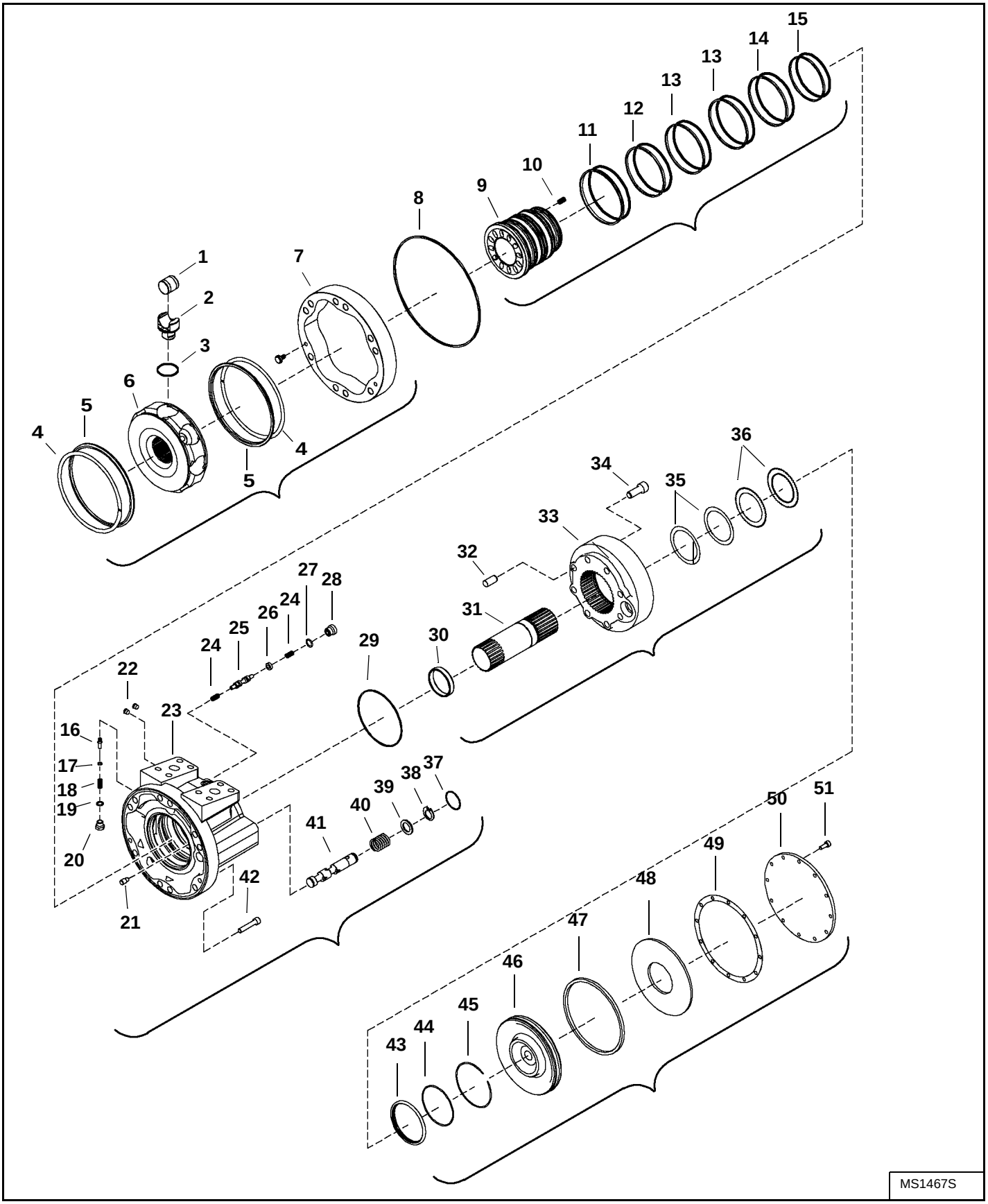
Figure 30-21-7



Installation: Replace the O-ring (Item 1) **[Figure 30-21-7]** and hold it in place with a light cover of lithium base grease. Tighten the 10 mounting bolts to 110 ft.-lb. (149 N•m) torque.

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Parts Identification



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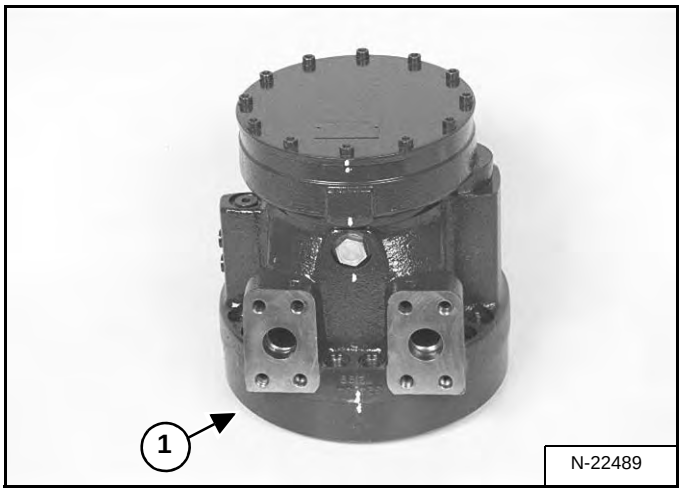
Parts Identification (Cont'd)

Ref.	Description
1.	Roller
2.	Piston
3.	Ring
4.	Clamp
5.	Ring
6.	Block
7.	Cam
8.	Quad Ring
9.	Distributor
10.	Spring
11.	Seal/O-ring
12.	Seal/O-ring
13.	Seal/O-ring
14.	Seal/O-ring
15.	Seal/O-ring
16.	Poppet
17.	Spool
18.	Spring
19.	O-ring
20.	Plug
21.	Pin
22.	Plug
23.	Housing
24.	Spring
25.	Spool
26.	Washer
27.	O-ring
28.	Plug
29.	Quad Ring
30.	Bushing
31.	Shaft
32.	Dowel
33.	Housing
34.	Bolt
35.	Shim
36.	Brake Disc
37.	O-ring
38.	Snap Ring
39.	Washer
40.	Spring
41.	Spool
42.	Bolt
43.	Seal
44.	O-ring
45.	Clamp
46.	Piston
47.	O-ring
48	Spring
49.	Gasket
50.	Cover
51.	Bolt

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Disassembly

Figure 30-21-8



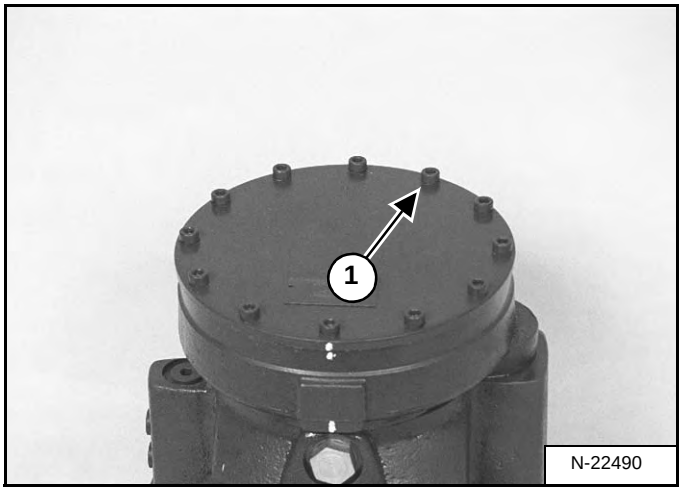
NOTE: Install a mark on the motor, brake, and motor carrier housings for correct assembly [Figure 30-21-8].

NOTE: Always protect any sealing surfaces. Any scratches or marks will cause premature failure.

Place the cam sealing surface (Item 1) **[Figure 30-21-8]** on a protective material.

Drain the oil from the motor casing.

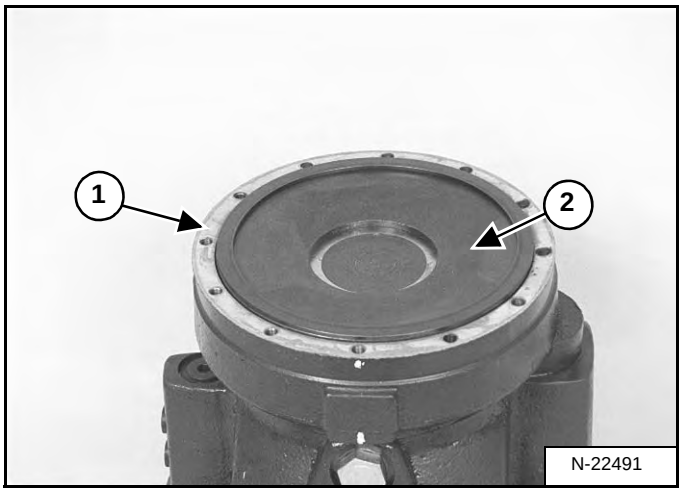
Figure 30-21-9



Remove the twelve mounting bolts (Item 1) **[Figure 30-21-9]** from the brake cover plate.

NOTE: The bolts should be remove and/or tightened, one turn at a time to maintain equal preload on the end cap.

Figure 30-21-10



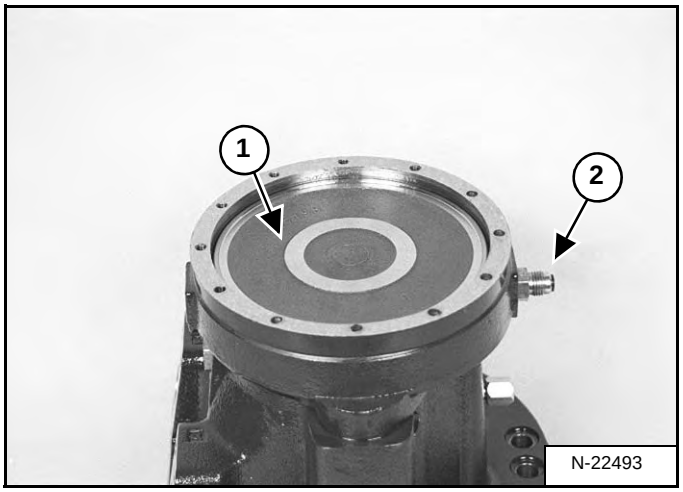
Remove the cover plate from the brake housing.

Remove the cover plate gasket (Item 1) **[Figure 30-21-10]**.

Remove the brake spring (Item 2) **[Figure 30-21-10]** from the brake housing.

NOTE: Mark the top side of the brake spring for proper installation.

Figure 30-21-11



Remove the piston from the brake housing (Item 1) **[Figure 30-21-11]**.

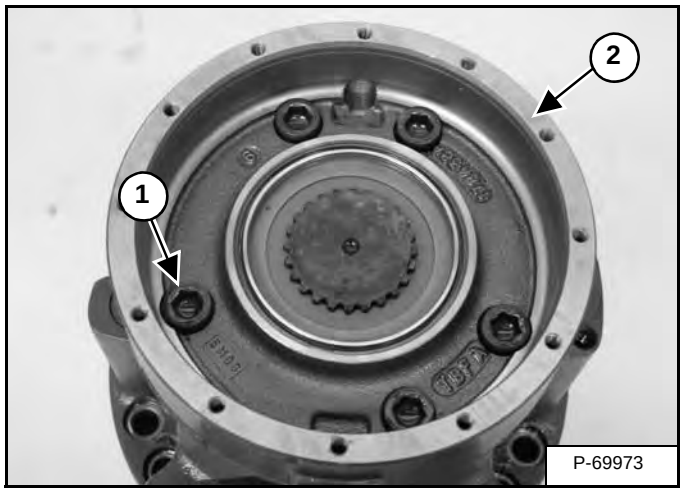
NOTE: The use of air pressure through the brake line connection (Item 2) [Figure 30-21-11] will aid in piston removal.

Check the brake piston for damage and replace the seal.

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Disassembly (Cont'd)

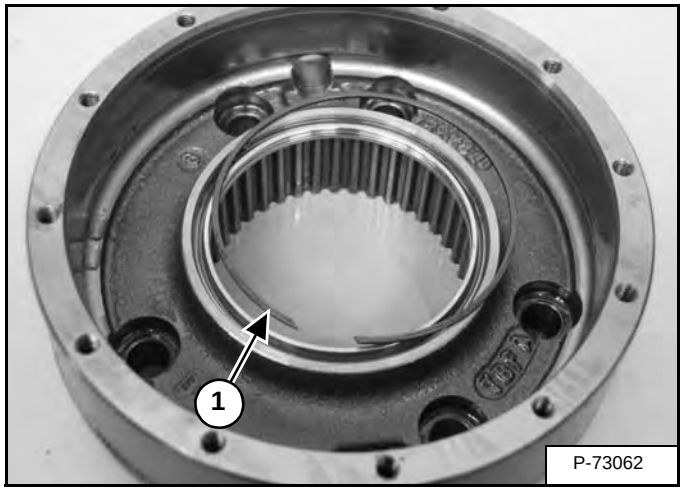
Figure 30-21-12



Remove the five mounting bolts (Item 1) **[Figure 30-21-12]** from the brake housing.

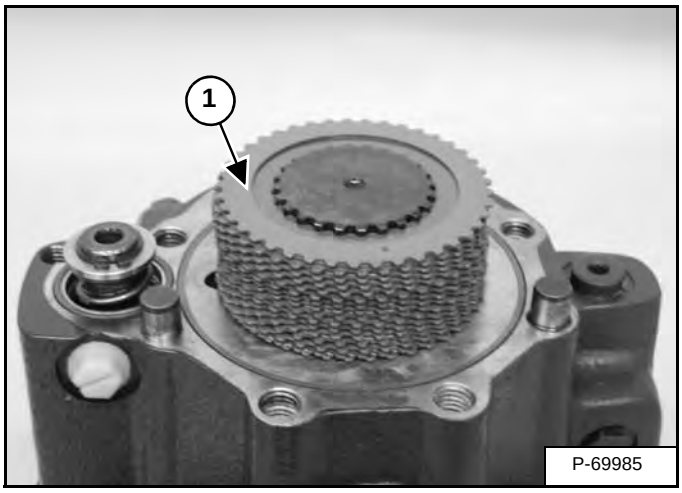
Remove the brake housing (Item 2) **[Figure 30-21-12]** from the rear housing.

Figure 30-21-13



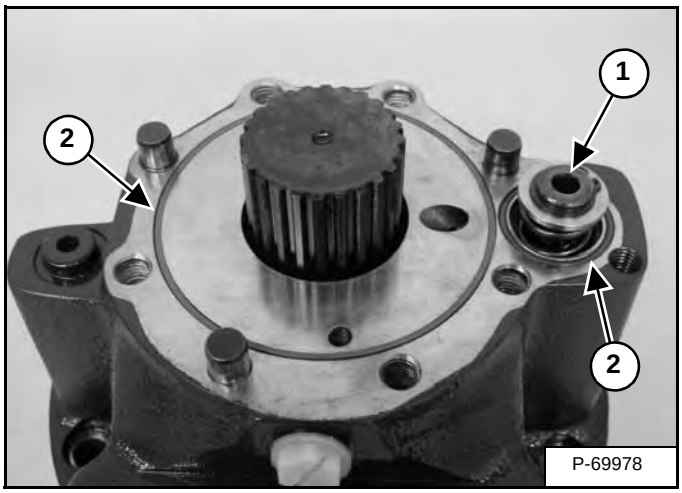
Protect the sealing surface. Remove the snap ring (Item 1) **[Figure 30-21-13]** to remove the seal from the brake housing.

Figure 30-21-14



Remove the brake disks (Item 1) **[Figure 30-21-14]** from the brake shaft. Note the position of the brake disks and the shims.

Figure 30-21-15



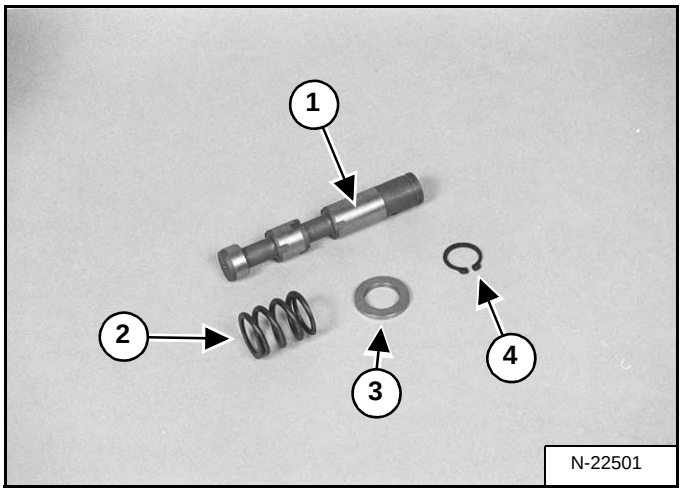
Remove the two-speed spool (Item 1) **[Figure 30-21-15]** from the housing assembly.

Remove and discard the o-rings (Item 2) **[Figure 30-21-14]** on the housing.

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Disassembly (Cont'd)

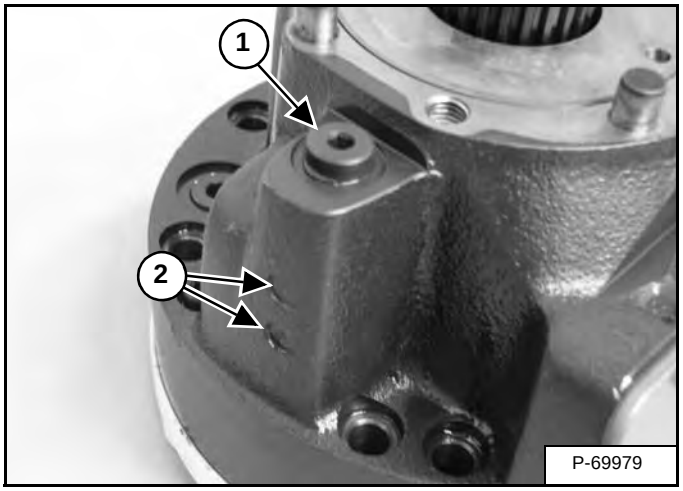
Figure 30-21-16



Inspect the spool (Item 1), the spring (Item 2), washer (Item 3) and the snap ring (Item 4) and replace as needed **[Figure 30-21-16]**.

NOTE: The spool (Item 1) [Figure 30-21-16] is marked with either an A or B. The spool must be replaced with a spool with the same mark.

Figure 30-21-17

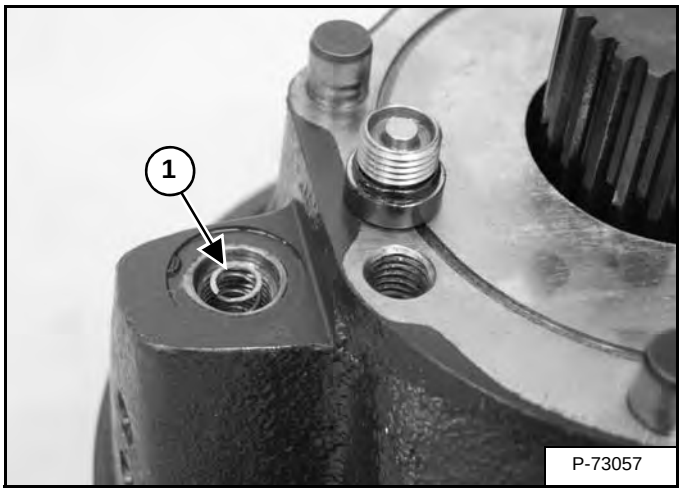


Remove the flushing spool plug (Item 1) **[Figure 30-21-17]** from the housing.

Installation: Tighten the plug to 22 ft.-lb. (30 N•m) torque.

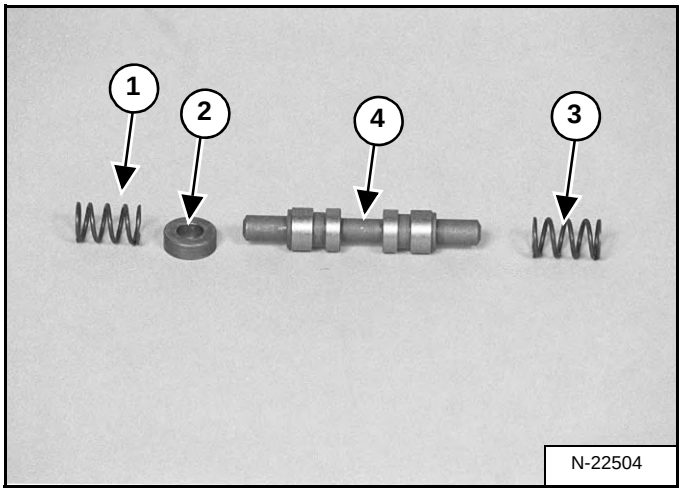
NOTE: Current motor housings are provided with break off plugs (Item 2) [Figure 30-21-17] on the side of the flushing spool housing. Earlier motors were equipped with threaded plugs.

Figure 30-21-18



Remove the flushing spool assembly (Item 1) **[Figure 30-21-18]** from the housing.

Figure 30-21-19



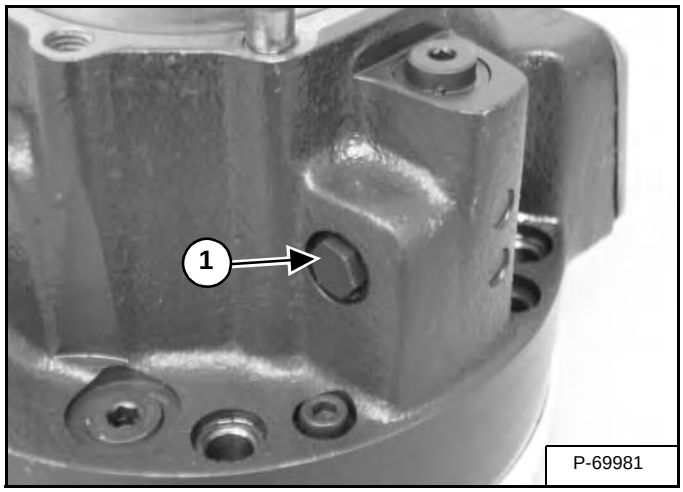
Remove the spring (Item 1), washer (Item 2) and rear spring (Item 3) from the spool (Item 4) **[Figure 30-21-19]**.

Inspect all parts and replace as needed.

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Disassembly (Cont'd)

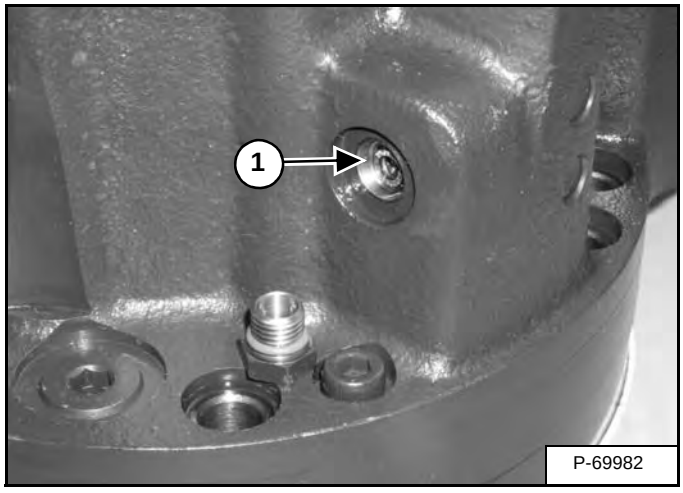
Figure 30-21-20



Remove the plug (Item 1) **[Figure 30-21-20]** from the housing.

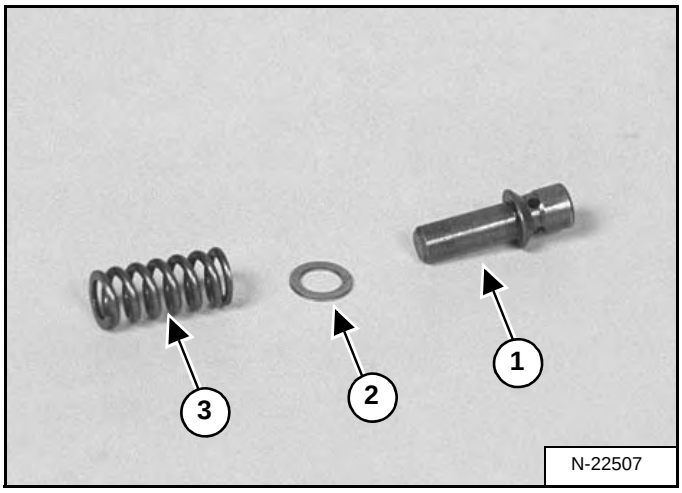
Installation: Tighten the plug to 18 ft.-lb. (22 N•m) torque.

Figure 30-21-21



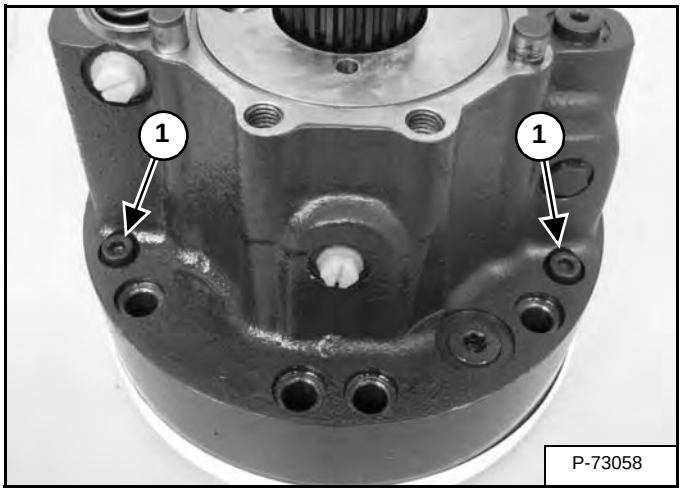
Remove the poppet assembly (Item 1) **[Figure 30-21-21]** from the housing.

Figure 30-21-22



Inspect the poppet (Item 1), shim (Item 2) and spring (Item 3) for wear and replace as needed **[Figure 30-21-22]**.

Figure 30-21-23



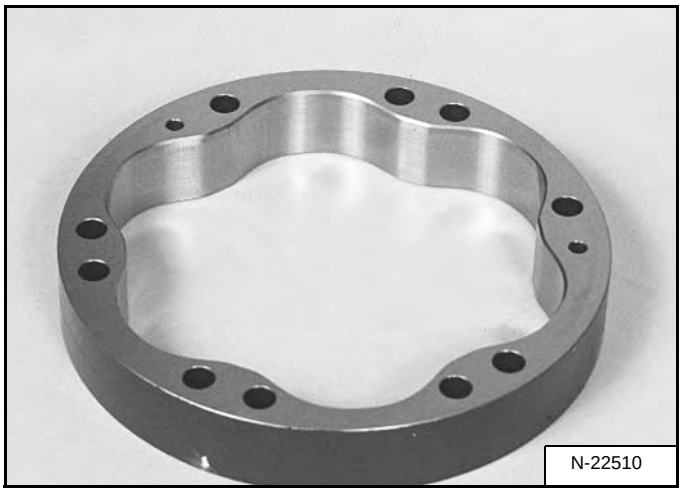
Remove the two (8 mm) cam ring mount bolts (Item 1) **[Figure 30-21-23]**.

Turn the housing, cam ring, and rotating group assembly over and place on a stand. Remove the cam ring from the housing.

Dealer Copy -- Not for Resale

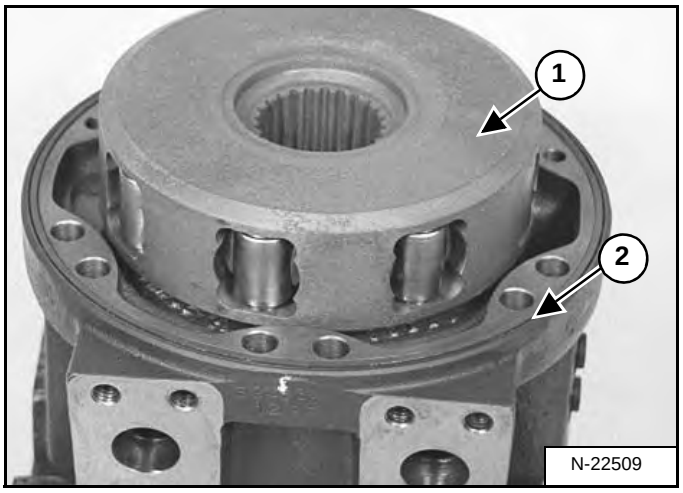
Disassembly (Cont'd)

Figure 30-21-24



Protect the sealing surfaces. Check the cam ring inside surface for wear and scratches **[Figure 30-21-24]**.

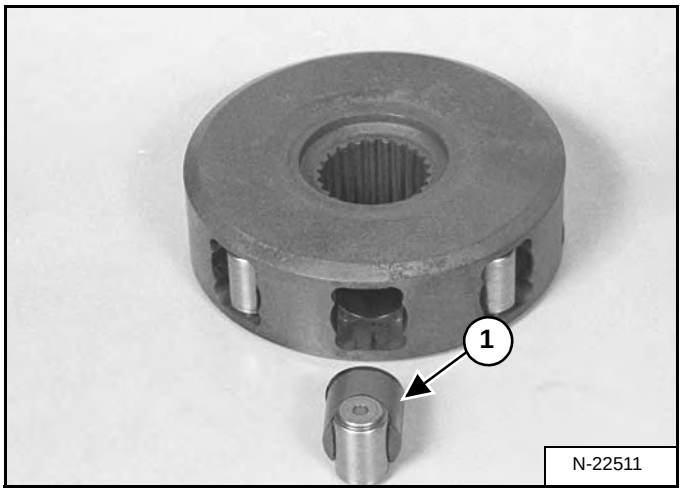
Figure 30-21-25



Remove the cylinder block (Item 1) **[Figure 30-21-25]** from the housing.

Remove the O-ring (Item 2) **[Figure 30-21-25]** from the housing.

Figure 30-21-26

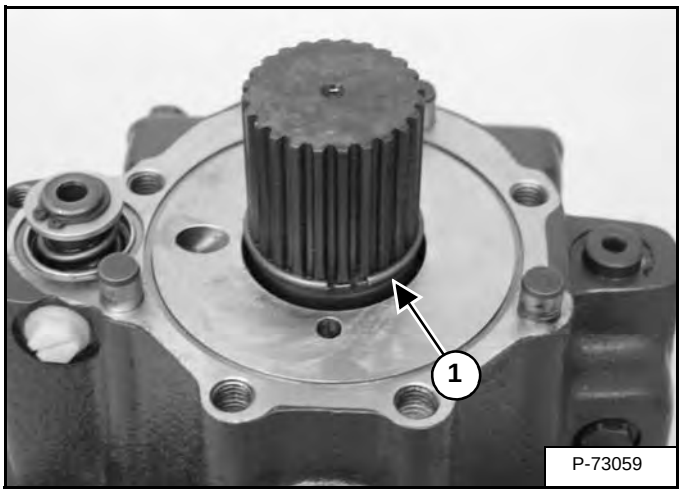


Protect the sealing surfaces. Remove the roller/piston assembly (Item 1) **[Figure 30-21-26]** from the cylinder block.

Check all roller and piston assemblies for wear and replace as needed.

NOTE: Put all roller/piston assembles back in the original bore.

Figure 30-21-27



Remove the shaft from the distributor **[Figure 30-21-27]**.

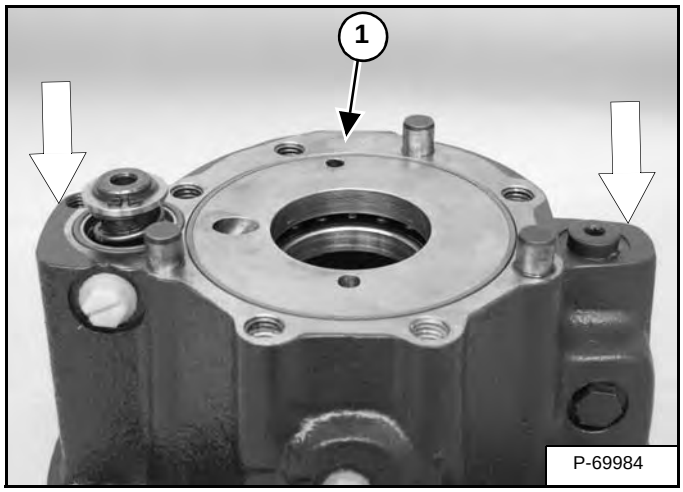
NOTE: The end of the shaft with the snap ring (Item 1) [Figure 30-21-27] must be toward the brake housing during assembly.

Remove the distributor from the housing.

Dealer Copy -- Not for Resale

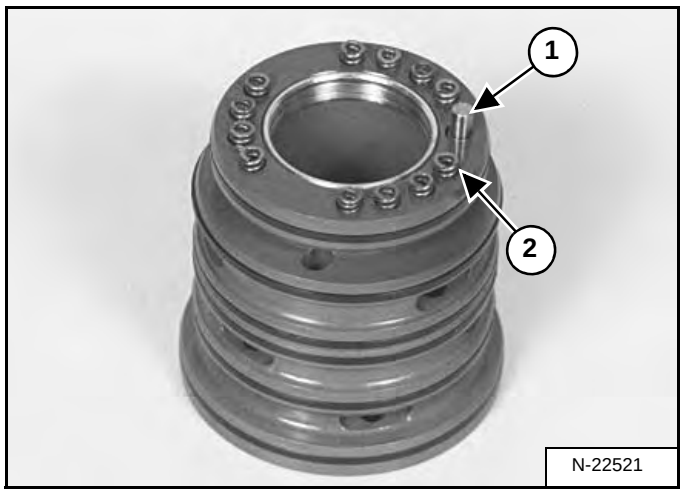
Disassembly (Cont'd)

Figure 30-21-28



NOTE: The distributor removal is best accomplished by lifting the housing (Item 1) [Figure 30-21-28] 2-3 inches above a wooden surface, and dropping the housing [Figure 30-21-28].

Figure 30-21-29

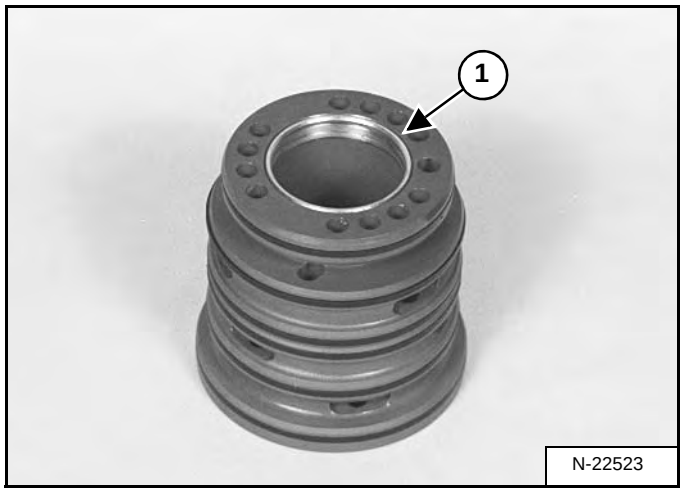


Protect the sealing surfaces. Remove the locating pin (Item 1) **[Figure 30-21-29]** from the distributor.

Remove the springs (Item 1) **[Figure 30-21-29]** from the distributor.

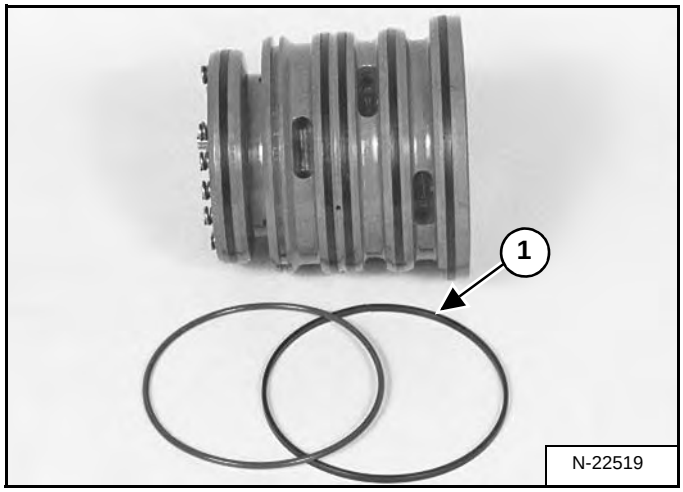
Inspect the springs, distributor surface and bushing for damage or wear and replace as needed.

Figure 30-21-30



Remove the bushing (Item 1) **[Figure 30-21-30]** from the distributor, if worn or scratched.

Figure 30-21-31



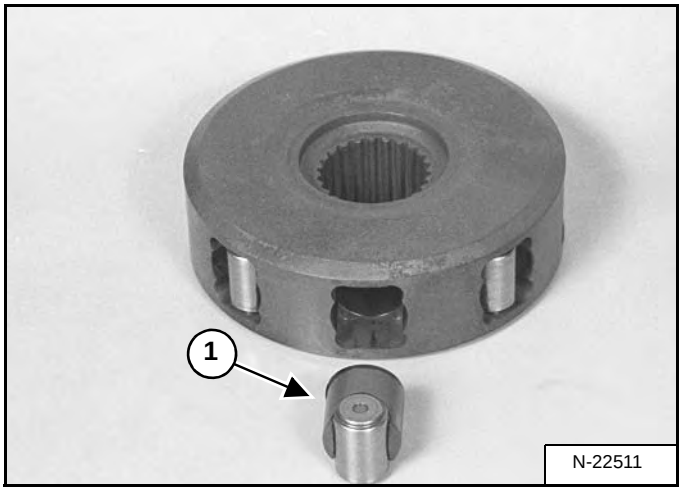
Remove the six seals (Item 1), and six back-up O-rings (Item 2) from the distributor **[Figure 30-21-31]**.

Dealer Copy -- Not for Resale

Assembly

NOTE: Always use new O-rings and seals during motor and brake assembly.

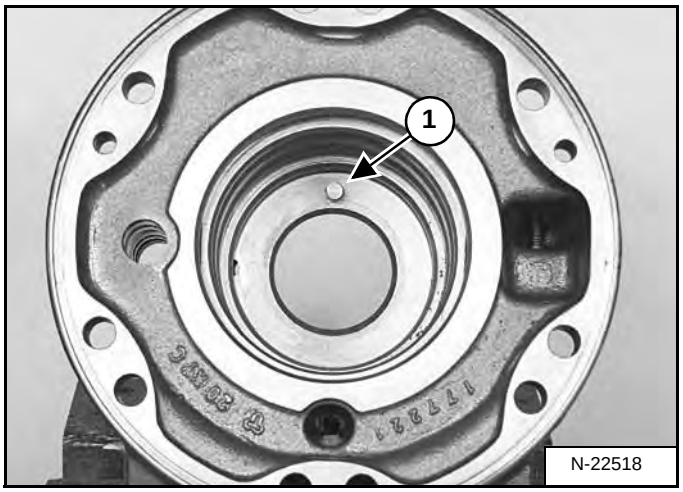
Figure 30-21-32



During installation of pistons in the bore, position the piston ring gap 180° from one piston to the next. One piston installed with the gap to the right, the next piston installed with the gap to the left.

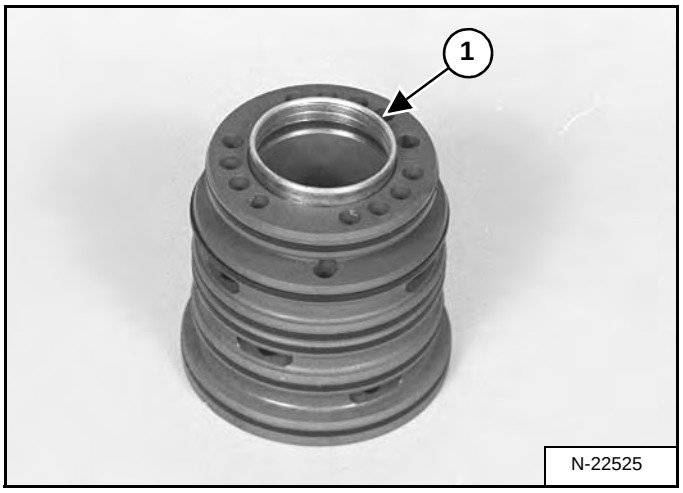
Dip each of the roller/piston assemblies (Item 1) **[Figure 30-21-32]** in oil and replace back its original bore.

Figure 30-21-33



Apply a small amount of grease to the locating pin (Item 1) **[Figure 30-21-33]** and install the locating pin in the housing

Figure 30-21-34

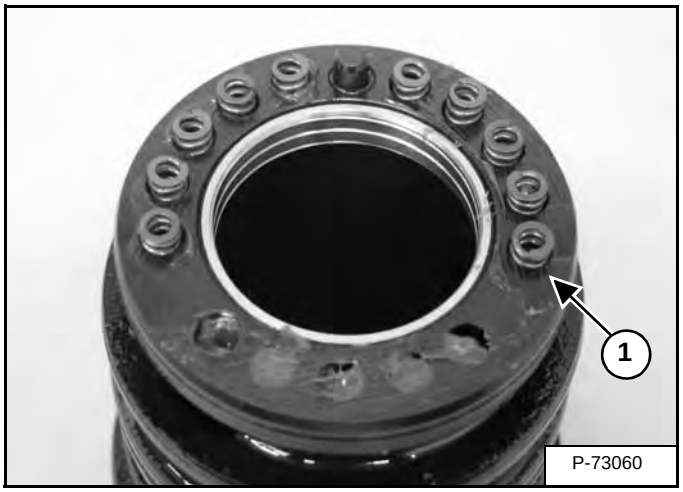


Install a new bushing (Item 1) **[Figure 30-21-34]** in the distributor if the old bushing was removed.

Install new O-rings and seals on the distributor **[Figure 30-21-35]**.

NOTE: When installing seals, apply a light coating of oil to the seal and the mating surfaces of the distributor. Install the O-rings and seals, allow 30 minutes for the seals to set on the distributor before installing the distributor in the housing.

Figure 30-21-35

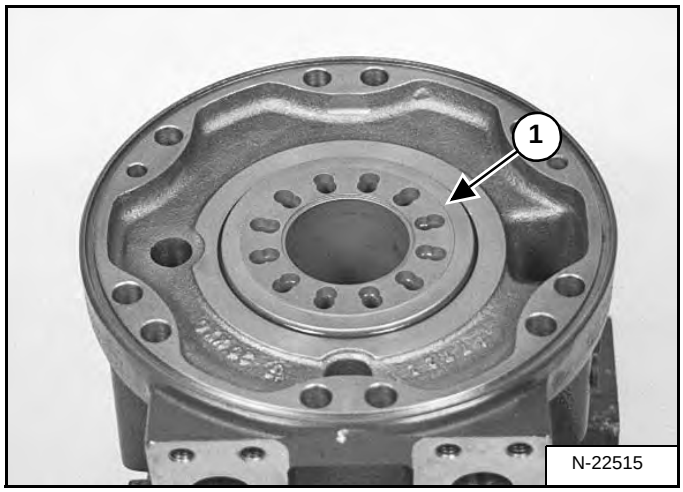


Using a small amount of grease, install the springs into the distributor valve (Item 1) **[Figure 30-21-35]**.

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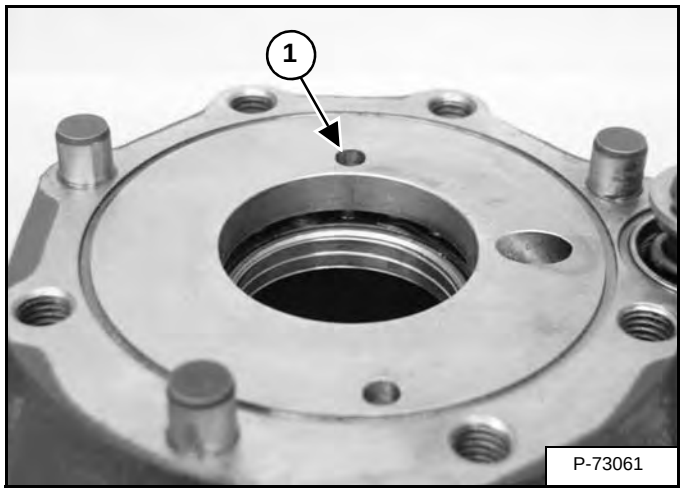
Assembly (Cont'd)

Figure 30-21-36



Install the distributor (Item 1) **[Figure 30-21-36]** in the housing. Protect the sealing surface of the distributor.

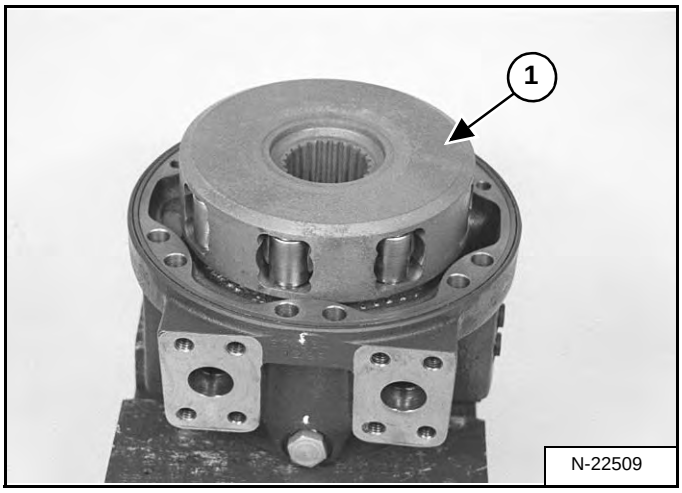
Figure 30-21-37



The pin in the distributor must align with the hole in the housing (Item 1) **[Figure 30-21-37]**. Use a hand press to push the distributor in place.

When installed correctly, the distributor will spring back slightly when pushed by hand into the housing.

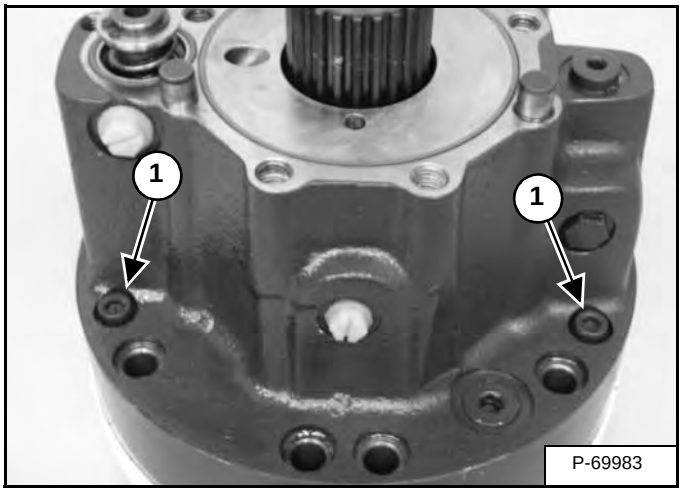
Figure 30-21-38



Install the cylinder block assembly (Item 1) **[Figure 30-21-38]**.

Install the cam ring to the rear housing. Apply liquid adhesive (Loctite® 243) to the two cam ring mounting bolts. Install the bolts finger tight.

Figure 30-21-39



Turn the motor so that it sets on the cam ring, and cylinder block **[Figure 30-21-39]**.

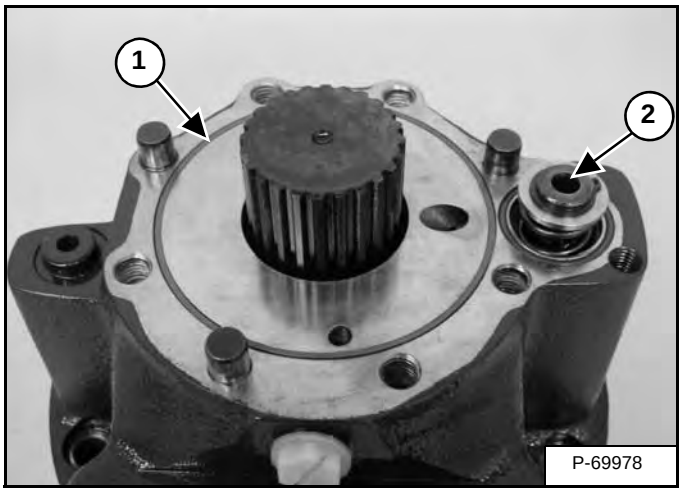
NOTE: Be careful when turning or moving the motor so the cylinder block stays in the motor housing and the sealing surfaces are protected.

Tighten the two cam ring mounting bolts to 26-29 ft.-lb. (35-39 N•m) torque.

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Assembly (Cont'd)

Figure 30-21-40

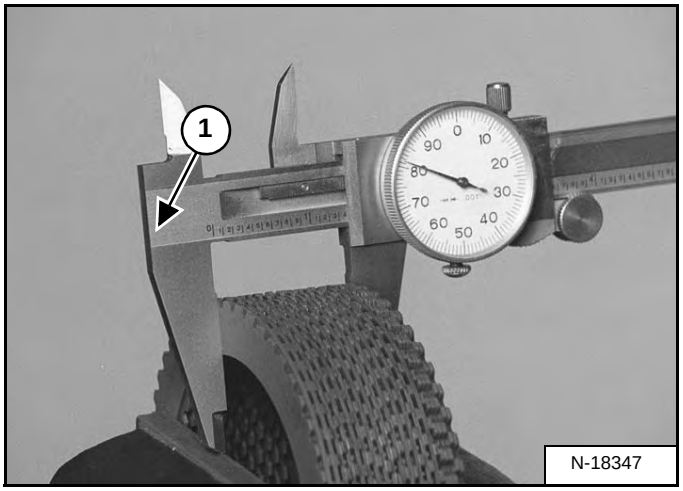


Install new o-rings (Item 1) **[Figure 30-21-40]** on the housing assembly and apply grease to the o-rings.

Install the two speed spool (Item 2) **[Figure 30-21-40]**.

Install the shaft into the distributor **[Figure 30-21-40]**.

Figure 30-21-41

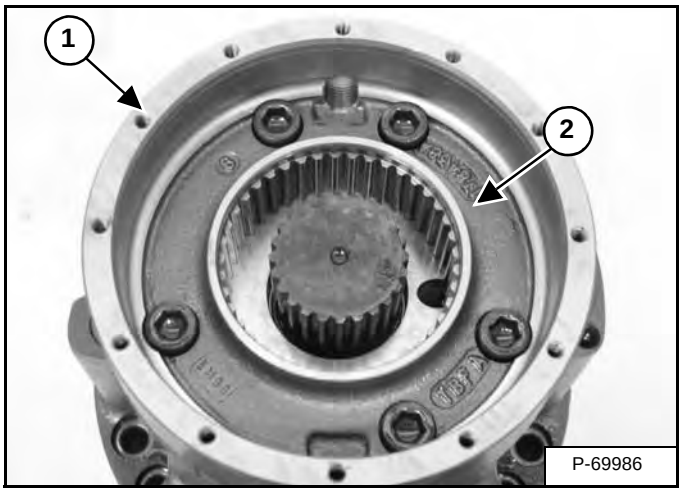


Clamp the disc pack in a vise and measure the height **[Figure 30-21-41]**. The height must be 1.22 inches (31.1 mm).

The normal thickness of the individual brake disc is 0.039 in. (1 mm).

If any individual disc's thickness is 0.037 in. (0,95 mm) or less, replace the complete disc pack.

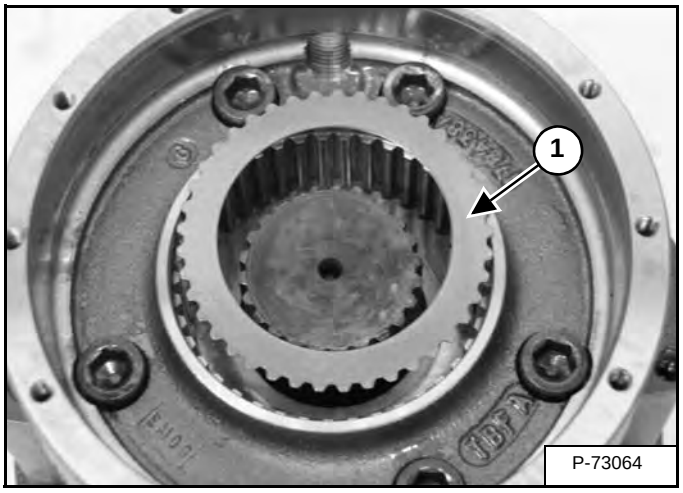
Figure 30-21-42



Install the brake housing (Item 1) **[Figure 30-21-42]** on the motor housing.

Apply liquid adhesive (Loctite® 243) to the five mounting bolts. Install the bolts (Item 2) **[Figure 30-21-42]** and tighten evenly to 86-90 ft.-lb. (117-122 N•m) torque.

Figure 30-21-43



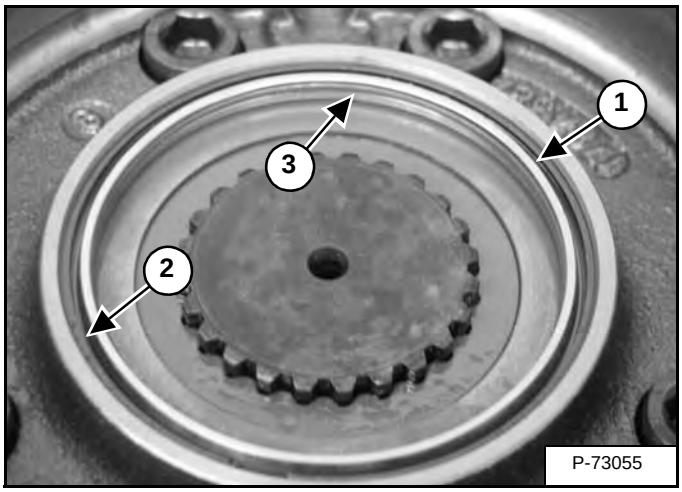
If needed, install the shims first, then install the brake disc pack starting with an outer disc (Item 1) **[Figure 30-21-43]** and alternating with an inner disc, throughout the pack.

End the disc pack with an outer disc.

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Assembly (Cont'd)

Figure 30-21-44



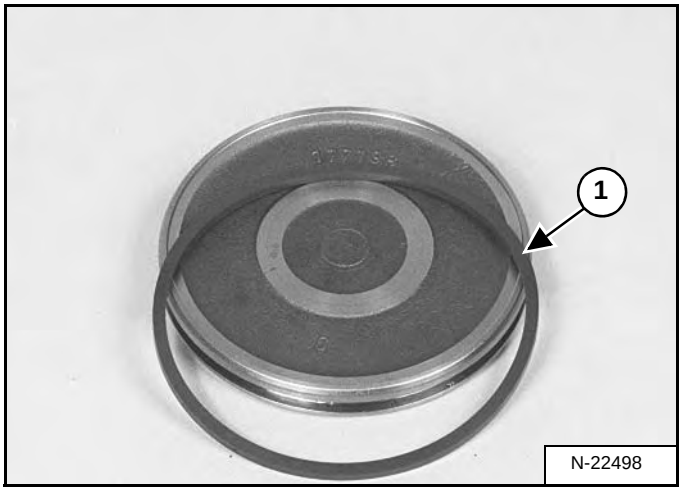
Install the brake seal (Item 1) **[Figure 30-21-44]**.

NOTE: Install the seal with the metal case end towards the brake pack.

Install the snap ring (Item 2) **[Figure 30-21-44]** to secure the seal in the brake housing.

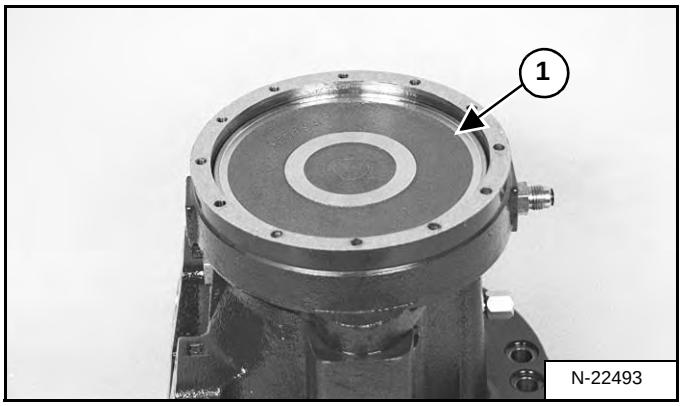
Install a new o-ring (Item 3) **[Figure 30-21-44]** in the seal.

Figure 30-21-45



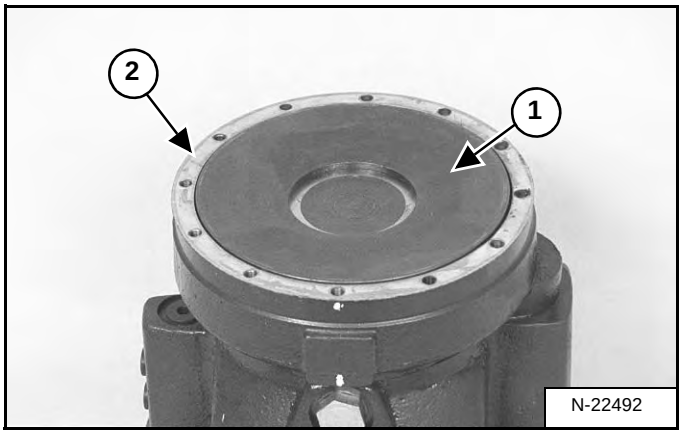
Lightly coat the piston with oil and install a new piston seal (Item 1) **[Figure 30-21-45]**.

Figure 30-21-46



Install the piston (Item 1) **[Figure 30-21-46]** in the brake housing.

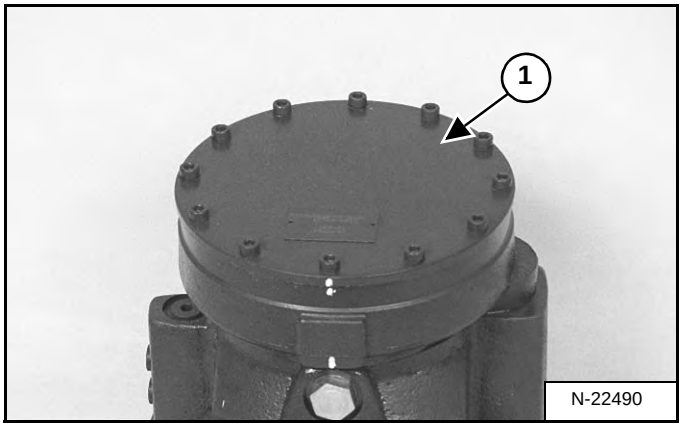
Figure 30-21-47



Install the brake spring (Item 1) **[Figure 30-21-47]**.

Install the end plate gasket (Item 2) **[Figure 30-21-47]**.

Figure 30-21-48



Install the brake end cover (Item 1) **[Figure 30-21-48]**.

Install the twelve end cover mount bolts and tighten evenly to 10-12 ft.-lb. (14-16 N•m) torque.

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HYDROSTATIC MOTOR CARRIER

Description

The hydrostatic motor carrier is the mating connection from the hydrostatic drive motor to the transmission chaincase.

The hydrostatic motor carrier contains a shaft that rotates on two tapered roller bearings. The shaft has two sprockets that turn the drive chains. Damaged or severely worn bearings can destroy a drive motor.

The hydrostatic motor carrier is sealed to the transmission case with a polyurethane sealant. A gasket is not used. Replacement sealant can be ordered through Bobcat Parts part number 6685372.

The hydrostatic motor carrier has a seal which isolates the chain case oil from the hydrostatic motor case drain oil.

A brake disk is installed on each hydrostatic motor carrier. The brake disk is mounted to the shaft in the motor carrier (single speed loaders only).

The hydrostatic motor carriers are made to fit on both the right and left hand sides of the loader.

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Removal and Installation



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the fluid from the chaincase. (See CHAINCASE on Page 40-30-1.)

Remove the center chaincase cover. (See Center Cover Removal And Installation on Page 40-30-2.)

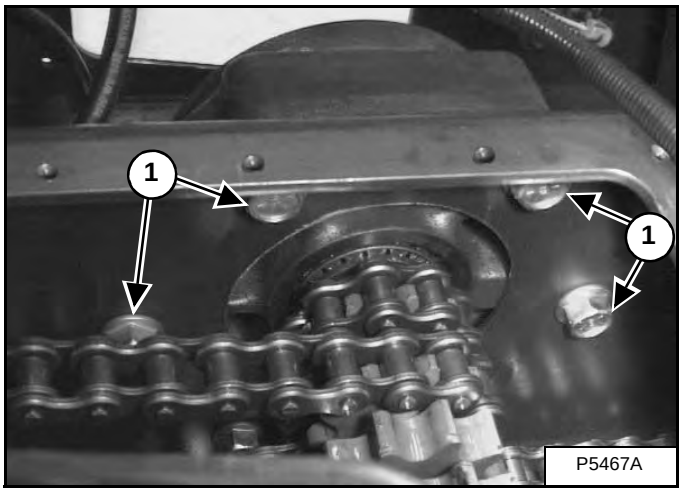
Remove the brake disc. (Single speed loaders only) (See Disc Removal And Installation on Page 40-10-2.)

Remove the front axle sprocket. (See Axle, Sprocket And Bearings Removal And Installation on Page 40-20-4.)

If the motor carrier is removed from the right side, remove the lift arm bypass valve, (See Removal And Installation on Page 20-50-2.) and remove the control panel. (See Removal And Installation on Page 50-100-2.)

Remove the control pedal linkages. (See Linkage Removal And Installation on Page 50-90-3.)

Figure 30-30-1

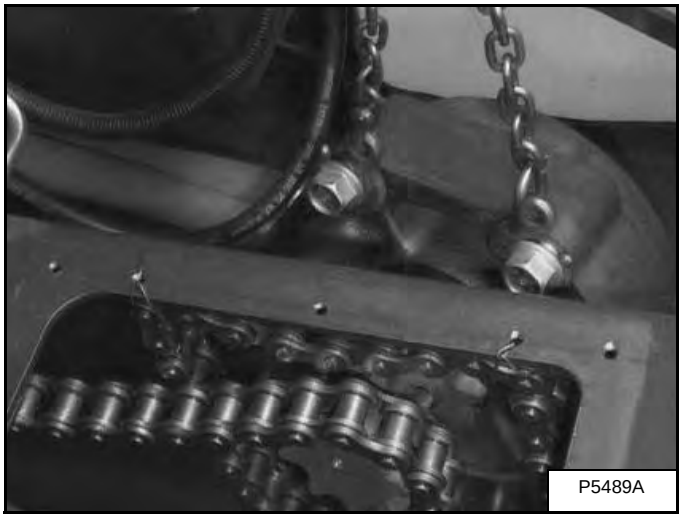


Remove the six mounting bolts (Item 1) **[Figure 30-30-1]** from the carrier.

Installation: Tighten the mounting bolts to 340-360 ft.-lb. (461-488 N•m) torque.

Slide the motor carrier toward the rear and remove the rear drive chain.

Figure 30-30-2



NOTE: For easier access for the motor carrier coming out and going into the chaincase, tie the front drive chain to the chaincase with a wire [Figure 30-30-2].

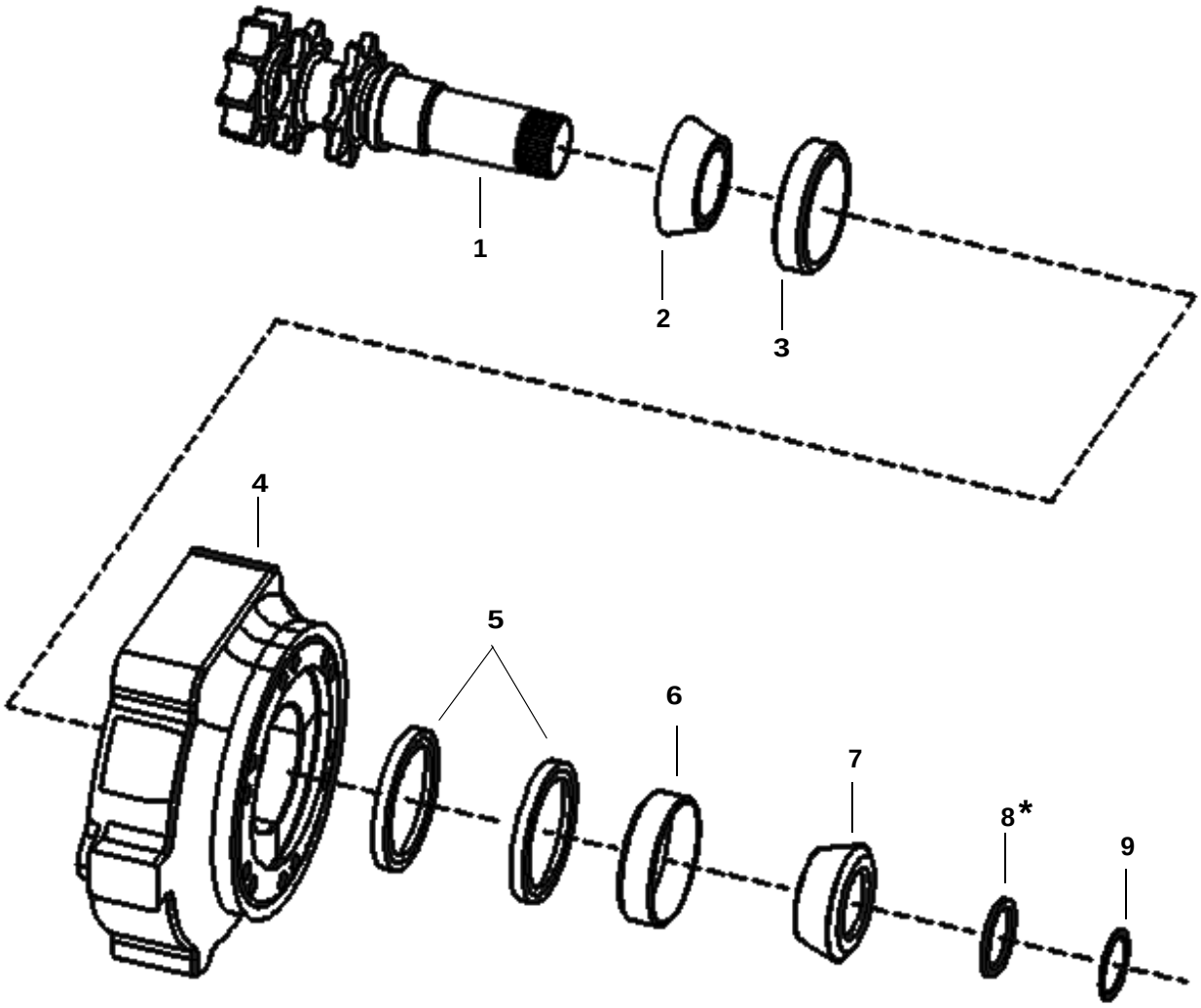
Slide the motor carrier out of the chaincase far enough to install a chain and chain hoist to the carrier **[Figure 30-30-2]**.

Pull the motor carrier away from the chaincase and out of the loader. **[Figure 30-30-2]**.

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Parts Identification

1. Shaft
2. Bearing
3. Race
4. Housing
5. Seal (2)
6. Race
7. Bearing
8. Washer*
9. Snap Ring



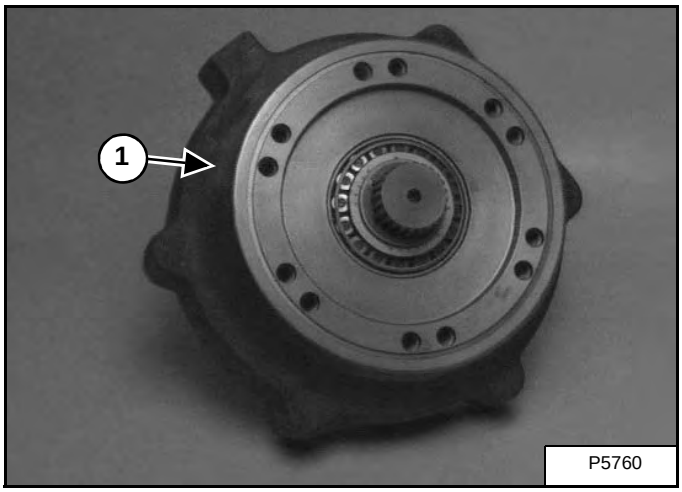
*** S/N 530714318 & BELOW AND 530811605 & BELOW**

TS-1227A

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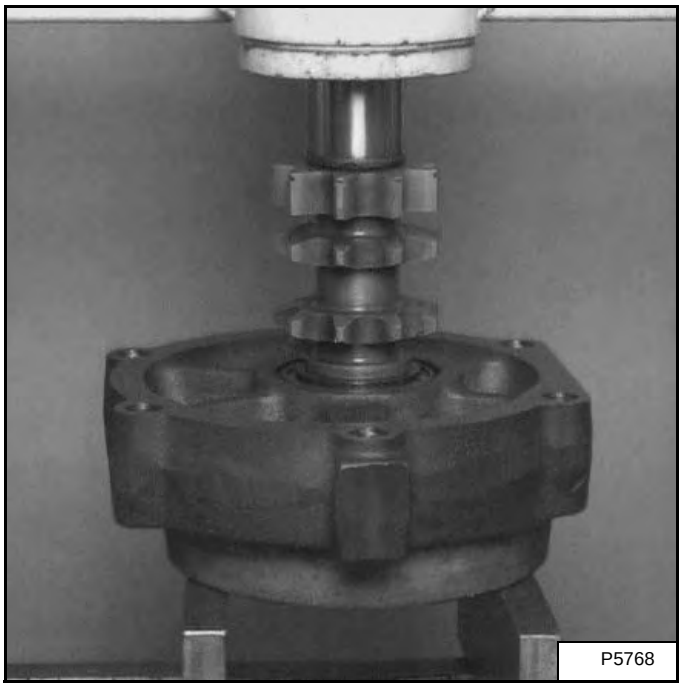
Disassembly

Figure 30-30-3



Remove the large O-ring from the groove (Item 1) **[Figure 30-30-3]** in the housing.

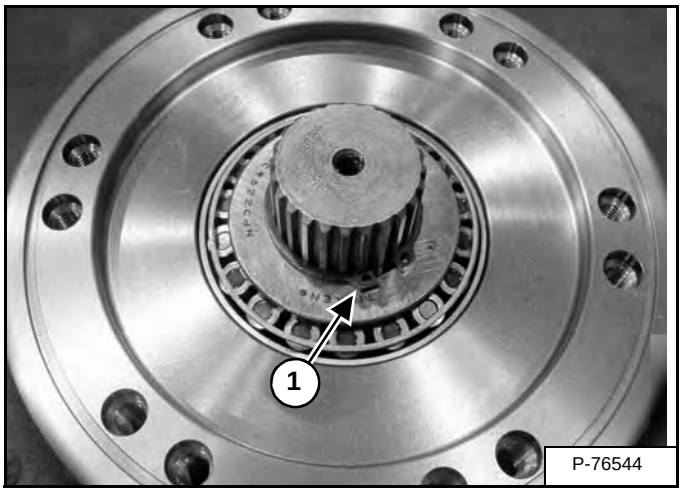
Figure 30-30-4



Put the motor carrier in a hydraulic press **[Figure 30-30-4]**.

Put a small amount of pressure on the shaft to release the pre-load on the snap ring.

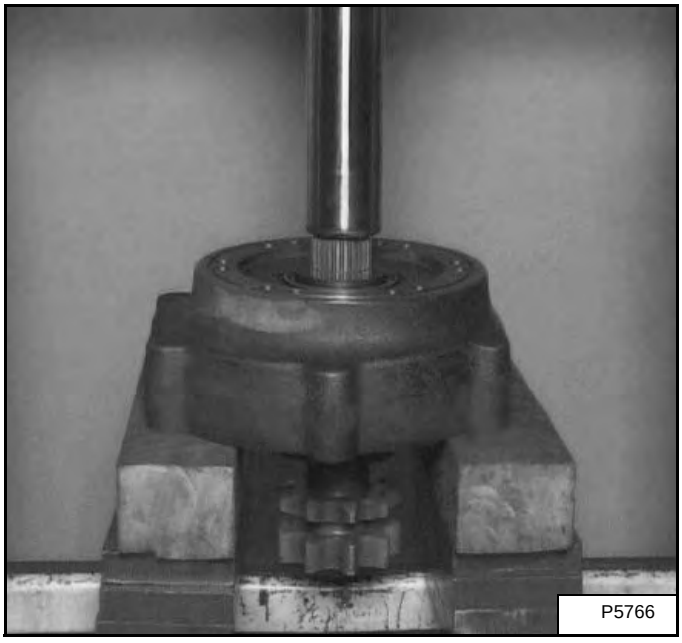
Figure 30-30-5



Remove the snap ring (Item 1) **[Figure 30-30-5]** from the shaft.

NOTE: Loaders with S/N 530714318 & Below and 530811605 & Below will have a washer between the snap ring and the bearing.

Figure 30-30-6

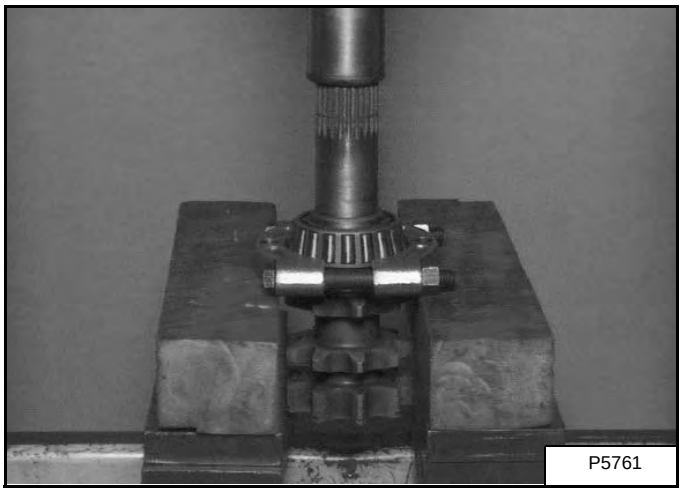


Use a hydraulic press to remove the shaft from the housing **[Figure 30-30-6]**.

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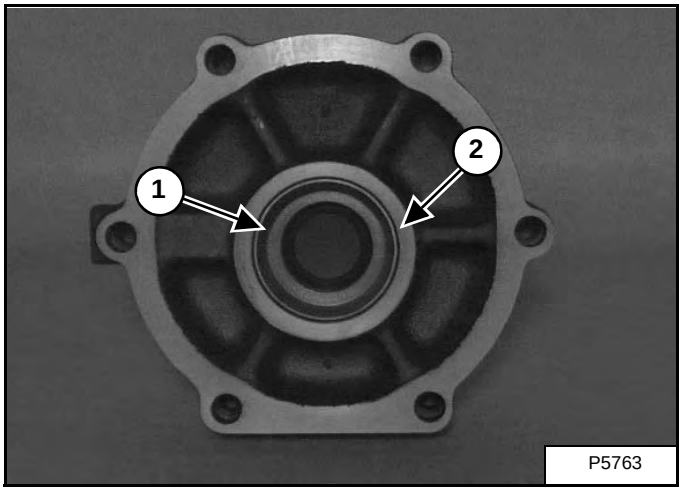
Disassembly (Cont'd)

Figure 30-30-7



Install the bearing puller tool under the bearing flange, use the hydraulic press to remove the bearing from the shaft **[Figure 30-30-7]**.

Figure 30-30-8

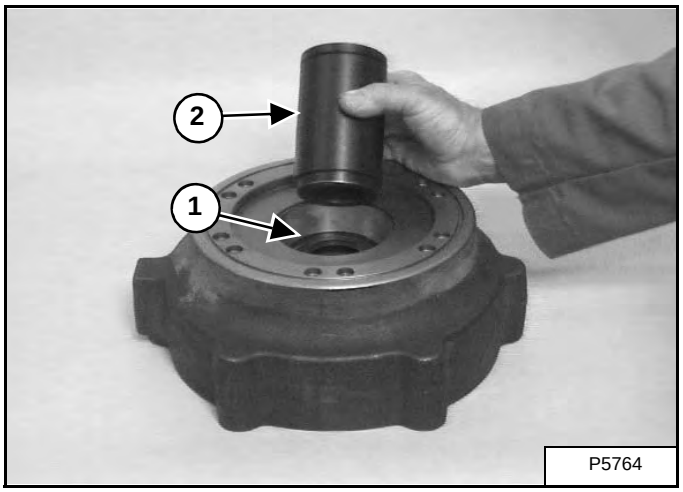


Remove the two seals (Item 1) **[Figure 30-30-8]** from the housing.

Check the bearing cup (Item 2) **[Figure 30-30-8]** (both sides) and replace as needed.

Assembly

Figure 30-30-9



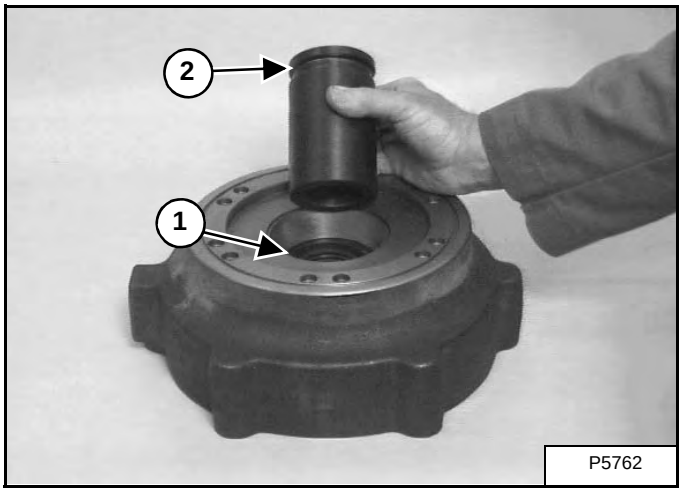
The tool listed will be needed to the following procedure:

MEL1431 - Seal Driver Tool

Install the first seal (Item 1) **[Figure 30-30-9]** into the housing with the seal lip facing away from you.

Use the tool (Item 2) **[Figure 30-30-9]** as shown in the figure.

Figure 30-30-10



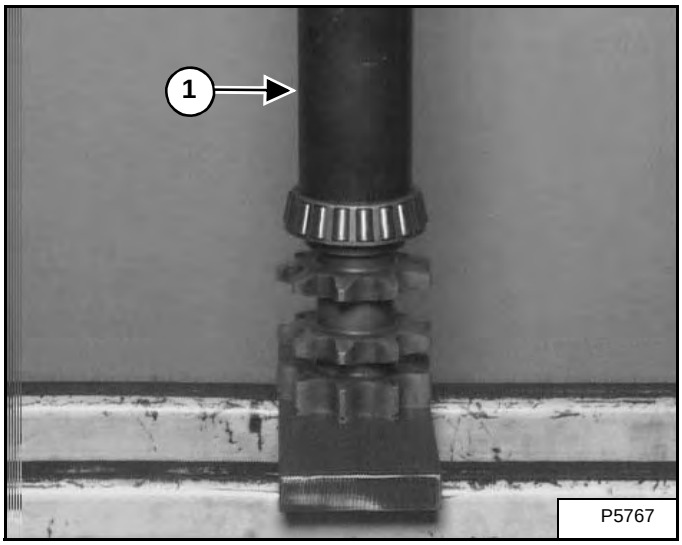
Install the second seal (Item 1) **[Figure 30-30-10]** into the housing with the seal lip facing toward you.

Use the tool (Item 2) **[Figure 30-30-10]** as shown in the figure.

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Assembly (Cont'd)

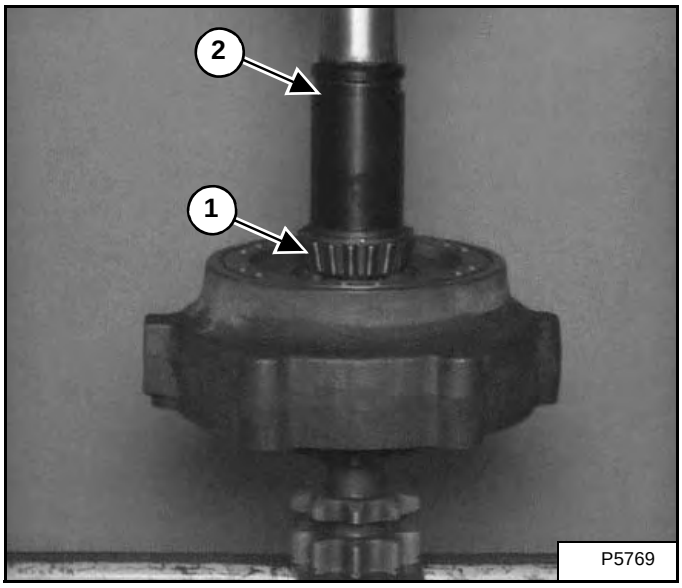
Figure 30-30-11



Install the bearing on the shaft **[Figure 30-30-11]**.

Use a pipe (Item 1) **[Figure 30-30-11]** with O.D. that seats on the I.D. of the bearing.

Figure 30-30-12



Install the shaft / bearing assembly into the housing.

Install the bearing (Item 1) using the tool (Item 2) **[Figure 30-30-12]** (MEL1431).

After the bearing is seated. Install the snap ring on the shaft and reposition the motor carrier to allow back press operation.

NOTE: Slight press pressure may be used to preload both bearings. After installation of the snap ring a back press operation may be necessary to reduce the preload and remove the clearance from between the snap ring and the main bearing.

Use the press and apply pressure to the end of the spline shaft to reduce preload and clearance.

NOTE: Loaders with S/N 530714318 & Below and 530811605 & Below will have a washer between the snap ring and the bearing.

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HYDROSTATIC MOTOR CARRIER (SJC)

Description

The hydrostatic motor carrier is the mating connection from the hydrostatic drive motor to the transmission chaincase.

The hydrostatic motor carrier contains a shaft that rotates on two tapered roller bearings. The shaft has two sprockets that turn the drive chains. Damaged or severely worn bearings can destroy a drive motor.

The hydrostatic motor carrier is sealed to the transmission case with a polyurethane sealant. A gasket is not used. Replacement sealant can be ordered through Bobcat Parts part number 6685372.

The hydrostatic motor carrier has a seal which isolates the chain case oil from the hydrostatic motor case drain oil.

The hydrostatic motor carrier with (SJC) uses a speed sensor installed in the motor carrier housing. The speed sensor senses a disk that is fixed to the shaft in the motor carrier.

A brake disk is installed on each hydrostatic motor carrier. The brake disk is mounted to the shaft in the motor carrier (single speed loaders only).

The hydrostatic motor carriers are made to fit on both the right and left hand sides of the loader.

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Removal and Installation



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the fluid from the chaincase. (See CHAINCASE on Page 40-30-1.)

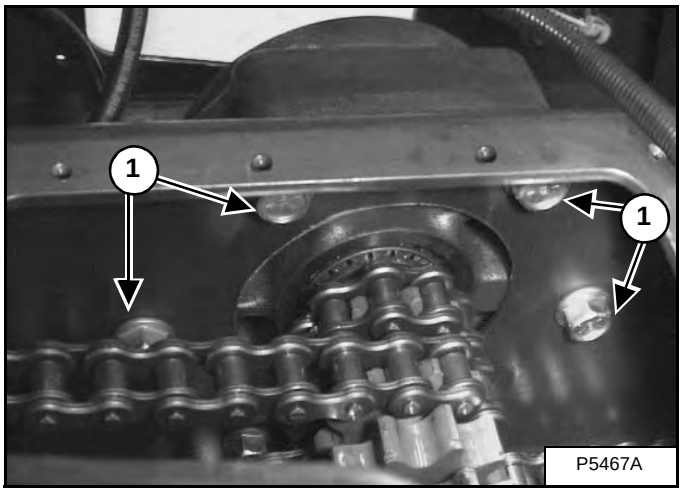
Remove the center chaincase cover. (See Center Cover Removal And Installation on Page 40-30-2.)

Remove the brake disc. (Single speed loaders only) (See Axle, Sprocket And Bearings Removal And Installation on Page 40-20-4.)

Remove the front axle sprocket. (See Axle, Sprocket And Bearings Removal And Installation on Page 40-20-4.)

If the motor carrier is removed from the right side, remove the lift arm bypass valve, (See Removal And Installation on Page 20-50-2.) and remove the control panel. (See Removal And Installation on Page 50-100-2.)

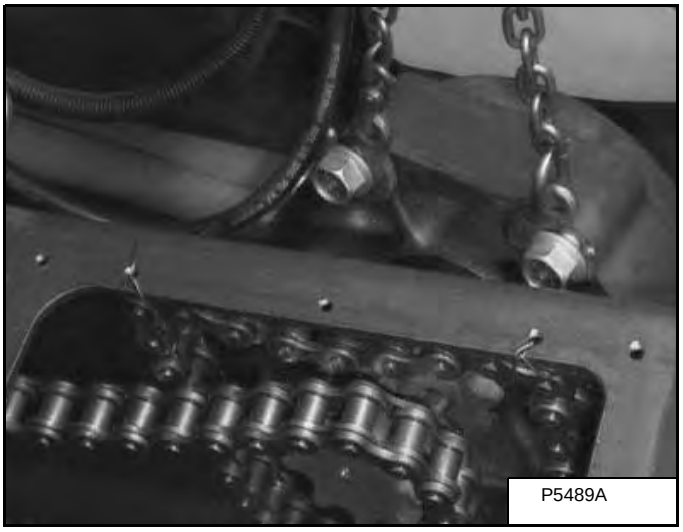
Figure 30-31-1



Remove the six mounting bolts (Item 1) **[Figure 30-31-1]** from the carrier.

Installation: Tighten the mounting bolts to 340-360 ft.-lb. (461-488 N•m) torque.

Figure 30-31-2



Slide the motor carrier toward the rear and remove the rear drive chain.

NOTE: For easier access for the motor carrier coming out and going into the chaincase, tie the front drive chain to the chaincase with a wire [Figure 30-31-2].

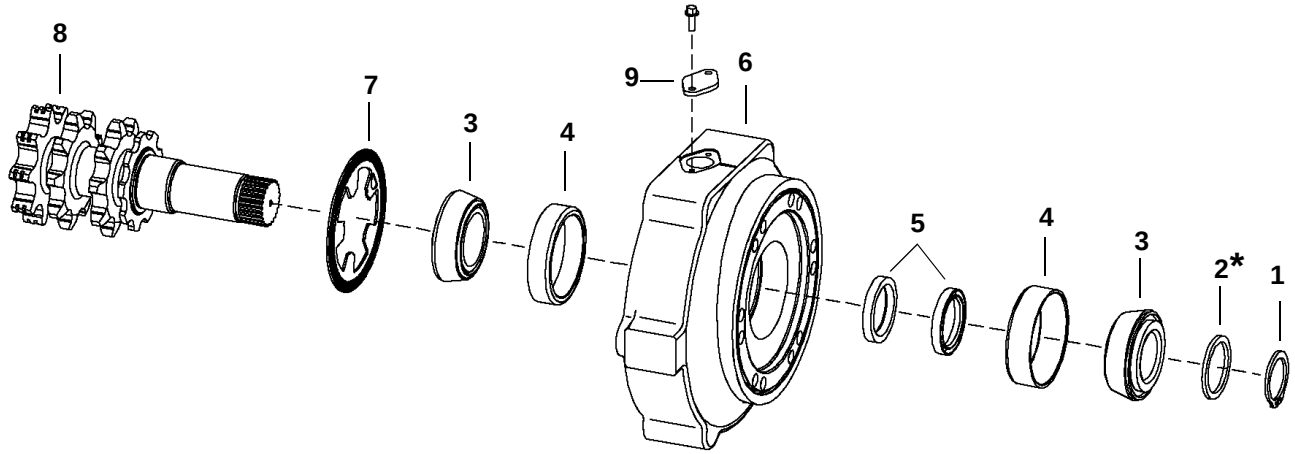
Slide the motor carrier out of the chaincase far enough to install a chain and chain hoist to the carrier **[Figure 30-31-2]**.

NOTE: When installing the motor carrier into the loader, use caution to protect the wheel speed washer from damage.

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Parts Identification

Ref.	Description
1.	Snap Ring
2.	Washer*
3.	Bearing
4.	Race
5.	Seal
6.	Housing
7.	Speed Washer
8.	Shaft
9.	Cover



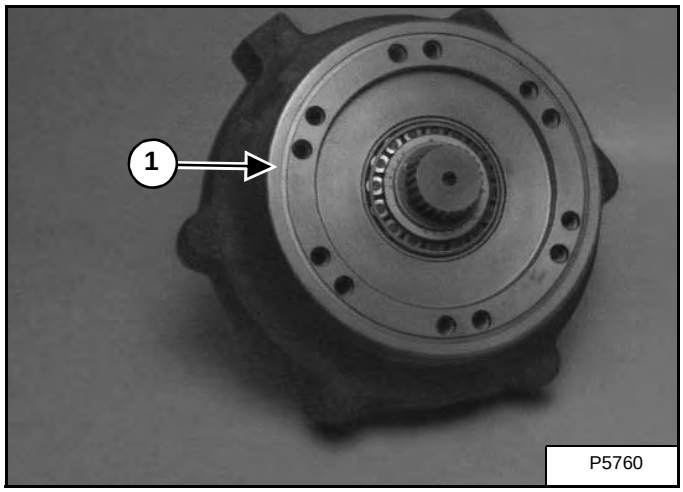
*** S/N 530714318 & BELOW AND 530811605 & BELOW**

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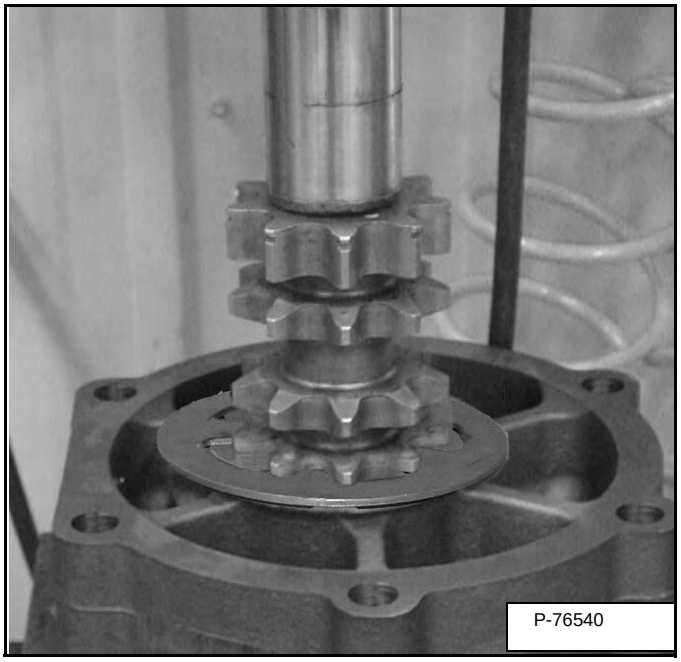
Disassembly

Figure 30-31-3



Remove the large O-ring from the groove (Item 1) **[Figure 30-31-3]** in the housing.

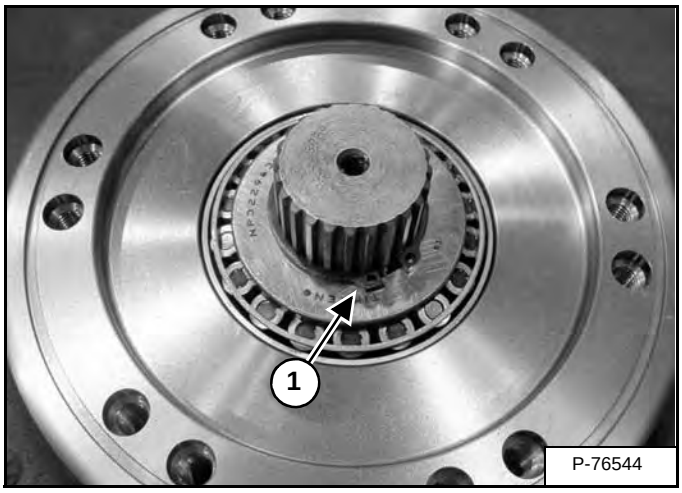
Figure 30-31-4



Put the motor carrier in a hydraulic press **[Figure 30-31-4]**.

Put a small amount of pressure on the shaft to release the pre-load on the snap ring.

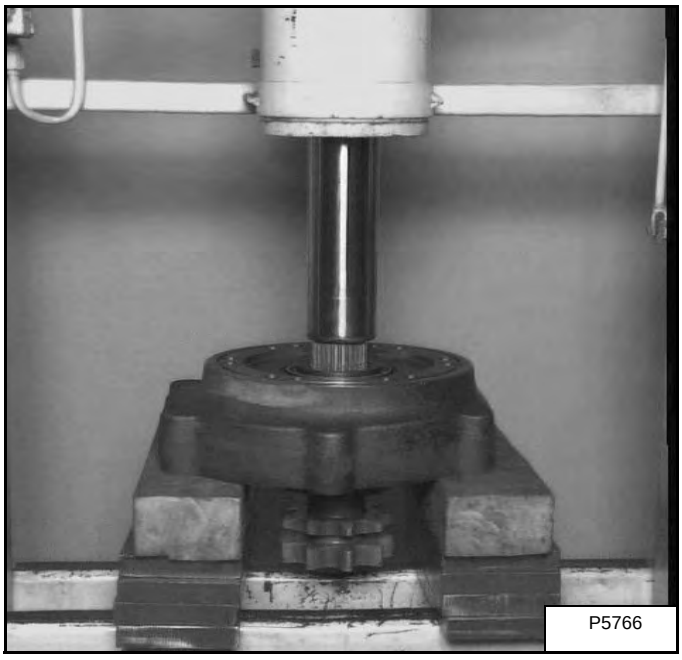
Figure 30-31-5



Remove the snap ring (Item 1) **[Figure 30-31-5]** from the shaft.

NOTE: Loaders with S/N 530714318 & Below and 530811605 & Below will have a washer between the snap ring and the bearing.

Figure 30-31-6

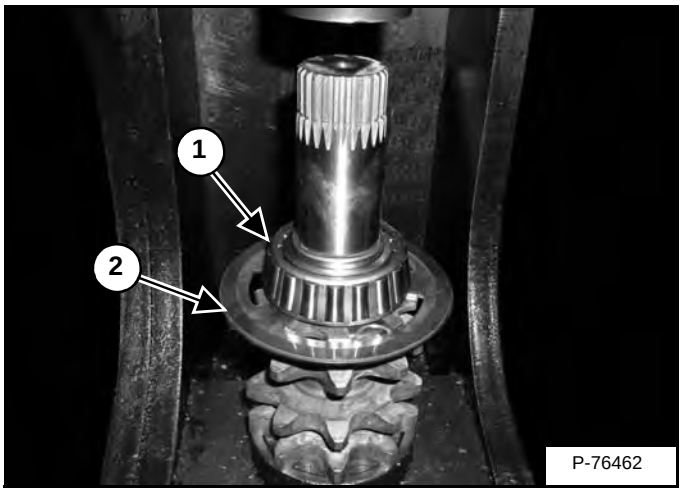


Use a hydraulic press to remove the shaft from the housing **[Figure 30-31-6]**.

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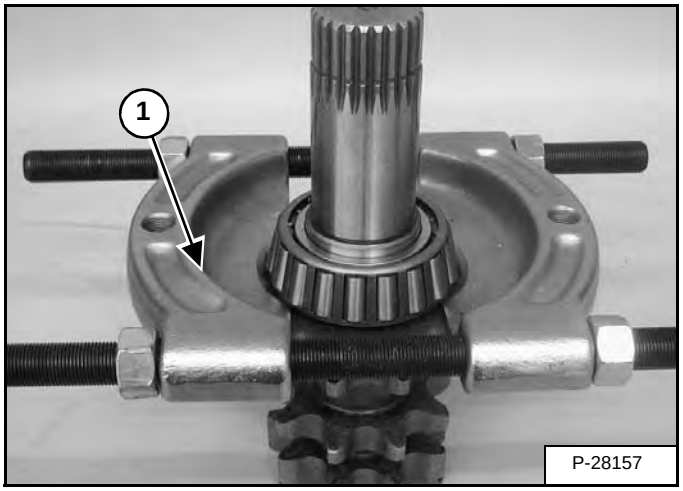
Disassembly (Cont'd)

Figure 30-31-7



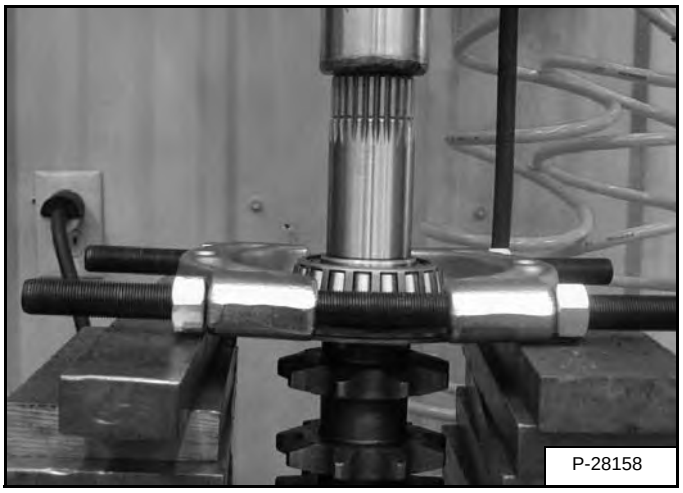
NOTE: The bearing (Item 1) [Figure 30-31-7] and the wheel speed washer (Item 2) [Figure 30-31-7], must both be replaced, due to damage to the wheel speed washer from removing the bearing.

Figure 30-31-8



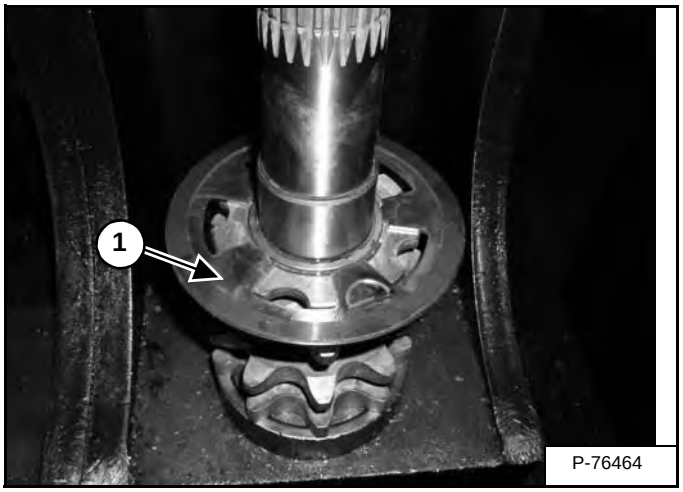
Install the bearing puller tool (Item 1) **[Figure 30-31-8]** under the bearing flange, between the bearing and the speed washer.

Figure 30-31-9



Use the hydraulic press to remove the bearing from the shaft **[Figure 30-31-9]**.

Figure 30-31-10

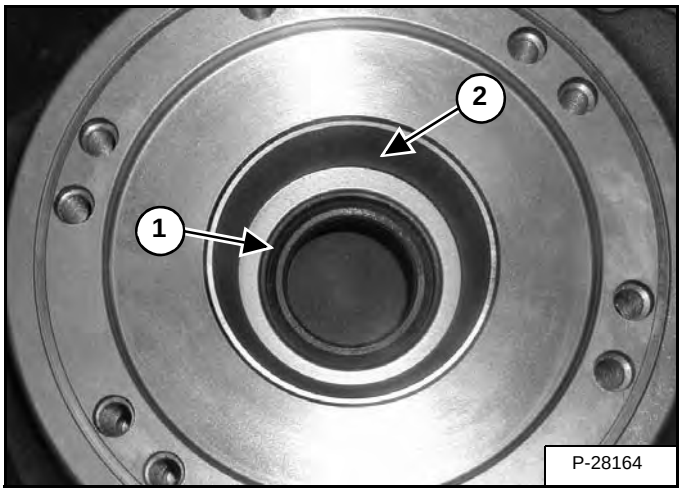


Remove the wheel speed washer (Item 1) **[Figure 30-31-10]** from the shaft.

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Disassembly (Cont'd)

Figure 30-31-11

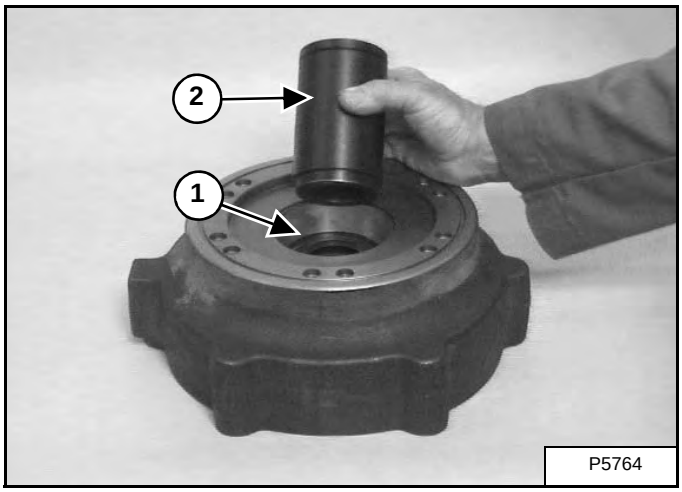


Remove the two seals (Item 1) **[Figure 30-31-11]** from the housing.

Check the bearing cup (Item 2) **[Figure 30-31-11]** (both sides) and replace as needed.

Assembly

Figure 30-31-12



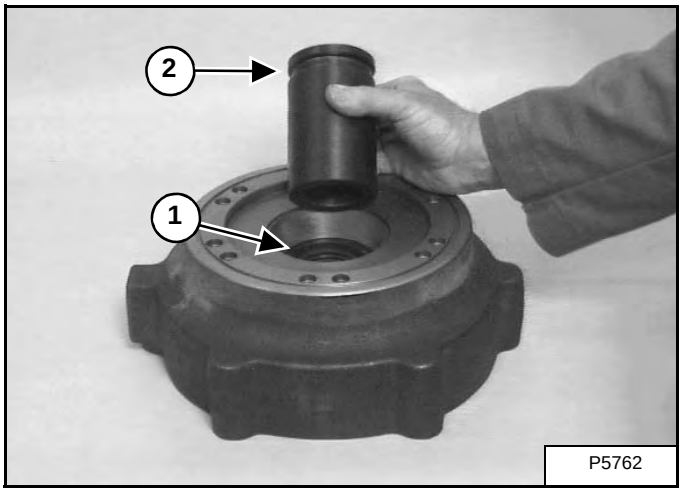
The tool listed will be needed to the following procedure:

MEL1431 - Seal Driver Tool

Install the first seal (Item 1) **[Figure 30-31-12]** into the housing with the seal lip facing away from you.

Use the tool (Item 2) **[Figure 30-31-12]** as shown in the figure.

Figure 30-31-13



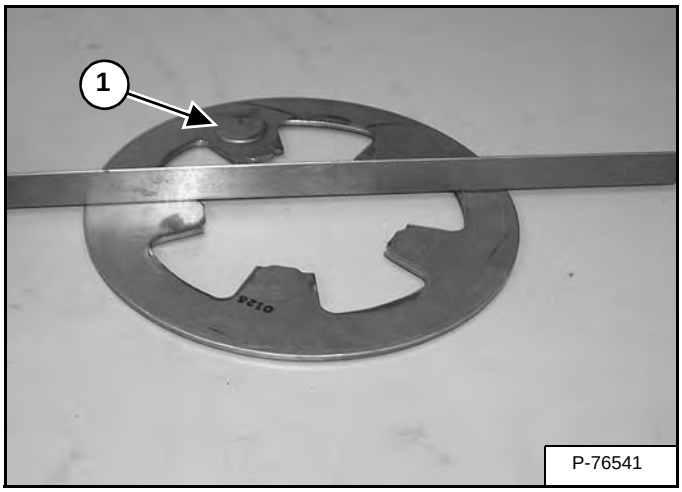
Install the second seal (Item 1) **[Figure 30-31-13]** into the housing with the seal lip facing toward you.

Use the tool (Item 2) **[Figure 30-31-13]** as shown in the figure.

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Assembly (Cont'd)

Figure 30-31-14

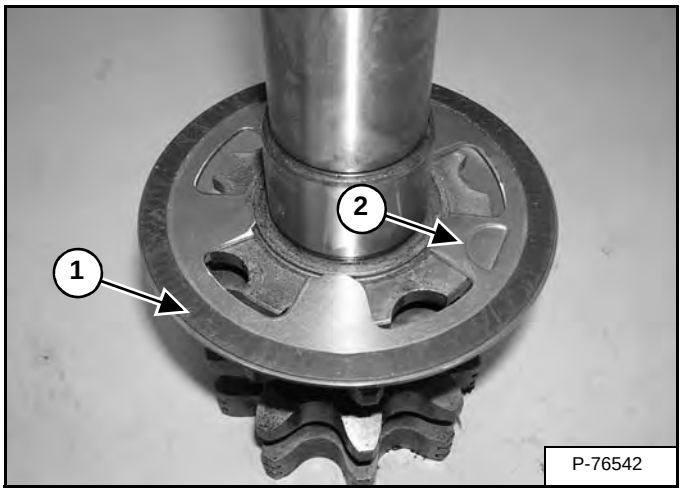


The wheel speed washer, has one alignment pin (Item 1) **[Figure 30-31-14]**.

Check the new wheel speed washer with a straight edge, to be sure it is square **[Figure 30-31-14]**.

If the washer is more than 0.080 (2,03 mm) out of square, it must be replaced.

Figure 30-31-15



Inspect the wheel speed washer for damage to the magnetic surface (Item 1) **[Figure 30-31-15]**.

NOTE: Do not contact the magnetic surface of the wheel speed washer (Item 1) [Figure 30-31-15], with a magnet. This may cause damage to the magnetic surface.

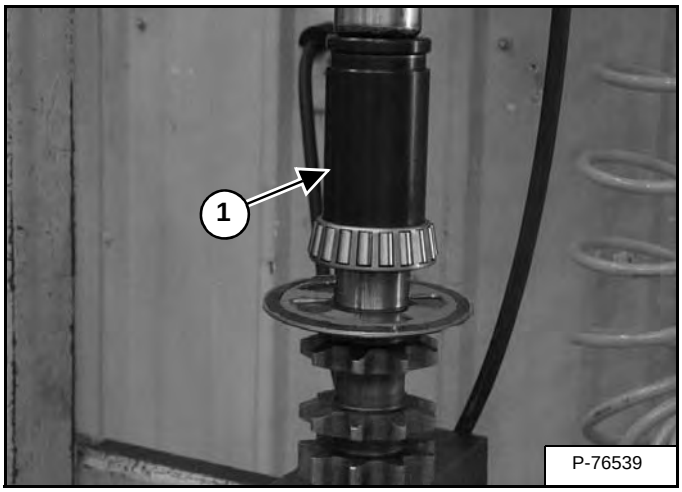
Install the wheel speed washer on the shaft **[Figure 30-31-15]**.

Align the one pin (Item 2) **[Figure 30-31-15]** in the sprocket.

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Assembly (Cont'd)

Figure 30-31-16



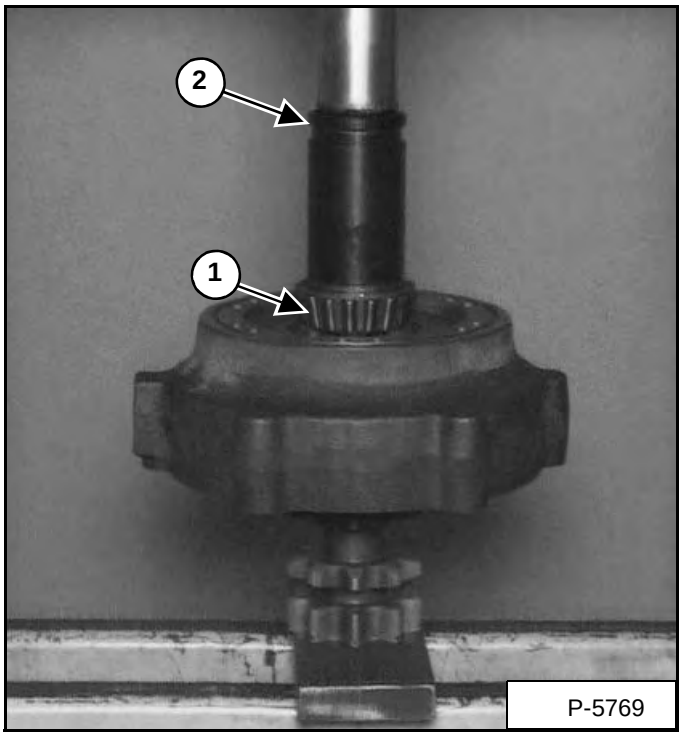
Install the bearing on the shaft **[Figure 30-31-16]**.

Use a pipe (Item 1) **[Figure 30-31-16]** with O.D. that seats on the I.D. of the bearing.

Seat the bearing on the shaft, down against the wheel speed washer.

NOTE: The wheel speed washer should be tight on the shaft.

Figure 30-31-17



Install the shaft / bearing assembly into the housing.

Install the bearing (Item 1) using the tool (MEL1431) (Item 2) **[Figure 30-31-17]**.

After the bearing is seated. Install the snap ring on the shaft and reposition the motor carrier to allow back press operation.

NOTE: Slight press pressure may be used to preload both bearings. After installation of the snap ring a back press operation may be necessary to reduce the preload and remove the clearance from between the snap ring and the main bearing.

Use the press and apply pressure to the end of the spline shaft to reduce preload and clearance.

NOTE: Loaders with S/N 530714318 & Below and 530811605 & Below will have a washer between the snap ring and the bearing.

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CHARGE PRESSURE

Description

Charge pressure is a supply of oil to the hydrostatic pumps. Charge pressure is regulated by a charge relief valve located inside the hydrostatic pump. Charge pressure is used to replenish hydrostatic fluid removed from the drive circuit, pump and motor “internal leakage” and from the hydrostatic motors shuttle (flushing) valve.

Charge pressure is obtained from the dedicated section of the hydraulic gear pump.

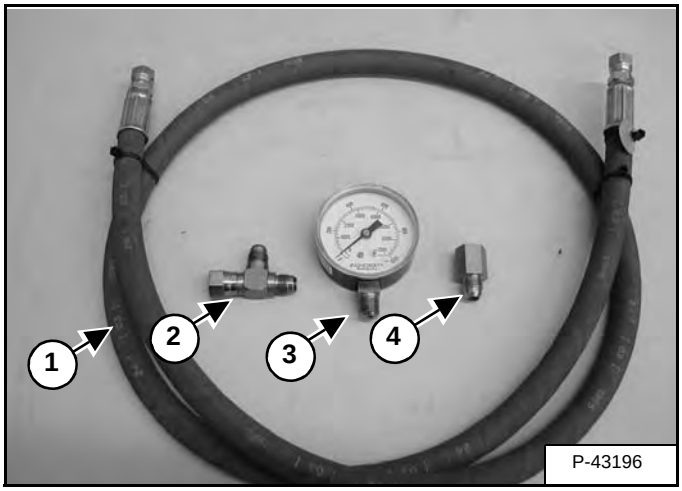
Charge pressure is also used to operate other hydraulic functions, such as shifting the auxiliary, lift and tilt spools in the main hydraulic control valve.

The charge pressure sender is located on the charge filter housing mounted next to the blower housing. Charge pressure alarm settings are pre-programmed into the main controller and are based on loader type and options installed.

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Testing

Figure 30-40-1



The tools needed to check charge pressure, hydraulic hose (Item 1), T fitting (P/N 13K-5) (Item 2), Hydraulic gauge (1000 PSI) (Item 3) and adapter fitting (P/N 93F-5) (Item 4) **[Figure 30-40-1]**.

WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

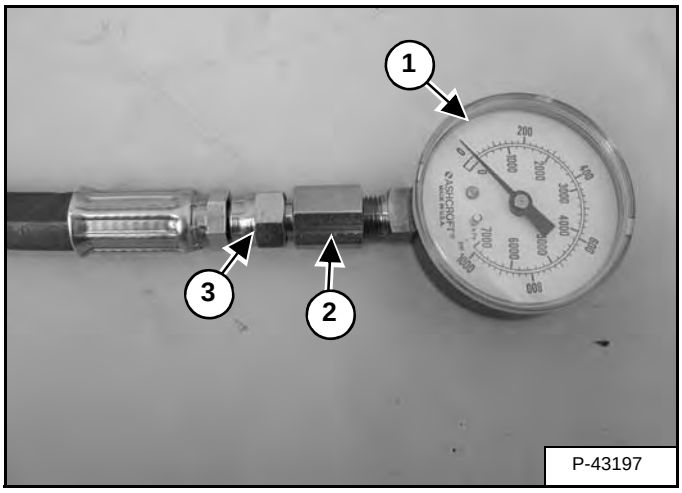
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Raise the loader lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Place the loader on jackstands. (See Procedure on Page 10-10-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

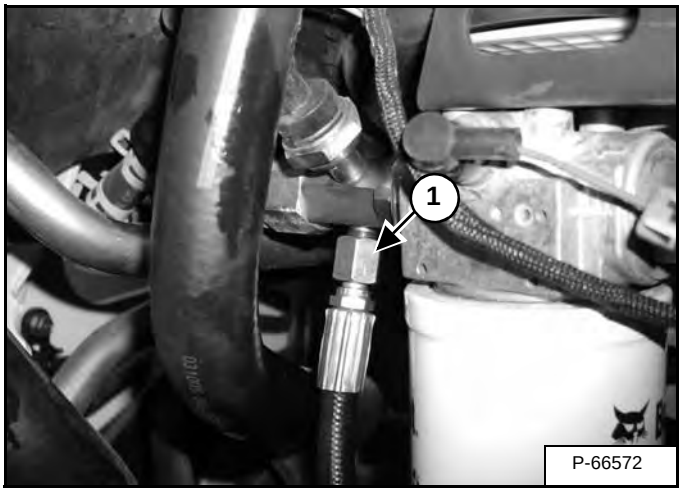
Figure 30-40-2



Connect the gauge (Item 1), to the adapter fitting (P/N 93F5) (Item 2) **[Figure 30-40-2]**.

Connect the hydraulic hose (Item 3) **[Figure 30-40-2]** to the adapter fitting. Tighten all connections.

Figure 30-40-3

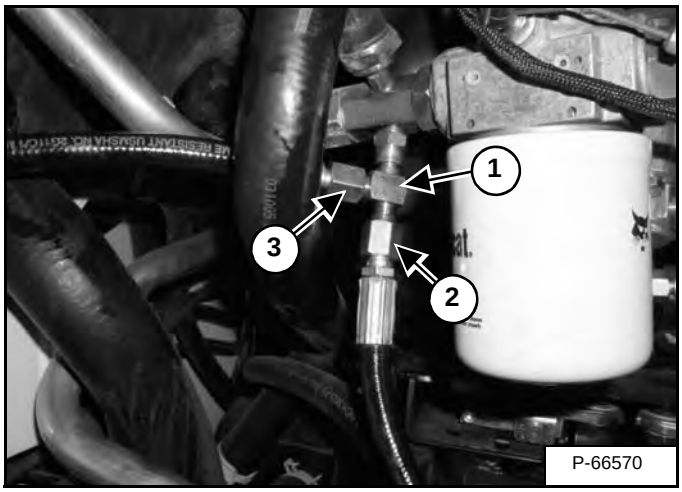


Disconnect the hydraulic hose (Item 1) **[Figure 30-40-3]** from the charge pressure sender.

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Testing (Cont'd)

Figure 30-40-4



Install the T fitting (P/N 13K-5) (Item 1) **[Figure 30-40-4]**.

Install the hose (Item 2) **[Figure 30-40-4]**, that was disconnected from the charge pressure sender, to the T fitting.

Install the hose (Item 3) **[Figure 30-40-4]**, that is attached to the pressure gauge, to the T fitting.

Tighten the hydraulic fittings.

Connect the remote start tool. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.)

Start the loader and run at an idle and allow the hydraulic fluid to warm to 140°F.

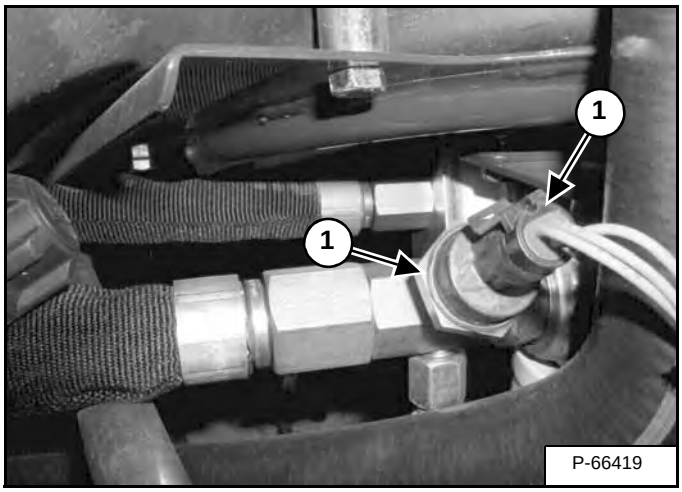
On non-SJC equipped loaders the charge pressure at high idle, with the fluid temperature of 140°F is **410-470 PSI** (28,3-32,4 bar) with the pump in neutral.

NOTE: If the machine is equipped with SJC option the charge pressure should be set at 335-385 PSI (23,1 - 26,5 bar) at 140°F (60°C) fluid @ High idle.

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Sender Removal And Installation

Figure 30-40-5



Disconnect the wire (Item 1) **[Figure 30-40-5]** from the sender.

Remove the sender (Item 2) **[Figure 30-40-5]** from the filter head.

Installation: Tighten the charge pressure sender to 7.4-8.1 ft.-lb. (10-11 N•m) torque.

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Adjusting

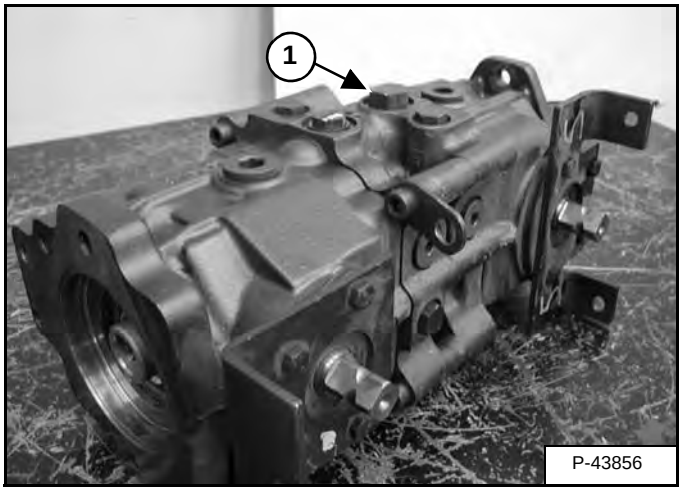
Non SJC Machines

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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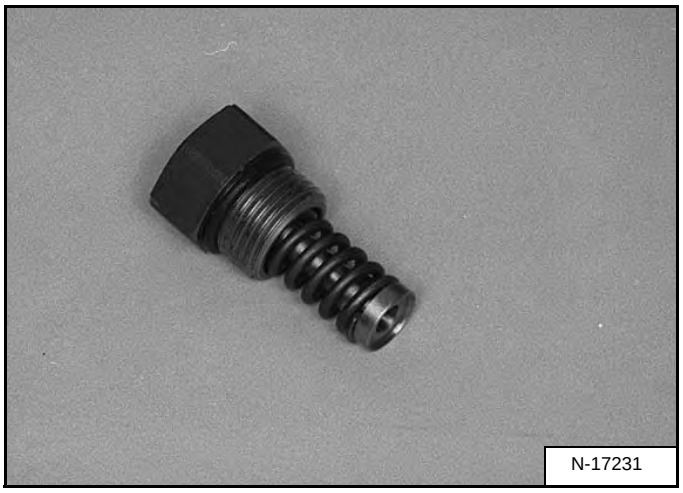
Figure 30-40-6



If the charge pressure is not correct loosen the charge relief valve plug (Item 1) **[Figure 30-40-6]**.

Always use a new O-ring. Tighten the plug to 30-50 ft.-lb. (41-68 N•m) torque.

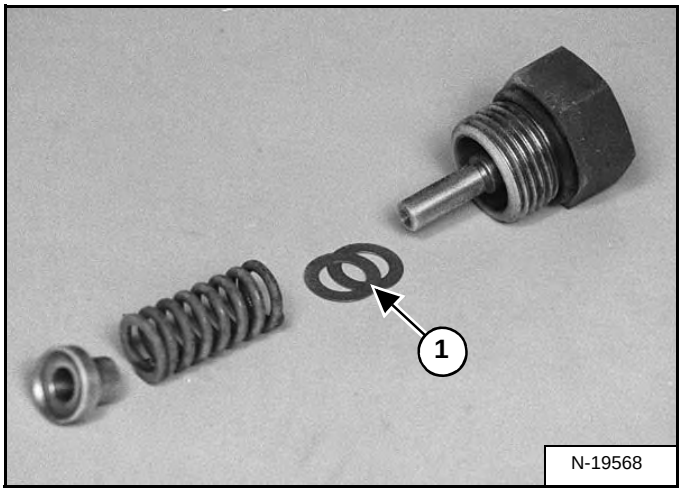
Figure 30-40-7



Remove the plug, spring and poppet **[Figure 30-40-7]**.

Check the poppet, spring and poppet seat for wear or damage.

Figure 30-40-8



There are several different thickness of the shims (Item 1) **[Figure 30-40-8]** and are used to adjust the charge pressure.

NOTE: 0.010 inch (0,254 mm) is approximately 8 PSI (55.16 kPa) increase in pressure. Do not add more than 5 shims without retesting. If testing is still low more shims may be added.

On non-SJC equipped loaders the charge pressure at high idle, with the fluid temperature of 140°F (60°C) is **410-470 PSI** (28,3-32,4 bar) with the pump in neutral.

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Adjusting (Cont'd)

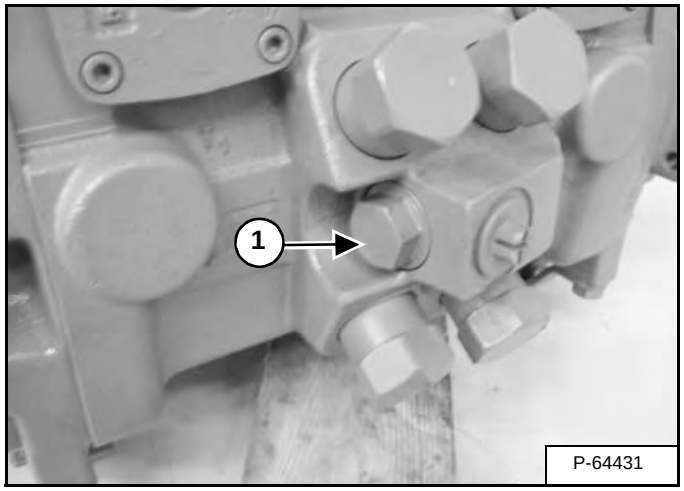
SJC Machines

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 30-40-9

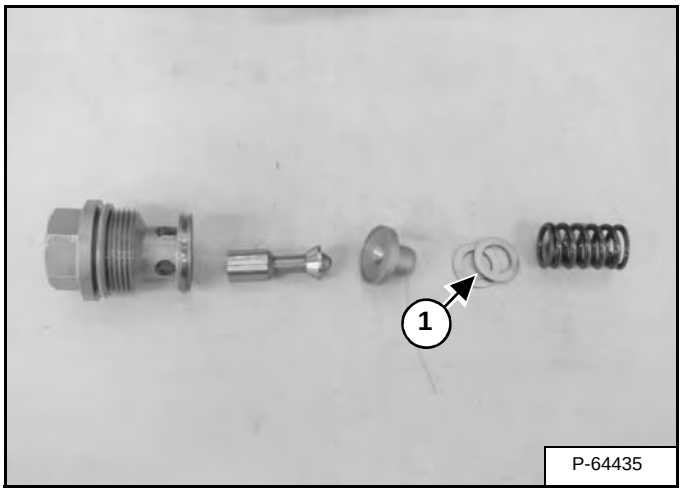


If the charge pressure is not correct remove the charge relief valve (Item 1) **[Figure 30-40-9]**.

NOTE: The pump has been removed for photo clarity. The charge pressure relief valve is located on the engine side of the hydrostatic pump when installed in the loader.

Assembly: Always use a new O-ring. Tighten the plug to 30-50 ft.-lb. (41-68 N•m) torque.

Figure 30-40-10



Check the poppet and spring for wear or damage.

Inspect the seat inside the hydrostatic pump case for wear or damage.

There are several different thickness of shims (Item 1) **[Figure 30-40-10]** used to adjust the charge pressure.

NOTE: 1.0 mm shim (Item 1) [Figure 30-40-10] = 43.5 PSI (3 bar) in pressure change. Adding shims increases charge pressure. Removing shims decreases charge pressure.

The charge pressure should be set at **335-385 PSI** (23,1-26,5 bar).

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HYDROSTATIC PUMP

Description

The hydrostatic pump is composed of two hydrostatic piston pumps connected together. The pumps provide bi-directional flow to two separate drive motors. The pump flow and direction are controlled by two hand levers, one for each pump.

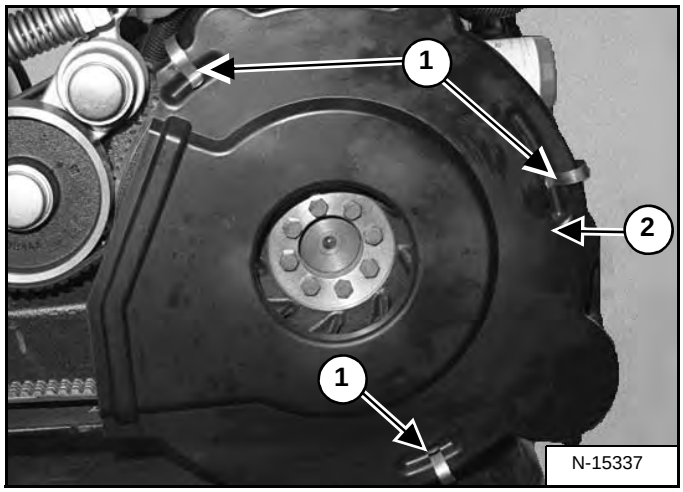
The hydrostatic pump contains replenishing valves. The function of these valves is to give replacement fluid to the low pressure side of the hydrostatic circuit. Replacement fluid is needed because of normal internal leakage and the controlled flow to the oil cooler for cooling. Another function of the replenishing valve is to keep high pressure fluid out of the low pressure side of the hydrostatic circuit.

The hydrostatic pump is located in the center of the mainframe mounted to the engine flywheel housing.

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Removal And Installation

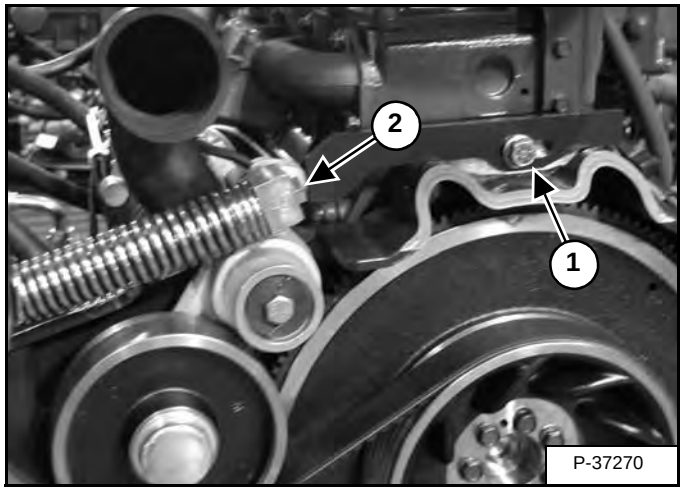
Figure 30-50-1



Remove the hydrostatic pump/engine assembly from the loader. (See Engine Removal And Installation on Page 70-10-9.)

Remove the belt shield clips (Item 1) and belt shield (Item 2) **[Figure 30-50-1]**.

Figure 30-50-2

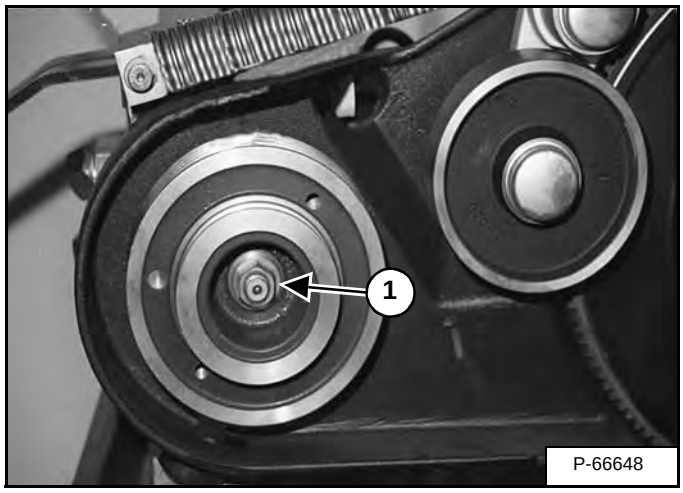


Loosen the stop mounting bolt (Item 1) **[Figure 30-50-2]**.

Loosen the spring tension bolt (Item 2) **[Figure 30-50-2]**.

Remove the drive belt.

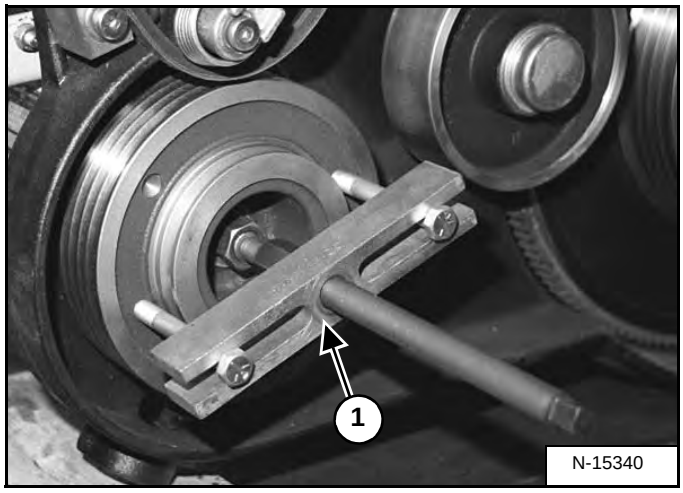
Figure 30-50-3



Remove the nut and washer (Item 1) **[Figure 30-50-3]** from the hydrostatic pump drive shaft.

Installation: Tighten the nut to 175-200 ft.-lb. (237-271 N•m) torque.

Figure 30-50-4



Install the nut on the end of the pump drive shaft (without washer).

Use a puller (Item 1) **[Figure 30-50-4]** to remove the pulley from the pump drive shaft.

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Removal And Installation (Cont'd)

Figure 30-50-5

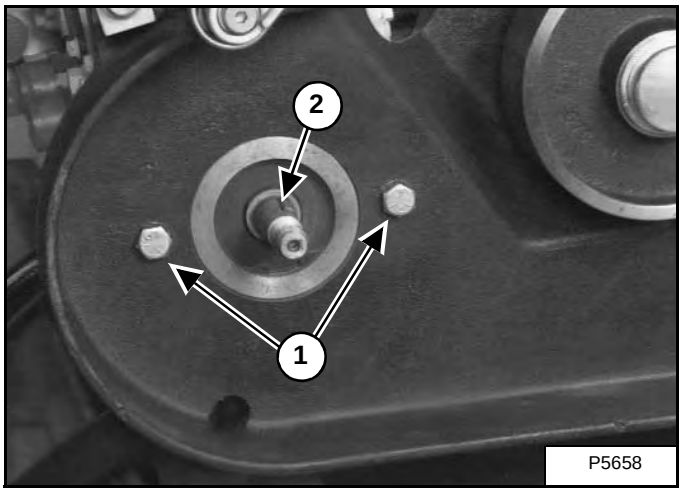
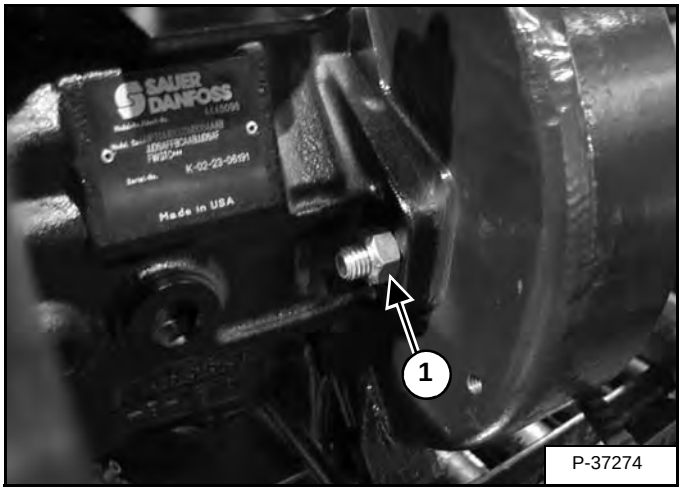


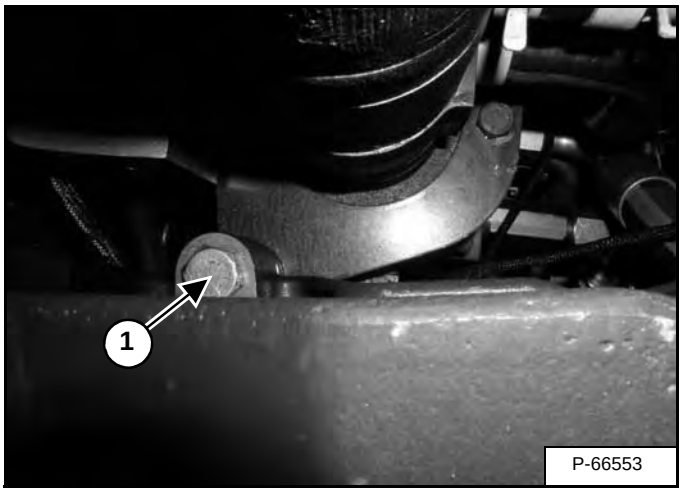
Figure 30-50-6



Remove the two mounting bolts (Item 1) **[Figure 30-50-5]** and nuts (Item 1) **[Figure 30-50-6]**.

Installation: Tighten the mounting bolts and nuts to 65-70 ft.-lb. (88-95 N•m) torque. Make sure the key (Item 2) **[Figure 30-50-5]** is installed.

Figure 30-50-7



Remove the mounting bolt (Item 1) **[Figure 30-50-7]** at the hydraulic pump end of the pump.

Remove the hydrostatic pump from the mounting bracket and drive belt housing.

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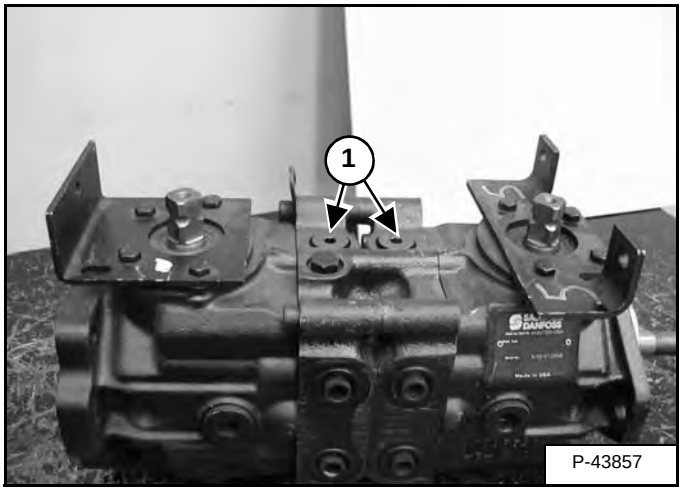
Hydrostatic Pump Start Up

Follow the hydraulic pump start up procedure. (See Hydraulic Pump Start Up on Page 20-60-11.)

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Replenishing / High Pressure Relief Valve Removal And Installation

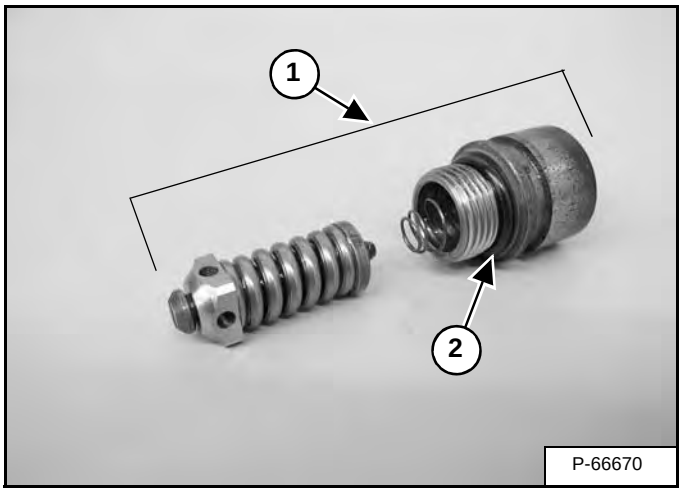
Figure 30-50-8



There are four replenishing/high pressure relief valves (Item 1) **[Figure 30-50-8]** in the hydrostatic pump assembly. Two are located at the top of the pumps and two at the bottom of the pumps for valve function.

NOTE: The two top valves are for the reverse drive loop and the two bottom valves are for the forward drive loop.

Figure 30-50-9



Remove the high pressure relief valve (Items 1) **[Figure 30-50-8]** and **[Figure 30-50-9]** from the pump.

Assemble: Tighten the plug to 30-50 ft.-lb. (41-68 N•m) torque.

Check for damage and replace as needed.

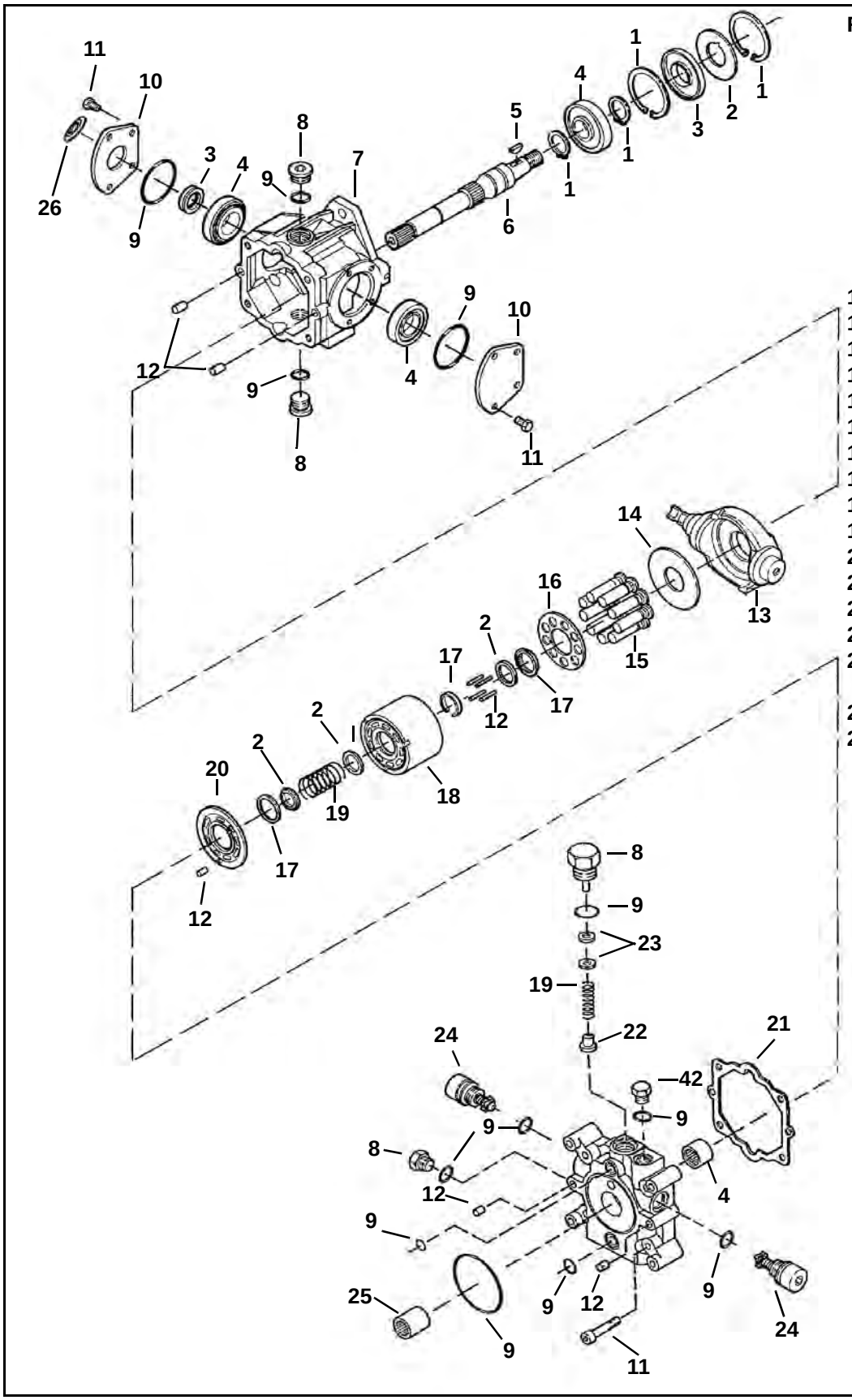
Check the O-ring (Items 2) **[Figure 30-50-9]** for damage and replace as needed.

If the high pressure relief valve must be replaced, it must be replaced as a complete unit.

The pressure setting for a new high pressure relief valve is 5000 PSI (34475 kPa).

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Parts Identification (Left Half)



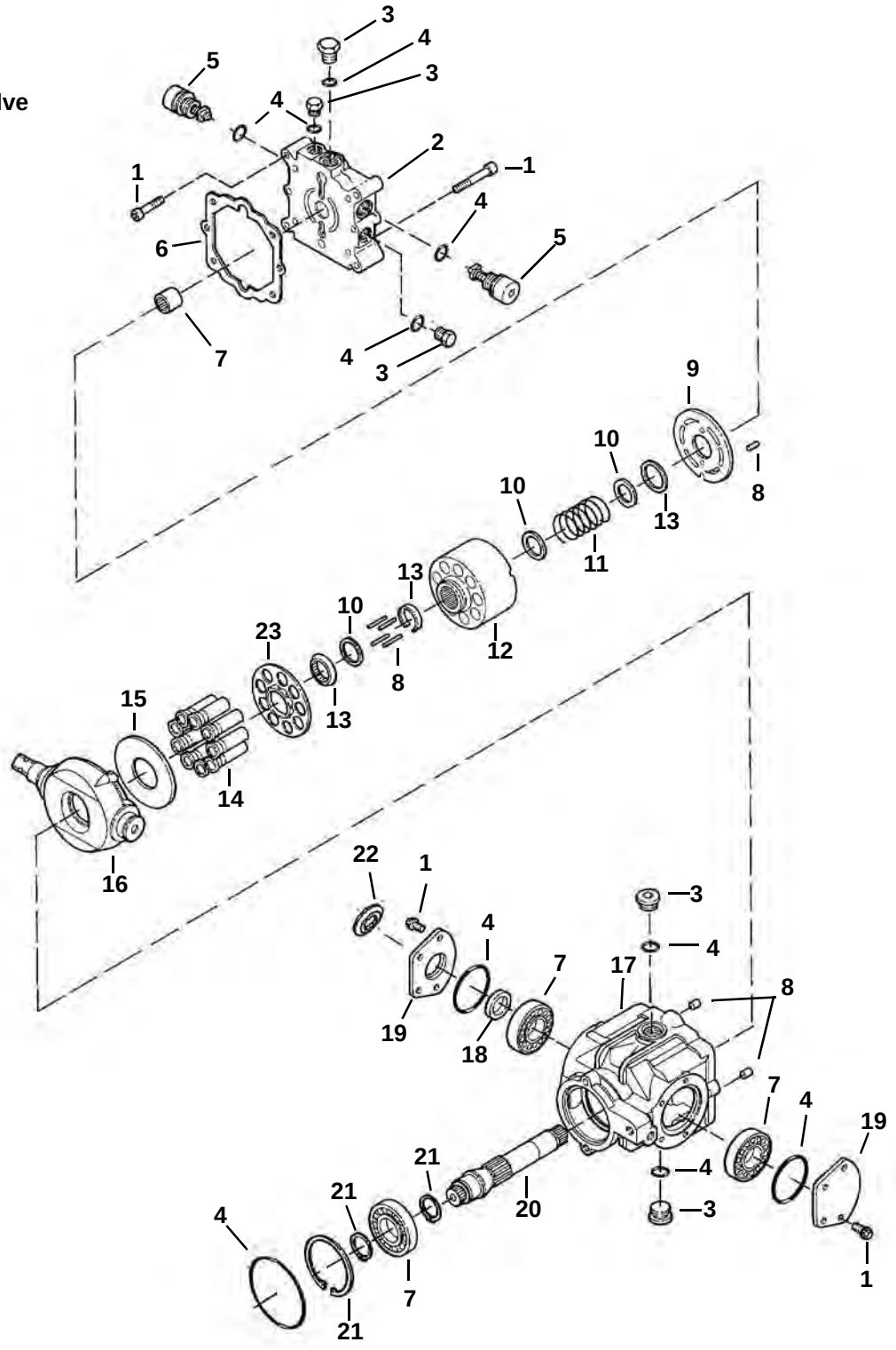
Ref.	Description
1.	Snap Ring
2.	Washer
3.	Seal
4.	Bearing
5.	Key
6.	Shaft
7.	Housing
8.	Plug
9.	O-ring
10.	Cover
11.	Bolt
12.	Pin
13.	Swash Plate
14.	Wear Plate
15.	Piston Assembly
16.	Piston Retainer
17.	Retainer
18.	Block
19.	Spring
20.	Valve Plate
21.	Gasket
22.	Poppet
23.	Shim
24.	Replenishing/High Pressure Relief Valve
25.	Coupler
26.	Dust Seal

D-2428C

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Parts Identification (Right Half)

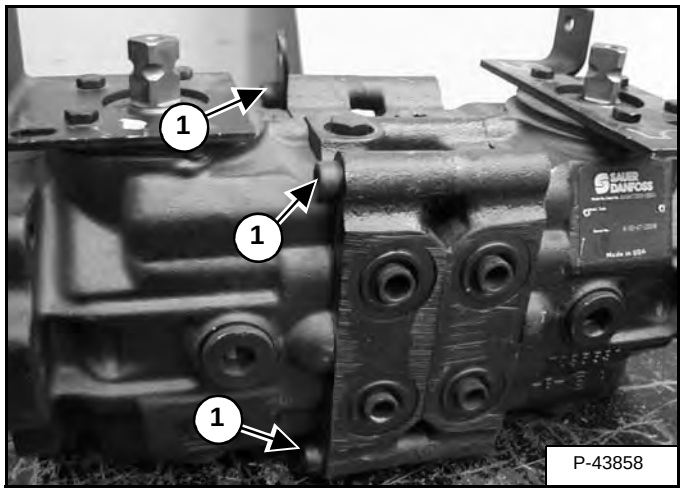
Ref.	Description
1.	Bolt
2.	End Cap
3.	Plug
4.	O-ring
5.	Replenishing/High Pressure Relief Valve
6.	Gasket
7.	Bearing
8.	Pin
9.	Valve Plate
10.	Washer
11.	Spring
12.	Block
13.	Retainer
14.	Piston Assembly
15.	Wear Plate
16.	Swash Plate
17.	Housing
18.	Seal
19.	Cover
20.	Shaft
21.	Snap Ring
22.	Dust Seal
23.	Piston Retainer



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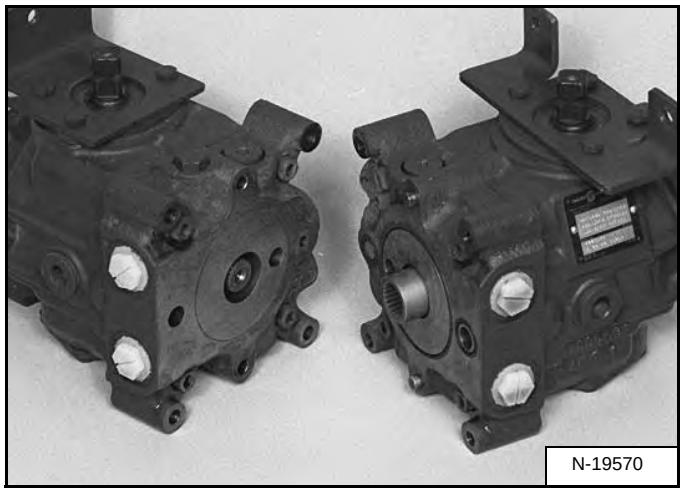
Disassembly

Figure 30-50-10



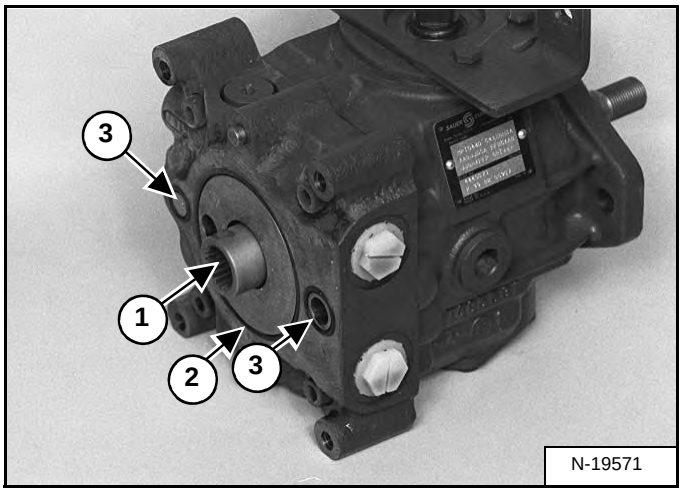
Remove the four mounting bolts (Item 1) **[Figure 30-50-10]**.

Figure 30-50-11



Separate the two hydrostatic pumps **[Figure 30-50-11]**.

Figure 30-50-12

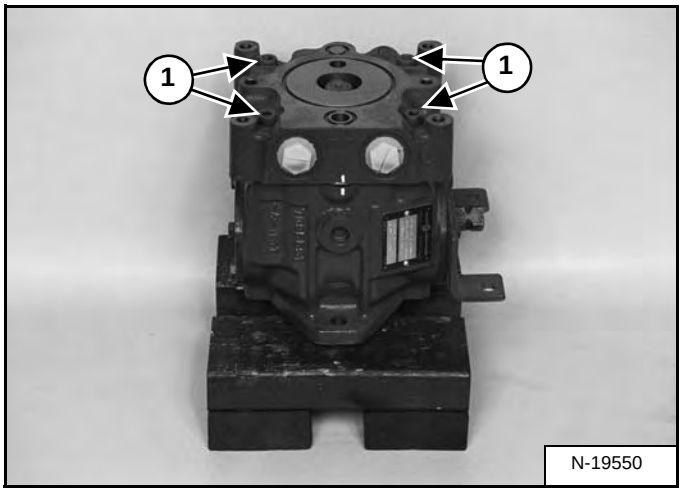


Remove the pump coupler (Item 1) **[Figure 30-50-12]**.

Remove the large O-ring (Item 2) **[Figure 30-50-12]**.

Remove the two small O-rings (Item 3) **[Figure 30-50-12]**.

Figure 30-50-13

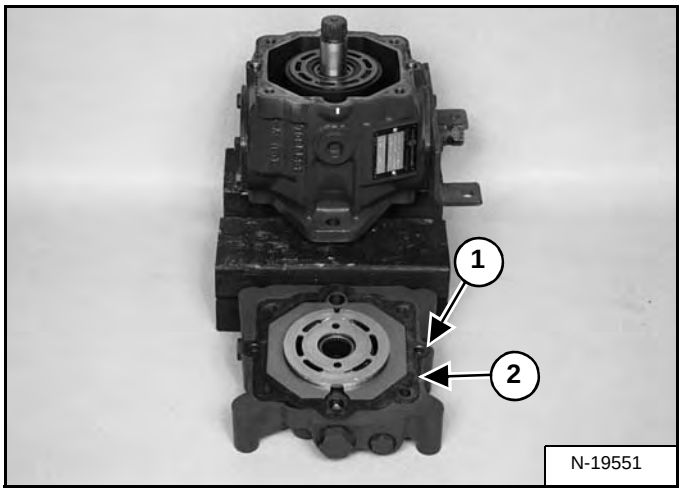


Remove the four bolts (Item 1) **[Figure 30-50-13]** from the pump housing end cap.

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Disassembly (Cont'd)

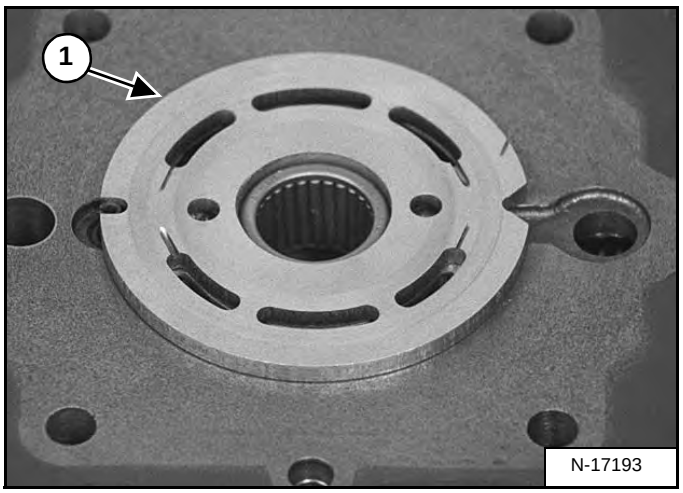
Figure 30-50-14



Remove the pump housing end cap (Item 1) **[Figure 30-50-14]**.

Remove the gasket (Item 2) **[Figure 30-50-14]**.

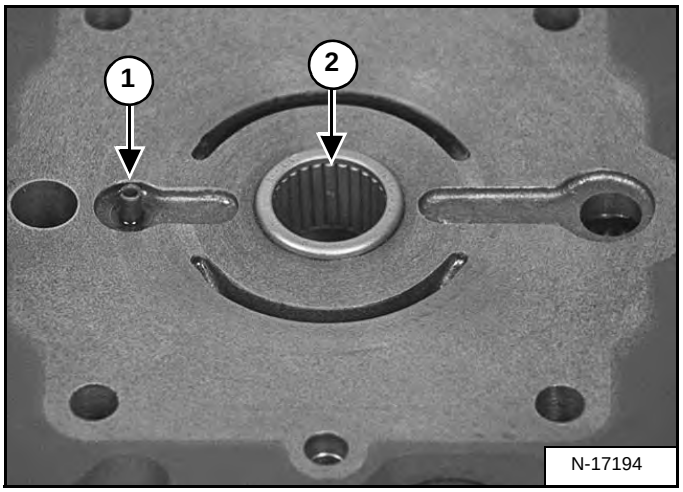
Figure 30-50-15



Remove the valve plate (Item 1) **[Figure 30-50-15]**.

Check the valve plate for wear. (Both Sides.)

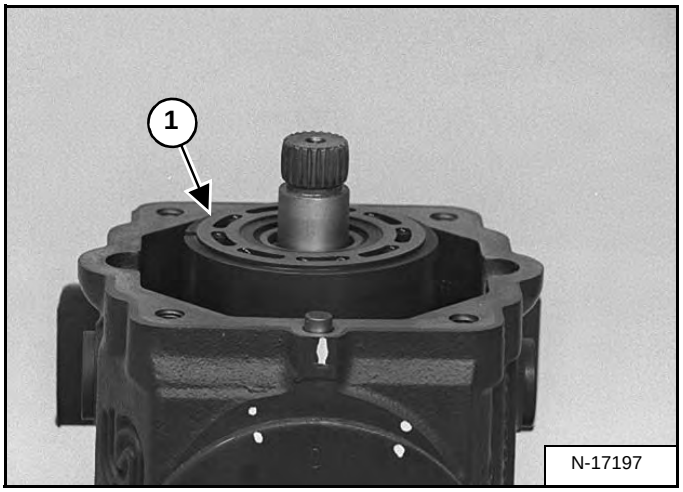
Figure 30-50-16



Check the valve plate locating pin (Item 1) **[Figure 30-50-16]** for wear and replace if needed.

Check the needle bearing (Item 2) **[Figure 30-50-16]** for wear and replace if needed.

Figure 30-50-17

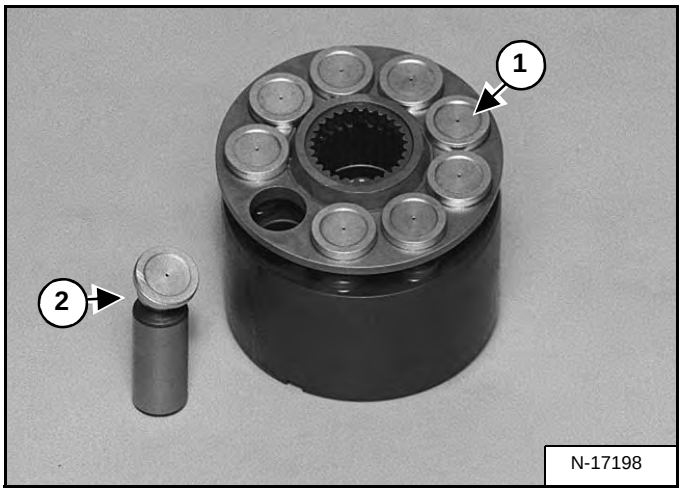


Remove the rotating group (Item 1) **[Figure 30-50-17]** from the pump.

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Disassembly (Cont'd)

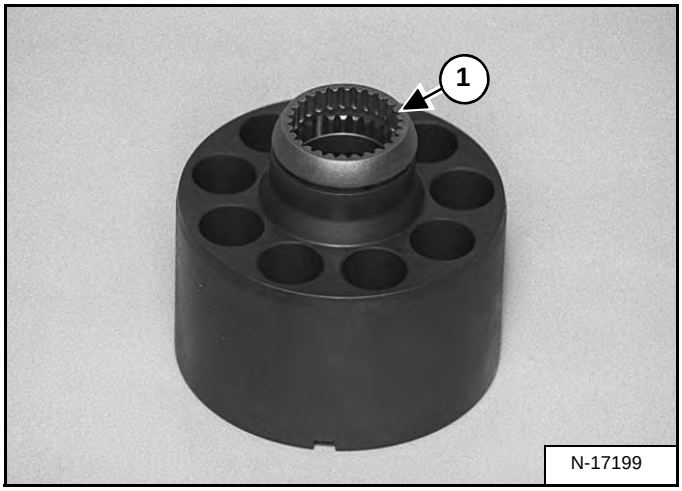
Figure 30-50-18



Remove the slipper guide and pistons (Item 1) **[Figure 30-50-18]** from the cylinder block.

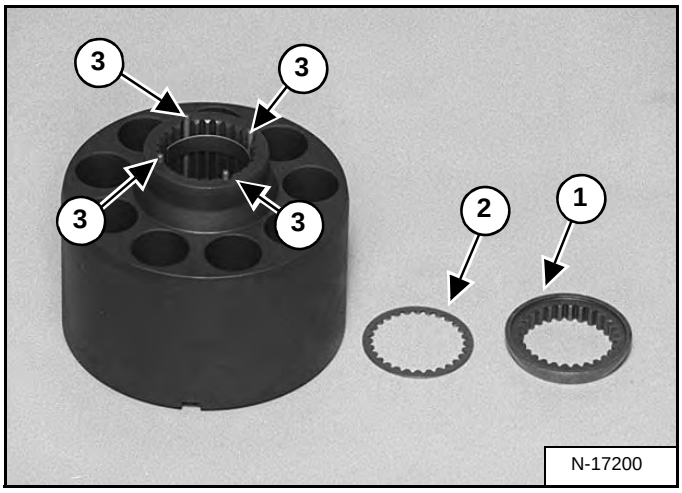
Check all the pistons (Item 2) **[Figure 30-50-18]** for wear and replace the rotating group as needed.

Figure 30-50-19



Remove the ball guide retainer (Item 1) **[Figure 30-50-19]** from the cylinder block.

Figure 30-50-20



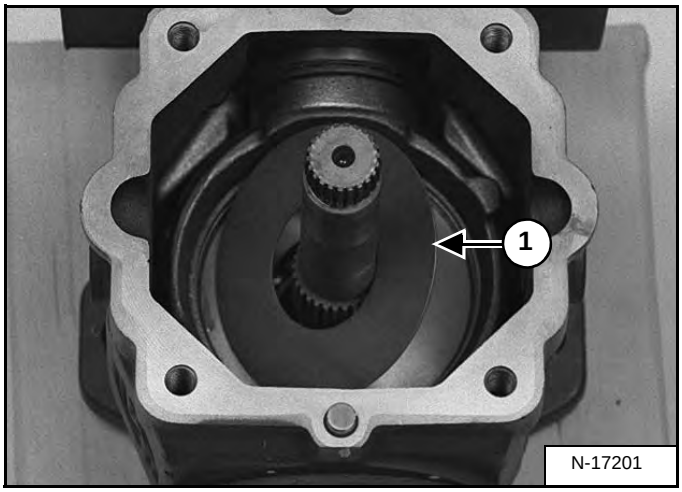
Check the ball guide retainer (Item 1) and washer (Item 2) **[Figure 30-50-20]** for wear and replace as needed.

Remove the four pins (Item 3) **[Figure 30-50-20]** from the cylinder block.

Check the cylinder block for wear and replace as needed.

Check pins (Item 3) **[Figure 30-50-20]** to see if they are all the same length.

Figure 30-50-21

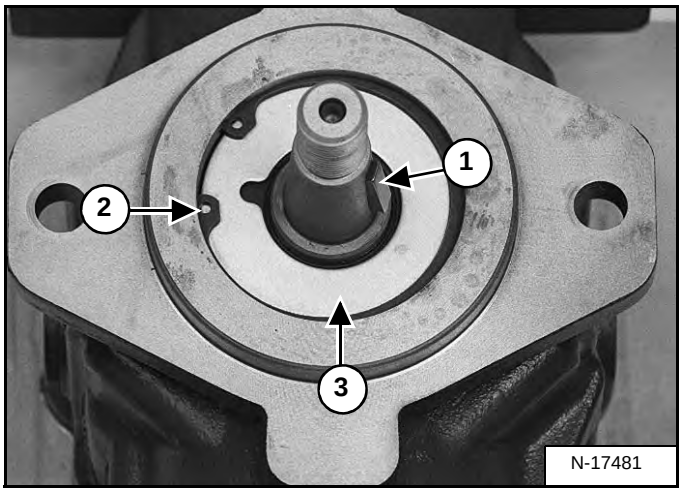


Remove the thrust plate (Item 1) **[Figure 30-50-21]** from the pump housing.

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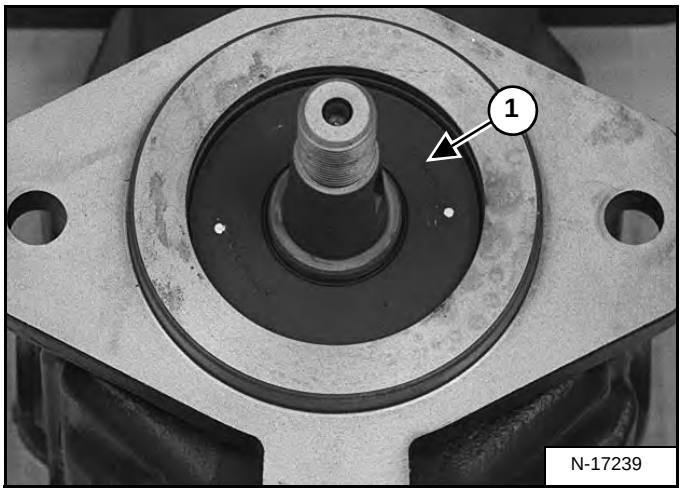
Disassembly (Cont'd)

Figure 30-50-22



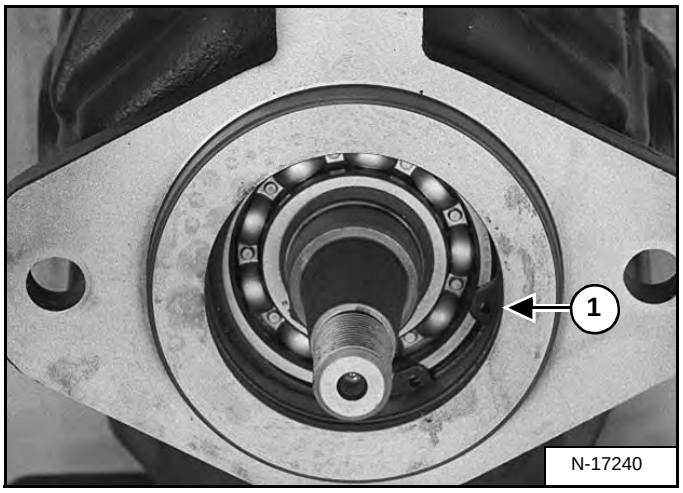
Remove the driveshaft key (Item 1) the snap ring (Item 2) and the support washer (Item 3) **[Figure 30-50-22]** from the drive shaft end of the pump.

Figure 30-50-23



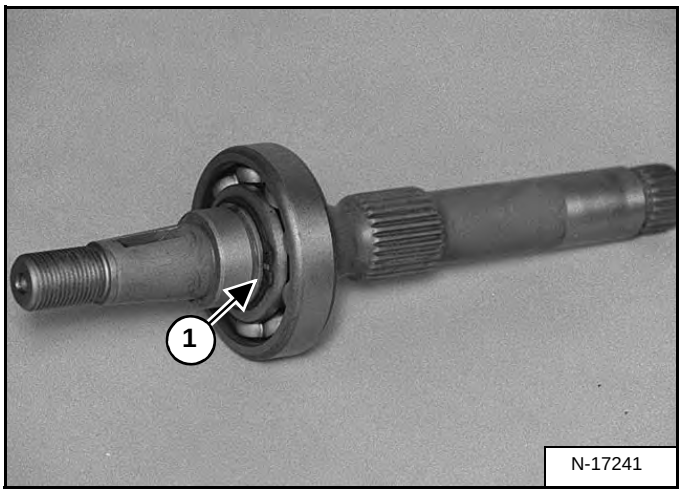
Use a seal puller and remove the seal (Item 1) **[Figure 30-50-23]** from the pump housing.

Figure 30-50-24



Remove the snap ring (Item 1) **[Figure 30-50-24]** from the pump housing and remove the driveshaft and bearing from the housing.

Figure 30-50-25



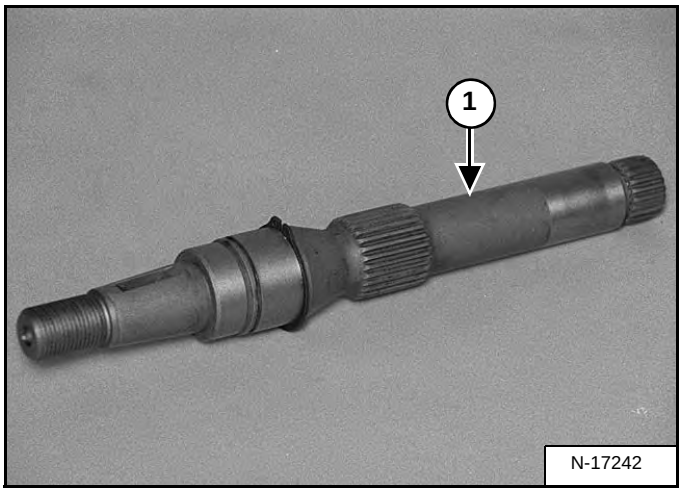
Remove the snap ring (Item 1) **[Figure 30-50-25]** from the driveshaft and remove the bearing.

Check the bearing for wear and replace if worn.

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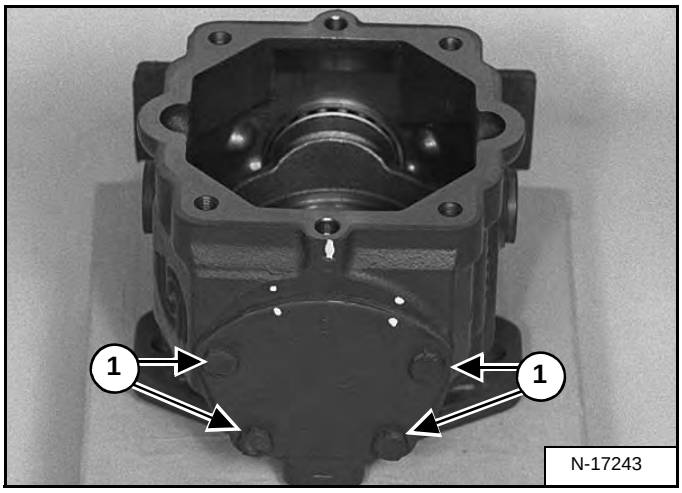
Disassembly (Cont'd)

Figure 30-50-26



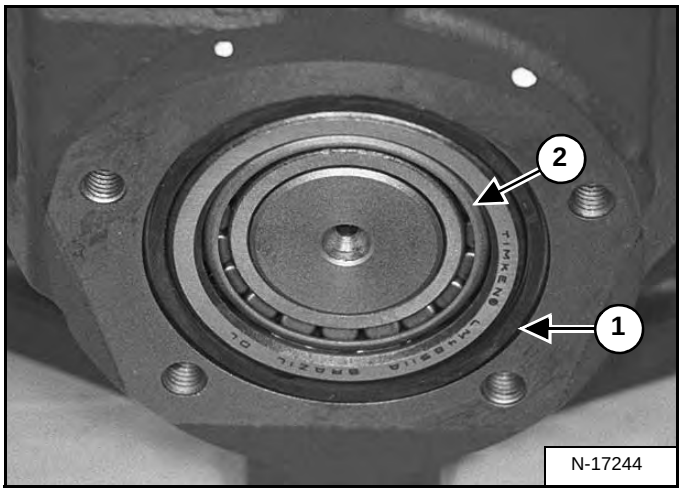
Check the pump shaft (Item 1) **[Figure 30-50-26]** for wear and replace if needed.

Figure 30-50-27



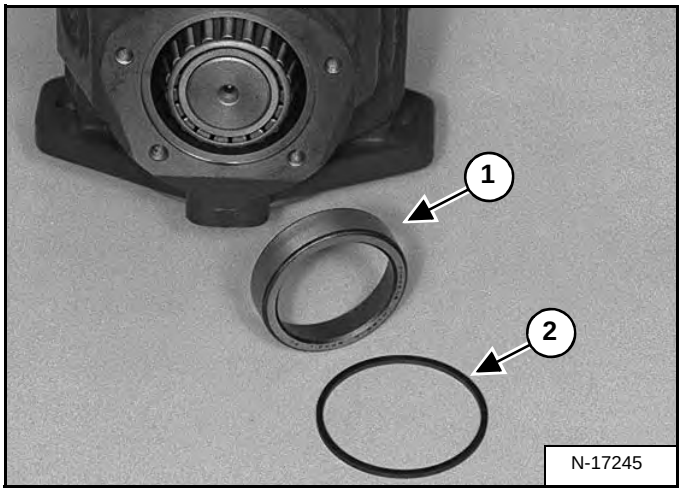
Remove the four mount bolts (Item 1) **[Figure 30-50-27]** from the lower trunnion cover. Remove the cover.

Figure 30-50-28



Remove the O-ring (Item 1) and bearing race (Item 2) **[Figure 30-50-28]** from the pump housing.

Figure 30-50-29

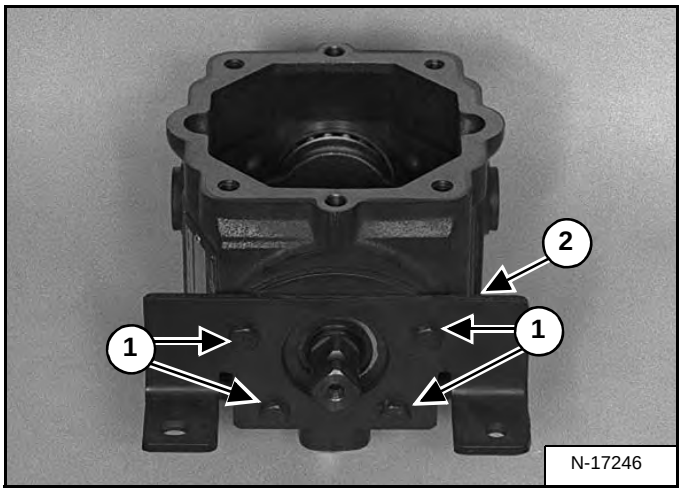


Check the bearing race (Item 1) and O-ring (Item 2) **[Figure 30-50-29]** for wear and replace as needed.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

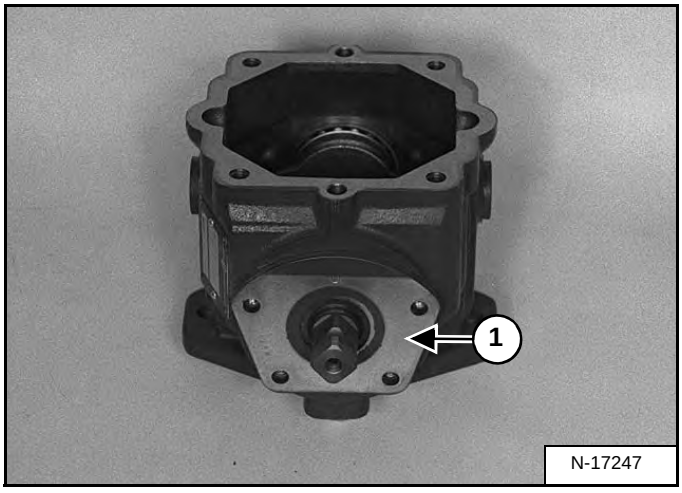
Figure 30-50-30



Inspect the dust seal on the pintle shaft.

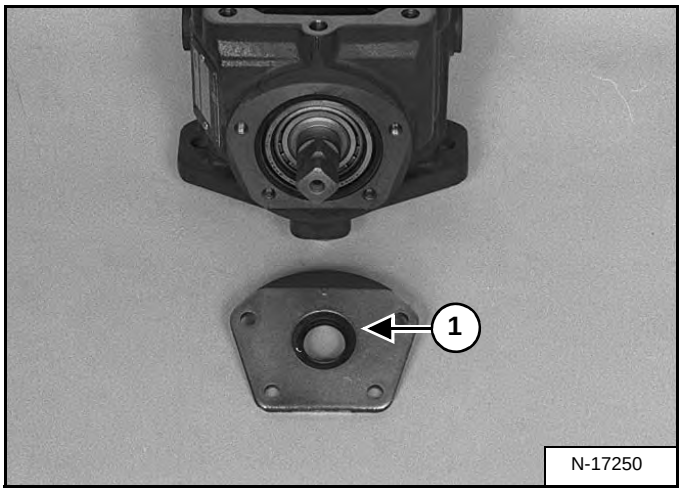
Remove the four mount bolts (Item 1) from the pump housing and remove the linkage bracket (Item 2) **[Figure 30-50-30]**.

Figure 30-50-31



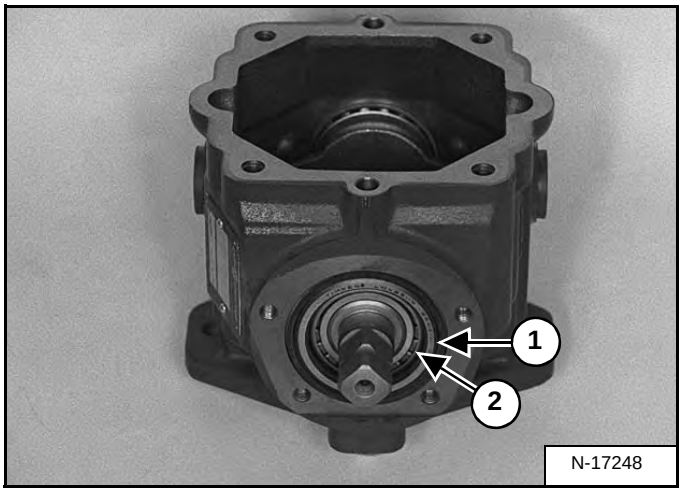
Remove the upper trunnion cover (Item 1) **[Figure 30-50-31]**.

Figure 30-50-32



Inspect the seal (Item 1) **[Figure 30-50-32]** in the upper trunnion cover and replace if needed.

Figure 30-50-33

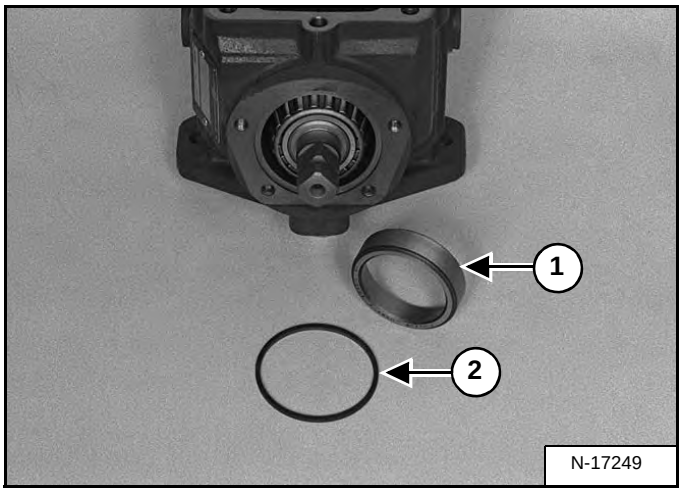


Remove the O-ring (Item 1) and bearing race (Item 2) **[Figure 30-50-33]** from the pump housing.

Dealer Copy -- Not for Resale

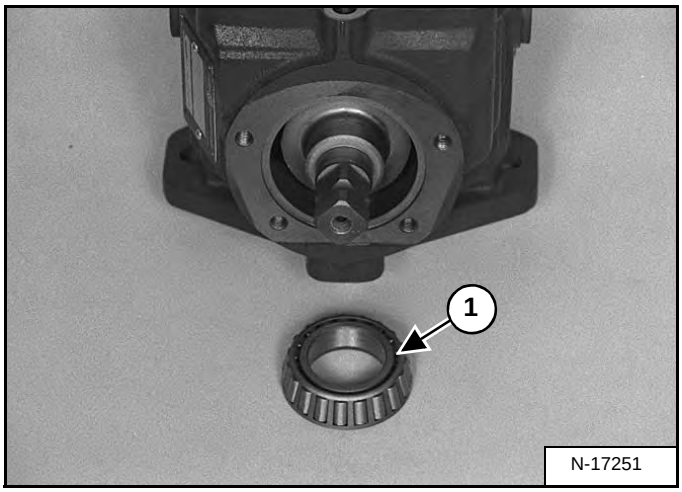
Disassembly (Cont'd)

Figure 30-50-34



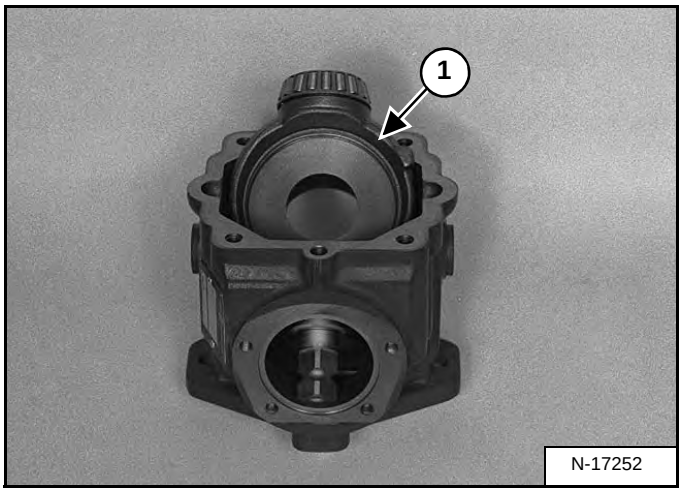
Inspect the bearing race (Item 1) and O-ring (Item 2) **[Figure 30-50-34]** and replace as needed.

Figure 30-50-35



Slide the swash plate from side to side and remove the tapered roller bearing (Item 1) **[Figure 30-50-35]** from the swash plate shaft.

Figure 30-50-36

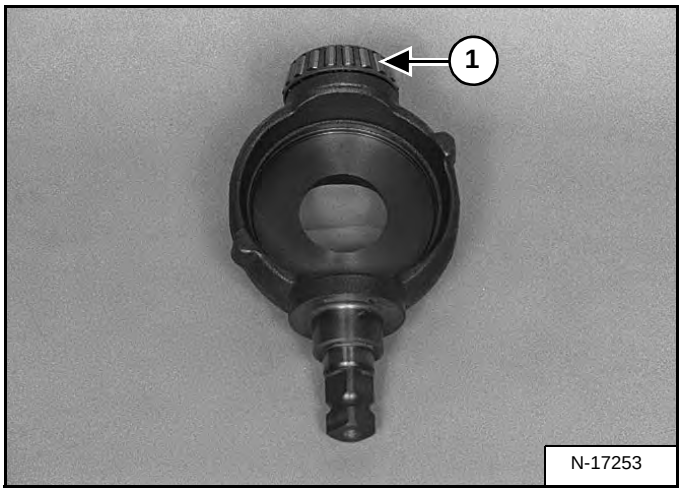


Tilt the swash plate (Item 1) **[Figure 30-50-36]** and remove the swash plate and lower bearing from the pump housing.

Dealer Copy -- Not for Resale

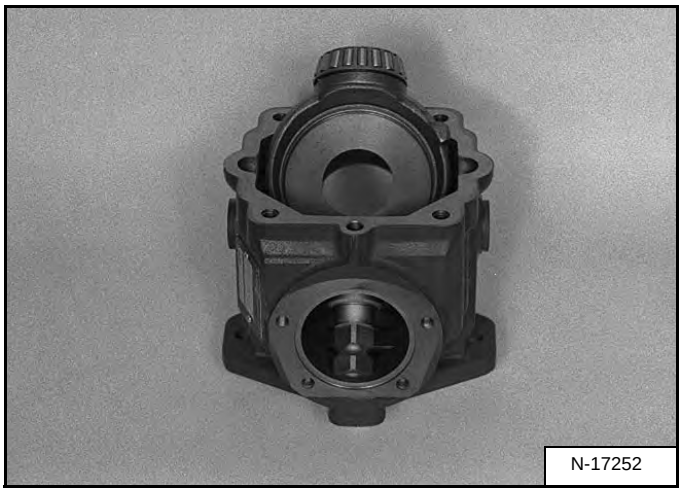
Assembly

Figure 30-50-37



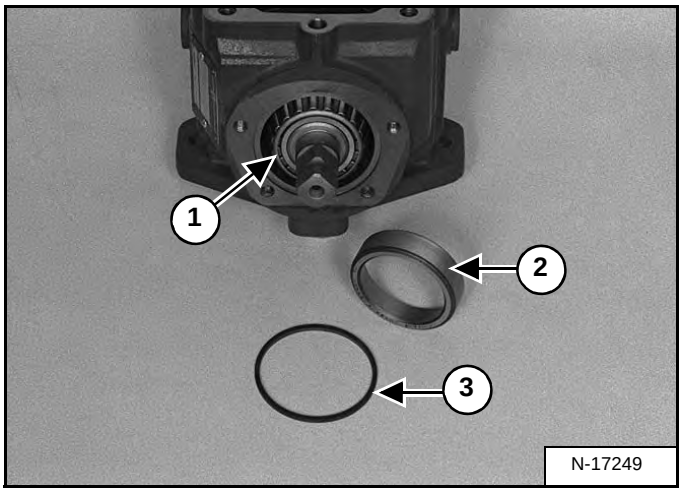
Install the lower bearing (Item 1) **[Figure 30-50-37]** on the swash plate.

Figure 30-50-38



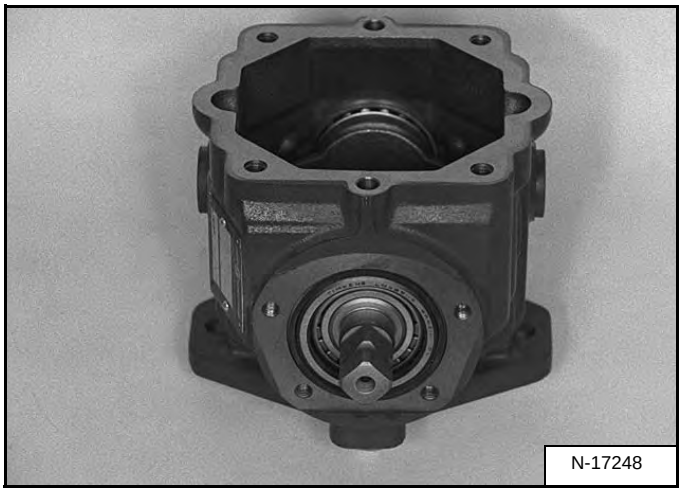
Install the swash plate and bearing into the pump housing **[Figure 30-50-38]**.

Figure 30-50-39



Install the tapered bearing (Item 1) **[Figure 30-50-39]** on the swash plate shaft.

Figure 30-50-40

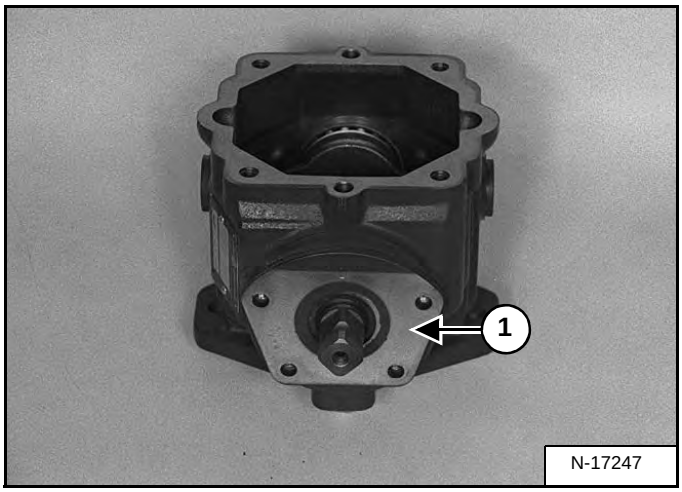


Install the bearing race (Item 2) **[Figure 30-50-39]** and O-ring (Item 3) **[Figure 30-50-39]** as shown in **[Figure 30-50-40]**.

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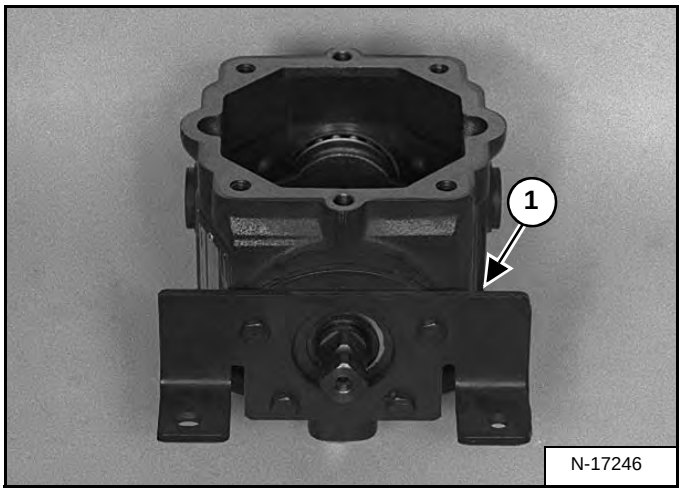
Assembly (Cont'd)

Figure 30-50-41



Install the upper trunnion seal (Item 1) **[Figure 30-50-41]** and cover.

Figure 30-50-42



Install the linkage bracket (Item 1) **[Figure 30-50-42]** and the four mounting bolts and tighten to 18-22 ft.-lb. (24-30 N•m) torque.

Install the dust seals onto the pintle shafts

Figure 30-50-43

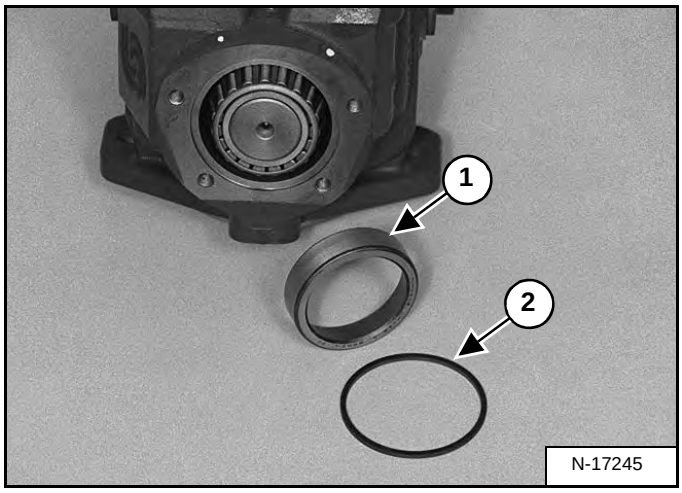
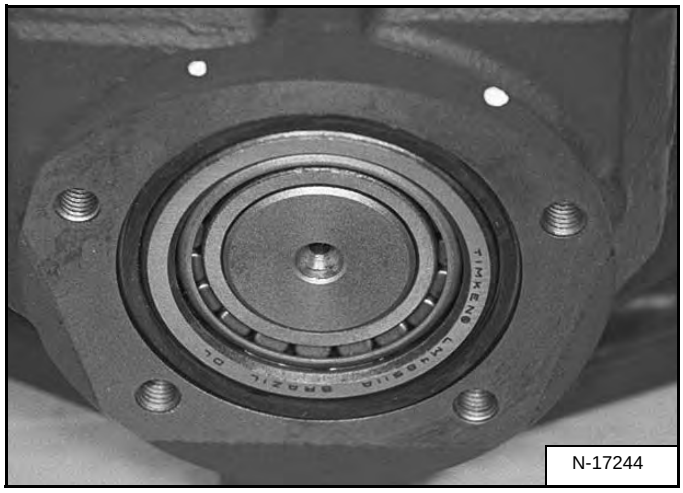


Figure 30-50-44

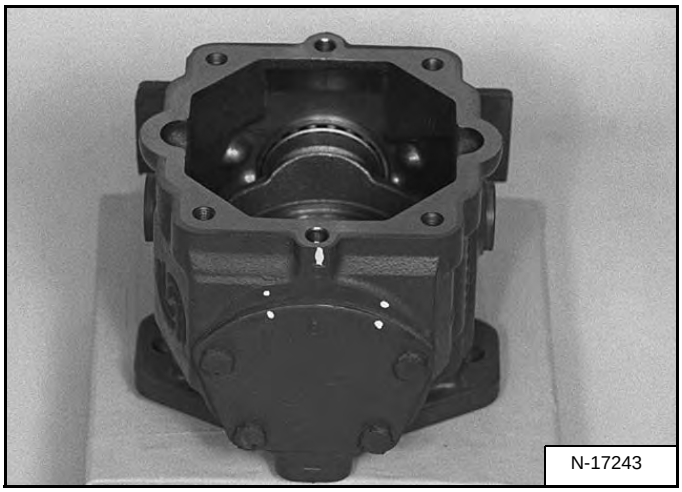


Install the bearing race (Item 1) **[Figure 30-50-43]** and O-ring (Item 2) **[Figure 30-50-43]** at the lower trunnion as shown in **[Figure 30-50-44]**.

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Assembly (Cont'd)

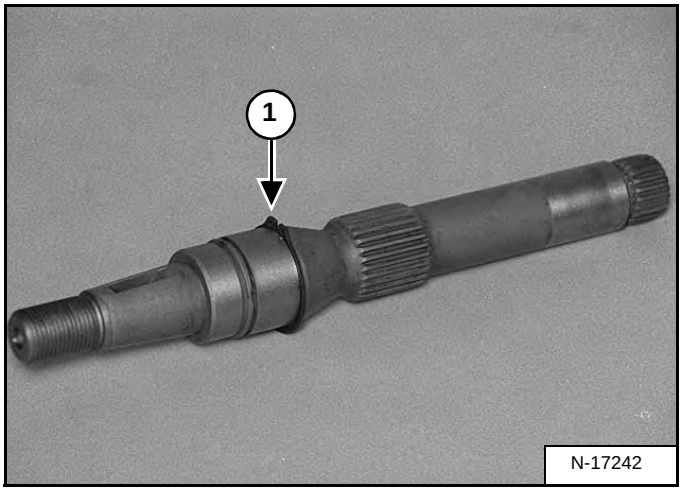
Figure 30-50-45



Align the marks on the lower trunnion cover and pump housing as shown in **[Figure 30-50-45]**.

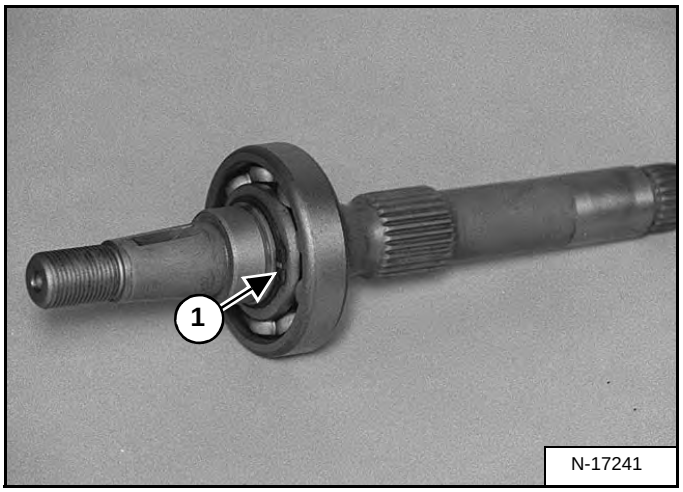
Install the four mounting bolts and tighten to 18-22 ft.-lb. (24-30 N•m) torque.

Figure 30-50-46



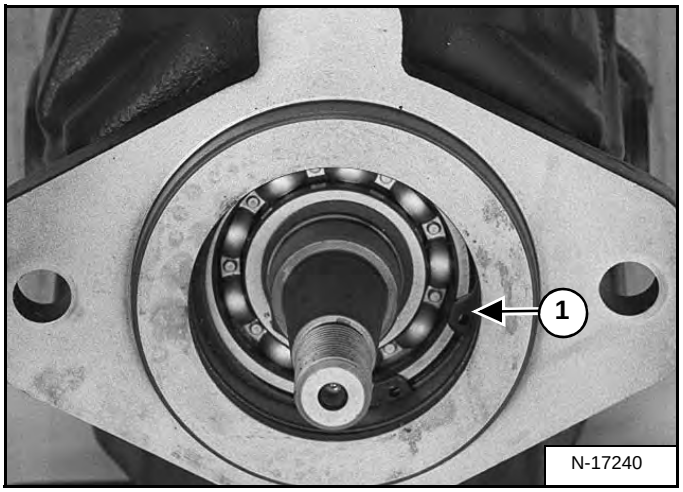
Install the snap ring (Item 1) **[Figure 30-50-46]** on the pump shaft.

Figure 30-50-47



Install the bearing and snap ring (Item 1) **[Figure 30-50-47]** on the pump shaft.

Figure 30-50-48



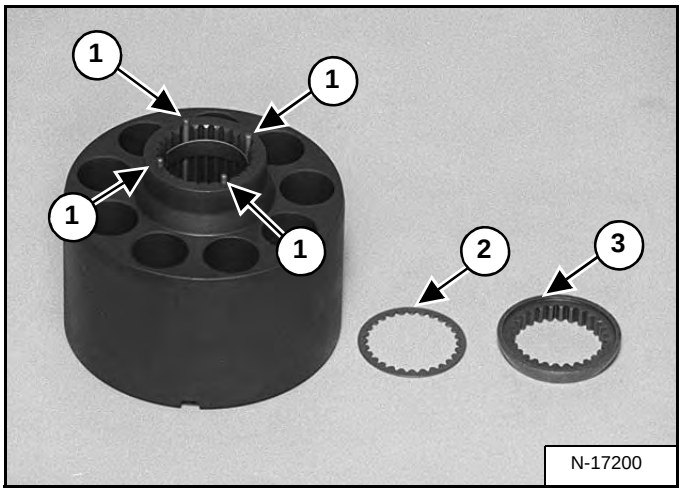
Install the pump shaft into the pump housing **[Figure 30-50-48]**.

Install the snap ring (Item 1) **[Figure 30-50-48]**.

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Assembly (Cont'd)

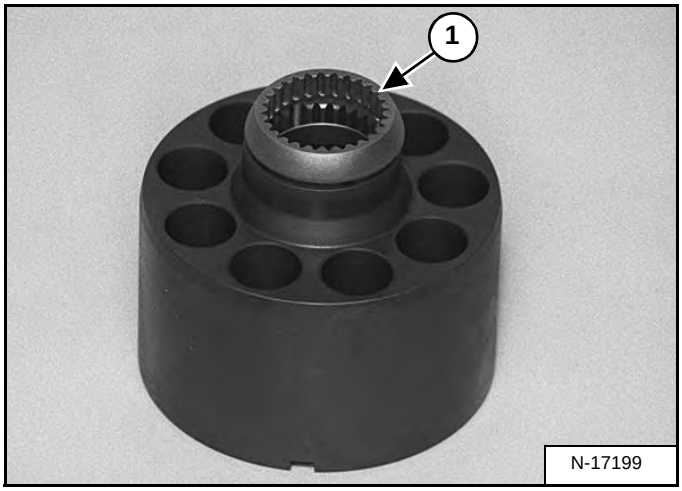
Figure 30-50-49



Install the four slipper pins (Item 1) **[Figure 30-50-49]** into the cylinder block.

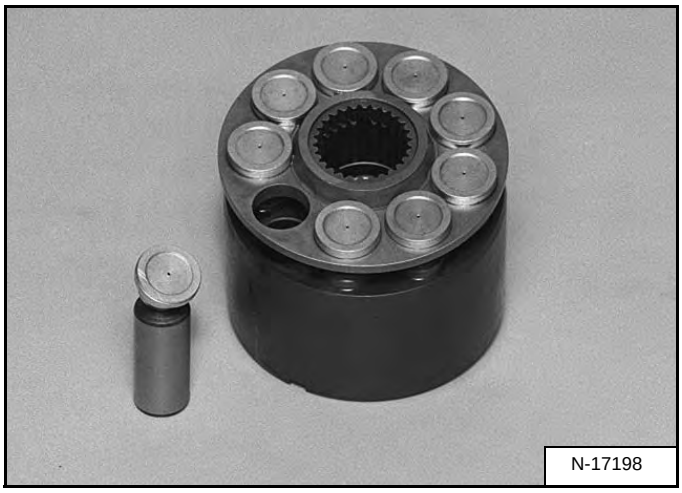
Apply a small amount of grease to the washer (Item 2) and install into the ball guide retainer (Item 3) **[Figure 30-50-49]**.

Figure 30-50-50



Install the ball guide retainer and washer (Item 1) **[Figure 30-50-50]** onto the slipper holddown pins.

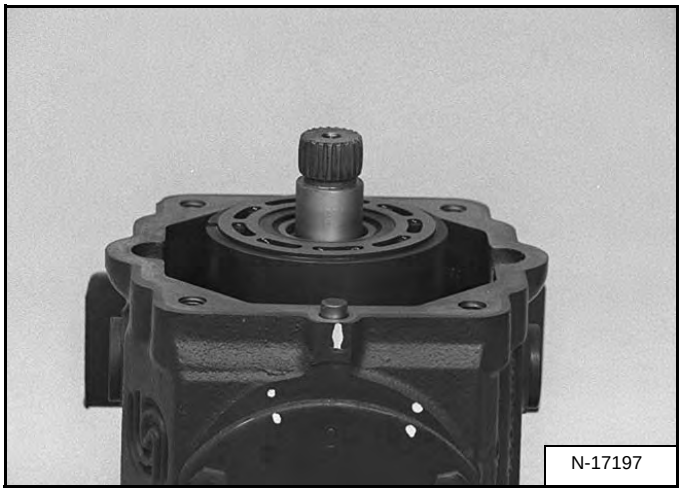
Figure 30-50-51



Assemble the piston assemblies into the slipper guide. Lubricate the pistons and cylinder block bores and insert the piston assemblies into the cylinder bores **[Figure 30-50-51]**.

Lay the pump housing on its side and install the cylinder block, piston assembly into the housing.

Figure 30-50-52

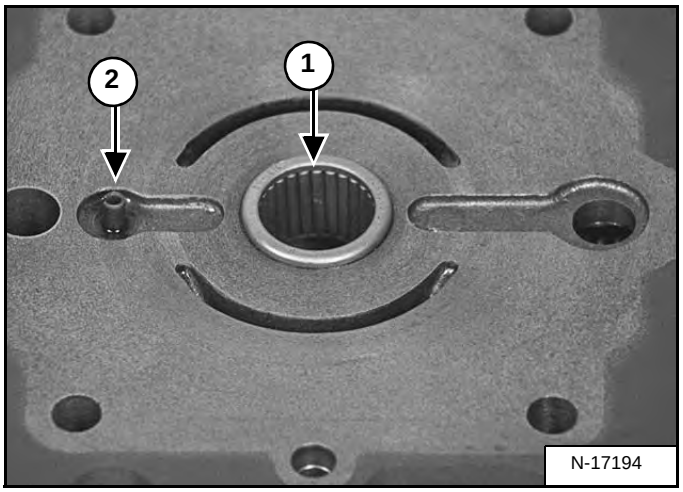


Place the pump on a work surface with the end cap opening up **[Figure 30-50-52]**.

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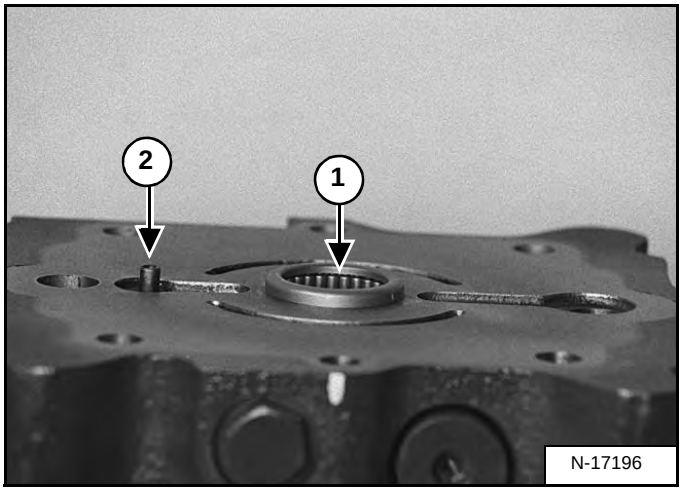
Assembly (Cont'd)

Figure 30-50-53



Replace the needle bearing (Item 1) and valve plate locating pin (Item 2) **[Figure 30-50-53]** in the charge pump.

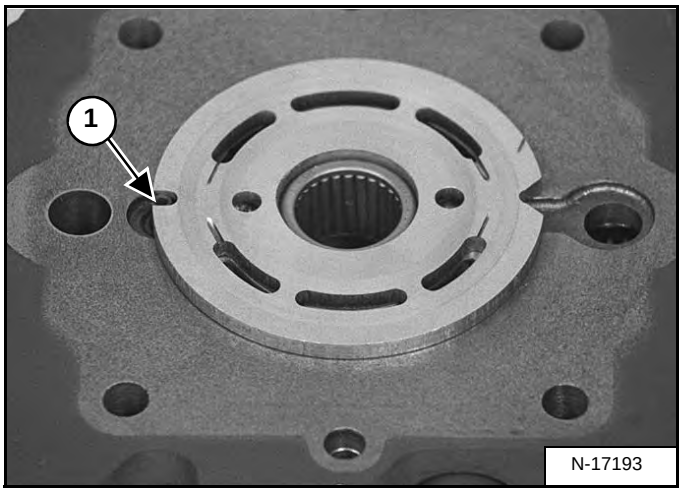
Figure 30-50-54



The bearing cage (Item 1) **[Figure 30-50-54]** will protrude from 0.08 - 0.10 in. (2,0 - 2,5 mm) from the surface of the charge pump.

The valve plate locating spring pin (Item 2) **[Figure 30-50-54]** will protrude from 0.165 - 0.185 in. (4,19 - 4,70 mm) from the surface of the charge pump.

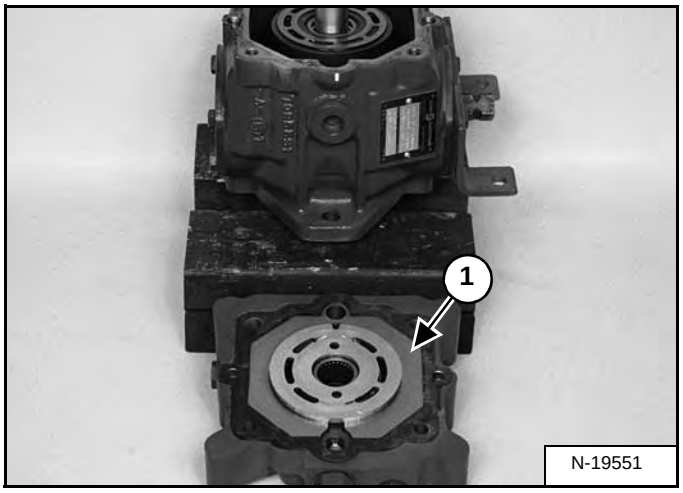
Figure 30-50-55



Coat the backside of the valve plate with petroleum jelly to hold it in position and install the valve plate onto the charge pump, bronze face up **[Figure 30-50-55]**.

The notch (Item 1) **[Figure 30-50-55]** on the valve plate must engage the locating pin.

Figure 30-50-56

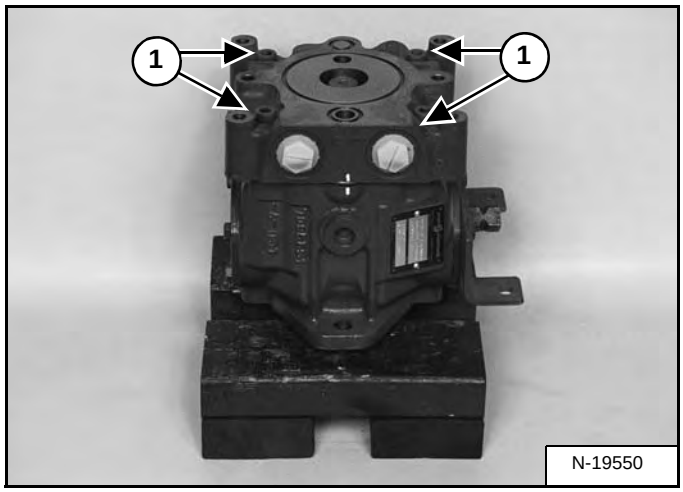


Coat a new end cap gasket (Item 1) **[Figure 30-50-56]** with petroleum jelly and install onto the end cap.

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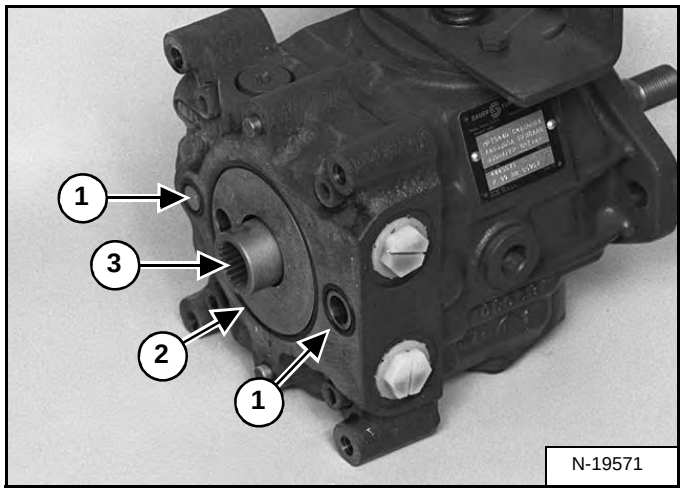
Assembly (Cont'd)

Figure 30-50-57



Install the valve plate and end cap on the pump housing. Tighten the bolts (Item 1) **[Figure 30-50-57]** to 35-45 ft.-lb. (47-61 N•m) torque.

Figure 30-50-58

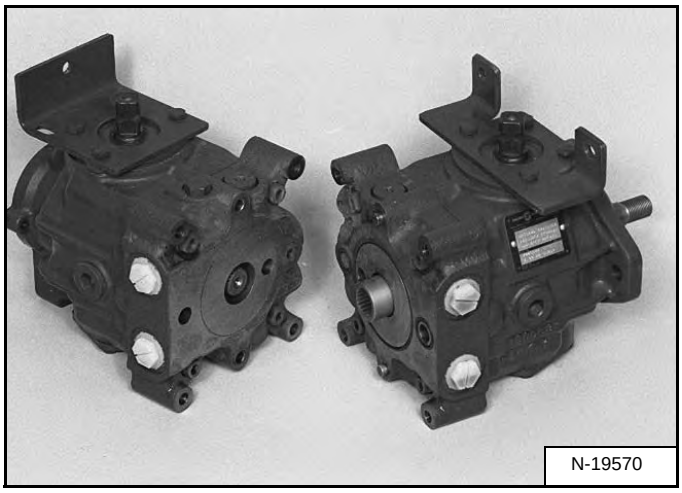


Install the two small O-rings (Item 1) **[Figure 30-50-58]**.

Install the large new O-ring (Item 2) **[Figure 30-50-58]**.

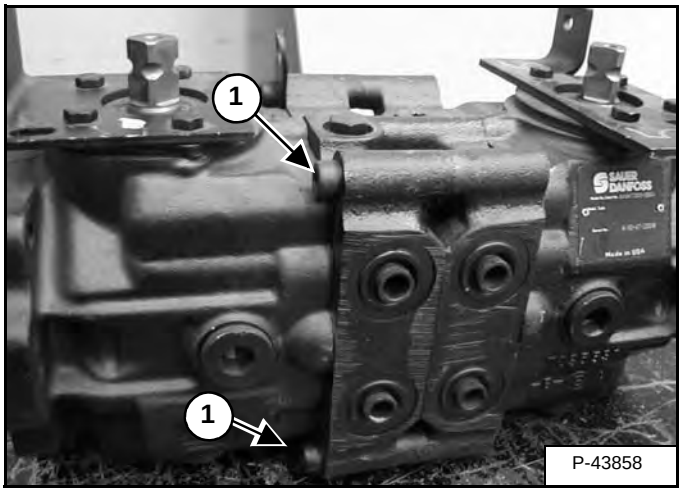
Install the pump coupler (Item 3) **[Figure 30-50-58]**.

Figure 30-50-59



Install the two pumps together **[Figure 30-50-59]**.

Figure 30-50-60



Tighten the four bolts (Item 1) **[Figure 30-50-60]** to 35-45 ft.-lb. (47-61 N•m) torque.

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HYDROSTATIC PUMP (SJC)

Description

The SJC hydrostatic pump is a fully proportional, dual piston pump in one pump casing. The endcaps are removable to gain access to the rotating assemblies.

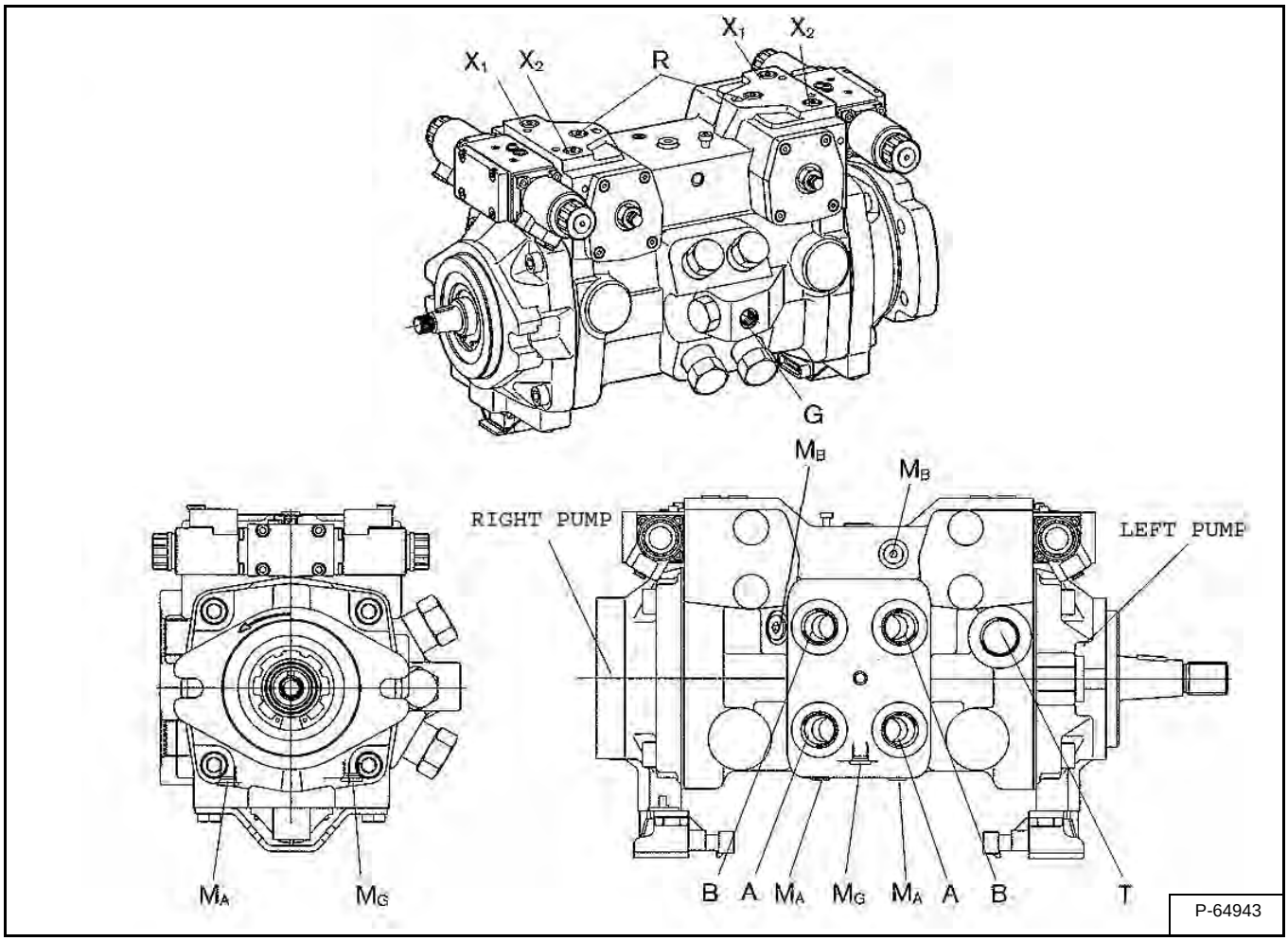
The hydraulic controllers are supplied charge pressure from an external charge pump. 12 volt electrical solenoids shift a spool in the hydraulic controller that directs flow to a servo piston.

The servo piston strokes the swash plate in the rotating group. The rotating group generates flow to the A or B ports on the hydrostatic pump. The flow from the A and B ports is sent to the hydrostatic drive motors where forward or reverse drive motor rotation is obtained.

There are swash plate angle sensors on the bottom of the pump that monitor swash plate movement.

Ports are labeled on the hydrostatic pump casting.

Figure 30-51-1



A,B Service Line Ports (High Pressure Outlet Ports to Drive Motors)

T_1 Case Drain Port

M_A Operating Pressure of “A” Port

M_B Operating Pressure of “B” Port

R Air Bleed Port

X_1,X_2 Control Pressure Gauge Port

G Charge Pressure Inlet Port

M_G Gauge Port For Charge Pressure

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Hydraulic Controller Removal And Installation

The loader's right hand side hydraulic controller can be removed with the hydrostatic pump still in the loader. The loader's left hand side hydraulic controller can only be removed when the hydrostatic pump is separated from the engine/hydrostatic pump cast mount.

Controller solenoids can be bled of trapped air in the controller. This should be performed when hydraulic controllers are replaced, removed or uncommanded oscillations in the controls are present.

Raise the lift arms and install and approved lift arm support device. (See Installing on Page 10-20-1.)

Place the loader on jack stands. (See Procedure on Page 10-10-1.)

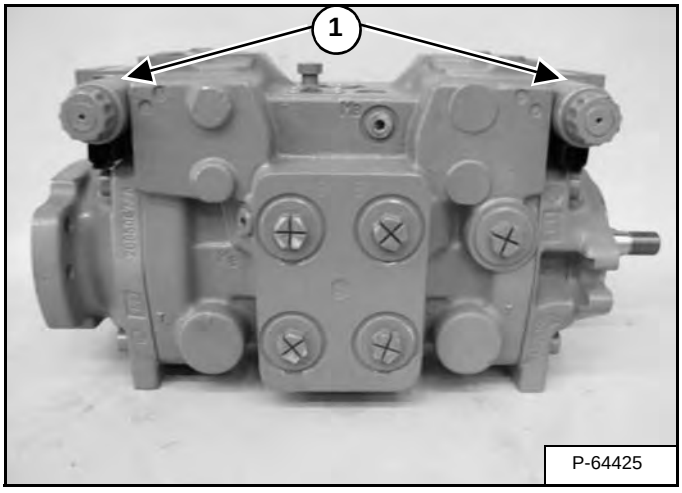
WARNING

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

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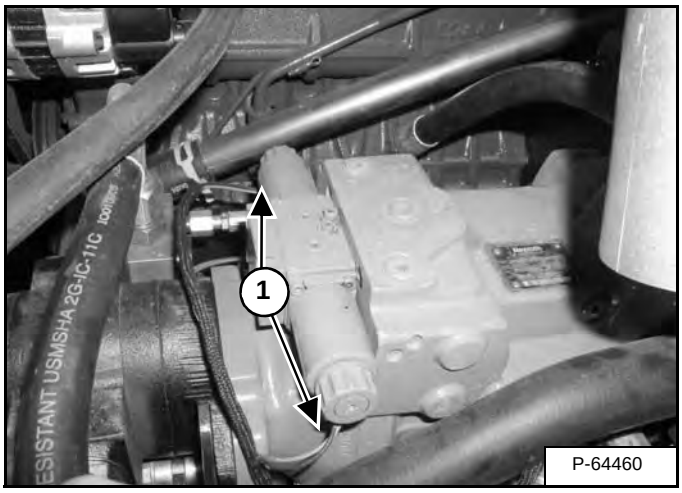
Raise the operator cab. (See Raising on Page 10-30-1.)

Figure 30-51-2



Locate the two hydraulic controllers (Item 1) **[Figure 30-51-2]** on the hydrostatic pumps.

Figure 30-51-3



Disconnect all of the electrical harness connectors (Item 1) **[Figure 30-51-3]** from the loader harness.

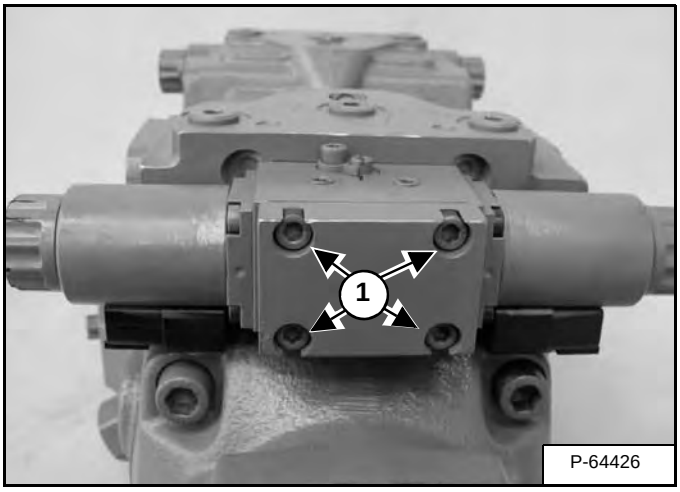
Removal:

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 30-51-4

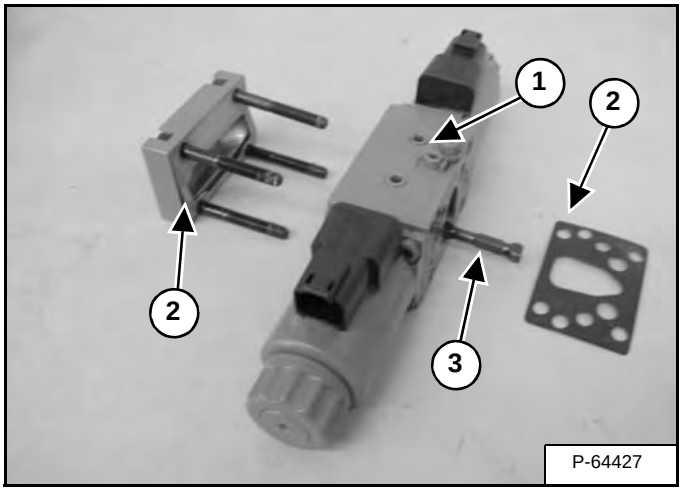


Remove the four mount bolts (Item 1) **[Figure 30-51-4]** from the hydraulic controller.

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Hydraulic Controller Removal And Installation (Cont'd)

Figure 30-51-5

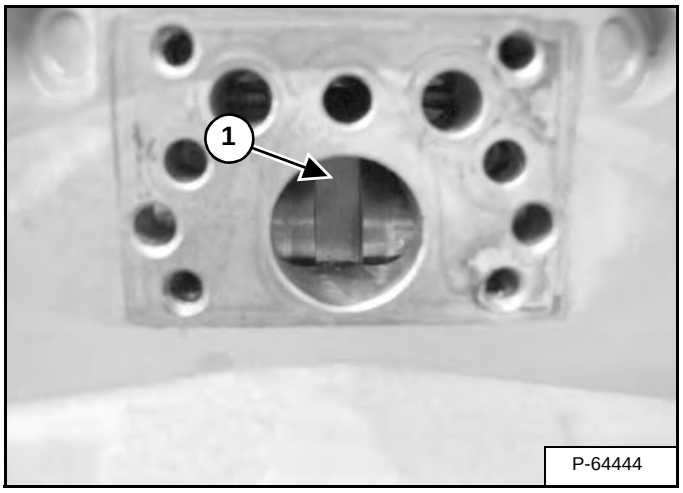


Remove the controller (Item 1) **[Figure 30-51-5]** from the pump.

Remove the controller gaskets (Item 2) **[Figure 30-51-5]** from the pump.

Installation:

Figure 30-51-6

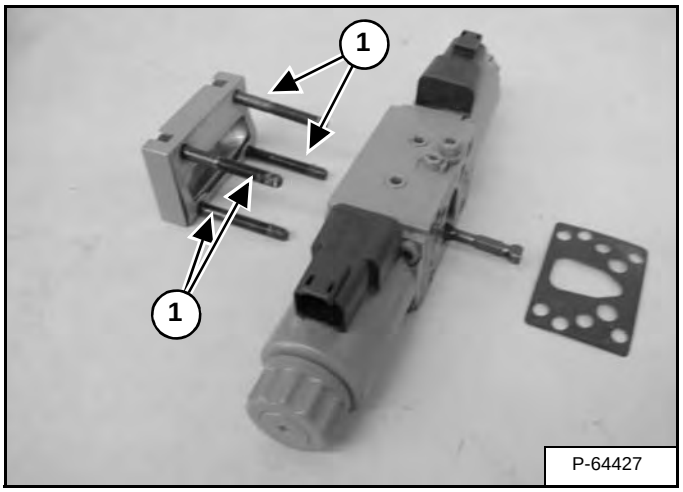


Be sure the feedback lever (Item 3) **[Figure 30-51-5]** is in the center of the servo piston groove (Item 1) **[Figure 30-51-6]**.

Use a small amount of grease on a new gasket and install the gasket on the hydraulic controller (Item 1) **[Figure 30-51-5]**.

Be sure the pump surface is clean.

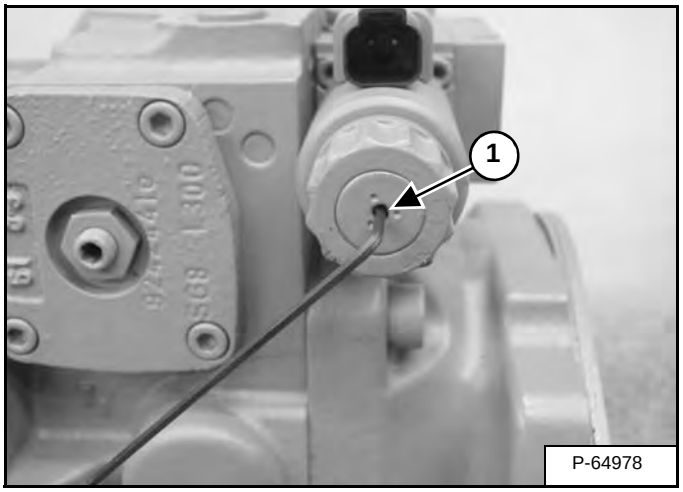
Figure 30-51-7



Alternately tighten bolts (Item 1) **[Figure 30-51-7]** to 7.7 ft.-lb. (10,4 N•m) torque. Ensure bolts are tight to specifications.

NOTE: When a hydraulic controller is replaced, the hydrostatic pumps must be calibrated. (See Hydraulic Controller Neutral Adjustment on Page 30-41-30.)

Figure 30-51-8



With the engine running and the loader on jack stands: Bleed the trapped air in the controller by loosening the small set screw (Item 1) **[Figure 30-51-8]** a maximum of 2 turns. Leave the screw loose until oil comes dripping out of the set screw. Tighten set screw to 18 in.-lb. (2 N•m) torque.

Repeat the bleeding procedure for all of the solenoids.

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Removal And Installation

Remove the hydrostatic pump/engine assembly from the loader. (See Engine Removal And Installation on Page 70-10-9.)

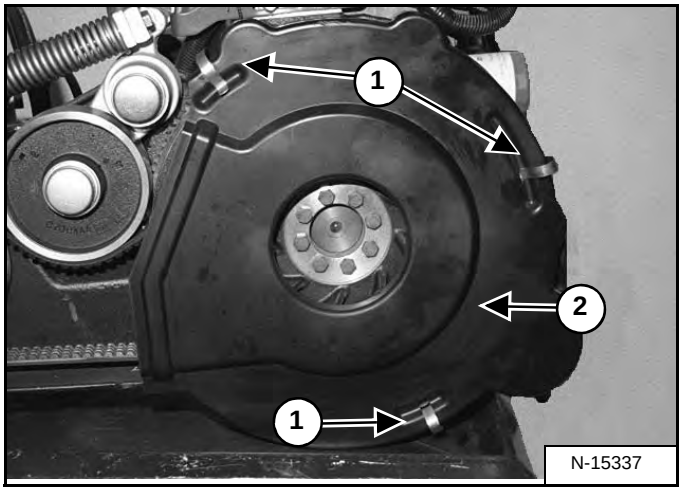
Remove the hydraulic pump (See Removal And Installation on Page 20-70-9.)

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.

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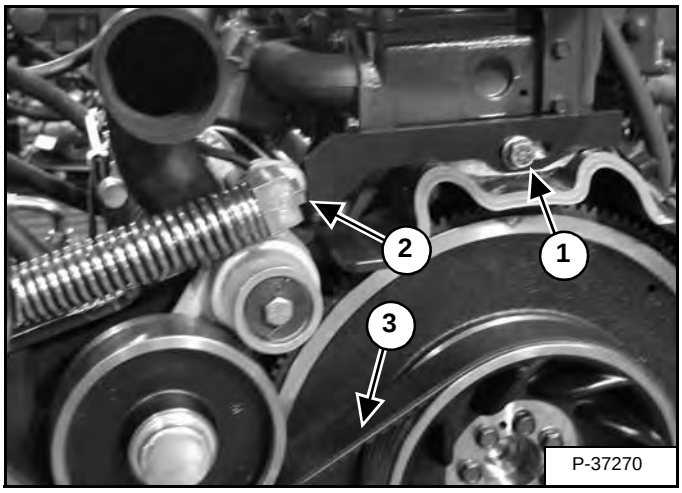
Figure 30-51-9



Remove the hydrostatic pump/engine assembly from the loader. (See Engine Removal And Installation on Page 70-10-9.)

Remove the belt shield clips (Item 1) and belt shield (Item 2) **[Figure 30-51-9]**.

Figure 30-51-10

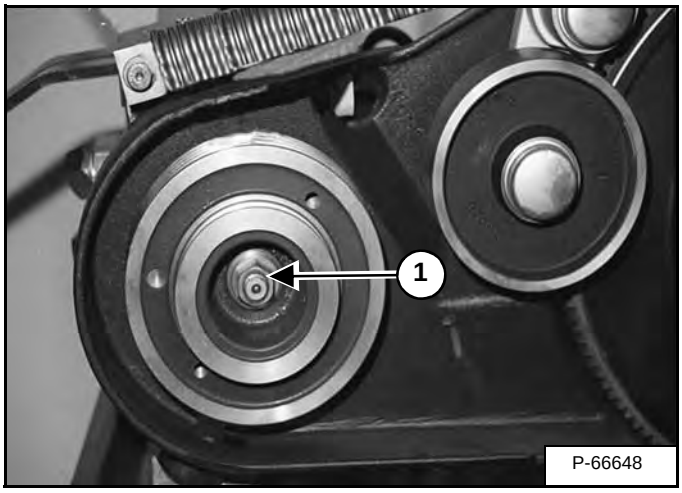


Loosen the stop mounting bolt (Item 1) **[Figure 30-51-10]**.

Loosen the spring tension bolt (Item 2) **[Figure 30-51-10]**.

Remove the drive belt (Item 3) **[Figure 30-51-10]**.

Figure 30-51-11



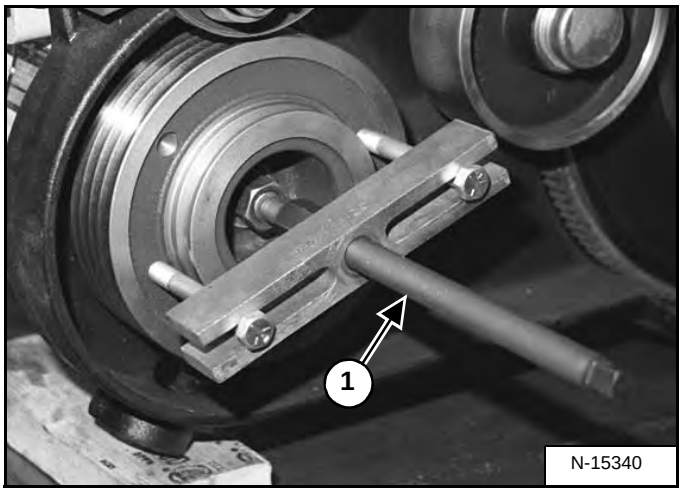
Remove the washer and nut (Item 1) **[Figure 30-51-11]** from the hydrostatic pump drive shaft.

Installation: Tighten the nut to 175-200 ft.-lb. (237-271 N•m) torque

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Removal And Installation (Cont'd)

Figure 30-51-12



Install the nut on the end of the pump drive shaft (without washer).

Use a puller (Item 1) **[Figure 30-51-12]** to remove the pulley from the pump drive shaft.

NOTE: DO NOT strike puller or pump shaft with a hammer. Internal pump damage may result.

Remove the nut and washer from the pump drive shaft.

Remove the pump pulley from the pump drive shaft.

Figure 30-51-13

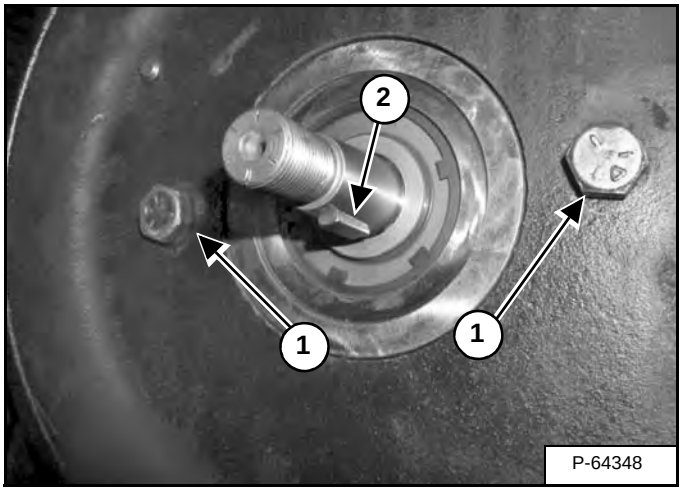
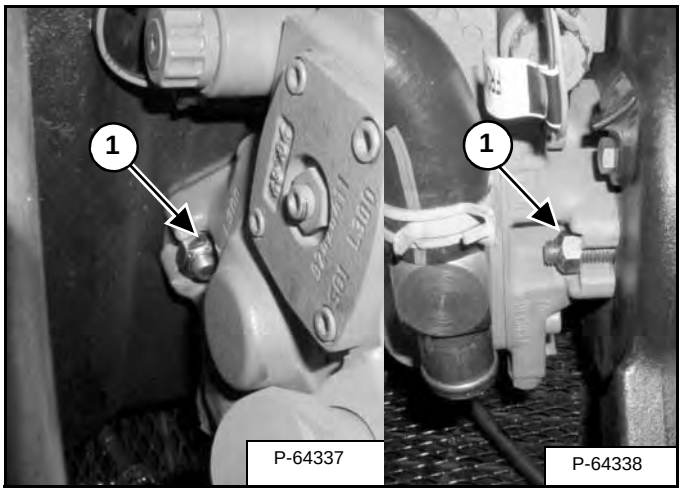


Figure 30-51-14



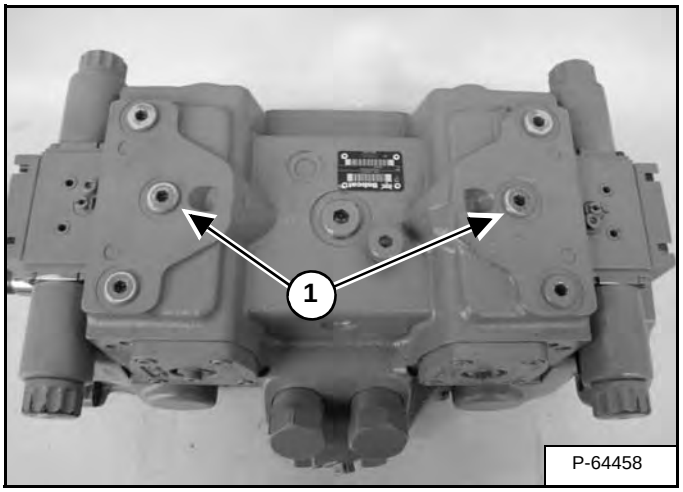
Remove the two mounting bolts (Item 1) **[Figure 30-51-13]** and nuts (Item 1) **[Figure 30-51-14]**.

Installation: Tighten the mounting bolts and nuts to 65-70 ft.-lb. (88-95 N•m) torque.

Make sure the key (Item 2) **[Figure 30-51-13]** is installed.

Remove the hydrostatic pump from the mounting bracket and drive belt housing.

Figure 30-51-15



Remove the air bleed plugs (Item 1) **[Figure 30-51-15]**.

BEFORE START UP: Fill one of the air bleed ports with new hydraulic oil until the hydraulic oil flows out of the other air bleed port. This will remove trapped air in the hydrostatic pumps before start up.

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

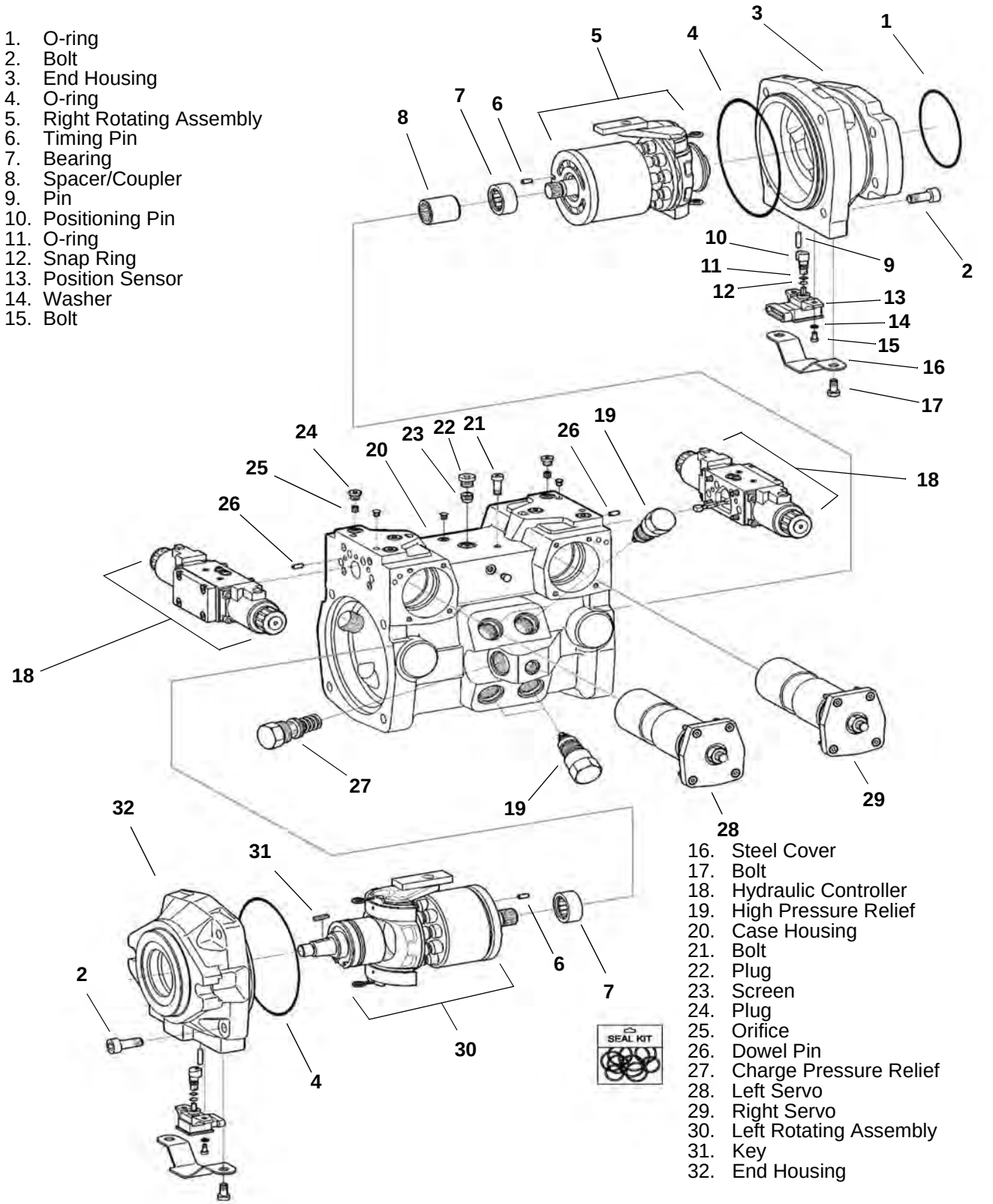
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Hydrostatic Pump Start Up

Follow the hydraulic pump (SJC) start up procedure. (See Hydraulic Pump Start Up on Page 20-70-11.)

Dealer Copy -- Not for Resale

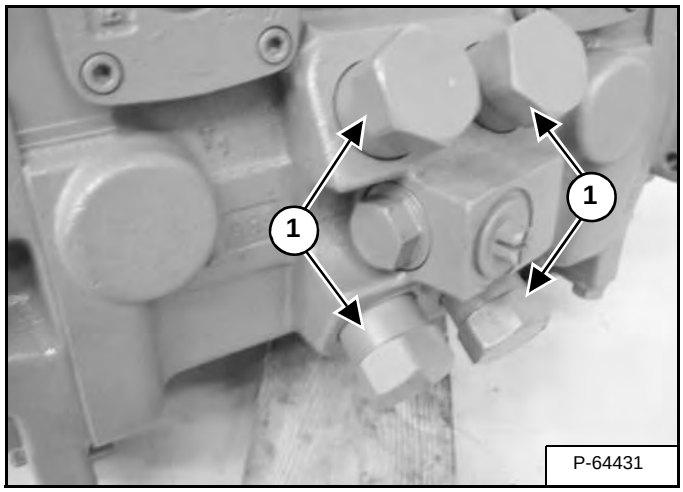
Parts Identification



Dealer Copy -- Not for Resale

High Pressure Relief And ByPass Valve

Figure 30-51-16

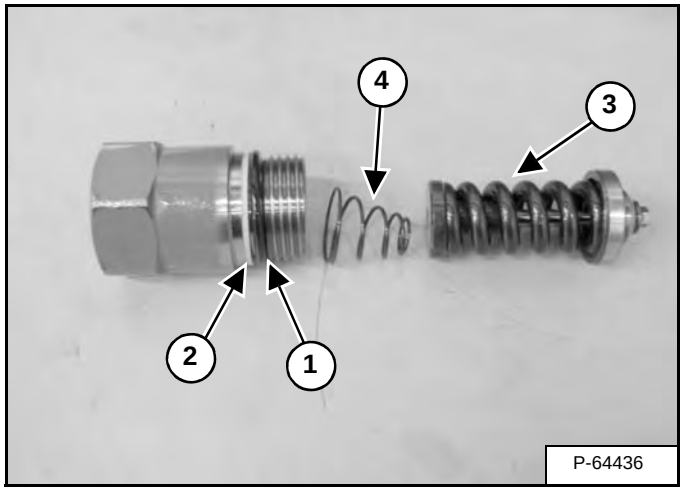


There are four system check relief valves (Item 1) **[Figure 30-51-16]** in the back of the hydrostatic pump.

Remove the relief valve cap (Item 1) **[Figure 30-51-16]**.

Assembly: Tighten cap to 111-125 ft.-lb. (150-170 N•m) torque.

Figure 30-51-17

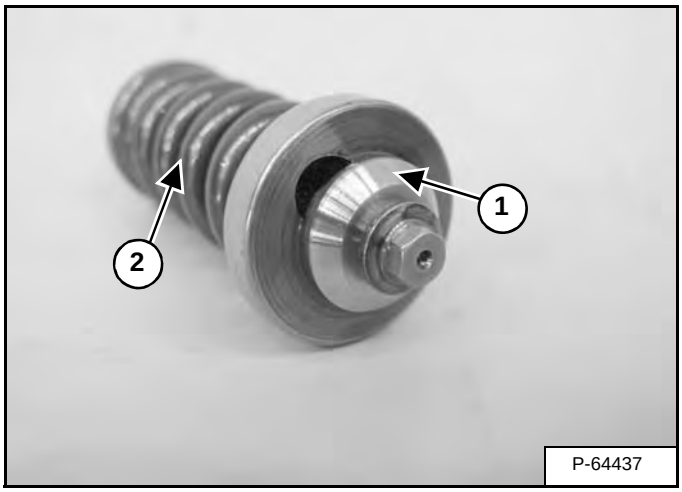


Check the valve cap O-ring (Item 1) and back-up ring (Item 2) **[Figure 30-51-17]**, replace as needed.

Remove relief valve assembly (Item 3) **[Figure 30-51-17]** from the valve cap.

Check the conical spring (Item 4) **[Figure 30-51-17]** to ensure it is not broken or flattened.

Figure 30-51-18



Check the valve seat surface (Item 1) **[Figure 30-51-18]** for scratches and replace as needed.

Inspect the spring (Item 2) **[Figure 30-51-18]** for breakage.

Inspect seats inside case housing.

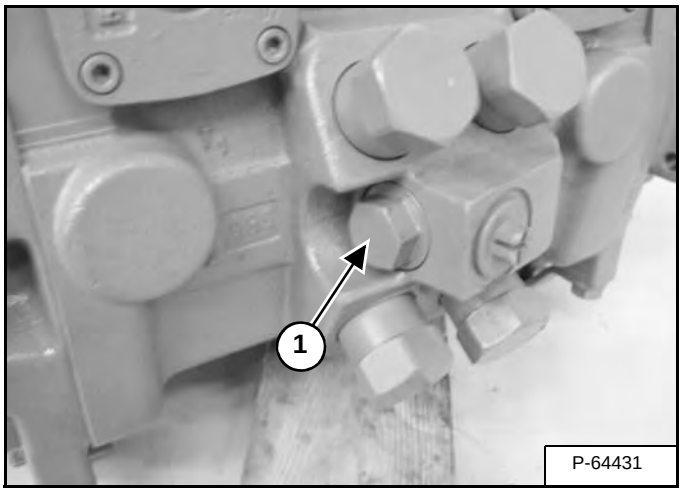
Do not disassemble the relief valve assembly. If replacement is required, replace as an assembly.

Factory setting on the relief valve is 5075 PSI (350 bar).

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Charge Relief Valve

Figure 30-51-19

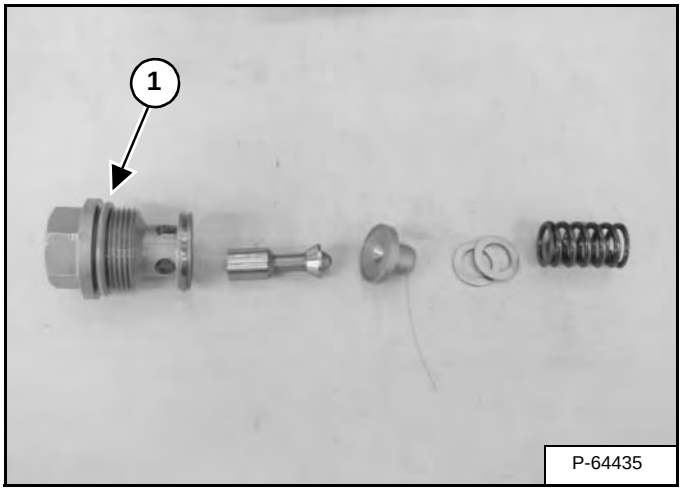


The charge relief valve (Item 1) **[Figure 30-51-19]** is located on the back of the hydrostatic pump.

Remove the charge relief valve.

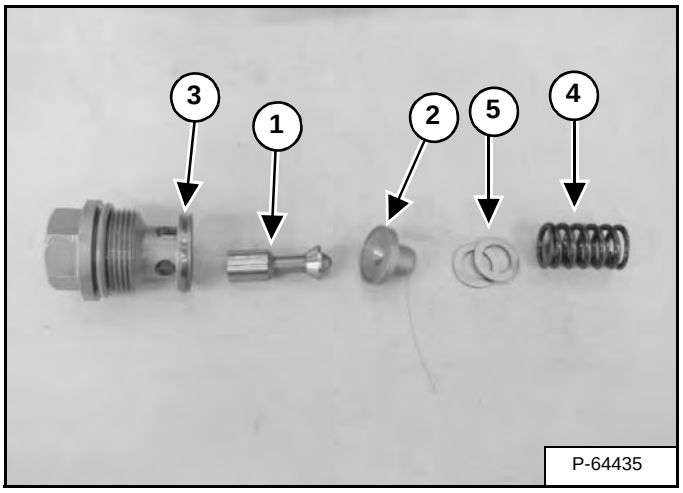
Assembly: Tighten charge relief valve to 52 ft.-lb. (70 N•m) torque.

Figure 30-51-20



Check and replace the O-ring (Item 1) **[Figure 30-51-20]**.

Figure 30-51-21



Inspect the poppet (Item 1) and the mating seat (Item 2) **[Figure 30-51-21]** for damage or foreign material. Ensure the poppet moves freely in it's bore.

Inspect the sealing ring (Item 3) **[Figure 30-51-21]** and the mating seat in the pump housing for damage or foreign material.

Inspect the spring (Item 4) and the charge relief valve shims (Item 5) **[Figure 30-51-21]**.

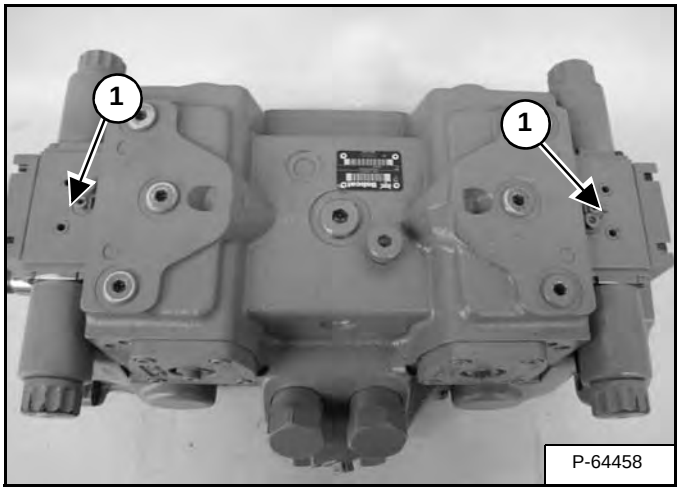
NOTE: 1.0 mm shim (Item 5) [Figure 30-51-21] = 43.5 PSI (3 bar) in pressure change. Adding shims increases charge pressure. Removing shims decreases charge pressure.

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Disassembly And Assembly

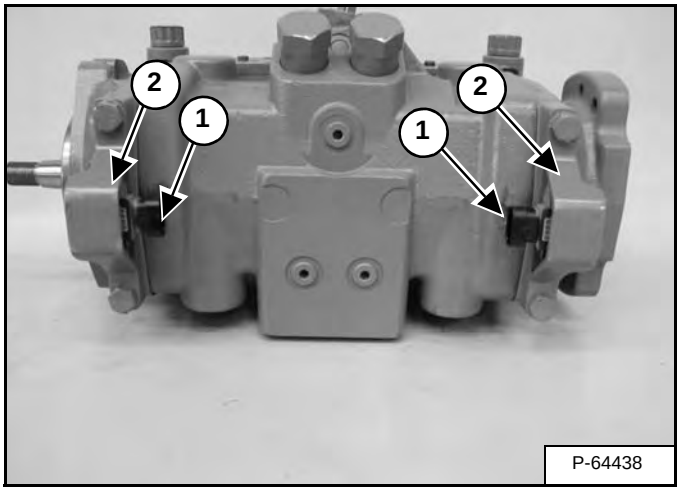
Remove the hydrostatic pump/engine assembly from the loader. (See Engine Removal And Installation on Page 70-10-9.)

Figure 30-51-22



Remove the hydraulic controllers (Item 1) **[Figure 30-51-22]**. (See Hydraulic Controller Removal And Installation on Page 30-41-2.)

Figure 30-51-23

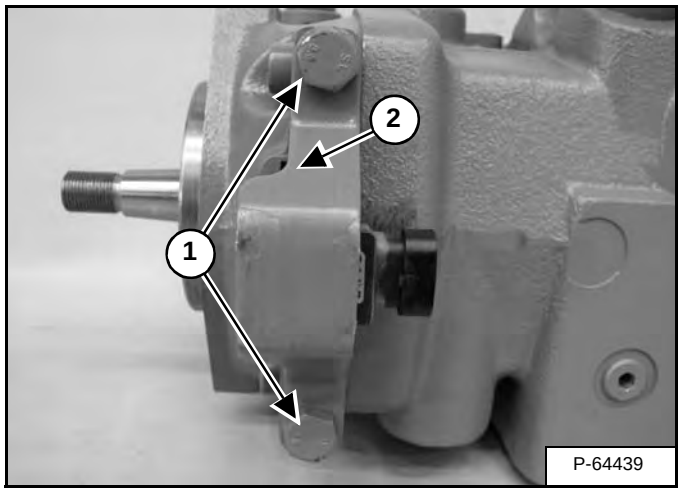


Swash plate angle sensors (Item 1) are mounted on the bottom of the hydrostatic pump. They are protected by steel covers (Item 2) **[Figure 30-51-23]**.

Note the connectors facing each other.

Note the steel covers facing direction.

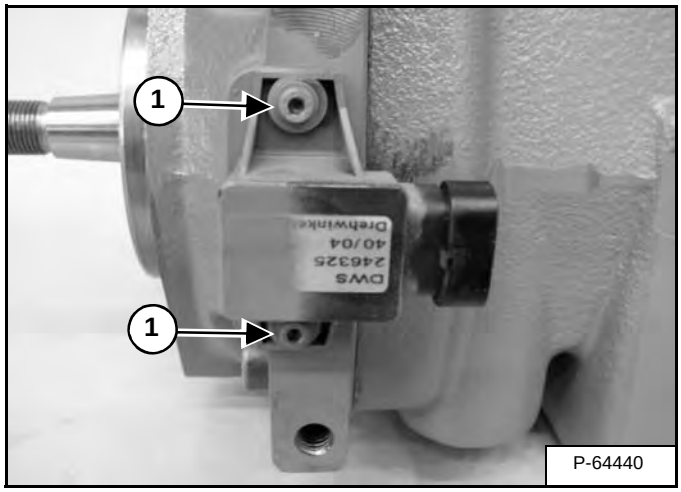
Figure 30-51-24



Remove the bolts (Item 1) mounting the steel covers (Item 2) **[Figure 30-51-24]**.

Assembly: Tighten bolts to 38 ft.-lb. (51 N•m) torque.

Figure 30-51-25



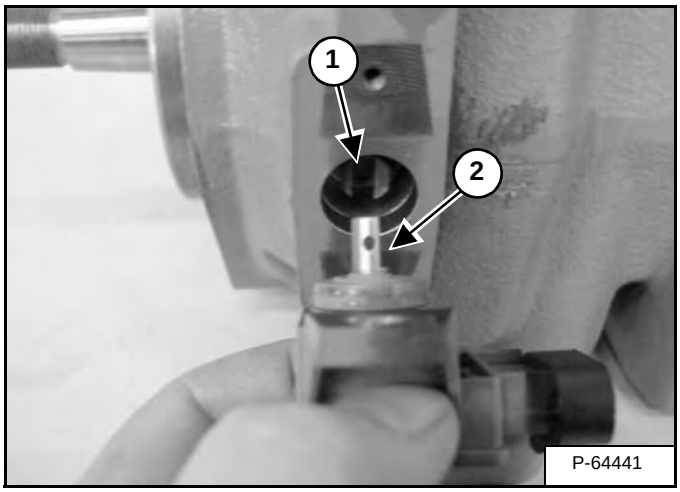
Remove the mounting bolts and washers for the swash plate angle sensor (Item 1) **[Figure 30-51-25]**.

Assembly: Tighten bolts to 27.4 in.-lb. (3,1 N•m) torque.

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Disassembly And Assembly (Cont'd)

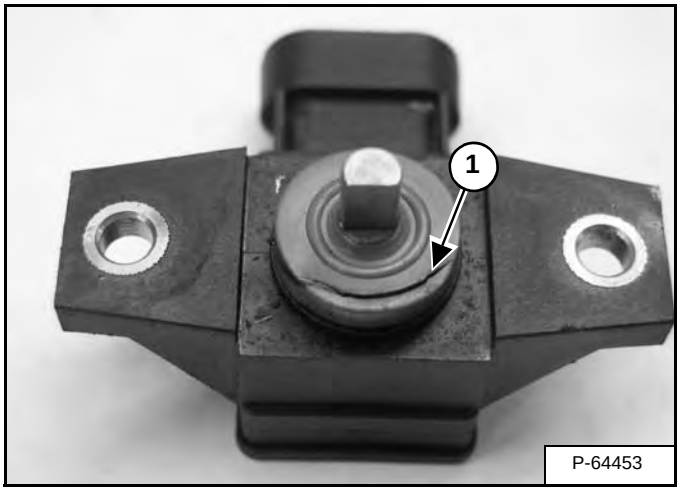
Figure 30-51-26



Assembly: Note the slotted portion (Item 1) of the positioning pin tightly fits the machined section on the swash plate angle sensor shaft (Item 2) **[Figure 30-51-26]**

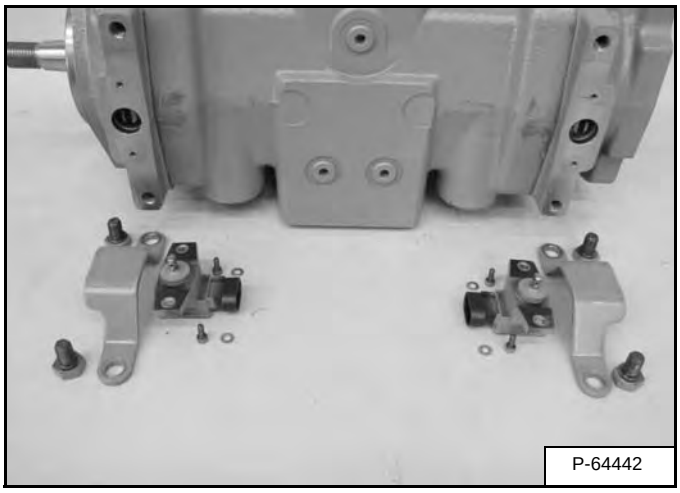
Note the machined section of the swash plate angle sensor shaft faces the center of the hydrostatic pump.

Figure 30-51-27



NOTE: Improperly installing the swash plate angle sensor, with the shaft facing toward the outside of the hydrostatic pump, will make it hard to install the sensor mounting bolts and also destroy the seal (Item 1) [Figure 30-51-27].

Figure 30-51-28



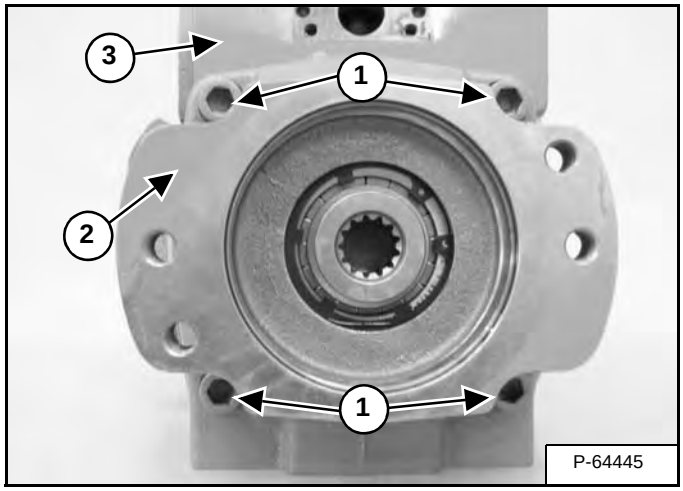
Both swash plate angle sensors and associated hardware removed from the hydrostatic pump **[Figure 30-51-28]**.

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Disassembly And Assembly (Cont'd)

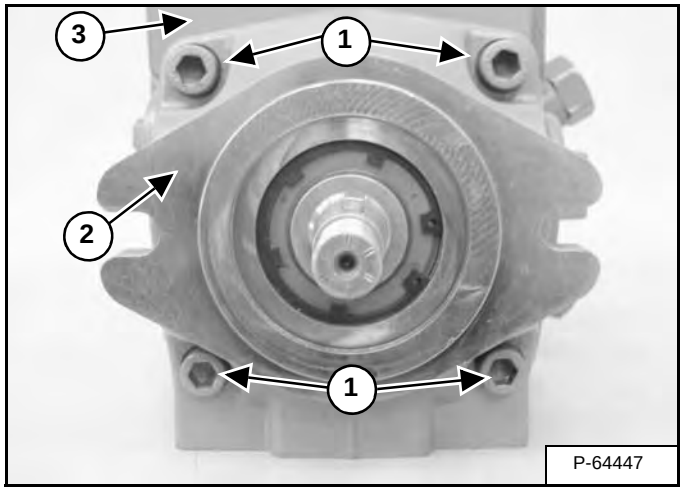
Right End Housing

Figure 30-51-29



Left End Housing

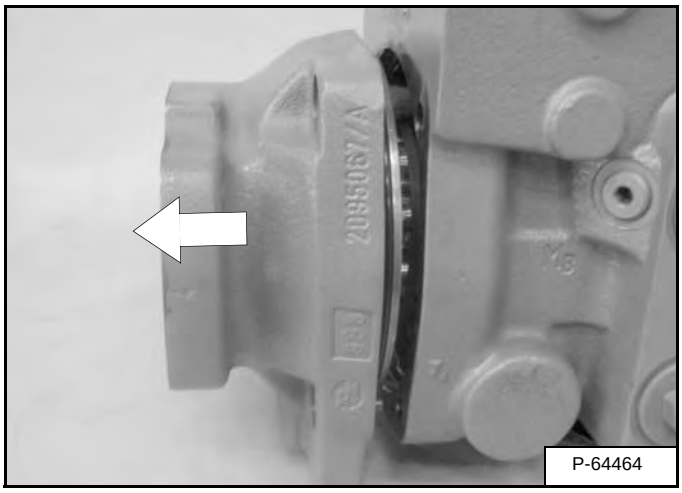
Figure 30-51-30



Remove the four mount bolts (Item 1) securing the end housing (Item 2) to the main case housing (Item 3) **[Figure 30-51-29]** and **[Figure 30-51-30]**.

Assembly: Alternately, tighten mount bolts to 96 ft.-lb. (130 N•m) torque.

Figure 30-51-31

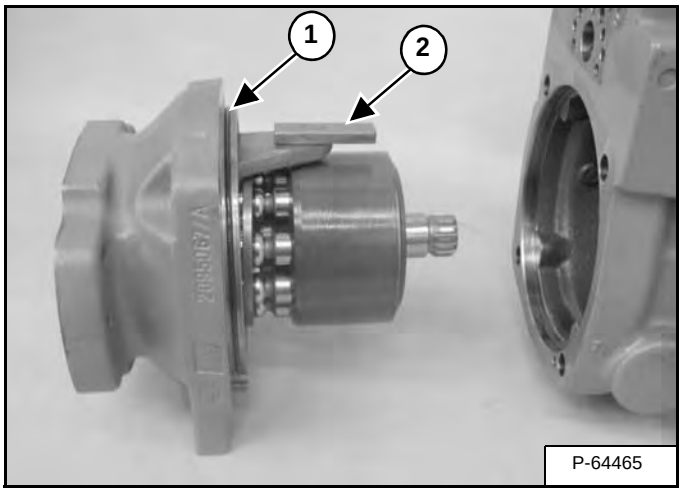


Pull the end housings from the case housing **[Figure 30-51-31]**.

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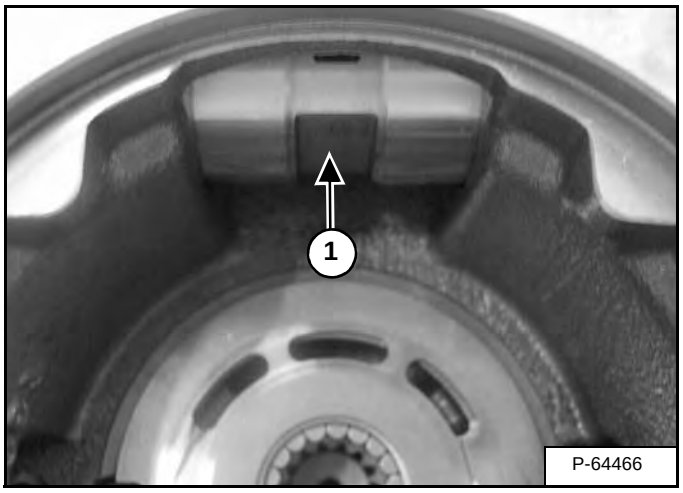
Disassembly And Assembly (Cont'd)

Figure 30-51-32



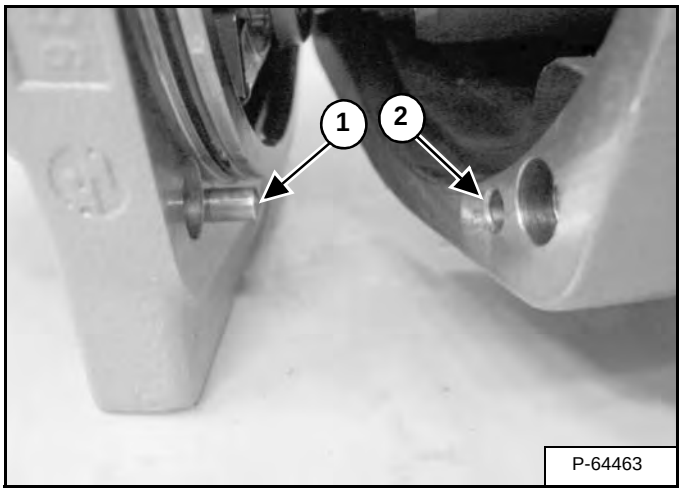
Replace O-ring (Item 1) **[Figure 30-51-32]**.

Figure 30-51-33



Ensure servo follower (Item 2) **[Figure 30-51-32]** is swung out for proper engagement with the notch in the servo piston (Item 1) **[Figure 30-51-33]**.

Figure 30-51-34



Assembly: Ensure dowel pin (Item 1) is aligned with hole in case housing (Item 2) **[Figure 30-51-34]** before tightening screws.

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Disassembly And Assembly (Cont'd)

Figure 30-51-35

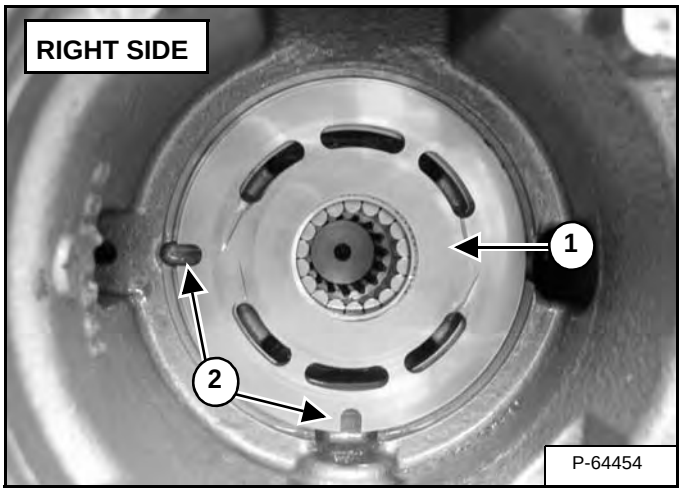
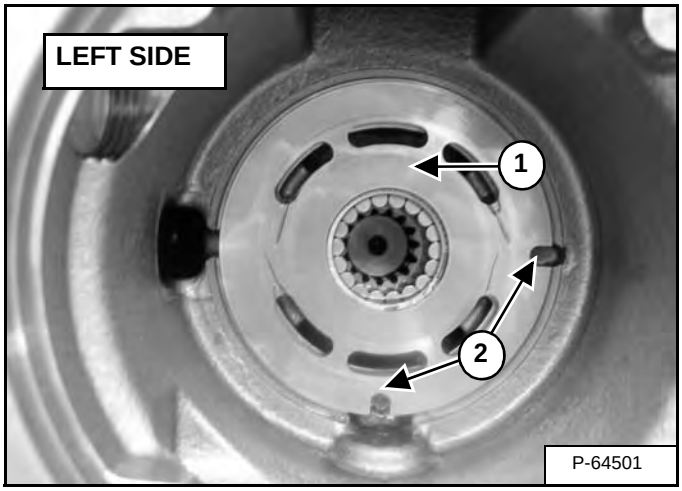


Figure 30-51-36



Remove valve plate (Item 1) **[Figure 30-51-35]** and **[Figure 30-51-36]** from the case housing.

Inspect valve plate for scratches or scoring. Replace a valve plate if the scratches are deep enough to catch with a fingernail.

NOTE: Pay attention to the notches (Item 2) [Figure 30-51-35] and [Figure 30-51-36] in the valve plate for assembly reasons. There are different valve plates for the left and right side. The valve plates are NOT interchangeable.

Dealer Copy -- Not for Resale

Disassembly And Assembly (Cont'd)

Figure 30-51-37

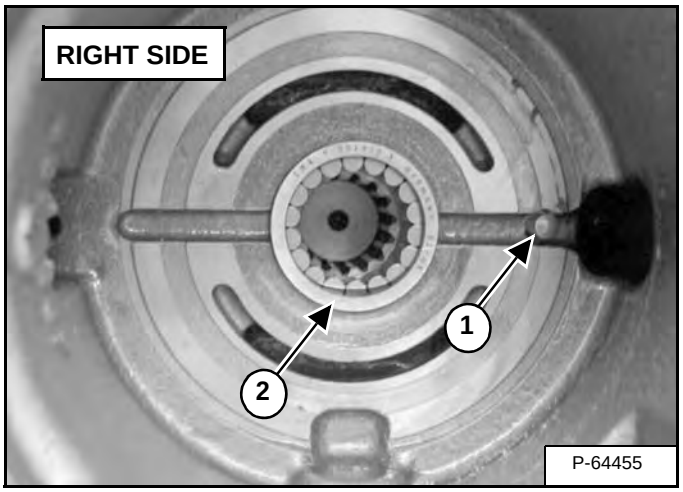


Figure 30-51-38

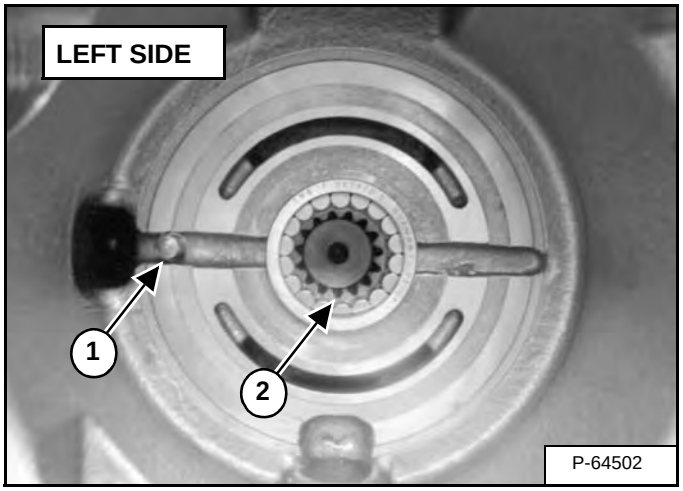


Figure 30-51-39

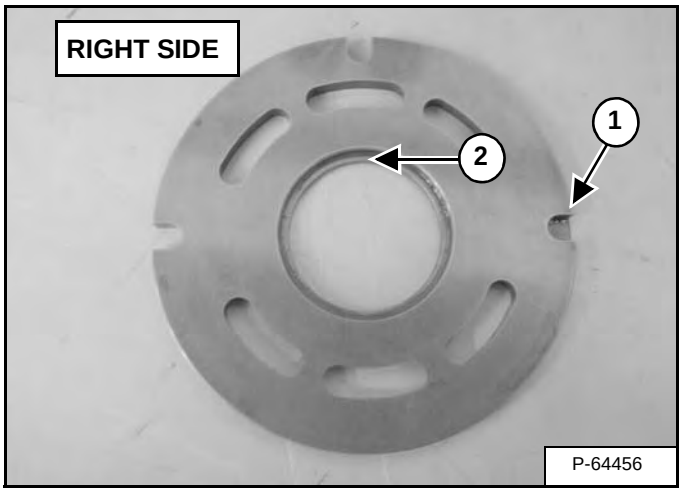
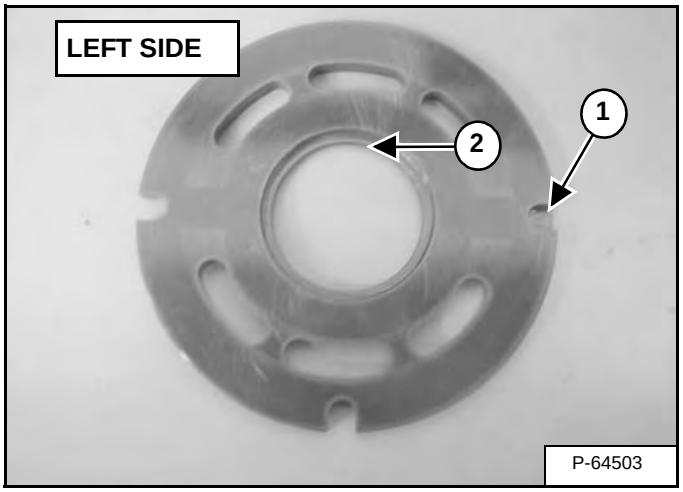


Figure 30-51-40



Assembly: Align the timing pin (Item 1) **[Figure 30-51-37]** and **[Figure 30-51-38]** in the case housing with the notch (Item 1) **[Figure 30-51-39]** and **[Figure 30-51-40]** that does not go through the valve plate.

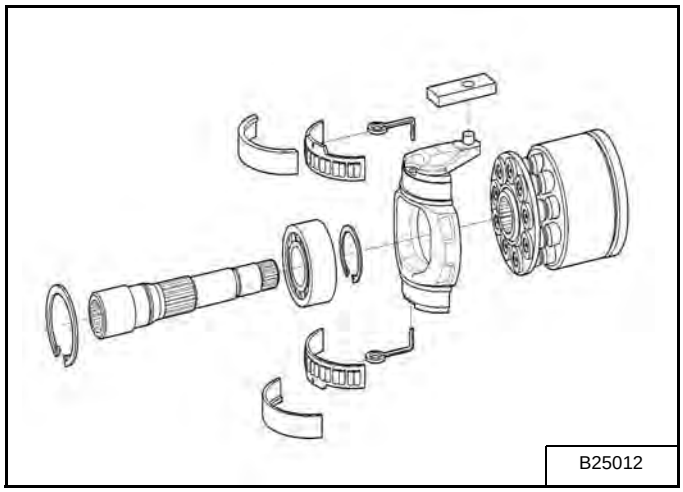
Align the shoulder of the roller bearing (Item 2) **[Figure 30-51-37]** and **[Figure 30-51-38]** with the beveled edge on the valve plate (Item 2) **[Figure 30-51-39]** and **[Figure 30-51-40]**.

NOTE: Valve plate should sit FLUSH with the case housing when properly installed.

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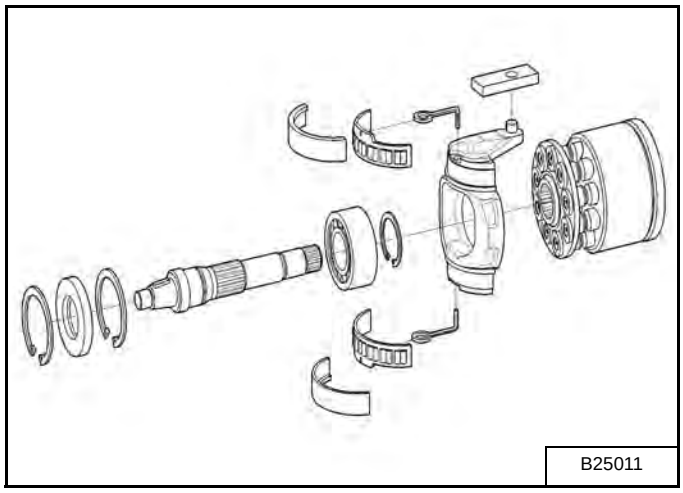
Disassembly And Assembly (Cont'd)

Figure 30-51-41



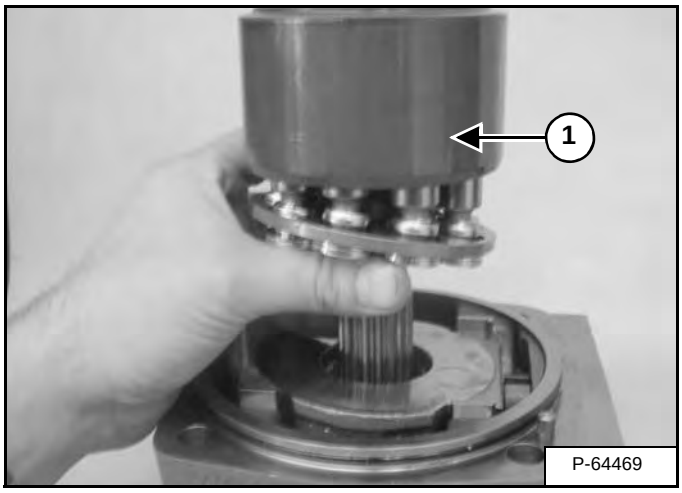
Right Side Rotating Group **[Figure 30-51-41]**.

Figure 30-51-42



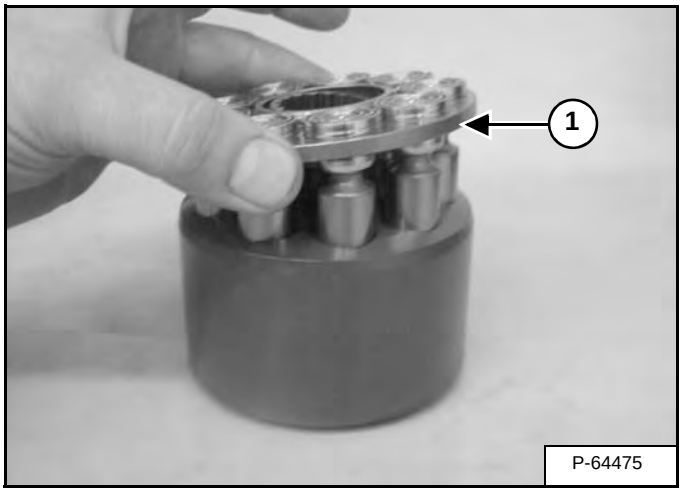
Left Side Rotating Group **[Figure 30-51-42]**.

Figure 30-51-43



Remove the piston assembly (Item 1) **[Figure 30-51-43]**.

Figure 30-51-44

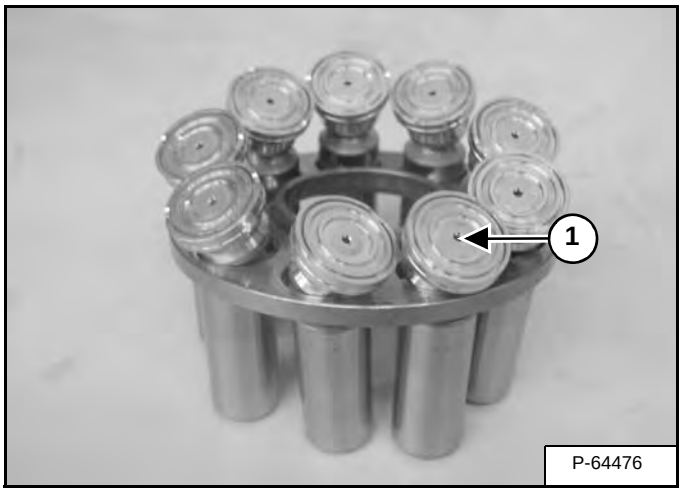


Remove the pistons (Item 1) **[Figure 30-51-44]** from the rotating block.

Dealer Copy -- Not for Resale

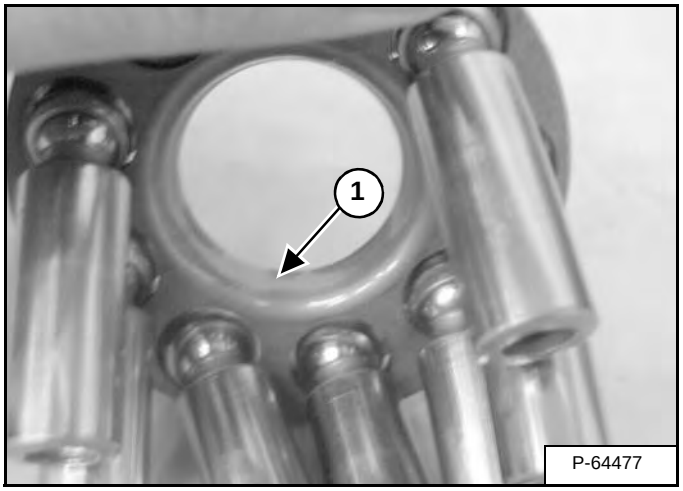
Disassembly And Assembly (Cont'd)

Figure 30-51-45



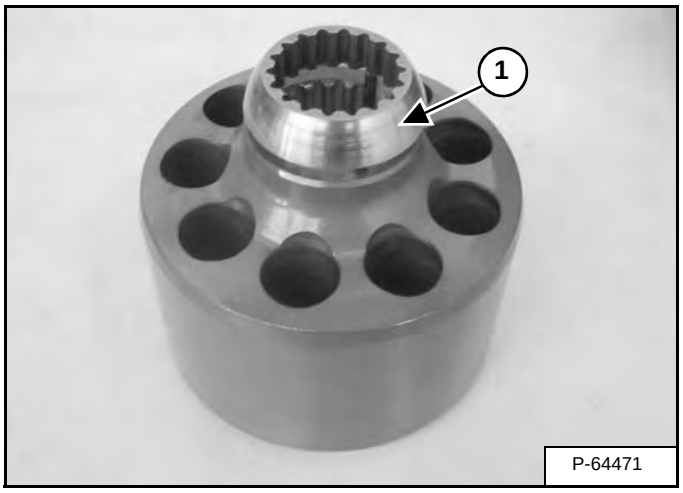
Inspect the pistons, look for scoring and scratches. Ensure the holes (Item 1) **[Figure 30-51-45]** in the slippers, are not plugged.

Figure 30-51-46



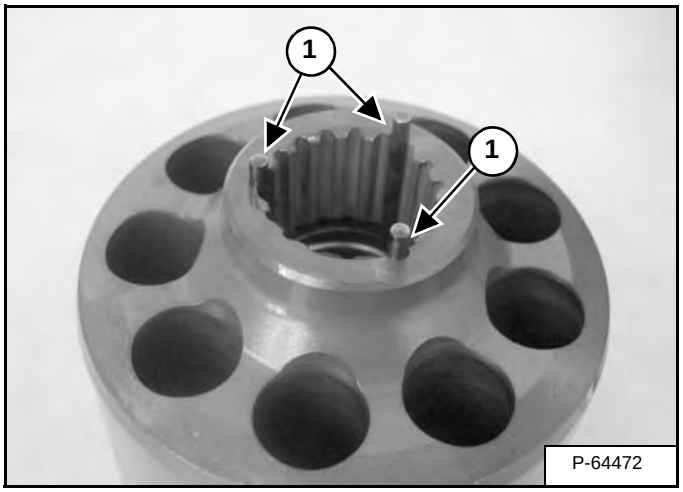
Inspect the mating surface of the spherical washer for scoring or scratches (Item 1) **[Figure 30-51-46]**.

Figure 30-51-47



Remove the spherical washer (Item 1) **[Figure 30-51-47]**.

Figure 30-51-48

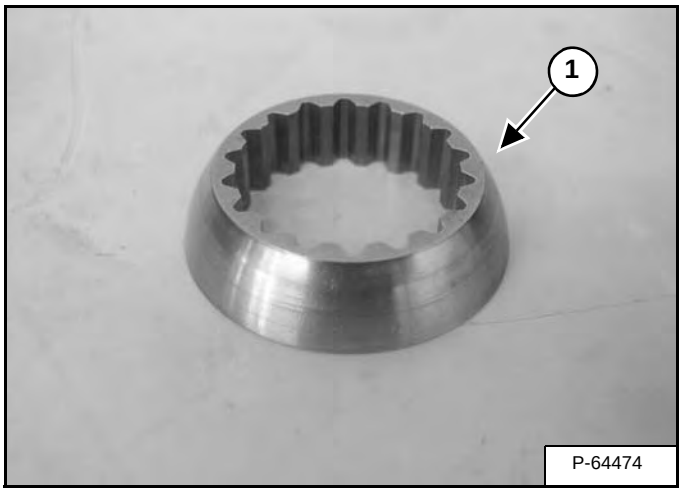


Inspect the pins (Item 1) **[Figure 30-51-48]**. They should be all the same length. Do not remove.

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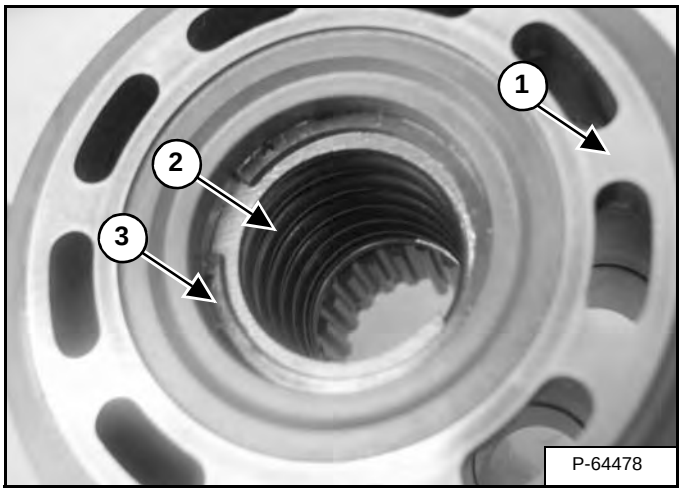
Disassembly And Assembly (Cont'd)

Figure 30-51-49



Inspect the spherical washer for scoring and wear (Item 1) **[Figure 30-51-49]**.

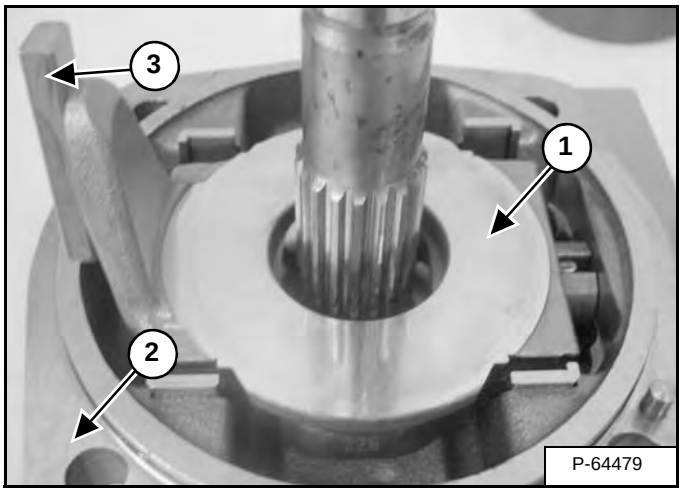
Figure 30-51-50



Inspect the back surface of the rotating block (Item 1) **[Figure 30-51-50]** where the valve plate seals. Ensure there is no scratches or scoring.

Visually ensure spring (Item 2) and c-clip (Item 3) **[Figure 30-51-50]** are not bent or damaged.

Figure 30-51-51

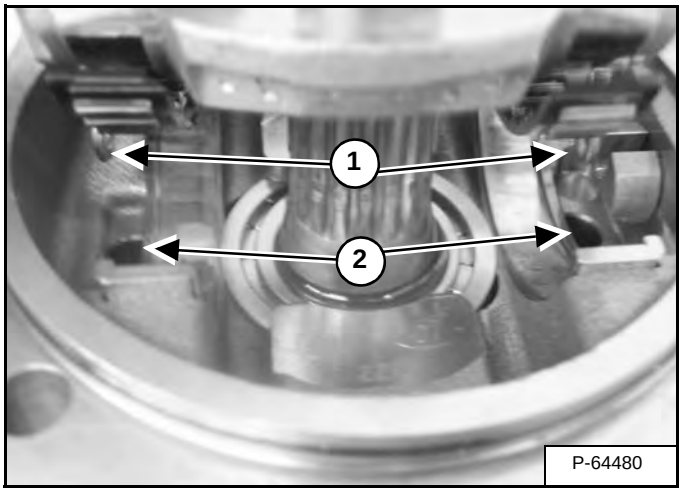


Inspect mating surface for the slippers on the swash plate (Item 1) **[Figure 30-51-51]**.

Remove the swash plate from the endcap housing (Item 2) **[Figure 30-51-51]**.

Remove the slide ring (Item 3) **[Figure 30-51-51]**, ensure it pivots freely.

Figure 30-51-52

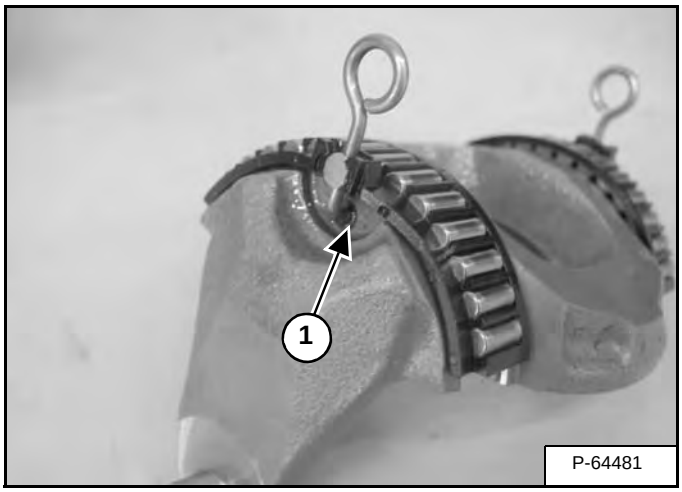


Assembly: Carefully align bearing pin eyelets (Item 1) into holes in endcap housing (Item 2) **[Figure 30-51-52]**.

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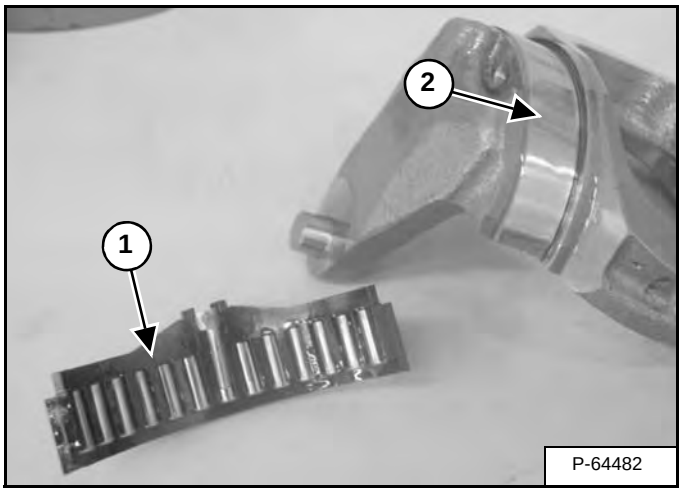
Disassembly And Assembly (Cont'd)

Figure 30-51-53



Assembly: Ensure bearing pins are in the holes of the swash plate (Item 1) **[Figure 30-51-53]**.

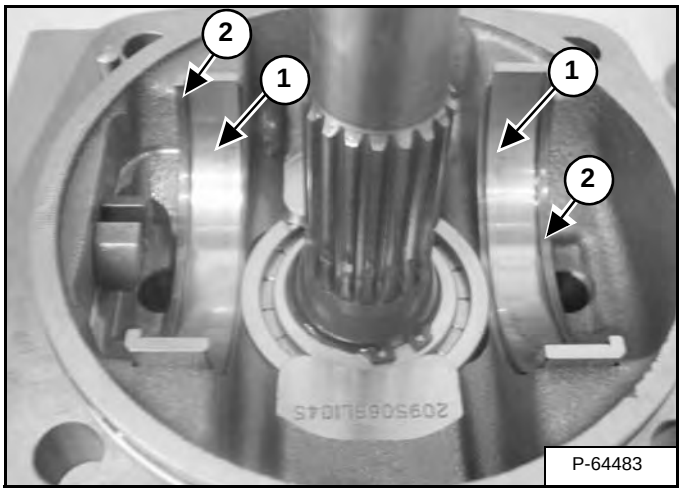
Figure 30-51-54



Remove the shell bearing (Item 1) **[Figure 30-51-54]**.

Inspect individual roller bearings and machined surfaces (Item 2) **[Figure 30-51-54]** on swash plate.

Figure 30-51-55



Remove the shell bearing races (Item 1) **[Figure 30-51-55]**.

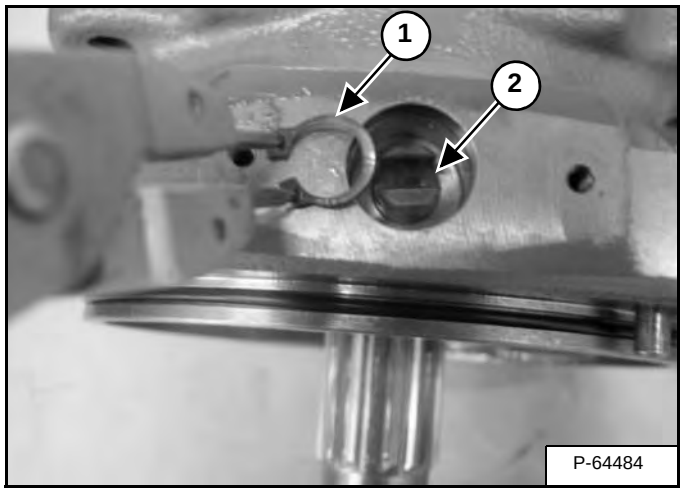
Assembly: Note shell bearing races have an edge (Item 2) **[Figure 30-51-55]** on them. The edges face towards the outside of the endcap housing

Inspect bearing surfaces for scratches or scoring.

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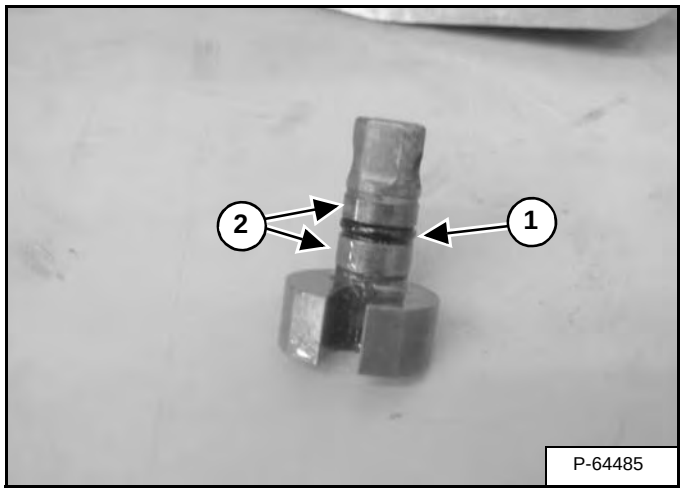
Disassembly And Assembly (Cont'd)

Figure 30-51-56



Remove the snap ring (Item 1) from the positioning pin (Item 2) **[Figure 30-51-56]**.

Figure 30-51-57



Pull the positioning pin from the end housing.

Replace O-ring (Item 1) **[Figure 30-51-57]**.

Inspect wear surfaces (Item 2) **[Figure 30-51-57]** for scratches or scoring. Ensure positioning pin can rotate smoothly in the end housing without excessive play.

Figure 30-51-58

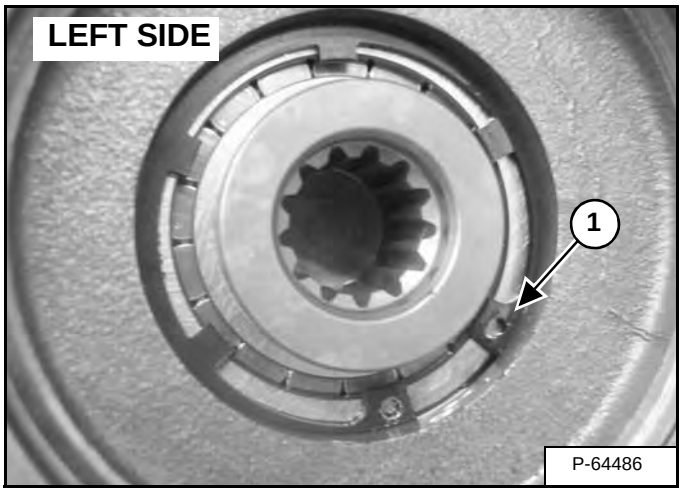
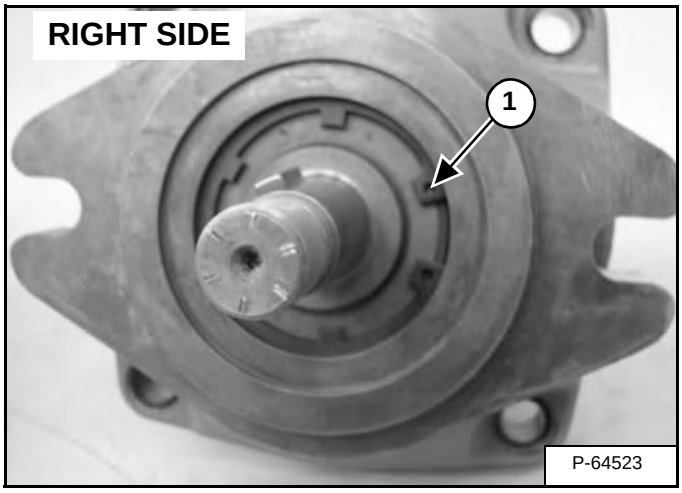
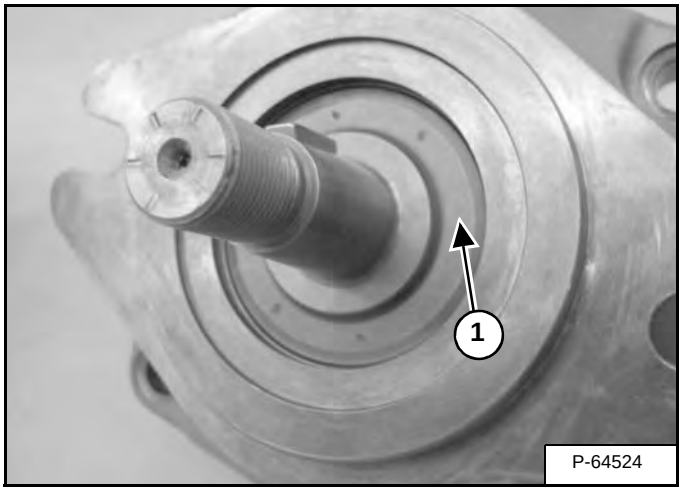


Figure 30-51-59



Remove the snap ring (Item 1) **[Figure 30-51-58]** and **[Figure 30-51-59]** from the end housing.

Figure 30-51-60

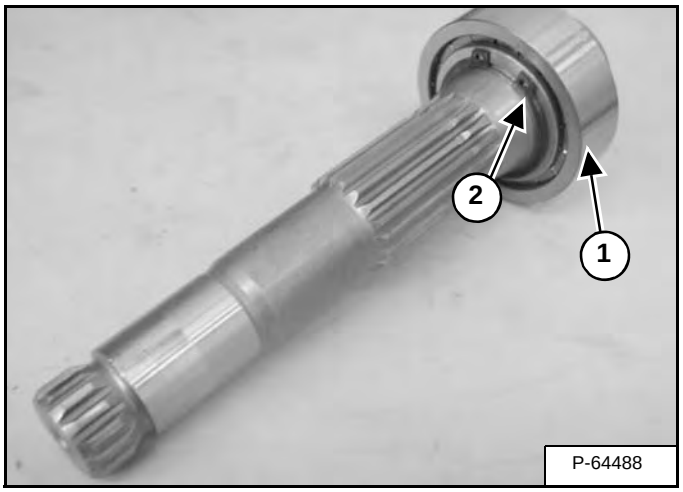


The pump seal (Item 1) **[Figure 30-51-60]** is removed by inserting a screw into the seal and prying out.

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Disassembly And Assembly (Cont'd)

Figure 30-51-61



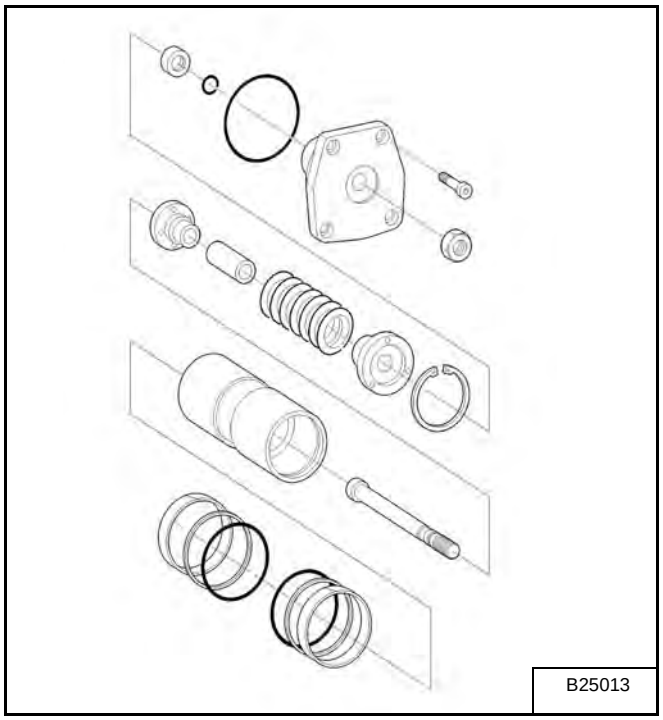
The drive shaft can be tapped out of the end housing with a rubber mallet.

Inspect wear surfaces for scratches, and inspect splines for excessive wear.

Inspect bearing (Item 1); if bearing needs replacement, remove snap ring (Item 2) **[Figure 30-51-61]** and remove bearing.

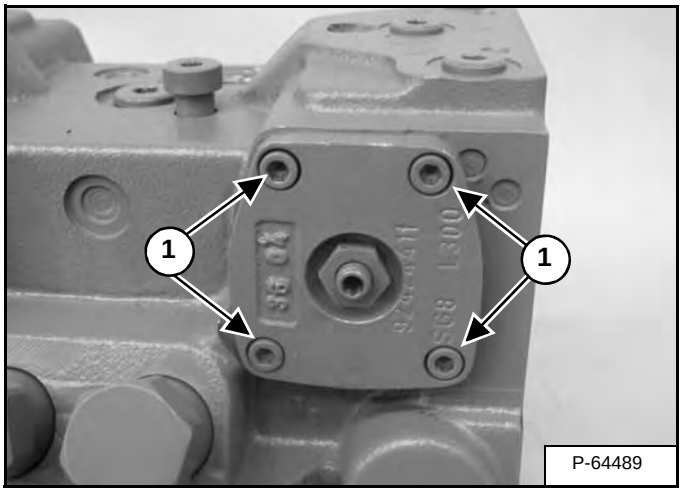
The Servo Piston Assembly **[Figure 30-51-62]** cannot be removed unless the hydraulic controller and rotating group is removed first.

Figure 30-51-62



Servo Piston Assembly **[Figure 30-51-62]**.

Figure 30-51-63



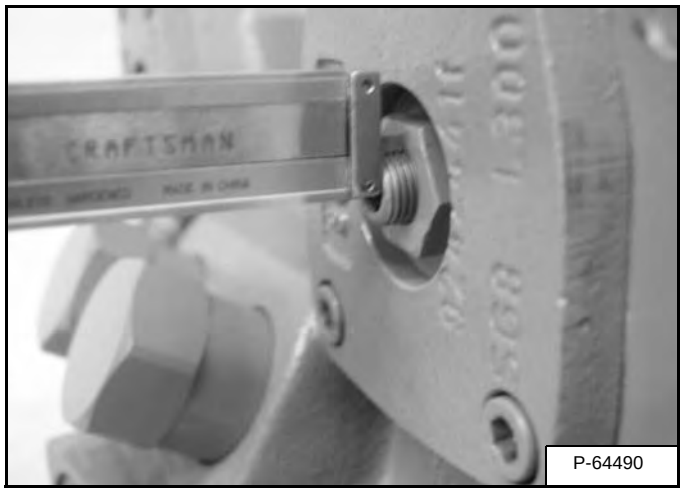
Remove servo piston mounting bolts (Item 1) **[Figure 30-51-63]**.

Installation: Tighten bolts to 7.7 ft.-lb. (10,4 N•m) torque.

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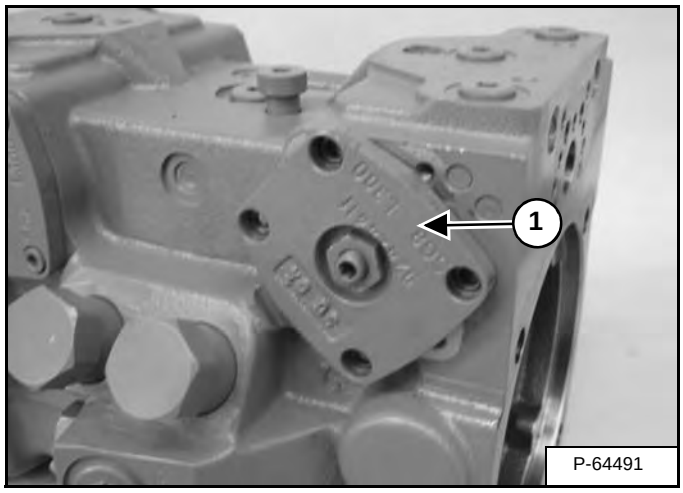
Disassembly And Assembly (Cont'd)

Figure 30-51-64



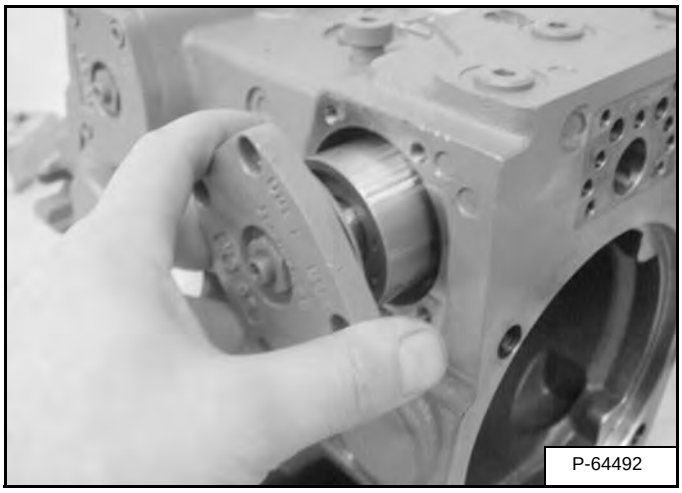
Measure and record servo piston depth at the adjustment screw **[Figure 30-51-64]**.

Figure 30-51-65



Use a rubber mallet to rotate servo piston cover (Item 1) **[Figure 30-51-65]**.

Figure 30-51-66



Slide the servo piston assembly out of the bore. **[Figure 30-51-66]**.

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Disassembly And Assembly (Cont'd)

Figure 30-51-67

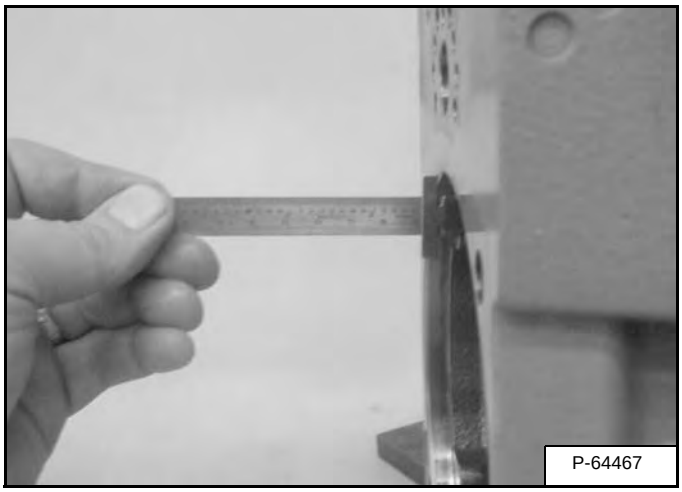
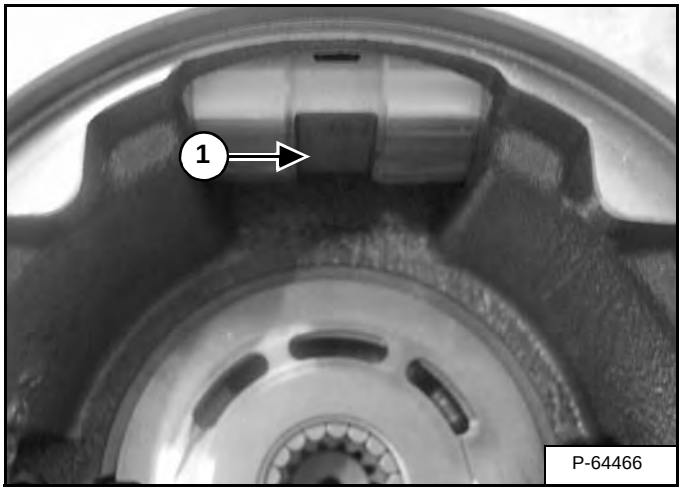
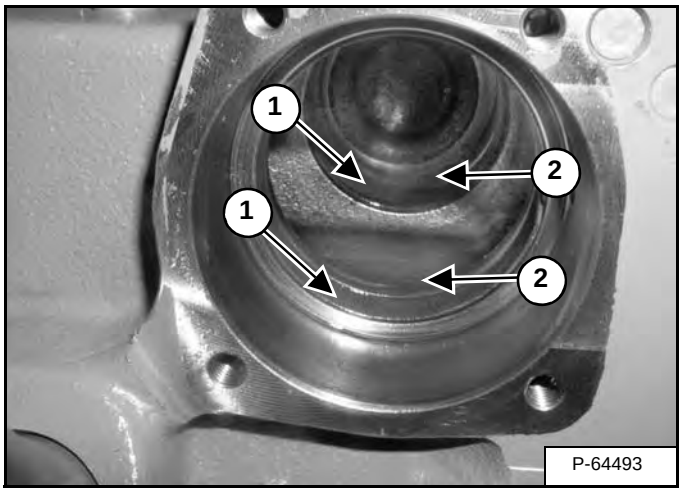


Figure 30-51-68



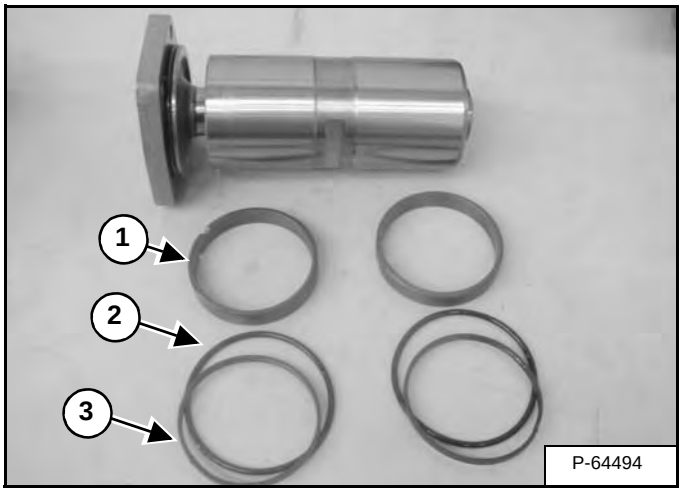
Assembly: Align the servo piston so the guide slot (Item 1) **[Figure 30-51-68]** is parallel to the driveshaft centerline. Measure with a straight-edge **[Figure 30-51-67]**.

Figure 30-51-69



Remove the bushings (Item 1), seals and O-rings (Item 2) **[Figure 30-51-69]** from the pump housing.

Figure 30-51-70

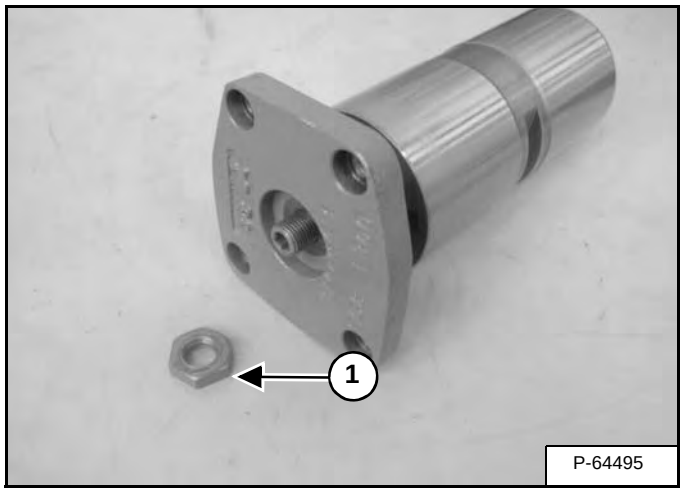


Each servo has a pair of bushings (Item 1), O-rings (Item 2) and square-cut seals (Item 3) **[Figure 30-51-70]**.

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Disassembly And Assembly (Cont'd)

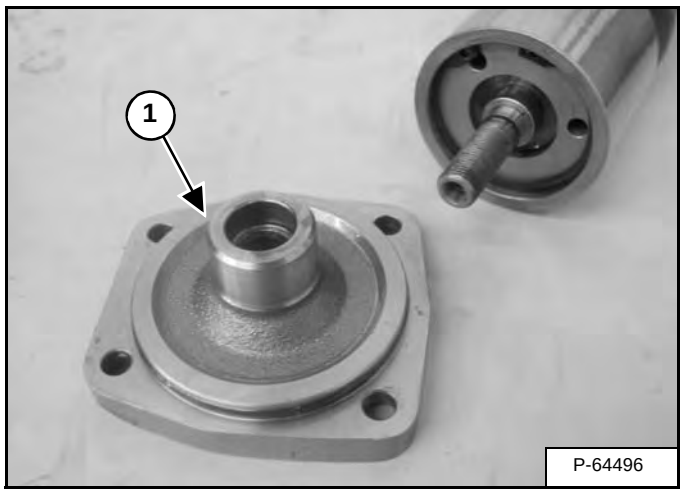
Figure 30-51-71



Remove the lock nut (Item 1) **[Figure 30-51-71]** from the servo piston.

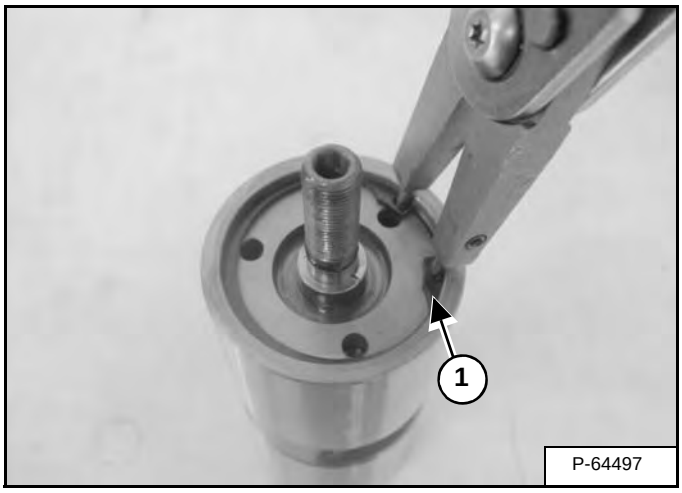
Assembly: Tighten lock nut to 22 ft.-lb. (30 N•m) torque.

Figure 30-51-72



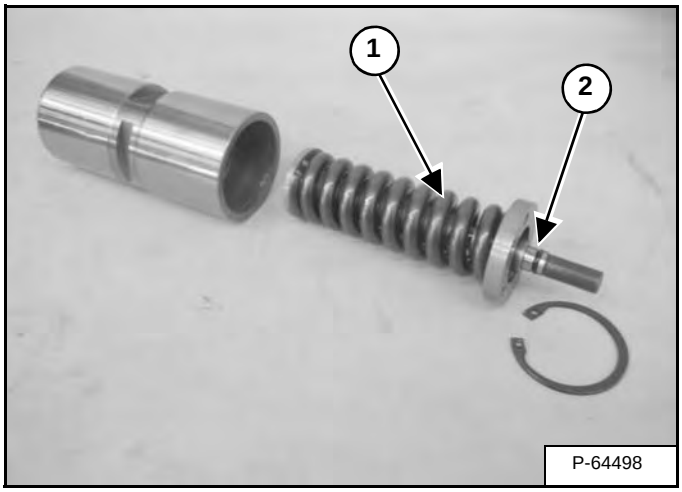
Remove the servo cover (Item 1) **[Figure 30-51-72]** from the servo piston.

Figure 30-51-73



Remove snap ring (Item 1) **[Figure 30-51-73]** from the servo piston.

Figure 30-51-74



Remove the piston stop adjustment mechanism (Item 1) **[Figure 30-51-74]** from the servo piston.

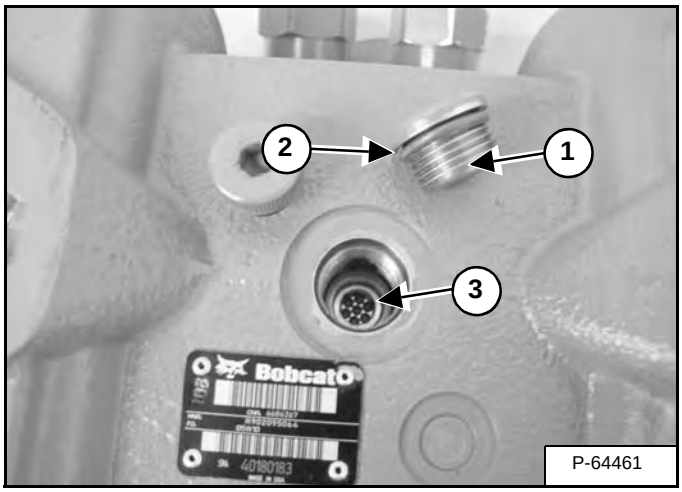
Inspect mechanism for broken parts.

Replace O-ring (Item 2) **[Figure 30-51-74]**

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Disassembly And Assembly (Cont'd)

Figure 30-51-75



Remove the plug (Item 1) from the top center of the case housing. Replace O-ring (Item 2) **[Figure 30-51-75]**.

Assembly: Tighten plug to 45 ft.-lb. (10 N•m) torque.

Remove internal screen (Item 3) **[Figure 30-51-75]**.

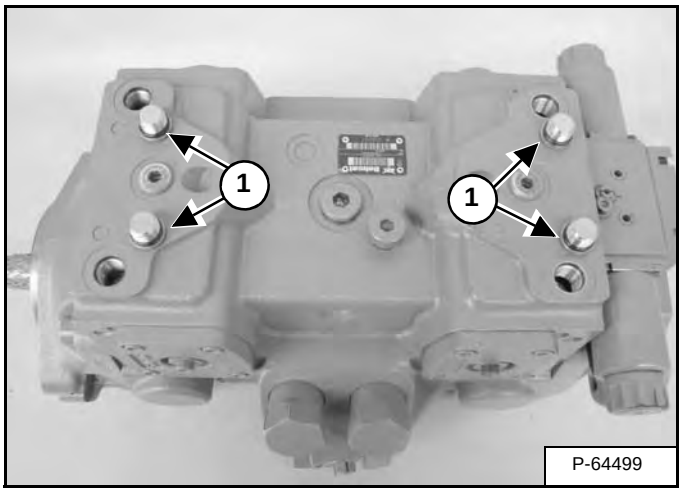
Assembly: Tighten internal screen to 7.4 ft.-lb. (62 N•m) torque.

Figure 30-51-76



Ensure screen is clean **[Figure 30-51-76]**.

Figure 30-51-77

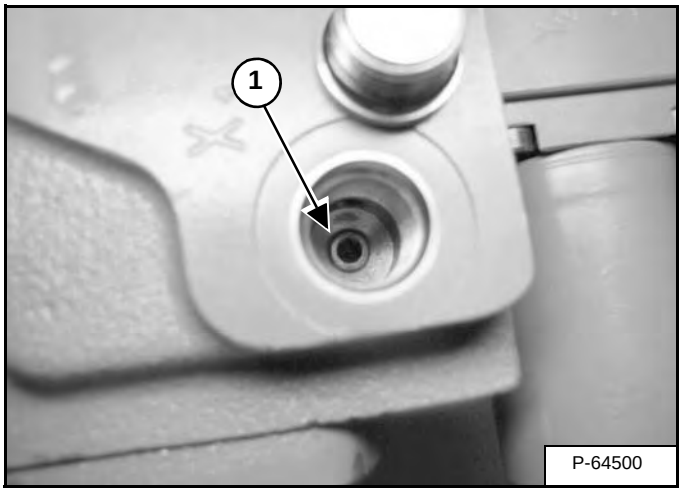


Remove the four control pressure plugs (Item 1) **[Figure 30-51-77]** at the top of the case housing to gain access to the four orifices (Item 1) **[Figure 30-51-78]**.

Replace O-rings on plugs.

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

Figure 30-51-78



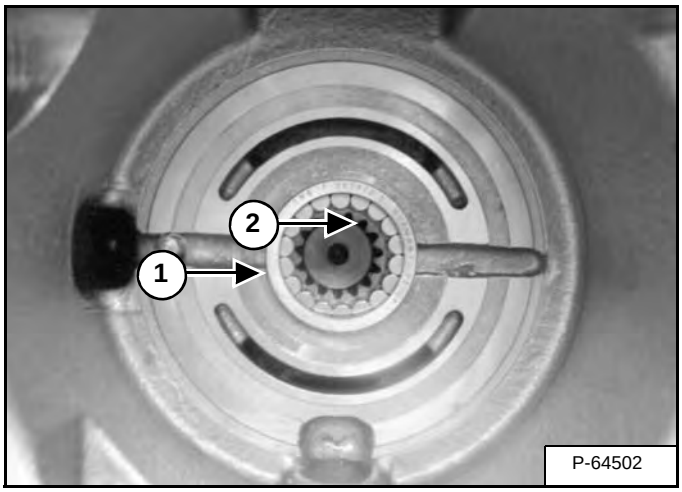
Ensure the four orifices (Item 1) **[Figure 30-51-78]** in case housing are clean and not plugged.

NOTE: The four orifices are no longer needed when software version 69 or above is installed on the loader.

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Disassembly And Assembly (Cont'd)

Figure 30-51-79



Bearings (Item 1) **[Figure 30-51-79]** in case housing are replaced by using a press and bearing driver.

Inspect center coupler (Item 2) **[Figure 30-51-79]**.

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Mechanical Neutral Adjustment

The pump mechanical neutral adjustment sets the position of the servo piston and pump swash plate relative to the hydraulic controller. This procedure should be followed if the hydrostatic pump has been disassembled for servicing the servo piston and the setting has been disrupted.

Place the loader on jackstands. (See Procedure on Page 10-10-1.)

⚠ WARNING

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

W-2017-0286

Raise the lift arms, and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Connect the remote start tool. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.)

Disconnect the swash plate angle sensors in the electrical harness. This prevents unwanted swash plate movement error codes from occurring during adjustments. Disconnecting the sensors does not have to be done directly at the sensor, follow the harness back to find an accessible connector to disconnect.

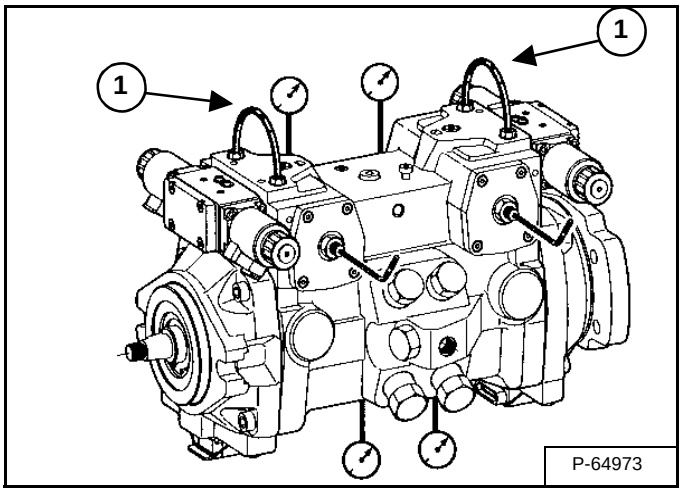
Disconnect the speed sensors located on the top of the motor carriers. This prevents uncommanded wheel movement error codes from occurring during adjustments.

⚠ 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.

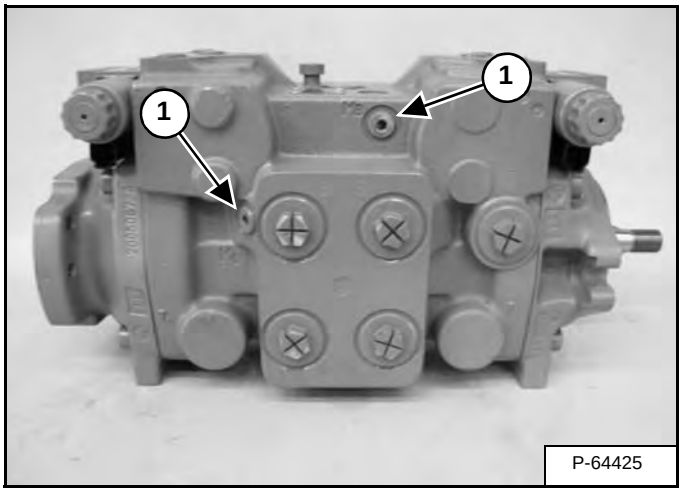
W-2145-0290

Figure 30-51-80



Connect a hydraulic hose (Item 1) **[Figure 30-51-80]** between port X1 and port X2 on each side of the hydrostatic pump, to equalize the pressures on both ends of the servo pistons.

Figure 30-51-81

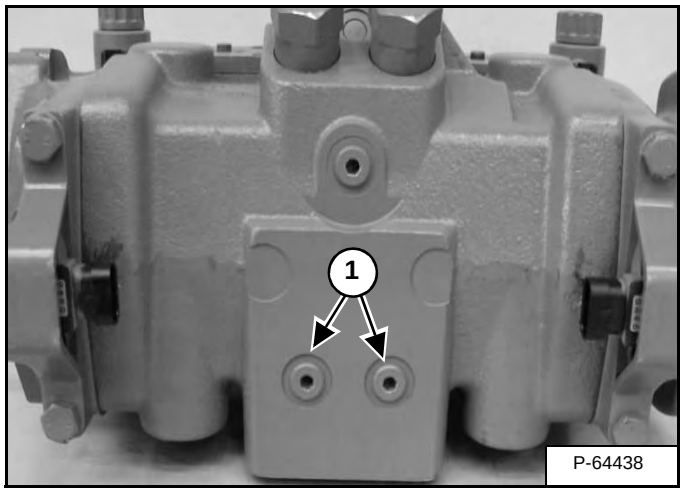


Remove the plugs (Item 1) **[Figure 30-51-81]** from the MB ports on the front side of the pump, and install 7500 PSI (241 bar) pressure gauges.

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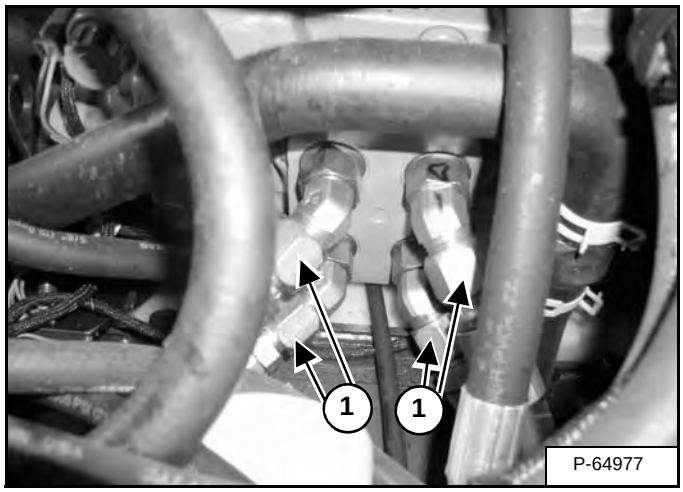
Mechanical Neutral Adjustment (Cont'd)

Figure 30-51-82



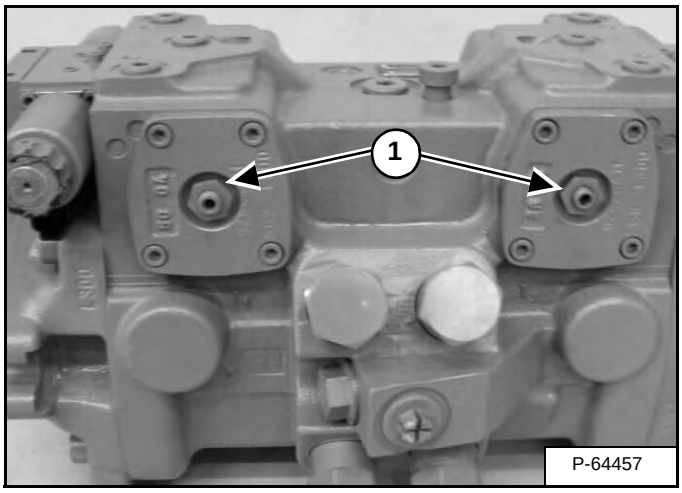
Remove the plugs (Item 1) **[Figure 30-51-82]** from the MA ports on the bottom of the pump, and install 7500 PSI pressure gauges.

Figure 30-51-83



Remove drive hoses from the A and B ports (Item 1) **[Figure 30-51-83]**. Plug the ports with metal caps. The caps must be able to handle at least 7500 PSI. Plugging the A and B ports eliminates leakage at the drive motors from causing errors in the pump mechanical neutral setting.

Figure 30-51-84



Loosen the pump neutral adjustment lock nut (Item 1) **[Figure 30-51-84]**.

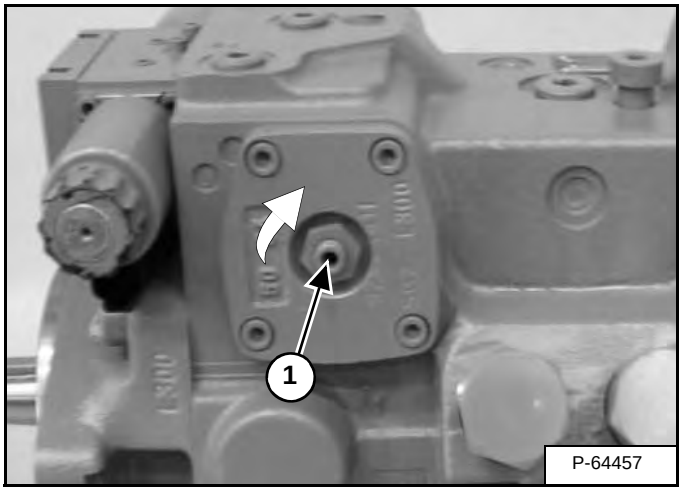
Start the loader using the remote start tool and run at an idle.

WARNING

Stay clear of the loader wheels. They will turn whenever the pump is not centered.

W-2276-1297

Figure 30-51-85

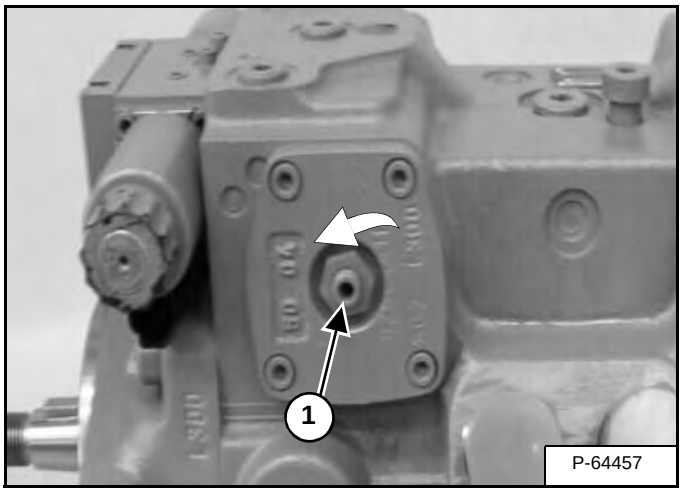


Turn the adjustment screw (Item 1) **[Figure 30-51-85]** clockwise, until one of the gauges registers an increase in system pressure. Mark the position of the adjustment screw.

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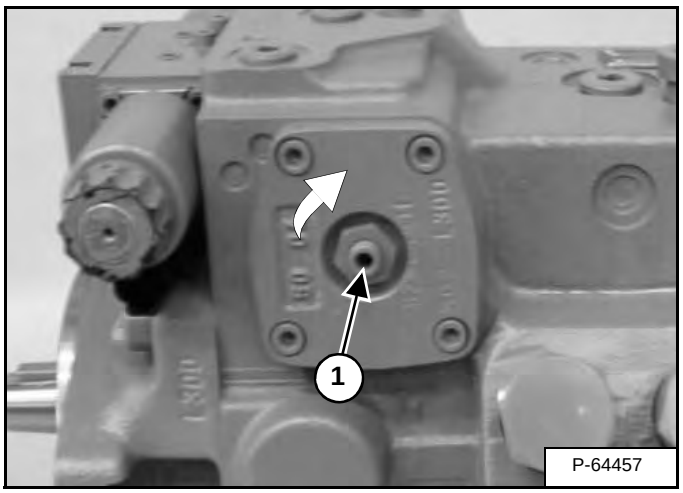
Mechanical Neutral Adjustment (Cont'd)

Figure 30-51-86



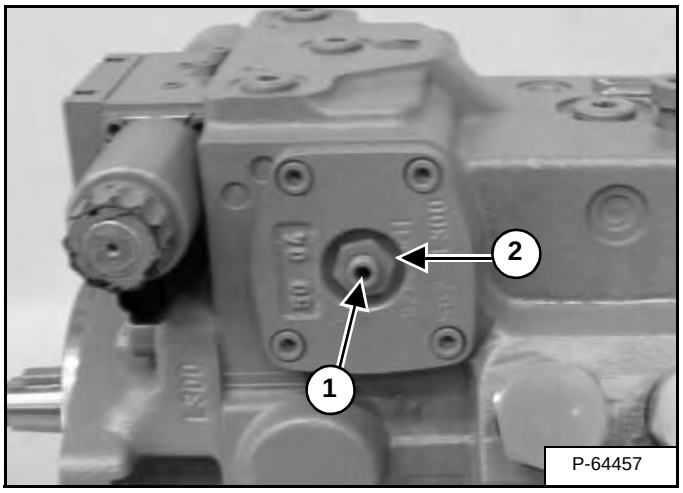
Turn the adjustment screw (Item 1) **[Figure 30-51-86]** counterclockwise, until the other gauge registers an increase in system pressure. Mark the position of the adjustment screw.

Figure 30-51-87



Turn the adjustment screw (Item 1) **[Figure 30-51-87]** clockwise, to a position halfway between the recorded positions. The pressure gauges should read equal pressures.

Figure 30-51-88



While holding the adjustment screw (Item 1) in position, tighten the lock nut (Item 2) **[Figure 30-51-88]** to 22 ft.-lb. (30 N•m) torque.

Shut loader OFF.

Remove the hydraulic hose from the X1 and X2 ports on the pump. Install the plugs and tighten to 18 ft.-lb. (25 N•m) torque.

Remove the pressure gauges from the MA and MB ports on the pump. Install the plugs and tighten to 18 ft.-lb. (25 N•m) torque.

NOTE: The Hydraulic Controller Neutral Adjustment must be performed whenever the Mechanical Neutral Adjustment is done. (See Hydraulic Controller Neutral Adjustment on Page 30-41-30.)

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Hydraulic Controller Neutral Adjustment

The hydraulic controller neutral adjustment, aligns the pump swash plate and the control spool so that a zero angle control setting provides a zero degree swash plate setting. This adjustment should be performed whenever any part of the control or swash plate mechanisms are adjusted or removed or after the pump mechanical neutral setting is adjusted. Ensure the pump mechanical neutral setting is correct before performing hydraulic controller neutral adjustments.

NOTE: Procedure is shown for the left side hydraulic controller. Procedure is the same for the right side hydraulic controller, except you disconnect the electrical connectors for the right side hydraulic controller and connect pressure gauges in the X1 and X2 ports on the right side of the pump.

Place the loader on jack stands. (See Procedure on Page 10-10-1.)

⚠ WARNING

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

W-2017-0286

Raise the lift arms, and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

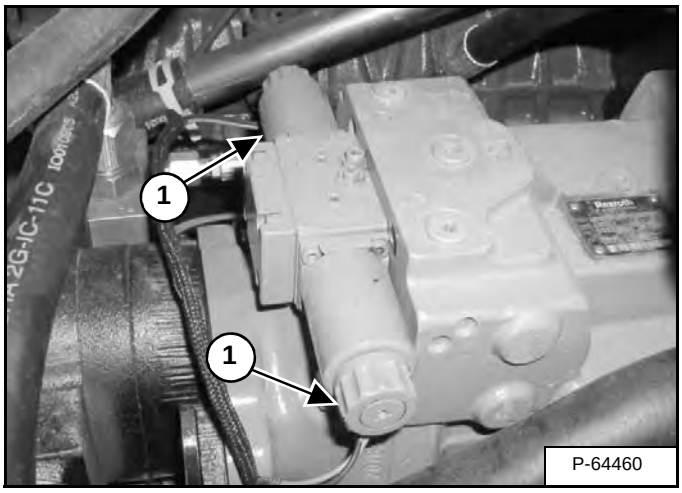
Connect the remote start tool. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.)

⚠ WARNING

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

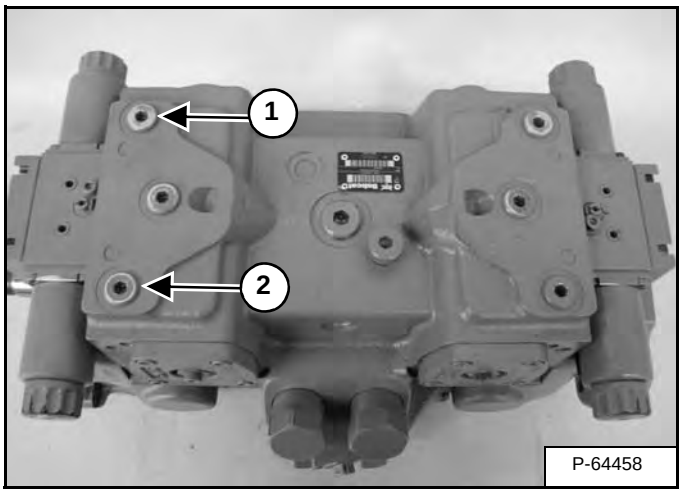
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Figure 30-51-89



Disconnect the hydraulic controller connectors (Item 1) **[Figure 30-51-89]** from the loader wiring harness for the hydraulic controller you are adjusting.

Figure 30-51-90

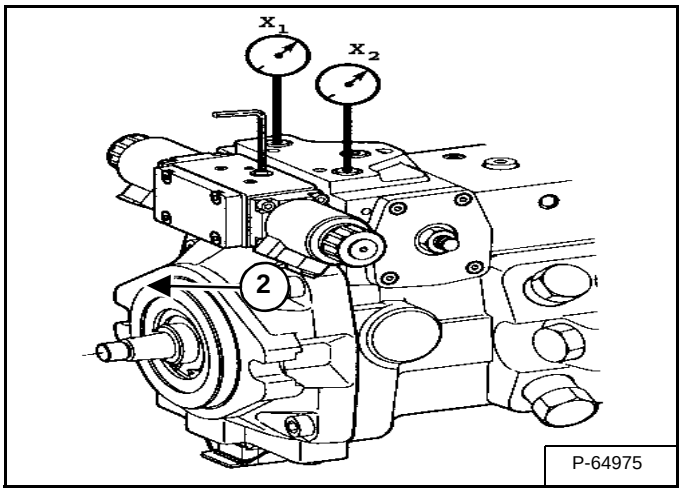


Remove the X1 plug (Item 1) and X2 plug (Item 2) **[Figure 30-51-90]** pertaining to the side of the hydrostatic pump you are adjusting.

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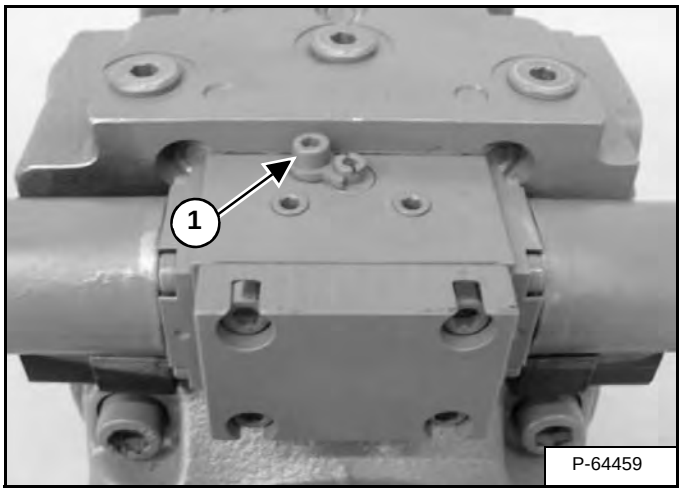
Hydraulic Controller Neutral Adjustment (Cont'd)

Figure 30-51-91



Install 500 PSI pressure gauges in the X1 and X2 ports pertaining to the side of the hydrostatic pump you are adjusting.

Figure 30-51-92



Loosen the locking screw (Item 1) **[Figure 30-51-92]**.

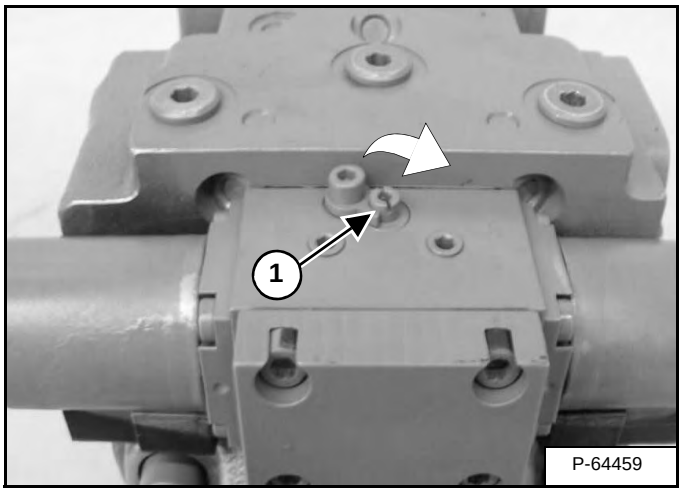
Start the loader using the remote start tool and run at an idle.

⚠ WARNING

Stay clear of the loader wheels. They will turn whenever the pump is not centered.

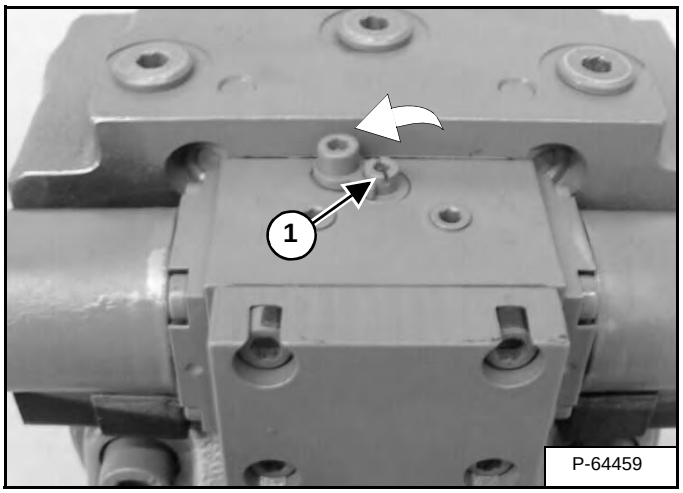
W-2276-1297

Figure 30-51-93



Turn the adjustment screw (Item 1) **[Figure 30-51-93]** clockwise, until one of the gauges registers an increase in system pressure. Mark the position of the adjustment screw.

Figure 30-51-94

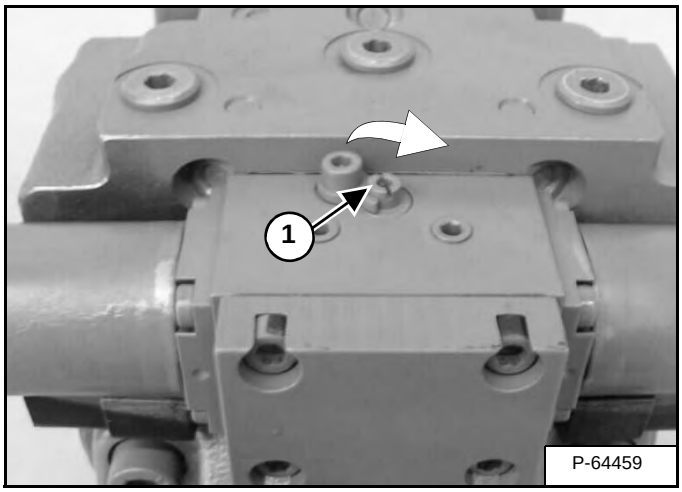


Turn the adjustment screw (Item 1) **[Figure 30-51-94]** counterclockwise, until the other gauge registers an increase in system pressure. Mark the position of the adjustment screw.

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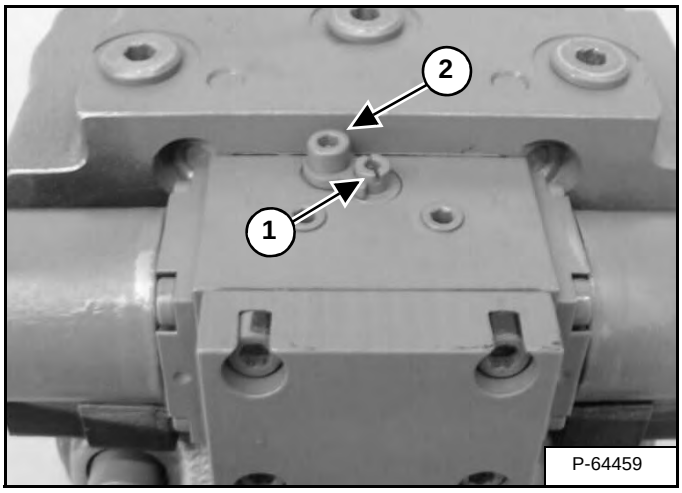
Hydraulic Controller Neutral Adjustment (Cont'd)

Figure 30-51-95



Turn the adjustment screw (Item 1) **[Figure 30-51-95]** clockwise, to a position halfway between the recorded positions. The pressure gauges should read equal pressures.

Figure 30-51-96



While holding the adjustment screw (Item 1) in position, tighten the locking screw (Item 2) **[Figure 30-51-96]** to 4.5 ft.-lb. (6,1 N•m) torque.

Shut loader OFF.

Remove the pressure gauges from the X1 and X2 ports on the pump. Install the plugs and tighten to 18 ft.-lb. (25 N•m) torque.

Connect the hydraulic controller wire connectors to the loader wiring harness.

Perform a controller calibration procedure. (See Lift And Tilt Calibration (SJC) on Page 60-160-5.)

Perform a hydrostatic pump calibration procedure. (See Hydrostatic Pump Calibration (SJC) on Page 60-160-7.)

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DRIVE BELT

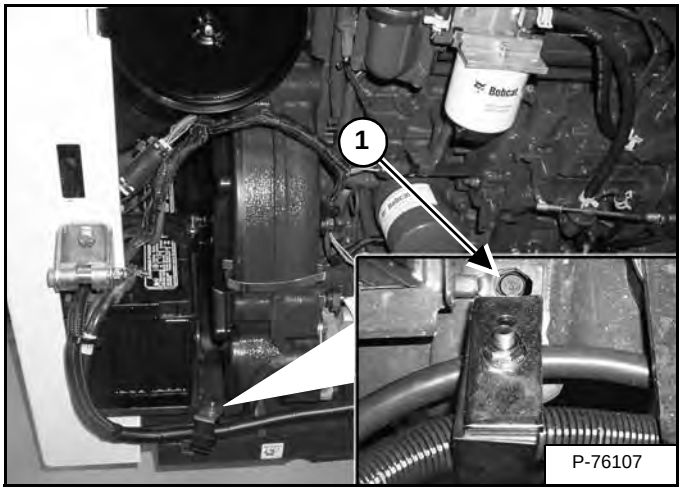
Description

The drive belt connects the engine to the hydrostatic pumps. The drive belt is tighten by a spring tensioner and is covered by a shield to protect operator.

The drive belt is located on the flywheel side of the engine by the battery.

Drive Belt Shield Removal And Installation

Figure 30-60-1



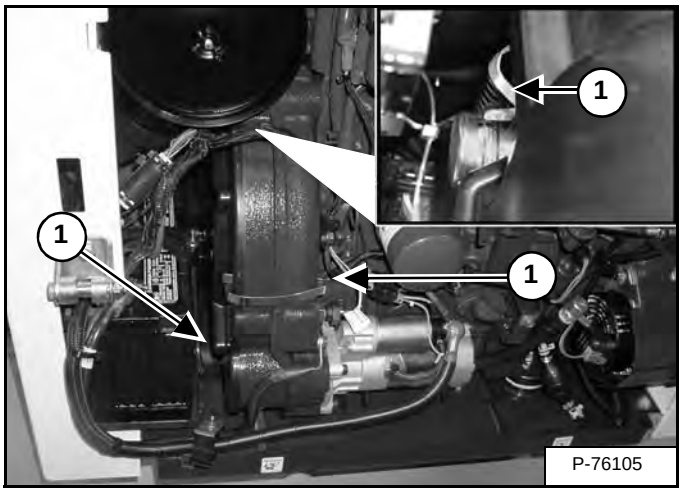
Stop the engine.

Open the rear door.

Remove the bolt (Item 1) **[Figure 30-60-1]** from the cable bracket.

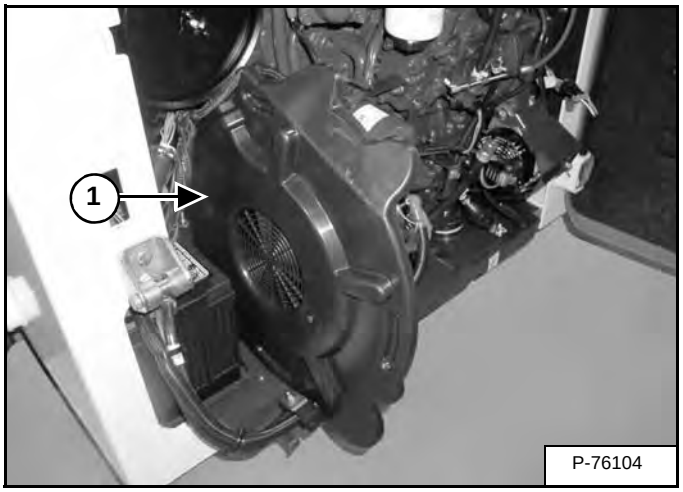
Move the cable to allow removal of the drive shield.

Figure 30-60-2



Remove the three drive belt shield clips (Item 1) **[Figure 30-60-2]**.

Figure 30-60-3



Remove the drive belt shield (Item 1) **[Figure 30-60-3]** from the drive belt housing.

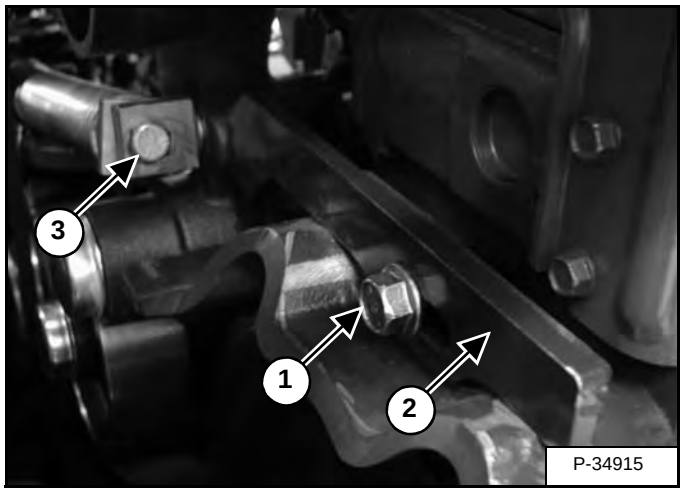
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Adjusting

The drive belt does not need adjustment. The belt has a spring loaded idler which is constantly adjusted.

Belt Removal And Installation

Figure 30-60-4

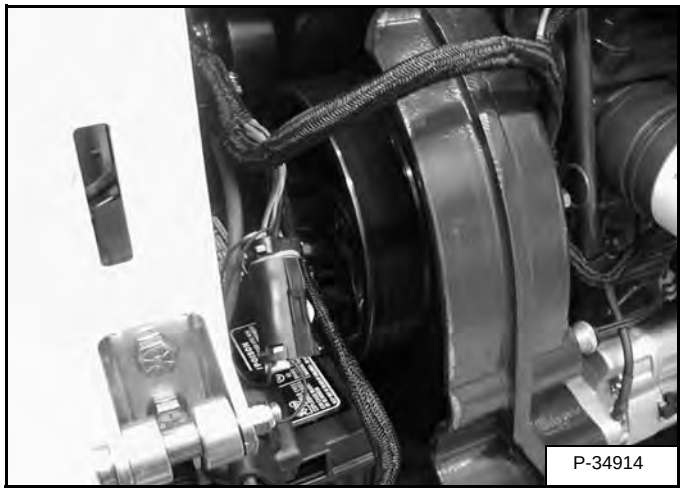


Remove the engine air cleaner. (See Housing Removal And Installation on Page 70-40-1.)

Loosen the stop mounting bolt (Item 1) **[Figure 30-60-4]**.

Loosen the spring tension bolt (Item 3) **[Figure 30-60-4]**.

Figure 30-60-5

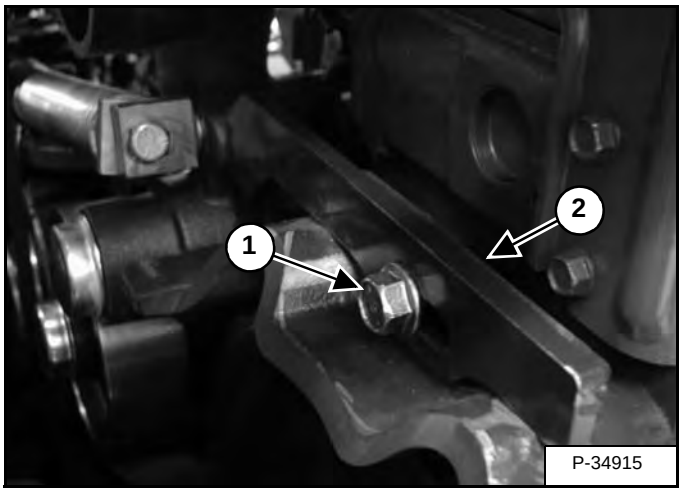


Remove the drive belt from the hydrostatic pump pulley and flywheel pulley **[Figure 30-60-5]**.

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Tensioner Pulley Removal And Installation

Figure 30-60-6



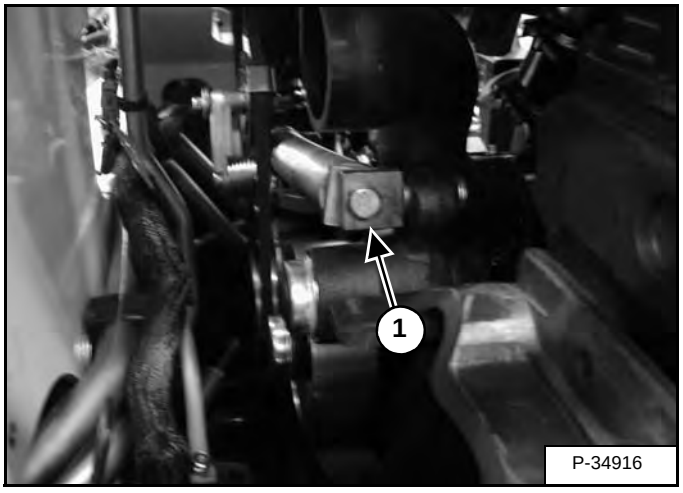
Remove the belt shield. (See Drive Belt Shield Removal And Installation on Page 30-50-1.)

Remove the engine air cleaner. (See Housing Removal And Installation on Page 70-40-1.)

Remove the stop mounting bolt (Item 1) **[Figure 30-60-6]**.

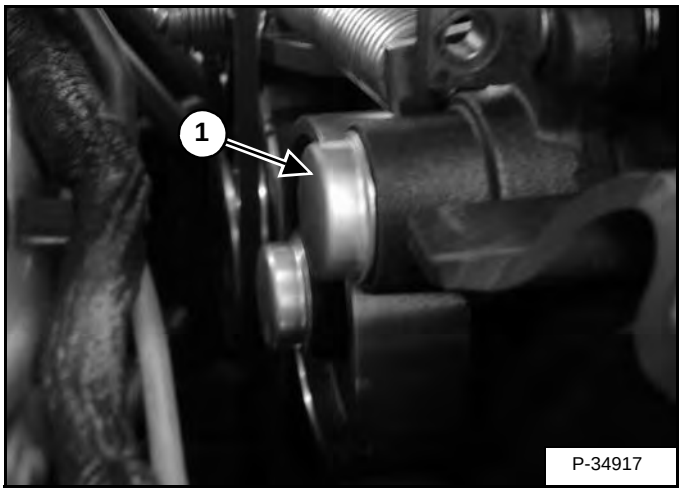
Remove the stop (Item 2) **[Figure 30-60-6]**.

Figure 30-60-7



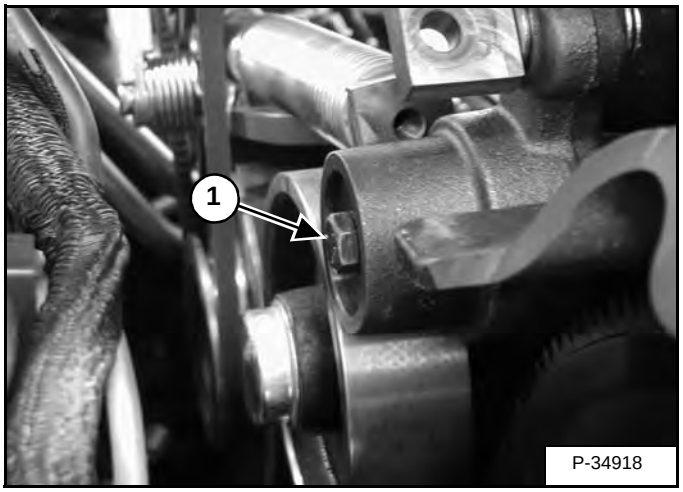
Remove the spring tension bolt (Item 1) **[Figure 30-60-7]**.

Figure 30-60-8



Remove the end cap (Item 1) **[Figure 30-60-8]** from the tension pulley arm.

Figure 30-60-9

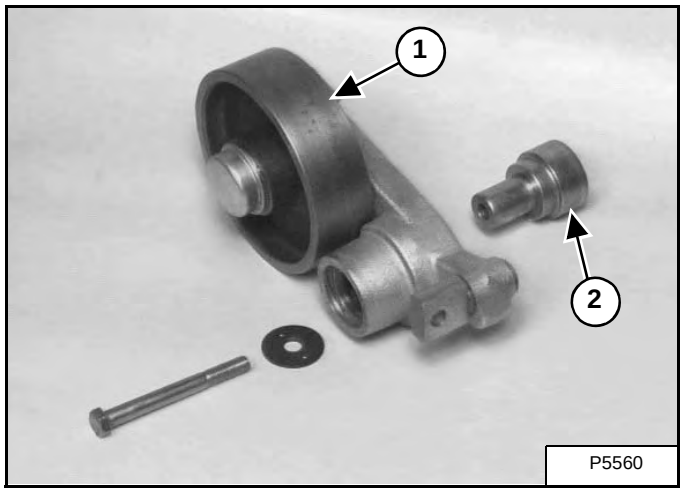


Remove the mounting bolt (Item 1) **[Figure 30-60-9]** from the tension pulley arm.

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Tensioner Pulley Removal And Installation (Cont'd)

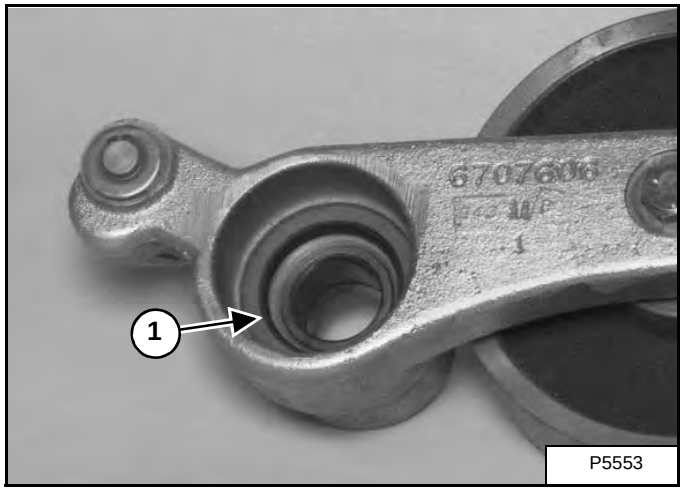
Figure 30-60-10



Remove the pulley/arm assembly (Item 1) **[Figure 30-60-10]** from the engine housing.

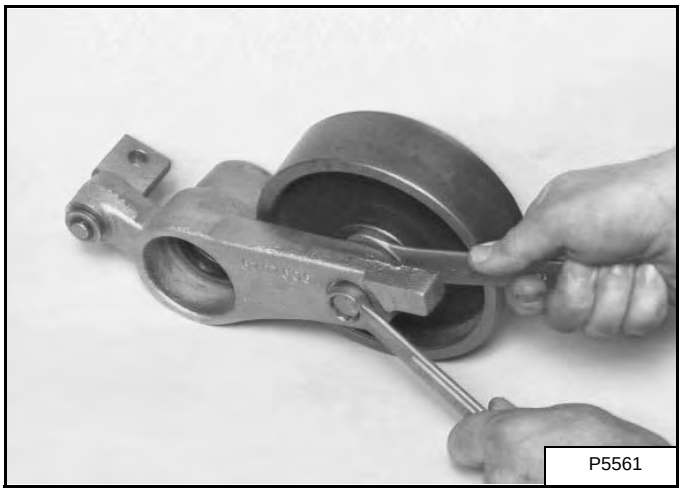
Remove the arm bushing (Item 2) **[Figure 30-60-10]**. Check for wear and replace as needed.

Figure 30-60-11



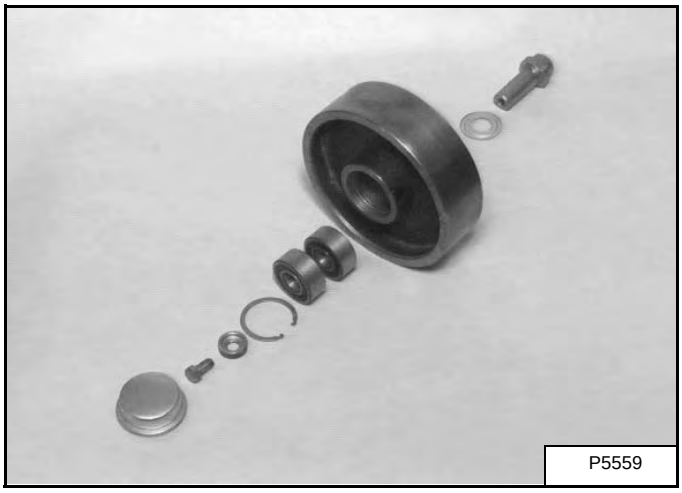
Check the arm seal (Item 1) **[Figure 30-60-11]**. Replace the seal as needed.

Figure 30-60-12



Remove the pulley mounting bolt **[Figure 30-60-12]**.

Figure 30-60-13



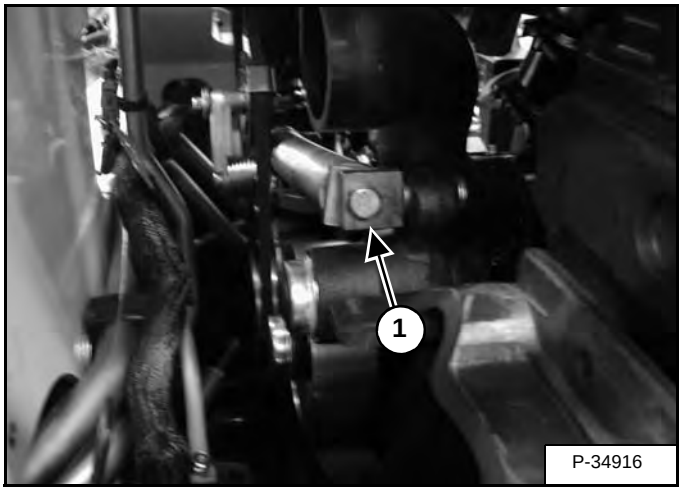
Disassembly the pulley and bearings as shown in figure **[Figure 30-60-13]**.

Check the parts for wear and replace as needed.

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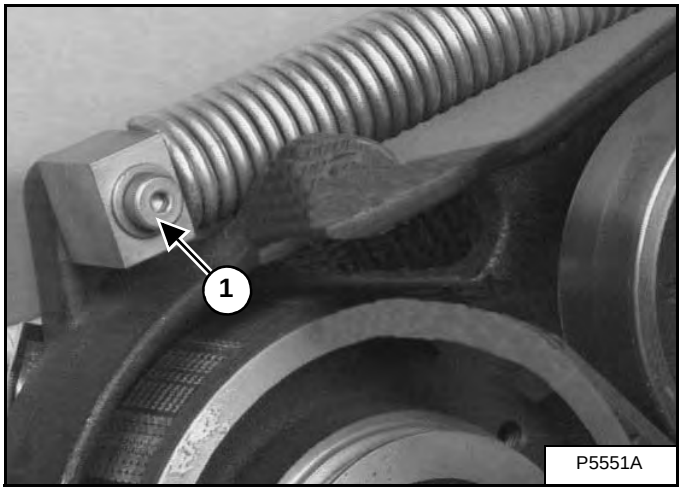
Tensioner Pulley Tension Spring Removal And Installation

Figure 30-60-14



Remove the spring tension bolt (Item 1) **[Figure 30-60-14]**.

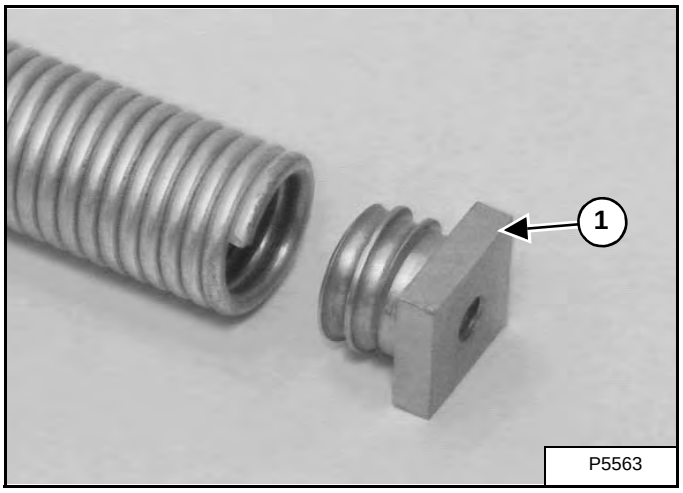
Figure 30-60-15



Remove the base end bolt (Item 1) **[Figure 30-60-15]** from the spring block.

Remove the tension spring from the engine housing.

Figure 30-60-16



Remove the end block (Item 1) **[Figure 30-60-16]** (both ends) from the spring.

Check the spring for wear and etc. Replace the spring as needed.

Check the spring end blocks for wear and replace as needed.

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CASE DRAIN FILTER

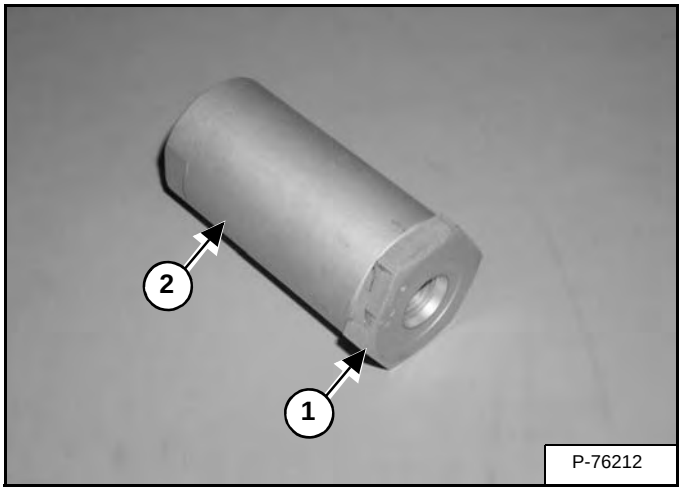
Description

The case drain filter is an external filter assembly in the case drain circuit that filters the case drain hydraulic oil. The case drain filter can be replaced as a complete assembly or disassembled to replace the element with an element kit and/or the spring kit purchased from Bobcat Parts.

Disassembly And Assembly

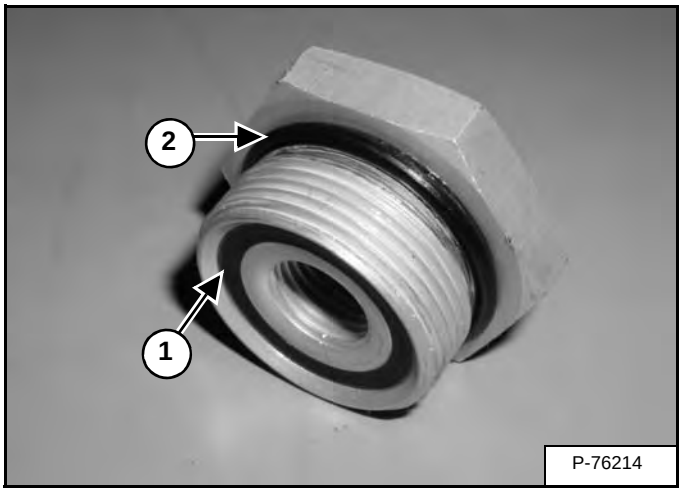
Remove the case drain filter(s) from the machine. (See Removing And Replacing Hydraulic Fluid on Page 10-120-2.) and (See Removing And Replacing Case Drain Filters on Page 10-120-4.)

Figure 30-70-1



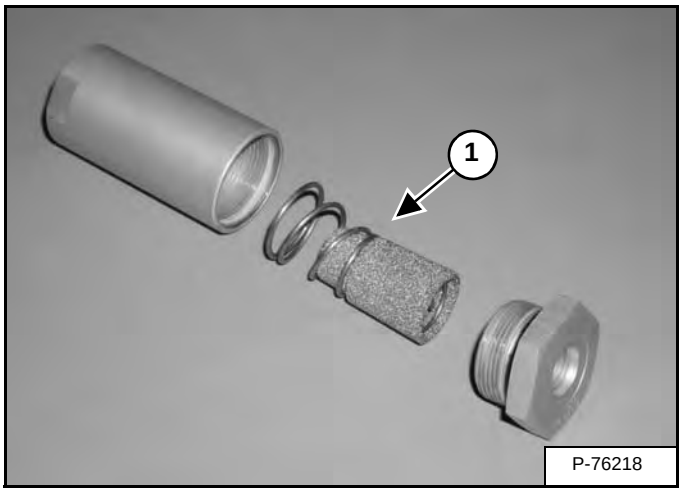
Remove the filter housing nut (Item 1) from the filter housing (Item 2) **[Figure 30-70-1]**.

Figure 30-70-2



Remove the packing (Item 1) and O-ring (Item 2) **[Figure 30-70-2]** from the filter housing nut.

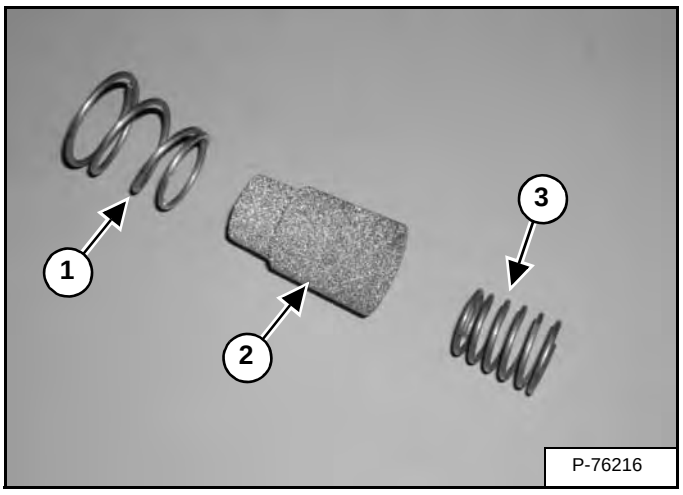
Figure 30-70-3



Remove the filter element and spring assembly (Item 1) **[Figure 30-70-3]**

NOTE: Remember the orientation of the filter element and spring assembly for correct assembly.

Figure 30-70-4



The larger taper spring (Item 1) slides over the end of the filter element (Item 2) and the smaller tapered spring (Item 3) **[Figure 30-70-4]** slides into the filter element.

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DRIVE SYSTEM

BRAKE (S/N 530714318 & BELOW AND 530811605 & BELOW) . 40-10-1
- Description 40-10-1
- Disc Removal And Installation 40-10-2

BRAKE (S/N 530714319 & ABOVE AND 530811606 & ABOVE) . . .40-11-1
- Description 40-11-1
- Disc Removal And Installation 40-11-2

BRAKE (TWO-SPEED) 40-12-1
- Block Disassembly And Assembly 40-12-4
- Block Removal And Installation 40-12-2
- Description 40-12-1

CHAINCASE 40-30-1
- Center Cover Removal And Installation 40-30-2
- Description 40-30-1
- Front Cover Removal And Installation 40-30-1
- Rear Cover Removal And Installation 40-30-3

DRIVE COMPONENTS. 40-20-1
- Axle Seal Removal And Installation 40-20-2
- Axle, Sprocket And Bearings Removal And Installation. 40-20-4
- Chain Removal And Installation 40-20-9
- Description 40-20-1

TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.

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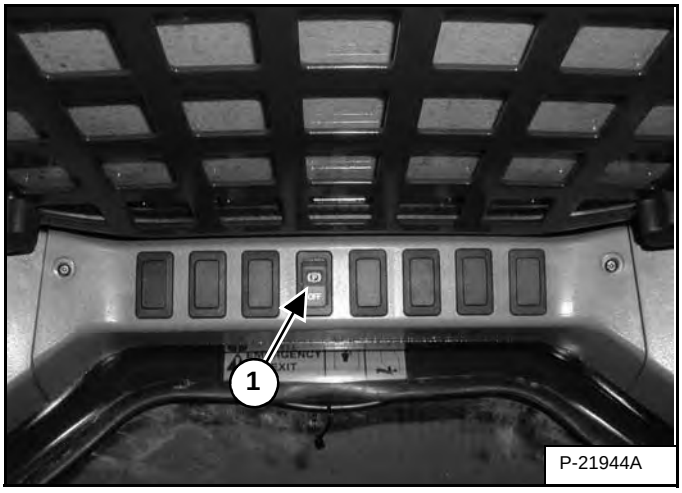


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BRAKE (S/N 530714318 & BELOW AND 530811605 & BELOW)

Description

Figure 40-10-1



The brake is used to hold the machine in place. The brake is operated by a switch (Item 1) **[Figure 40-10-1]** located on the front accessory panel.

The brake is applied by a spring-loaded wedge that drops into two notched brake discs attached to the motor carrier shafts. An electric solenoid is sent power from a relay to pull the wedge away from the discs. A signal from the main Bobcat controller holds the wedge away from the discs.

The hold signal will be interrupted and the wedge will drop if the engine RPM drops below 700 RPM, the seat bar sensor fails or if there is a break in the wires for the brake solenoid.

For more information on the brake. (See TRACTION LOCK on Page 60-120-1.)

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Disc Removal And Installation

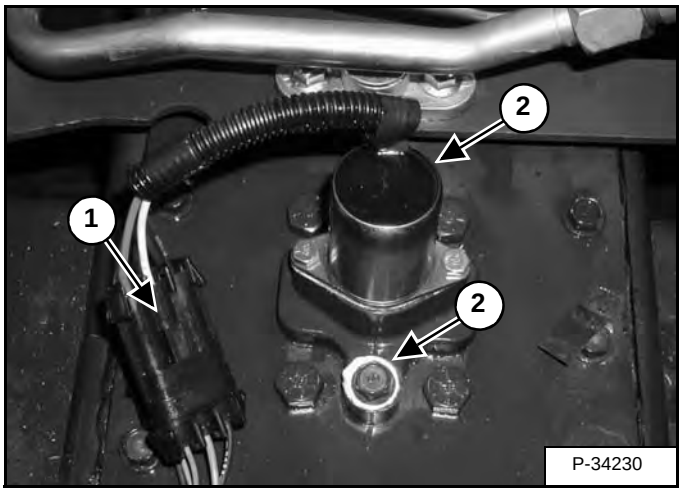


WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Figure 40-10-2



Raise the lift arms and install an approved lift arm support device. (See Procedure on Page 10-10-1.)

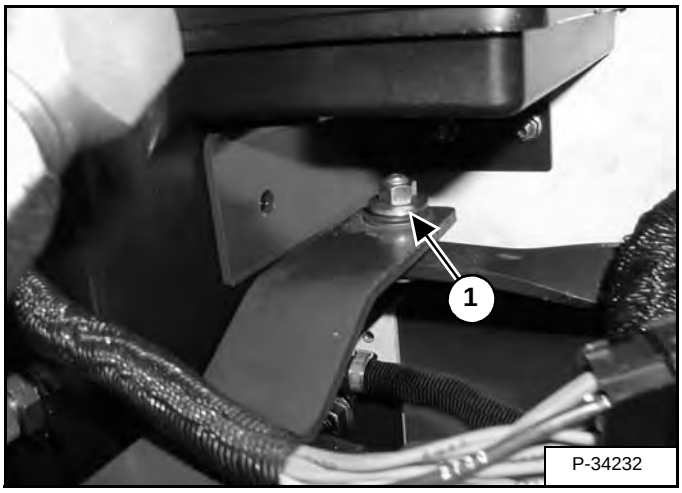
Raise the operator cab. (See Installing on Page 10-20-1.)

Disconnect the wiring connector (Item 1) **[Figure 40-10-2]** at the traction lock solenoid.

Remove the two mount bolts (Item 2) **[Figure 40-10-2]** from the traction lock mount, and remove the traction lock solenoid and mount bracket from the loader.

Remove the crossbar linkage. (See Linkage Removal And Installation on Page 50-90-3.)

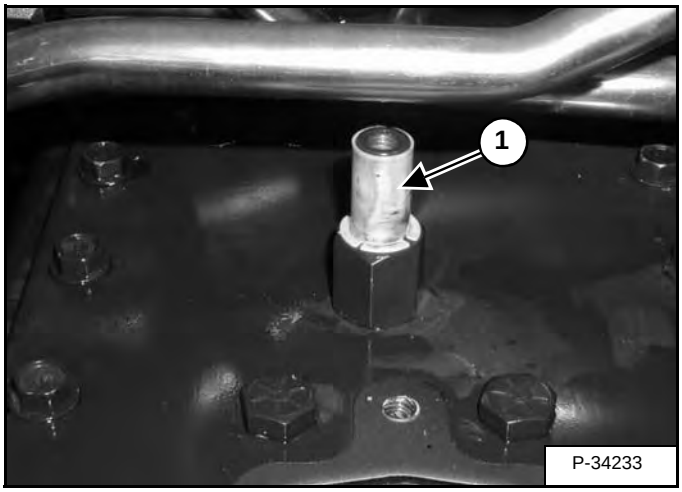
Figure 40-10-3



Remove the nut and bolt (Item 1) **[Figure 40-10-3]** that attaches the lift linkage to the crossmember.

Remove the crossmember from the pivot.

Figure 40-10-4

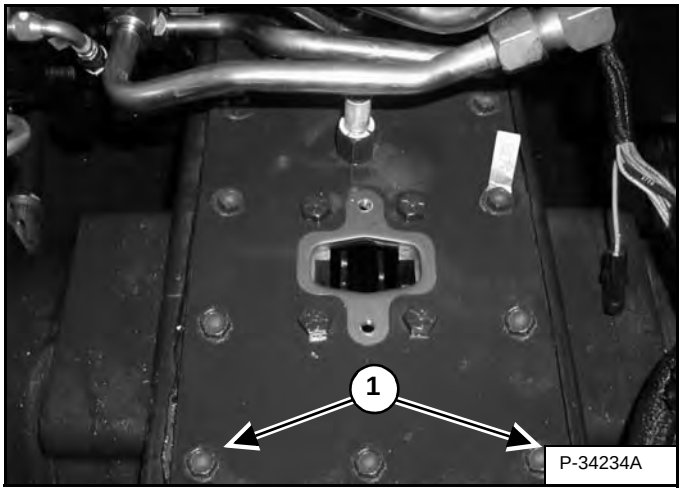


Installation: Check the nylon bushing (Item 1) **[Figure 40-10-4]** for wear and replace as needed.

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Disc Removal And Installation (Cont'd)

Figure 40-10-5

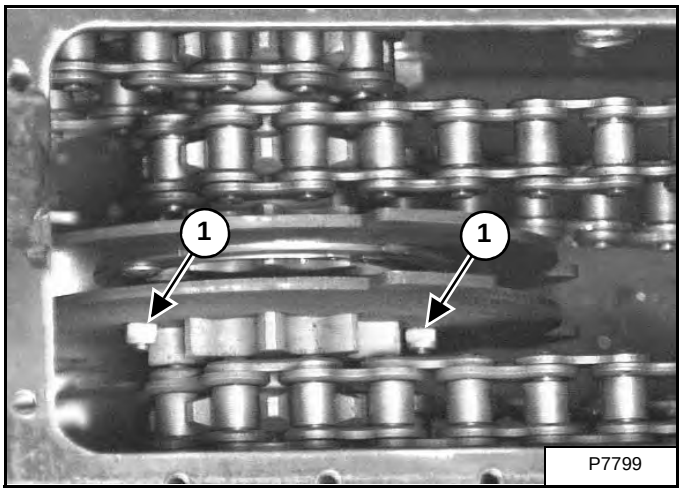


Remove the twelve center cover mounting bolts (Item 1) **[Figure 40-10-5]**.

Remove the center chaincase cover/guide assembly.

Installation: Clean the chaincase cover to remove all old sealant and apply new polyurethane sealant to the chaincase cover, chaincase cover bolt threads and the chaincase.

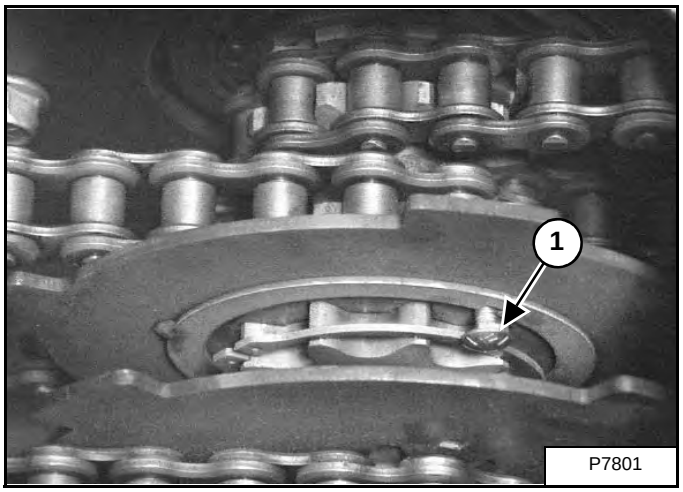
Figure 40-10-6



Remove the two nuts (Item 1) **[Figure 40-10-6]** from the disc bolts.

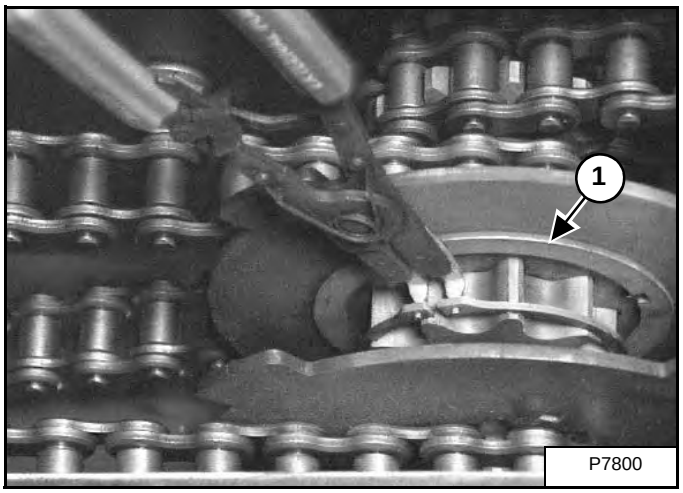
NOTE: To remove the brake disc and snap ring on some earlier models it will be required that the motor carrier bolts be loosened. This will allow enough room for the snap ring pliers. (See Removal and Installation on Page 30-30-2.)

Figure 40-10-7



Remove the two disc bolts (Item 1) **[Figure 40-10-7]** from the disc.

Figure 40-10-8



A snap ring pliers with 905 tips are needed for removing the brake disc snap ring.

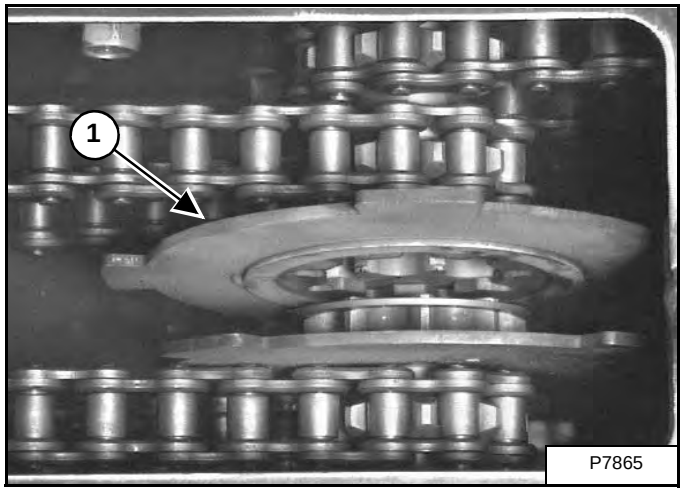
Pull the disc away from snap ring.

Remove the snap ring (Item 1) **[Figure 40-10-8]** from the end of the carrier shaft.

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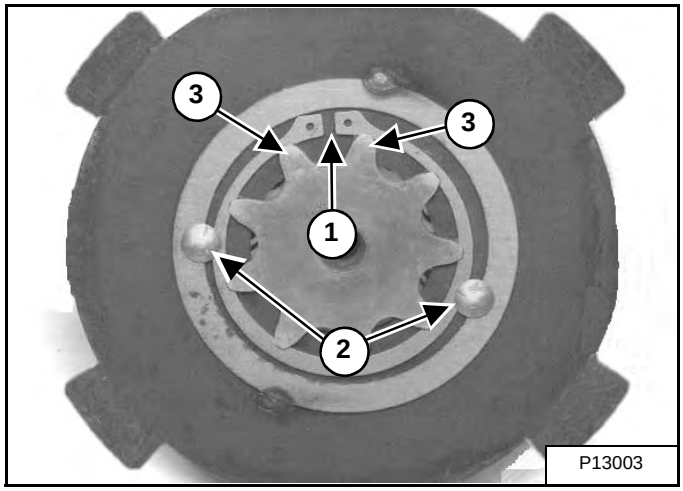
Disc Removal And Installation (Cont'd)

Figure 40-10-9



Remove the disc (Item 1) **[Figure 40-10-9]** from the shaft.

Figure 40-10-10



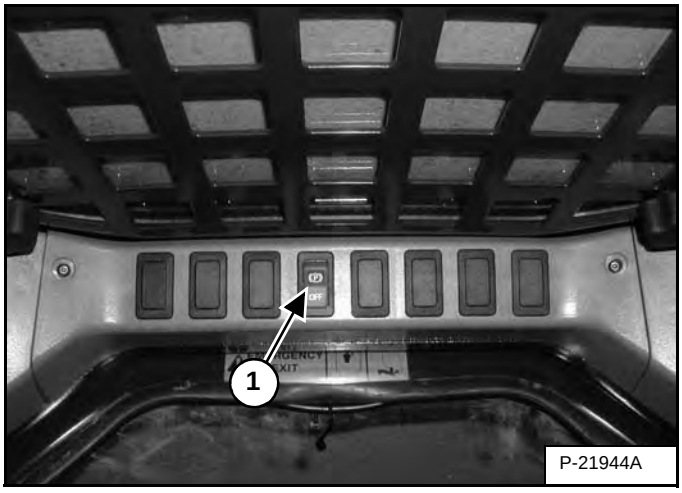
Installation: Bolting the disc to the snap ring provides proper disc alignment. Disc and shaft are shown removed for photo clarity. The snap ring end gap (Item 1) **[Figure 40-10-10]** must be between the disc bolts (Item 2) **[Figure 40-10-10]** and sprocket teeth (Item 3) **[Figure 40-10-10]** after the brake disc is installed on the shaft.

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BRAKE (S/N 530714319 & ABOVE AND 530811606 & ABOVE)

Description

Figure 40-11-1



The brake is used to hold the machine in place. The brake is operated by a switch (Item 1) **[Figure 40-11-1]** located on the front accessory panel.

The brake is applied by a spring-loaded wedge that drops into two notched brake discs attached to the motor carrier shafts. An electric solenoid receives power from a relay to pull the wedge away from the discs. A signal from the main Bobcat controller holds the wedge away from the discs.

The hold signal will be interrupted and the wedge will drop if the engine RPM drops below 700 RPM, the seat bar sensor fails or if there is a break in the wires to the brake solenoid.

For more information on the brake (See TRACTION LOCK on Page 60-120-1.)

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BRAKE (S/N 530714319 & ABOVE AND 530811606 & ABOVE) (CONT'D)

Disc Removal And Installation



WARNING

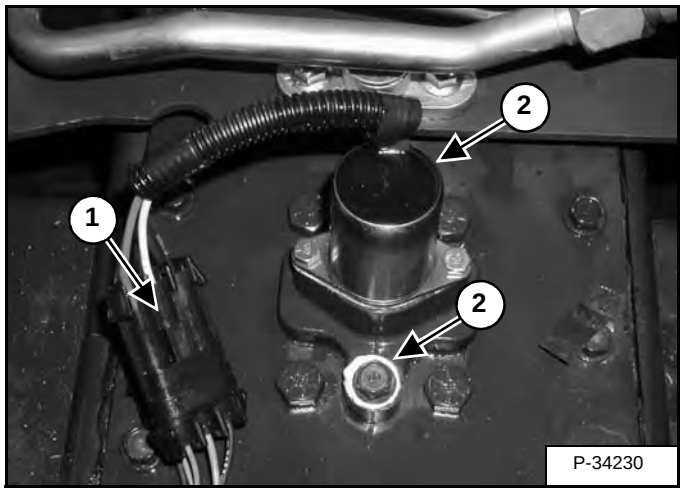
Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Raise the lift arms and install an approved lift arm support device. (See Procedure on Page 10-10-1.)

Raise the operator cab.

Figure 40-11-2

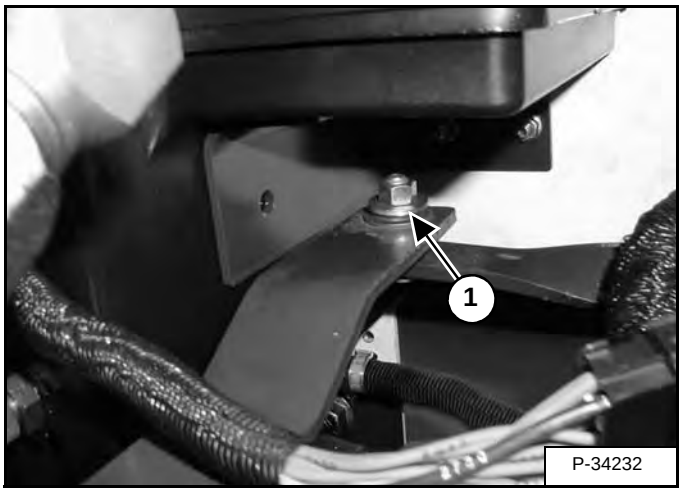


Disconnect the wiring connector (Item 1) **[Figure 40-11-2]** at the traction lock solenoid.

Remove the two mount bolts (Item 2) **[Figure 40-11-2]** from the traction lock mount, and remove the traction lock solenoid and mount bracket from the loader.

Remove the crossbar linkage. (See Linkage Removal And Installation on Page 50-90-3.)

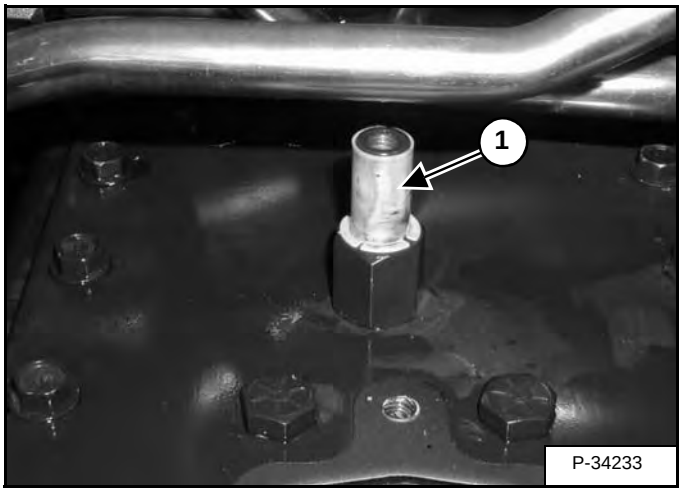
Figure 40-11-3



Remove the nut and bolt (Item 1) **[Figure 40-11-3]** that attaches the lift linkage to the crossmember.

Remove the crossmember from the pivot.

Figure 40-11-4



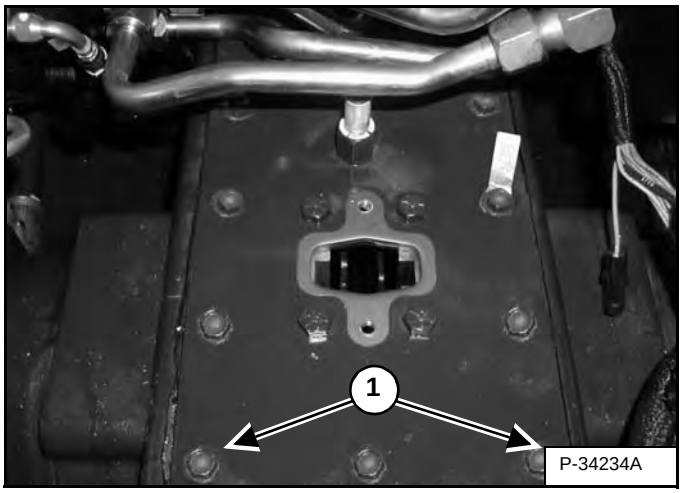
Installation: Check the nylon bushing (Item 1) **[Figure 40-11-4]** for wear and replace as needed.

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BRAKE (S/N 530714319 & ABOVE AND 530811606 & ABOVE) (CONT'D)

Disc Removal And Installation (Cont'd)

Figure 40-11-5

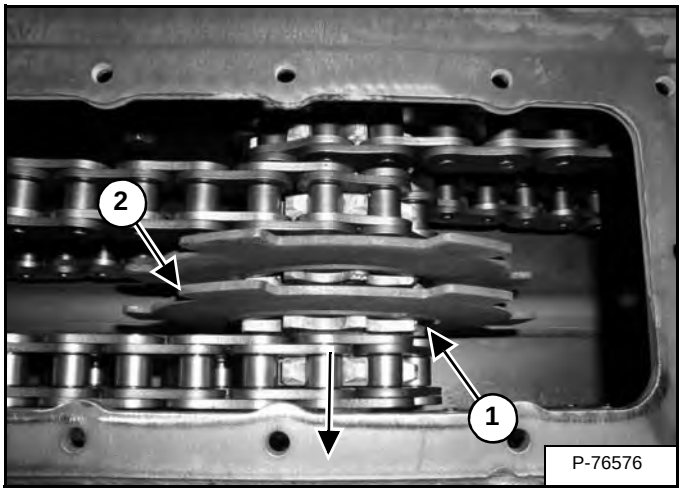


Remove the twelve mounting bolts from the center cover (Item 1) **[Figure 40-11-5]**.

Remove the center chaincase cover / guide assembly.

Installation: Clean the chaincase cover to remove all old sealant and apply new polyurethane sealant to the chaincase cover, chaincase cover bolt threads and the chaincase.

Figure 40-11-6

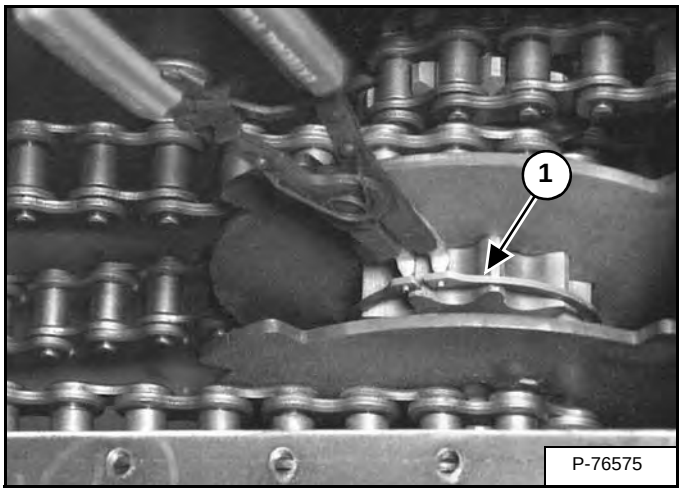


Using a snap ring pliers move the inside snap ring (Item 1) **[Figure 40-11-6]** towards the motor carrier.

Slide the disk (Item 2) **[Figure 40-11-6]** towards the motor carrier.

NOTE: To remove the brake disc and snap ring on some earlier models it will be required that the motor carrier bolts be loosened. This will allow enough room for the snap ring pliers. (See Removal and Installation on Page 30-30-2.)

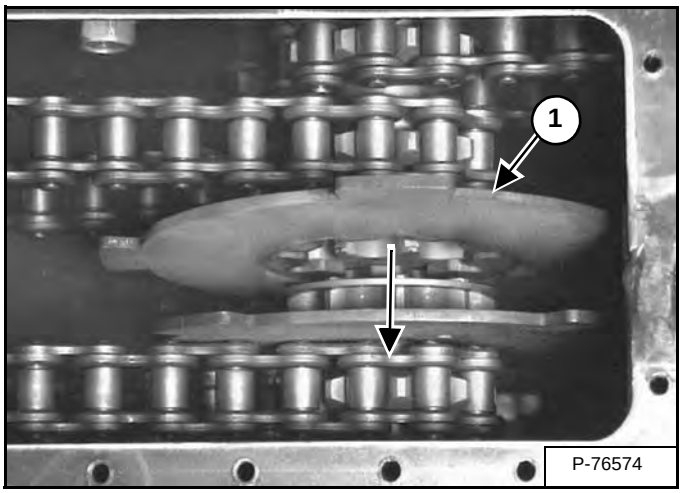
Figure 40-11-7



Snap ring pliers with 90° tips are needed for removing the brake disc snap ring.

Remove the snap ring (Item 1) **[Figure 40-11-7]** from the end of the carrier shaft.

Figure 40-11-8



Slide the disk (Item 1) **[Figure 40-11-8]** off the shaft.

There is now enough room to access the outside snap ring on the opposite shaft.

Remove the outside snap ring and slide the disk off the shaft.

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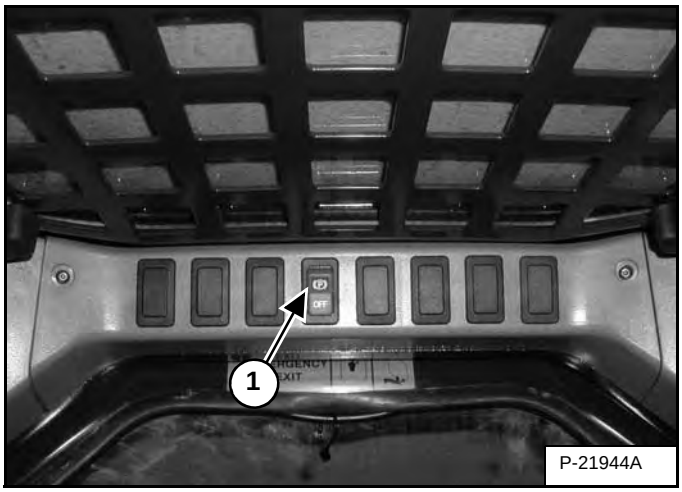


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BRAKE (TWO-SPEED)

Description

Figure 40-12-1



The brake is used to hold the machine in place. The brake is operated by a switch (Item 1) **[Figure 40-12-1]** located on the front accessory panel.

The brake is a spring applied pressure release system, which is self contained on the end of each drive motor.

The brake block solenoid is sent power from a relay to open the circuit which releases the charge pressure oil to the brakes. The charge pressure oil pushes the spring away from the brake discs allowing the drive motor to move.

A signal from the main Bobcat controller holds the brake solenoid open to allow constant flow of the charge pressure oil to hold the spring away from the brake discs.

When the hold signal is interrupted the solenoid will close the circuit and the charge oil will be shut off an the spring will apply the brakes. This will happen if the engine rpm drops below a set rpm, the seat bar sensor fails or if there is a break in the wires for the brake block solenoid.

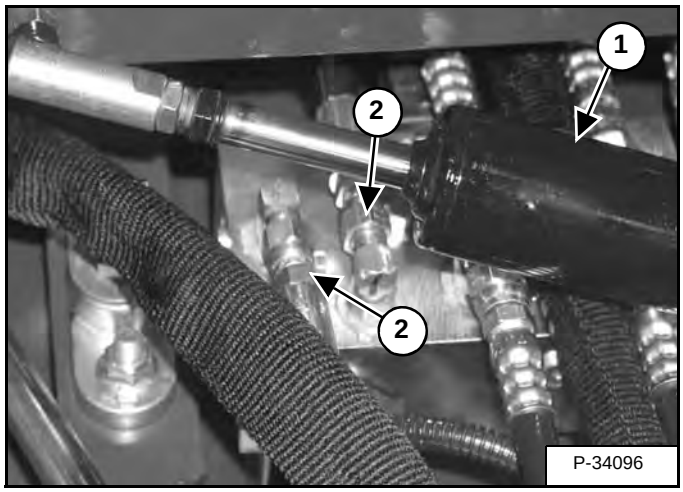
For more information on the brake. (See TRACTION LOCK on Page 60-120-1.)

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BRAKE (TWO-SPEED) (CONT'D)

Block Removal And Installation

Figure 40-12-2



Lift and block the loader. (See Procedure on Page 10-10-1.)

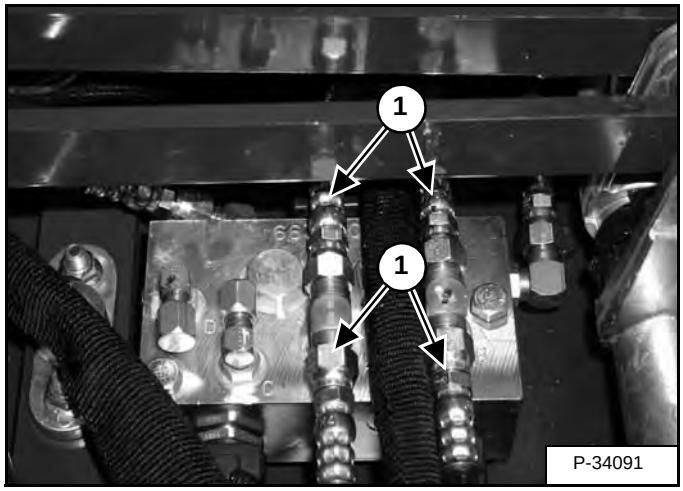
Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the steering shock (Item 1) **[Figure 40-12-2]**.

Mark all hydraulic hoses for proper installation.

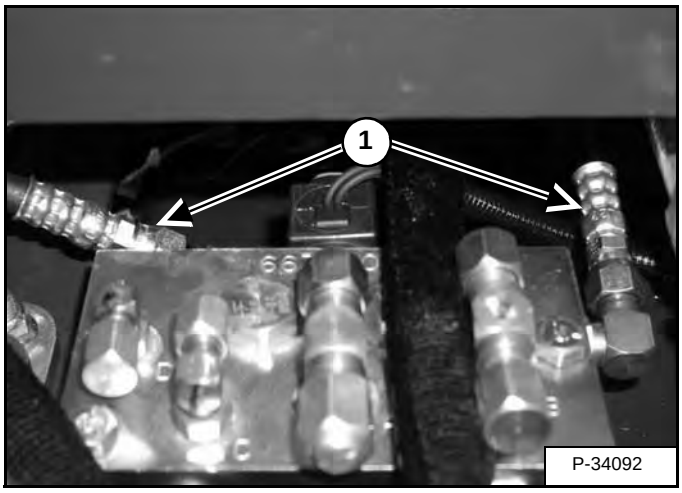
Disconnect the two hydraulic hoses (Item 2) **[Figure 40-12-2]** from the brake/two speed block.

Figure 40-12-3



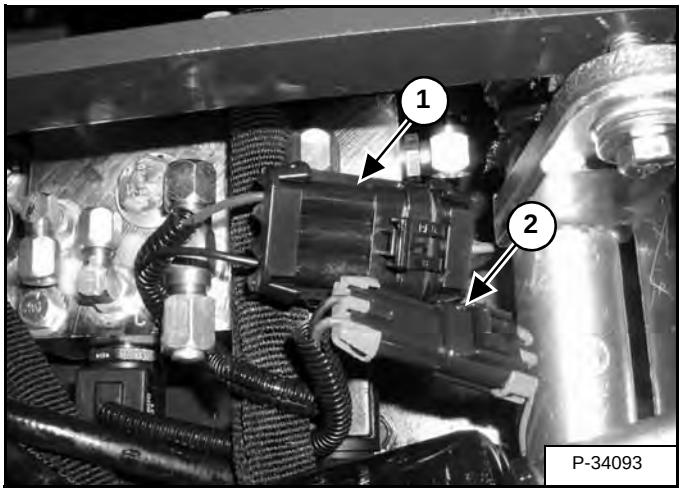
Disconnect the four hydraulic hoses (Item 1) **[Figure 40-12-3]** from the brake/two speed block.

Figure 40-12-4



Disconnect the two hydraulic hoses (Item 1) **[Figure 40-12-4]** from the brake/two speed block.

Figure 40-12-5



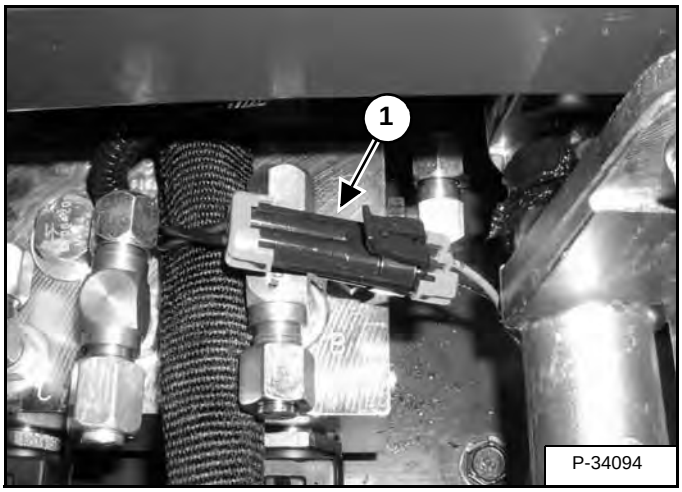
Disconnect the wire harness connector (Item 1) **[Figure 40-12-5]** from the brake solenoid.

Disconnect the wire harness connector (Item 2) **[Figure 40-12-5]** from the two speed solenoid.

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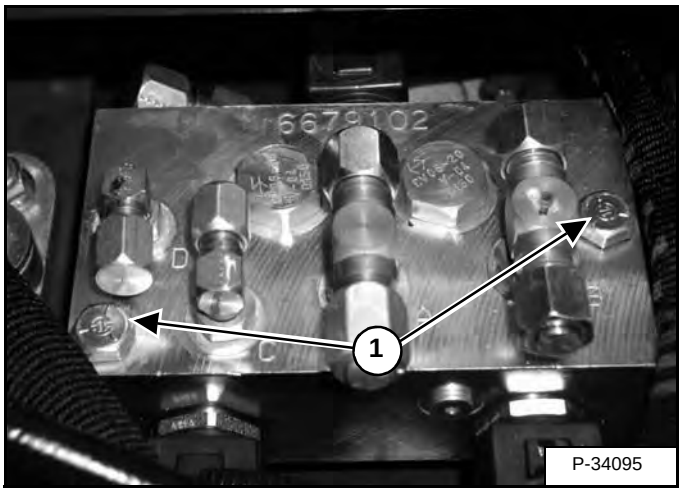
Block Removal And Installation (Cont'd)

Figure 40-12-6



Disconnect the wire harness connector (Item 1) **[Figure 40-12-6]** from the make-up valve solenoid.

Figure 40-12-7



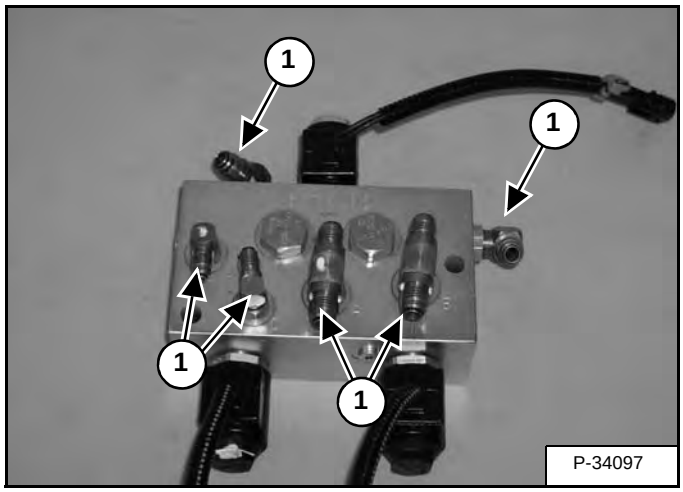
Remove the two mounting bolts (Item 1) **[Figure 40-12-7]** from the valve.

Remove the brake/two-speed block from the loader.

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Block Disassembly And Assembly

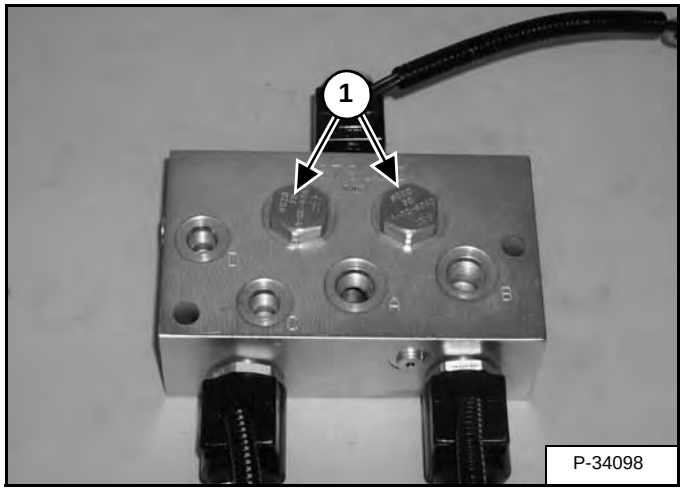
Figure 40-12-8



Mark all hydraulic hoses and fittings for proper installation.

Remove the hydraulic fittings (Item 1) **[Figure 40-12-8]** from the block.

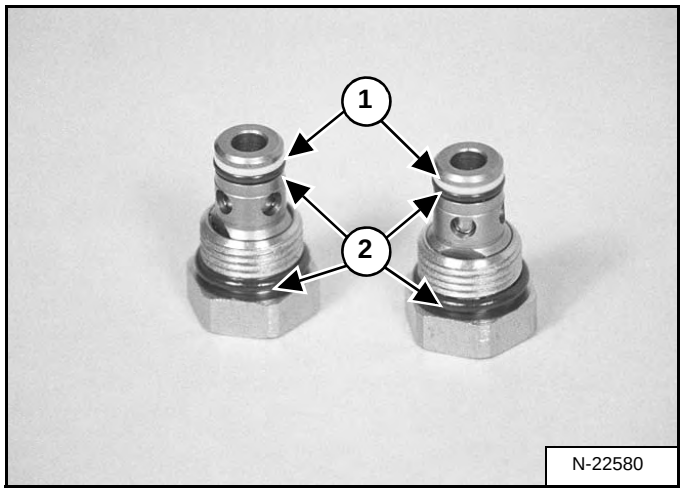
Figure 40-12-9



Remove the check valves (Items 1 & 2) **[Figure 40-12-9]** from the two-speed valve.

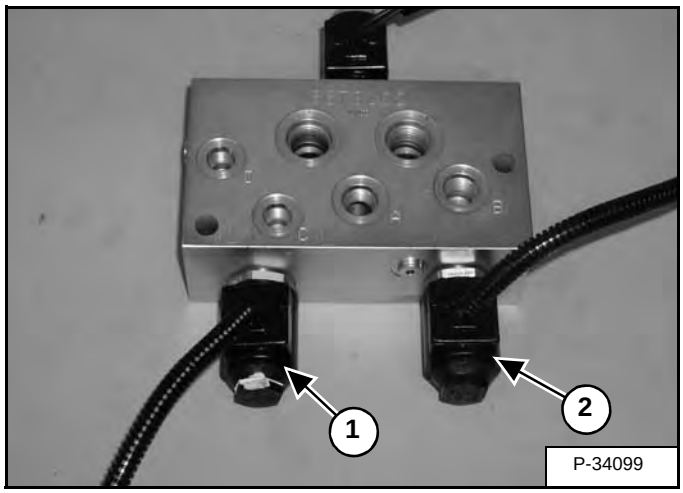
NOTE: The check valves (Items 1 & 2) [Figure 40-12-9] are interchangeable.

Figure 40-12-10



Check the back-up washers (Item 1) **[Figure 40-12-10]** and O-rings (Item 2) **[Figure 40-12-10]** for wear and replace as needed.

Figure 40-12-11



Loosen the electrical solenoid nut (Item 1) **[Figure 40-12-11]** from the make-up valve solenoid.

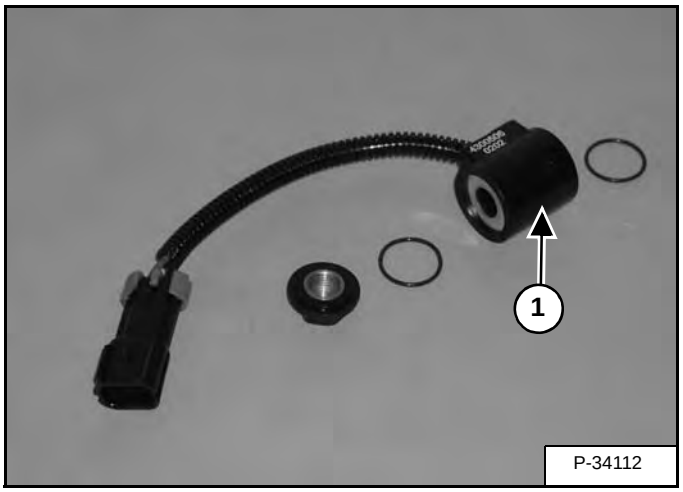
Remove the brake solenoid nut (Item 2) **[Figure 40-12-11]** from the brake solenoid.

Assembly: Tighten the nut to 60-84 in.-lb. (6,78-9,49 N•m) torque.

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Block Disassembly And Assembly (Cont'd)

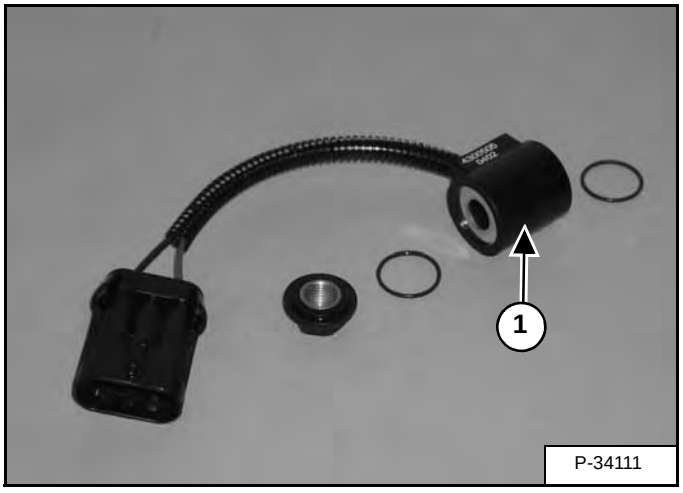
Figure 40-12-12



Use a test meter and test the solenoid (Item 1) **[Figure 40-12-12]** for resistance.

The resistance value for the solenoid coil can be found on the electrical schematic.

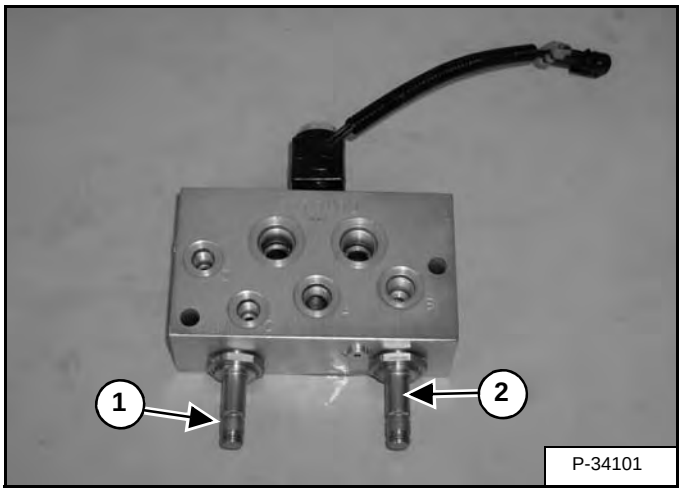
Figure 40-12-13



Use a test meter and test the brake solenoid (Item 1) **[Figure 40-12-13]** for resistance.

The resistance value for the solenoid coil can be found on the electrical schematic.

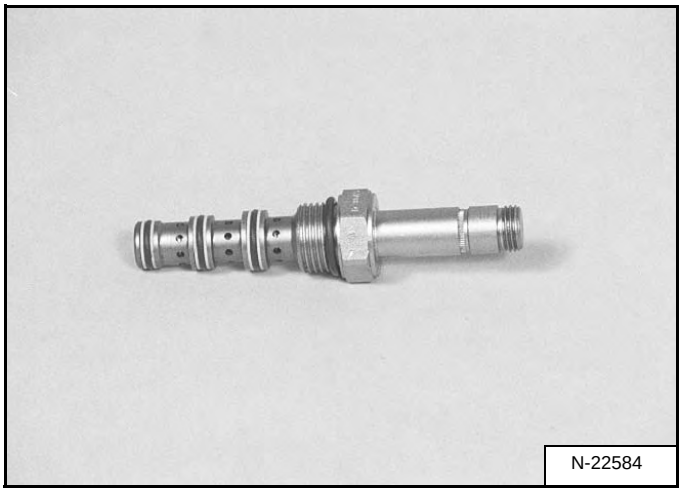
Figure 40-12-14



Remove the solenoid valve (Item 1) **[Figure 40-12-14]** from the block.

Remove the brake solenoid (Item 2) **[Figure 40-12-14]** from the block.

Figure 40-12-15



Assembly: Always install new O-rings and back-up washers **[Figure 40-12-15]**. Tighten the solenoid valve to 20 ft.-lb. (27,1 N•m) torque.

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Block Disassembly And Assembly (Cont'd)

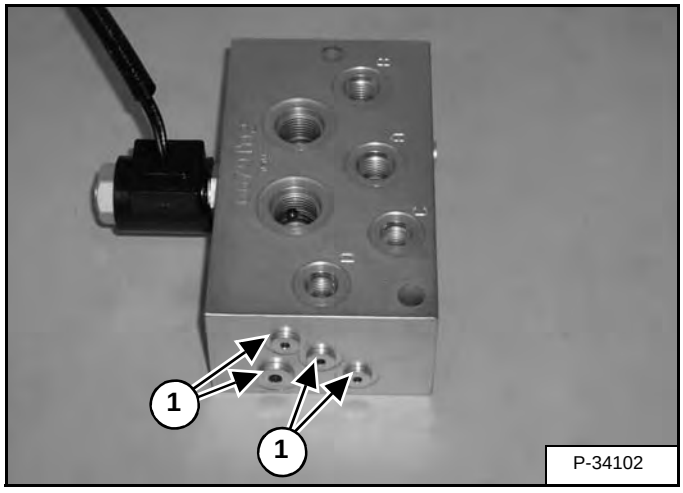
Figure 40-12-16



Assembly: Always install new O-rings. Tighten the solenoid valve to 20 ft.-lb. (27,1 N•m) torque.

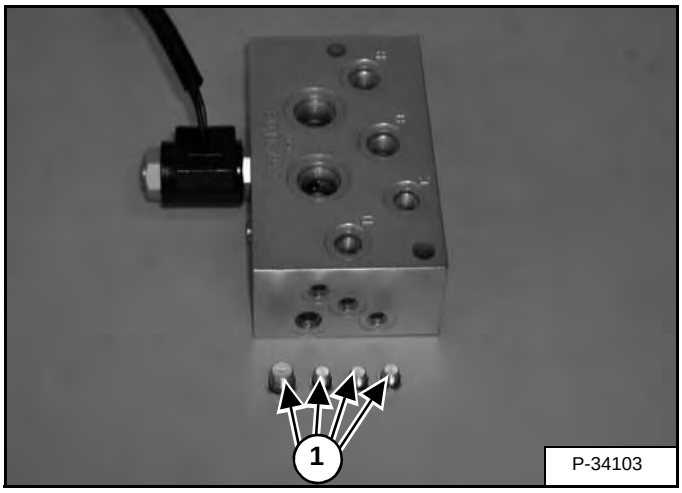
Check the O-rings **[Figure 40-12-16]** and replace as needed.

Figure 40-12-17



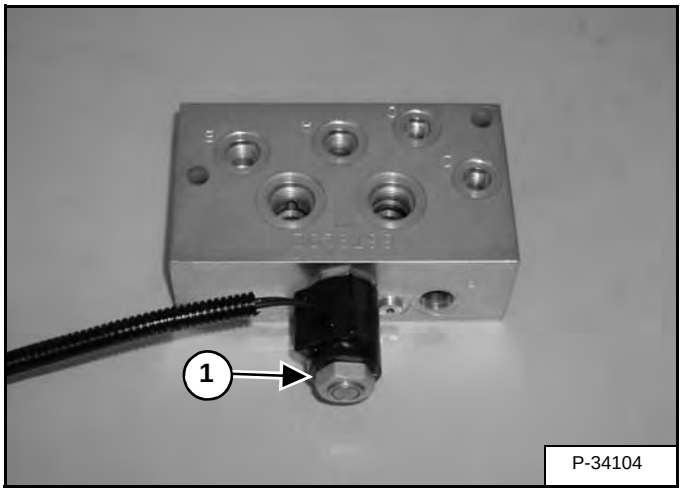
Remove the plugs (Item 1) **[Figure 40-12-17]** from the brake/two-speed block.

Figure 40-12-18



Check the O-ring (Item 1) **[Figure 40-12-18]** on the plugs and replace as needed.

Figure 40-12-19



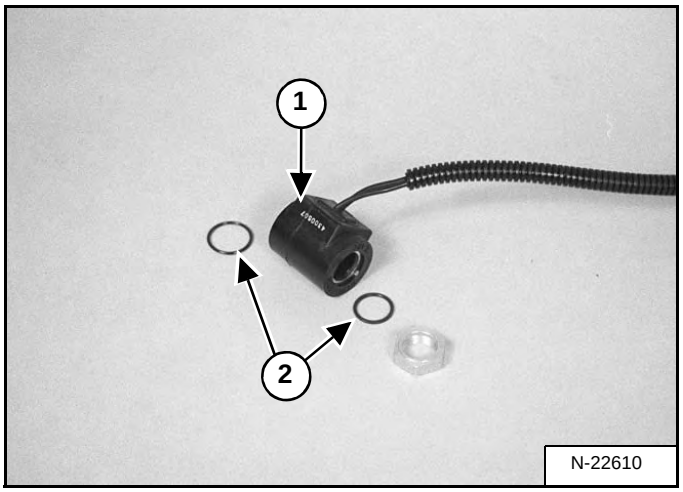
Remove the two speed solenoid nut (Item 1) **[Figure 40-12-19]**.

Assembly: Tighten the nut to 60-84 in.-lb. (6,78-9,49 N•m) torque.

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Block Disassembly And Assembly (Cont'd)

Figure 40-12-20

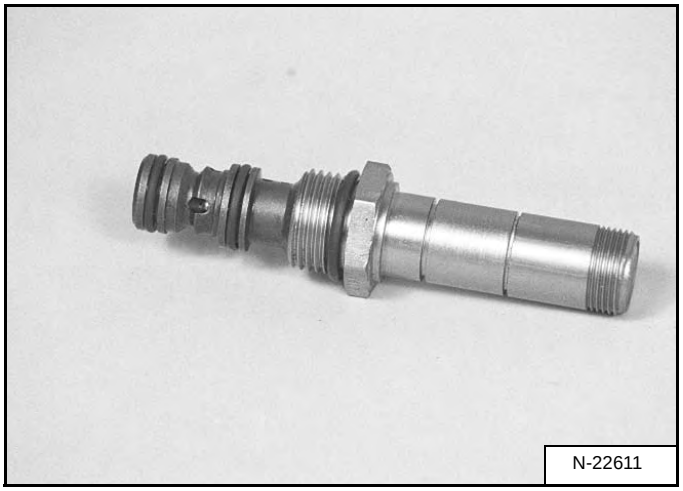


Use a test meter and test the solenoid (Item 1) **[Figure 40-12-20]** for resistance.

The resistance value for the solenoid coil can be found on the electrical schematic.

Replace the O-rings (Item 2) **[Figure 40-12-20]**.

Figure 40-12-21



Assembly: Always install new O-rings. Tighten the solenoid valve to 20 ft.-lb. (27,1 N•m) torque.

Check the O-rings **[Figure 40-12-21]** and replace as needed.

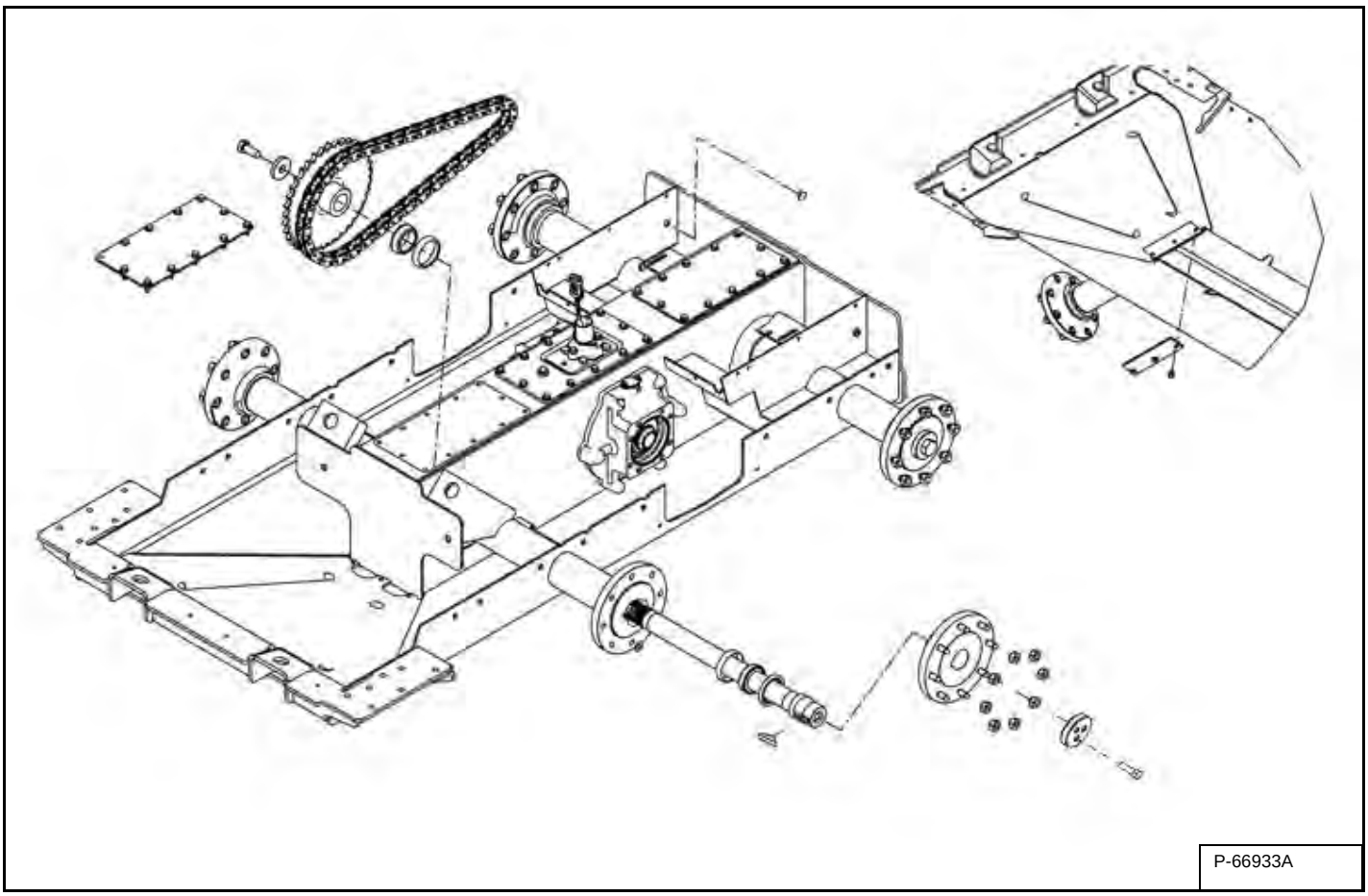
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DRIVE COMPONENTS

Description



The drive components consist of the chaincase, drive chains, sprockets, axleshafts, hubs, drive motor carrier and a brake (Single speed only).

The two speed brake is part of the two speed drive motor.

The chaincase is partially filled with hydraulic fluid to lubricate the chains and bearings.

On the bottom of the chaincase, these is a cover for access to the fuel tank drain plug.

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Axle Seal Removal And Installation

The tools listed are needed for the following procedure:

Axle Hub Puller Tool
MEL1407 - Seal Driver Tool
MEL1242 - Power Ram (may be used if desired)

Lift and block the loader. (See Procedure on Page 10-10-1.)

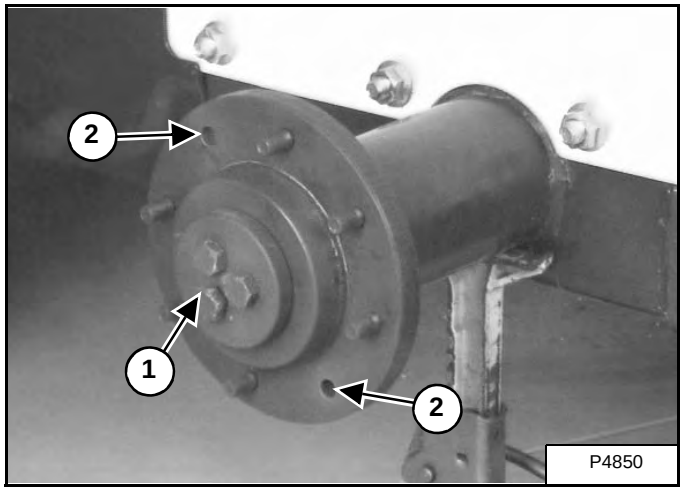
NOTE: If the axle and bearings are being replaced, also loosen the sprocket mounting bolt inside the chaincase before lifting and blocking the loader. (See Axle, Sprocket And Bearings Removal And Installation on Page 40-20-4.)

Remove the tire/wheel assembly. (See Mounting on Page 10-160-2.)

Remove the front chaincase cover. (See Front Cover Removal And Installation on Page 40-30-1.)

Remove the fluid from the chaincase. (See Removing And Replacing Oil on Page 10-130-1.)

Figure 40-20-1

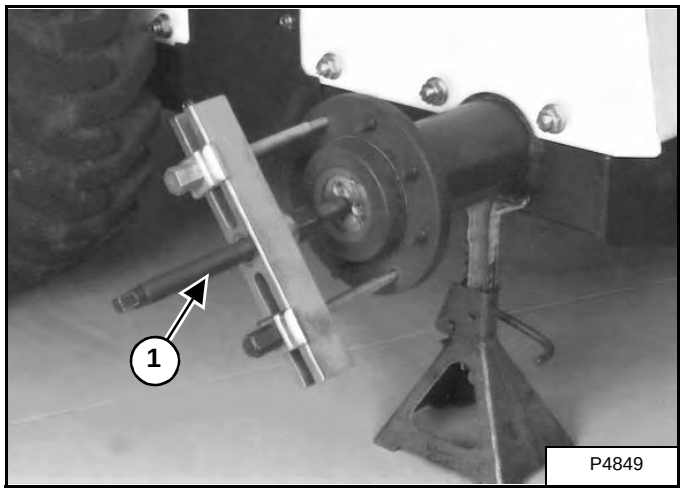


Remove the bolts (Item 1) **[Figure 40-20-1]** and plate.

Installation: Tighten the bolts to 175-190 ft.-lb. (240-260 N•m) torque.

Remove the two wheel studs (Item 2) **[Figure 40-20-1]** across from each other.

Figure 40-20-2



Install puller (Item 1) **[Figure 40-20-2]** on the wheel hub.

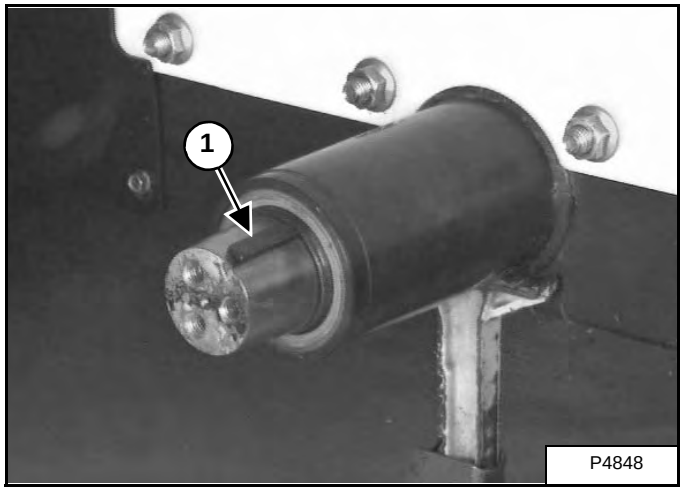
WARNING

NEVER STAND IN-LINE OF THE HUB WHEN REMOVING A HUB FROM AN AXLE. The hub has a tapered fit on the axle end and can come off the axle with great force and cause serious injury.

W-2186-0395

Remove the hub from the axle.

Figure 40-20-3

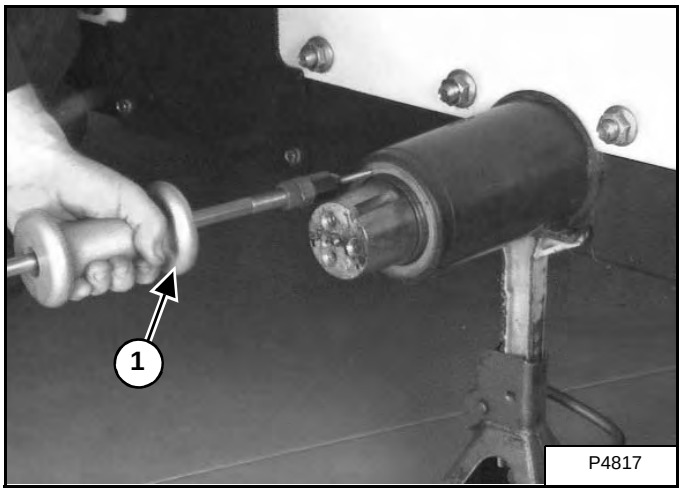


Remove the key (Item 1) **[Figure 40-20-3]** from the axle.

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Axle Seal Removal And Installation

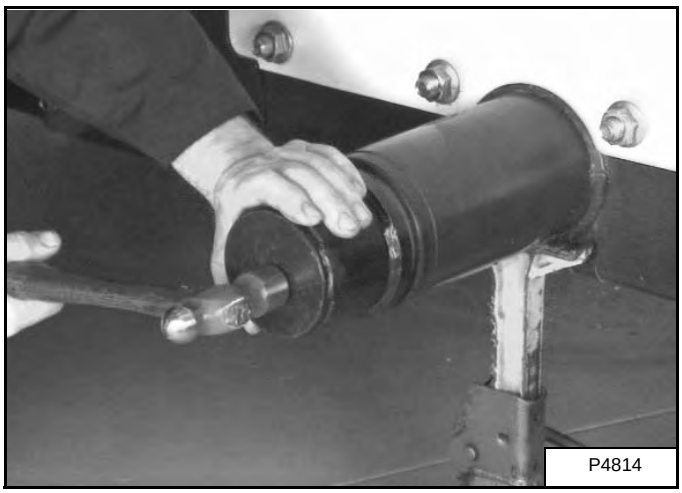
Figure 40-20-4



Install a slide hammer (Item 1) **[Figure 40-20-4]** with a screw tip end into the axle seal.

Remove the axle seal.

Figure 40-20-5



Installation: Place the seal with the lip facing in **[Figure 40-20-5]**.

Installation: Use a hammer, install the new axle seal until the tool (MEL1407) is flush with the edge of the axle tube **[Figure 40-20-5]**.

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Axle, Sprocket And Bearings Removal And Installation

The tools listed will be needed to do the following procedure:

MEL1242 - Port-a-Power
MEL1202B - Axle Bearing Service Set

NOTE: The procedure shown for removal and installation of the axle, sprocket and bearings is for a front axle. This procedure will be the same for the rear axle.



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

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Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Lift and block the loader. (See Procedure on Page 10-10-1.)

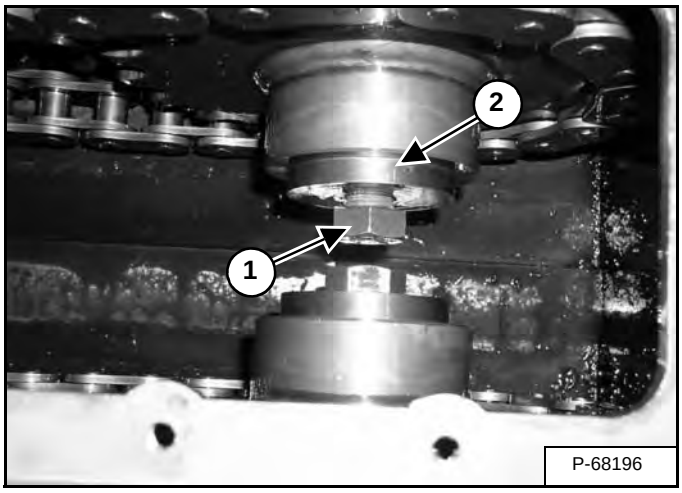
Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the control panel. (See Removal And Installation on Page 50-100-2.)

Remove the front chaincase cover. (See Front Cover Removal And Installation on Page 40-30-1.)

Remove the fluid from the chaincase. (See Removing And Replacing Oil on Page 10-130-1.)

Figure 40-20-6

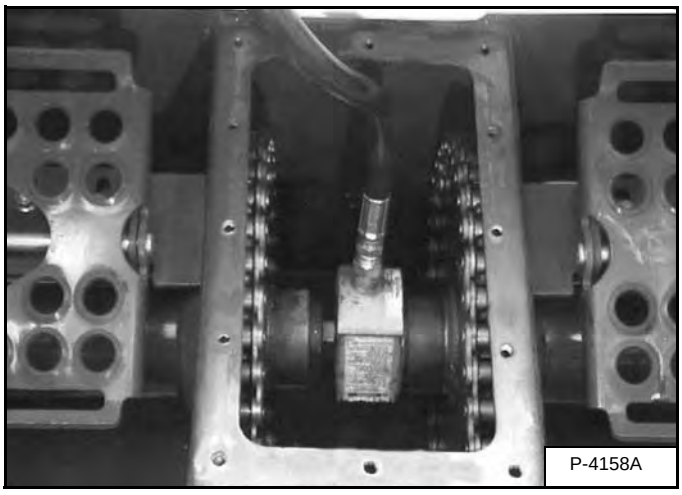


Remove the axle sprocket bolt (Item 1) and backing washer (Item 2) **[Figure 40-20-6]**.

Installation: Tighten the axle sprocket bolt to 515-535 ft.-lb. (699-726 N•m) torque.

Remove the axle hub. (See Axle Seal Removal And Installation on Page 40-20-2.)

Figure 40-20-7

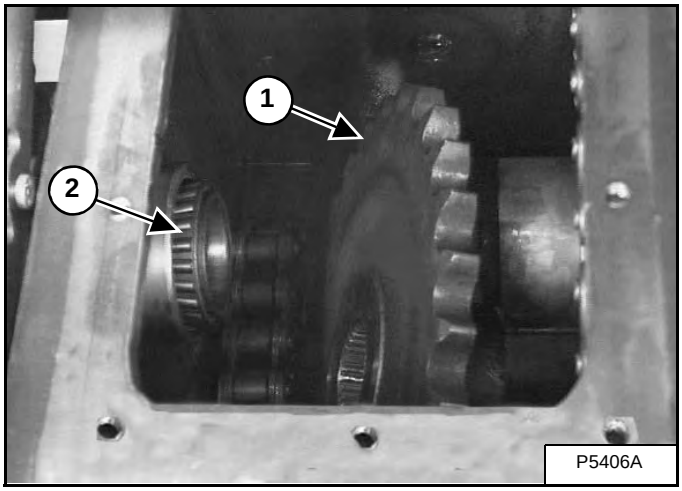


Install a Port-a-Power ram between the two sprockets **[Figure 40-20-7]**.

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Axle, Sprocket And Bearings Removal And Installation (Cont'd)

Figure 40-20-8



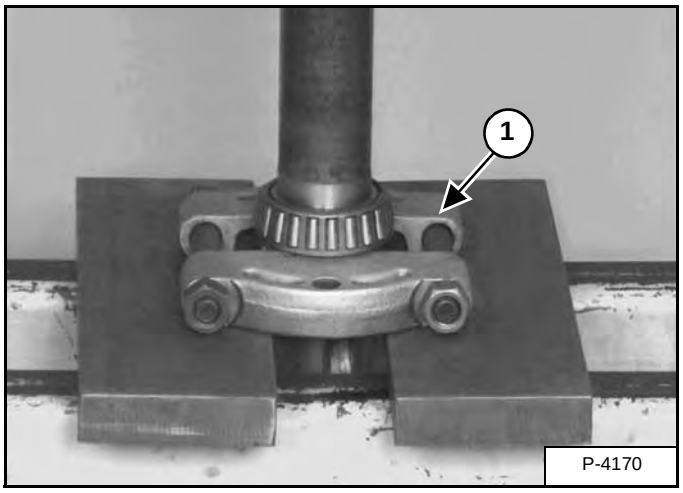
Push the axle out until the ram is at the end of the stroke. Add a spacer and push the axle out again. Repeat this procedure until the axle is out of the sprocket.

Remove the drive chain from the sprocket.

Remove the sprocket (Item 1) and inner bearing (Item 2) **[Figure 40-20-8]**.

Installation: Pack the inner and outer bearing with grease before installing them.

Figure 40-20-9

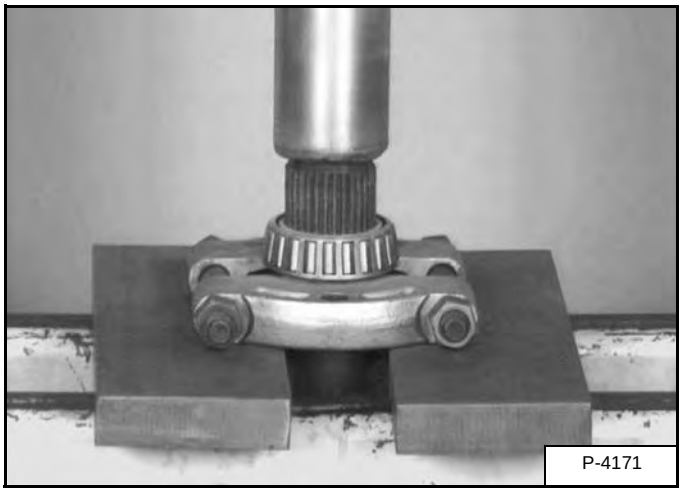


A bearing puller (Item 1) **[Figure 40-20-9]** is needed to do the following procedure:

Be sure the bearing puller makes good contact with the inner race and press the bearing off the mounting surface of the axle **[Figure 40-20-9]**.

NOTE: Hold the axle during removal because it will slide freely after the bearing is removed from the mounting surface.

Figure 40-20-10

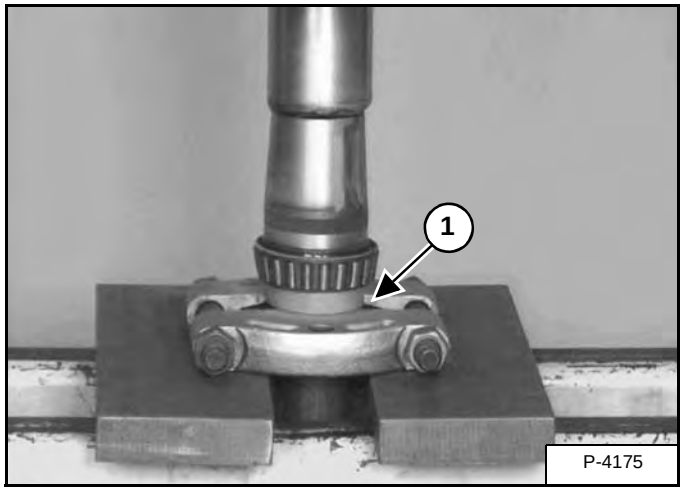


Press the splined end of the axle free from the bearing **[Figure 40-20-10]**.

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Axle, Sprocket And Bearings Removal And Installation (Cont'd)

Figure 40-20-11



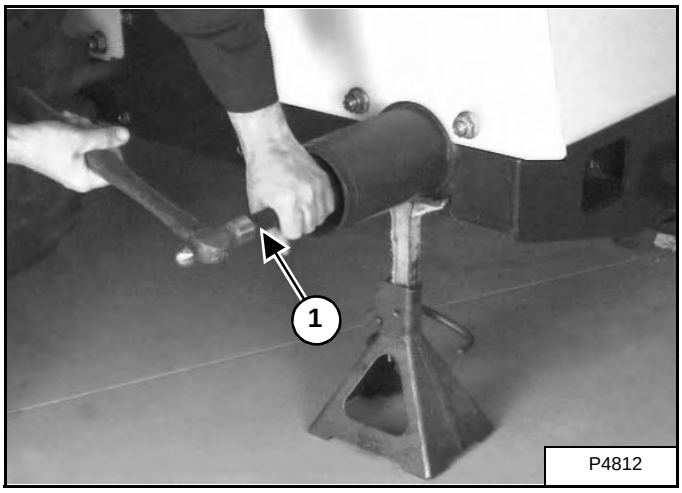
Installation: Put the spline end of the axle shaft into the bearing and press the bearing onto the axle.

NOTE: Hold the axle during installation because it will slide freely after the bearing is pressed over the splined end of the shaft.

Put a piece of tubing over the axle (Item 1) **[Figure 40-20-11]** that contacts inner race of the bearing only.

Press the bearing onto the mounting surface until the bearing is fully seated **[Figure 40-20-11]**.

Figure 40-20-12

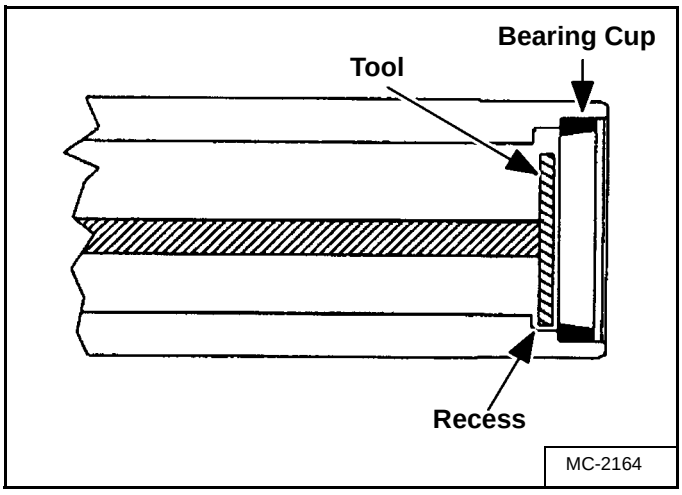


Use the tools provided in the MEL1202B Axle Bearing Service Set. A slide hammer is also needed.

Use the long driver handle (Item 1) **[Figure 40-20-12]** and the bearing cup removal tool to remove the inner bearing cup.

The bearing cup removal tool must fall into the recess behind the bearing cup, drive the cup out of the axle tube **[Figure 40-20-13]**.

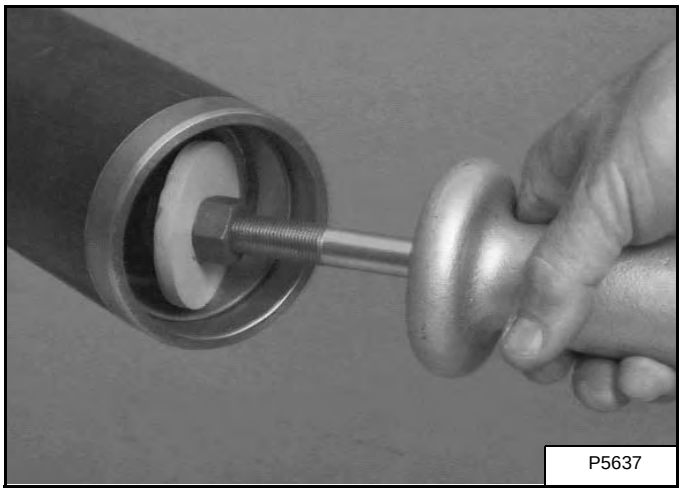
Figure 40-20-13



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Axle, Sprocket And Bearings Removal And Installation (Cont'd)

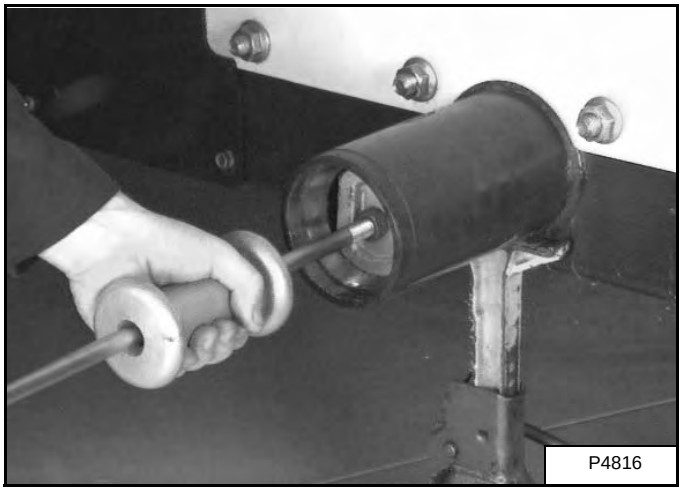
Figure 40-20-14



To remove the outer bearing, install a bearing cup removal tool on the slide hammer.

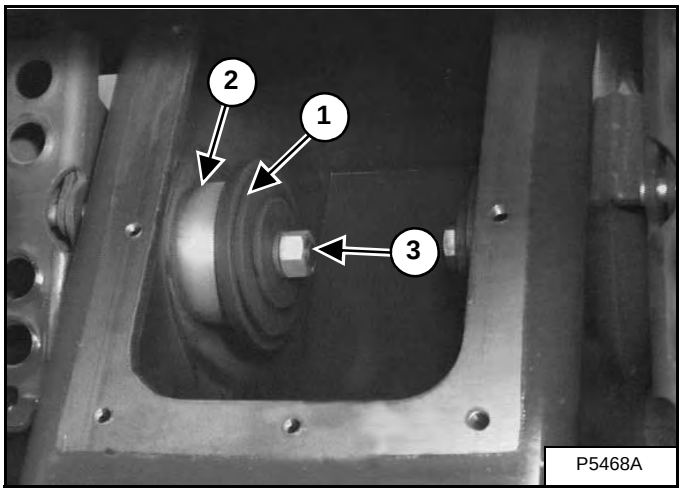
Install the slide hammer/tool assembly behind the bearing cup **[Figure 40-20-14]**.

Figure 40-20-15



Use the slide hammer to remove the bearing cup from the axle tube **[Figure 40-20-15]**.

Figure 40-20-16



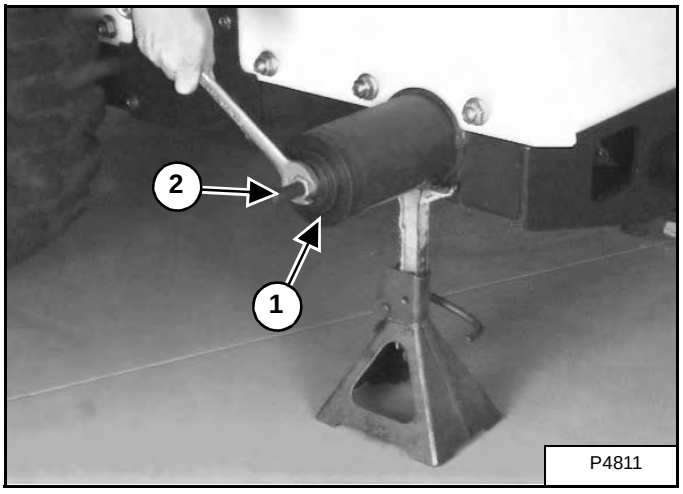
Use the bearing cup installation tool (Item 1) **[Figure 40-20-16]** and (Item 1) **[Figure 40-20-17]**.

Put the inner cup (Item 2) **[Figure 40-20-16]** in the axle tube.

Install the long treaded rod (Item 2) **[Figure 40-20-17]** into the axle tube and through the installation tool (Item 1) **[Figure 40-20-16]**.

Install the nut (Item 3) **[Figure 40-20-16]**.

Figure 40-20-17



Install the installation tool (Item 1) **[Figure 40-20-17]** on the threaded rod. Install the nut.

Hold the inside nut (Item 3) **[Figure 40-20-16]** with a wrench and tighten the outside nut **[Figure 40-20-17]**.

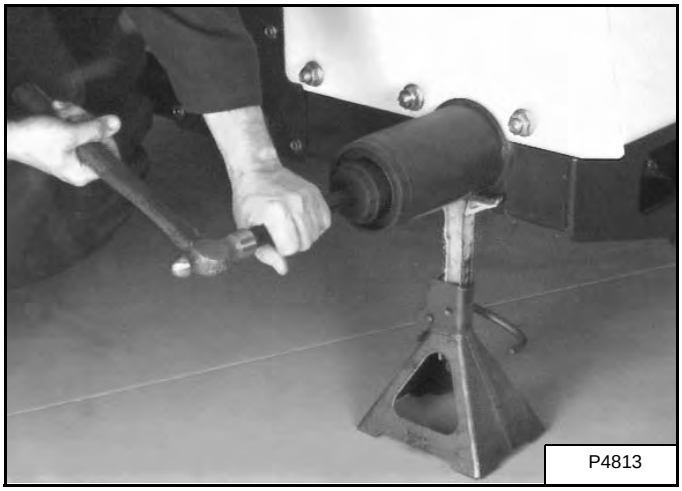
Tighten the nut until the bearing cup is seated.

Remove the installation tool and threaded rod.

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Axle, Sprocket And Bearings Removal And Installation (Cont'd)

Figure 40-20-18



To install the outer bearing cup, install the bearing cup installation tool on the driver handle.

Install the bearing cup into the axle tube, and put the tool into the bearing cup.

Hit the driver handle with a hammer until the bearing cup is seated inside the axle tube **[Figure 40-20-18]**.

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Chain Removal And Installation



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the control panel. (See Removal And Installation on Page 50-100-2.)

Remove the front or rear chaincase cover. (See Front Cover Removal And Installation on Page 40-30-1.)

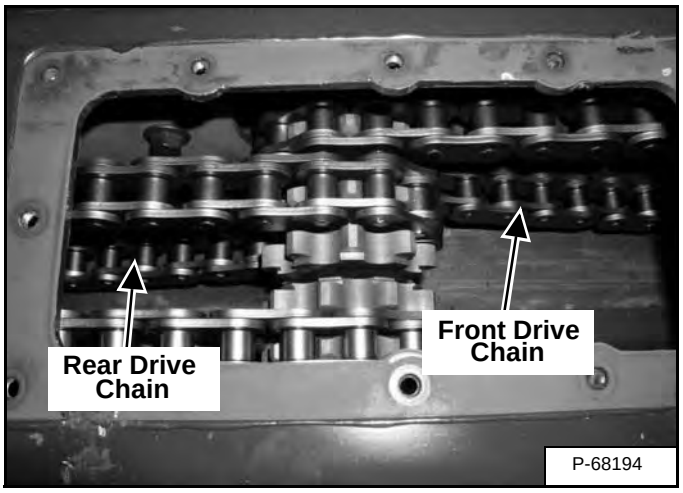
Remove the center chaincase cover. (See Center Cover Removal And Installation on Page 40-30-2.)

Remove the fluid from the chaincase. (See Removing And Replacing Oil on Page 10-130-1.)

Remove the brake disc. (See Disc Removal And Installation on Page 40-10-2.)

Remove the front or rear axle and sprocket. (See Axle, Sprocket And Bearings Removal And Installation on Page 40-20-4.)

Figure 40-20-19

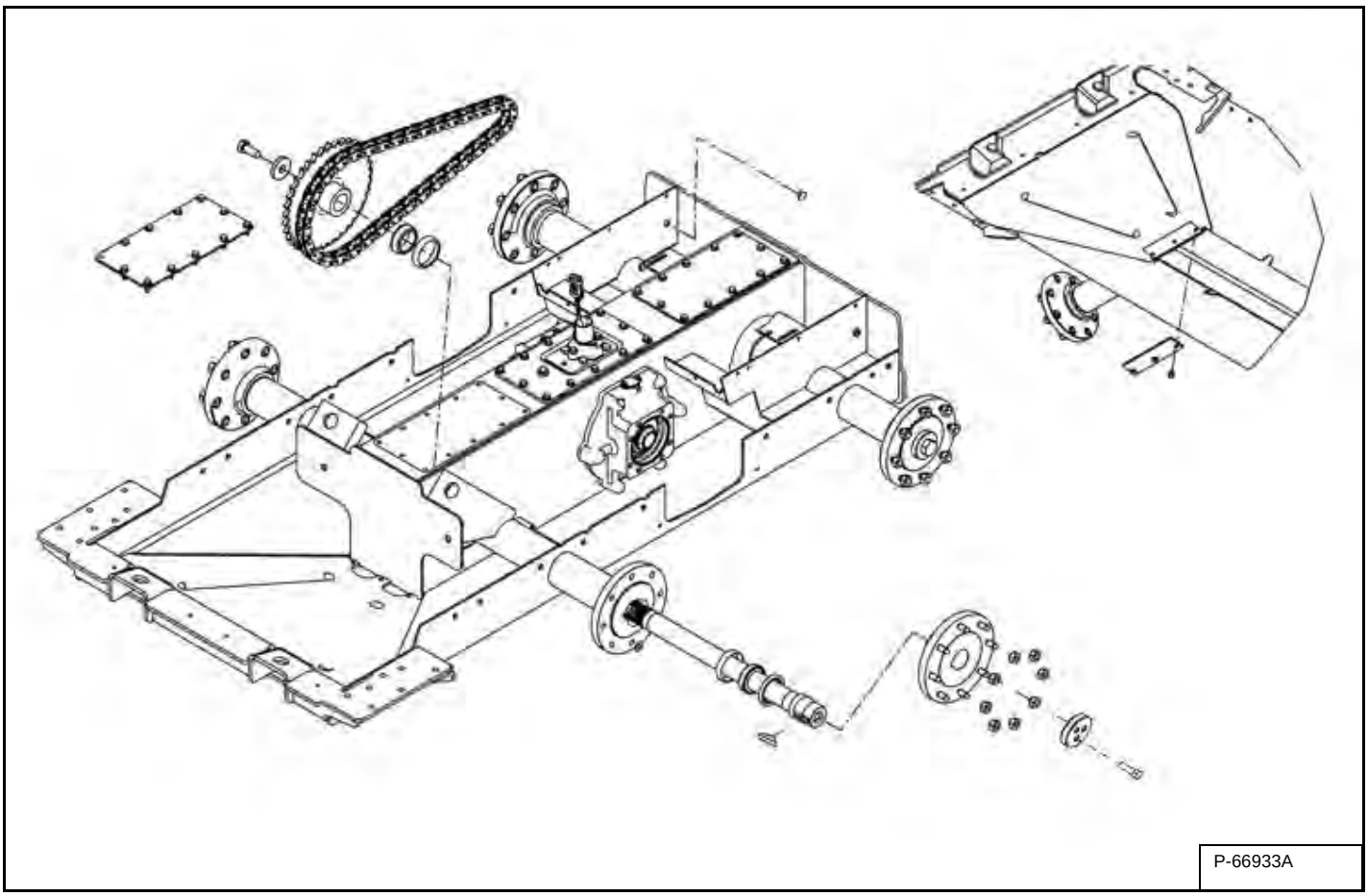


NOTE: It is necessary to remove the rear axle and drive chain if the front chain has to be removed.

Remove the motor carrier. (See Removal and Installation on Page 30-30-2.)

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Description



The drive components consist of the chaincase, drive chains, sprockets, axleshafts, hubs, drive motor carrier and a brake (Single speed only).

The two speed brake is part of the two speed drive motor.

The chaincase is partially filled with hydraulic fluid to lubricate the chains and bearings.

On the bottom of the chaincase, these is a cover for access to the fuel tank drain plug.

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Axle Seal Removal And Installation

The tools listed are needed for the following procedure:

Axle Hub Puller Tool
MEL1407 - Seal Driver Tool
MEL1242 - Power Ram (may be used if desired)

Lift and block the loader. (See Procedure on Page 10-10-1.)

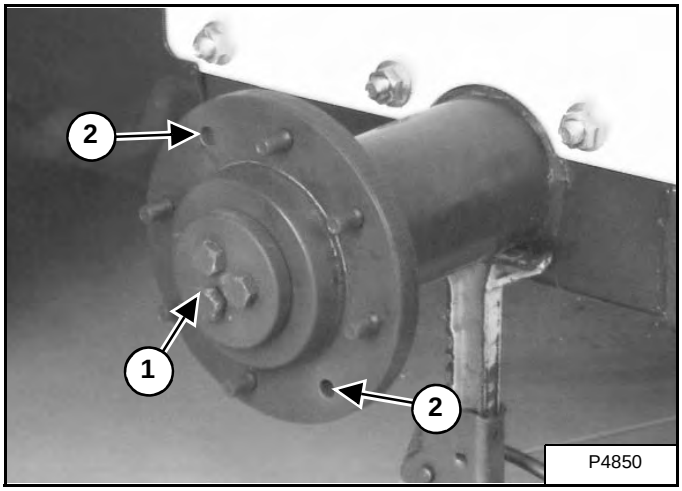
NOTE: If the axle and bearings are being replaced, also loosen the sprocket mounting bolt inside the chaincase before lifting and blocking the loader. (See Axle, Sprocket And Bearings Removal And Installation on Page 40-20-4.)

Remove the tire/wheel assembly. (See Mounting on Page 10-160-2.)

Remove the front chaincase cover. (See Front Cover Removal And Installation on Page 40-30-1.)

Remove the fluid from the chaincase. (See Removing And Replacing Oil on Page 10-130-1.)

Figure 40-20-1

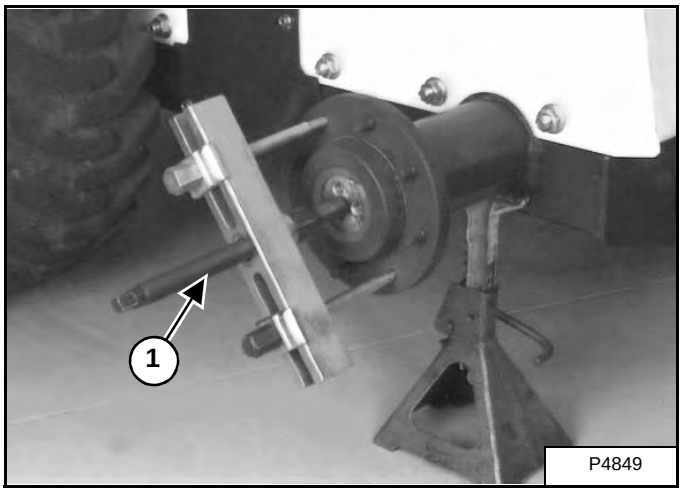


Remove the bolts (Item 1) **[Figure 40-20-1]** and plate.

Installation: Tighten the bolts to 175-190 ft.-lb. (240-260 N•m) torque.

Remove the two wheel studs (Item 2) **[Figure 40-20-1]** across from each other.

Figure 40-20-2



Install puller (Item 1) **[Figure 40-20-2]** on the wheel hub.

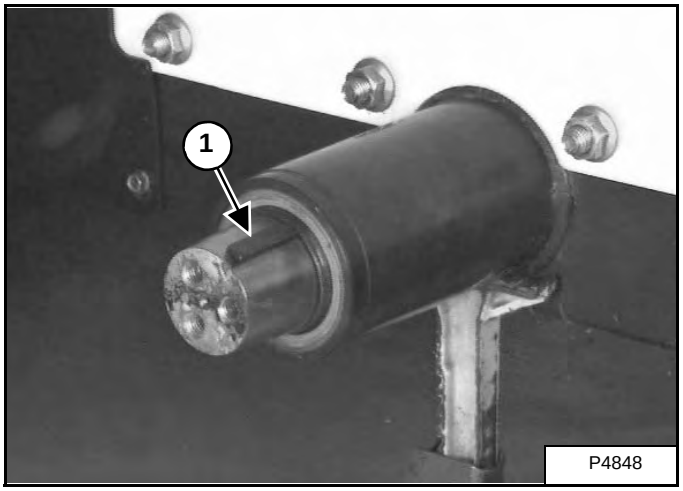
⚠ WARNING

NEVER STAND IN-LINE OF THE HUB WHEN REMOVING A HUB FROM AN AXLE. The hub has a tapered fit on the axle end and can come off the axle with great force and cause serious injury.

W-2186-0395

Remove the hub from the axle.

Figure 40-20-3

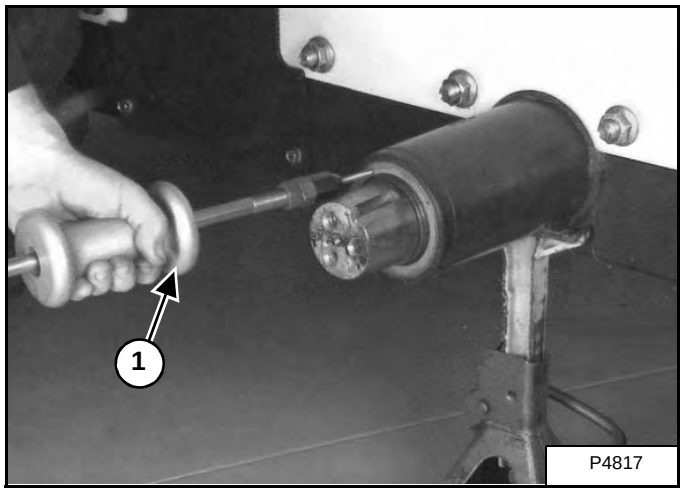


Remove the key (Item 1) **[Figure 40-20-3]** from the axle.

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Axle Seal Removal And Installation

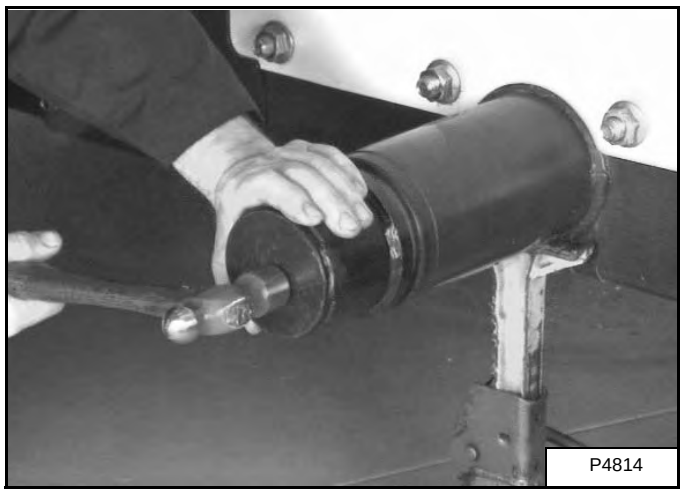
Figure 40-20-4



Install a slide hammer (Item 1) **[Figure 40-20-4]** with a screw tip end into the axle seal.

Remove the axle seal.

Figure 40-20-5



Installation: Place the seal with the lip facing in **[Figure 40-20-5]**.

Installation: Use a hammer, install the new axle seal until the tool (MEL1407) is flush with the edge of the axle tube **[Figure 40-20-5]**.

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Axle, Sprocket And Bearings Removal And Installation

The tools listed will be needed to do the following procedure:

MEL1242 - Port-a-Power
MEL1202B - Axle Bearing Service Set

NOTE: The procedure shown for removal and installation of the axle, sprocket and bearings is for a front axle. This procedure will be the same for the rear axle.



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Lift and block the loader. (See Procedure on Page 10-10-1.)

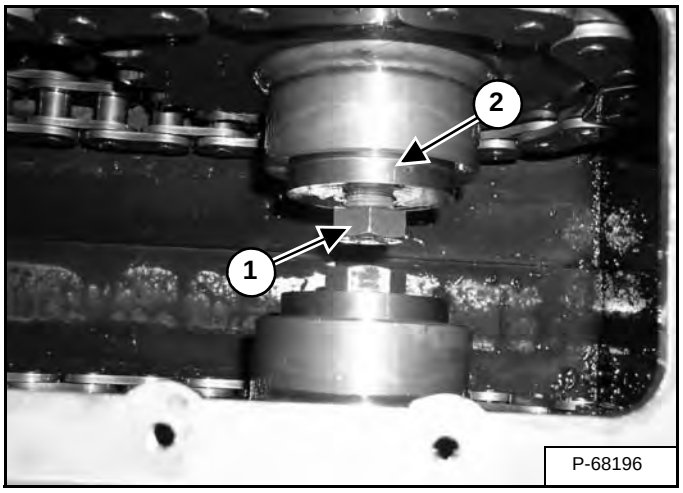
Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the control panel. (See Removal And Installation on Page 50-100-2.)

Remove the front chaincase cover. (See Front Cover Removal And Installation on Page 40-30-1.)

Remove the fluid from the chaincase. (See Removing And Replacing Oil on Page 10-130-1.)

Figure 40-20-6

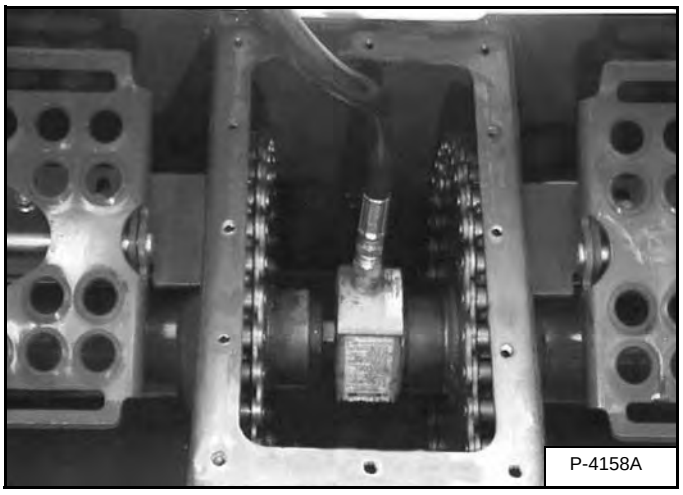


Remove the axle sprocket bolt (Item 1) and backing washer (Item 2) **[Figure 40-20-6]**.

Installation: Tighten the axle sprocket bolt to 515-535 ft.-lb. (699-726 N•m) torque.

Remove the axle hub. (See Axle Seal Removal And Installation on Page 40-20-2.)

Figure 40-20-7

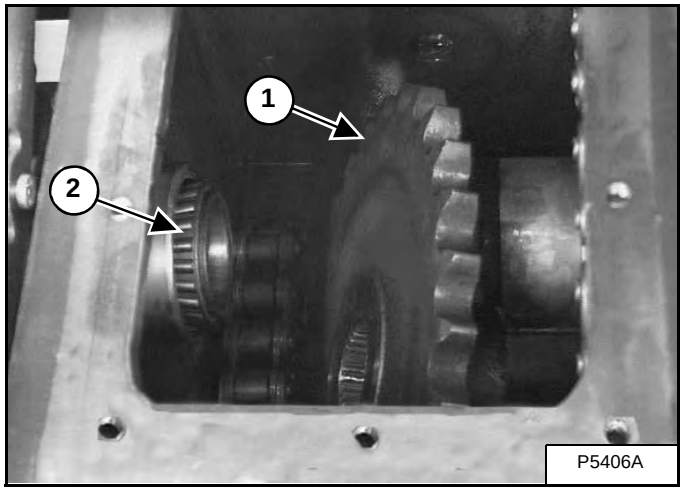


Install a Port-a-Power ram between the two sprockets **[Figure 40-20-7]**.

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Axle, Sprocket And Bearings Removal And Installation (Cont'd)

Figure 40-20-8



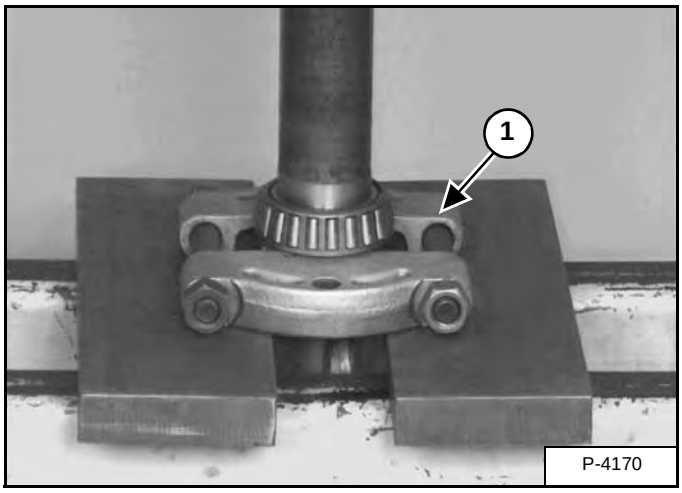
Push the axle out until the ram is at the end of the stroke. Add a spacer and push the axle out again. Repeat this procedure until the axle is out of the sprocket.

Remove the drive chain from the sprocket.

Remove the sprocket (Item 1) and inner bearing (Item 2) **[Figure 40-20-8]**.

Installation: Pack the inner and outer bearing with grease before installing them.

Figure 40-20-9

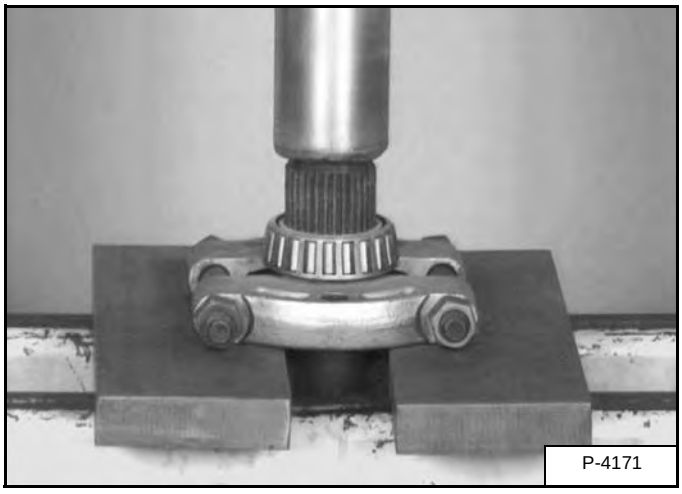


A bearing puller (Item 1) **[Figure 40-20-9]** is needed to do the following procedure:

Be sure the bearing puller makes good contact with the inner race and press the bearing off the mounting surface of the axle **[Figure 40-20-9]**.

NOTE: Hold the axle during removal because it will slide freely after the bearing is removed from the mounting surface.

Figure 40-20-10

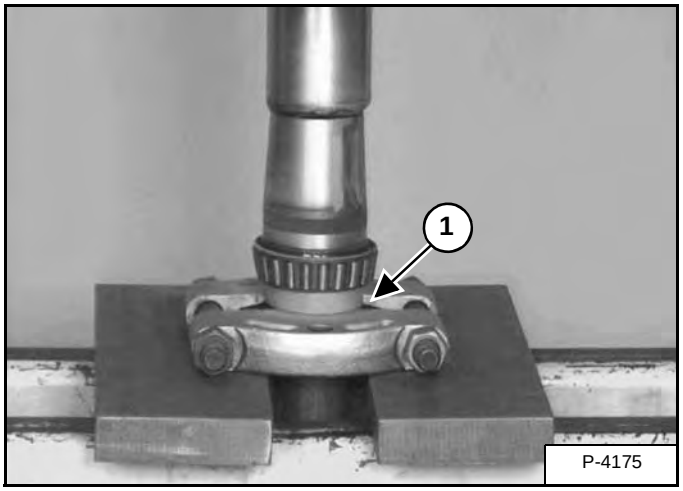


Press the splined end of the axle free from the bearing **[Figure 40-20-10]**.

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Axle, Sprocket And Bearings Removal And Installation (Cont'd)

Figure 40-20-11



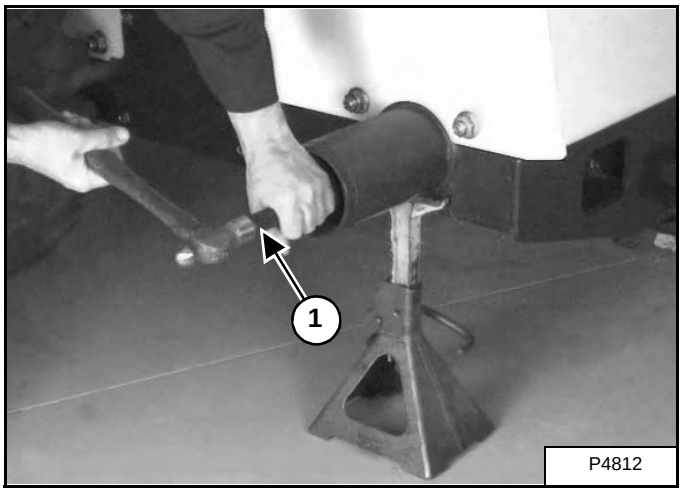
Installation: Put the spline end of the axle shaft into the bearing and press the bearing onto the axle.

NOTE: Hold the axle during installation because it will slide freely after the bearing is pressed over the splined end of the shaft.

Put a piece of tubing over the axle (Item 1) **[Figure 40-20-11]** that contacts inner race of the bearing only.

Press the bearing onto the mounting surface until the bearing is fully seated **[Figure 40-20-11]**.

Figure 40-20-12

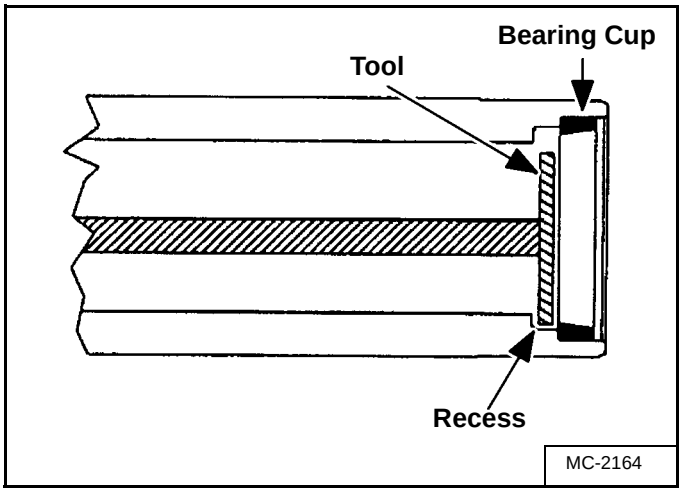


Use the tools provided in the MEL1202B Axle Bearing Service Set. A slide hammer is also needed.

Use the long driver handle (Item 1) **[Figure 40-20-12]** and the bearing cup removal tool to remove the inner bearing cup.

The bearing cup removal tool must fall into the recess behind the bearing cup, drive the cup out of the axle tube **[Figure 40-20-13]**.

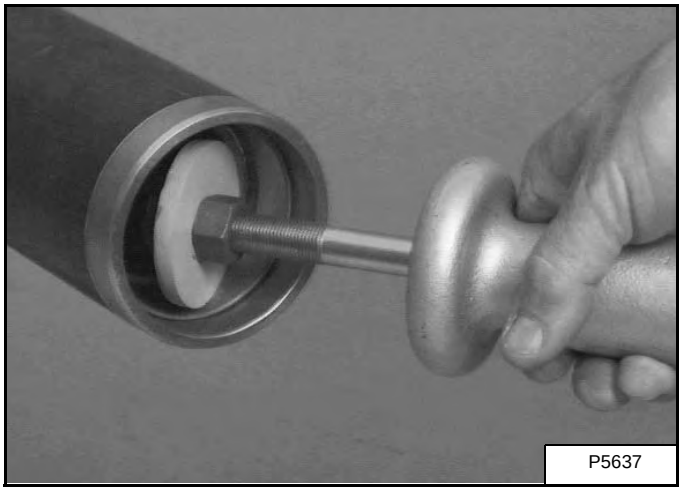
Figure 40-20-13



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Axle, Sprocket And Bearings Removal And Installation (Cont'd)

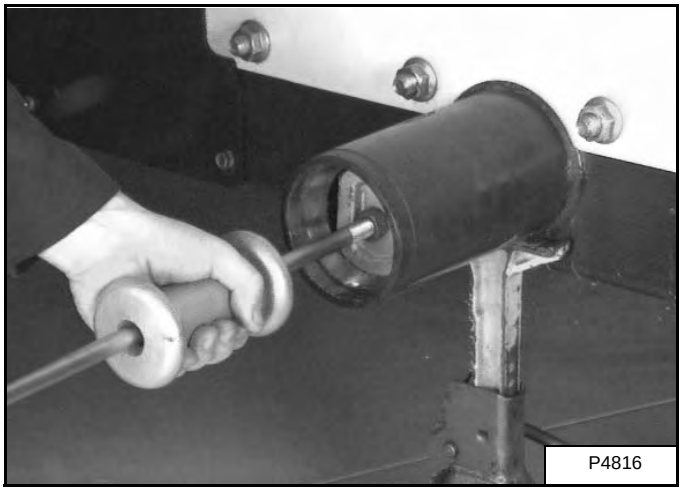
Figure 40-20-14



To remove the outer bearing, install a bearing cup removal tool on the slide hammer.

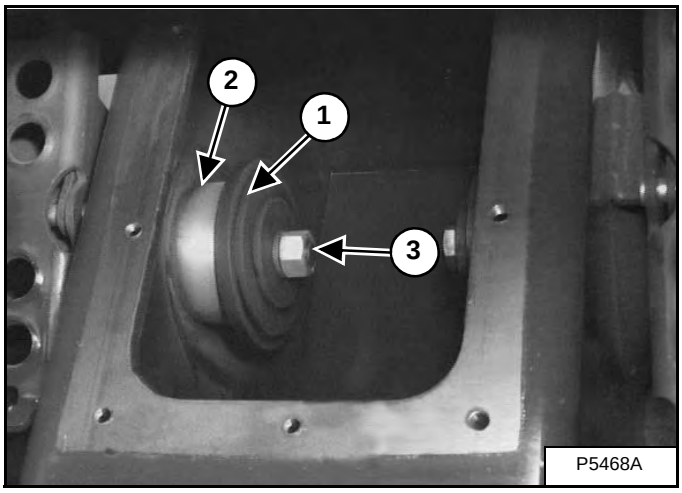
Install the slide hammer/tool assembly behind the bearing cup **[Figure 40-20-14]**.

Figure 40-20-15



Use the slide hammer to remove the bearing cup from the axle tube **[Figure 40-20-15]**.

Figure 40-20-16



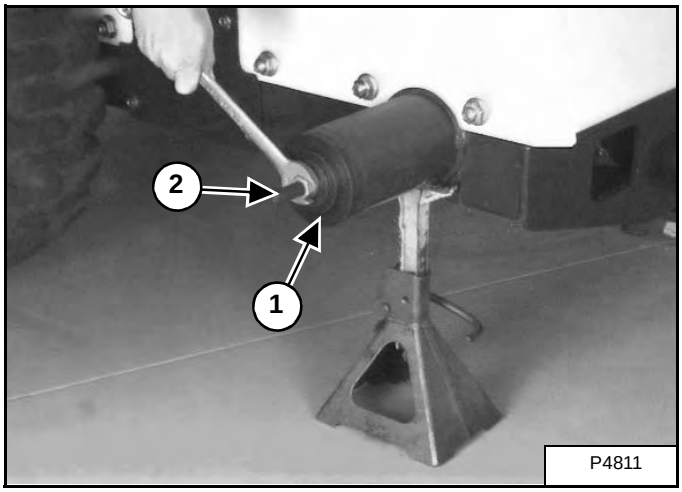
Use the bearing cup installation tool (Item 1) **[Figure 40-20-16]** and (Item 1) **[Figure 40-20-17]**.

Put the inner cup (Item 2) **[Figure 40-20-16]** in the axle tube.

Install the long treaded rod (Item 2) **[Figure 40-20-17]** into the axle tube and through the installation tool (Item 1) **[Figure 40-20-16]**.

Install the nut (Item 3) **[Figure 40-20-16]**.

Figure 40-20-17



Install the installation tool (Item 1) **[Figure 40-20-17]** on the threaded rod. Install the nut.

Hold the inside nut (Item 3) **[Figure 40-20-16]** with a wrench and tighten the outside nut **[Figure 40-20-17]**.

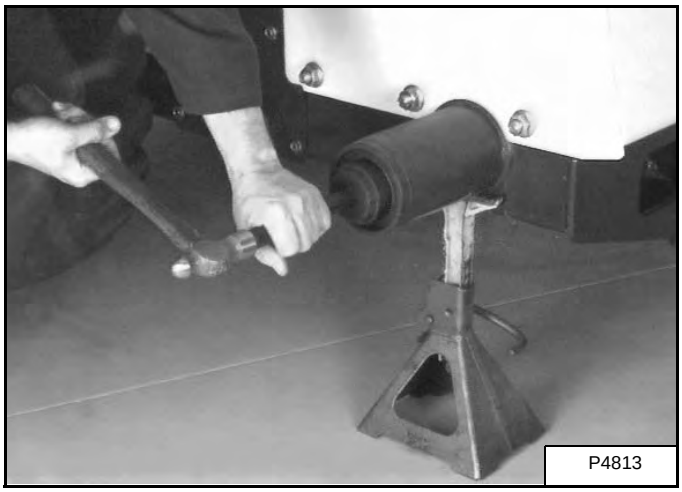
Tighten the nut until the bearing cup is seated.

Remove the installation tool and threaded rod.

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Axle, Sprocket And Bearings Removal And Installation (Cont'd)

Figure 40-20-18



To install the outer bearing cup, install the bearing cup installation tool on the driver handle.

Install the bearing cup into the axle tube, and put the tool into the bearing cup.

Hit the driver handle with a hammer until the bearing cup is seated inside the axle tube **[Figure 40-20-18]**.

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Chain Removal And Installation



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the control panel. (See Removal And Installation on Page 50-100-2.)

Remove the front or rear chaincase cover. (See Front Cover Removal And Installation on Page 40-30-1.)

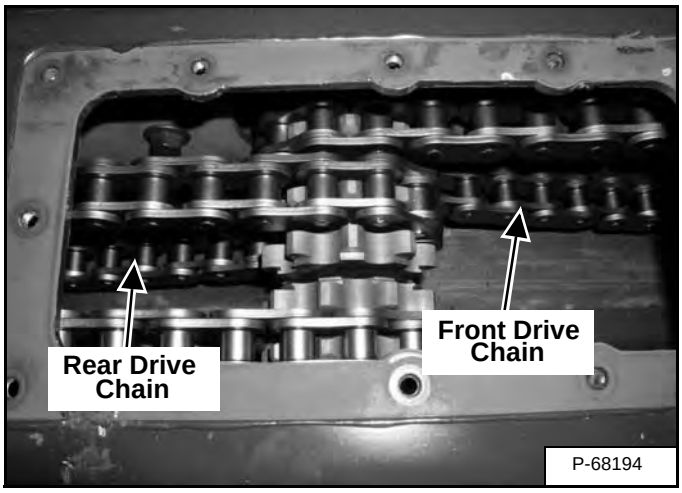
Remove the center chaincase cover. (See Center Cover Removal And Installation on Page 40-30-2.)

Remove the fluid from the chaincase. (See Removing And Replacing Oil on Page 10-130-1.)

Remove the brake disc. (See Disc Removal And Installation on Page 40-10-2.)

Remove the front or rear axle and sprocket. (See Axle, Sprocket And Bearings Removal And Installation on Page 40-20-4.)

Figure 40-20-19



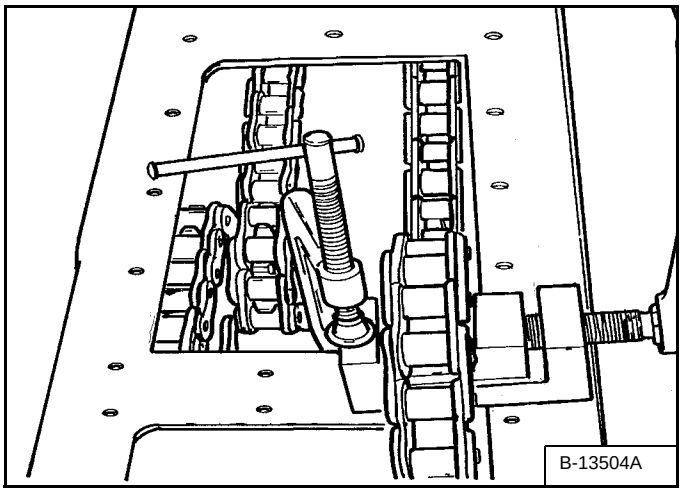
NOTE: It is necessary to remove the rear axle and drive chain if the front chain has to be removed.

Remove the motor carrier. (See Removal and Installation on Page 30-30-2.)

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Chain Removal And Installation (Cont'd)

Figure 40-20-20



The tool listed is needed for the following procedure:

MEL1246 - Chain Link Tool

Installation: If a new chain is installed, a connector link must be used to connect the chain together.

Use MEL1246 Chain Link Tool and #120 chain adapter.

Secure the tool and place the connector link in the tool as shown **[Figure 40-20-20]**.

Turn the threaded rod of the tool and press the connector link together on the chain **[Figure 40-20-20]**. Tighten the threaded rod of the chain link tool to 250 ft.-lb. (339 N•m) torque.

⚠ WARNING

DO NOT exceed the recommended torque. The tool may fail under too much torque. Put cloth around the tool to protect yourself from flying debris.

W-2233-0307

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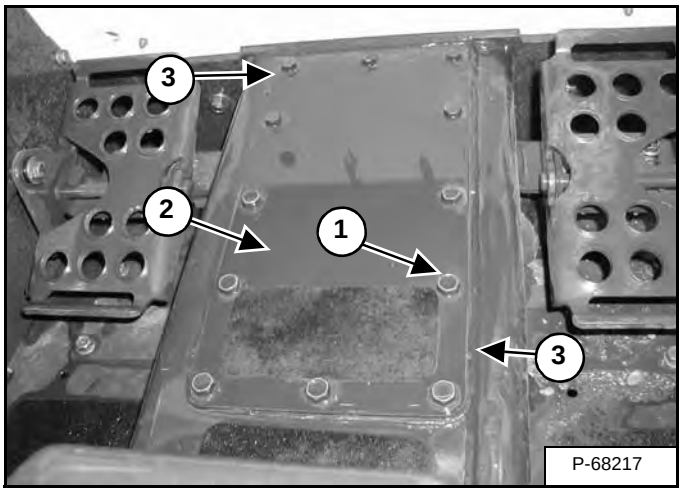
CHAINCASE

Description

The chaincase contains the drive components and makes up the lower portion of the mainframe. There are three chain covers that allow access into the chain area.

Front Cover Removal And Installation

Figure 40-30-1



Clean the area around the cover to keep dirt and debris from entering the chaincase area.

Remove the twelve mounting bolts (Item 1) from the front chaincase cover (Item 2) **[Figure 40-30-1]**.

Remove the cover.

Installation: Torque the bolts to 25-28 ft.-lb. (34-38 N•m).

NOTE: There are machined recesses (Item 3) [Figure 40-30-1] on the bottom side of the cover to help pry the covers off.

Installation: Apply polyurethane sealer to mating surfaces. Polyurethane sealant should be applied to the screw threads to stop oil leakage. Tighten the mounting screws to 15 - 20 ft.-lb. (20 - 27 N•m) torque.

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Center Cover Removal And Installation



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

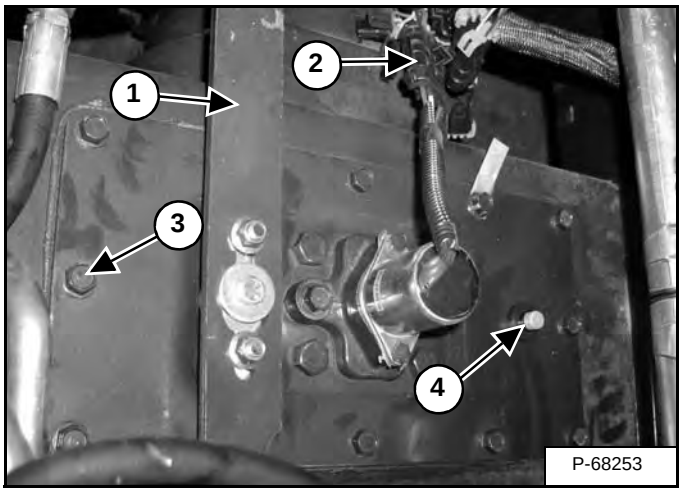
W-2059-0598

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the control panel. (See Removal And Installation on Page 50-100-2.)

Figure 40-30-2



Clean the area around the cover to keep dirt and debris from entering the chaincase area.

Remove the crossbar linkage (Item 1) **[Figure 40-30-2]**. (See Linkage Removal And Installation on Page 50-90-3.)

Disconnect the brake solenoid connector (Item 2) **[Figure 40-30-2]**.

Remove the twelve mounting bolts (Item 3) **[Figure 40-30-2]** from the center chaincase cover.

Inspect the chaincase breather (Item 4) **[Figure 40-30-2]** and replace as needed.

Remove the cover.

NOTE: There are machined recesses (Item 3) [Figure 40-30-1] on the bottom side of the cover to help pry the covers off.

Installation: Apply polyurethane sealer to mating surfaces. Polyurethane sealant should be applied to the screw threads to stop oil leakage. Tighten the mounting screws to 15 - 20 ft.-lb. (20 - 27 N•m) torque.

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Rear Cover Removal And Installation



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

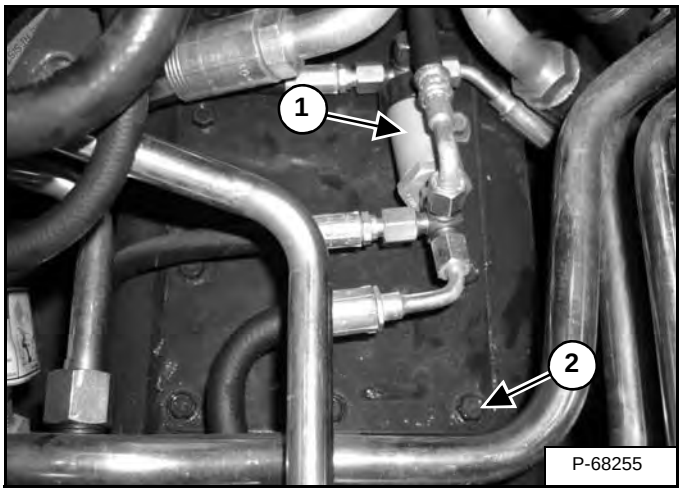
W-2059-0598

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the control panel. (See Removal And Installation on Page 50-100-2.)

Figure 40-30-3



Clean the area around the cover to keep dirt and debris from entering the chaincase area.

Remove the case drain filter (Item 1) **[Figure 40-30-3]** from the top of the cover.

Remove the twelve mounting bolts (Item 2) **[Figure 40-30-3]** from the rear chaincase cover.

Remove the cover.

NOTE: There are machined recesses (Item 3) [Figure 40-30-1] on the bottom side of the cover to help pry the covers off.

Installation: Apply polyurethane sealer to mating surfaces. Polyurethane sealant should be applied to the screw threads to stop oil leakage. Tighten the mounting screws to 15 - 20 ft.-lb. (20 - 27 N•m) torque.

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ACCESS PANEL (INSIDE) 50-120-1
Removal And Installation (Left) 50-120-1
Removal And Installation (Right) 50-120-1

ACCESS PANEL (INSIDE) (SJC) 50-121-1
Removal And Installation (Left) 50-121-1
Removal And Installation (Right) 50-121-2

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Removal And Installation 50-40-1

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Lever And Wedge Disassembly And Assembly 50-41-4
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- Linkage Removal And Installation 50-101-6
- Linkage Travel (Adjusting) 50-101-15
- Pintle Arm Disassembly and Assembly 50-101-10
- Removal And Installation 50-101-2
- Shaft Removal And Installation 50-101-5
- Shock Removal And Installation 50-101-4

CONTROL PANEL (S/N 530714202 & BELOW AND 530811539 & BELOW) 50-100-1
- Description 50-100-1
- Linkage Neutral (Adjusting) 50-100-11
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- Linkage Travel (Adjusting) 50-100-15
- Pintle Arm Disassembly and Assembly 50-100-10
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CONTROL PANEL (S/N 530714202 & BELOW AND 530811539 & BELOW) (SJC) 50-102-1
- Description 50-102-1
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- Description 50-103-1
- Removal And Installation 50-103-2

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SEAT BAR 50-10-1
Compression Spring Disassembly And Assembly 50-10-4
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WINDOW (REAR) 50-130-1
Installation 50-130-1
Removal. 50-130-1

WINDOW (TOP) 50-131-1
Removal And Installation 50-131-1

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WINDOW (SIDE) 50-132-1
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WINDOW (FRONT DOOR) 50-133-1
Installation (Standard Window) 50-133-2
Removal And Installation (Special Applications Window) . . . 50-133-4
Removal (Standard Window) 50-133-1

TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.

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SEAT BAR

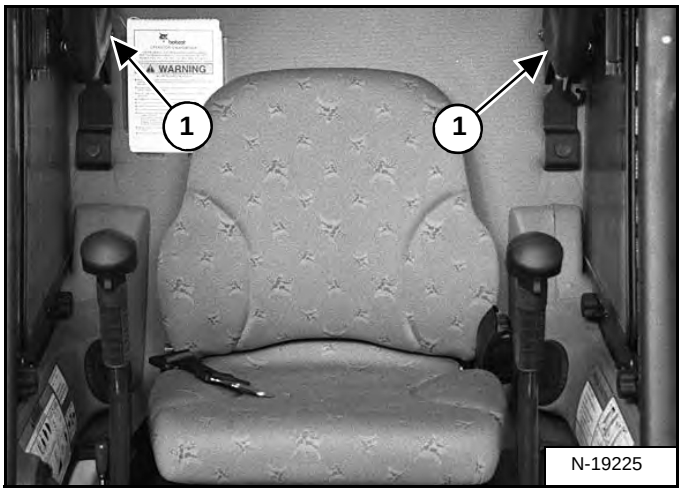
Description

The seat bar is the secondary restraint system that has a sensor that automatically stops the loader functions until the seat bar is lowered.

The seat bar is located in the operator cab.

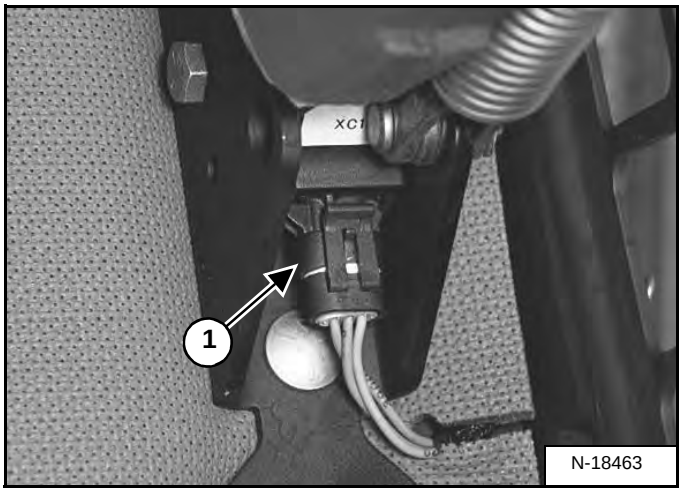
Removal And Installation

Figure 50-10-4



Raise the seat bar (Item 1) **[Figure 50-10-4]**.

Figure 50-10-5



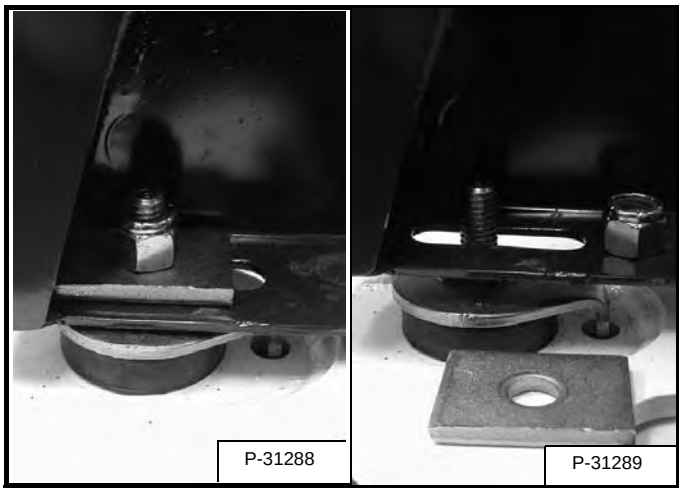
Disconnect the seat bar sensor (Item 1) **[Figure 50-10-5]** from the cab harness.

Lower the seat bar.

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Removal And Installation (Cont'd)

Figure 50-10-6



Loosen the nut (both sides) at the front corner of the operator cab **[Figure 50-10-6]**.

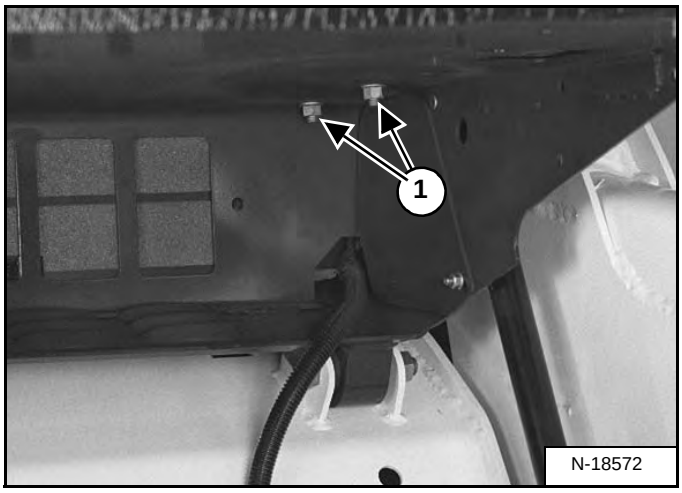
Remove the nuts and plates **[Figure 50-10-6]** (both sides).

Figure 50-10-7



Lift on the grab handle and bottom of the operator cab slowly until the cab is all the way up and the latching mechanism engages **[Figure 50-10-7]**.

Figure 50-10-8

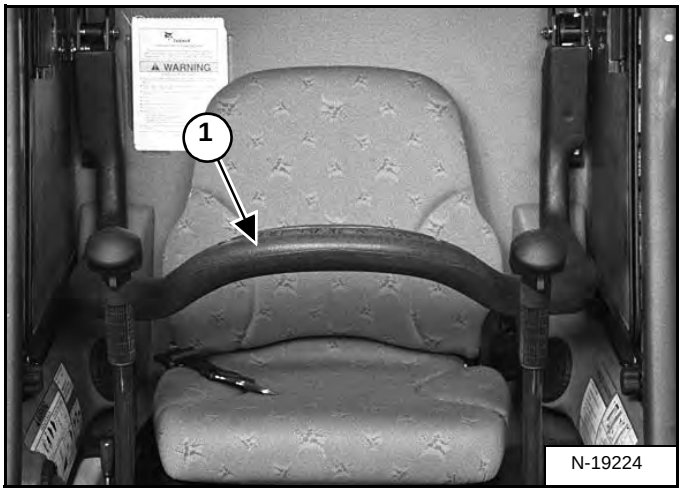


Remove the seat bar mounting nuts (Item 1) **[Figure 50-10-8]** (both sides).

Installation: Tighten the nuts to 25 - 28 ft.-lb. (33,9 - 38 N•m) torque.

Lower the operator cab. (See Lowering on Page 10-30-2.)

Figure 50-10-9



Remove the seat bar (Item 1) **[Figure 50-10-9]** from the operator cab.

Reverse the above procedure to install the seat bar into the operator cab.

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SEAT BAR (CONT'D)

Disassembly And Assembly

Figure 50-10-10

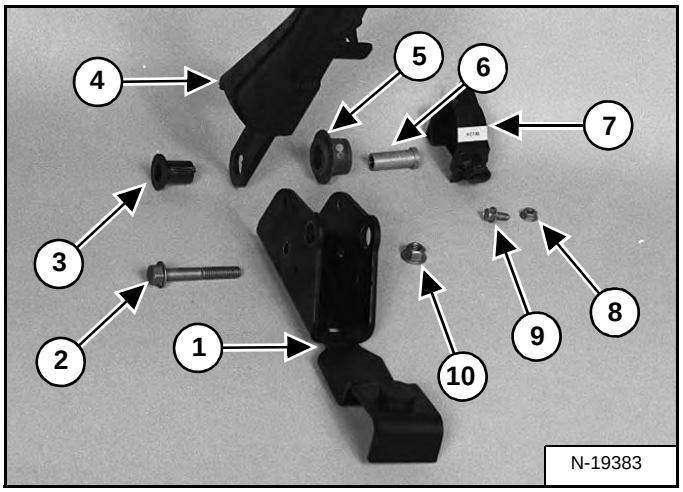
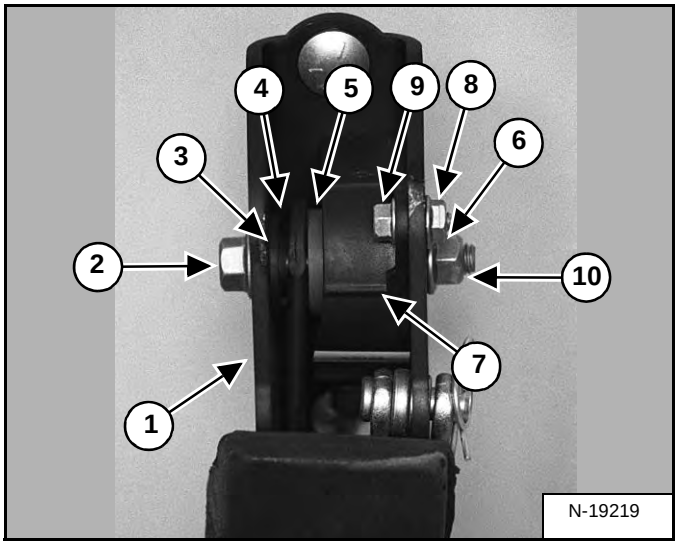


Figure 50-10-11



Assemble the parts as shown for the left side of the seat bar pivot assembly **[Figure 50-10-10]** & **[Figure 50-10-11]**.

Seat Bar Mount (Item 1)
Mounting Bolt (Item 2)
Keyed Plastic Bushing (Item 3)
Seat Bar (Item 4)
Magnetic Bushing Assembly (Item 5)
Pivot Bushing (Item 6)
Sensor Bracket (Item 7)
Sensor Mounting Nut (Item 8)
Sensor Mounting Bolt (Item 9)
Mounting Nut (Item 10)

Installation: Tighten the mounting bolt (Item 2) **[Figure 50-10-10]** & **[Figure 50-10-11]** to 50-70 in.-lb. (5,6-7,9 N•m) torque.

Figure 50-10-12

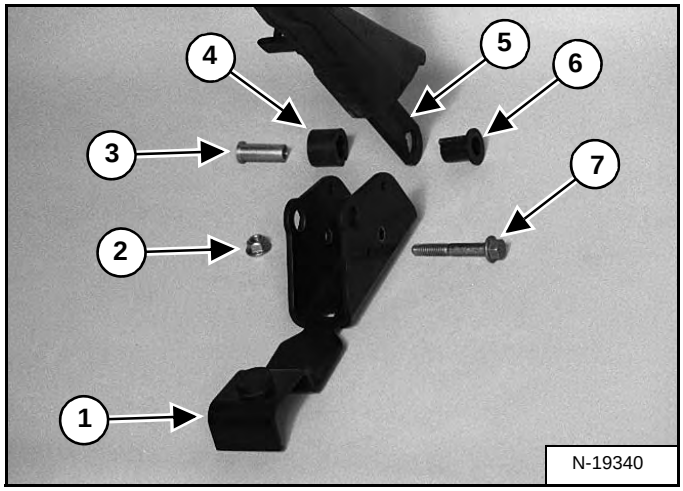
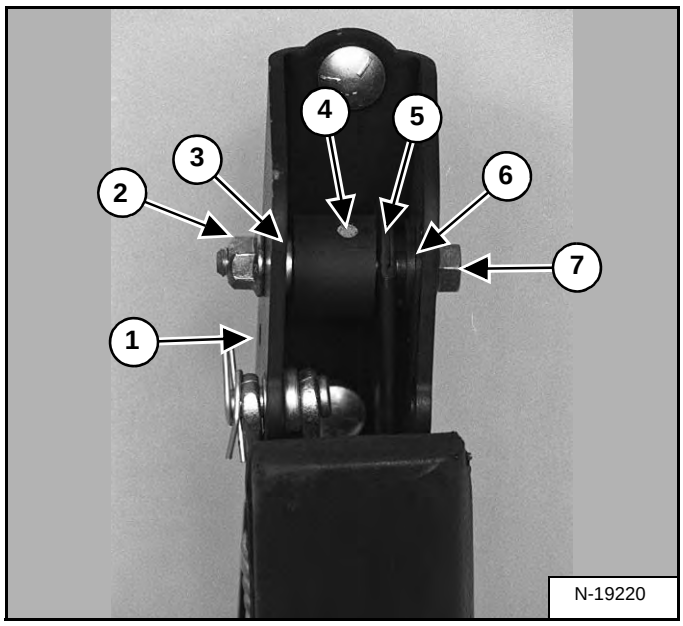


Figure 50-10-13



Assemble the parts as shown for the right side of the seat bar pivot assembly **[Figure 50-10-12]** & **[Figure 50-10-13]**.

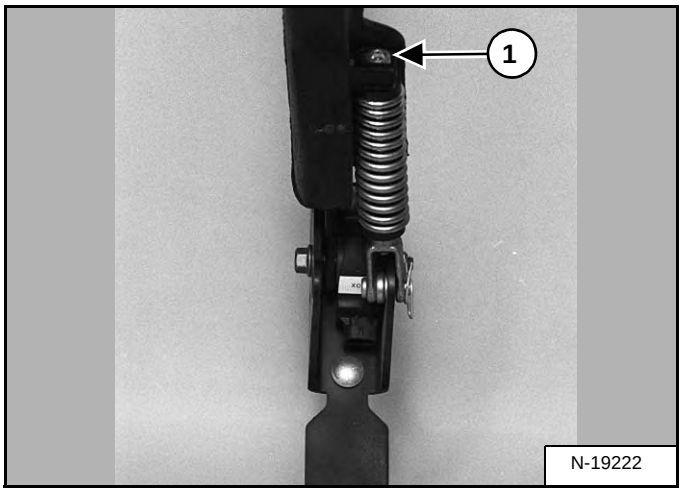
Seat Bar Mount (Item 1)
Mounting Nut (Item 2)
Pivot Bushing (Item 3)
Spacer Bushing (Item 4)
Seat Bar (Item 5)
Keyed Plastic Bushing (Item 6)
Mounting Bolt (Item 7)

Installation: Tighten the mounting bolt (Item 7) **[Figure 50-10-12]** & **[Figure 50-10-13]** to 25 - 28 ft.-lb. (33,9 - 38 N•m) torque.

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Compression Spring Disassembly And Assembly

Figure 50-10-14

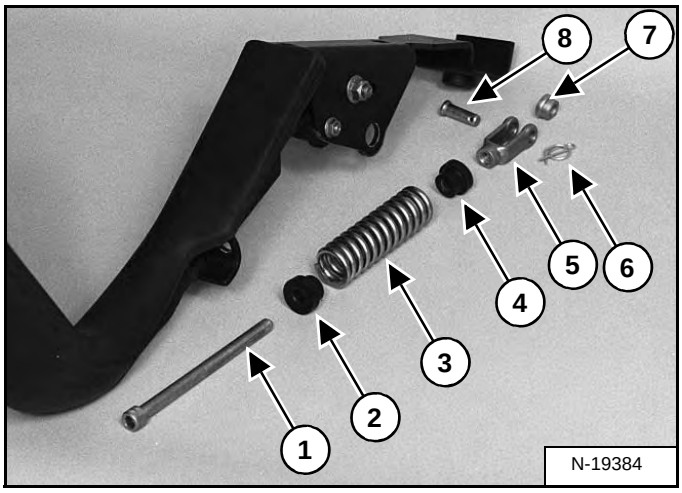


Turn the bolt (Item 1) **[Figure 50-10-14]** & **[Figure 50-10-15]** out of the clevis.

Assembly: Apply Loctite® #518 adhesive to the bolt threads. Adjust the compression spring by turning the bolt in past the end of the clevis three turns.

NOTE: For procedures requiring the use of Loctite® #518 adhesive, thoroughly clean and dry affected parts before the application of Loctite® #518.

Figure 50-10-15



Disassemble and assemble the seat bar compression spring and parts as shown in Fig. **[Figure 50-10-15]**.

Bolt (Item 1)
Bushing (Item 2)
Spring (Item 3)
Bushing (Item 4)
Clevis (Item 5)
Retaining Pin (Item 6)
Bushing (Item 7)
Pin (Item 8)

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OPERATOR CAB

Gas Cylinder Removal And Installation

NOTE: Pages 50-20-1 to 50-20-2 of this procedure is for loaders equipped with standard cab. These loaders only have one gas cylinder per cab side.

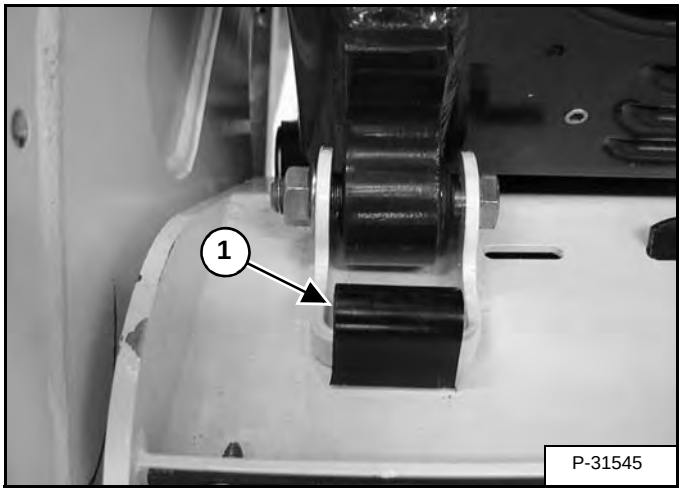
Page 50-20-3 shows the removal of the third gas cylinder which is usually found on loaders equipped with the optional cab enclosure, heat, A/C system and cab door.

⚠ WARNING

Cylinder contains high pressure gas. Do not open. Opening cylinder can release rod and cause injury or death.

W-2113-0288

Figure 50-20-1



Remove the operator cab stop (Item 1) **[Figure 50-20-1]**. (Both sides.)

NOTE: Be careful not to break the rear window when the cab is raised after the cab stops are removed.

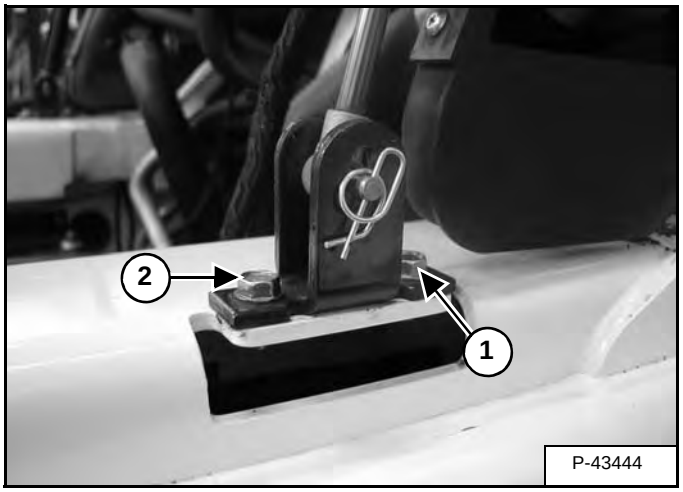
Raise the operator cab. (See Raising on Page 10-30-1.)

Figure 50-20-2



Install a chain (Item 1) **[Figure 50-20-2]** from the operator cab to the loader main frame to prevent the cab from tipping forward when the gas cylinder(s) are removed.

Figure 50-20-3



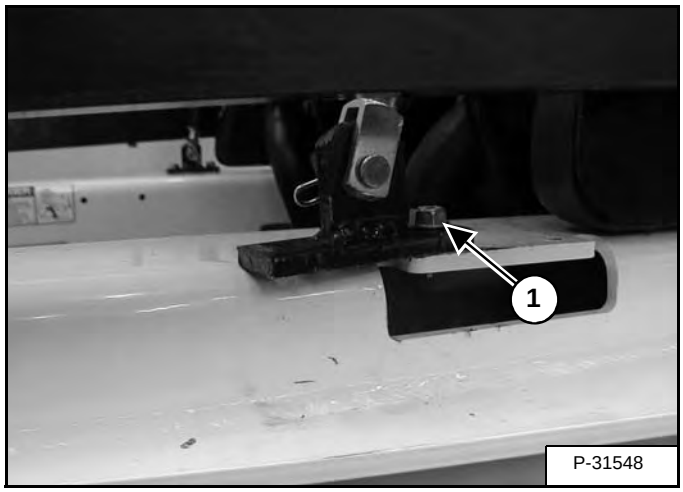
Remove the bolt (Item 1) **[Figure 50-20-3]** from the gas cylinder mounting bracket.

Loosen the mount bolt (Item 2) **[Figure 50-20-3]**.

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Gas Cylinder Removal And Installation (Cont'd)

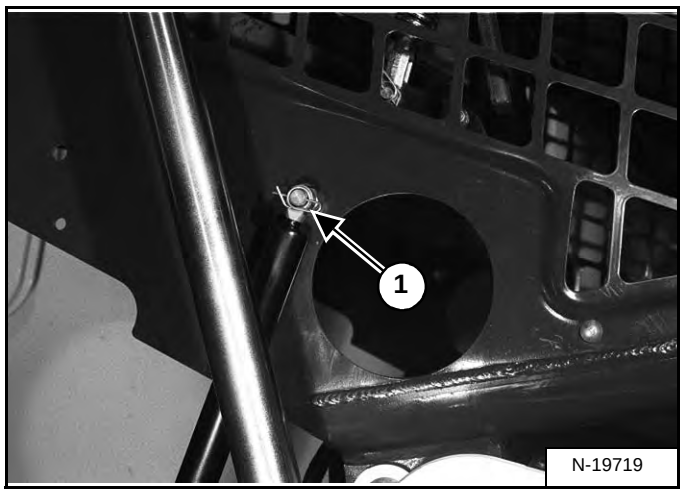
Figure 50-20-4



Turn the mounting bracket forward to relieve any remaining tension on the gas cylinder **[Figure 50-20-4]**.

Remove the mount bolt (Item 1) **[Figure 50-20-4]**.

Figure 50-20-5

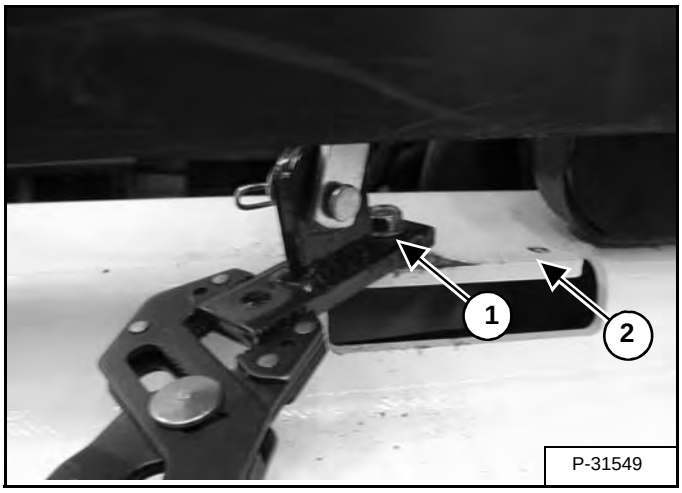


Remove the retainer clip (Item 1) **[Figure 50-20-5]** from the top pivot pin.

Remove the gas cylinder from the cab.

Repeat the procedure for the opposite side.

Figure 50-20-6



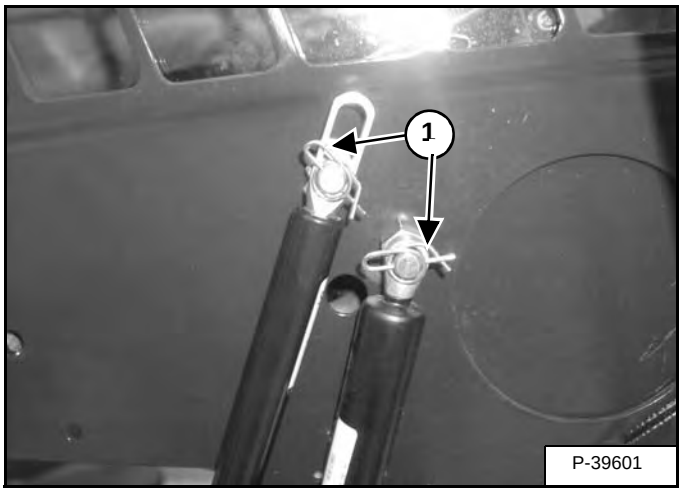
Installation: Mount the gas cylinder to the cab pivot pin **[Figure 50-20-5]**. Install the front mount bolt (Item 1) **[Figure 50-20-6]**. Use a locking pliers and turn the mount bracket to align the bracket with the hole (Item 2) **[Figure 50-20-6]**. Install the bolt and tighten the mount bolts to 15 - 20 ft.-lb. (20,3 - 27,1 N•m) torque.

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Gas Cylinder Removal And Installation (Cont'd)

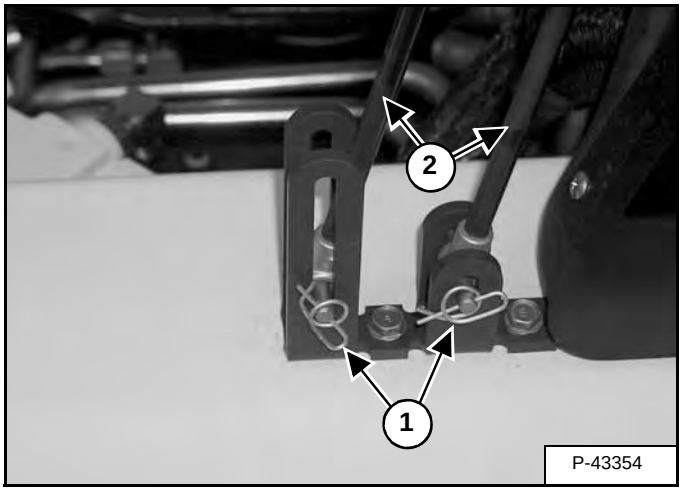
NOTE: [Figure 50-20-7] and [Figure 50-20-8] are for loaders equipped with the third gas cylinder. The third gas cylinder is found on the left side of the operator cab.

Figure 50-20-7



Remove the retaining pins (Item 1) **[Figure 50-20-7]** from the cab pivot pins.

Figure 50-20-8

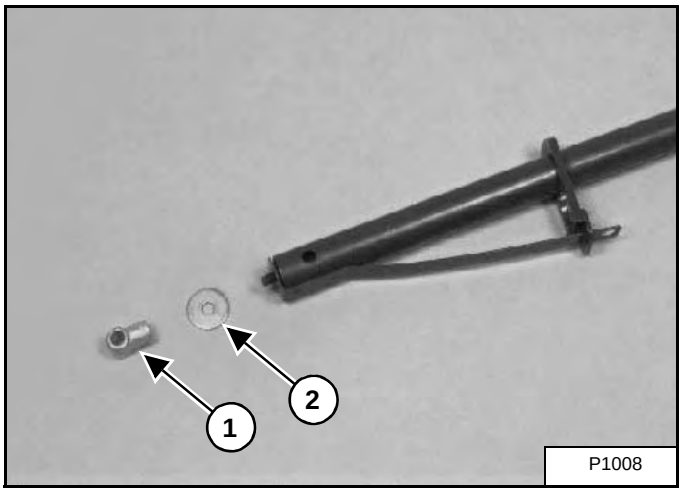


Remove the retaining pins (Item 1) **[Figure 50-20-8]** from the lower pivot pins.

Remove the gas cylinders (Item 2) **[Figure 50-20-8]** from the operator cab.

Gas Cylinder Bracket Disassembly And Assembly

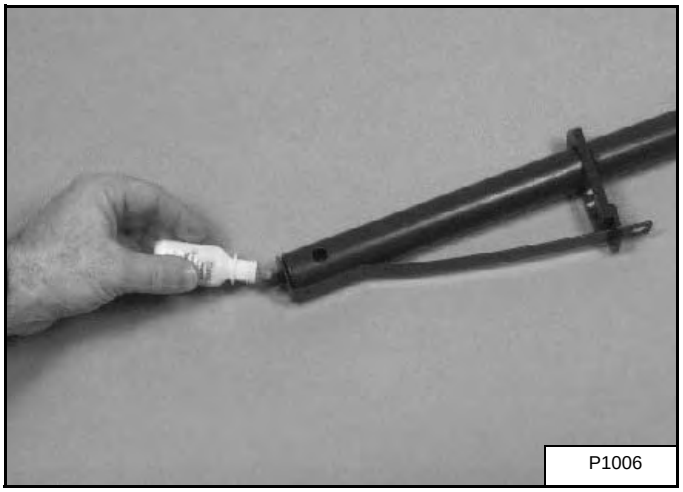
Figure 50-20-9



Remove the clevis (Item 1) and washer (Item 2) **[Figure 50-20-9]** from the end of the gas cylinder.

Remove the gas cylinder from the outer housing.

Figure 50-20-10



Assembly: Install a replacement cylinder inside the cylinder housing.

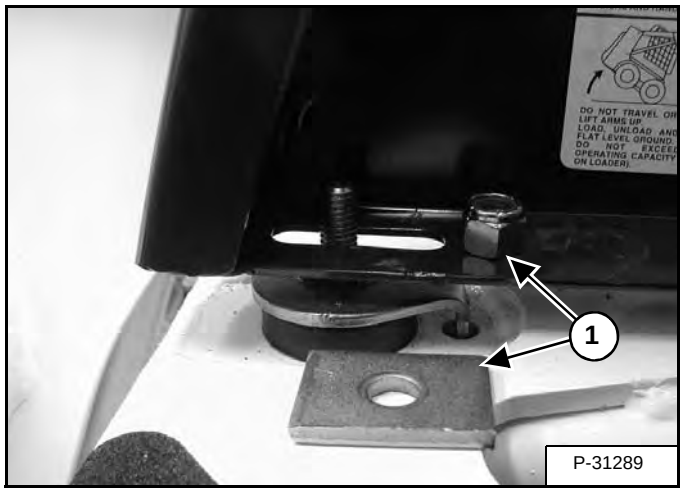
Apply a small amount of Loctite® on the threads of the cylinder rod **[Figure 50-20-10]**.

Reinstall the washer and clevis on the cylinder rod.

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Removal And Installation

Figure 50-20-11

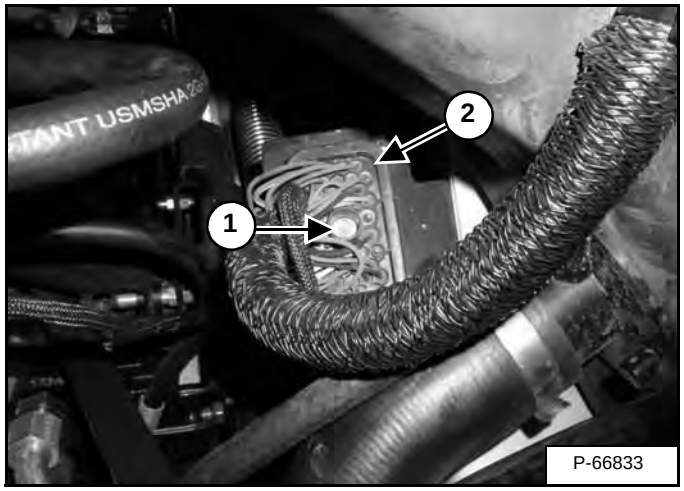


Remove the cab nut and holddown plate (Item 1) **[Figure 50-20-11]** (both sides).

Installation: Tighten the nut to 40-50 ft.-lb. (54-68 N•m) torque.

Raise the operator cab. (See Raising on Page 10-30-1.)

Figure 50-20-12

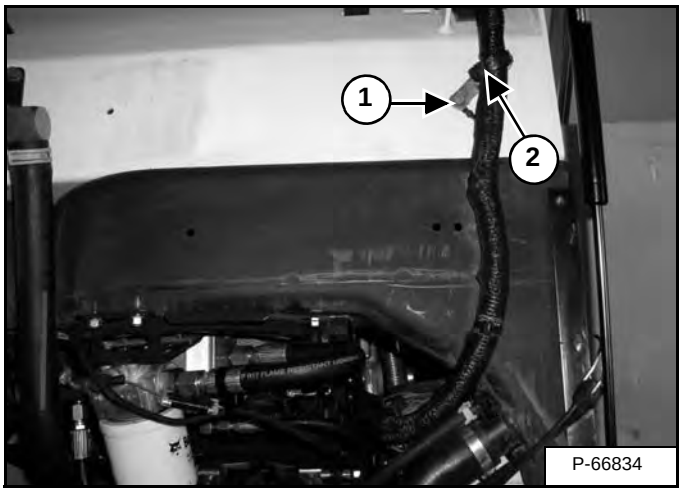


Loosen the harness connector bolt (Items 1) **[Figure 50-20-12]**.

Installation: Tighten the connector bolt to 30-35 in.-lb. (3,4-4 N•m) torque.

Disconnect the electrical connector (Item 2) **[Figure 50-20-12]**.

Figure 50-20-13



Remove the tie-straps from the wiring harness.

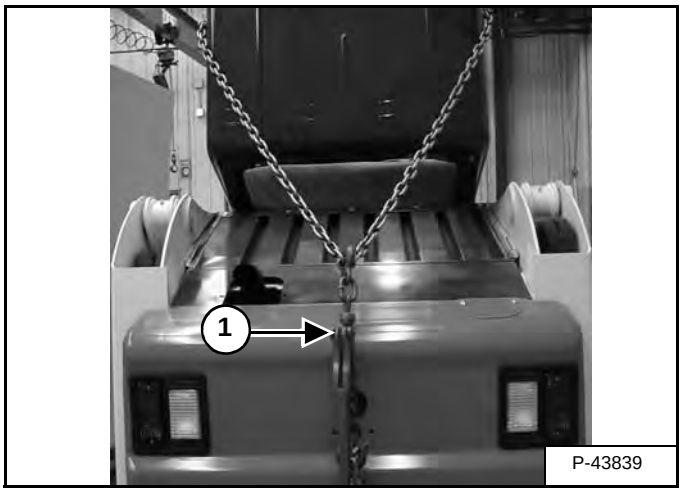
Remove the mount bolt (Item 1) and disconnect the wire harness from the mounting clamp (Item 2) **[Figure 50-20-13]**.

Position the wiring harness, so that it does not get damaged when the cab is removed.

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Removal And Installation (Cont'd)

Figure 50-20-14



Install a chain (Item 1) **[Figure 50-20-14]** from the operator cab to the loader main frame to prevent the cab from tipping forward when the gas cylinders are removed.

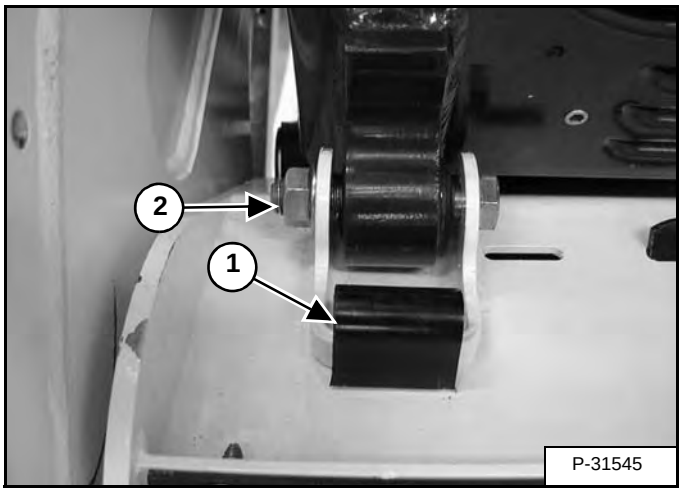
Remove both gas cylinders. (See Gas Cylinder Removal And Installation on Page 50-20-1.)

Figure 50-20-15



Connect a sling and chain hoist to the operator cab grab handles and lower (or raise) the operator cab when the gas cylinders are disconnected **[Figure 50-20-15]**.

Figure 50-20-16



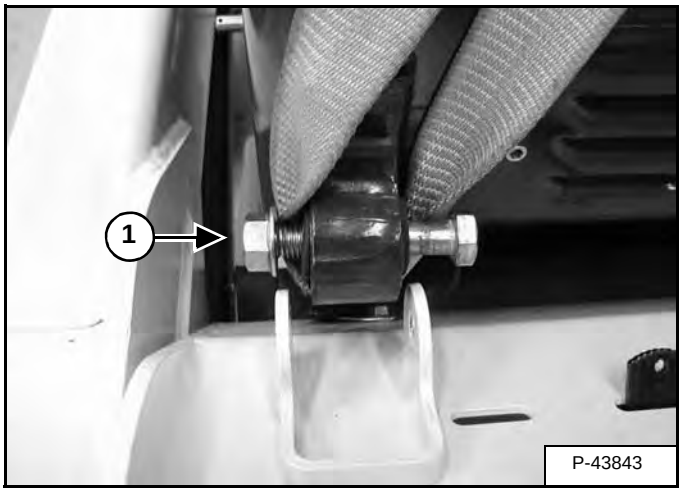
Remove the operator cab stop (Item 1) **[Figure 50-20-16]**.

Remove the nut (Item 2) **[Figure 50-20-16]** from the pivot bolt (both sides).

Installation: Tighten the pivot bolt and nut to 25-35 ft.-lb. (34-47 N•m) torque.

Remove the pivot bolt (both sides).

Figure 50-20-17



Move the operator cab forward a small amount for clearance at the pivot mounting brackets **[Figure 50-20-17]**.

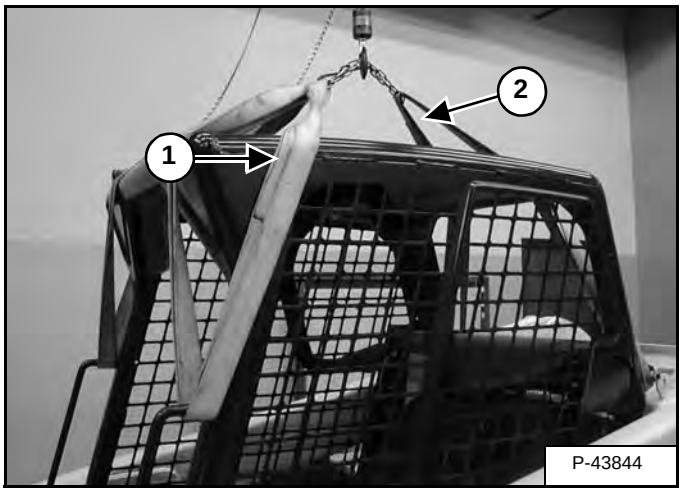
Install the pivot bolt, washer and nut (Item 1) **[Figure 50-20-17]** in the cab pivot (both sides).

Install the sling under the pivot bolt and pivot of the operator cab **[Figure 50-20-17]**.

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Removal And Installation (Cont'd)

Figure 50-20-18



Connect the slings (Items 1 & 2) **[Figure 50-20-18]** to a chain hoist.

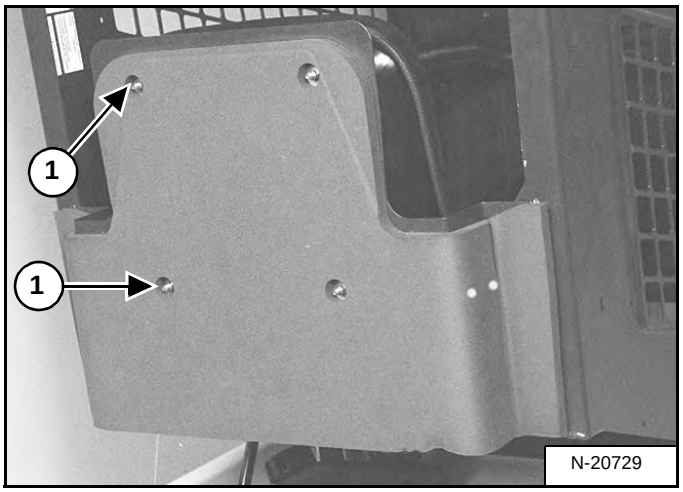
Remove the operator cab from the loader **[Figure 50-20-18]**.

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OPERATOR SEAT

Removal And Installation

Figure 50-30-1



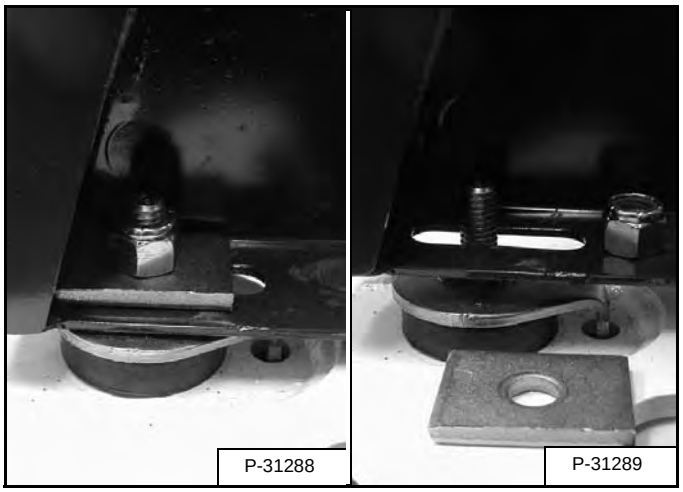
Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the four seat mounting nuts (Item 1) **[Figure 50-30-1]** and washers from the operator seat mounting studs.

Installation: Tighten the mounting nuts to 20 ft.-lb. (27 N•m) torque.

NOTE: Ensure the washers are installed.

Figure 50-30-2



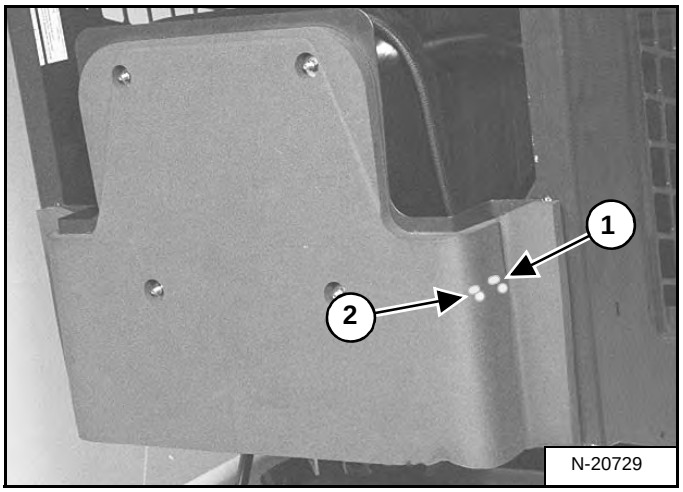
Lower the cab and install one of the mounting washer and nut **[Figure 50-30-2]**.

NOTE: With the seat removed the cab will raise.

Reverse the removal procedure to install the operator seat.

Seat Belt Removal And Installation

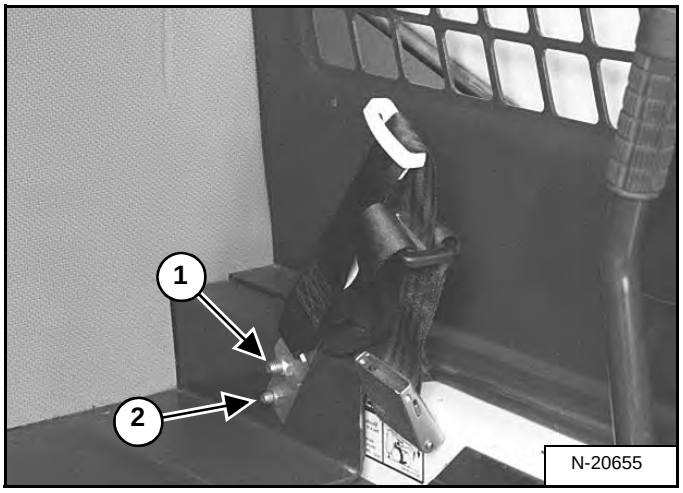
Figure 50-30-3



Raise the operator cab. (See Raising on Page 10-30-1.)

Locate the seat belt bolts under seat pan insulation (Items 1 & 2) **[Figure 50-30-3]** and peel back or cut insulation to gain access to the head.

Figure 50-30-4



Remove the two nuts (Items 1 & 2) **[Figure 50-30-4]**.

Installation: Tighten nut (Item 1) **[Figure 50-30-4]** to 54 ft.-lb. (73 N•m) torque. Tighten nut (Item 2) **[Figure 50-30-4]** to 34 ft.-lb. (46 N•m) torque.

Repeat for other half of seat belt and guide.

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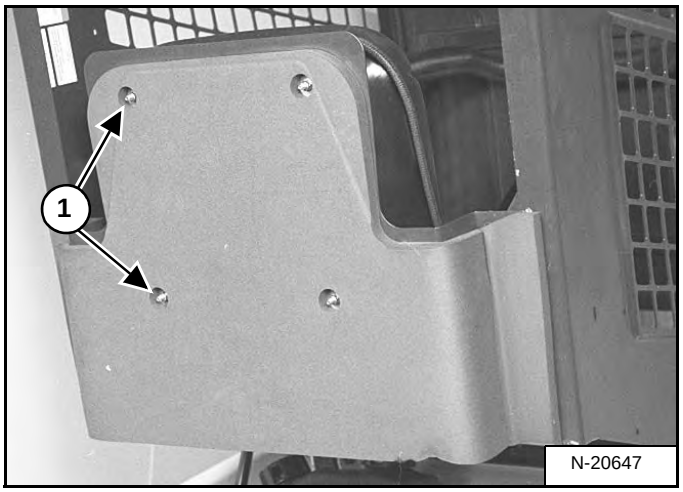


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OPERATOR SEAT (SUSPENSION)

Removal And Installation

Figure 50-31-1

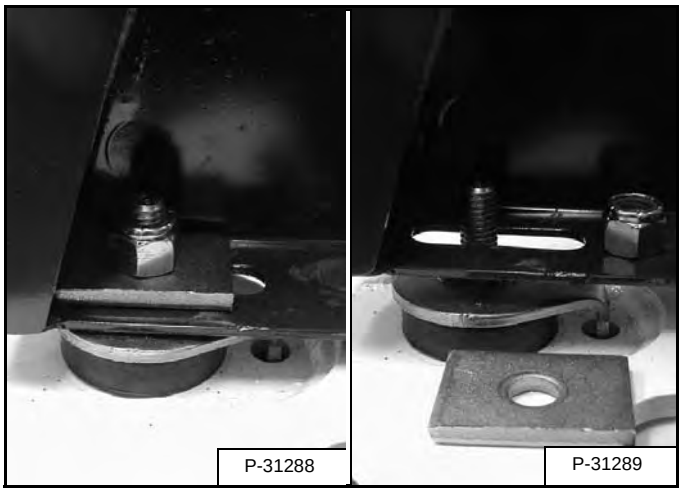


Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the four seat mounting nuts (Item 1) **[Figure 50-31-1]** and washers from the operator seat mounting studs.

Installation: Tighten the mounting nuts to 20 ft.-lb. (27 N•m) torque.

Figure 50-31-2

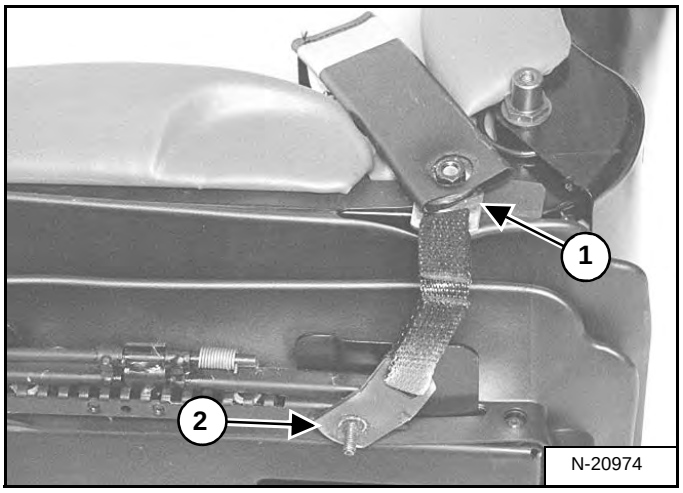


Lower the cab and install one of the mounting washer and nut **[Figure 50-31-2]**.

NOTE: With the seat removed the cab will raise.

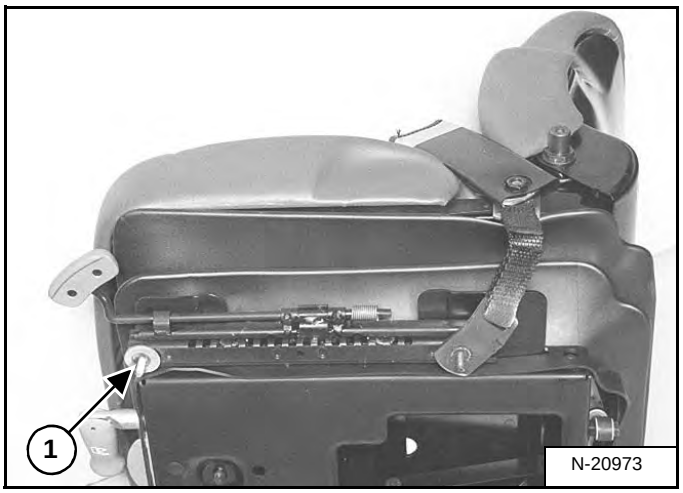
Reverse the removal procedure to install the operator seat.

Figure 50-31-3



NOTE: Assure seat tethers are securely fastened to seatbelt studs (Item 1) and seat rail studs (Item 2) [Figure 50-31-3].

Figure 50-31-4

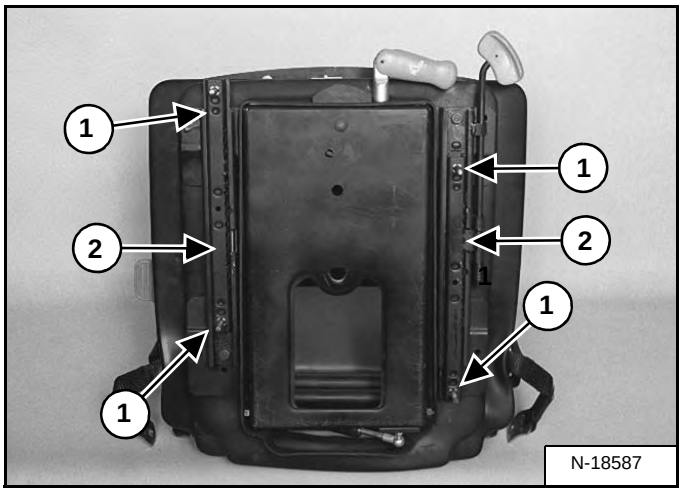


NOTE: Verify the front two seat rail studs have washers attached (Item 1) [Figure 50-31-4].

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Slide Rail Removal And Installation

Figure 50-31-5



Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the operator seat. (See Removal And Installation on Page 50-31-1.)

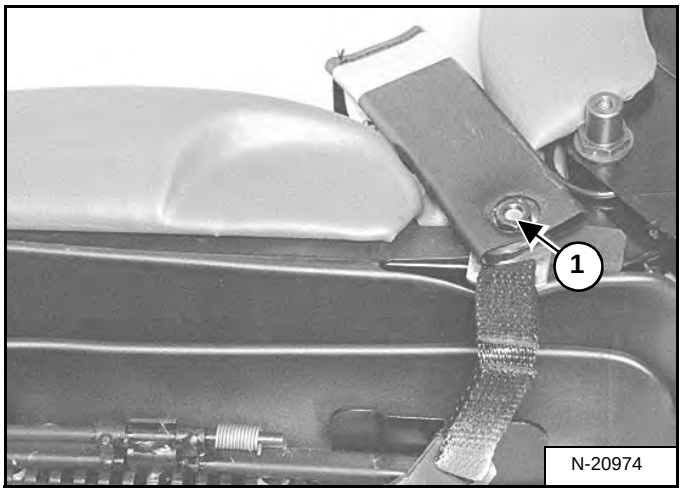
Remove the two slide rail mounting bolts (Item 1) **[Figure 50-31-5]**.

Remove the slide rail (Item 2) **[Figure 50-31-5]** from the bottom of the seat frame.

Reverse the removal procedure to install the operator seat slide rail.

Seat Belt Removal And Installation

Figure 50-31-6



Remove the nut (Item 1) **[Figure 50-31-6]** from the seat belt mount.

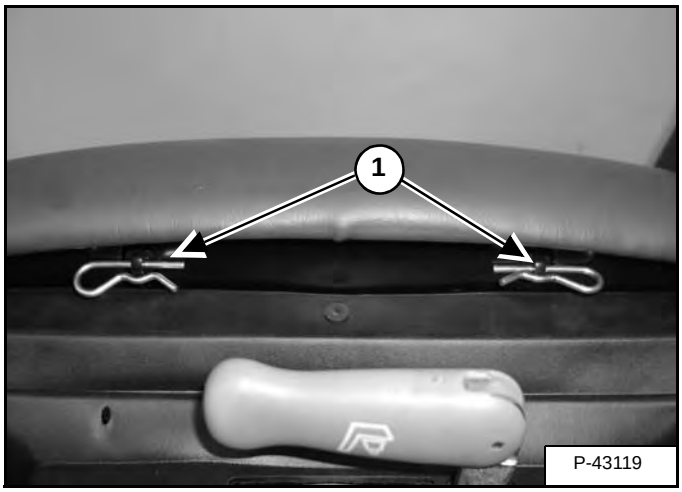
Remove the seat belt.

Installation: Tighten the mounting nuts to 58 to 62 ft.-lb. (78.6 to 84 N•m) torque.

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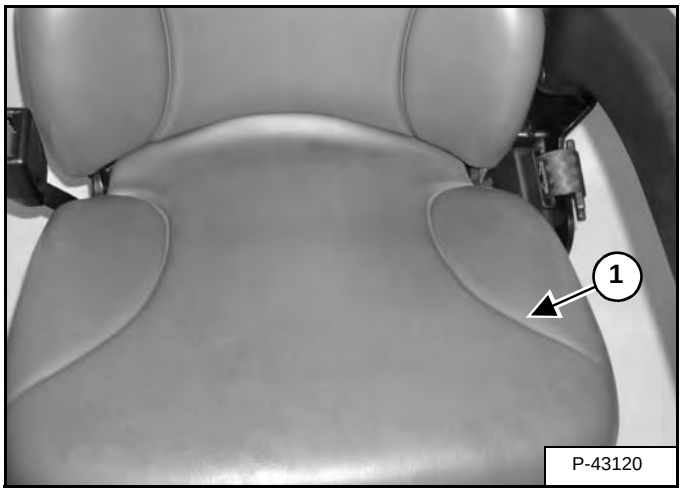
Cushion Removal And Installation

Figure 50-31-7



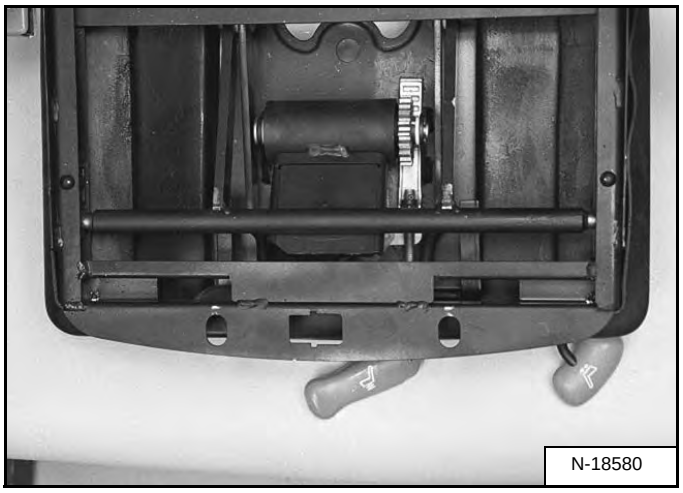
Remove the clips (Item 1) **[Figure 50-31-7]** from the seat cushion.

Figure 50-31-8



Lift and remove the seat cushion (Item 1) **[Figure 50-31-8]** from the seat frame.

Figure 50-31-9



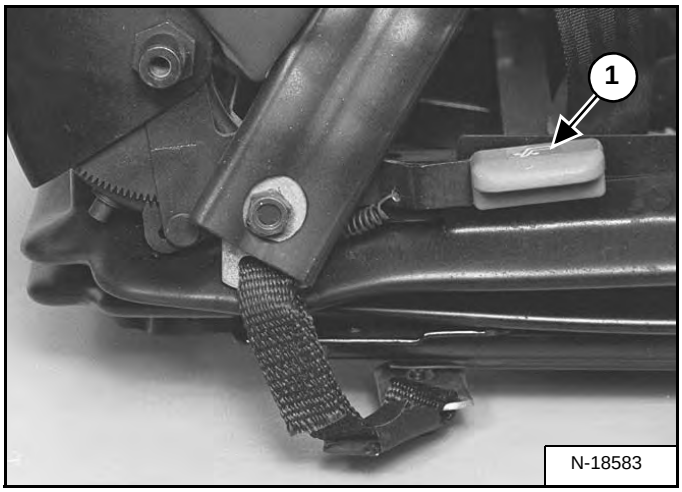
Inspect the seat ride adjustment **[Figure 50-31-9]**.

Reverse the removal procedure to install the operator seat back.

Dealer Copy -- Not for Resale

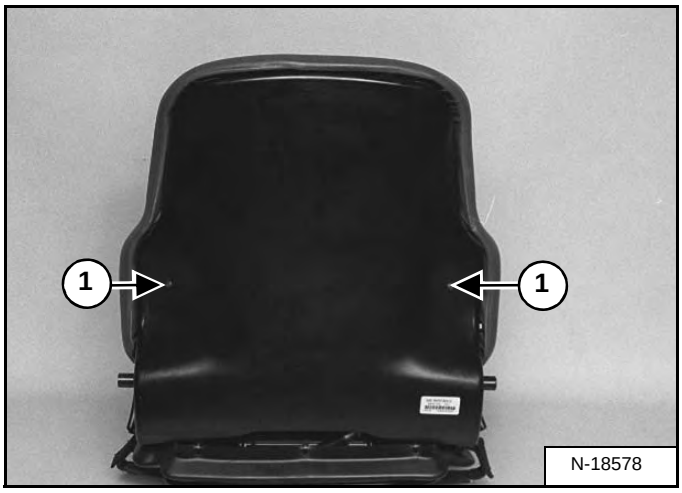
Back Removal And Installation

Figure 50-31-10



Pull the seat back adjustment lever (Item 1) **[Figure 50-31-10]** and tilt the seat back all the way forward.

Figure 50-31-11

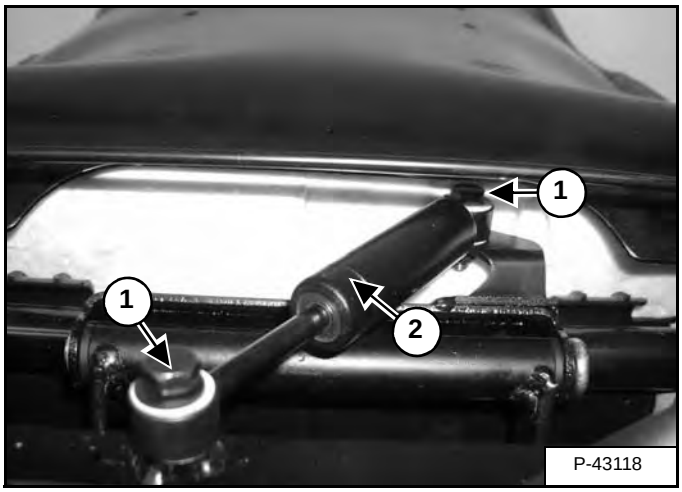


Remove the two mounting screws (Item 1) **[Figure 50-31-11]** from the seat back and remove the back.

Reverse the removal procedure to install the operator seat back.

Shock Removal And Installation

Figure 50-31-12



Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the operator seat. (See Removal And Installation on Page 50-31-1.)

Remove the seat shock mounting bolts (Item 1) **[Figure 50-31-12]** (Both ends.)

Remove the seat shock (Item 2) **[Figure 50-31-12]**.

Reverse the removal procedure to install the operator seat shock.

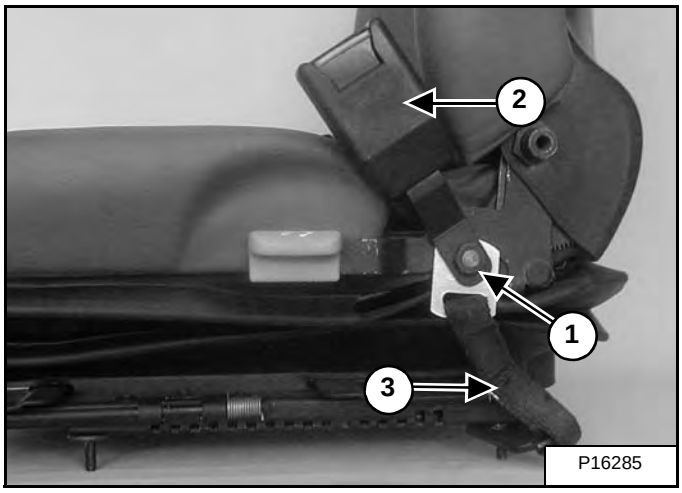
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3-Point Seat Belt Removal And Installation

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the operator seat. (See Removal And Installation on Page 50-31-1.)

Figure 50-31-13

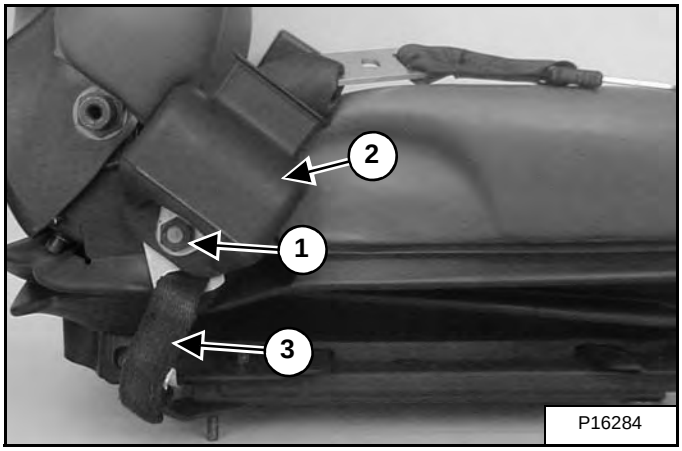


Remove the mounting nut (Item 1) **[Figure 50-31-13]**

Remove the end release buckle (Item 2) **[Figure 50-31-13]**.

Installation: Be sure tether strap (Item 3) **[Figure 50-31-13]** is on the seat belt stud behind the end release buckle.

Figure 50-31-14

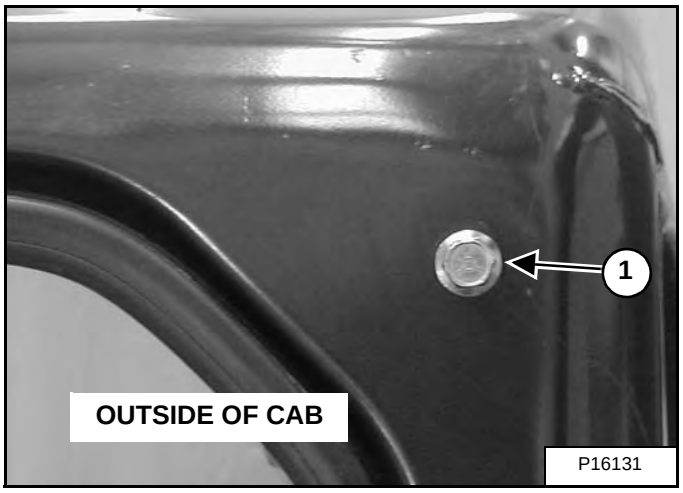


Remove the mounting nut (Item 1) **[Figure 50-31-14]**.

Remove the seat belt retractor (Item 2) **[Figure 50-31-14]**

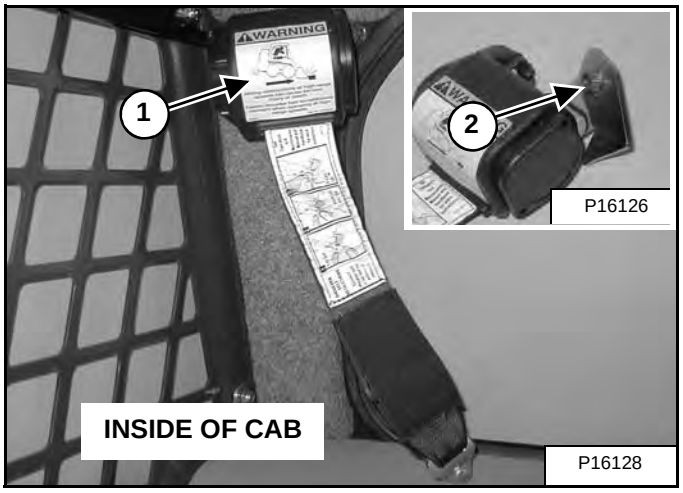
Installation: Be sure tether strap (Item 3) **[Figure 50-31-14]** is on the seat belt stud behind the seat belt retractor.

Figure 50-31-15



Remove the mounting bolt (Item 1) **[Figure 50-31-15]**

Figure 50-31-16



Remove the shoulder harness retractor (Item 1) **[Figure 50-31-16]**.

Installation: Line up the bolt (Item 1) **[Figure 50-31-15]** with the mounting bracket (Item 2) **[Figure 50-31-16]** on the inside of the cab.

Installation: Be sure tether strap (Item 3) **[Figure 50-31-14]** is on the seat belt stud behind the seat belt retractor.

Remove the mounting bolt (Item 1) **[Figure 50-31-15]**

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BOB-TACH (HAND LEVER)

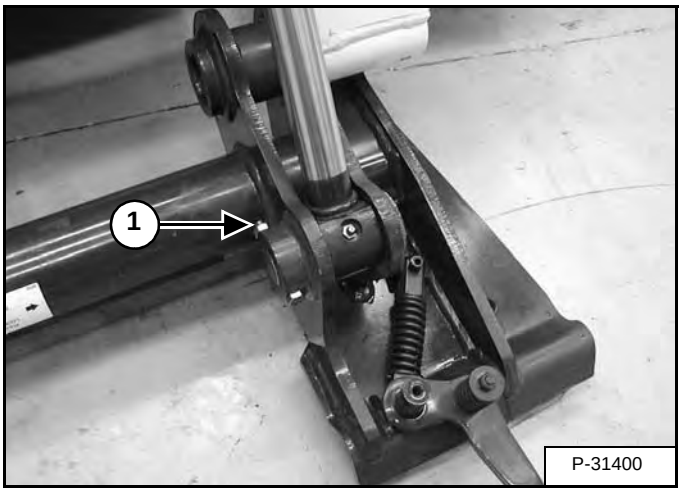
Description

The Bob-Tach is the section of the loader lift arm that attachments mount to. The Power Bob-Tach uses two manually operated, spring assisted, locking wedge and lever assemblies to secure the attachment the Bob-Tach.

The Bob-Tach is located on the front of the loader connected to the loader lift arms.

Removal And Installation

Figure 50-40-1

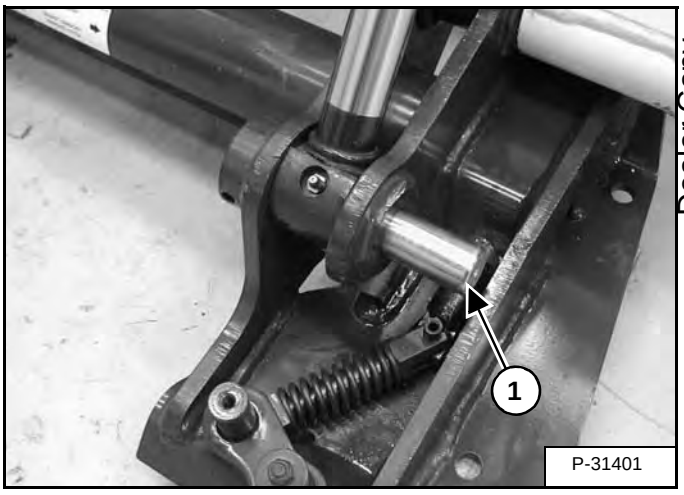


Tilt the Bob-Tach forward, so it is parallel to the floor. Put blocks (approximately 3 inches) under each side of the Bob-Tach **[Figure 50-40-1]**.

Lower the Bob-Tach onto the blocks.

Remove the retainer nut (Item 1) **[Figure 50-40-1]** and bolt from the tilt cylinder rod end pin (both sides).

Figure 50-40-2



Remove the pivot pin (Item 1) **[Figure 50-40-2]** from the tilt cylinder rod end (both sides).

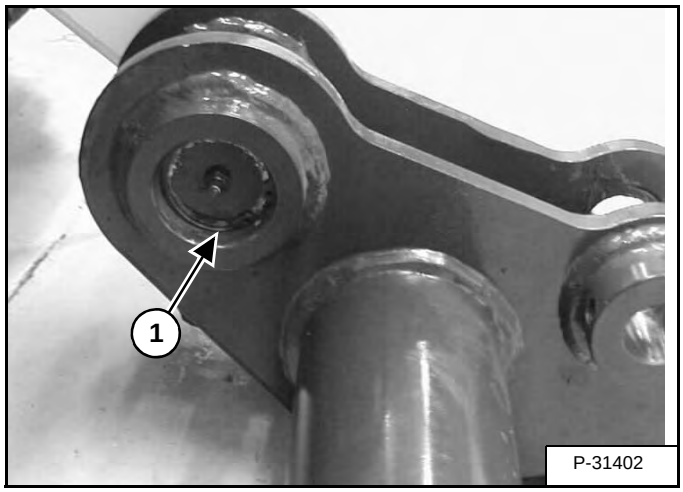
Remove the tilt cylinder rod end from the Bob-Tach (both sides).

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BOB-TACH (HAND LEVER) (CONT'D)

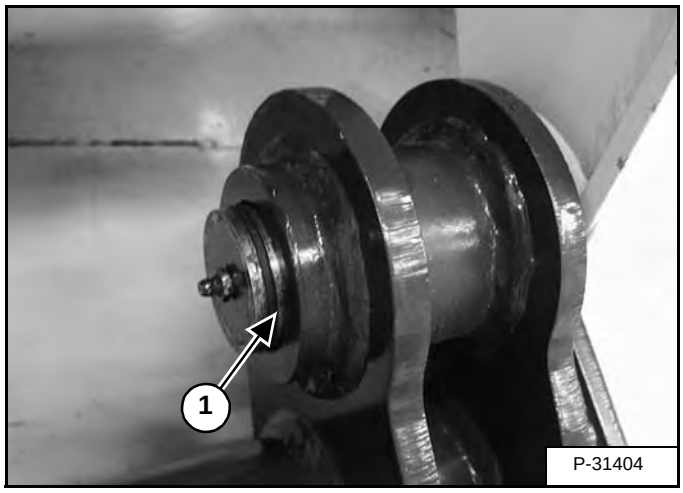
Removal And Installation (Cont'd)

Figure 50-40-3



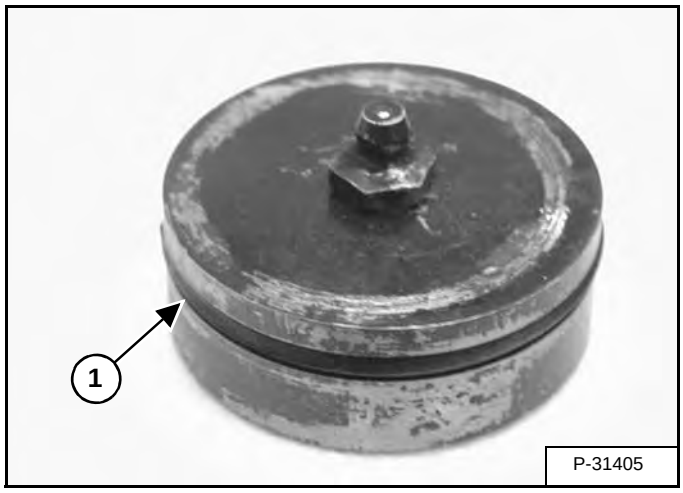
Remove the snap ring (Item 1) **[Figure 50-40-3]** from the Bob-Tach pivot pin grease plug (both sides).

Figure 50-40-4



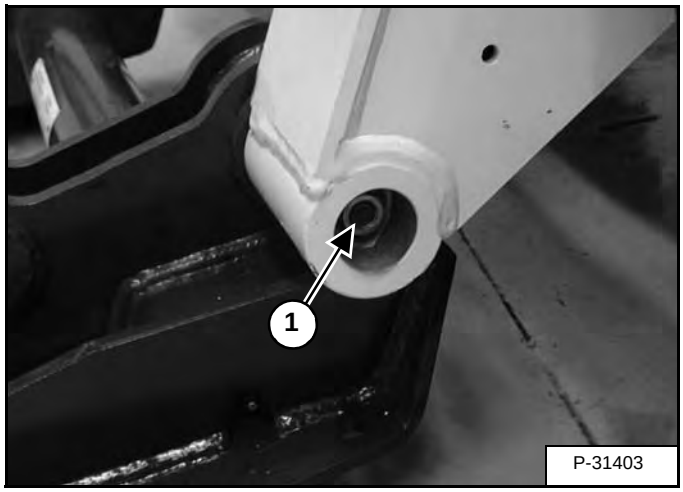
Use a grease gun and pump grease into the pivot pin forcing the grease plug out of the Bob-Tach (Item 1) **[Figure 50-40-4]**.

Figure 50-40-5



Check and replace O-ring (Item 1) **[Figure 50-40-5]** on the grease plug.

Figure 50-40-6



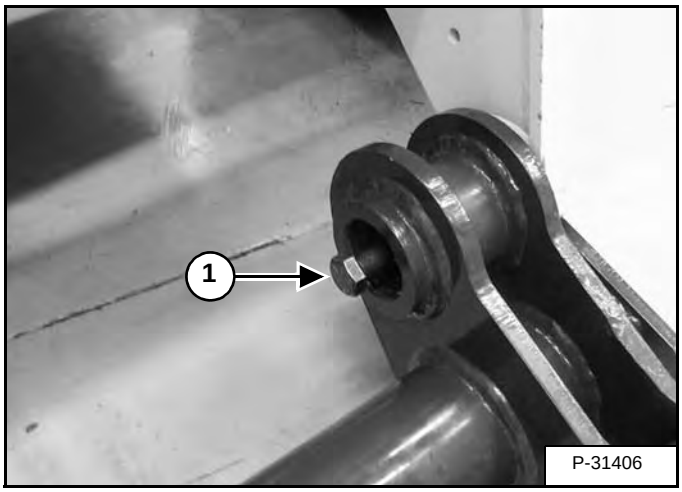
Remove the nut (Item 1) **[Figure 50-40-6]** from the Bob-Tach pivot pin retaining bolt (both sides).

Installation: Tighten the retainer nut and bolt to 190 ft.-lb. (258 N•m) torque.

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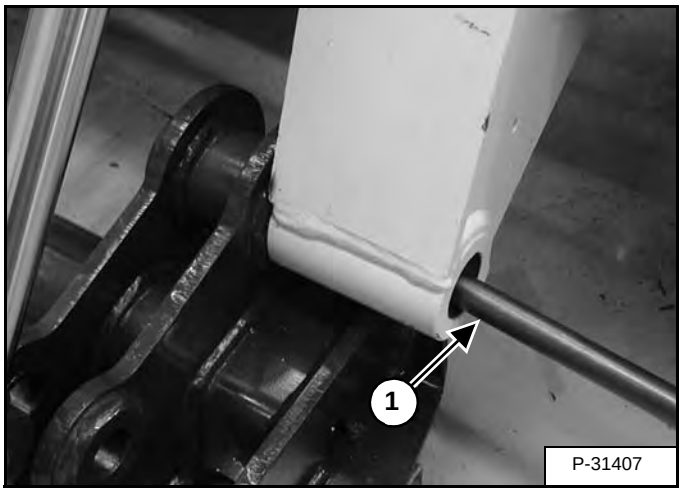
Removal And Installation (Cont'd)

Figure 50-40-7



Remove the retainer bolt (Item 1) **[Figure 50-40-7]** from the Bob-Tach pin.

Figure 50-40-8

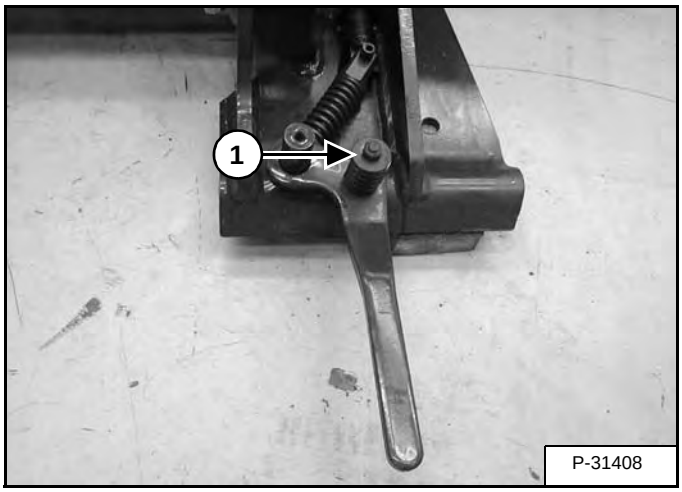


With a 7/8 in. (.875 mm) drift (Item 1) **[Figure 50-40-8]** and a hammer, drive the pivot pin out of the lift arm & Bob-Tach.

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Lever And Wedge Disassembly And Assembly

Figure 50-40-9

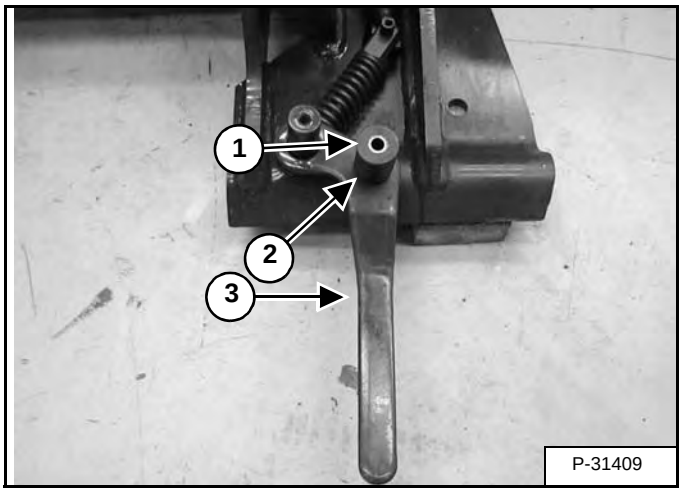


Tilt the Bob-Tach forward, so it is parallel to the floor. Put blocks (approximately 3 inches) under each side of the Bob-Tach **[Figure 50-40-9]**.

Remove the nut (Item 1) **[Figure 50-40-9]** from the Bob-Tach lever pivot bolt.

NOTE: Removal procedure is shown for the left side. Right side procedure is the same.

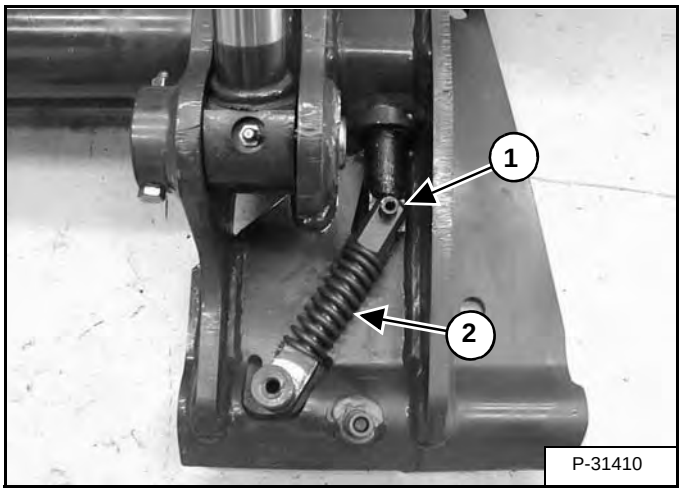
Figure 50-40-10



Remove the lever mounting washer (Item 1), spring (Item 2) and lever (Item 3) **[Figure 50-40-10]**.

Installation: Tighten the nut to 25-28 ft.-lb. (34-38 N•m) torque.

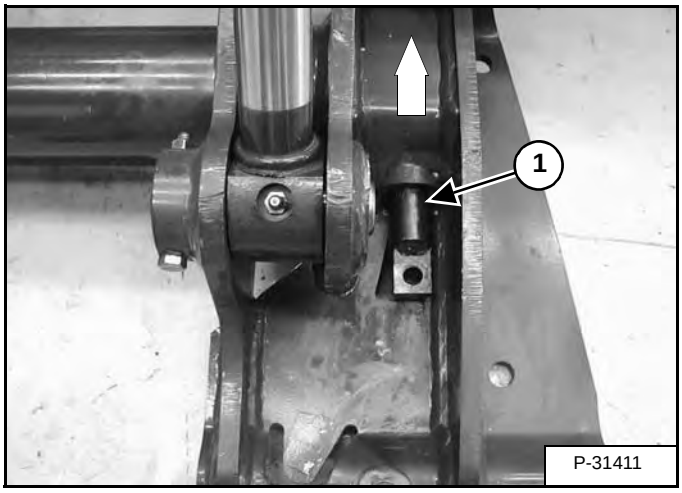
Figure 50-40-11



Use a punch and hammer, remove the roll pin (Item 1) **[Figure 50-40-11]** from the Bob-Tach wedge and spring clevis.

Remove the spring/clevis (Item 2) **[Figure 50-40-11]** assembly.

Figure 50-40-12



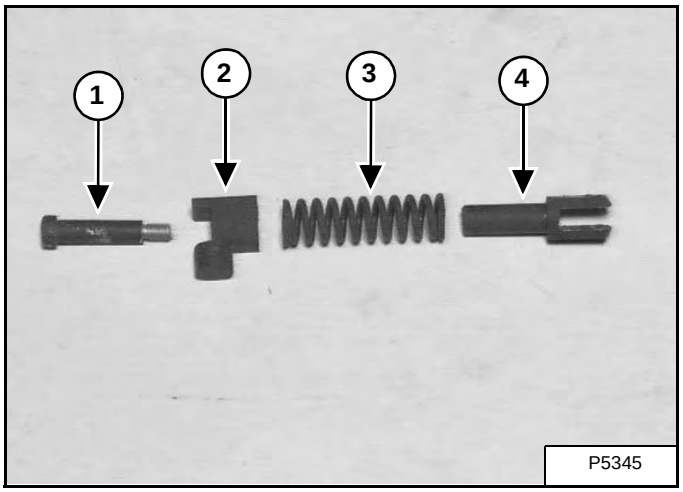
Remove the wedge (Item 1) **[Figure 50-40-12]** out of the bottom of the Bob-Tach.

Always replace bent or broken wedges.

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Lever And Wedge Disassembly And Assembly (Cont'd)

Figure 50-40-13



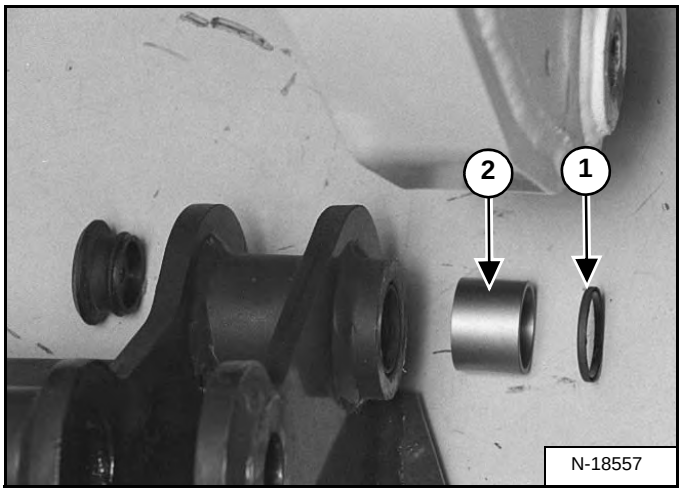
If the bolt (Item 1), handle pivot (Item 2), spring (Item 3) or clevis (Item 4) are damaged, put the assembly in a vise **[Figure 50-40-13]**.

Remove the bolt and replace the damaged parts as needed,

Reverse the removal procedure to install the Bob-Tach lever and wedge.

Pivot Pin Bushing And Seal Removal And Installation

Figure 50-40-14



Remove the Power Bob-Tach. (See Removal And Installation on Page 50-41-1.)

Use a seal pick to remove seal (Item 1) **[Figure 50-40-14]** on the Bob-Tach.

Remove and replace bushing (Item 2) **[Figure 50-40-14]** with a driver tool and hammer.

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BOB-TACH (POWER - OPTION)

Description

The Bob-Tach is the section of the loader lift arm that attachments mount to. The Power Bob-Tach option uses two hydraulically operated, spring assisted, locking wedge and lever assemblies to secure the attachment to the Bob-Tach.

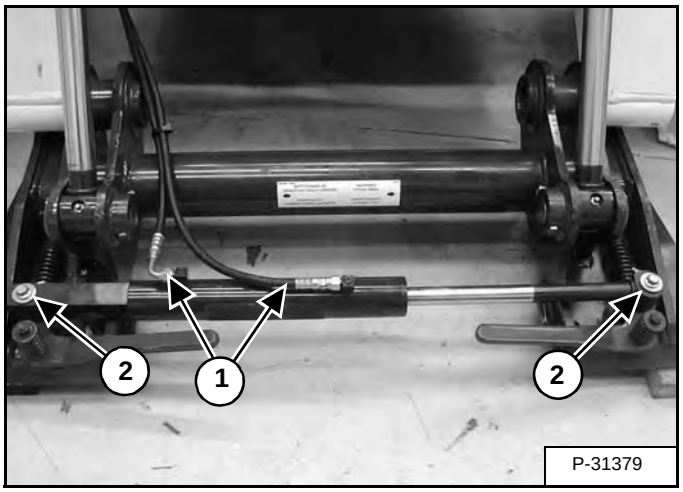
The hydraulically operated Power Bob-Tach has a hydraulic cylinder that opens and closes both wedge and lever assemblies by pressing a switch on the front accessory panel. The switch activates the Power Bob-Tach block to allow flow into or out of the hydraulic cylinder connected to the levers on the Bob-Tach.

The Power Bob-Tach block is located on the rear of the gear pump.

The Bob-Tach is located on the front of the loader connected to the loader lift arms.

Removal And Installation

Figure 50-41-1



Tilt the Bob-Tach forward, so it is parallel to the floor. Put 2x4 blocks under each side of the Bob-Tach **[Figure 50-41-1]**.

Lower the Bob-Tach onto the blocks.

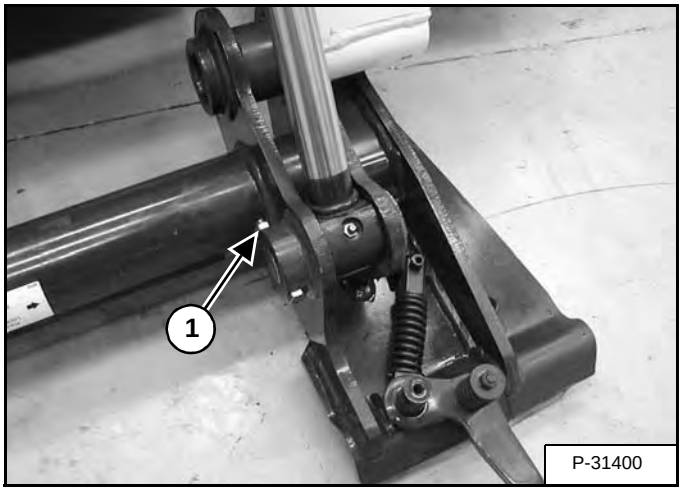
Mark the hoses (Item 1) **[Figure 50-41-1]** for correct installation.

Remove the hoses from the cylinder fittings.

Remove the mount bolt (Item 2) **[Figure 50-41-1]** from the cylinder (both ends).

Remove the cylinder from the Bob-Tach.

Figure 50-41-2

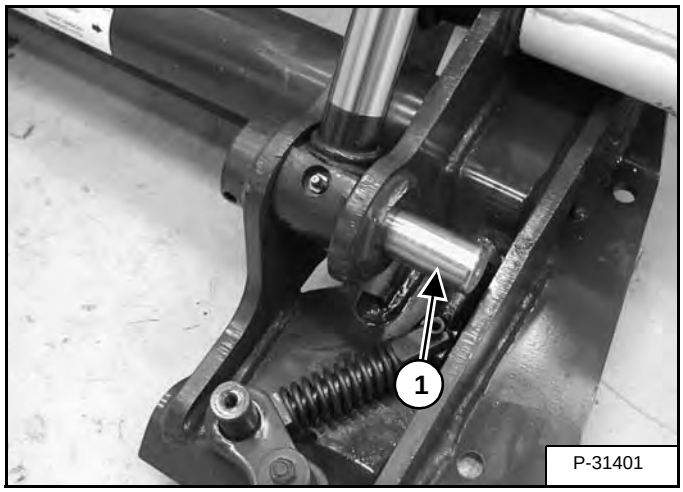


Remove the retainer nut and bolt (Item 1) **[Figure 50-41-2]** from the tilt cylinder rod end pin (both sides).

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Removal And Installation (Cont'd)

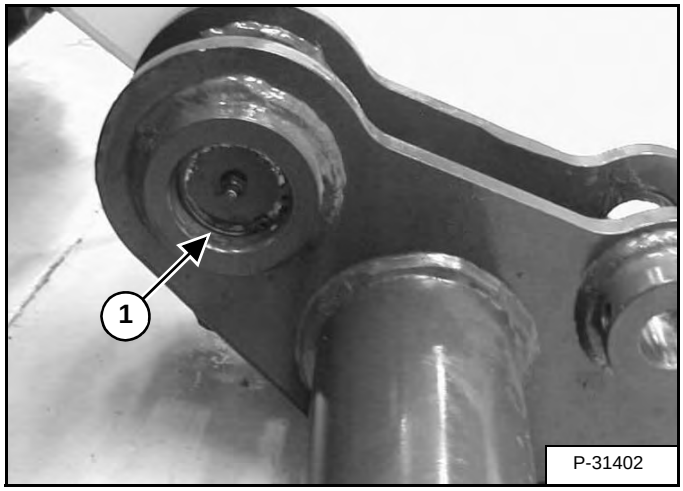
Figure 50-41-3



Remove the pivot pin (Item 1) **[Figure 50-41-3]** from the tilt cylinder rod end (both sides).

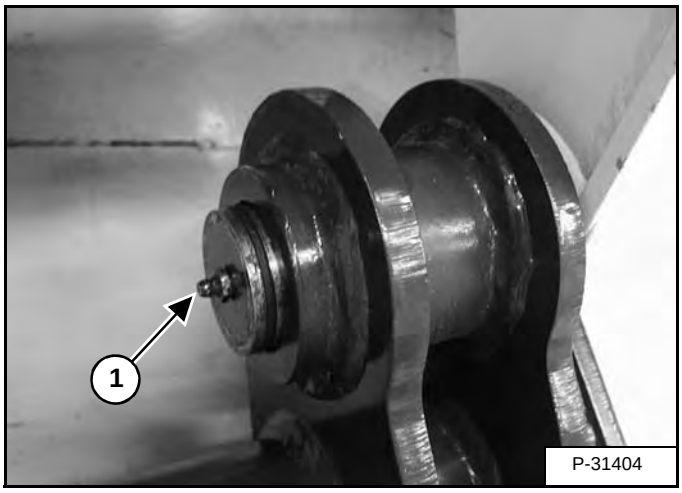
Remove the tilt cylinder rod end from the Bob-Tach (both sides).

Figure 50-41-4



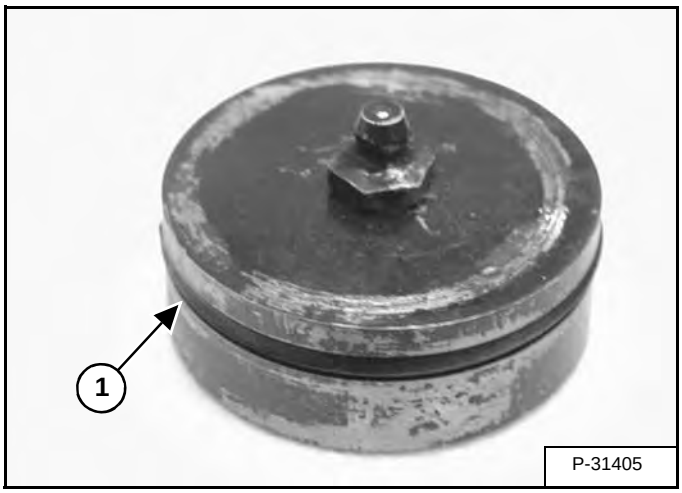
Remove the snap ring (Item 1) **[Figure 50-41-4]** at the Bob-Tach pivot pin grease plug (both sides).

Figure 50-41-5



Use a grease gun and pump grease into the pivot pin forcing the grease plug out of the Bob-Tach (Item 1) **[Figure 50-41-5]** (both sides).

Figure 50-41-6

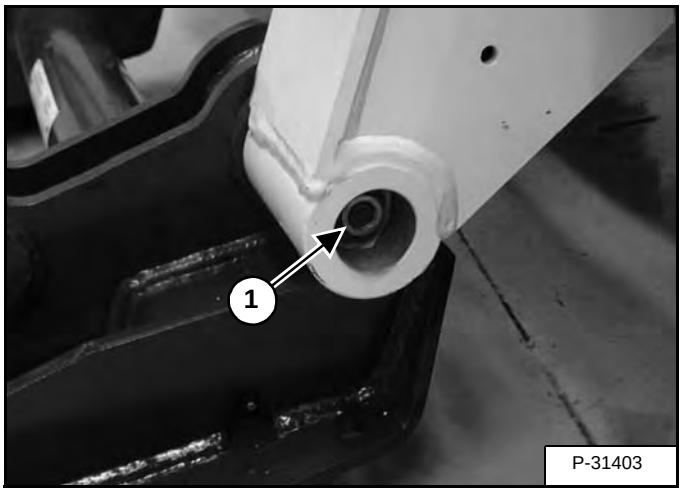


Check and replace the O-ring (Item 1) **[Figure 50-41-6]** on the grease plug.

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Removal And Installation (Cont'd)

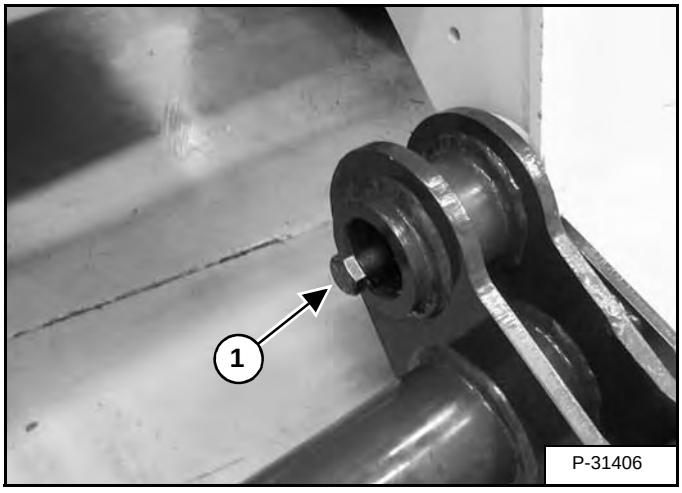
Figure 50-41-7



Remove the nut (Item 1) **[Figure 50-41-7]** from the Bob-Tach pivot pin retaining bolt (both sides).

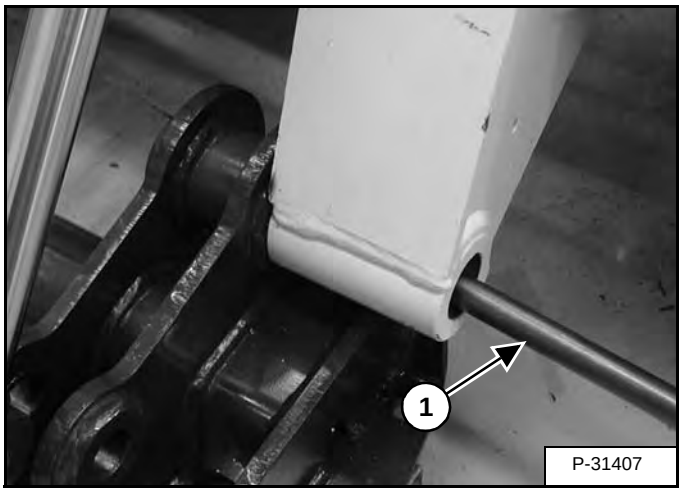
Installation: Tighten the retainer nut and bolt to 190 ft.-lb. (258 N•m) torque.

Figure 50-41-8



Remove the retainer bolt (Item 1) **[Figure 50-41-8]** from the Bob-Tach pivot pin (both sides).

Figure 50-41-9



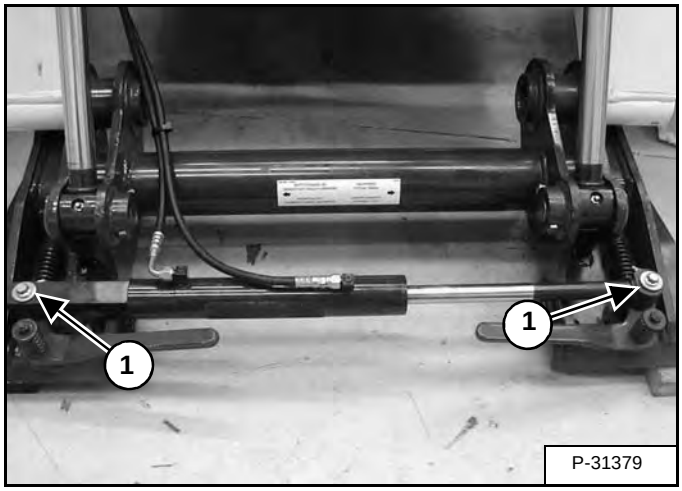
With a 7/8 in. (.875 mm) drift (Item 1) **[Figure 50-41-9]** and a hammer, drive the pivot pin out of the lift arm and Bob-Tach (both sides).

Remove the Bob-Tach from the loader.

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Lever And Wedge Disassembly And Assembly

Figure 50-41-10

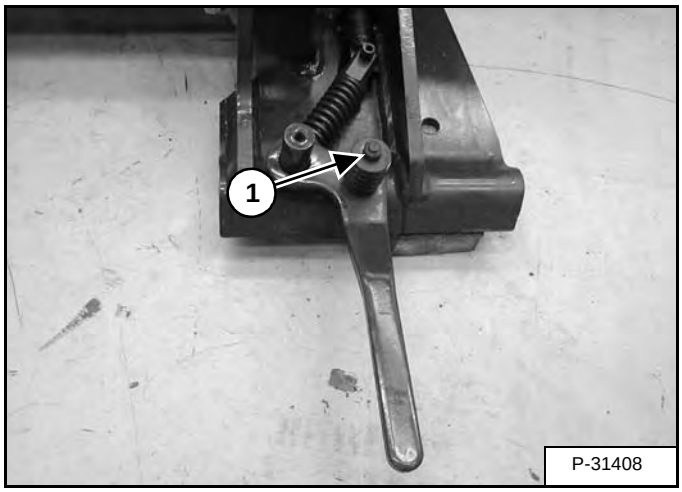


Remove the washers and bolts (Item 1) **[Figure 50-41-10]** (both ends of the cylinder).

Installation: Tighten the bolts to 25 - 28 ft.-lb. (34 - 38 N•m) torque.

Remove the cylinder from the lever pivots.

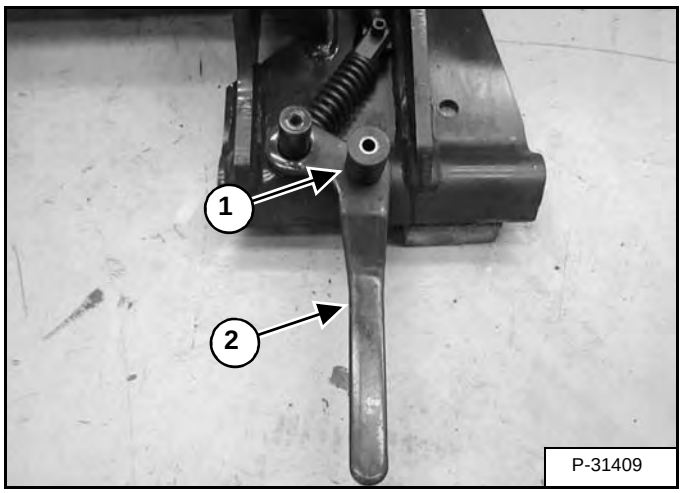
Figure 50-41-11



Remove the lever mounting nut (Item 1) **[Figure 50-41-11]**.

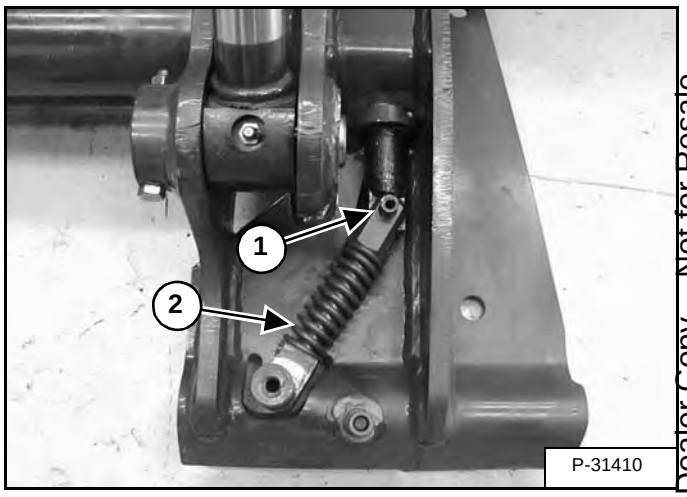
Installation: Tighten the nut to 25-28 ft.-lb. (34-38 N•m) torque.

Figure 50-41-12



Remove the washer and spring, (Item 1) and the lever assembly (Item 2) **[Figure 50-41-12]**.

Figure 50-41-13



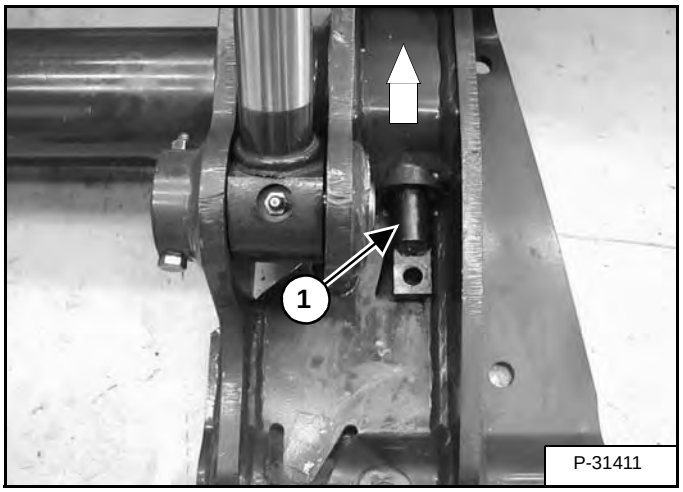
Use a punch and hammer to remove the roll pin (Item 1) **[Figure 50-41-13]** from the Bob-Tach wedge and spring clevis.

Remove the spring clevis assembly (Item 2) **[Figure 50-41-13]**.

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Lever And Wedge Disassembly And Assembly (Cont'd)

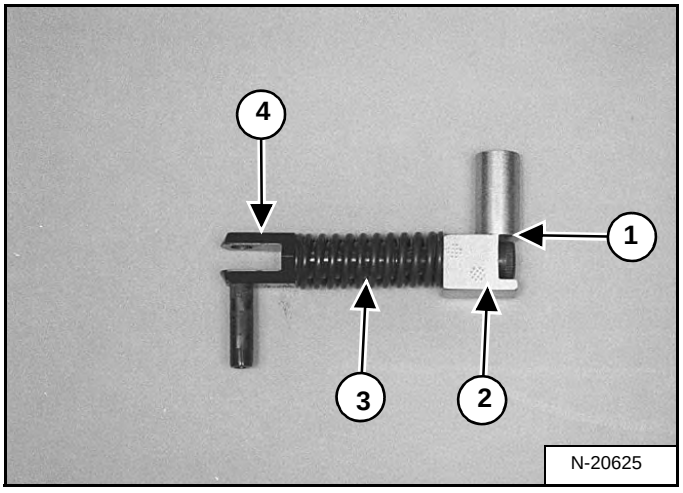
Figure 50-41-14



Remove the wedge (Item 1) **[Figure 50-41-14]** out of the bottom of the Bob-Tach.

Always replace bent or broken wedges.

Figure 50-41-15



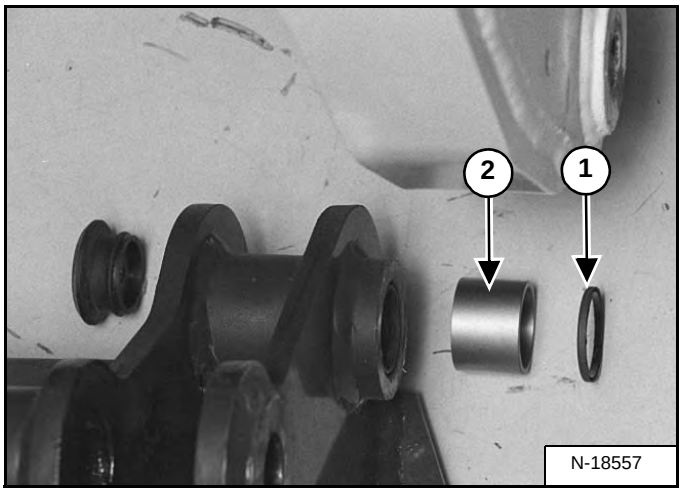
If the bolt (Item 1), handle pivot (Item 2), spring (Item 3), or clevis (Item 4) are damaged, put the assembly in a vise **[Figure 50-41-15]**.

Remove the bolt and replace the damaged parts as needed.

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Pivot Pin Bushing And Seal Removal And Installation

Figure 50-41-16



Remove the Power Bob-Tach. (See Removal And Installation on Page 50-41-1.)

Use a seal pick to remove seal (Item 1) **[Figure 50-41-16]** on the Bob-Tach.

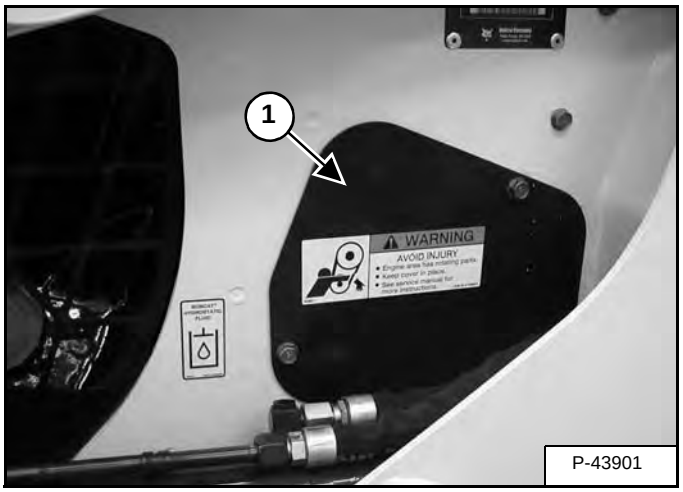
Remove and replace bushing (Item 2) **[Figure 50-41-16]** with a driver tool and hammer.

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LIFT ARMS

Removal And Installation

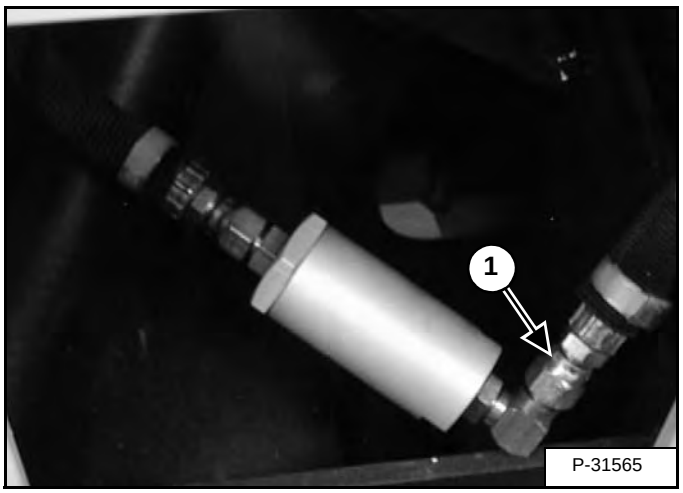
Figure 50-50-1



Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the left side access panel (Item 1) **[Figure 50-50-1]**.

Figure 50-50-2

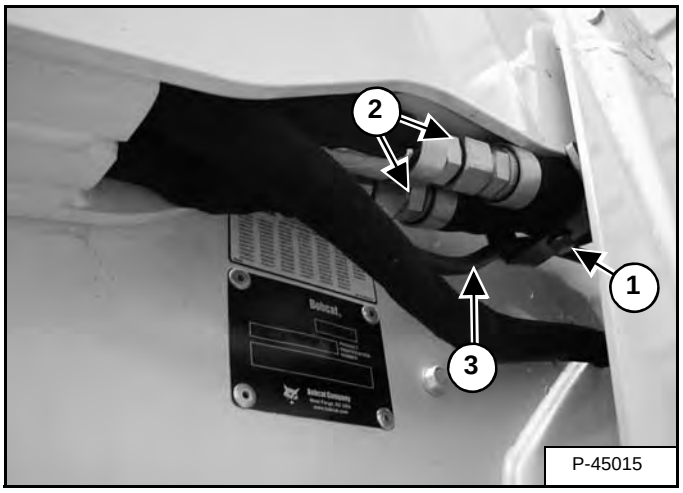


Disconnect the hydraulic hose (Item 1) **[Figure 50-50-2]** from the filter that goes to the case drain on the auxiliary hydraulic coupler.

Cap and plug the hose and filter fittings.

Pull the hose up and out of the upright to allow for lift arm removal.

Figure 50-50-3



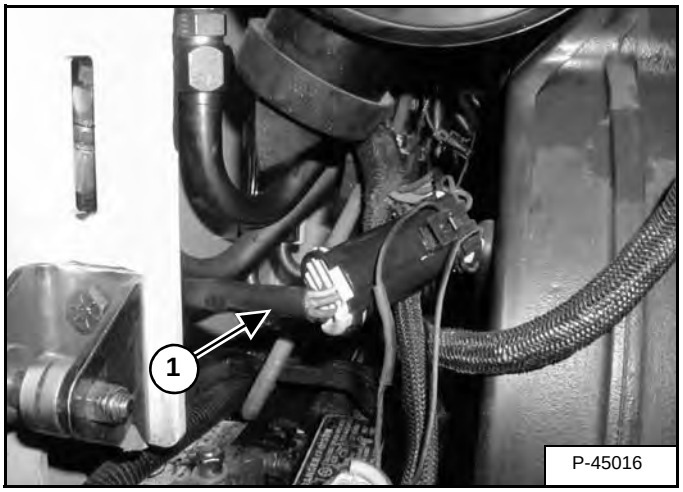
At the left side upright, mark the auxiliary hydraulic hoses for proper installation.

Remove the hose clamp (Item 1) **[Figure 50-50-3]**.

Disconnect the two auxiliary hydraulic hoses (Item 2) **[Figure 50-50-3]**.

NOTE: The electrical controls harness (Item 3) [Figure 50-50-3] must be disconnected in the engine compartment. (If so equipped.)

Figure 50-50-4



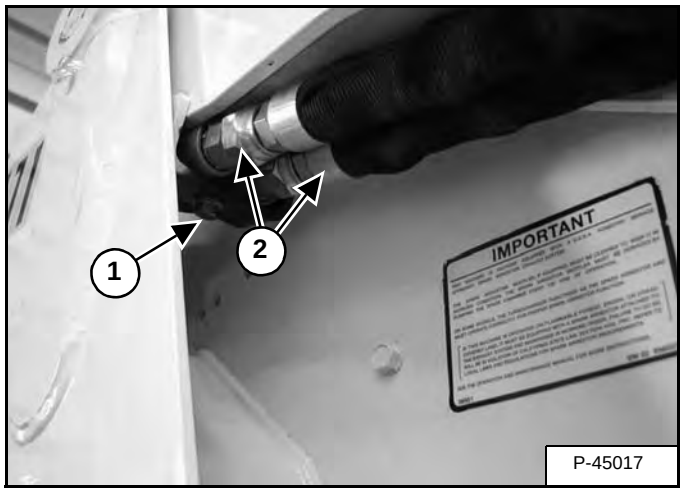
Disconnect the electrical controls harness (Item 1) **[Figure 50-50-4]**. (If so equipped.)

Pull the electrical controls harness up and out of the upright to allow for lift arm removal.

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Removal And Installation (Cont'd)

Figure 50-50-5

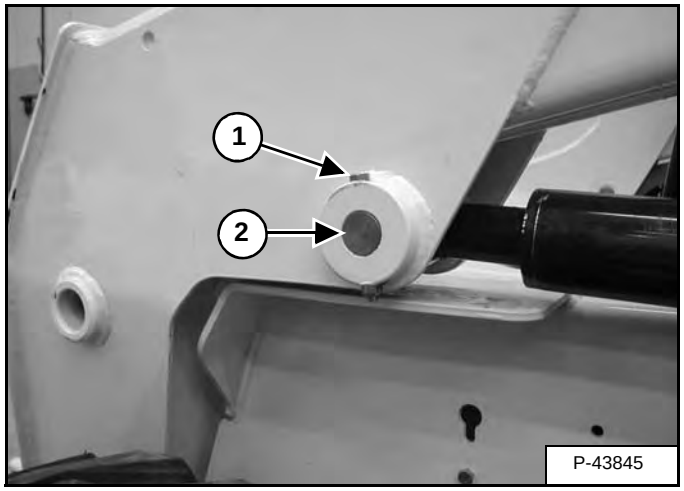


At the right side of the loader, mark the two tilt hoses for proper installation.

Remove the hose clamp (Item 1) **[Figure 50-50-5]**.

Disconnect the two tilt hoses (Item 1) **[Figure 50-50-5]** from the tubelines.

Figure 50-50-6

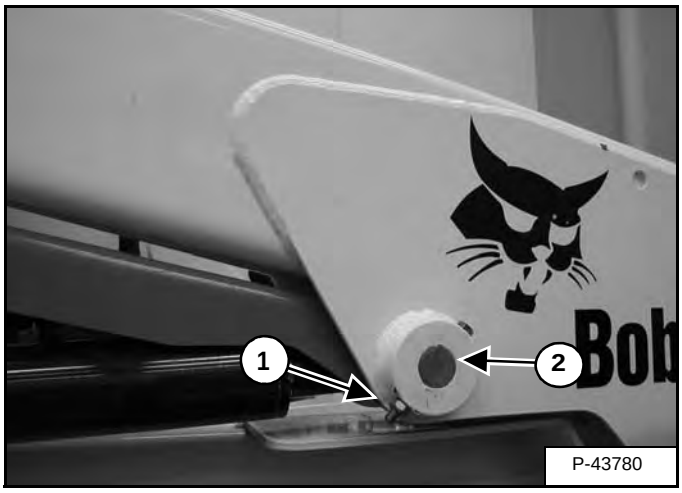


Remove the retainer bolt and nut (Item 1) **[Figure 50-50-6]** from the left side, rod end lift cylinder.

Installation: Tighten retainer bolt and nut to 25-28 ft.-lb. (34-38 N•m) torque.

Remove the lift cylinder rod pin (Item 2) **[Figure 50-50-6]**.

Figure 50-50-7

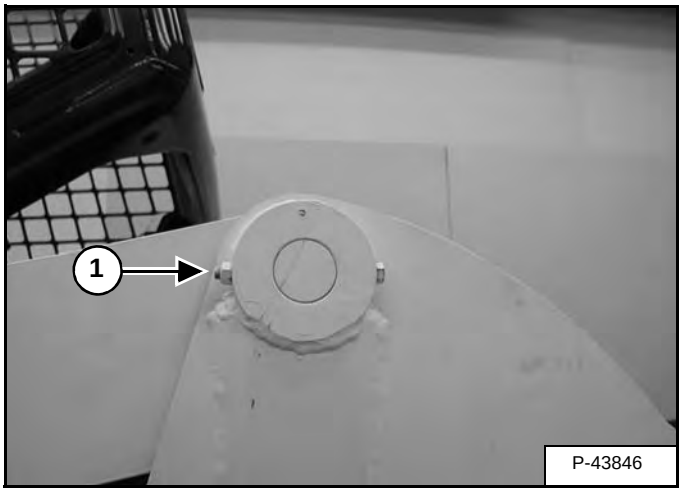


Remove the retainer bolt and nut (Item 1) **[Figure 50-50-7]** from the right side, rod end, lift cylinder pin.

Installation: Tighten retainer bolt and nut to 25-28 ft.-lb. (34-38 N•m) torque.

Remove the lift cylinder rod pin (Item 2) **[Figure 50-50-7]**.

Figure 50-50-8



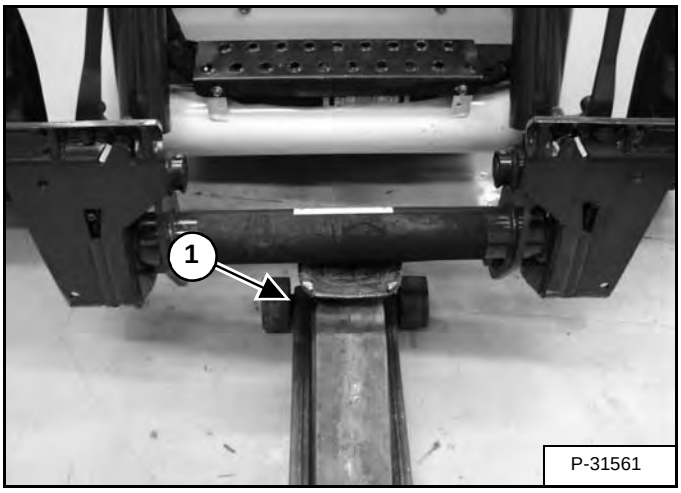
Remove the retainer bolt and nut (Item 1) **[Figure 50-50-8]**. (Both sides.)

Installation: Tighten retainer bolt and nut to 25-28 ft.-lb. (34-38 N•m) torque.

Dealer Copy -- Not for Resale

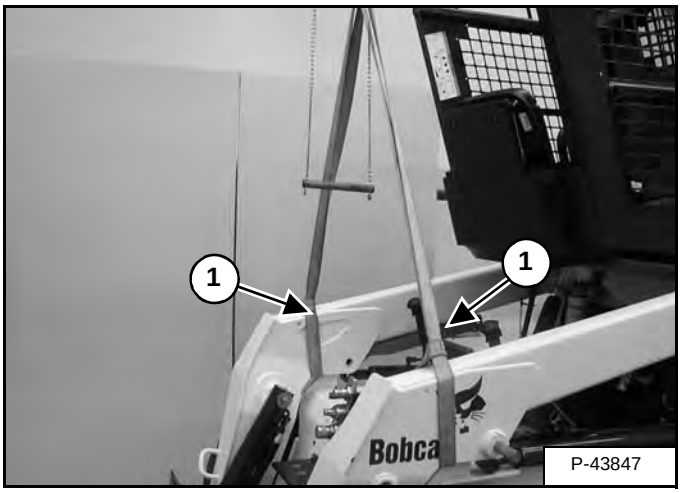
Removal And Installation (Cont'd)

Figure 50-50-9



Install a floor jack (Item 1) **[Figure 50-50-9]** under the front of the lift arms, and raise the lift arms 2-3 inches.

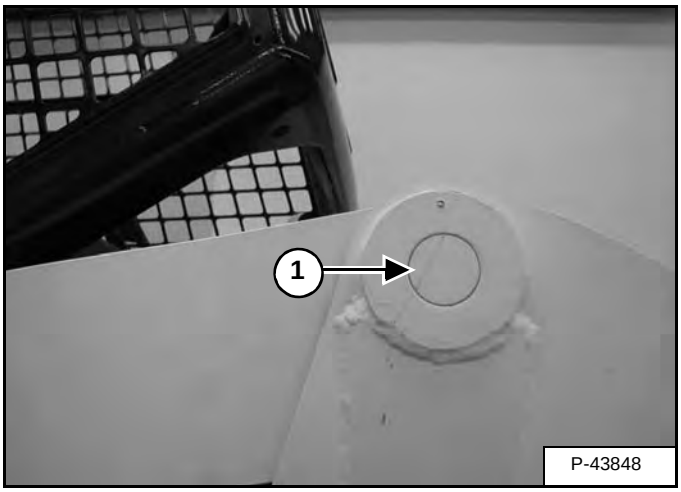
Figure 50-50-10



Install two lift straps (Item 1) **[Figure 50-50-10]** on the lift arms as shown.

NOTE: Position the lift straps as shown in [Figure 50-50-10] to balance the lift arms for removal and installation.

Figure 50-50-11



Remove the lift arm pivot pin (Item 1) **[Figure 50-50-11]**. (Both sides.)

Remove the lift arms from the loader.

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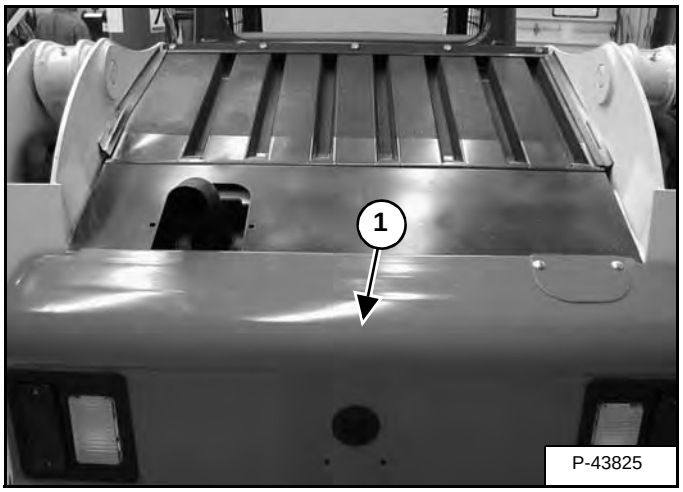


Dealer Copy -- Not for Resale

REAR GRILL

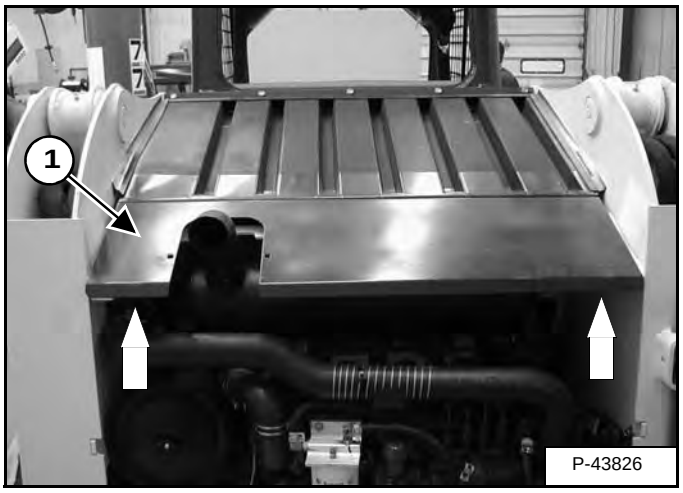
Removal And Installation

Figure 50-60-1



Open the rear door (Item 1) **[Figure 50-60-1]**.

Figure 50-60-2



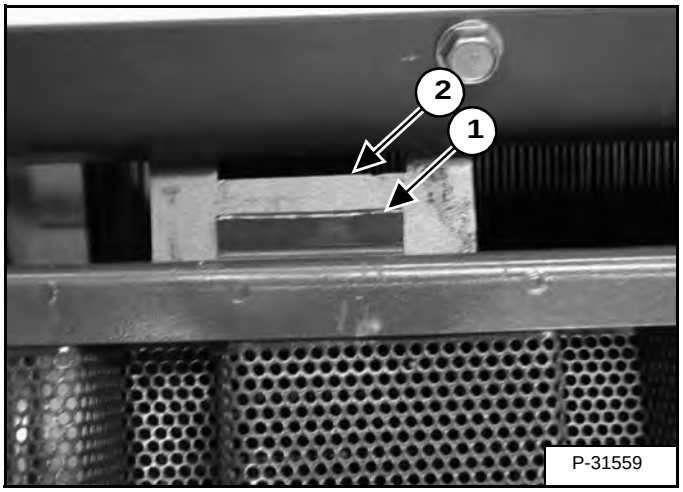
Lift the rear grill assembly (Item 1) **[Figure 50-60-2]** over the muffler.

Figure 50-60-3



Lift and pull the rear grill and remove it from the loader **[Figure 50-60-3]**.

Figure 50-60-4



Installation: Insert the tab on the rear grill (Item 1) into the notch (Item 2) **[Figure 50-60-4]** on the loader frame. (Both sides.)

Dealer Copy -- Not for Resale

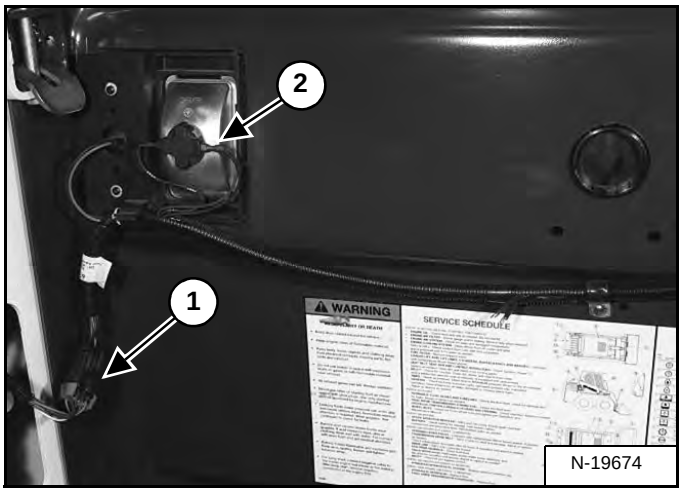


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REAR DOOR

Removal And Installation

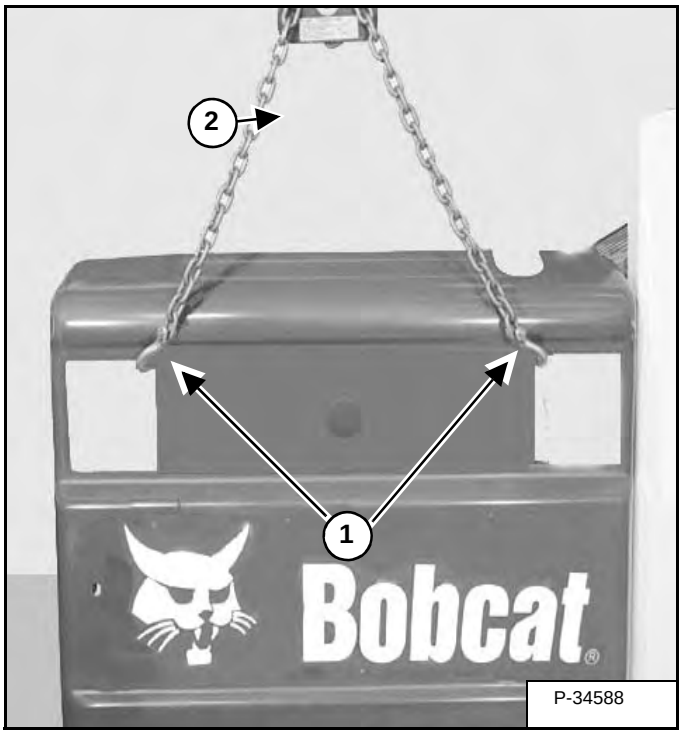
Figure 50-70-1



Disconnect the light harness connector (Item 1) **[Figure 50-70-1]** from the engine harness.

Remove both rear lights (Item 2) **[Figure 50-70-1]** from the door. (See Rear Removal And Installation on Page 60-60-2.)

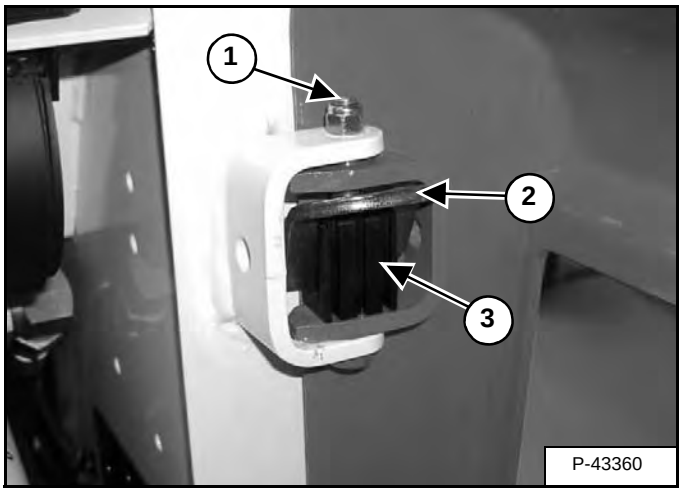
Figure 50-70-2



Secure the chain hooks (Item 1) **[Figure 50-70-2]** to the door as shown.

Connect a chain hoist (Item 2) **[Figure 50-70-2]** to the lifting chain.

Figure 50-70-3



Remove the top and bottom door hinge mounting bolts (Item 1) **[Figure 50-70-3]** and nuts.

NOTE: Install the door stop (Item 2) and the door stop retainer (Item 3) [Figure 50-70-3] in the top hinge as shown.

Installation: Tighten the mounting bolts and nuts to 25-28 ft.-lb. (34-38 N•m) torque.

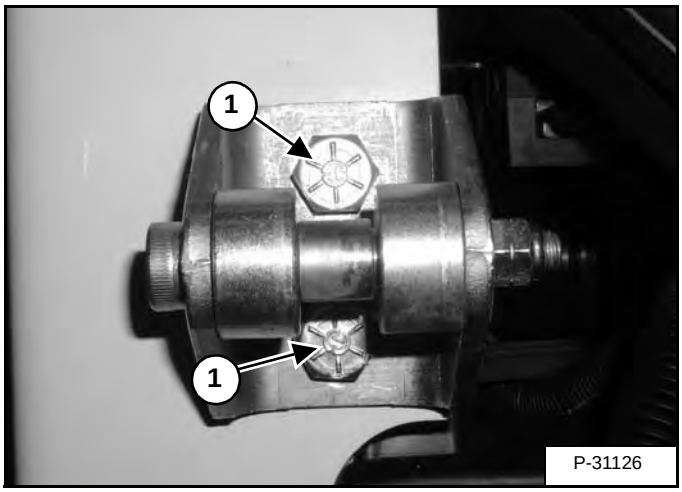
Lift the door away from the loader frame and put the door flat on the floor.

Installation: Reverse the removal procedure to install the rear door.

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Striker Removal And Installation

Figure 50-70-4

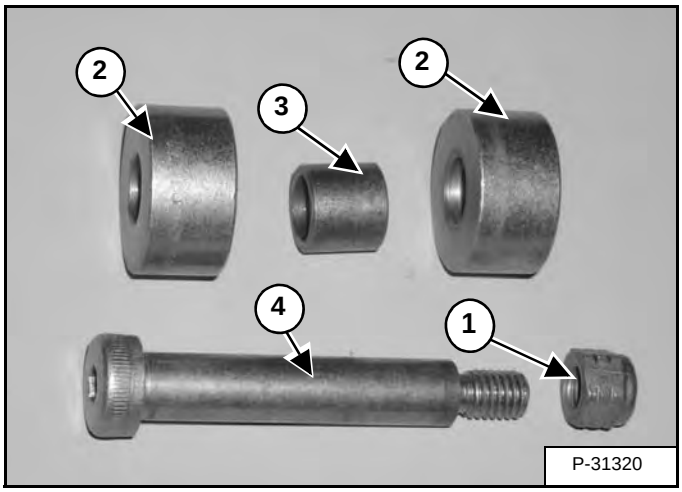


Remove the two striker mount bolts (Item 1) **[Figure 50-70-4]**.

Remove the striker assembly from the loader.

Striker Disassembly And Assembly

Figure 50-70-5



Remove the lock nut (Item 1) **[Figure 50-70-5]**.

Remove the rollers (Item 2) and the spacer (Item 3) from the bolt (Item 4) **[Figure 50-70-5]**.

Check the parts for wear and replace as needed.

Installation: Reverse the removal procedure to install the rear door striker.

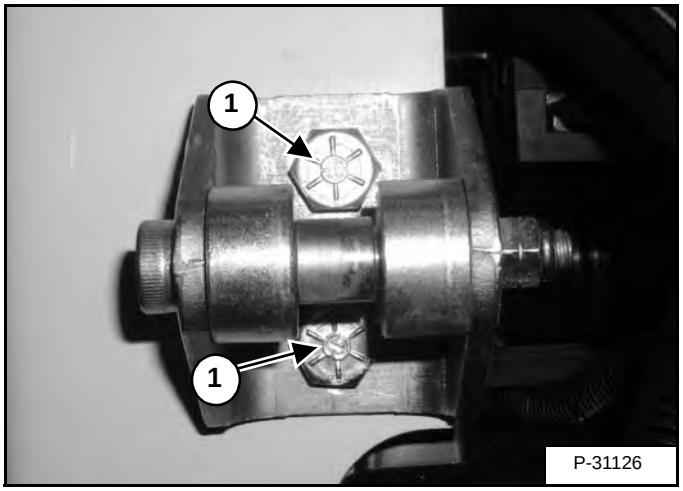
Dealer Copy -- Not for Resale

Striker (Adjusting)

⚠ WARNING

AVOID INJURY OR DEATH
Never service or adjust the machine when the engine is running unless instructed to do so in the manual.
W-2012-0497

Figure 50-70-6



Loosen the striker assembly mount bolts (Item 1) **[Figure 50-70-6]**.

Align the striker assembly in the center of the mounting holes.

NOTE: Tighten the striker assembly, top mount bolt only, until it will hold the striker assembly in the center of the mounting slots.

Close the rear door. (This will align the striker assembly to the correct position.)

Open the door.

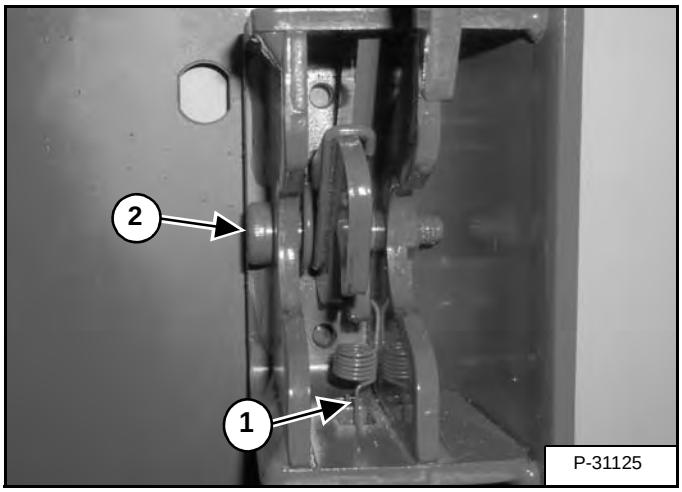
Installation: Tighten the mounting bolts (Item 1) **[Figure 50-70-6]** to 90-100 ft.-lb. (125-135 N•m) torque.

Close the rear door.

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Latch Removal And Installation

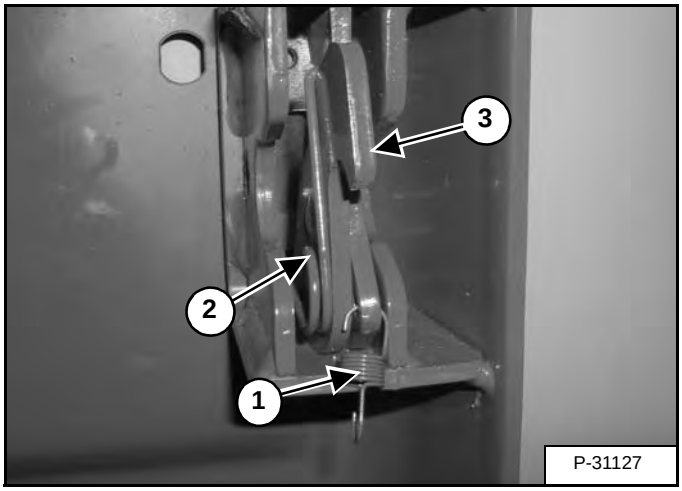
Figure 50-70-7



Disconnect the spring (Item 1) **[Figure 50-70-7]** from the rear door.

Remove the bolt and nut (Item 2) **[Figure 50-70-7]** from the latch.

Figure 50-70-8

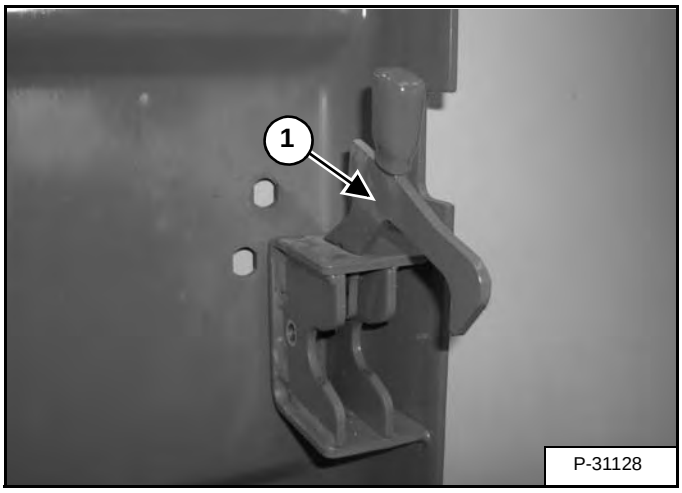


Remove the spring (Item 1) **[Figure 50-70-8]** from the door handle.

Remove the spring (Item 2) **[Figure 50-70-8]** from the door latch.

Remove the door latch (Item 3) **[Figure 50-70-8]** from the door handle.

Figure 50-70-9



Remove the door handle (Item 1) **[Figure 50-70-9]** from the rear door.

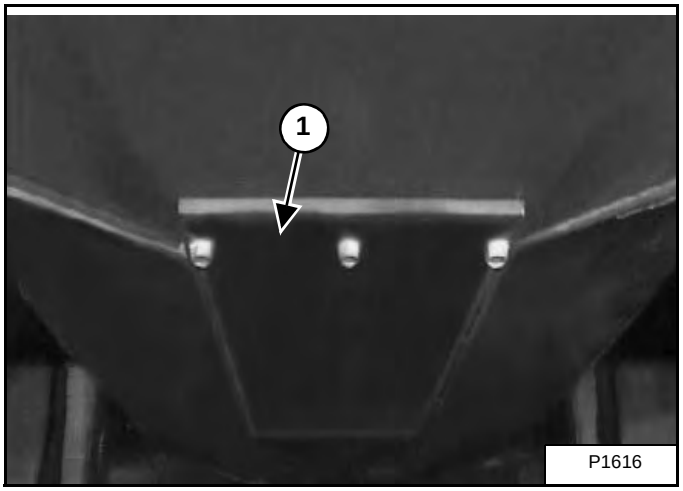
Dealer Copy -- Not for Resale

FUEL TANK

Removal And Installation

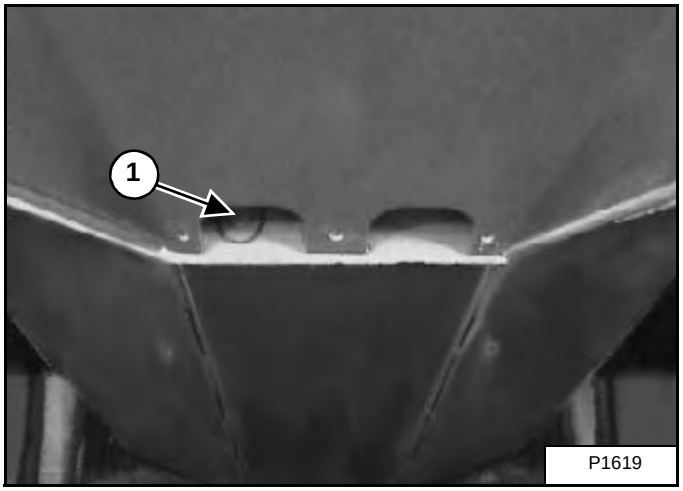
Place the loader on jackstands. (See Procedure on Page 10-10-1.)

Figure 50-80-1



Remove the access cover (Item 1) **[Figure 50-80-1]** which covers the drain plug.

Figure 50-80-2

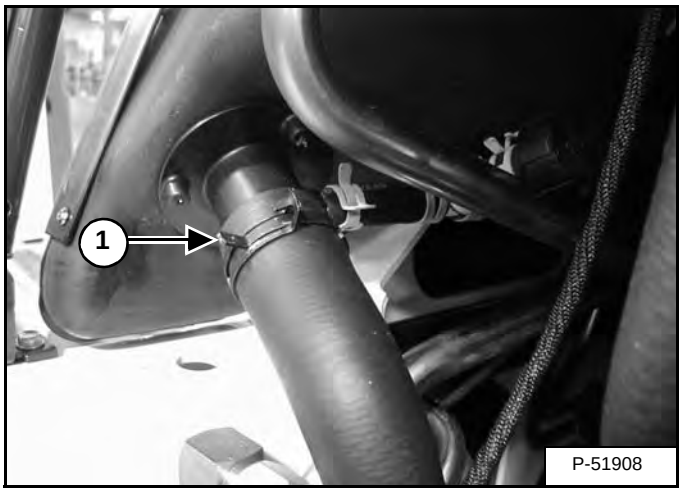


Remove the drain plug (Item 1) **[Figure 50-80-2]**.

Drain the fuel into a container.

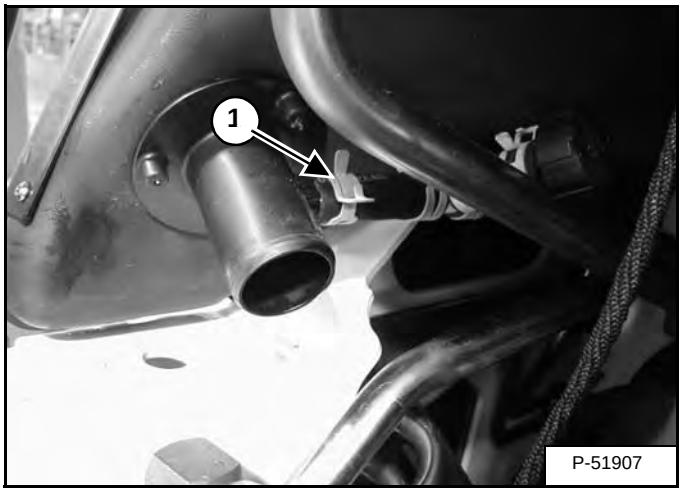
Check the drain plug and replace if necessary.

Figure 50-80-3



Disconnect the fuel fill hose (Item 1) **[Figure 50-80-3]**.

Figure 50-80-4



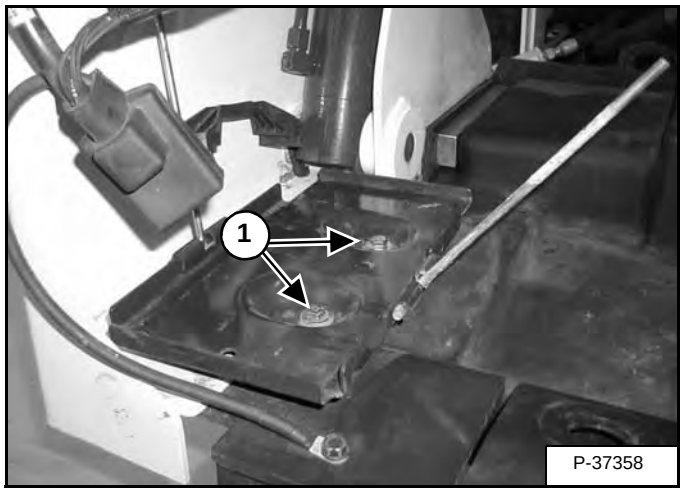
Disconnect the tank vent hose (Item 1) **[Figure 50-80-4]**.

Remove the engine/hydrostatic pump assembly from the loader. (See Engine Removal And Installation on Page 70-10-9.)

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Removal And Installation (Cont'd)

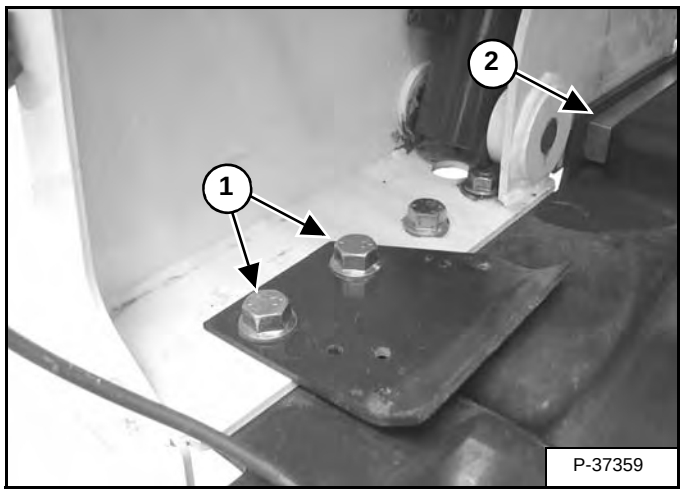
Figure 50-80-5



Remove the bolts (Item 1) **[Figure 50-80-5]** from the battery holddown plate.

Remove the holddown plate from the loader.

Figure 50-80-6



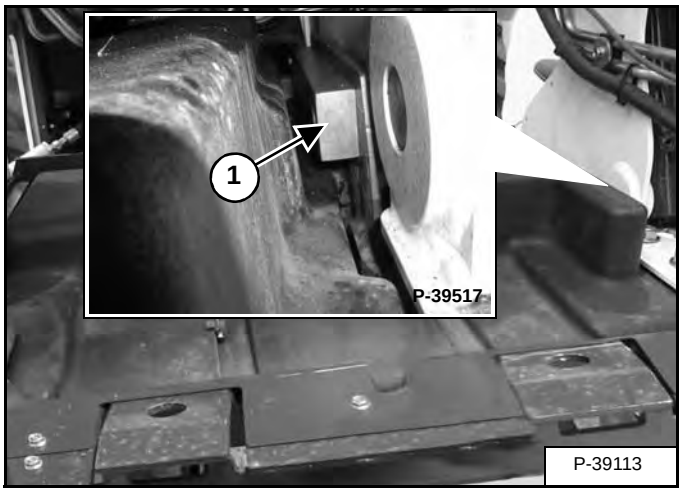
Remove the two mounting bolts (Item 1) **[Figure 50-80-6]** from the battery hold down plate mounting bracket.

Remove the mount bracket from the loader.

At the left side of the loader, remove the three main frame mount bolts from the mounting block (Item 2) **[Figure 50-80-6]**. Remove the mount block from the loader.

Installation: Tighten the main frame mount bolts to 300-330 ft.-lb. (407-447 N•m) torque.

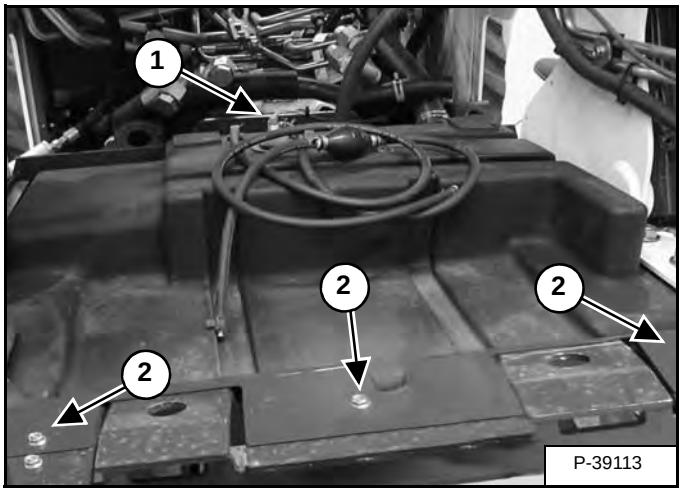
Figure 50-80-7



At the right side of the loader, remove the three main frame mount bolts from the mounting block (Item 1) **[Figure 50-80-7]**. Remove the mount block from the loader.

Installation: Tighten the main frame mount bolts to 300 - 330 ft.-lb. (407-447 N•m) torque.

Figure 50-80-8



Disconnect the wire harness connector (Item 1) **[Figure 50-80-8]** from the fuel level sender.

Remove the three mount bolts (Item 2) **[Figure 50-80-8]** from the fuel tank mount plate. Remove the mount plate.

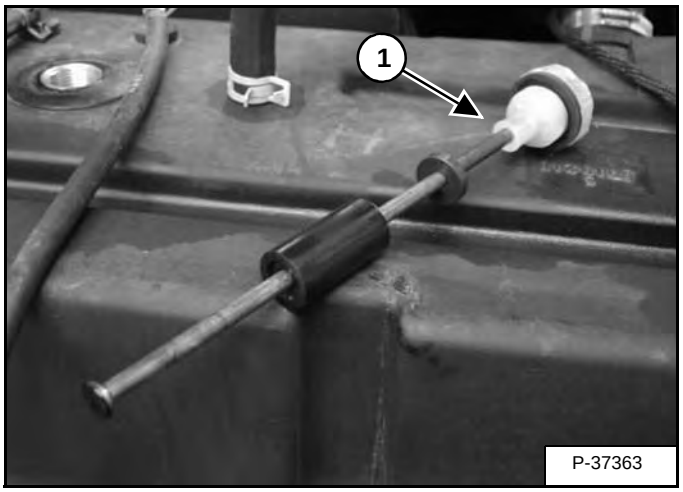
Lift the fuel tank and remove it from the loader frame.

NOTE: When installing the fuel tank, avoid striking the tank with heavy objects to prevent damage.

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Fuel Level Sender Removal And Installation

Figure 50-80-9



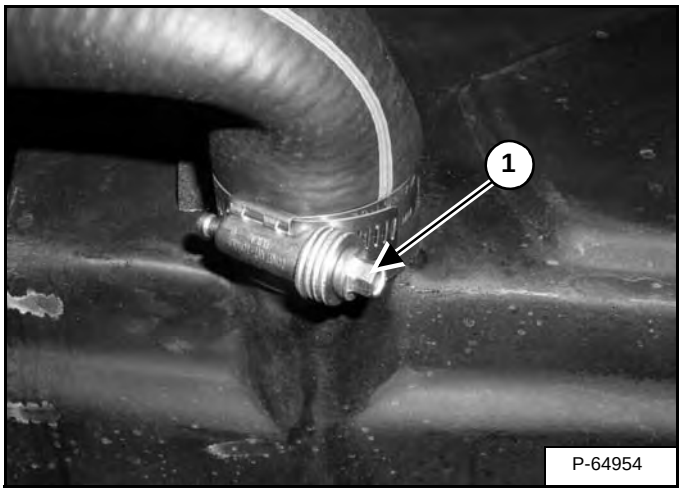
Disconnect the wire harness connector from the fuel level sender.

Loosen the fuel level sender in fuel tank.

Remove the fuel level sender (Item 1) **[Figure 50-80-9]**.

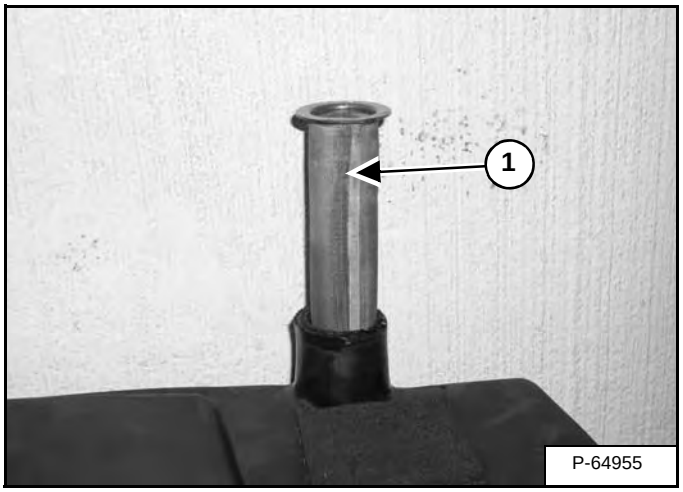
Fuel Fill Screen Removal And Installation

Figure 50-80-10



Loosen the hose clamp (Item 1) **[Figure 50-80-10]** on the tank end of the fuel fill hose.

Figure 50-80-11



Remove the fuel fill screen (Item 1) **[Figure 50-80-11]**. Inspect and replace as needed.

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CONTROL PEDALS AND LINKAGES

Description

The control pedals and linkages are connected to the control valve. The control pedals will mechanically move the lift and tilt spools on the control valve.

The control pedals and linkages are located on the lower mainframe at the operators feet.

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Pedal Removal And Installation



WARNING

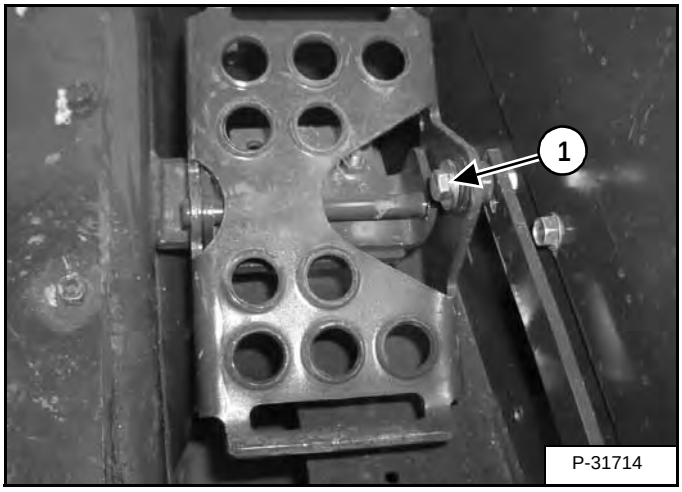
Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Raise the lift arms and install an approved lift arm support device.(See Installing on Page 10-20-1.)

Raise the operator cab.(See Raising on Page 10-30-1.)

Figure 50-90-1

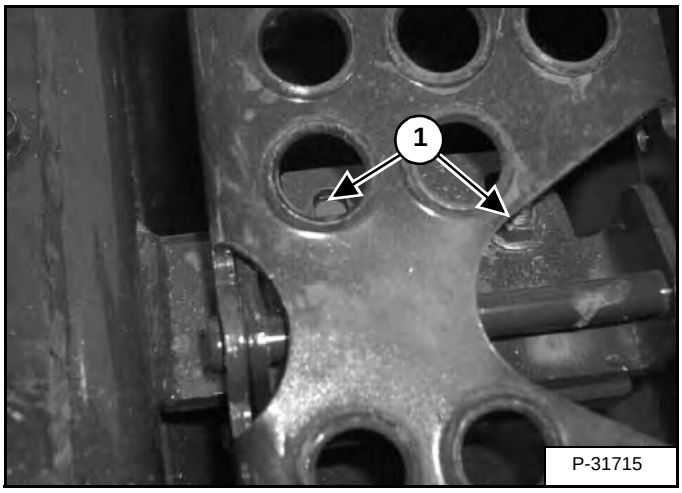


Remove the bolt and nut (Item 1) **[Figure 50-90-1]** from the pedal linkage.

Installation: Tighten the bolt and nut to 21-25 ft.-lb. (28-34 N•m) torque.

Check the rubber bushing in the pedal for wear and replace as needed.

Figure 50-90-2



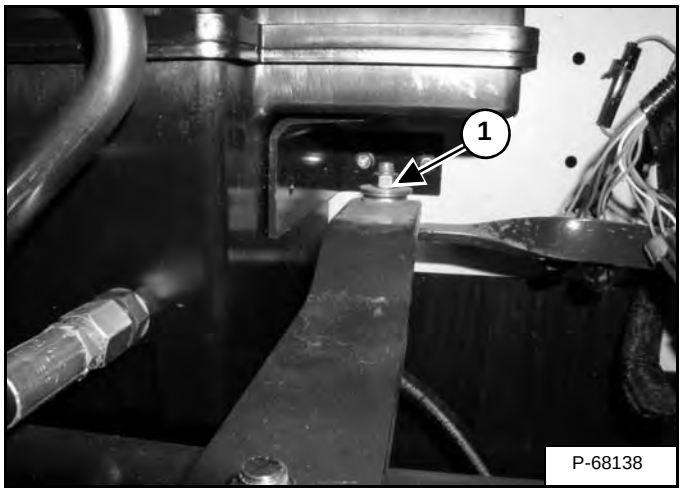
Remove the two mounting bolts (Item 1) **[Figure 50-90-2]**.

Remove the pedal assembly from the loader.

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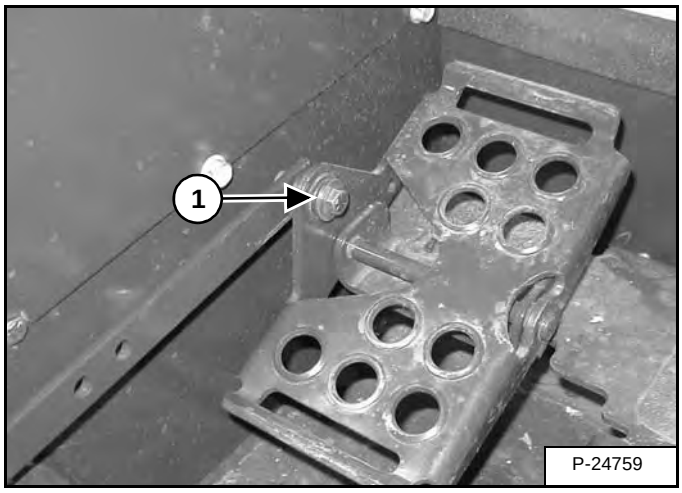
Linkage Removal And Installation

Figure 50-90-3



Remove the bolt and nut (Item 1) **[Figure 50-90-3]** to disconnect the lift pedal linkage from the crossbar.

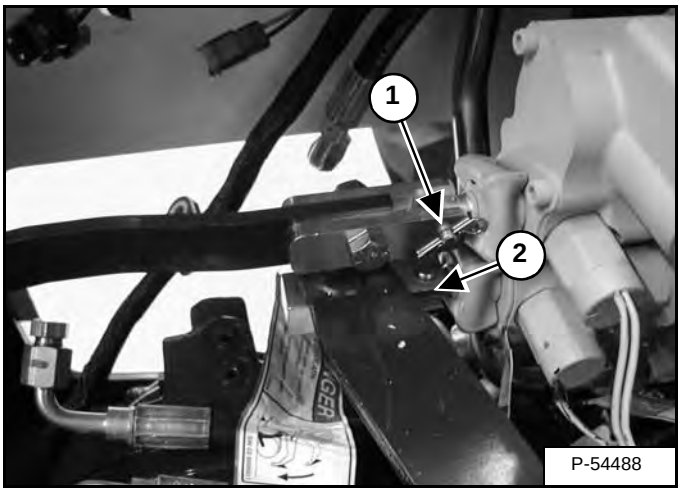
Figure 50-90-4



Remove the bolt and nut (Item 1) **[Figure 50-90-4]** to disconnect the lift foot pedal.

Remove and replace foot pedal linkage as needed.

Figure 50-90-5

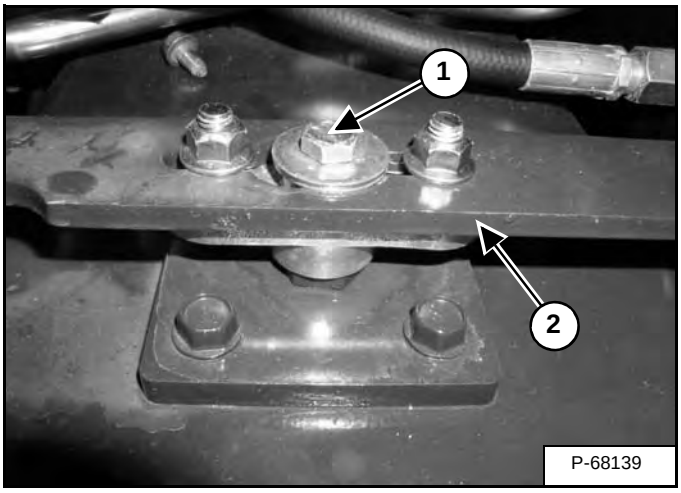


Remove the hairpin clip and cross-pin (Item 1) **[Figure 50-90-5]** from the control valve tilt spool.

Remove the hairpin clip and cross-pin (Item 2) **[Figure 50-90-5]** from the control valve lift spool.

Disconnect the crossbar from the control valve.

Figure 50-90-6



Remove the crossbar pivot bolt (Item 1) **[Figure 50-90-6]**.

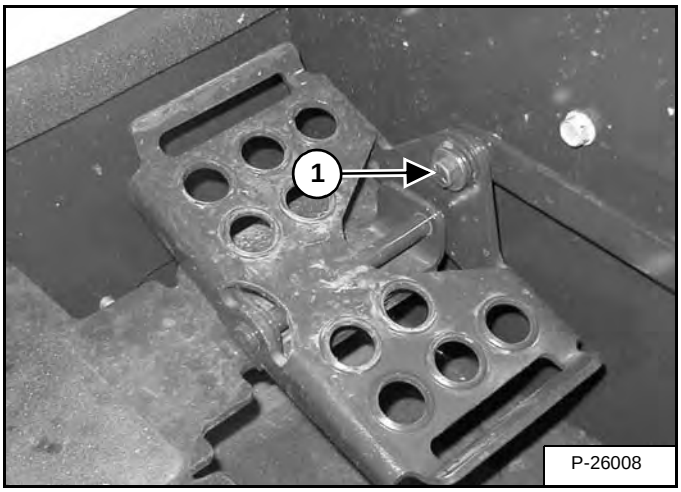
Remove the crossbar from the pivot (Item 2) **[Figure 50-90-6]**.

Installation: Check the nylon bushing for wear and replace as needed. The nylon bushing is located between the crossbar mount and the crossbar.

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Linkage Removal And Installation (Cont'd)

Figure 50-90-7



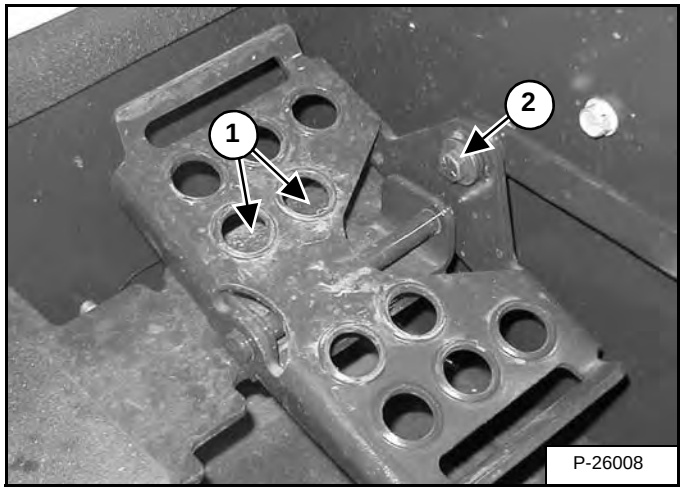
Remove the bolt and nut (Item 1) **[Figure 50-90-7]** to disconnect the lift foot pedal.

Pedal (Adjusting)

After installing the pedal, adjust the pedal angle so that there is clearance under the rear of the pedal. The valve spool must travel full stroke without the pedal hitting the floor panel.

The pedals should be positioned at a comfortable angle so full movement of the pedal can be reached easily while properly sitting in the loader seat.

Figure 50-90-8



Loosen the mounting bolts (Item 1) **[Figure 50-90-8]** on the pedal.

Loosen the bolts (Item 2) **[Figure 50-90-8]** and nut on the pedal linkage.

Check the rubber bushing in the pedal for wear and replace as needed.

Tilt the pedal back and forth until an acceptable "neutral" angle is achieved on the pedal.

Tighten the two mounting bolts (Item 1) and pivot bolt (Item 2) on the pedal assembly to standard torque **[Figure 50-90-8]**.

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CONTROL PEDALS (ACS)

Description

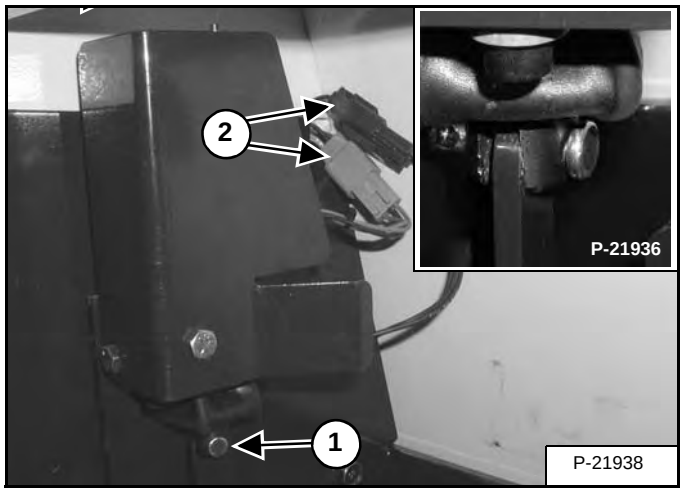
The control pedals send an electronic pulse to the actuators on the control valve. The electronic pulse tells the actuators to move the lift or tilt spools on the control valve.

The control pedals are located on the lower mainframe at the operators feet.

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Foot Sensor Removal And Installation

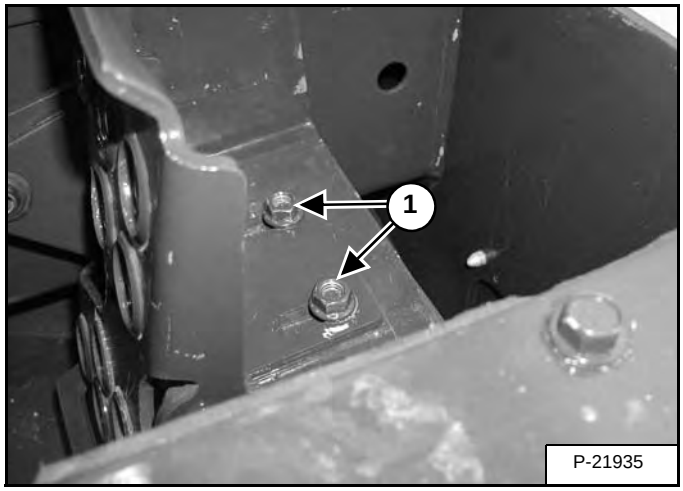
Figure 50-91-1



Pull the pin (Item 1) **[Figure 50-91-1]** holding the foot pedal linkage to the sensor.

Disconnect the two connectors (Item 2) **[Figure 50-91-1]** from the sensor and lock solenoid.

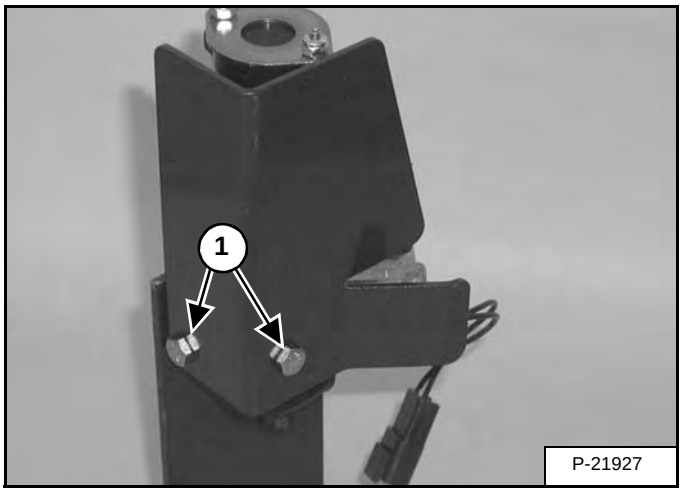
Figure 50-91-2



Tilt the foot pedal up and remove the two nuts (Item 1) **[Figure 50-91-2]**.

Remove the foot pedal and sensor assembly from the loader.

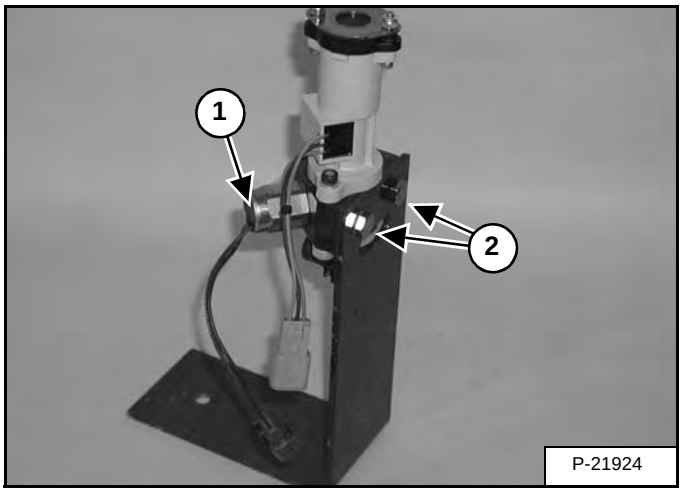
Figure 50-91-3



Remove the two bolts (Item 1) **[Figure 50-91-3]** from the foot sensor shield.

Installation: Tighten the bolts to 80 - 90 in.-lb. (9,0 - 10,2 N•m) torque.

Figure 50-91-4



Remove foot lock solenoid (Item 1) **[Figure 50-91-4]**.

Installation: Apply a drop of oil to the solenoid threads and tighten the solenoid to 35 - 40 ft.-lb. (47 - 54 N•m) lubed torque.

Remove the two bolts (Item 2) **[Figure 50-91-4]** from the bracket and sensor assembly.

Installation: Tighten the bolts to 25 - 28 ft.-lb. (34 - 38 N•m) torque.

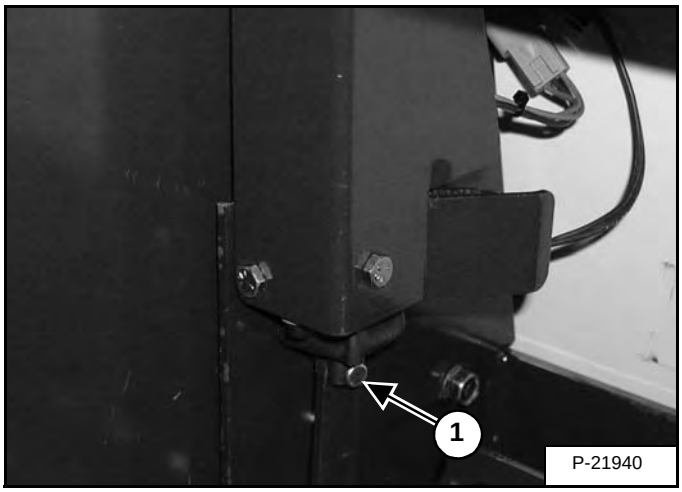
Remove the sensor assembly

NOTE: The calibration must be followed when replacing handle sensor, foot pedal sensor, actuator or ACS Controller. (See Lift And Tilt Calibration (ACS) on Page 60-160-3.)

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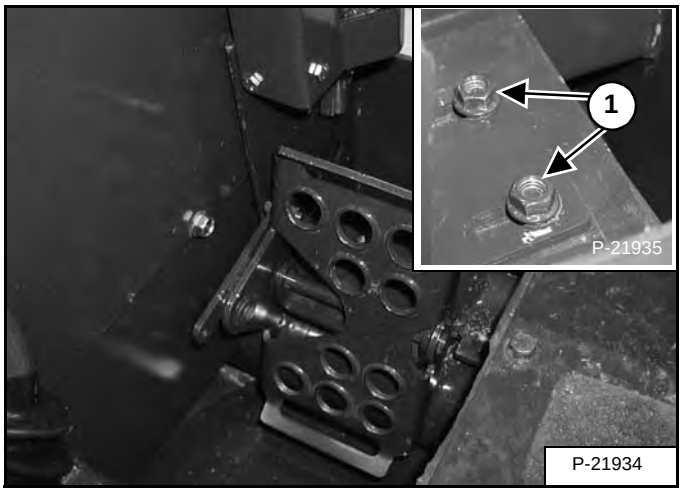
Foot Pedal Removal And Installation

Figure 50-91-5



Remove the pin (Item 1) **[Figure 50-91-5]** holding the linkage to the sensor.

Figure 50-91-6



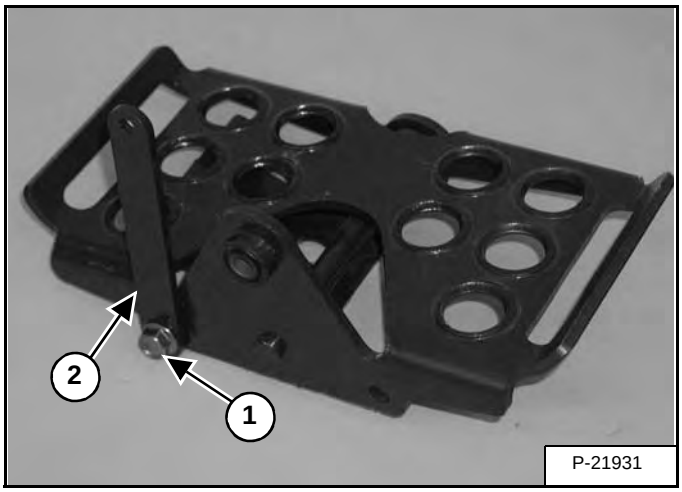
Tip the foot pedal up and remove the two nuts (Item 1) **[Figure 50-91-6]**.

Remove the foot pedal assembly.

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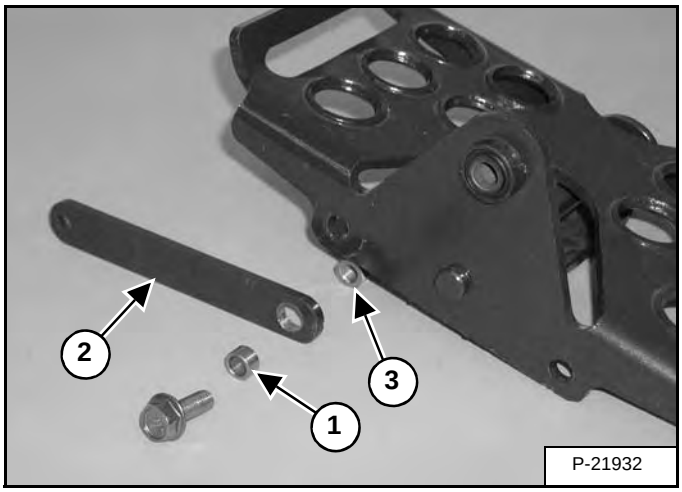
Foot Pedal Linkage Disassembly And Assembly

Figure 50-91-7



Remove the bolt (Item 1) holding the linkage (Item 2) **[Figure 50-91-7]** to the side of the foot pedal.

Figure 50-91-8



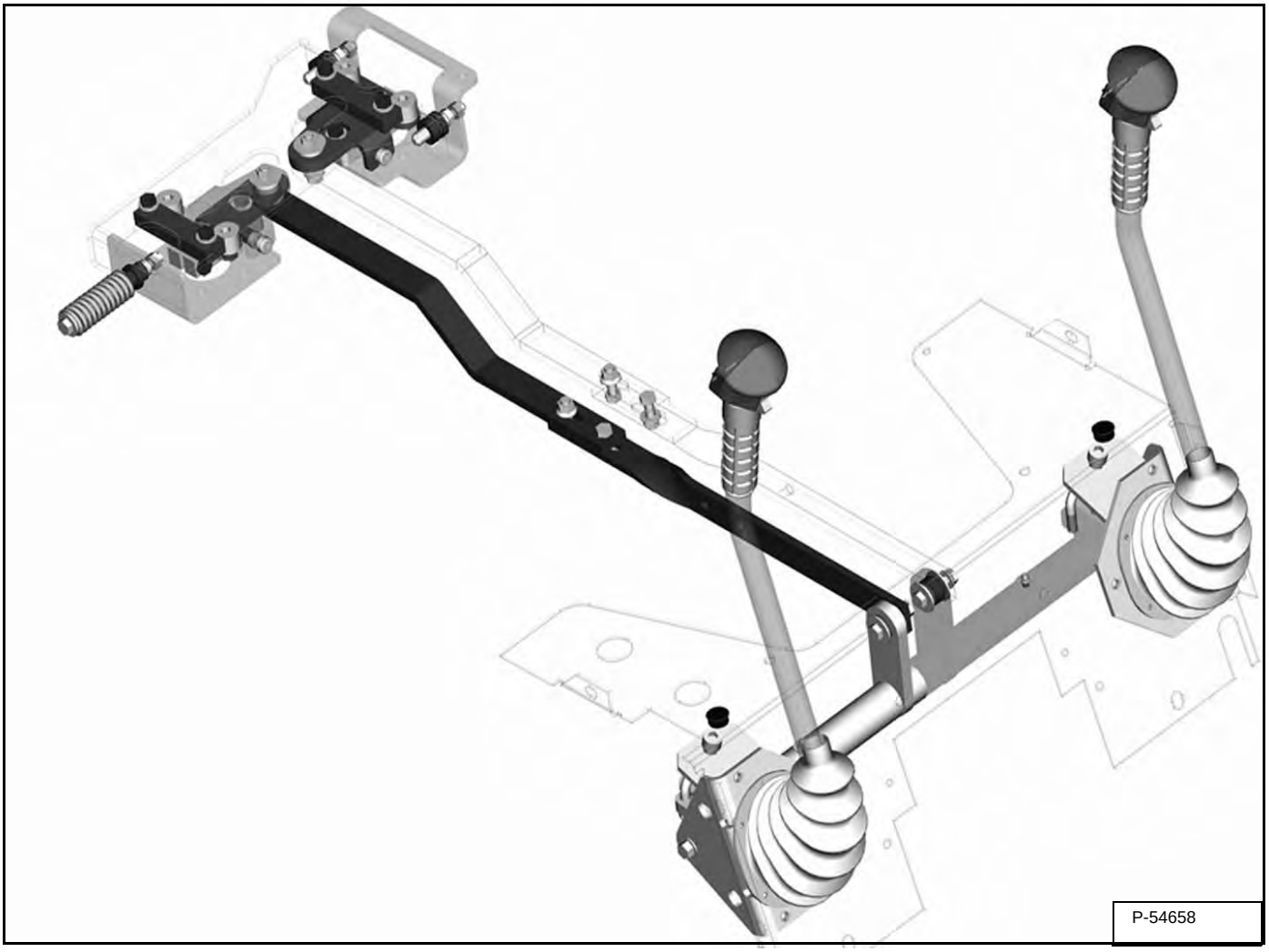
Remove the spacer (Item 1), linkage (Item 2), and nut (Item 3) **[Figure 50-91-8]** from the foot pedal.

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CONTROL PANEL (S/N 530714202 & BELOW AND 530811539 & BELOW)

Description

Figure 50-100-1



Dealer Copy -- Not for Resale

The steering system consists of independent steering levers the operator uses to provide steering input to the loader.

The steering levers are attached to pivoting bellcranks that pivot on a steering shaft and plastic bushings. The bellcranks have grease fittings.

The forward travel is adjusted by drift adjustment bolts.

The bellcranks are attached to steering linkage bars with rubber torsion bushings pressed into the bellcranks. Bellcranks mount to the control panel.

Steering linkage bars are a two-piece design. Steering linkage bars are adjustable in length for “full travel adjustment”.

Steering linkage bars attach to the pintle arms where a rubber torsion bushing is pressed into the pintle arms.

Pintle arms are of a two-piece design that allow easy adjustment of the neutral or “creep”.

The steering system returns the levers to their starting position by means of the centering spring and the returning force of the torsion bushings.

NOTE: Torsion bushings need to be replaced if torn or rotating in the housing. Loosen torsion bushing bolts slightly before adjustments are made. Do not fully tighten torsion bushing bolts again until all steering adjustments have been made first.

Sequence of steering adjustments:

1. Set neutral of pintle arms, “creep”
2. Set full travel at steering linkage bars
3. Set drift at drift adjustment bolts

The control panel is now common between the large frame and the medium frame loaders.

Removal And Installation



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

WARNING

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

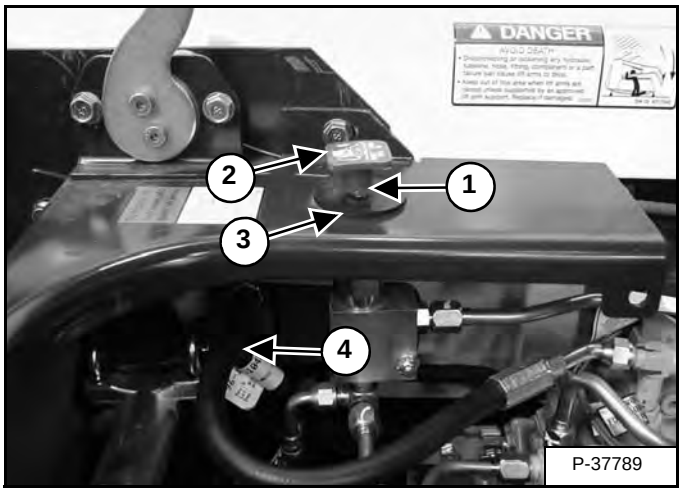
W-2017-0286

Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Figure 50-100-2

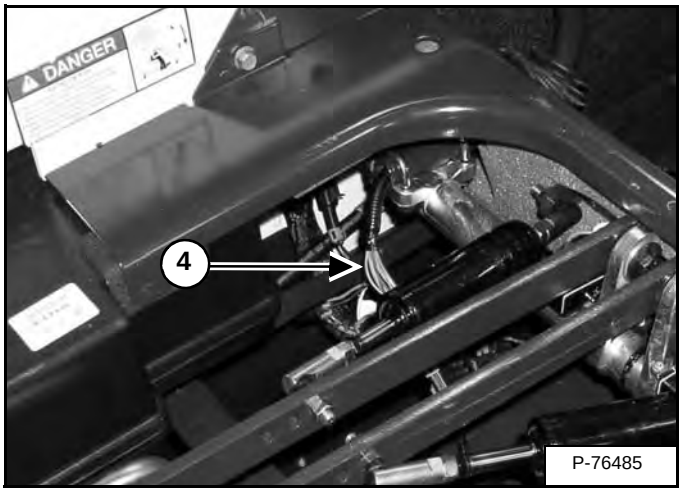


Loosen the jam nut (Item 1) from the lift arm bypass control knob (Item 2) **[Figure 50-100-2]**.

Remove the control knob (Item 2), jam nut (Item 1) and rubber washer (Item 3) **[Figure 50-100-2]**.

Remove the engine speed control. (See Removal And Installation on Page 70-20-1.)

Figure 50-100-3



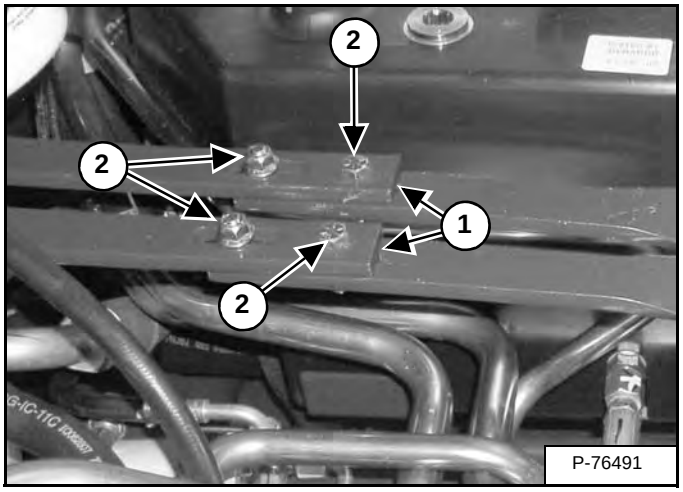
Disconnect the control harness connectors (Item 4) **[Figure 50-100-2]** & **[Figure 50-100-3]** from the control levers.

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CONTROL PANEL (S/N 530714202 & BELOW AND 530811539 & BELOW) (CONT'D)

Removal And Installation (Cont'd)

Figure 50-100-4

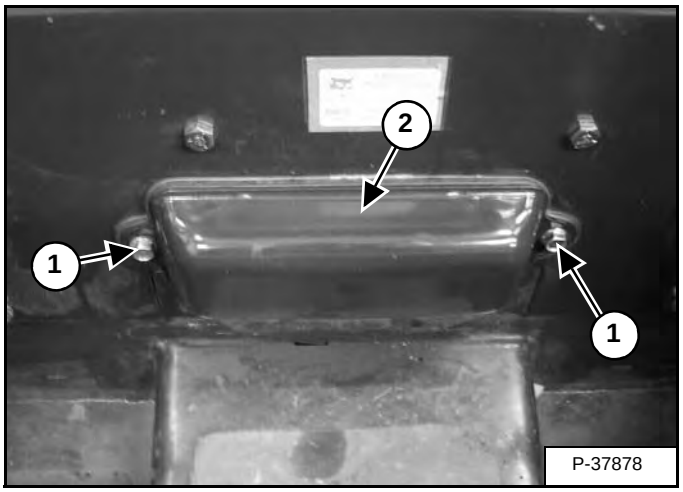


Scribe a mark across the top of the steering linkage bars (Item 1) **[Figure 50-100-4]** which are connected to the steering shaft on the control panel.

Remove the four steering linkage mounting bolts (Item 2) **[Figure 50-100-4]**.

Installation: Align the marks on the steering linkage bars. Tighten the steering linkage mounting bolts to 35-40 ft.-lb. (47,5-54,2 N•m) torque.

Figure 50-100-5



Remove the fuse / relay mounting bolts (Item 1) **[Figure 50-100-5]**.

Remove the fuse / relay cover (Item 2) **[Figure 50-100-5]**.

Figure 50-100-6

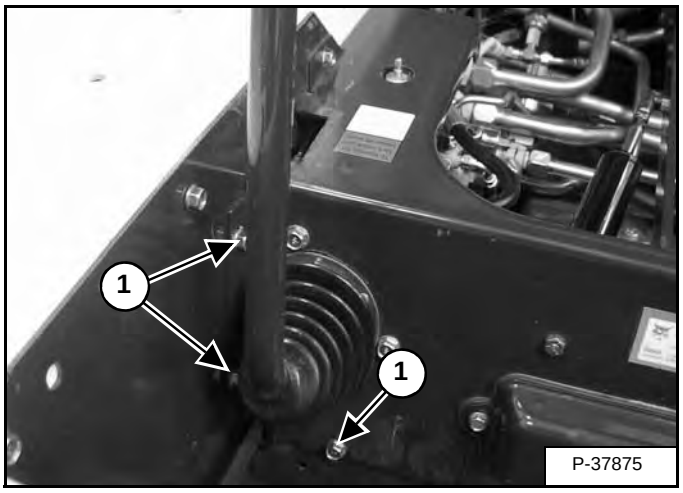
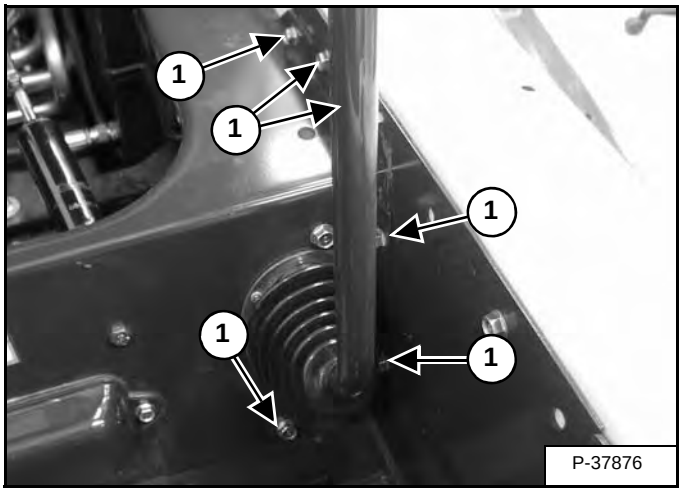


Figure 50-100-7



Remove the control panel mounting bolts (Item 1) **[Figure 50-100-6]** & **[Figure 50-100-7]** from both sides of the control panel.

Installation: Tighten the control panel mounting bolts to 20 ft.-lb. (27 N•m) torque.

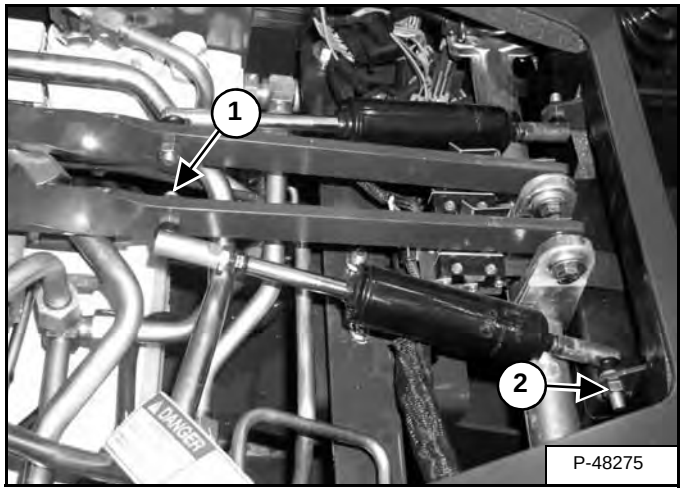
Remove the control panel from the loader.

Reverse the removal procedure to install the control panel.

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Shock Removal And Installation

Figure 50-100-8



Remove the mounting nut (Item 1) **[Figure 50-100-8]** from the end of the shock connected to the steering linkage.

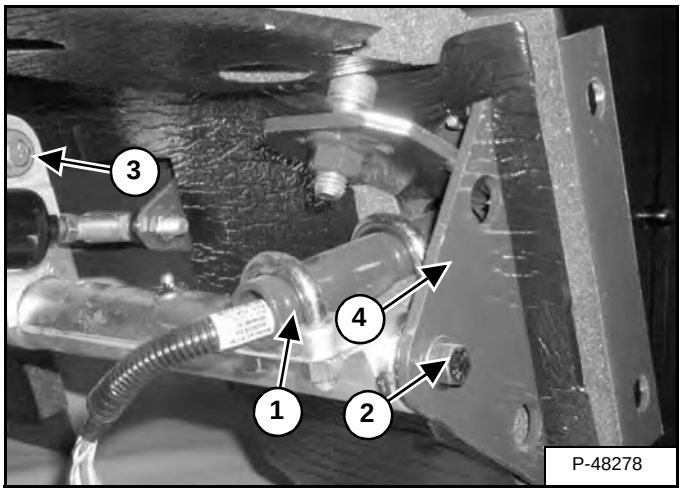
Remove the mounting nut (Item 2) **[Figure 50-100-8]** from the other end of the shock connected to the bracket on the control panel.

Installation: Tighten the mounting bolts to 25-28 ft.-lb. (34-38 N•m) torque.

Shaft Removal And Installation

NOTE: The steering shaft can be removed without removing the control panel from the loader. Photo [Figure 50-100-9] shows the control panel removed for clarity purpose only.

Figure 50-100-9



Remove Control Handle / Lever (Item 1) **[Figure 50-100-9]**. (See Lever Removal And Installation on Page 50-110-1.)

Remove the steering shaft pivot bolt (Item 2) **[Figure 50-100-9]** from both sides of the control panel.

Remove the steering linkage mounting bolts (Item 3) **[Figure 50-100-9]** from both sides.

Installation: Tighten the pivot bolts to 25-28 ft.-lb. (34-38 N•m) torque.

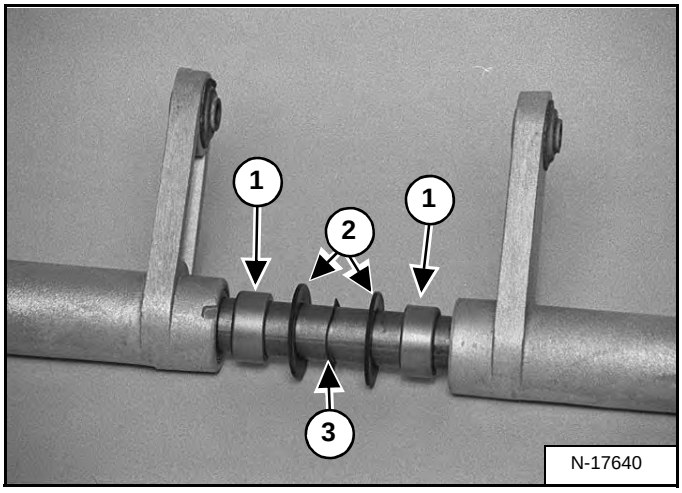
Remove the steering shaft from the control panel.

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CONTROL PANEL (S/N 530714202 & BELOW AND 530811539 & BELOW) (CONT'D)

Shaft Disassembly And Assembly

Figure 50-100-10



Disassemble the right and left steering bellcranks from the cross shaft assembly.

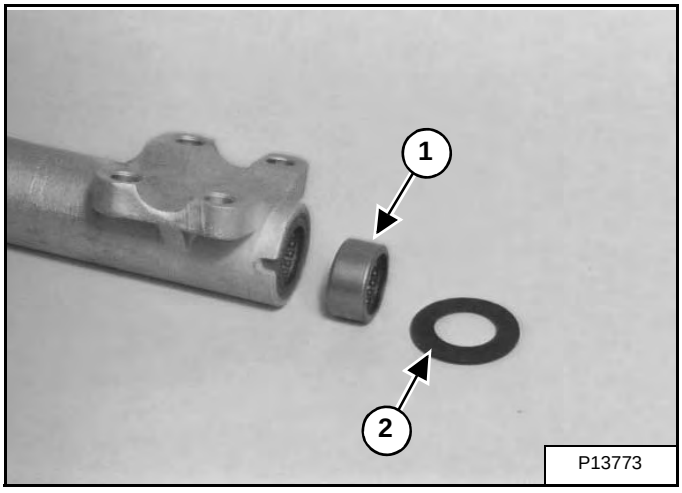
Check the bearings (Item 1) **[Figure 50-100-10]** for wear and replace as needed.

Check the fiber washers (Item 2) **[Figure 50-100-10]** for wear and replace as needed.

Replace the wave washer (Item 3) **[Figure 50-100-10]** if worn.

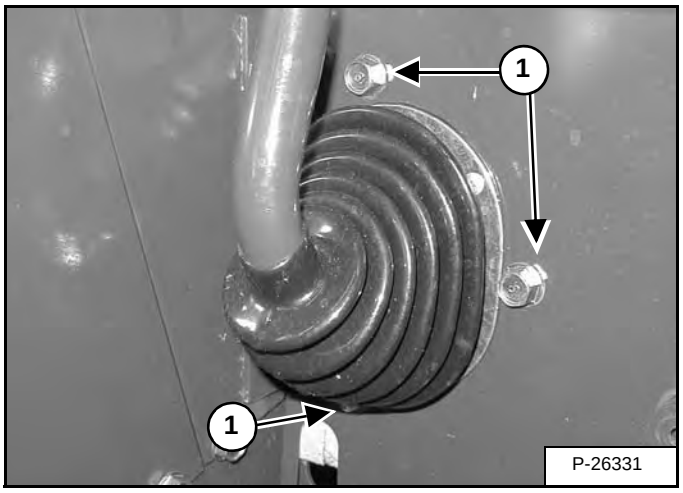
NOTE: The bellcranks should pivot freely on the cross shaft when assembled correctly.

Figure 50-100-11



Check the end bearing (Item 1) and fiber washer (Item 2) and replace as needed **[Figure 50-100-11]**.

Figure 50-100-12



To remove the steering shaft mounting bracket (Item 4) **[Figure 50-100-9]**, remove the three mounting bolts (Item 1) **[Figure 50-100-12]** from the front of the control panel.

Remove the steering shaft mounting bracket.

Installation: Tighten the mounting bolts to 20 ft.-lb. (27 N•m) torque.

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Linkage Removal And Installation

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

⚠ WARNING

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

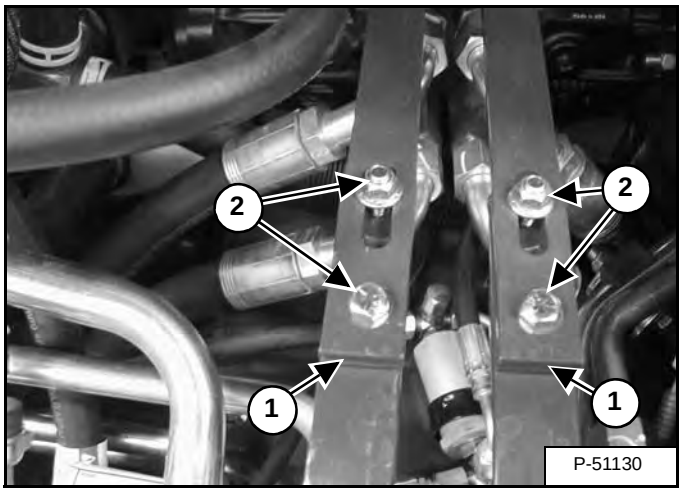
W-2017-0286

Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Figure 50-100-13



Scribe a mark across the top of the steering linkage bars (Item 1) **[Figure 50-100-13]** which are connected to the steering shaft on the control panel.

Remove the four steering linkage mounting bolts (Item 2) **[Figure 50-100-13]**.

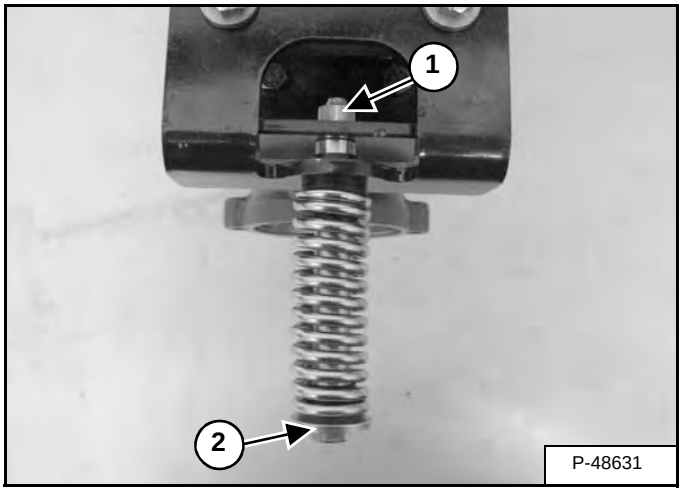
Installation: Align the marks on the steering linkage bars. Tighten the steering linkage mounting bolts to 35-40 ft.-lb. (47,5-54,2 N•m) torque.

NOTE: After removal and installation of the linkage, the linkage neutral adjusting procedure must be performed. (See Linkage Neutral (Adjusting) on Page 50-100-11.)

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Linkage Removal And Installation (Cont'd)

Figure 50-100-14

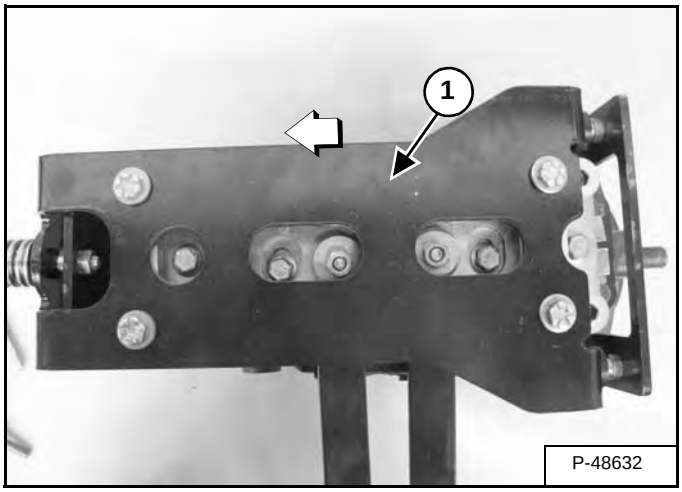


Remove the nut (Item 1) from the end of the centering spring shoulder bolt (Item 2) **[Figure 50-100-14]**.

Remove the bolt / spring assembly.

Installation: Tighten the centering spring bolt and a **NEW** lock nut to 25-28 ft.-lb. (34-38 N•m) torque.

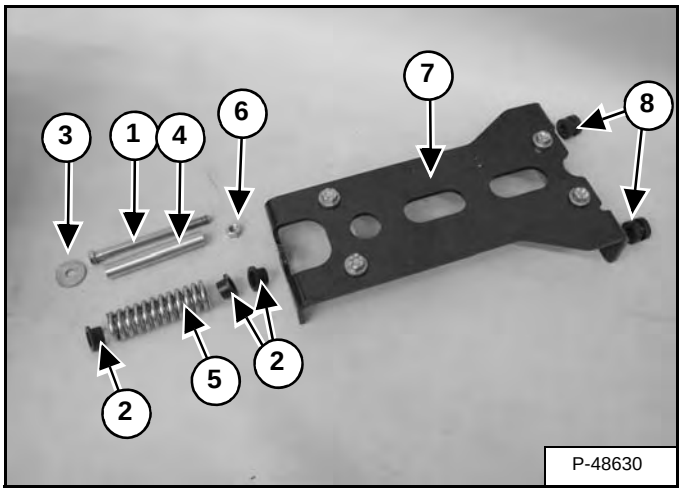
Figure 50-100-15



Slide the centering plate (Item 1) **[Figure 50-100-15]** to the right to remove it from the hydrostatic pumps.

NOTE: Directions are shown and stated as if you were sitting in the operator's seat.

Figure 50-100-16



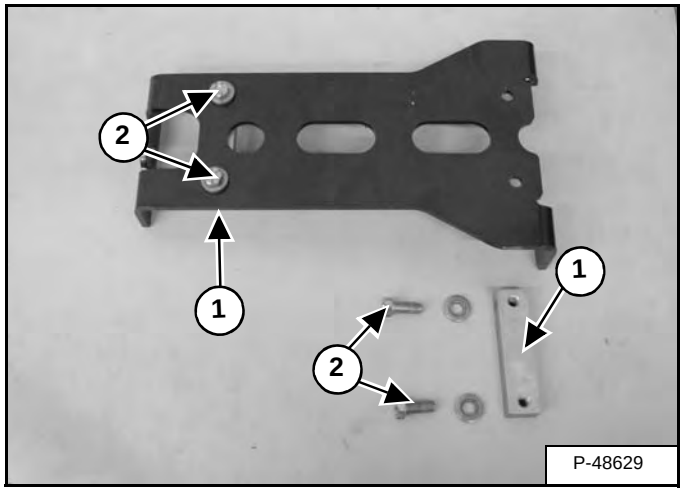
The centering plate / centering spring assembly consists of the following parts:

ITEM	DESCRIPTION
1	Bolt
2	Bushings
3	Washer
4	Bushing Spacer
5	Spring
6	Lock Nut
7	Centering Plate
8	Guide Bushings

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Linkage Removal And Installation (Cont'd)

Figure 50-100-17



Check the wear on the centering blocks (Item 1) **[Figure 50-100-17]**.

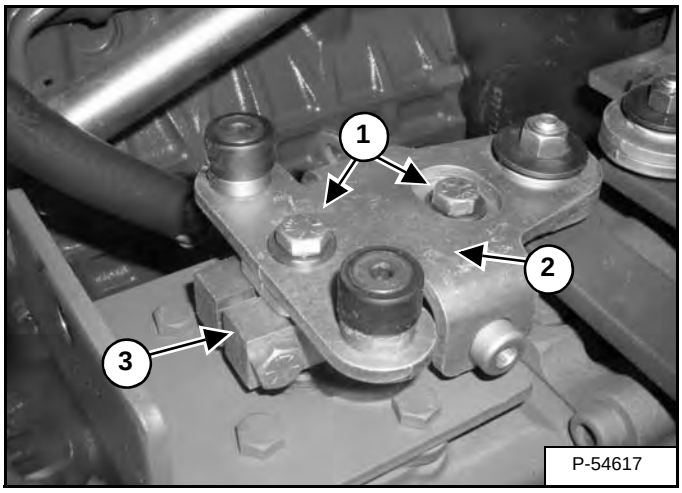
If the centering blocks need replacement, remove the bolts (Item 2) **[Figure 50-100-17]**. Remove the centering blocks.

Installation: Tighten the centering block bolts to 35-40 ft.-lb. (47,5-54,2 N•m) torque.

NOTE: The washers go between the bolts and the centering plate.

NOTE: If the centering blocks are worn, they can be removed and rotated 180 degrees and reinstalled.

Figure 50-100-18

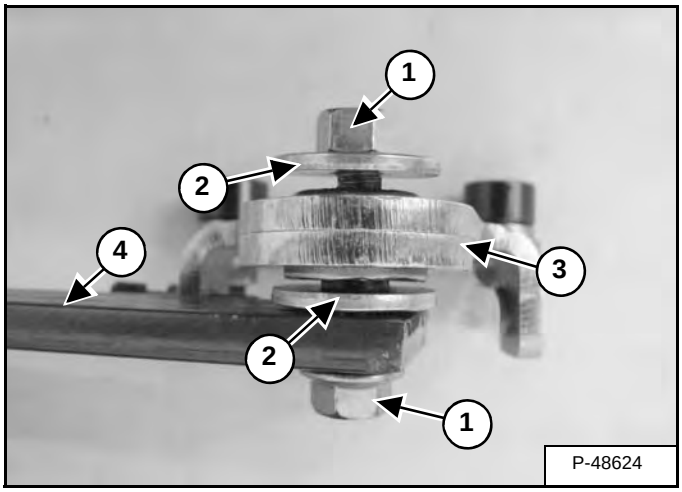


Remove the bolts and washers (Item 1) **[Figure 50-100-18]** from the pintle.

Installation: Tighten the bolts to 35-40 ft.-lb. (47,5-54,2 N•m) torque.

Remove the pintle arm (Item 2) from the pintle base (Item 3) **[Figure 50-100-18]**.

Figure 50-100-19



Remove the bolt and nut (Item 1) **[Figure 50-100-19]**.

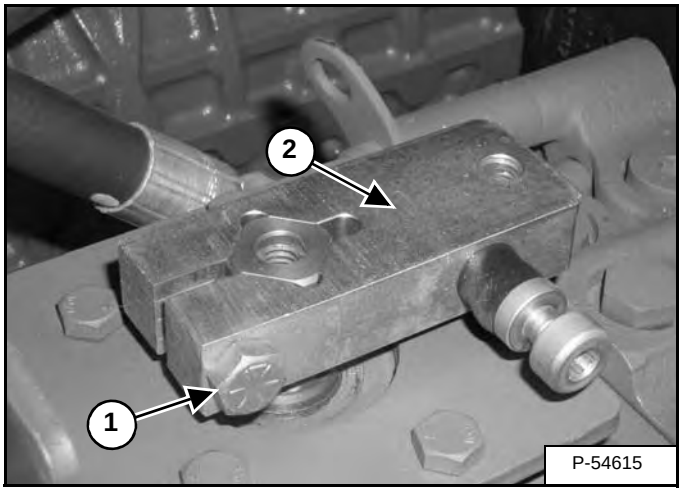
Inspect the washers (Item 2), pintle arm (Item 3) and the steering control lever (Item 4) for damage and replace as needed **[Figure 50-100-19]**.

NOTE: The washers (Item 2) [Figure 50-100-19] are hardened, and should only be replaced through Bobcat Parts.

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Linkage Removal And Installation (Cont'd)

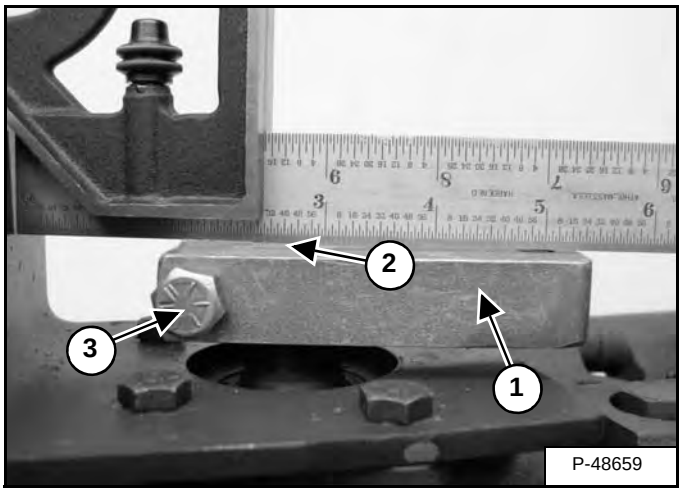
Figure 50-100-20



Loosen the bolt (Item 1) **[Figure 50-100-20]**.

Remove the pintle base (Item 2) **[Figure 50-100-20]**.

Figure 50-100-21



NOTE: When installing the pintle base (Item 1) onto the pump shaft, the cutouts on the pump shaft will not line up with the bolt (Item 3) [Figure 50-100-21].

Installation: Install the pintle base (Item 1) onto the pump shaft (Item 2) **[Figure 50-100-21]**. The top of the pintle base should be level with the top of the pump shaft. Tighten the bolts to 35-40 ft.-lb. (47,5-54,2 N•m) torque.

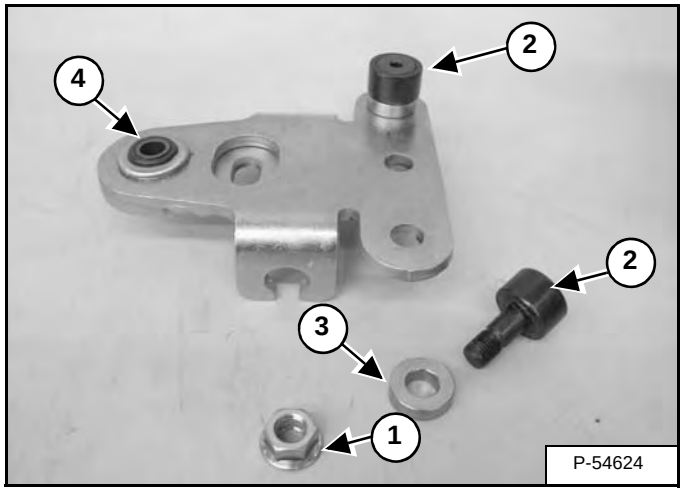
NOTE: After installing the linkage onto the hydrostatic pumps the linkage neutral adjusting procedure must be performed. (See Linkage Neutral (Adjusting) on Page 50-100-11.)

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CONTROL PANEL (S/N 530714202 & BELOW AND 530811539 & BELOW) (CONT'D)

Pintle Arm Disassembly and Assembly

Figure 50-100-22

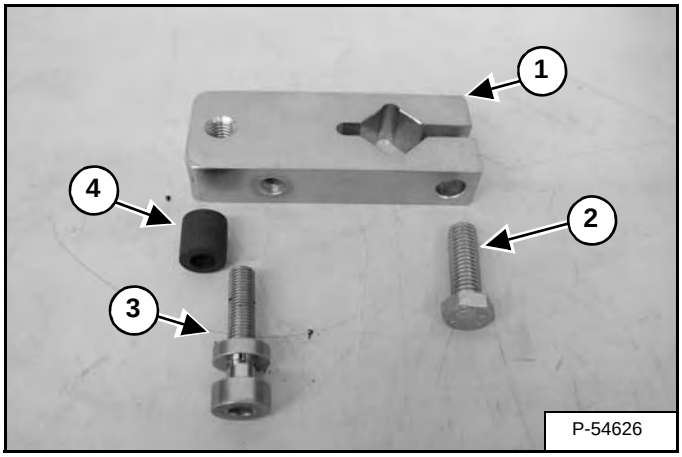


Remove the nut (Item 1) from the pintle roller cams (Item 2) and inspect the pintle roller cams and washers (Item 3) for damage **[Figure 50-100-22]**.

Inspect the torsion bushing (Item 4) **[Figure 50-100-22]** for damage and replace as needed.

Installation: Tighten the nuts to 35-40 ft.-lb. (47,5-54,2 N•m) torque.

Figure 50-100-23



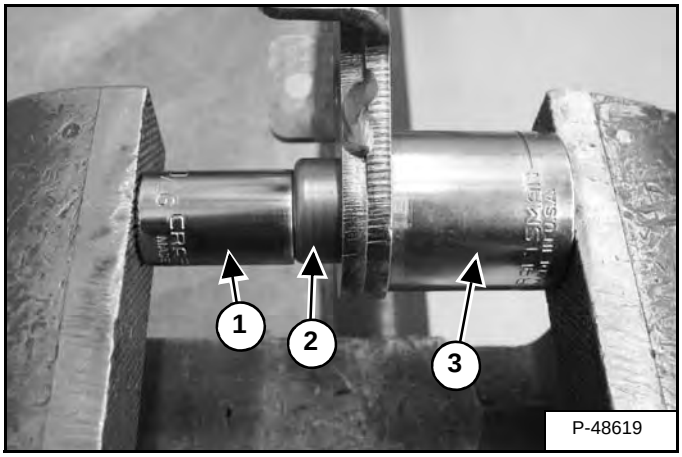
Remove the base pintle (Item 1) **[Figure 50-100-23]** from the pump shaft.

Remove the retaining bolt (Item 2), adjusting screw (Item 3) and neoprene dampener (Item 4) from the base pintle **[Figure 50-100-23]**.

Inspect parts for wear and damage, replace as needed **[Figure 50-100-23]**.

NOTE: Anti-sieze should be used on the adjusting screw to prevent corrosion and allow free movement while adjusting.

Figure 50-100-24



Using a bushing driver (Item 1) remove the torsion bushing (Item 2) by pressing the bushing through the pintle arm into an oversized socket (Item 3) to catch the torsion bushing **[Figure 50-100-24]**.

Installation: Install the torsion bushing (Item 2) **[Figure 50-100-24]** into the pintle arm using the same procedure as the removal.

NOTE: When the torsion bushing is installed, the amount of bushing on each side of the pintle arm should be the same.

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CONTROL PANEL (S/N 530714202 & BELOW AND 530811539 & BELOW) (CONT'D)

Linkage Neutral (Adjusting)

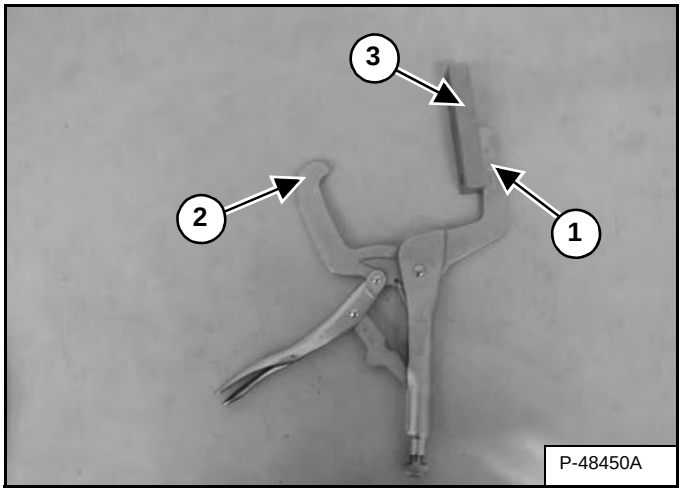
The following tool listed will be needed to do the following procedure:

Kit - 6689778 Remote Start Tool (Service Tool) or MEL1563 Remote Start Tool.

Connect the Remote Start Tool (Service Tool) to the loader. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.) ***OR*** (See REMOTE START TOOL (SERVICE TOOL) KIT - 6689779 on Page 10-61-1.)

Lift and block the loader. (See Procedure on Page 10-10-1.)

Figure 50-100-25



Tool that may assist in the neutral adjustment **[Figure 50-100-25]**.

To make this tool use a locking grip C-Clamp and grind one edge flat (Item 1) and grind the other edge (Item 2) **[Figure 50-100-25]** to a small rounded edge.

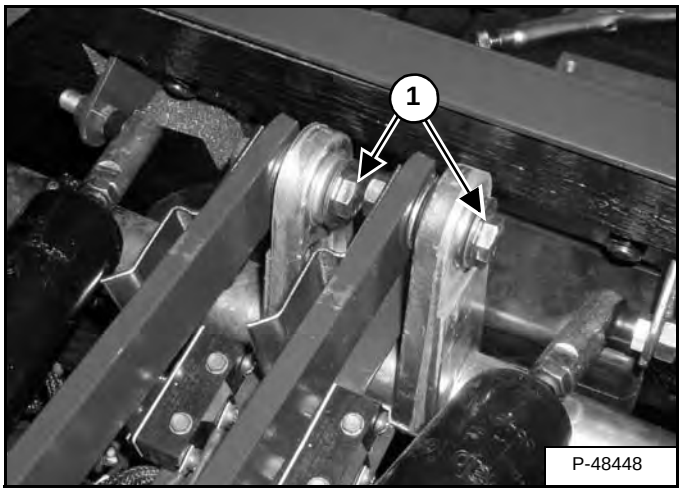
A steering centering block (Item 3) **[Figure 50-100-25]** is also needed. The centering block can be placed as shown and welded to the C-clamp if desired.

⚠ WARNING

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

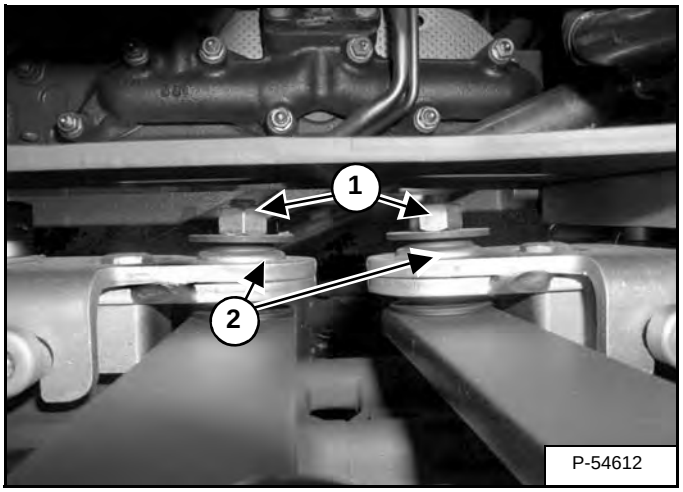
W-2017-0286

Figure 50-100-26



Loosen the bolt / nut (Item 1) **[Figure 50-100-26]** only until the tension is released from the torsion bushing.

Figure 50-100-27



Loosen the nut (Item 1) only until the tension is released from the torsion bushing (Item 2) **[Figure 50-100-27]**.

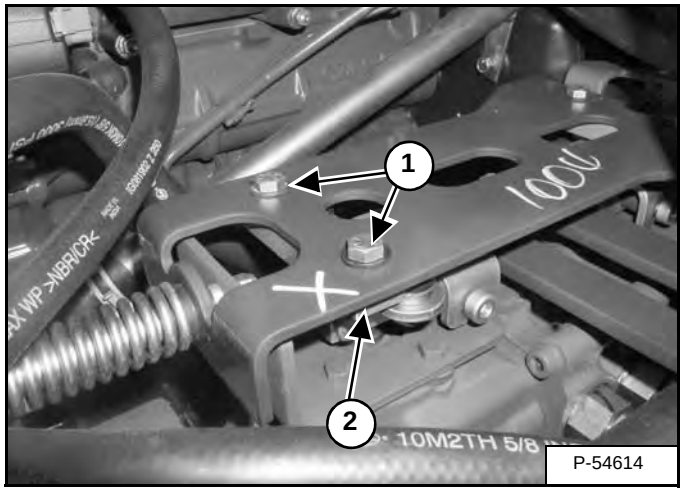
NOTE: The bolt must be loose enough to allow the torsion bushing (Item 2) [Figure 50-100-27] to turn freely between the torsion bushing and the steering linkage bar.

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CONTROL PANEL (S/N 530714202 & BELOW AND 530811539 & BELOW) (CONT'D)

Linkage Neutral (Adjusting) (Cont'd)

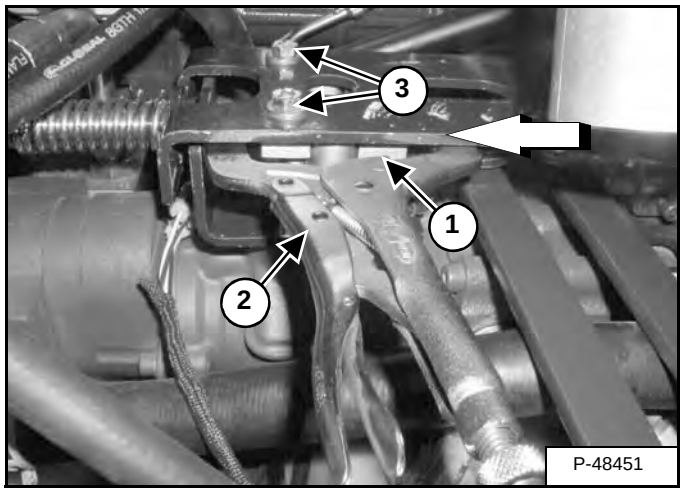
Figure 50-100-28



Loosen the two bolts (Item 1) holding the right centering block. Move the right hand centering block (Item 2) **[Figure 50-100-28]** until both pintle cams contact the centering block.

NOTE: The left centering block is not adjustable. By adjusting the right centering block the left centering block will also become aligned properly.

Figure 50-100-29



A modified locking grip C-Clamp and steering block shown in **[Figure 50-100-25]** may be used to help in aligning the centering blocks.

Install the centering block (Item 1) on the inside of the pintle cams and the C-Clamp (Item 2) **[Figure 50-100-29]** around both centering blocks.

Lock the C-Clamp in place.

⚠ WARNING

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

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Connect the Remote Start Tool (Service Tool) to the loader. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.) ***OR*** (See REMOTE START TOOL (SERVICE TOOL) KIT - 6689779 on Page 10-61-1.)

Start the engine and run at low idle.

Move the traction lock override switch so the traction function is unlocked. On a standard loader the wedge brake will unlock.

NOTE: When the engine is started, the wheels / tracks may begin to move.

NOTE: In loaders equipped with manual steering and hydraulic brake, the steering levers may have to be moved during engine start-up to reduce the amount of creep. This reduction in creep will allow time for the engine to run and build up hydraulic charge pressure, which will release the hydraulic brake.

Tighten bolts (Item 3) **[Figure 50-100-29]** to 35-40 ft.-lb. (47,5-54,2 N•m).

NOTE: Check for slack between centering blocks and pintle cams. If there is excessive slack repeat above steps [Figure 50-100-28] & [Figure 50-100-29].

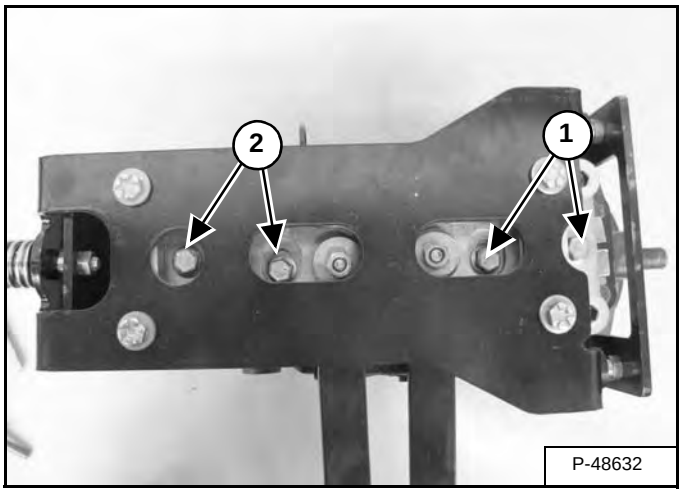
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CONTROL PANEL (S/N 530714202 & BELOW AND 530811539 & BELOW) (CONT'D)

Linkage Neutral (Adjusting) (Cont'd)

Start the neutral adjustment procedure with the left pump first and complete the neutral adjustment for the left pump before adjusting the right pump.

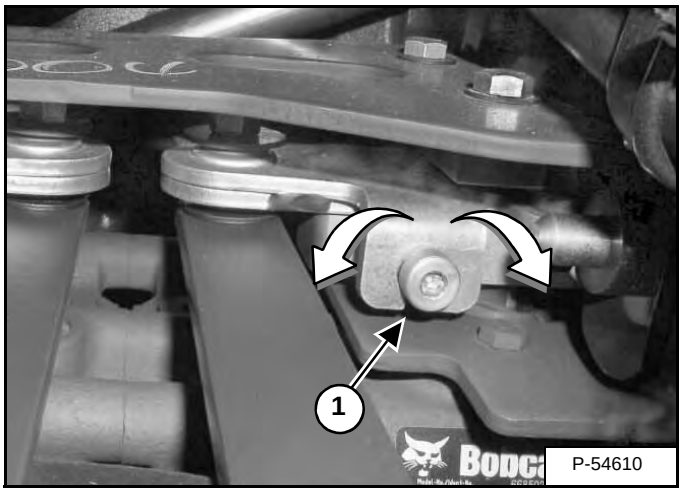
Figure 50-100-30



Loosen the left pump pintle adjustment lock bolts (Item 1). (The right pump pintle adjustment lock bolts are (Item 2) **[Figure 50-100-30]**.) Loosen the bolts enough to allow free movement between the pintle arm and the pintle base.

NOTE: If the bolts are too loose or too tight, the neutral adjustment may be affected.

Figure 50-100-31



Move the engine speed control to high idle.

NOTE: The neutral range (dead-band) will vary between the hydrostatic pumps.

NOTE: This procedure is shown for neutral adjustment on the left side of the loader. The procedure is the same for the right side neutral adjustment.

Turn the adjustment screw (Item 1) **[Figure 50-100-31]** counterclockwise until forward creep is seen.

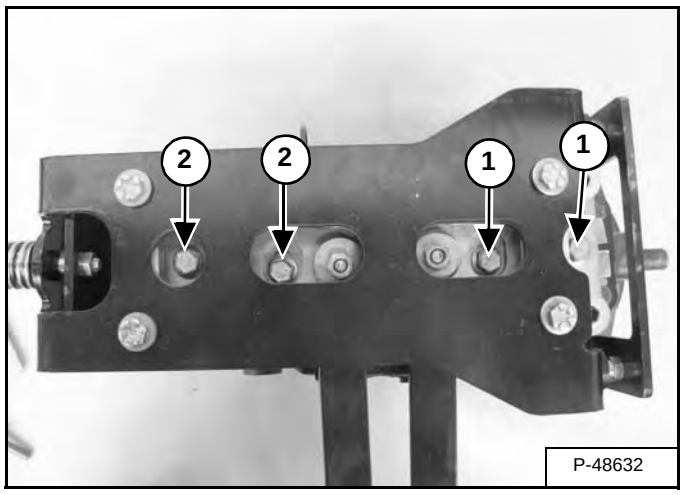
Turn the adjustment screw (Item 1) **[Figure 50-100-31]** counterclockwise to a point between forward and reverse where there is **zero** creep.

Stroke the left steering lever to forward and allow the lever to return to neutral. Stroke the left steering lever to reverse and allow the lever to return to neutral. Check that there is zero creep when the lever returns from either direction, on the left side. Turn the adjustment screw (if necessary) until zero creep is obtained.

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Linkage Neutral (Adjusting) (Cont'd)

Figure 50-100-32



Torque the left pump pintle adjustment lock bolts (Item 1) **[Figure 50-100-32]** to 35-40 ft.-lb. (47,5-54,2 N•m).

Repeat the adjustment procedure for the right pump.

Torque the right pump pintle adjustment lock bolts (Item 2) **[Figure 50-100-32]** to 35-40 ft.-lb. (47,5-54,2 N•m).

Test both levers by moving them backward and forward and letting them return to neutral by the return spring force.

If the levers do not return to neutral and the wheels / tracks do not come to a complete stop, repeat the adjustment procedure again.

Stop the engine.

Remove one pintle adjustment bolt (Item 1) **[Figure 50-100-32]** at a time and apply Loctite® #242 or equivalent thread locker to the bolt and re-install the bolt. Torque the bolt to 35-40 ft.-lb. (47,5-54,2 N•m). Repeat for the three remaining pintle adjustment lock bolts.

NOTE: To maintain proper adjustment setting, remove and reinstall only one bolt at a time. New bolts can be installed with pre-applied Loctite®.

Remove the Remote Start Tool (Service Tool).

NOTE: After the neutral adjustment is completed on both pumps, the linkage travel adjustment MUST be completed. (See Linkage Travel (Adjusting) on Page 50-100-15.)

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CONTROL PANEL (S/N 530714202 & BELOW AND 530811539 & BELOW) (CONT'D)

Linkage Travel (Adjusting)

NOTE: When the linkage travel adjusting procedure is being done as part of the loader neutral adjusting procedure, check the torsion bushings at the pump and at the bell cranks to be sure they are not binding or too loose, which will affect the procedure.

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

⚠ WARNING

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

W-2017-0286

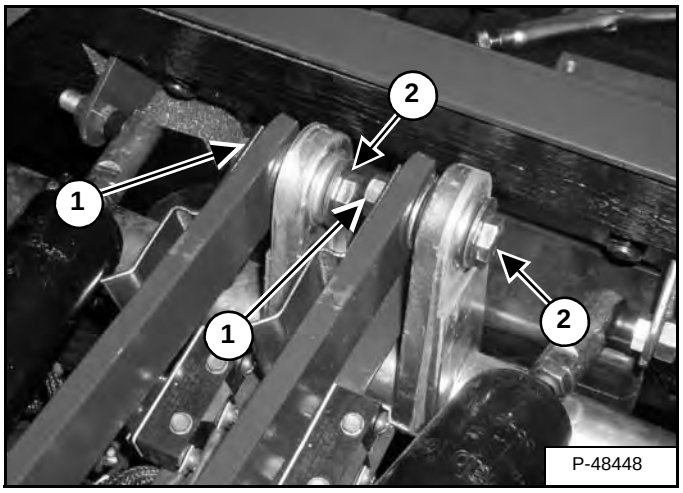
Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

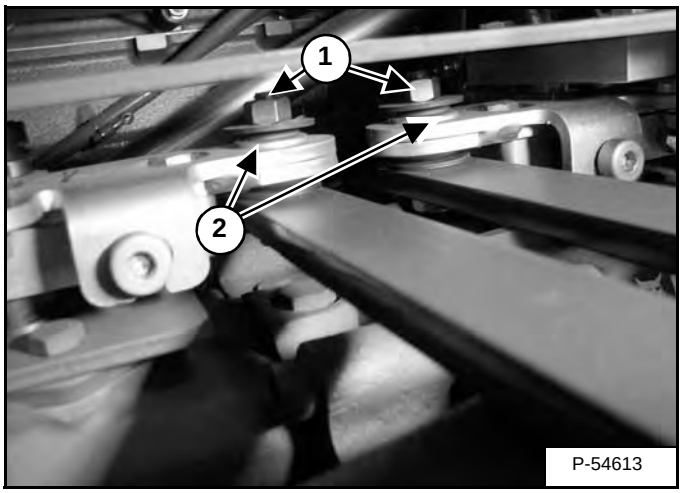
Pre-load tension in the torsion bushings must be removed before adjusting the steering linkage.

Figure 50-100-33



Loosen the nut (Item 1) 3 to 4 turns, then loosen the bolt (Item 2). The bolt (Item 2) **[Figure 50-100-33]** must be loosened enough to allow the torsion bushing to turn freely between the steering bellcrank and the linkage bar.

Figure 50-100-34



Loosen the nut (Item 1) only until the tension is released from the torsion bushing (Item 2) **[Figure 50-100-34]**.

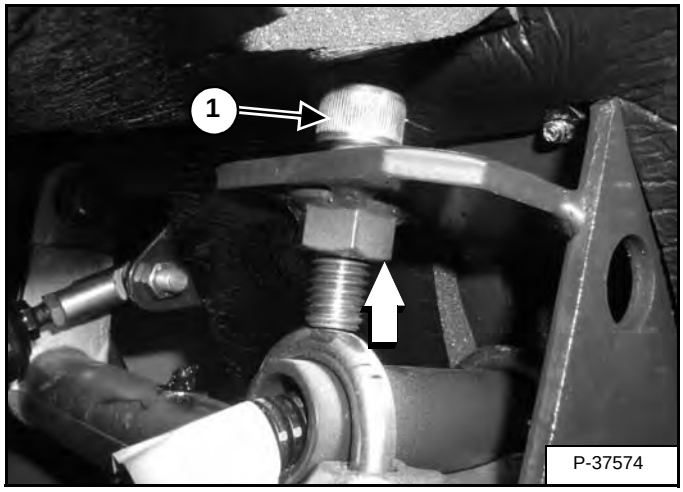
The bolt must be loose enough to allow the torsion bushing (Item 2) **[Figure 50-100-34]** to turn freely between the torsion bushing and the linkage bar.

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CONTROL PANEL (S/N 530714202 & BELOW AND 530811539 & BELOW) (CONT'D)

Linkage Travel (Adjusting) (Cont'd)

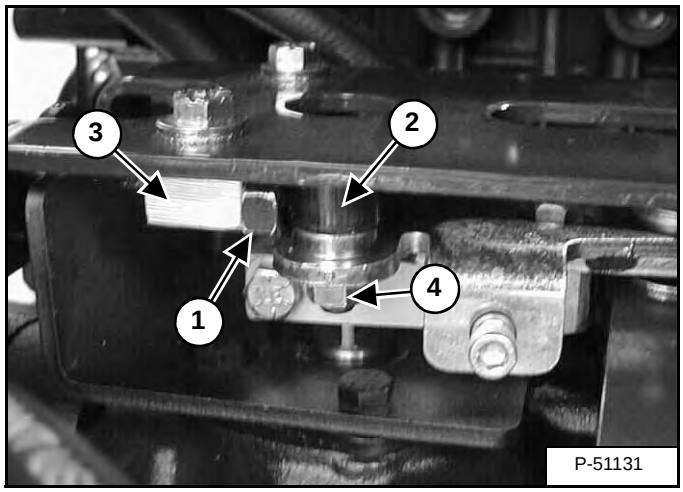
Figure 50-100-35



Remove access plug from the top of the control panel.

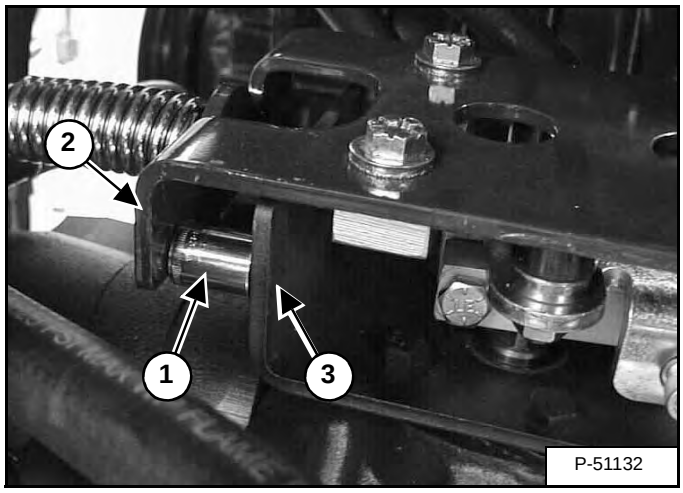
Turn the control lever drift adjustment bolts (Item 1) **[Figure 50-100-35]** (one on each control lever) out until it is flush with the bottom of the nut.

Figure 50-100-36



Move the right side steering lever to the rear and install a 3/8 in. (10 mm) thick spacer (Item 1) between the pintle arm cam (Item 2) and the centering block (Item 3) **[Figure 50-100-36]**.

Figure 50-100-37

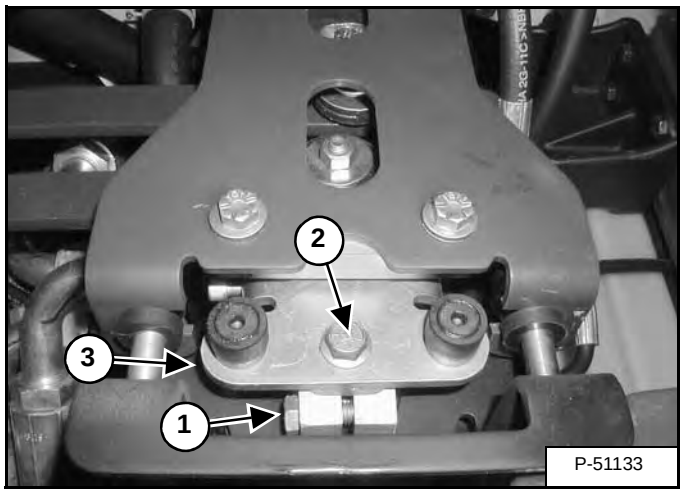


Move the right side steering lever forward and install a 15/16 in. (24 mm) thick spacer (Item 1) between the center plate (Item 2) and the mounting plate (Item 3) **[Figure 50-100-37]**.

This will allow the pintle arms to move freely while adjusting the steering linkage for full forward travel speed.

Remove the 3/8 in. (10 mm) thick spacer.

Figure 50-100-38



Before adjusting the linkage, verify the base pintle arm mounting bolt (Item 1) and both of the upper pintle mount bolts (Item 2) are tightened to 35-40 ft.-lb. (48-54 N•m) torque. There should be no play between the pintle arm and the square pump shaft **[Figure 50-100-38]**.

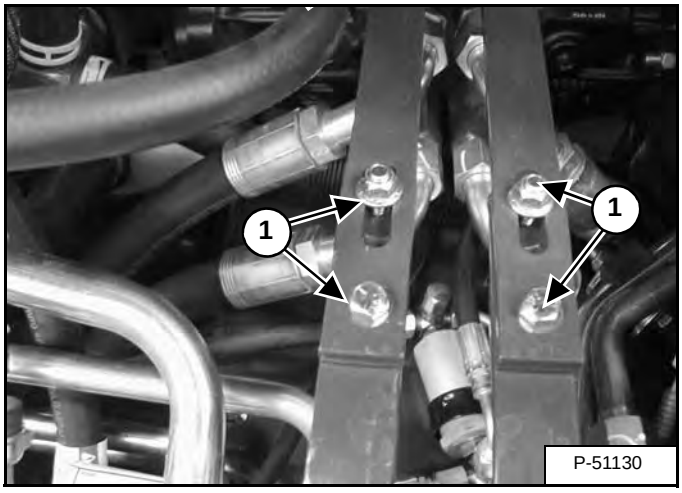
Verify the cam mounting nuts (Item 4) **[Figure 50-100-36]** are tightened to 35-40 ft. lb. (48-54 N•m) torque.

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CONTROL PANEL (S/N 530714202 & BELOW AND 530811539 & BELOW) (CONT'D)

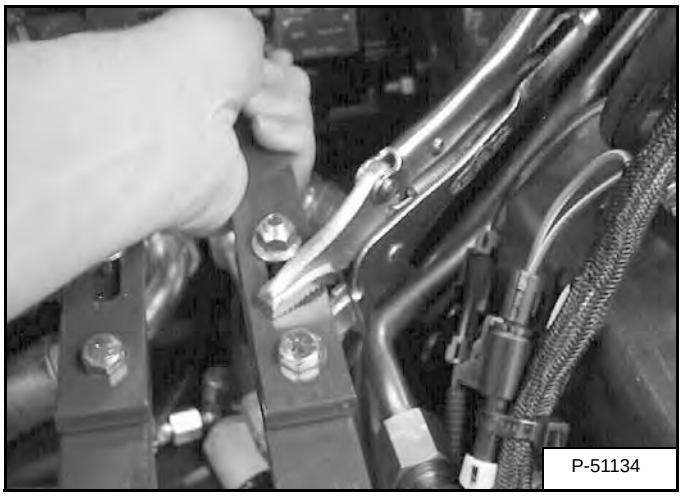
Linkage Travel (Adjusting) (Cont'd)

Figure 50-100-39



Loosen the two bolts and nuts (Item 1) **[Figure 50-100-39]** on each steering linkage bar.

Figure 50-100-40



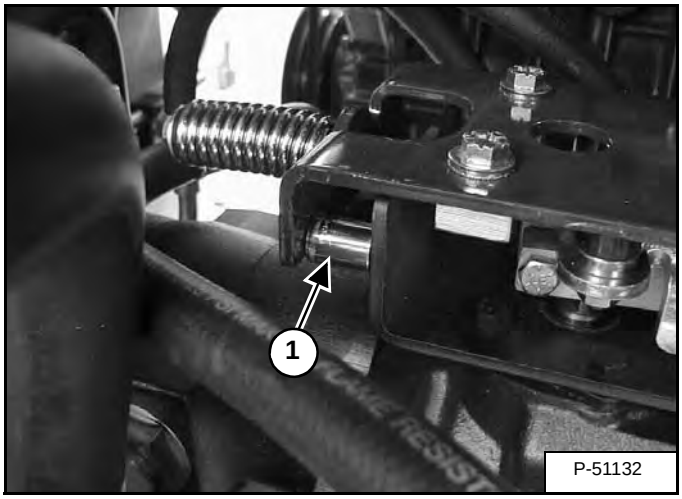
Move the left control lever to the full forward position, then pull forward on the left rear linkage bar until the pintle arm is rotated to the front as far as possible **[Figure 50-100-40]**. Use a locking plier, clamp the two linkage bars together.

Installation: Tighten the nuts and bolts to 35-40 ft.-lb. (47,5-54,2 N•m) torque.

Check the lever movement to make sure that the pintle arm and the control lever are both at full stroke at the same time. This will allow for maximum forward speed.

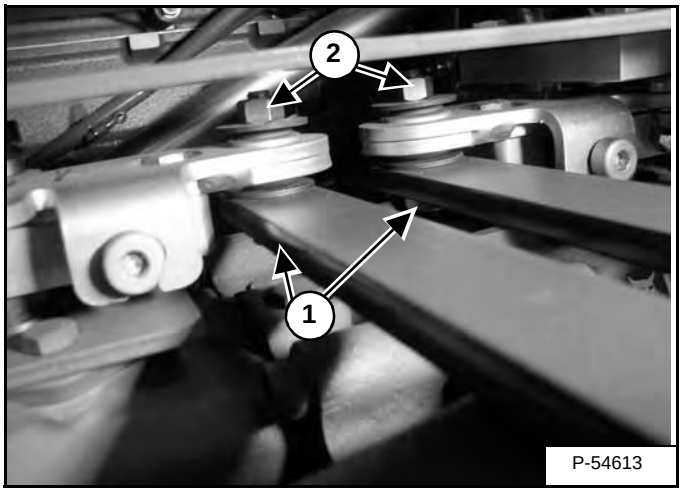
Repeat the linkage travel adjustment procedure for the right side linkage.

Figure 50-100-41



Remove the spacer (Item 1) **[Figure 50-100-41]**.

Figure 50-100-42

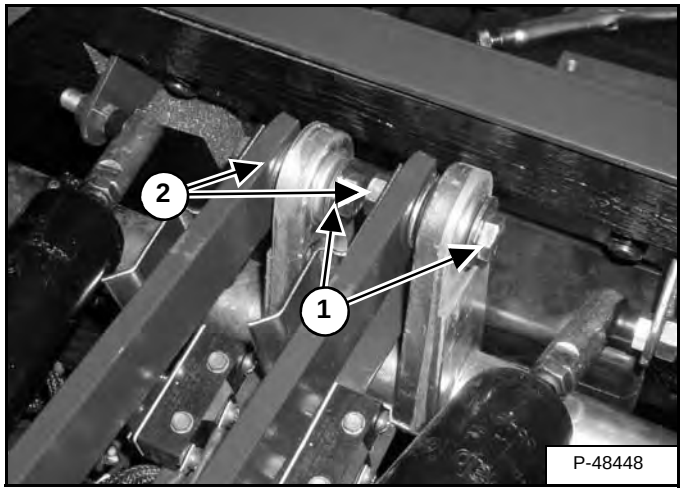


Tighten the two bolts (Item 1) and nuts (Item 2) to 35-40 ft.-lb. (47,5-54,2 N•m) **[Figure 50-100-42]**.

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Linkage Travel (Adjusting) (Cont'd)

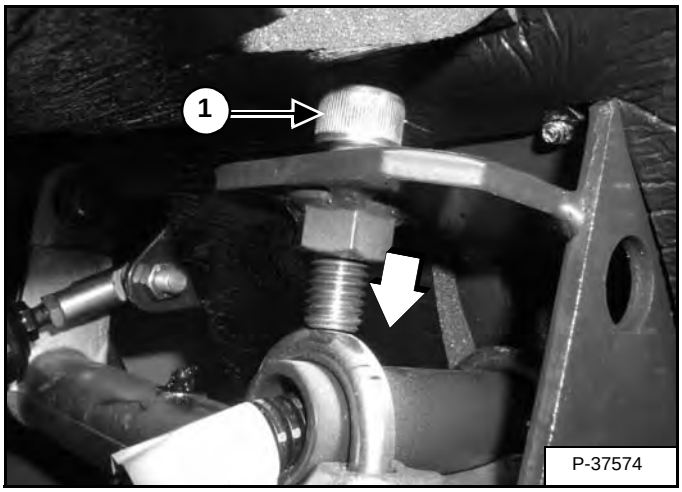
Figure 50-100-43



Tighten the two bolts and nuts (Items 1 & 2) **[Figure 50-100-43]** to 35-40 ft.-lb. (47,5-54,2 N•m) torque at the steering bell cranks.

NOTE: After removal, installation, and adjusting of the linkage, the Back-up Alarm must be inspected. (See Inspecting on Page 60-210-1.)

Figure 50-100-44



Push the control lever to full stroke and turn drift adjustment bolt (Item 1) **[Figure 50-100-44]** in until it touches the U-bolt holding the control lever.

Repeat steps on the other control lever.

Drive the loader forward and check for drift.

The traditional benchmark for drift is less than 10 ft. of “drift” in 100 ft. of travel distance.

If the drift is excessive to the left, turn the right adjustment bolt (Item 1) **[Figure 50-100-44]** in.

If the drift is excessive to the right, turn the left adjustment bolt in.

NOTE: When using the drift adjustment bolts, only adjust one bolt for each test drive.

In addition, only move each bolt a maximum of one turn for each test drive. This will help prevent over-correction and excessive reduction in travel speed.

Drift adjustment is for forward travel only.

Adjust the drift to an acceptable level.

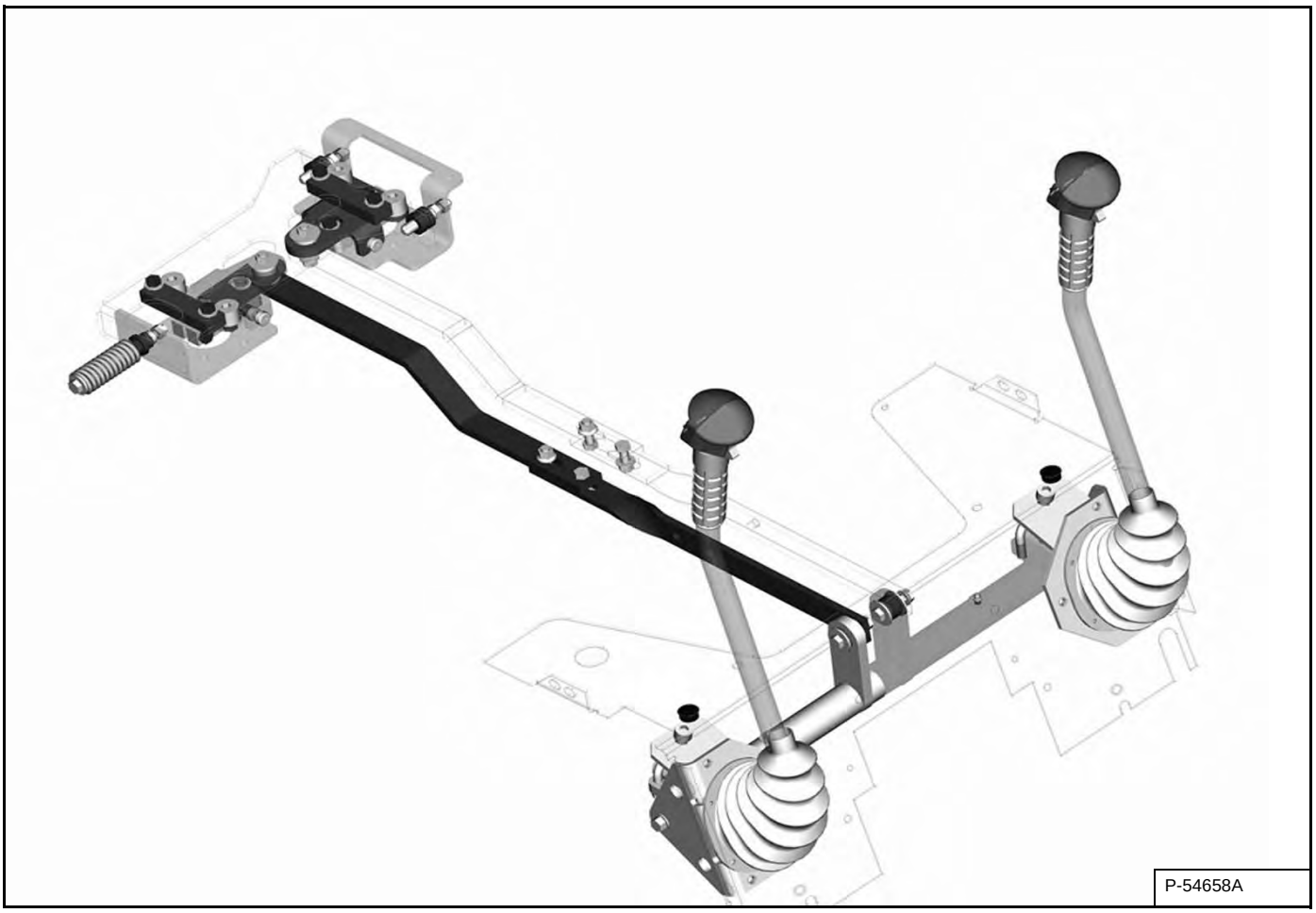
Re-install the plug in the drift bolt access hole after adjustment.

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CONTROL PANEL (S/N 530714203 & ABOVE AND 530811540 & ABOVE)

Description

Figure 50-101-1



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The steering system consists of independent steering levers the operator uses to provide steering input to the loader.

The steering levers are attached to pivoting bellcranks that pivot on a steering shaft and plastic bushings. The bellcranks have grease fittings.

The forward travel is adjusted by drift adjustment bolts.

The bellcranks are attached to steering linkage bars with rubber torsion bushings pressed into the bellcranks. Bellcranks mount to the control panel.

Steering linkage bars are a two-piece design. Steering linkage bars are adjustable in length for “full travel adjustment”.

Steering linkage bars attach to the pintle arms where a rubber torsion bushing is pressed into the pintle arms.

Pintle arms are of a two-piece design that allow easy adjustment of the neutral or “creep”.

The steering system returns the levers to their starting position by means of the centering spring and the returning force of the torsion bushings.

NOTE: Torsion bushings need to be replaced if torn or rotating in the housing. Loosen torsion bushing bolts slightly before adjustments are made. Do not fully tighten torsion bushing bolts again until all steering adjustments have been made first.

Sequence of steering adjustments:

1. Set neutral of pintle arms, “creep”
2. Set full travel at steering linkage bars
3. Set drift at drift adjustment bolts

The control panel is now common between the large frame and the medium frame loaders.

Removal And Installation



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

WARNING

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

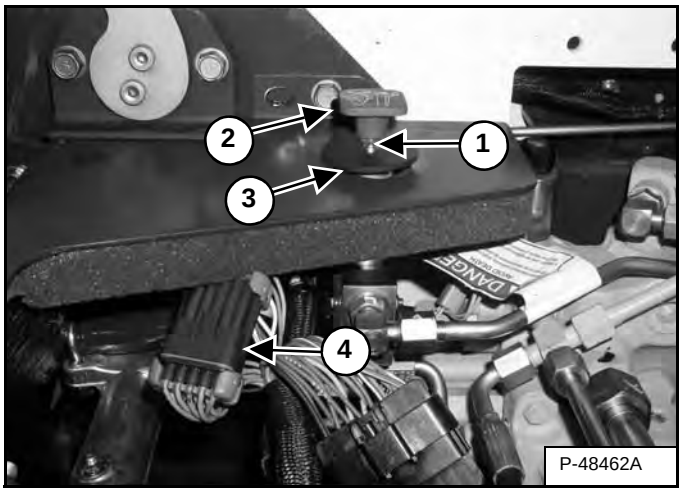
W-2017-0286

Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Figure 50-101-2

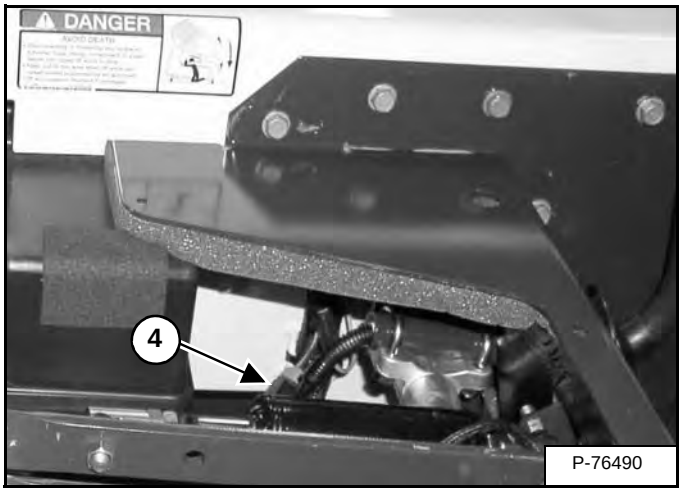


Loosen the jam nut (Item 1) from the lift arm bypass control knob (Item 2) **[Figure 50-101-2]**.

Remove the control knob (Item 2), jam nut (Item 1) and rubber washer (Item 3) **[Figure 50-101-2]**.

Remove the engine speed control. (See Removal And Installation on Page 70-20-1.)

Figure 50-101-3



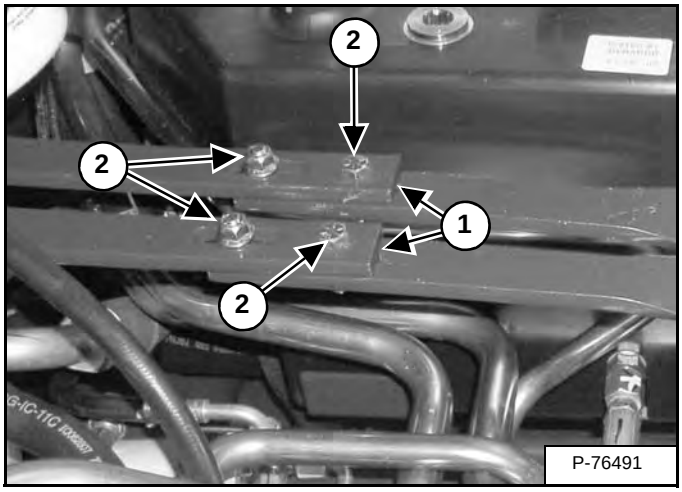
Disconnect the control harness connectors (Item 4) **[Figure 50-101-2]** & **[Figure 50-101-3]** from the control levers.

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CONTROL PANEL (S/N 530714203 & ABOVE AND 530811540 & ABOVE) (CONT'D)

Removal And Installation (Cont'd)

Figure 50-101-4

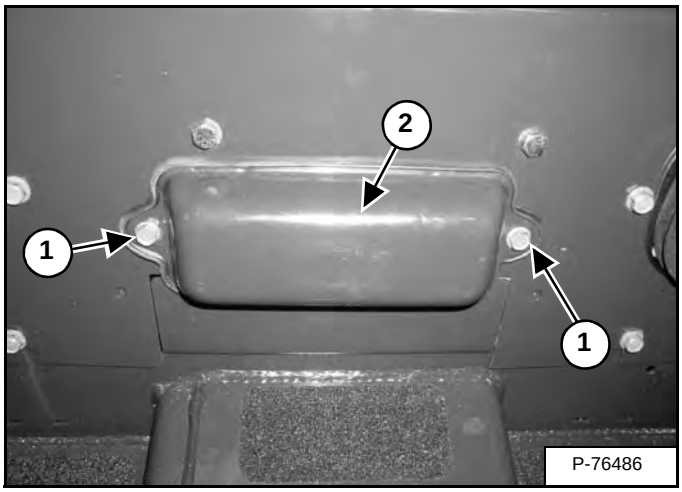


Scribe a mark across the top of the steering linkage bars (Item 1) **[Figure 50-101-4]** which are connected to the steering shaft on the control panel.

Remove the four steering linkage mounting bolts (Item 2) **[Figure 50-101-4]**.

Installation: Align the marks on the steering linkage bars. Tighten the steering linkage mounting bolts to 35-40 ft.-lb. (47,5-54,2 N•m) torque.

Figure 50-101-5



Remove the fuse / relay mounting bolts (Item 1) **[Figure 50-101-5]**.

Remove the fuse / relay cover (Item 2) **[Figure 50-101-5]**.

Figure 50-101-6

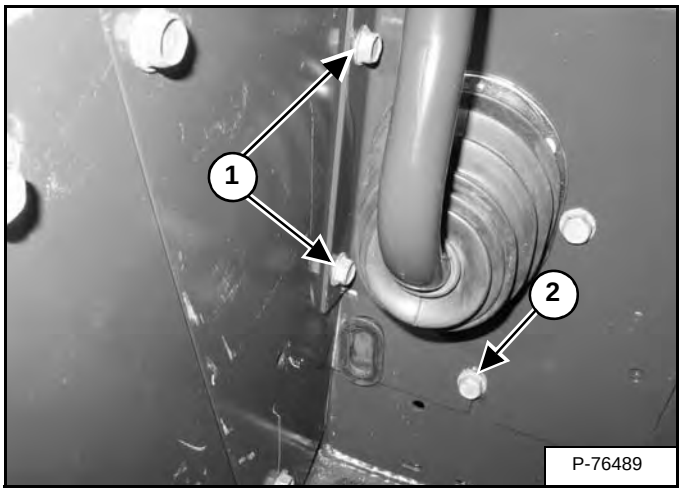
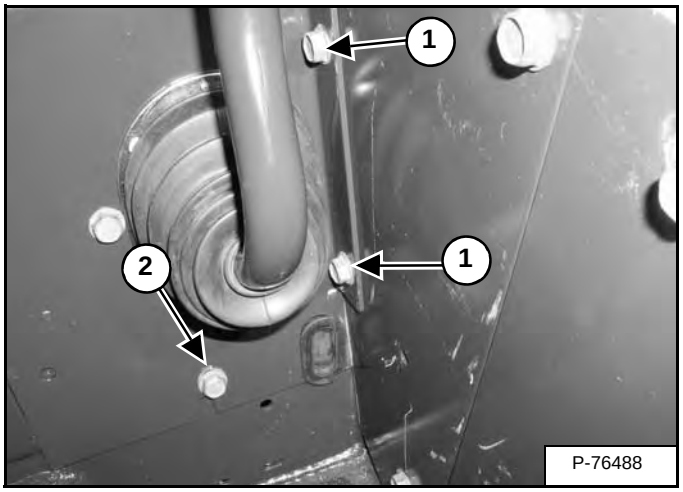


Figure 50-101-7



Remove the control panel mounting bolts (Item 1 & 2) **[Figure 50-101-6]** & **[Figure 50-101-7]** from both sides of the control panel.

Installation: Tighten the control panel mounting bolts to 20 ft.-lb. (27 N•m) torque.

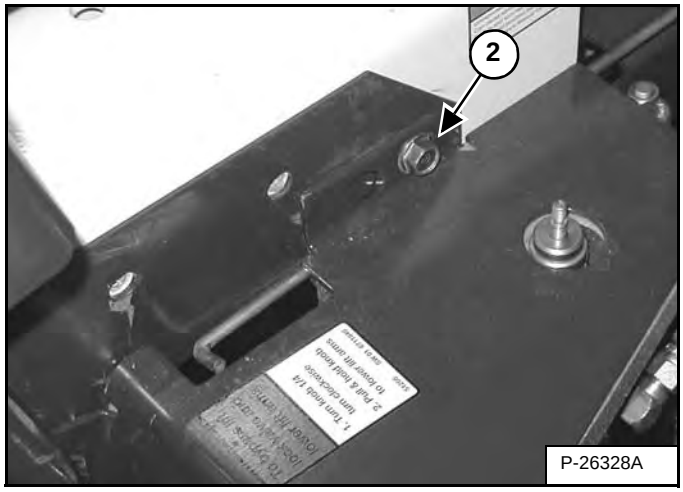
NOTE: Install the bottom bolts (Item 2) [Figure 50-101-6] & [Figure 50-101-7] through the hole in the control panel, do not install them in the slotted area.

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CONTROL PANEL (S/N 530714203 & ABOVE AND 530811540 & ABOVE) (CONT'D)

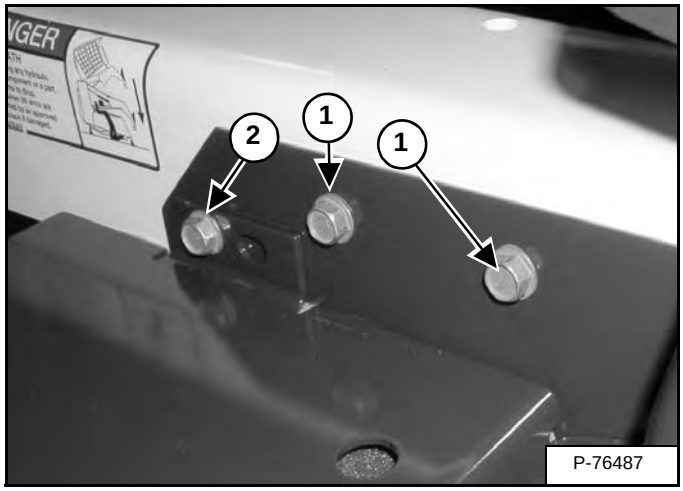
Removal And Installation (Cont'd)

Figure 50-101-8



Remove the control panel mounting bolt (Item 2) **[Figure 50-101-8]** from the loader.

Figure 50-101-9



Remove the side panel mounting bolts (Item 1) **[Figure 50-101-9]** from the loader.

Remove the control panel mounting bolt (Item 2) **[Figure 50-101-9]** from the loader.

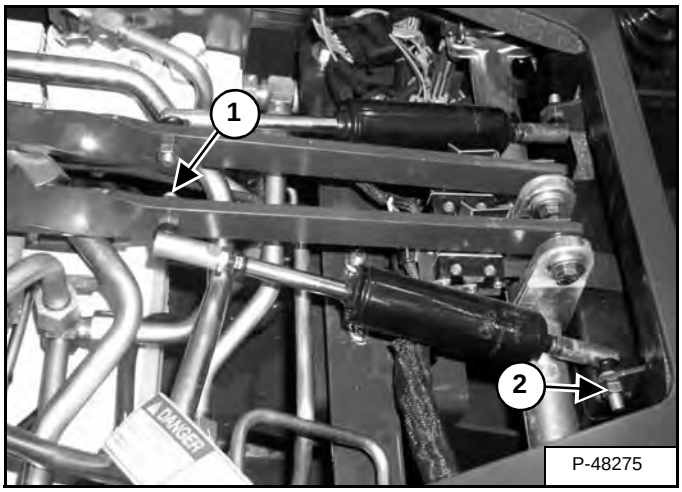
Remove the control panel from the loader.

Installation: Install the mounting bolt (Item 2) **[Figure 50-101-8]** and **[Figure 50-101-9]** into the rear hole of the control panel. Tighten the control panel mounting bolts to 20 ft.-lb. (27 N•m) torque

Reverse the removal procedure to install the control panel.

Shock Removal And Installation

Figure 50-101-10



Remove the mounting nut (Item 1) **[Figure 50-101-10]** from the end of the shock connected to the steering linkage.

Remove the mounting nut (Item 2) **[Figure 50-101-10]** from the other end of the shock connected to the bracket on the control panel.

Installation: Tighten the mounting bolts to 25-28 ft.-lb. (34-38 N•m) torque.

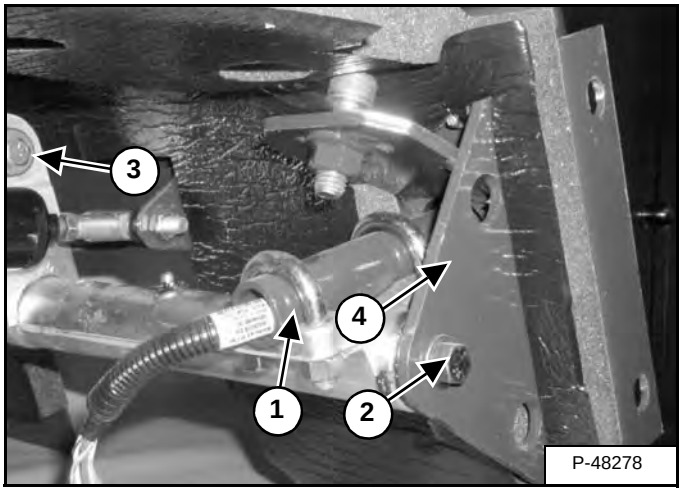
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CONTROL PANEL (S/N 530714203 & ABOVE AND 530811540 & ABOVE) (CONT'D)

Shaft Removal And Installation

NOTE: The steering shaft can be removed without removing the control panel from the loader. Photo [Figure 50-101-11] shows the control panel removed for clarity purpose only.

Figure 50-101-11



Remove Control Handle / Lever (Item 1) **[Figure 50-101-11]**. (See Lever Removal And Installation on Page 50-110-1.)

Remove the steering shaft pivot bolt (Item 2) **[Figure 50-101-11]** from both sides of the control panel.

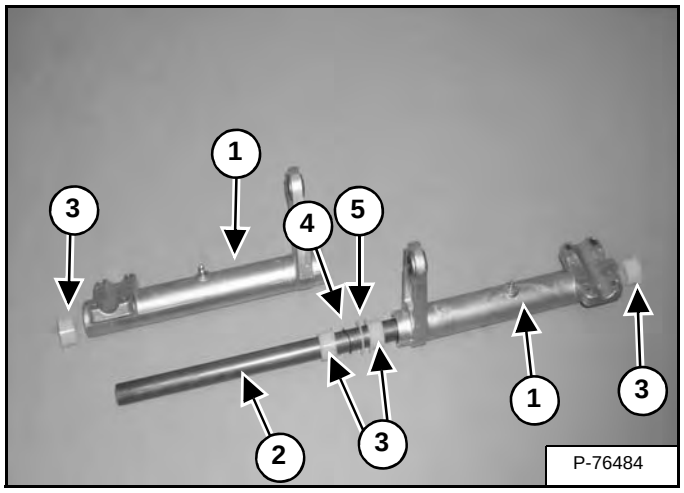
Remove the steering linkage mounting bolts (Item 3) **[Figure 50-101-11]** from both sides.

Installation: Tighten the pivot bolts to 25-28 ft.-lb. (34-38 N•m) torque.

Remove the steering shaft from the control panel.

Shaft Disassembly And Assembly

Figure 50-101-12

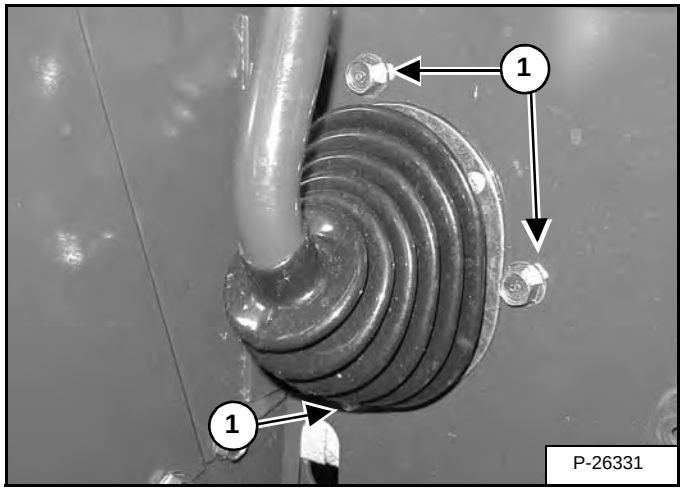


Disassemble the right and left steering bellcranks (Item 1) from the cross shaft assembly (Item 2) **[Figure 50-101-12]**.

Assembly: Install new nylon bushings (Item 3), wave washer (Item 4), and plastic washer (Item 5) **[Figure 50-101-12]** as needed when assembling the steering shaft. Be sure to apply grease on the cross shaft before installing the right and left bellcranks.

NOTE: The bellcranks should pivot freely on the cross shaft when assembled correctly.

Figure 50-101-13



To remove the steering shaft mounting bracket (Item 4) **[Figure 50-101-11]**, remove the three mounting bolts (Item 1) **[Figure 50-101-13]** from the front of the control panel.

Remove the steering shaft mounting bracket.

Installation: Tighten the mounting bolts to 20 ft.-lb. (27 N•m) torque.

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CONTROL PANEL (S/N 530714203 & ABOVE AND 530811540 & ABOVE) (CONT'D)

Linkage Removal And Installation

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

⚠ WARNING

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

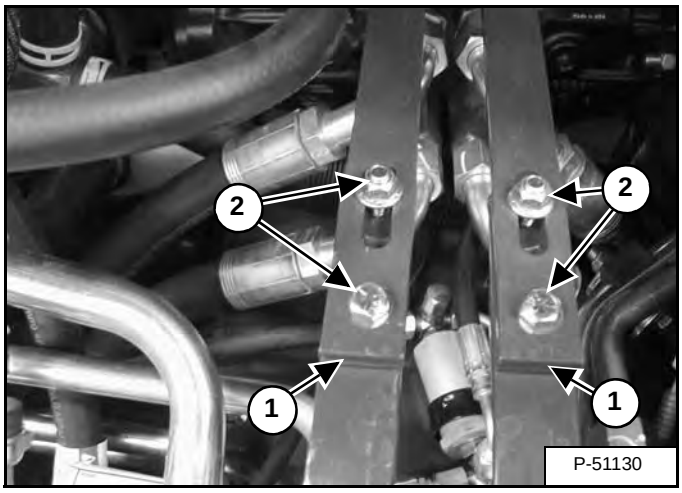
W-2017-0286

Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Figure 50-101-14



Scribe a mark across the top of the steering linkage bars (Item 1) **[Figure 50-101-14]** which are connected to the steering shaft on the control panel.

Remove the four steering linkage mounting bolts (Item 2) **[Figure 50-101-14]**.

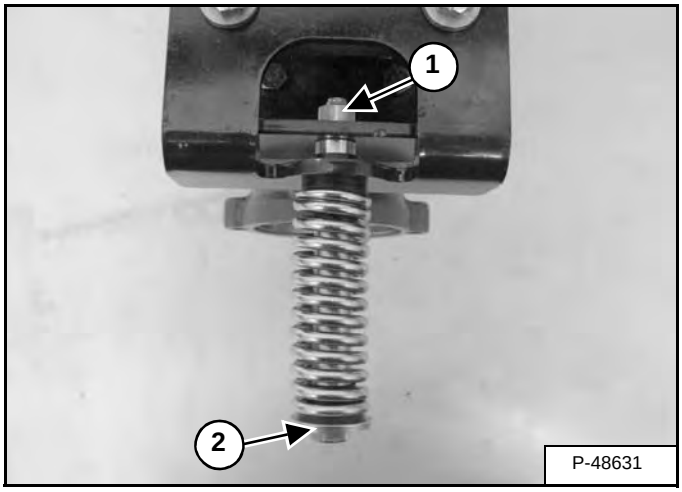
Installation: Align the marks on the steering linkage bars. Tighten the steering linkage mounting bolts to 35-40 ft.-lb. (47,5-54,2 N•m) torque.

NOTE: After removal and installation of the linkage, the linkage neutral adjusting procedure must be performed. (See Linkage Neutral (Adjusting) on Page 50-101-11.)

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Linkage Removal And Installation (Cont'd)

Figure 50-101-15

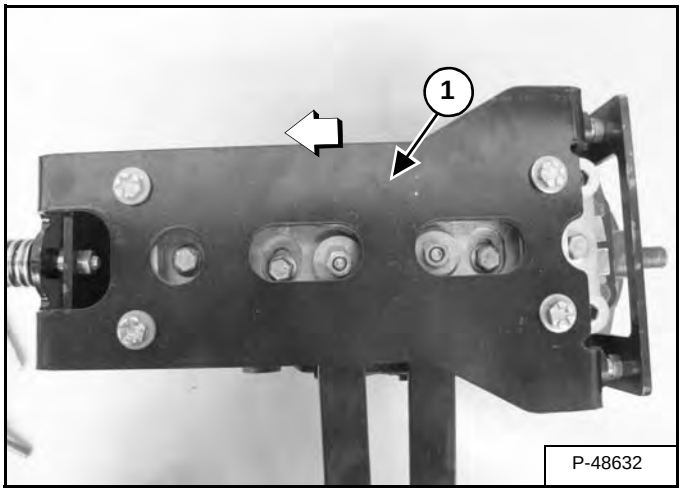


Remove the nut (Item 1) from the end of the centering spring shoulder bolt (Item 2) **[Figure 50-101-15]**.

Remove the bolt / spring assembly.

Installation: Tighten the centering spring bolt and a **NEW** lock nut to 25-28 ft.-lb. (34-38 N•m) torque.

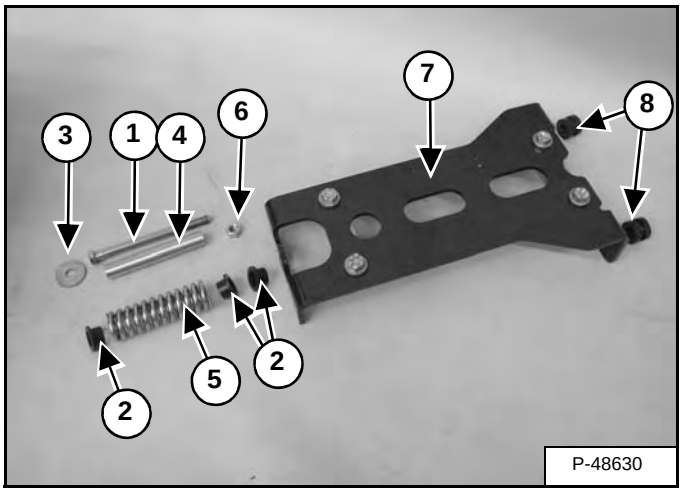
Figure 50-101-16



Slide the centering plate (Item 1) **[Figure 50-101-16]** to the right to remove it from the hydrostatic pumps.

NOTE: Directions are shown and stated as if you were sitting in the operator's seat.

Figure 50-101-17



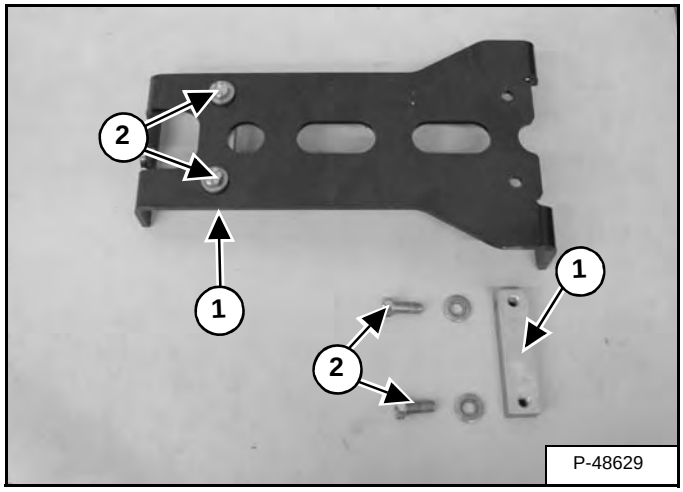
The centering plate / centering spring assembly consists of the following parts:

ITEM	DESCRIPTION
1	Bolt
2	Bushings
3	Washer
4	Bushing Spacer
5	Spring
6	Lock Nut
7	Centering Plate
8	Guide Bushings

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Linkage Removal And Installation (Cont'd)

Figure 50-101-18



Check the wear on the centering blocks (Item 1) **[Figure 50-101-18]**.

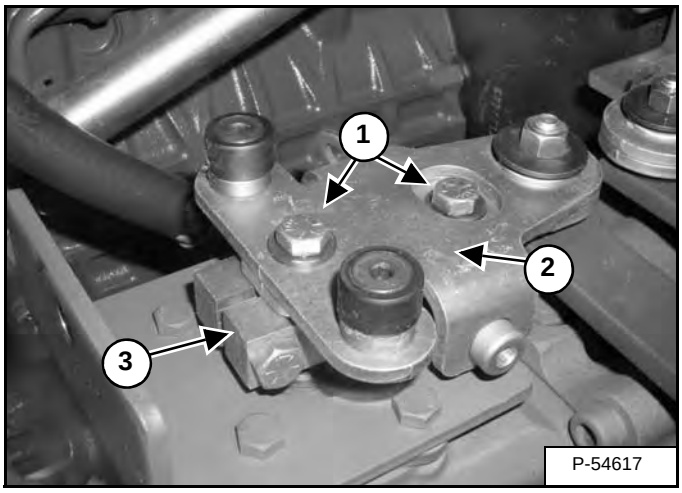
If the centering blocks need replacement, remove the bolts (Item 2) **[Figure 50-101-18]**. Remove the centering blocks.

Installation: Tighten the centering block bolts to 35-40 ft.-lb. (47,5-54,2 N•m) torque.

NOTE: The washers go between the bolts and the centering plate.

NOTE: If the centering blocks are worn, they can be removed and rotated 180 degrees and reinstalled.

Figure 50-101-19

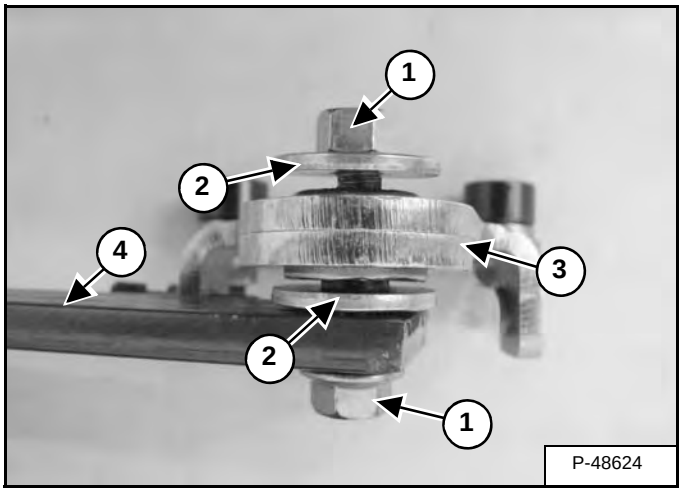


Remove the bolts and washers (Item 1) **[Figure 50-101-19]** from the pintle.

Installation: Tighten the bolts to 35-40 ft.-lb. (47,5-54,2 N•m) torque.

Remove the pintle arm (Item 2) from the pintle base (Item 3) **[Figure 50-101-19]**.

Figure 50-101-20



Remove the bolt and nut (Item 1) **[Figure 50-101-20]**.

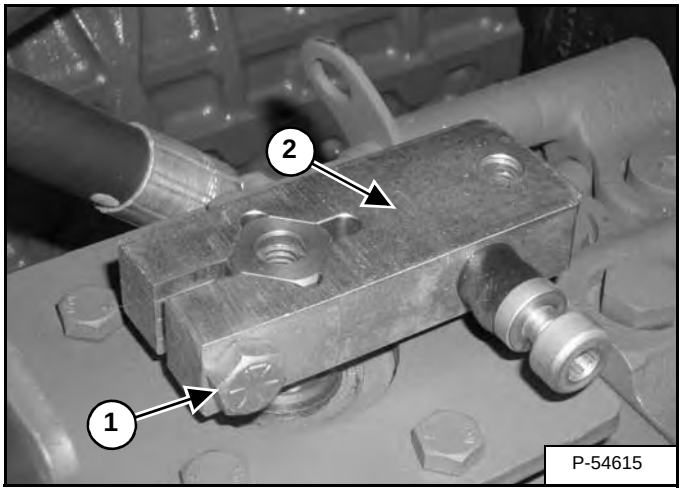
Inspect the washers (Item 2), pintle arm (Item 3) and the steering control lever (Item 4) for damage and replace as needed **[Figure 50-101-20]**.

NOTE: The washers (Item 2) [Figure 50-101-20] are hardened, and should only be replaced through Bobcat Parts.

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Linkage Removal And Installation (Cont'd)

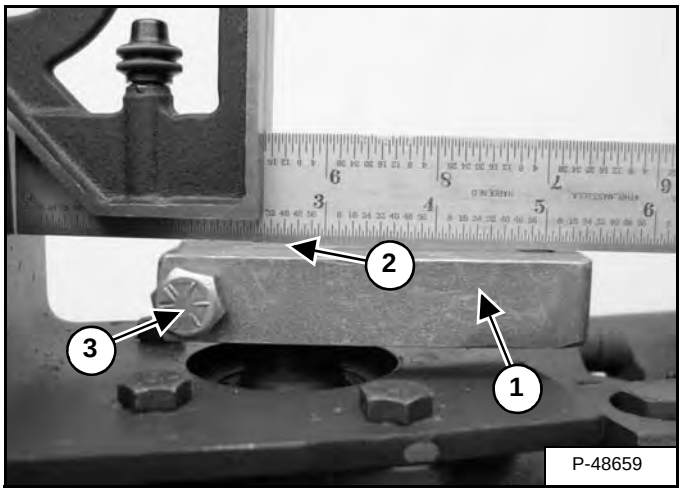
Figure 50-101-21



Loosen the bolt (Item 1) **[Figure 50-101-21]**.

Remove the pintle base (Item 2) **[Figure 50-101-21]**.

Figure 50-101-22



NOTE: When installing the pintle base (Item 1) onto the pump shaft, the cutouts on the pump shaft will not line up with the bolt (Item 3) [Figure 50-101-22].

Installation: Install the pintle base (Item 1) onto the pump shaft (Item 2) **[Figure 50-101-22]**. The top of the pintle base should be level with the top of the pump shaft. Tighten the bolts to 35-40 ft.-lb. (47,5-54,2 N•m) torque.

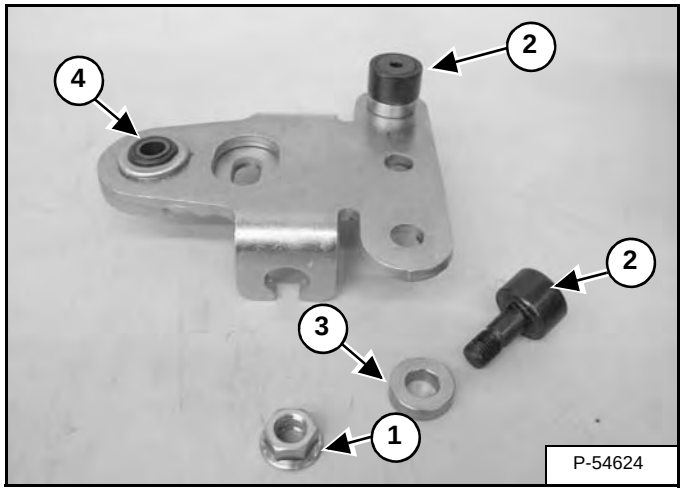
NOTE: After installing the linkage onto the hydrostatic pumps the linkage neutral adjusting procedure must be performed. (See Linkage Neutral (Adjusting) on Page 50-101-11.)

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CONTROL PANEL (S/N 530714203 & ABOVE AND 530811540 & ABOVE) (CONT'D)

Pintle Arm Disassembly and Assembly

Figure 50-101-23

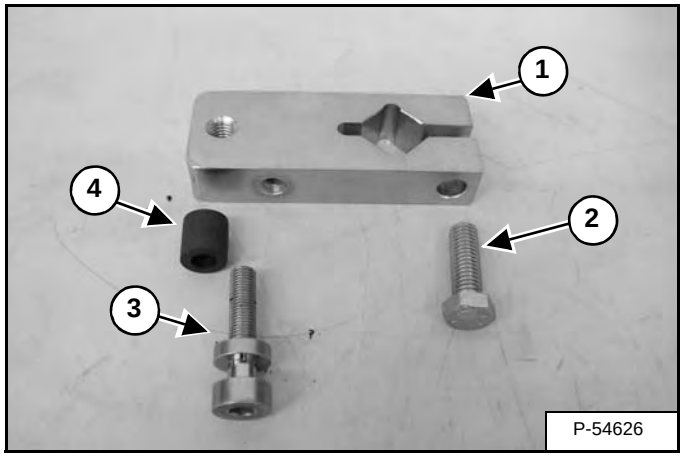


Remove the nut (Item 1) from the pintle roller cams (Item 2) and inspect the pintle roller cams and washers (Item 3) for damage **[Figure 50-101-23]**.

Inspect the torsion bushing (Item 4) **[Figure 50-101-23]** for damage and replace as needed.

Installation: Tighten the nuts to 35-40 ft.-lb. (47,5-54,2 N•m) torque.

Figure 50-101-24



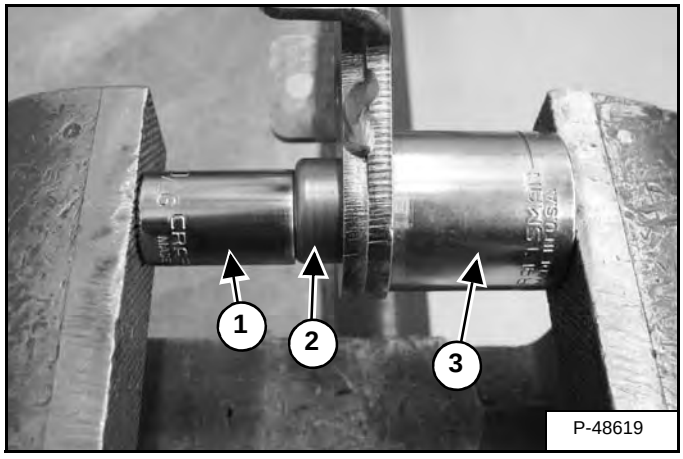
Remove the base pintle (Item 1) **[Figure 50-101-24]** from the pump shaft.

Remove the retaining bolt (Item 2), adjusting screw (Item 3) and neoprene dampener (Item 4) from the base pintle **[Figure 50-101-24]**.

Inspect parts for wear and damage, replace as needed **[Figure 50-101-24]**.

NOTE: Anti-sieze should be used on the adjusting screw to prevent corrosion and allow free movement while adjusting.

Figure 50-101-25



Using a bushing driver (Item 1) remove the torsion bushing (Item 2) by pressing the bushing through the pintle arm into an oversized socket (Item 3) to catch the torsion bushing **[Figure 50-101-25]**.

Installation: Install the torsion bushing (Item 2) **[Figure 50-101-25]** into the pintle arm using the same procedure as the removal.

NOTE: When the torsion bushing is installed, the amount of bushing on each side of the pintle arm should be the same.

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CONTROL PANEL (S/N 530714203 & ABOVE AND 530811540 & ABOVE) (CONT'D)

Linkage Neutral (Adjusting)

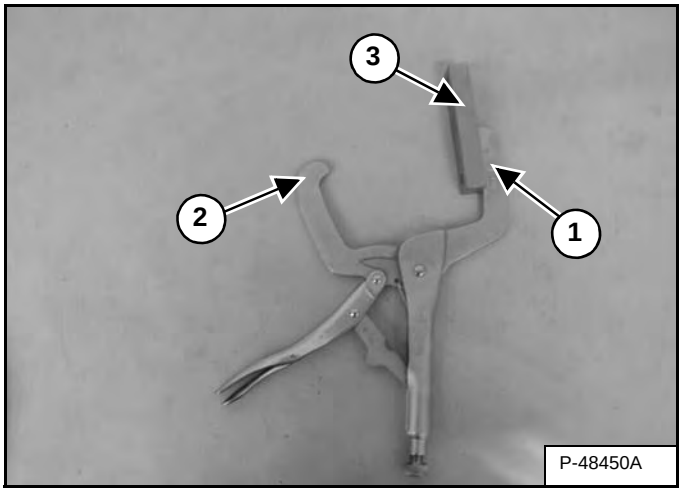
The following tool listed will be needed to do the following procedure:

Kit - 6689778 Remote Start Tool (Service Tool) or MEL1563 Remote Start Tool.

Connect the Remote Start Tool (Service Tool) to the loader. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.) ***OR*** (See REMOTE START TOOL (SERVICE TOOL) KIT - 6689779 on Page 10-61-1.)

Lift and block the loader. (See Procedure on Page 10-10-1.)

Figure 50-101-26



Tool that may assist in the neutral adjustment **[Figure 50-101-26]**.

To make this tool use a locking grip C-Clamp and grind one edge flat (Item 1) and grind the other edge (Item 2) **[Figure 50-101-26]** to a small rounded edge.

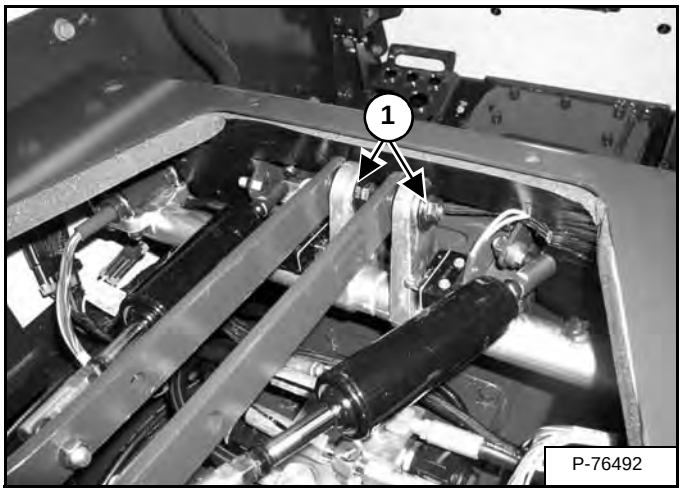
A steering centering block (Item 3) **[Figure 50-101-26]** is also needed. The centering block can be placed as shown and welded to the C-clamp if desired.

⚠ WARNING

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

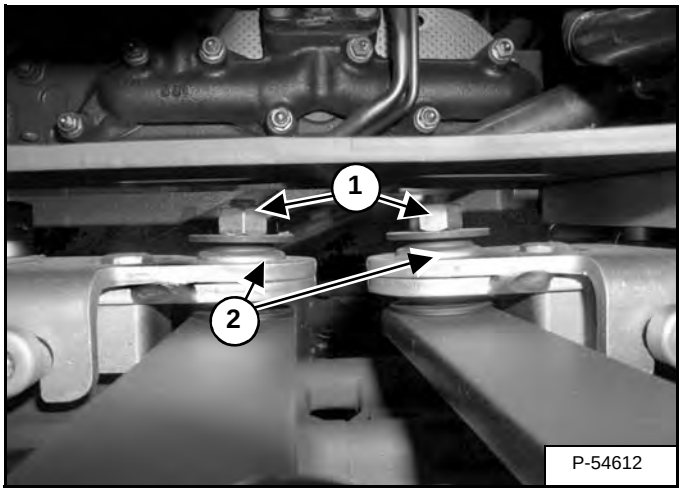
W-2017-0286

Figure 50-101-27



Loosen the bolt / nut (Item 1) **[Figure 50-101-27]** only until the tension is released from the torsion bushing.

Figure 50-101-28



Loosen the nut (Item 1) only until the tension is released from the torsion bushing (Item 2) **[Figure 50-101-28]**.

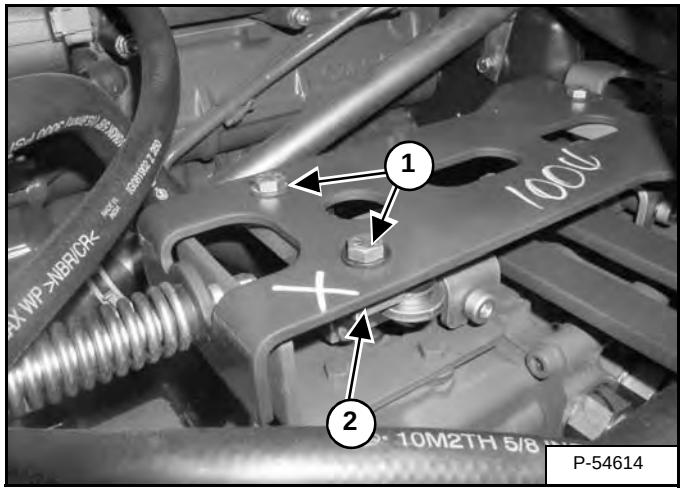
NOTE: The bolt must be loose enough to allow the torsion bushing (Item 2) [Figure 50-101-28] to turn freely between the torsion bushing and the steering linkage bar.

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CONTROL PANEL (S/N 530714203 & ABOVE AND 530811540 & ABOVE) (CONT'D)

Linkage Neutral (Adjusting) (Cont'd)

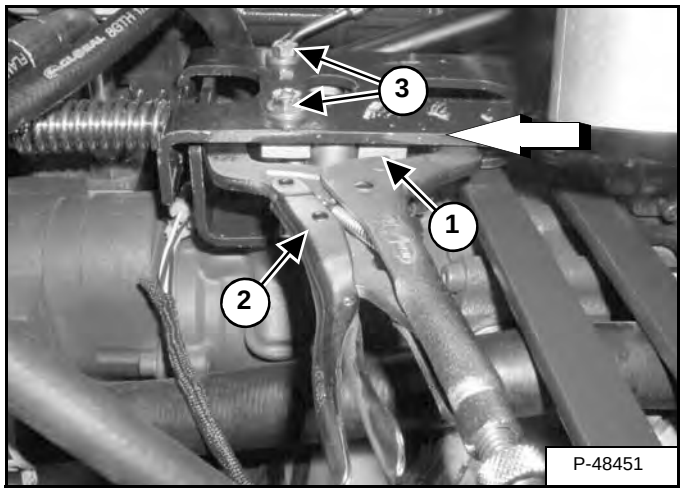
Figure 50-101-29



Loosen the two bolts (Item 1) holding the right centering block. Move the right hand centering block (Item 2) **[Figure 50-101-29]** until both pintle cams contact the centering block.

NOTE: The left centering block is not adjustable. By adjusting the right centering block the left centering block will also become aligned properly.

Figure 50-101-30



A modified locking grip C-Clamp and steering block shown in **[Figure 50-101-26]** may be used to help in aligning the centering blocks.

Install the centering block (Item 1) on the inside of the pintle cams and the C-Clamp (Item 2) **[Figure 50-101-30]** around both centering blocks.

Lock the C-Clamp in place.

⚠ WARNING

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

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Connect the Remote Start Tool (Service Tool) to the loader. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.) ***OR*** (See REMOTE START TOOL (SERVICE TOOL) KIT - 6689779 on Page 10-61-1.)

Start the engine and run at low idle.

Move the traction lock override switch so the traction function is unlocked. On a standard loader the wedge brake will unlock.

NOTE: When the engine is started, the wheels / tracks may begin to move.

NOTE: In loaders equipped with manual steering and hydraulic brake, the steering levers may have to be moved during engine start-up to reduce the amount of creep. This reduction in creep will allow time for the engine to run and build up hydraulic charge pressure, which will release the hydraulic brake.

Tighten bolts (Item 3) **[Figure 50-101-30]** to 35-40 ft.-lb. (47,5-54,2 N•m).

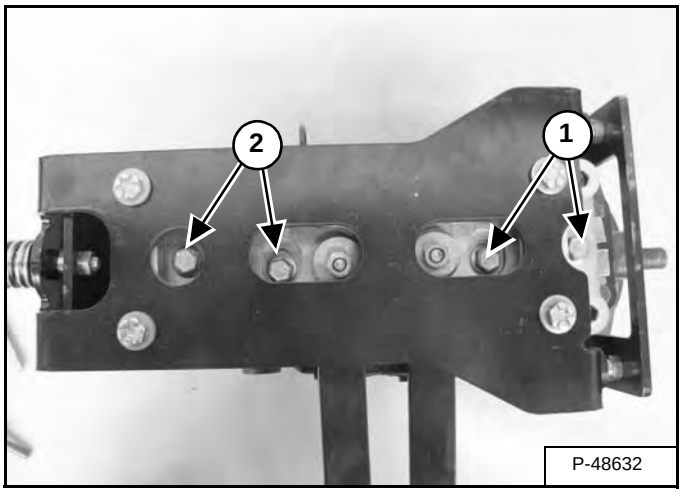
NOTE: Check for slack between centering blocks and pintle cams. If there is excessive slack repeat above steps [Figure 50-101-29] & [Figure 50-101-30].

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Linkage Neutral (Adjusting) (Cont'd)

Start the neutral adjustment procedure with the left pump first and complete the neutral adjustment for the left pump before adjusting the right pump.

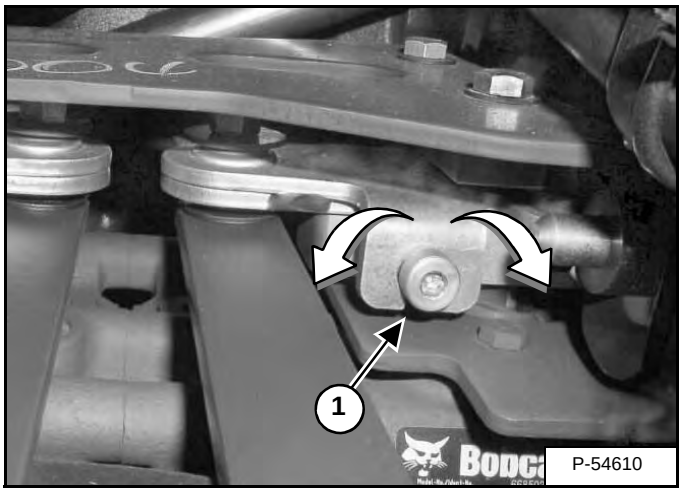
Figure 50-101-31



Loosen the left pump pintle adjustment lock bolts (Item 1). (The right pump pintle adjustment lock bolts are (Item 2) **[Figure 50-101-31]**.) Loosen the bolts enough to allow free movement between the pintle arm and the pintle base.

NOTE: If the bolts are too loose or too tight, the neutral adjustment may be affected.

Figure 50-101-32



Move the engine speed control to high idle.

NOTE: The neutral range (dead-band) will vary between the hydrostatic pumps.

NOTE: This procedure is shown for neutral adjustment on the left side of the loader. The procedure is the same for the right side neutral adjustment.

Turn the adjustment screw (Item 1) **[Figure 50-101-32]** counterclockwise until forward creep is seen.

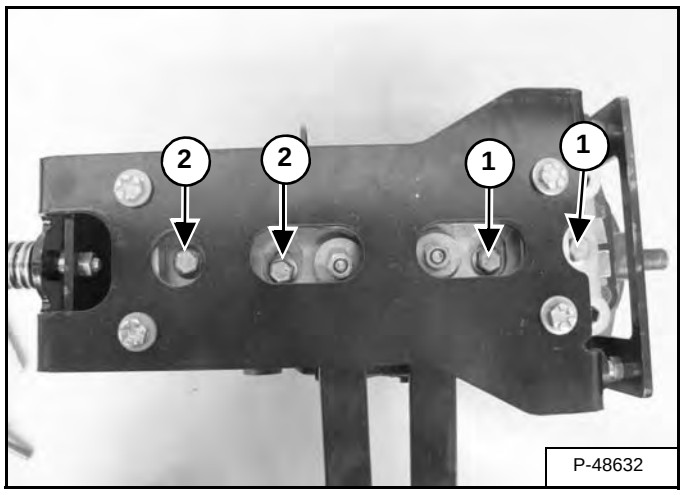
Turn the adjustment screw (Item 1) **[Figure 50-101-32]** counterclockwise to a point between forward and reverse where there is **zero** creep.

Stroke the left steering lever to forward and allow the lever to return to neutral. Stroke the left steering lever to reverse and allow the lever to return to neutral. Check that there is zero creep when the lever returns from either direction, on the left side. Turn the adjustment screw (if necessary) until zero creep is obtained.

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Linkage Neutral (Adjusting) (Cont'd)

Figure 50-101-33



Torque the left pump pintle adjustment lock bolts (Item 1) **[Figure 50-101-33]** to 35-40 ft.-lb. (47,5-54,2 N•m).

Repeat the adjustment procedure for the right pump.

Torque the right pump pintle adjustment lock bolts (Item 2) **[Figure 50-101-33]** to 35-40 ft.-lb. (47,5-54,2 N•m).

Test both levers by moving them backward and forward and letting them return to neutral by the return spring force.

If the levers do not return to neutral and the wheels / tracks do not come to a complete stop, repeat the adjustment procedure again.

Stop the engine.

Remove one pintle adjustment bolt (Item 1) **[Figure 50-101-33]** at a time and apply Loctite® #242 or equivalent thread locker to the bolt and re-install the bolt. Torque the bolt to 35-40 ft.-lb. (47,5-54,2 N•m). Repeat for the three remaining pintle adjustment lock bolts.

NOTE: To maintain proper adjustment setting, remove and reinstall only one bolt at a time. New bolts can be installed with pre-applied Loctite®.

Remove the Remote Start Tool (Service Tool).

NOTE: After the neutral adjustment is completed on both pumps, the linkage travel adjustment MUST be completed. (See Linkage Travel (Adjusting) on Page 50-101-15.)

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Linkage Travel (Adjusting)

NOTE: When the linkage travel adjusting procedure is being done as part of the loader neutral adjusting procedure, check the torsion bushings at the pump and at the bell cranks to be sure they are not binding or too loose, which will affect the procedure.

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

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⚠ WARNING

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

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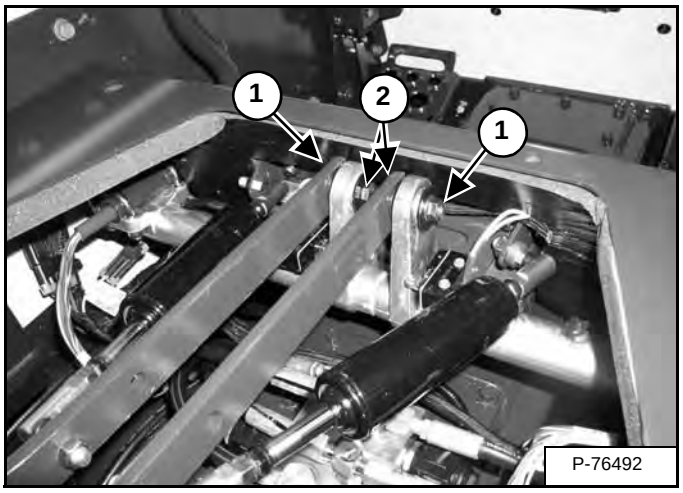
Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

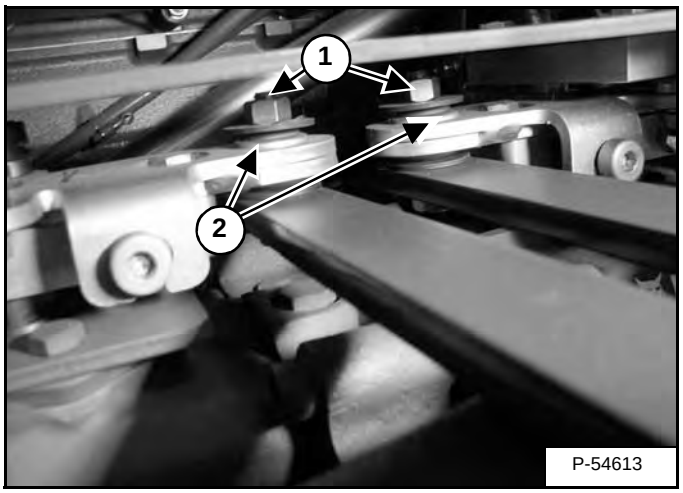
Pre-load tension in the torsion bushings must be removed before adjusting the steering linkage.

Figure 50-101-34



Loosen the nut (Item 1) 3 to 4 turns, then loosen the bolt (Item 2). The bolt (Item 2) **[Figure 50-101-34]** must be loosened enough to allow the torsion bushing to turn freely between the steering bellcrank and the linkage bar.

Figure 50-101-35



Loosen the nut (Item 1) only until the tension is released from the torsion bushing (Item 2) **[Figure 50-101-35]**.

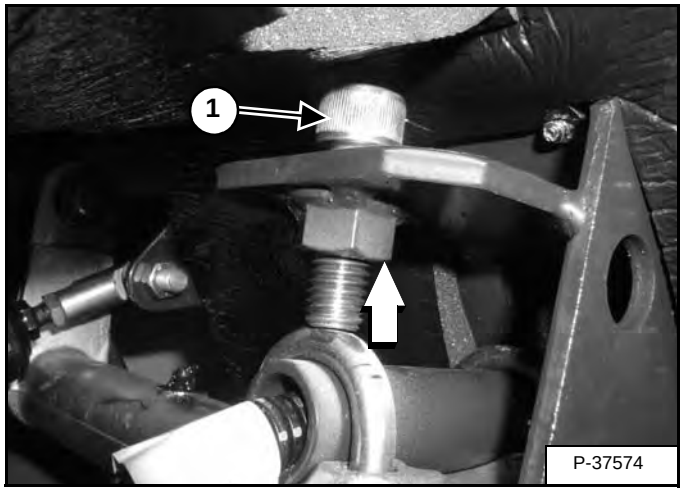
The bolt must be loose enough to allow the torsion bushing (Item 2) **[Figure 50-101-35]** to turn freely between the torsion bushing and the linkage bar.

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CONTROL PANEL (S/N 530714203 & ABOVE AND 530811540 & ABOVE) (CONT'D)

Linkage Travel (Adjusting) (Cont'd)

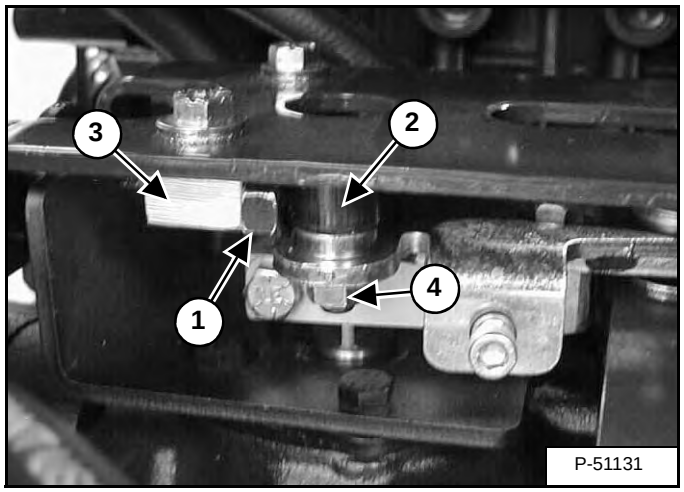
Figure 50-101-36



Remove access plug from the top of the control panel.

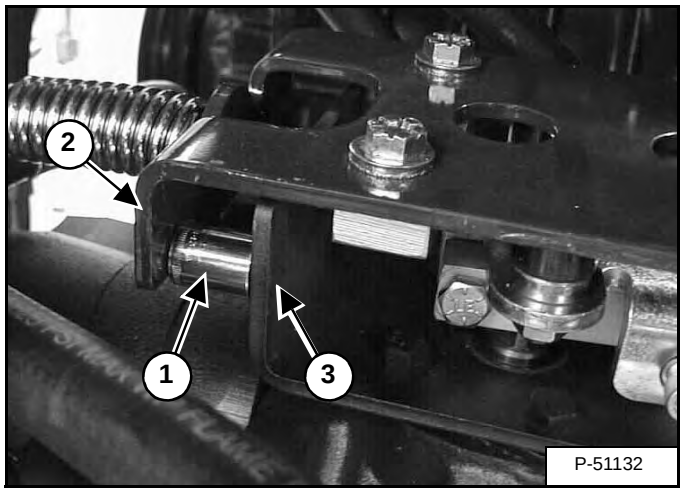
Turn the control lever drift adjustment bolts (Item 1) **[Figure 50-101-36]** (one on each control lever) out until it is flush with the bottom of the nut.

Figure 50-101-37



Move the right side steering lever to the rear and install a 3/8 in. (10 mm) thick spacer (Item 1) between the pintle arm cam (Item 2) and the centering block (Item 3) **[Figure 50-101-37]**.

Figure 50-101-38

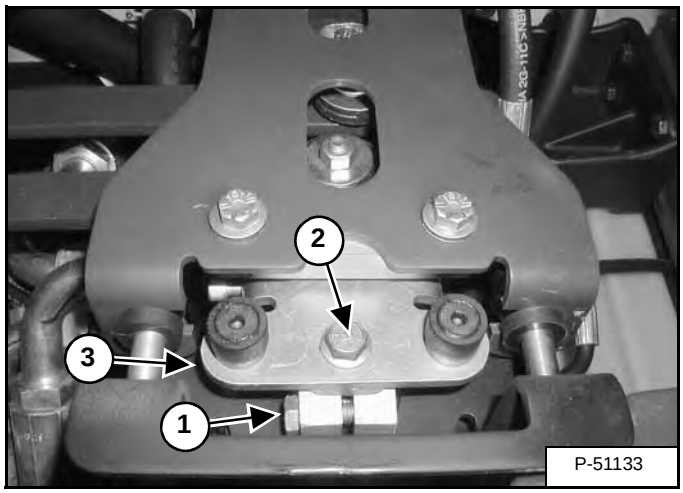


Move the right side steering lever forward and install a 15/16 in. (24 mm) thick spacer (Item 1) between the center plate (Item 2) and the mounting plate (Item 3) **[Figure 50-101-38]**.

This will allow the pintle arms to move freely while adjusting the steering linkage for full forward travel speed.

Remove the 3/8 in. (10 mm) thick spacer.

Figure 50-101-39



Before adjusting the linkage, verify the base pintle arm mounting bolt (Item 1) and both of the upper pintle mount bolts (Item 2) are tightened to 35-40 ft.-lb. (48-54 N•m) torque. There should be no play between the pintle arm and the square pump shaft **[Figure 50-101-39]**.

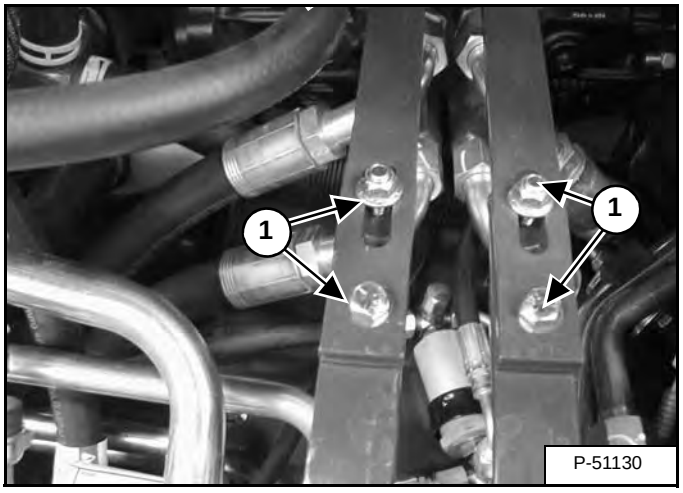
Verify the cam mounting nuts (Item 4) **[Figure 50-101-37]** are tightened to 35-40 ft. lb. (48-54 N•m) torque.

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CONTROL PANEL (S/N 530714203 & ABOVE AND 530811540 & ABOVE) (CONT'D)

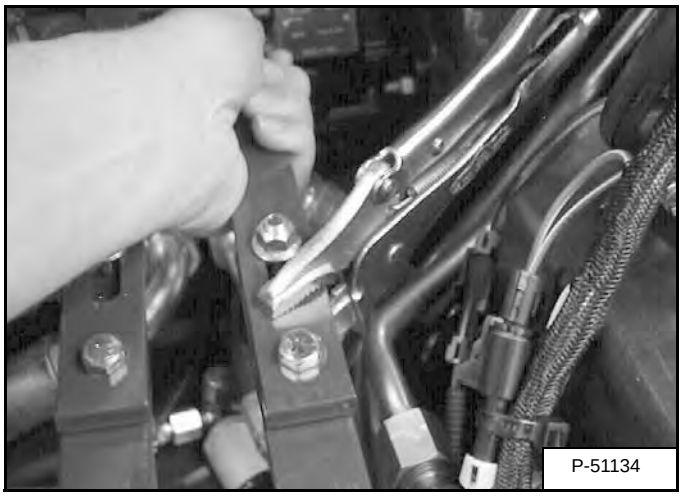
Linkage Travel (Adjusting) (Cont'd)

Figure 50-101-40



Loosen the two bolts and nuts (Item 1) **[Figure 50-101-40]** on each steering linkage bar.

Figure 50-101-41



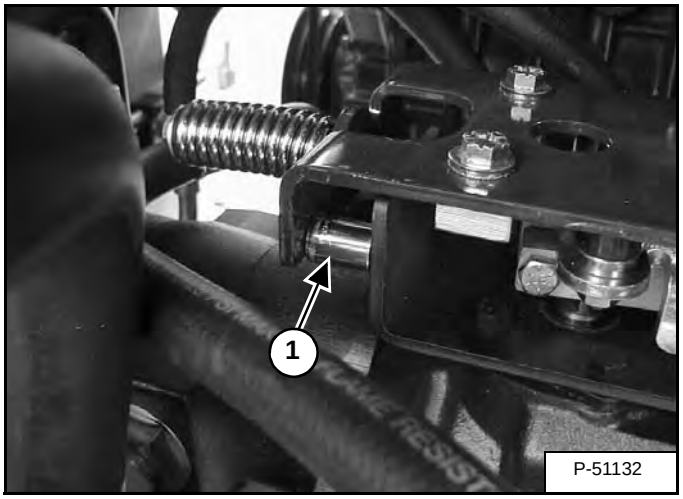
Move the left control lever to the full forward position, then pull forward on the left rear linkage bar until the pintle arm is rotated to the front as far as possible **[Figure 50-101-41]**. Use a locking plier, clamp the two linkage bars together.

Installation: Tighten the nuts and bolts to 35-40 ft.-lb. (47,5-54,2 N•m) torque.

Check the lever movement to make sure that the pintle arm and the control lever are both at full stroke at the same time. This will allow for maximum forward speed.

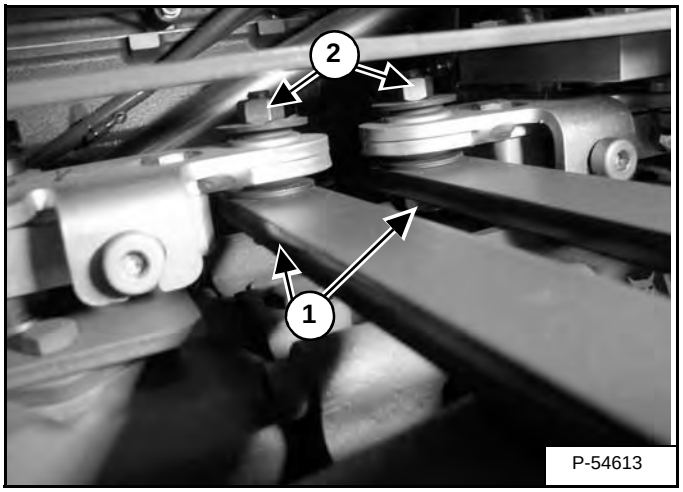
Repeat the linkage travel adjustment procedure for the right side linkage.

Figure 50-101-42



Remove the spacer (Item 1) **[Figure 50-101-42]**.

Figure 50-101-43

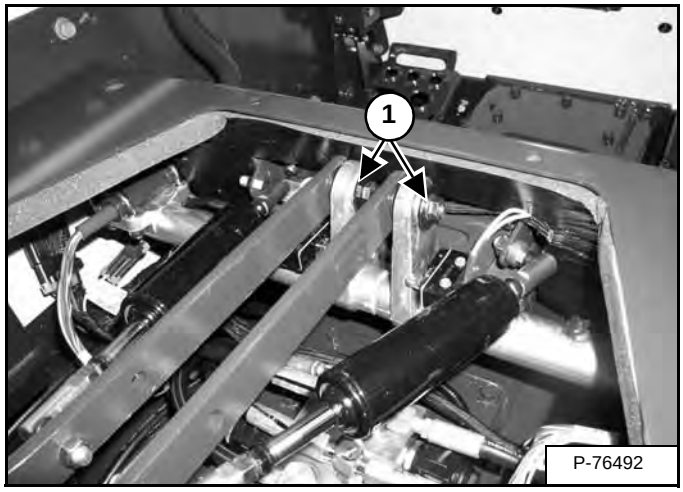


Tighten the two bolts (Item 1) and nuts (Item 2) to 35-40 ft.-lb. (47,5-54,2 N•m) **[Figure 50-101-43]**.

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Linkage Travel (Adjusting) (Cont'd)

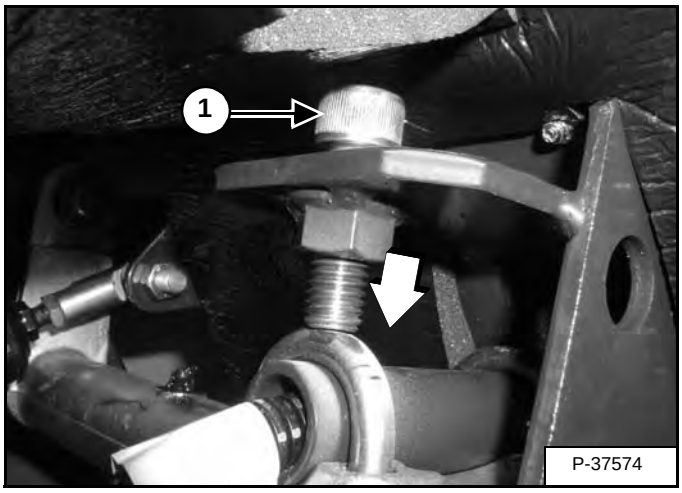
Figure 50-101-44



Tighten the two bolts and nuts (Items 1) **[Figure 50-101-44]** to 35-40 ft.-lb. (47,5-54,2 N•m) torque at the steering bell cranks.

NOTE: After removal, installation, and adjusting of the linkage, the Back-up Alarm must be inspected. (See Inspecting on Page 60-210-1.)

Figure 50-101-45



Push the control lever to full stroke and turn drift adjustment bolt (Item 1) **[Figure 50-101-45]** in until it touches the U-bolt holding the control lever.

Repeat steps on the other control lever.

Drive the loader forward and check for drift.

The traditional benchmark for drift is less than 10 ft. of “drift” in 100 ft. of travel distance.

If the drift is excessive to the left, turn the right adjustment bolt (Item 1) **[Figure 50-101-45]** in.

If the drift is excessive to the right, turn the left adjustment bolt in.

NOTE: When using the drift adjustment bolts, only adjust one bolt for each test drive.

In addition, only move each bolt a maximum of one turn for each test drive. This will help prevent over-correction and excessive reduction in travel speed.

Drift adjustment is for forward travel only.

Adjust the drift to an acceptable level.

Re-install the plug in the drift bolt access hole after adjustment.

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CONTROL PANEL (S/N 530714202 & BELOW AND 530811539 & BELOW) (SJC)

Description

The control panel has two electronic handles that control the steering, lift and tilt functions. There is no mechanical linkages connecting to the hydrostatic pumps or the control valve.

The control panel is connected to the lower main frame and wraps around the operator seat.

The control panel is now common between the large frame and the medium frame loaders.

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CONTROL PANEL (S/N 530714202 & BELOW AND 530811539 & BELOW) (SJC) (CONT'D)

Removal And Installation

⚠ WARNING

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

W-2017-0286



⚠ WARNING

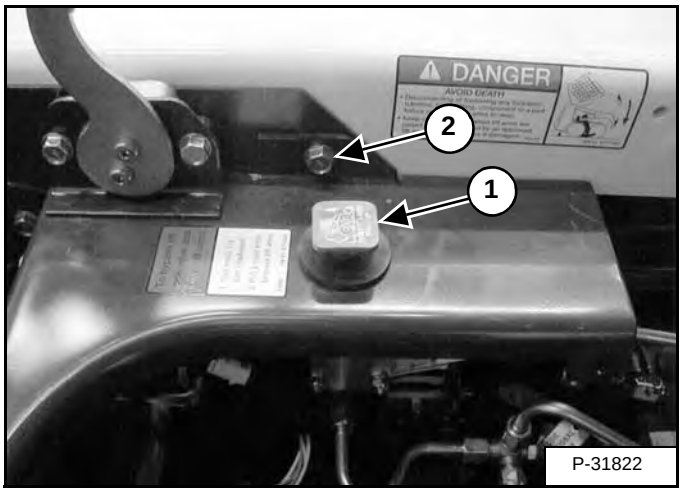
Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Figure 50-102-1

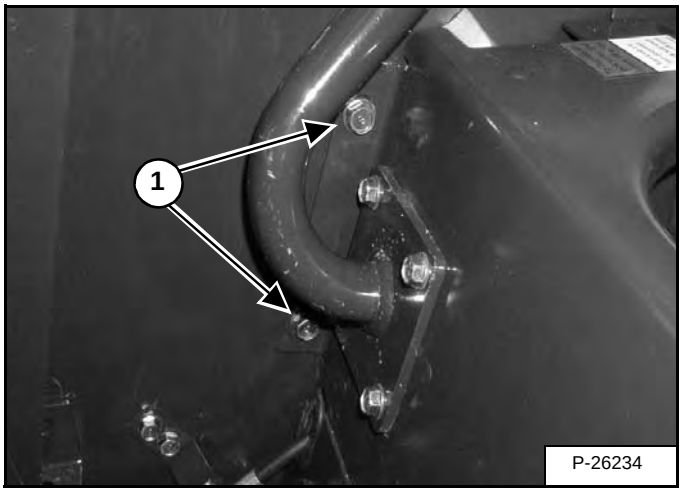


Remove the lift arm bypass control knob and washer (Item 1) **[Figure 50-102-1]**.

Remove the control panel mount bolt (Item 1) **[Figure 50-102-1]**.

Remove the engine speed control. (See Removal And Installation on Page 70-20-1.)

Figure 50-102-2



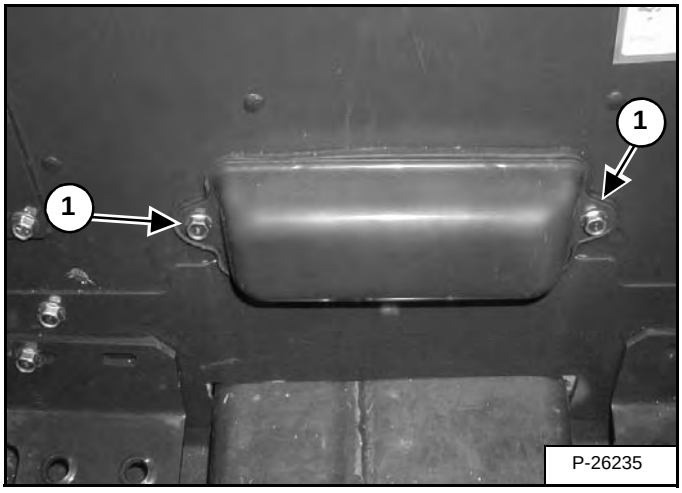
Remove the two control panel mount bolts (Item 1) **[Figure 50-102-2]**.

Installation: Tighten the control panel mounting bolts to 20 ft.-lb. (27 N•m) torque.

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Removal And Installation (Cont'd)

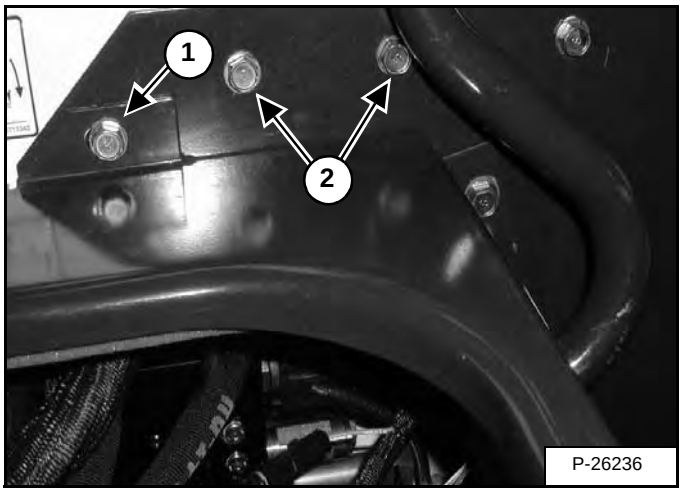
Figure 50-102-3



Remove the fuse cover mount bolts (Item 1) **[Figure 50-102-3]**.

Remove the fuse cover.

Figure 50-102-4

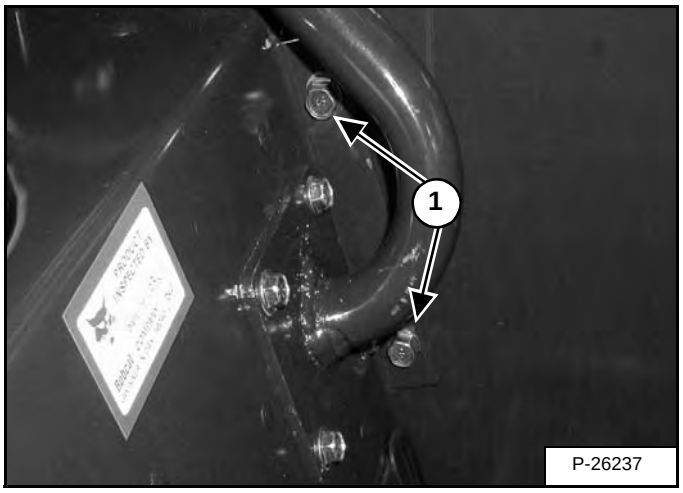


Remove the control panel mount bolt (Item1) **[Figure 50-102-4]** from the left side of the control panel.

Remove the two side panel mount bolts (Item 2) **[Figure 50-102-4]**, to allow clearance for the removal of the control panel.

Installation: Tighten the control panel mounting bolts to 20 ft.-lb. (27 N•m) torque.

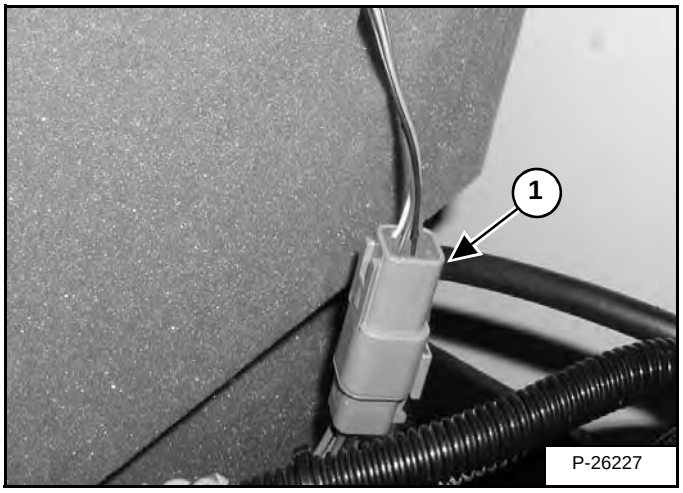
Figure 50-102-5



Remove the two side panel mount bolts (Item 1) **[Figure 50-102-5]**, to allow clearance for the removal of the control panel.

Installation: Tighten the control panel mounting bolts to 20 ft.-lb. (27 N•m) torque.

Figure 50-102-6

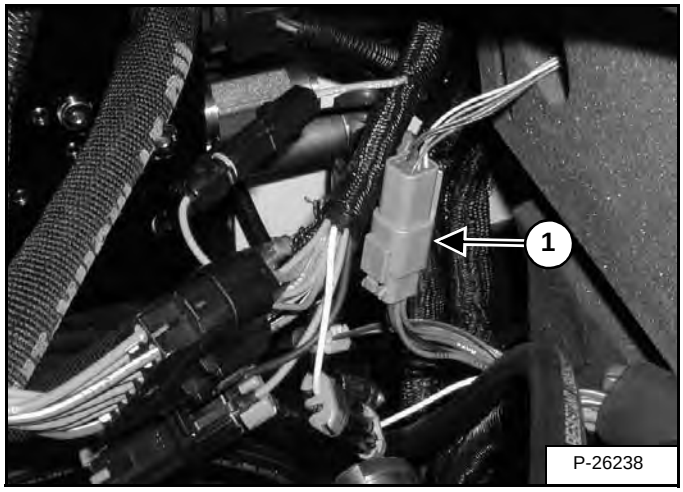


Disconnect the right joystick wire harness connector (Item 1) **[Figure 50-102-6]**.

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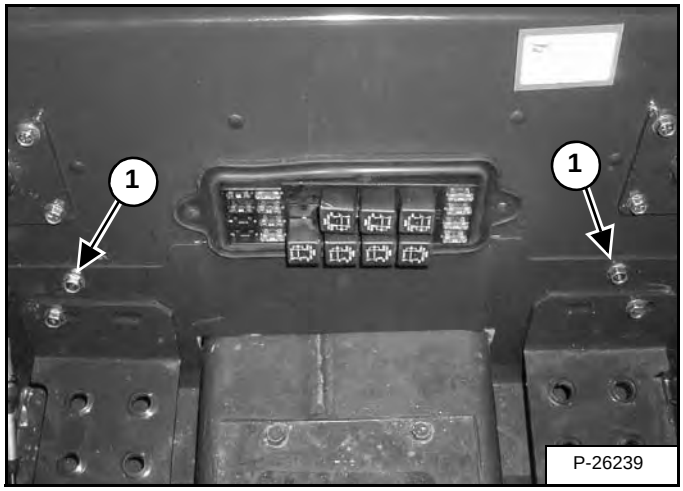
Removal And Installation (Cont'd)

Figure 50-102-7



Disconnect the left joystick wire harness connector (Item 1) **[Figure 50-102-7]**.

Figure 50-102-8



Remove the two control panel mount bolts (Item 1) **[Figure 50-102-8]**.

Remove the control panel from the loader.

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CONTROL PANEL (S/N 530714203 & ABOVE AND 530811540 & ABOVE) (SJC)

Description

The control panel has two electronic handles that control the steering, lift and tilt functions. There is no mechanical linkages connecting to the hydrostatic pumps or the control valve.

The control panel is connected to the lower main frame and wraps around the operator seat.

The control panel is now common between the large frame and the medium frame loaders.

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Removal And Installation

⚠ WARNING

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

W-2017-0286



⚠ WARNING

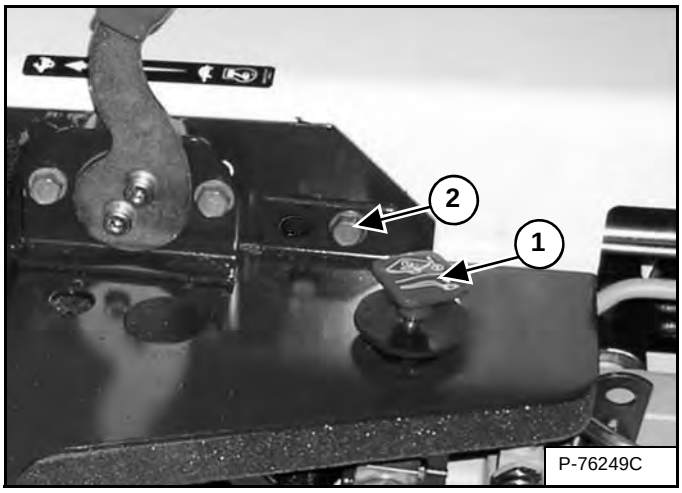
Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Figure 50-103-1

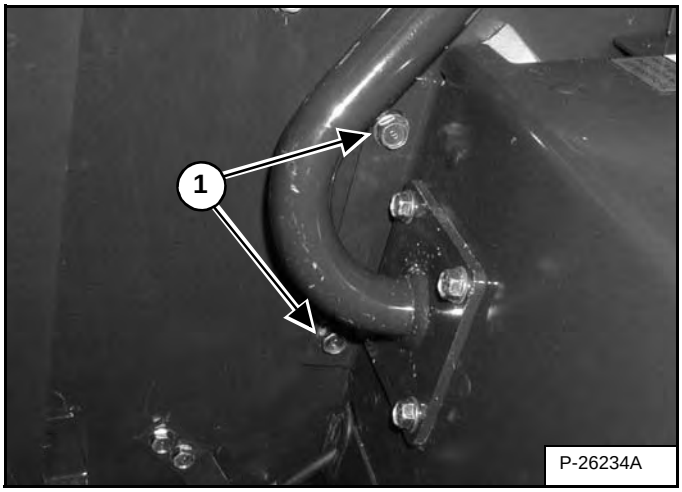


Remove the lift arm bypass control knob and washer (Item 1) **[Figure 50-103-1]**.

Remove the control panel mount bolt (Item 2) **[Figure 50-103-1]**.

Remove the engine speed control. (See Removal And Installation on Page 70-20-1.)

Figure 50-103-2



Remove the two control panel mount bolts (Item 1) **[Figure 50-103-2]**.

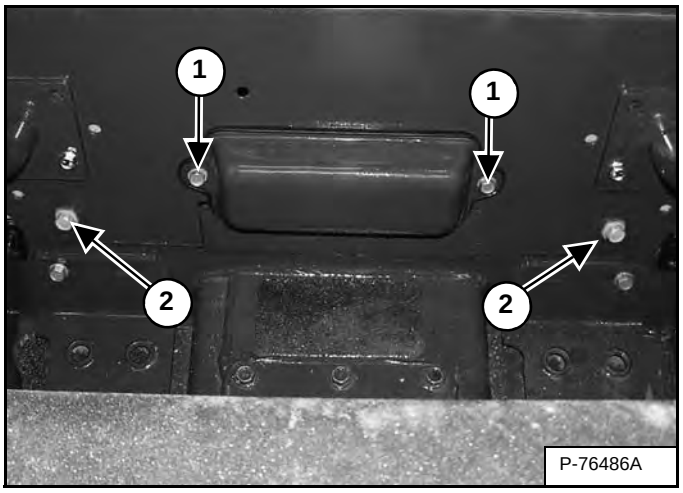
Installation: Tighten the control panel mounting bolts to 20 ft.-lb. (27 N•m) torque.

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CONTROL PANEL (S/N 530714203 & ABOVE AND 530811540 & ABOVE) (SJC) (CONT'D)

Removal And Installation (Cont'd)

Figure 50-103-3



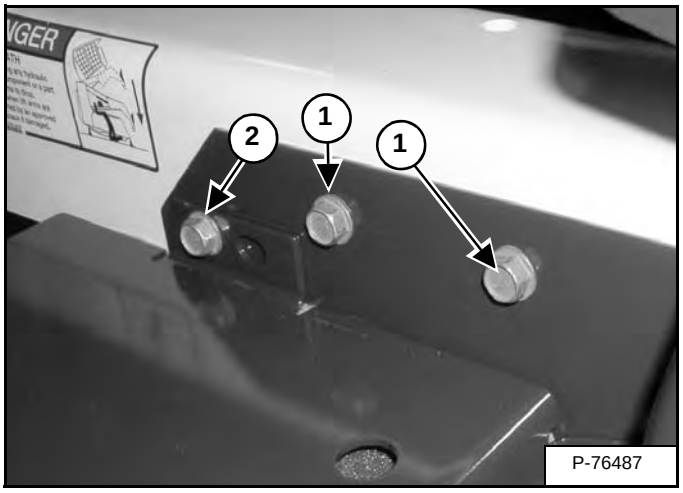
Remove the fuse / relay mounting bolts (Item 1) **[Figure 50-103-3]**.

Remove the control panel mounting bolts (Item 2) **[Figure 50-103-3]** from the loader.

NOTE: Install the bottom bolts (Item 2) [Figure 50-103-3] through the hole in the control panel, do not install them in the slotted area.

Remove the fuse cover.

Figure 50-103-4

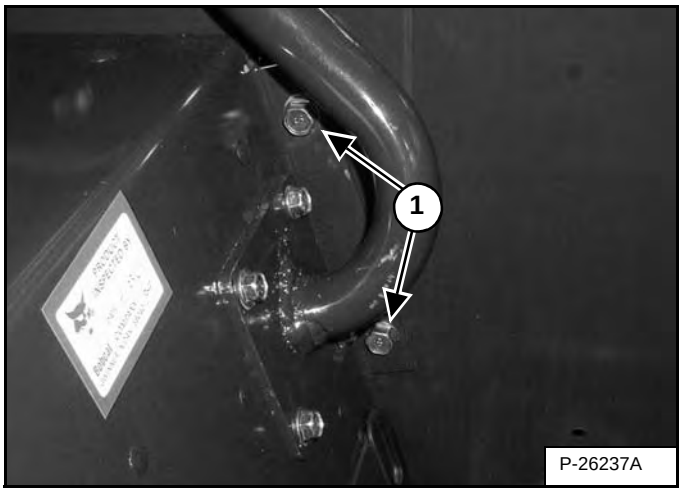


Remove the side panel mounting bolts (Item 1) **[Figure 50-103-4]** from the loader.

Remove the control panel mounting bolt (Item 2) **[Figure 50-103-4]** from the loader.

Installation: Tighten the control panel mounting bolts to 20 ft.-lb. (27 N•m) torque.

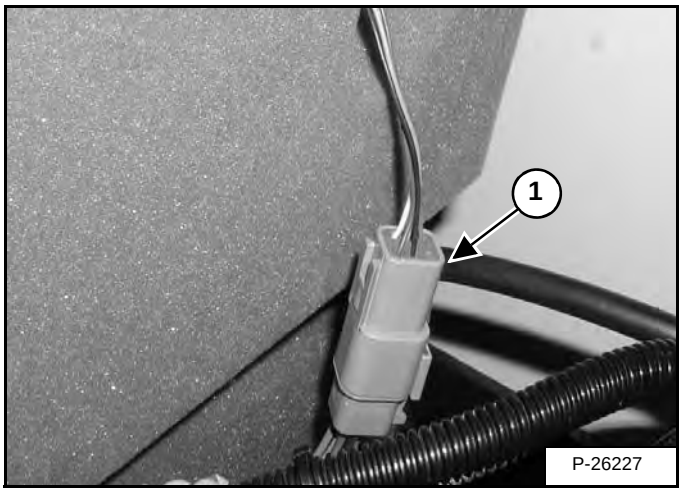
Figure 50-103-5



Remove the two side panel mount bolts (Item 1) **[Figure 50-103-5]**, to allow clearance for the removal of the control panel.

Installation: Tighten the control panel mounting bolts to 20 ft.-lb. (27 N•m) torque.

Figure 50-103-6

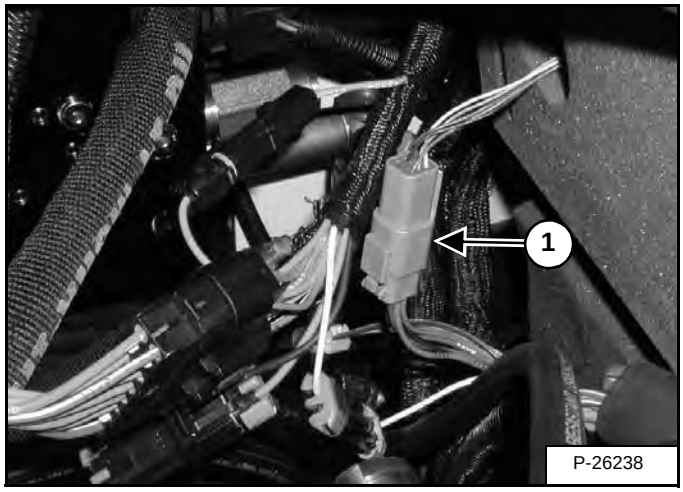


Disconnect the right joystick wire harness connector (Item 1) **[Figure 50-103-6]**.

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Removal And Installation (Cont'd)

Figure 50-103-7



Disconnect the left joystick wire harness connector (Item 1) **[Figure 50-103-7]**.

Remove the control panel from the loader.

Reverse the removal procedure to install the control panel.

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CONTROL HANDLE / LEVER

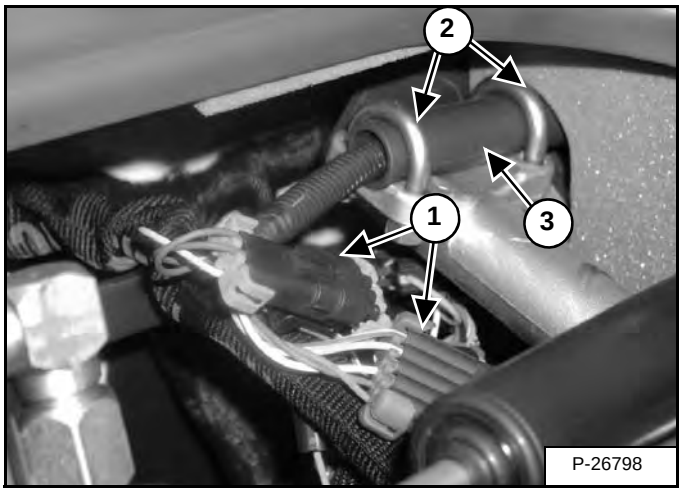
Description

The control handles/levers are used to control the forward and reverse travel.

The control handles/levers are mounted to the control panel.

Lever Removal And Installation

Figure 50-110-1



Disconnect the electrical connectors (Item 1) **[Figure 50-110-1]** from the control lever.

Remove the nuts from the two U-bolts (Item 2) **[Figure 50-110-1]** used to mount the control lever.

Remove the U-bolts from the control lever mount.

Remove the control lever (Item 3) **[Figure 50-110-1]** by sliding the lever through the rubber boot (Item 1) **[Figure 50-110-2]** on the front of the control panel.

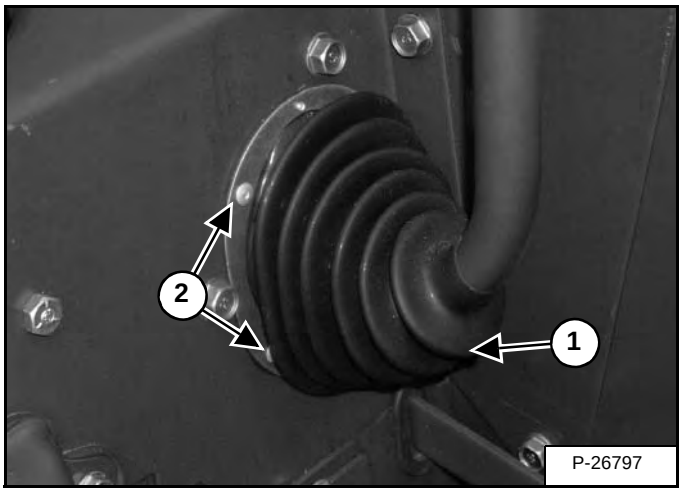
Installation: Tighten the u-bolts so the lever can not be moved either right or left when seated in the operator seat. Be sure the control lever does not interfere with the operator cab when lowering or raising the cab.

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CONTROL HANDLE / LEVER (CONT'D)

Boot Removal And Installation

Figure 50-110-2



To replace the rubber boot (Item 1) **[Figure 50-110-2]** on the control panel, remove the steering lever. (See above procedure.)

Drill out the four rivets (Item 2) **[Figure 50-110-2]** located on the flange of the rubber boot and remove the old boot.

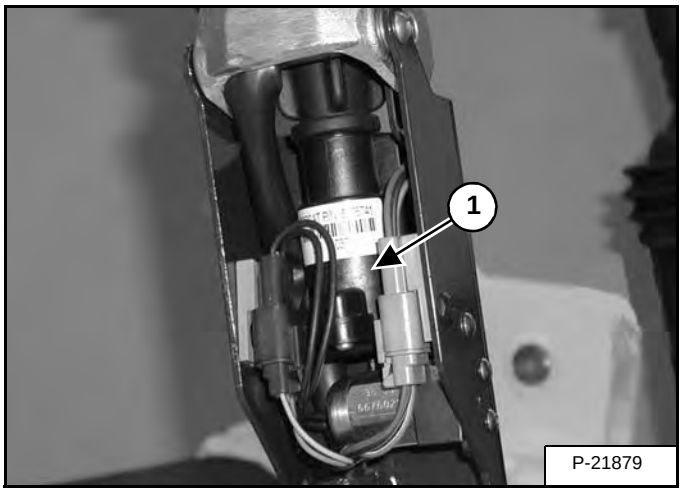
Install the new boot and reinstall the steering lever.

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CONTROL HANDLE / LEVER (ACS)

Description

Figure 50-111-1

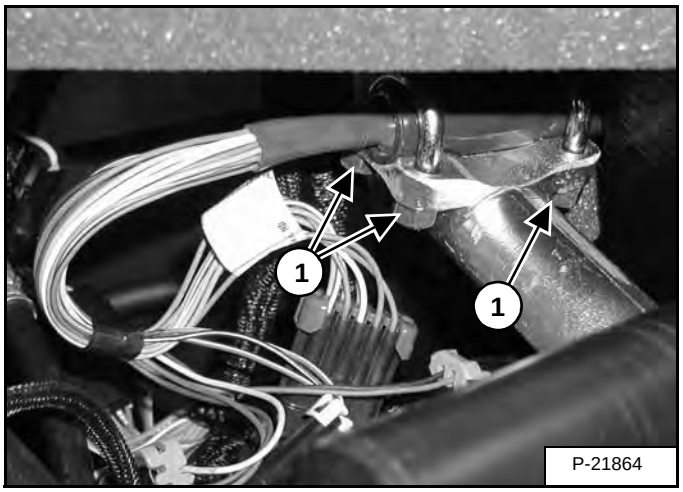


The control handles/levers are used to control the forward and reverse travel and the lift and tilt functions.The lift and tilt functions can be controlled by handle sensors (Item 1) **[Figure 50-111-1]** that are located in the base of the control handle/levers.

The control handles/levers are mounted to the control panel.

Handle Sensor Removal And Installation

Figure 50-111-2

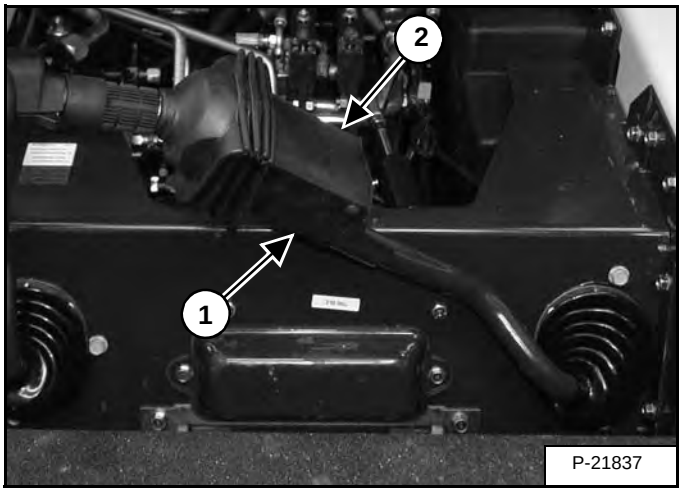


NOTE: The calibration procedure must be followed when replacing handle sensor, foot pedal sensor, actuator or ACS Controller. (See Lift And Tilt Calibration (ACS) on Page 60-160-3.)

Loosen the nuts (Item 1) **[Figure 50-111-2]**.

Installation: Tighten the u-bolts so the lever can not be moved either right or left when seated in the operator seat. Be sure the control lever does not interfere with the operator cab when lowering or raising the cab.

Figure 50-111-3



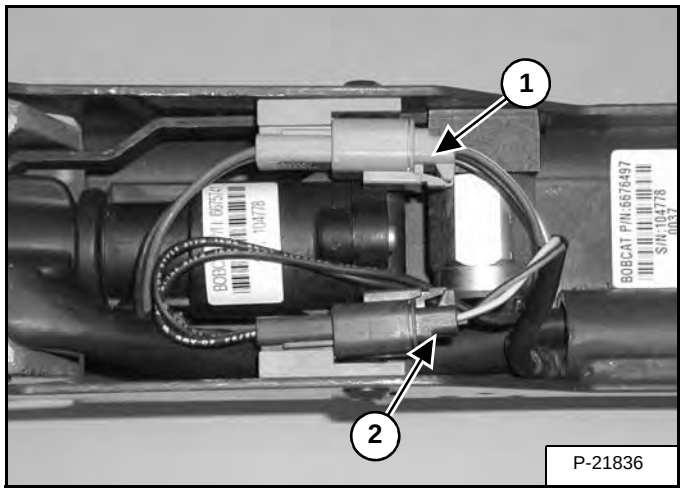
Tilt the control handle (Item 1) **[Figure 50-111-3]** to the center of the loader.

Lift the boot cover (Item 2) **[Figure 50-111-3]**.

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Handle Sensor Removal And Installation (Cont'd)

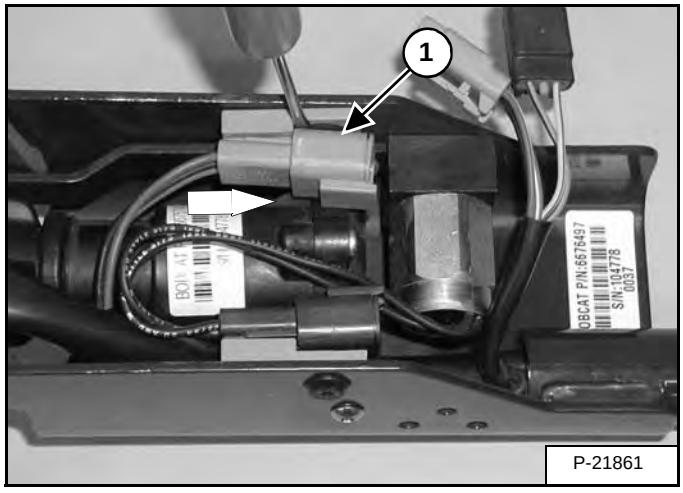
Figure 50-111-4



Disconnect the harness connector (Item 1) from the handle sensor connector.**[Figure 50-111-4]**.

Disconnect the harness connector (Item 2) **[Figure 50-111-4]** from the handle lock solenoid connector.

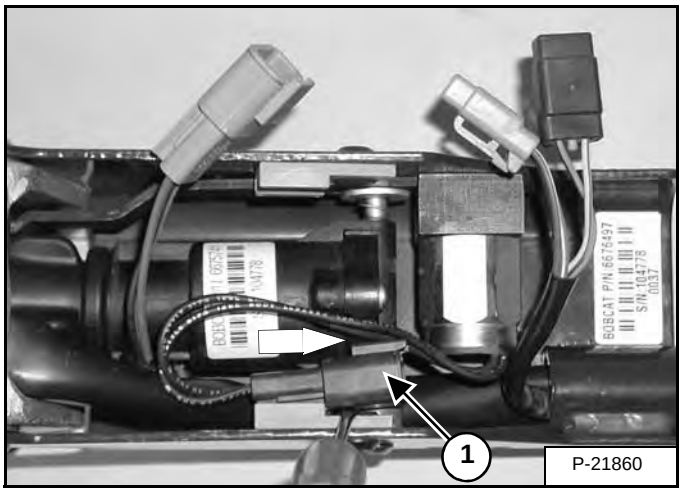
Figure 50-111-5



Remove the handle sensor connector (Item 1) **[Figure 50-111-5]** from the clip.

NOTE: Pry out with a small screwdriver and push the connector down.

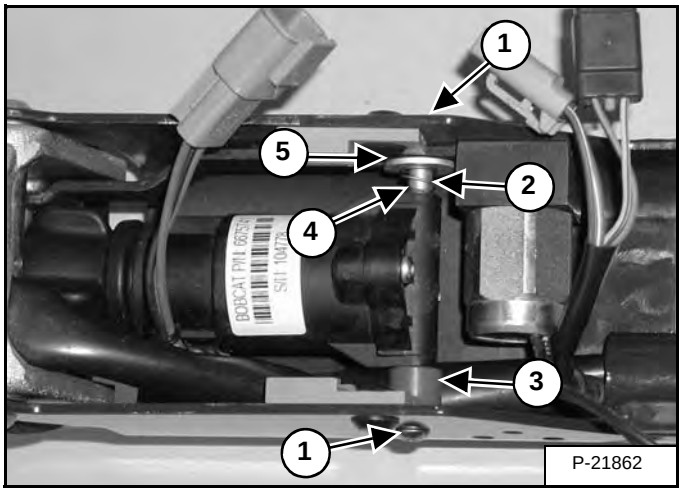
Figure 50-111-6



Remove the handle lock solenoid connector (Item 1) **[Figure 50-111-6]** from the clip.

NOTE: Pry out with a small screwdriver and push the connector down.

Figure 50-111-7



Remove one of the two mounting screws (Item 1) B from the handle sensor.

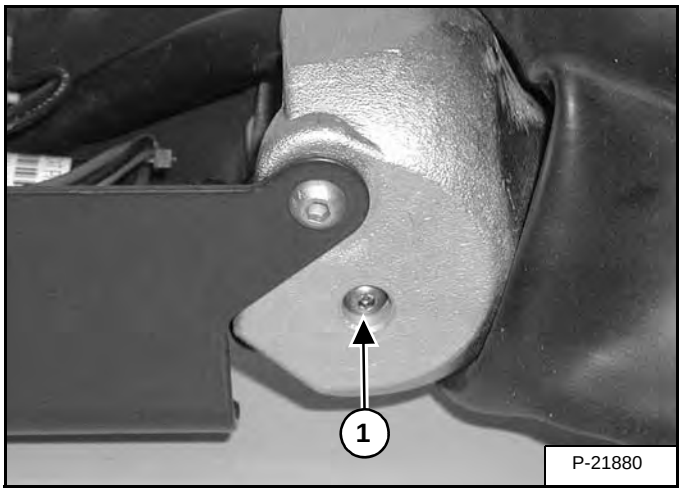
Installation: Tighten screws to 32-38 in.-lb. (3,6-4,3 N•m) torque.

While removing the mounting pin (Item 2) from the handle sensor, remove the one plastic spacer (Item 3), the spring (Item 4) and washer (Item 5) **[Figure 50-111-7]**.

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Handle Sensor Removal And Installation (Cont'd)

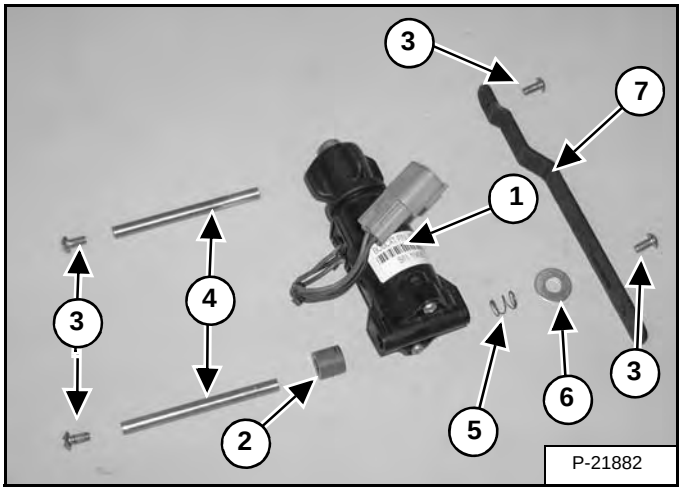
Figure 50-111-8



Remove one of the two mounting screws (Item 1) **[Figure 50-111-8]** from the handle sensor.

Installation: Tighten bolt to 32 - 38 in.-lb. (3,6 - 4,3 N•m) torque.

Figure 50-111-9



Remove the handle sensor (Item 1) **[Figure 50-111-9]** from the handle assembly.

NOTE: The handle sensor (Item 1) [Figure 50-111-9] can only be replaced as a complete assembly.

Check the spacers (Item 2), and screws (Item 3), mounting pins (Item 4), spring (Item 5), washer (Item 6), stop strap (Item 7) **[Figure 50-111-9]** and replace as needed.

Figure 50-111-10

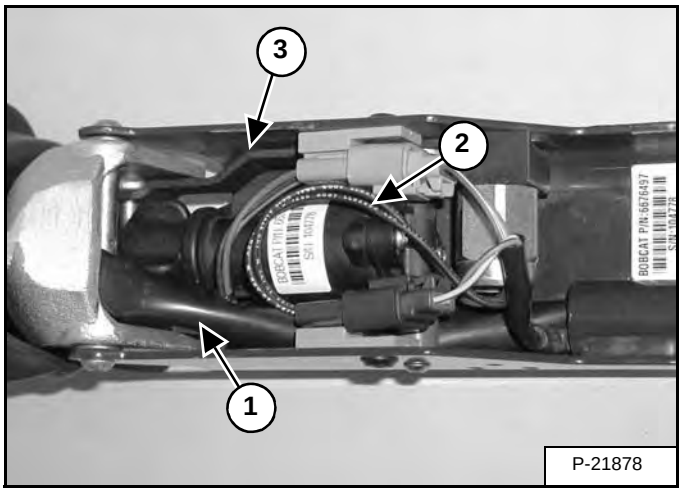
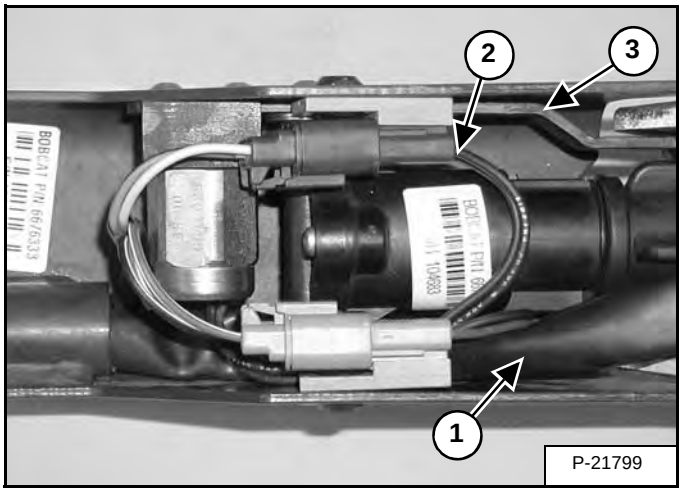


Figure 50-111-11



Installation: When installing the handle sensor into the control handle, check the routing of the switch handle wire harness (Item 1) **[Figure 50-111-10]** & **[Figure 50-111-11]** to assure proper return of the control handle to neutral and minimize harness movement.

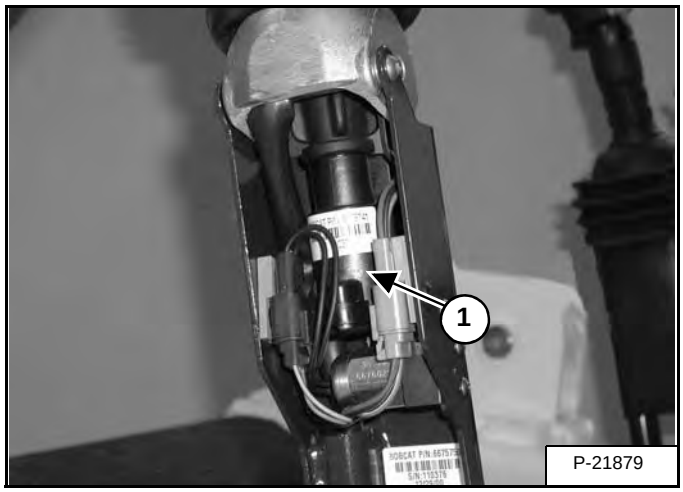
NOTE: Route wires (Item 2) [Figure 50-111-10] & [Figure 50-111-11] as shown away from stop strap (Item 3) [Figure 50-111-10] & [Figure 50-111-11] to avoid wire damage.

NOTE: The calibration procedure must be followed when replacing handle sensor, foot pedal sensor, actuator or ACS Controller. (See Lift And Tilt Calibration (ACS) on Page 60-160-3.)

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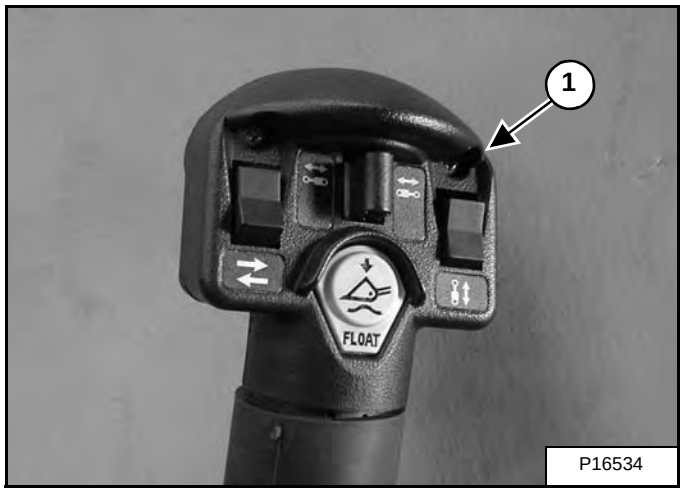
Handle Removal And Installation

Figure 50-111-12



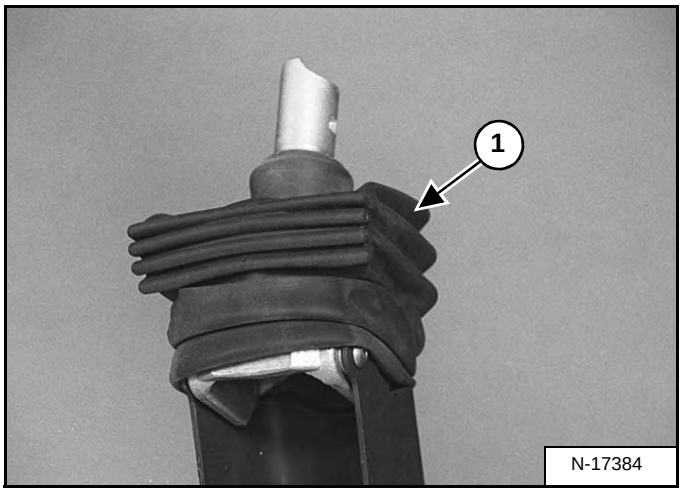
Remove the handle sensor (Item 1) **[Figure 50-111-12]**. (See Handle Sensor Removal And Installation on Page 50-111-1.)

Figure 50-111-13



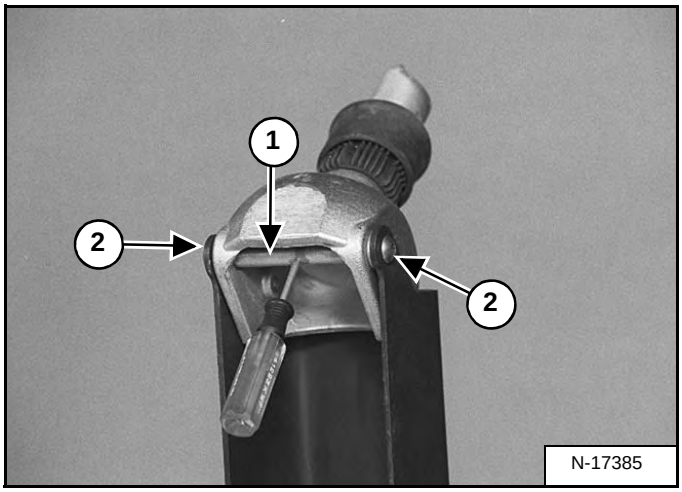
Remove the switch handle (Item 1) **[Figure 50-111-13]**. (See Switch Handle Removal on Page 60-130-4.)

Figure 50-111-14



Remove the rubber handle cover (Item 1) **[Figure 50-111-14]** from the handle.

Figure 50-111-15



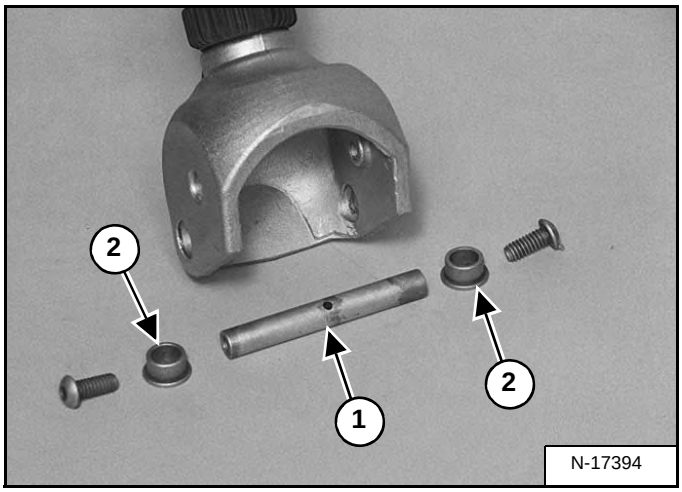
Using a small screwdriver, hold the handle spacer (Item 1) and remove the allen head screws (Item 2) **[Figure 50-111-15]** from the handle assembly.

Installation: Tighten the allen head screws to 35 in.-lb. (4 N•m) torque.

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Handle Disassembly And Assembly

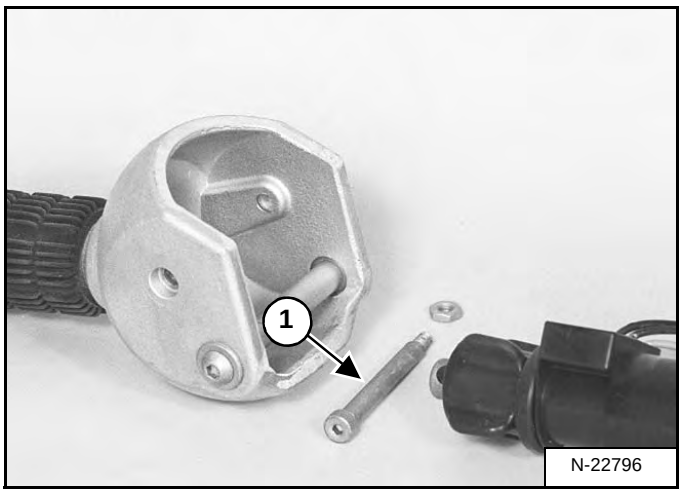
Figure 50-111-16



Remove the handle sleeve (Item 1) and bushings (Item 2) **[Figure 50-111-16]** from the handle.

Check all parts for wear and replace as needed.

Figure 50-111-17



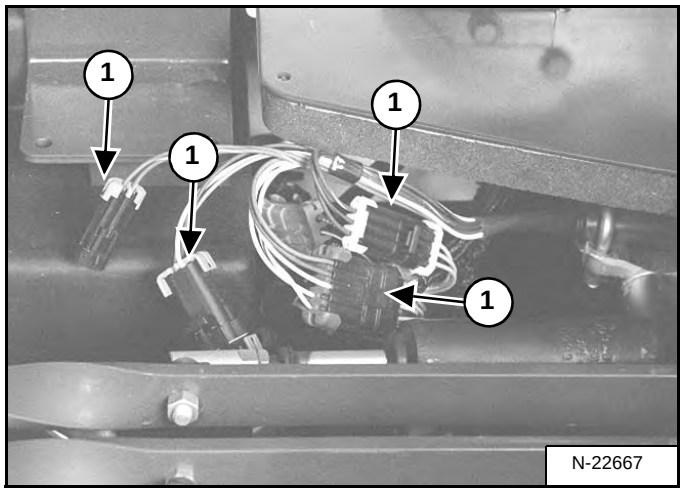
Check the mounting bolt (Item 1) **[Figure 50-111-17]** that connects the handle to the handle sensor unit for wear, replace as needed.

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CONTROL HANDLE / LEVER (ACS) (CONT'D)

Lever Removal And Installation

Figure 50-111-18



Disconnect the electrical connectors (Item 1) **[Figure 50-111-18]** from the control lever switch handle.

Remove the electrical connectors from the control lever switch handle **[Figure 50-111-18]**.

Figure 50-111-19

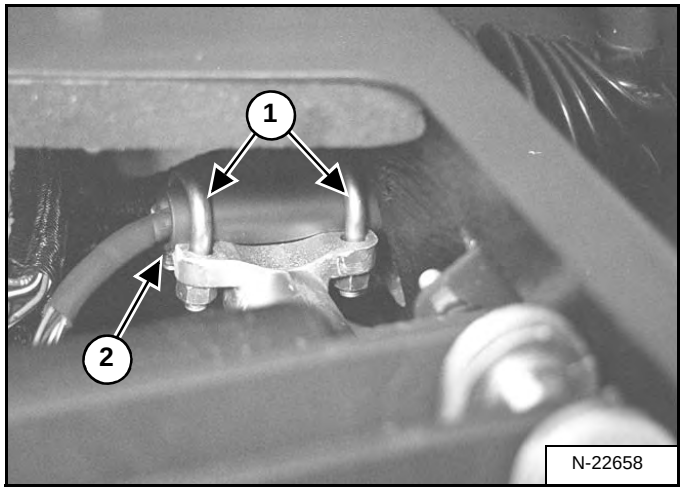
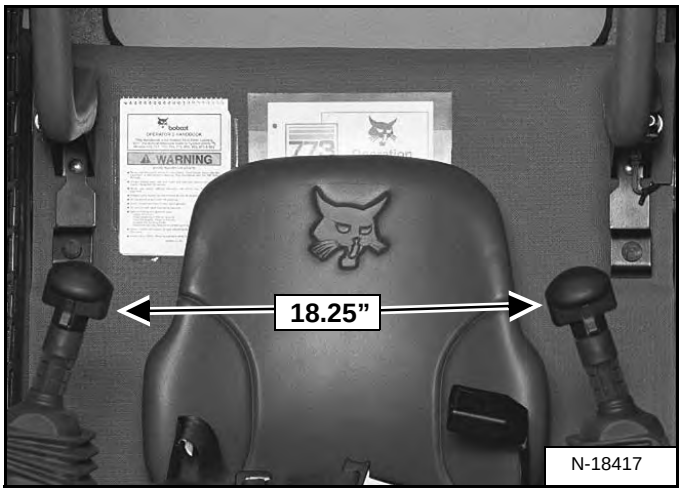


Figure 50-111-20

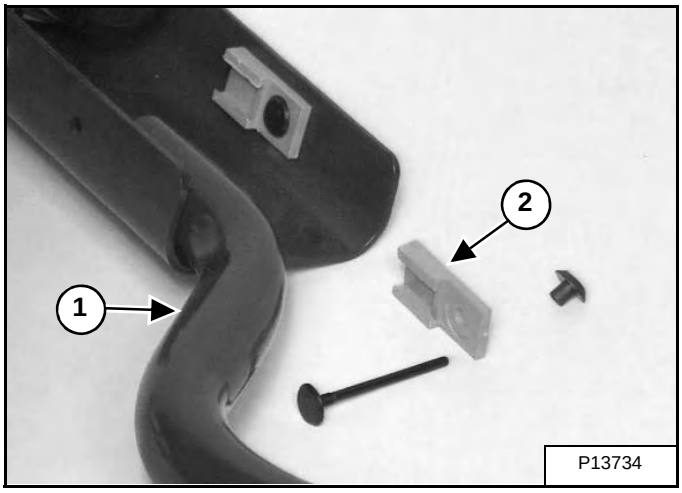


Loosen the two u-clamps (Item 1) **[Figure 50-111-19]** nuts.

Installation: Tighten the u-bolts so the lever can not be moved either right or left when seated in the operator seat. Control lever end (Item 2) **[Figure 50-111-19]** should be flush with bellcrank. Be sure the control lever does not interfere with the operator cab when lowering or raising the cab. The distance between handles should be 18.25 in. **[Figure 50-111-20]**.

Remove the control lever from the cross shaft and control panel.

Figure 50-111-21



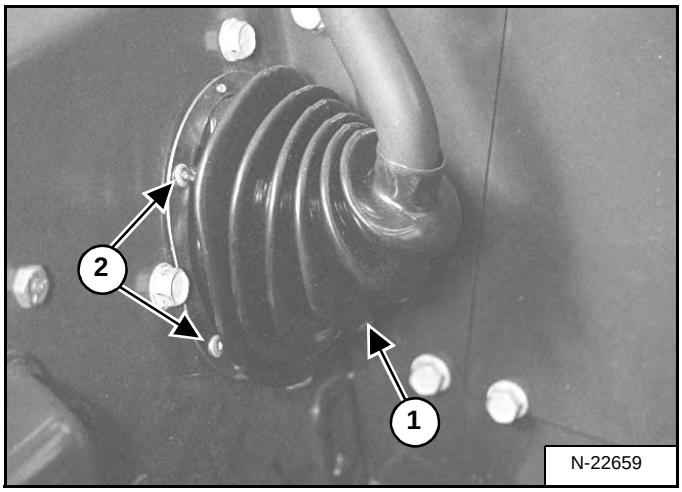
The control lever (Item 1) **[Figure 50-111-21]** must be replaced as a complete unit.

The connector clip (Item 2) **[Figure 50-111-21]** can be replaced separately from the control lever.

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Boot Removal And Installation

Figure 50-111-22



To replace the rubber boot (Item 1) **[Figure 50-111-22]** on the control panel, remove the control lever. (See Lever Removal And Installation on Page 50-110-1.)

Drill out the four rivets (Item 2) **[Figure 50-111-22]** located on the flange of the rubber boot and remove the old boot.

Install the new boot and reinstall the control lever. (See Lever Removal And Installation on Page 50-110-1.)

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JOYSTICK CONTROL

Description (Earlier Models And Later Models)

The control panel has two electronic handles that control the steering, lift, and tilt functions. There is no mechanical linkages connecting to the hydrostatic pumps or the control valve.

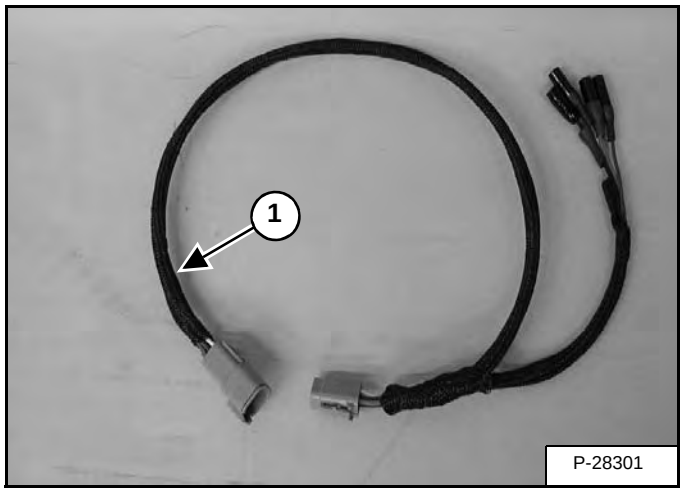
The control panel is connected to the lower main frame and wraps around and underneath the operator seat.

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JOYSTICK CONTROL (CONT'D)

Testing (Earlier Models And Later Models)

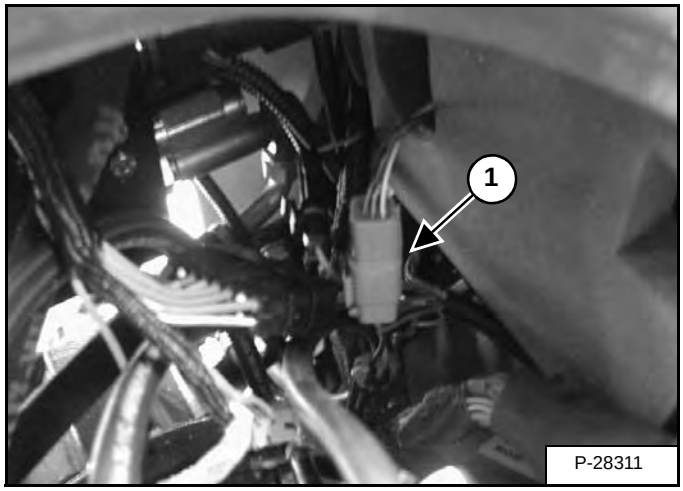
Figure 50-112-1



The tools listed will be needed to do the following procedure:

MEL1608-Joystick Test Harness **[Figure 50-112-1]**
MEL1563 or 6689779-Remote Start Tool
Multimeter

Figure 50-112-2



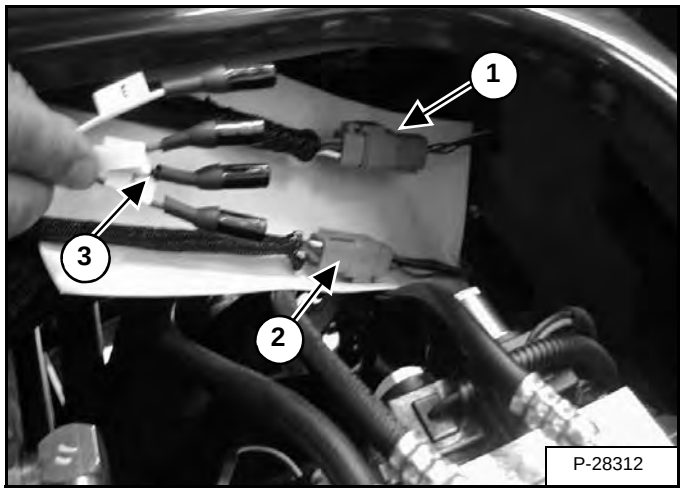
Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Connect the remote start tool to the loader. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.)

At the back side of the control panel, locate the left joystick wire connector (Item 1) **[Figure 50-112-2]**.

Figure 50-112-3



Disconnect the joystick harness connector (Item 1) from the loader wiring harness (Item 2) **[Figure 50-112-3]**.

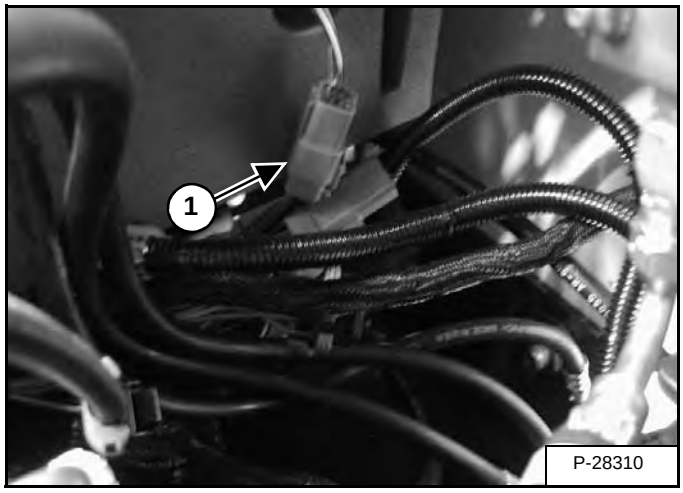
Install the test harness (Item 3) **[Figure 50-112-3]** between the two connectors.

Turn the remote start key to ON position without starting the loader.

Check the voltage between pin 3 and pin 5 on the joystick test harness (Item 3) **[Figure 50-112-3]**.

The voltage should be between 2.45 and 2.55 volts.

Figure 50-112-4



Repeat the procedure at the right joystick wiring harness connector (Item 1) **[Figure 50-112-4]**. (If needed.)

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JOYSTICK CONTROL (CONT'D)

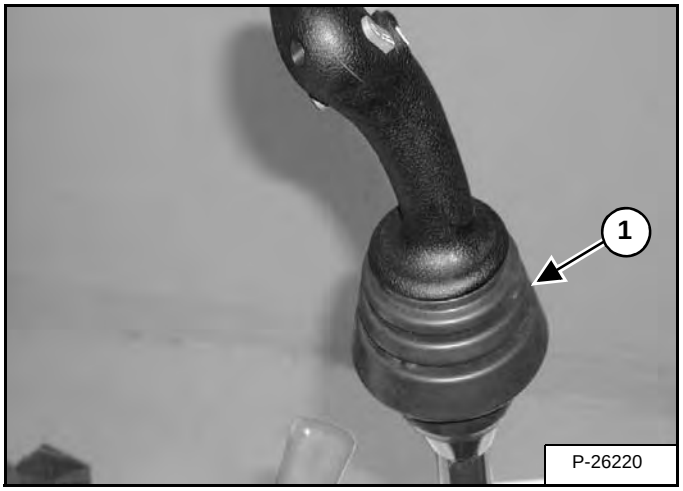
Removal And Installation (Earlier Models)

When replacing the joystick assemblies, they are available as a complete assembly with the boot and lever already attached. This procedure us shown so the electrical connections can be checked at the bottom of the joystick, if suspected to be loose or disconnected

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

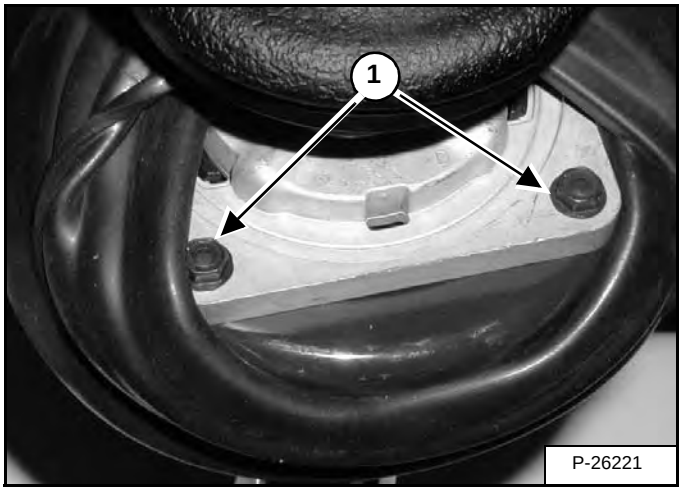
Raise the operator cab. (See Raising on Page 10-30-1.)

Figure 50-112-5



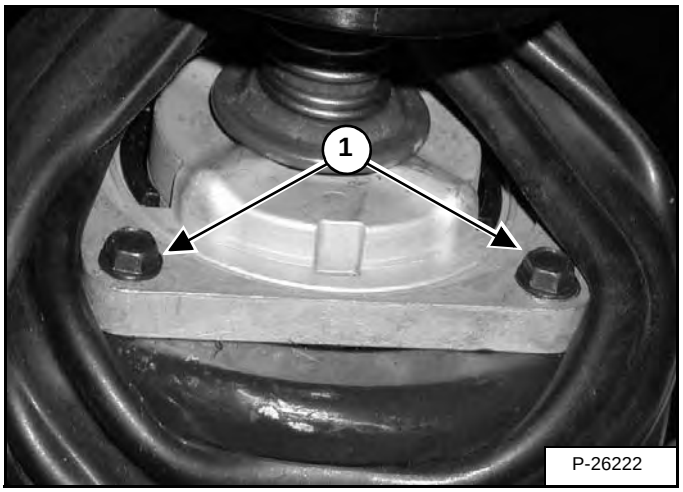
Roll the joystick rubber boot (Item 1) **[Figure 50-112-5]** down from the joystick handle.

Figure 50-112-6



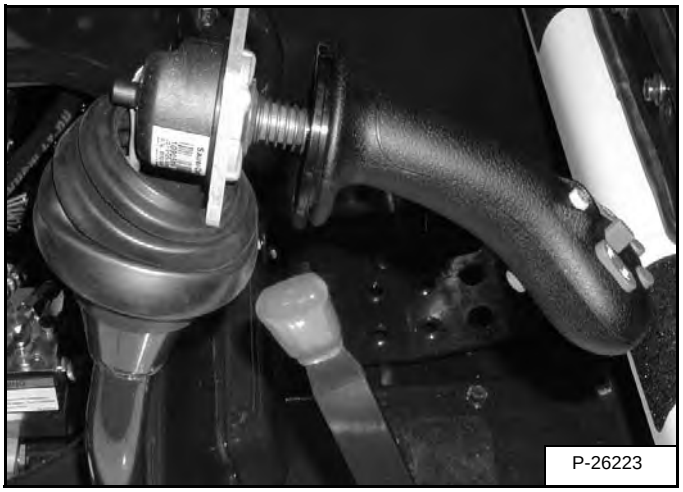
Remove the two inside joystick mount bolts (Item 1) **[Figure 50-112-6]**.

Figure 50-112-7



Remove the two outside joystick mount bolts (Item 1) **[Figure 50-112-7]**.

Figure 50-112-8

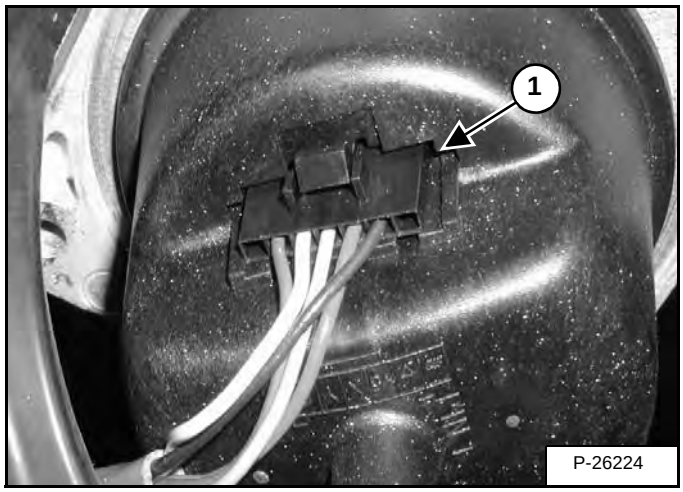


Remove the joystick from the rubber boot **[Figure 50-112-8]**.

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Removal And Installation (Earlier Models) (Cont'd)

Figure 50-112-9

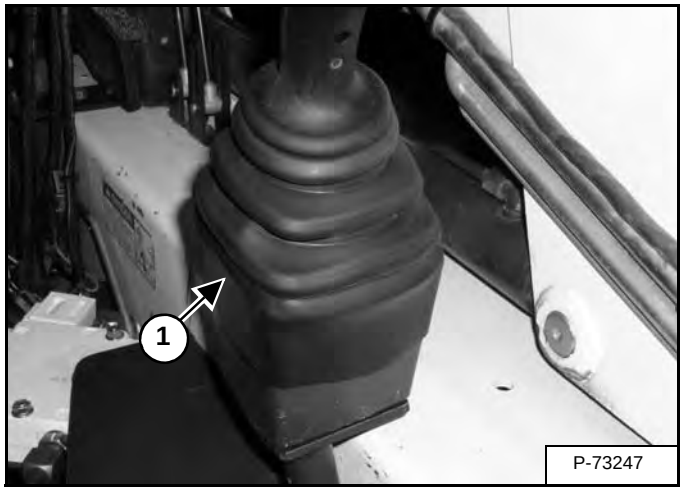


Disconnect the electrical harness (Item 1) **[Figure 50-112-9]** from the joystick.

Remove the joystick from the loader.

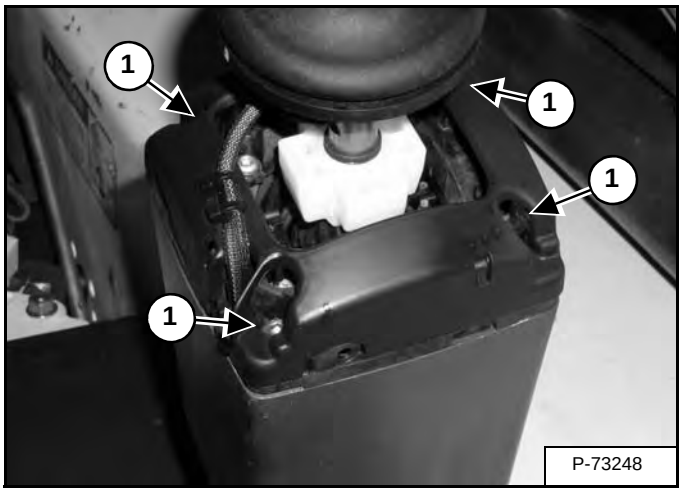
Removal And Installation (Later Models)

Figure 50-112-10



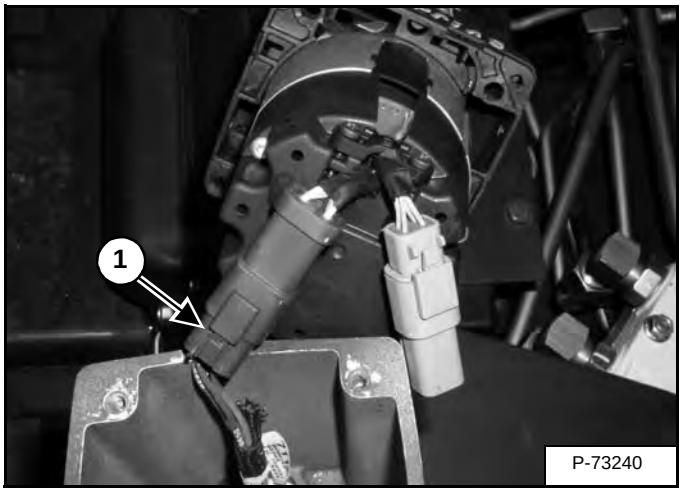
Lift the rubber boot (Item 1) **[Figure 50-112-10]**.

Figure 50-112-11



Remove the four screws (Item 1) **[Figure 50-112-11]** to lift the joystick control from the base.

Figure 50-112-12



Disconnect the joystick connector (Item 1) **[Figure 50-112-12]** from the harness connector.

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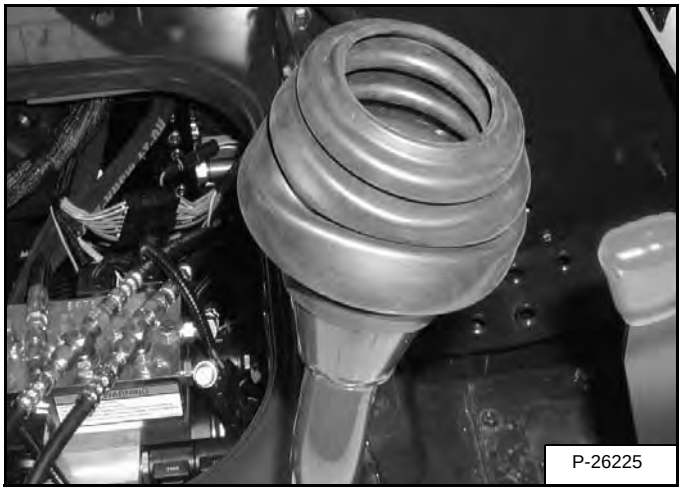
Boot Removal And Installation (Earlier Models)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the joystick. (See Removal And Installation (Earlier Models) on Page 50-100-3.)

Figure 50-112-13



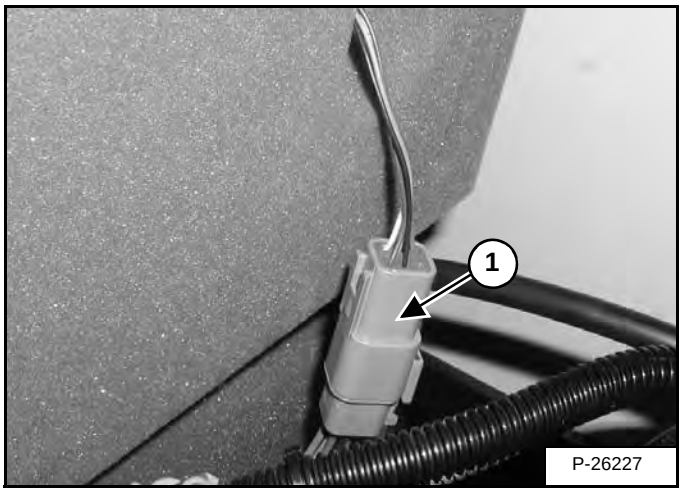
Remove the joystick boot from the control lever assembly **[Figure 50-112-13]**.

Joystick Mount Removal And Installation (Earlier Models)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

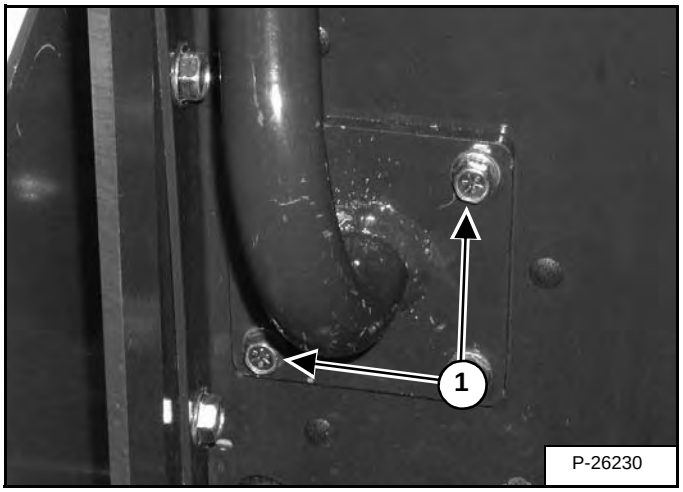
Raise the operator cab. (See Raising on Page 10-30-1.)

Figure 50-112-14



Disconnect the joystick wiring harness connector (Item 1) **[Figure 50-112-14]** located behind the control panel.

Figure 50-112-15



Remove the two control lever mounting bolts (Item 1) **[Figure 50-112-15]**.

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Joystick Mount Removal And Installation (Earlier Models) (Cont'd)

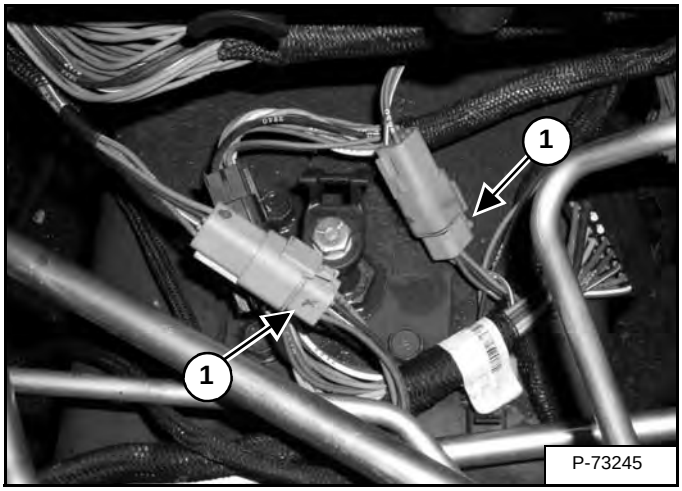
Figure 50-112-16



Remove the control lever from the loader **[Figure 50-112-16]**.

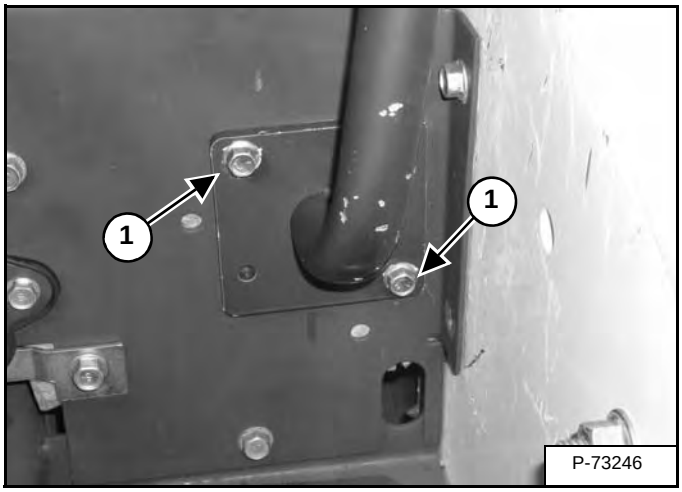
Joystick Mount Removal And Installation (Later Models)

Figure 50-112-17



Disconnect both of the electrical harness connectors from the loader harness (Item 1) **[Figure 50-112-17]**.

Figure 50-112-18



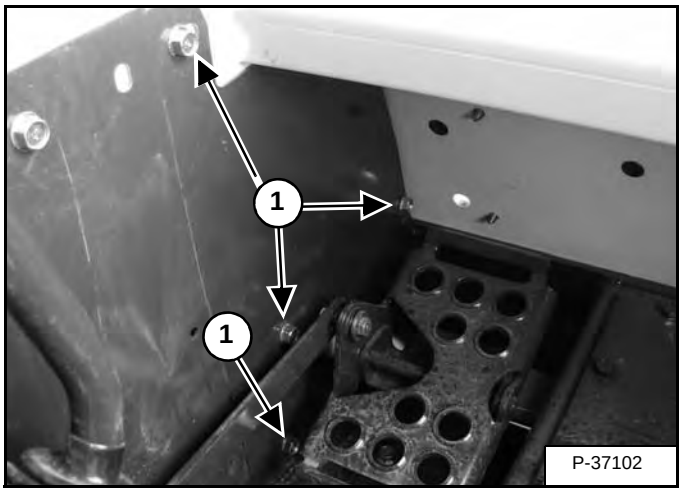
Remove the bolts (Item 1) **[Figure 50-112-18]** to remove the control lever from the loader.

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ACCESS PANEL (INSIDE)

Removal And Installation (Left)

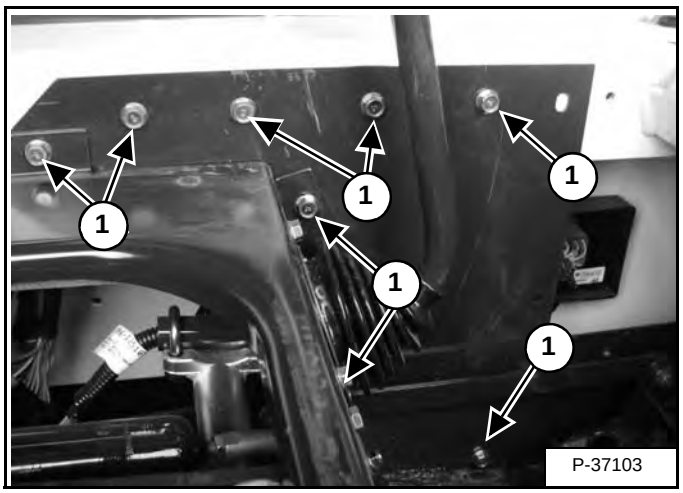
Figure 50-120-1



Remove the four mounting bolts (Item 1) **[Figure 50-120-1]** from the front access panel.

Remove the front access panel from the loader.

Figure 50-120-2

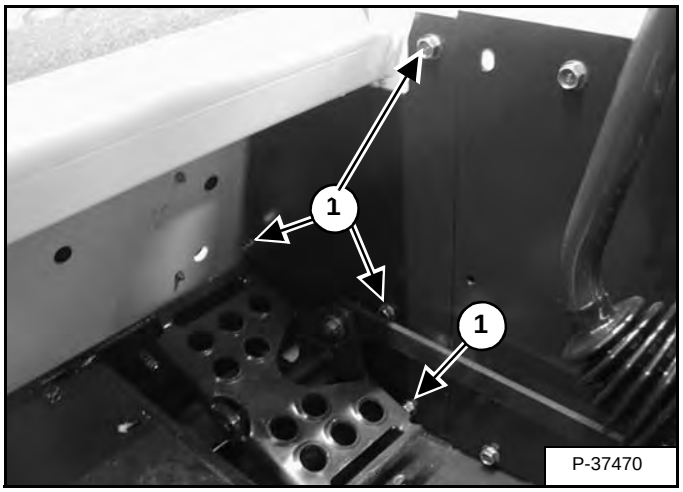


Remove the eight mount bolts (Item 1) **[Figure 50-120-2]** from the rear access panel.

Remove the rear access panel from behind the steering panel, remove the panel from the loader.

Removal And Installation (Right)

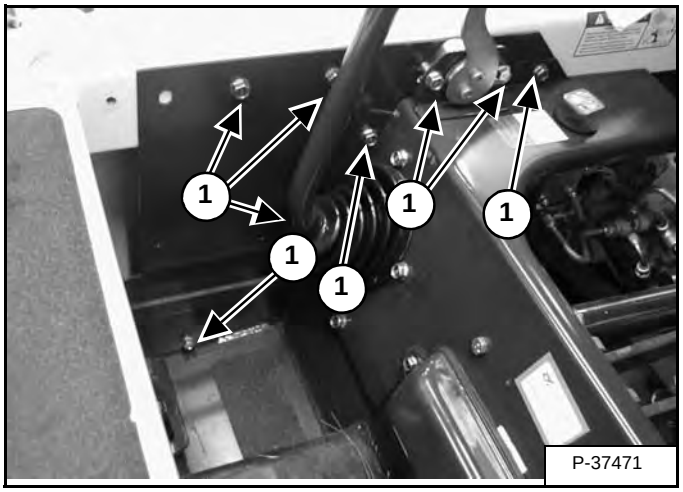
Figure 50-120-3



Remove the four mounting bolts (Item 1) **[Figure 50-120-3]** from the front access panel.

Remove the front access panel from the loader.

Figure 50-120-4



Remove the eight mount bolts (Item 1) **[Figure 50-120-4]** from the rear access panel.

Remove the throttle lever assembly from the access panel.

Remove the rear access panel from behind the steering panel, remove the panel from the loader.

Dealer Copy -- Not for Resale

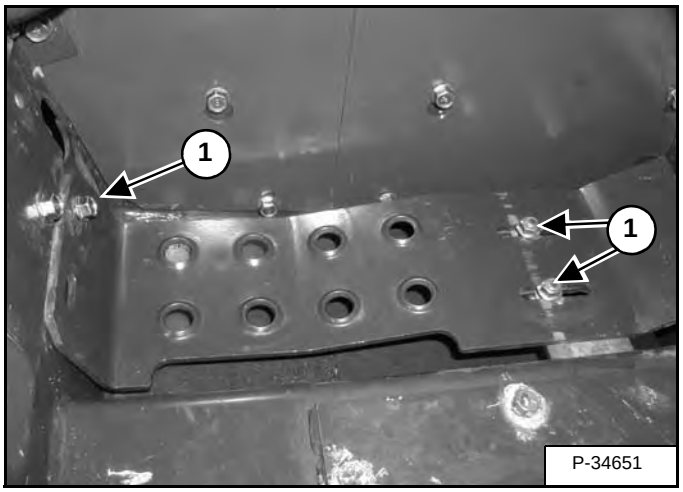


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ACCESS PANEL (INSIDE) (SJC)

Removal And Installation (Left)

Figure 50-121-1



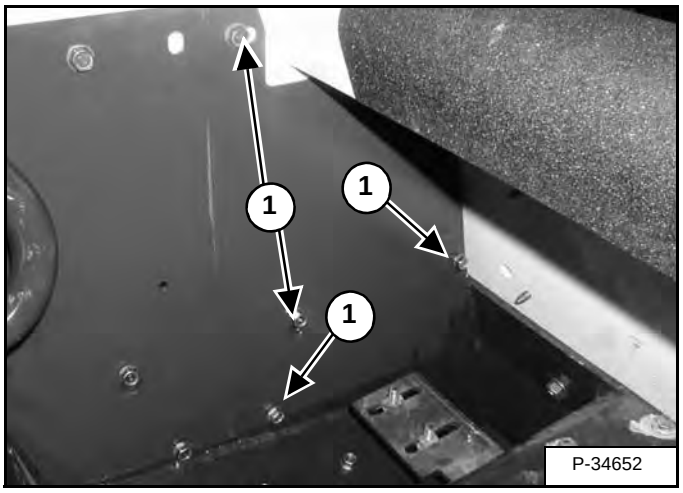
Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the three mounting bolts (Item 1) **[Figure 50-121-1]**, from the left foot rest.

Remove the foot rest from the loader.

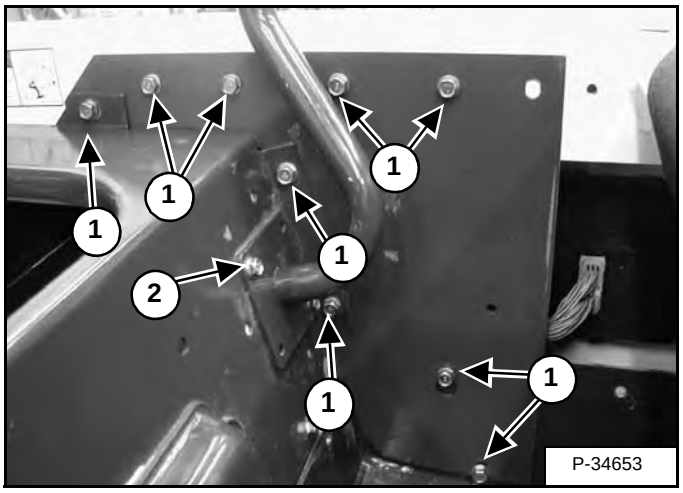
Figure 50-121-2



Remove the four mounting bolts (Item 1) **[Figure 50-121-2]**.

Remove the front access panel from the loader.

Figure 50-121-3



Remove the nine mount bolts (Item 1) **[Figure 50-121-3]**

Remove the mount bolt (Item 2) **[Figure 50-121-3]** from the lever assembly. Move the lever assembly a slight amount toward the center of the loader, to allow clearance for the panel to be removed.

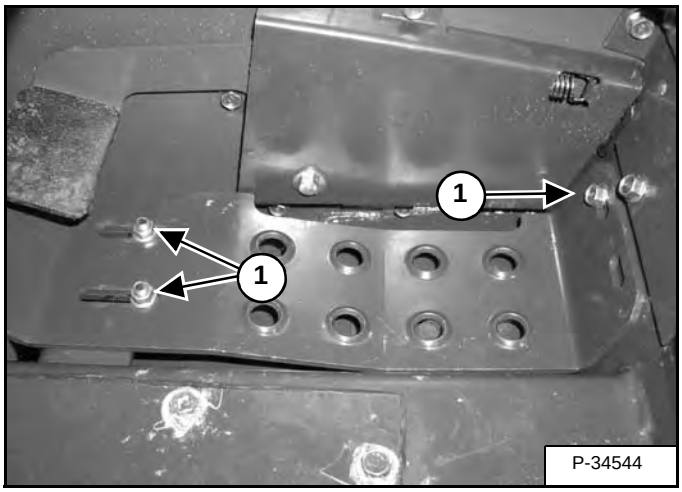
Remove the inside access panel from the loader.

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ACCESS PANEL (INSIDE) (SJC) (CONT'D)

Removal And Installation (Right)

Figure 50-121-4



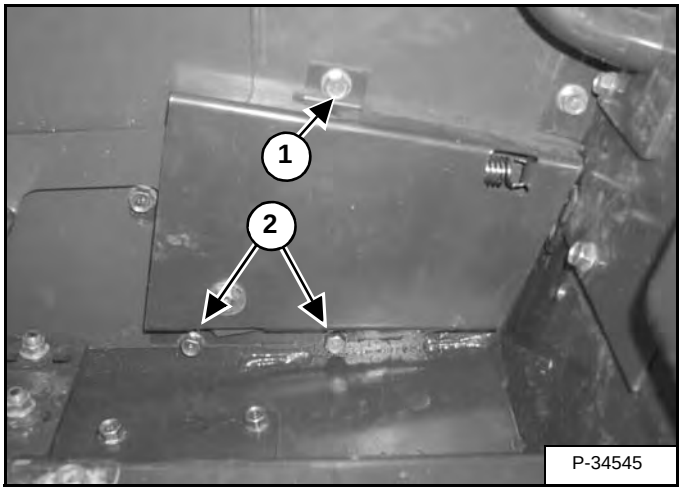
Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the three mounting bolts (Item 1) **[Figure 50-121-4]**, from the right side foot rest.

Remove the foot rest, from the loader.

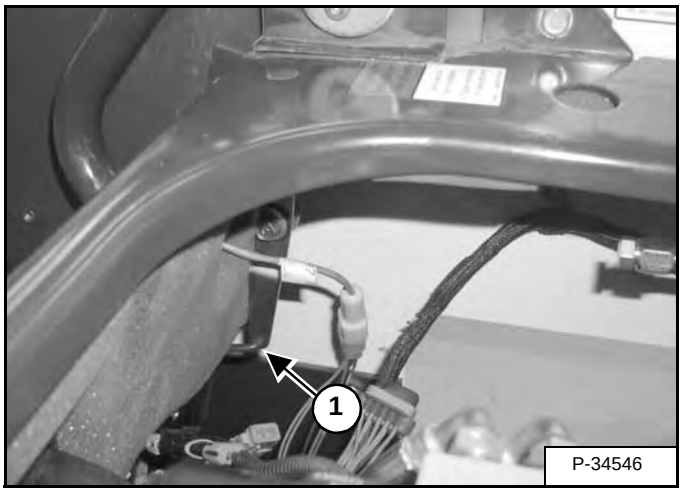
Figure 50-121-5



Remove the mount bolt (Item 1) **[Figure 50-121-5]** from the foot operated speed control assembly.

Loosen the two mount bolts (Item 2) **[Figure 50-121-5]** from the foot operated speed control assembly.

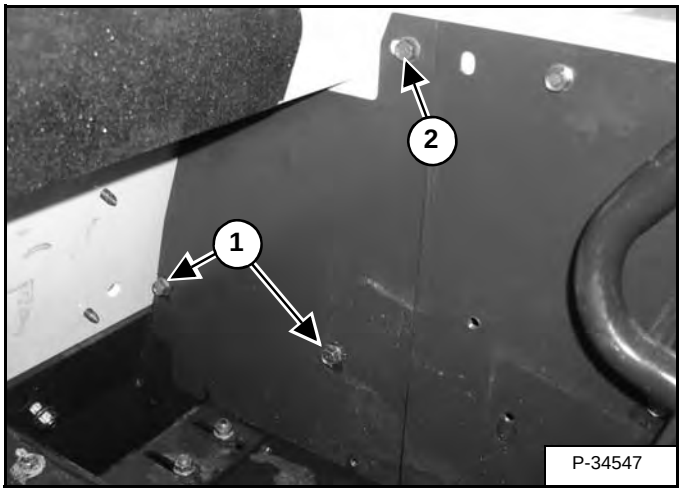
Figure 50-121-6



Disconnect the foot operated speed control linkage (Item 1) **[Figure 50-121-6]** from the hand operated speed control lever arm.

Remove the foot operated speed control assembly from the loader.

Figure 50-121-7



Loosen the two mount bolts (Item 1) **[Figure 50-121-7]** from the front inside access panel.

Remove the mount bolt (Item 2) **[Figure 50-121-7]** from the front inside access panel.

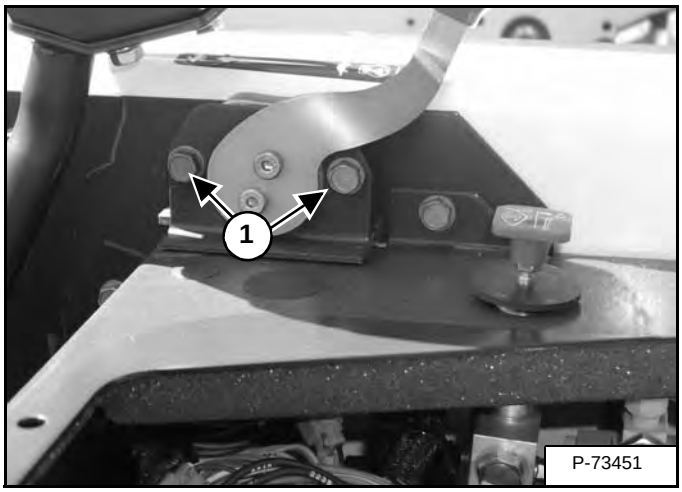
Remove the inside access panel from the loader.

Dealer Copy -- Not for Resale

ACCESS PANEL (INSIDE) (SJC) (CONT'D)

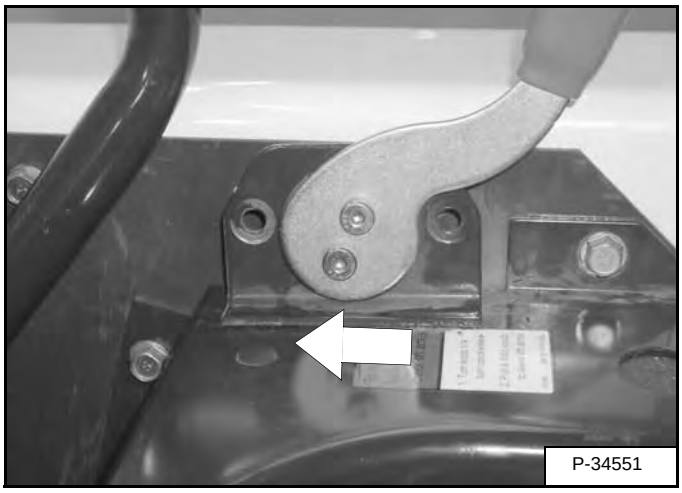
Removal And Installation (Right) (Cont'd)

Figure 50-121-8



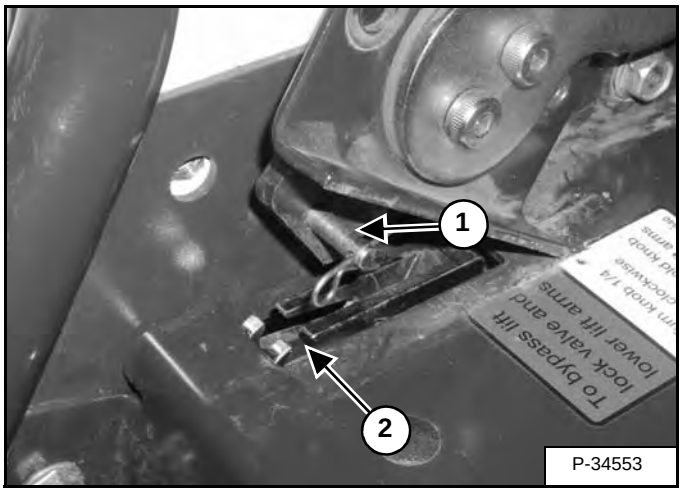
Remove the two mount bolts (Item 1) **[Figure 50-121-8]** from the hand operated speed control lever.

Figure 50-121-9



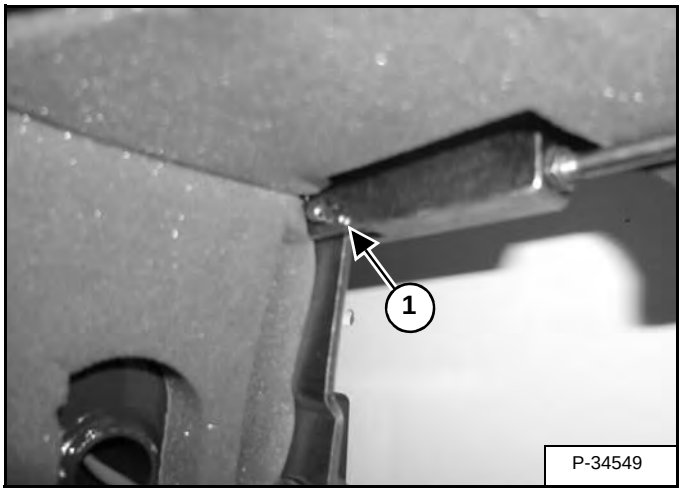
Lift slightly on the speed control handle and move it toward the front of the loader **[Figure 50-121-9]**.

Figure 50-121-10



Lift the speed control pin (Item 1) from the notch (Item 2) **[Figure 50-121-10]** in throttle cable.

Figure 50-121-11



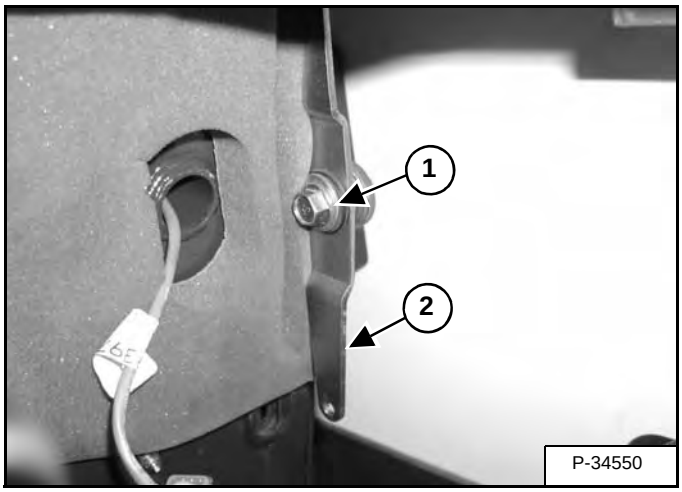
At the bottom right side of the control panel, remove the keeper and pin (Item 1) **[Figure 50-121-11]** that connects the speed control linkage arm to the speed control cable.

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ACCESS PANEL (INSIDE) (SJC) (CONT'D)

Removal And Installation (Right) (Cont'd)

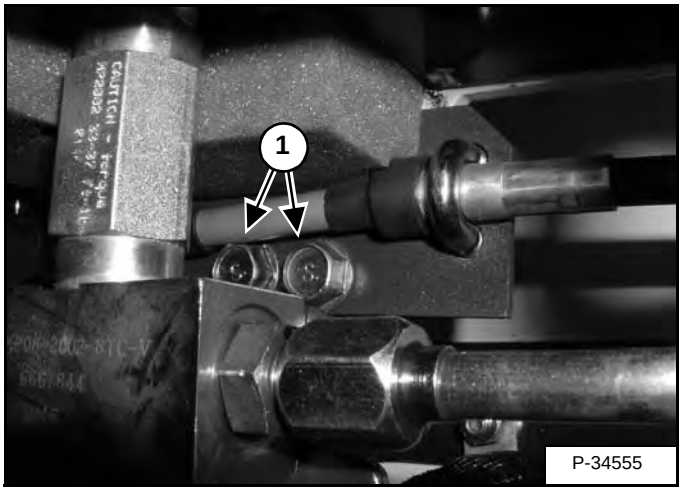
Figure 50-121-12



Remove the mount bolt and nut (Item 1) **[Figure 50-121-12]** from the speed control linkage arm.

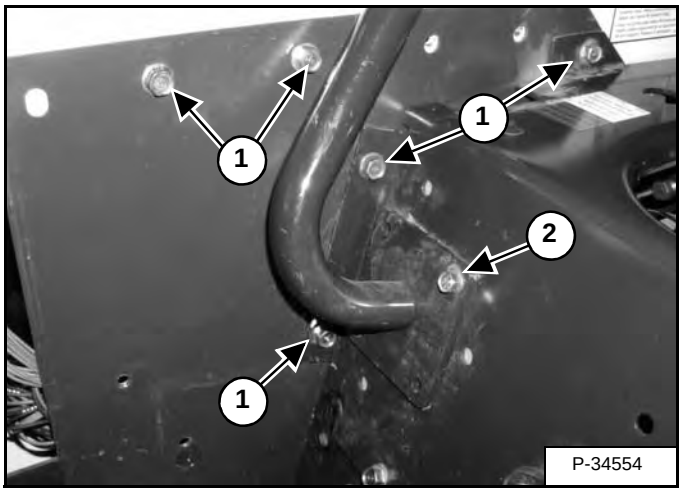
Remove the speed control linkage arm (Item 1) **[Figure 50-121-12]** from the access panel.

Figure 50-121-13



At the bottom right side of the control panel, behind the lift arm bypass valve, remove the two bolts and nuts (Item 1) **[Figure 50-121-13]** that mount the engine speed cable to the access panel.

Figure 50-121-14



Remove the five mount bolts (Item 1) **[Figure 50-121-14]** from the access panel.

Remove the mount bolt (Item 2) **[Figure 50-121-14]** from the lever assembly. Move the lever assembly a slight amount toward the center of the loader, to allow clearance for the panel to be removed.

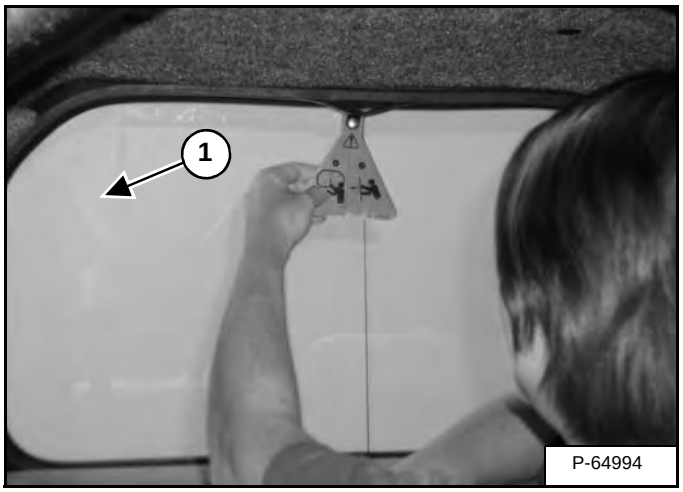
Remove the panel from the loader.

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WINDOW (REAR)

Removal

Figure 50-130-1



Pull on the tag (Item 1) **[Figure 50-130-1]** on the rear window to remove the rubber cord.

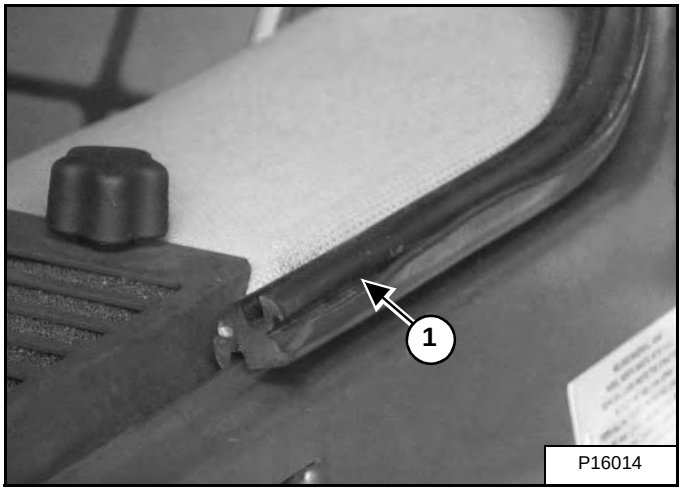
Using gloves, push the rear window out the rear of the operator cab.

NOTE: If rear window was broke, remove all glass fragments from the rubber molding before installing a new window.

Installation

Clean the area before installing the rubber molding.

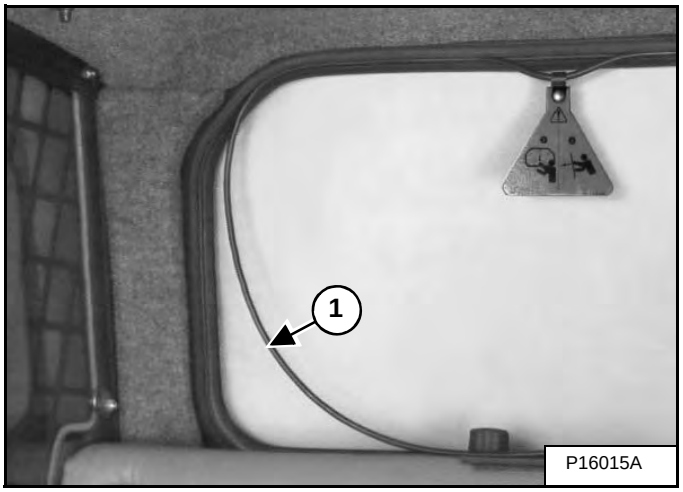
Figure 50-130-2



Install the rubber molding (Item 1) **[Figure 50-130-2]** around the edge of the rear opening in the operator cab.

If replacing the rubber molding (Item 1) **[Figure 50-130-2]** cut off the excess molding.

Figure 50-130-3



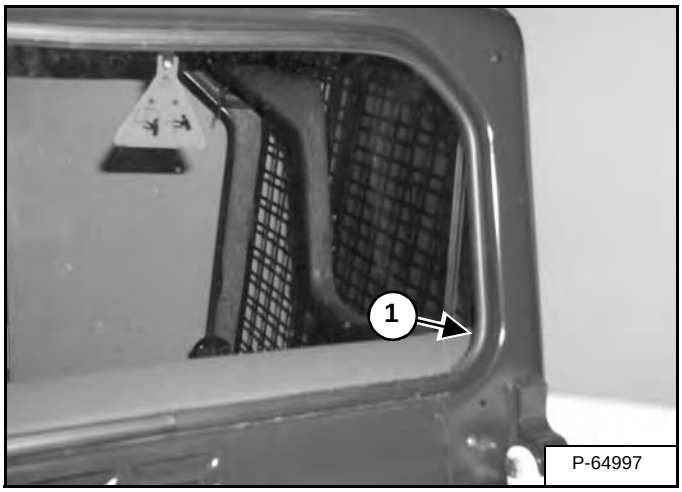
Apply liquid soap on the rubber cord to make installation easier. Install the rubber cord (Item 1) **[Figure 50-130-3]** into the molding on the inside of the operator cab.

Install the safety tag in the top center of the cord.

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Installation (Cont'd)

Figure 50-130-4



Apply liquid soap in the rubber molding (Item 1) **[Figure 50-130-4]** to make installation easier.

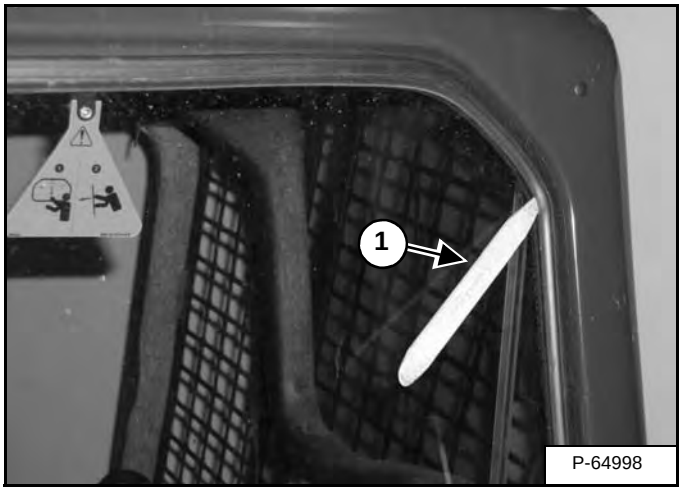
Install the window from the outside of the operator cab.

Install a lower corner of the rear window into the corner of the molding. **[Figure 50-130-4]**.

Align the other lower corner of the window in the molding.

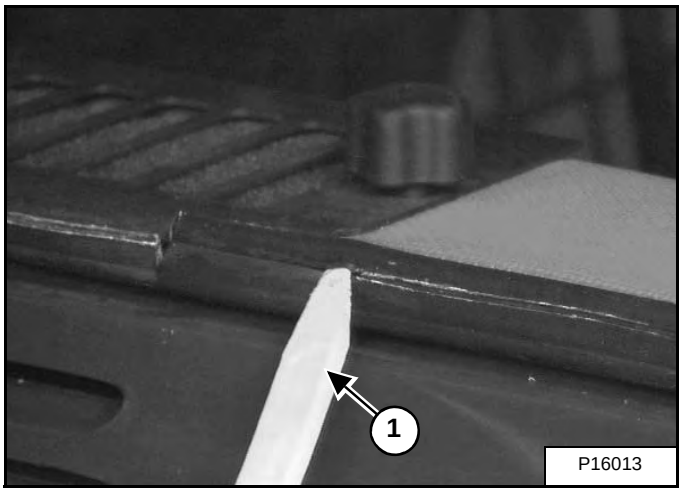
Work the window downward until the window is fully seated in the lower portion of the molding.

Figure 50-130-5



Use a plastic stick (Item 1) **[Figure 50-130-5]** under the molding lip to guide the window into the molding groove.

Figure 50-130-6



Use the plastic stick (Item 1) **[Figure 50-130-6]** to position the locking tab into the groove to secure the window in the molding.

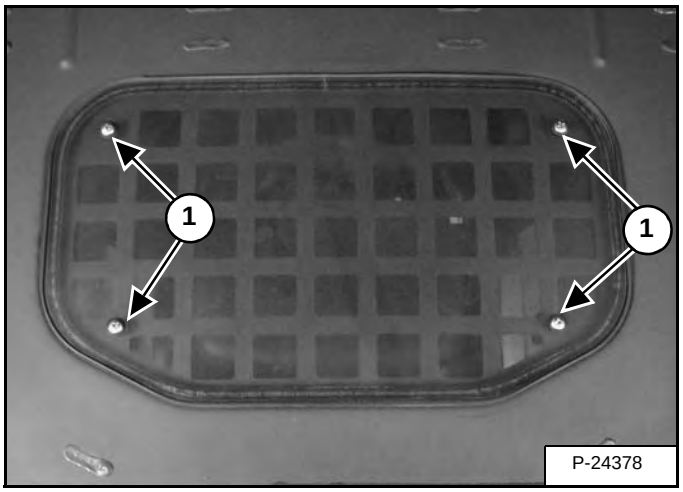
Tapping the window corners will help seat the window in the molding.

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WINDOW (TOP)

Removal And Installation

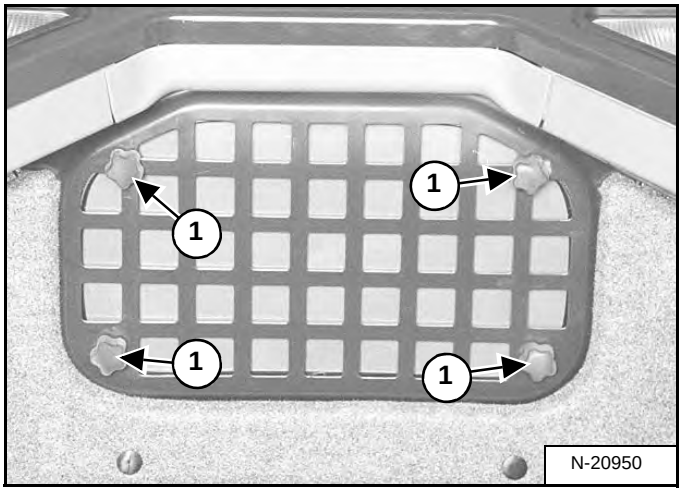
Figure 50-131-1



Position the window in the recess area.

Install the bolts (Item 1) **[Figure 50-131-1]** through the window grommets, the nylon bushings and through the cab holes.

Figure 50-131-2



From inside the operator cab, install and tighten the knobs (Item 1) **[Figure 50-131-2]** on the window bolts.

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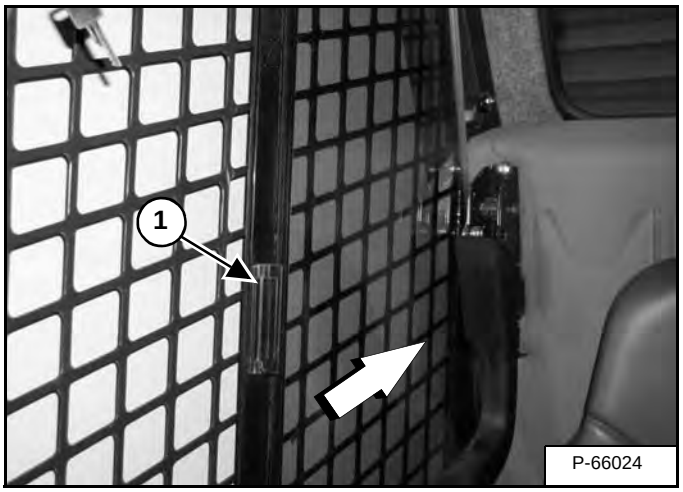


Dealer Copy -- Not for Resale

WINDOW (SIDE)

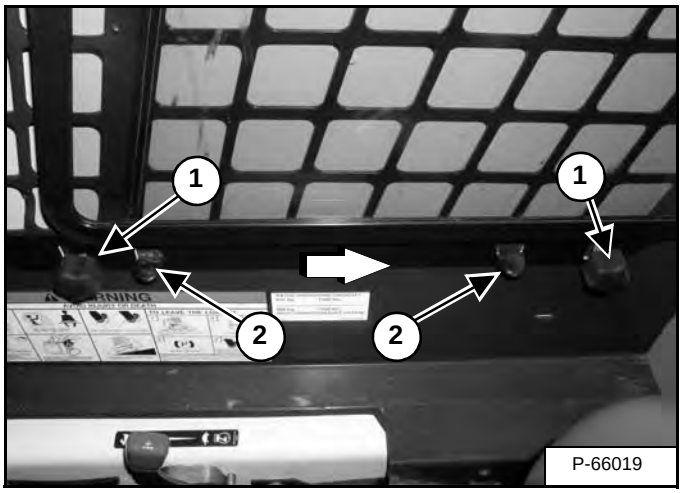
Removal And Installation

Figure 50-132-1



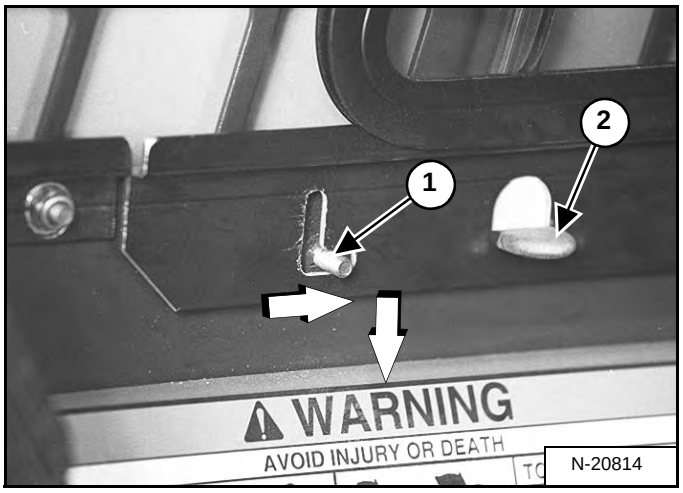
Release the latch (Item 1) **[Figure 50-132-1]** and slide the front window back towards the rear of the operator cab.

Figure 50-132-2



From inside the operator cab, loosen the knobs (Item 1) **[Figure 50-132-2]** and **[Figure 50-132-3]** on the window slide rail bolts.

Figure 50-132-3



NOTE: [Figure 50-132-3] is shown with the washer and knob removed to illustrate the direction of movement.

Move the window slide rail using the two thumb pads (Item 2) **[Figure 50-132-2]** and **[Figure 50-132-3]** towards the rear of the operator cab and then down towards the bottom of the operator cab.

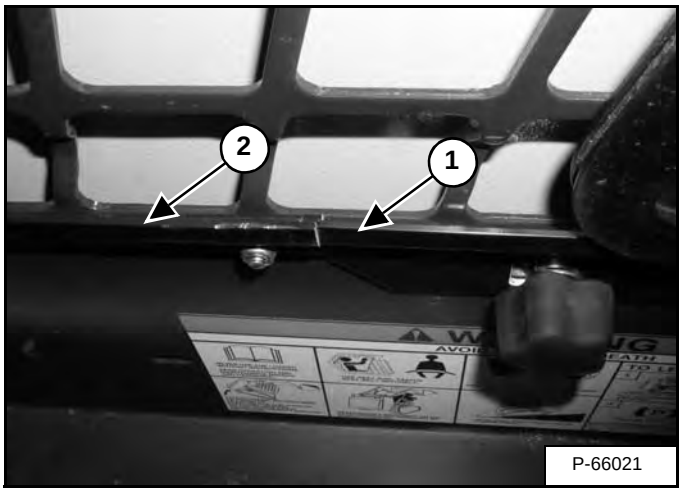
NOTE: The top of the window should come out of the top slide rail at this time. Make sure the window is secure and does not fall. Make sure the slide rails are in alignment and the window is positioned in the top track during installation.

Remove the front side window from the operator cab.

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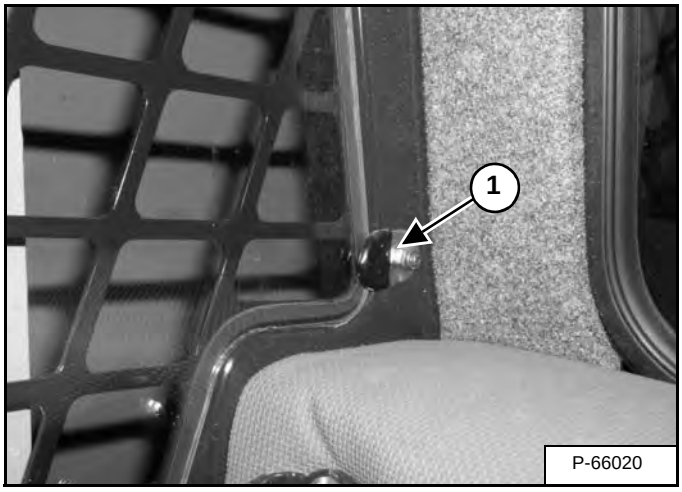
Removal And Installation (Cont'd)

Figure 50-132-4



Installation: When installing the window make sure the slide rail (Item 1) adjoins the front stationary slide rail (Item 2) **[Figure 50-132-4]**.

Figure 50-132-5



The rear side window sets in a recessed groove.

NOTE: The window should be secured to prevent damage when the bolt (Item 1) [Figure 50-132-5] is loosened.

Loosen the bolt (Item 1) **[Figure 50-132-5]** on the rear side window.

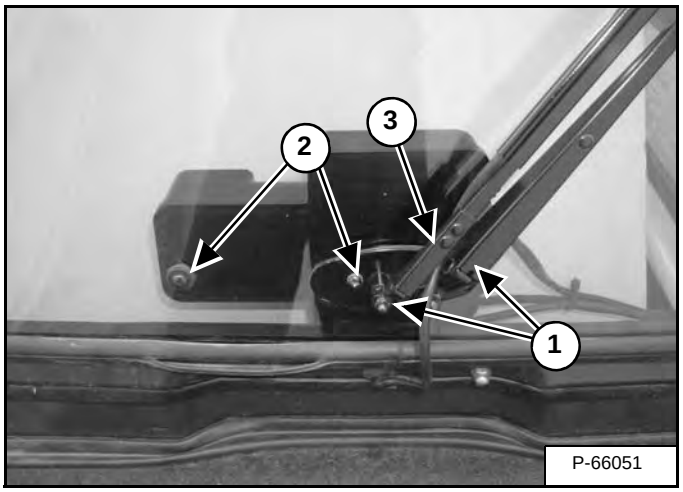
Remove the rear side window.

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WINDOW (FRONT DOOR)

Removal (Standard Window)

Figure 50-133-1

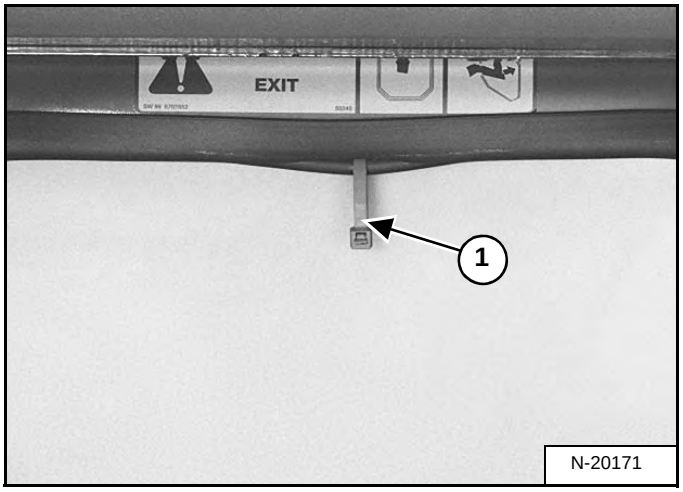


Remove the wiper arm assembly (Item 1) **[Figure 50-133-1]**.

Remove the two screws (Item 2) and the nut (Item 3) **[Figure 50-133-1]**.

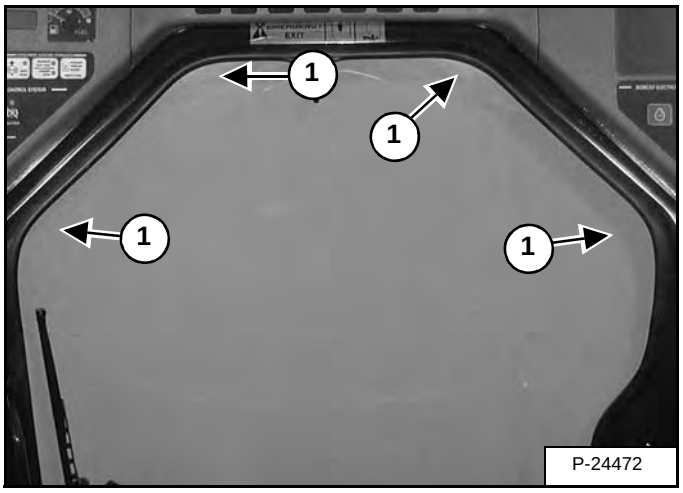
Secure the wiper motor inside the cab.

Figure 50-133-2



Pull the plastic loop (Item 1) **[Figure 50-133-2]** at the top of the window to remove the rubber cord.

Figure 50-133-3



Push the window out at any corner of the window (Item 1) **[Figure 50-133-3]**.

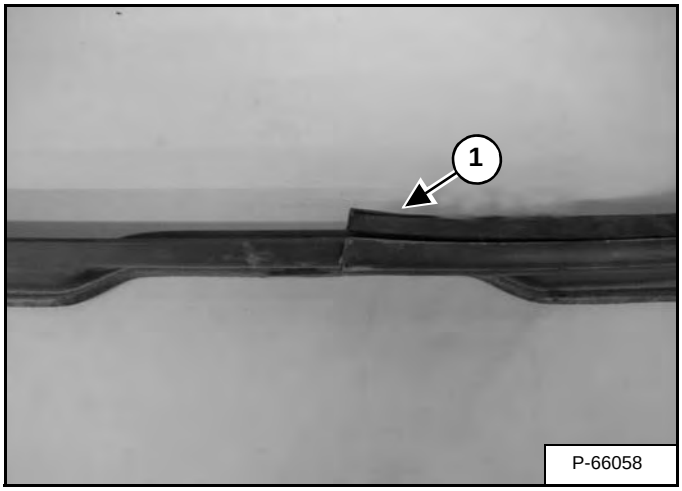
NOTE: The window may fall when pushing on the corners. Have a second technician assist you during the removal of the window.

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Installation (Standard Window)

Clean the area before installing the rubber molding.

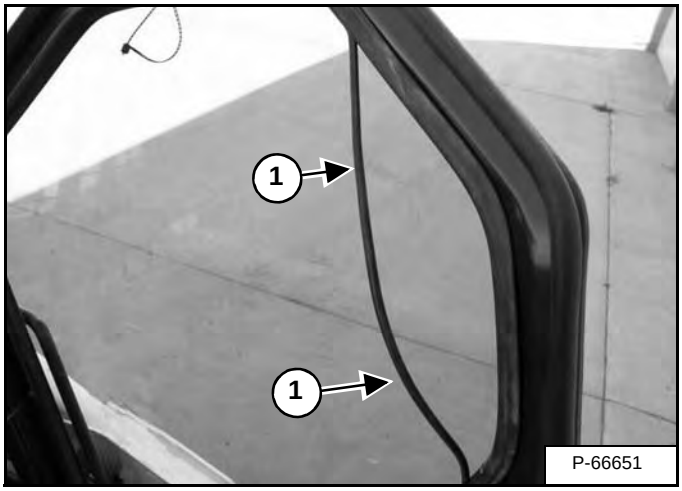
Figure 50-133-4



Install the rubber molding (Item 1) **[Figure 50-133-4]** around the edge of the front door frame starting at the bottom of the door frame.

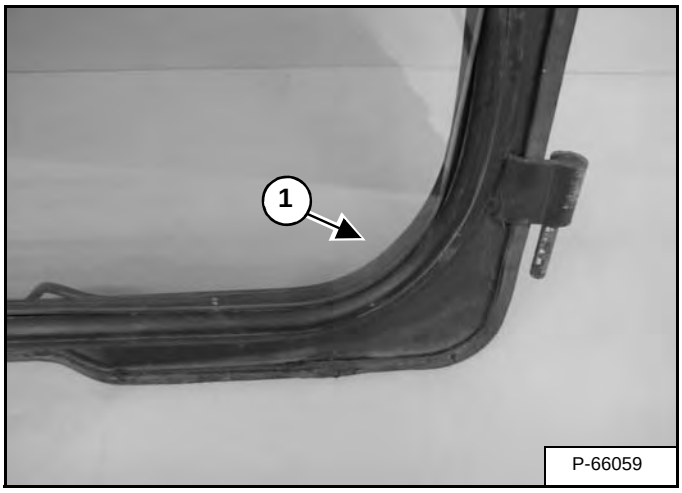
If replacing the rubber molding (Item 1) **[Figure 50-133-4]** cut off the excess molding.

Figure 50-133-5



Apply liquid soap on the rubber cord to make installation easier. Install the rubber cord (Item 1) **[Figure 50-133-5]** into the molding on the inside of the operator cab.

Figure 50-133-6



Apply liquid soap in the rubber molding to make installation easier.

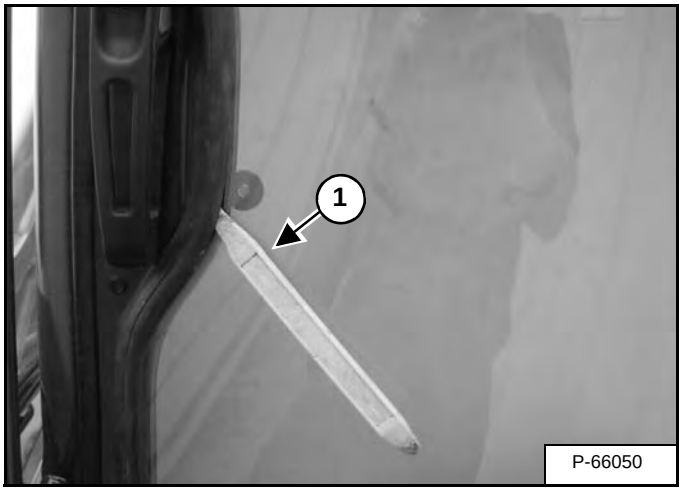
Install the window from the outside of the door frame.

Install a lower corner of the rear window (Item 1) **[Figure 50-133-6]** into the corner of the molding.

Align the other lower corner of the window in the molding.

Work the window downward until the window is fully seated in the lower portion of the molding.

Figure 50-133-7

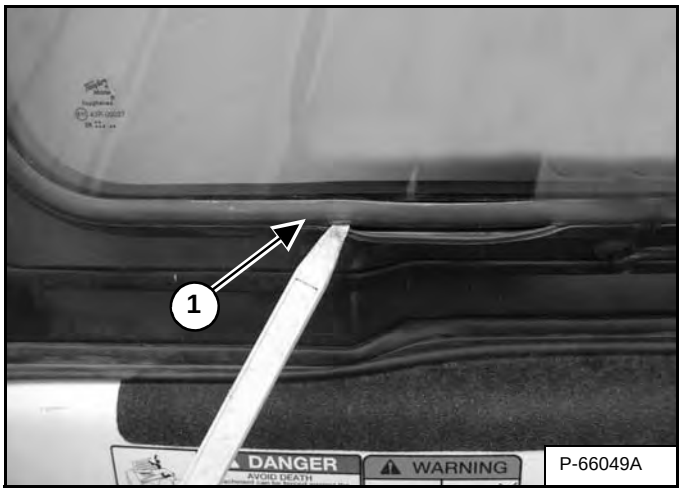


Use a plastic stick (Item 1) **[Figure 50-133-7]** under the molding lip to guide the window into the molding groove.

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Installation (Standard Window) (Cont'd)

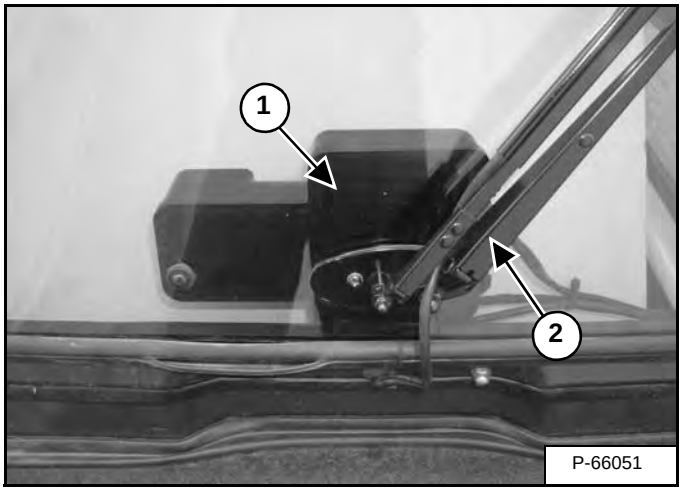
Figure 50-133-8



Use the plastic stick (Item 1) **[Figure 50-133-8]** to position the locking tab into the groove to secure the window in the molding.

Tapping the window corners will help seat the window in the molding.

Figure 50-133-9



Install the wiper motor (Item 1) and wiper arm assembly (Item 2) **[Figure 50-133-9]**.

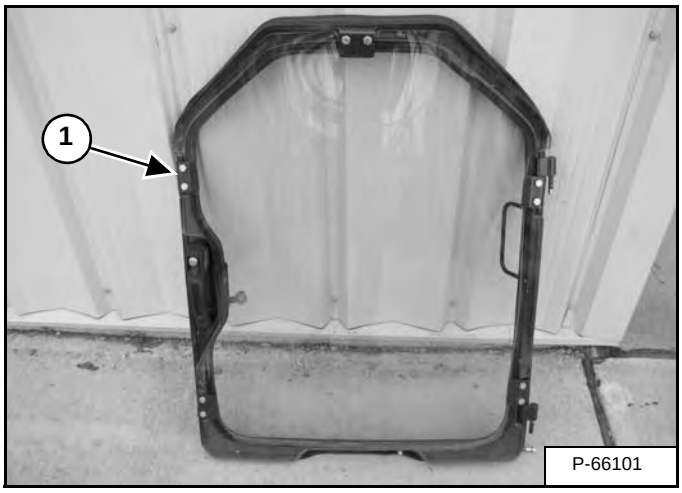
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Removal And Installation (Special Applications Window)

Replace the Lexan glazing under the following conditions:

- When the glazing is four years old;
- When the glazing becomes yellow or hazed;
- Is scratched on either side with scratches that can be felt with the fingernail;
- Has cracks coming from the edges or mounting holes. or fine cracks on the surface area;
- Has contacted any fluids that have caused cloudiness.

Figure 50-133-10



Remove window from loader.

NOTE: The Special Applications window is held on by the brackets only, it does not sit in the rubber molding. During Removal the window may fall as the mounting bolts are loosened.

Remove the five mounting brackets and bolts (Item 1) **[Figure 50-133-10]**.

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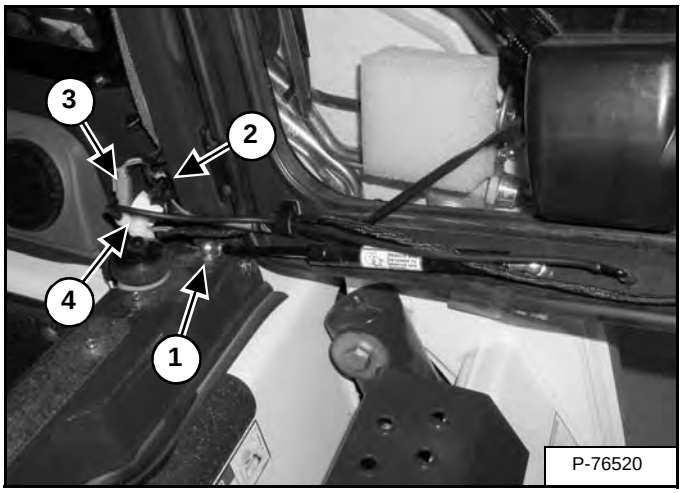
CAB DOOR

Description

The standard cab door is available as an option or dealer installed kit. The Special Application Kit Door or Forestry Door kit are available for use with certain attachments.

Removal And Installation

Figure 50-140-1



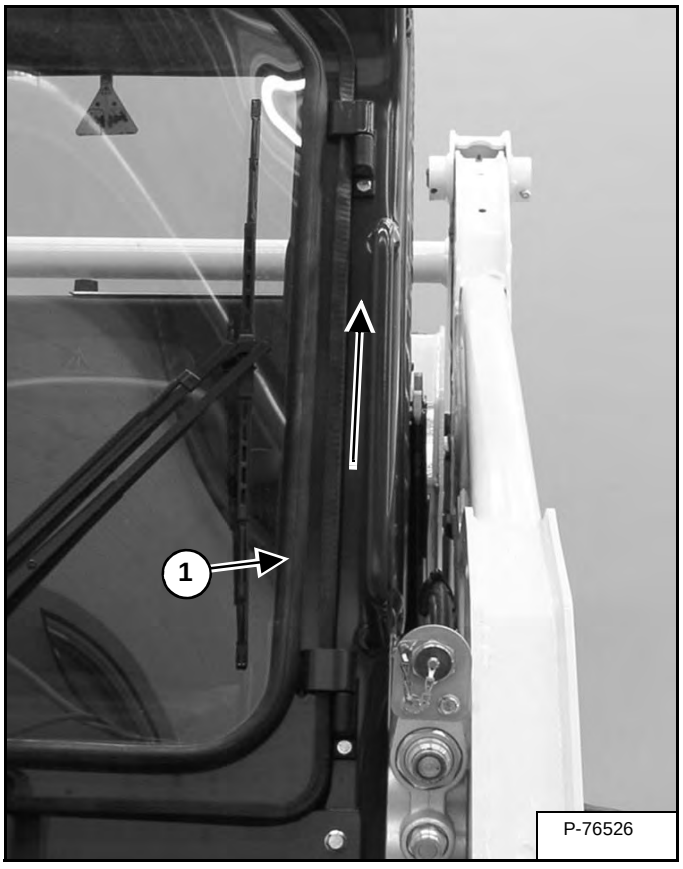
Open the cab door.

Remove the gas spring (Item 1) **[Figure 50-140-1]** from the threshold.

Disconnect the electrical harnesses (Items 2 and 3) **[Figure 50-140-1]**.

Disconnect the washer bottle hose (Item 4) **[Figure 50-140-1]**.

Figure 50-140-2

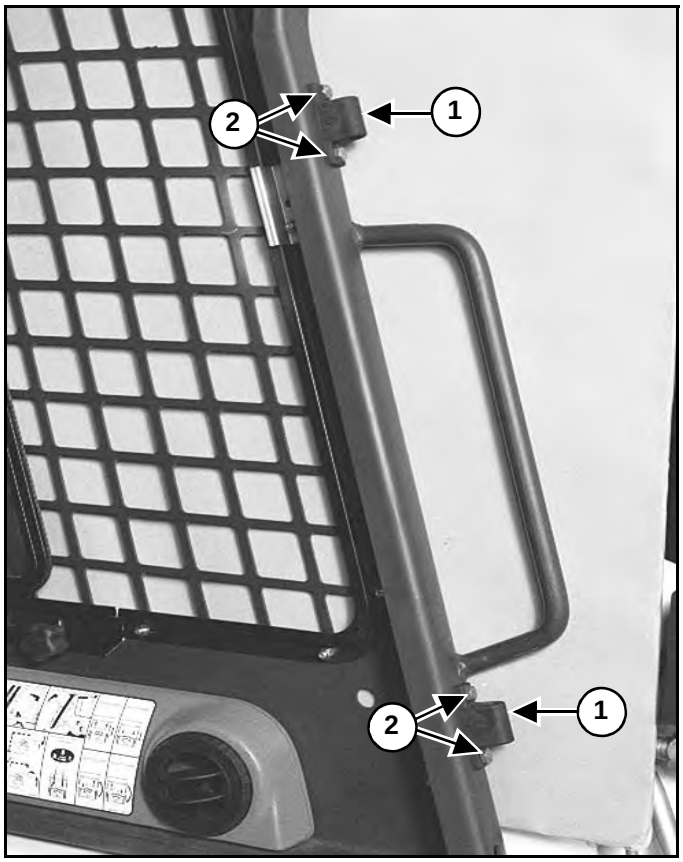


Lift the door (Item 1) **[Figure 50-140-2]** off the hinges.

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Removal And Installation (Cont'd)

Figure 50-140-3



Remove the four bolts and nuts (Item 2) **[Figure 50-140-3]** from the cab.

Remove the hinges (Item 1) **[Figure 50-140-3]** from the cab.

Installation: Install the hinges (Item 1) on the cab and use the bolts and nuts (Item 2) **[Figure 50-140-3]** to secure the hinges. Tighten to 7-7.9 ft.-lb. (9,6-10,7 N•m) torque.

Aligning

Figure 50-140-4

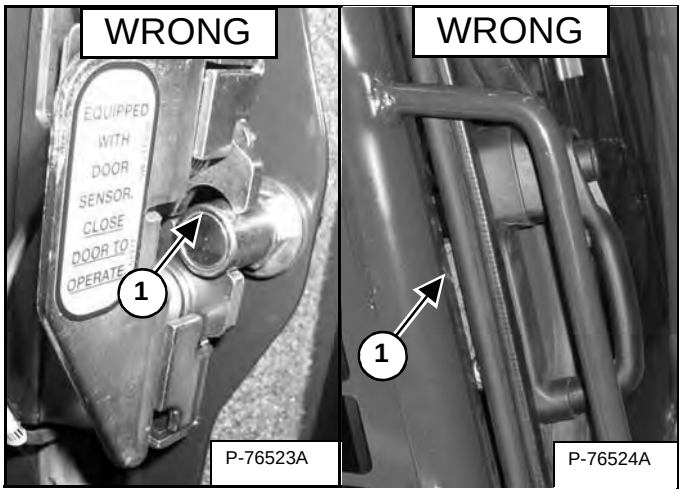
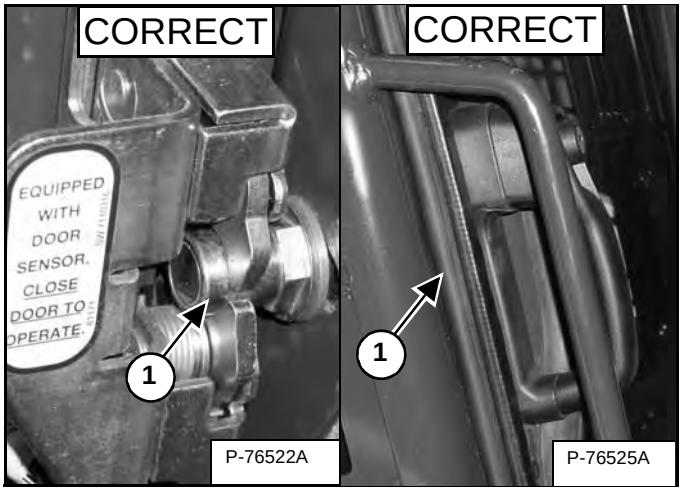


Figure 50-140-5



When the striker or latch is NOT adjusted properly there will be a gap (Item 1) **[Figure 50-140-4]** between the door and the cab or the striker and the latch.

If adjustment is needed. (See Adjusting on Page 50-140-3.)

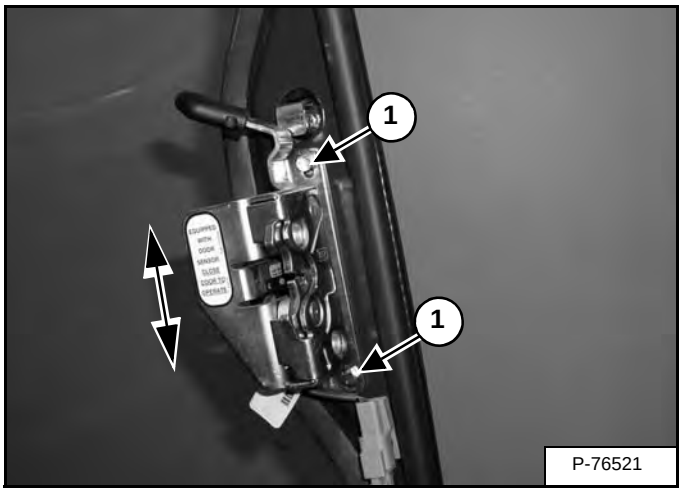
When the striker or latch is adjusted properly there will be no gap (Item 1) **[Figure 50-140-5]** between the door and the cab or the striker and the latch.

After verifying alignment check for proper operation. (See Checking Operation on Page 50-140-3.)

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Adjusting

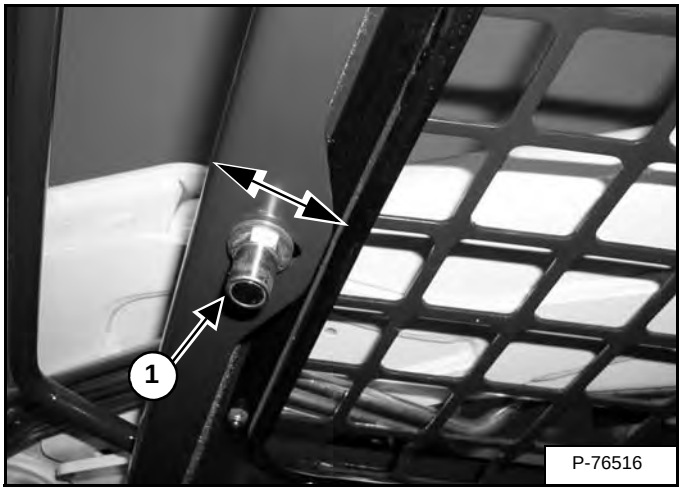
Figure 50-140-6



Loosen the two bolts (Item 1) **[Figure 50-140-6]** and adjust the latch as needed.

NOTE: For the initial adjustment, position the latch towards the bottom of the door.

Figure 50-140-7



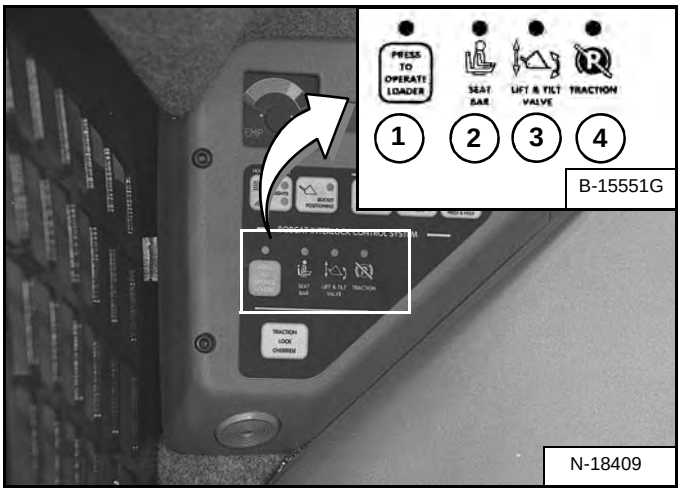
Loosen the striker and adjust as needed (Item 1) **[Figure 50-140-7]**.

NOTE: For the initial adjustment, position the striker towards the front of the machine.

After adjusting the striker and latch recheck the alignment of the door sensor. (See Aligning on Page 50-140-2.)

Checking Operation

Figure 50-140-8



Sit in operator's seat. Turn key ON. (Key Switch Panel), press RUN / ENTER button (Keyless Panel), lower seat bar and close the door. Press the PRESS TO OPERATE LOADER button. Three BICS lights (Items 1, 2 and 3) [PRESS TO OPERATE LOADER, SEAT BAR, AND LIFT & TILT VALVE] on left instrument panel should be ON **[Figure 50-140-8]**.

Open the door. The LIFT & TILT VALVE light (Item 3) **[Figure 50-140-8]** will flash, an audible tone will sound, and the message **[door]** will appear in the display.

Close the door and the LIFT & TILT VALVE light (Item 3) **[Figure 50-140-8]** will come back on and the display will return to machine hours.

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- Connector Identification 60-72-2
- Description 60-72-1
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TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.

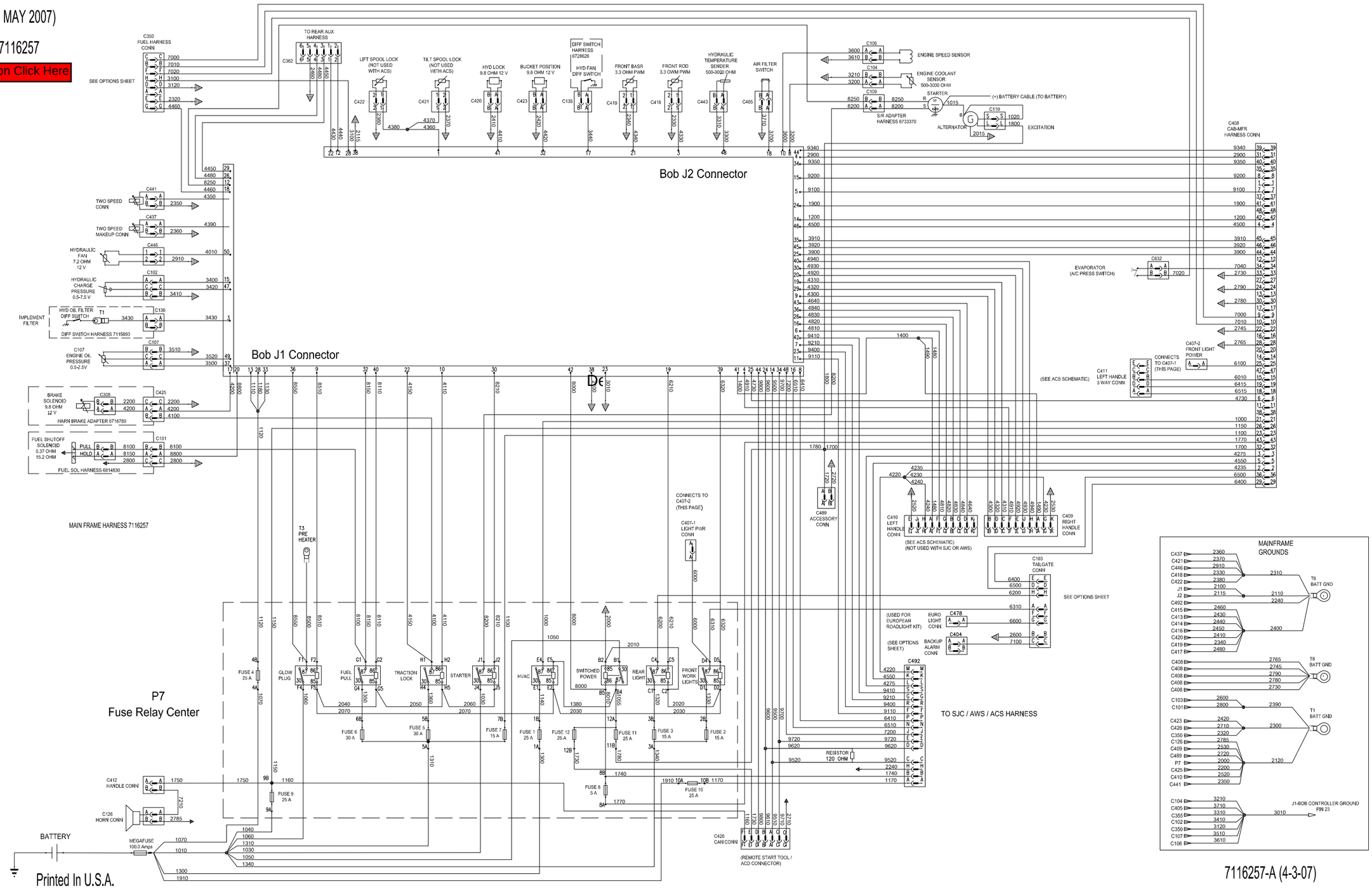
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WIRING SCHEMATIC
(MAIN FRAME)
S220 (S/N 530711001 - 530711210)
(S/N 530811001 - 530811019)

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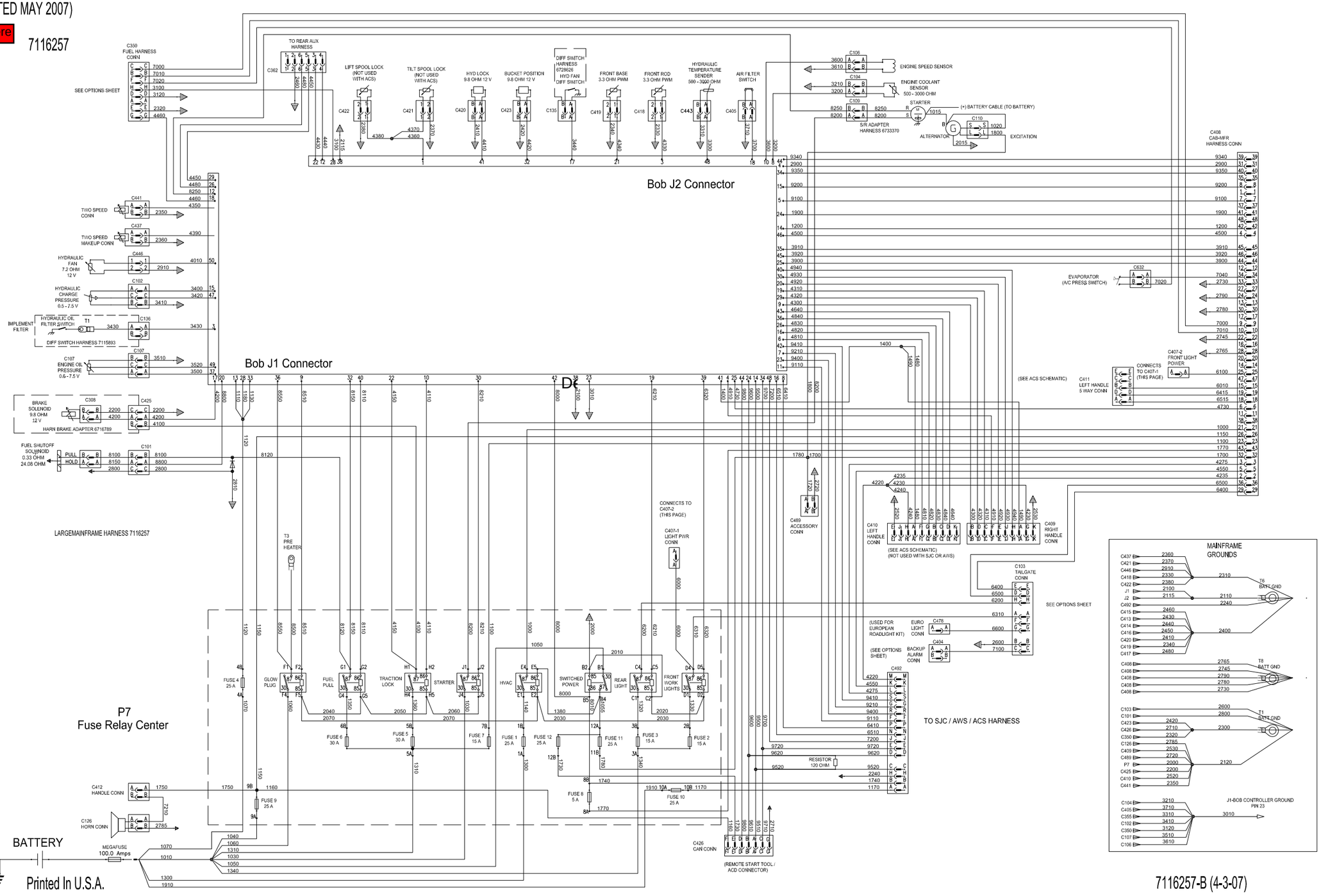
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WIRING SCHEMATIC
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S220 (S/N 530711211 - 530712576)
(S/N 530811020 - 530811132)

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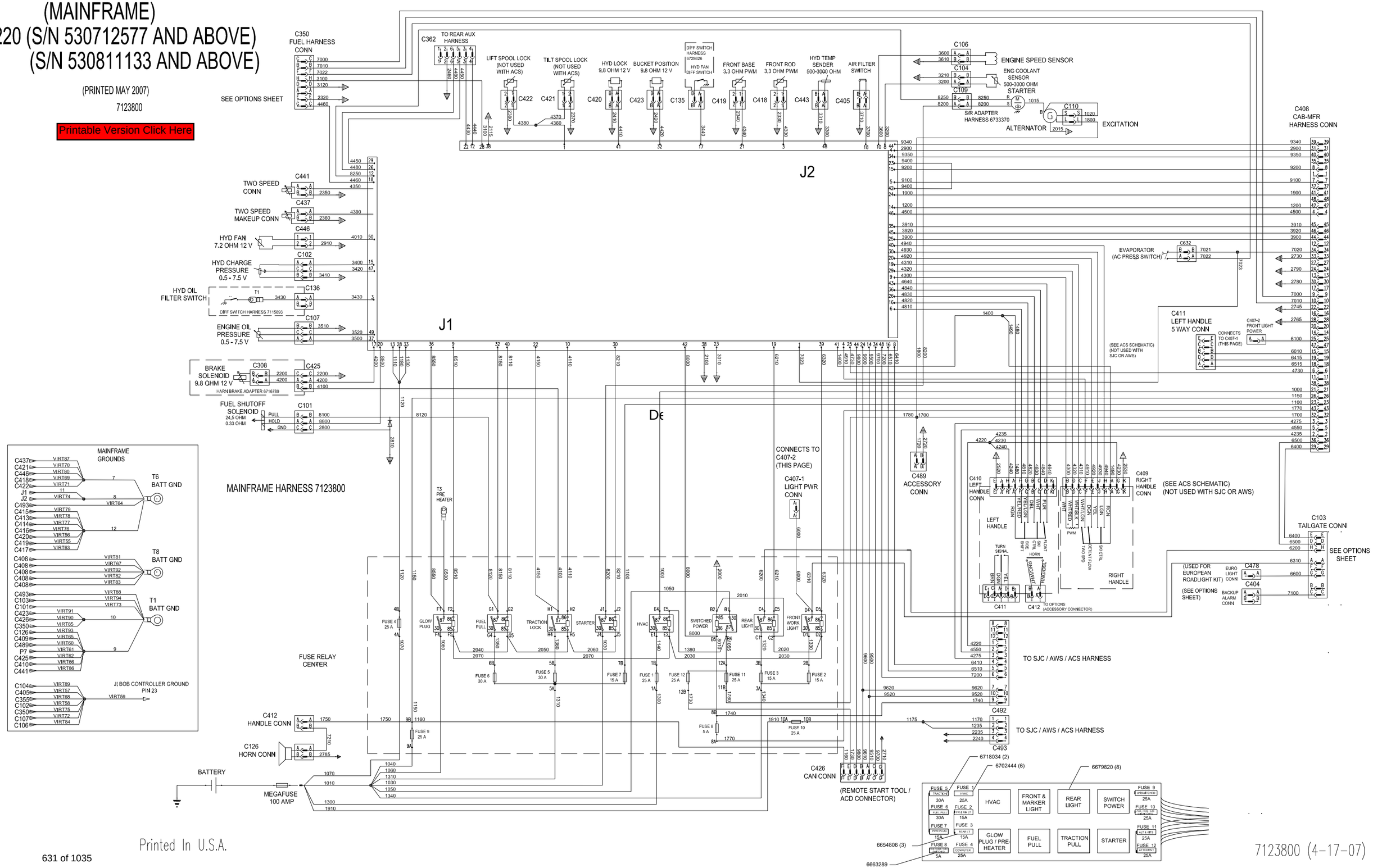
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WIRING SCHEMATIC
(MAINFRAME)
S220 (S/N 530712577 AND ABOVE)
(S/N 530811133 AND ABOVE)

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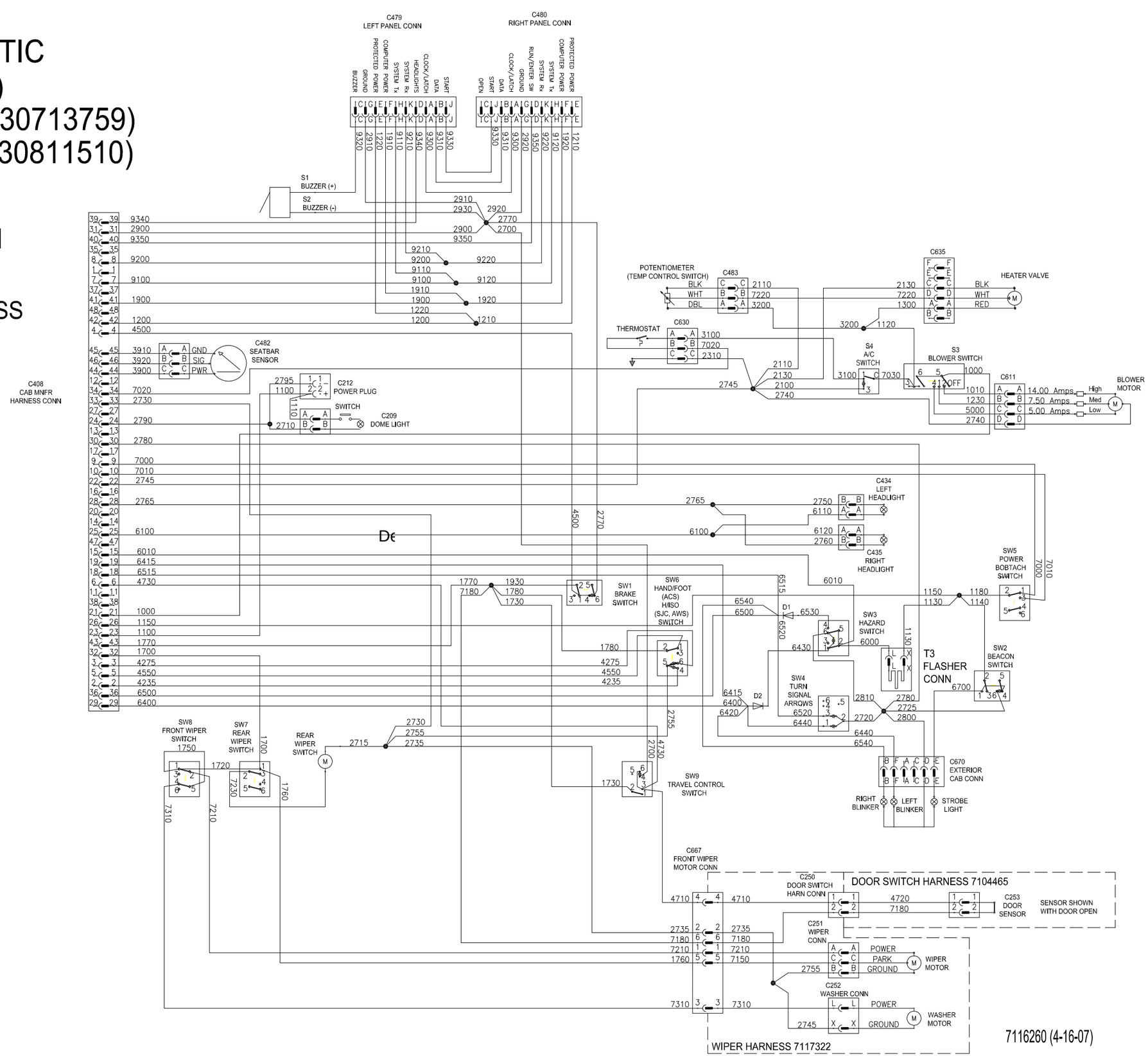
WIRING SCHEMATIC
(DELUXE CAB)
S220 (S/N 530711001 - 530713759)
(S/N 530811001 - 530811510)

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DLX CAB HARNESS
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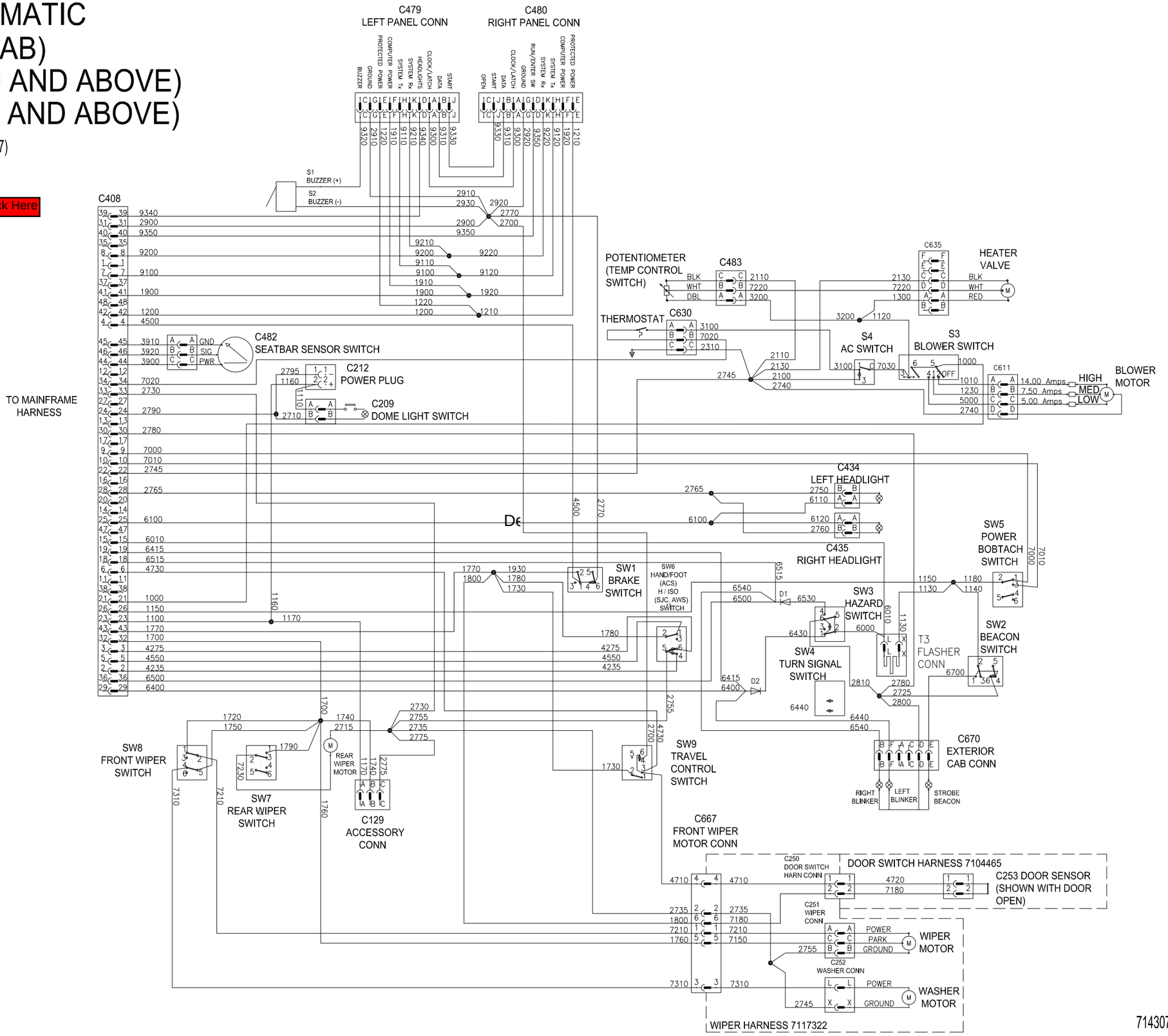
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(DELUXE CAB)
S220 (S/N 530713760 AND ABOVE)
(S/N 530811511 AND ABOVE)

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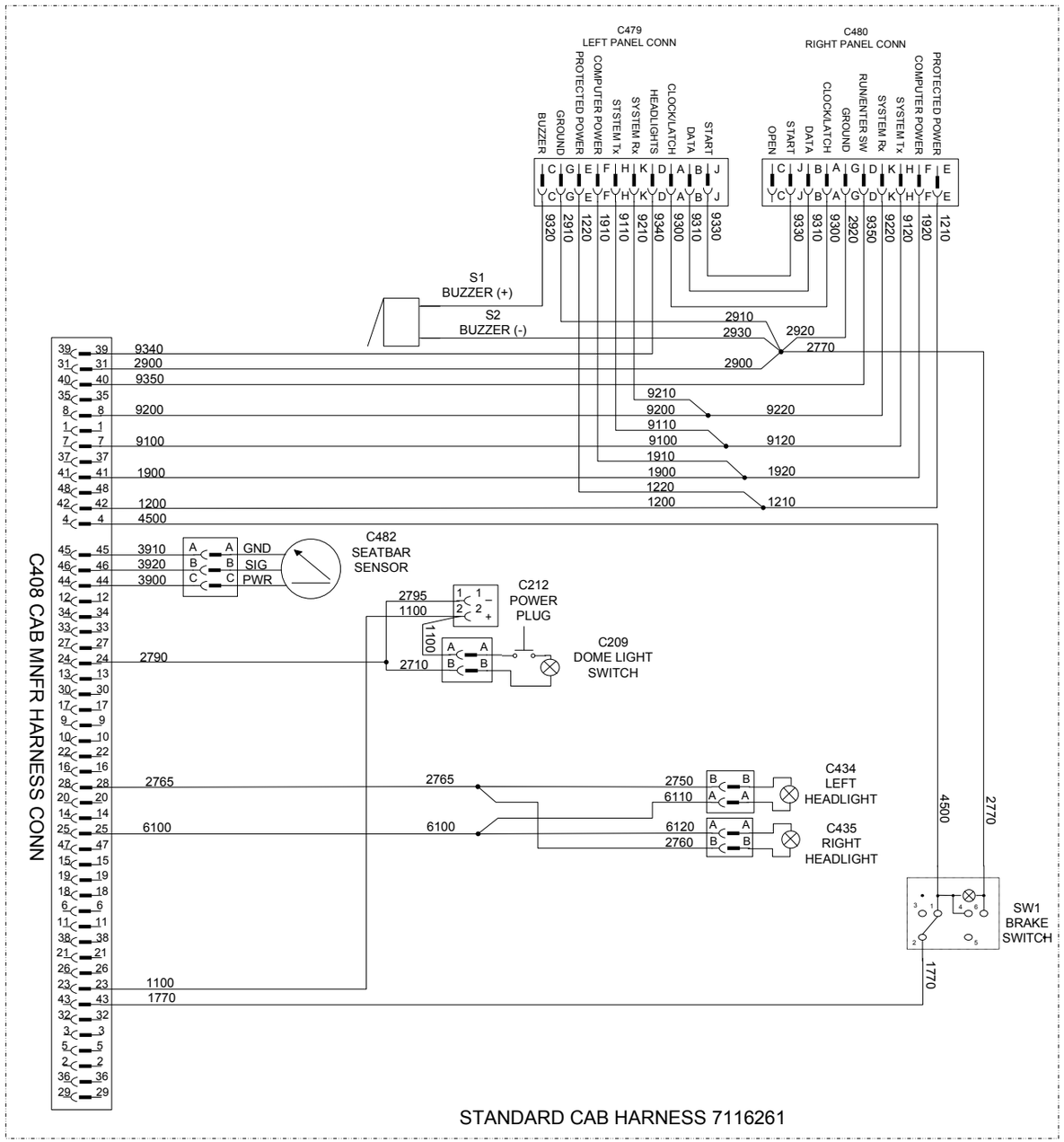
WIRING SCHEMATIC

STD CAB HARNESS

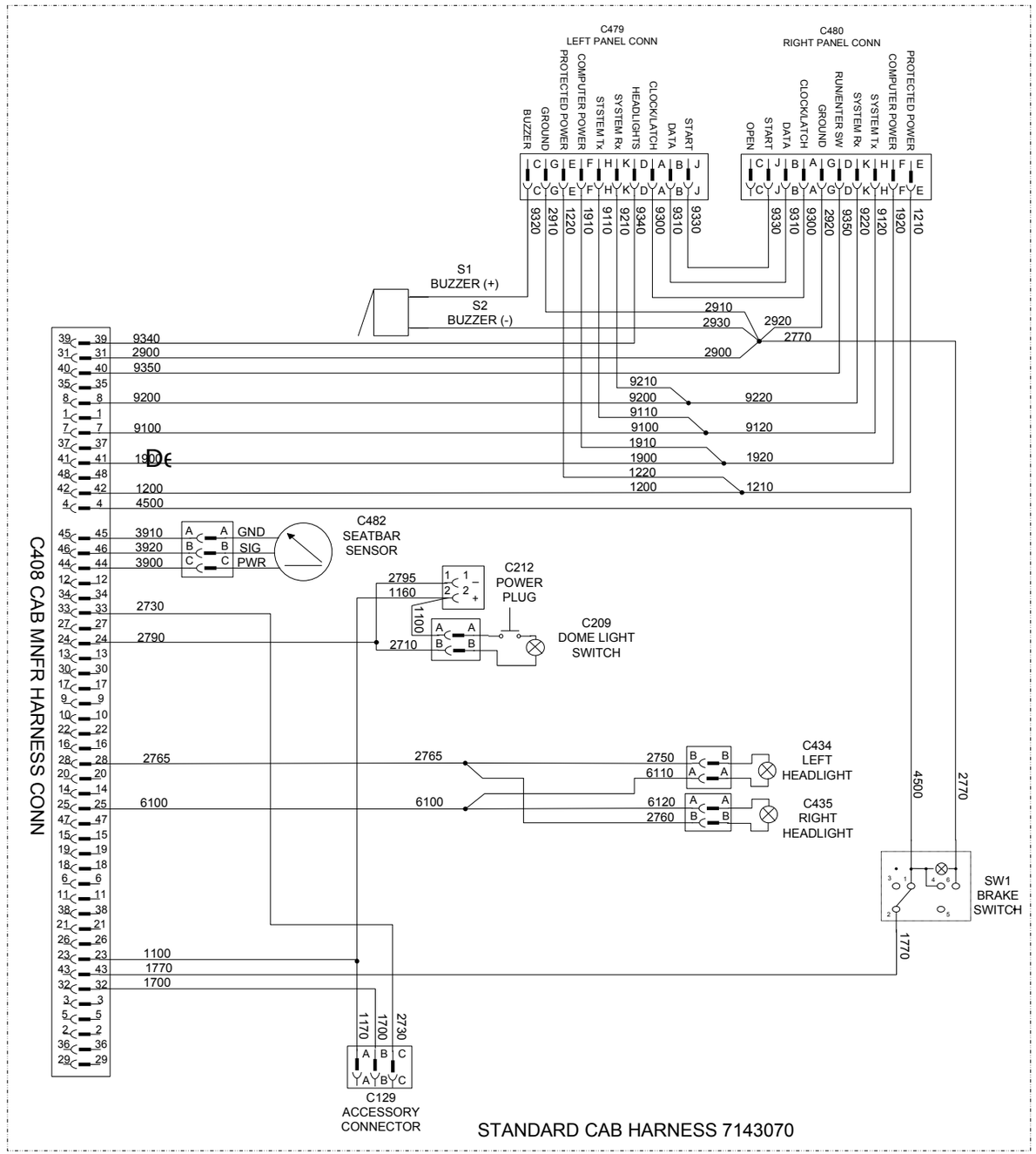
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STANDARD CAB HARNESS 7116261



STANDARD CAB HARNESS 7143070

RED = RED
RNG = ORANGE
BLK = BLACK
LBL = LIGHT BLUE
DBL = DARK BLUE
LGN = LIGHT GREEN
DGN = DARK GREEN
YEL = YELLOW
PNK = PINK
WHT = WHITE
BRN = BROWN
TAN = TAN
PUR = PURPLE
GRY = GRAY

WIRES CONNECT BY LETTER ACROSS CONNECTORS

SOME CONNECTOR BODIES NOT SHOWN FOR DRAWING CLARITY

BATTERY FEED 1000-1999 RED, RED/WHT, RNG
GROUND 2000-2999 BLK
MONITORING 3000-3999 LBL
HYDRAULIC 4000-4999 LGN
ATTACHMENT CONTROLS 5000-5999 YEL
LIGHTS 6000-6999 PNK
ACCESSORIES 7000-7999 WHT
ENGINE 8000-8999 TAN
COMMUNICATION 9000-9999 PUR

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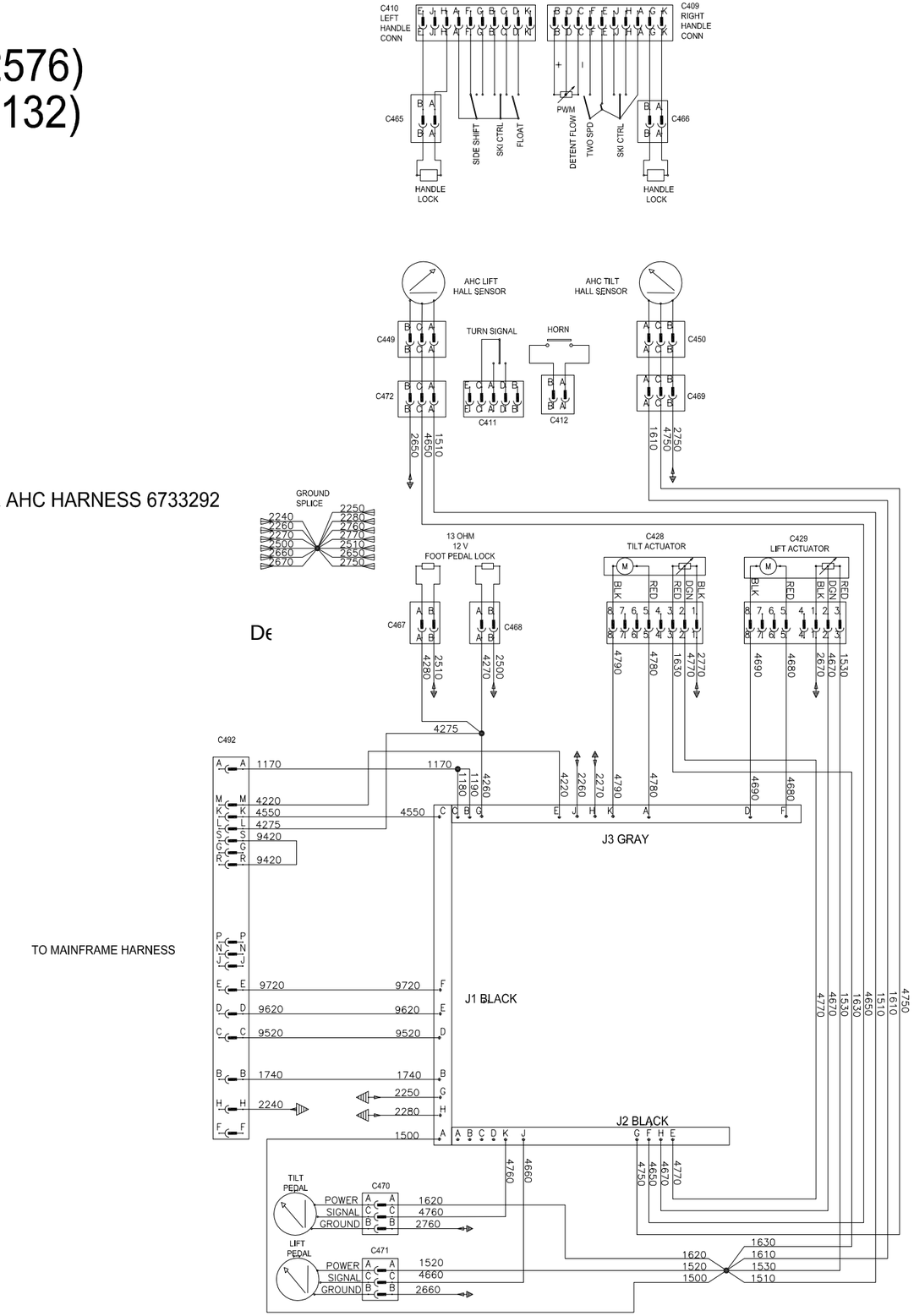
WIRING SCHEMATIC
(ACS)
S220 (S/N 530711001 - 530712576)
(S/N 530811001 - 530811132)

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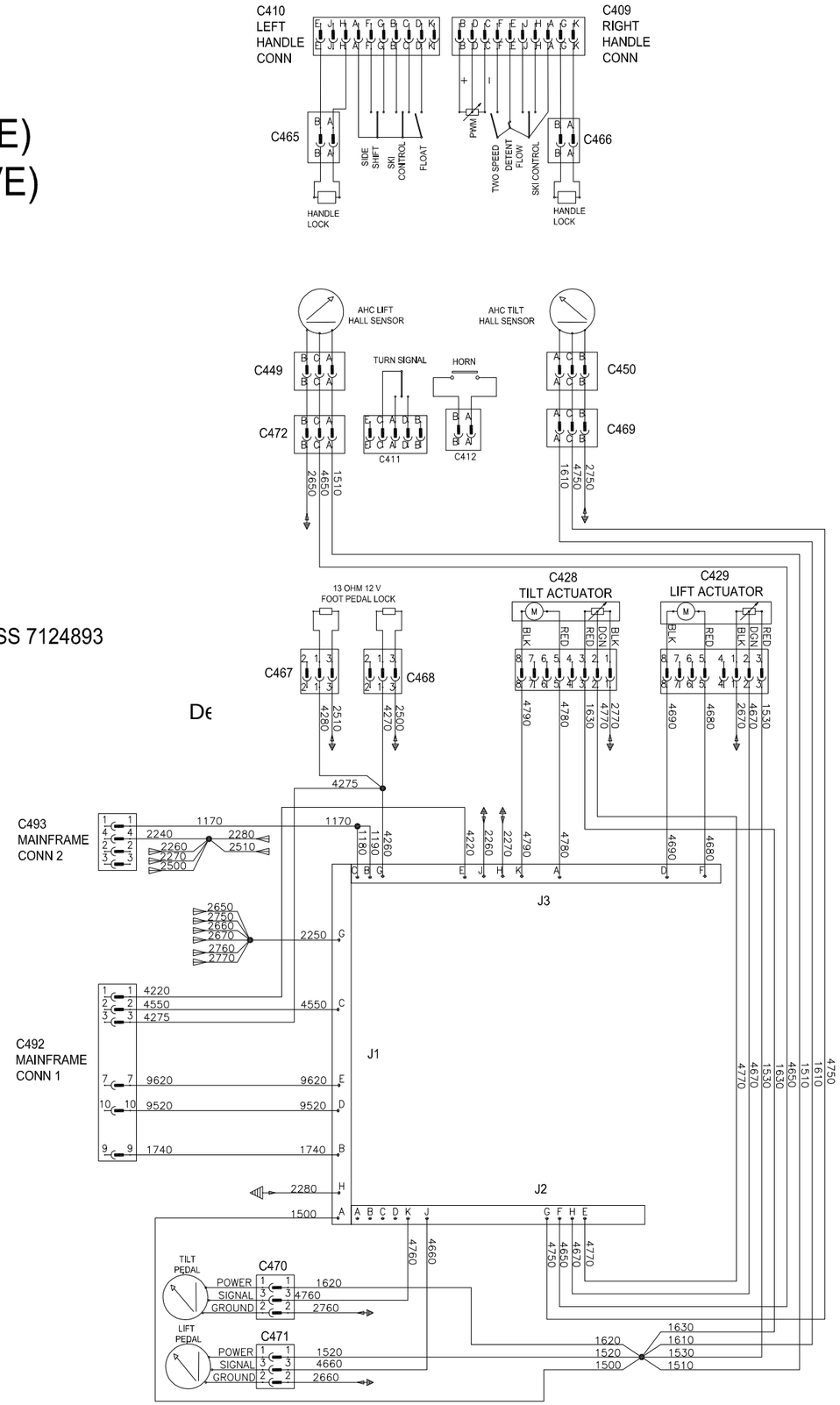
WIRING SCHEMATIC
(ACS)
S220 (S/N 530712577 AND ABOVE)
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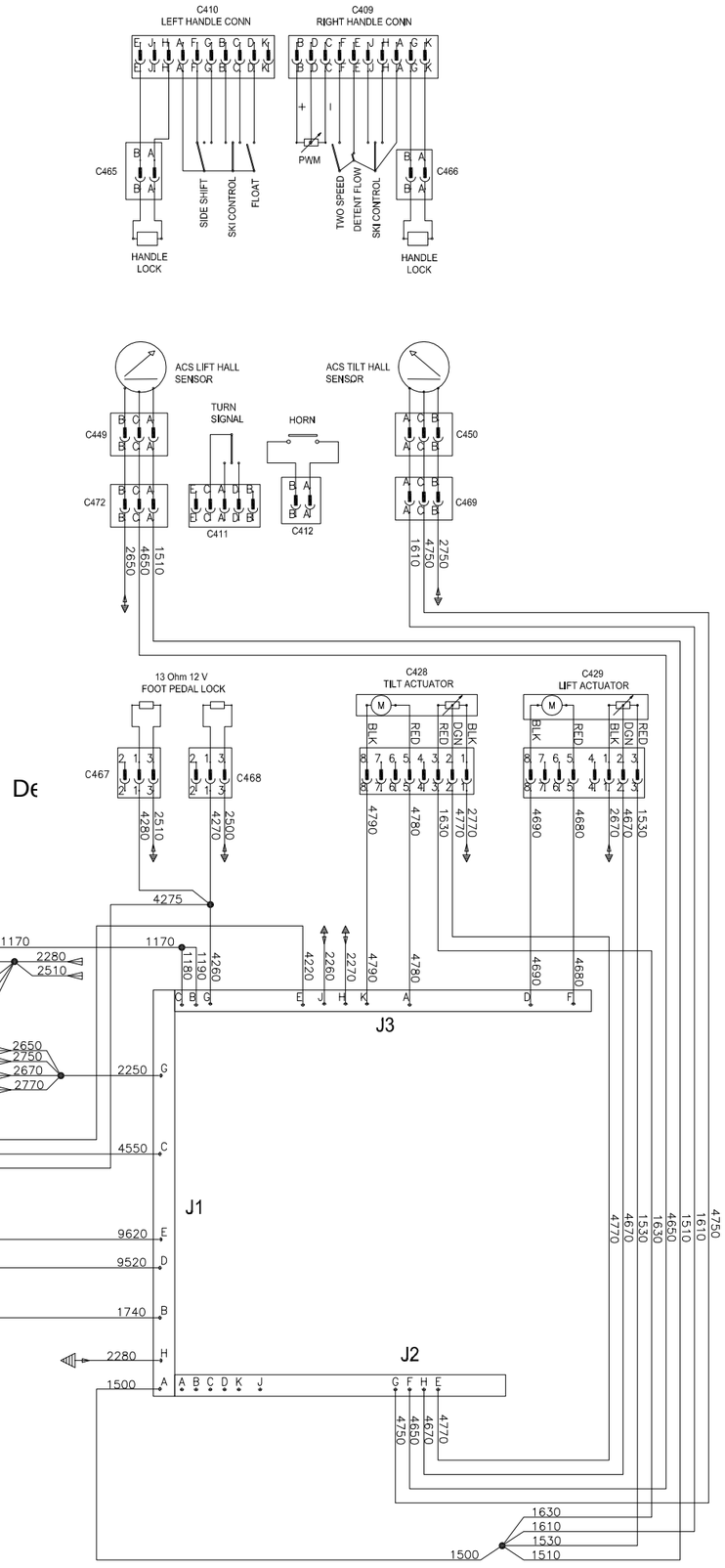
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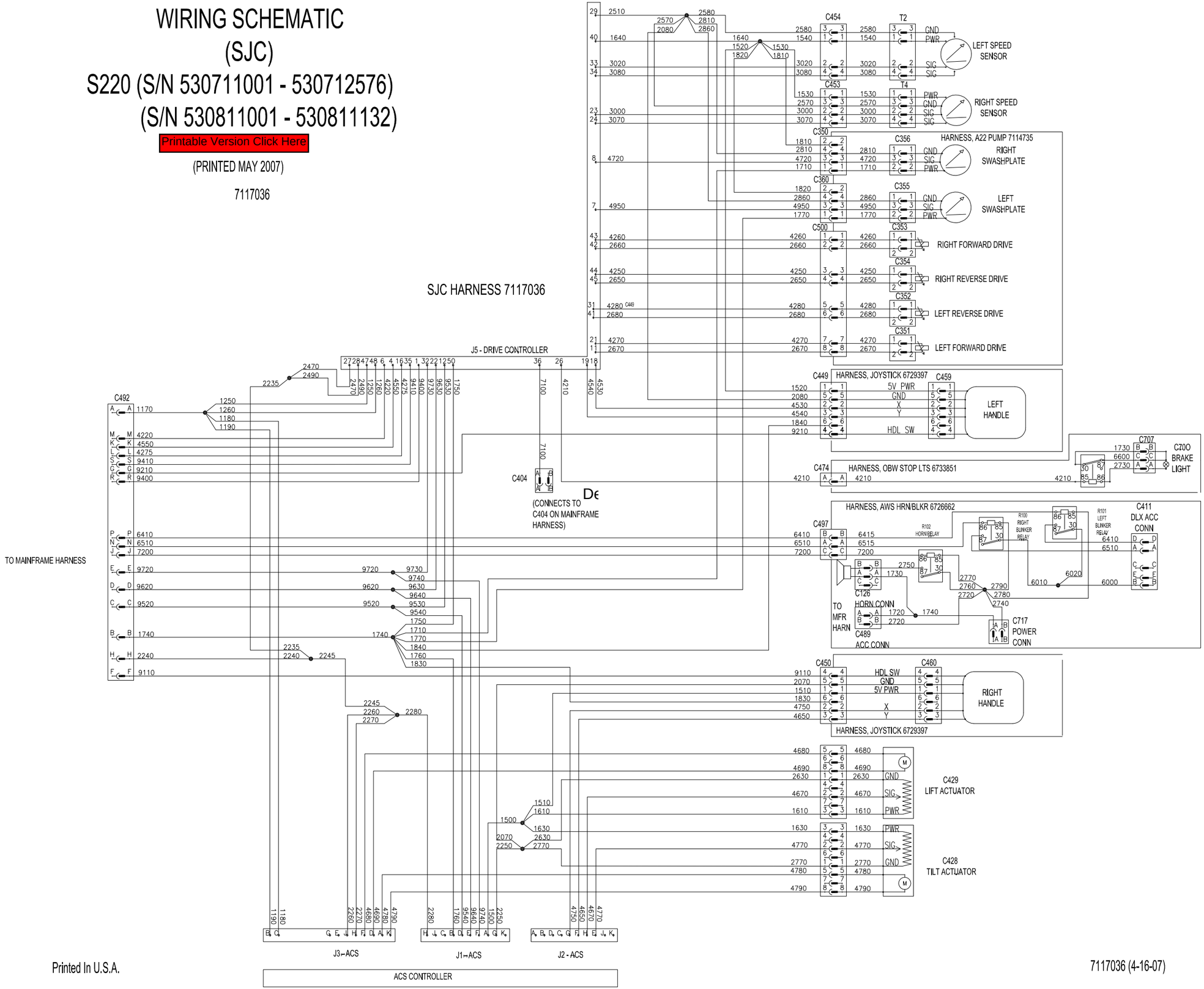
WIRING SCHEMATIC
(SJC)
S220 (S/N 530711001 - 530712576)
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SJC HARNESS 7117036



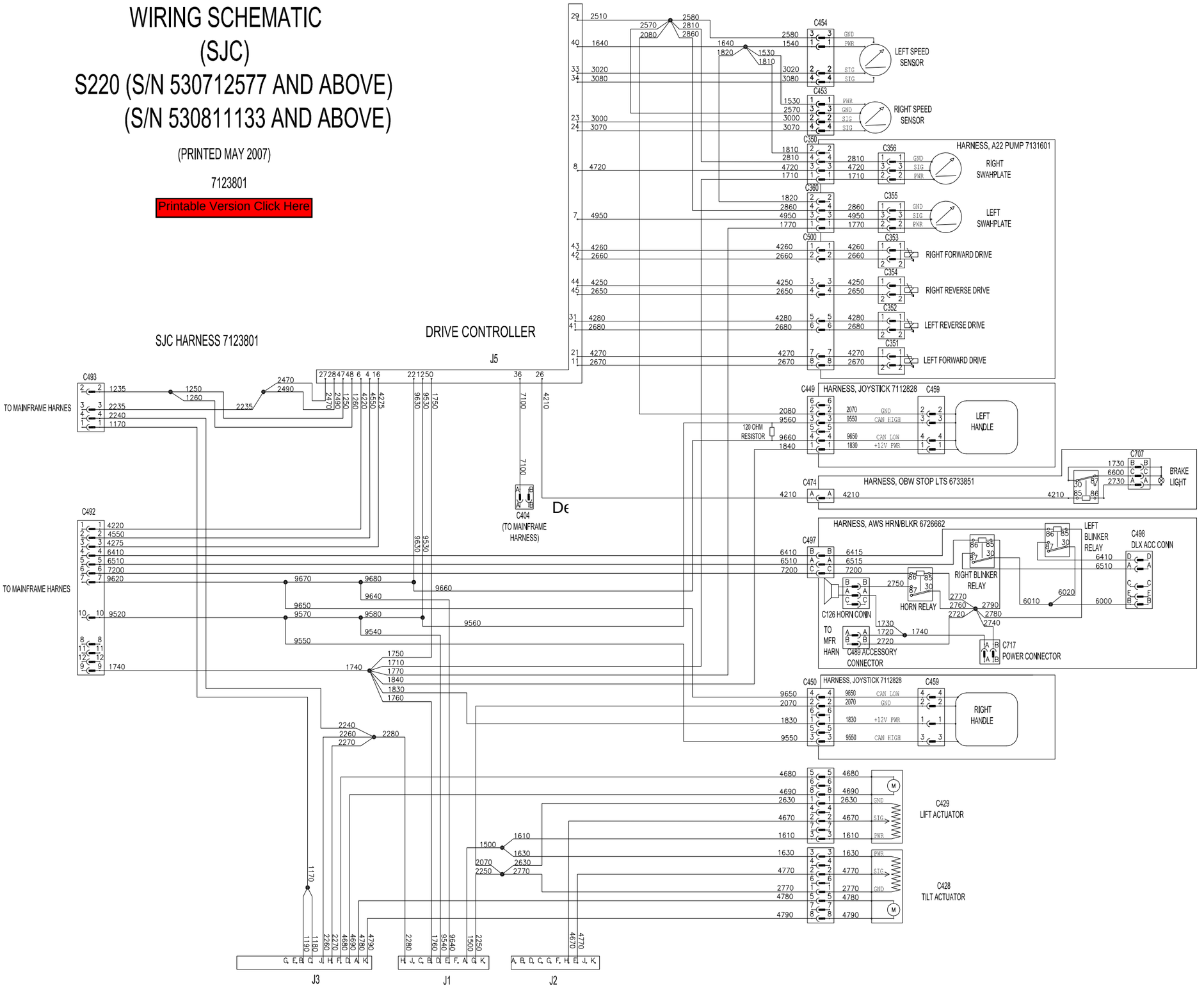
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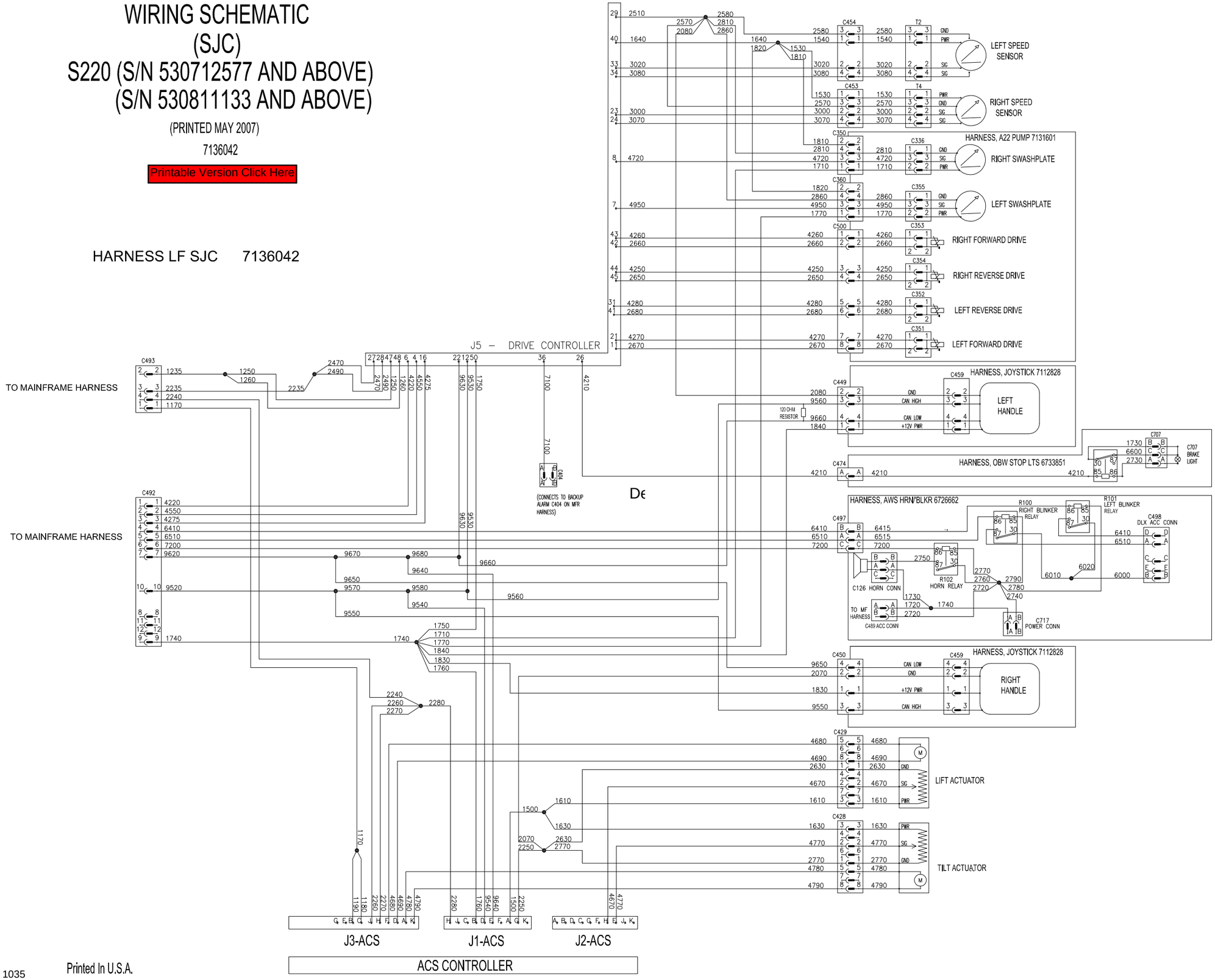
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S220 (S/N 530712577 AND ABOVE)
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HARNESS LF SJC 7136042



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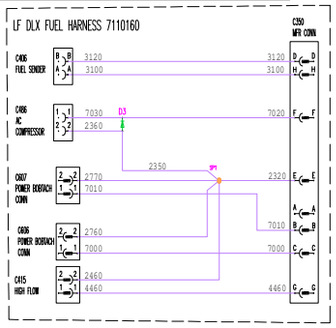
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OPTIONS

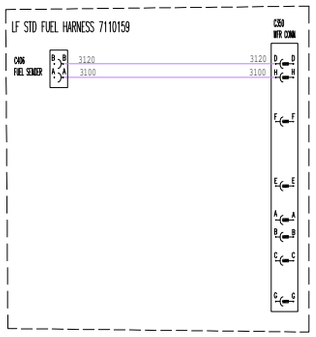
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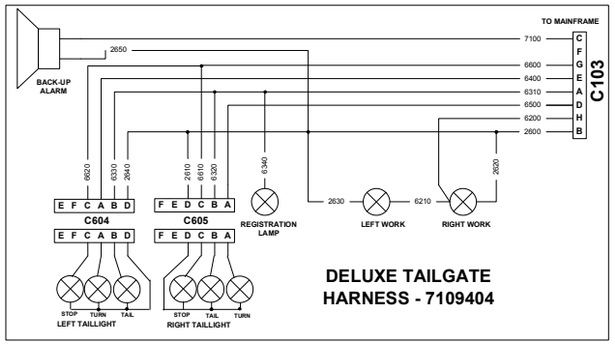
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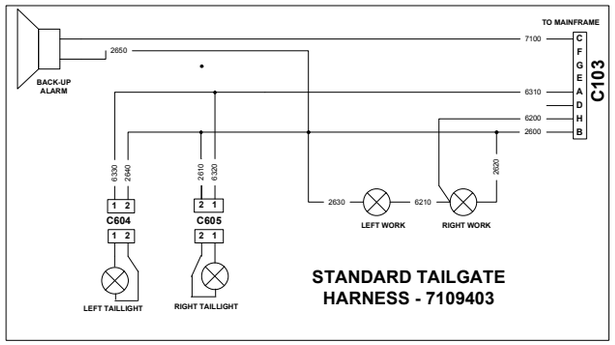
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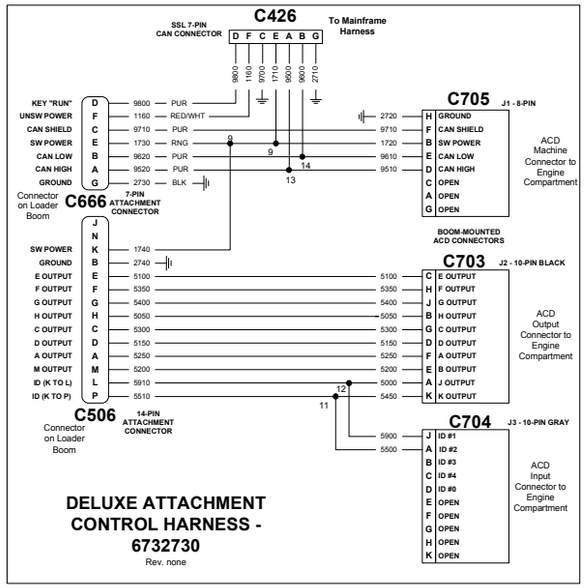
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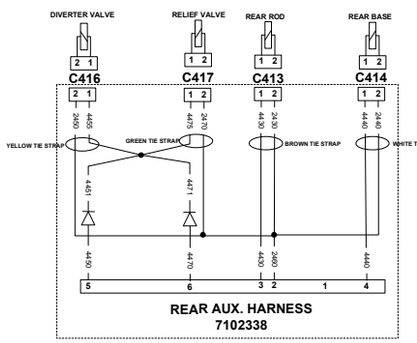


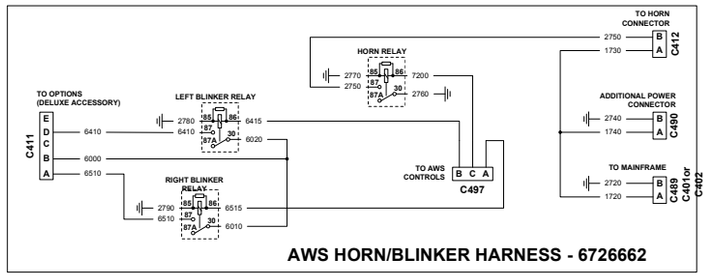


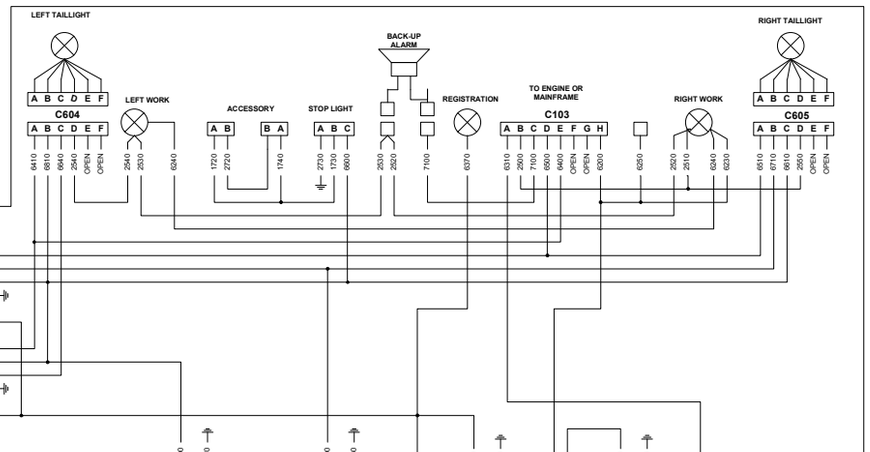


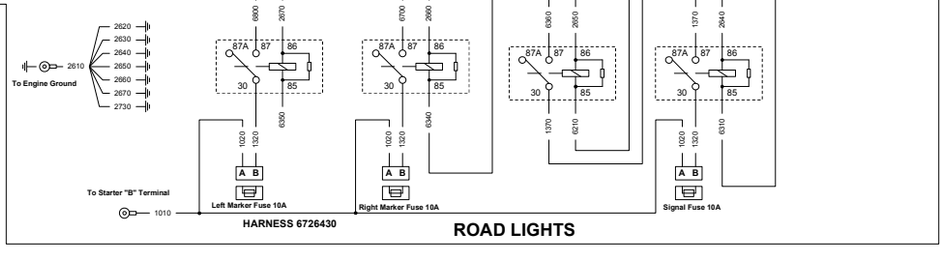


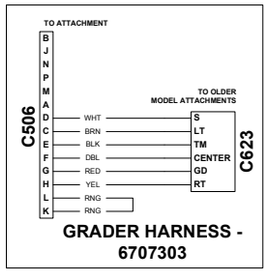


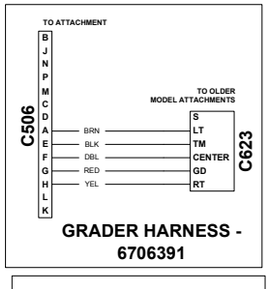


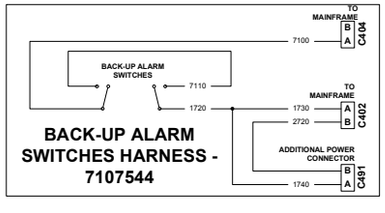


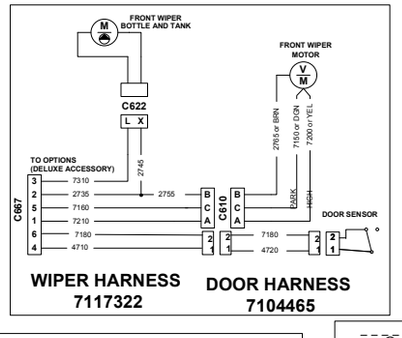


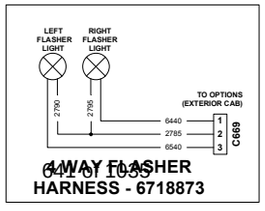


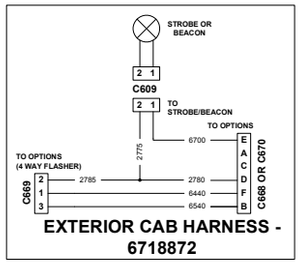


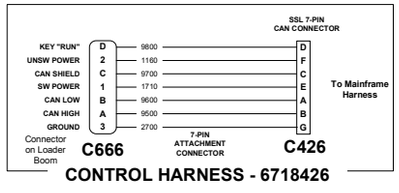


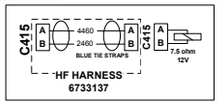


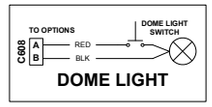












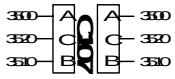
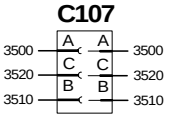
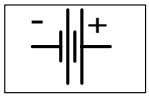
RED = RED
RNG = ORANGE
BLK = BLACK
LBL = LIGHT BLUE
DBL = DARK BLUE
LGN = LIGHT GREEN
DGN = DARK GREEN
YEL = YELLOW
PNK = PINK
WHT = WHITE
BRN = BROWN
TAN = TAN
PUR = PURPLE
GRY = GRAY

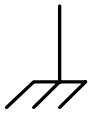
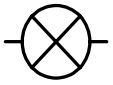
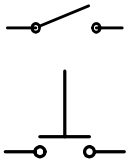
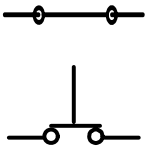
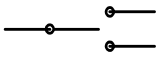
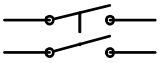
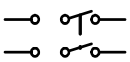
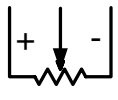
WIRES CONNECT BY LETTER ACROSS CONNECTORS

SOME CONNECTOR BODIES NOT SHOWN FOR DRAWING CLARITY

BATTERY FEED 1000-1999 RED, RED/WHT, RNG
GROUND 2000-2999 BLK
MONITORING 3000-3999 LBL
HYDRAULIC 4000-4999 LGN
ATTACHMENT CONTROLS 5000-5999 YEL
LIGHTS 6000-6999 PNK
ACCESSORIES 7000-7999 WHT
ENGINE 8000-8999 TAN
COMMUNICATION 9000-9999 PUR

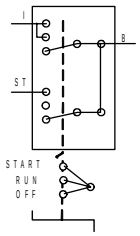
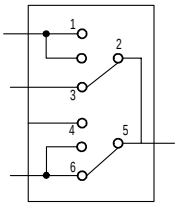
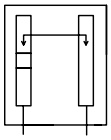
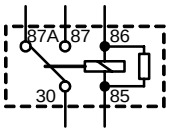
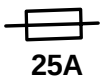
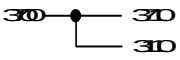
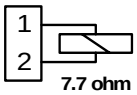
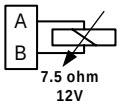
Glossary Of Electrical Symbols

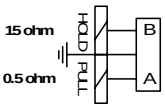
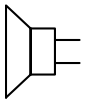
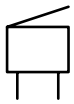
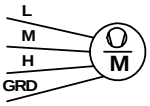
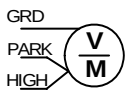
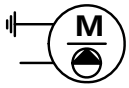
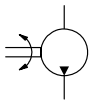
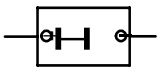
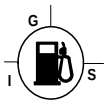
SYMBOL	DESCRIPTION
	CONNECTIONS
	CONNECTOR - Harness - Used for connecting 2 harnesses together or a harness to a component. The connector can vary from a single pin to any number of pins (Example: 3 pin connectors shown). The connector pins can be numbered alphabetical (shown) or numerical (1, 2, 3 etc.). The harness wires numbers are called out next to the connector (Example: 3500).
	The connector number is called out next to the connector (Example: C107). These connector numbers are used for schematic identification only and do not appear on the harness or connector.
	COMPONENTS
	BATTERY - Used for supplying and storing electrical power for the machine.
	POSITIVE ELECTRICAL CIRCUIT - Indicates positive battery circuit.
	NEGATIVE ELECTRICAL CIRCUIT - Indicates battery ground circuit.
	ALTERNATOR - Used to create the electrical current to supply voltage to the battery and components.
	STARTER - Uses battery current to start the machine engine.
	GROUND - Used to represent an external ground connection.

SYMBOL	DESCRIPTION
	COMPONENTS
	GROUND - Frame - Used to represent an component that is internally grounded.
	LIGHT -
	SWITCH - Single Pole - Single Throw (ON-OFF) Normally Open
	SWITCH - Single Pole - Single Throw (ON-OFF) Normally Closed.
	SWITCH - Single Pole - Double Throw (ON-OFF-ON) - This switch can be in any of three positions. (Some switches are spring activated to return them to a certain position when released.)
	SWITCH - Double Pole - Single Throw (ON-OFF) Open and Closed positions will be specified depending on switch application.)
	SWITCH - Double Pole - Double Throw (ON-OFF) Open and Closed positions will be specified depending on switch application.
	POTENTIOMETER - Variable resistance - Provides variable resistance.

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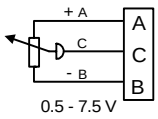
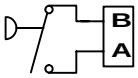
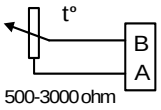
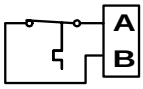
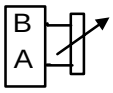
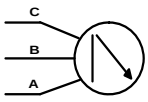
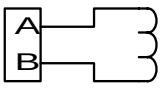
Glossary Of Electrical Symbols (Cont'd)

SYMBOL	DESCRIPTION
	COMPONENTS
	SWITCH - Ignition - Multi position switch to activate various start functions at different positions.
	SWITCH - Light - Multi position switch to activate various lights at different positions.
	ROTARY CONTROL - Provides variable voltage proportional to position.
	RELAY - Uses a low amp switch to control a high amp component.
 **25A**	FUSE - Used to protect the wire harness from an overloaded circuit. (The fuse rating is listed next to the fuse.)
	SPLICE (•) - Used to show when multiple wires are connected together on the schematic.
	SOLENOID - ON / OFF - Electrically activated coil that controls movement magnetically. (The ohm rating of the solenoid coil is listed next to the component [if available]).
	SOLENOID - VARIABLE - Electrically activated coil that controls movement magnetically. (The ohm rating and voltage of the solenoid coil is listed next to the component [if available]).

SYMBOL	DESCRIPTION
	SOLENOID - Fuel and Traction Lock - Dual solenoids. (The ohm rating of the solenoid coils are listed next to the component [if available]). The pull solenoid is energized for a short time.
	HORN - Audible alarm. Sound is activated manually by a switch to warn personnel.
	BUZZER - Audible alarm. Sounds at a predetermined setting to warn the operator of a component condition.
	RESISTOR - Limits current flow.
	DIODE - Allows electrical current to flow in 1 direction only.
	MOTOR - HVAC - Multi speed motor.
	MOTOR - Wiper - Single or multi speed motor.
	MOTOR - Washer - Single speed.
	PUMP - FUEL
	HOURMETER - Records the time the engine is running.
	POWER PLUG - Supplies 12 volt power for customer supplied accessories.
	GAUGE - Instrument - Indicates certain engine or other component conditions. (The different types of gauge are marked with a icon that represents what function the gauge is monitoring. Example: the gauge shown is for fuel.)

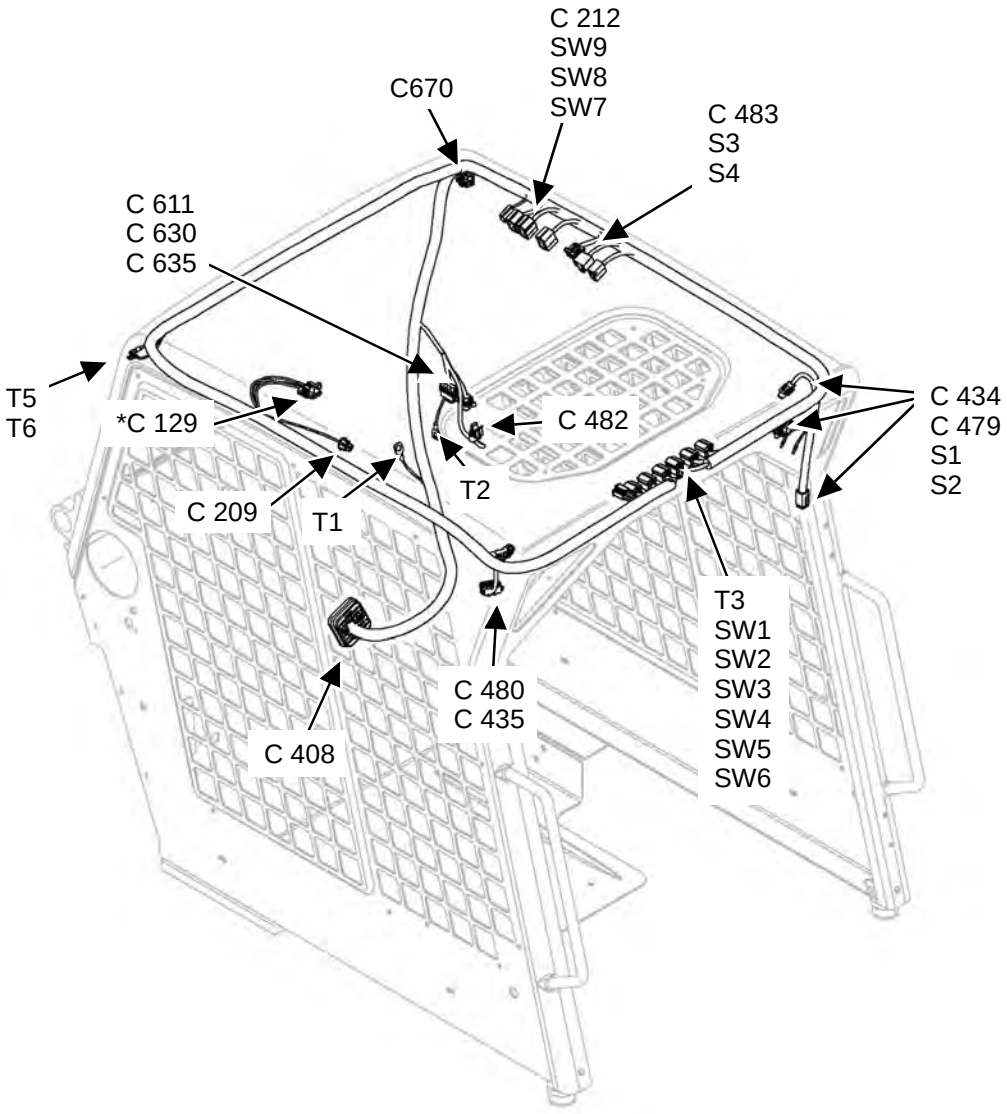
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Glossary Of Electrical Symbols (Cont'd)

SYMBOL	DESCRIPTION
	SENDERS AND SENSORS
	PRESSURE SENDER - Provides a variable voltage proportional to pressure. (Sender voltage rating is listed to show volts at high and low setting.)
	PRESSURE SWITCH - Switch opens or closes at a predetermined pressure to active a function or to turn on a warning light. (Switch is shown in the open position.)
	TEMPERATURE SENDER - Provides a variable resistance (ohm) signal proportional to temperature. (Sender ohm rating is listed to show ohms at high and low setting.)
	TEMPERATURE SWITCH - The switch opens or closes at a predetermined temperature to active a function or to turn on a warning light. (Switch is shown in the closed position.)
	FUEL SENDER - Provides a variable resistance, based on the fuel level in the tank. (Sender ohm rating is listed to show ohms at full and empty setting.)
	HALL EFFECT SENSOR - Detects linear or rotary position and provides a proportional variable voltage.
	SPEED SENSOR - magnetic pickup - detects RPM.

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Cab Harness Connectors

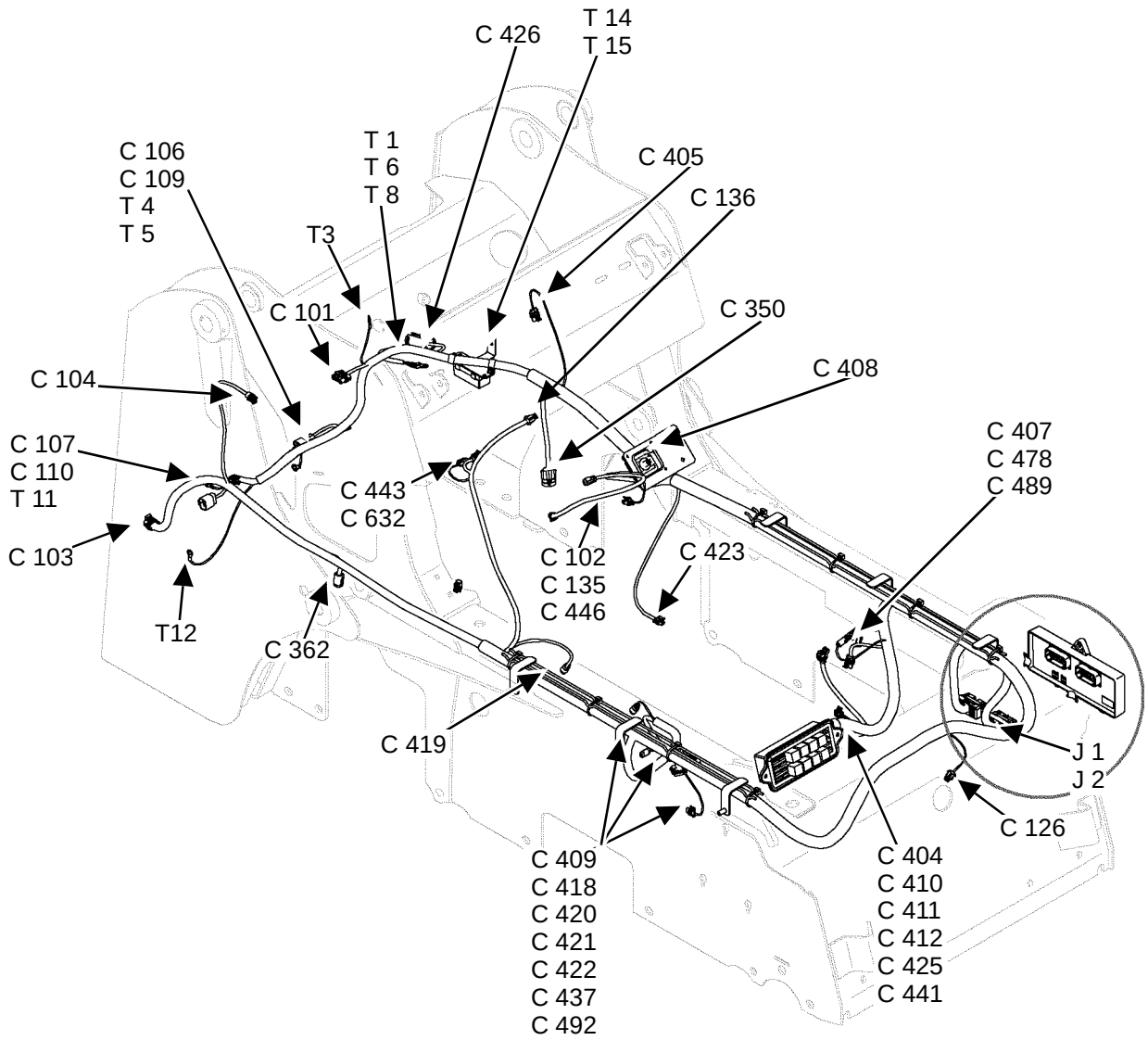


* S/N 530713760 & Above and 530811511 & Above

MS2441

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Mainframe Harness Connectors



MS2180

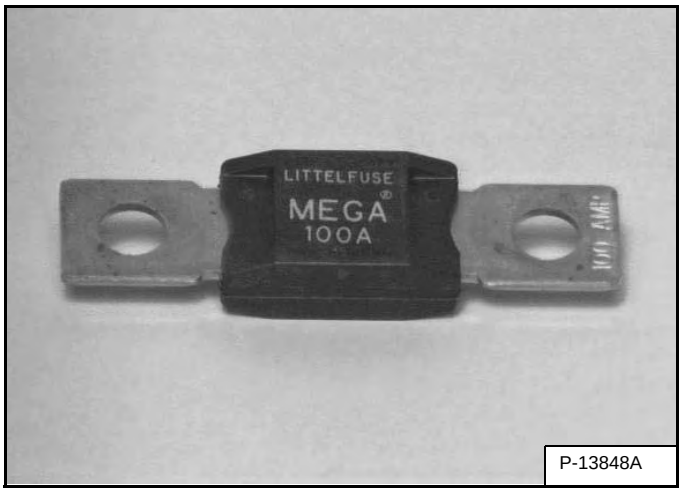
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Description

Figure 60-10-1



The loader has a 12 volt, negative ground alternator charging system. The electrical system is protected by a 100 amp master fuse (Item 1) **[Figure 60-10-1]** to protect against serious system overloads that could lead to a burned up harness or loader damage.

Figure 60-10-2

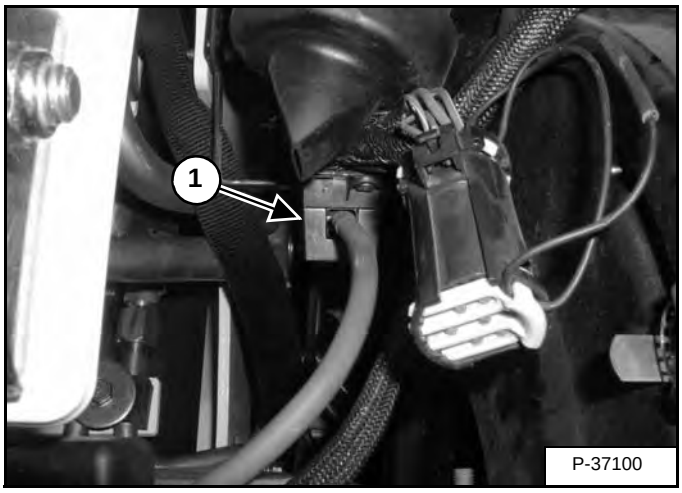
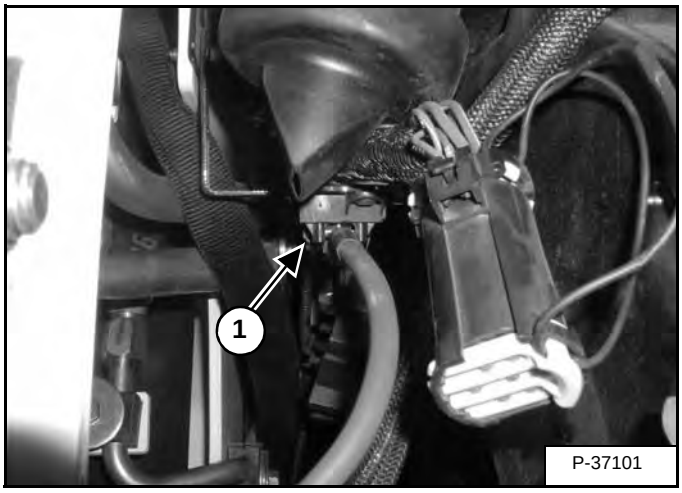


Figure 60-10-3

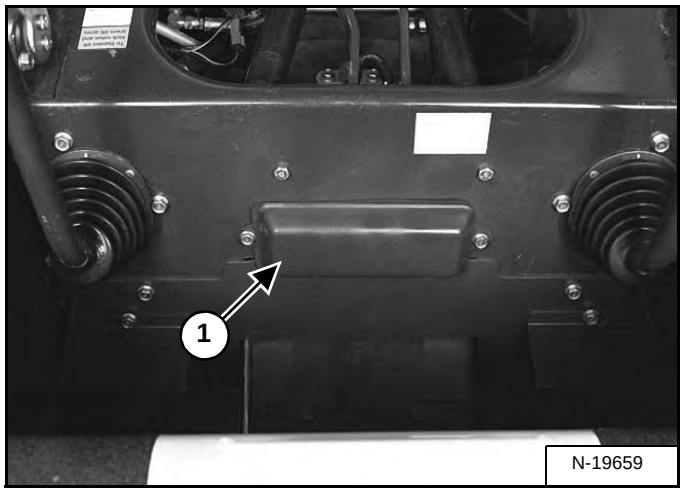


The fuse holder (Item 1) **[Figure 60-10-2]** & **[Figure 60-10-3]** is located in the engine compartment, below the air cleaner.

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Description (Cont'd)

Figure 60-10-4



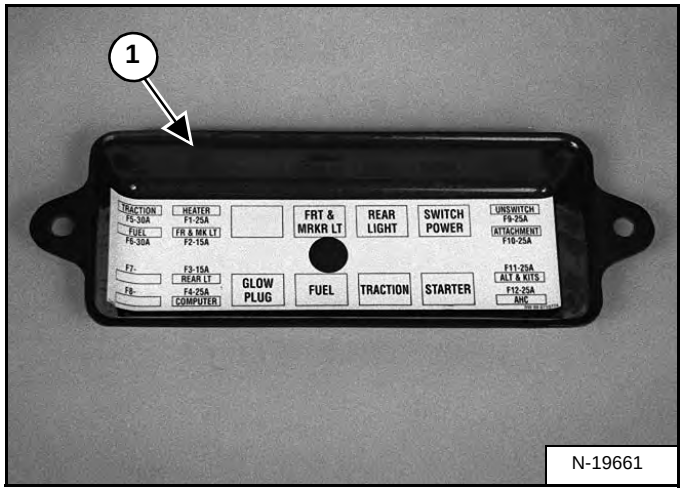
The electrical system is also protected by fuses and relays under the fuse panel cover (Item 1) **[Figure 60-10-4]** located in the cab on the steering control panel.

IMPORTANT

Do Not use silicone base sprays and/or sealants on harness connectors or components.

I-2123-0397

Figure 60-10-5



Remove the fuse panel cover (Item 1) **[Figure 60-10-4]**.

The fuse panel decal (Item 1) **[Figure 60-10-5]** is shown inside the cover.

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Troubleshooting

The following troubleshooting chart is provided for assistance in locating and correcting BICS system problems. It is recommended that these procedures 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 a charge.	1, 2, 3, 4, 5
Alternator will not charge.	1, 2, 5
Starter will not turn the 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 cable & wire connection are not making a good contact.
5. The alternator is damaged.
6. The engine is locked.
7. The starter is damaged.
8. The wiring or the solenoid is damaged.
9. Check the fuses.

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Fuse And Relay Location / Identification

Figure 60-10-6



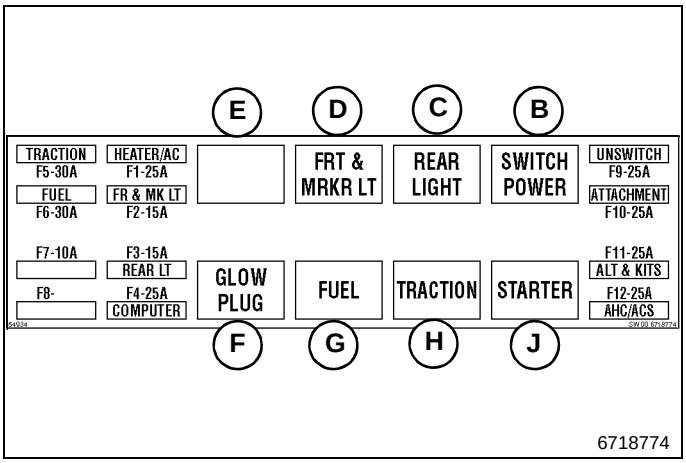
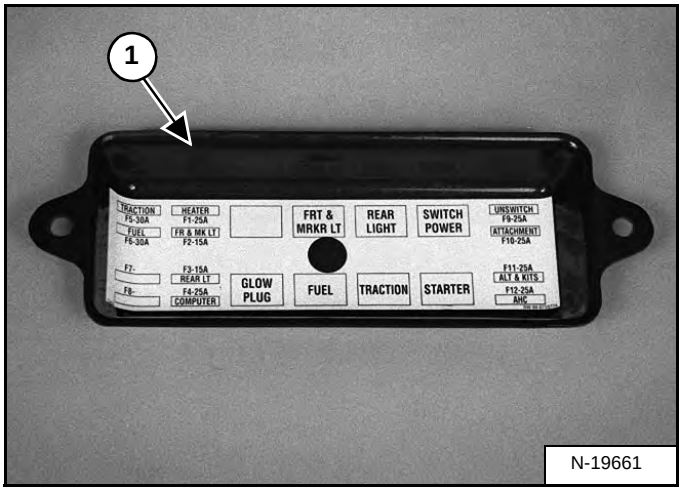


Figure 60-10-7



Remove the cover to check or replace the fuses.

The fuse location and sizes are shown in **[Figure 60-10-6]** & **[Figure 60-10-7]**.

Ref	Description	Amp.	Ref	Description	Amp.
F1	Heater	25	**F9**	Unswitched Attch.	25
F2	Front & Marker Lights	15	**F10**	Switched Attach.	25
F3	Rear Lights	15	**F11**	Alternator & Kits	25
F4	Bobcat Controller	25	**F12**	ACS/SJC/AWS Power	25
F5	Traction	30			
F6	Fuel Shutoff	30			
F7	*Not Used*	- -			
F8	*Not Used*	- -			

Remove the cover to check or replace the relays.

The Relay Switch location is shown in **[Figure 60-10-6]** & **[Figure 60-10-7]**.

Ref	Description	Ref	Description
B	Switch Power	**F**	Glow Plugs
C	Rear Lights	**G**	Fuel Shutoff
D	Front & Marker Lights	**H**	Traction
E	*Not Used*	**J**	Starter

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Solenoid Testing

Figure 60-10-8



Use a test meter to measure coil resistance **[Figure 60-10-8]**. Coil wires do not have polarity. Correct resistance for the pressure relief (small) coil is 7-10 ohm and the other coils 5-8 ohms.

Replace the test meter with 12 volt power. You can see and hear the spool shift.

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BATTERY

Removal And Installation

⚠ 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.

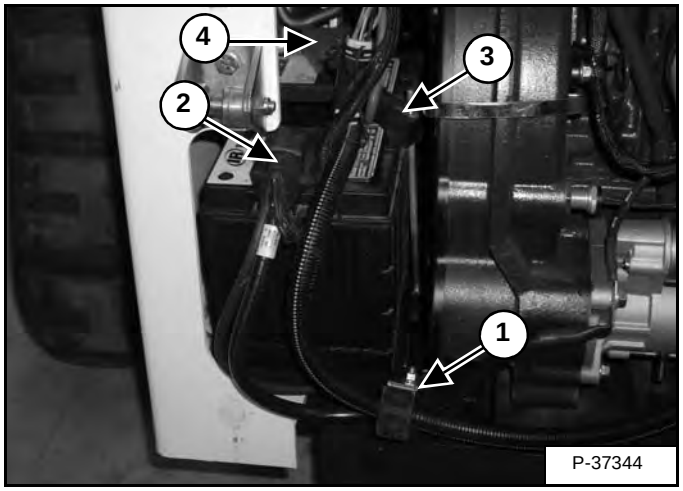
In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

Open the rear door.

Figure 60-20-1



Remove the harness clamp (Item 1) **[Figure 60-20-1]**.

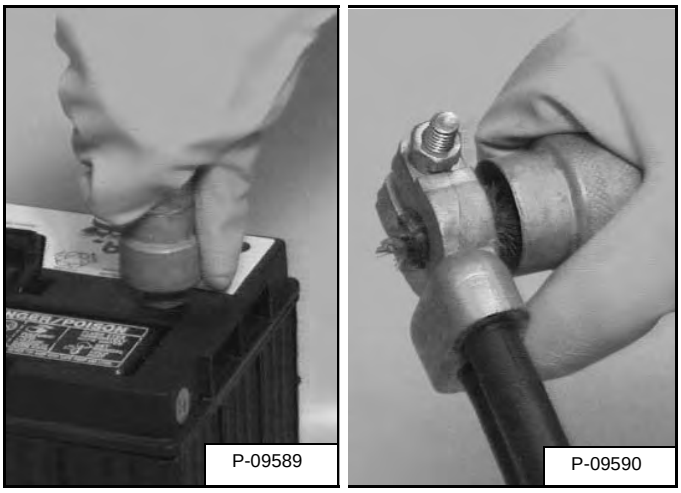
Disconnect the negative (-) cable (Item 2) **[Figure 60-20-1]**.

Remove the battery hold down clamp (Item 3) **[Figure 60-20-1]**.

Disconnect the positive (+) cable (Item 4) **[Figure 60-20-1]** from the battery.

Remove the battery from the loader.

Figure 60-20-2



Always clean the battery terminals and cable ends when installing a new or used battery **[Figure 60-20-2]**.

When installing the battery in the loader, do not touch any metal parts with the battery terminals.

Connect the negative (-) cable last to prevent sparks.

Connect and tighten the battery cables.

Install and tighten the battery hold down.

⚠ WARNING

AVOID 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 60°F (16°C) before connecting to a charger. Unplug charger before connecting or disconnecting cables to battery. Never lean over battery while boosting, testing or charging.

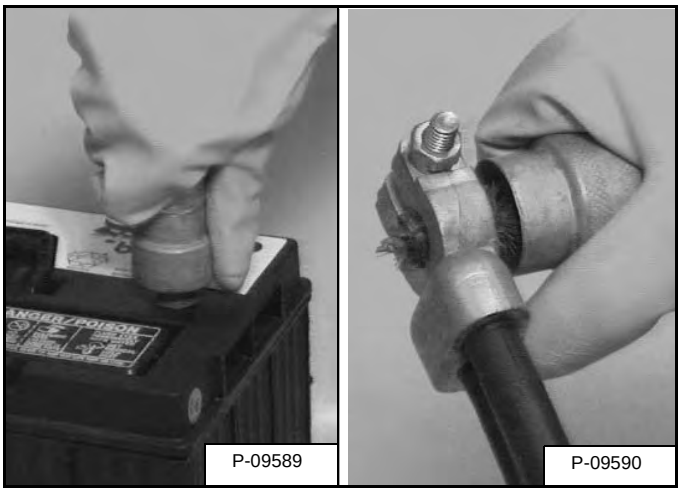
Battery gas can explode and cause serious injury.

W-2066-0705

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Servicing

Figure 60-20-3



The battery cables must be clean and tight **[Figure 60-20-3]**. Check electrolyte level in the battery. Add distilled water as needed. Remove acid or corrosion from battery and cables with sodium bicarbonate (baking soda) and water solution.

Put Battery Saver (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

BATTERY (CONT'D)

Using A Booster Battery (Jump Starting)

If it is necessary to use a booster battery to start the engine, BE CAREFUL! There must be one person in the operator's seat and one person to connect and disconnect the battery cables.

The key switch must be OFF *(Key Switch Panel)* OR the STOP button must be pressed *(Keyless Panel)*. The booster battery must be 12 volt.

⚠ WARNING

AVOID 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 60°F (16°C) before connecting to a charger. Unplug charger before connecting or disconnecting cables to battery. Never lean over battery while boosting, testing or charging.

Battery gas can explode and cause serious injury.

W-2066-0705

IMPORTANT

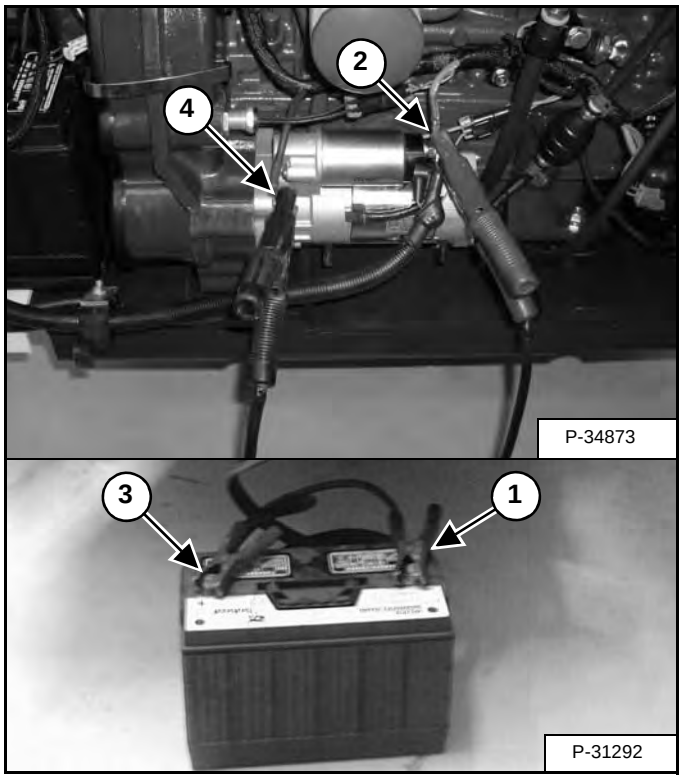
Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the loader. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

I-2023-1285

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Figure 60-20-4



Connect the end of the first cable (Item 1) **[Figure 60-20-4]** to the positive (+) terminal of the booster battery. Connect the other end of the same cable (Item 2) **[Figure 60-20-4]** to the positive terminal on the loader starter.

Connect the end of the second cable (Item 3) **[Figure 60-20-4]** to the negative terminal of the booster battery. Connect the other end of the same cable (Item 4) **[Figure 60-20-4]** to the engine.

Keep cables away from moving parts. Start the engine.

After the engine has started, remove the ground (-) cable (Item 4) **[Figure 60-20-4]** first. Remove the cable from the positive terminal (Item 2) **[Figure 60-20-4]**.

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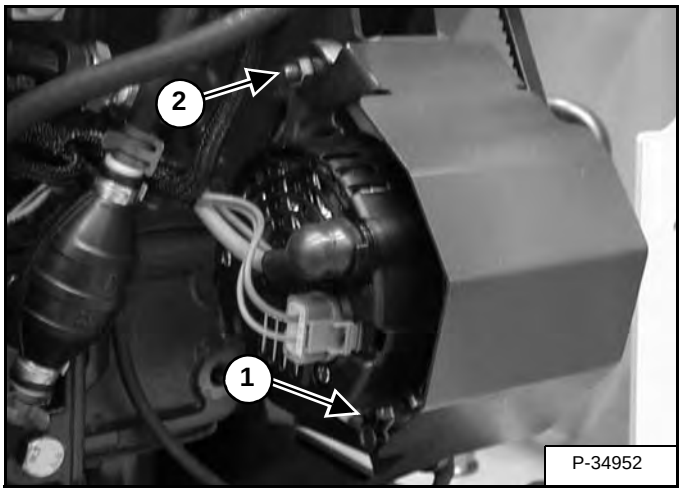


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ALTERNATOR

Belt Adjustment

Figure 60-30-1



Stop the engine and open the rear door.

Loosen the alternator adjustment bolt (Item 1) **[Figure 60-30-1]**.

At the top side of the alternator, loosen the alternator mounting bolt (Item 2) **[Figure 60-30-1]**.

Move the alternator until the belt has 5/16 inch (8,0 mm) movement at the middle of the belt span with 15 lb. (66 N) of force.

Tighten the adjustment bolts and mounting bolt.

Close the rear door.

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Charging System Inspection

WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

WARNING

AVOID 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 60°F (16°C) before connecting to a charger. Unplug charger before connecting or disconnecting cables to battery. Never lean over battery while boosting, testing or charging.

Battery gas can explode and cause serious injury.

W-2066-0705

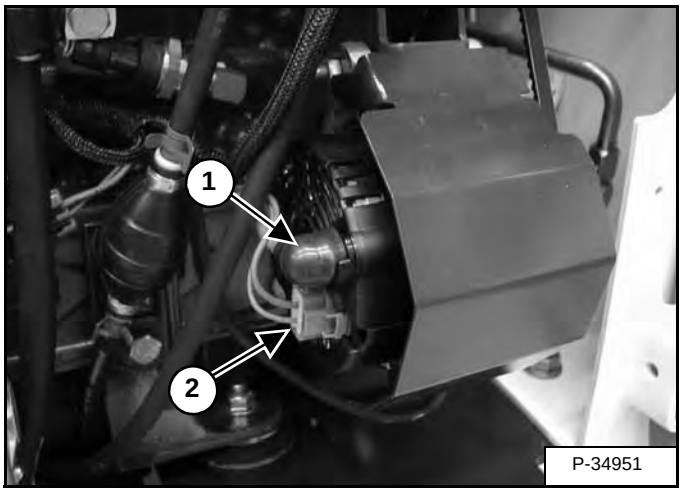
IMPORTANT

Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the loader. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

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Figure 60-30-2



If the charging system malfunctions check the following:

Check the condition and tension of the alternator belt. (See Belt Adjustment on Page 60-30-1.) If belt is worn or deteriorated replace.

Inspect the alternator wiring harness and connectors at alternator. Harness and connectors must be clean and tight.

Check the fuse for the alternator in the fuse panel. If fuse is burned, find the cause and repair/replace. If fuse is in doubt, remove it and check for continuity.

Check the electrolyte level in the battery. Add distilled water as needed. (Does not apply to maintenance free batteries.)

Verify the charge of the battery. Make sure battery is fully charged.

Disconnect the battery cables (negative first, then positive). Inspect the cable clamps and battery posts for corrosion. Remove acid or corrosion from the battery and cables with a sodium bicarbonate and water solution. Put grease on the cable ends and battery terminals to prevent corrosion. Reconnect the cable to the positive terminal.

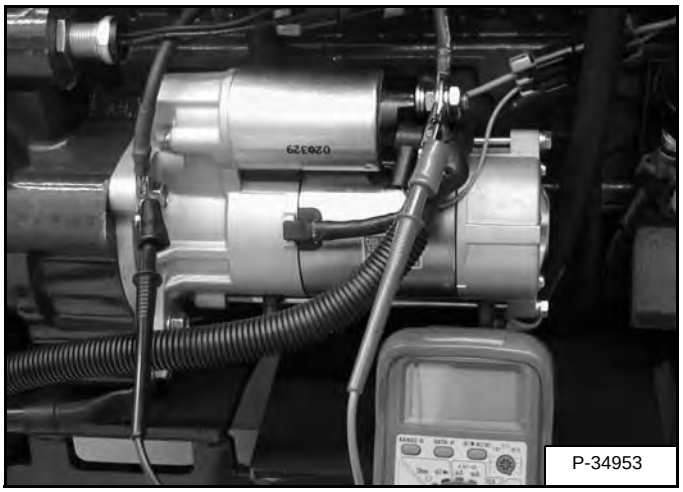
With the key off, connect a test light between the negative battery post and the disconnected negative cable clamp.

1. If the test light does not light up, reattach the clamp and proceed to alternator voltage test. (See Below.)
2. If the test light lights up, there is a short (drain) in the electrical system of the loader. The short must be repaired before the charging system can be checked.
3. Disconnect the alternator B+ terminal (Item 1) and L & S terminal connector (Item 2) **[Figure 60-30-2]** and if the test light goes out, the alternator is faulty. If the test light stays on, find the short in the system and repair it.

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Alternator Voltage Testing

Figure 60-30-3



Open rear door.

Connect the remote start tool to the loader. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.)

Turn the engine on with the remote start tool and run at idle. With a voltmeter, check the voltage between the B+ terminal and ground at the starter **[Figure 60-30-3]**.

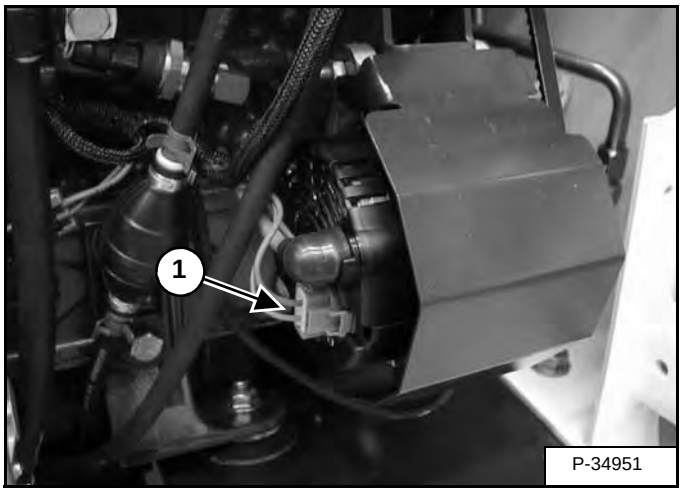
The voltage must be higher than 13.5 volts but lower than 14.7 volts at 70° F (Alternator Temperature).

If the voltage is higher that 14.7 volts, proceed to the following high voltage test.

If the voltage is lower than 13.5 volts, run the engine at high idle and recheck voltage. If voltage is still below 13.5 volts, proceed with the following low voltage test.

Low Voltage Testing

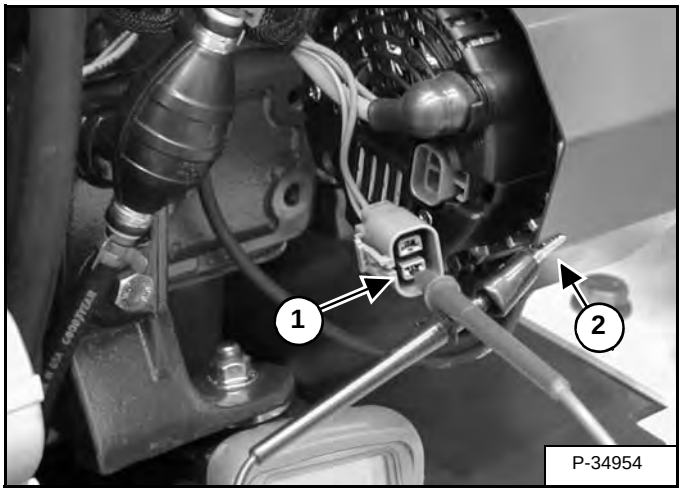
Figure 60-30-4



Turn engine OFF and remove the L & S terminal connector (Item 1) **[Figure 60-30-4]** off the alternator.

Turn the remote start tool key to the ON position.

Figure 60-30-5

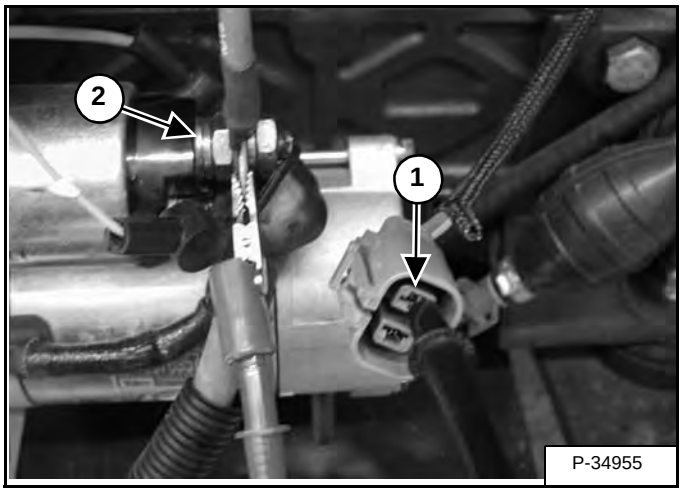


Check the voltage across the “L” terminal (Item 1) and ground (Item 2) **[Figure 60-30-5]**. The voltage should be what the battery voltage is. If not, check wire harness, relay and fuses. If the wire harness, relay and fuses are OK then remove alternator for replacement or repair.

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High Voltage Testing

Figure 60-30-6



Turn engine OFF and remove the L & S Terminal connector (Item 1) **[Figure 60-30-4]** off the alternator.

Check the continuity between the “S” terminal (Item 1) **[Figure 60-30-6]** and the positive (+) terminal on the battery or starter terminal (Item 2) **[Figure 60-30-6]**. There should be continuity. If no continuity, replace wire harness.

If voltage is still above 14.7 volts at 70° F (Alternator Temperature), then remove alternator for replacement or repair.

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Removal And Installation

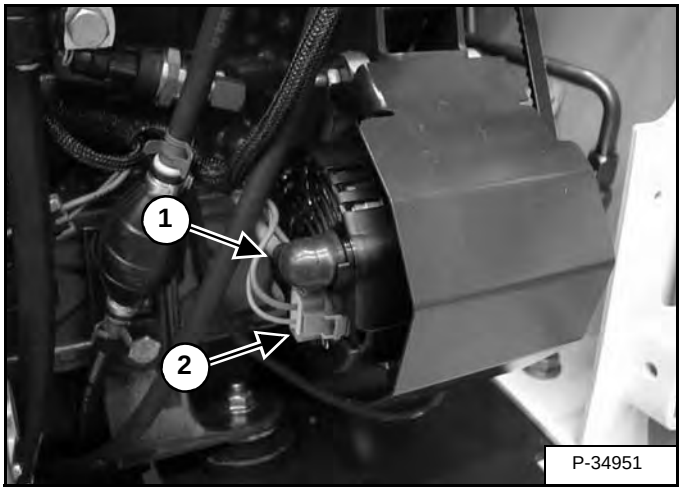
IMPORTANT

Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the loader. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

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Figure 60-30-7



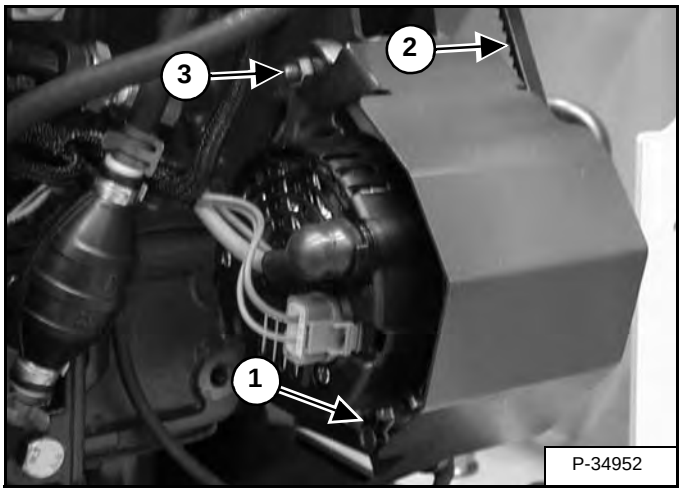
Place jackstands under the rear corners of the loader.

Disconnect the negative (-) cable from the battery.

Disconnect the red wire (Item 1) **[Figure 60-30-7]** from the alternator which comes from the battery.

Disconnect the wiring harness connector (Item 2) **[Figure 60-30-7]** from the alternator.

Figure 60-30-8



Remove the adjustment bolt (Item 1) **[Figure 60-30-8]** from the mounting bracket.

Remove the alternator belt (Item 2) **[Figure 60-30-8]** from the alternator pulley.

At the top of the alternator, remove the mounting bolt (Item 3) **[Figure 60-30-8]**.

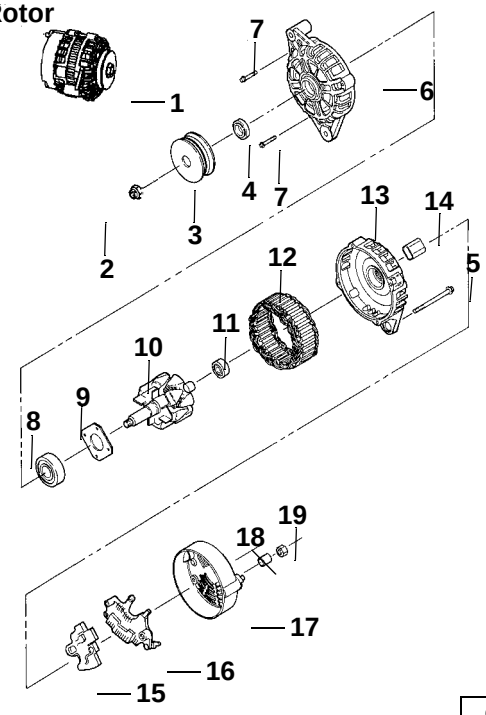
Remove the alternator from the loader.

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Parts Identification

Figure 60-30-9

1. Alternator
2. Nut
3. Pulley
4. Spacer
5. Bolt
6. Bracket
7. Bolt
8. Bearing
9. Retainer
10. Rotor
11. Bearing
12. Stator
13. Bracket
14. Sleeve
15. Regulator
16. Rectifier
17. Cover
18. Spacer
19. Nut

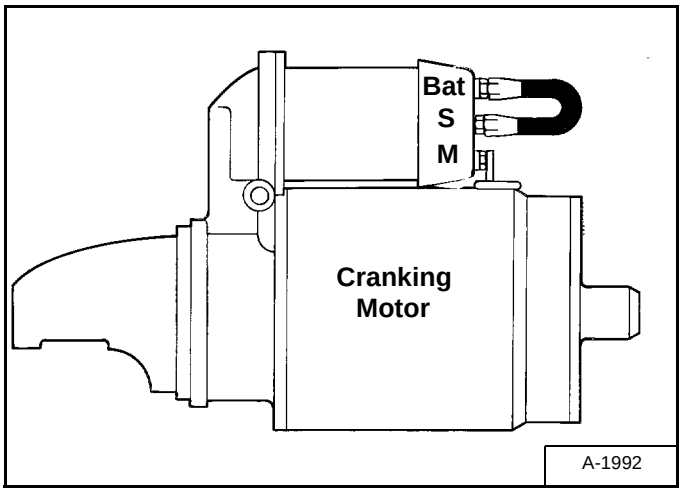


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STARTER

Testing

Figure 60-40-1



The key switch must be in the OFF position.

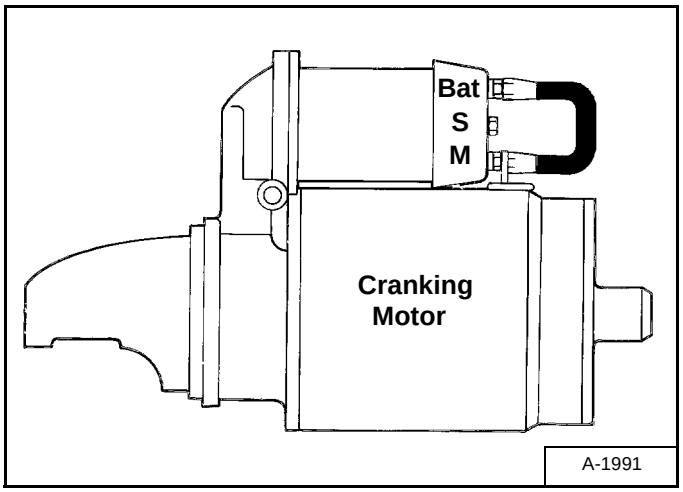
The battery must be at full charge.

The cable connections on the battery must be clean and tight.

Connect a jumper wire between S terminal and BAT terminal **[Figure 60-40-1]**.

If the starter turns but does not turn the engine, the starter drive has a defect.

Figure 60-40-2



Connect a jumper wire **(of at least 4 gauge in size)** between the M terminal and the BAT terminal **[Figure 60-40-2]**.

If the starter turns, the defect is in the solenoid.

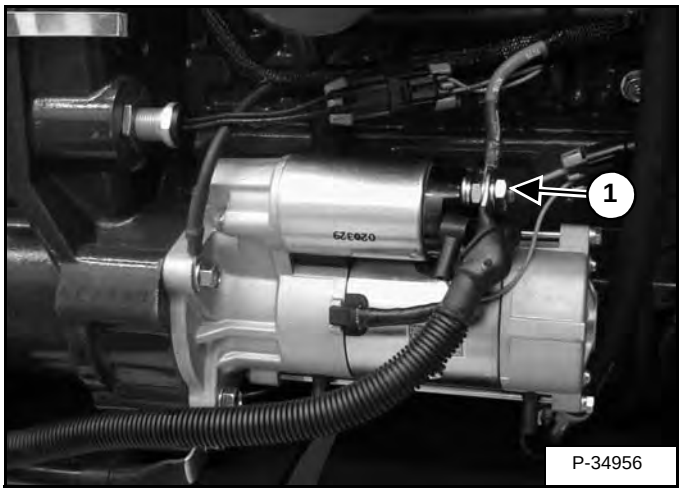
If the starter does not turn, the starter is defective.

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STARTER (CONT'D)

Removal And Installation

Figure 60-40-3



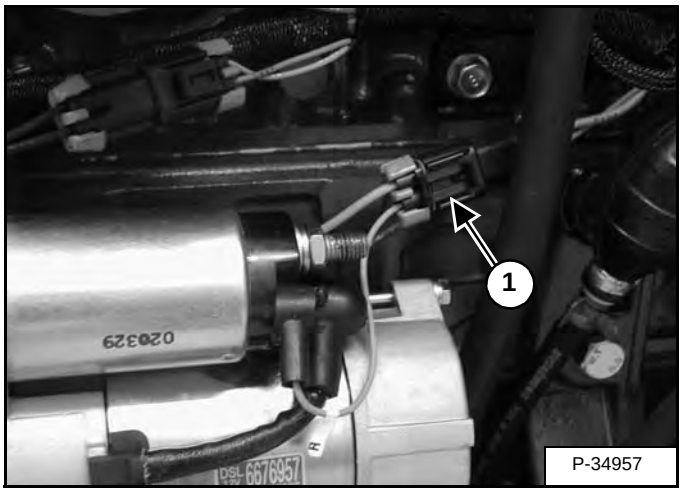
Open the rear door.

Disconnect the negative (-) cable from the battery.

Disconnect the wires and positive (+) cable (Item 1) **[Figure 60-40-3]** from the starter solenoid.

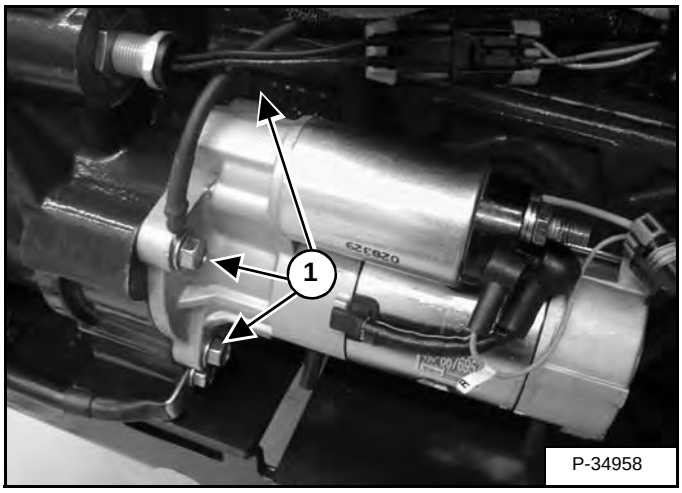
Installation: Tighten the nut to 10.8 -12.3 ft.-lb. (14,7-16,7 N•m) torque.

Figure 60-40-4



Disconnect the wire connector (Item 1) **[Figure 60-40-4]** from the two solenoid wires.

Figure 60-40-5

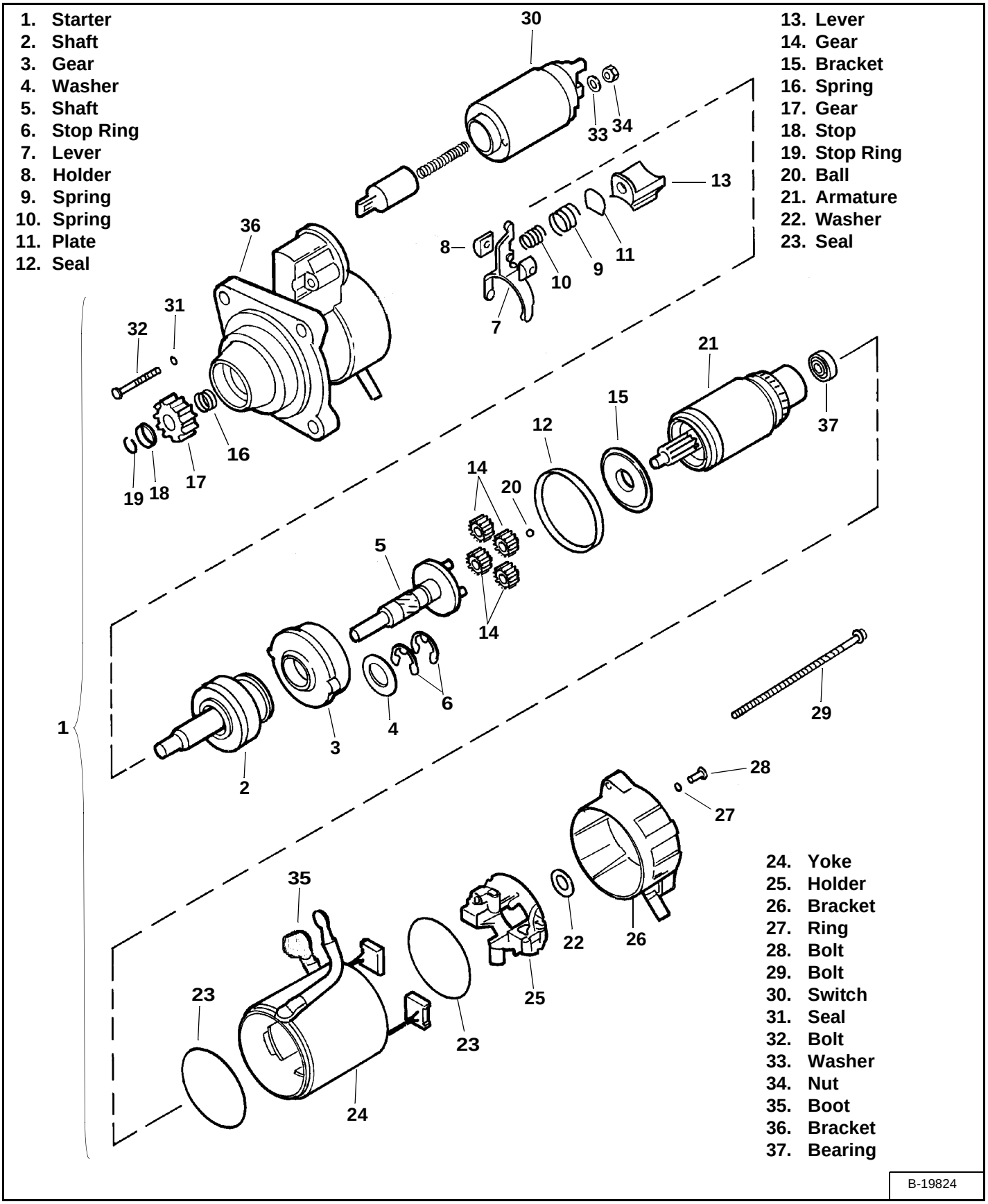


Remove the three mounting bolts (Item 1) **[Figure 60-40-5]**.

Remove the starter from the engine.

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Parts Identification



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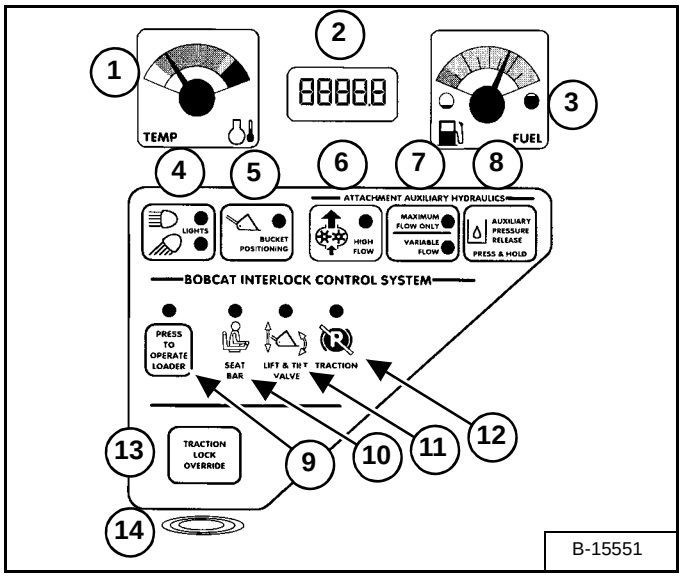


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INSTRUMENT PANELS

Left Panel

Figure 60-50-1



The left instrument panel **[Figure 60-50-1]** is the same for both Key Switch and Keyless equipped machines.

The table below shows the DESCRIPTION and FUNCTION / OPERATION for each of the components of the left panel.

REF. NO	DESCRIPTION	FUNCTION / OPERATION
1	TEMPERATURE GAUGE	Shows the engine coolant temperature.
2	HOURMETER / CODE DISPLAY / ENGINE PREHEAT COUNTDOWN	HOURMETER - Records operating hours of loader. CODE DISPLAY - Display numeric SERVICE CODES* relating to the loader monitoring system. ENGINE PREHEAT COUNTDOWN - Preheat time remaining.
3	FUEL GAUGE	Shows the amount of fuel in the tank.
4	LIGHTS / HOLD FOR CODES	LIGHTS - Press once for FRONT LIGHTS. Press a second time for FRONT AND REAR lights. Press a third time to turn all lights off. HOLD FOR CODES - Press and hold two seconds for display of SERVICE CODES (Item 2). (CODES* show only when there is an error found by loader monitoring system.)
5	BUCKET POSITIONING (Option)	Press to engage the BUCKET POSITIONING function. Press again to disengage. Press and hold two seconds to view [SHTDN] and Operational Code Number in HOURMETER / CODE DISPLAY.
	ATTACHMENT AUXILIARY HYDRAULICS	
6	HIGH FLOW (Option)	Press to engage the HIGH FLOW auxiliary hydraulics. Press again to disengage.
7	MAXIMUM FLOW / VARIABLE FLOW	Press once to engage the VARIABLE FLOW auxiliary hydraulics. Press a second time to engage MAXIMUM FLOW. Press a third time to disengage all auxiliary hydraulics. [VARIABLE FLOW allows for slow-to-fast movement of auxiliary functions (The farther you move the switch, the faster the movement of auxiliary functions.) MAXIMUM FLOW allows for only fast movement.]
8	AUXILIARY PRESSURE RELEASE	Rear Auxiliary Only - With key ON and engine running, press to shut down engine and relieve rear auxiliary hydraulic pressure. (See Relieve Hydraulic Pressure - Loader and Attachment Page OI-23 for front auxiliary pressure release.)
	BOBCAT INTERBLOCK CONTROL SYSTEM (BICS)	
9	PRESS TO OPERATE LOADER	Press to activate BICS when the Seat Bar is down and operator is seated in operating position.
10	SEAT BAR	The light comes *ON* when the seat bar is down.
11	LIFT & TILT VALVE	The light comes *ON* when the seat bar is down and the PRESS TO OPERATE button is pressed. The lift and tilt functions can be operated when the light is *ON*.
12	TRACTION	The light comes *ON* when the seat bar is down, engine is running, and parking brake is released. The loader can be moved forward or backward when the light is *ON*.
13	TRACTION LOCK OVERRIDE	(Functions Only When Seat Bar Is Raised And The Engine Is Running) Press to unlock the brakes. Allows you to use the steering levers to move the loader forward or backward when using the backhoe attachment or for loader service. (See TRACTION LOCK OVERRIDE Page OI-12). Press a second time to lock the brakes.
14	ALARM	The ALARM beeps when there is an Error, WARNING or SHUTDOWN condition.

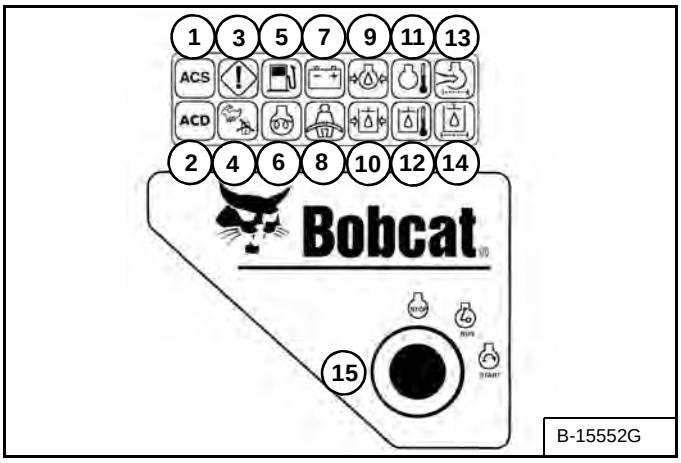
* See SYSTEM SETUP & ANALYSIS, (See DIAGNOSTIC SERVICE CODES on Page 60-90-1) for further description of SERVICE CODES.

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INSTRUMENT PANELS (CONT'D)

Right Panel (Key Switch)

Figure 60-50-2



The right instrument panel shown **[Figure 60-50-2]** is the Key Switch Panel.

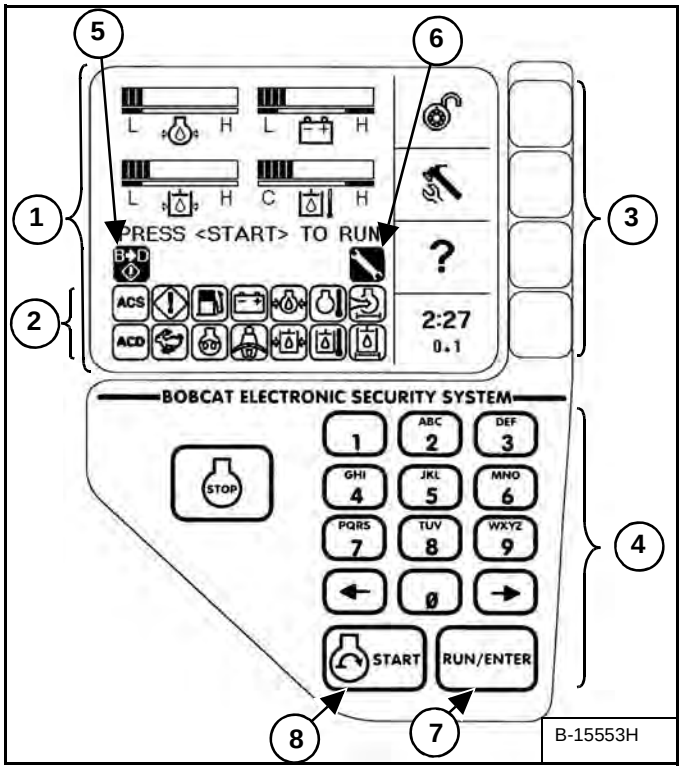
The table below shows the icons and other components of the Right Key Switch Panel.

REF.	FUNCTION	ICON/ LIGHT	ALARM	CODE	CONDITION	DESCRIPTION
1	Advanced Control System (ACS)	ON	3 Beeps	*	Error	Error with Advanced Control System (ACS).
2	Attachment Control Device (ACD)	ON FLASHING	- - - 3 Beeps	- - - *	- - - Error	Electrical controlled attachment is present. Error with Attachment Control Device (ACD).
3	General Warning	ON ON FLASHING	3 Beeps 3 Beeps Continuous	* ** 	Error WARNING SHUTDOWN	Error with one or more engine or hydraulic functions. Engine speed high or in shutdown. Engine speed very high. Engine will stop in 10 seconds.
4	NOT USED	- - -	- - -	- - -	- - -	- - -
5	Fuel Level	ON FLASHING	3 Beeps 3 Beeps	* *	Error WARNING	Fuel level sender system fault. Fuel level low.
6	Engine Preheat	ON FLASHING	- - - 3 Beeps	- - - *	- - - Error	Air Intake Heater energized. Error with Air Intake Heater.
7	System Voltage	ON	3 Beeps	*	WARNING	Voltage low, high or very high.
8	Seat Belt	ON	- - -	- - -	- - -	Light stays on for 45 seconds to remind operator to fasten seat belt.
9	Engine Oil Pressure	ON ON FLASHING	3 Beeps 3 Beeps Continuous	* * *	Error WARNING SHUTDOWN	Engine oil pressure sender out of range. Engine oil level low. Engine oil pressure very low. Engine will shutdown in 10 seconds.
10	Hydrostatic Charge Pressure	ON ON FLASHING	3 Beeps 3 Beeps Continuous	* * *	Error WARNING SHUTDOWN	Hydraulic oil pressure sender out of range. Hydraulic oil pressure low. Hydraulic charge pressure very low. Engine will stop in 10 seconds.
11	Engine Coolant Temperature	ON ON FLASHING	3 Beeps 3 Beeps Continuous	* * *	Error WARNING SHUTDOWN	Engine coolant sender out of range. Engine coolant temperature high. Engine coolant temperature very high. Engine will stop in 10 seconds.
12	Hydraulic Oil Temperature	ON ON FLASHING	3 Beeps 3 Beeps Continuous	* * 	Error WARNING SHUTDOWN	Hydraulic oil temperature out of range. Hydraulic oil temperature high. Hydraulic oil temperature very high. Engine will stop in 10 seconds.
13	Engine Air Filter	ON FLASHING	3 Beeps 3 Beeps	* *	Error WARNING	Air filter with high restriction. Air filter switch not connected.
14	Hydraulic Filter	ON FLASHING	3 Beeps 3 Beeps	* *	Error WARNING	Hydraulic filter with high restriction. Hydraulic filter switch not connected.
15	Key Switch	- - -	- - -	- - -	- - -	Used to start and stop the engine.

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Right Panel (Keyless)

Figure OI-3



The right instrument panel shown **[Figure OI-3]** is the Keyless Panel.

1. **Display Screen:** The Display Screen is where all system setup, monitoring, troubleshooting, and error conditions are displayed.

2. **Function Icons:** The lower left area of the Display Screen contains the same icons as the Key Switch Panel. These icons are only visible when the monitoring system has detected the associated condition.

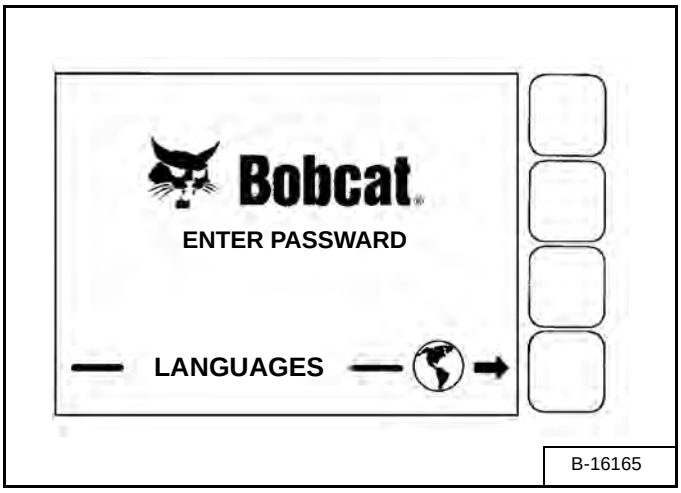
3. **Selection Buttons:** The four Selection Buttons allow you to select items from the Display Screen and scroll through screens.

4. **Keypad:** The numeric keypad has two functions:
   - To enter a number code (password) to allow starting the engine (Keyless Start).
   - To enter a number as directed for further use of the Display Screen.

5. **Bobcat Controller / Display Icon:** Indicates communication error between Bobcat controller and instrument panel. (See DIAGNOSTIC SERVICE CODES on Page 60-90-1)

6. **BobCARE PM^{SM} Icon:** Indicates planned maintenance is due. (See MAINTENANCE CLOCK on Page 60-200-1.)

Figure 60-50-4



The first screen you will see on your new loader will be as shown in **[Figure 60-50-4]**.

When this screen is on the display you can enter the password and start the engine or change the Display Screen setup features.

NOTE: Your new loader (with Keyless Instrument Panel) will have an Owner Password. Your dealer will provide you with this password. Change the password to one that you will easily remember to prevent unauthorized use of your loader. (See Changing The Owner And User Passwords on Page 60-190-2.) Keep your password in a safe place for future needs.

Start Engine: Press the RUN / ENTER key (Item 7) and use the Keypad (Item 4) **[Figure OI-3]** to enter the numbers (letters) of your password.

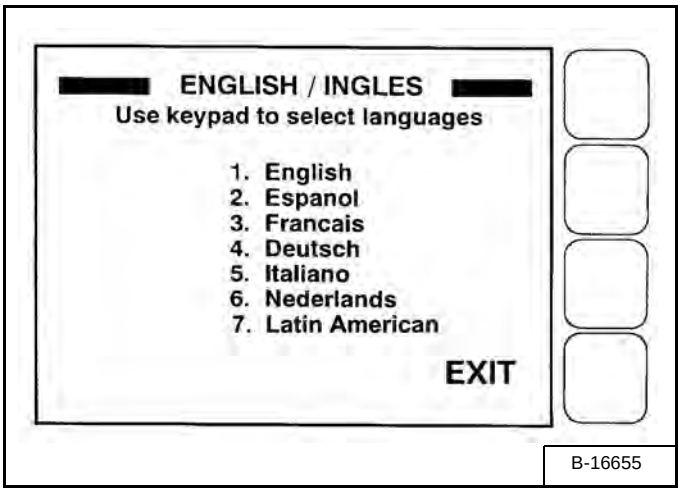
Press and hold the START button (Item 8) **[Figure OI-3]** until the engine starts.

Change Language: Press the Selection Button at the end of the arrow **[Figure 60-50-4]** to go to the next screen.

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Right Panel (Keyless) (Cont'd)

Figure 60-50-5



Use the Keypad to select the number of the language **[Figure 60-50-5]**.

Press EXIT. The screen will return to **[Figure 60-50-4]**. You can then enter the password and start the engine.

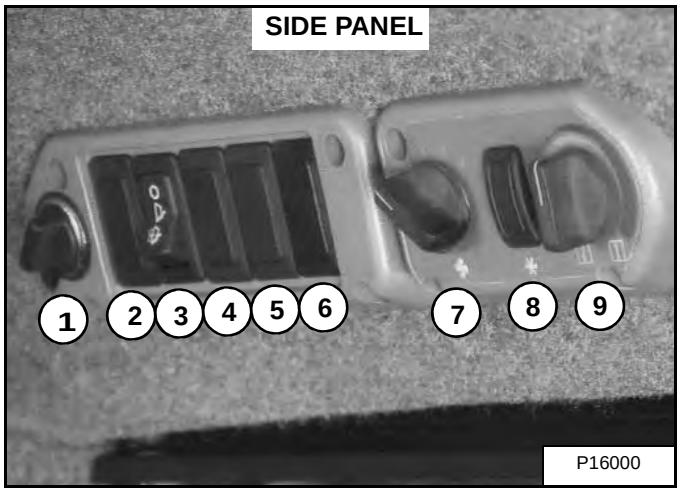
For further description of screens to setup the system for your use (See CONTROL PANEL SETUP on Page 60-180-1.)

NOTE: Pressing the EXIT key will go to the pervious screen and you can continue pressing until you get to the initial (home) screen. SHORTCUT: Press the "0" (zero) key to get to the home screen immediately.

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Side And Front Panels

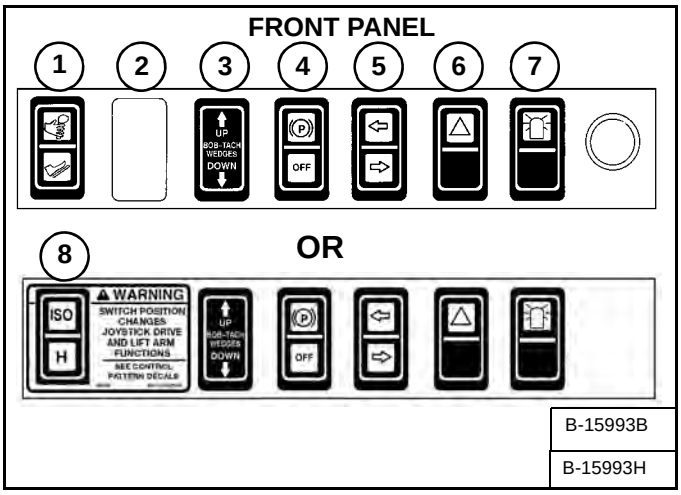
Figure 60-50-6



Side Panel
[Figure 60-50-6]

REF. NO.	DESCRIPTION	FUNCTION / OPERATION
1	POWER PLUG (Option)	Provides a 12V receptacle for accessories.
2	NOT USED	- - -
3	FRONT WIPER (Option)	Press the bottom of the switch to start the front wiper (press and hold for washer fluid). Press the top of the switch to stop the wiper.
4	REAR WIPER (Option)	Press the bottom of the switch to start the rear wiper. Press the top of the switch to provide washer fluid to clean the rear window.
5	NOT USED	- - -
6	NOT USED	- - -
7	FAN MOTOR (Option)	Turn clockwise to increase fan speed; counterclockwise to decrease. There are four positions; OFF-1-2-3.
8	AIR CONDITIONER SWITCH (Option)	Press bottom of switch to start; top to stop. Fan Motor (Item 7) must be ON for A/C to operate.
9	TEMPERATURE CONTROL (Option)	Turn clockwise to increase the temperature; counterclockwise to decrease.

Figure 60-50-7



NOTE: Parking Brake (Item 4) [Figure 60-50-7] is standard on all loaders.

Front Panel
[Figure 60-50-7]

REF. NO.	DESCRIPTION	FUNCTION / OPERATION
1	ADVANCED CONTROL SYSTEM (ACS) (Option)	Press the top to select Hand Controls; bottom to select Foot Controls.
2	NOT USED	- - -
3	POWER BOB-TACH (Option)	Press and hold the up arrow to disengage the Bob-Tach wedges. Press and hold the down arrow to engage the wedges into the mounting frame holes.
4	PARKING BRAKE (Standard on all Loaders)	Press the top to engage the PARKING BRAKE; bottom to disengage.
5	TURN SIGNAL INDICATORS (Option)	Indicates left or right TURN SIGNALS are ON.
6	HAZARD LIGHTS (Option)	Press the top to turn the HAZARD LIGHTS ON; bottom to turn OFF.
7	ROTATING BEACON (Option)	Press the top to turn the ROTATING BEACON ON; bottom to turn OFF.
8	SELECTABLE JOYSTICK CONTROL (SJC) (Option)	Press the top to select 'ISO' Control Pattern; bottom to select 'H' Control Pattern.

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Removal And Installation (Left And Right)

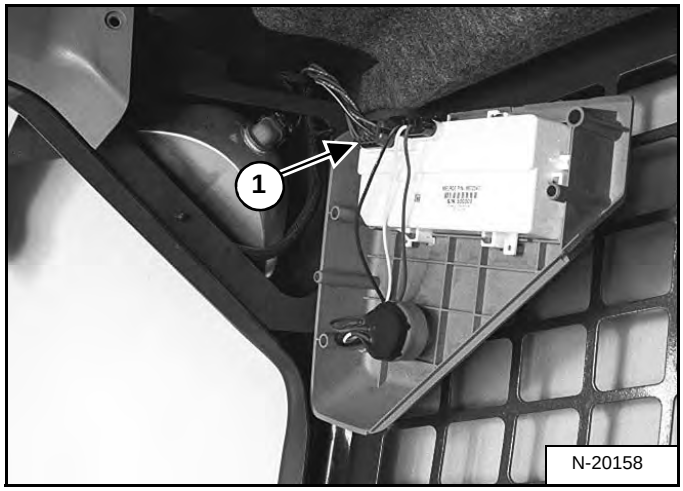
Figure 60-50-8



Remove the three mounting bolts (Item 1) **[Figure 60-50-8]**.

Installation: Be careful to not overtighten the instrument panel mounting bolts to prevent stripping of the threaded holes in the panels.

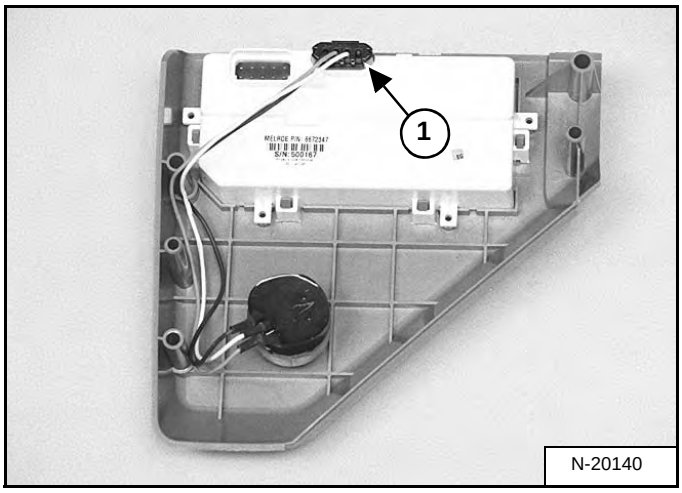
Figure 60-50-9



Pull the right instrument panel down and disconnect the wire harness connector (Item 1) **[Figure 60-50-9]** from the panel.

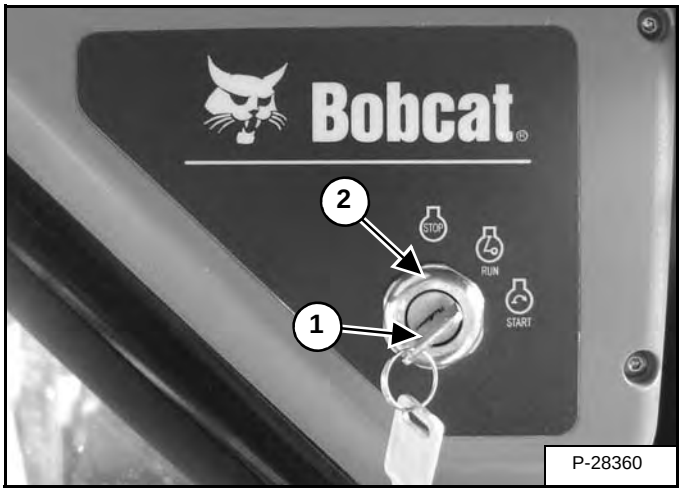
Remove the panel from the loader cab.

Figure 60-50-10



Disconnect the key switch wiring harness (Item 1) **[Figure 60-50-22]** from the back of the control panel.

Figure 60-50-11

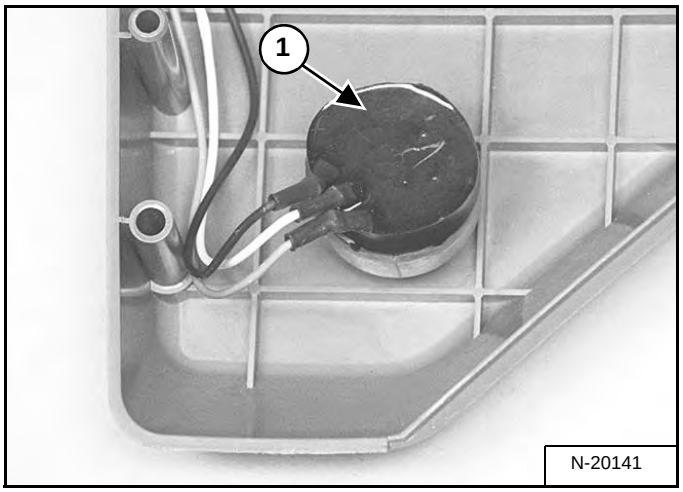


Remove the ignition key (Item 1) from the switch. Remove the ignition switch retaining nut (Item 2) **[Figure 60-50-23]** from the switch.

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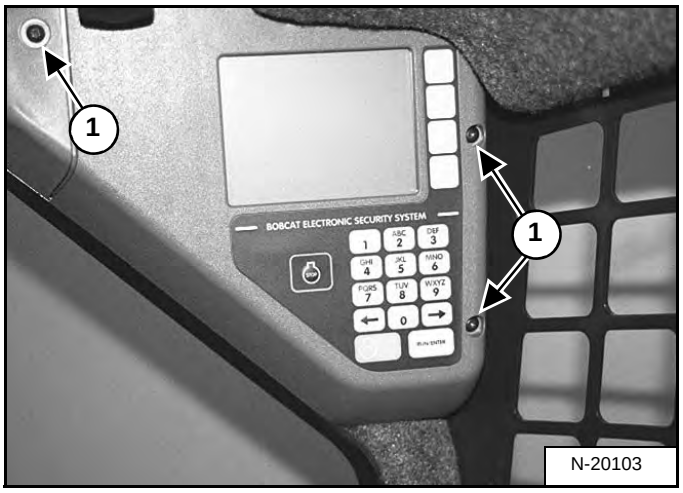
Removal And Installation (Left And Right) (Cont'd)

Figure 60-50-12



Remove the ignition switch (Item 1) **[Figure 60-50-24]** from the control panel.

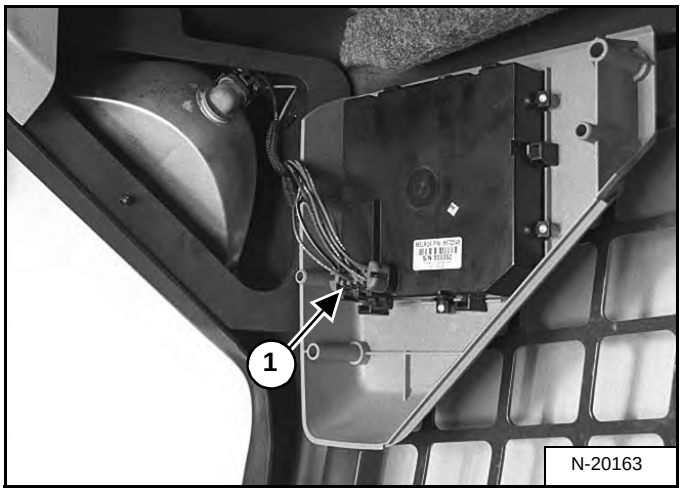
Figure 60-50-13



Remove the three mounting bolts (Item 1) **[Figure 60-50-13]**.

Installation: Be careful to not overtighten the instrument panel mounting bolts to prevent stripping of the threaded holes in the panels.

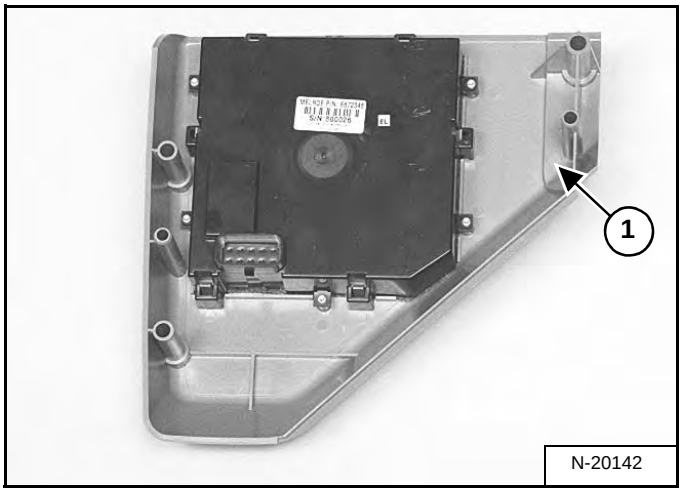
Figure 60-50-14



Pull the right instrument panel down and disconnect the wire harness connector (Item 1) **[Figure 60-50-14]** from the panel.

Remove the panel from the loader cab.

Figure 60-50-15

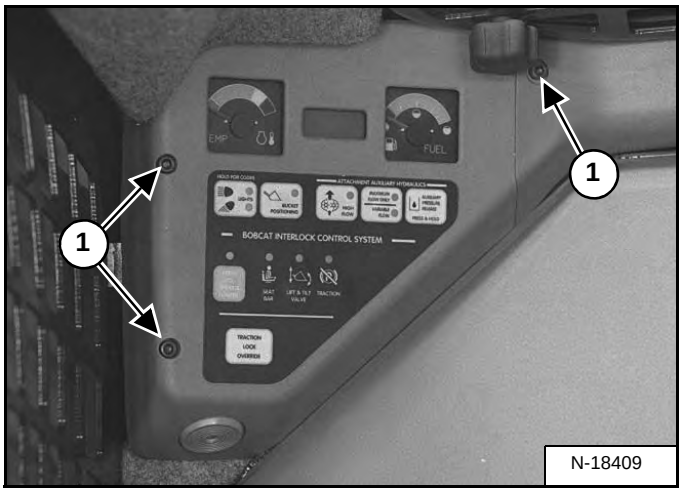


NOTE: The instrument panel (Item 1) [Figure 60-50-15] must be replaced as a complete unit.

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Removal And Installation (Left And Right) (Cont'd)

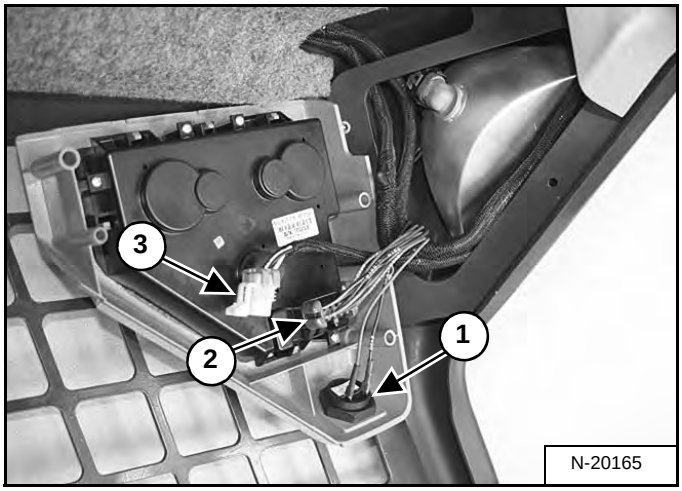
Figure 60-50-16



Remove the three mounting bolts (Item 1) **[Figure 60-50-16]**.

Installation: Be careful to not overtighten the instrument panel mounting bolts to prevent stripping of the threaded holes in the panels.

Figure 60-50-17



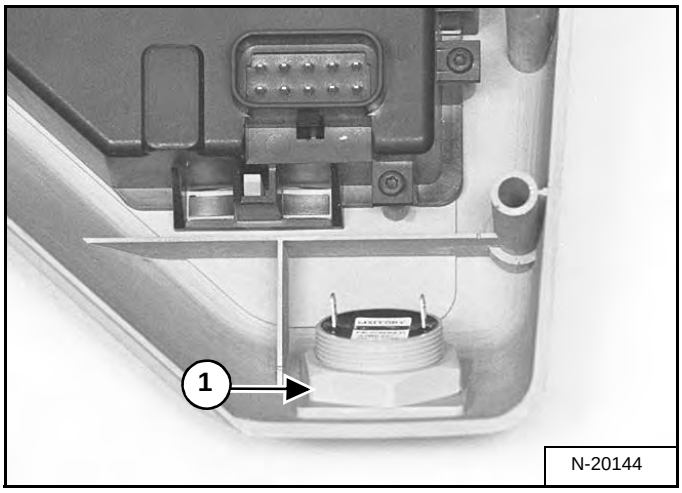
Pull the left instrument panel down and disconnect the wire harness connector (Item 1) **[Figure 60-50-17]** from the loader alarm.

Disconnect the wire harness connector (Item 2) **[Figure 60-50-17]** from the loader instrument panel.

NOTE: The wiring harness (Item 3) [Figure 60-50-17] is an optional accessory harness.

Remove the instrument panel from the loader.

Figure 60-50-18



Remove the left side instrument panel.

Remove the retaining nut (Item 1) **[Figure 60-50-25]** from the loader alarm.

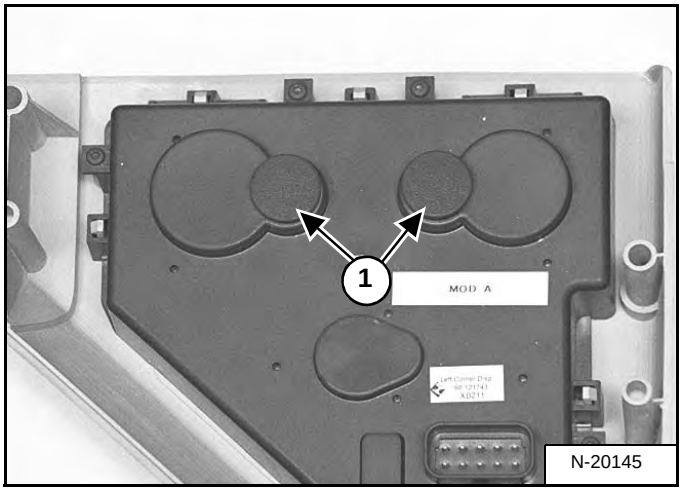
Remove the alarm from the loader instrument panel.

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Bulb Removal And Installation (Left Only)

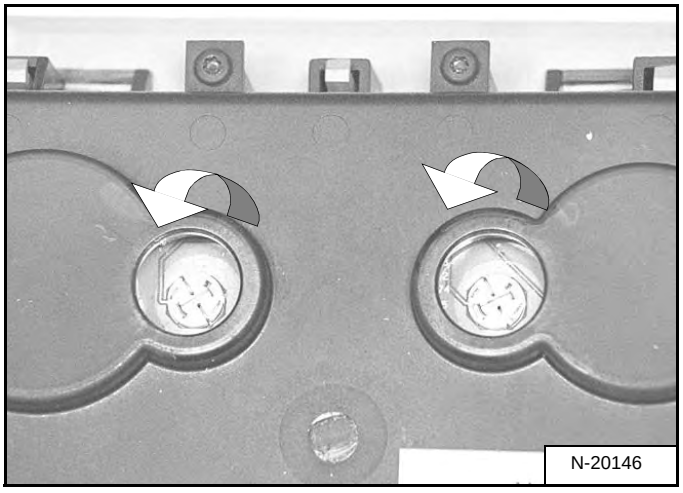
Remove the left side instrument panel. (See Removal And Installation (Left And Right) on Page 60-50-6.)

Figure 60-50-19



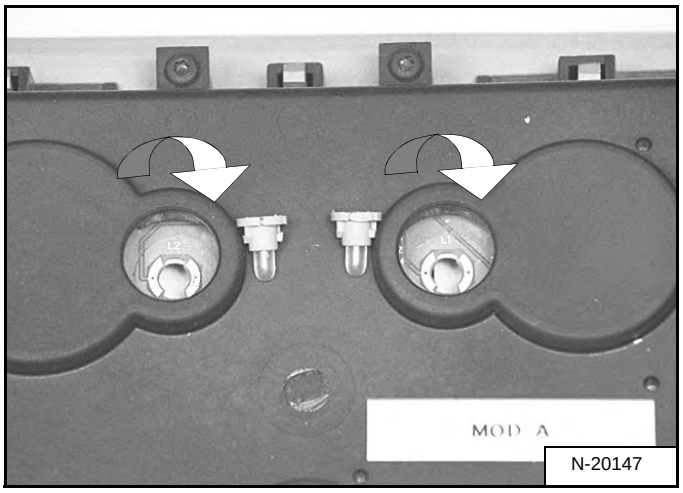
Remove the two light bulb covers (Item 1) **[Figure 60-50-19]** from the back of the instrument panel.

Figure 60-50-20



With a flat blade screw driver, turn the light bulb counterclockwise **[Figure 60-50-20]** and remove from the panel.

Figure 60-50-21



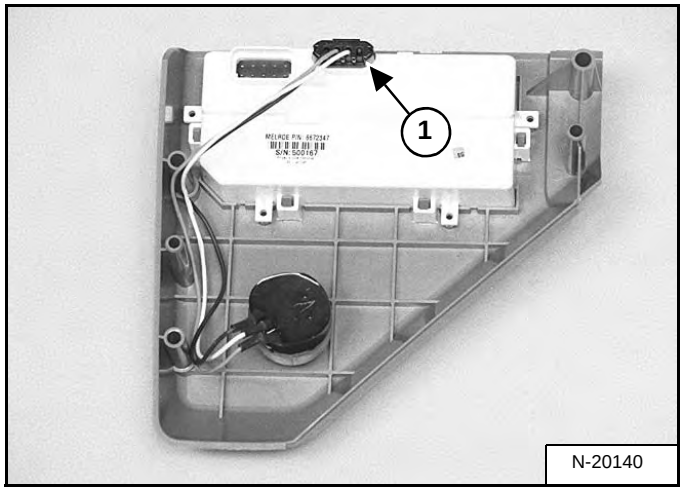
To install the bulbs, place them in the sockets and turn clockwise **[Figure 60-50-21]**.

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Key Switch Removal And Installation

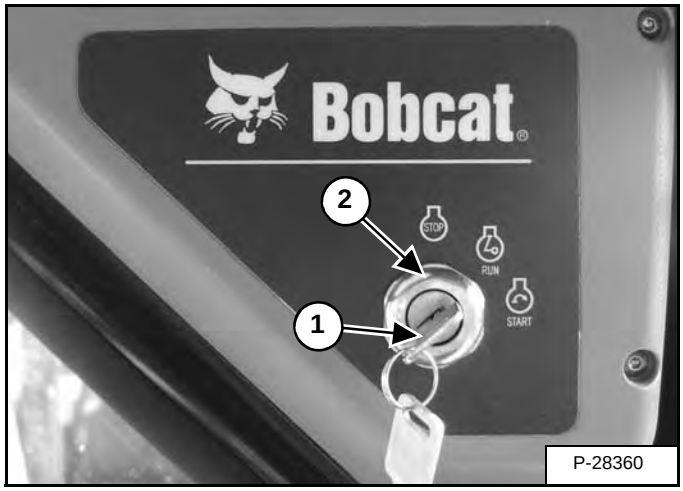
Remove the right side instrument panel. (See Removal And Installation (Left And Right) on Page 60-50-6.)

Figure 60-50-22



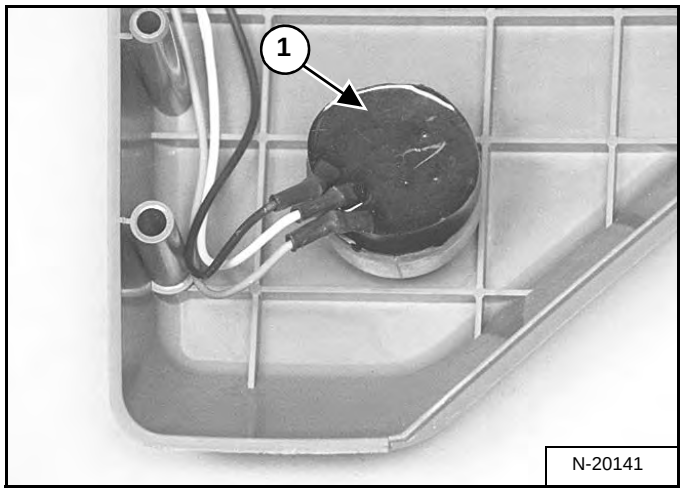
Disconnect the key switch wiring harness (Item 1) **[Figure 60-50-22]** from the back of the control panel.

Figure 60-50-23



Remove the ignition key (Item 1) from the switch. Remove the ignition switch retaining nut (Item 2) **[Figure 60-50-23]** from the switch.

Figure 60-50-24



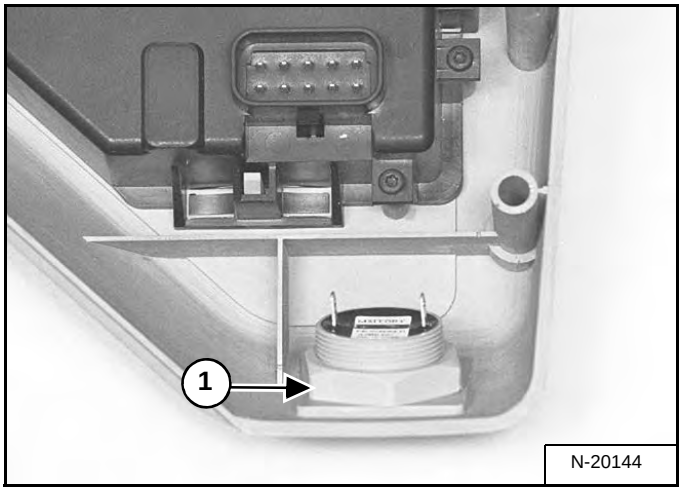
Remove the ignition switch (Item 1) **[Figure 60-50-24]** from the control panel.

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Alarm Removal And Installation

Remove the left side instrument panel. (See Removal And Installation (Left And Right) on Page 60-50-6.)

Figure 60-50-25

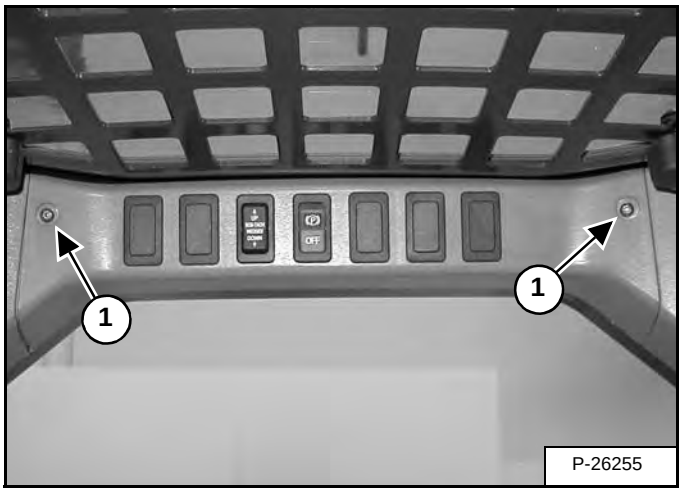


Remove the retaining nut (Item 1) **[Figure 60-50-25]** from the loader alarm.

Remove the alarm from the loader instrument panel.

Front Panel Removal And Installation

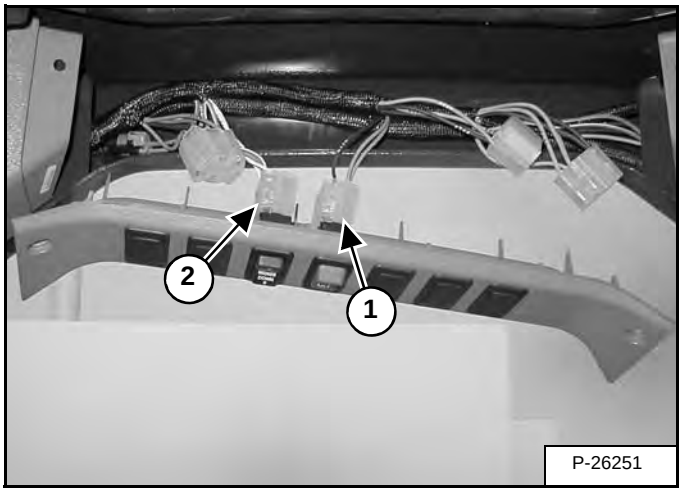
Figure 60-50-26



Remove the two mounting bolts (Item 1) **[Figure 60-50-26]**.

Installation: Be careful to not overtighten the front accessory panel mounting bolts to prevent damage to the plastic panel.

Figure 60-50-27



Pull the front accessory panel down and disconnect the wire harness connector(s) (Items 1 & 2) **[Figure 60-50-27]** from the switches.

Remove the panel.

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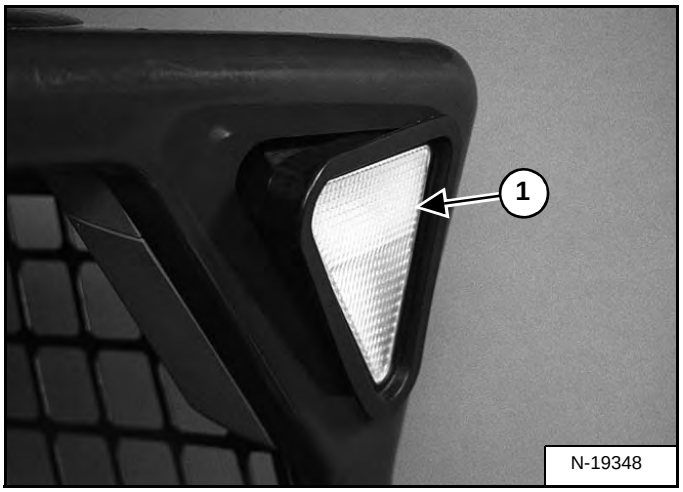


Dealer Copy -- Not for Resale

LIGHTS

Front Removal And Installation

Figure 60-60-1

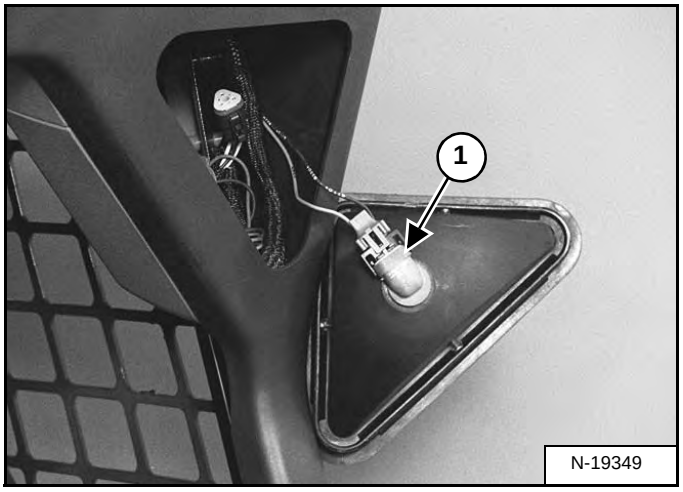


Open the rear door.

Disconnect the negative (-) cable from the battery. (See Removal And Installation on Page 60-20-1.)

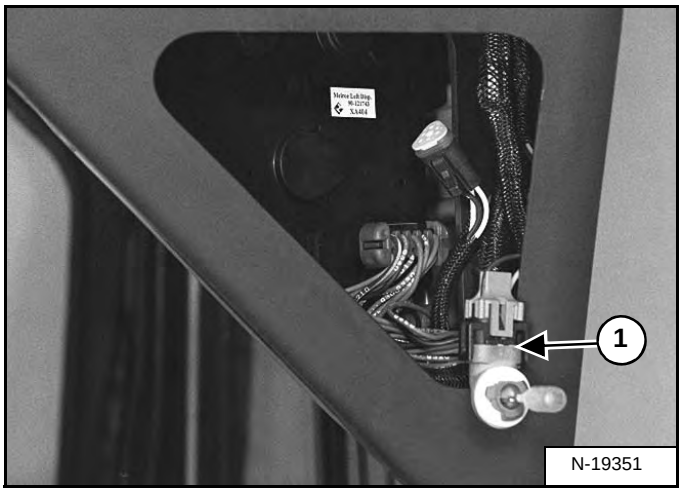
Remove the light housing (Item 1) **[Figure 60-60-1]** from the operator cab.

Figure 60-60-2



Remove the bulb assembly (Item 1) **[Figure 60-60-2]** from the light housing by turning the bulb assembly a 1/4 turn.

Figure 60-60-3



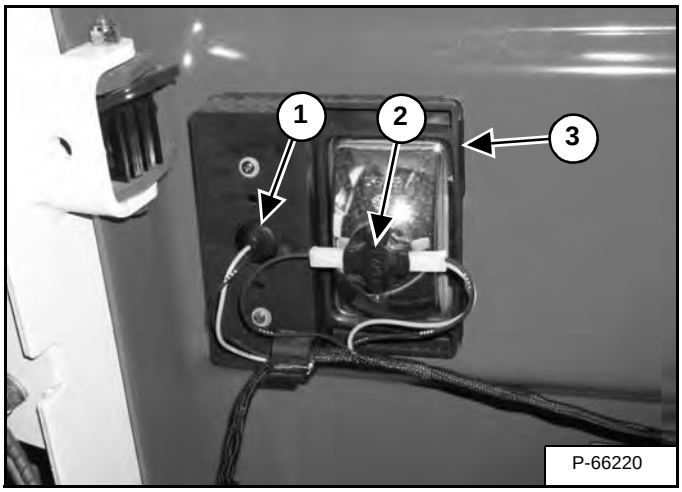
Disconnect and remove the bulb (Item 1) **[Figure 60-60-3]** from the socket.

Reverse the above procedure to install the bulb.

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Rear Removal And Installation

Figure 60-60-4



Remove the bulb assemblies (Items 1 & 2) from the light housing (Item 3) by turning the bulb assemblies a 1/4 turn **[Figure 60-60-4]**.

Figure 60-60-5

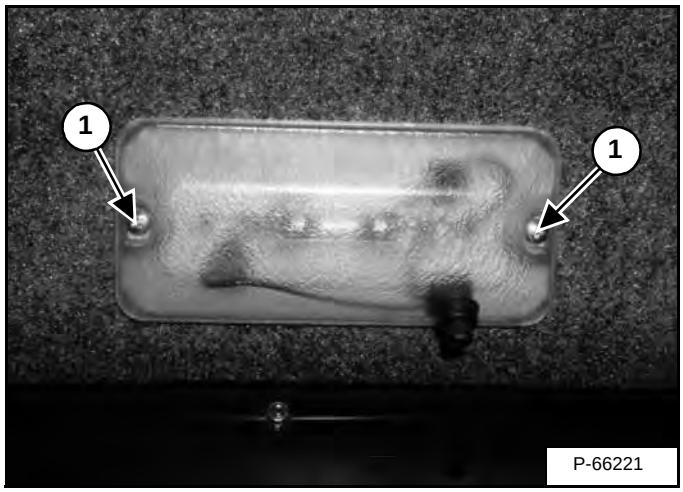


Using care press the rear light and housing from the door **[Figure 60-60-5]**.

Reverse this procedure for installation.

Cab Light Removal And Installation

Figure 60-60-6

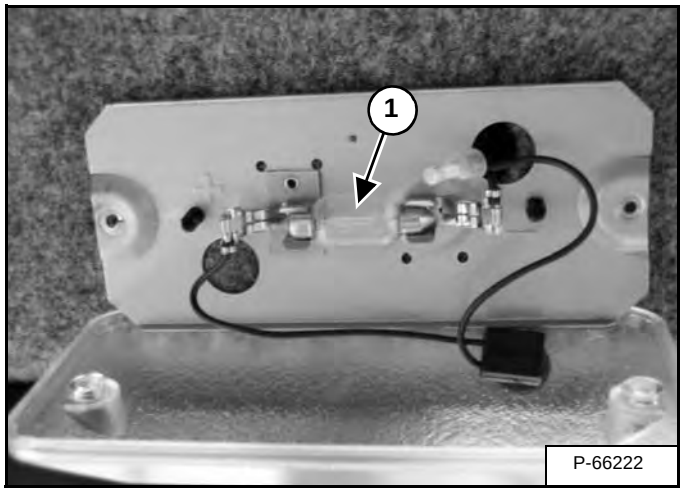


Remove the screws (Items 1) **[Figure 60-60-6]** from the light cover.

NOTE: The wires for the switch will hold the light cover. Do not pull the light cover to far away from the light housing to prevent damage to the wires.

Move the light cover to allow access to the bulb.

Figure 60-60-7



Remove and replace the bulb (Item 1) **[Figure 60-60-7]** from the light housing.

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BOBCAT CONTROLLER (MAIN)

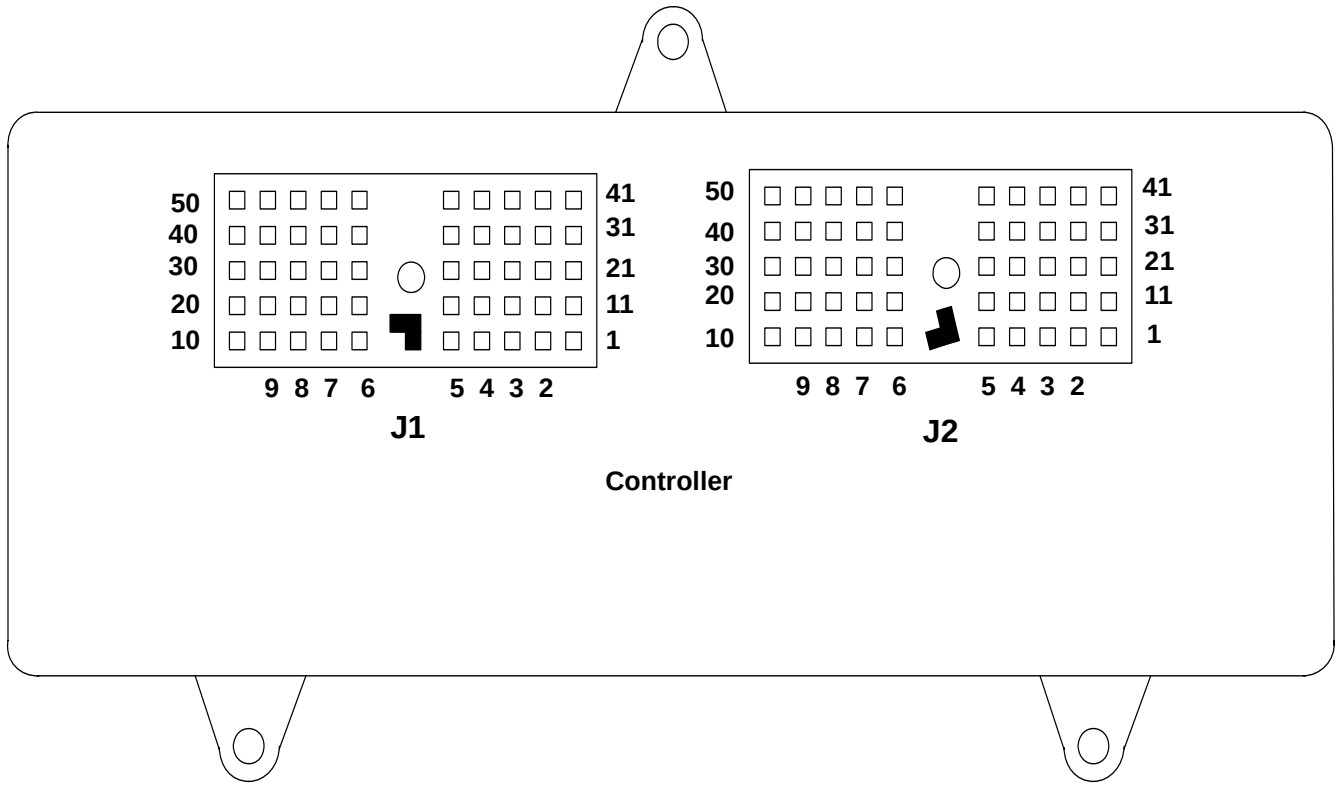
Description

The main controller provides information to all other controllers. All loaders have a main controller.

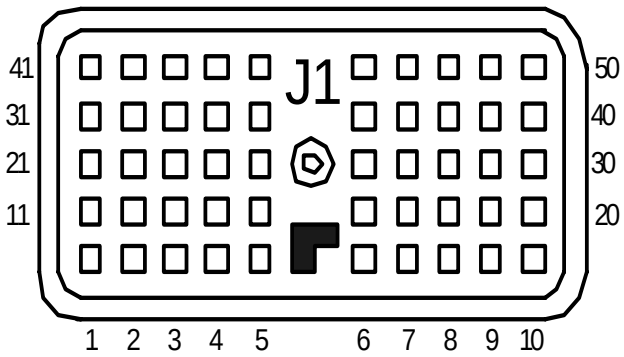
The main controller is located behind the access panel near the operators left foot.

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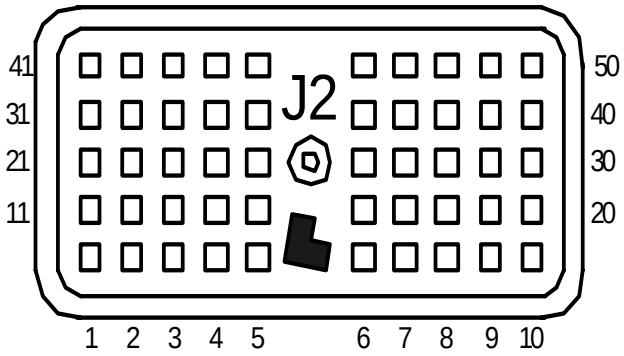
Connector Identification



Harness Connector View



Harness Connector View

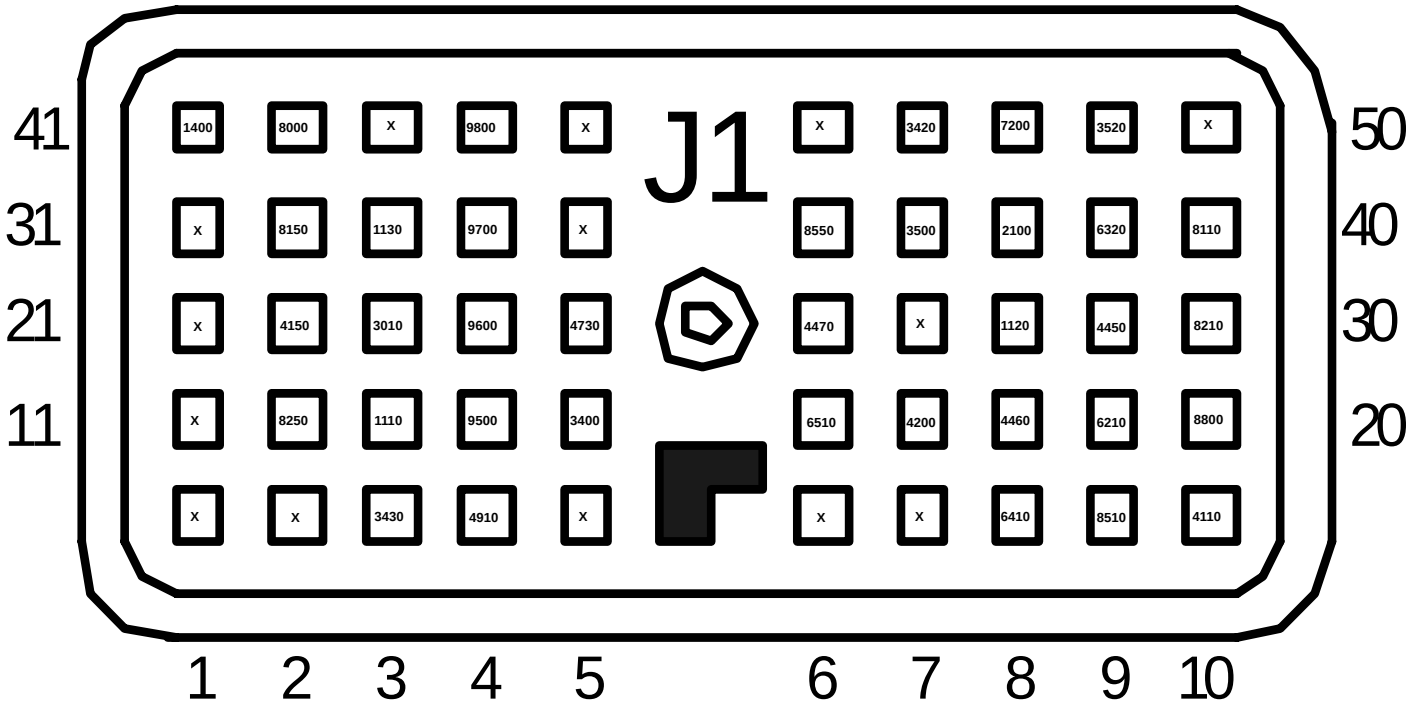


V-171/V-17

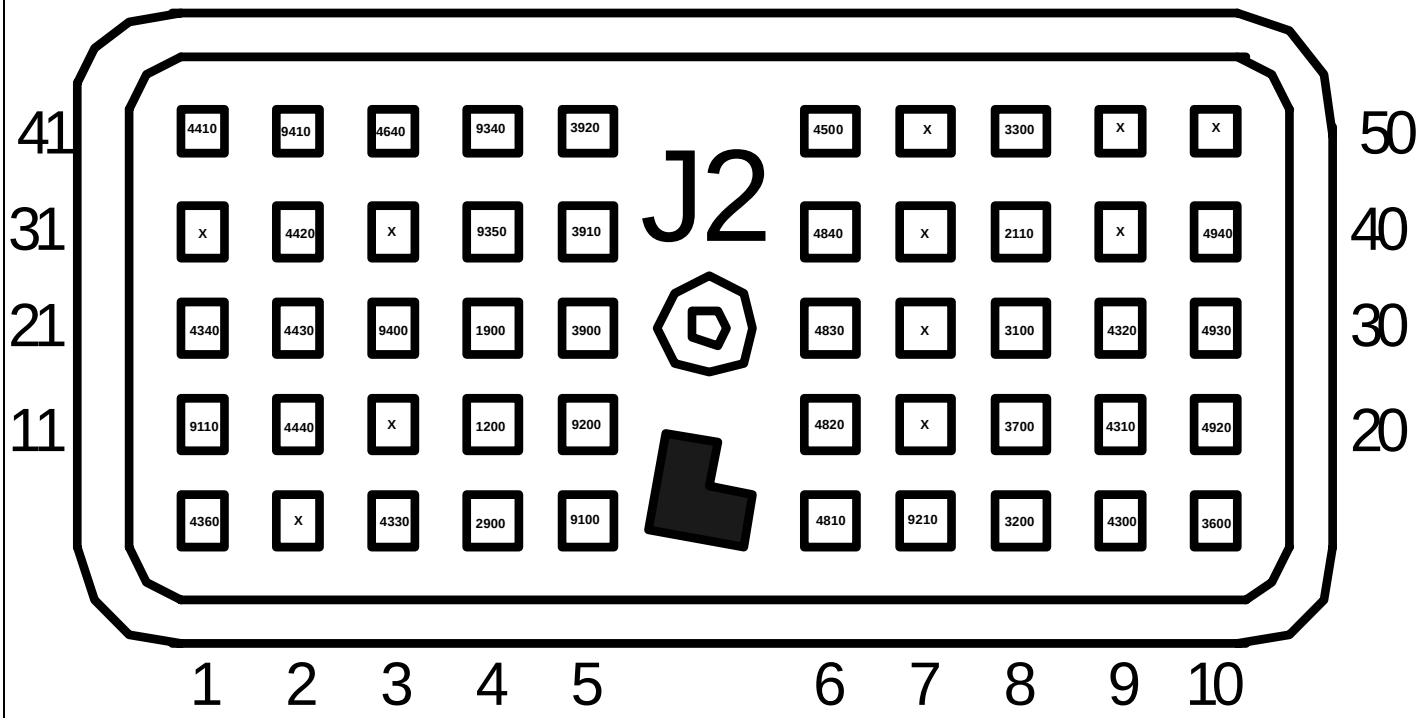
Dealer Copy -- Not for Resale

Connector Identification (Cont'd)

Harness Connector View



Harness Connector View

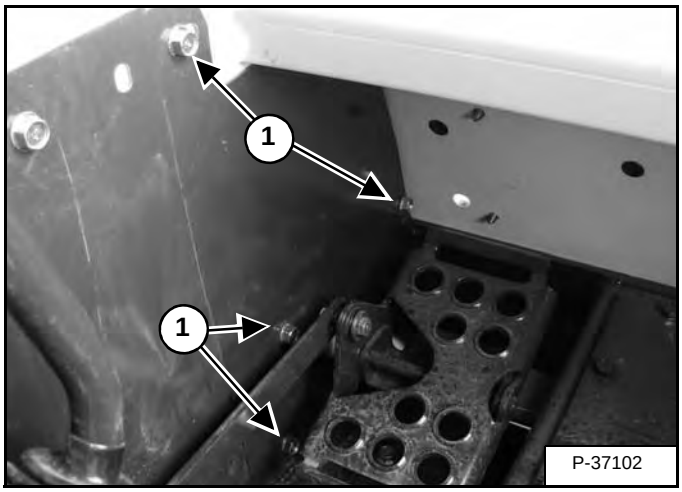


V-172

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Removal And Installation

Figure 60-70-1



Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Stop the engine. Raise the seat bar.

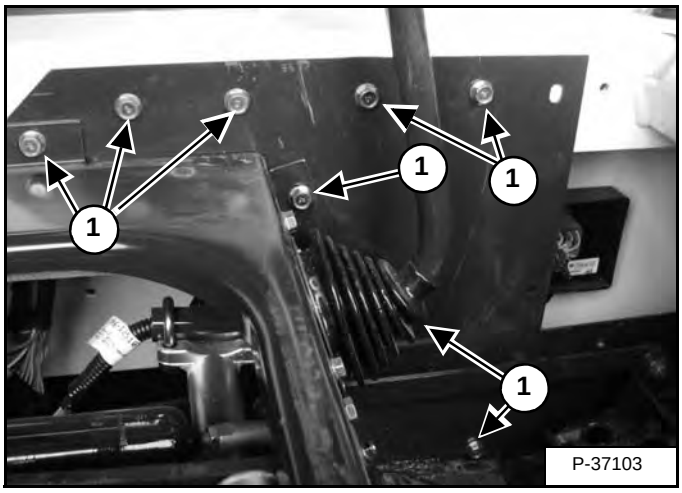
Lift and block the rear of the loader. (See Procedure on Page 10-10-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the four left front side panel mount bolts (Item 1) **[Figure 60-70-1]**.

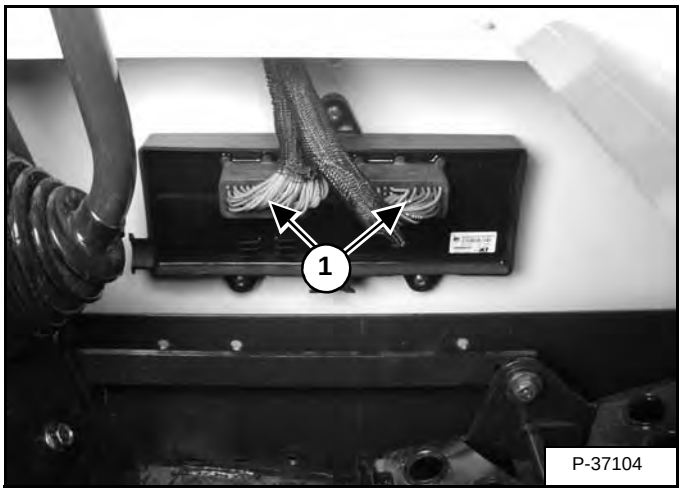
Remove the front panel from the loader.

Figure 60-70-2



Remove the eight panel mount bolts (Item 1) **[Figure 60-70-2]** and remove the rear panel.

Figure 60-70-3



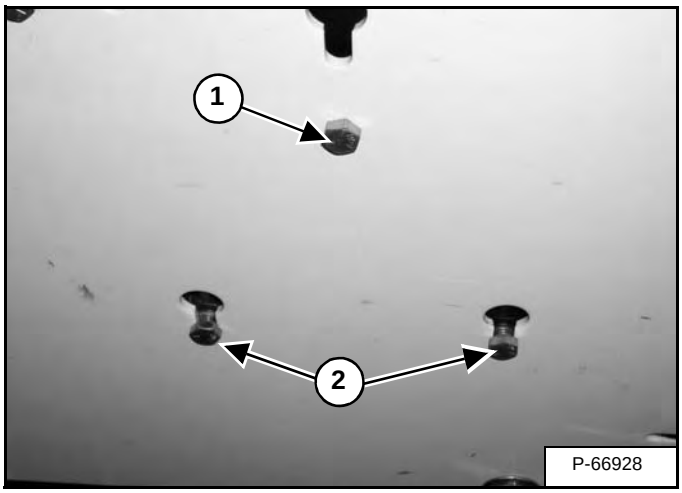
Remove the two harness connector bolts (Item 1) **[Figure 60-70-3]**.

Installation: Tighten the connector mounting bolts to 30-35 in.-lb. (3,39-3,96 N•m) torque.

Unplug the two harness connectors from the controller.

NOTE: The connectors are keyed and will only plug in one way.

Figure 60-70-4



Remove the top controller mount bolt (Item 1) **[Figure 60-70-4]** from the left fender.

Loosen the two controller mounting bolts (Item 2) **[Figure 60-70-4]**.

Installation: Tighten the controller mounting bolts to 12-14 ft.-lb. (16-19 N•m) torque.

Lift and remove the system controller from the loader.

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BOBCAT CONTROLLER (ACS)

Description

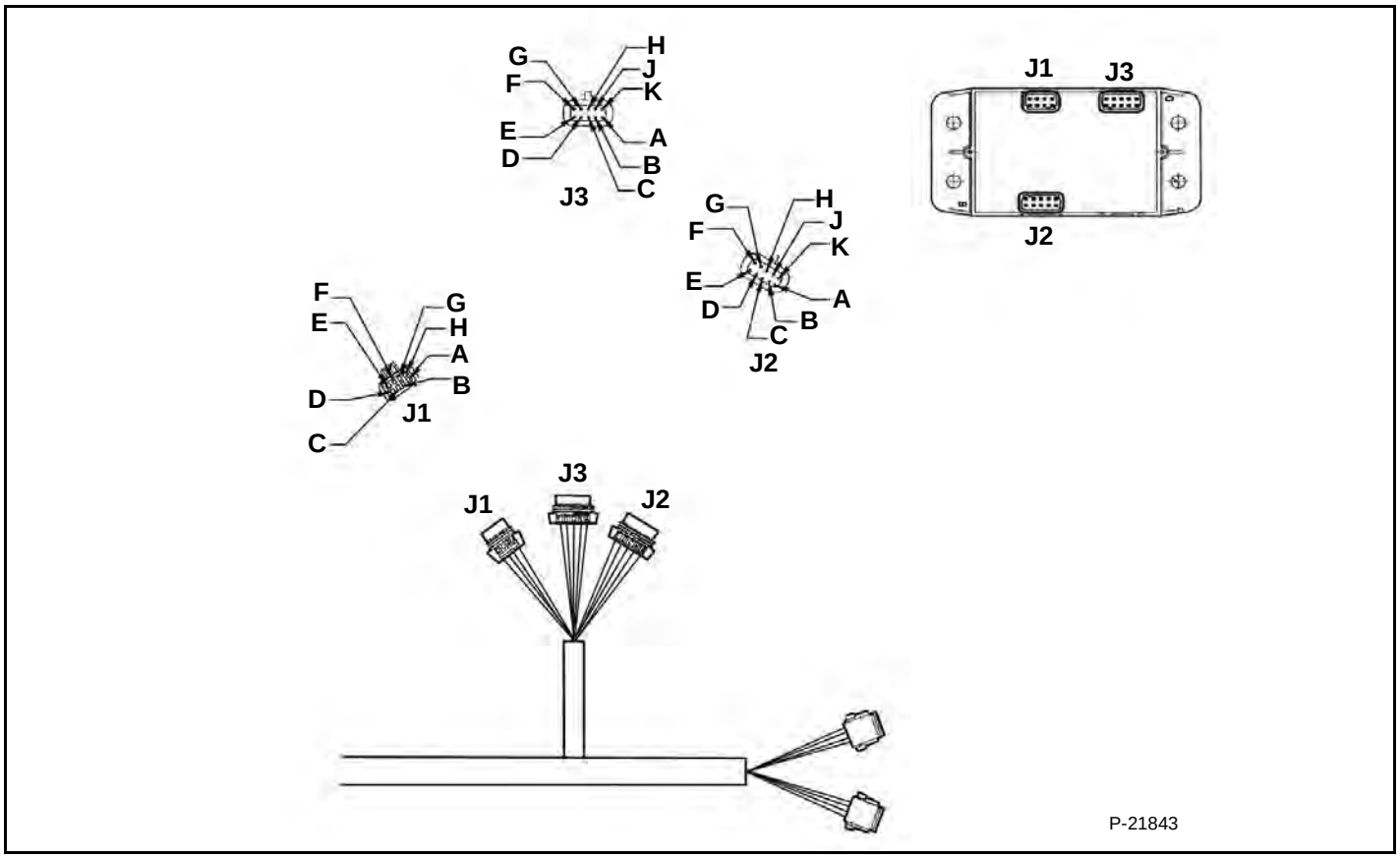
The ACS controller is on loaders equipped with the ACS or the SJC option. This controller processes information for the lift and tilt functions.

The ACS controller is housed in a grey colored plastic shell with black potting. The ACS controller communicates with the Main Bobcat Controller by CAN communication wires. The ACS controller is capable of receiving upgrades to the software.

The ACS controller is located behind the right side access panel near the operators right foot.

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Connector And Wire Identification



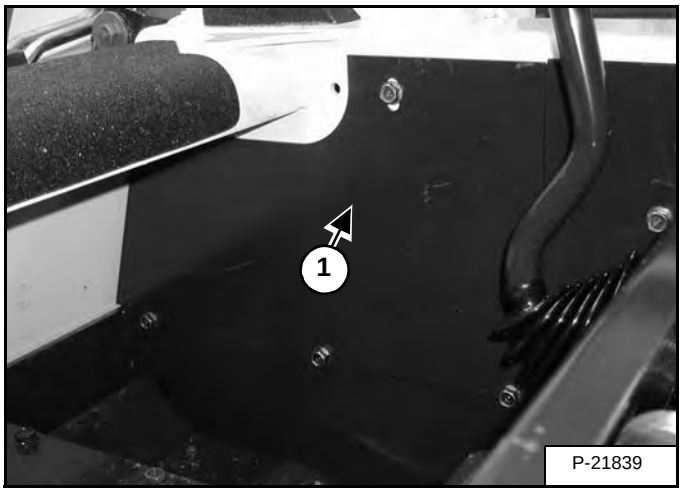
P/N	PIN	DESCRIPTION
J1		CONNECTOR, METRI-PACK
Orange	A	5V HALL EFFECT SUPPLY
Orange	B	SWITCHED AHC POWER
Green	C	HAND/FOOT INPUT
Purple	D	CAN SIGNAL HIGH AHC
Purple	E	CAN SIGNAL LOW AHC
Purple	F	CAN SHIELD AHC
Black	G	AHC GROUND
Black	H	AHC GROUND
J2		CONNECTOR, METRI-PACK
	A	OPEN
	B	OPEN
	C	OPEN
	D	OPEN
Green	E	TILT SPOOL SIGNAL
Green	F	LIFT HANDLE SIGNAL
Green	G	TILT HANDLE SIGNAL
Green	H	LIFT SPOOL SIGNAL
Green	J	LIFT PEDAL SIGNAL
Green	K	TILT PEDAL SIGNAL

P/N	PIN	DESCRIPTION
J3		CONNECTOR, METRI-PACK
Red	A	TILT ACTUATOR FORWARD
Red/White	B	UNSWITCHED AHC POWER
Red/White	C	UNSWITCHED AHC POWER
Black	D	LIFT ACTUATOR REVERSE
Green	E	HANDLE LOCK POWER
Red	F	LIFT ACTUATOR FORWARD
Green	G	PEDAL LOCK POWER
Black	H	AHC GROUND
Black	J	AHC GROUND
Black	K	TILT ACTUATOR REVERSE

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Removal And Installation

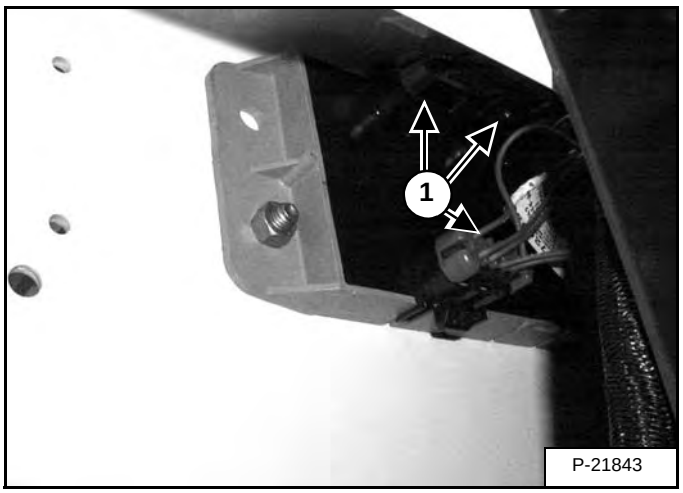
Figure 60-71-1



Loosen the bottom bolts and remove the top bolt.

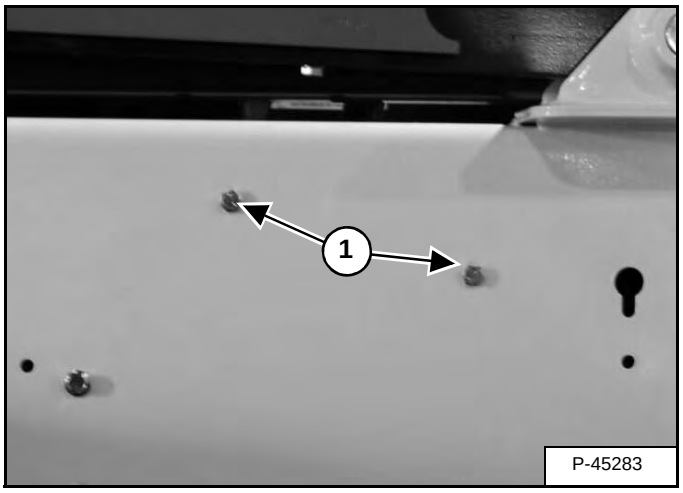
Remove the right front panel (Item 1) **[Figure 60-71-1]** from the loader.

Figure 60-71-2



Disconnect the wiring harness connectors (Item 1) **[Figure 60-71-2]** from the controller.

Figure 60-71-3



Remove the two mounting bolts (Item 1) **[Figure 60-71-3]** from the controller.

Remove the controller from the loader.

NOTE: The calibration procedure must be followed when replacing a controller. (See Lift And Tilt Calibration (ACS) on Page 60-160-3.)

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BOBCAT CONTROLLER (SJC) (DRIVE)

Description

The drive controller is only on loaders equipped with the SJC option. This controller processes information for the drive functions.

The drive controller is located behind the right side access panel near the operators right foot.

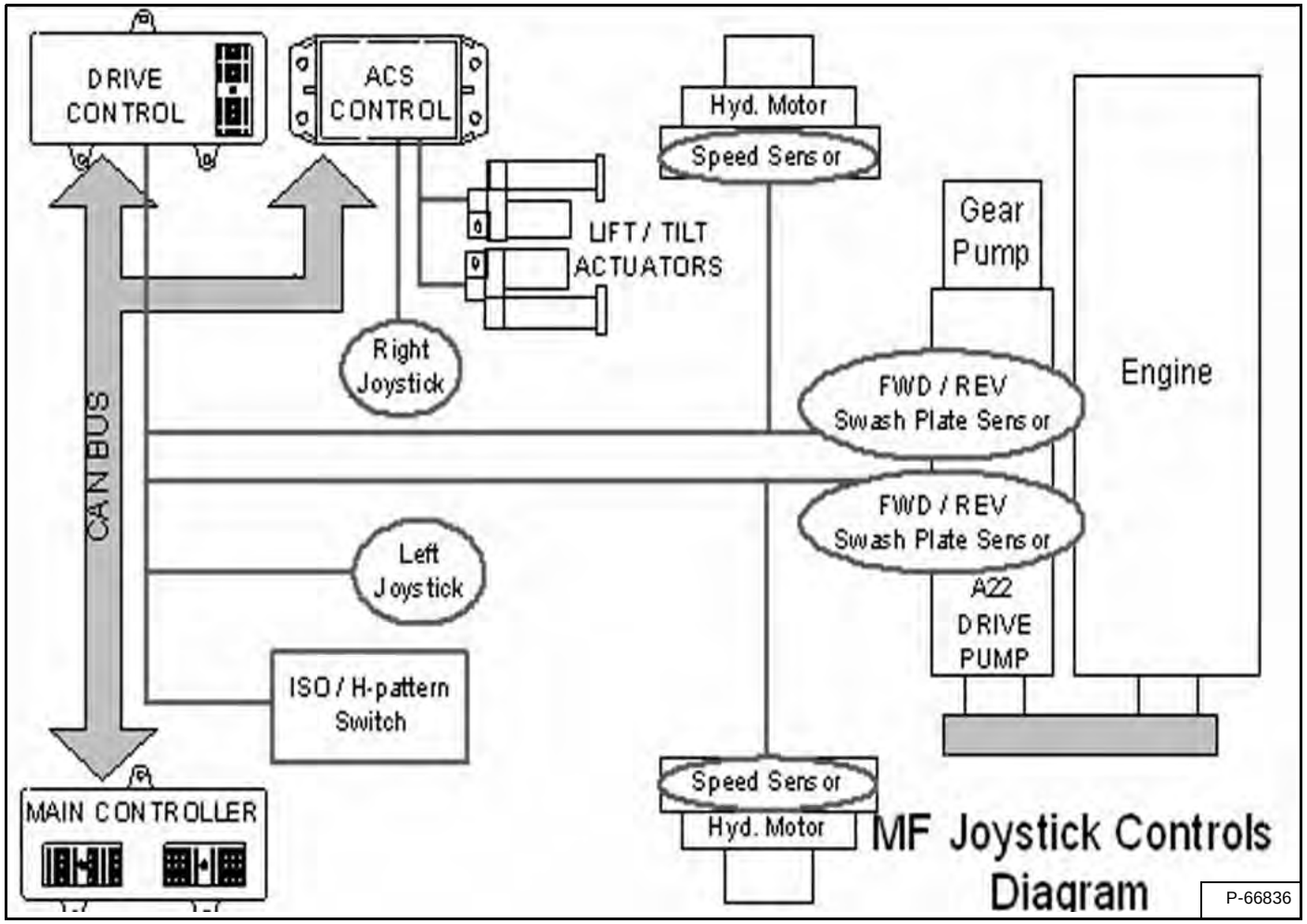
The drive controller monitors the position of the left joystick, pump swash plate angles and the output of the wheel speed sensors.

The drive controller works along with the ACS controller and communicates with the main Bobcat controller in an SJC system. All these controllers are capable of software upgrades.

The SJC system uses electronic joysticks to control both of the workgroups (lift and tilt) and the drive functions of the loader. The control can be switched from ISO and H-Pattern drive control layouts.

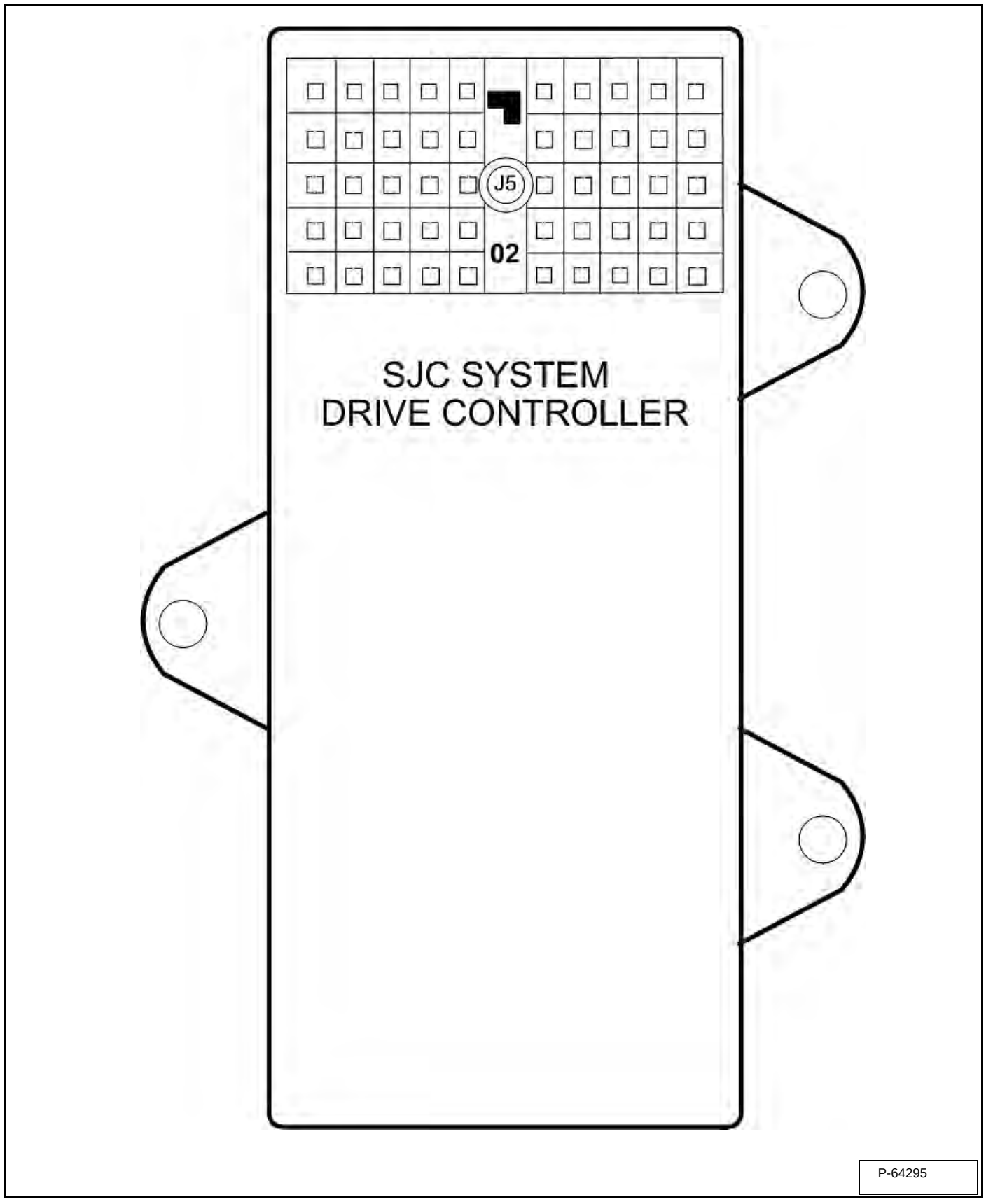
The workgroup actuators are the same used on the ACS system.

The hydrostatic drive pump is a Rexroth A22 unit. It has two electromagnetic coils on each of the two pumps to control the drive of the loader. The coils will direct the forward and reverse outputs of the pump to the drive motors. The Rexroth pump is equipped with position sensors mounted to the bottom of the swash plates to provide feedback to the controllers to sense uncommanded swash plate movement.



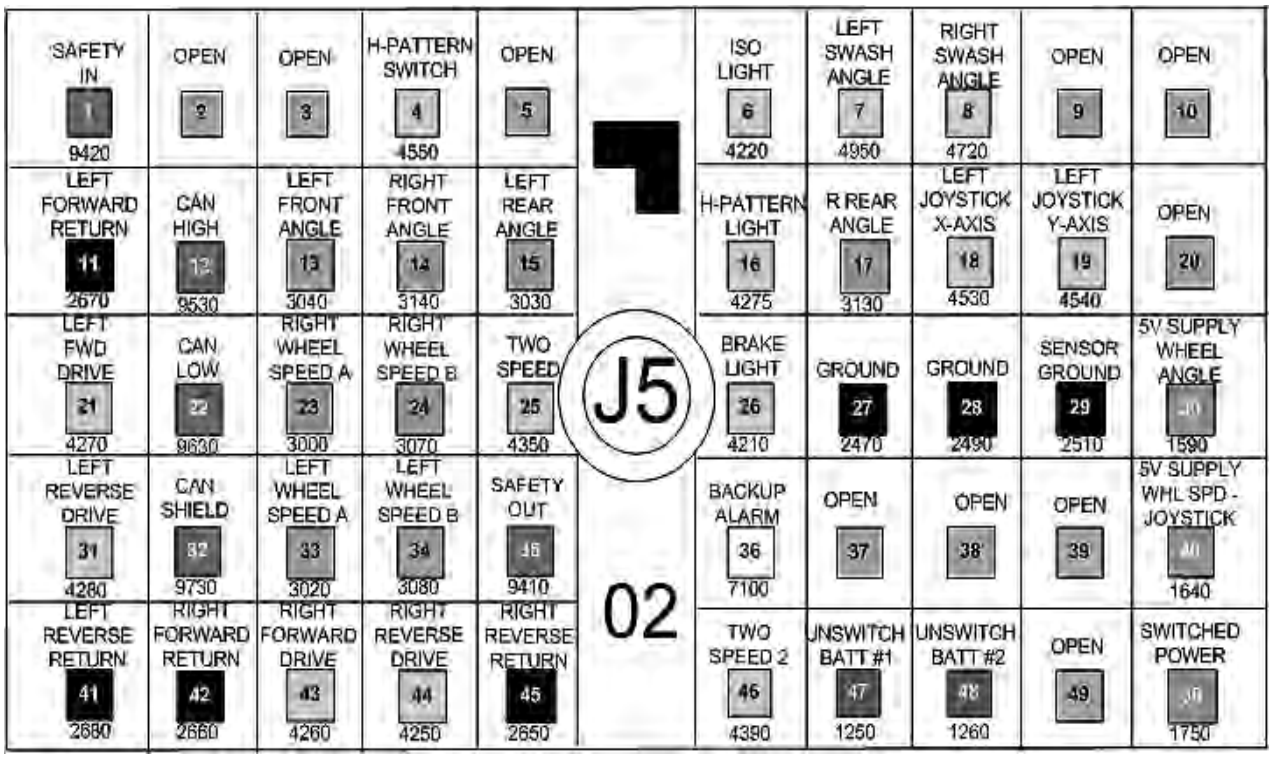
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Connector Identification



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Connector Identification (Cont'd)



P-64296

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Removal And Installation

WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

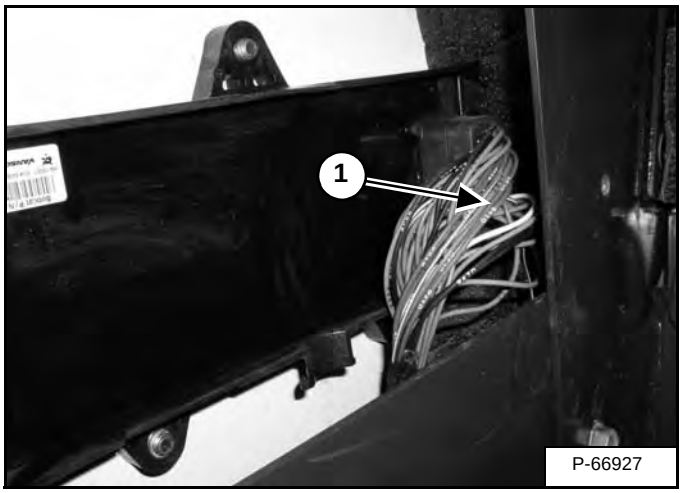
Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the engine speed control. (See Removal And Installation on Page 70-20-1.)

Remove the inside access panels (right side). (See Removal And Installation (Right) on Page 50-121-2.)

Figure 60-72-1



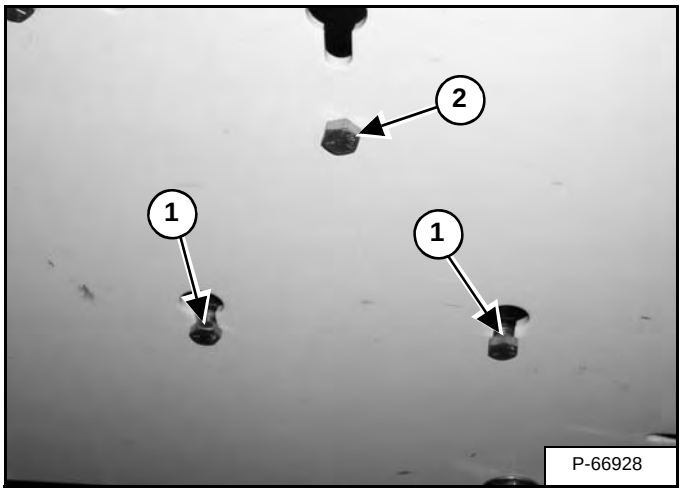
Remove the harness connector bolt (Item 1) **[Figure 60-72-1]**.

Installation: Tighten the connector mounting bolts to 30-35 in.-lb. (3,39-3,96 N•m) torque.

Unplug the harness connector from the controller.

NOTE: The connector is keyed and will only plug in one way.

Figure 60-72-2



Loosen the two controller mounting bolts (Item 1) **[Figure 60-72-2]** on the right side fender.

Remove the controller mounting bolt (Item 2) **[Figure 60-72-2]**.

Installation: Tighten the mounting bolts to 12-14 ft.-lb. (16-19 N•m) torque.

Lift and remove the system controller from the fender.

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SPEED SENSOR (SJC)

Description

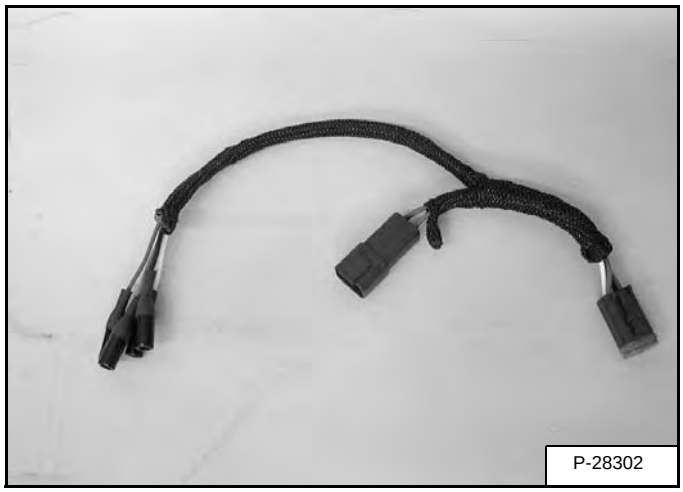
The speed sensors are used to monitor travel speed. The speed sensor communicates to the system by sending a pulse of electricity to the SJC controller.

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SPEED SENSOR (SJC) (CONT'D)

Testing

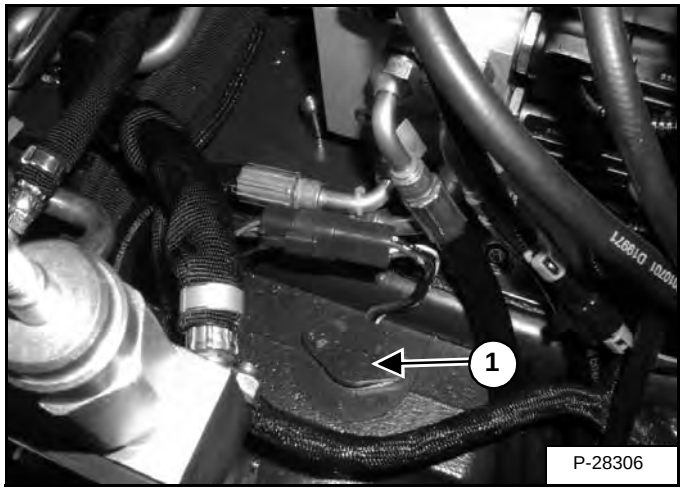
Figure 60-80-1



The tools listed will be needed to do the following procedure:

MEL1609-Wheel Speed Sensor Test Harness
[Figure 60-80-1]
MEL1563 or 6689779-Remote Start Tool
Multimeter

Figure 60-80-2



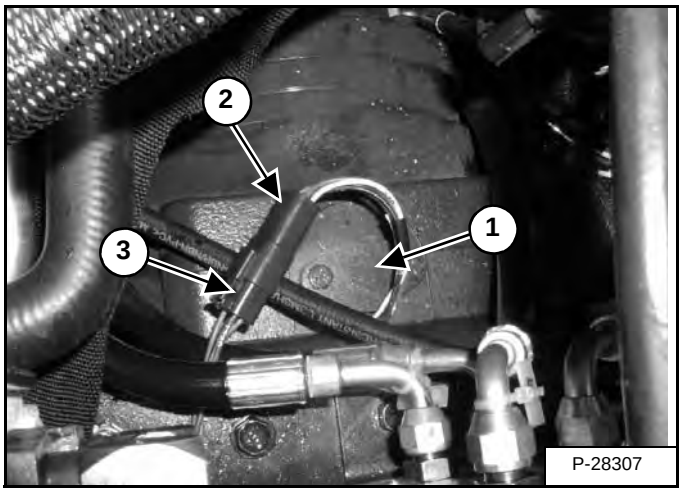
Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Connect the remote start tool to the loader. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.)

Locate the speed sensor (Item 1) **[Figure 60-80-2]** on the right side hydrostatic motor carrier.

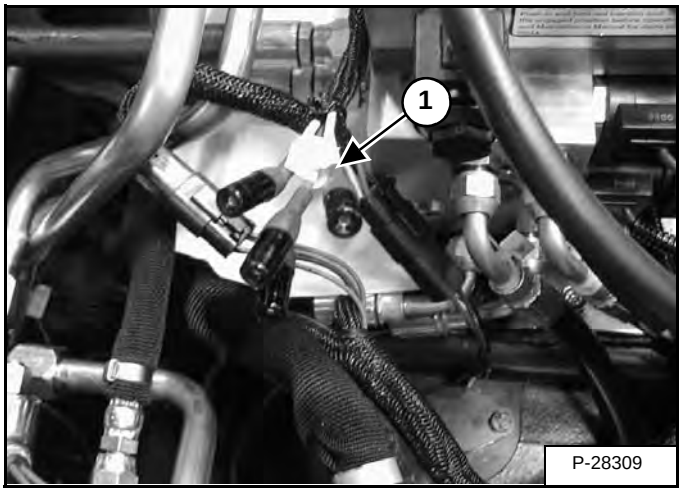
Figure 60-80-3



Locate the speed sensor (Item 1) **[Figure 60-80-3]** on the left side hydrostatic motor carrier.

Disconnect the speed sensor wire connector (Item 2) from the loader harness wire connector (Item 3) **[Figure 60-80-3]**.

Figure 60-80-4



Connect the speed sensor test harness (Item 1) **[Figure 60-80-4]** in line, between the loader wiring harness and the speed sensor harness.

Turn the remote start key to ON position without starting the loader.

Take a voltage reading, with the multimeter, at the speed sensor test harness, between pin 1 and pin 3 (Item 1) **[Figure 60-80-4]**.

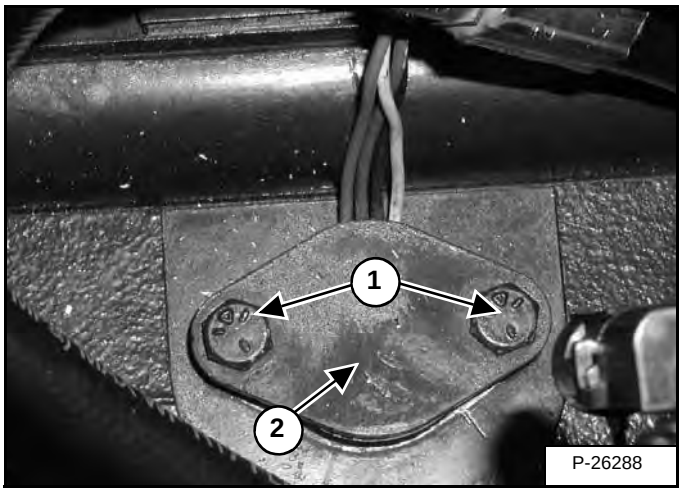
The voltage should be between 5 volts.

Repeat the procedure for the opposite side speed sensor. (If needed.)

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Removal And Installation

Figure 60-80-5



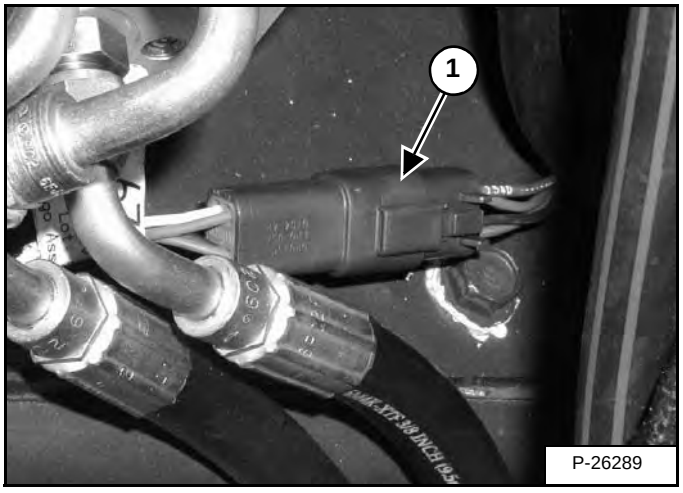
Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the two, speed sensor mount bolts (Item 1) **[Figure 60-80-5]** from the top of the hydrostatic motor carrier.

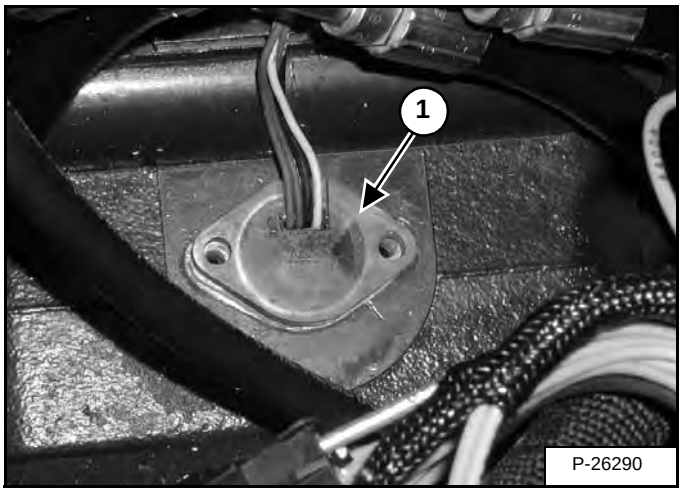
Remove the mount plate (Item 2) **[Figure 60-80-5]**.

Figure 60-80-6



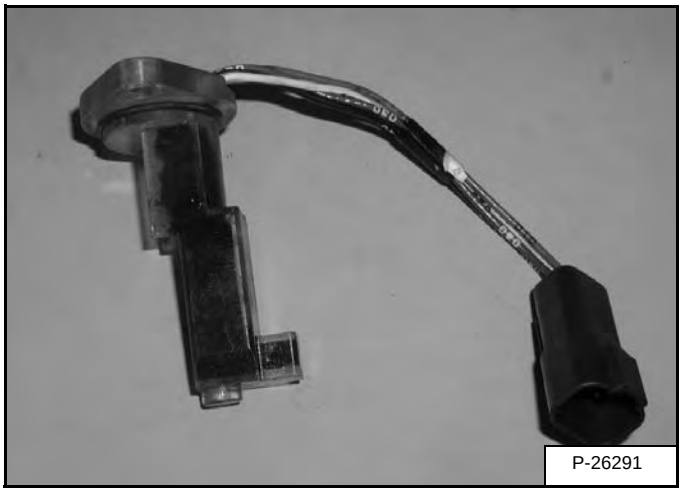
Disconnect the speed sensor electrical harness connector (Item 1) **[Figure 60-80-6]**.

Figure 60-80-7



Lift the speed sensor (Item 1) **[Figure 60-80-7]** out from the motor carrier.

Figure 60-80-8

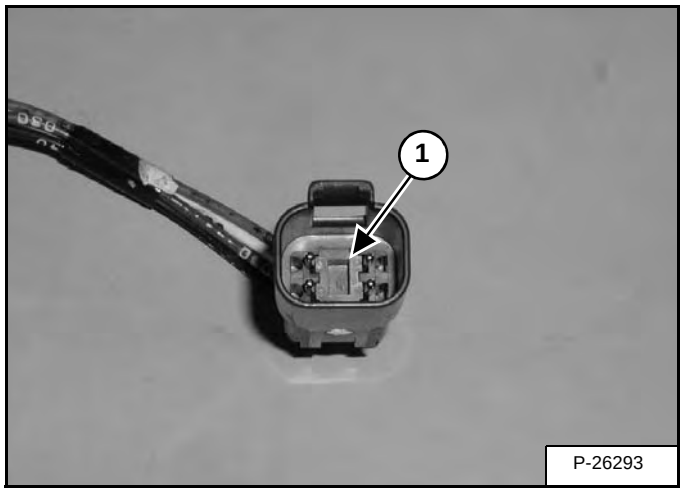


Remove the speed sensor **[Figure 60-80-8]**.

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Removal And Installation (Cont'd)

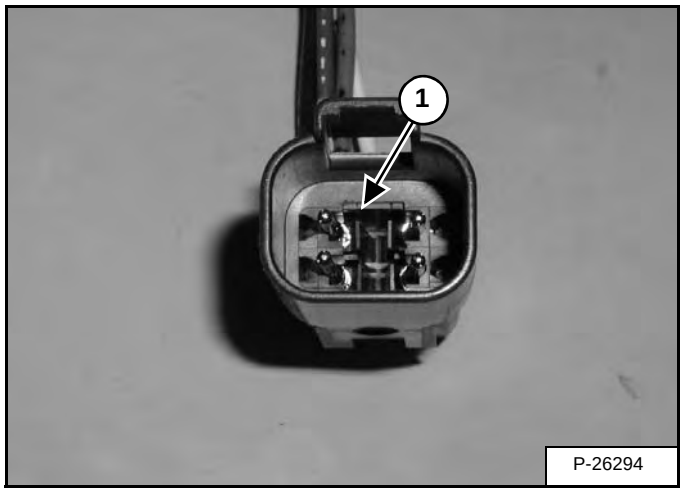
Figure 60-80-9



The electrical connector can be replaced.

Remove the connector wedge (Item 1) **[Figure 60-80-9]**.

Figure 60-80-10

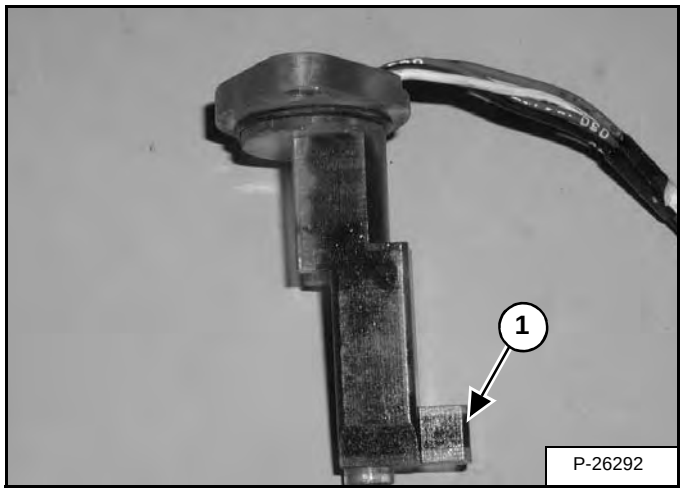


With a thin screwdriver lift the tabs and remove the wires from the connector **[Figure 60-80-10]**.

Wire Code

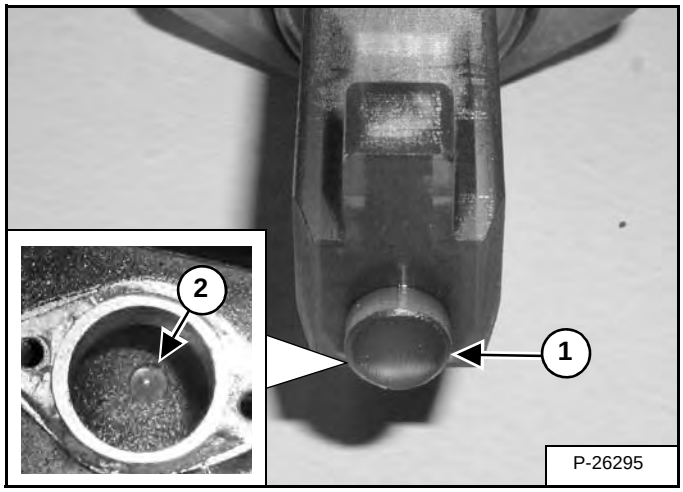
1 Red
2 White
3 Black
4 Blue

Figure 60-80-11



Installation: Be sure to install the speed sensor (Item 1) **[Figure 60-80-11]** pointing toward the transmission case.

Figure 60-80-12



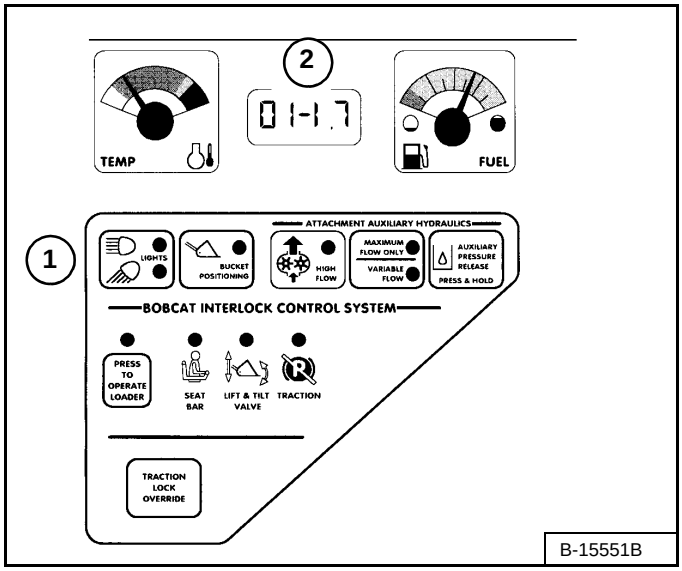
Installation: The alignment pin (Item 1) **[Figure 60-80-12]** at the bottom of the speed sensor must be installed in the hole (Item 2) **[Figure 60-80-12]** in the motor carrier.

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DIAGNOSTIC SERVICE CODES

Description

Figure 60-90-1



The left instrument panel is the same for both the Standard and Keyless Instrumentation **[Figure 60-90-1]**.

NOTE: Corroded or loose grounds can cause multiple service codes and/or abnormal symptoms. All dash lights flashing, buzzer going off, headlights and taillights flashing, could indicate a bad ground. The same symptoms could apply if the voltage is low, such as loose or corroded battery cables. If you observe these symptoms, check grounds and positive leads first.

Press and hold LIGHTS Button (Item 1) **[Figure 60-90-1]** for two seconds to view SERVICE CODES in the HOURMETER/CODE DISPLAY (Item 2) **[Figure 60-90-1]**. If more than one SERVICE CODE is present, the codes will scroll on the HOURMETER/CODE DISPLAY.

The following word errors may be displayed.

REPLY One or both instrument panel(s) not communicating with the controller.

INPUT The controller not communicating with the left instrument panel.

CODE The controller is asking for a password. (Keyless instrument panel only.)

ERROR The wrong password was entered. (Keyless instrument panel only.)

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DIAGNOSTIC SERVICE CODES (CONT'D)

Service Codes List

CODE		CODE	
01-16	Air filter not connected	10-16	Hydraulic Implement filter not connected
01-17	Air filter plugged	10-17	Hydraulic Implement filter plugged
02-16	Hydraulic Charge filter not connected	11-05	Seat bar sensor short to battery
02-17	Hydraulic Charge filter plugged	11-06	Seat bar sensor short to ground
03-09	Battery voltage low	12-21	Front auxiliary PWM switch out of range high
03-10	Battery voltage high	12-22	Front auxiliary PWM switch out of range low
03-11	Battery voltage extremely high	12-23	Front auxiliary PWM switch not in neutral
03-14	Battery voltage extremely low		
03-22	Battery voltage out of range low	13-05	Fuel shut-off hold solenoid short to battery
		13-06	Fuel shot-off hold solenoid short to ground
04-09	Engine oil pressure low	13-07	Fuel shut-off solenoid open circuit
04-14	Engine oil pressure extremely low		
04-15	Engine oil pressure shutdown level	14-02	Fuel shut-off pull solenoid error ON
04-21	Engine oil pressure out of range high	14-03	Fuel shut-off pull solenoid error OFF
04-22	Engine oil pressure out of range low		
		15-02	Traction lock pull solenoid error ON
05-09	Hydraulic charge pressure low	15-03	Traction lock pull solenoid error OFF
05-10	Hydraulic charge pressure high		
05-11	Hydraulic charge pressure extremely high	16-05	Traction lock hold solenoid short to battery
05-14	Hydraulic charge pressure extremely low	16-06	Traction lock hold solenoid short to ground
05-15	Hydraulic charge pressure shutdown level	16-07	Traction lock hold solenoid open circuit
05-21	Hydraulic charge pressure out of range high		
05-22	Hydraulic charge pressure of range low	17-05	Hydraulic lock valve solenoid short to battery
06-10	Engine speed high	17-06	Hydraulic lock valve solenoid short to ground
06-11	Engine speed extremely high	17-07	Hydraulic lock valve solenoid open circuit
06-13	Engine speed no signal		
06-15	Engine speed shutdown level	18-05	Spool Lock Solenoid short to battery
06-18	Engine speed out of range	18-06	Spool Lock Solenoid short to ground
07-10	Hydraulic oil temperature high	18-07	Spool Lock Solenoid open circuit
07-11	Hydraulic oil temperature extremely high		
07-15	Hydraulic oil temperature shutdown level	19-02	Bucket position solenoid error ON
07-21	Hydraulic oil temperature out of range high	19-03	Bucket position solenoid error OFF
07-22	Hydraulic oil temperature out of range low		
		20-02	Two-speed solenoid error ON
08-10	Engine coolant temperature high	20-03	Two-speed solenoid error OFF
08-11	Engine coolant temperature extremely high		
08-15	Engine coolant temperature shutdown level	21-02	Glow plug error ON
08-21	Engine coolant temperature out of range high	21-03	Glow plug error OFF
08-22	Engine coolant temperature out of range low		
		22-02	Starter error ON
09-09	Fuel level low	22-03	Starter error OFF
09-21	Fuel level out of range high		
09-22	Fuel level out of range low	23-02	Rear base solenoid error ON
		23-03	Rear base solenoid error OFF

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Service Codes List (Cont'd)

CODE		CODE	
		32-57	Lift actuator reduced performance
24-02	Rear rod solenoid error ON	32-58	Tilt actuator reduced performance
24-03	Rear rod solenoid error OFF	32-59	Lift actuator wrong direction
		32-60	Tilt actuator wrong direction
25-02	Rear auxiliary relief solenoid error ON	32-61	Handle lock short to ground
25-03	Rear auxiliary relief solenoid error Off	32-62	Handle lock short to battery
		32-63	Pedal lock short to ground
26-02	Front base solenoid error ON	32-64	Pedal lock short to battery
26-03	Front base solenoid error OFF	32-65	Sensor supply voltage out of range
		32-66	Battery voltage out of range
27-02	Front rod solenoid error ON	32-67	Switch flipped while operating
27-03	Front rod solenoid error OFF	32-68	Lift handle information error
		32-69	Control pattern switch flipped while operating
28-02	Diverter solenoid error ON	32-70	Right drive handle short to ground
28-03	Diverter solenoid error OFF	32-71	Right drive handle short to battery
		32-75	Interrupted unswitched power
29-02	High flow solenoid error ON		
29-03	High flow solenoid error OFF	33-23	Main Controller (Bobcat Controller) not programmed
30-28	Controller Memory failure	34-04	Deluxe panel no communication to Bobcat controller
31-28	Interrupted power failure	35-02	Hydraulic fan error ON
		35-03	Hydraulic fan error OFF
32-04	ACS not communicating with Bobcat Controller		
32-23	ACS Not calibrated	36-48	ACD multiple controllers present
32-31	Tilt actuator fault		
32-32	Tilt actuator wiring fault	37-02	Two-speed secondary error ON
32-33	Tilt handle wiring fault	37-03	Two-speed secondary error OFF
32-34	Tilt actuator not in neutral		
32-35	Tilt handle/pedal not in neutral		
32-36	Lift actuator fault		
32-37	Lift actuator wiring fault		
32-38	Lift handle wiring fault		
32-39	Lift actuator not in neutral		
32-40	Lift handle/pedal not in neutral		
32-41	No communication		
32-49	Lift actuator short to ground		
32-50	Tilt actuator short to ground		
32-51	Lift actuator short to battery		
32-52	Tilt actuator short to battery		
32-53	Lift handle/pedal short to ground		
32-54	Tilt handle/pedal short to ground		
32-55	Lift handle/pedal short to battery		
32-56	Tilt handle/pedal short to battery		

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Service Codes List (Cont'd)

CODE		CODE	
38-04	No communication from joystick controller	38-53	Left forward drive solenoid error OFF
38-05	Left joystick X axis not in neutral	38-54	Left reverse drive solenoid error OFF
38-06	Right joystick X axis not in neutral	38-55	Right forward drive solenoid error OFF
38-07	Left joystick Y as not in neutral	38-56	Right reverse drive solenoid error OFF
38-08	Right joystick Y axis not in neutral	38-57	Front right extend steering solenoid error OFF
38-09	Control pattern switch - Short to Battery or Ground	38-58	Front right retract steering solenoid error OFF
38-11	Lift actuator not in neutral	38-59	Front left extend steering solenoid error OFF
38-12	Tilt actuator not in neutral	38-60	Front left retract steering solenoid error OFF
38-13	Lift actuator fault	38-61	Rear right extend steering solenoid error OFF
38-14	Tilt actuator fault	38-62	Rear right retract steering solenoid error OFF
38-15	Right wheel speed fault	38-63	Rear left extend steering solenoid error OFF
38-16	Left wheel speed fault	38-64	Rear left retract steering solenoid error OFF
38-17	Tilt actuator reduced performance	38-65	Steering pressure solenoid error OFF
38-18	Lift actuator reduced performance	38-66	Back-up alarm error OFF
38-19	Left joystick X axis out of range high	38-67	No communication from Bobcat controller
38-20	Right joystick X axis out of range low	38-68	Wheel angles (alignment) not calibrated
38-21	Left joystick Y axis out of range high	38-69	Lift & tilt actuators not calibrated
38-22	Right joystick Y axis out of range high	38-70	Interrupted power
38-23	Front right steering sensor out of range high	38-71	Battery out of range
38-24	Front left steering sensor out of range high	38-72	Drive pump not calibrated
38-25	Rear right steering sensor out of range high	38-73	Steering mode / drive mode switch flipped while operating
38-26	Rear left steering sensor out of range high	38-74	Uncommanded right wheel speed error ON
38-27	Lift actuator out of range high	38-75	Uncommanded left wheel speed error ON
38-28	Tilt actuator out of range high	38-76	Undercurrent steer pressure solenoid
38-29	Left joystick X axis out of range low	38-77	Undercurrent front right extend steer solenoid
38-30	Right joystick X axis out of range low	38-78	Undercurrent front right retract steer solenoid
38-31	Left joystick Y axis out of range low	38-79	Undercurrent front left extend steer solenoid
38-32	Right joystick Y axis out of range low	38-80	Undercurrent front left retract steer solenoid
38-33	Front right steering sensor out of range low	38-81	Undercurrent rear right extend steer solenoid
38-34	Front left steering sensor out of range low	38-82	Undercurrent rear right retract steer solenoid
38-35	Rear right steering sensor out of range low	38-83	Undercurrent rear left extend steer solenoid
38-36	Rear left steering sensor out of range low	38-84	Undercurrent rear left retract steer solenoid
38-37	5 volt sensor supply 1 out of range low	38-85	5 Volt sensor supply 1 out of range high
38-38	5 volt sensor supply 2 out of range low	38-86	5 Volt sensor supply 2 out of range high
38-39	Lift actuator short to ground / out of range low	38-87	Front right wheel blocked (steering mechanical failure)
38-40	Tilt actuator short to ground / out of range low	38-88	Front left wheel blocked (steering mechanical failure)
38-41	Tilt actuator wrong direction	38-89	Rear right wheel blocked (steering mechanical failure)
38-42	Lift actuator wrong direction	38-90	Rear left steering error
38-43	Left forward drive solenoid error ON	38-91	Right speed sensor missing pulses
38-44	Left reverse drive solenoid error ON	38-92	Left speed sensor missing pulses
38-45	Right forward drive solenoid error ON	38-93	Unresponsive right speed sensor
38-46	Right reverse drive solenoid error ON	38-94	Unresponsive left speed sensor
38-47	Front right steering solenoid error ON	38-95	Left speed sensor reverse direction
38-48	Front left steering solenoid error ON	38-96	Right speed sensor reverse direction
38-49	Rear right steering solenoid error ON	38-98	Controller in drive calibration mode
38-50	Rear left steering solenoid error ON	38-99	Controller in wheel position calibration mode.
38-51	Steering pressure solenoid error ON		
38-52	Back-up alarm error ON		

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Service Codes List (Cont'd)

CODE		CODE	
39-04	Left joystick no communication to Bobcat controller	50-38	Front reverse error OFF
		50-39	Rear PWM error on
40-04	Right joystick no communication to Bobcat controller	50-41	Rear PWM no signal
		50-42	Rear PWM not calibrate
44-02	Horn error ON	50-43	Rear forward error ON
44-03	Horn error OFF	50-44	Rear forward error OFF
		50-45	Rear reverse error ON
45-02	Right blinker error ON	50-46	Rear reverse error OFF
45-03	Right blinker error OFF	50-47	Two speed error OFF
		50-48	Two speed error ON
46-02	Left blinker error ON	50-49	Brake solenoid error ON
46-03	Left blinker error OFF	50-50	Brake solenoid error OFF
		50-51	Brake solenoid no signal
47-21	8 volt sensor supply out of range high	50-52	Brake light relay error ON
47-22	8 volt sensor supply out of range low	50-53	Brake light relay error OFF
		50-54	Differential lock error ON
48-02	Front light relay error ON	50-55	Differential lock error OFF
48-03	Front light relay error OFF	50-56	CAN communications fault
		50-57	Drive controller not calibrated
49-02	Rear light relay error ON		
49-03	Rear light relay error OFF	50-59	Front speed sensor missing pulses
		50-60	Rear speed sensor missing pulses
50-01	Travel pedal out of range high		
50-02	Travel pedal out of range low		
50-03	Travel pedal not calibrated	50-63	Front angle sensor not calibrated
50-04	Brake Pedal out of range high		
50-05	Brake Pedal out of range low		
50-06	Brake Pedal not calibrated	50-66	Rear angle sensor not calibrated
50-07	Drive selector switch no signal	50-67	Front forward no signal
50-08	Drive selector switch multiple inputs	50-68	Front reverse no signal
50-09	Front wheel speed sensor out of range high	50-69	Rear forward no signal
50-10	Front wheel speed sensor out of range low	50-70	Rear reverse no signal
50-11	Rear wheel speed sensor out of range high	50-99	In calibration mode
50-12	Rear wheel speed sensor out of range low		
50-13	Front wheel speed sensor no signal	60-21	Rear auxiliary control out of range high
50-14	Rear wheel speed sensor no signal	60-22	Rear auxiliary control out of range low
50-15	Dual wheel speed sensor fault	60-23	Rear auxiliary control not returning to neutral
50-24	Battery voltage over voltage		
50-27	5V sensor #1 over voltage	62-04	Load moment monitoring in error
50-28	5V sensor #1 under voltage		
50-29	5V sensor #2 over voltage	63-05	Short to battery
50-30	5V sensor #2 under voltage	63-06	Short to ground
50-31	Front PWM error on		
50-33	Front PWM no signal	64-02	Switched power relay error ON
50-34	Front PWM not calibrate	64-03	Switched power relay error OFF
50-35	Front forward error ON		
50-36	Front forward error OFF		
50-37	Front reverse error ON		

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Service Codes List (Cont'd)

CODE		CODE	
65-02	Workgroup lockout error on	75-74	Left wheel speed uncommanded motion
65-03	Workgroup lockout error off	75-75	Right wheel speed uncommanded motion
65-05	Workgroup lockout short to battery	75-76	No communication from ACS Controller
65-06	Workgroup lockout short to ground	75-77	Left speed sensor out of range high
65-07	Workgroup lockout open circuit	75-78	Right speed sensor out of range high
		75-79	Left speed sensor out of range low
66-05	Pilot pressure short to battery	75-80	Right speed sensor out of range low
66-06	Pilot pressure short to ground	75-85	5 volt sensor supply 1 out of range high
		75-91	Left swash plate sensor reversed
74-72	Bobcat controller in boot code	75-92	Right swash plate sensor reversed
74-73	Left hand panel system RX error	75-93	Unresponsive right speed sensor
		75-94	Unresponsive left speed sensor
75-04	No communication from Drive Controller	75-95	Left speed sensor reversed direction
75-05	Left joystick X-Axis not in neutral	75-96	Left speed sensor reversed direction
75-07	Left joystick Y-Axis not in neutral	75-98	Controller in Calibration Mode
75-08	Right joystick Y-Axis not in neutral		
75-09	ISO/H pattern switch short to ground or battery	76-73	Left display panel RX error
75-17	Left swash plate not in neutral		
75-18	Right swash plate not in neutral	77-48	Key Switch - Multiple
75-19	Left joystick X-Axis out of range high		
75-21	Left joystick Y-Axis out of range high	78-74	Door/Transport Lock - Open/Active
75-22	Right joystick Y-Axis out of range high		
75-27	Left swash plate out of position		
75-28	Right swash plate out of position		
75-29	Left joystick X-Axis out of range low		
75-31	Left joystick Y-Axis out of range low		
75-32	Right joystick Y-Axis out of range low		
75-37	5 volt sensor supply 1 out of range low		
75-39	Left swash plate sensor out of range high		
75-40	Left swash plate sensor out of range low		
75-41	Right swash plate sensor out of range high		
75-42	Right swash plate sensor out of range low		
75-43	Left forward drive solenoid error ON		
75-44	Left reverse drive solenoid error ON		
75-45	Right forward drive solenoid error ON		
75-46	Right reverse drive solenoid error ON		
75-52	Backup alarm error ON		
75-53	Left forward drive solenoid error OFF		
75-54	Left reverse drive solenoid error OFF		
75-55	Right forward drive solenoid error OFF		
75-56	Right reverse drive solenoid error OFF		
75-66	Backup alarm error OFF		
75-67	No communication from Bobcat Controller		
75-69	Battery voltage out of range high		
75-70	Interrupted power (also occurs after software update)		
75-71	Battery voltage out of range low		
75-72	Drive pump not calibrated		
75-73	ISO/H pattern switch flipped while operating		

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Service Codes List (Cont'd)

CODE		CODE	
80-02	ACD output 'A' error ON		
80-03	ACD output 'A' error OFF		
81-02	ACD output 'B' error ON		
81-03	ACD output' B' error OFF		
82-02	ACD output 'C' error ON		
82-03	ACD output 'C' error OFF		
83-02	ACD output 'D' error ON		
83-03	ACD output 'D' error OFF		
84-02	ACD output 'E' error ON		
84-03	ACD output 'E' error OFF		
85-02	ACD output 'F' error ON		
85-03	ACD output 'F' error OFF		
86-02	ACD output 'G' error ON		
86-03	ACD output 'G' error OFF		
87-02	ACD output 'H' error ON		
87-03	ACD output 'H' error OFF		
90-02	Service tool output 'C' error ON		
90-03	Service tool output 'C' error OFF		
91-02	Service tool output 'D' error ON		
91-03	Service tool output 'D' error OFF		
92-02	Service tool output 'E' error ON		
92-03	Service tool output 'E' error OFF		
93-02	Service tool output 'F' error ON		
93-03	Service tool output 'F' error OFF		

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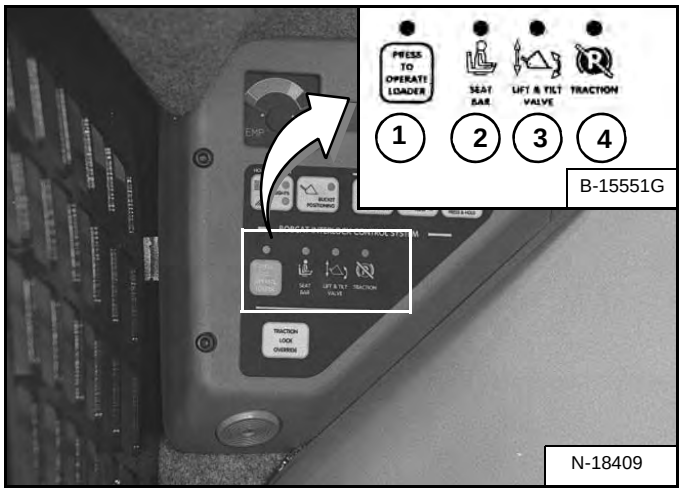


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BOBCAT INTERLOCK CONTROL SYSTEM (BICS)

Description

Figure 60-100-1



The Bobcat Interlock Control System is an electronic system that is used to protect the operator. The system consists of the traction lock, seat bar sensor and the lift and tilt lockouts solenoid.

These all have indicator lights on the left panel **[Figure 60-100-2]** of the loader cab.

The Press To Operate button activates the system and allows the operator to function the loader.

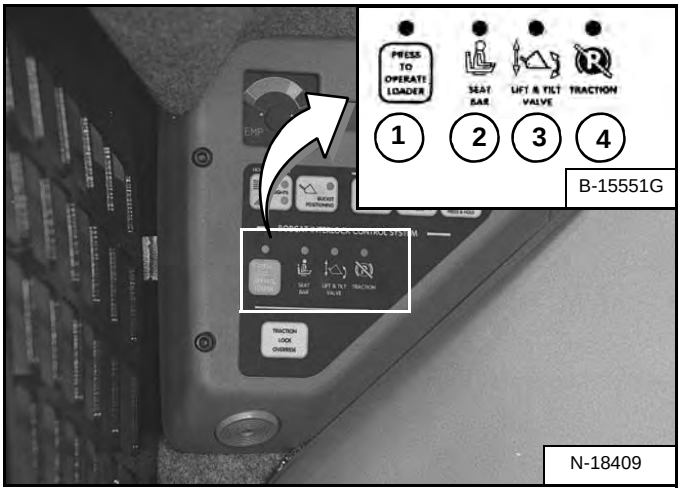
If any of these indicator lights do not illuminate the loader will not function.

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BOBCAT INTERLOCK CONTROL SYSTEM (BICS) (CONT'D)

Inspecting The BICS Controller (Engine STOPPED - Key ON)

Figure 60-100-2



1. Sit in the operator's seat. Turn key ON (Standard Panel), press RUN / ENTER Button (Deluxe Panel, lower the Seat Bar and disengage the parking brake pedal. Press the PRESS TO OPERATE LOADER Button. Three BICS lights (Items 1, 2, & 3) [PRESS TO OPERATE LOADER, SEAT BAR, and LIFT & TILT VALVE] on left instrument panel should be ON **[Figure 60-100-2]**.

2. Raise the Seat Bar fully. All four BICS lights (Items 1, 2, 3, & 4) [PRESS TO OPERATE LOADER, SEAT BAR, LIFT & TILT VALVE and TRACTION*] on left instrument panel should be OFF **[Figure 60-100-2]**.

NOTE: Record what lights are blinking (if any) and number of light flashes. (See Troubleshooting on Page 60-100-3.)

Inspecting Deactivation Of The Auxiliary Hydraulics System (Engine STOPPED - Key ON)

3. Sit in the operator's seat, lower the Seat Bar, and press the PRESS TO OPERATE LOADER Button. Press the auxiliary hydraulics FLOW Button. The auxiliary FLOW Button light will come ON. Raise the Seat Bar. The light should be OFF.

Inspecting The Seat Bar Sensor (Engine RUNNING)

4. Sit in the operator's seat, lower the seat bar, engage the parking brake pedal and fasten the seat belt

5. Start the engine and operate at low idle. Press the PRESS TO OPERATE LOADER Button. While raising the lift arms, raise the Seat Bar fully. The lift arms should stop. Repeat using the tilt function.

Inspecting The Traction Lock (Engine RUNNING)

6. Fasten seat belt, disengage parking brake, press the PRESS TO OPERATE LOADER Button and raise seat bar fully. Move steering levers slowly forward and backward. The TRACTION lock should be engaged. Lower the seat bar. Press the PRESS TO OPERATE LOADER Button.

7. Engage parking brake and move steering levers slowly forward and backward. The TRACTION lock should be engaged.

NOTE: *The TRACTION light on the left instrument panel will remain OFF until the engine is started, the PRESS TO OPERATE LOADER Button is pressed and the parking brake is disengaged.

Inspecting The Lift Arm Bypass Control

8. Raise the lift arms 6 feet (2 meters) off the ground. Stop engine. Turn lift arm bypass control knob clockwise 1/4 turn. Pull up and hold lift arm bypass control knob until lift arms slowly lower.

Inspecting Deactivation Of Lift And Tilt Functions (ACS And SJC)

9. Sit in operator's seat and fasten seat belt. Lower seat bar, start engine and press the PRESS TO OPERATE LOADER Button.

10. Raise lift arms about 6 feet (2 meters) off the ground.

11. Turn key OFF *(Standard Panel)*, press STOP Button *(Deluxe Panel)*, and wait for the engine to come to a complete stop.

12. Turn key ON *(Standard Panel)*, press RUN/ENTER Button *(Deluxe Panel)*. Press the PRESS TO OPERATE LOADER Button, move hand control or joystick to lower the lift arms. Lift arms should not lower.

13. Move the control (foot pedal, hand control or joystick) to tilt the bucket (or attachment) forward. The bucket (or attachment) should not tilt forward.

⚠ WARNING

AVOID INJURY OR DEATH

The Bobcat Interlock Control System (BICS) must deactivate the lift, tilt and traction drive functions. If it does not, contact your dealer for service. DO NOT modify the system.

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Troubleshooting

The following troubleshooting chart is provided for assistance in locating and correcting BICS system problems. It is recommended that these procedures be done by authorized Bobcat Service Personnel only.

WARNING

Check for correct function after adjustments, repairs or service. Failure to make correct repairs or adjustments can cause injury or death.

W-2004-1285

PROBLEM	CAUSE
All indicator lights flashing.	5
One of the indicator lights flashing.	1
Intermittent indicator lights.	2, 3, 4

KEY TO CORRECT THE CAUSE
1. Refer to BICS troubleshooting chart. (See Page 60-100-4.)
2. Check wire connections on Bobcat Controller to make sure connectors are locked into place.
3. Check pins in connectors for pins pushed back or bent.
4. Use seat bar sensor tester MEL1428 to isolate problem between sensor and controller and wiring.
5. Possible low or high voltage.

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BOBCAT INTERLOCK CONTROL SYSTEM (BICS) (CONT'D)

Troubleshooting Chart

The following list shows the effects which can happen to the loader, and the probable causes when the BICS System lights are off or flashing and associated service code. (See Service Codes List on Page 60-90-2.)

Indicator Light	Light ON	Light OFF	Effect on Operation of Loader When Light is OFF	SERVICE CODES Means System Error (See Your Bobcat Dealer for Service)		
				No. of Flashes	Service Code	Causes
1 	PRESS TO OPERATE LOADER Button is pressed.	PRESS TO OPERATE LOADER Button is not pressed.	Lift, tilt and traction functions will not operate.	----	----	----
2 	Seat Bar is down.	Seat Bar is up.	Lift and tilt functions will not operate.	2	11-05	Seat Bar sensor circuit shorted to battery voltage*.
				3	11-06	Seat Bar sensor circuit shorted to ground.
3 	Control valve can be used.	Control valve cannot be used.	Lift, tilt and traction functions will not operate.	1	17-07	Valve output circuit is open.
				2	17-05	Valve output circuit shorted to battery voltage*.
				3	17-06	Valve output circuit shorted to ground.
				3	17-06	Controller not grounded or intermittent ground.
4 	Loader can be moved forward & backward	Loader cannot be moved forward and backward.	Loader cannot be moved forward and backward.	1	16-07	Traction lock hold solenoid circuit is open.
				2	16-05	Traction lock hold solenoid circuit shorted to battery voltage*.
				3	16-06	Traction lock hold solenoid circuit shorted to ground.
				5	15-02	Traction lock pull solenoid circuit is shorted to battery voltage* - ERROR ON (Should be OFF).
				6	15-03	Traction lock pull solenoid circuit ERROR OFF (Should be ON).
SEAT BAR 2 LIFT & TILT VALVE 3 TRACTION 4				Continuous Flashing	03-09 03-10	System voltage low System voltage high

NOTES:

Multiple SERVICE CODES and/or Abnormal Symptoms can be caused by corroded or loose ground. Check grounds and both battery connections.

ERROR OFF = shorted to ground or bad fuse, faulty wiring, faulty open relay, no voltage from relay to controller.
ERROR ON = shorted to battery voltage, faulty wiring, faulty closed relay.

*Normal BICS operating voltage is less than the electrical system voltage.

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SEAT BAR SENSOR

Description

The seat bar sensor is part of the BICS system. The seat bar sensor sends a signal that indicates whether the seat bar is in the down or up position.

The sensor is located on the left side of seat bar.

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Troubleshooting

The following troubleshooting chart is provided for assistance in locating and correcting BICS system problems. It is recommended that these procedures be done by authorized Bobcat Service Personnel only.

WARNING

Check for correct function after adjustments, repairs or service. Failure to make correct repairs or adjustments can cause injury or death.

W-2004-1285

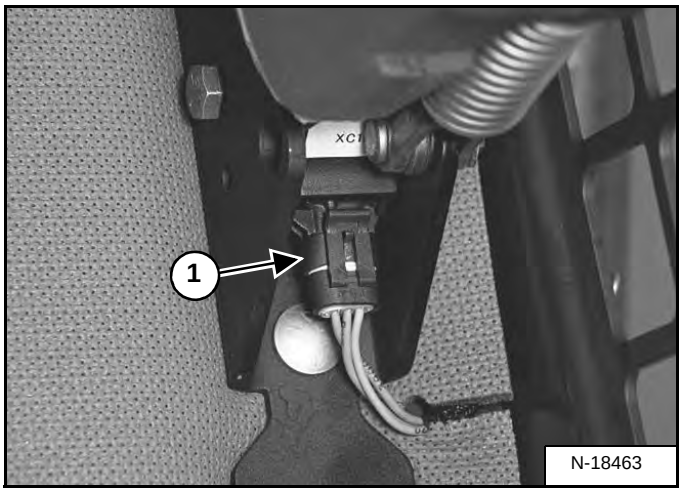
PROBLEM	CAUSE
Indicator light does not come ON when seat bar is lowered.	1, 2, 3, 4, 5

KEY TO CORRECT THE CAUSE
1. Check sensor wire connection.
2. Use the BICS sensor tester MEL1428 with seat bar adapter MEL1567 to check sensor and controller.
3. Check for loose hardware.
4. Check keyed bushing to make sure magnet collar rotates with seat bar.
5. Check magnet collar magnets for contamination such as metal particles.

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Testing

Figure 60-110-1

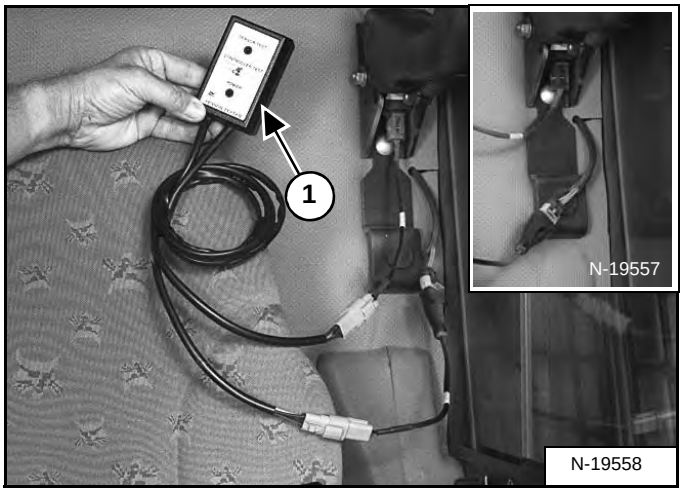


Use Sensor Tester (MEL1428) and seat bar sensor tester adapter (MEL1567) for the following procedure:

Connect the seat bar adapter sensor leads (MEL1567) to the sensor tester.

Disconnect the seat bar sensor connector (Item 1) **[Figure 60-110-1]**.

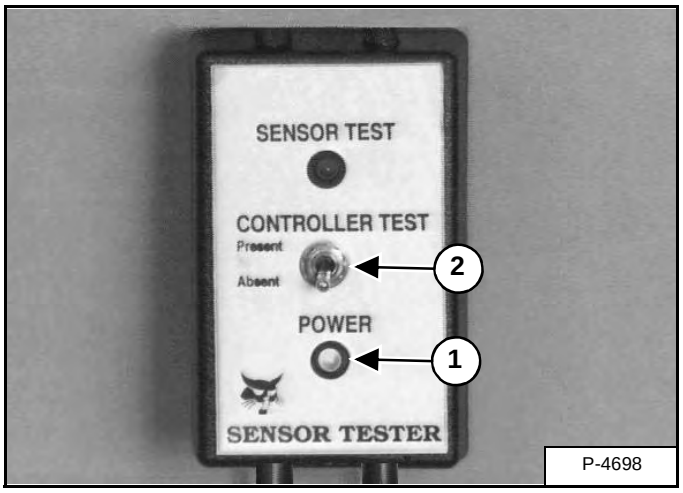
Figure 60-110-2



Connect the Sensor Tester (Item 1) inline, to the seat bar sensor connectors. See inset **[Figure 60-110-2]**.

Turn the key to the ON position. DO NOT START THE ENGINE.

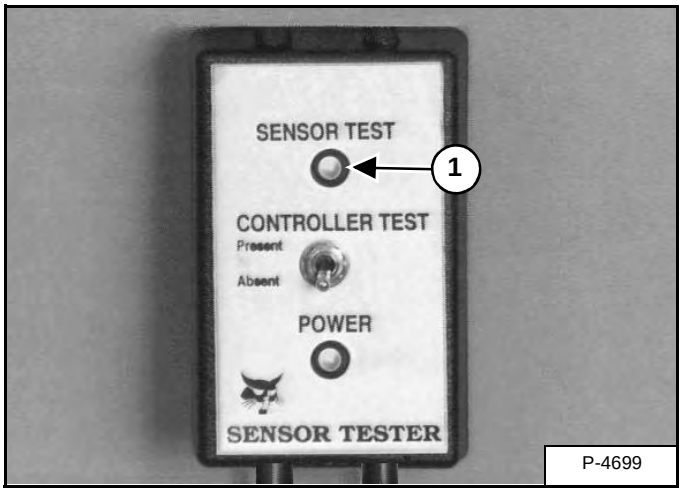
Figure 60-110-3



The toggle switch (Item 2) **[Figure 60-110-3]** can be in either the Absent or Present position.

If there is no power light (Item 1) **[Figure 60-110-3]** on the sensor tester, check the tester or wiring harness.

Figure 60-110-4



Lower the seat bar. The Sensor Test light (Item 1) **[Figure 60-110-4]** should illuminate.

Raise the seat bar. The Sensor Test light (Item 1) **[Figure 60-110-4]** should go off.

If the above test fails, there is a problem with the seat bar sensor.

Disconnect the Sensor Tester.

Replace the Seat Bar Sensor. (See Removal And Installation on Page 60-110-4.)

If the above test passes, run the seat bar sensor BICS circuit test. (See Bobcat Interlock Control System (BICS) Circuit Test on Page 60-110-5.)

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SEAT BAR SENSOR (CONT'D)

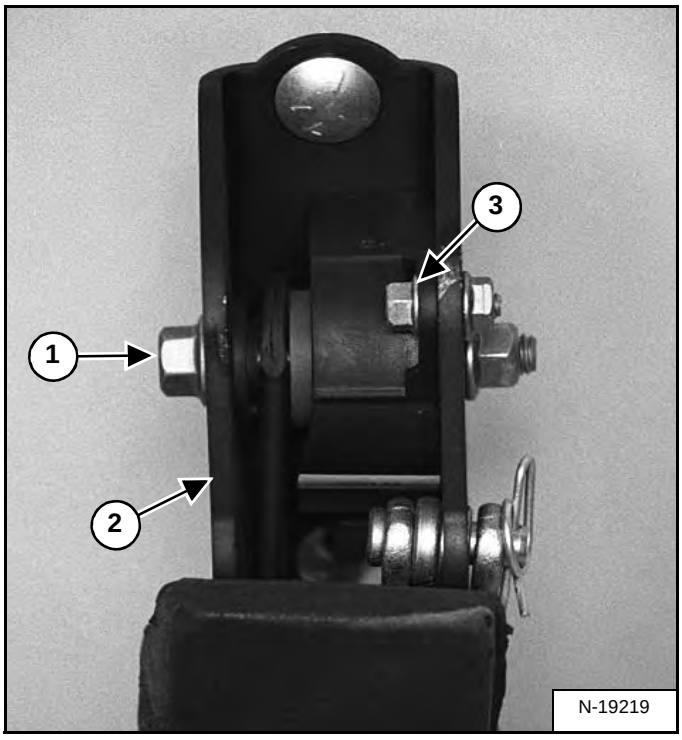
Removal And Installation

Figure 60-110-5



Remove the seat bar (Item 1) **[Figure 60-110-5]** from the loader. (See Removal And Installation on Page 50-10-1.)

Figure 60-110-6

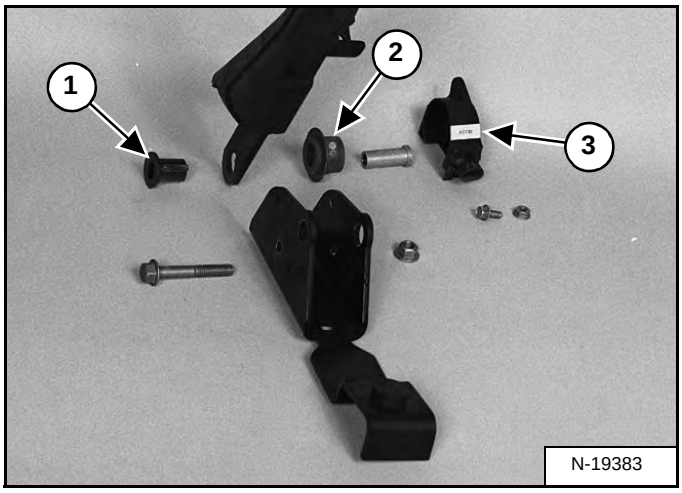


Remove the mounting bolt (Item 1) from the seat bar mount (Item 2) **[Figure 60-110-6]**.

Installation: Tighten the mounting bolt (Item 3) **[Figure 60-110-6]** to 50-70 in.-lb. (5,6-7,9 N•m) torque.

Remove the sensor mounting bolt (Item 3) **[Figure 60-110-6]** and nut.

Figure 60-110-7



Remove the keyed plastic bushing (Item 1), magnetic bushing assembly (Item 2) and sensor bracket (Item 3) **[Figure 60-110-7]**.

IMPORTANT

Be careful to not overtighten the sensor mounting bolt and nut to prevent breakage of the sensor.

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Installation: Be sure the tabs on the pivot bushing are positioned in the slotted hole (Item 1) **[Figure 60-110-7]** of the seat bar

Inspect all parts for damage and wear and replace if necessary.

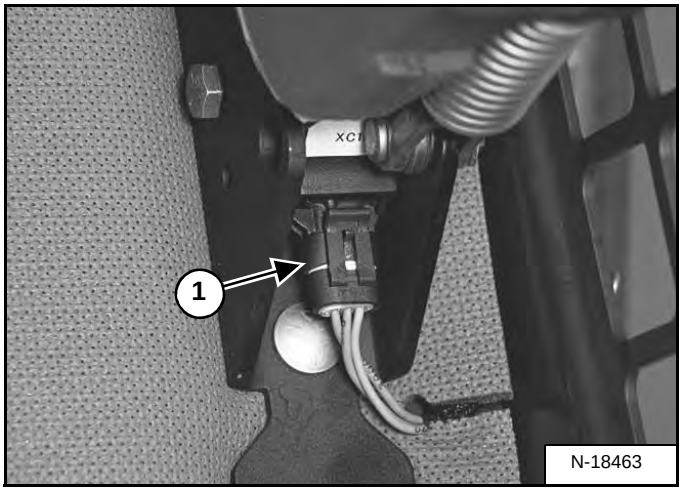
Reverse the removal procedure to install the seat bar sensor.

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Bobcat Interlock Control System (BICS) Circuit Test

This (BICS) circuit test is for the seat bar section only.

Figure 60-110-8

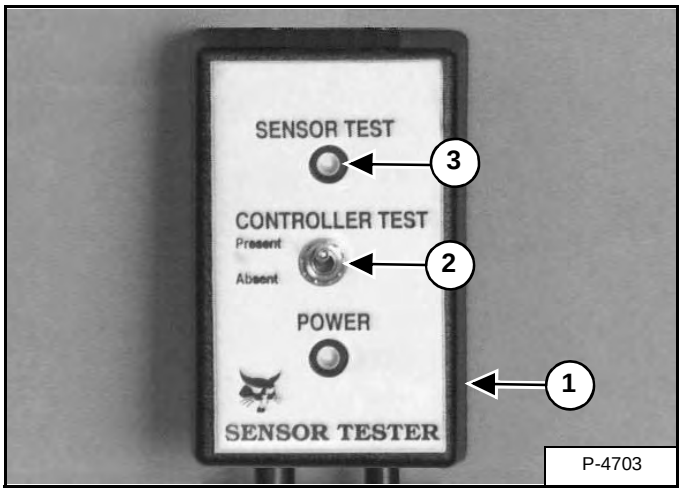


Use Sensor Testers (MEL1428) and seat bar sensor tester adapter (MEL1567) for the following procedure:

Connect the seat bar sensor tester adapter MEL1567 to the sensor tester.

Disconnect the seat bar sensor connector (Item 1) **[Figure 60-110-8]**.

Figure 60-110-9



Connect Sensor Tester (Item 1) **[Figure 60-110-9]** inline to the seat bar sensor connectors.

Turn the key to the ON position. DO NOT START THE ENGINE.

If there is no power light on the sensor tester, check the tester or wiring harness.

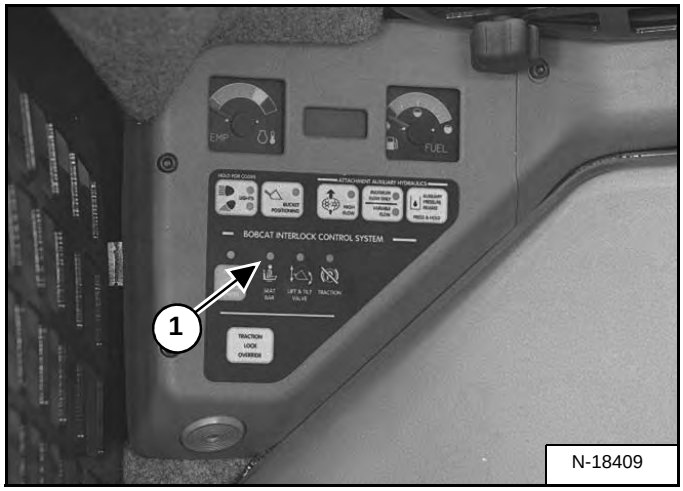
When the power light is illuminated, move the toggle switch (Item 2) **[Figure 60-110-9]** on the sensor tester to the Present position.

NOTE: The sensor test light (Item 3) [Figure 60-110-9] is only activated by the seat bar. It will be off with the seat bar up or on with the seat bar down.

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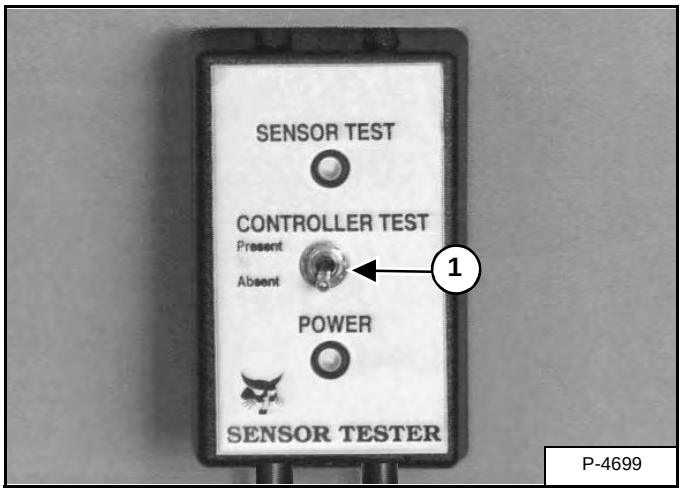
Bobcat Interlock Control System (BICS) Circuit Test (Cont'd)

Figure 60-110-10



The BICS seat bar indicator light (Item 1) **[Figure 60-110-10]** should illuminate.

Figure 60-110-11



Move the toggle switch (Item 1) **[Figure 60-110-11]** on the sensor tester to the Absent position.

The Seat Bar light (Item 1) **[Figure 60-110-11]** should go off.

If the above test fails, there is a problem with the Bobcat controller or the wiring harness.

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TRACTION LOCK

Description

The Traction Lock Control System will lock the traction drive system when the engine stops. The Traction Lock Control System is incorporated into the Bobcat Interlock Control System (BICS).

Two speed loaders don’t have a wedge block brake in the transmission chaincase. The brakes on the two speed loaders are incorporated into the end of the hydrostatic motor. The traction lock inspecting is still valid to the two speed loaders because all loaders have an rpm sensor.

For more information on the two speed brakes (See BRAKE (TWO-SPEED) on Page 40-12-1.) or (See HYDROSTATIC MOTOR (TWO-SPEED) on Page 30-21-1.) for information on the two speed hydrostatic motor.

The traction lock solenoid and wedge are located on the center cover of the transmission chaincase.

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Troubleshooting

The following troubleshooting chart is provided for assistance in locating and correcting BICS system problems. It is recommended that these procedures be done by authorized Bobcat Service Personnel only.

WARNING

Check for correct function after adjustments, repairs or service. Failure to make correct repairs or adjustments can cause injury or death.

W-2004-1285

PROBLEM	CAUSE
Traction lock stays engaged.	1, 2, 3, 4, 5, 6, 7,11,12,13
Intermittent activation of traction lock.	8, 9, 10, 11

KEY TO CORRECT THE CAUSE
1. Make sure brake pedal is not engaged.
2. Maneuver loader to allow brake discs to move and remove pressure on the brake wedge so it can retract.
3. If all lights indicate the brake should be released, but it has not released, check the brake 30 amp. fuse.
4. When checking fuse, also check other fuses. Check the fuse block for correct orientation and location of fuses. (See Fuse And Relay Location / Identification on Page 60-10-10.)
5. To test the solenoid, the pull coil should be about 0.3 ohms and the hold coil should be about 10.9 ohms.
6. Check brake solenoid and cover mounting hardware for the correct torque.
7. Remove brake cover and check wedges for binding in the wedge guides.
8. Check wire connections for loose connector body.
9. Check for loose or bent pins in connectors.
10. Check for loose spade connectors in fuse holder.
11. Check flywheel RPM sensor and wiring.
12. Check the Display Panel for an error code. (See Electrical System Service Manual)
13. Check brake solenoid wiring voltage, solenoid wiring should read 12 volts.

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Removal And Installation (Single Speed)

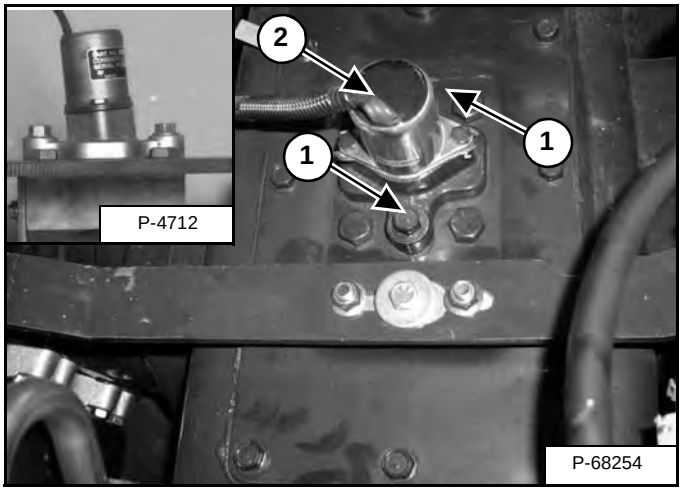
⚠ WARNING

AVOID INJURY OR DEATH

Do not modify the electrical wiring connected to the traction lock solenoid or any part of the traction lock system. The traction lock provides the locking function of the parking brake. Service work on the traction lock system should only be performed by a qualified technician. Use only genuine Bobcat Company parts if repair is necessary.

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Figure 60-110-1



Raise the operator cab. (See Raising on Page 10-30-1.)

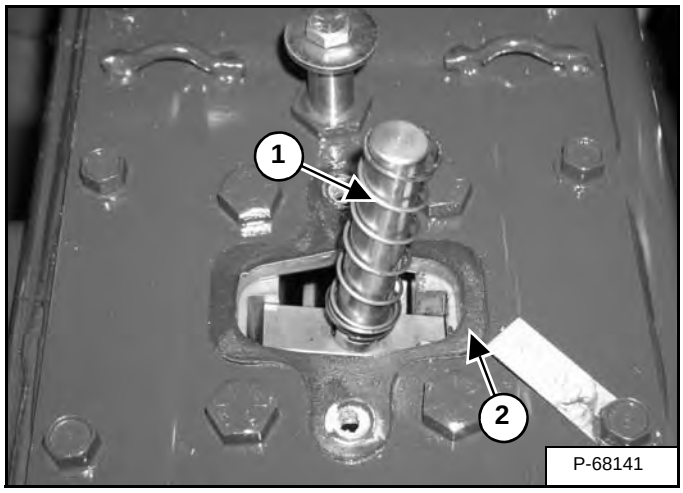
Remove the two mounting bolts (Item 1) **[Figure 60-110-1]** from the electric solenoid mounting bracket.

Remove the electric solenoid and bracket assembly from the chaincase cover (Item 2) **[Figure 60-110-1]**.

Installation: Apply polyurethane sealer to the bolt threads and tighten the mounting bolts to 25-28 ft.-lb. (34-38 N•m) torque.

Be sure the solenoid mounting bracket is installed in the same position. The solenoid mounting surface has a slight angle which tips the top of the solenoid toward the rear of the loader when installed correctly. See inset photo **[Figure 60-110-1]**.

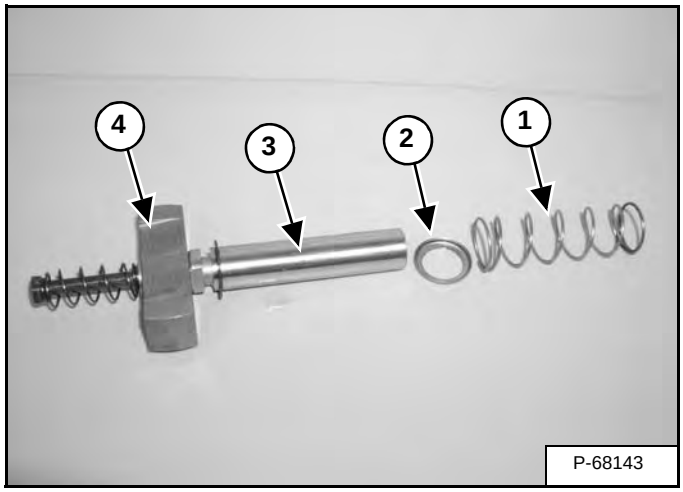
Figure 60-120-2



Remove the traction lock assembly (Item 1) **[Figure 60-120-2]** from the chaincase.

Inspect gasket (Item 2) **[Figure 60-120-2]**, replace as needed.

Figure 60-120-3



Remove and inspect the compression spring (Item 1) and spring cap washer (Item 2) **[Figure 60-120-3]** for wear or damage. Replace if necessary. The spring may also stay with the shaft when the electric solenoid and bracket are removed from the chaincase.

Installation: Install the compression spring (Item 1) **[Figure 60-120-3]** on the collar located on the electric solenoid.

Inspect the shaft (Item 3) and wedge (Item 4) **[Figure 60-120-3]** for scoring and deep scratches, replace if damaged.

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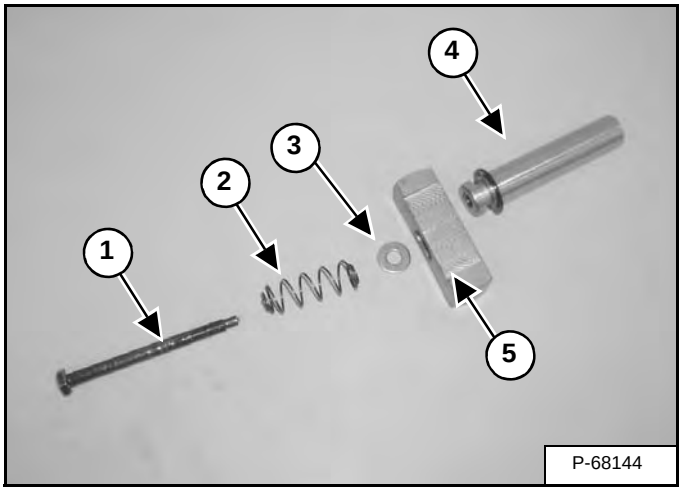
Removal And Installation (Single Speed) (Cont'd)

IMPORTANT

Failure to use Loctite® may allow the traction lock assembly to loosen up which can cause damage to the traction lock system.

I-2090-1095

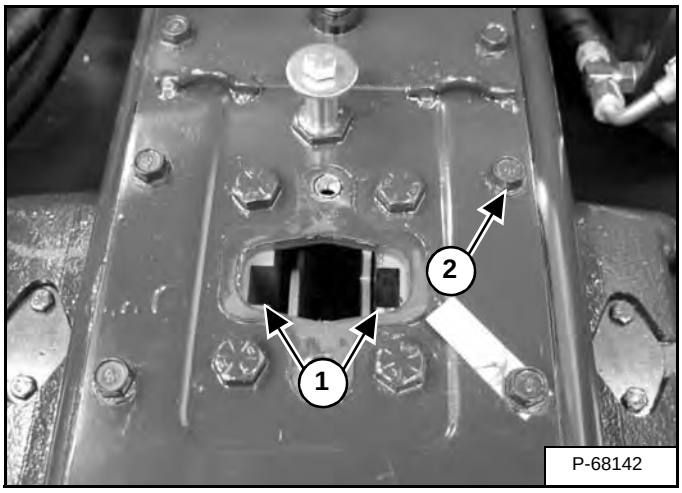
Figure 60-120-4



Remove the shaft mounting bolt (Item 1), spring (Item 2) and washer (Item 3) from the assembly shaft (Item 4). Remove the wedge (Item 5) **[Figure 60-120-4]** and inspect all parts for damage or wear. Replace if necessary.

Installation: Thoroughly clean and dry the shaft mounting bolt (Item 1), the shaft (Item 4) and wedge (Item 5) **[Figure 60-120-4]**. Use Loctite® #242 when assembling these parts to the traction lock assembly.

Figure 60-120-5

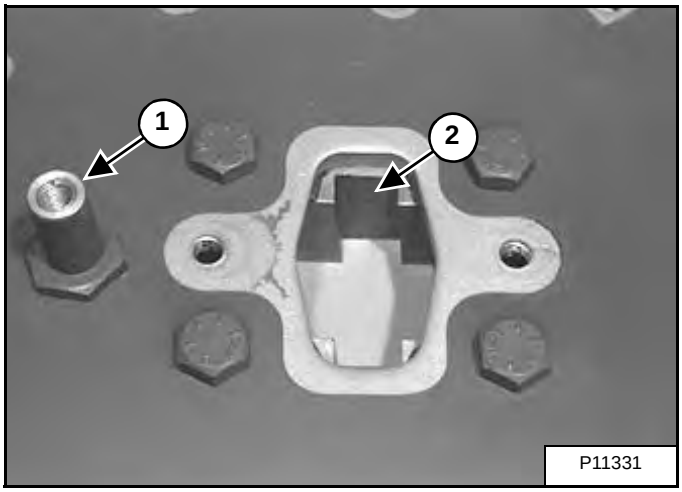


Inspect the guides (Item 1) **[Figure 60-120-5]** for wear or damage. Replace if necessary.

If replacement is necessary, remove the center chaincase cover. Remove the screws (Item 2) **[Figure 60-120-5]** and pry the center cover off.

Installation: Apply polyurethane sealant to the screw threads and center chaincase cover. Tighten screws to 15-20 ft.-lb. (20-27 N•m) torque.

Figure 60-120-6

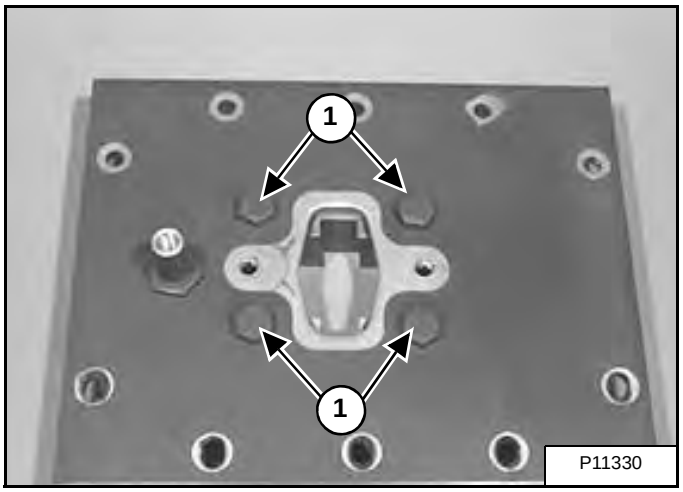


NOTE: Bolt (Item 1) is on the rear of the chaincase cover, notice the direction of the groove (Item 2) [Figure 60-120-6] in the traction lock guides.

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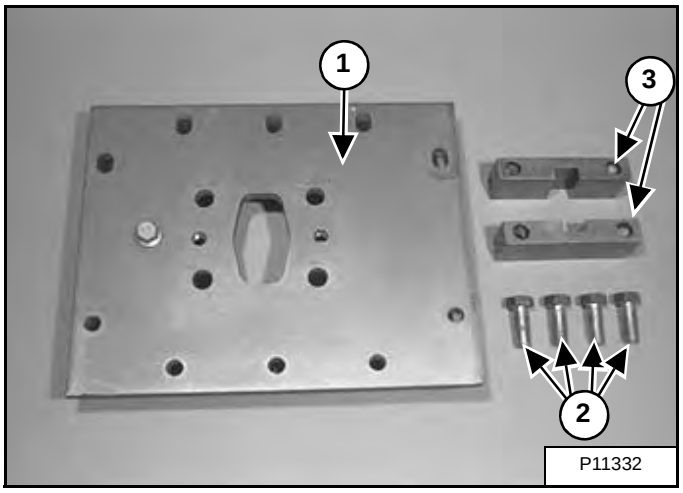
Removal And Installation (Single Speed) (Cont'd)

Figure 60-120-7



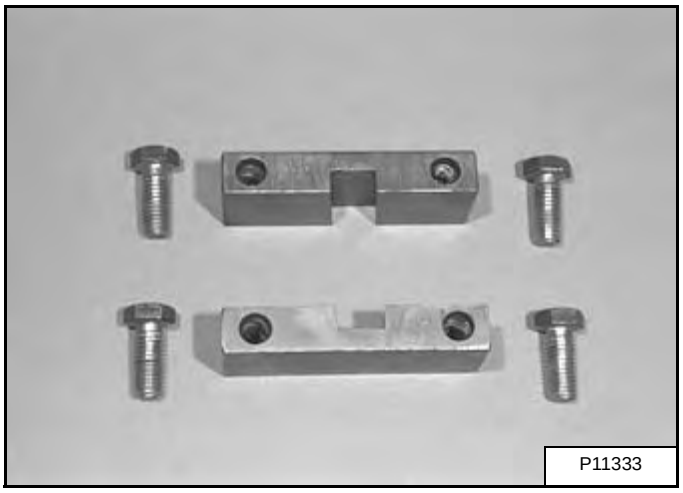
To remove the traction lock guides remove the four bolts (Item 1) **[Figure 60-120-7]**.

Figure 60-120-8



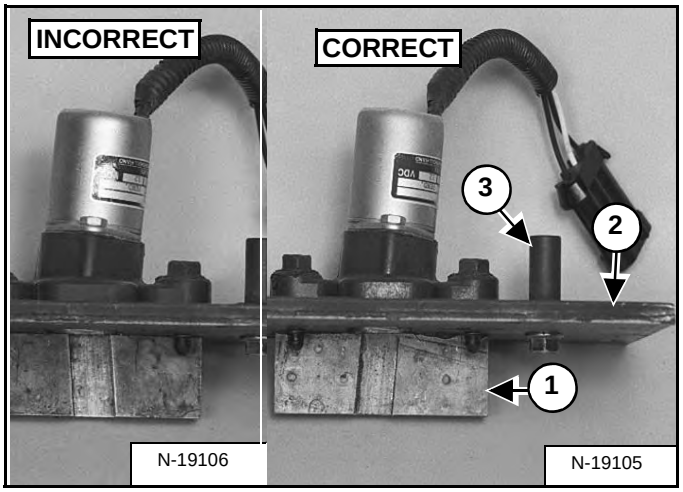
Installation: Thoroughly clean the polyurethane from the chaincase cover (Item 1), bolts (Item 2) and traction lock guides (Item 3) **[Figure 60-120-8]** and dry.

Figure 60-120-9



Installation: Apply a bead of polyurethane on the traction lock guides and bolts **[Figure 60-120-9]**.

Figure 60-120-10



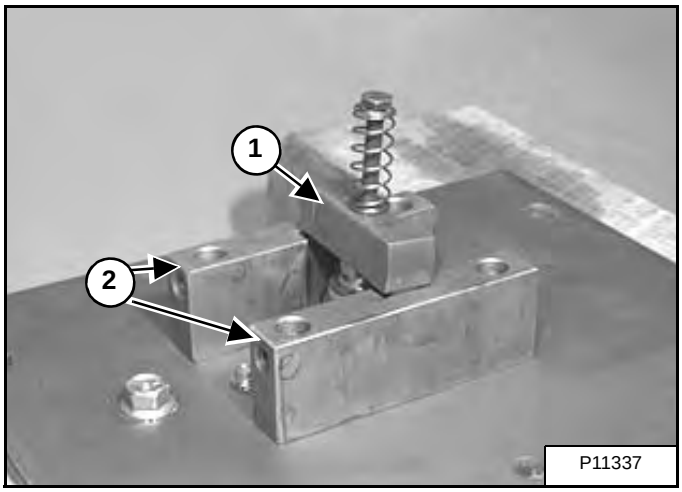
Install the traction lock guides (Item 1) to the chaincase cover (Item 2) **[Figure 60-120-10]** using the four bolts (removed earlier).

Do not tighten at this time.

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Removal And Installation (Single Speed) (Cont'd)

Figure 60-120-11



Install the traction wedge assembly (Item 1) into the solenoid and traction lock guides (Item 2) **[Figure 60-120-11]**.

After the bolts have been tightened recheck to make sure the shaft assembly is moving freely in the guides.

Remove the wedge assembly (Item 1) **[Figure 60-120-11]**.

NOTE: The wedge assembly must slide freely in the grooves of the guides. Tighten the four guide bolts to 90-100 ft.-lb. (123-135 N•m) torque.

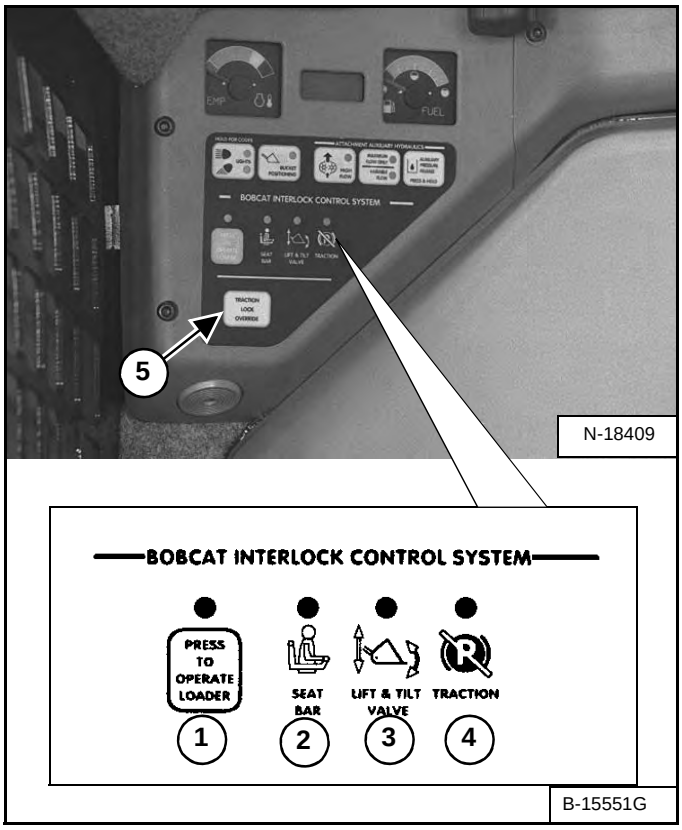
Lower operator cab. (See Lowering on Page 10-30-2.)

Perform the BICS inspection procedure. (See BOBCAT INTERLOCK CONTROL SYSTEM (BICS) on Page 60-100-1.)

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Inspecting (Single And Two Speed)

Figure 60-120-12

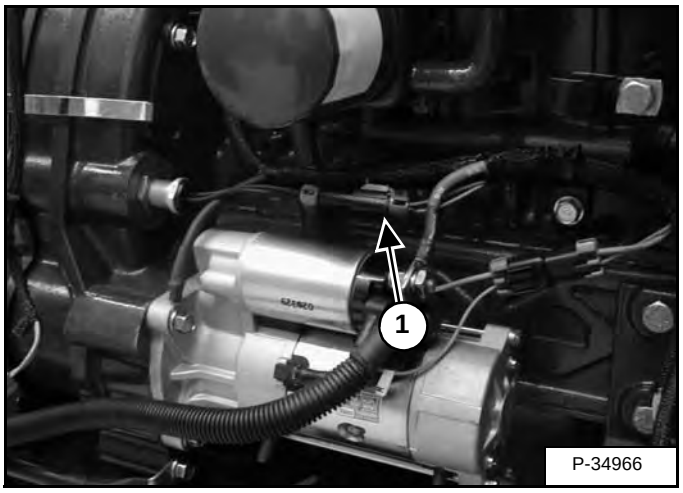


Fasten the seat belt, disengage the parking brake pedal, press the PRESS TO OPERATE LOADER Button (Item 1) **[Figure 60-120-12]** and raise the Seat Bar fully. Move the steering levers slowly forward and backward. The TRACTION lock should be engaged. Lower the Seat Bar. Press the PRESS TO OPERATE LOADER Button (Item 1) **[Figure 60-120-12]**.

Engage the parking brake pedal and move the steering levers slowly forward and backward. The TRACTION lock should be engaged.

NOTE: The TRACTION light on the left instrument panel will remain OFF until the engine is started, the PRESS TO OPERATE LOADER Button is pressed and the parking brake is disengaged.

Figure 60-120-13



Check the wire connections at the engine flywheel RPM speed sensor (Item 1) **[Figure 60-120-13]**.

NOTE: When the Traction Lock Override Button is activated, the Traction Lock Override Control System will NOT engage the Traction Lock if the engine stops.

See Adjustment on Page 60-170-2 for Flywheel RPM sensor adjustment.

Fasten the seat belt, disengage the parking brake pedal, press the green *PRESS TO OPERATE* Button and raise the Seat Bar fully. Move the control levers slowly forward and backward. The Traction lock should be engaged. Lower the Seat Bar. Press the green *PRESS TO OPERATE* Button.

Engage the parking brake pedal and move the control levers slowly forward and backward. The Traction lock should be engaged.

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CONTROL SYSTEM (ACS)

Description

The ACS option allows the operator to quickly switch between foot and hand control modes. It uses the electric actuators to control the lift and tilt spools, foot sensors, handle sensors and a specially designed control handle.

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CONTROL SYSTEM (ACS) (CONT'D)

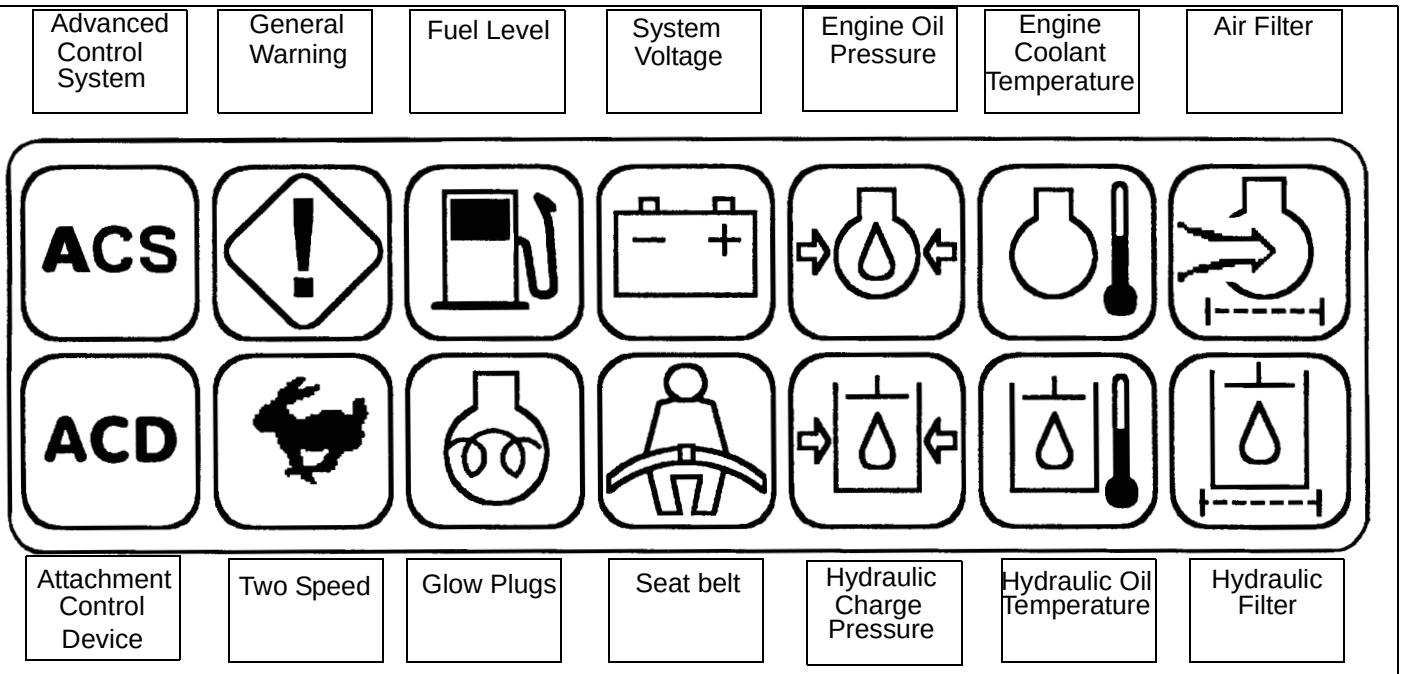
Troubleshooting Chart

The Advanced Control System (ACS) has a built-in diagnostic function which uses an icon on the right instrument panel to indicate the condition of the ACS SYSTEM. The system also records the alarm condition as a service code.

The control module continually checks the system in the order listed. The checks start with the lift handle sensor and then the lift actuator. If no problems are present, it will then check the tilt handle sensor and the tilt actuator. The system will stop its check at the first problem and then illuminate the icon.

The system starts its diagnostics and calibration when the ignition key is turned ON.

The following list shows the probable causes when the icon is illuminated.



ACS

Advanced Control System

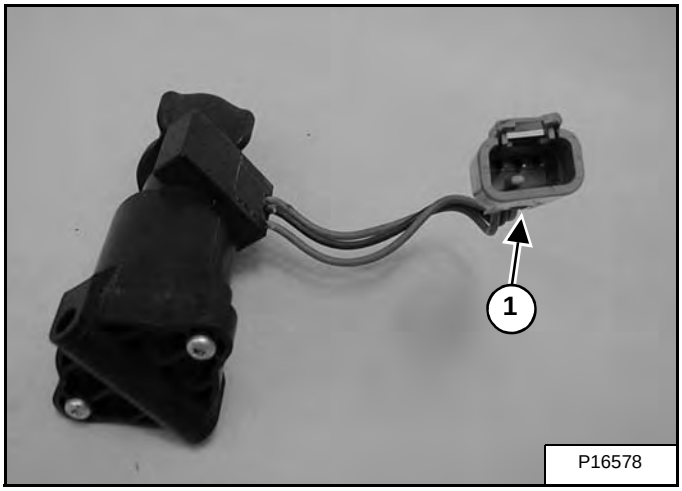
Errors - **lights** solid with 3 beeps
32-04 - **ACS** in error
32-23 - **ACS** not calibrated
32-49 - **Lift** actuator short to ground
32-50 - **Tilt** actuator short to ground
32-51 - **Lift** actuator short to battery
32-52 - **Tilt** actuator short to battery
32-53 - **Lift** handle/pedal short to ground
32-54 - **Tilt** handle/ pedal short to ground
32-55 - **Lift** handle/pedal short to battery
32-56 - **Tilt** handle/pedal short to battery
32-57 - **Lift** actuator reduced performance
32-58 - **Tilt** actuator reduced performance
32-59 - **Lift** actuator wrong direction
32-60 - **Tilt** actuator wrong direction
32-61 - **Handle** lock short to ground
32-62 - **Handle** lock short to battery
32-63 - **Pedal** lock short to ground
32-64 - **Pedal** lock short to battery
32-65 - **Sensor** supply voltage out of range
32-66 - **Battery** out of range
32-67 - **Switch** moved while operating

To see what error occurred. Check the service code on the left instrument panel. (See Diagnostics Page 60-90.)

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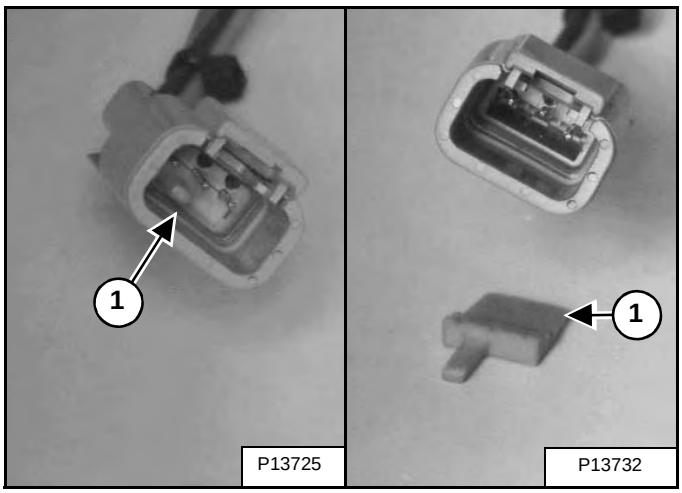
Handle Sensor Connector Disassembly And Assembly

Figure 60-130-1



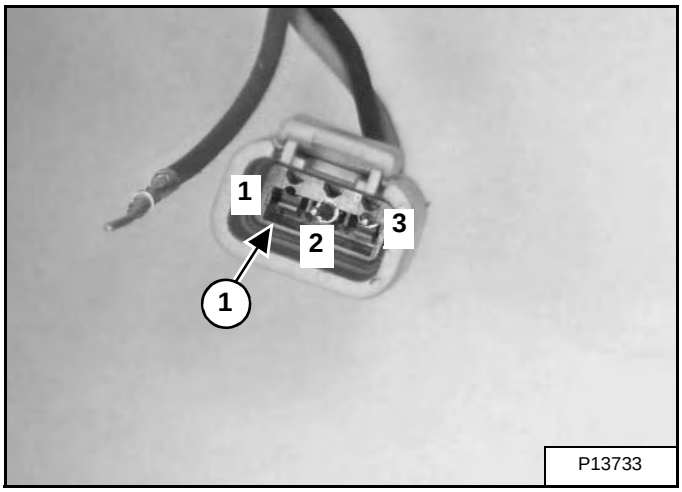
The wire connector (Item 1) **[Figure 60-130-1]** can be removed from the handle sensor wires, use the following procedure.

Figure 60-130-2



Remove the wedge (Item 1) **[Figure 60-130-2]** from the connector.

Figure 60-130-3



With a pointed tool, lift the tab (Item 1) **[Figure 60-130-3]** and pull the wire from the connector.

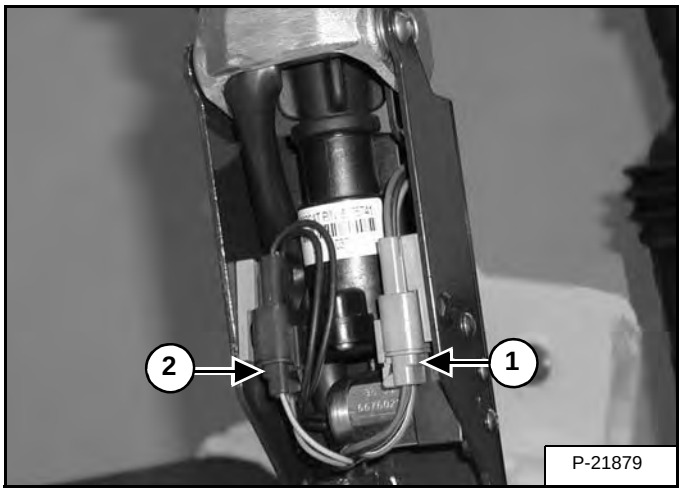
Installation: Install the wires into the connector as listed below **[Figure 60-130-3]**:

1-Terminal - Red
2-Terminal - Black
3-Terminal - Green

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Switch Handle Removal

Figure 60-130-4

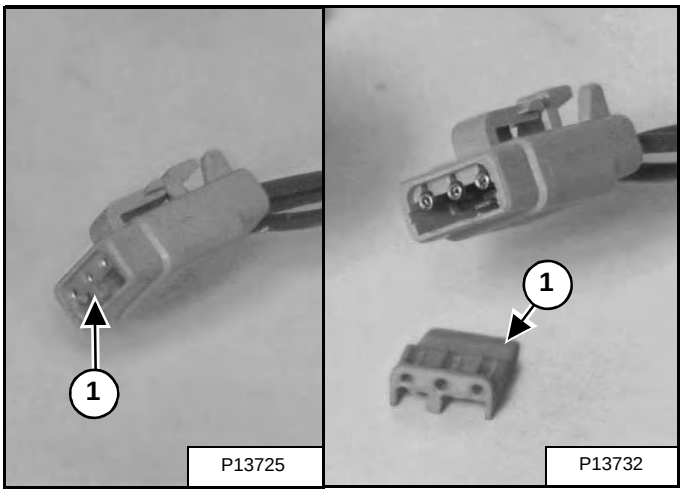


NOTE: Switch handle can be removed and installed while in loader.

Disconnect the harness connector (Item 1) **[Figure 60-130-4]** from the handle sensor connector.

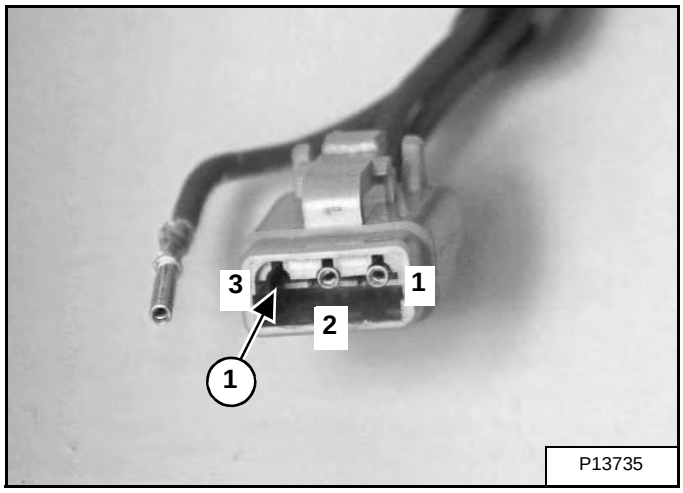
Disconnect the harness connector (Item 2) **[Figure 60-130-4]** from the handle lock solenoid connector.

Figure 60-130-5



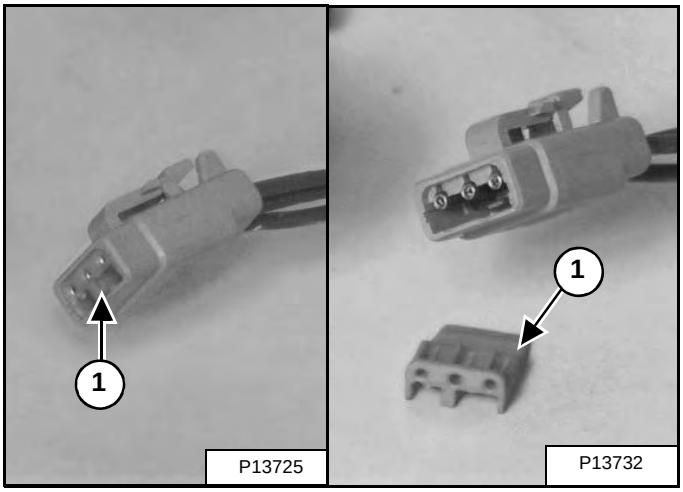
Remove the wedge (Item 1) **[Figure 60-130-5]** from the harness connector (Gray) that connects to the handle sensor connector.

Figure 60-130-6



Using a pointed tool, press down on the tab (Item 1) **[Figure 60-130-6]** and pull the wire from the connector.

Figure 60-130-7

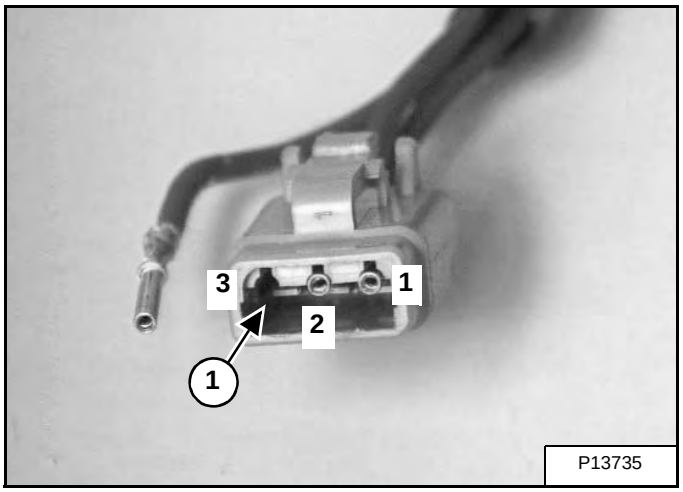


Remove the wedge (Item 1) **[Figure 60-130-7]** from the harness connector (Black) that connects to the handle lock solenoid connector.

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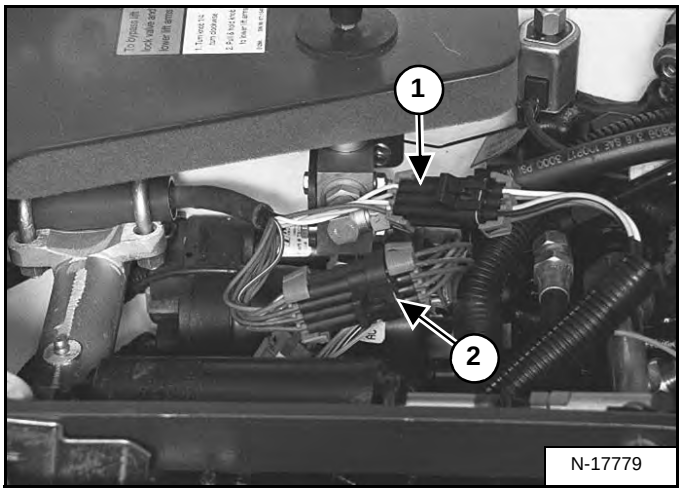
Switch Handle Removal (Cont'd)

Figure 60-130-8



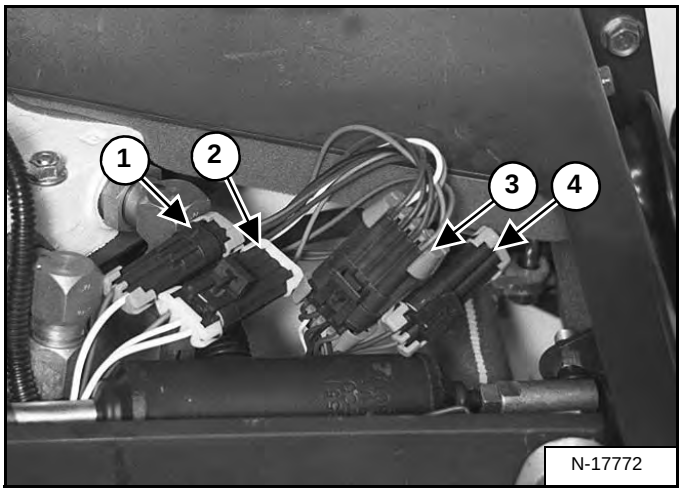
Use a pointed tool, press down on the tab (Item 1) **[Figure 60-130-8]** and pull the wire from the connector.

Figure 60-130-9



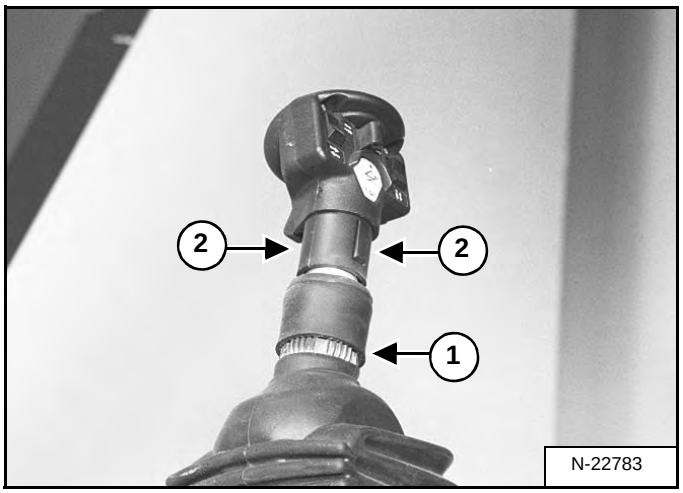
Disconnect the right switch handle connectors (Items 1 & 2) **[Figure 60-130-9]** from the loader wiring harness connectors.

Figure 60-130-10



Disconnect the left switch handle connectors (Items 1, 2, 3 & 4) **[Figure 60-130-10]** from the loader wiring harness connectors.

Figure 60-130-11



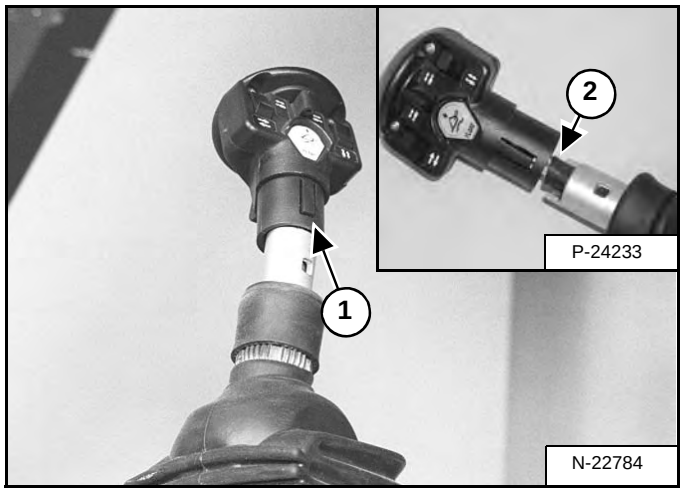
Roll the pistol grip handle cover (Item 1) **[Figure 60-130-11]** down.

Using a small screwdriver, lift the handle tabs (Item 2) **[Figure 60-130-11]** and slightly rotate the switch handle.

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Switch Handle Removal (Cont'd)

Figure 60-130-12

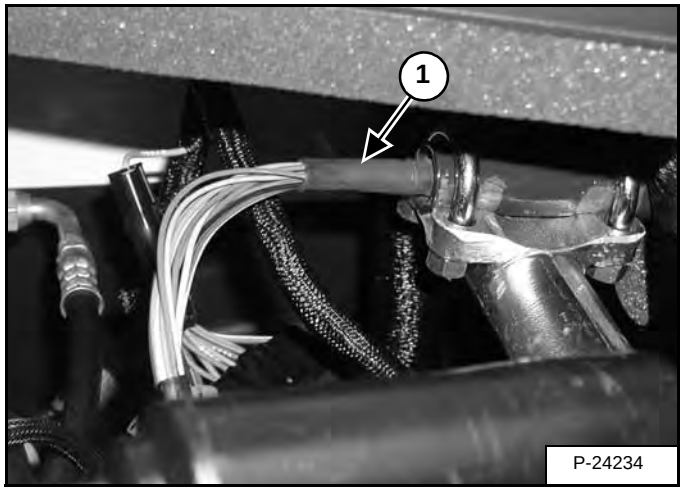


Pull the switch handle and wiring harness assembly (Item 1) **[Figure 60-130-12]** from the control lever.

Cut the wires (Item 2) **[Figure 60-130-12]** below the switch handle and remove switch handle.

NOTE: Only cut the wires if the switch handle is bad and needs replacement. If the switch handle is good and just needs to be removed for control handle or lever replacement, then remove the connectors on the end of the harness and pull switch handle up out of lever tube.

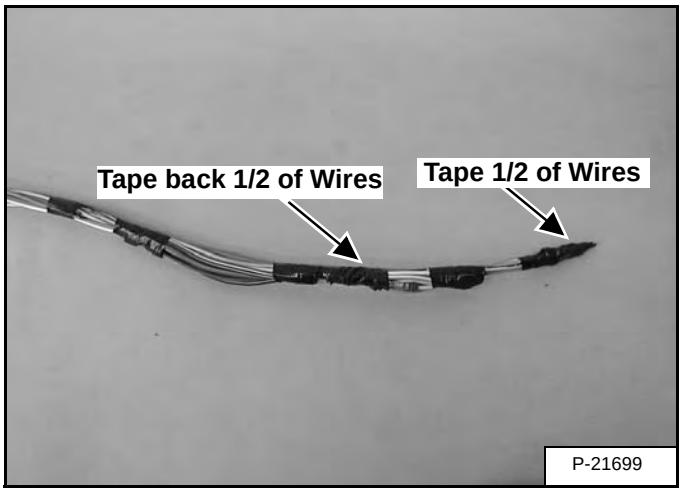
Figure 60-130-13



Pull harness (Item 1) **[Figure 60-130-13]** out the bottom of the control lever tube.

Switch Handle Installation

Figure 60-130-14



When installing the new switch handle, tape the wire terminals together.

The switch handle comes with a 6 inch piece of heat shrink tube side on the end of the wires. Remove the heat shrink tube from the end of the wires before routing through handle and control lever tube.

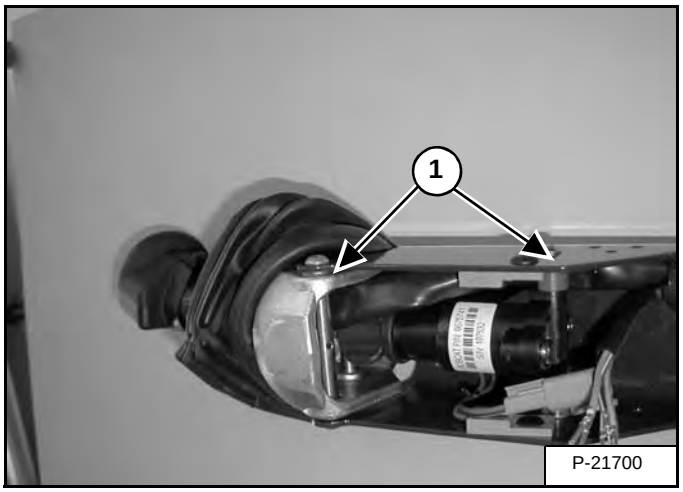
NOTE: Leave all the other heat shrink tube on the wires for protection.

Tape half of the wires back and half forward **[Figure 60-130-14]** to keep the harness small enough to route through the control lever tube.

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Switch Handle Installation (Cont'd)

Figure 60-130-15

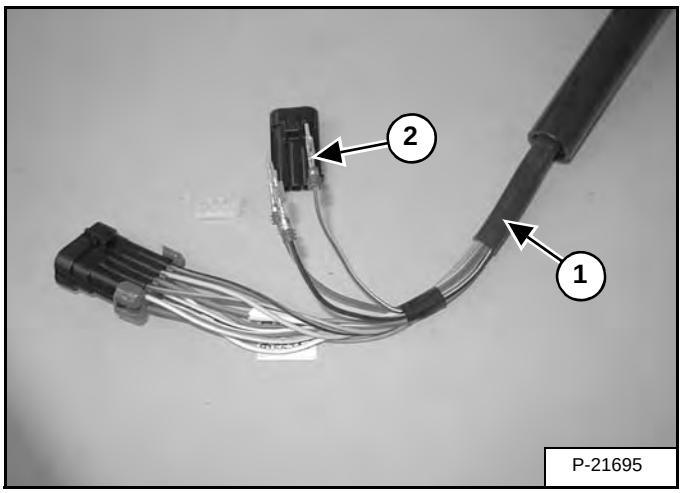


Install the new switch handle and wires from the top of the control lever.

Route wire (Item 1) **[Figure 60-130-15]** through the casting, along side the handle sensor and into the control lever tube.

NOTE: Do not pull the wire harness tight, allow a small amount of slack or slight bend at the handle pivot area. Verify the control handle returns to neutral position.

Figure 60-130-16



Remove tape from wires for installation and install the 6 inches of heat shrink tube (Item 1) **[Figure 60-130-16]** approximately 3 inches into the control lever. Apply heat to the exposed heat shrink tube.

Inspect the wire terminal tabs (Item 2) **[Figure 60-130-16]** and re-bend tabs if necessary.

Install the wires into the connectors as listed below:

Right Switch Handle

Ten-Pin Connector
- A-Terminal - Orange
- B-Terminal - White
- C-Terminal - White/Black
- D-Terminal - White/Red
- E-Terminal - Dk. Green
- F-Terminal - White/Lt. Green
- G-Terminal - Yellow/Red
- H-Terminal - Lt. Green
- J-Terminal - Yellow
- K-Terminal - Orange/Black

Three-Pin Connector
- A-Terminal - Red/White
- B-Terminal - Black/White
- C-Terminal - Purple/White

Left Switch Handle

Ten-Pin Connector
- A-Terminal - Orange
- B-Terminal - Dk. Blue
- C-Terminal - White
- D-Terminal - Purple
- E-Terminal - Yellow/Red
- F-Terminal - Tan
- G-Terminal - Pink
- H-Terminal - Orange/Black
- J-Terminal - Blank
- K-Terminal - Blank

Three-Pin Connector
- A-Terminal - Red/White
- B-Terminal - Black/White
- C-Terminal - Purple/White

Two-Pin Connector
- A-Terminal - Black
- B-Terminal - Red

Five-Pin Connector
- A-Terminal - Dk. Green
- B-Terminal - Brown
- C-Terminal - Blank
- D-Terminal - Yellow
- E-Terminal - Blank

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Switch Handle Installation (Cont'd)

Figure 60-130-17

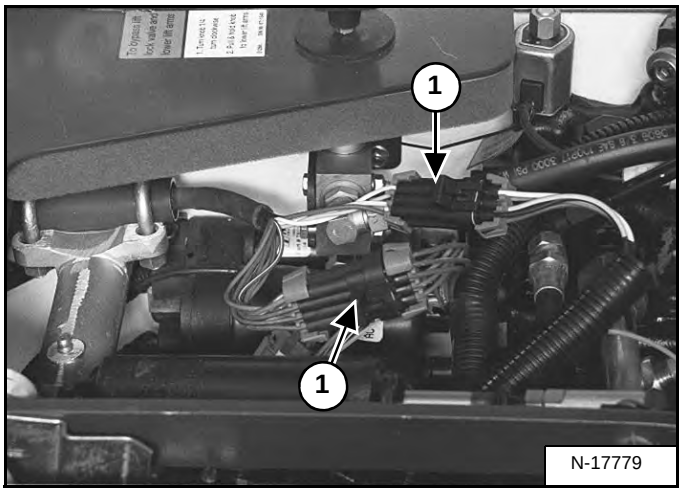
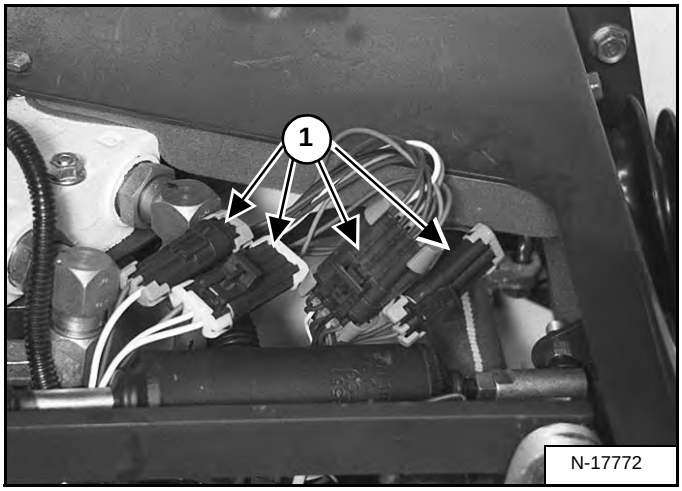
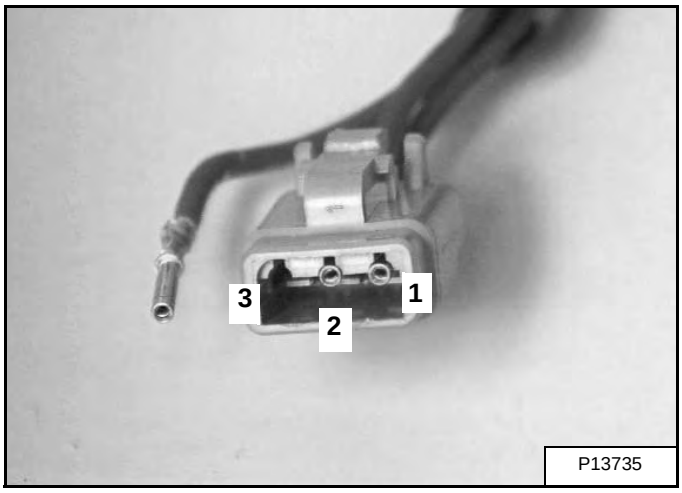


Figure 60-130-18



Connect the handle harness connectors (Item 1) **[Figure 60-130-17]** & **[Figure 60-130-18]** to the loader harness connectors.

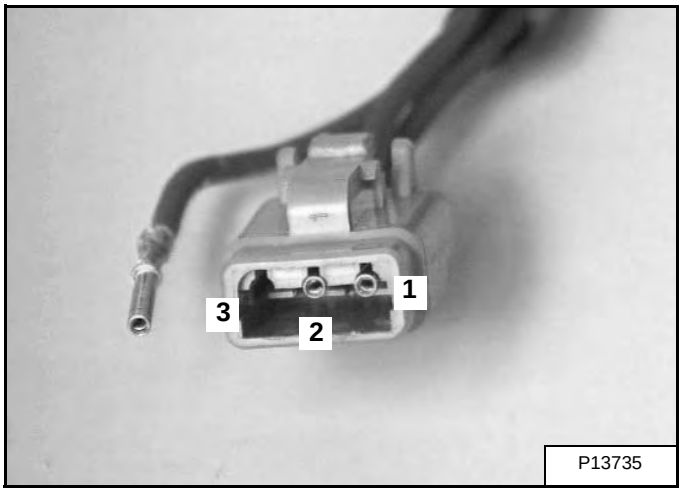
Figure 60-130-19



Install the wires into the connectors as listed below:

Left and Right Control Lever Switch Handle **[Figure 60-130-19]**
1-Terminal - Red/White
2-Terminal - Black/White
3-Terminal - Purple/White

Figure 60-130-20

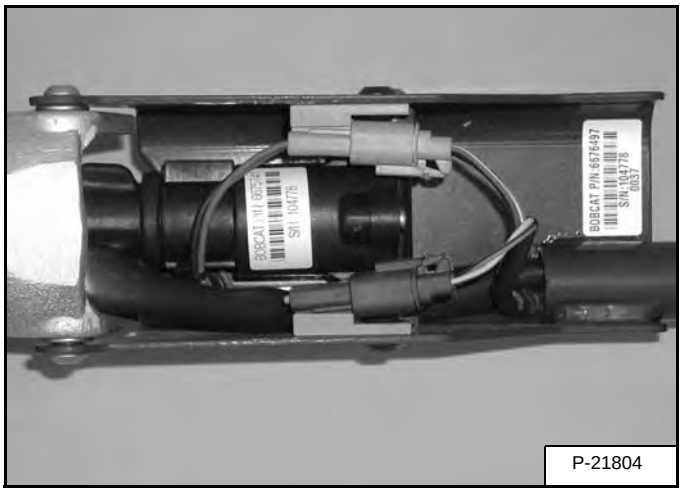


Left and Right Control Lever Switch Handle **[Figure 60-130-20]**
1-Terminal - Yellow/Red
2-Terminal - Open
3-Terminal - Orange/Black

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Switch Handle Installation (Cont'd)

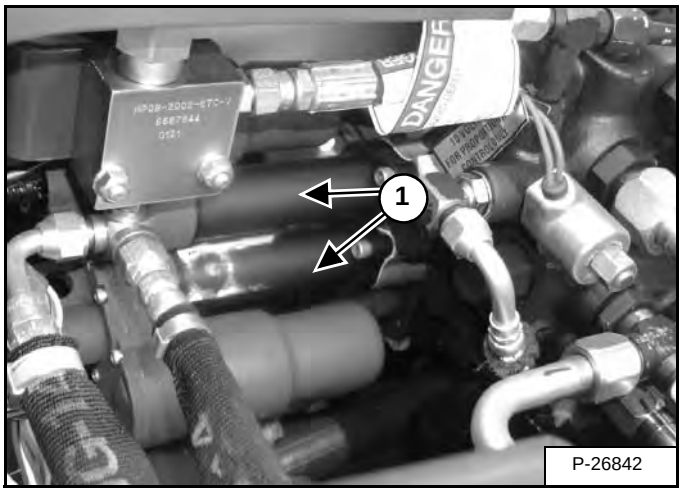
Figure 60-130-21



Connect the handle harness connectors to the sensor and lock solenoid connectors **[Figure 60-130-21]**.

Actuator Connector Disassembly And Assembly

Figure 60-130-22

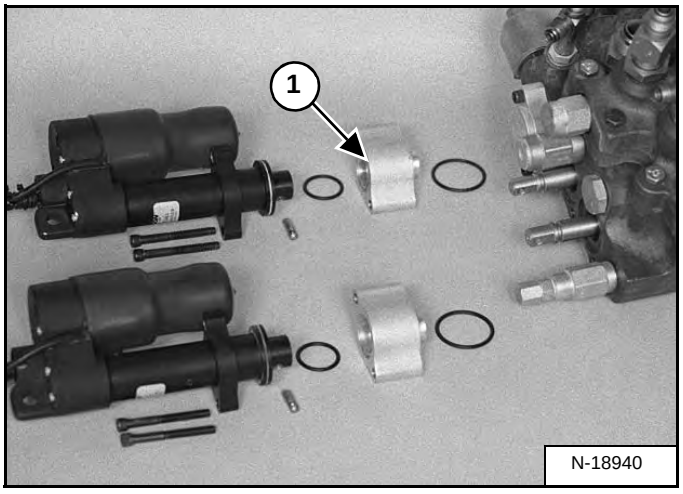


Remove the control panel. (See Removal And Installation on Page 50-100-2.)

Remove the actuator (Item 1) **[Figure 60-130-22]** from the hydraulic control valve. (See Actuator Removal And Installation (In Loader) on Page 20-41-6.)

Installation: Tighten the mount bolts to 90-100 in.-lb. (10,2-11,3 N•m) torque.

Figure 60-130-23

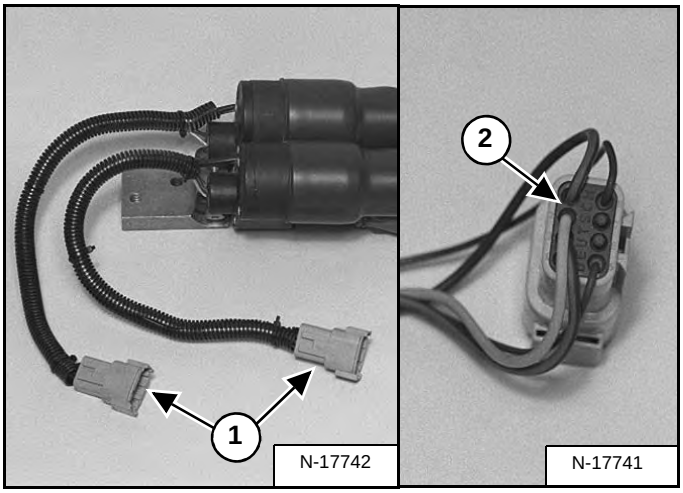


Check the mounting block (Item 1) **[Figure 60-130-23]** and bolts for wear and replace as needed.

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Actuator Connector Disassembly And Assembly (Cont'd)

Figure 60-130-24



Check the actuator wiring harness connector (Item 1) **[Figure 60-130-24]** and replace if broken.

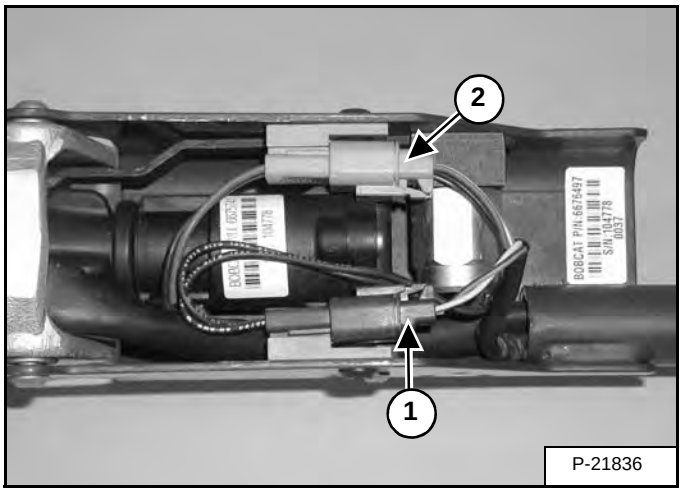
Installation: Install the wires into the connector as listed below. The terminal numbers are written on the back of the connector (Item 2) **[Figure 60-130-24]**.

Lift and Tilt Actuator
1 - Terminal-Black/Green-Larger dia. wire (16 gauge)
2 - Terminal-Green-Larger diameter wire (16 gauge)
3 - Terminal-Red/Green-Larger diameter wire (16 gauge)
4 - Terminal-Open
5 - Terminal-Red-Smaller diameter wire (18 gauge)
6 - Terminal-Open
7 - Terminal-Open
8 - Terminal-Black-Smaller diameter wire (18 gauge)

NOTE: The calibration procedure must be followed when replacing a handle sensor, foot pedal sensor, actuator or ACS Controller. (See Lift And Tilt Calibration (ACS) on Page 60-160-3.)

Handle Lock Solenoid Removal And Installation

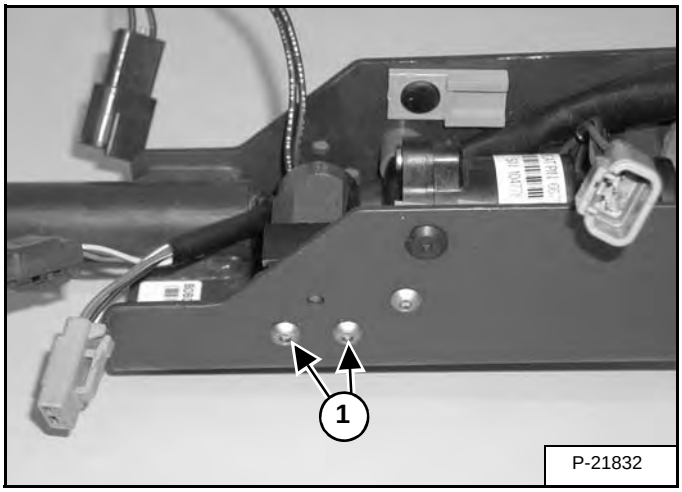
Figure 60-130-25



Disconnect the harness connector (Item 1) **[Figure 60-130-25]** from the handle sensor connector.

Disconnect the harness connector (Item 2) **[Figure 60-130-25]** from the handle lock solenoid connector.

Figure 60-130-26



Remove the two screws (Item 1) **[Figure 60-130-26]** holding the handle lock solenoid to the handle.

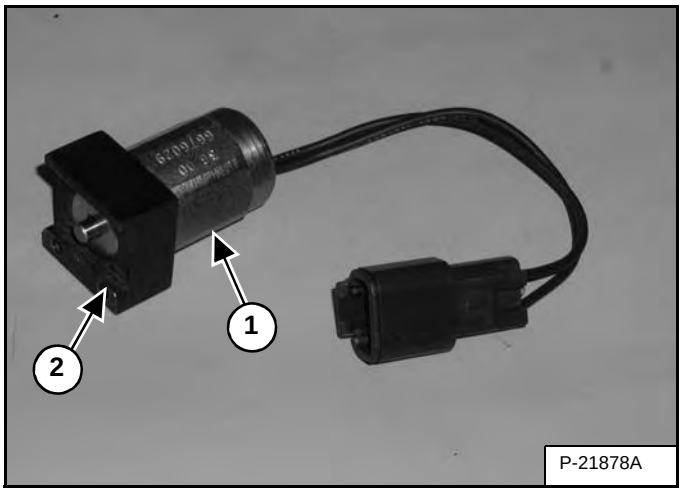
Installation: Tighten the screws to 32-38 in.-lb. (3,6-4,3 N•m) torque.

Remove handle lock solenoid assembly from handle.

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Handle Lock Solenoid Disassembly And Assembly

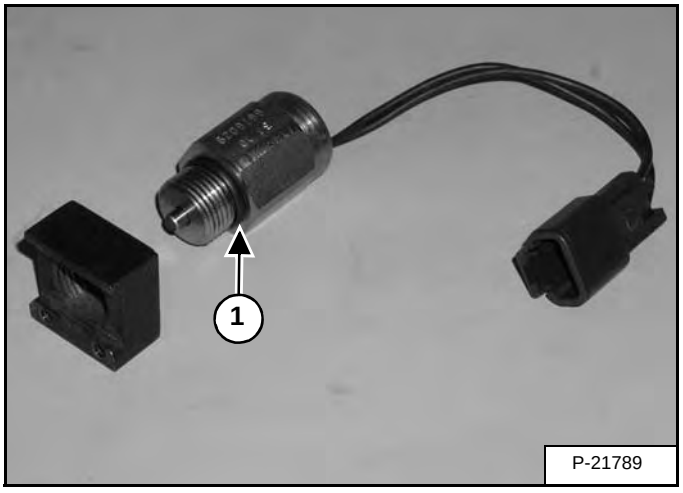
Figure 60-130-27



Remove solenoid (Item 1) from the solenoid mount (Item 2) **[Figure 60-130-27]**.

Installation: Apply a drop of oil to the solenoid threads and tighten solenoid to 35-40 ft.-lb. (47-54 N•m) lubed torque.

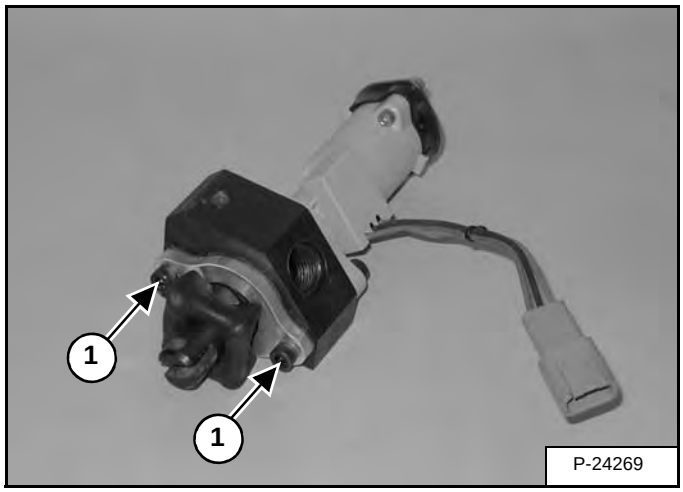
Figure 60-130-28



Check the O-ring (Item 1) **[Figure 60-130-28]** for damage. Replace as necessary.

Foot Sensor Disassembly And Assembly

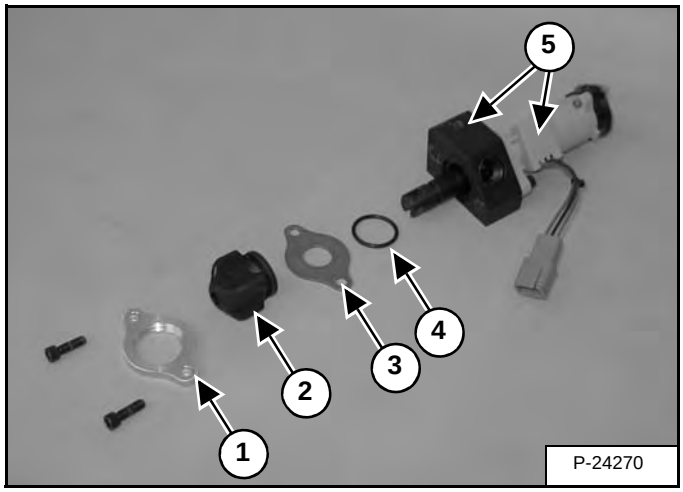
Figure 60-130-29



Remove the two bolts (Item 1) **[Figure 60-130-29]** from the end of the foot sensor.

Installation: Tighten the bolts to 90 in.-lb. (10,2 N•m) torque. Apply Loctite® #242 to the threads.

Figure 60-130-30



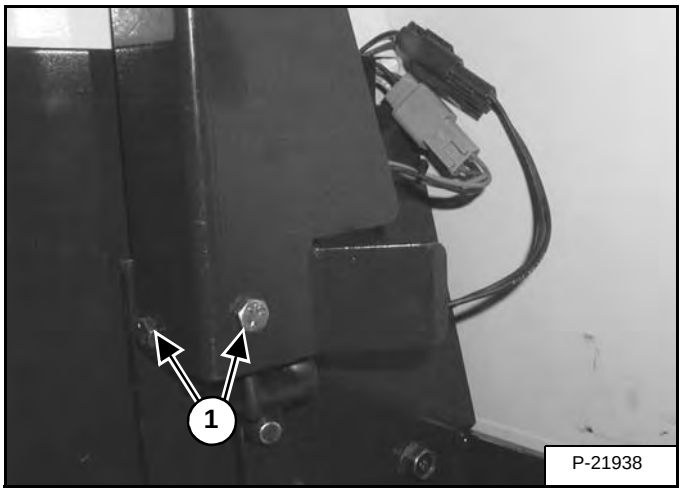
Remove the boot retainer (Item 1), boot (Item 2), spool stop plate (Item 3) and O-ring (Item 4) **[Figure 60-130-30]**.

NOTE: Do not disassemble the sensor assembly (Item 5) [Figure 60-130-30]. The sensor assembly is a calibrated assembly and cannot be serviced. Order through Bobcat Parts.

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Foot Lock Solenoid Removal And Installation

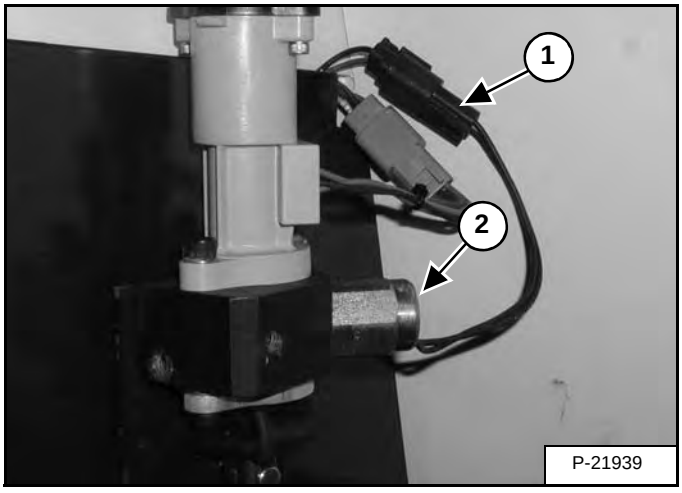
Figure 60-130-31



Remove the two bolts (Item 1) **[Figure 60-130-31]** from the foot sensor shield.

Installation: Tighten the bolts to 80-90 in.-lb. (9,0-10,2 N•m) torque.

Figure 60-130-32

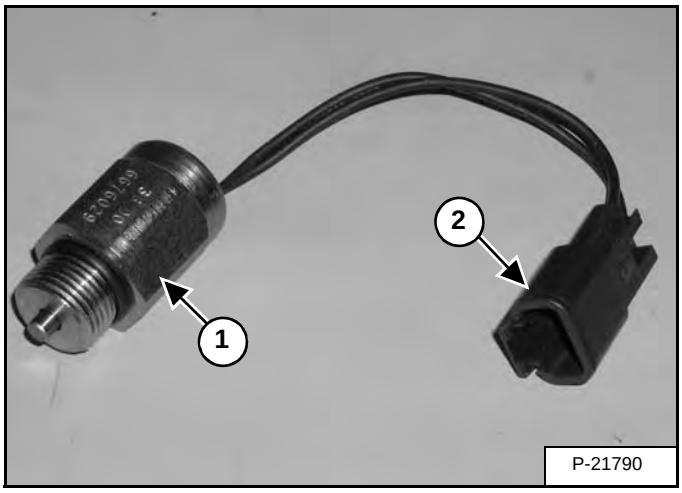


Disconnect the foot lock solenoid connector (Item 1) **[Figure 60-130-32]** from the harness.

Remove foot lock solenoid (Item 2) **[Figure 60-130-32]**.

Installation: Apply a drop of oil on the solenoid threads and tighten the solenoid to 35-40 ft.-lb. (47-54 N•m) lubed torque.

Figure 60-130-33

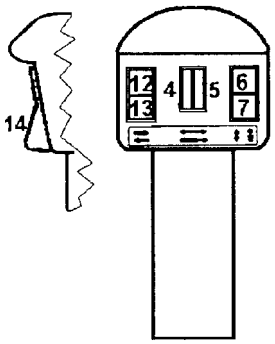


Check the O-ring (Item 1) **[Figure 60-130-33]** for damage. Replace as necessary.

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Identification Chart

Left Side Control Handle Switches

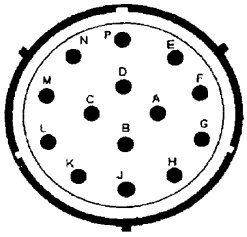


B-16447

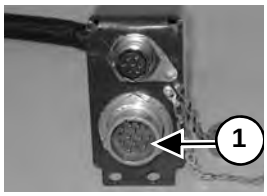
Switch Number	Solenoid Number Activated			Attachment Harness Terminal Activated
		RH	HFH	
1	1	1	1, 8	K
2	2	2	2	K
3	1	1	1, 8	K
4	2	2, 3	6, 7	K, A, D
5	1	1, 3	5, 7	K, A, C
6	1	1, 3	5, 7	K, E
7	1	1, 3	5, 7	K, F
8	1	1, 3	5, 7	K, G
9	1	1, 3	5, 7	K, H
10, 11, 12, 13, 14	-	--	--	K

Attachment Harness Connector

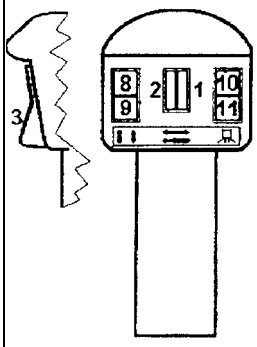
Fourteen Pin Connector Viewed from front (pin side of connector) of loader.



B-16449



Right Side Control Handle Switches



B-16448

NOTE: All diagnostics must be done at the fourteen pin connector (Item 1). (If so equipped as a dealer installed kit.)

The ACD (Attachment Control Device) automatically recognizes the use of the seven or fourteen pin connector when connected.

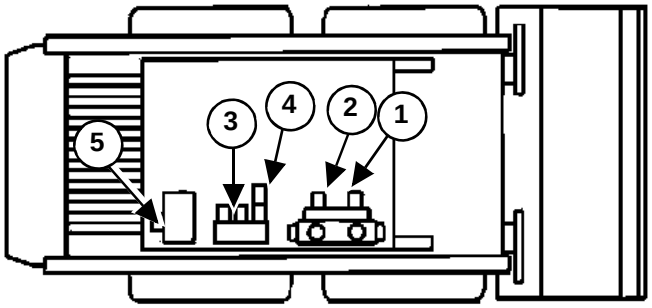
If the ACD light flashes, check for diagnostic service codes. See the Electrical System Service Manual for the proper procedure.

RH - Loaders with Rear Hydraulics Option.
HFH - Loaders with High Flow Hydraulics Option.
*** If harness terminals K & L are jumped together, switches 4 thru 9 will function the same as switch 1 & 2.**
*** Terminal K is activated with Key switch ON.**

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Identification Chart (Cont'd)

S220



Solenoid Number	Hydraulic Coupler	Wiring Number
1	Front Female (Rod)	4330
2	Front Male (Base)	4340
3	Diverter & Bleed	4450/4480
4	Bleed - Rear Male & Female	4430/4440
5	High Flow on Pump	4460

NOTE: Front Auxiliary Pressure Release is accomplished by manually pushing the male and female couplers in at the front auxiliary block.

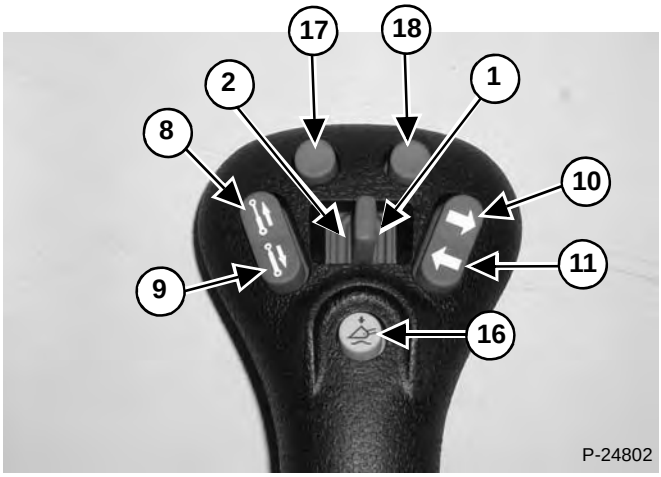
The Hydraulic Pressure Release Button will activate solenoid number 4 at the diverter valve, shut down the loader, and bleed the rear auxiliary (If so equipped.) and also the right side front auxiliary. (If so equipped.)

The High Flow Button in the left side instrument panel must be pushed ON to activate solenoid number 5 at the gear pump.

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Identification Chart

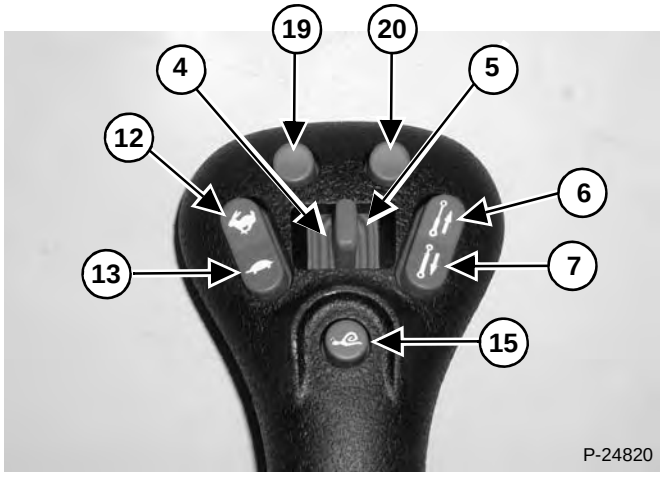
RIGHT HAND



1. Front Aux.
2. Front Aux.
3. Auxiliary Detent
8. Right Ski (Up)
9. Right Ski (Down)
10. Right Blink
11. Left Blink
16. Float (Yellow in Color)
17. Future Function
18. Future Function



LEFT HAND

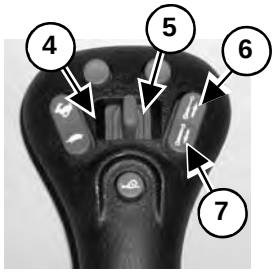
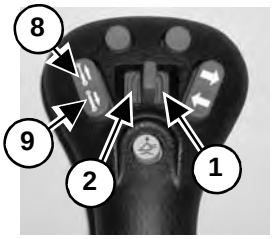


4. Rear Aux. (Side Shift
5. Rear Aux. (Side Shift)
6. Left Skit (Up)
7. Left Ski (Down)
12. Two-Speed (High)
13. Two-Speed (Low)
14. Horn
15. Inching Control (Grey in Color)
19. Future Function
20. Future Function



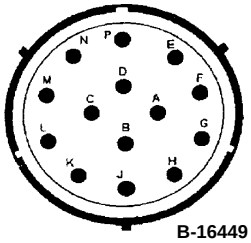
Dealer Copy -- Not for Resale

Identification Chart (Cont'd)

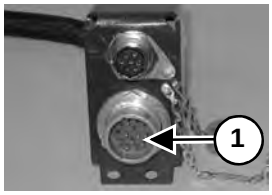
Left Side Control Handle Switches	Switch Number	Solenoid Number Activated				Attachment Harness Terminal Activated	Right Side Control Handle Switches
		STD	RH	HFH	HRH		 
	1	1	1	1, 6	1, 6	K	
	2	2	2	2	2	K	
	3	1	1	1, 6	1, 6	K	
	4	2	3, 5	2	3, 5	K, A, D	
	5	1	3, 4	1	3, 4	K, A, C	
	6	1	3, 4	1	3, 4	K, E	
	7	1	3, 4	1	3, 4	K, F	
	8	1	3, 4	1	3, 4	K, G	
	9	1	3, 4	1	3, 4	K, H	

Attachment Harness Connector

Fourteen Pin Connector Viewed from front (pin side of connector) of loader.



B-16449



NOTE: All diagnostics must be done at the fourteen pin connector (Item 1). (If so equipped as a dealer installed kit.)

The ACD (Attachment Control Device) automatically recognizes the use of the seven or fourteen pin connector when connected.

If the ACD light flashes, check for diagnostic service codes. See the Electrical System Service Manual for the proper procedure.

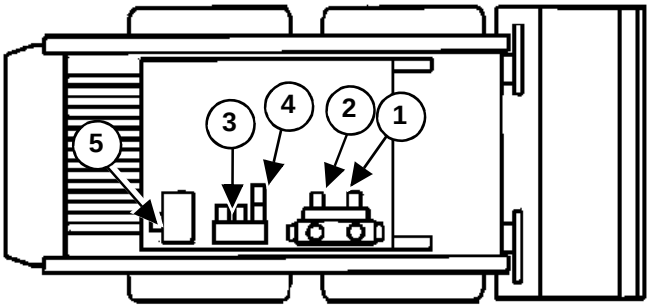
RH - Loaders with Rear Hydraulics Option.
HFH - Loaders with High Flow Hydraulics Option.
*** If harness terminals K & L are jumped together, switches 4 thru 9 will function the same as switch 1 & 2.**
*** Terminal K is activated with Key switch ON.**

HRH - Loaders with High Flow and Rear Hydraulics Option.

Dealer Copy -- Not for Resale

Identification Chart (Cont'd)

S220



Solenoid Number	Hydraulic Coupler	Wiring Number
1	Front Female (Rod)	4330
2	Front Male (Base)	4340
3	Diverter & Bleed	4450/4480
4	Bleed - Rear Male & Female	4430/4440
5	High Flow on Pump	4460

NOTE: Front Auxiliary Pressure Release is accomplished by manually pushing the male and female couplers in at the front auxiliary block.

The Hydraulic Pressure Release Button will activate solenoid number 4 at the diverter valve, shut down the loader, and bleed the rear auxiliary (If so equipped.) and also the right side front auxiliary. (If so equipped.)

The High Flow Button in the left side instrument panel must be pushed ON to activate solenoid number 5 at the gear pump.

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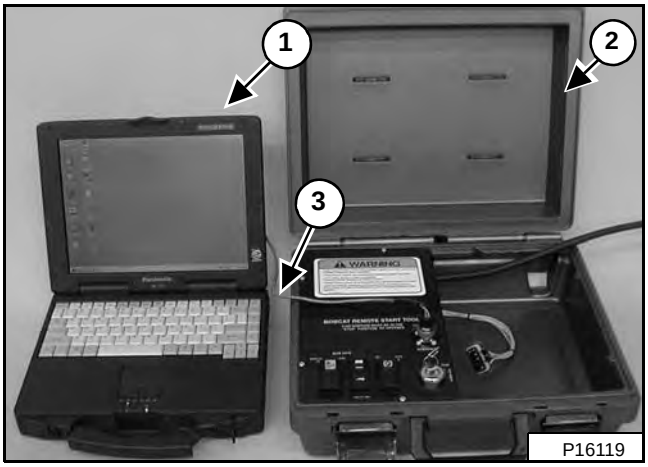


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SERVICE PC (LAPTOP COMPUTER)

Connecting Remote Start Tool

Figure 60-150-1



The tools listed will be needed to do the following procedure:

MEL1563 or 6689779 - Remote Start Tool
MEL1565 - Service Tool Harness Control
MEL1566 - Service Tool Harness Communicator (Computer Interface)

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

The Service PC (Item 1) with the Remote Start Tool (Item 2) **[Figure 60-150-1]**. When connected to the loader, the Service PC is used to monitor, conduct diagnostics, and upgrade software.

Connect the Service Tool Harness Communicator (MEL1566) (Item 3) **[Figure 60-150-1]** to the designated serial port on the Service PC.

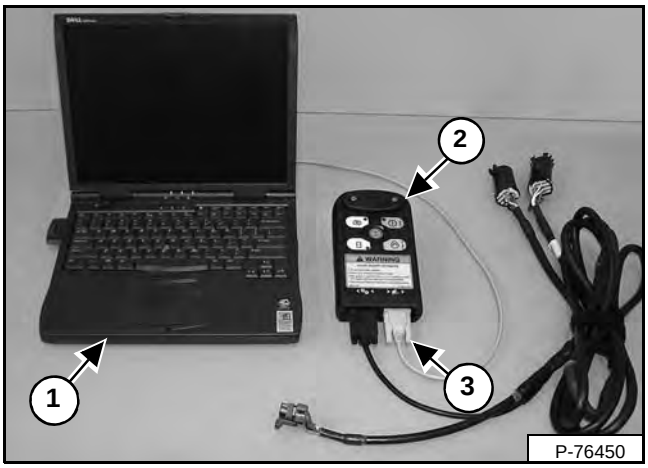
NOTE: The recommended serial cable length should not exceed 15 feet. A serial cable longer than 15 feet will create a degraded signal causing communication errors.

Connect the other end to the connector on the Remote Start Tool.

Connect the Remote Start Tool to the loader. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.)

Connecting Remote Start Tool (Service Tool)

Figure 60-150-2



The tools listed will be needed to do the following procedure:

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

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

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

The Service PC (Item 1) with the Remote Start Tool (Service Tool) (Item 2) **[Figure 60-150-2]**. When connected to the loader, the Service PC is used to monitor, conduct diagnostics, and upgrade software.

Connect the Remote Start Tool (Service Tool) Computer Service Tool Harness (Item 3) **[Figure 60-150-2]** 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 loader. (See REMOTE START TOOL (SERVICE TOOL) KIT - 6689779 on Page 10-61-1.)

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CALIBRATION

Description

Calibration procedures must be followed when replacing a hydraulic control valve, actuator, Drive / Drive+ Controller, ACS Controller, pump controller, hydrostatic pump, or hydrostatic motor. Failure to calibrate after component replacement may result in poor performance or reduced life of actuator(s).

The **Actuator Test** is performed with the Service PC. The Actuator Test should be used if reduced performance codes are present or when replacing a controller or actuator.

NOTE: The Actuator Test should be used as the preferred method of actuator and valve spool calibration.

The **Lift and Tilt Calibration (ACS)** provides set points to the ACS controller to actuate the lift and tilt valve. The Lift and Tilt Calibration (ACS) should be used if reduced performance codes are present or when replacing a controller or actuator.

The **Lift and Tilt Calibration (SJC)** provides set points to the ACS controller to actuate the lift and tilt valve. The Lift and Tilt Calibration (SJC) should be used if reduced performance codes are present or when replacing a controller or actuator.

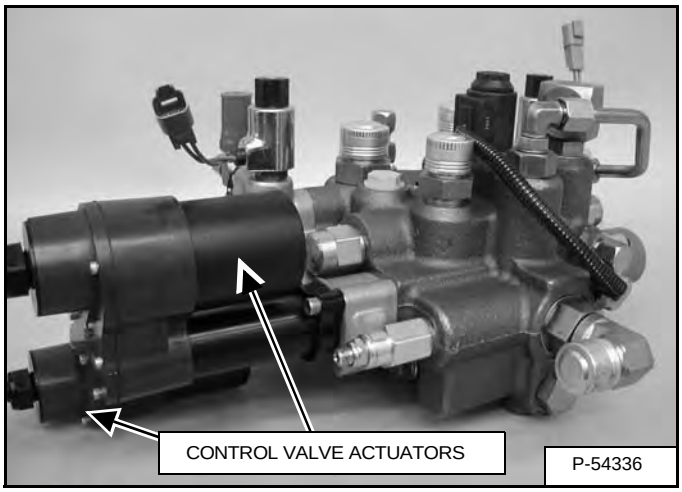
The **Hydrostatic Pump Calibration (SJC)** provides set points to the Drive controller to actuate the hydrostatic controller that directs flow to a servo piston. Hydrostatic Pump Calibration (SJC) should be performed when a desired travel path can not be attained or replacing the hydrostatic pump, hydrostatic motor, or controller. After Performing a Hydrostatic Pump Calibration (SJC), Steering Drift Compensation can be used to fine tune the hydrostatic pump control.

For more information on Steering Drift Compensation (See STEERING DRIFT COMPENSATION on Page 60-161-1.)

NOTE: The Actuator Test is the only test that uses a Service PC. The Lift and Tilt Calibration (ACS or SJC) does not need to be performed if the Actuator Testing is being performed with the Service PC. The Hydrostatic Pump Calibration does not need to be performed with the Actuator Test or Lift and Tilt Calibration (SJC).

Actuator Testing

Figure 60-160-1



[Figure 60-160-1] Excessive actuator loading can occur if the actuator and valve spool components are misaligned. Misalignment may reduce spool stroke performance and reduce the life of the actuator. Starting with software version 36, the Bobcat Service Analyzer will be able to perform tests to diagnose actuator and valve spool misalignment.

Connect the Service PC (See SERVICE PC (LAPTOP COMPUTER) on Page 60-150-1.)

If a Service PC is not available, (See Lift And Tilt Calibration (SJC) on Page 60-160-5.) **or** (See Lift And Tilt Calibration (ACS) on Page 60-160-3.).

NOTE: Warm the hydraulic oil to room temperature 72°F (22°C), stop the engine and clear all active service codes before running the test.

Once the test is initiated, an automatic calibration sequence will start. When calibration is complete, the test will be performed and the results can be viewed on the Service PC (Laptop) monitor.

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CALIBRATION (CONT'D)

Actuator Testing (Cont'd)

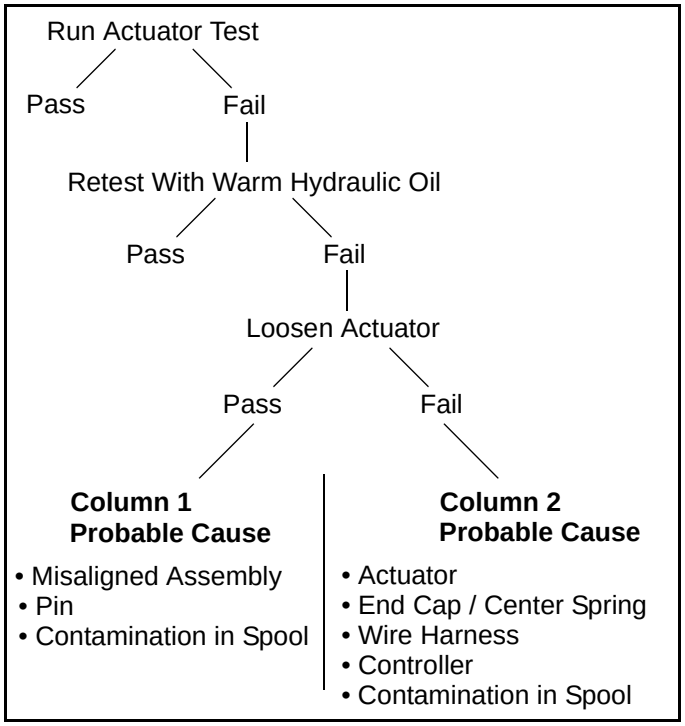
This test will engage both actuators to fully stroke the spools then allow the centering springs to return the spools to neutral. Next, both actuators are engaged to move the spools just past the neutral points then allow the centering springs to return the spools to neutral.

When complete, the Actuator Test will show a pass mode or fail mode. The pass mode indicates that no problems were detected. The fail mode indicates one or a combination of three problems below.

- ***Actuator slow return to neutral.*** The spool returns to neutral too slowly.
- ***Actuator did not fully extend/retract.*** During the test, the spool was not able to fully stroke in both directions.
- ***Actuator out of neutral.*** The spool did not return to the neutral window during the test.

NOTE: A time out will occur if the test cannot be completed within 8 seconds. If this happens, retry the test.

Figure 60-160-2



[Figure 60-160-2] If the initial Actuator Test results in a fail mode due to a ***slow return to neutral,*** follow the troubleshooting tree to pinpoint the probable cause.

If the Actuator Test fails after the hydraulic oil is warmed, go to the next step and loosen the bolts that mount the actuator to the control valve. Loosen the bolts just enough so the actuator can be moved slightly up / down or side / side.

Rerun the Actuator Test, if the test passes, check the following probable causes in **Column 1 [Figure 60-160-2]**. Check the probable causes in the order they are listed. Repairing one cause may be all that is required. Re-run the test to verify.

NOTE: Actuator and spool misalignment. Re-tighten the two bolts evenly, turn the first bolt one turn, then turn the other bolt one turn until both bolts are tight.

The pin may be too large. Oversized pins exceeding 0.248 in. (6,30 mm) in diameter should be replaced.

If the Actuator Test failed due to a ***slow return to neutral*** after checking the probable causes in **Column 1 [Figure 60-160-2]**, check the following probable causes in **Column 2 [Figure 60-160-2]**.

- Contamination in the spool.
- The spool end cap may be defective or the centering spring may be broken. Inspect the end cap and the centering spring, replace if necessary.
- The wire harness or connectors may have an intermittent short. Check the connections and wire harnesses.
- The controller may be defective, replace the controller.

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Actuator Testing (Cont'd)

If the initial Actuator Test results in the fail mode ***actuator did not fully extend / retract,*** check the following.

- The actuator connectors may be reversed between the lift and tilt actuator. Reverse the connectors and rerun the Actuator Test.
- The actuator may be weak, replace the actuator.
- The spool end cap may be defective or the centering spring may be broken. Inspect the end cap and the centering spring, replace if necessary.
- Contamination in the spool.

If the initial Actuator Test results in the fail mode ***actuator out of neutral,*** check the following.

- The actuator may be defective, replace the actuator.
- The spool end cap may be defective or the centering spring may be broken. Inspect the end cap and the centering spring, replace if necessary.
- Contamination in the spool.

Lift And Tilt Calibration (ACS)

The controller uses a calibration sequence to optimize the control system. The optimizing ensures full spool stroke (full flow) while preventing over stroke (loading) of the actuator and resets the calibration points in the controller.

NOTE: The Actuator Test is the preferred method to calibrate the lift and tilt actuator. (See Actuator Testing on Page 60-160-1.)

NOTE: This calibration procedure must be followed when replacing a hydraulic control valve, actuator or ACS controller. Failure to calibrate after component replacement may result in poor performance or reduced life of actuator(s).

Figure 60-160-3



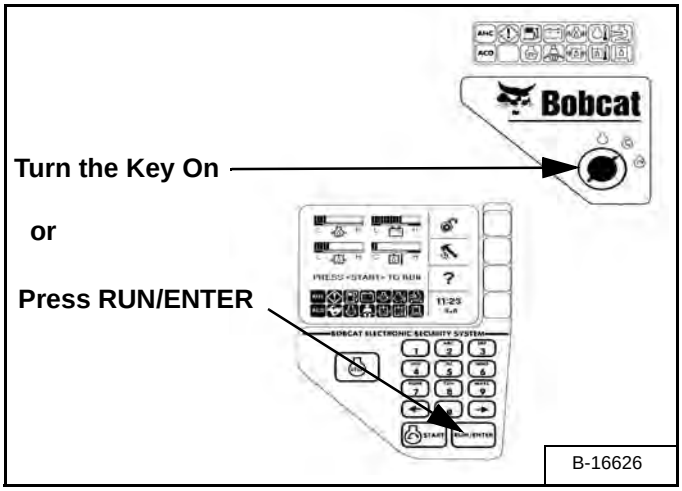
Update the loader service software to the latest version.

Place the rocker switch (Item 1) **[Figure 60-160-3]** in the hand control mode.

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Lift And Tilt Calibration (ACS) (Cont'd)

Figure 60-160-4

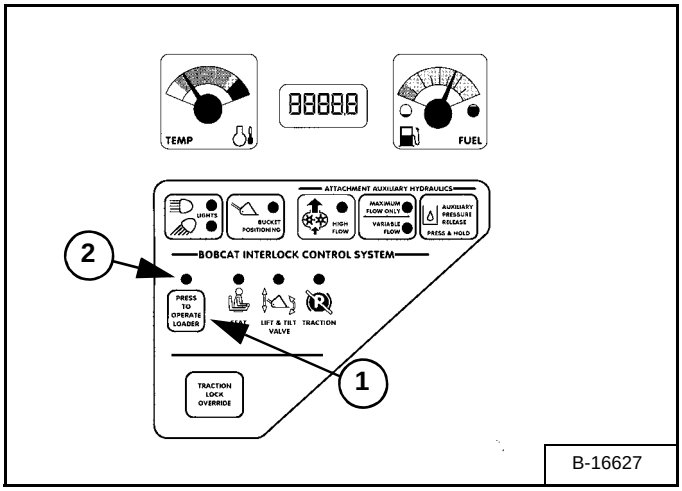


Close the cab door. (If loader is equipped.)

With the seat bar down, turn the ignition key ON (keyless panel press RUN/ENTER) **[Figure 60-160-4]**.

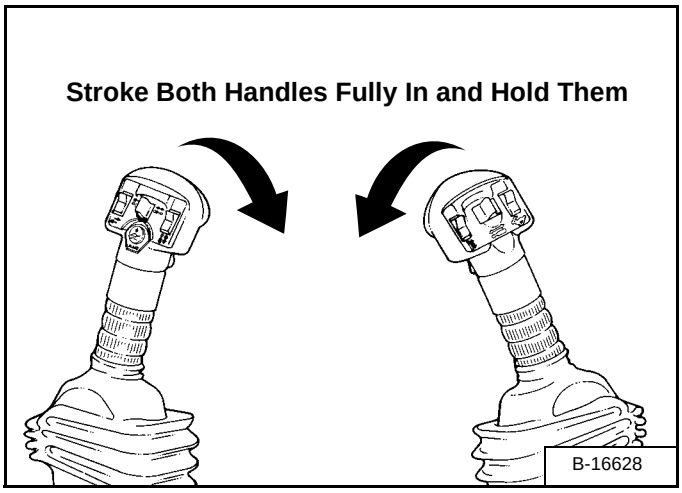
NOTE: Do not start the engine.

Figure 60-160-5



Push the PRESS TO OPERATE button (Item 1) **[Figure 60-160-5]** to unlock the hand controls.

Figure 60-160-6

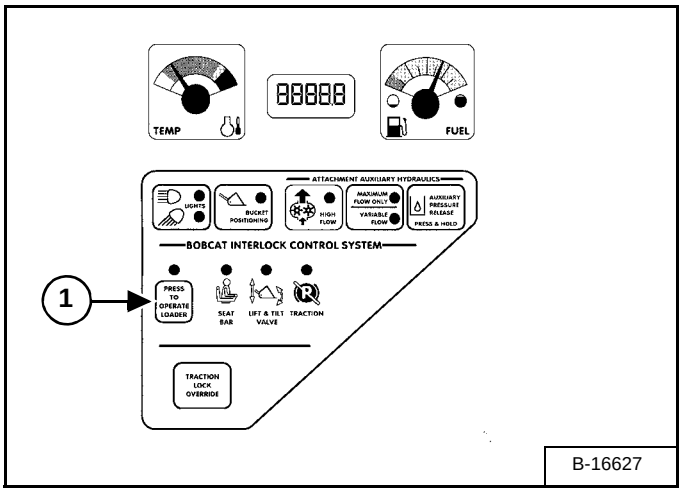


Fully stroke both control handles in toward the center of the cab and hold the handles **[Figure 60-160-6]**.

Lift the seat bar, high enough for the PRESS TO OPERATE light (Item 2) **[Figure 60-160-5]** to go **OFF**.

Lower the seat bar.

Figure 60-160-7



Push the PRESS TO OPERATE button (Item 1) **[Figure 60-160-7]** to begin calibration.

NOTE: The ACS icon will light up and if you listen closely the cycling of the actuators can be heard. The ACS icon will stay lit until the ignition key is cycled or the loader is started and a function is operated.

NOTE: During the calibration cycle, the system will beep three times. Once the calibration is complete code 32-24 (Calibration Performed) will be generated.

Release the control handles.

Calibration is complete.

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Lift And Tilt Calibration (SJC)

The controller uses a calibration sequence to optimize the control system. The optimizing ensures full spool stroke (full flow) while preventing over stroke (loading) of the actuator and resets the calibration points in the controller.

NOTE: The Actuator Test is the preferred method to calibrate the lift and tilt actuator. (See Actuator Testing on Page 60-160-1.)

NOTE: This calibration procedure must be followed when replacing the hydraulic control valve, lift or tilt actuator, or drive controller. Failure to calibrate after component replacement may result in poor performance or reduced life of actuator(s).

Figure 60-160-8

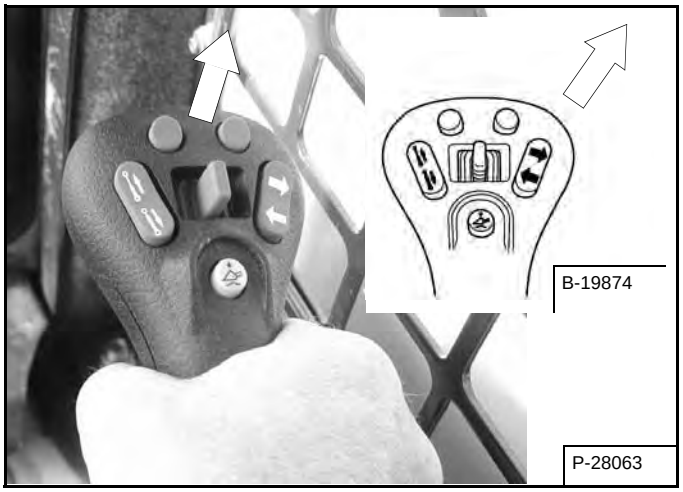


With an operator in the seat and the seat bar down.

Close the cab door. (If loader is equipped.)

Place the loader Control Pattern Switch (Item 1) **[Figure 60-160-8]** in the **ISO** position.

Figure 60-160-9



Move the right joystick to the forward-right corner position **[Figure 60-160-9]** and hold in position.

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Lift And Tilt Calibration (SJC) (Cont'd)

Figure 60-160-10

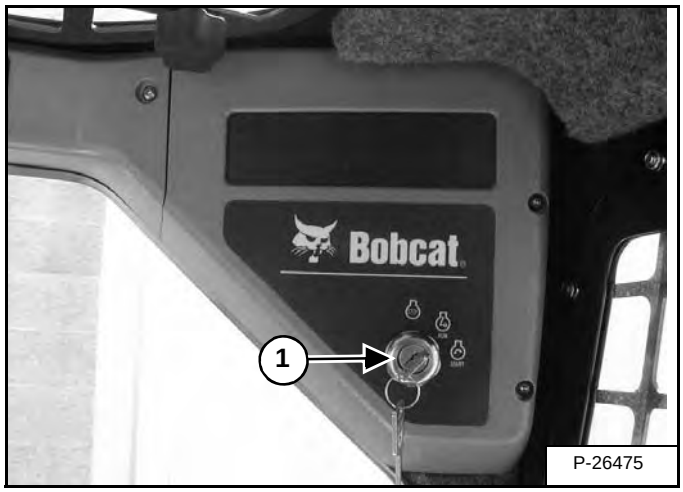


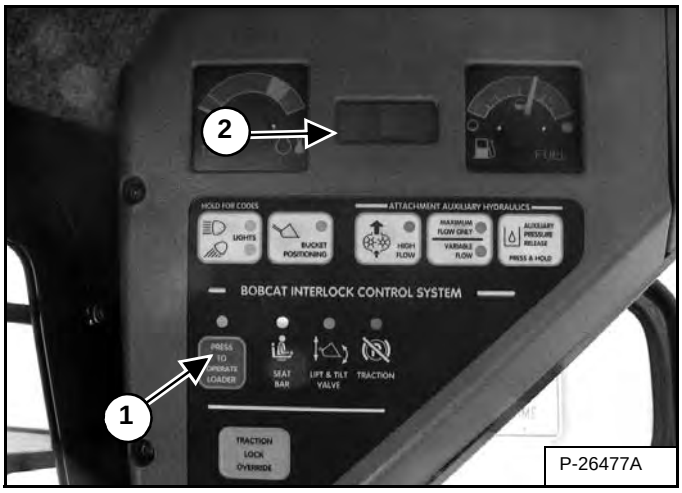
Figure 60-160-11



Turn the key (Item 1) **[Figure 60-160-10]** to the RUN position or press the RUN/ENTER button (Item 1) **[Figure 60-160-11]** for power, without starting the loader.

The loader Control Pattern Switch (Item 1) **[Figure 60-160-8]** will start flashing and will continue to flash until the calibration procedure is completed.

Figure 60-160-12



At the left panel, press the PRESS TO OPERATE Button (Item 1) **[Figure 60-160-12]** while holding the right joystick in position.

Release the joystick.

NOTE: During the calibration cycle, the system will beep three times. Once the calibration is complete code 32-24 (Calibration Performed) will be generated.

The *ACS* controller will cycle the actuators.

The lift and tilt calibration is complete.

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Hydrostatic Pump Calibration (SJC)

⚠ WARNING

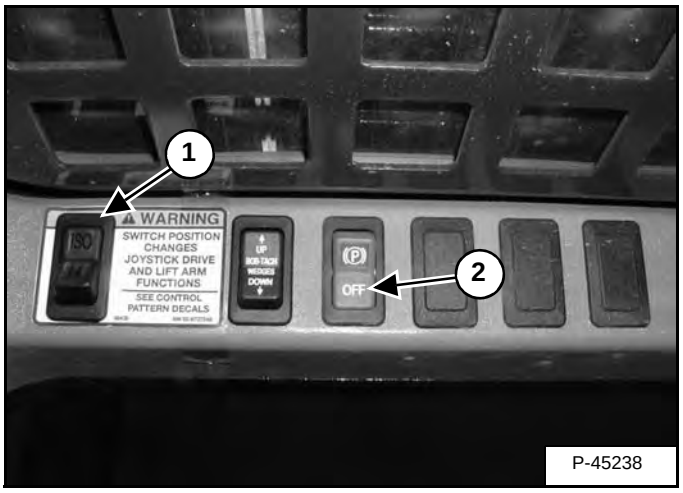
Put jackstands under the front axles and rear corners of the frame before running the engine for service. Failure to use jackstands can allow the machine to fall or move and cause injury or death.

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Place the loader on jackstands. (See Procedure on Page 10-10-1.)

Operator must be in the seat and the seat bar down.

Figure 60-160-13



Close the cab door. (If loader is so equipped.)

Place the loader Control Pattern Switch (Item 1) **[Figure 60-160-13]** in the **ISO** position.

Verify the parking brake (Item 2) **[Figure 60-160-13]** is **OFF**.

Figure 60-160-14

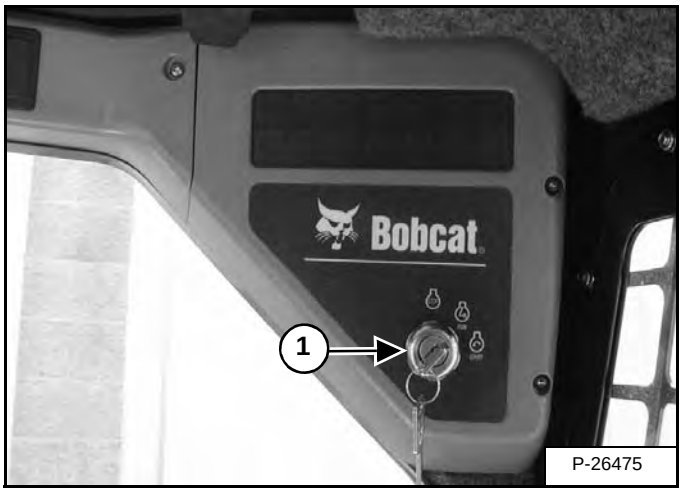


Figure 60-160-15



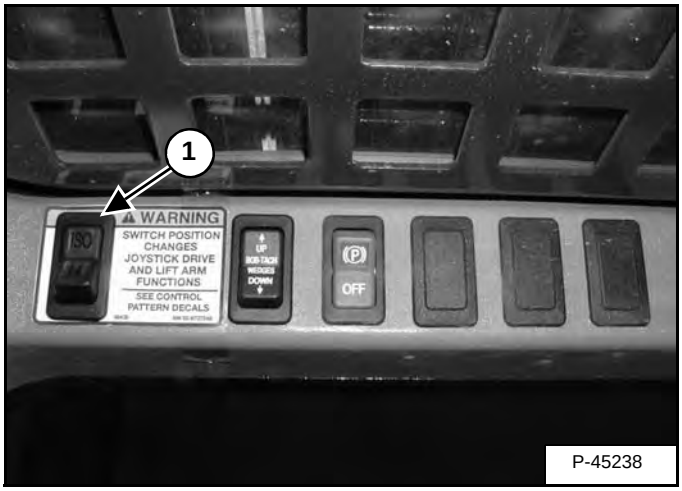
Turn the key (Item 1) **[Figure 60-160-14]** to the *RUN* position **or** press the *RUN/ENTER* button (Item 1) **[Figure 60-160-15]** for power, without starting the loader.

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CALIBRATION (CONT'D)

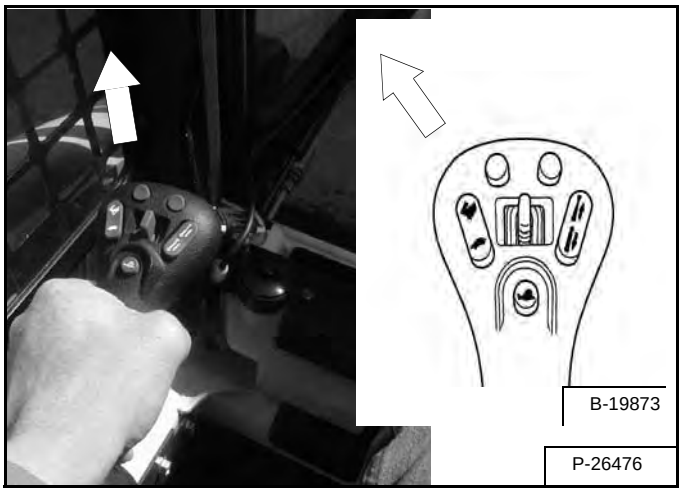
Hydrostatic Pump Calibration (SJC) (Cont'd)

Figure 60-160-16



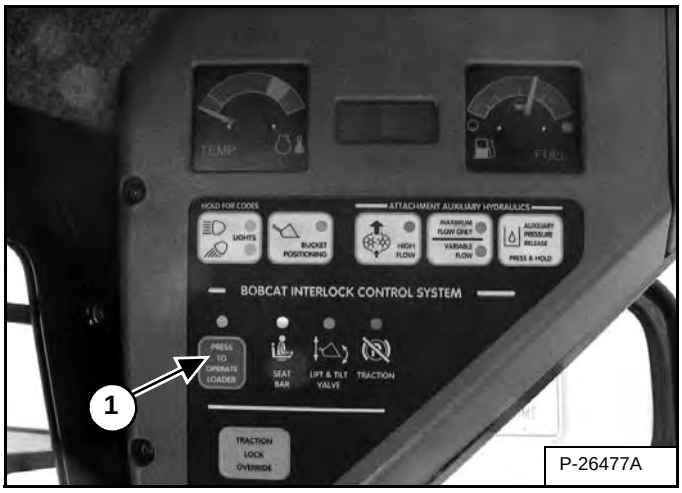
The Control Pattern **ISO** Switch (Item 1) **[Figure 60-160-16]** will start flashing.

Figure 60-160-17



Move the left joystick to the forward-left corner position **[Figure 60-160-17]** and hold in position.

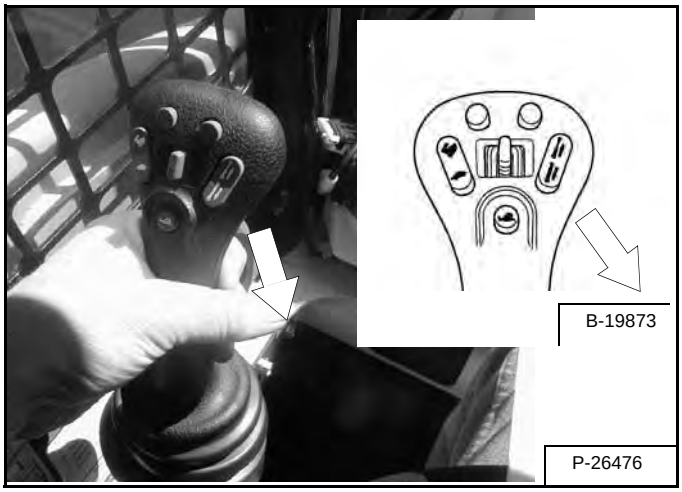
Figure 60-160-18



Press the *PRESS TO OPERATE LOADER* Button (Item 1) **[Figure 60-160-18]** while holding the left joystick in position.

Three audible beeps will sound.

Figure 60-160-19



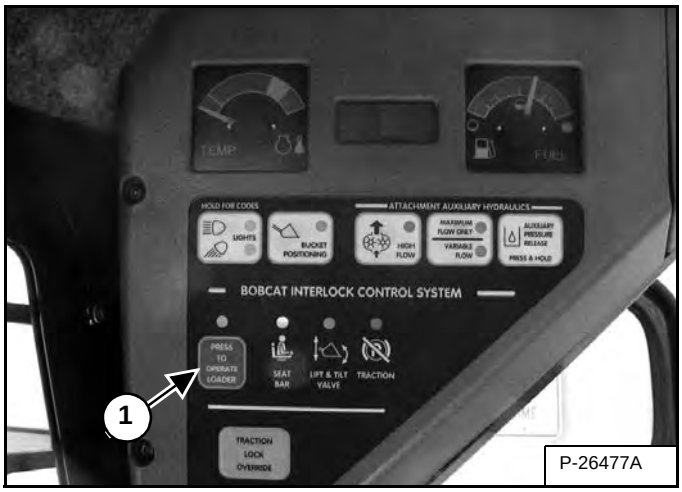
Move the left joystick to the reverse-right corner position **[Figure 60-160-19]** and hold in position.

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CALIBRATION (CONT'D)

Hydrostatic Pump Calibration (SJC) (Cont'd)

Figure 60-160-20



Press the *PRESS TO OPERATE LOADER* Button (Item 1) **[Figure 60-160-20]** while holding the left joystick in position.

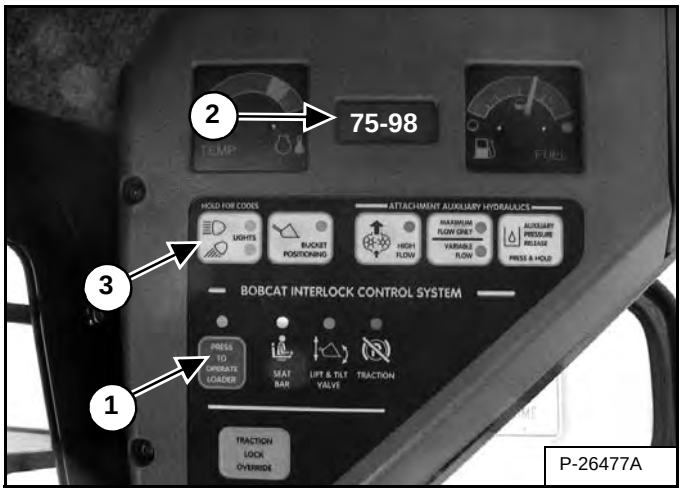
Three audible beeps will sound.

Figure 60-160-21



Allow the left joystick to go to the neutral position **[Figure 60-160-21]**.

Figure 60-160-22

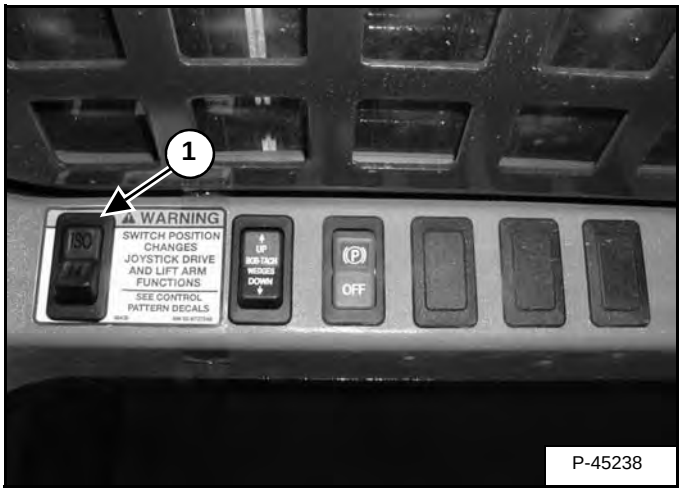


Press the *PRESS TO OPERATE LOADER* Button (Item 1) **[Figure 60-160-22]**.

Three audible beeps will sound and the error code (Item 2) **(75-98)** will be displayed if the operator presses the HOLD FOR CODES (LIGHTS) switch (Item 3) **[Figure 60-160-22]**.

Start the engine from the *RUN, RUN/ENTER* position. **DO NOT TURN TO OFF POSITION**. This would cancel the calibration mode and the procedure would have to be repeated.

Figure 60-160-23

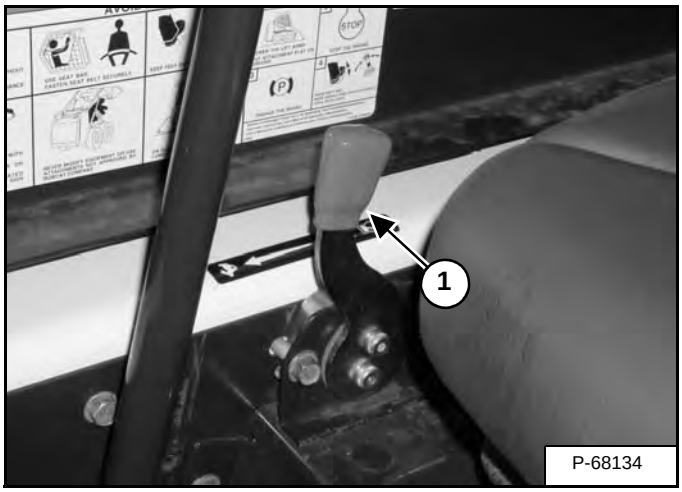


The Control Pattern **ISO** Switch (Item 1) **[Figure 60-160-23]** will stop flashing, and will remain **ON** for the rest of the calibration procedure.

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Hydrostatic Pump Calibration (SJC) (Cont'd)

Figure 60-160-24



Move the throttle (Item 1) **[Figure 60-160-24]** to high idle.

NOTE: If at any time, during calibration, the operator needs to stop the loader, turn the key OFF, lift the seat bar, or return the joystick to the neutral position.

The calibration procedure will stop.

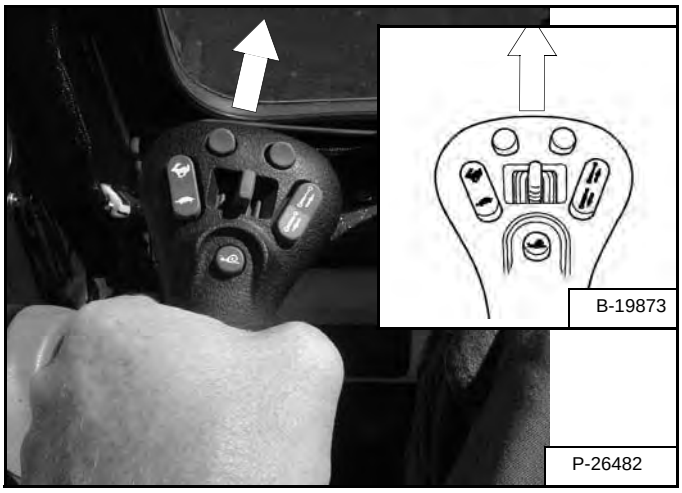
To return to calibration mode, the operator must start the complete procedure from the beginning.

⚠ WARNING

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

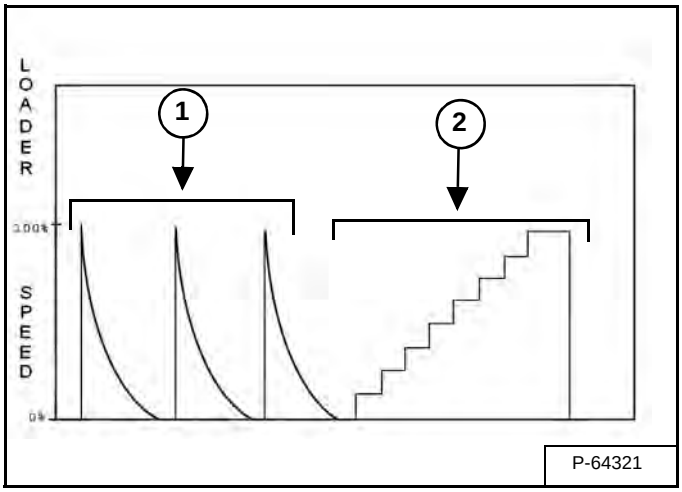
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Figure 60-160-25



Move and hold the left joystick to the forward position **[Figure 60-160-25]** until the forward calibration is completed.

Figure 60-160-26



The loader speed will “ramp up” quickly (Item 1) **[Figure 60-160-26]** and slow down 3 times in a row.

The loader will then “stair step” the speed (Item 2) **[Figure 60-160-26]** until it reaches full speed and then come to a stop.

Continue to hold the left joystick in the forward position until the loader wheels or tracks come to a stop and an audible beep is heard.

Forward calibration is complete.

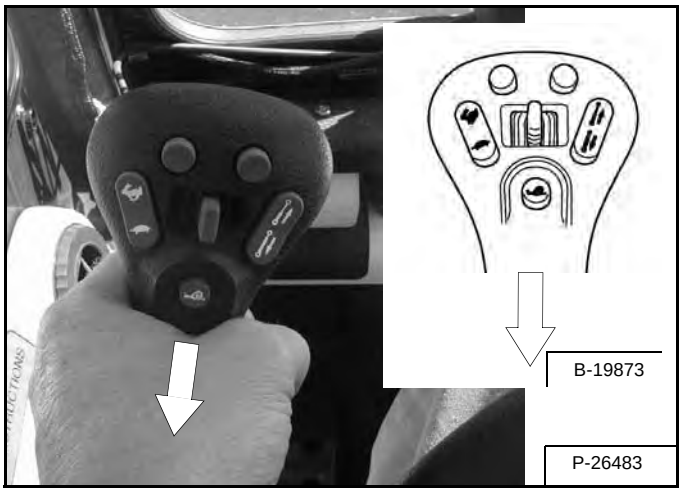
NOTE: If the wheels or tracks do not stop moving in Full Speed Forward in 2 minutes or less, there was an error in the calibration procedure. The operator must shut the loader OFF, and start the calibration procedure from the beginning.

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CALIBRATION (CONT'D)

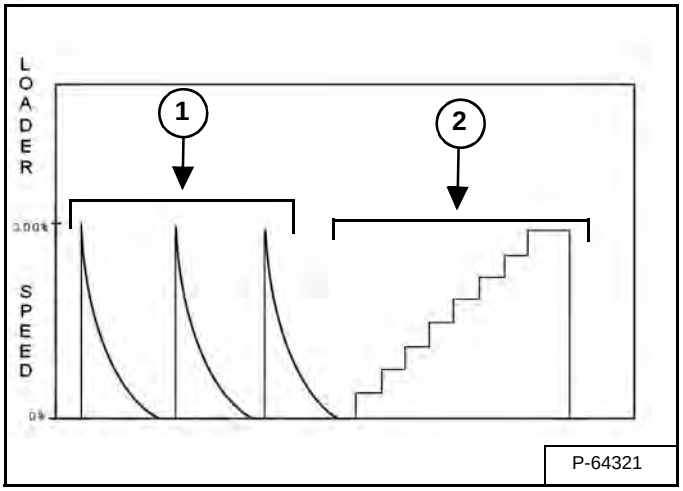
Hydrostatic Pump Calibration (SJC) (Cont'd)

Figure 60-160-27



Move and hold the left joystick to the reverse position **[Figure 60-160-27]** until the reverse calibration is completed.

Figure 60-160-28



The loader speed will “ramp up” quickly (Item 1) **[Figure 60-160-28]** and slow down 3 times in a row.

The loader will then “stair step” the speed (Item 2) **[Figure 60-160-28]** until it reaches full speed and then come to a stop.

Continue to hold the left joystick in the reverse position until the loader wheels or tracks come to a stop and an audible beep is heard.

Reverse calibration is complete.

NOTE: If the wheels or tracks do not stop moving in Full Speed Reverse in 2 minutes or less, there was an error in the calibration procedure. The operator must shut the loader OFF, and start the calibration procedure from the beginning.

There will be an audible beep and the PRESS TO OPERATE LOADER and TRACTION lights will go out. The SEAT BAR and LIFT AND TILT lights will remain on. The **75-98** error code will clear. There should be no other codes in the display area.

Allow the joystick to go to the neutral position.

Once the calibration procedure is complete the Steering Drift Compensation values will be reset to [S----] or neutral.

Press the *PRESS TO OPERATE LOADER* button. Move the left joystick to forward position **[Figure 60-160-25]** and check for normal forward wheel or track rotation.

Move the left joystick to the reverse position **[Figure 60-160-27]** and check for normal reverse wheel or track rotation.

Stop the engine, and remove the loader from jackstands.

The calibration procedure is completed.

After calibration is complete, use Steering Drift Compensation for fine tuning or if an acceptable line of drift can not be achieved. (See STEERING DRIFT COMPENSATION on Page 60-161-1.)

If loader does not maintain a desired travel path with Steering Drift Compensation at maximum setting **[S-r10]** or **[S-L10]**, see the electrical and hydrostatic troubleshooting. (See Troubleshooting on Page 30-10-1.) or (See Troubleshooting on Page 60-10-9.)

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STEERING DRIFT COMPENSATION

Steering Drift Compensation is available on SJC equipped machines.

NOTE: Software version 61 or higher is required to support this feature. The loader's software version can be displayed in the HOURMETER / CODE display. (See Operation and Maintenance Manual for correct procedure.) See your Bobcat dealer to update your machine's software version if necessary.

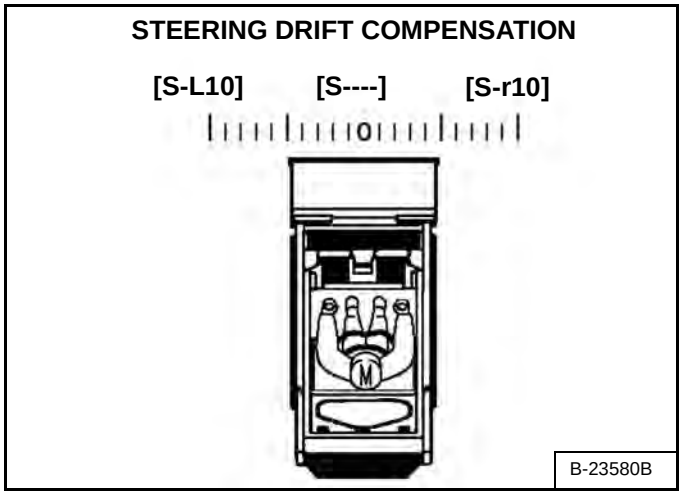
Description

Steering Drift Compensation can be used to reduce steering drift to maintain a desired travel path.

Examples of applications where this feature can be used:

- To compensate for normal variations such as tire inflation pressure, track tension, tire wear and track wear.
- Using side shift attachments such as trenchers, planers and silt fence installers.
- Driving on uneven terrain such as crowned road surfaces.

Figure 60-160-1



Steering drift compensation contains a total of 21 settings. Steering drift compensation can be set to any point from neutral to **[S-L10]** left and from neutral to **[S-r10]** right. **[S----]** is displayed when set for neutral **[Figure 60-160-1]**.

Selecting And Adjusting

NOTE: Changes CANNOT be performed until the seat bar is lowered, the engine is started and the PRESS TO OPERATE LOADER button is pressed to enable the BICS.

Perform pre-starting and starting procedures:

1. Fasten seat belt.
2. Lower seat bar.
3. Place joysticks in neutral position.
4. Start the engine.
5. Press the PRESS TO OPERATE LOADER button.

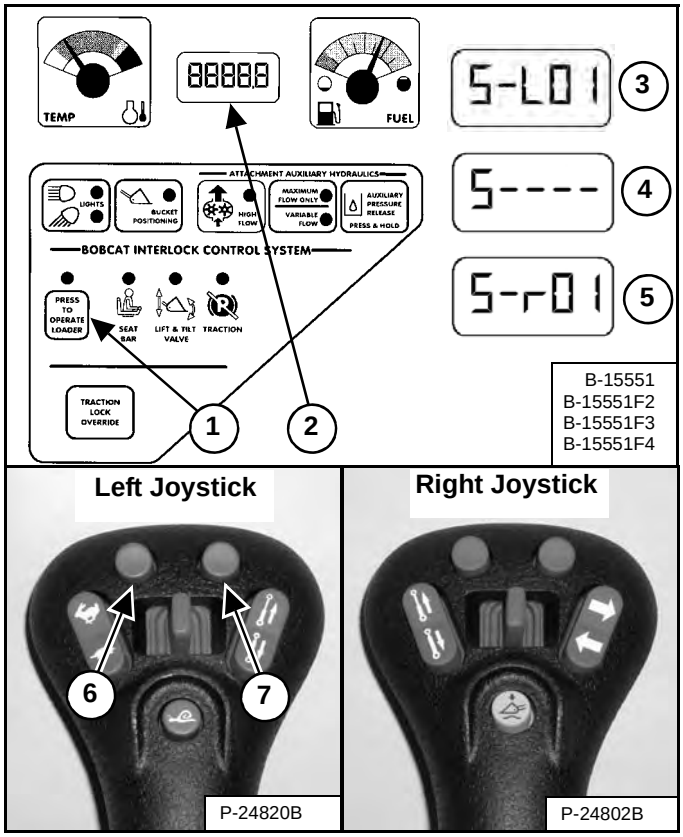
NOTE: Raising the seat bar or changing drive control patterns (ISO / H) will cause the machine to disengage from steering drift compensation. The current settings will remain in effect until the STOP button is pressed (Keyless Panel) or the key is turned OFF (Key Switch Panel).

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STEERING DRIFT COMPENSATION (CONT'D)

Selecting And Adjusting (Cont'd)

Figure 60-160-2



Press and hold the PRESS TO OPERATE LOADER button (Item 1) for **three seconds**. The current steering drift compensation setting will appear in the HOURMETER / CODE display (Item 2) **[Figure 60-160-2]**.

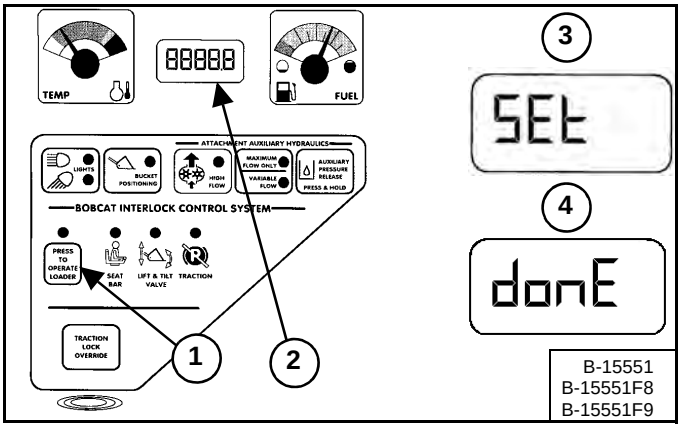
Press the upper left button (Item 6) on the left joystick to adjust the machine left. **[S-L01]** (Item 3) through a maximum of **[S-L10]** will appear in the display (Item 2) **[Figure 60-160-2]**. The number will increase by one each time you press the button. The higher the number, the greater the amount of steering drift compensation to the left. Adjustments to steering drift compensation will be effective immediately.

Press the upper right button (Item 7) on the left joystick to adjust back toward center. The display will decrease down to neutral displayed as **[S----]** (Item 4). Another press of the upper right button will cause **[S-r01]** (Item 5) to appear in the display (Item 2) **[Figure 60-160-2]**. The number will increase by one each time you press the button up to a maximum of **[S-r10]**. The higher the number, the greater the amount of steering drift compensation to the right. Adjustments to steering drift compensation will be effective immediately.

NOTE: The display will revert back to hourmeter after a brief period of time. The machine will remain in steering drift compensation and continue at the current setting. Pressing the upper left or upper right button on the left joystick will adjust steering drift compensation accordingly and cause the new setting to appear in the display.

Exiting And Saving

Figure 60-160-3



The current setting can be saved by pressing and holding the PRESS TO OPERATE LOADER button (Item 1) for **three seconds**. **[SEt]** (Item 3) will appear in the display (item 2) **[Figure 60-160-3]** and the machine will disengage from steering drift compensation.

OR

Press the PRESS TO OPERATE LOADER button to disengage from steering drift compensation without saving the current setting. **[donE]** (Item 4) will appear in the display (Item 2) **[Figure 60-160-3]** and the upper left and upper right buttons on the left joystick will no longer make changes to steering drift compensation. The current settings will remain in effect until the STOP button is pressed (Keyless Panel) or the key is turned OFF (Key Switch Panel). The machine will revert back to the last saved settings the next time it is started.

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FLYWHEEL RPM SENSOR

Description

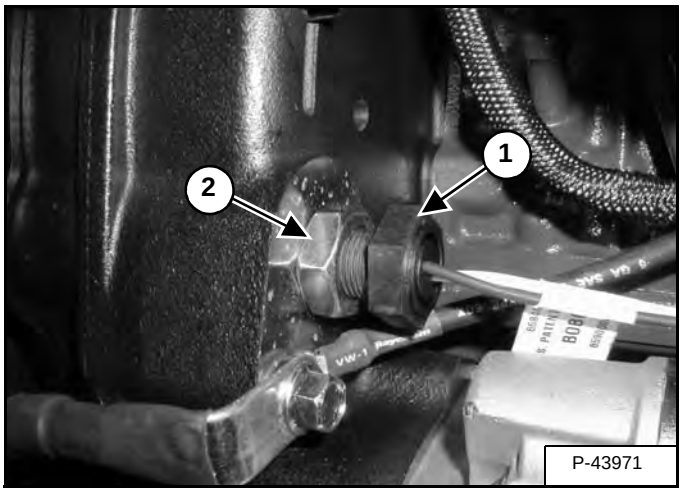
The flywheel RPM sensor has a magnet located on the end of the sensor which senses breaks between the ring gear teeth, the sensor relays this information back to the controller which registers the RPM of the engine.

The flywheel RPM sensor is located just above the starter on the left side of the engine.

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Adjustment

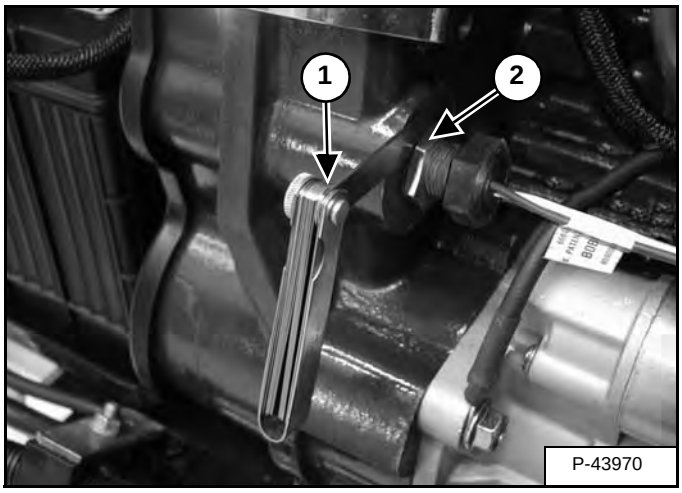
Figure 60-170-1



When reinstalling the RPM sensor, turn the RPM sensor (Item 1) **[Figure 60-170-1]** in until it makes contact with the engine flywheel.

Turn the jam nut (Item 2) **[Figure 60-170-1]** until it contacts the flywheel housing. The jam nut should not be tightened, it needs to turn with the RPM sensor when the sensor is turned back out for adjustment.

Figure 60-170-2



Turn the RPM sensor and the jam nut out from the flywheel. Set a clearance of 0.050 inch. (1,27 mm) between the jam nut and the housing with a feeler gauge (Item 1) **[Figure 60-170-2]**.

Remove the feeler gauge.

Tighten the jam nut (Item 2) **[Figure 60-170-2]** to 12-17 ft.-lb. (16-23 N•m) torque.

NOTE: New RPM sensors have a plastic tip which is used as a gauge during installation. The plastic tip is designed to come off after the engine is started.

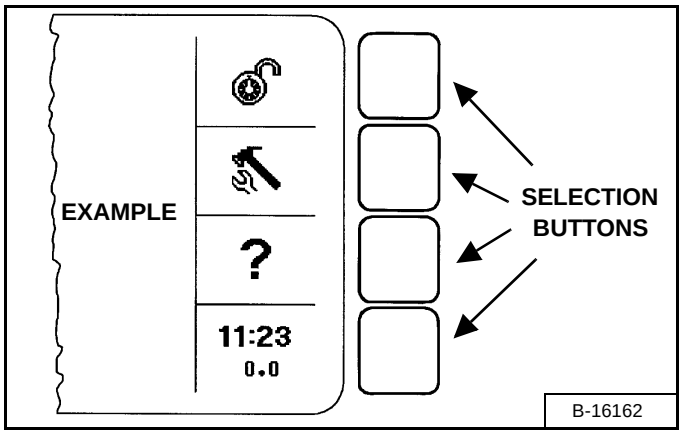
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CONTROL PANEL SETUP

Right Panel Setup (Keyless)

Icon Identification

Figure 60-180-1

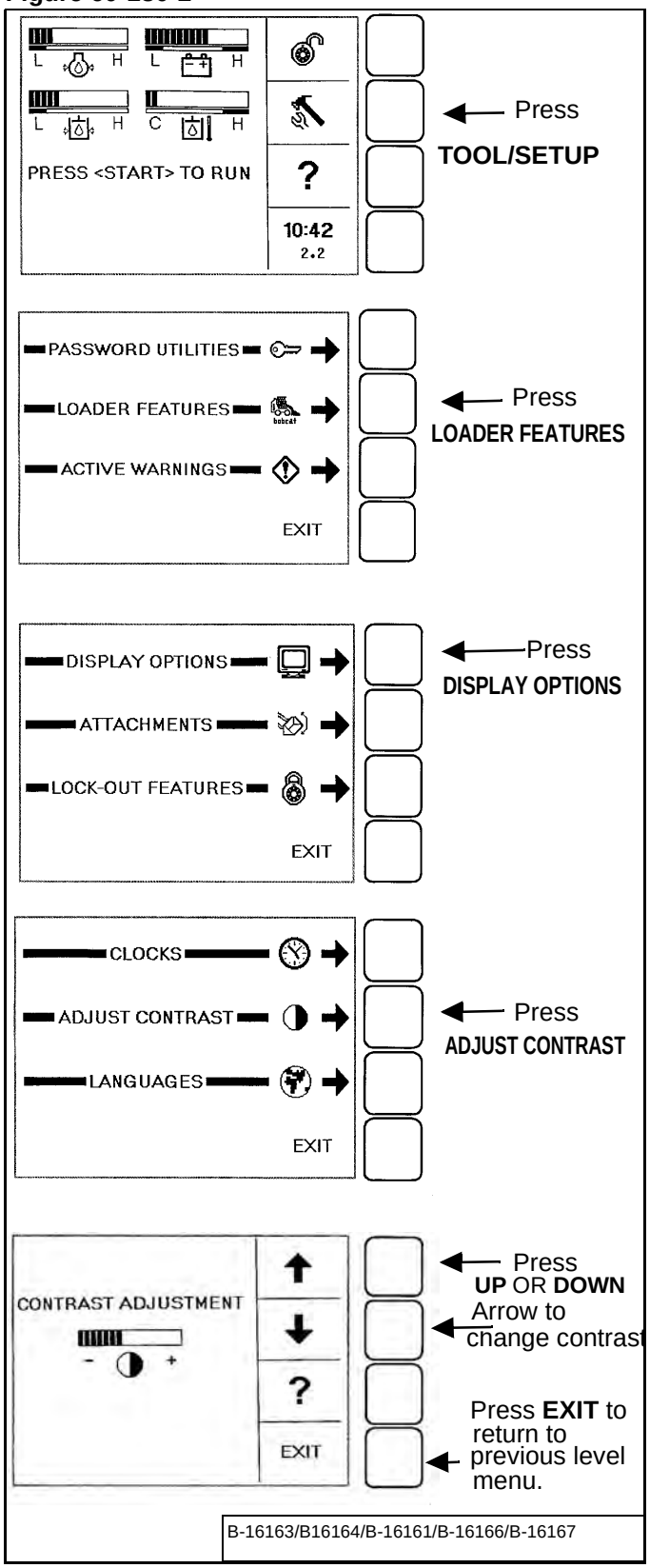


Make selection by pressing the SELECTION BUTTON adjacent to the icon **[Figure 60-180-1]**.

ICON	DESCRIPTION
	LOCK/UNLOCK: Allows machine to be locked/unlocked. You must lock machine to activate security system. When system is unlocked, the user can press RUN/ENTER then press START to begin operation. A valid password will need to be entered at startup to run a locked machine.
	TOOL/SETUP: Access system options. Use to set clock, check system warnings, select language, set passwords, etc.
?	**HELP:** Access help on current menu item.
EXIT	**EXIT** returns you to previous level menu.
11:23 0.0	**CLOCK/JOB CLOCK:** Press to clear or lock job clock; TOOL/SETUP to set time.
	UP ARROW: Goes backward one screen. **DOWN ARROW:** Goes forward one screen.
	OUTLINE ARROWS: No screen available (backward/forward).
	SELECTION ARROW: Use to select menu item.
NEXT	Goes to the NEXT screen in series. EXAMPLE: the next Active Warning screen.
INFO	Goes to more information about attachments.
YES/NO	Answer yes/no to current setup question.
CLEAR	Removes previously installed password.
SET	Set accepts current installed password.

Examples

Figure 60-180-2



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Right Panel Setup (Keyless) (Cont'd)

More Examples

Clocks

Press . . .
TOOL/SETUP
LOADER FEATURES
DISPLAY OPTIONS
CLOCKS

SET CLOCK
Use the keypad to set time.
Press **RUN/ENTER** to set clock.
Press **EXIT** to return to previous level menu.

RESET JOB CLOCK (Password required)
(Job Clock keeps a running total for job hours)
Press **CLEAR** to reset Job Clock to zero.
Press **LOCK/UNLOCK** to unlock.
Enter Password and press **RUN/ENTER**.

Languages

Press . . .
TOOL/SETUP
LOADER FEATURES
DISPLAY OPTIONS

LANGUAGES
Select the language, press **RUN/ENTER**.
Press **EXIT** to return to previous level menu.

Vitals (Monitor the engine, hydraulic/hydrostatic, electrical functions when engine is running.)

Press . . .
TOOL/SETUP
LOADER FEATURES.

VITALS
Press **SELECTION ARROW** to select METRIC or ENGLISH **(M/E)** readouts

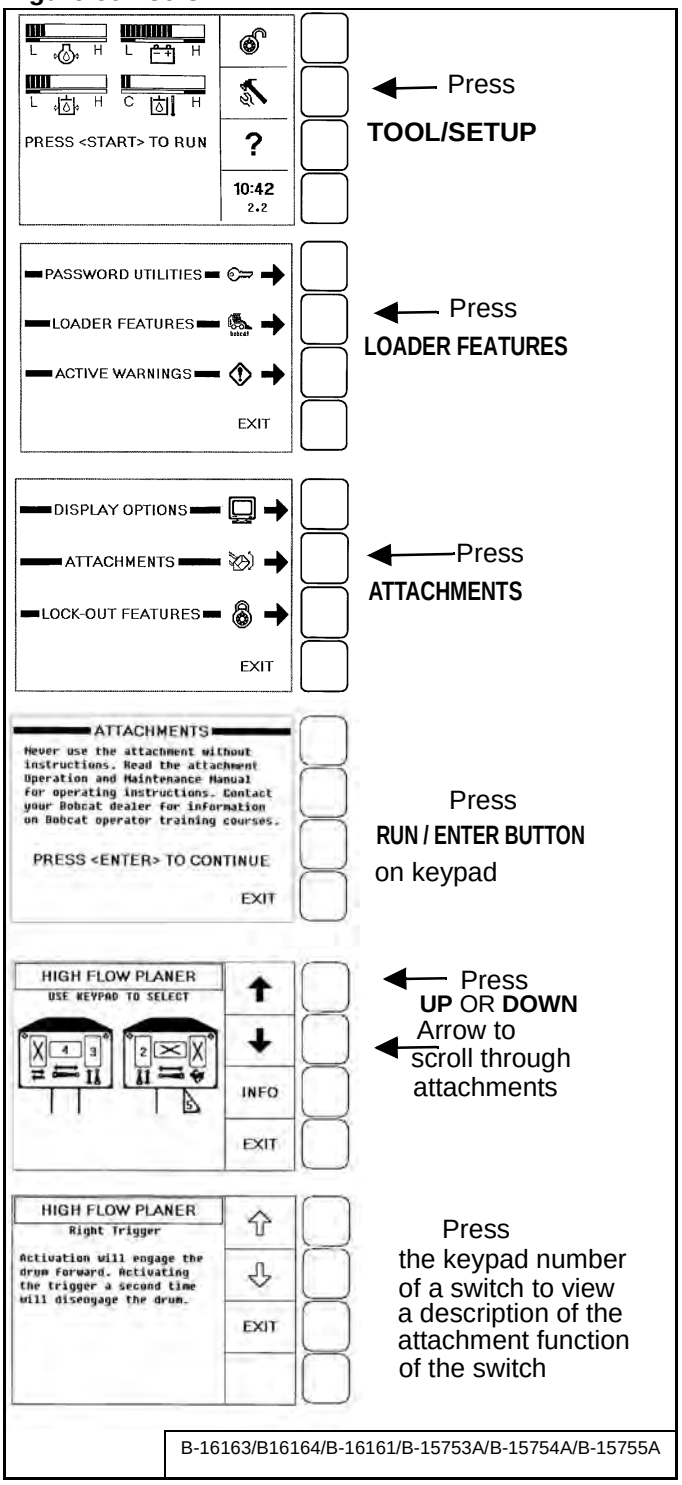
You can monitor real-time readouts of:
- **Engine Oil Pressure**
- **Engine Coolant Temperature**
- **Hydraulic Charge Pressure**
- **Hydraulic Oil Temperature**
- **System Voltage**
- **Engine Speed**

The Keyless Right Panel is easy to use. Continue to set your own preferences for running / monitoring your Bobcat Loader.

Attachment Control Information (Keyless)

The Keyless Right Panel allows the user to view information concerning the operation of Bobcat attachments.

Figure 60-180-3



Attachments are listed alphabetically. Press the exit button to return one screen or press the "0" (zero) key to return to the home screen immediately **[Figure 60-180-3]**.

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PASSWORD SETUP (IF EQUIPPED WITH KEYLESS START)

Password Description

All new machines with keyless start arrive at Bobcat dealerships with the keypad in locked mode. This means that a password must be used to start the engine.

For security purposes, your dealer may change the password and also set it in the locked mode. Your dealer will provide you with the password.

Master Password:

A permanent, randomly selected password 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:

Allows for full use of the loader and to setup the Keyless Right Panel. There is only one owner password. It must be used to change the owner or user passwords. Owner should change the password as soon as possible for security of the loader.

User Password:

Allows starting and operating the loader; cannot change password or any of the other setup features.

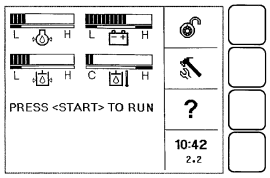
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PASSWORD SETUP (IF EQUIPPED WITH KEYLESS START) (CONT'D)

Changing The Owner And User Passwords

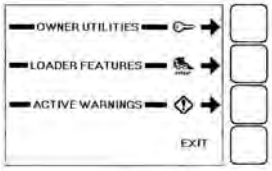
Figure 60-190-1

Changing the Password - Keyless Right Panel Display Screen



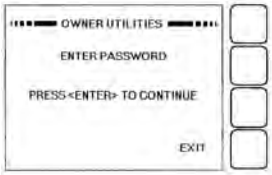
B-16163

Press **TOOL / SETUP**



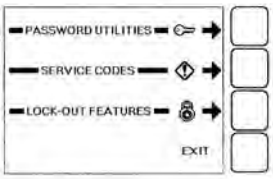
B-24288

Press **OWNER UTILITIES**



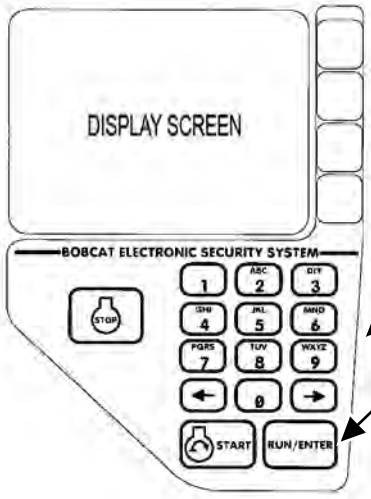
B-24290

Enter **PASSWORD** (owner or master) on ***Keypad*** then press **ENTER** to Continue



B-24291

Press **PASSWORD UTILITIES**



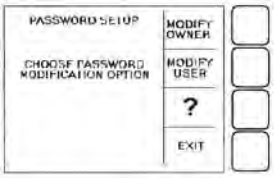
B-24289

Keypad

ENTER

OWNER PASSWORD

USER PASSWORD



B-16171

Press **MODIFY OWNER**



B-24292

Enter new **OWNER PASSWORD** on ***Keypad*** then press ***ENTER*** to Continue.



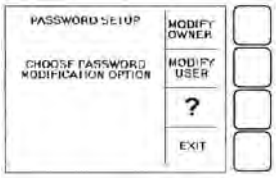
B-24293

Re-Enter new **OWNER PASSWORD** on ***Keypad*** then press ***ENTER*** to Continue.



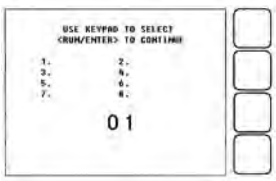
B-24294

OWNER PASSWORD procedure is now complete.



B-16171

Press **MODIFY USER**



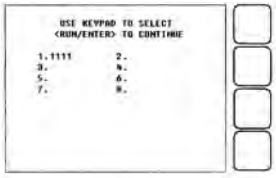
B-24295

Enter **USER** number on ***Keypad*** (There can be up to 8 different Users, each with their own password.) then press ***ENTER*** to Continue.



B-24296

Enter **USER PASSWORD** on ***Keypad*** then press ***ENTER*** to Continue.



B-24297

USER PASSWORD procedure is now complete.

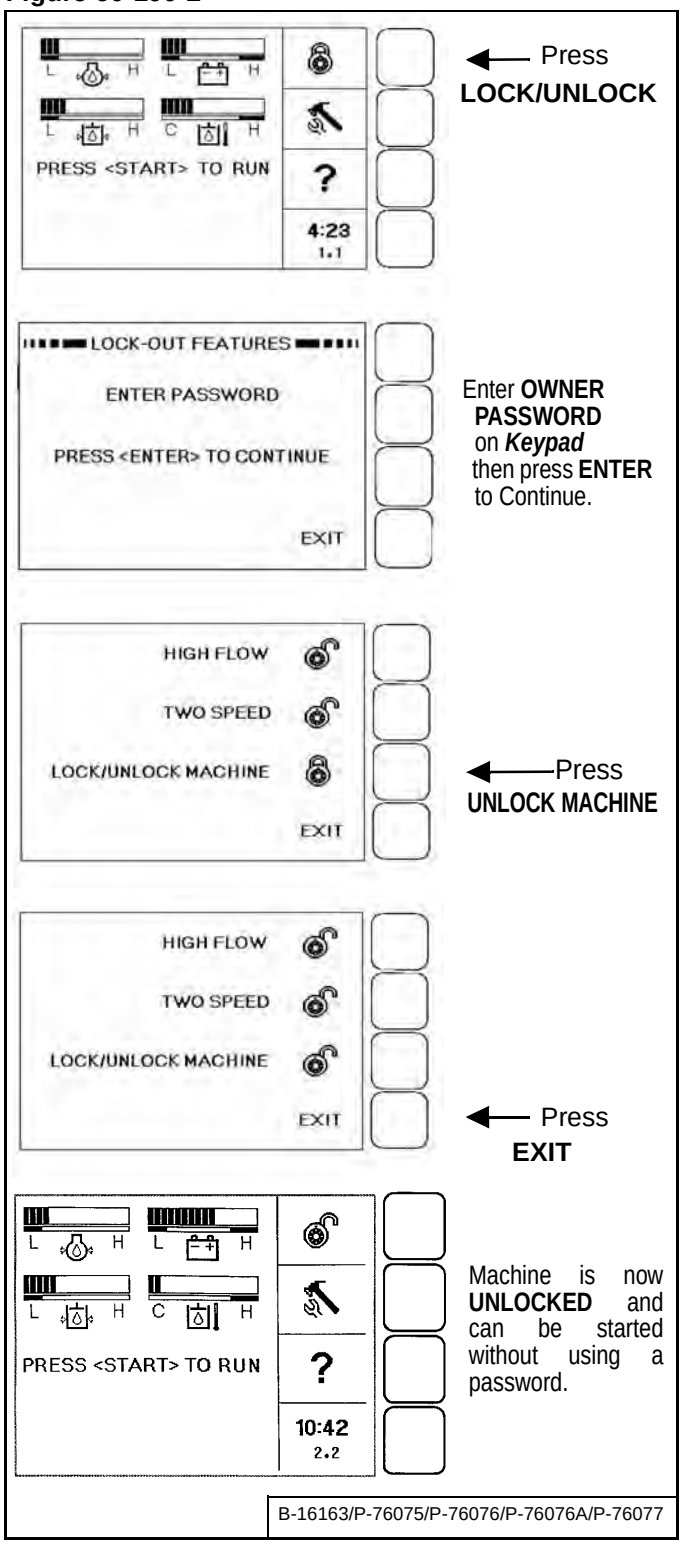
Dealer Copy -- Not for Resale

PASSWORD SETUP (IF EQUIPPED WITH KEYLESS START) (CONT'D)

Password Lockout Feature

This feature allows the owner to unlock the password feature so that a password does not need to be used every time the engine is started.

Figure 60-190-2



Dealer Copy -- Not for Resale



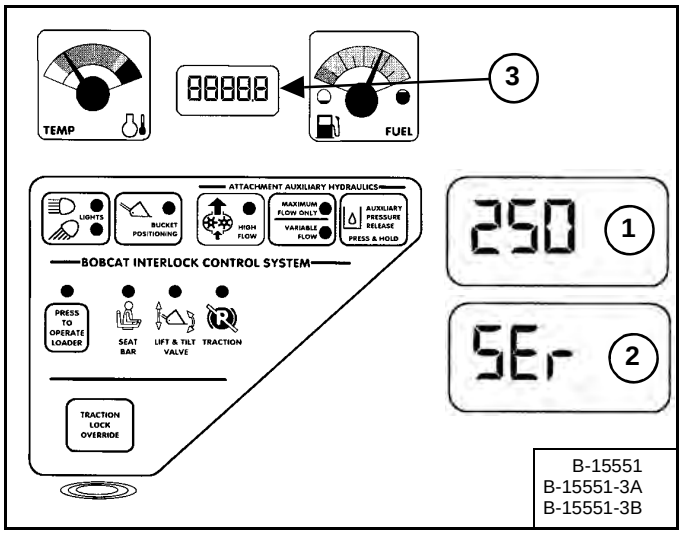
Dealer Copy -- Not for Resale

MAINTENANCE CLOCK

Description

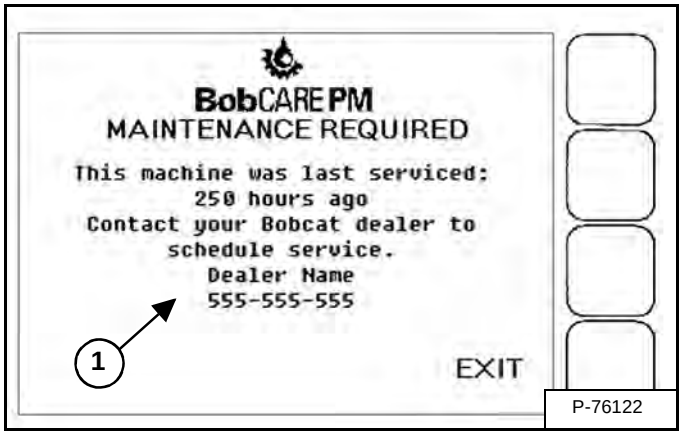
The Maintenance Clock alerts the operator when the next service interval is due. *EXAMPLE:* The Maintenance Clock can be set to a 250 hour interval as a reminder for the next 250 hour planned maintenance.

Figure 60-200-1



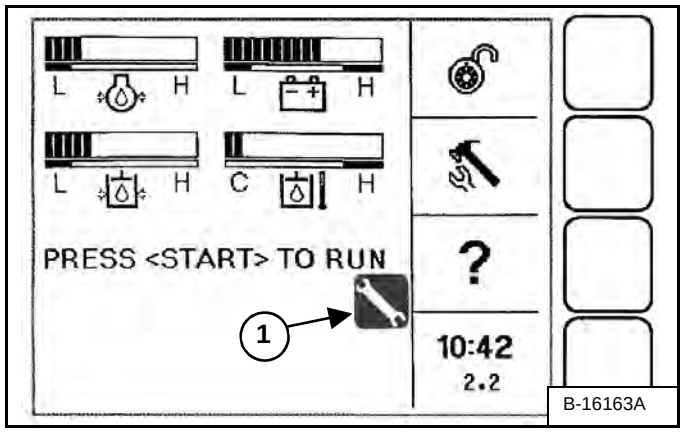
During machine operation, a two beep alarm will sound when there are less than 10 hours until the next planned maintenance. The hour interval (Item 1) and **[SEr]** (Item 2) will alternate in the display screen (Item 3) **[Figure 60-200-1]** for 10 seconds. The display will then revert back to the previous display and will appear for 10 seconds every time the machine is started until the maintenance clock is reset.

Figure 60-200-2



The Keyless Right Panel, if equipped, will display a message (Item 1) **[Figure 60-200-2]** alerting the operator to service the machine. This message will remain for 10 seconds before reverting back to the previous screen and will appear for 10 seconds every time the machine is started until the maintenance clock is reset.

Figure 60-200-3



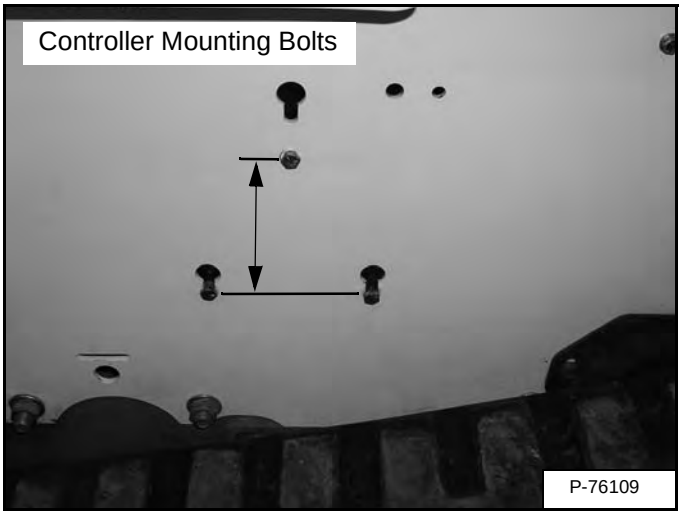
The Keyless Right Panel, if equipped, will display a wrench icon (Item 1) **[Figure 60-200-3]** alerting the operator to service the machine. This icon will remain on the display until the maintenance clock is reset.

NOTE: Key Switch machines will not display the BobCARE^{SM} PM message or wrench icon on the right panel.

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Setup

Figure 60-200-4

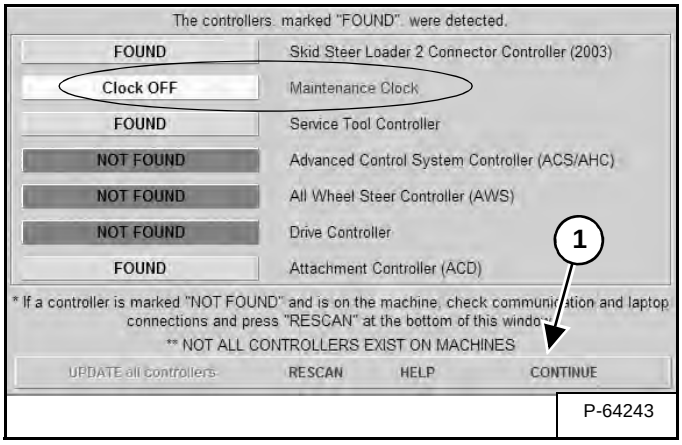


The easiest way to determine if a Bobcat controller is recent enough to add the maintenance clock is to measure the controller mounting bolt pattern on the left side of the loader mainframe. Controllers with a bolt pattern measuring 5.8 inches are maintenance clock compatible. The previous controller pattern measures 7.0 inches (not maintenance clock compatible) **[Figure 60-200-4]**.

Using the remote start tool and service PC, connect and upgrade the Bobcat controller to version 37 or greater software. (See SERVICE PC (LAPTOP COMPUTER) on Page 60-150-1.)

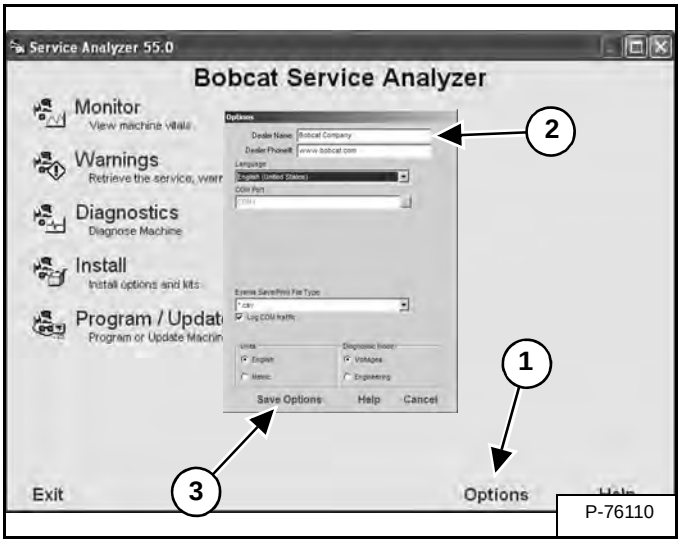
If the loader is equipped with keyless panel, also update the keyless panel software.

Figure 60-200-5



The first analyzer screen has an added bar for the Maintenance Clock. The clock will remain OFF until activated. Click **Continue** (Item 1) **[Figure 60-200-5]** to view the next analyzer screen.

Figure 60-200-6



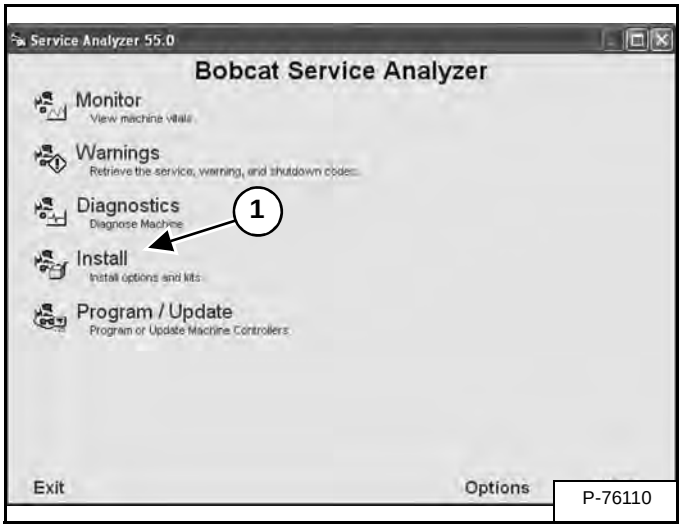
Click **Options** (Item 1) and add your dealer name and phone number (Item 2). Click **Save Options** (Item 3) **[Figure 60-200-6]** the information is now stored and will automatically be entered on each machine as the maintenance clock is activated. This will be displayed on keyless panel equipped loaders when the maintenance clock is less than 10 hours until next planned maintenance.

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MAINTENANCE CLOCK (CONT'D)

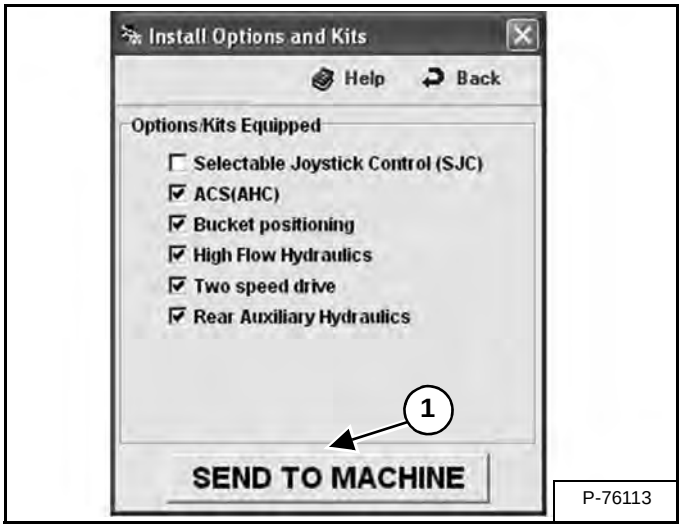
Setup (Cont'd)

Figure 60-200-7



Select **Install** (Item 1) **[Figure 60-200-7]** to begin sending the dealer information to the controller.

Figure 60-200-8



Click **SEND TO MACHINE** (Item 1) **[Figure 60-200-8]** to send the dealer information to the machine controller.

Figure 60-200-9

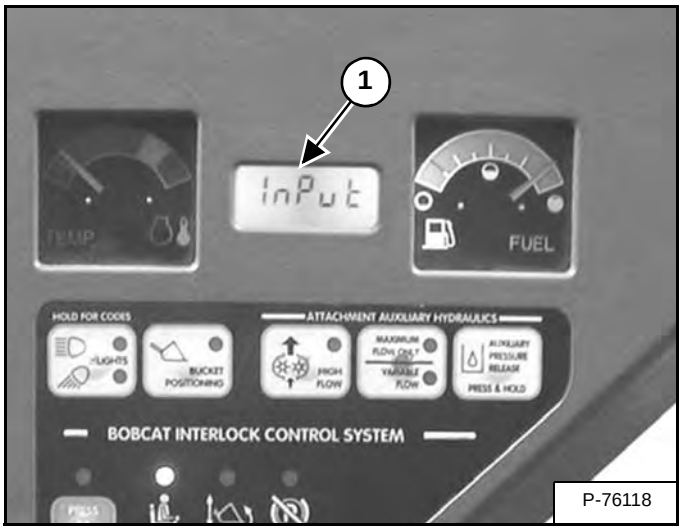
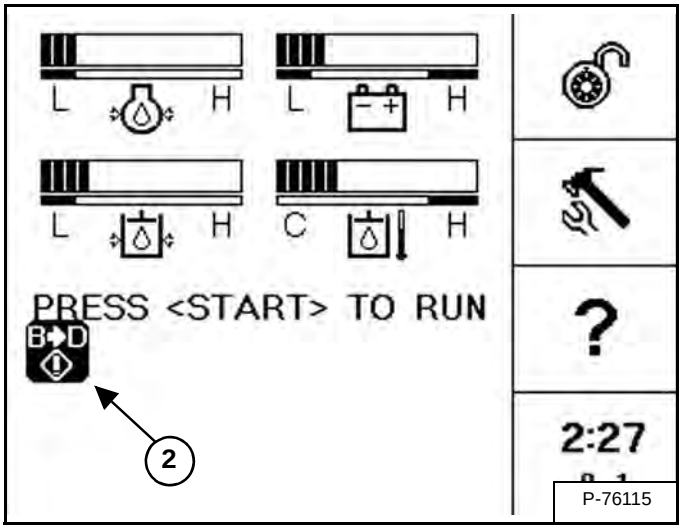


Figure 60-200-10



On key switch machines, during the installation process the left panel will display **[InPut]** (Item 1) **[Figure 60-200-9]** and the machine will beep twice confirming the transfer of data.

On keyless machines, during the installation process the left panel will display **[InPut]** (Item 1) **[Figure 60-200-9]**, the right panel will display an icon (Item 2) **[Figure 60-200-10]** and the machine will beep twice confirming the transfer of data.

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Setup (Cont'd)

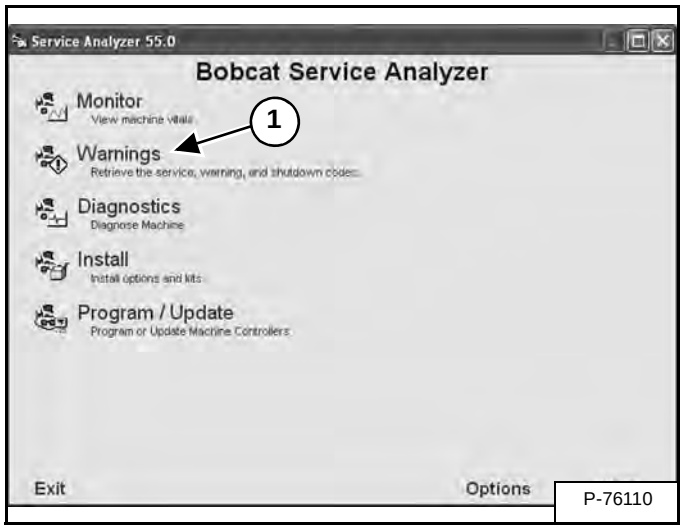
Figure 60-200-11



A green **COMPLETE** (Item 1) **[Figure 60-200-11]** message will be displayed when the dealer information has been transferred to the machine controller.

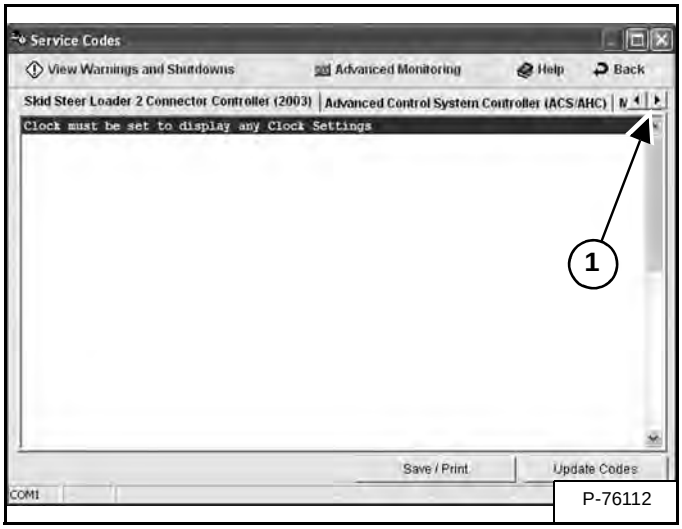
Click **Back** (Item 2) **[Figure 60-200-11]** to return to the Bobcat Service Analyzer screen.

Figure 60-200-12



Select **Warnings** (Item 1) **[Figure 60-200-12]**.

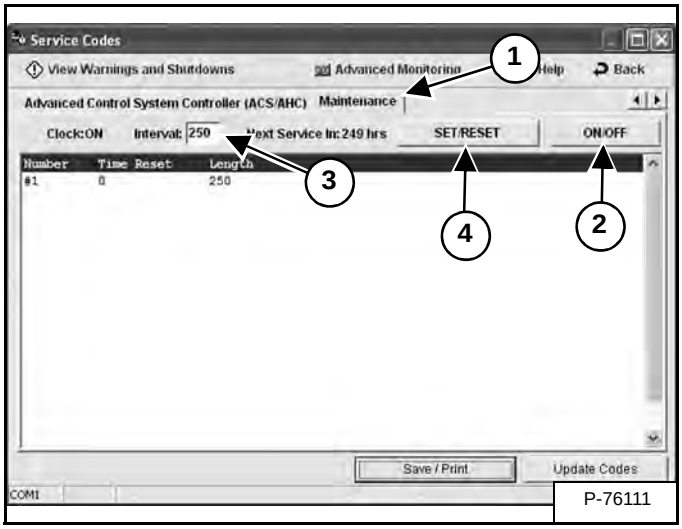
Figure 60-200-13



Click the right arrow (Item 1) **[Figure 60-200-13]** to scroll through the tabs.

NOTE: The Maintenance tab (Item 1) [Figure 60-200-14] will not appear when servicing loaders equipped with the older controller.

Figure 60-200-14



Click the **Maintenance** tab (Item 1) **[Figure 60-200-14]** to view the maintenance clock screen.

Click **ON/OFF** (Item 2) to turn the maintenance clock on or off **[Figure 60-200-14]**.

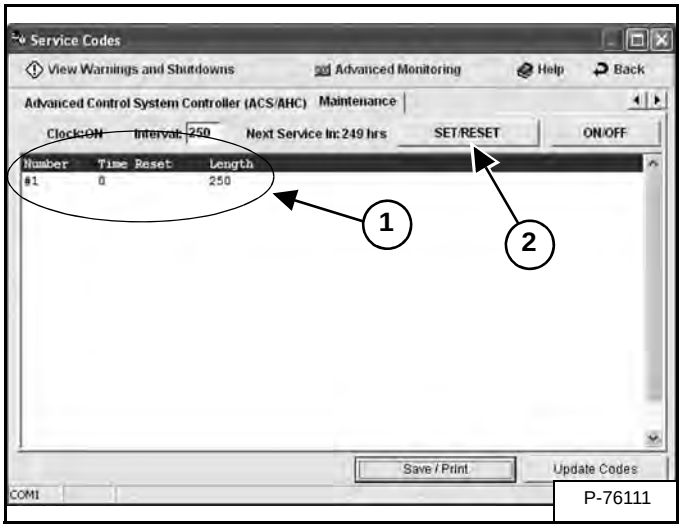
The default Interval (Item 3) is 250 hours, it can also be changed by placing the cursor in the box and typing the new interval. Click **SET/RESET** (Item 4) **[Figure 60-200-14]** to reset and set the maintenance clock.

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MAINTENANCE CLOCK (CONT'D)

Setup (Cont'd)

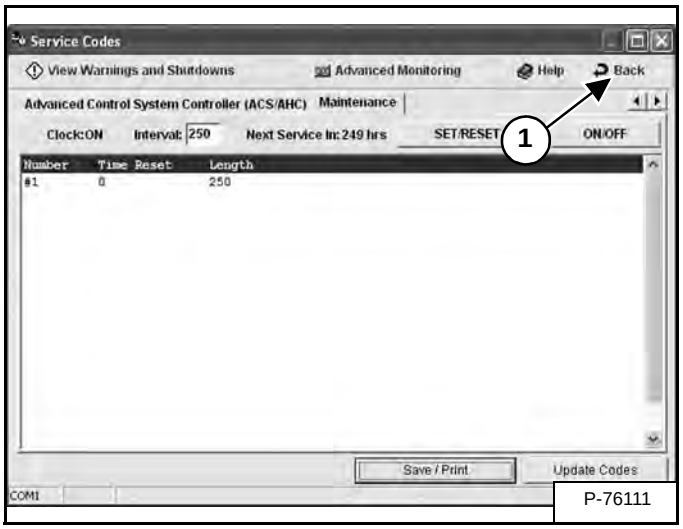
Figure 60-200-15



The current maintenance clock **Length** (Interval) and **Time Reset** will be displayed (Item 1). This screen will also store the most recent 20 entries of history. Once an entry is added, it can not be changed. If an entry is made and the interval is not correct, make another entry and click **SET/RESET** (Item 2) **[Figure 60-200-15]**.

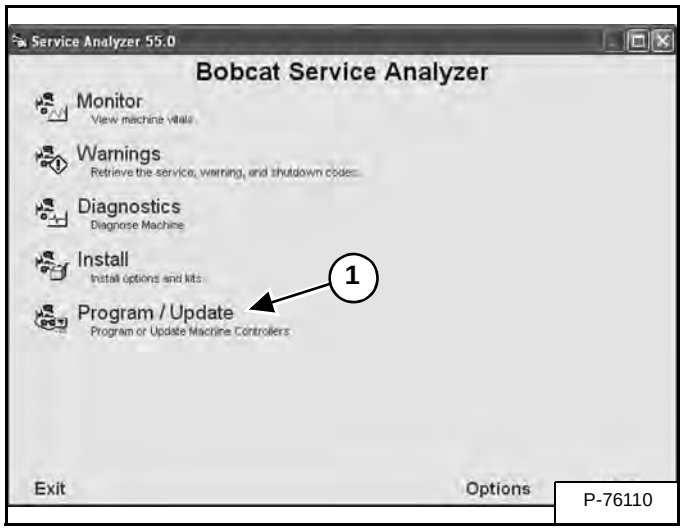
NOTE: If the interval is set to 10 hours or less, the maintenance clock will reset and log a reset time but the wrench icon, alternating hour interval and [SEr] will NOT be removed from the left and right instrument panel display screens.

Figure 60-200-16



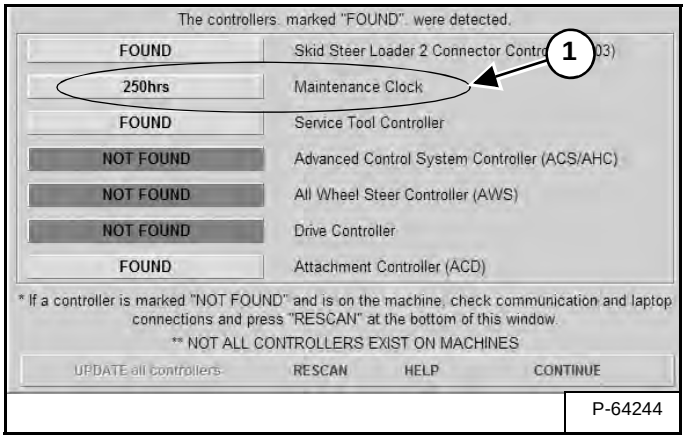
Select **Back** (Item 1) **[Figure 60-200-16]** to return to the main menu.

Figure 60-200-17



Select **Program / Update** (Item 1) **[Figure 60-200-17]** to view the maintenance clock.

Figure 60-200-18



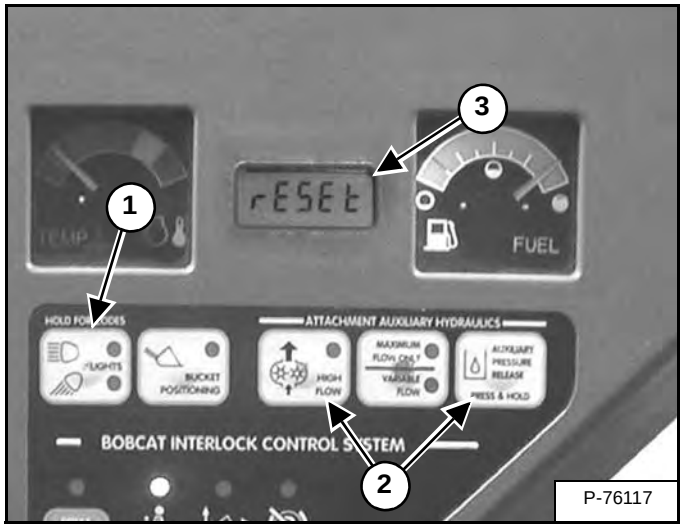
After the maintenance clock has been activated, the first analyzer screen shows the hours remaining on current maintenance interval (Item 1) **[Figure 60-200-18]**. If past the interval, the number will reflect negative hours.

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MAINTENANCE CLOCK (CONT'D)

Reset

Figure 60-200-19



Place the key switch in the OFF position (Key Switch) or press the STOP button (Keyless).

Press the LIGHTS button (Item 1) **[Figure 60-200-19]** to turn the panel ON.

Press and hold the HIGH FLOW and AUXILIARY PRESSURE RELEASE buttons (Item 2) simultaneously, until **[rESEt]** appears in the display screen (Item 3) **[Figure 60-200-19]**.

The maintenance clock can also be reset by clicking **Set / Reset** (Item 4) **[Figure 60-200-14]** in service analyzer.

NOTE: If the interval is set to 10 hours or less, the maintenance clock will reset and log a reset time but the wrench icon, alternating hour interval and [SEr] will NOT be removed from the left and right instrument panel display screens.

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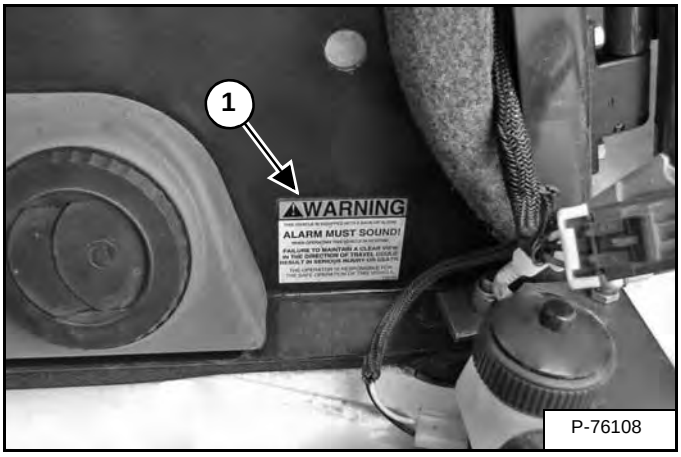
BACK-UP ALARM SYSTEM

Description

This machine may be equipped with a back-up alarm system. The back-up alarm will sound when the operator moves both steering levers or joystick(s) in the reverse position. Slight movement of the steering levers in the reverse position is required with hydrostatic transmissions, before the back-up alarm will sound.

Inspecting

Figure 60-210-1



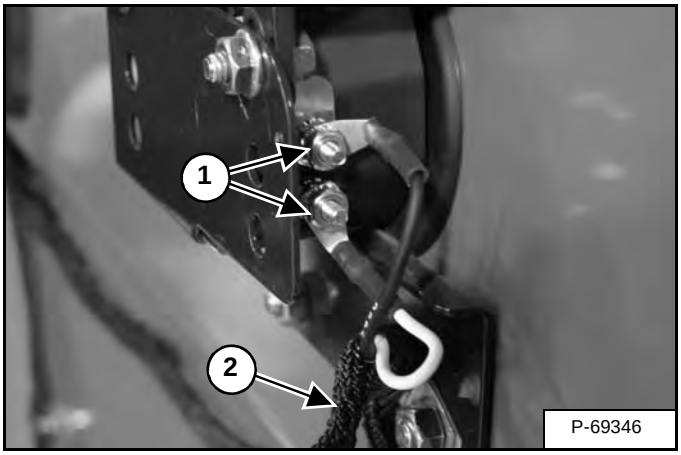
Inspect for damaged or missing back-up alarm decal (Item 1) **[Figure 60-210-1]**. Replace if required.

Sit in the seat and fasten the seat belt. Engage the parking brake. Pull the seat bar all the way down. Start the engine. Press the PRESS TO OPERATE LOADER button. Disengage the parking brake.

Move both steering levers or joystick(s) in the reverse position. The back-up alarm must sound when all wheels or both tracks are moving in reverse.

The back-up alarm is located on the inside of the rear door.

Figure 60-210-2



Inspect the back-up alarm electrical connections (Item 1) **[Figure 60-210-2]**, wire harness (Item 2) **[Figure 60-210-2]** and back-up alarm switches (if equipped) (Item 2) **[Figure 60-210-3]** for tightness and damage. Repair or replace any damaged components.

If the back-up alarm switches require adjustment, (See Adjusting Switch Position on Page 60-210-2.)

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BACK-UP ALARM SYSTEM (CONT'D)

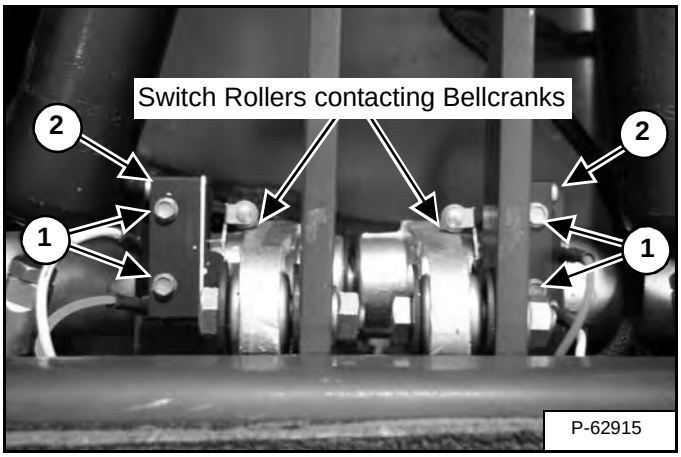
Adjusting Switch Position

NOTE: Joystick equipped machines do not have back-up alarm switches and can not be adjusted.

Standard Controls and ACS (If Equipped)

Stop the engine and raise the operator cab. (See Raising on Page 10-30-1.)

Figure 60-210-3



Place the steering levers in the neutral position.

Loosen the screws (Item 1) **[Figure 60-210-3]** securing the back-up alarm switches.

Position the back-up alarm switch rollers so that they just make contact with bellcranks without compressing the switch springs **[Figure 60-210-3]**. Torque the screws (Item 1) **[Figure 60-210-3]** securing the switches to the bracket to 14 - 19 in.-lb. (1,6 - 2,1 N•m).

Lower the operator cab (See Lowering on Page 10-30-2.) and inspect back-up alarm system for proper function. (See Inspecting on Page 60-210-1.)

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Troubleshooting (Standard And ACS)

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
Back-up alarm will not sound when the operator moves both steering levers in the reverse position.	1, 2, 3, 4, 5, 6, 7
Back-up alarm sounds when steering levers in neutral / forward position.	2, 6, 7

KEY TO CORRECT THE CAUSE
1. The ground connection is not making a good contact. 2. The back-up alarm switches are damaged. 3. The alarm is damaged. 4. The alarm or back-up switch wires are disconnected. 5. Check the fuses. 6. The wiring is damaged. 7. The back-up alarm switches need adjusting.

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Troubleshooting (Joystick)

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
Back-up alarm will not sound when the operator moves joystick(s) in the reverse position.	1, 2, 3, 4, 5, 6
Back-up alarm sounds when joystick(s) in neutral / forward position.	5, 6

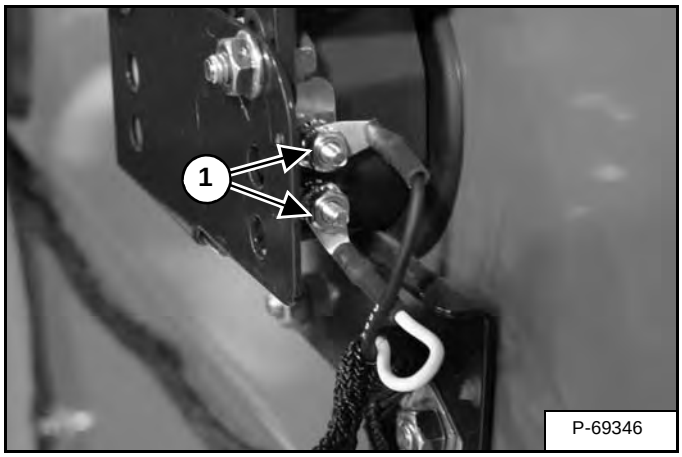
KEY TO CORRECT THE CAUSE
1. The ground connection is not making a good contact.
2. The alarm is damaged.
3. The alarm wires are disconnected.
4. Check the fuses.
5. The wiring is damaged.
6. The joystick controller is not working correctly.

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Alarm Removal And Installation

Stop the engine and open the tailgate.

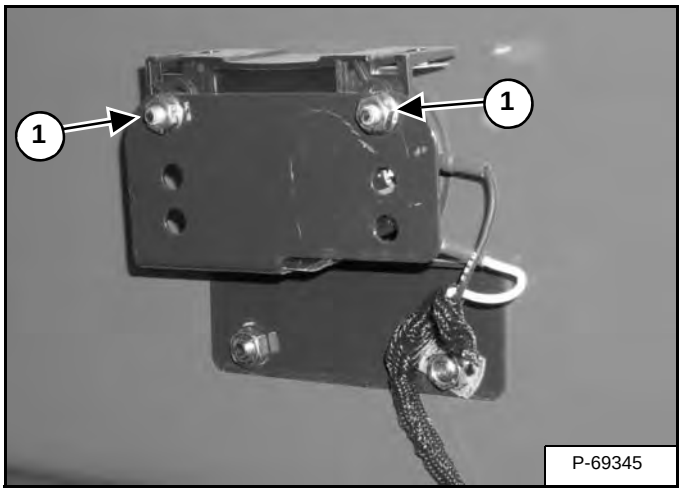
Figure 60-210-4



Mark the wires for ease of assembly. Disconnect the wires (Item 1) **[Figure 60-210-4]** from the alarm.

Installation: Make sure the wire harness ends do not touch the mounting bolts during assembly.

Figure 60-210-5



Remove the two hex head bolts, washers, and lock nuts (Item 1) **[Figure 60-210-5]**. Remove the alarm from the mounting bracket.

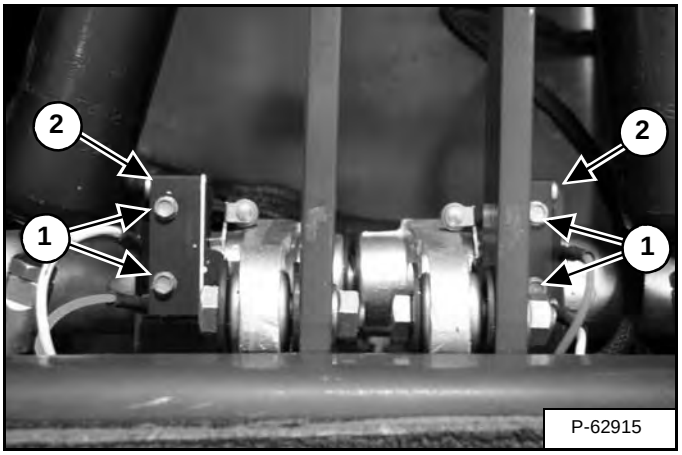
Switch Removal And Installation

NOTE: Joystick equipped machines do not have back-up alarm switches and can not be adjusted.

Standard Controls and ACS (If Equipped)

Stop the engine and raise the operator cab. (See Raising on Page 10-30-1.)

Figure 60-210-6



Place the steering levers in the neutral position.

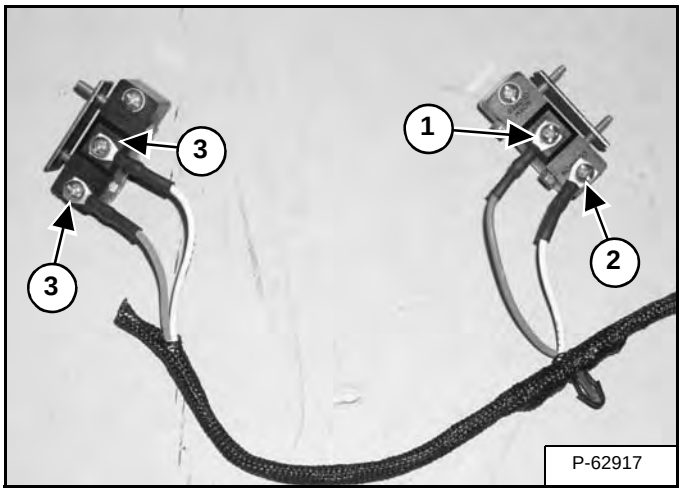
Loosen the screws (Item 1) securing the back-up alarm switches. Slide the switch assemblies (Item 2) **[Figure 60-210-6]** off the mounting bracket.

Installation: Slide the alarm switches onto the mounting bracket so the threaded plates are under the mounting bracket. The rollers will face to the inside. During installation of switches, adjusting the switches (See Adjusting Switch Position on Page 60-210-2.) and inspecting back-up alarm operation (See Inspecting on Page 60-210-1.) are required.

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Switch Removal And Installation (Cont'd)

Figure 60-210-7



Mark the wires for ease of assembly.

Disconnect the Orange wire from the common terminal (Item 1) **[Figure 60-210-7]**.

Disconnect the White wire from the normally open terminal (Item 2) **[Figure 60-210-7]**.

Disconnect the remaining White wires to the other switch terminals (Item 3) **[Figure 60-210-7]**.

Remove the switches.

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TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.

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ENGINE INFORMATION

Description

The S220 has a Kubota direct injected V3300 Turbo diesel engine with a displacement of 202.5 cu.in. (3,3 L).The engine is rated at (SAE Net) 71.7 HP (53,5 Kwh) and has an open crankcase ventilation system.

The engine has 4 cylinders and the rotation is counter-clockwise (viewed from the flywheel side). It is also equipped with an air intake heater for assisting in cold starts. Engine block heaters are also available from Bobcat Parts.

The engine serial number is stamped on the engine and is located near the injection pump. The model number is located on the valve cover. Use these numbers to obtain the correct service parts.

The engine is liquid cooled with a propylene glycol/water mixture. The cooling fan is driven by a hydraulic motor. The speed of the fan is determined by the engine coolant temperature sensor and the hydraulic/hydrostatic fluid temperature sensor.

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Specifications

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Fuel System

Injection Timing	12° - 13° before T.D.C. 0.21 to 0.23 rad.
Fuel Injection Pressure - 1st Stage	2702 - 2845 PSI 18.63 - 19.61 MPa 190 - 200 kgf/cm²
Fuel Injection Pressure - 2nd Stage	3414-3556 PSI 23.54-24.52 MPa 240-250 kgf/cm²
Fuel Tightness of Nozzle Valve Seat	When the pressure is 16.67 MPa (170 kgf/cm², 2418 PSI), the valve seat must be fuel tightness

Valves

Valve Seat Width (Intake)	0.06
Valve Seat Width (Exhaust)	0.09
Valve Seat and Face Angle (Intake)	60° 1.047 rad.
Valve Seat and Face Angle (Exhaust)	45° 0.785 rad.
Valve Stem O.D.	0.2740 to 0.2764 in. (6.960 to 6.975 mm)
Valve Guide I.D.	0.2768 to 0.2774 in. (7.030 to 7.045 mm)
Clearance Between Valve Stem And Valve Guide (Intake and Exhaust)	0.0022 to 0.0033 in. (0.055 to 0.085 mm)
Allowable Limit	0.0039 in. (0.1 mm)
Valve Clearance (Cold)	0.0091 to 0.0106 in. (0.23 to 0.27 mm)
Valve Recessing (Intake)	0.0236 to 0.0315 in. (0.6 to 0.8 mm)
Allowable Limit	0.0472 in. (1.2 mm)
Valve Recessing (Exhaust)	0.0335 to 0.0413 in. (0.85 to 1.05 mm)
Allowable Limit	0.0472 in. (1.2 mm)

Valve Springs

Valve Spring (Intake)	1.3819 to 1.4016 in. (35.1 to 35.6 mm)
Allowable Limit	1.3622 in. (34.6 mm)
Valve Spring (Exhaust)	1.3819 to 1.4016 in. (35.1 to 35.6 mm)
Allowable Limit	1.3622 in. (34.6 mm)
Setting Load/Setting Length (Intake)	14.256 lb. / 1.2401 in. (63.547 N / 31.5 mm) (6.48 kgf / 31.5 mm)
Allowable Limit	10.296 lb. /1.2401 in. (45.864 N / 31.5 mm) (4.68 kgf / 31.5 mm)
Setting Load/Setting Length (Exhaust)	14.256 lb. / 1.2401 in. (63.547 N / 31.5 mm) (6.48 kgf / 31.5 mm)
Allowable Limit	10.296 lb. /1.2401 in. (45.864 N / 31.5 mm) (4.68 kgf / 31.5 mm)
Tilt - Allowable Limit	0.039 in. (1.0 mm)

Valve Tappets

Clearance Between Tappet And Guide	0.0008 to 0.0024 in. (0.020 to 0.062 mm)
Allowable Limit	0.0028 in. (0.07 mm)
Tappet Guide I.D.	0.9449 to 0.9457 in. (24.000 to 24.021 mm)
Tappet O.D.	0.9433 to 0.9441 in. (23.959 to 23.980 mm)

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Specifications (Cont'd)

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Valve Timing

Intake Valve - Open	14° before T.D.C. 0.24 rad.
Closed	36° after B.D.C. 0.61 rad.
Exhaust Valve - Open	45° before B.D.C. 0.76 rad.
Closed	17° after T.D.C. 0.29 rad.

Rocker Arm

Clearance Between Valve Arm Bridge And Valve Arm Bridge Shaft	0.0007 to 0.0026 in. (0.018 to 0.042 mm)
Allowable Limit	0.0059 in. (0.15 mm)
Valve Arm Bridge I.D.	0.3563 to 0.3569 in. (9.050 to 9.065 mm)
Valve Arm Bridge Shaft O.D.	0.3552 to 0.3566 in. (9.023 to 9.032 mm)
Clearance Between Rocker Arm Shaft And Rocker Arm	0.0006 to 0.0018 in. (0.016 to 0.045 mm)
Allowable Limit	0.0059 in. (0.15 mm)
Rocker Arm Shaft O.D.	0.6289 to 0.6293 in. (15.973 to 15.984 mm)
Rocker Arm I.D. For Shaft	0.6299 to 0.6306 in. (16.000 to 16.018 mm)

Camshaft

Clearance Between Tappet And Guide	0.0008 to 0.0024 in. (0.020 to 0.062 mm)
Allowable Limit	0.0028 in. (0.07 mm)
Tappet Guide I.D.	0.9449 to 0.9457 in. (24.000 to 24.021 mm)
Tappet O.D.	0.9433 to 0.9441 in. (23.959 to 23.980 mm)

Timing Gear

Timing Gear Backlash	
Crank Gear - Idler Gear	0.0019 to 0.0076 in. (0.049 to 0.193 mm)
Allowable Limit	0.0087 in. (0.22 mm)
Idler Gear - Cam Gear	0.0019 to 0.0074 in. (0.049 to 0.189 mm)
Allowable Limit	0.0087 in. (0.22 mm)
Idle Gear - Injection Pump Gear	0.0012 to 0.0065 in. (0.030 to 0.165 mm)
Allowable Limit	0.0087 in. (0.22 mm)
Clearance Between Idle Gear Shaft And Idle Gear Bushing	0.0020 to 0.0036 in. (0.05 to 0.091 mm)
Allowable Limit	0.0039 in. (0.10 mm)
Idle Gear Bushing I.D.	1.7726 to 1.7736 in. (45.025 to 45.050 mm)
Idle Gear Shaft O.D.	1.7700 to 1.7707 in. (44.959 to 44.975 mm)
Idle Gear Side Clearance	0.0059 to 0.0118 in. (0.15 to 0.30 mm)
Allowable Limit	0.0354 in. (0.9 mm)

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Specifications (Cont'd)

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Cylinder Head

Cylinder Head Surface Flatness - Allowable Limit	0.0019 in. (0.05 mm)
Compression Pressure	498 to 526 PSI / 250 RPM 3.43 to 3.63 MPa / 250 RPM 35 to 37 kgf/cm² / 250 RPM
Compression Ratio	19.3
Variance Among Cylinder - Allowable Limit	10% or less
Firing Order	1-3-4-2

Piston And Piston Ring

Piston Pin Bore I.D.	1.1811 to 1.1816 in. (30.000 to 30.013 mm)
Allowable Limit	1.1831 in. (30.05 mm)
Clearance Between Compression Ring 1 and Ring Groove	0.0020 to 0.0028 in. (0.05 to 0.07 mm)
Allowable Limit	0.0059 in. (0.15 mm)
Clearance Between Compression Ring 2 and Ring Groove	0.0037 to 0.0047 in. (0.093 to 0.120 mm)
Allowable Limit	0.0079 in. (0.20 mm)
Clearance Between Oil Ring And Ring Groove	0.0008 to 0.0023 in. (0.02 to 0.06 mm)
Allowable Limit	0.0059 in. (0.15 mm)
Ring Gap	
Compression Ring 1	0.0118 to 0.0177 in. (0.30 to 0.45 mm)
Allowable Limit	0.0492 in. (1.25 mm)
Compression Ring 2	0.0118 to 0.0177 in. (0.30 to 0.45 mm)
Allowable Limit	0.0492 in. (1.25 mm)
Oil Ring	0.0098 to 0.0177 in. (0.25 to 0.45 mm)
Allowable Limit	0.0492 in. (1.25 mm)

Connecting Rod

Connecting Rod Alignment - Allowable Limit	0.0020 in. (0.05 mm)
Clearance Between Piston Pin And Small End Bushing	0.0008 to 0.0016 in. (0.02 to 0.040 mm)
Allowable Limit	0.0059 in. (0.15 mm)
Piston Pin O.D.	1.1813 to 1.1815 in. (30.006 to 30.011 mm)
Small End Busing I.D.	1.1823 to 1.1829 in. (30.031 to 30.046 mm)

Cylinder Bore

Cylinder Bore I.D.	3.8582 to 3.8591 in. (98.000 to 98.022 mm)
Allowable Limit	3.8642 in. (98.15 mm)
Oversized Cylinder Liner I.D.	3.8780 to 3.8788 in. (98.500 to 98.522 mm)
Allowable Limit	3.8839 in. (98.65 mm)

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Specifications (Cont'd)

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Crankshaft

Crankshaft Alignment - Allowable Limit	0.00079 in. (0.02 mm)
Crankpin O.D.	2.0857 to 2.0862 in. (52.977 to 52.990 mm)
Crankshaft Journal O.D.	2.9518 to 2.9548 in. (74.977 to 74.990 mm)
Oil Clearance Between Crankshaft Journal And Crankshaft Bearing	0.0007 to 0.0024 in. (0.018 to 0.062 mm)
Allowable Limit	0.0079 in (0.20 mm)
Oil Clearance Between Crank Pin And Pin Bearing	0.0007 to 0.0020 in. (0.018 to 0.051 mm)
Allowable Limit	0.0079 in (0.20 mm)
Crankshaft Side Clearance	0.0059 to 0.0122 in. (0.015 to 0.31 mm)
Allowable Limit	0.0197 in (0.50 mm)

Oil Pump

Engine Oil Pressure - At Idle Speed	14 PSI (98 kPa) 1.0 kgf/cm²
Allowable Limit	7 PSI (49 kPa) 0.5 kgf/cm²
Engine Oil Pressure - At Rated Speed	28 to 56 PSI (196 to 392 kPa) 2.0 to 4.0 kgf/cm²
Allowable Limit	21.3 PSI (147.1 kPa) 1.5 kgf/cm²
Engine Oil Pressure Switch Working Pressure	5.6 to 8.4 PSI (39.2 to 58.8 kPa) 0.4 to 0.6 kgf/cm²
Clearance Between Inner Rotor And Outer Rotor	0.0016 to 0.0063 in. (0.04 to 0.16 mm)
Clearance Between Outer Rotor And Pump Body	0.0039 to 0.0072 in. (0.100 to 0.184 mm)
Clearance Between Rotor And Cover	0.0010 to 0.0030 in. (0.025 to 0.075 mm)
Allowable Limit	0.0089 in. (0.225 mm)
Relief Valve Working Pressure	129 PSI (885 kPa) 9.04 kgf/cm²

Thermostat

Thermostat Valve Opening Temperature	166.1 to 173.3°F (74.5 to 78.5°C)
Temperature At Which Thermostat Completely Opens	194°F (90°C)

Intake Air Heater

Intake Air Heater Resistance (at cold occasion)	Approximately 0.3Ω

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Torque Values

Kubota Metric Engine Bolts

Thread Size (Dia. x Pitch)	Material		
	Head Mark 4	Head Mark 7	Head Mark 10
M5 x 0.8		3 - 4 ft.-lb. (4 - 5 N•m)	
M6 x 1.0		6 - 7 ft.-lb. (8 - 9 N•m)	6 - 9 ft.-lb. (8 - 12 N•m)
M8 x 1.25	6 - 9 ft.-lb. (8 - 12 N•m)	11 - 16 ft.-lb. (15 - 22 N•m)	18 - 25 ft.-lb. (24 - 34 N•m)
M10 x 1.25	13 - 18 ft.-lb. (18 - 24 N•m)	22 - 30 ft.-lb. (30 - 41 N•m)	36 - 50 ft.-lb. (49 - 68 N•m)
M12 x 1.25	22 - 30 ft.-lb. (30 - 41 N•m)	40 - 54 ft.-lb. (54 - 73 N•m)	69 - 87 ft.-lb. (94 - 118 N•m)
M14 x 1.5	36 - 50 ft.-lb. (49 - 68 N•m)	58 - 80 ft.-lb. (79 - 108 N•m)	116 - 137 ft.-lb. (157 - 186 N•m)

Tightening Torques For General Use Screws, Bolts And Nuts

Grade / Nominal Diameter / Unit	Standard Screw and Bolt (4)			Special Screw and Bolt (7)		
	N·m	kgf·m	ft-lb.	N·m	kgf·m	ft-lb.
M6	7.9 to 9.3	0.80 to 0.95	5.8 to 6.9	9.8 to 11.3	1.00 to 1.15	7.23 to 8.32
M8	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
M10	39.2 to 45.1	4.0 to 4.6	28.9 to 33.3	49.0 to 55.9	5.0 to 5.7	36.2 to 41.2
M12	62.8 to 72.6	6.4 to 7.4	46.3 to 53.5	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5

Screw and bolt material grades are shown by numbers punched on the screw and bolt heads. Prior to tightening, be sure to check out the numbers as shown below.

Punched number	Screw and bolt material grade
None or 4	Standard screw and bolt SS400, S20C
7	Special screw and bolt S43C, S48C (Refined)

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Troubleshooting

The following troubleshooting chart is provided for assistance in locating and correcting problems which are most common. Many of the recommended procedures must be done by authorized Bobcat Service Personnel only.

PROBLEM	CAUSE
Slow cranking speed.	1, 2, 3
Engine will not start.	2, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 19, 27, 28, 29
Difficult to start.	1, 2, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 25, 27, 28, 29, 54
No power for engine.	8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 20, 21, 22, 23, 27, 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 warning.	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

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Troubleshooting (Cont'd)

KEY TO CORRECT THE CAUSE	
1. Alternator belt is loose or damaged.	28. Worn valve and seats.
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 crankcase.
6. Fuel tank empty.	33. Switch/sensor is defective.
7. Faulty stop control operation.	34. Oil pump worn.
8. Plugged fuel line.	35. Relief valve is sticking open.
9. Plugged fuel filter.	36. Relief valve is sticking 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 flywheel alignment.
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. Faulty water pump.
22. Overheating.	49. Plugged breather pipe.
23. Cold running.	50. Damaged valve stem deflectors.
24. Incorrect tappet adjustment.	51. Coolant level to low.
25. Sticking valves.	52. Plugged oil pump pipe strainer.
26. Incorrect fuel lines.	53. Broken valve spring.
27. Worn cylinder bores.	54. Damaged Battery

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Engine Removal And Installation



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Lift and block the loader. (See Procedure on Page 10-10-1.)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Drain the hydraulic fluid from the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-2.)

Disconnect the steering linkage. (See Linkage Removal And Installation on Page 50-100-6.)

Remove the battery from the loader. (See Removal And Installation on Page 60-20-1.)

Drain the engine coolant from the cooling system. (See Removing And Replacing Coolant on Page 10-90-2.)

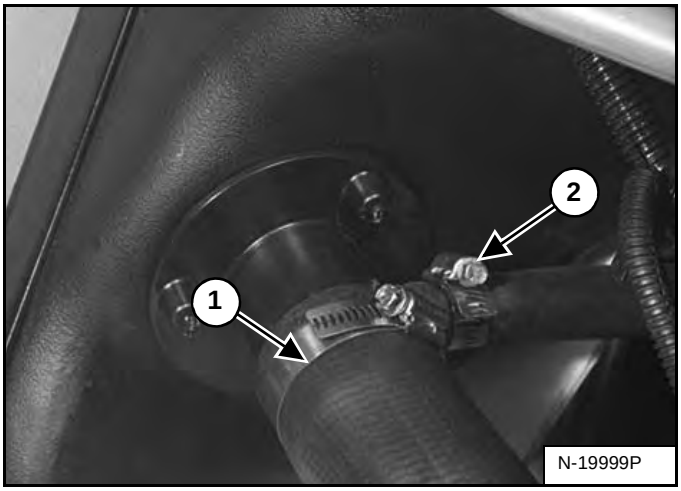
Remove the air cleaner. (See Housing Removal And Installation on Page 70-40-1.)

Remove the air conditioning compressor (If so equipped). (See Removal And Installation on Page 80-50-1.)

Remove the muffler. (See Removal And Installation on Page 70-30-1.)

Remove the side access covers located by the lift cylinders.

Figure 70-10-8

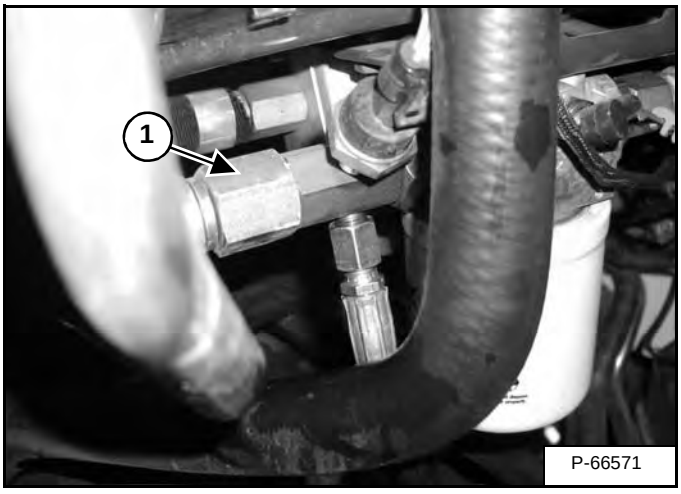


NOTE: The engine and hydrostatic pump will be removed as an assembly.

Disconnect the fuel fill hose (Item 1) **[Figure 70-10-8]** from the fuel fill neck.

Disconnect the air vent hose (Item 2) **[Figure 70-10-8]** from the fuel fill neck.

Figure 70-10-9

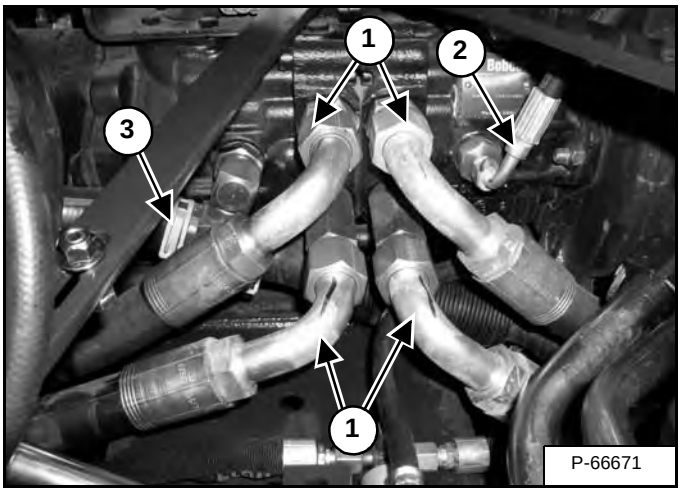


Disconnect the charge filter outlet hose (Item 1) **[Figure 70-10-9]** that goes to the back of the hydrostatic pumps.

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Engine Removal And Installation (Cont'd)

Figure 70-10-10

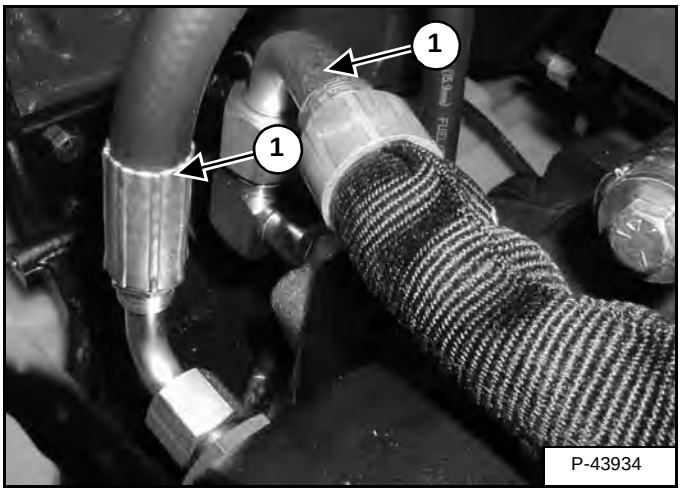


Remove the four high pressure hydraulic hoses (Item 1) **[Figure 70-10-10]** from the hydrostatic pump.

Disconnect the cooling fan case drain hose (Item 2) **[Figure 70-10-10]** from the hydrostatic pump.

Disconnect the hydraulic pump supply hose (Item 3) **[Figure 70-10-10]** from the fitting on the hydrostatic pump.

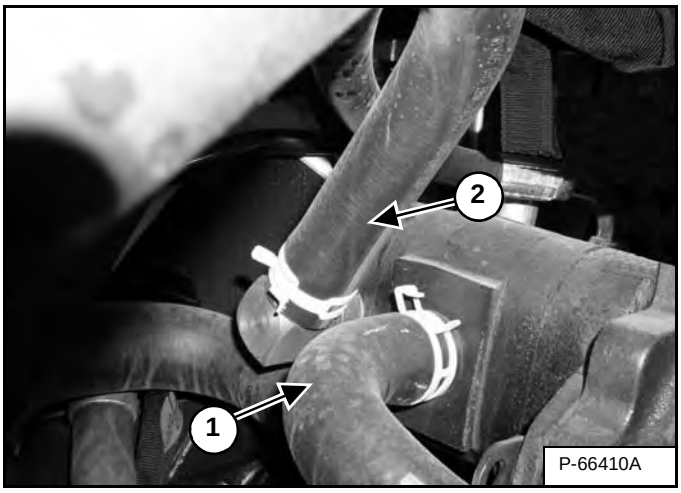
Figure 70-10-11



At the right side access hole, remove all hoses (Item 1) **[Figure 70-10-11]** from the hydraulic gear pump outlet side.

NOTE: Loaders equipped with high flow option may have additional hoses to remove from the gear pump inlet and outlet sides.

Figure 70-10-12



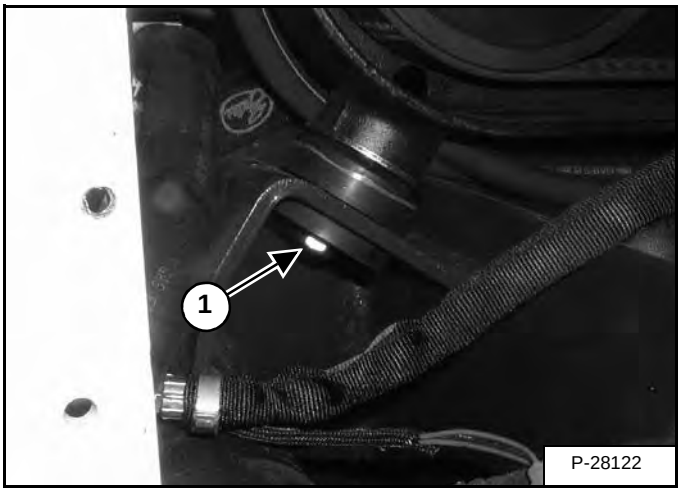
Disconnect the hose (Item 1) **[Figure 70-10-12]** that goes from the hydraulic reservoir to the pump.

Disconnect the hose (Item 2) **[Figure 70-10-12]** that comes from the hydraulic filter.

NOTE: Loaders equipped with high flow option may have additional hoses to remove from the gear pump inlet and outlet sides.

Cap and plug the hoses and fittings.

Figure 70-10-13



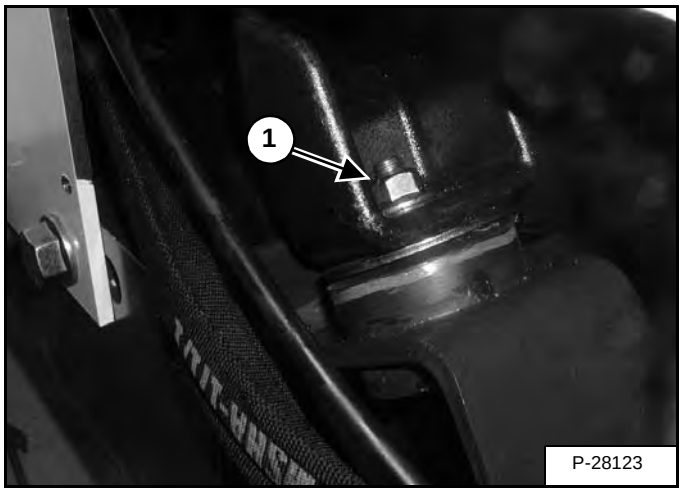
Remove the engine mount bolt (Item 1) **[Figure 70-10-13]** at the left front engine mount.

Installation: Tighten the mounting bolt 61 - 69 ft.-lb. (83 - 94 N•m) torque.

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Engine Removal And Installation (Cont'd)

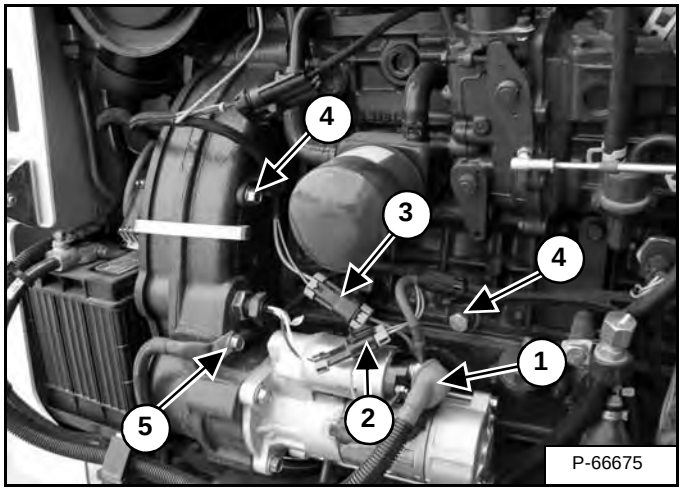
Figure 70-10-14



Remove the engine mount bolt (Item 1) **[Figure 70-10-14]** at the right front engine mount.

Installation: Tighten the mounting bolt 61 - 69 ft.-lb. (83 - 94 N•m) torque.

Figure 70-10-15



Disconnect the positive (+) wires (Item 1) **[Figure 70-10-15]** from the starter.

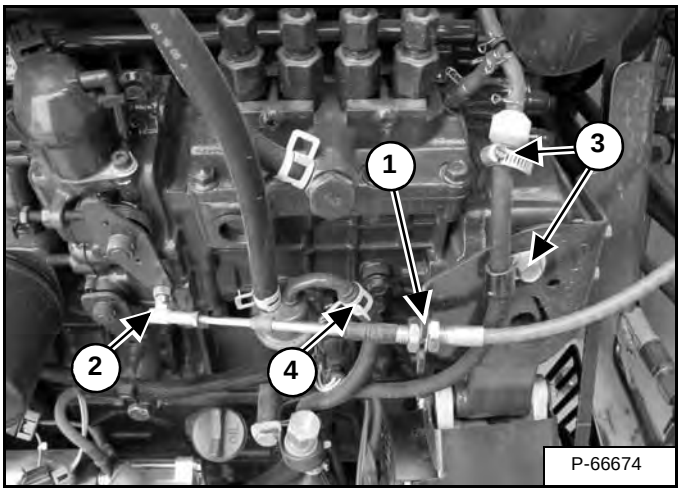
Disconnect the wire connector (Item 2) **[Figure 70-10-15]** from the engine speed sensor.

Disconnect the wire connector (Item 3) **[Figure 70-10-15]** from the starter solenoid wires.

Remove the two wire harness clamps (Item 4) **[Figure 70-10-15]**.

Remove the ground cable (Item 5) **[Figure 70-10-15]**.

Figure 70-10-16



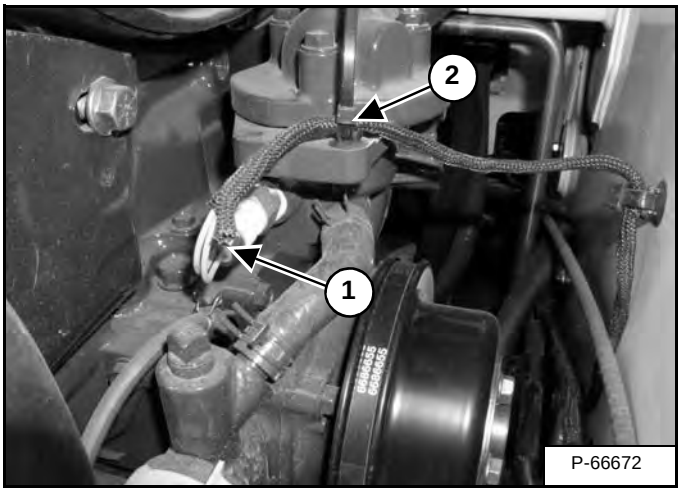
Loosen the mounting jam nut (Item 1) **[Figure 70-10-16]** on the engine throttle cable.

Remove the throttle cable nut (Item 2) **[Figure 70-10-16]**, and remove the cable from the injector pump.

Remove the fuel return hose and mount clamp (Item 3) **[Figure 70-10-16]**. Plug and cap the fuel hose and fitting.

Disconnect the fuel inlet hose (Item 4) **[Figure 70-10-16]**. Plug and cap the fuel line and fitting.

Figure 70-10-17



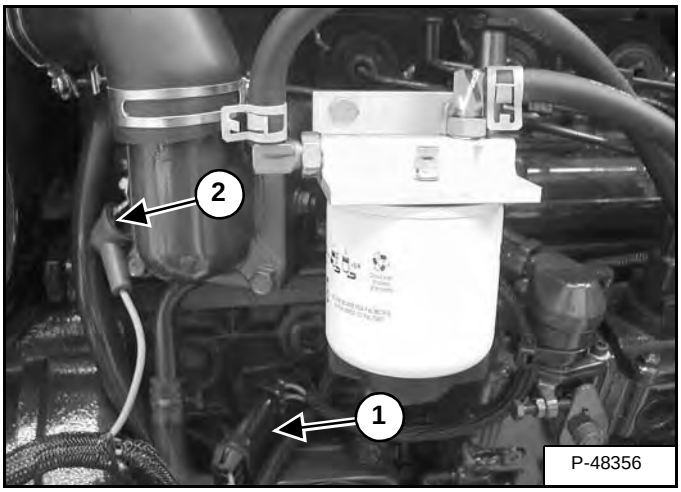
Disconnect the wiring harness connector (Item 1) **[Figure 70-10-17]** from the water temperature sender.

Remove the tie-strap (Item 2) **[Figure 70-10-17]** from the thermostat housing and place the wire harness away from the engine.

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Engine Removal And Installation (Cont'd)

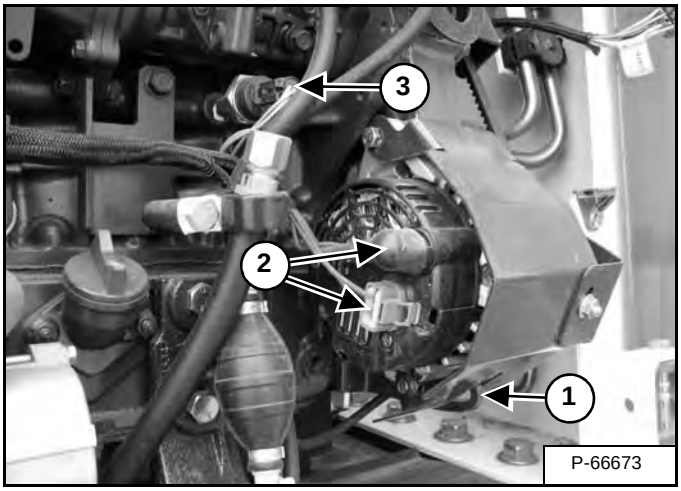
Figure 70-10-18



Disconnect the wiring harness connector (Item 1) **[Figure 70-10-18]** from the fuel shut-off solenoid.

Disconnect the wiring harness (Item 2) **[Figure 70-10-18]** from the air intake heater.

Figure 70-10-19

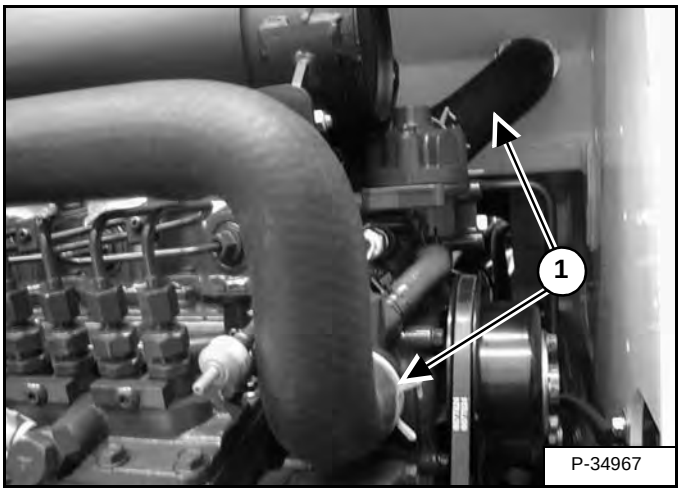


Remove the ground wire (Item 1) **[Figure 70-10-19]** from the alternator.

Disconnect the two wires (Item 2) **[Figure 70-10-19]** from the alternator.

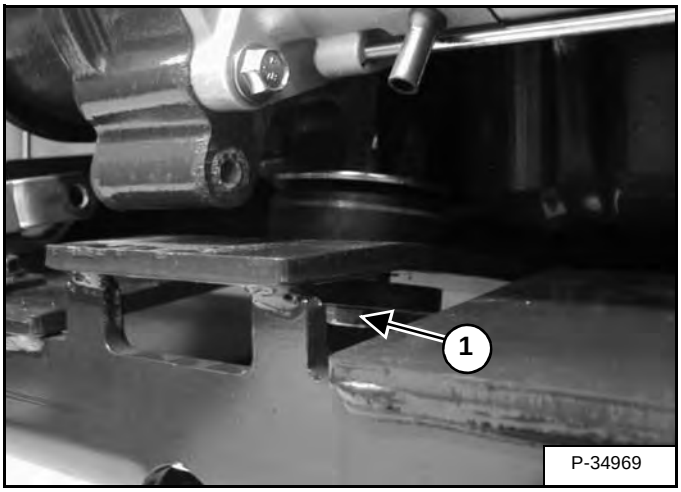
Disconnect the wire connector (Item 3) **[Figure 70-10-19]** from the oil pressure sender.

Figure 70-10-20



Remove the two radiator hoses (Item 1) **[Figure 70-10-20]**.

Figure 70-10-21



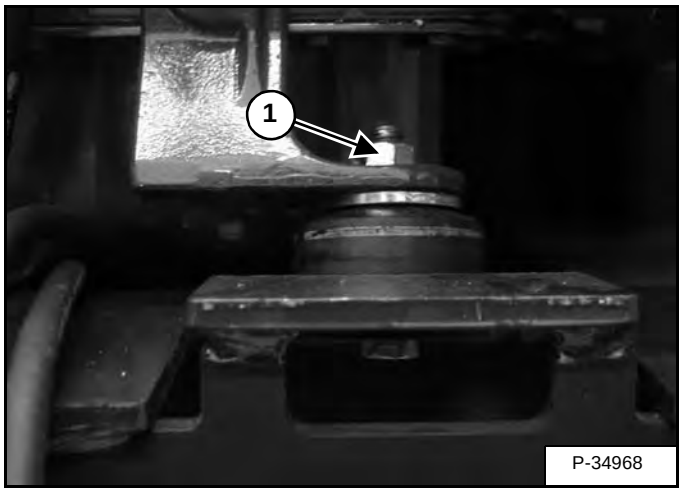
Remove the left rear engine mounting bolt (Item 1) **[Figure 70-10-21]**.

Installation: Tighten the nut and bolt to 61 - 69 ft.-lb. (83 - 94 N•m) torque.

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Engine Removal And Installation (Cont'd)

Figure 70-10-22

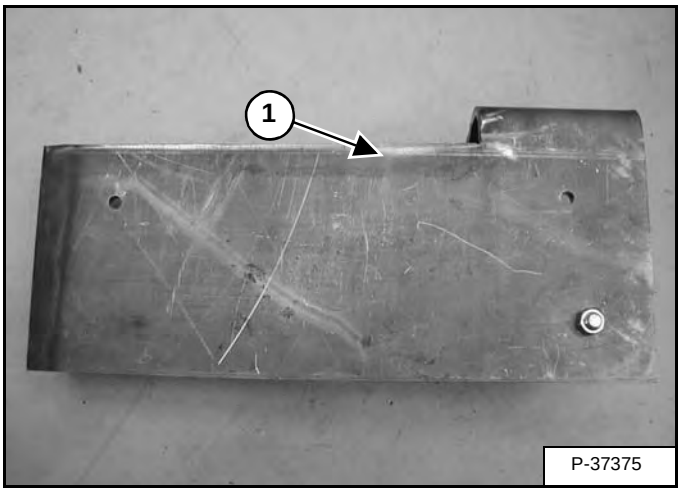


Remove the right rear engine mounting bolt (Item 1) **[Figure 70-10-22]**.

Installation: Tighten the nut and bolt to 61 - 69 ft.-lb. (83 - 94 N•m) torque.

Use the dimensions to make the engine removal and installation tools.

Figure 70-10-23



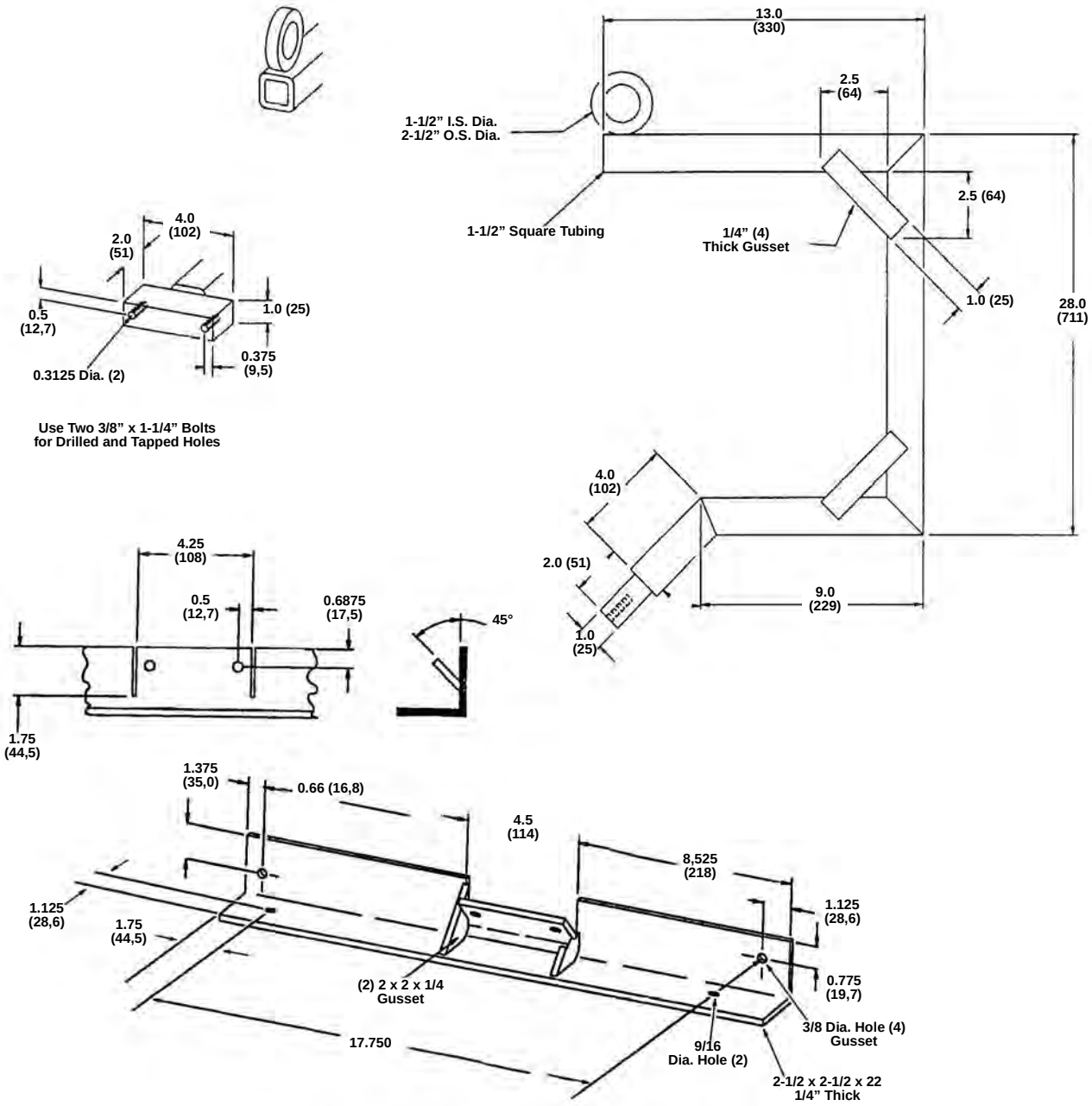
Use the dimensions from **[Figure 70-10-24]** and **[Figure 70-10-25]** to make the engine removal and installation tools.

Install the engine removal bracket (Item 1) **[Figure 70-10-23]** on the engine.

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Engine Removal And Installation (Cont'd)

Figure 70-10-24

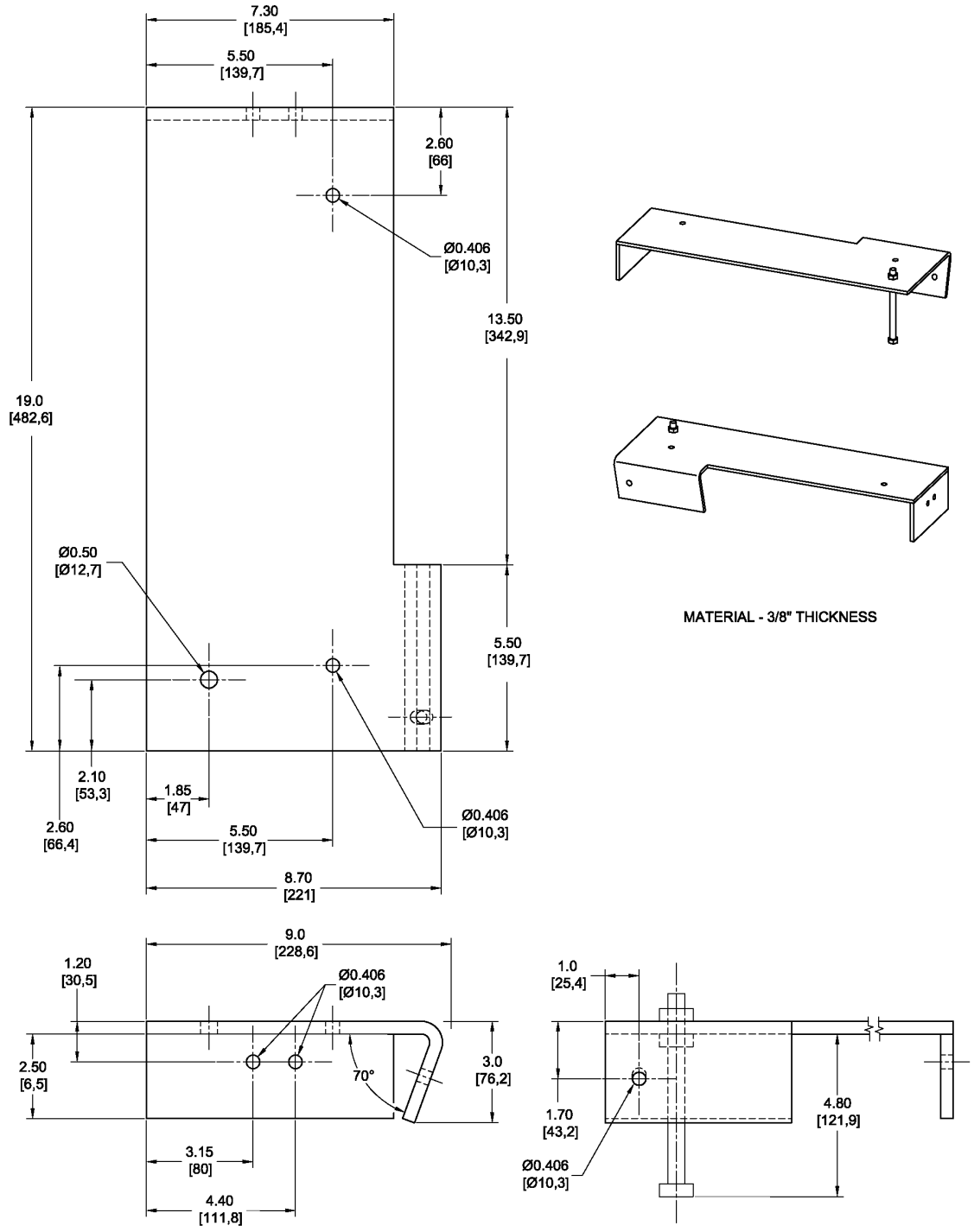


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Engine Removal And Installation (Cont'd)

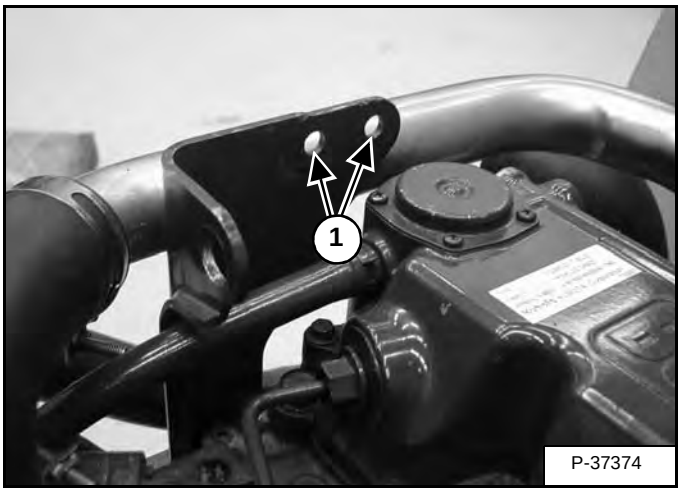
Figure 70-10-25



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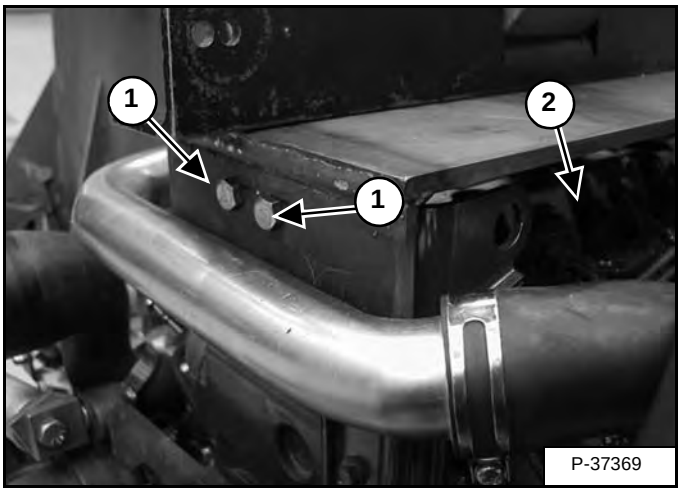
Engine Removal And Installation (Cont'd)

Figure 70-10-26



Install the engine removal bracket on the engine using the two holes (Item 1) **[Figure 70-10-26]** and **[Figure 70-10-27]** on the muffler mount bracket.

Figure 70-10-27



Install two bolts (Item 1) **[Figure 70-10-27]** through the engine removal bracket and through the two holes in the muffler bracket (Item 1) **[Figure 70-10-26]**.

Installation: Use 0.375 in. x 1.5 in. (9.525 mm x 38,1mm) bolts and nuts.

Finger tighten the bolts.

Figure 70-10-28

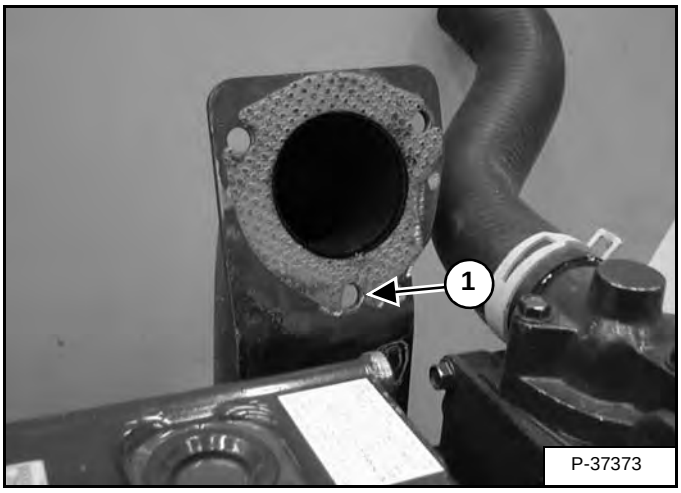
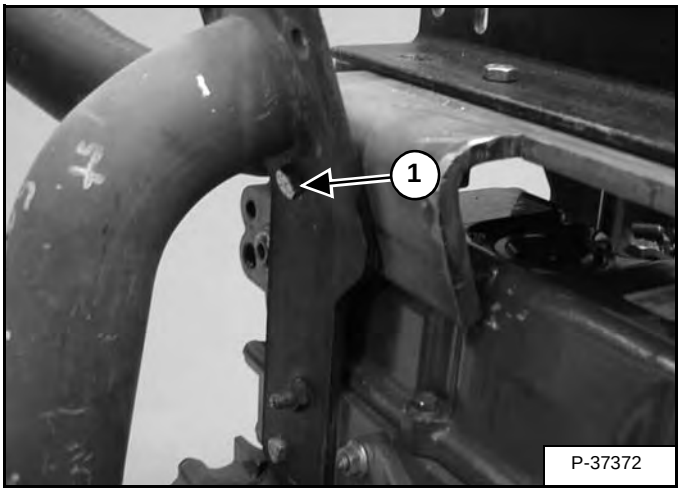


Figure 70-10-29



Install the bolt (Item 1) **[Figure 70-10-28]** and **[Figure 70-10-29]** through the exhaust bracket on the engine, and through the engine removal bracket.

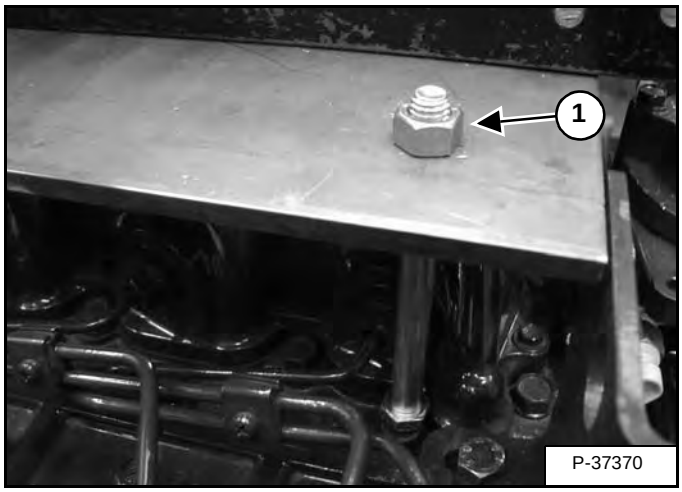
Installation: Use 0.375 in. x 1.5 in. (9.525 mm x 38,1mm) bolts and nuts.

Tighten the all bolts and nuts that hold the engine removal bracket onto the engine.

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Engine Removal And Installation (Cont'd)

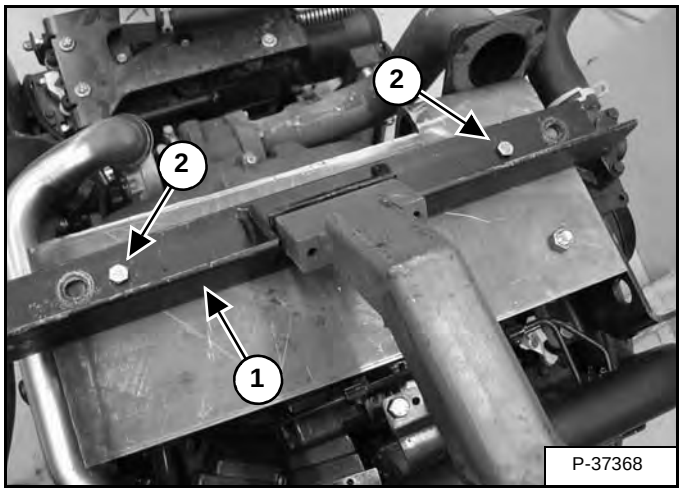
Figure 70-10-30



Install a bolt, with two nuts (Item 1) **[Figure 70-10-30]** through the engine removal bracket, and allow it to set on the engine head bolt. Use the nuts to adjust the length of the bolt against the engine head. Lock the nuts tight against the removal bracket, when the proper length has been obtained.

Installation: Use 0.500 in. x 5.5 in. (12.7 mm x 139,7mm) bolt and nuts.

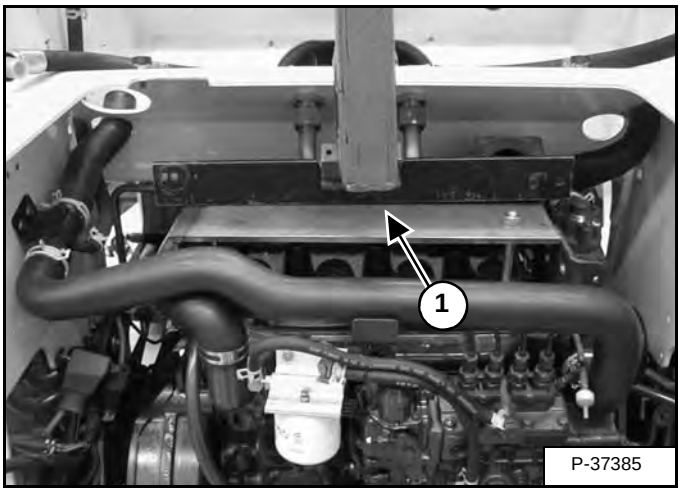
Figure 70-10-31



Install the engine lift bracket (Item 1) to the removal bracket using two bolts (Item 2) **[Figure 70-10-31]**.

Installation: Use two 0.375 in. x 1.5 in. (9.525 mm x 38,1mm) bolts and nuts.

Figure 70-10-32



Check all bolts that attach the engine lift brackets (Item 1) **[Figure 70-10-32]** to the engine and tighten as needed.

Figure 70-10-33



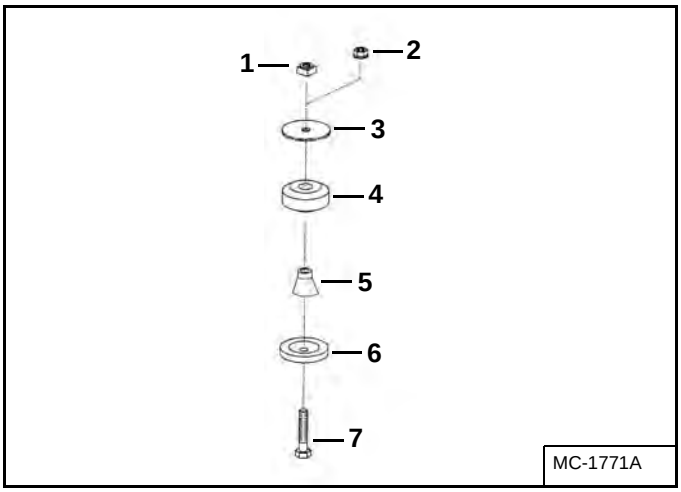
Connect a chain hoist to the lifting ring **[Figure 70-10-33]** on the lift bracket.

Remove the engine/hydrostatic pump assembly from the loader **[Figure 70-10-33]**

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Engine Mount Replacement

Figure 70-10-34



Use the following procedure to install new engine mounts:

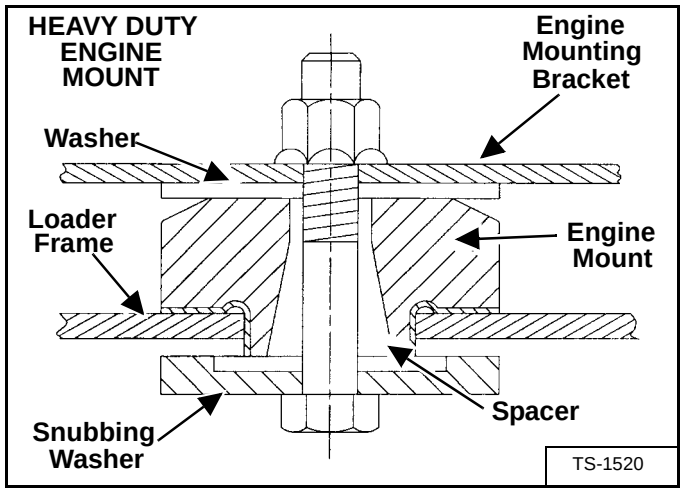
Remove the existing mount from the engine. Refer to engine removal and installation for engine mount locations.

Replace all four engine mounts (two front and two rear).

Use the parts shown to install the new engine mounts **[Figure 70-10-34]**.

Item 1 - Square Nut - Used on left side engine mounts
Item 2 - Hex Nut - Used on right side engine mounts
Item 3 - Mount Washer
Item 4 - Engine Mount
Item 5 - Tube Spacer
Item 6 - Snubbing Washer
Item 7 - Mounting Bolt

Figure 70-10-35



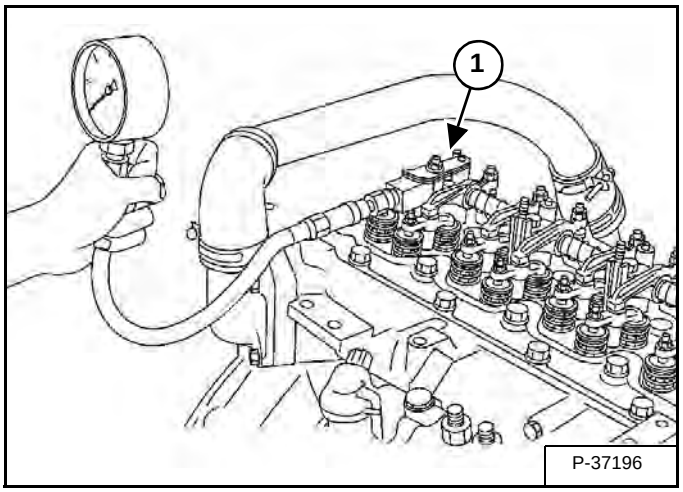
Install the new engine mount as shown in the cut away side view **[Figure 70-10-35]**.

Tighten the mounting bolts to 61 - 69 ft.-lb. (83 - 94 N•m) torque.

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Compression -Checking

Figure 70-10-36



After warming up the engine, stop it and remove the air cleaner, the muffler, high pressure pipes, cylinder head cover, overflow pipe, all nozzle holders and all nozzle gaskets.

Install a compression tester and nozzle adaptor MEL1614 for diesel engines to nozzle holder hole (Item 1) **[Figure 70-10-36]**.

After making sure that the speed control lever is set at the stop position (Non-injection), run the engine at 200 to 300 RPM with the starter.

Read the maximum pressure. Measure the pressure more than twice.

If the measurement is below the allowable limit, apply a small amount of oil to the cylinder wall through the nozzle hole and measure the compression pressure again.

If the compression pressure increase after applying oil. check the cylinder wall and piston rings.

If the compression pressure is still less than the allowable limit, check the top clearance, valve and cylinder head.

NOTE: Check the compression pressure with the specified valve clearance.

Always use a fully charged battery for performing this test.

Variances in cylinder compression values should be under 10%.

Compression pressure	Factory spec.	3.43 to 3.63 MPa / 250 RPM 35 to 37 kgf/cm² / 250 RPM 498 to 526 PSI / 250 RPM
	Allowable limit	2.60 MPa / 250 RPM 26.5 kgf/cm² / 250 RPM 377 PSI / 250 RPM

Tightening Torque	Nozzle holder clamp nut	17.7 to 20.6 N•m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft.-lb.
	Overflow pipe assembly retaining screw	9.8 to 11.3 N•m 1.0 to 1.15 kgf·m 7.23 to 8.32 ft.-lb.
	Cylinder head cover screw	1.6 to 2.3 N•m 0.15 to 0.23 kgf·m 1.15 to 1.66 ft.-lb.
	Injection pipe retaining nut	22.6 to 36.3 N•m 2.3 to 3.7 kgf·m 16.6 to 26.8 ft.-lb.

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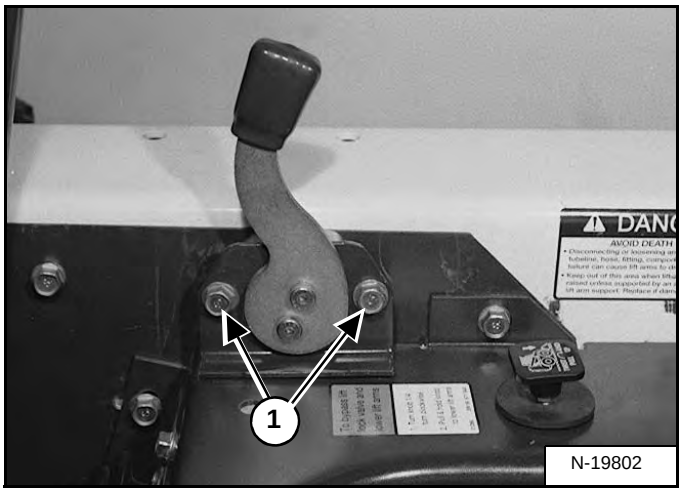


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ENGINE SPEED CONTROL

Removal And Installation

Figure 70-20-1



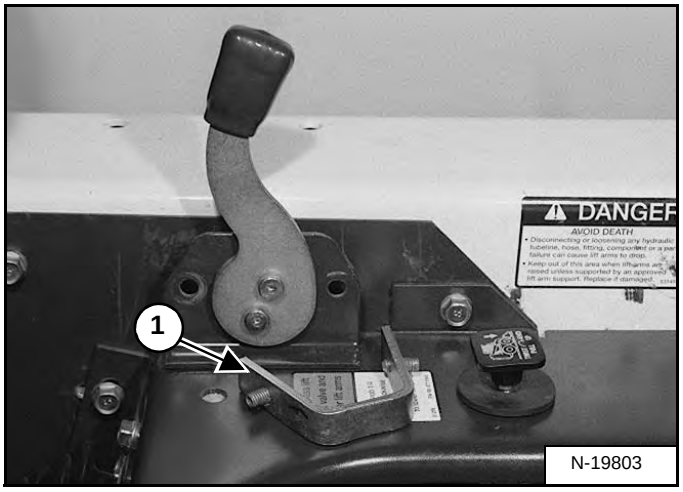
Raise the lift arms and install an approved lift arm device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the two mounting bolts (Item 1) **[Figure 70-20-1]**.

Installation: Tighten the bolts evenly until the speed control lever moves backward and forward at a comfortable tension.

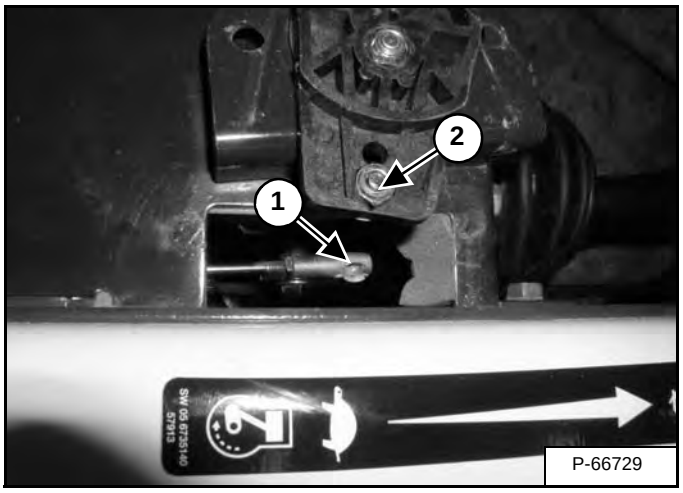
Figure 70-20-2



Remove the stop bracket (Item 1) **[Figure 70-20-2]** from behind the speed control handle.

Mark the front of the stop bracket (Item 1) **[Figure 70-20-2]** and remove the stop bracket.

Figure 70-20-3



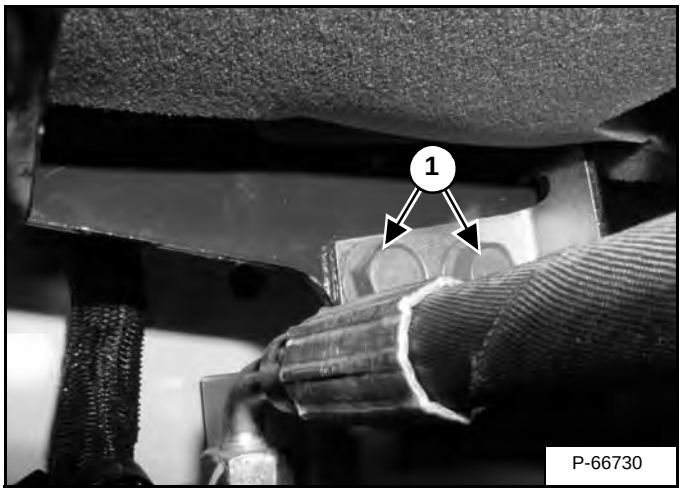
The speed control cable (Item 1) is connected to the speed control handle (Item 2) by a ball and socket end **[Figure 70-20-3]**.

Disconnect the speed control cable (Item 1) from the speed control handle (Item 2) by rolling the handle away from the mainframe **[Figure 70-20-3]**.

Dealer Copy -- Not for Resale

Cable Removal And Installation

Figure 70-20-4



Raise the lift arm and install an approved lift arm support device. (See Installing on Page 10-20-1.)

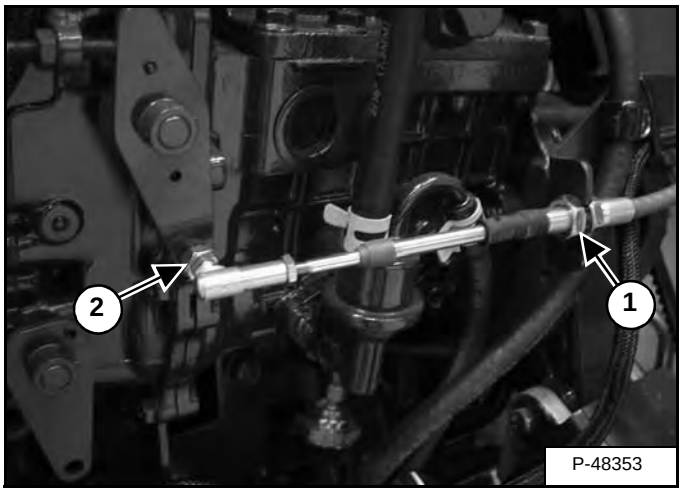
Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the speed control lever.

Remove the two bolts (Item 1) **[Figure 70-20-4]** from the clamp that secures the cable.

Open the rear door.

Figure 70-20-5



Loosen the jam nut (Item 1) **[Figure 70-20-5]** from the speed control cable.

Remove the nut (Item 2) **[Figure 70-20-5]**, and disconnect the cable from the linkage.

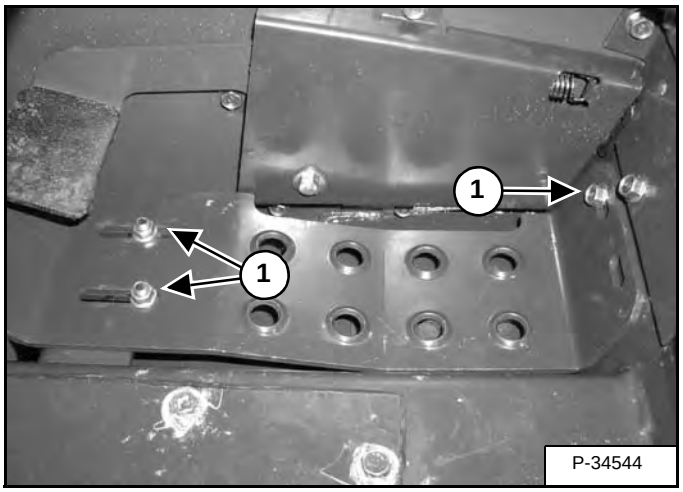
Remove the speed control cable.

Dealer Copy -- Not for Resale

ENGINE SPEED CONTROL (SJC)

Removal And Installation

Figure 70-21-1



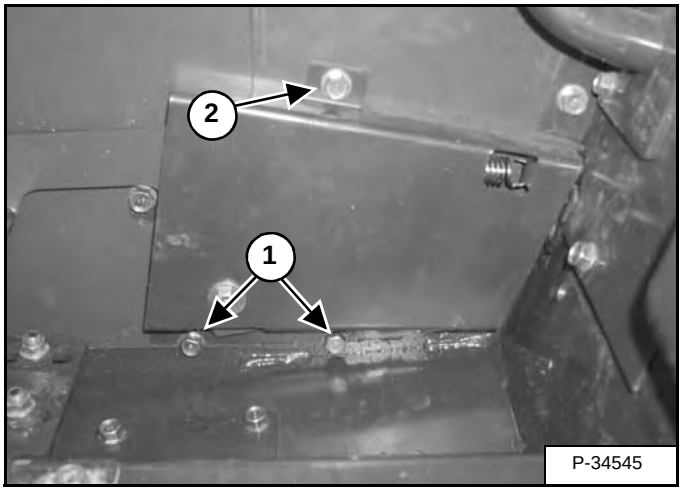
Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the three mounting bolts (Item 1) **[Figure 70-21-1]**, from the right side foot rest.

Remove the foot rest, from the loader.

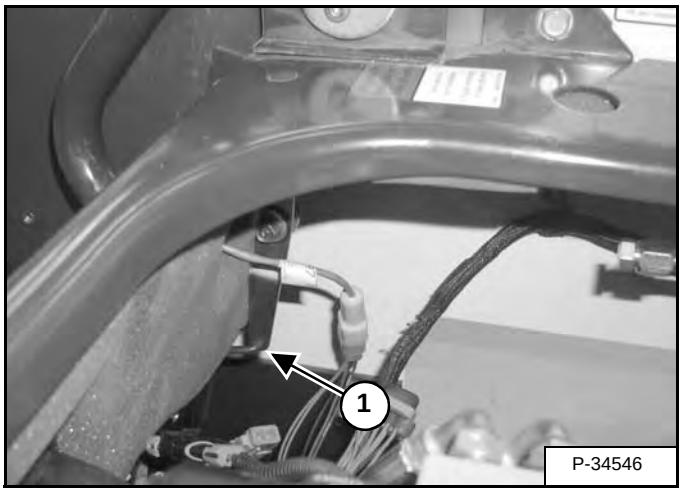
Figure 70-21-2



Loosen the two lower access panel mount bolts (Item 1) **[Figure 70-21-2]**

Remove the upper mount bolt (Item 2) **[Figure 70-21-2]**

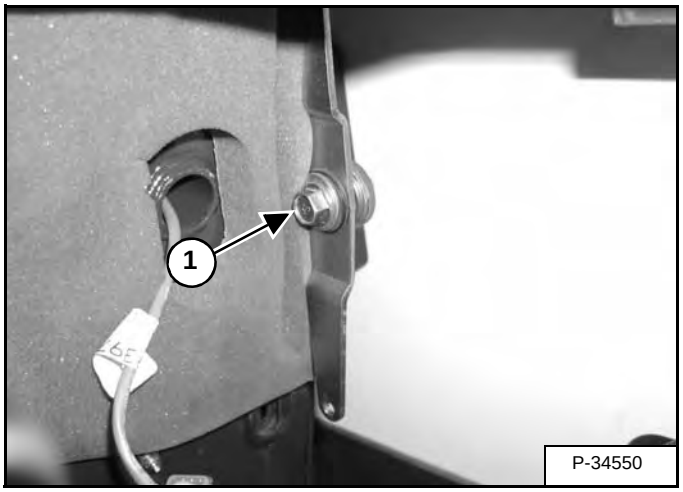
Figure 70-21-3



Disconnect the foot speed control linkage (Item 1) **[Figure 70-21-3]** from the hand control pivot arm.

Remove the foot speed control assembly from the loader.

Figure 70-21-4

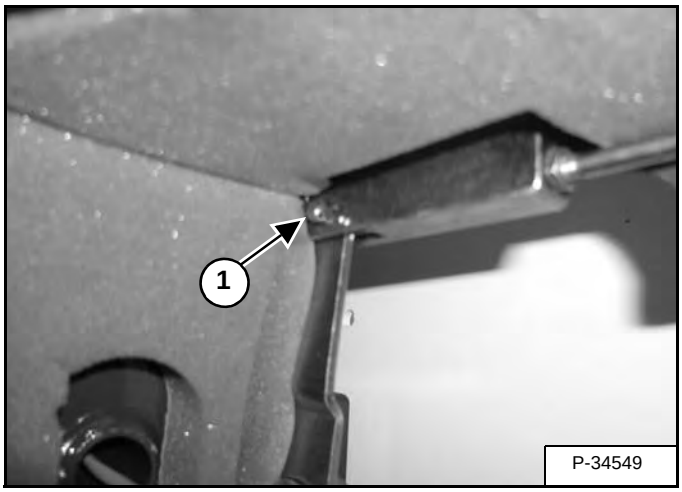


Remove the bolt and nut (Item 1) **[Figure 70-21-4]** from the hand speed control pivot arm.

Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

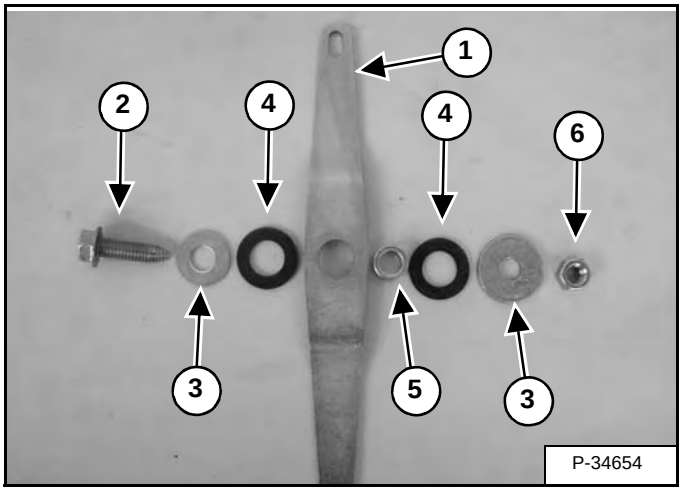
Figure 70-21-5



Remove the keeper and pin (Item 1) **[Figure 70-21-5]** that attaches the pivot arm to the speed control cable.

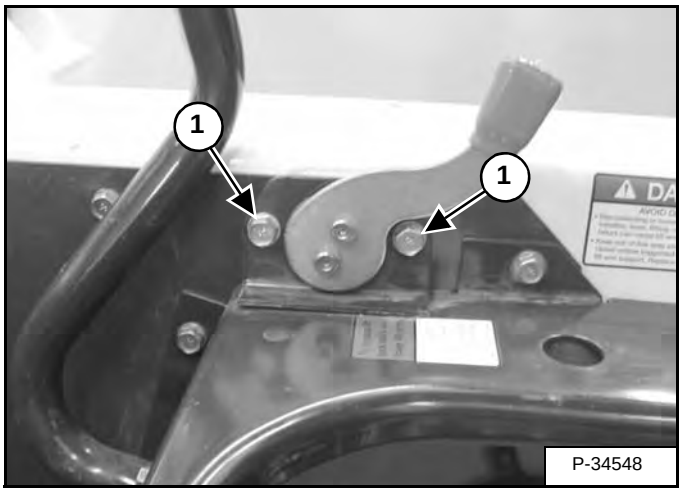
Remove the speed control pivot arm from the loader.

Figure 70-21-6



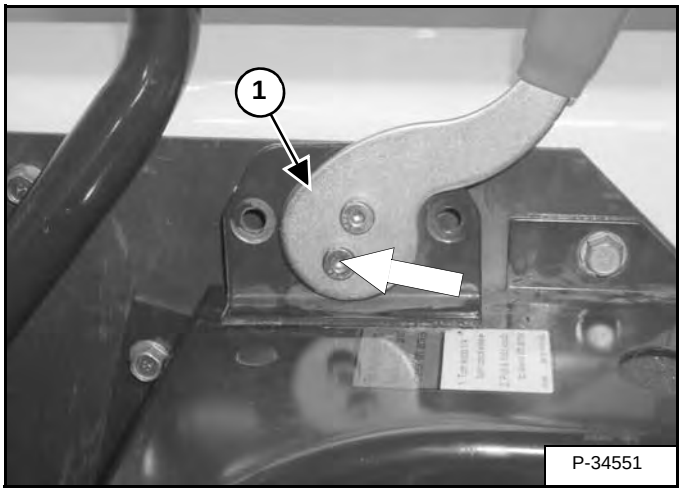
The parts that go into the pivot arm (Item 1) are the bolt (Item 2), washers (Items 3), fiber washers (Items 4), spacer (Item 5) and nut (Item 6) **[Figure 70-21-6]**.

Figure 70-21-7



Remove the two bolts (Item 1) **[Figure 70-21-7]** from the hand speed control lever assembly.

Figure 70-21-8



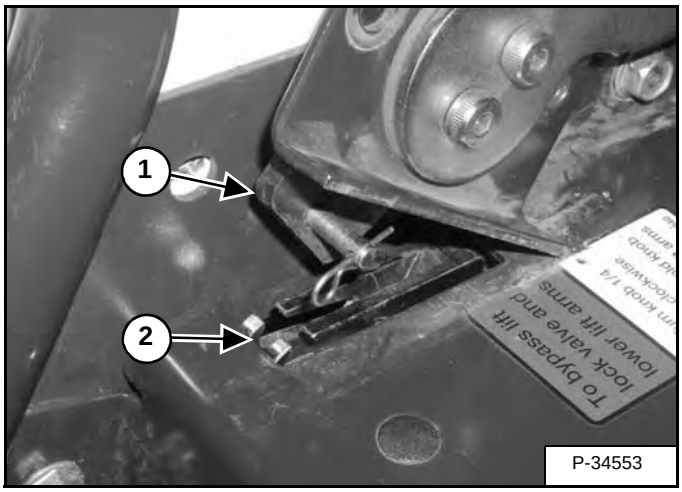
At the bottom side of the control panel, move the speed control linkage toward the rear of the loader.

Slide the hand speed control lever (Item 1) **[Figure 70-21-8]** forward and lift, and disconnect the assembly from the speed control cable.

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Removal And Installation (Cont'd)

Figure 70-21-9

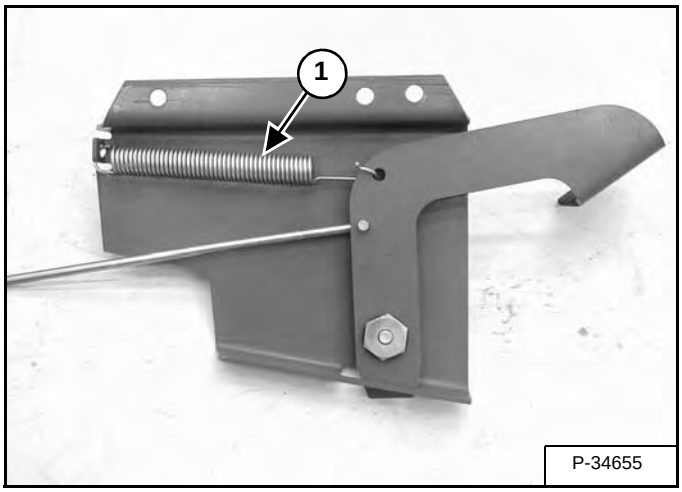


Installation: When installing the hand speed control to the speed control cable, be sure the speed control lever (Item 1) fits in the notch (Item 2) **[Figure 70-21-9]** of the speed control cable clevis.

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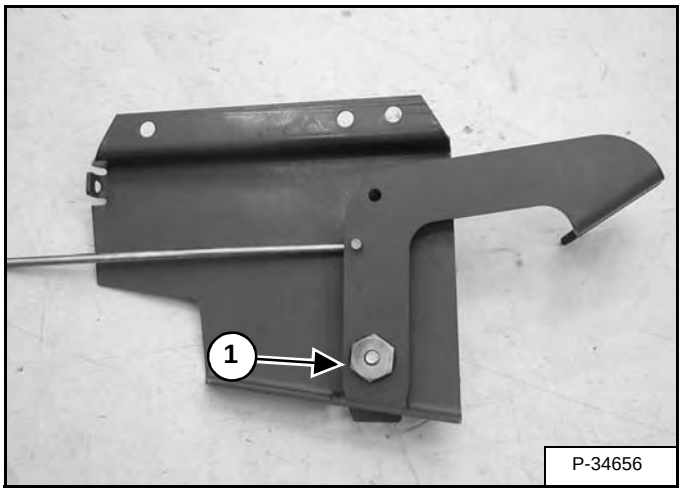
Disassembly And Assembly

Figure 70-21-10



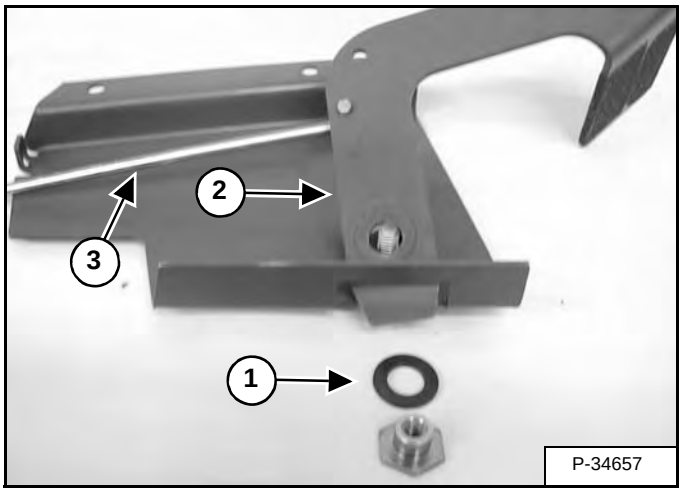
Remove the spring (Item 1) **[Figure 70-21-10]** from the foot speed control assembly.

Figure 70-21-11



Remove the bushing/nut (Item 1) **[Figure 70-21-11]** from the pedal lever.

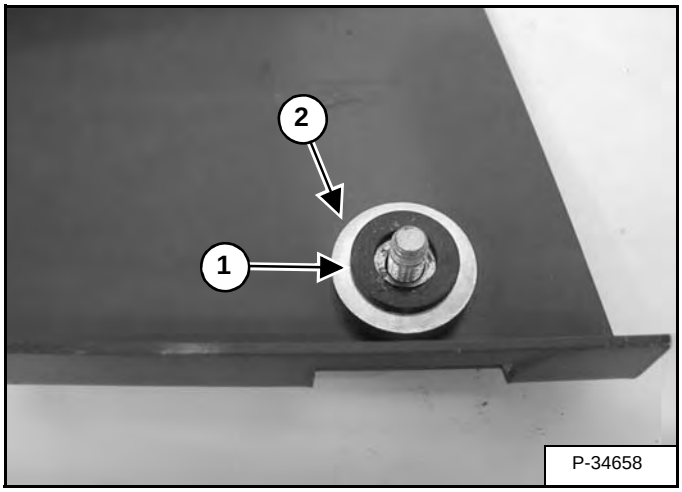
Figure 70-21-12



Remove the fiber washer (Item 1) **[Figure 70-21-12]** from the bushing/nut.

Remove the foot pedal lever (Item 2) and linkage rod (Item 3) **[Figure 70-21-12]**.

Figure 70-21-13

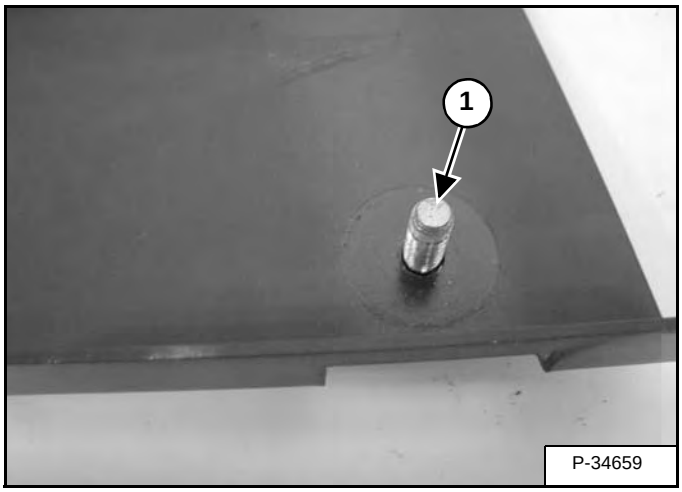


Remove the fiber washer (Item 1) and washer (Item 2) **[Figure 70-21-13]** from the pivot bolt.

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Disassembly And Assembly (Cont'd)

Figure 70-21-14

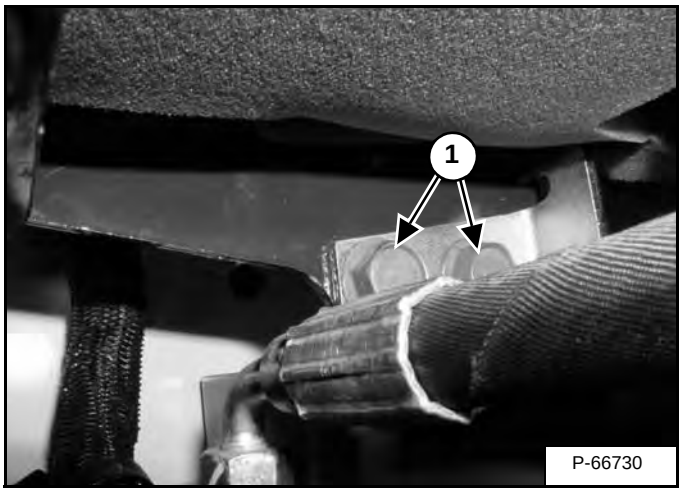


Remove the pivot bolt (Item 1) **[Figure 70-21-14]** from the speed control.

Dealer Copy -- Not for Resale

Speed Control Cable Removal And Installation

Figure 70-21-15



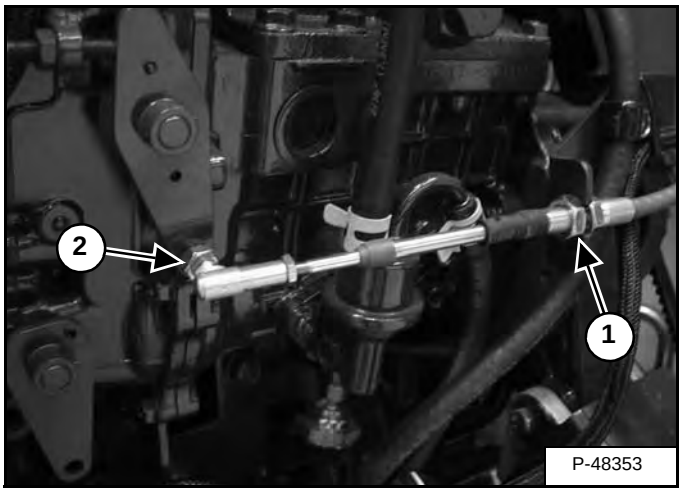
Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the speed control lever assembly. (See Removal And Installation on Page 70-21-1.)

At the lower right side of the control panel, remove the two mounting bolts (Item 1) **[Figure 70-21-15]** from the speed control cable mount bracket.

Figure 70-21-16



At the right side of the engine compartment loosen the jam nut (Item 1) **[Figure 70-21-16]** from the speed control cable.

Remove the nut (Item 2) **[Figure 70-21-16]**, and disconnect the cable from the linkage.

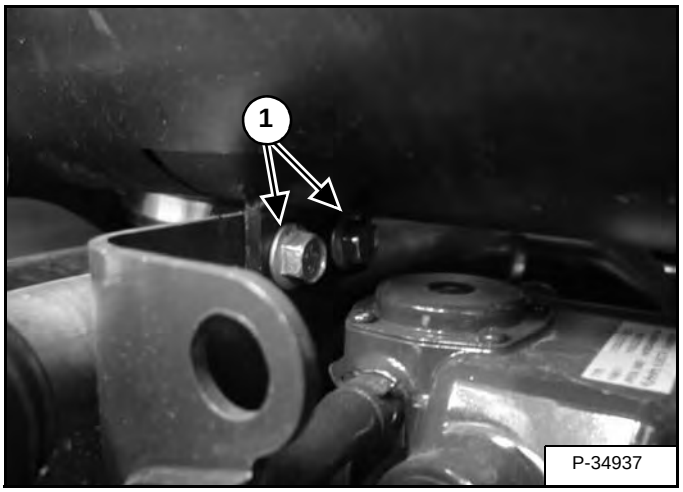
Remove the speed control cable.

Dealer Copy -- Not for Resale

MUFFLER

Removal And Installation

Figure 70-30-1

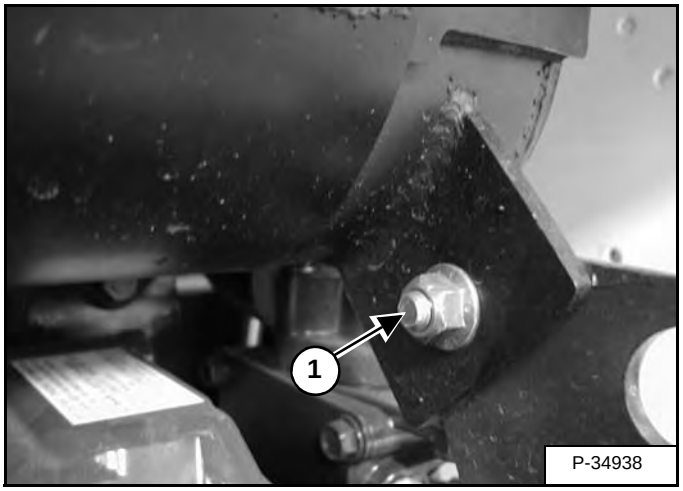


Open the rear door.

Remove the rear grill.

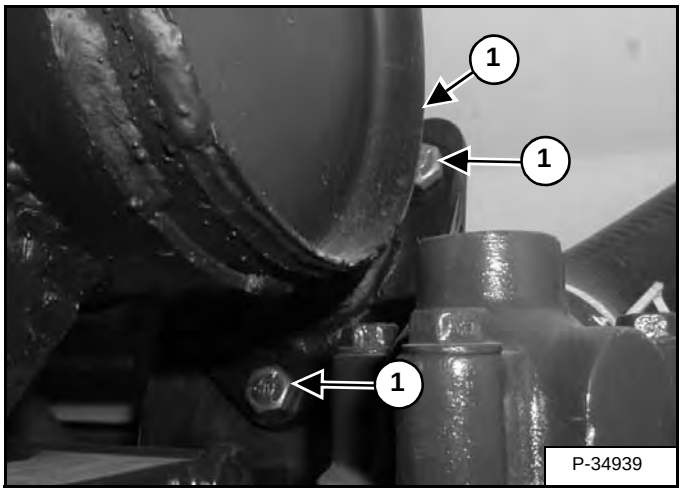
Remove the two bolts and nuts (Item 1) **[Figure 70-30-1]** from the left end of the engine muffler.

Figure 70-30-2



Remove the bolt and nut (Item 1) **[Figure 70-30-2]** from the right end of the engine muffler.

Figure 70-30-3



Remove the three bolts and nuts (Item 1) **[Figure 70-30-3]** from the muffler mounting bracket.

Remove the muffler from the loader.

Dealer Copy -- Not for Resale

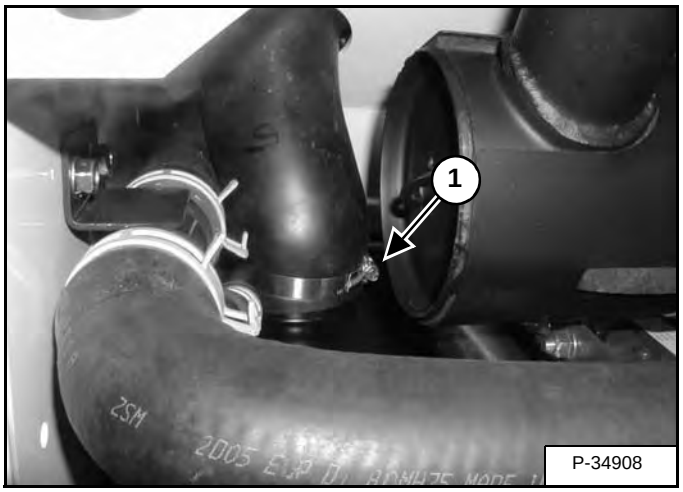


Dealer Copy -- Not for Resale

AIR CLEANER

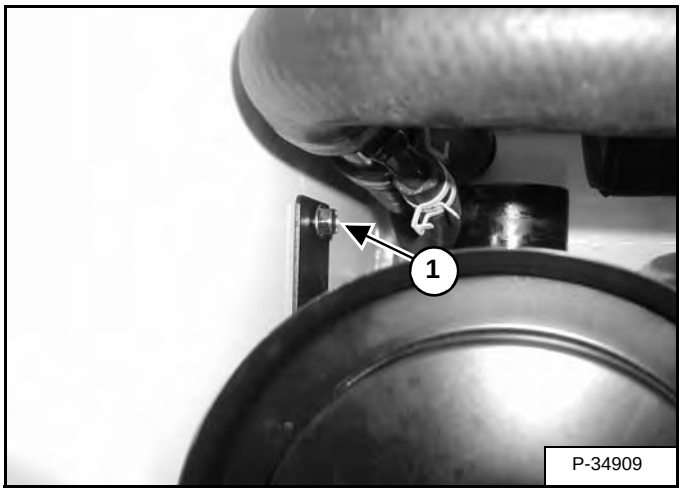
Housing Removal And Installation

Figure 70-40-1



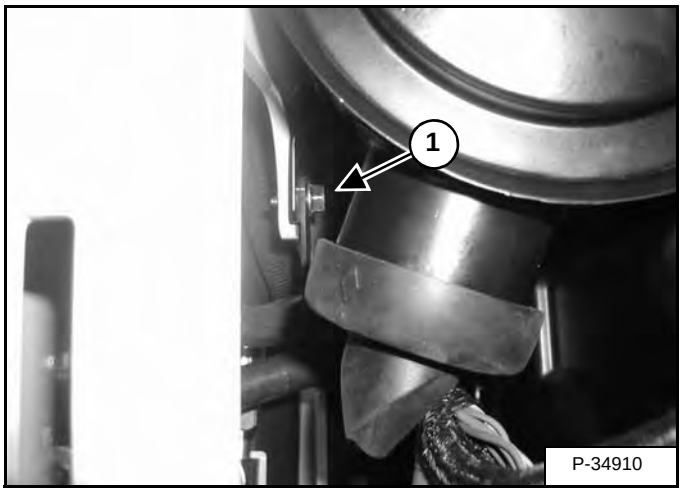
Loosen the hose clamp (Item 1) **[Figure 70-40-1]** and disconnect the inlet hose from the air cleaner.

Figure 70-40-2



Remove the top mounting bolt (Item 1) **[Figure 70-40-2]** from the air cleaner mount bracket.

Figure 70-40-3



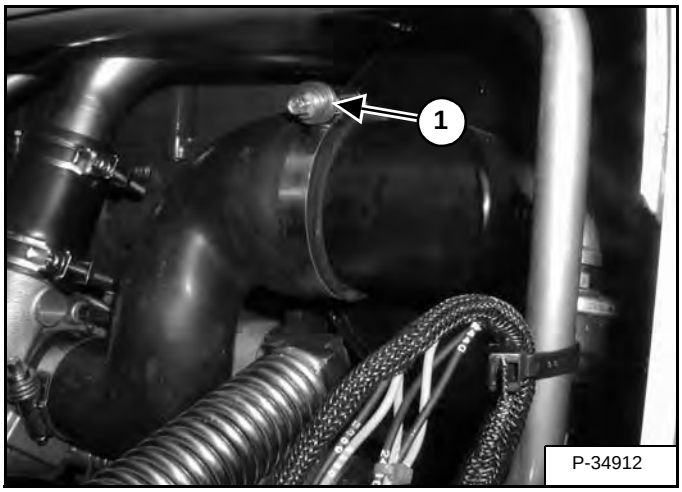
Remove the lower mount bolt (Item 1) **[Figure 70-40-3]** from the air cleaner mount bracket.

Remove the left side access panel behind the lift cylinder from the loader.

Dealer Copy -- Not for Resale

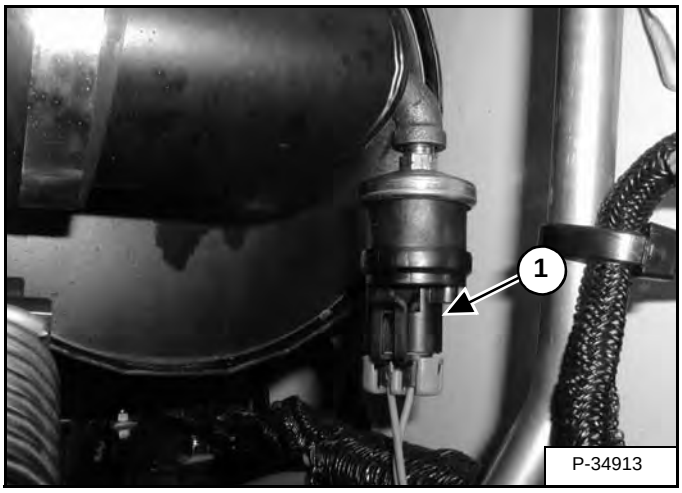
Housing Removal And Installation (Cont'd)

Figure 70-40-4



Remove the hose clamp (Item 1) **[Figure 70-40-4]** from the hose that goes from the air cleaner to the turbo charger.

Figure 70-40-5



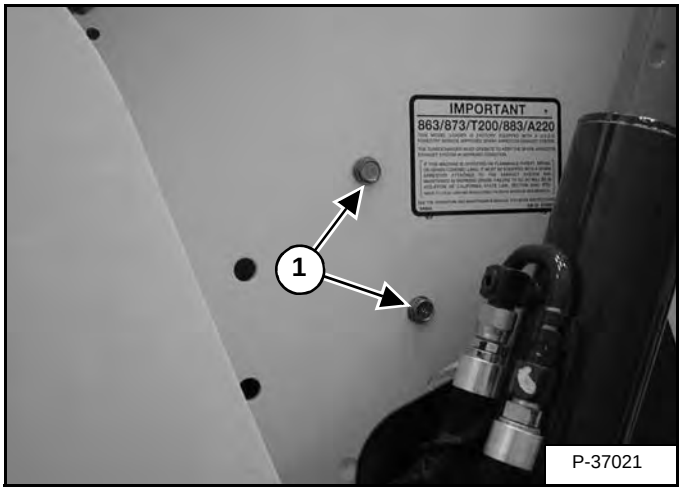
Disconnect the wire connector (Item 1) **[Figure 70-40-5]** from the air cleaner sender.

Remove the air cleaner from the loader.

Dealer Copy -- Not for Resale

Radiator Removal And Installation (S/N 530713065 & Below, 530811453 & Below)

Figure 70-50-1



Remove the rear grill.

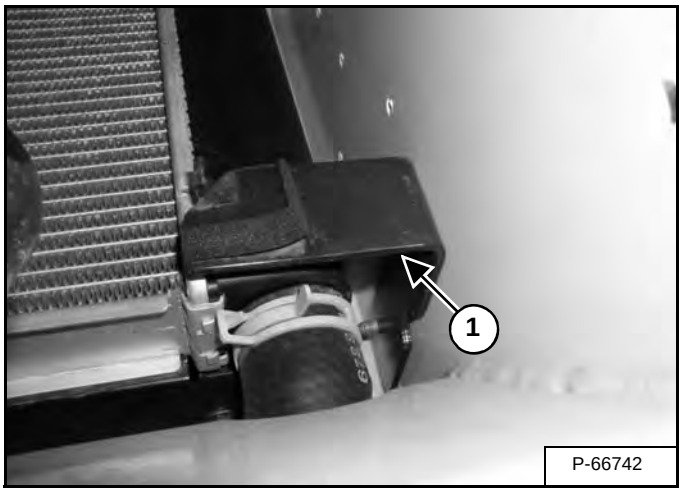
Remove air conditioning condenser. (If Equipped) (See Removal And Installation on Page 80-60-1.)

Drain the fluid from the radiator. (See Removing And Replacing Coolant on Page 10-90-2.)

Remove the hydraulic oil cooler. (See Removal And Installation on Page 20-100-1.)

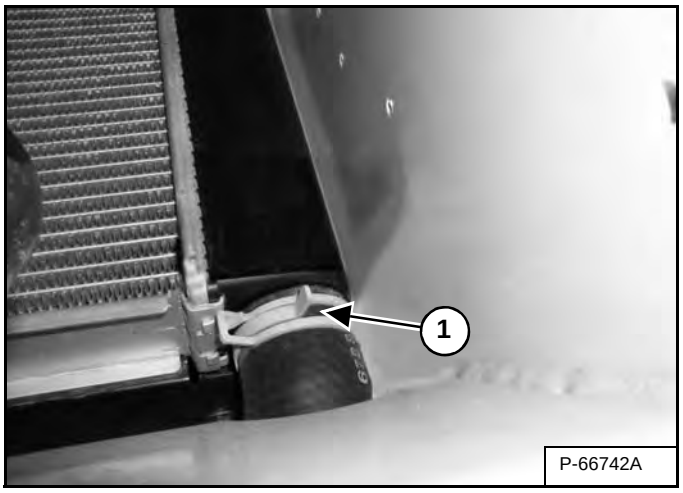
Remove the two mounting bolts (Item 1) **[Figure 70-50-1]** from the oil cooler mount bracket. (Both sides.)

Figure 70-50-2



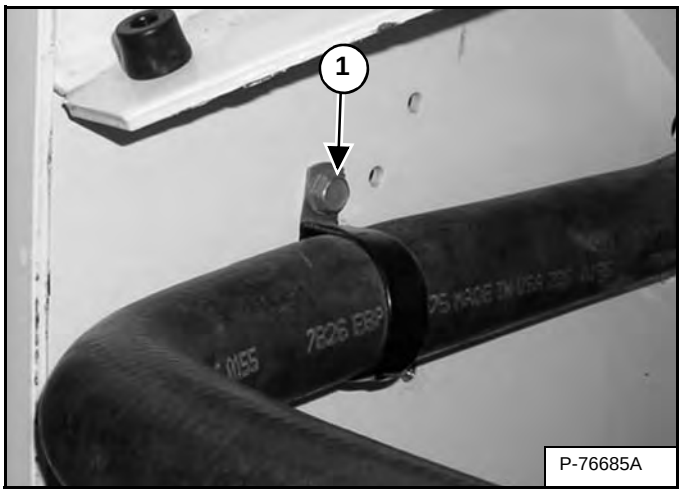
Remove the oil cooler mount bracket (Item 1) **[Figure 70-50-2]**. (Both sides.)

Figure 70-50-3



Remove the radiator hose clamp (Item 1) **[Figure 70-50-3]** and remove the right side radiator hose from the radiator.

Figure 70-50-4

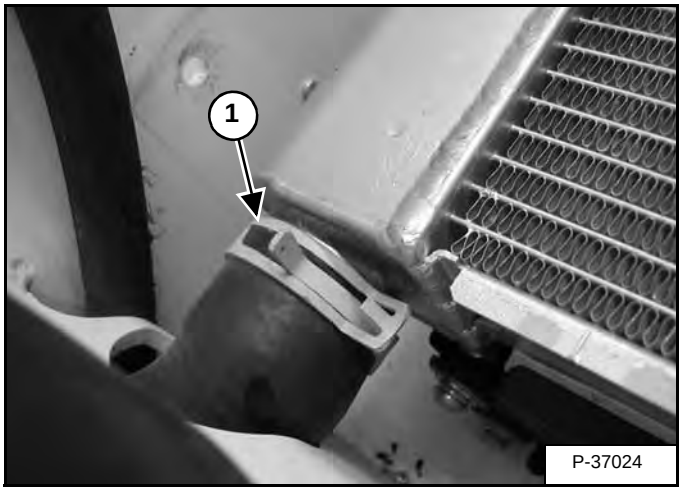


Remove the mounting bolt (Item 1) **[Figure 70-50-4]**.

Dealer Copy -- Not for Resale

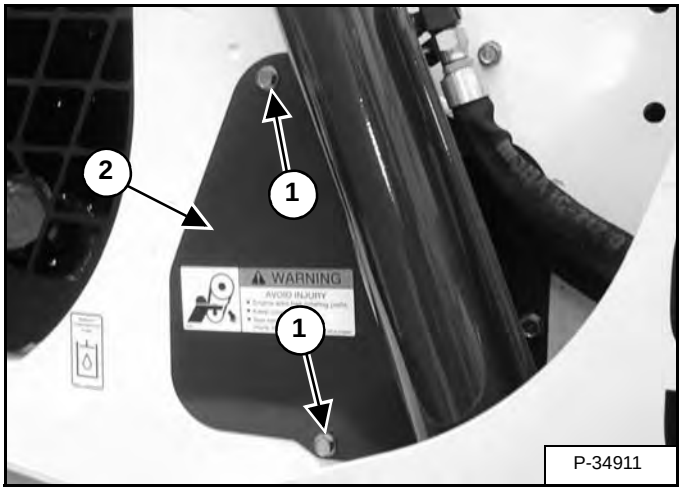
Radiator Removal And Installation (S/N 530713065 & Below, 530811453 & Below) (Cont'd)

Figure 70-50-5



Remove the radiator hose clamp (Item 1) **[Figure 70-50-5]** and remove the left side radiator hose.

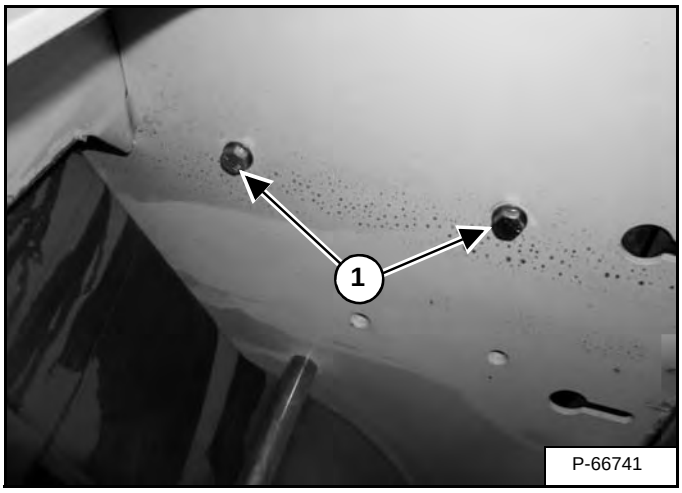
Figure 70-50-6



Remove the two bolts (Item 1) and the side access panel (Item 2) **[Figure 70-50-6]**.

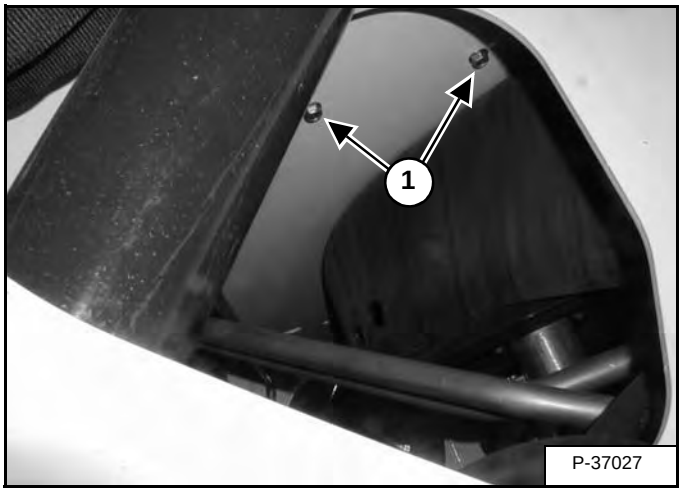
Repeat for other side.

Figure 70-50-7



At the left side access hole, remove the two radiator mount bolts (Item 1) **[Figure 70-50-7]**.

Figure 70-50-8



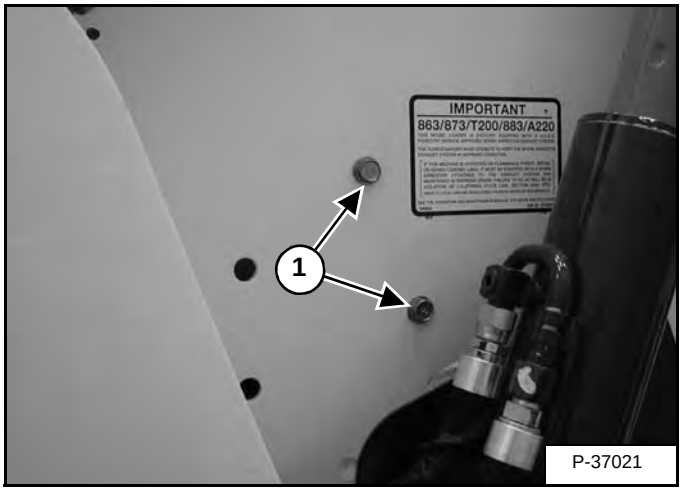
At the right side access hole, remove the two radiator mount bolts (Item 1) **[Figure 70-50-8]**.

Remove the radiator and mount assembly from the loader.

Dealer Copy -- Not for Resale

Radiator Removal And Installation (S/N 530713066 & Above, 530811454 & Above)

Figure 70-50-9



Remove the rear grill.

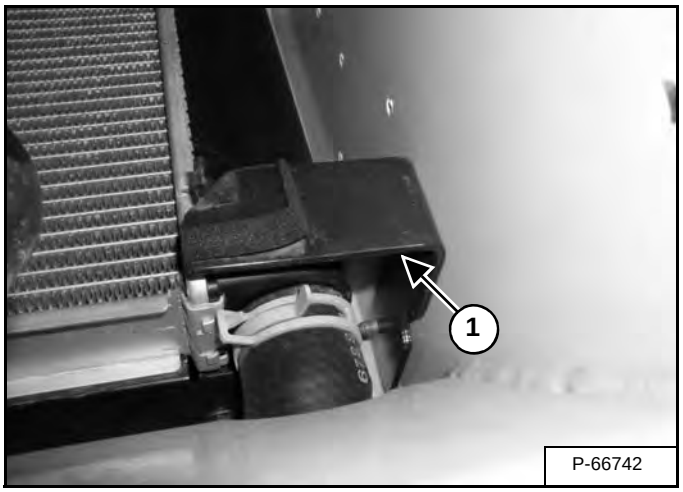
Remove air conditioning condenser. (If Equipped) (See Removal And Installation on Page 80-60-1.)

Drain the fluid from the radiator. (See Removing And Replacing Coolant on Page 10-90-2.)

Remove the hydraulic oil cooler. (See Removal And Installation on Page 20-100-1.)

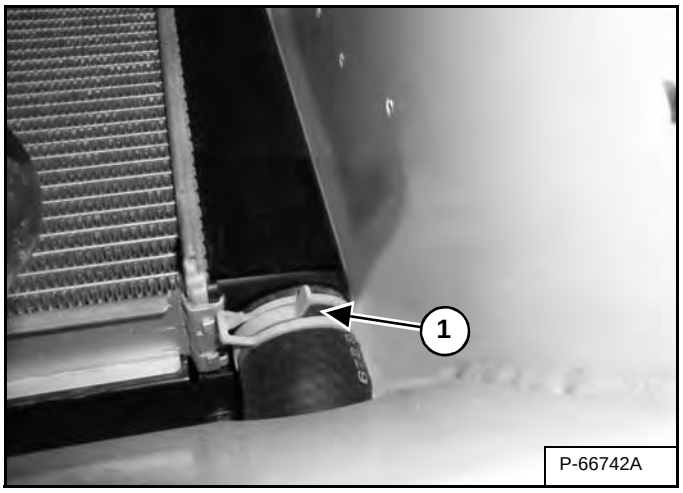
Remove the two mounting bolts (Item 1) **[Figure 70-50-9]** from the oil cooler mount bracket. (Both sides.)

Figure 70-50-10



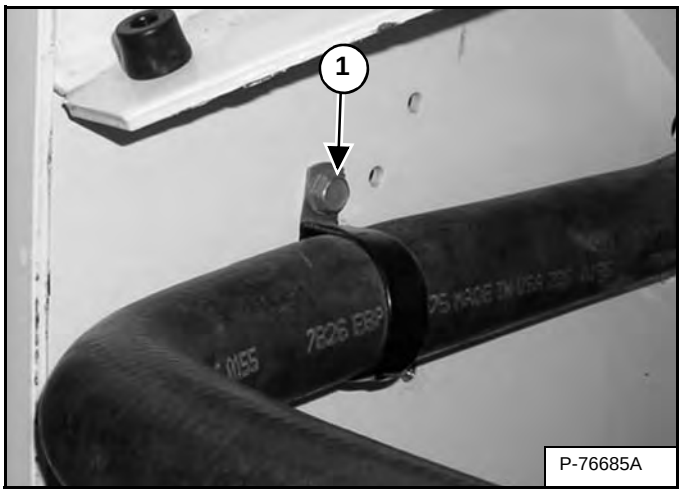
Remove the oil cooler mount bracket (Item 1) **[Figure 70-50-10]**. (Both sides.)

Figure 70-50-11



Remove the radiator hose clamp (Item 1) **[Figure 70-50-11]** and remove the right side radiator hose from the radiator.

Figure 70-50-12

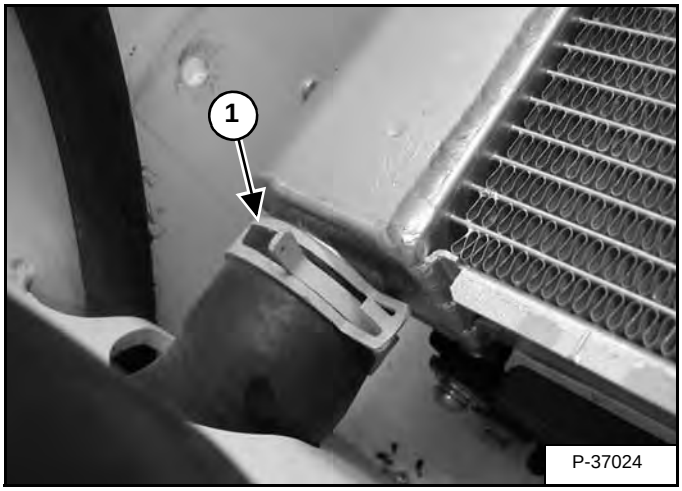


Remove the mounting bolt (Item 1) **[Figure 70-50-12]**.

Dealer Copy -- Not for Resale

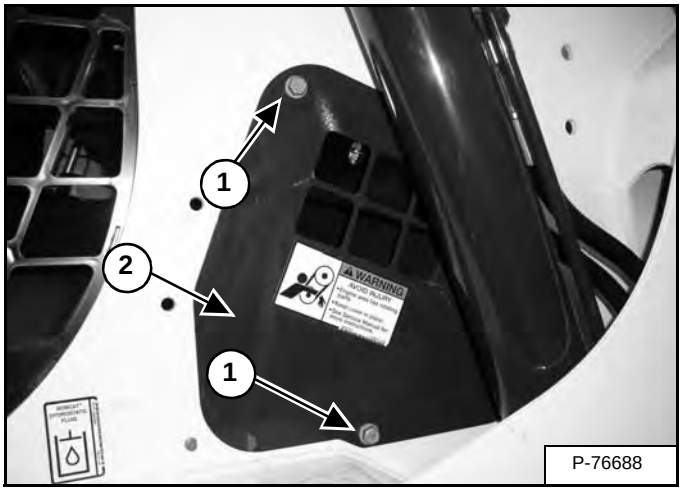
Radiator Removal And Installation (S/N 530713066 & Above, 530811454 & Above) (Cont'd)

Figure 70-50-13



Remove the radiator hose clamp (Item 1) **[Figure 70-50-13]** and remove the left side radiator hose.

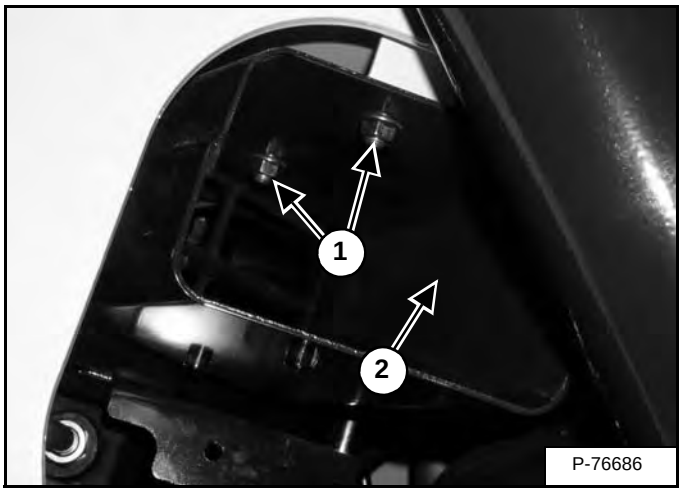
Figure 70-50-14



Remove the two bolts (Item 1) and the side access panel (Item 2) **[Figure 70-50-14]**.

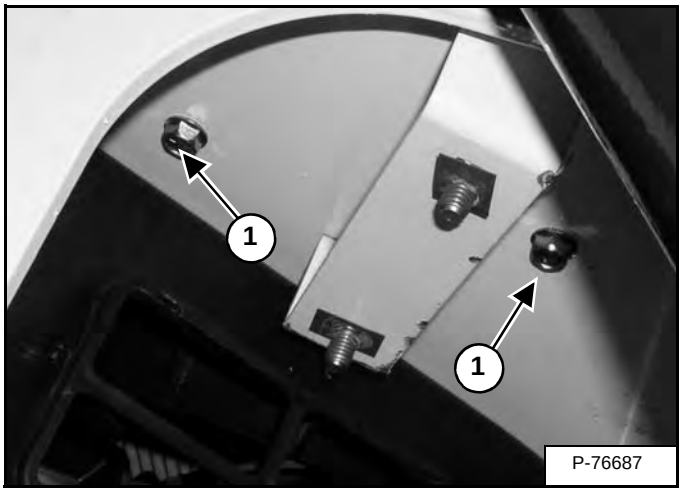
Repeat for other side.

Figure 70-50-15



At the left side access hole, remove the two nuts (Item 1) and the chute (Item 2) **[Figure 70-50-15]**.

Figure 70-50-16

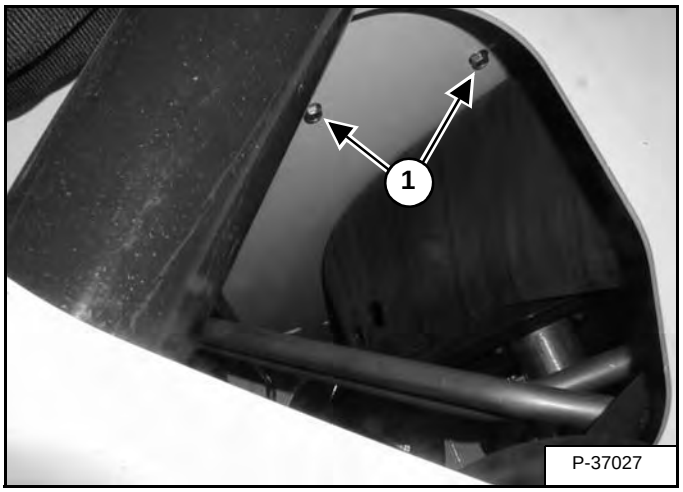


At the left side access hole, remove the two radiator mount bolts (Item 1) **[Figure 70-50-16]**.

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Radiator Removal And Installation (S/N 530713066 & Above, 530811454 & Above) (Cont'd)

Figure 70-50-17

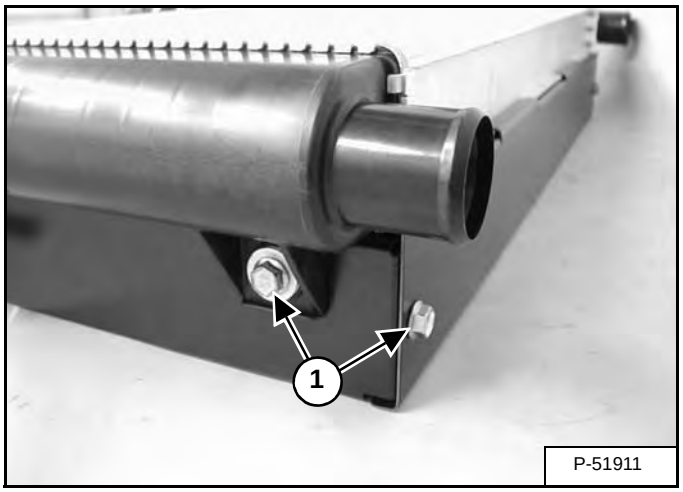


At the right side access hole, remove the two radiator mount bolts (Item 1) **[Figure 70-50-17]**.

Remove the radiator and mount assembly from the loader.

Radiator Mount Removal And Installation

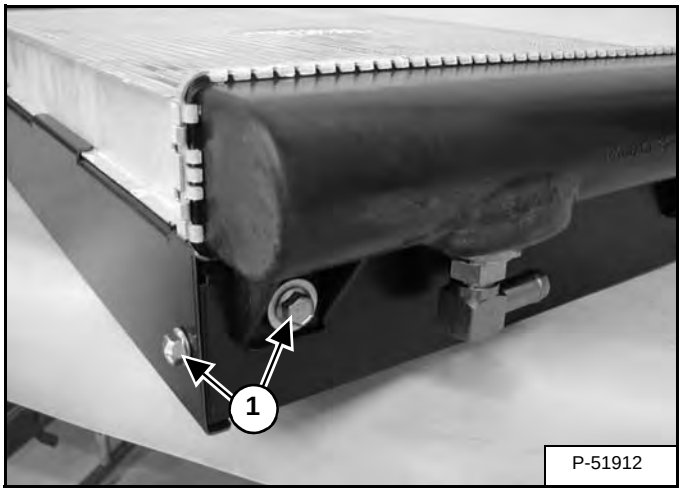
Figure 70-50-18



Remove the two mounting bolts (Item 1) **[Figure 70-50-18]** from the radiator and radiator mount bracket.

Installation: Tighten the bolts to 7.5-11.5 ft.-lb. (10,1-15,5 N•m) torque.

Figure 70-50-19



Remove the two mounting bolts (Item 1) **[Figure 70-50-19]** from the radiator and radiator mount bracket.

Installation: Tighten the bolts to 7.5-11.5 ft.-lb. (10,1-15,5 N•m) torque.

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Hydraulic Fan Motor Description (S/N 530713065 & Below, 530811453 & Below)

The hydraulic fan is used to cool the engine and hydraulic/hydrostatic systems. The hydraulic fan consist of a fan and hydraulic motor that is controlled by a proportioning valve.

The proportioning valve meters the flow through the fan motor. The proportioning valve receives signals from the controller which gathers information from both the engine and hydraulic temperature sensors.

NOTE: The proportioning valve is factory set and can not be adjusted accurately in the field. The adjustment screw is sealed with a tamper evident white material, if this screw has been adjusted the proportioning valve must be replaced.

If the flow from the proportioning valve is determined inaccurate it must be replaced with a new one from Bobcat Service Parts.

The fan speed is determined by the engine coolant temperature and the hydraulic fluid temperature. Depending on these temperatures the fan speed (RPM's) can range from 0 to 4000 RPM's.

The hydraulic fan speed at cold engine startup will range from 0 to 500 RPM's until the engine coolant and the hydraulic fluid reach basic operating temperatures.

During normal operating temperatures the fan speed may range from approximately 1900 to 3500 RPM's.

Blower Housing Removal And Installation (S/N 530713065 & Below, 530811453 & Below)



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

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

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Drain the hydraulic fluid from the reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-2.)

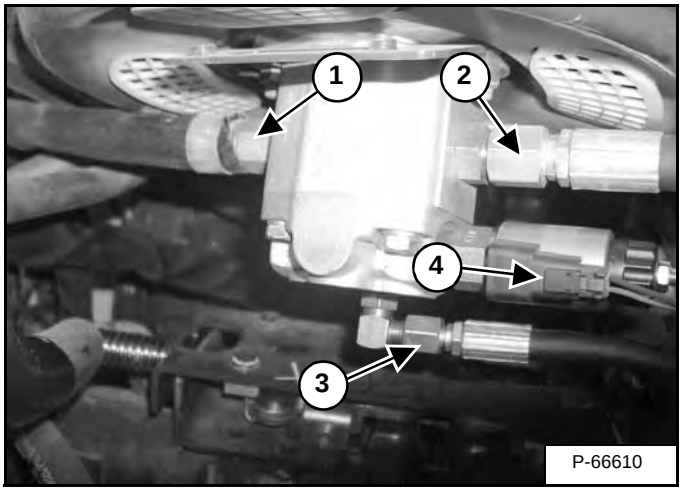
Remove the hydraulic/hydrostatic filter housing. (See Housing Removal And Installation on Page 20-80-1.)

Remove the fan motor filter housing. (See Charge Filter Housing Removal And Installation on Page 20-80-3.)

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Blower Housing Removal And Installation (S/N 530713065 & Below, 530811453 & Below) (Cont'd)

Figure 70-50-20

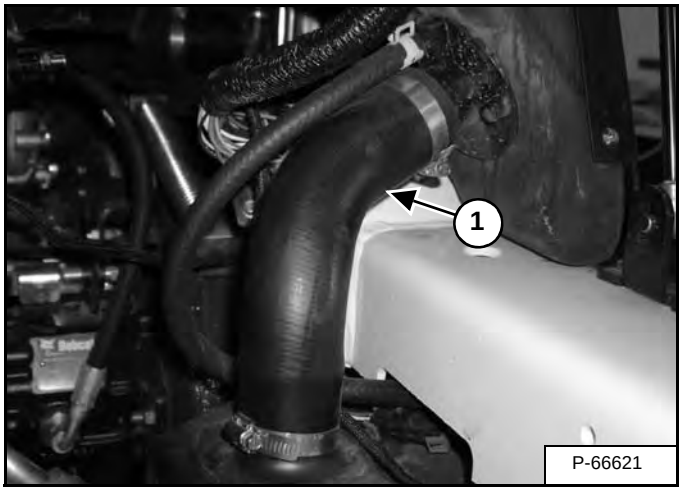


Remove the fan motor inlet hose (Item 1) and outlet hose (Item 2) **[Figure 70-50-20]**.

Remove the fan case drain hose (Item 3) **[Figure 70-50-20]**.

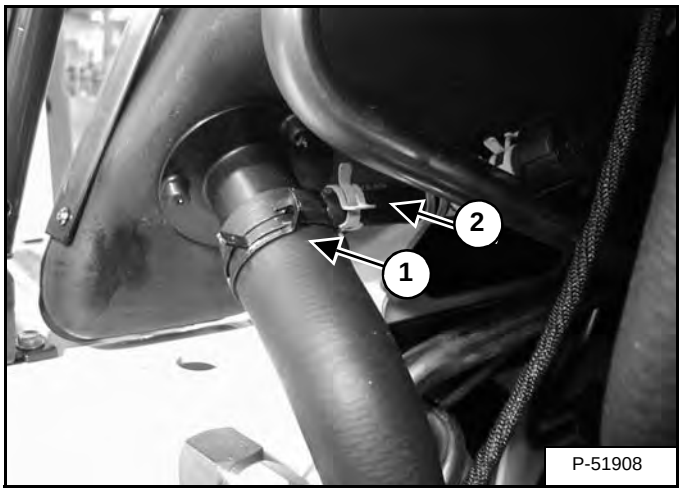
Disconnect the electrical connector (Item 4) **[Figure 70-50-20]**.

Figure 70-50-21



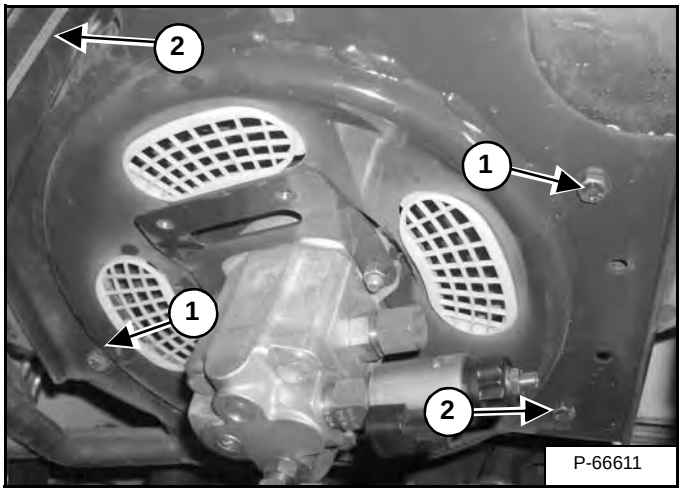
Remove hydraulic reservoir fill hose (Item 1) **[Figure 70-50-21]**.

Figure 70-50-22



Disconnect the fuel fill hose (Item 1) and the vent hose (Item 2) **[Figure 70-50-22]**.

Figure 70-50-23



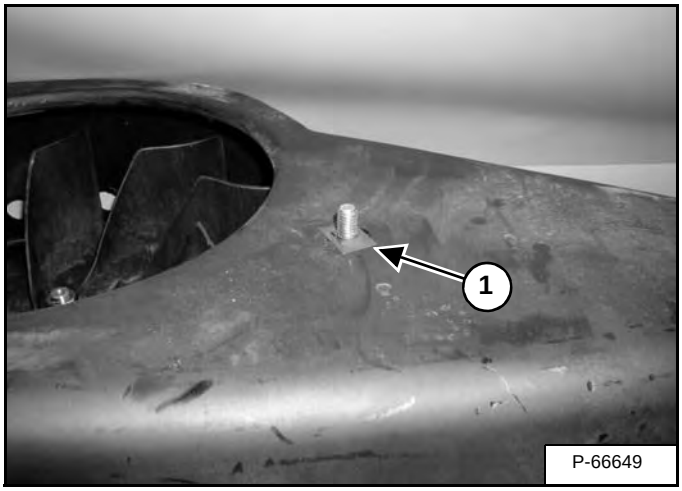
Remove the four mounting bolts (Item 1) and (Item 2) and spacer tubes. The only visible spacers are on the rear two mounting bolts (Item 2) **[Figure 70-50-23]**.

NOTE: Remove the two rear mounting bolts and spacers first.

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Blower Housing Removal And Installation (S/N 530713065 & Below, 530811453 & Below) (Cont'd)

Figure 70-50-24

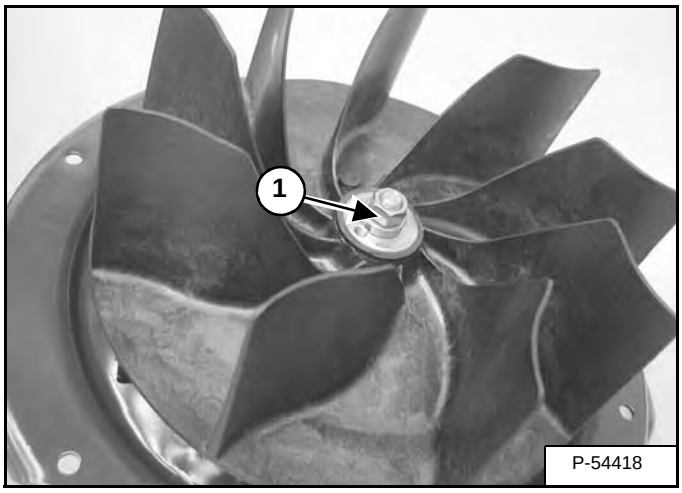


NOTE: The picture shows the blower housing and fan assembly removed from the loader. Two of the mounting bolts (Item 2) [Figure 70-50-23] have clips (Item 1) [Figure 70-50-24] to hold the bolts from falling out during installation of the blower housing and fan together.

Remove the blower housing from the loader.

Fan Removal And Installation (S/N 530713065 & Below, 530811453 & Below)

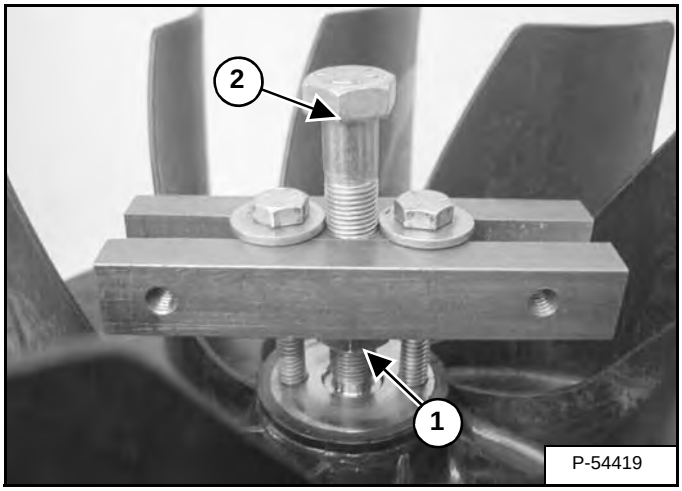
Figure 70-50-25



Remove the lock nut and spacer (Item 1) **[Figure 70-50-25]**.

Installation: Tighten the nut to 45-55 ft.-lb. (61-75 N•m) torque.

Figure 70-50-26



Use the following procedure to remove the fan from the shaft:

Install the nut (Item 1) **[Figure 70-50-26]** on the tapered shaft to protect the shaft and threads.

Install the puller on the fan as shown **[Figure 70-50-26]**.

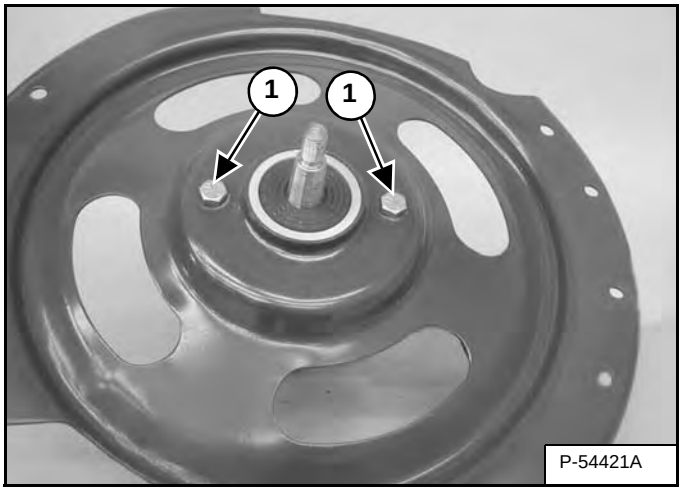
As the center bolt (Item 2) **[Figure 70-50-26]** is tightened, periodically strike the bolt head to loosen the fan from the shaft.

Remove the fan from the tapered shaft **[Figure 70-50-26]**.

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Hydraulic Fan Motor Removal And Installation (S/N 530713065 & Below, 530811453 & Below)

Figure 70-50-27

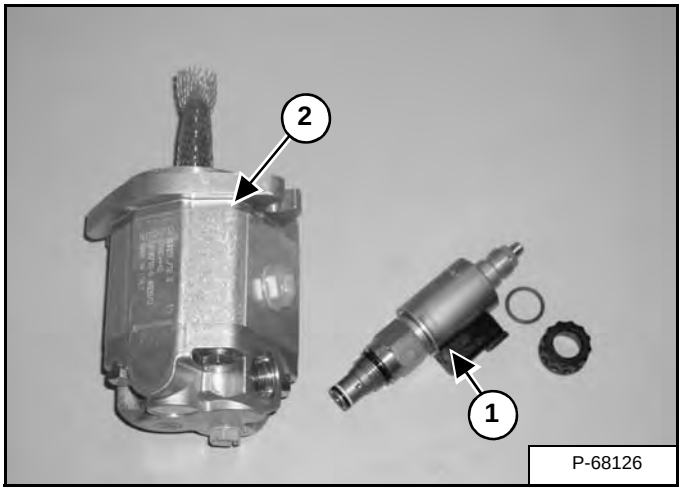


To remove the hydraulic fan motor remove the two bolts (Item 1) **[Figure 70-50-27]**.

Installation: Torque fan motor mounting bolts and nuts (Item 1) to 25-28 ft.-lb. (34-38 N•m).

Hydraulic Fan Motor Disassembly And Assembly (S/N 530713065 & Below, 530811453 & Below)

Figure 70-50-28



NOTE: The seals, O-rings and coil nut on the proportioning valve (Item 1) [Figure 70-50-28] are available by ordering from Bobcat Service Parts. The fan motor (Item 2) [Figure 70-50-28] must be replaced as a complete unit if damaged.

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Hydraulic Fan Motor Description (S/N 530713066 - 530740000, 530811454 - 530840000)

The hydraulic fan is used to cool the engine and hydraulic/hydrostatic systems. The hydraulic fan consist of a fan and hydraulic motor that is controlled by a proportioning valve.

The proportioning valve meters the flow through the fan motor. The proportioning valve receives signals from the controller which gathers information from both the engine and hydraulic temperature sensors.

NOTE: The proportioning valve is factory set and can not be adjusted accurately in the field. The adjustment screw is sealed with a tamper evident white material, if this screw has been adjusted the proportioning valve must be replaced.

If the flow from the proportioning valve is determined inaccurate it must be replaced with a new one from Bobcat Service Parts.

The fan speed is determined by the engine coolant temperature and the hydraulic fluid temperature. Depending on these temperatures the fan speed (RPM's) can range from 0 to 4000 RPM's.

The hydraulic fan speed at cold engine startup will range from 0 to 500 RPM's until the engine coolant and the hydraulic fluid reach basic operating temperatures.

During normal operating temperatures the fan speed may range from approximately 1900 to 3500 RPM's.

Axial Fan Housing Removal And Installation (S/N 530713066 - 530740000, 530811454 - 530840000)



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

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

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Drain the hydraulic fluid from the reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-2.)

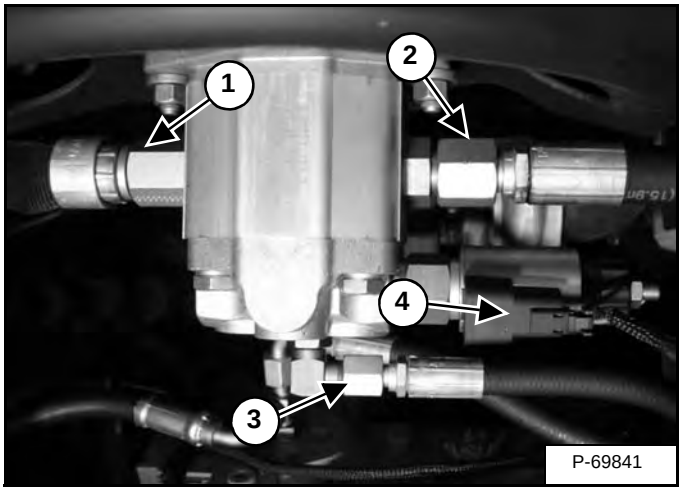
Remove the hydraulic/hydrostatic filter housing. (See Housing Removal And Installation on Page 20-80-1.)

Remove the charge filter housing. (See Charge Filter Housing Removal And Installation on Page 20-80-3.)

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Axial Fan Housing Removal And Installation (S/N 530713066 - 530740000, 530811454 - 530840000) (Cont'd)

Figure 70-50-29

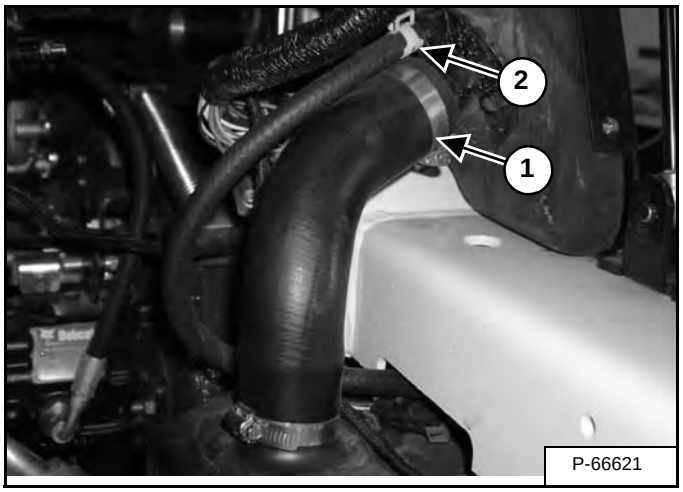


Remove the fan motor inlet hose (Item 1) and outlet hose (Item 2) **[Figure 70-50-29]**.

Remove the fan case drain hose (Item 3) **[Figure 70-50-29]**.

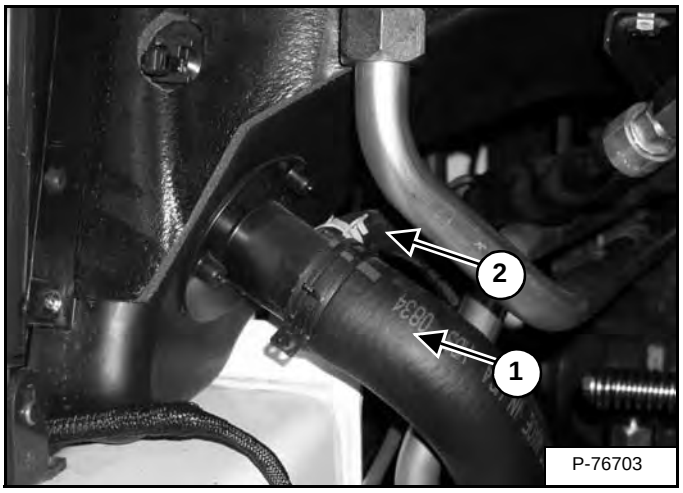
Disconnect the electrical connector (Item 4) **[Figure 70-50-29]**.

Figure 70-50-30



Remove the hydraulic reservoir fill hose (Item 1) and the bleed hose (Item 2) **[Figure 70-50-30]**.

Figure 70-50-31

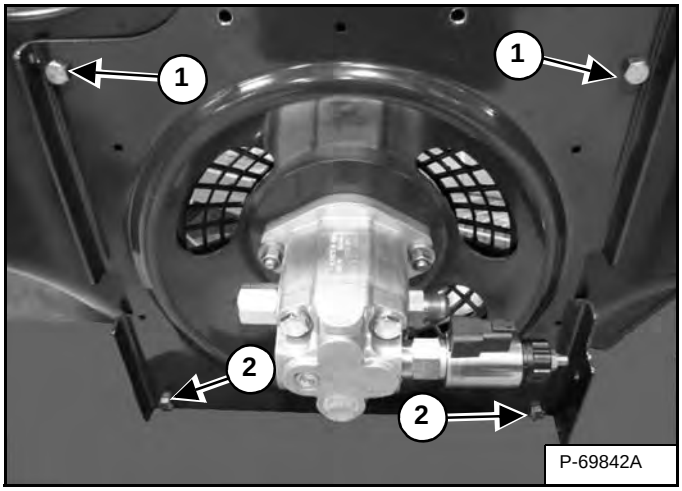


Remove the fuel fill hose (Item 1) and the vent hose (Item 2) **[Figure 70-50-31]**.

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Axial Fan Housing Removal And Installation (S/N 530713066 - 530740000, 530811454 - 530840000) (Cont'd)

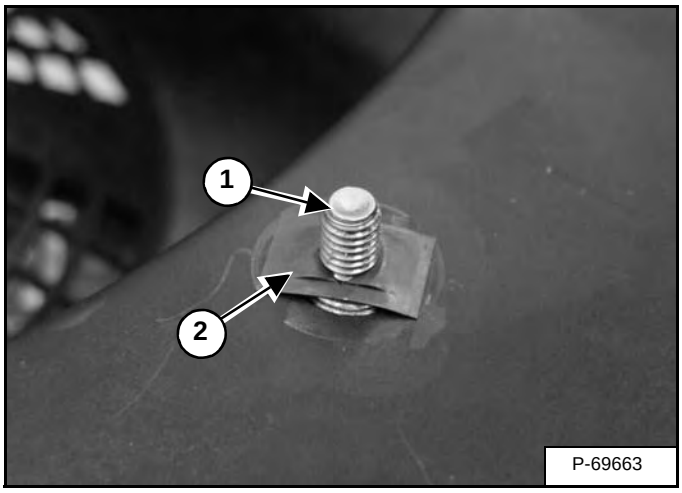
Figure 70-50-32



Remove the four mounting bolts (Items 1 & 2) and spacer tubes. The two rear mounting bolts (Item 2) **[Figure 70-50-32]** have visible spacers.

NOTE: Remove the two rear mounting bolts (Item 2) [Figure 70-50-32] first.

Figure 70-50-33

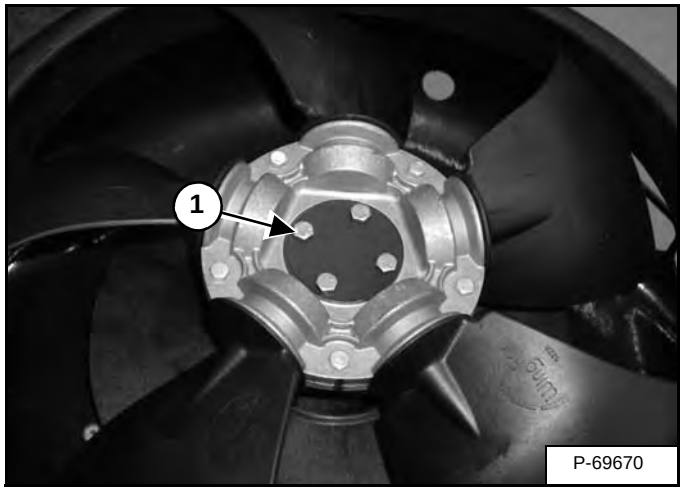


NOTE: The picture shows the fan housing and fan assembly removed from the loader. Two of the mounting bolts (Item 1) have clips (Item 2) [Figure 70-50-33] to hold the bolts from falling out during installation.

Remove the fan housing from the loader.

Axial Fan Removal And Installation (S/N 530713066 - 530740000, 530811454 - 530840000)

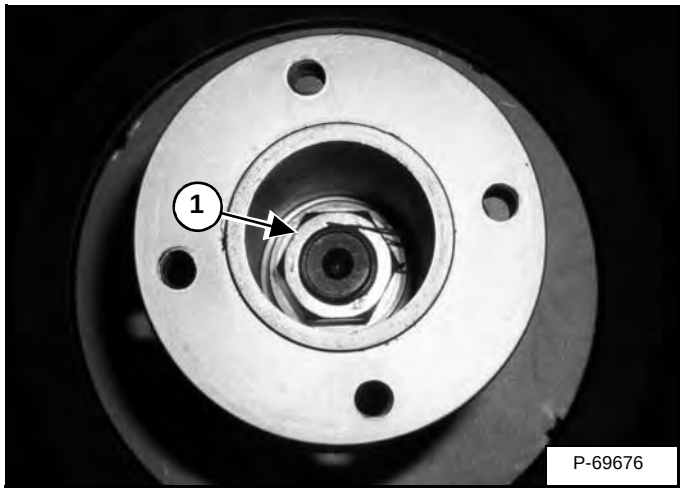
Figure 70-50-34



Remove the four bolts (Item 1) **[Figure 70-50-34]** to remove the plate and the upper fan.

Installation: Tighten the bolts to 140 in.-lb. (16 N•m) torque.

Figure 70-50-35



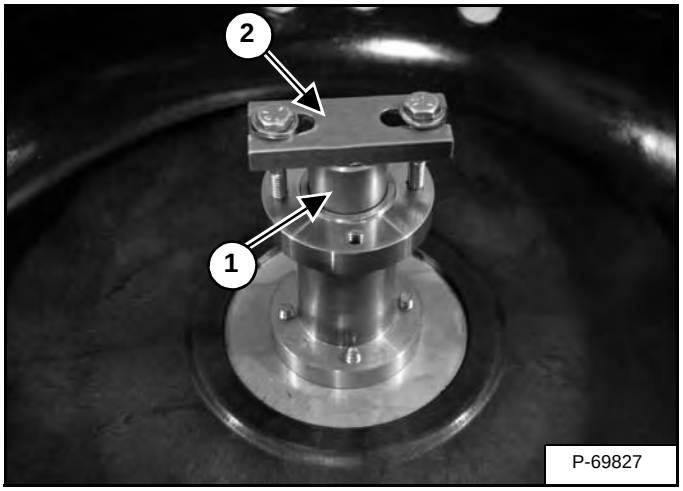
Remove the nut (Item 1) **[Figure 70-50-35]** and washer from the motor shaft.

Installation: Tighten the nut to 45-55 ft.-lb. (61-75 N•m) torque.

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Axial Fan Removal And Installation (S/N 530713066 - 530740000, 530811454 - 530840000) (Cont'd)

Figure 70-50-36



Use the following procedure to remove the lower fan from the fan motor shaft:

Install a bushing (Item 1) **[Figure 70-50-36]** in the coupler to protect the fan motor shaft and threads during removal.

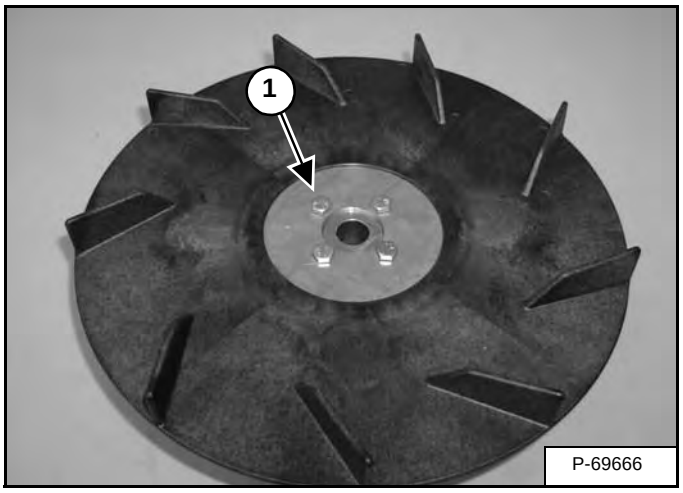
Use two bolts to position a puller (Item 2) on the bushing (Item 1) as shown **[Figure 70-50-36]**.

NOTE: If a puller is not available one can be made if needed to remove the coupler from the shaft.

Tighten the bolts and strike the puller with a hammer to loosen the coupler from the motor shaft.

Remove the lower fan from the tapered shaft **[Figure 70-50-36]**.

Figure 70-50-37



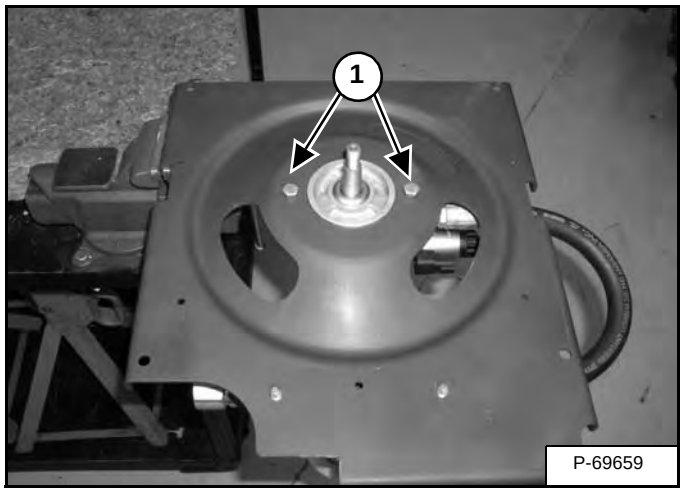
Remove the four bolts (Item 1) **[Figure 70-50-37]** to remove the lower fan from the coupler.

Installation: Tighten the bolts to 140 in.-lb. (16 N•m) torque.

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Hydraulic Fan Motor Removal And Installation (S/N 530713066 - 530740000, 530811454 - 530840000)

Figure 70-50-38

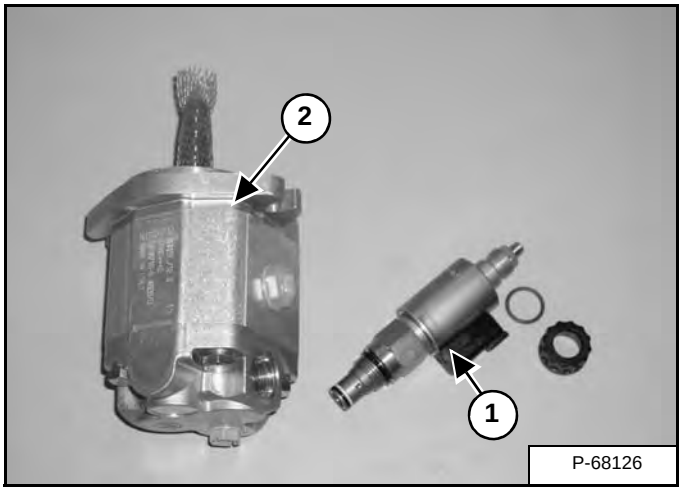


Remove the two bolts (Item 1) **[Figure 70-50-38]** to remove the hydraulic fan motor.

Installation: Tighten the bolts to 25-28 ft.-lb. (34-38 N•m) torque.

Hydraulic Fan Motor Disassembly And Assembly (S/N 530713066 - 530740000, 530811454 - 530840000)

Figure 70-50-39



NOTE: The seals, O-rings and coil nut on the proportioning valve (Item 1) [Figure 70-50-39] are available by ordering from Bobcat Service Parts. The fan motor (Item 2) [Figure 70-50-39] must be replaced as a complete unit if damaged.

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Hydraulic Fan Motor Description (S/N 530740001 & Above, 530840001 & Above)

The proportioning valve meters the flow through the fan motor. The proportioning valve receives signals from the controller which gathers information from both the engine and hydraulic temperature sensors.

The hydraulic fan is used to cool the engine and hydraulic/hydrostatic systems. The hydraulic fan consist of a fan and hydraulic motor that is controlled by a proportioning valve.

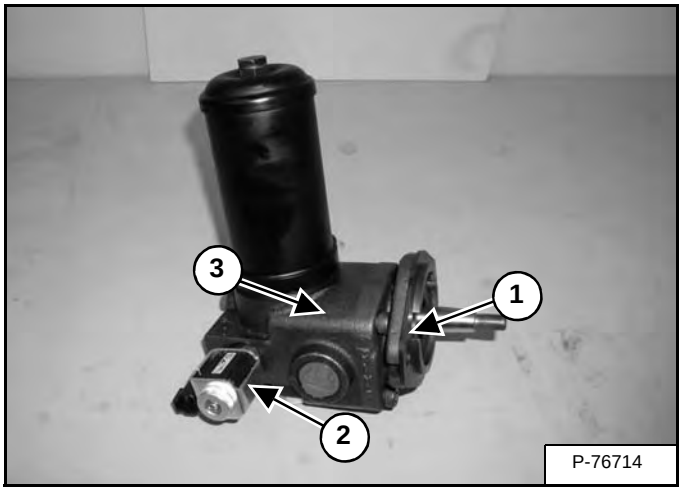
NOTE: The proportioning valve is factory set and can not be adjusted accurately in the field due to the adjustment being tamper proof.

The fan speed is determined by the engine coolant temperature and the hydraulic fluid temperature. Depending on these temperatures the fan speed (RPM's) can range from 0 to 4000 RPM's.

The hydraulic fan speed at cold engine startup will range from 0 to 500 RPM's until the engine coolant and the hydraulic fluid reach basic operating temperatures.

During normal operating temperatures the fan speed may range from approximately 1900 to 3500 RPM's.

Figure 70-50-40



NOTE: The mounting gasket (Item 1), proportioning valve, and proportioning valve O-rings, back up washer and coil mounting nut (Item 2) are available from Bobcat Parts. The fan motor (Item 3) [Figure 70-50-40] must be replaced as an assembly if damaged.

Axial Fan Housing Removal And Installation (S/N 530740001 & Above, 530840001 & Above)



WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W-2059-0598

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Drain the hydraulic fluid from the reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-2.)

IMPORTANT

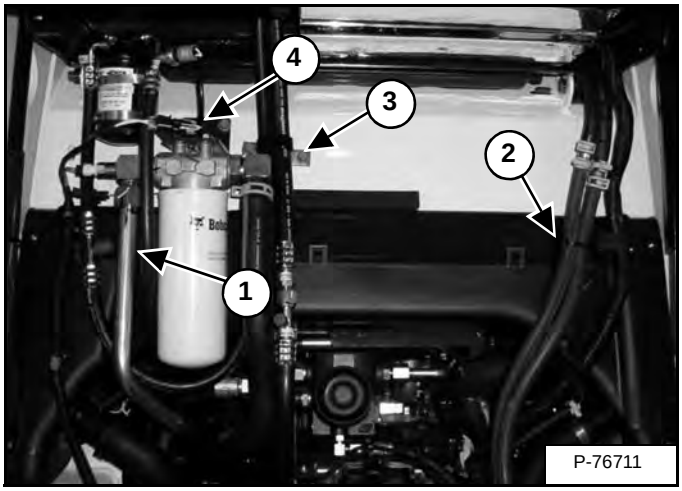
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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Axial Fan Housing Removal And Installation (S/N 530740001 & Above, 530840001 & Above) (Cont'd)

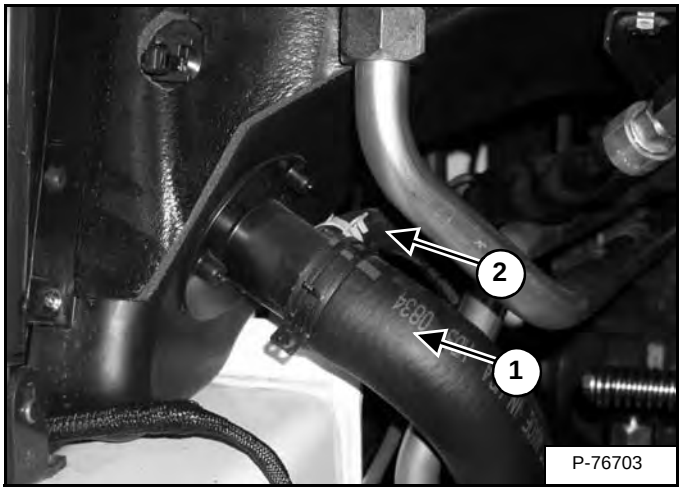
Figure 70-50-41



Remove tubeline (Item 1), the tie strap (Item 2), and the hose clamp (Item 3) **[Figure 70-50-41]**.

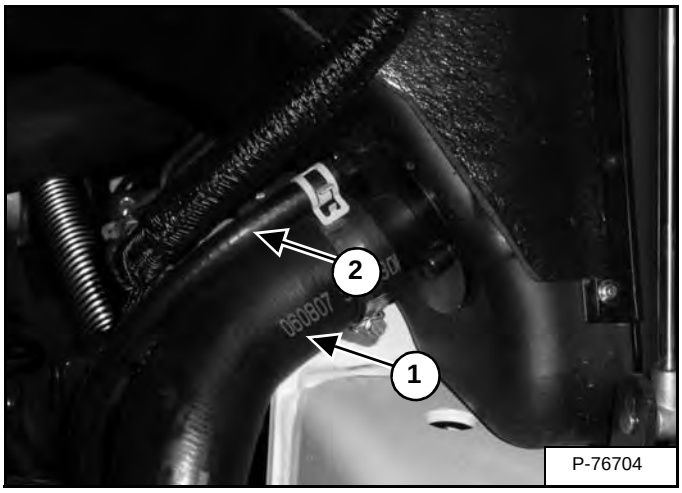
Remove two bolts (Item 4) and position the filter and dryer assembly (Item 5) **[Figure 70-50-41]** out of the way.

Figure 70-50-42



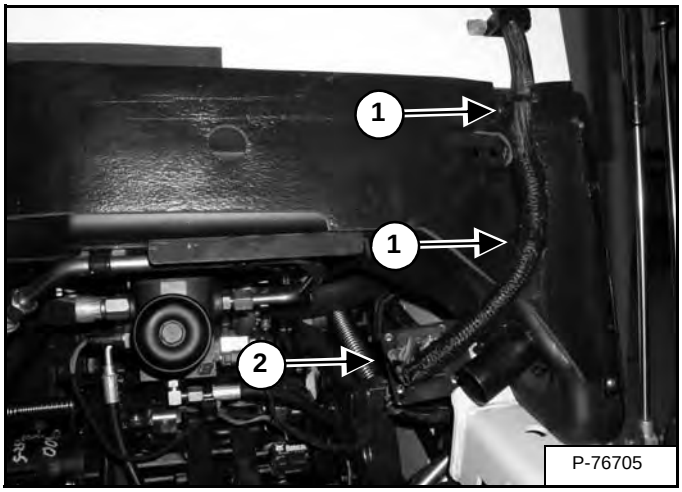
Remove the fuel fill hose (Item 1) and the vent hose (Item 2) **[Figure 70-50-42]**.

Figure 70-50-43



Remove the hydraulic reservoir fill hose (Item 1) and the bleed hose (Item 2) **[Figure 70-50-43]**.

Figure 70-50-44

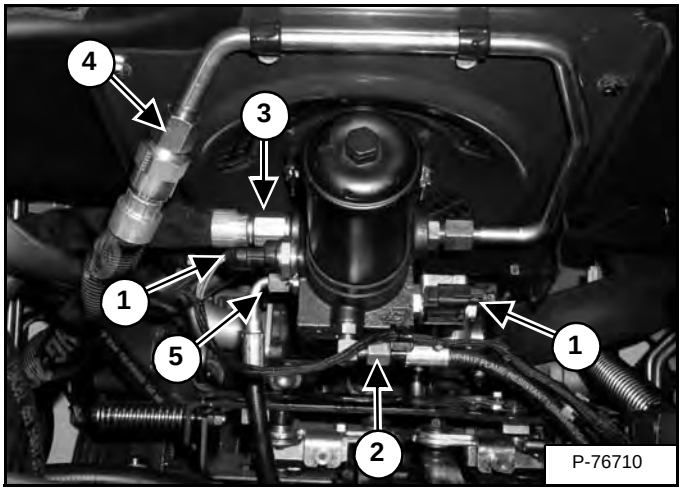


Remove the two tie straps (Item 1) and disconnect the cab harness (Item 2) **[Figure 70-50-44]**.

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Axial Fan Housing Removal And Installation (S/N 530740001 & Above, 530840001 & Above) (Cont'd)

Figure 70-50-45

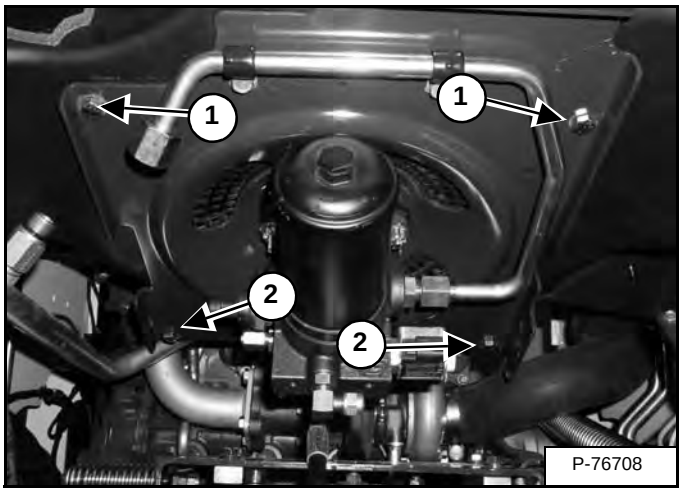


Disconnect the two electrical connectors (Item 1) **[Figure 70-50-45]**.

Remove and cap the case drain hose (Item 2) and fan inlet hose (Item 3) **[Figure 70-50-45]**.

Remove and cap the fan outlet hose (Item 4) and the pilot pressure hose (Item 5) **[Figure 70-50-45]**.

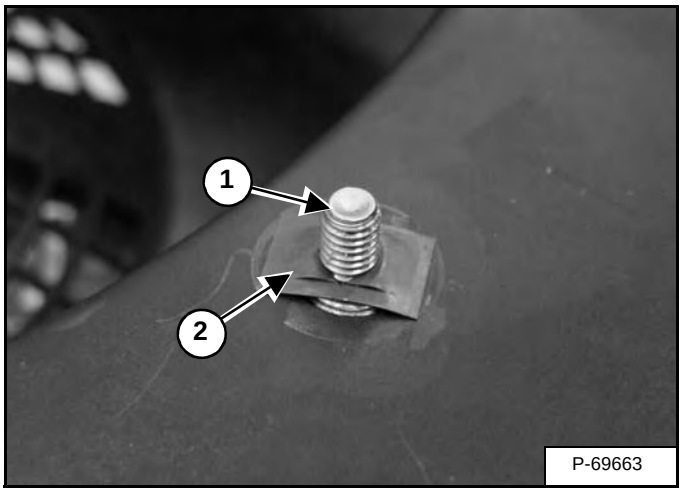
Figure 70-50-46



Remove the four mounting bolts (Items 1 & 2) and spacer tubes. The two rear mounting bolts (Item 2) **[Figure 70-50-46]** have visible spacers.

NOTE: Remove the two rear mounting bolts (Item 2) [Figure 70-50-46] first.

Figure 70-50-47



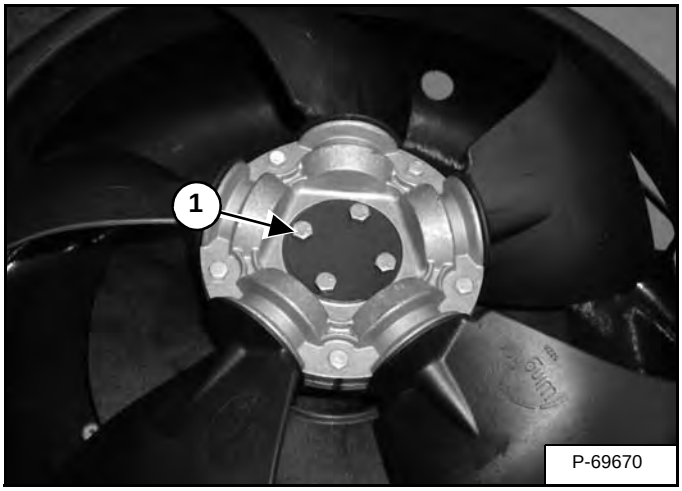
NOTE: The picture shows the fan housing and fan assembly removed from the loader. Two of the mounting bolts (Item 1) have clips (Item 2) [Figure 70-50-47] to hold the bolts from falling out during installation.

Remove the axial fan housing from the loader.

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Axial Fan Removal And Installation (S/N 530740001 & Above, 530840001 & Above)

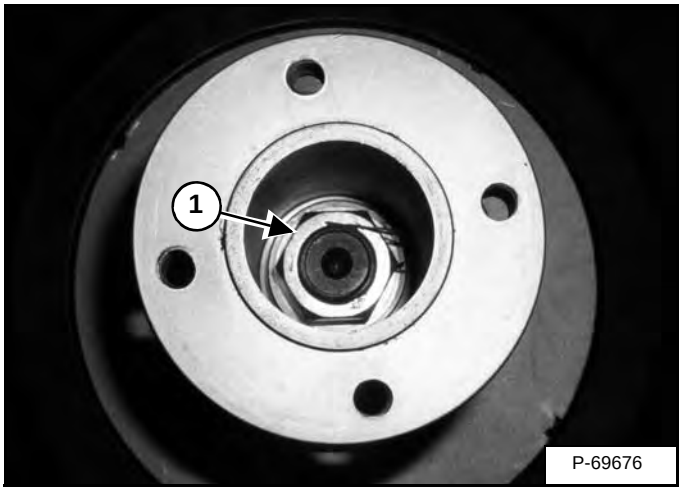
Figure 70-50-48



Remove the four bolts (Item 1) **[Figure 70-50-48]** to remove the plate and the upper fan.

Installation: Tighten the bolts to 140 in.-lb. (16 N•m) torque.

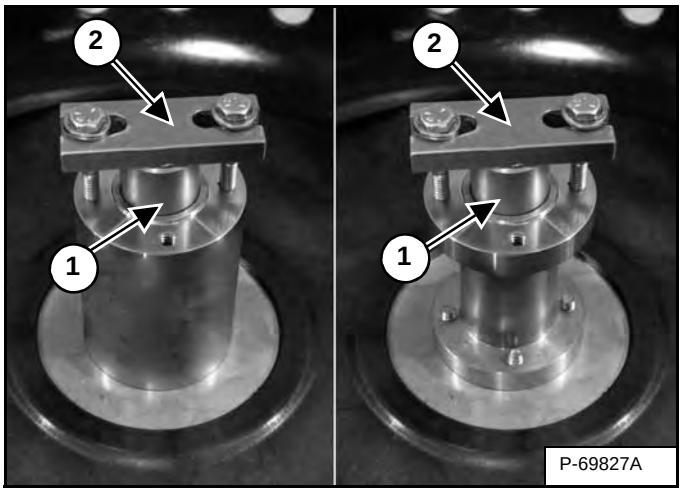
Figure 70-50-49



Remove the nut (Item 1) **[Figure 70-50-49]** and washer from the motor shaft.

Installation: Tighten the nut to 45-55 ft.-lb. (61-75 N•m) torque.

Figure 70-50-50



NOTE: Two different style couplers are used on the fan motor shaft. The removal and installation procedure is the same for both.

Use the following procedure to remove the lower fan from the fan motor shaft:

Install a bushing (Item 1) **[Figure 70-50-50]** in the coupler to protect the fan motor shaft and threads during removal.

Use two bolts to position a puller (Item 2) on the bushing (Item 1) as shown **[Figure 70-50-50]**.

NOTE: If a puller is not available one can be made if needed to remove the coupler from the shaft.

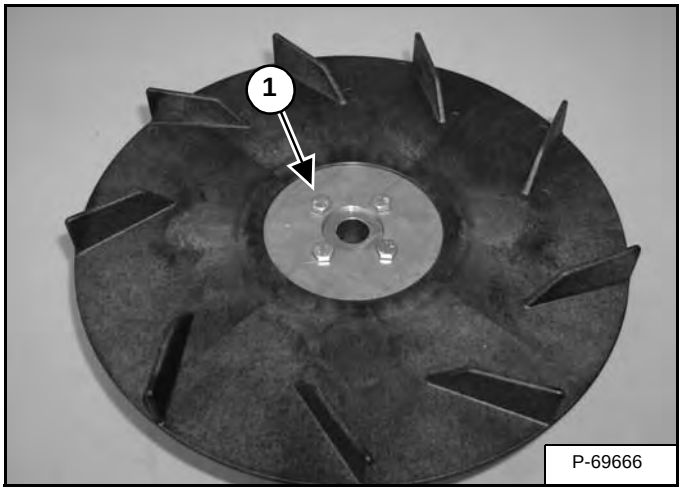
Tighten the bolts and strike the puller with a hammer to loosen the coupler from the motor shaft.

Remove the lower fan from the tapered shaft.

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Axial Fan Removal And Installation (S/N 530740001 & Above, 530840001 & Above) (Cont'd)

Figure 70-50-51

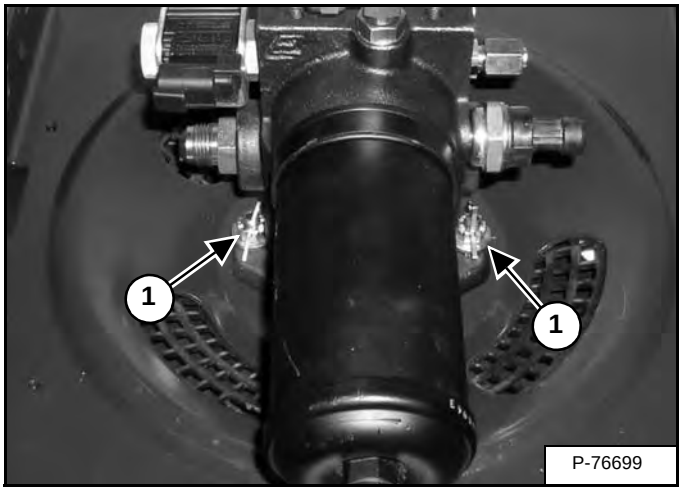


Remove the four bolts (Item 1) **[Figure 70-50-51]** to remove the lower fan from the coupler.

Installation: Tighten the bolts to 140 in.-lb. (16 N•m) torque.

Hydraulic Fan Motor Removal And Installation (S/N 530740001 & Above, 530840001 & Above)

Figure 70-50-52

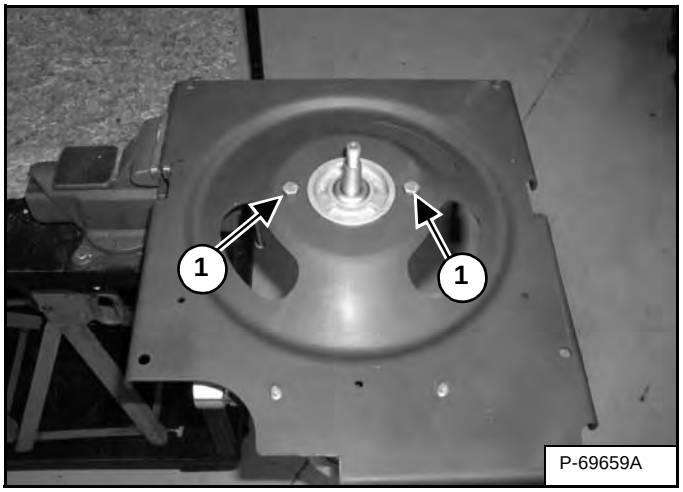


Remove and discard the two nuts and cotter pins (Item 1) **[Figure 70-50-52]**.

Remove the two washers (Item 1) **[Figure 70-50-52]**.

Installation: Tighten the nuts to 5-9 ft.-lb. (6,78-12,20 N•m) torque.

Figure 70-50-53



Remove and discard the two bolts (Item 1) **[Figure 70-50-53]** and the hydraulic fan motor from the mounting plate.

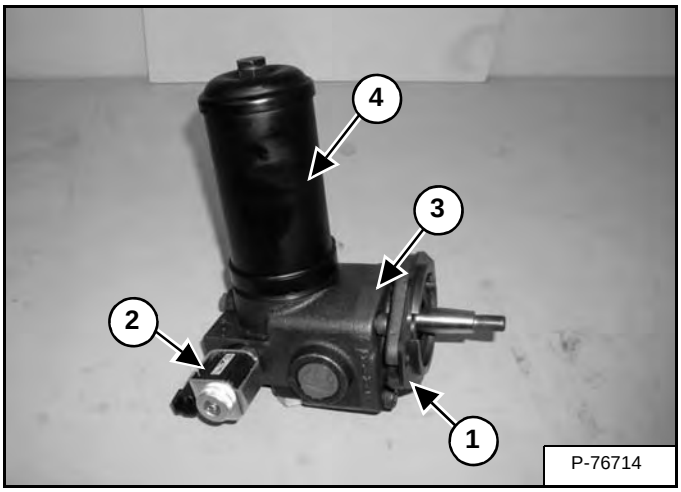
Installation: Tighten the bolts to 5-9 ft.-lb. (6,78-12,20 N•m) torque.

NOTE: Always install new bolts, nuts, cotter pins, and rubber gasket when installing the fan motor.

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Hydraulic Fan Motor Disassembly And Assembly (S/N 530740001 & Above, 530840001 & Above)

Figure 70-50-54

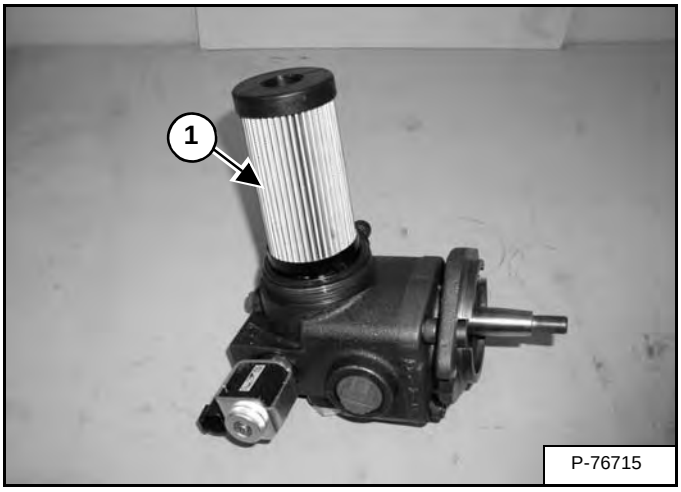


NOTE: The mounting gasket (Item 1), proportioning valve, and proportioning valve O-rings, back up washer and coil mounting nut (Item 2) are available from Bobcat Parts. The fan motor (Item 3) [Figure 70-50-54] must be replaced as an assembly if damaged.

Remove the filter cover (Item 4) **[Figure 70-50-54]**.

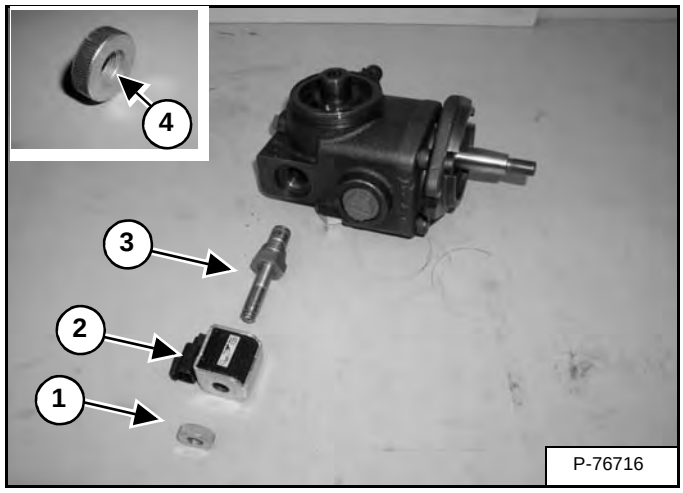
Installation: Tighten filter cover (Item 4) **[Figure 70-50-54]** 35-40 ft.-lb. (47,5-54 N•m) torque.

Figure 70-50-55



Remove the filter (Item 1) **[Figure 70-50-55]**.

Figure 70-50-56



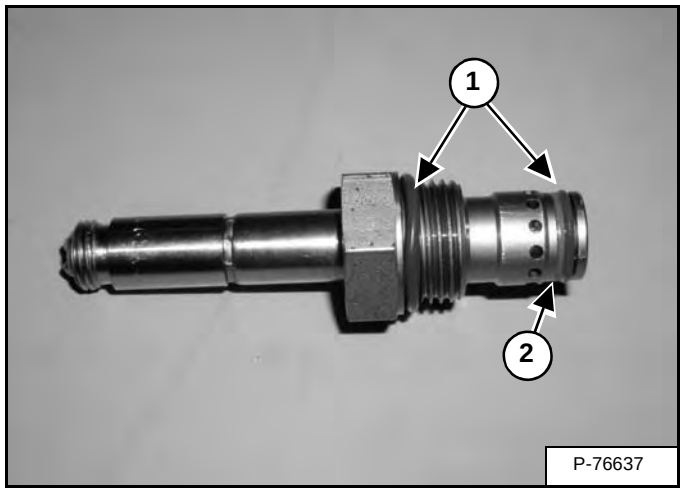
Remove coil mounting nut (Item 1), the coil (Item 2), and the coil valve stem (Item 3) **[Figure 70-50-56]**.

NOTE: Coil mounting nut must be replaced each time it is removed. Coil mounting nuts are available from Bobcat Parts.

Installation: Install coil mounting nut with the counterbored space (Item 4) **[Figure 70-50-56]** facing towards the coil and tighten securely by hand.

Installation: Tighten coil valve stem (Item 3) **[Figure 70-50-56]** 21-25 ft.-lb. (28-34 N•m) torque.

Figure 70-50-57

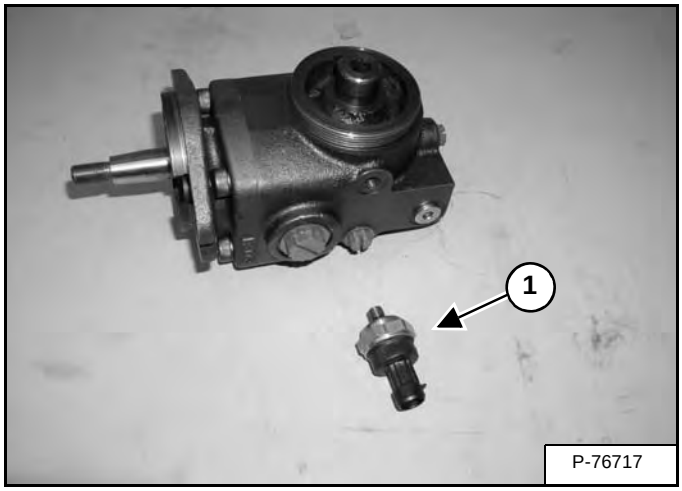


Inspect and replace O-rings (Item 1) and back up washer (Item 2) **[Figure 70-50-57]** if necessary.

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Hydraulic Fan Motor Disassembly And Assembly (S/N 530740001 & Above, 530840001 & Above) (Cont'd)

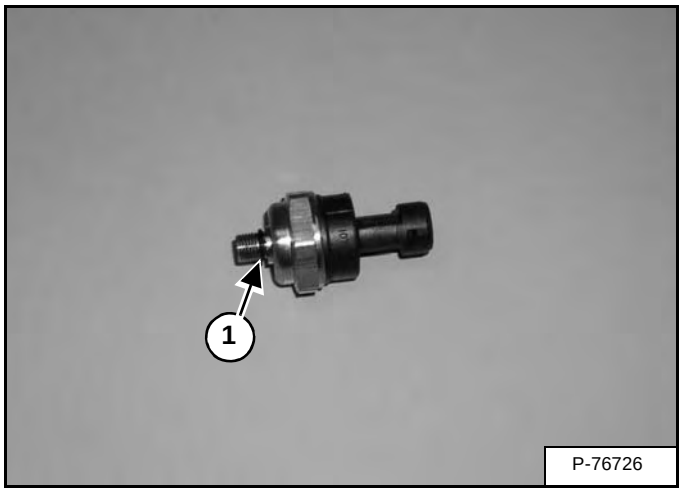
Figure 70-50-58



Remove the pressure transducer (Item 1) **[Figure 70-50-58]**.

Installation: Tighten the pressure transducer (Item 1) **[Figure 70-50-58]** 7.4 - 8.1 ft.-lb. (10 - 10,9 N•m) torque.

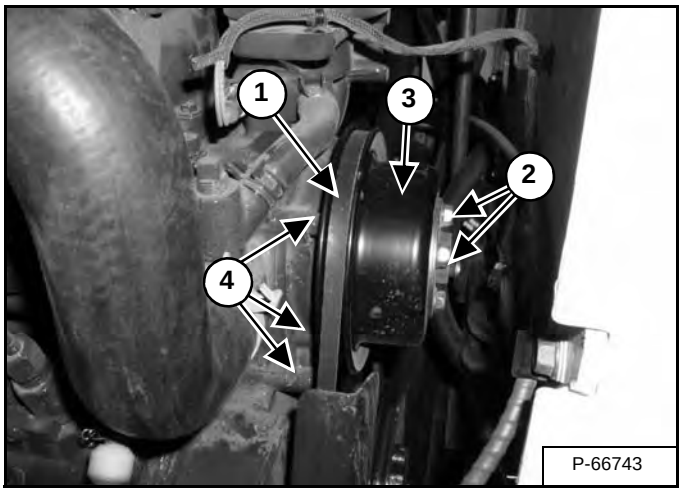
Figure 70-50-59



Inspect and replace the O-ring (Item 1) **[Figure 70-50-59]** if necessary.

Water Pump Removal And Installation

Figure 70-50-60



Drain the fluid from the radiator. (See Removing And Replacing Coolant on Page 10-90-2.)

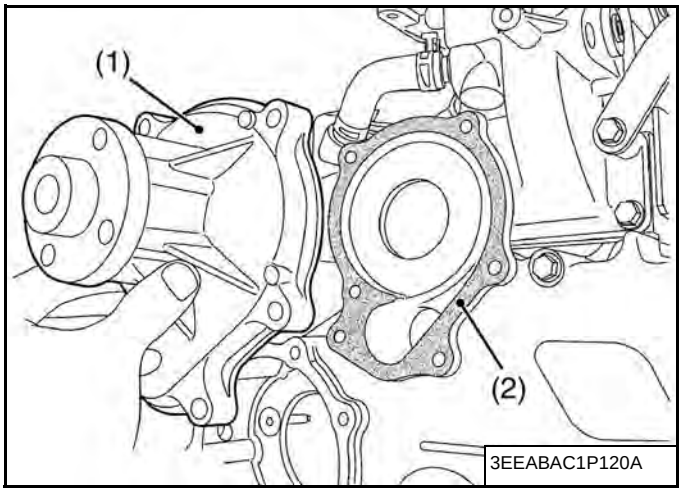
Remove the alternator belt (Item 1) **[Figure 70-50-60]**.

Remove the four bolts (Item 2) from the water pump pulley (Item 3) **[Figure 70-50-60]**.

Remove the water pump pulley (Item 3) **[Figure 70-50-60]**

Remove the six water pump bolts (Item 4) **[Figure 70-50-60]**.

Figure 70-50-61



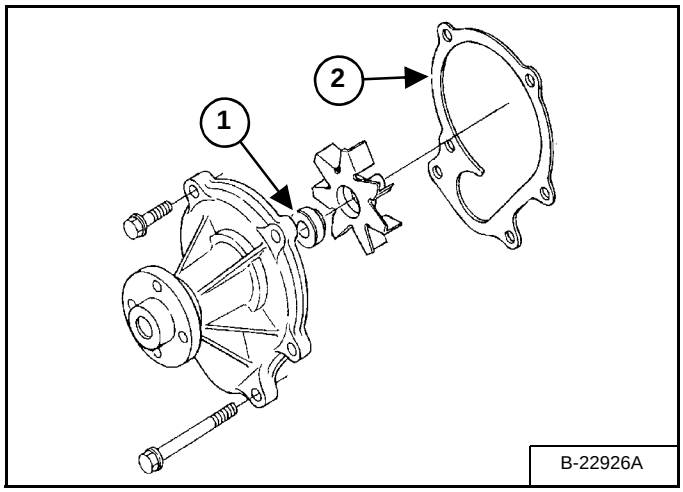
Remove the water pump (Item 1) **[Figure 70-50-61]** from the gearcase.

When mounting the water pump, use the new gasket (Item 2) **[Figure 70-50-61]**.

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Water Pump Disassembly And Assembly

Figure 70-50-62



Remove the water pump assembly.

NOTE: The seal (Item 1) and the gasket (Item 2) are available for replacement parts [Figure 70-50-62].

Thermostat Housing Removal And Installation

Figure 70-50-63

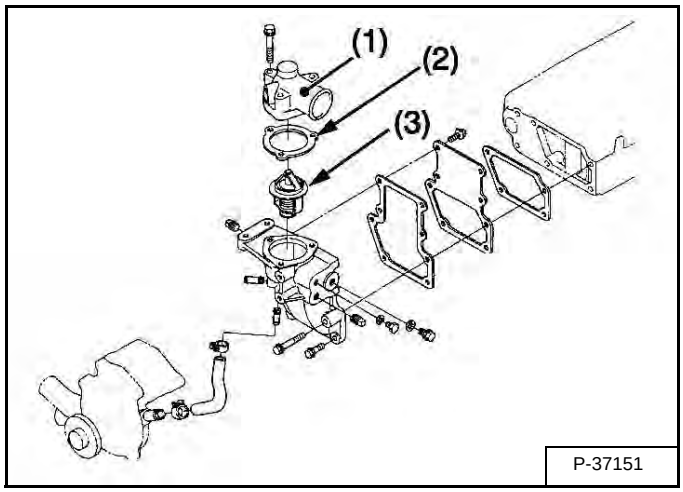
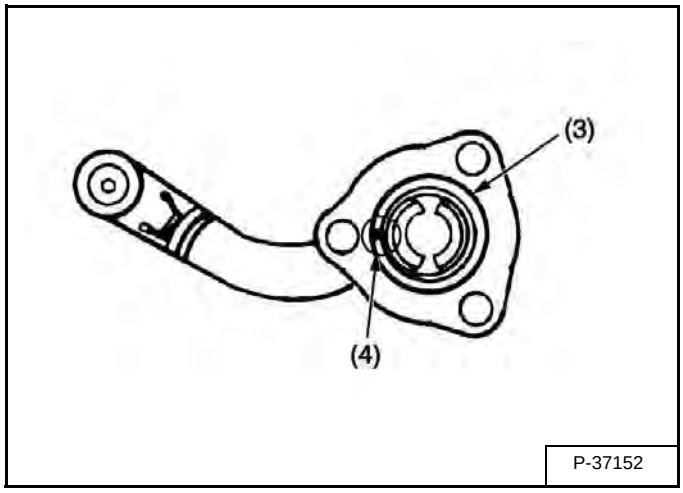


Figure 70-50-64



Remove the thermostat cover mounting screws, and remove the thermostat cover (Item 1) **[Figure 70-50-63]**.

Remove the thermostat assembly (Item 3) **[Figure 70-50-63]**.

Apply a liquid gasket (Three Bond 1215 or equivalent) only at the thermostat cover side of the gasket (Item 2) **[Figure 70-50-63]**.

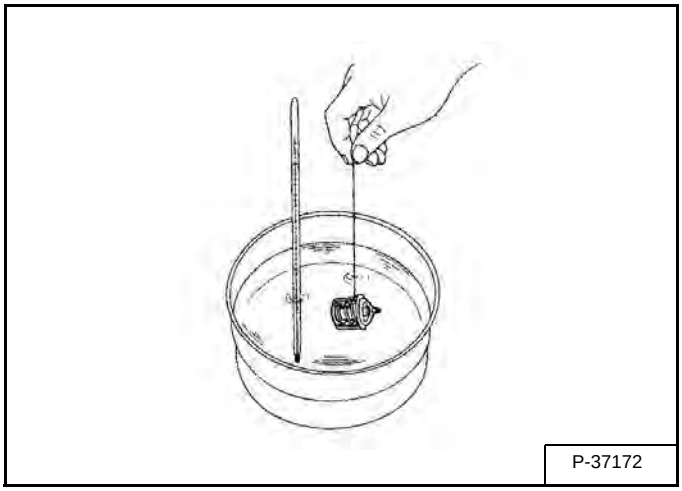
Attach the thermostat (Item 3) with its hole (Item 4) facing toward the air suction side **[Figure 70-50-64]**.

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Thermostat Housing Removal And Installation (Cont'd)

Thermostat Checking

Figure 70-50-65



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 70-50-65]**.

Hold the string to suspend the thermostat in the water. When the water temperature rises, the thermostat valve will open, allowing it to fall down from the string.

Continue heating the water and read the temperature when the valve has risen by about 8 mm (0.315 in.).

If the measurement is not acceptable, replace the thermostat.

Thermostat's valve opening temperature	Factory spec.	74.5 to 78.5°C 166.1 to 173.3°F
Temperature at which thermostat completely opens	Factory spec.	90°C 194°F

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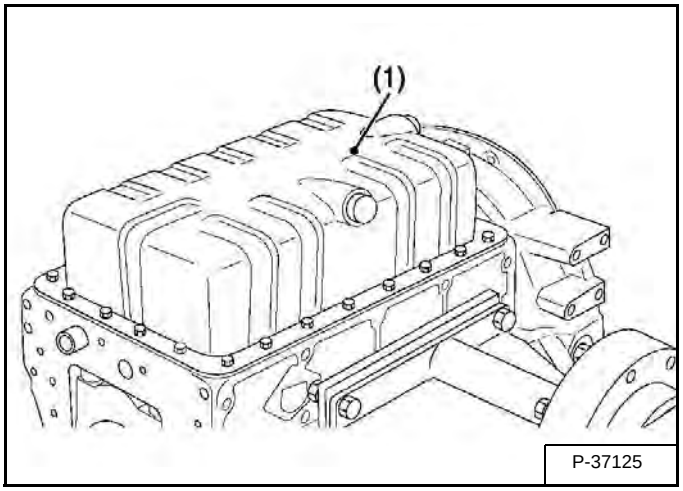
Dealer Copy -- Not for Resale

LUBRICATION SYSTEM

Oil Pan Removal And Installation

Remove the engine/hydrostatic pump package from the loader. (See Engine Removal And Installation on Page 70-10-9.)

Figure 70-60-1



Unscrew the oil pan mounting screws and remove the oil pan (Item 1) **[Figure 70-60-1]**.

Figure 70-60-2

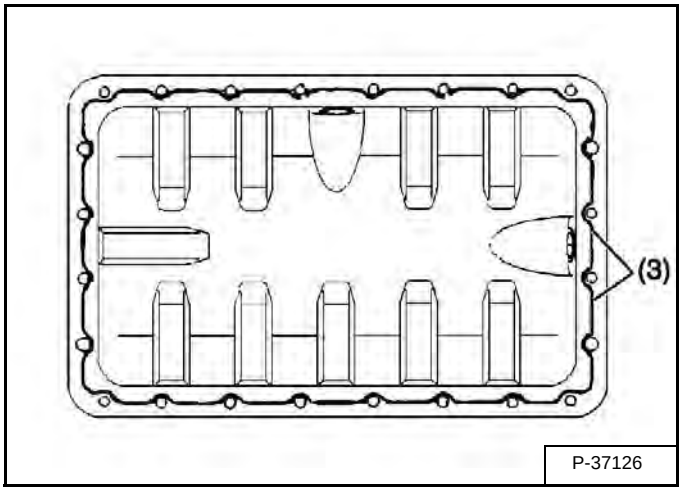
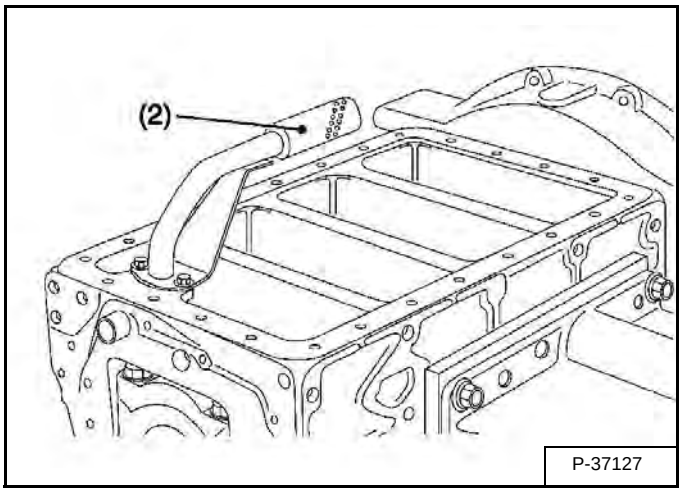


Figure 70-60-3



Unscrew the oil strainer mounting screw, and remove the oil strainer (Item 2) **[Figure 70-60-3]**.

Install the oil strainer, using care not to damage the O-ring.

Apply liquid gasket to the oil pan (Item 3) **[Figure 70-60-2]**.

Confirm that the liquid gasket coating surface is free of water, dust and oil in order to maintain sealing effect.

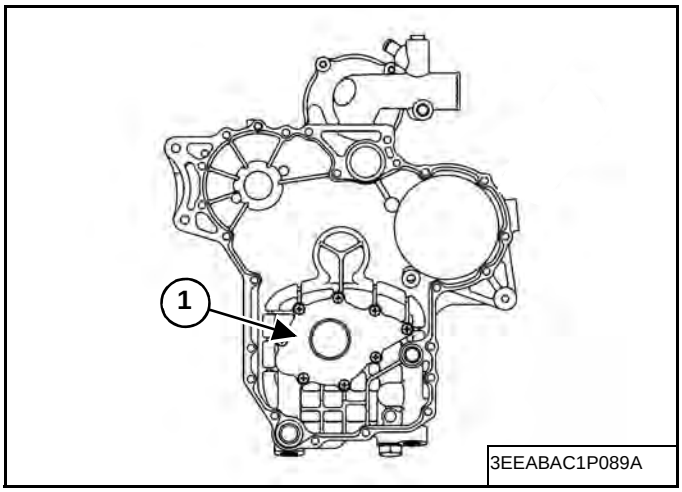
Carefully apply the adhesive evenly.

NOTE: When mounting the adhesive-applied parts, take care to fit them to the mating parts.
Assemble the adhesive-applied parts within ten minutes.
To avoid uneven tightening, tighten mounting screws in diagonal order from the center.
After cleaning the oil strainer, install it.
Attach the oil pan with its central drain plug facing toward the air suction side.

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Oil Pump Removal And Installation

Figure 70-60-4



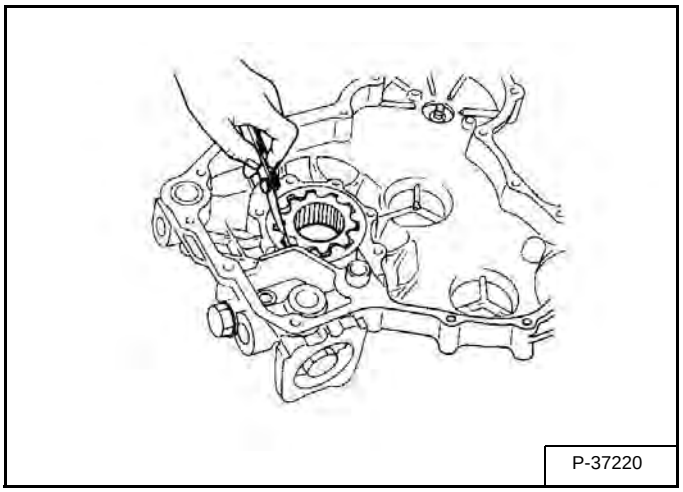
Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 70-100-1.)

Remove the oil pump cover (Item 1) **[Figure 70-60-4]**.

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Oil Pump Inspection

Figure 70-60-5

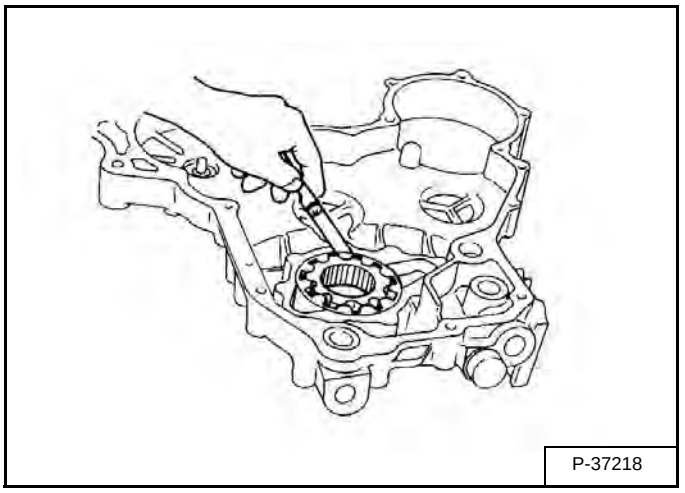


Measure the clearance between lobes of the inner rotor and the outer rotor with a feeler gauge **[Figure 70-60-5]**.

If the clearance exceeds the factory specifications, replace the oil pump rotor assembly.

Clearance between inner rotor and outer rotor	Factory spec.	0.04 to 0.16 mm 0.0016 to 0.0063 in.

Figure 70-60-6



Measure the clearance between the outer rotor and the pump body with a feeler gauge **[Figure 70-60-6]**.

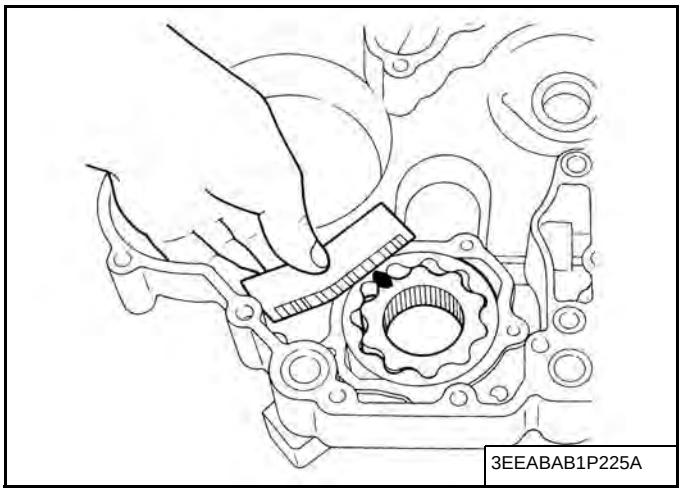
If the clearance exceeds the factory specifications, replace the oil pump rotor assembly.

Clearance between outer rotor and pump body	Factory spec.	0.100 to 0.184 mm 0.0039 to 0.0072 in.
	Allowable limit	0.3 mm 0.0118 in.

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Oil Pump Inspection (Cont'd)

Figure 70-60-7



Put a strip of plastigage (Code No. 07909-30241) onto the rotor face with grease **[Figure 70-60-7]**.

Install the cover and tighten the screws with the specified torque.

Remove the cover carefully, and measure the amount of the flattening with the scale and get the clearance.

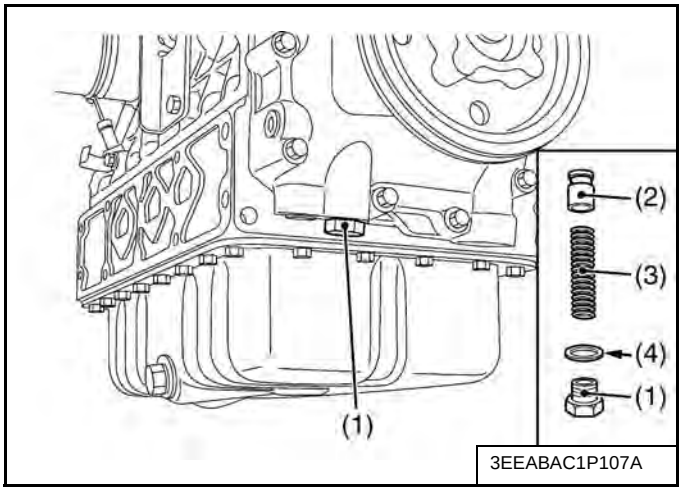
If the clearance exceeds the allowable limit, replace oil pump rotor assembly and the cover.

Clearance between rotor and cover	Factory spec.	0.025 to 0.075 mm 0.0010 to 0.0030 in.
	Allowable limit	0.225 mm 0.0089 in.

Tightening torque	Oil pump cover screw	7.9 to 9.3 N•m 0.80 to 0.95 kgf·m 5.8 to 6.9 ft.-lb.

Relief Valve

Figure 70-60-8



Remove the bolt (Item 1) **[Figure 70-60-8]**.

Remove the relief valve (Item 2), the spring (Item 3) and the packing (Item 4) **[Figure 70-60-8]**.

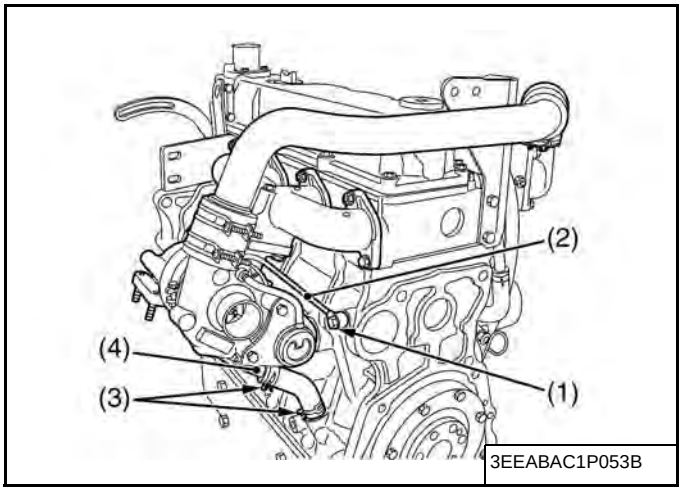
Tightening torque	Relief valve	68.6 to 78.4 N•m 7.0 to 8.0 kgf·m 50.6 to 57.9 ft.-lb.

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Oil Pump Inspection (Cont'd)

Oil Pipe

Figure 70-60-9



Remove the joint bolt (Item 1) and take off the pipe (Item 2) **[Figure 70-60-9]**.

Remove the bolts (Item 3) and release the clamp (Item 4) **[Figure 70-60-9]**.

Remove the oil pipe 2 (Item 5) **[Figure 70-60-9]**.

Before installation pour fresh engine oil through the oil supply port of the turbocharger.

Replace the gasket with new one.

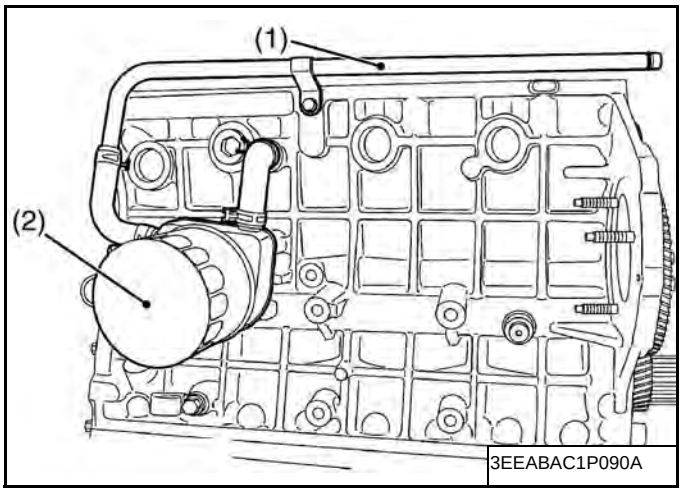
Be careful not to allow dust, dirt and other foreign matters in the oil pipes.

NOTE: Tape or plug all openings to prevent foreign matters from damaging the oil cavities in the turbocharger.

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Oil Filter Cooler Removal And Installation

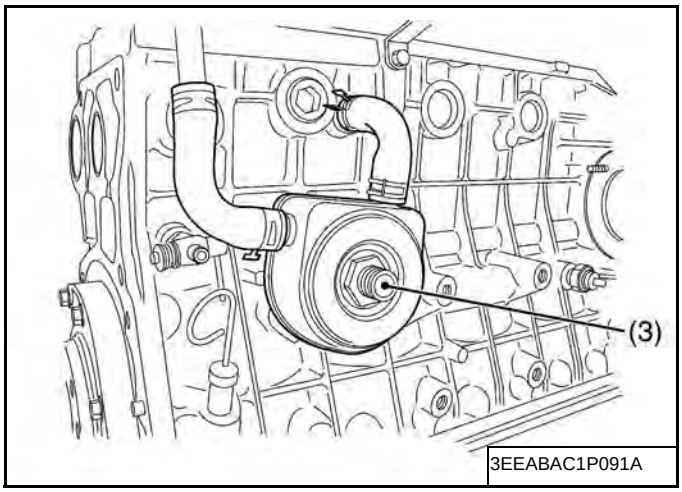
Figure 70-60-10



Remove the water pipe (Item 1) **[Figure 70-60-10]**.

Remove the oil filter cartridge (Item 2) **[Figure 70-60-10]**.

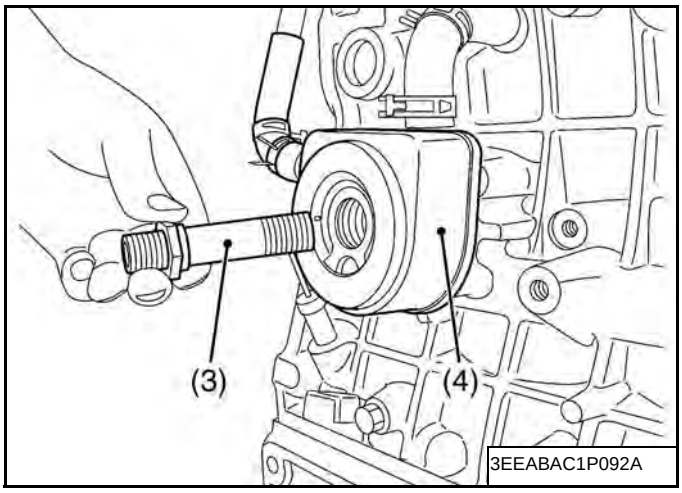
Figure 70-60-11



Remove the oil cooler joint bolt (Item 3) **[Figure 70-60-11]** & **[Figure 70-60-12]**.

Installation: Tighten the oil cooler joint bolt to 29 - 32.5 ft.-lb. (39,2 - 44,1 N•m)

Figure 70-60-12

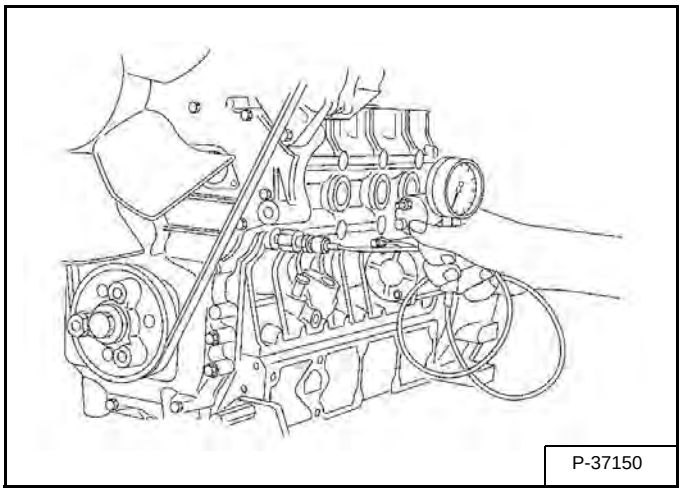


Remove the oil cooler (Item 4) **[Figure 70-60-12]**.

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Engine Oil Pressure - Testing

Figure 70-60-13



Remove the oil switch and set a pressure tester (Code No. 07916-32031) **[Figure 70-60-13]**.

Start the engine. After warming up, measure the oil pressure of both idling and rated speeds.

If the oil pressure is less than the allowable limit, check the following:

Engine oil insufficient
Oil pump defective
Oil strainer clogged
Oil filter cartridge
Oil gallery clogged
Excessive oil clearance of bearing
Foreign matter in the relief valve

After checking the engine oil pressure, tighten the engine oil pressure switch to the specified torque.

At idle speed	Allowable limit	0,49 bar 0.5 kgf/cm² 7 PSI

At rated speed	Factory spec.	1,93 to 3,86 bar 2.0 to 4.0 kgf/cm² 28 to 56 PSI
	Allowable limit	1,47 bar 1.5 kgf/cm² 21.3 PSI

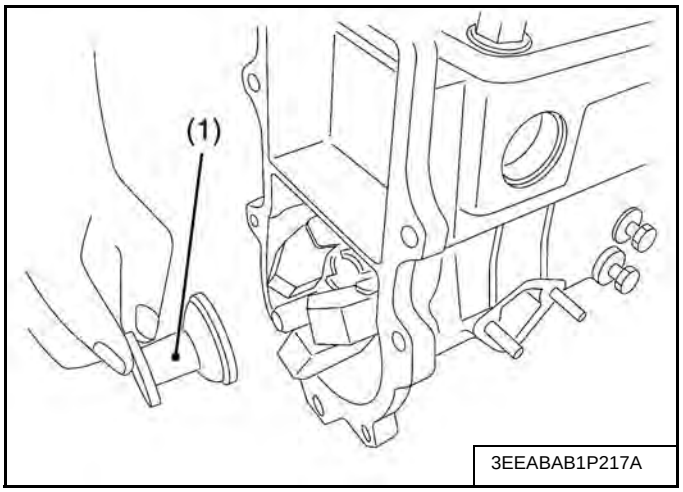
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Fuel Camshaft Removal And Installation

Figure 70-70-1

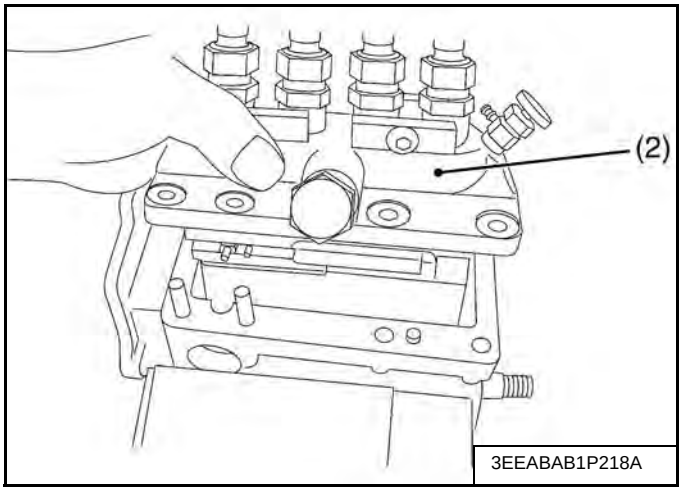


Separate the governor housing assembly from the injection pump unit.

Remove the fuel feed pump from the injection pump unit.

Remove the governor sleeve (Item 1) **[Figure 70-70-1]**.

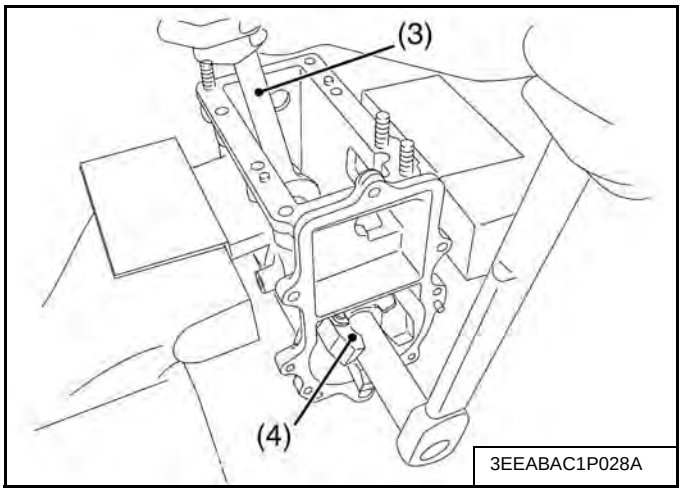
Figure 70-70-2



Remove the injection pump assembly (Item 2) **[Figure 70-70-2]**.

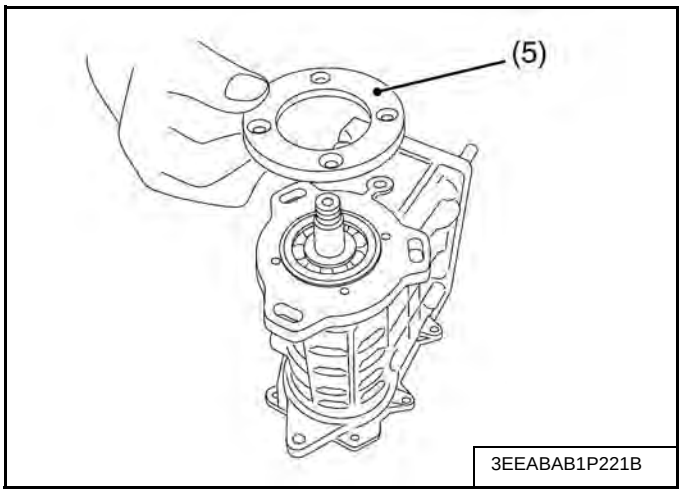
Remove the fuel camshaft lock bolts.

Figure 70-70-3



Fix the fuel camshaft with open end wrench (Item 3), and remove the governor weight mounting nut and the governor weight (Item 4) **[Figure 70-70-3]**.

Figure 70-70-4

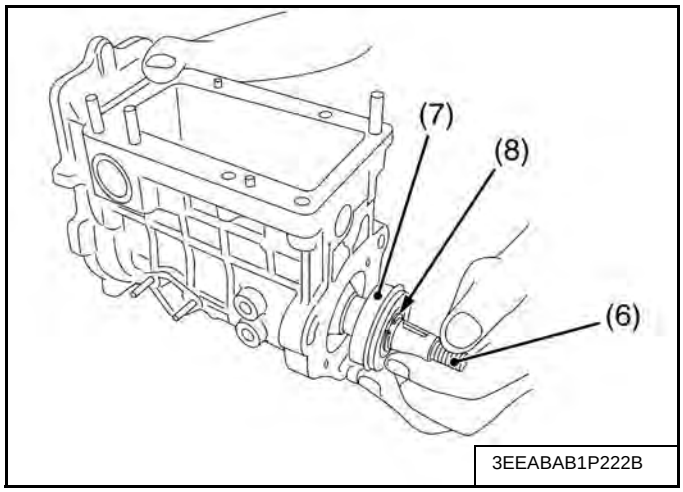


Loosen the fuel camshaft stopper mounting screws and remove the fuel camshaft stopper (Item 5) **[Figure 70-70-4]**.

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Fuel Camshaft Removal And Installation (Cont'd)

Figure 70-70-5



Pull out the fuel camshaft (Item 6) and bearings (Item 7) **[Figure 70-70-5]** together.

After removing the bearing's cir-clip (Item 8) **[Figure 70-70-5]**, press out the bearings.

NOTE: Do not use the fuel camshaft lock bolts, when remove the governor weight mounting nut. Otherwise, the lock bolts or injection pump housing might get damaged.

Press the bearings into the fuel camshaft.

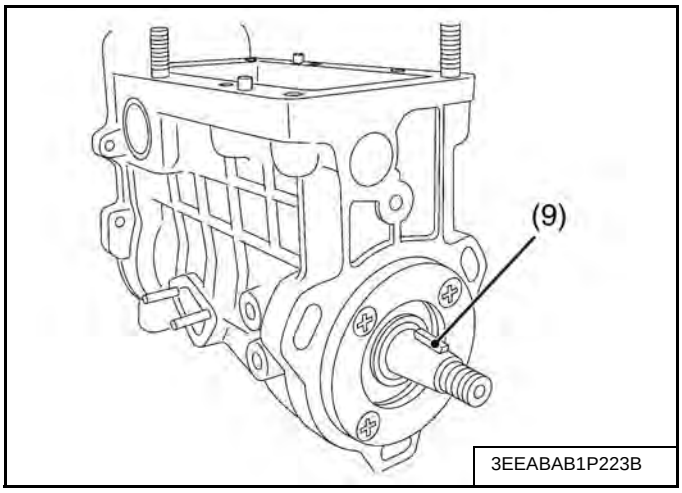
Set the cir-clip at the gear side's bearing.

Install the fuel camshaft and bearings to the injection pump housing.

Attach the fuel camshaft stopper and tighten the fuel camshaft stipper mounting screws with the specified torque.

Attach the governor weight to the fuel camshaft and tighten the governor weight mounting nut with specified torque.

Figure 70-70-6



Fix the fuel camshaft with lock bolts as the key way to fuel camshaft (Item 9) **[Figure 70-70-6]** is right-downward.

Install the injection pump assembly to the injection pump housing.

Attach the O-ring and the cover and tighten the cover mounting bolts.

Install the governor sleeve to the fuel camshaft.

Check the movement of the governor sleeve.

NOTE: Be careful not to damage the O-ring.

NOTE: Be careful the direction of the governor sleeve.

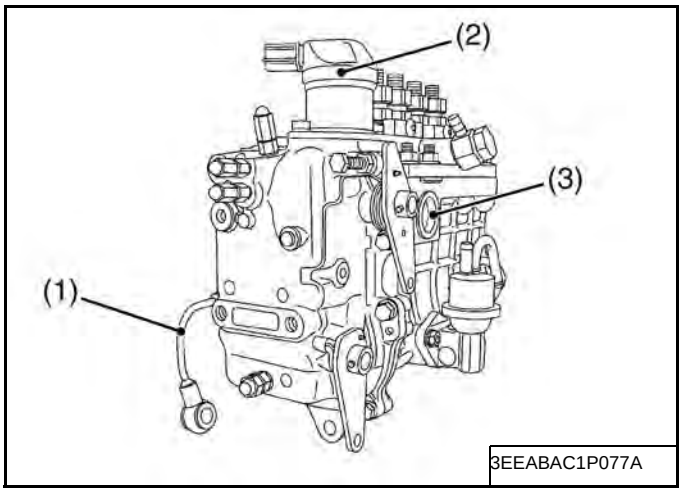
NOTE: When reassembling the inside parts, put the oil on each inside part slightly.

Tightening torque	Fuel camshaft stopper mounting screw	7.9 to 9.3 N•m 0.80 to 0.95 kgf·m 5.8 to 6.9 ft.-lb.
	Governor weight mounting screw	62.8 to 72.6 N•m 6.4 to 7.4 kgf·m 46.3 to 53.5 ft.-lb.

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Injection Pump Governor Housing Removal And Installation

Figure 70-70-7



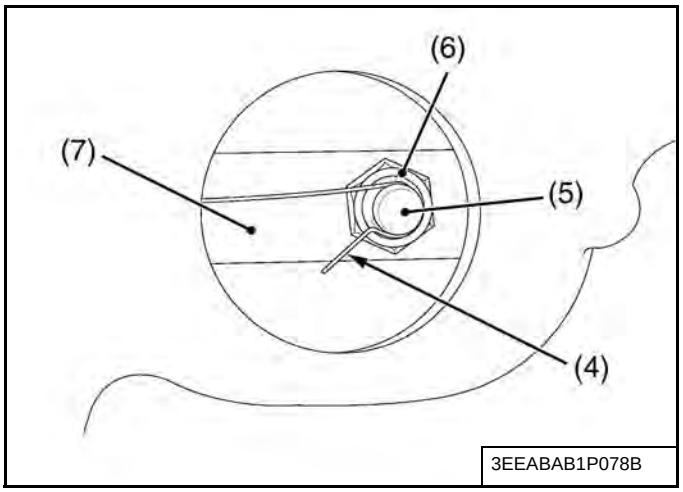
Remove the injection pump unit from the engine.

Remove the governor lubricating pipe (Item 1) **[Figure 70-70-7]**.

Remove the stop solenoid (Item 2) **[Figure 70-70-7]**.

Detach the sight cover (Item 3) **[Figure 70-70-7]** from the injection pump unit.

Figure 70-70-8



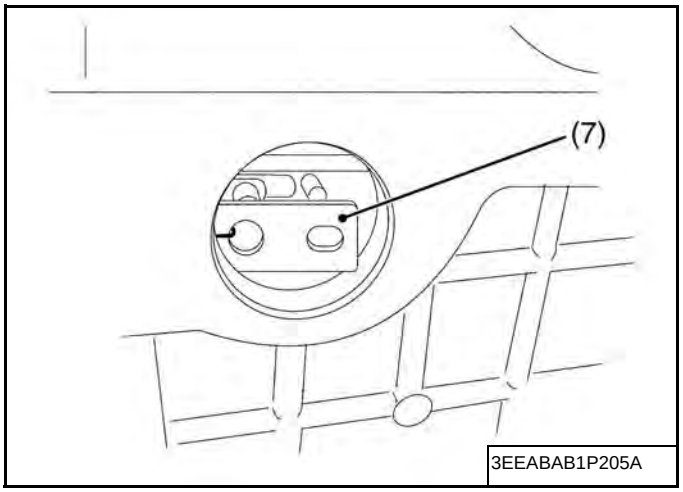
Unhook the start spring (Item 4) from the rack pin (Item 5) **[Figure 70-70-8]** of injection pump assembly.

Remove the nut (Item 6) **[Figure 70-70-8]**.

NOTE: Be careful not to drop the nut inside.

NOTE: (See Fuel Injection Pump Removal And Installation on Page 70-70-8.) for proper alignment of the governor connection rod procedure. The procedure will require a special tool part number MEL1637.

Figure 70-70-9



Slide off the governor connecting rod (Item 7) **[Figure 70-70-9]** from the rack pin of injection pump assembly.

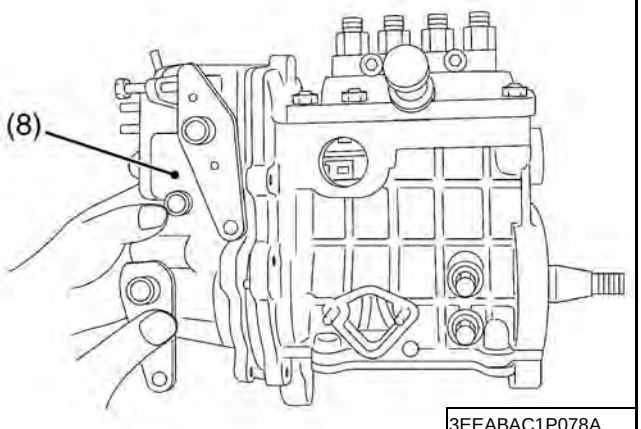
For convenient sake, temporarily hook the start spring on the rack pin hole of the governor connecting rod.

Remove the governor housing mounting bolts.

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Injection Pump Governor Housing Removal And Installation (Cont'd)

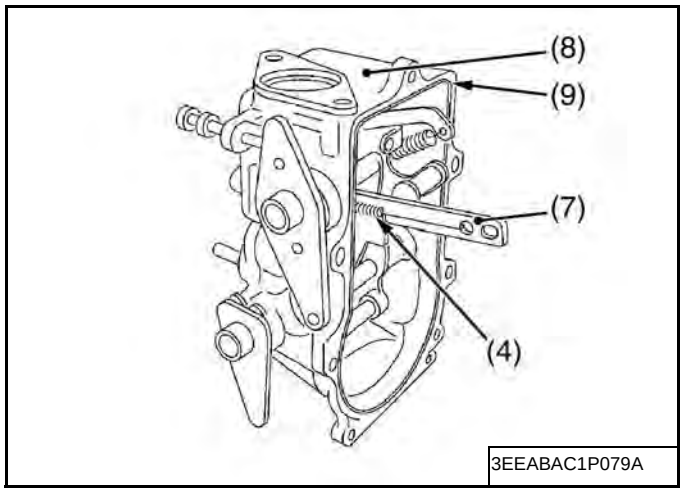
Figure 70-70-10



Detach the governor housing assembly (Item 8) **[Figure 70-70-10]** from the injection pump unit.

NOTE: The injection pump unit is lubricated with engine oil. Oil will leak when the governor housing is removed from the injection pump.

Figure 70-70-11



When reassembling the inside parts, put the oil on each inside part slightly.

After sliding on the governor connecting rod to the rack pin, tighten the nut with the specified torque with using the jig for keeping the control rod horizontal.

After tightening the nut, hook the start spring on the rack pin.

Check the movement of control rack of injection pump assembly by the stop lever.

NOTE: When installing the governor housing assembly to the injection pump unit, be careful not to damage O-ring (Item 9) [Figure 70-70-11].

NOTE: When linking the control rod to the rack pin of injection pump, use the jig for keeping the control rod horizontal. Otherwise the control rack may be stuck, and causes to be difficult to start the engine or hunting of governor.

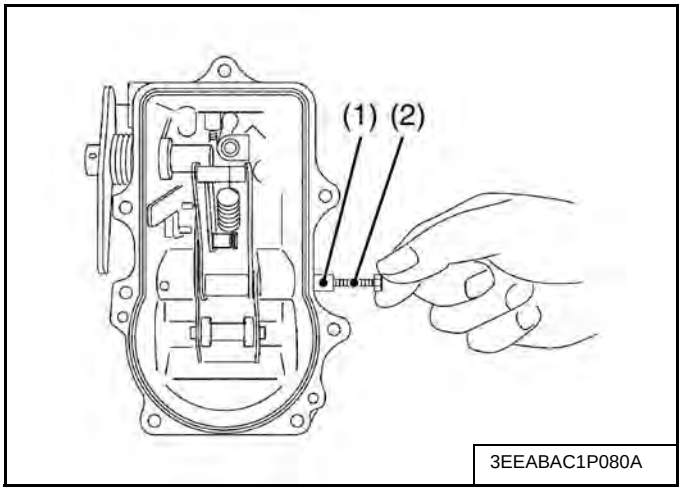
Tightening torque	Governor housing mounting bolt	9.8 to 11.3 N•m 1.00 to 1.15 kgf·m 7.23 to 8.32 ft.-lb.
	Anti-rotation nut	3.43 N•m 0.35 kgf·m 2.5 ft.-lb.

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Injection Pump Governor Housing Disassembly And Assembly

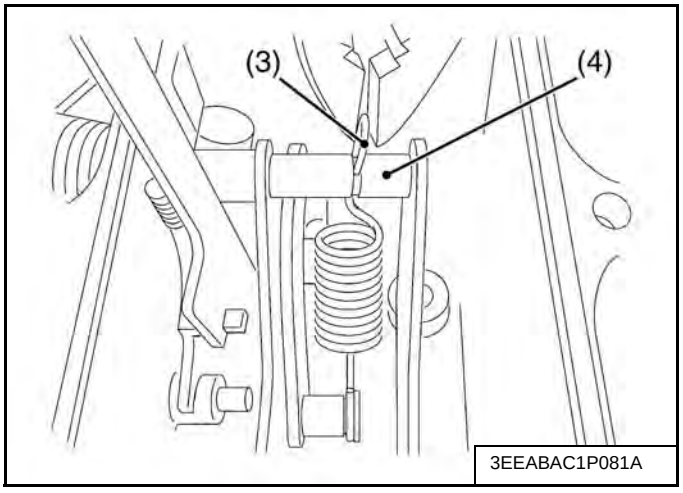
Fork Lever

Figure 70-70-12



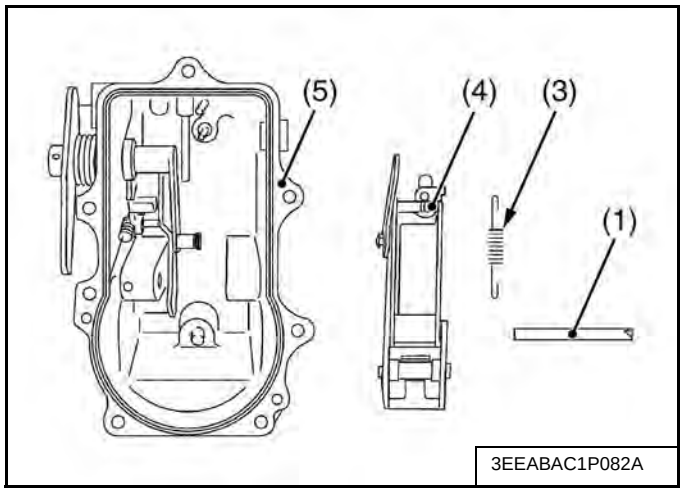
Pull off the governor for lever shaft (Item 1) with the extra bolt (Dia.: 4 mm, Pitch: 0.7 mm, Length: more than 25 mm) (Item 2) **[Figure 70-70-12]**.

Figure 70-70-13



Unhook the governor spring (Item 3) at the governor fork lever (Item 4) **[Figure 70-70-13]** side.

Figure 70-70-14



Remove the governor fork lever assembly from the governor housing (Item 5) **[Figure 70-70-14]**.

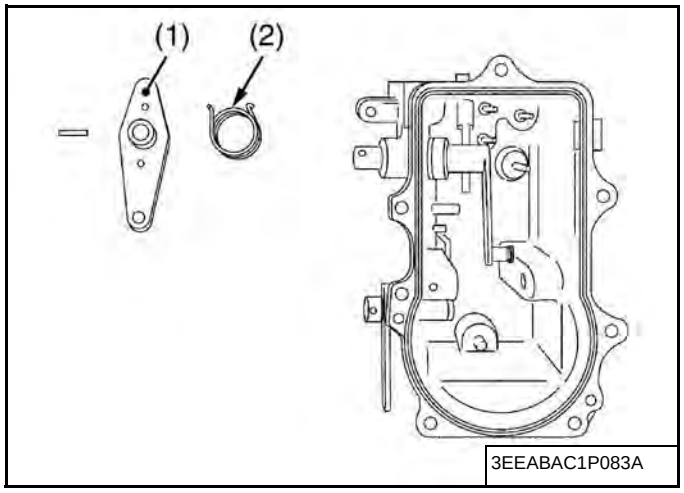
After reassembling the governor housing assembly, check the movement of the governor fork lever assembly, the speed control lever and the stop lever.

NOTE: When assembling the inside parts, put the oil on each inside part slightly.

NOTE: Be careful not to deform the start spring.

Speed Lever

Figure 70-70-15



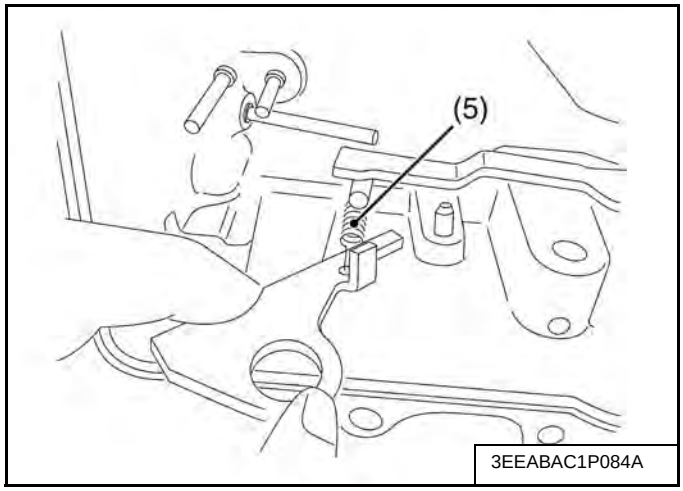
Remove the speed control lever (Item 1) and the return spring (Item 2) **[Figure 70-70-15]**.

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Injection Pump Governor Housing Disassembly And Assembly (Cont'd)

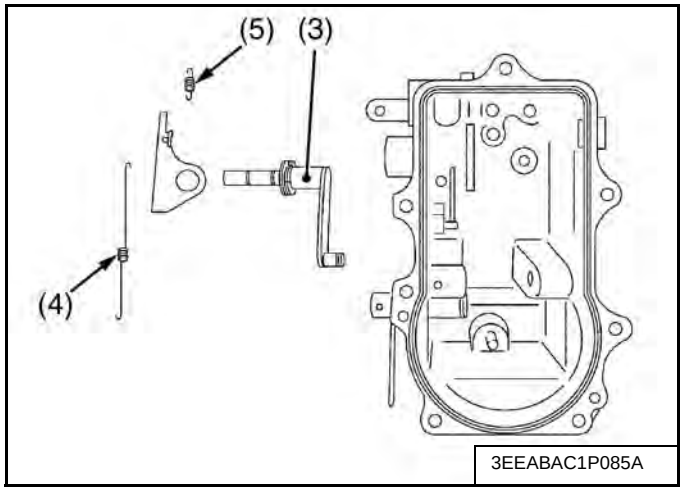
Governor Fork

Figure 70-70-16



Remove the governor lever assembly (Item 3) **[Figure 70-70-16]** from the governor housing.

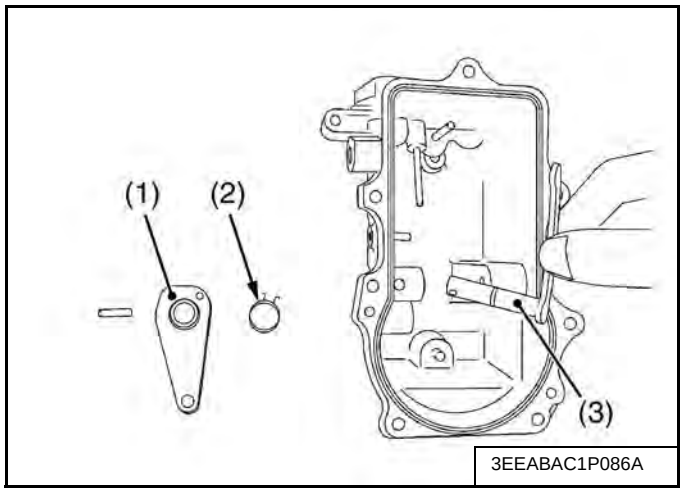
Figure 70-70-17



Remove the start spring (Item 4) and the stop spring (Item 5) **[Figure 70-70-17]**

Stop Lever

Figure 70-70-18



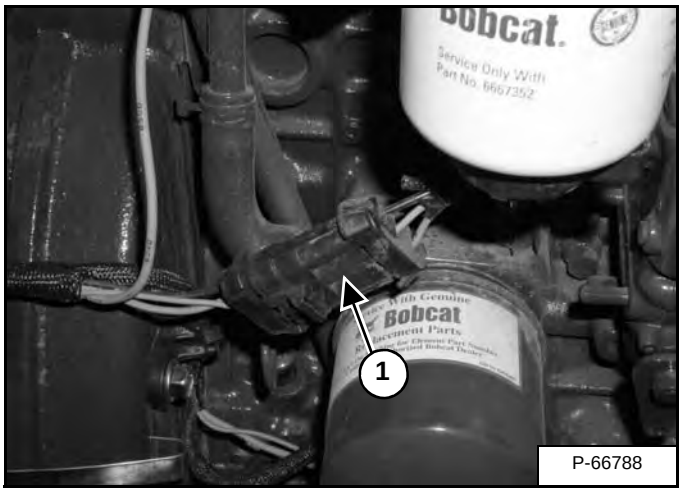
Remove the stop lever (Item 1) and the return spring (Item 2) **[Figure 70-70-18]**.

Remove the stop lever shaft (Item 3) **[Figure 70-70-18]**.

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Fuel ShutOff Solenoid - Checking

Figure 70-70-19

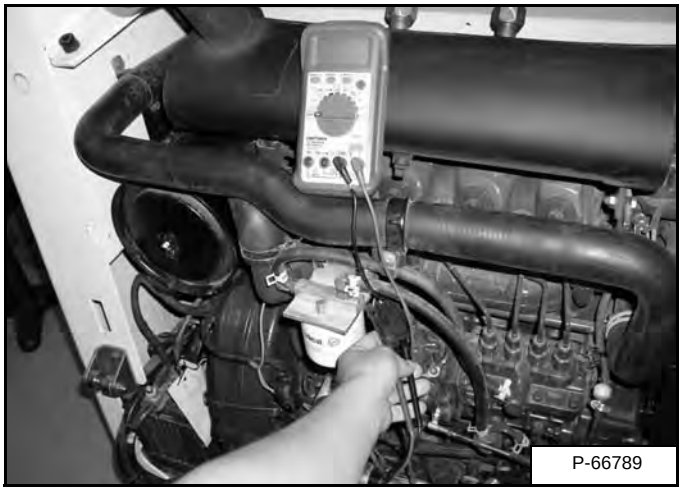


Stop the engine. The fuel shutoff solenoid connector is located between the fuel filter and the oil filter.

Disconnect the fuel shutoff solenoid connector (Item 1) **[Figure 70-70-19]**.

Use an ohmmeter to check the fuel shutoff solenoid.

Figure 70-70-20

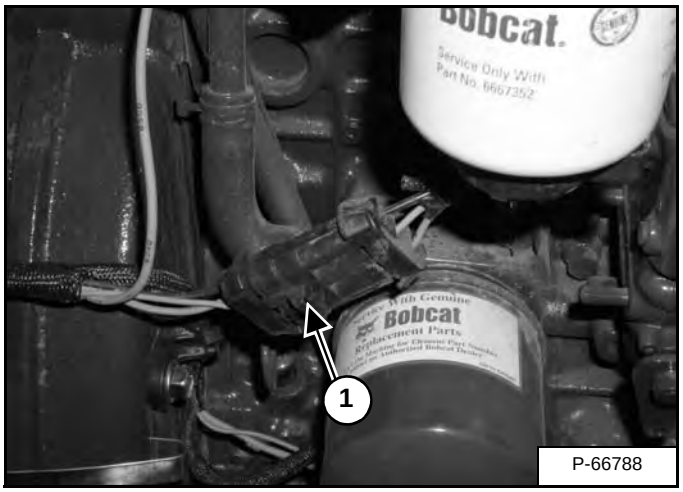


The reading between electrical connector terminal C and terminal A must be approximately 15.6 ohms **[Figure 70-70-20]**.

The reading between electrical connector terminal C and terminal B must be approximately 0.35 to 0.40 ohms.

Fuel ShutOff Solenoid - Removal And Installation

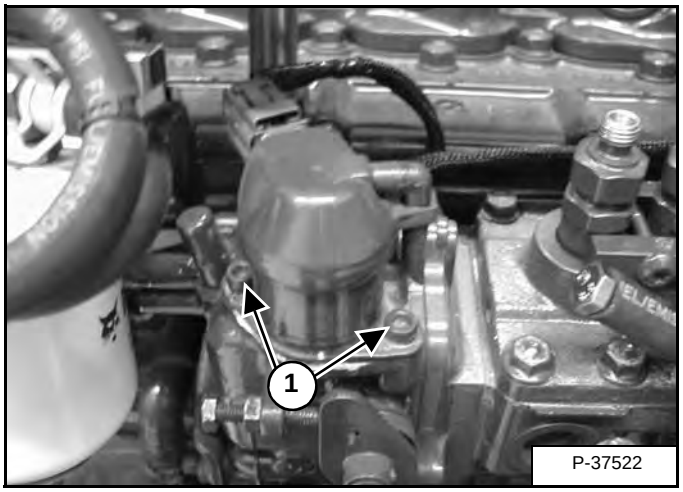
Figure 70-70-21



Stop the engine. The fuel shutoff solenoid connector is located between the fuel filter and the oil filter.

Disconnect the fuel shutoff solenoid connector (Item 1) **[Figure 70-70-21]**.

Figure 70-70-22

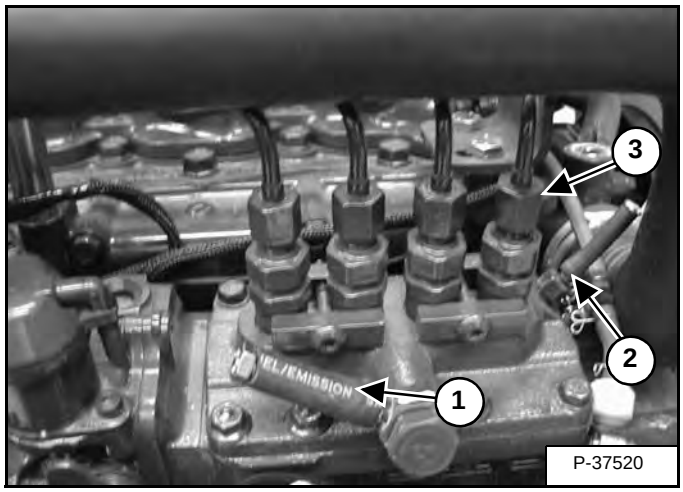


Remove the two mounting bolts (Item 1) **[Figure 70-70-22]** from the fuel stop solenoid. Remove the solenoid from the injection pump.

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Fuel Injection Pump Removal And Installation

Figure 70-70-23



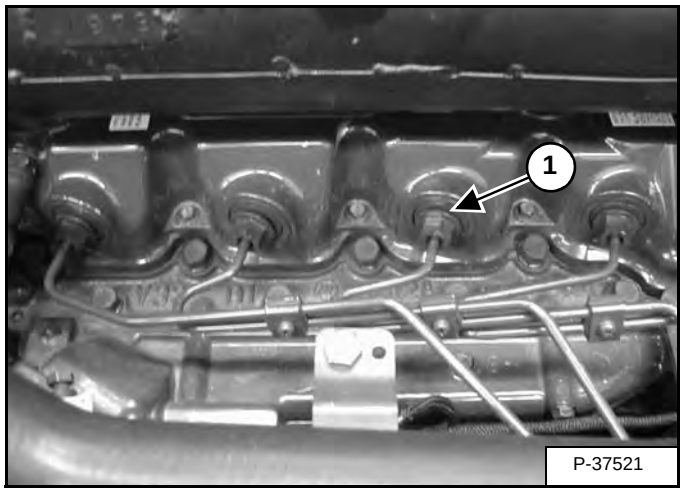
NOTE: The injection pump must be removed as a complete unit. Do Not remove individual pump barrels. If individual pump barrels are removed, the pump must be recalibrated in a certified injection shop.

NOTE: The injection pump can be replaced with the engine crankshaft in any position.

Disconnect and plug the fuel hose (Item 1) and fuel overflow hose (Item 2) **[Figure 70-70-23]**.

Disconnect the four injection lines (Item 3) **[Figure 70-70-23]** at the injection pump.

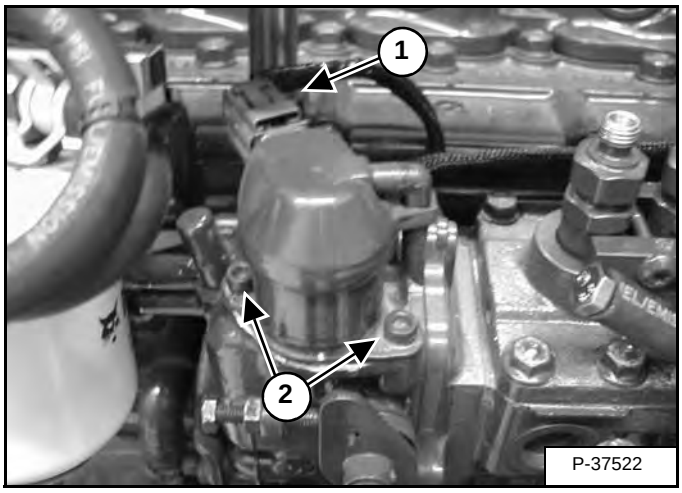
Figure 70-70-24



Disconnect the four injection lines (Item 1) **[Figure 70-70-24]** at the injectors.

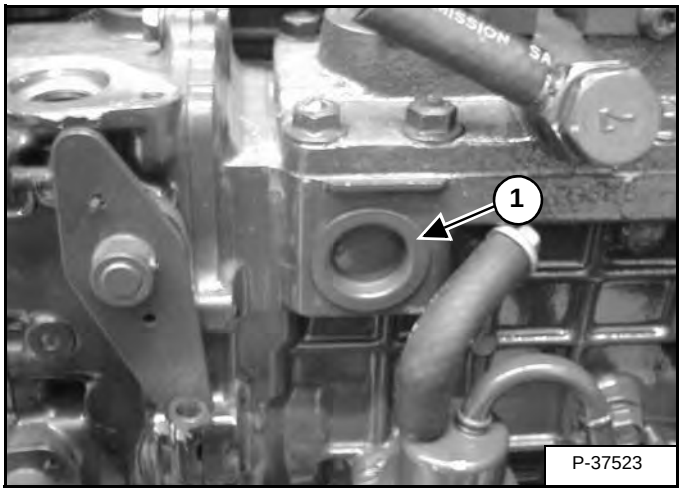
Remove the injection lines from the loader.

Figure 70-70-25



Disconnect the electrical connector (Item 1) from the fuel stop solenoid. Then remove the two mounting bolts (Item 2) **[Figure 70-70-25]** from the fuel stop solenoid. Remove the solenoid from the injection pump.

Figure 70-70-26

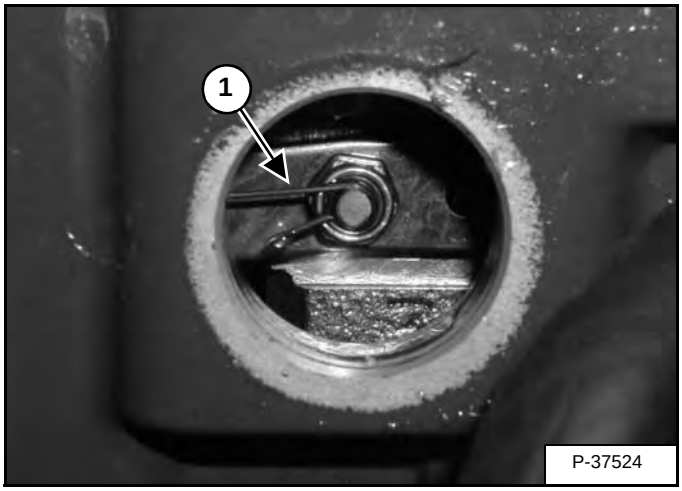


Remove the sight cover (Item 1) **[Figure 70-70-26]** from the injection pump unit.

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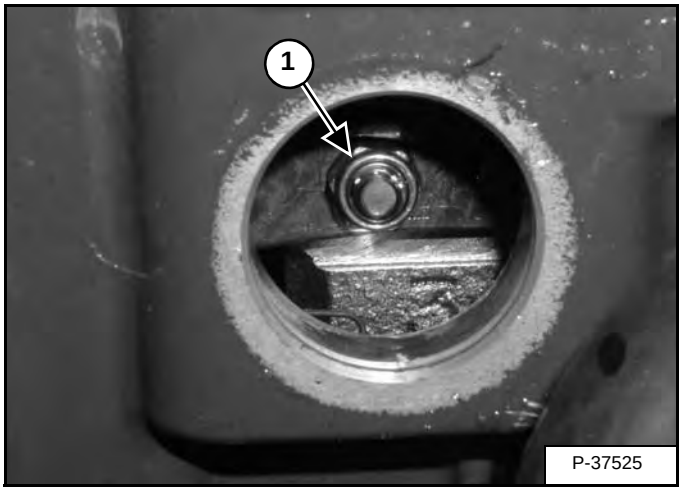
Fuel Injection Pump Removal And Installation (Cont'd)

Figure 70-70-27



Disconnect the starter spring hook (Item 1) **[Figure 70-70-27]**. *(Be careful to not deform the starter spring.)*

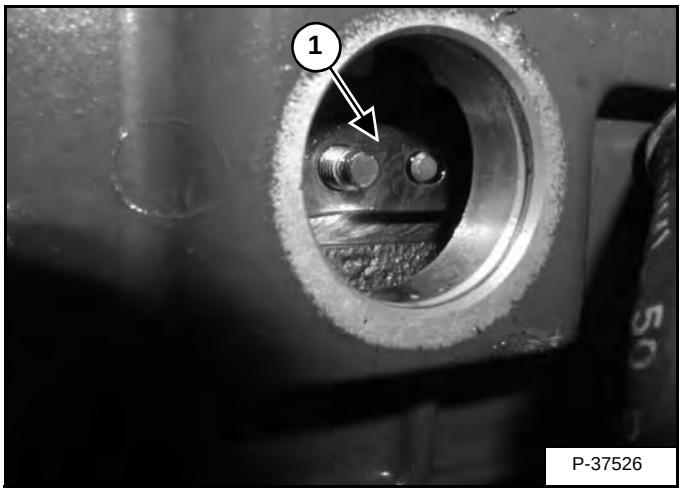
Figure 70-70-28



Remove the control rod nut (Item 1) **[Figure 70-70-28]**. *(Be careful not to drop the control rod nut.)*

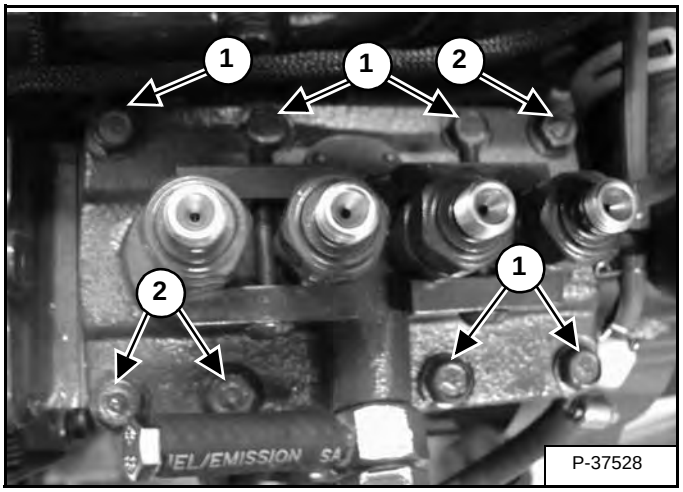
Installation: Tighten the control rod nut to 24-36 in.-lb. (3-4 N•m) torque.

Figure 70-70-29



Disconnect the control rod (Item 1) **[Figure 70-70-29]** from the injection pump.

Figure 70-70-30



Remove the five injection pump mounting bolts (Item 1) **[Figure 70-70-30]**.

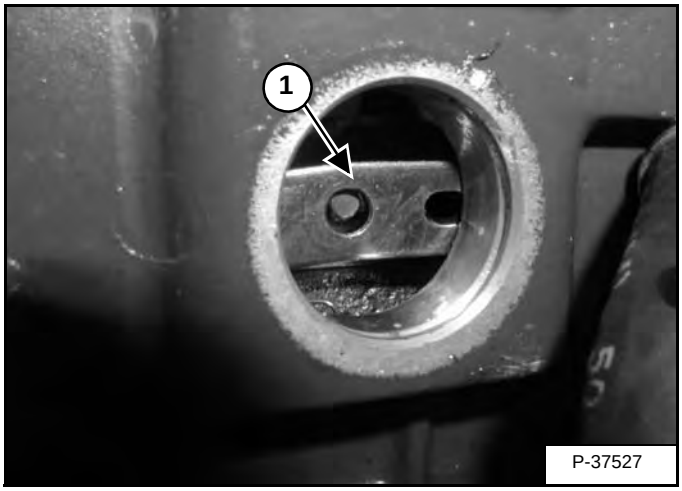
Remove the three injection pump mounting nuts (Item 2) **[Figure 70-70-30]**.

Installation: Tighten the injection pump mounting bolts to 17-20 ft.-lb. (24-28 N•m) torque. Tighten the injection pump mounting nuts to 13-15 ft.-lb. (18-21 N•m) torque.

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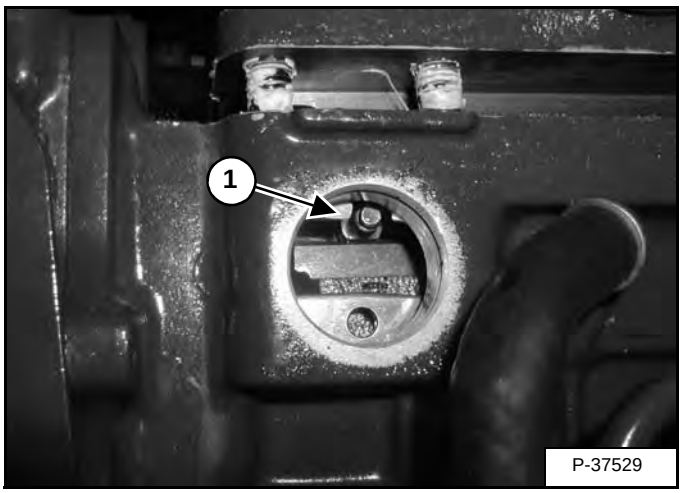
Fuel Injection Pump Removal And Installation (Cont'd)

Figure 70-70-31



With the injection pump mounting bolts and nuts loose, be sure the control rod (Item 1) **[Figure 70-70-31]** clears the pin on the injection pump.

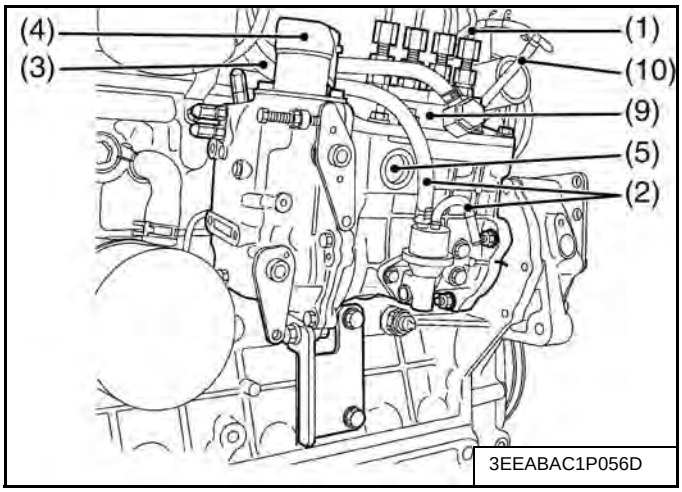
Figure 70-70-32



Align the pin on the injection pump (Item 1) **[Figure 70-70-32]** with the notch in the housing.

Remove the injection pump from the injection pump housing.

Figure 70-70-33



The injection pump can be replaced with the crankshaft in whatever position.

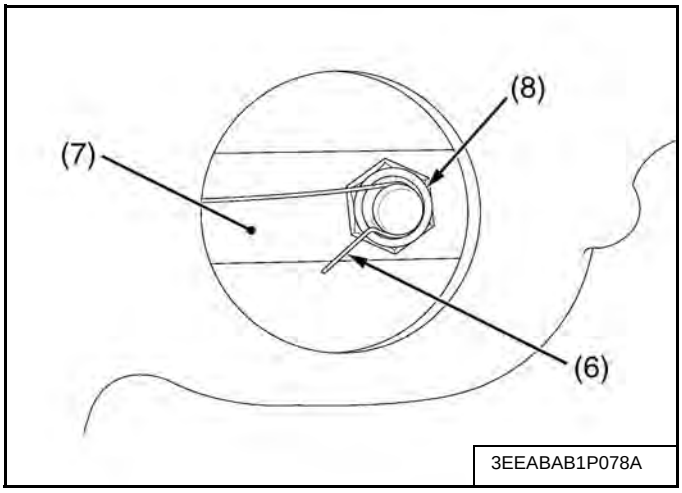
Disconnect all injection pipes (Item 1) **[Figure 70-70-33]**.

Disconnect the fuel pipe (Item 2) and fuel overflow pipe (Item 10) **[Figure 70-70-33]**.

Disconnect the connector (Item 3) from the stop solenoid. Then remove the stop solenoid (Item 4) **[Figure 70-70-33]**.

Detach the sight cover (Item 5) **[Figure 70-70-33]** from the injection pump unit.

Figure 70-70-34

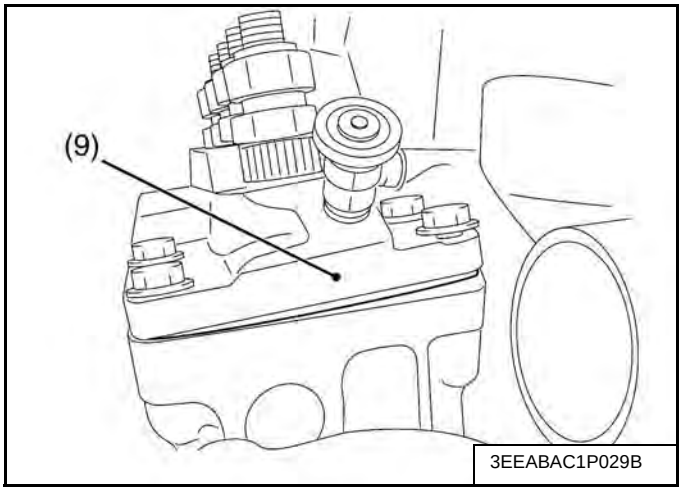


Unhook the start spring (Item 6), and remove the anti-rotation nut (Item 8) **[Figure 70-70-34]**.

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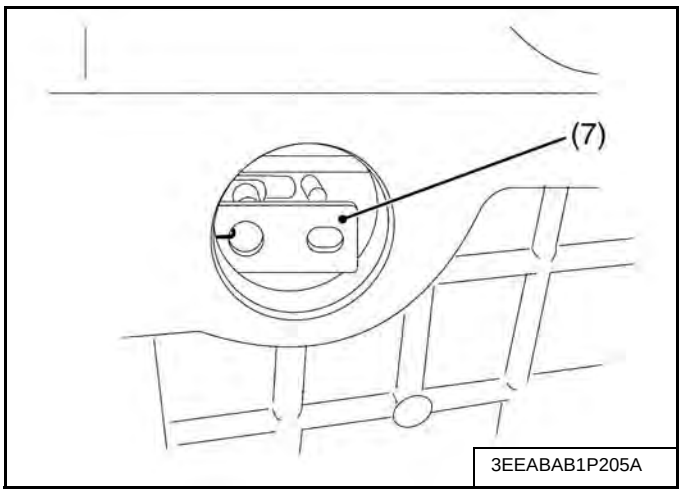
Fuel Injection Pump Removal And Installation (Cont'd)

Figure 70-70-35



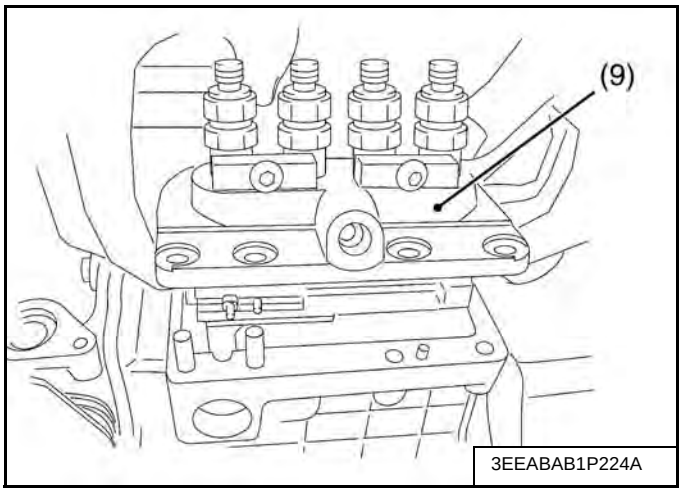
Just loosen the injection pump assembly mounting bolts and nuts, which the injection pump assembly (Item 9) **[Figure 70-70-35]** keeps tilted.

Figure 70-70-36



Slide off the governor connecting rod (Item 7) **[Figure 70-70-36]** from the rack pin of injection pump assembly.

Figure 70-70-37



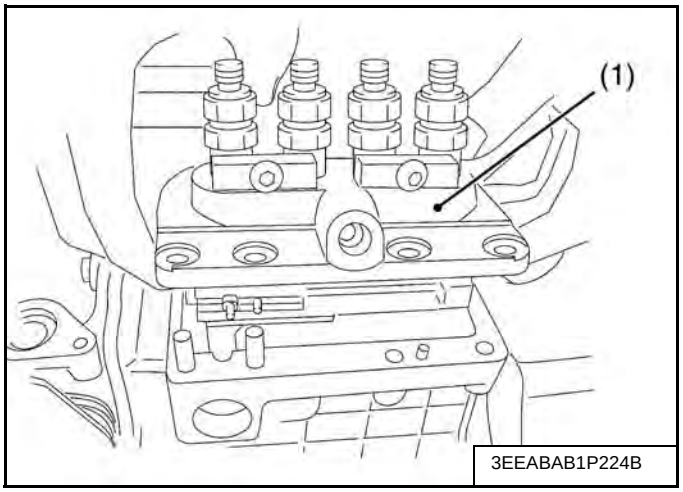
Remove the injection pump mounting bolts and nuts completely and take out the injection pump assembly (Item 9) **[Figure 70-70-37]**.

NOTE: Be careful not to drop the anti-rotation nut.

NOTE: Be careful not to deform the start spring.

NOTE: When taking out the injection pump assembly, be careful not to hit it against the governor connecting rod.

Figure 70-70-38



Install the injection pump assembly (Item 1) in the unit, and tighten the mounting bolts and nuts, which the injection pump assembly (Item 1) **[Figure 70-70-38]** keeps tilted.

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Fuel Injection Pump Removal And Installation (Cont'd)

Figure 70-70-39

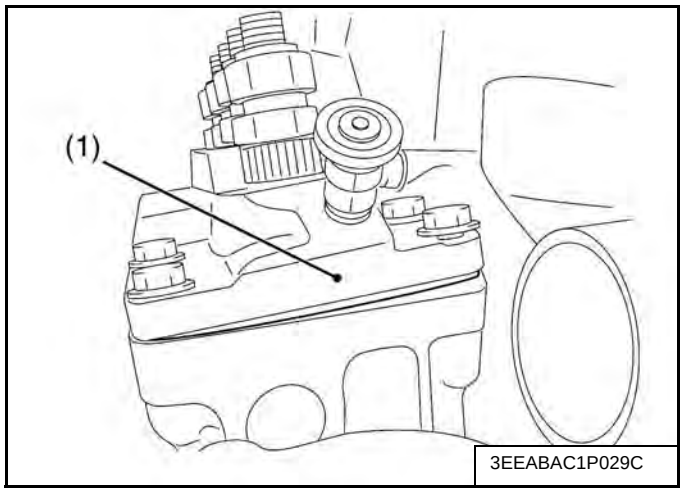
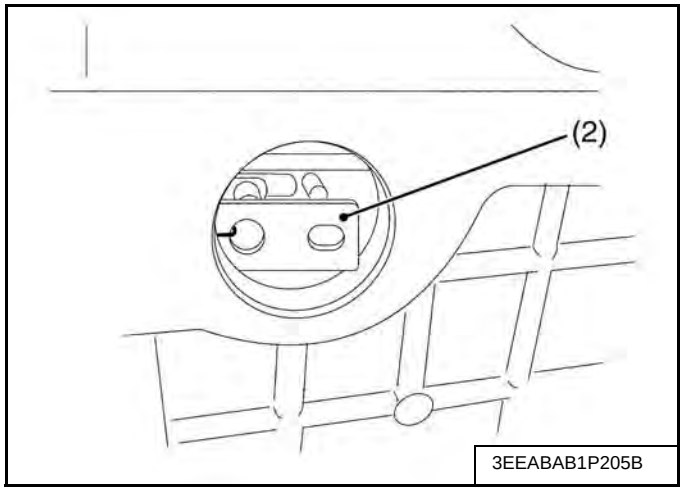


Figure 70-70-40



Hook the governor connecting rod (Item 2) **[Figure 70-70-40]** to the rack pin of the injection pump assembly (Item 1) **[Figure 70-70-39]**.

Tighten the mounting bolts and nuts with the specified torque, not to slide off the governor connecting rod (Item 2) **[Figure 70-70-40]** from the rack pin.

Figure 70-70-41

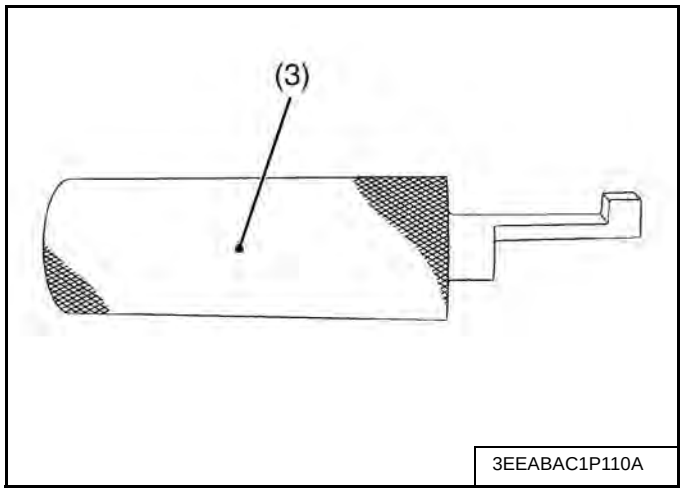
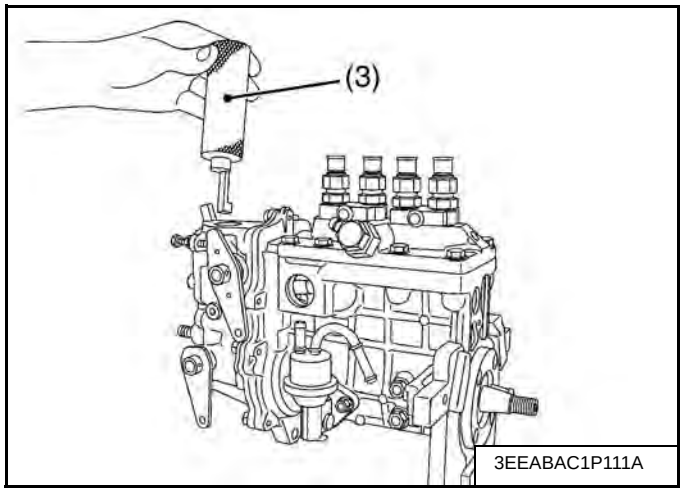


Figure 70-70-42



Place the jig (Item 3) **[Figure 70-70-41]** & **[Figure 70-70-42]** in the stop solenoid mounting hole of the injection pump unit.

NOTE: The tool (JIG) part number is MEL1637 for the governor connection rod alignment tool (Item 3) [Figure 70-70-41].

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Fuel Injection Pump Removal And Installation (Cont'd)

Figure 70-70-43

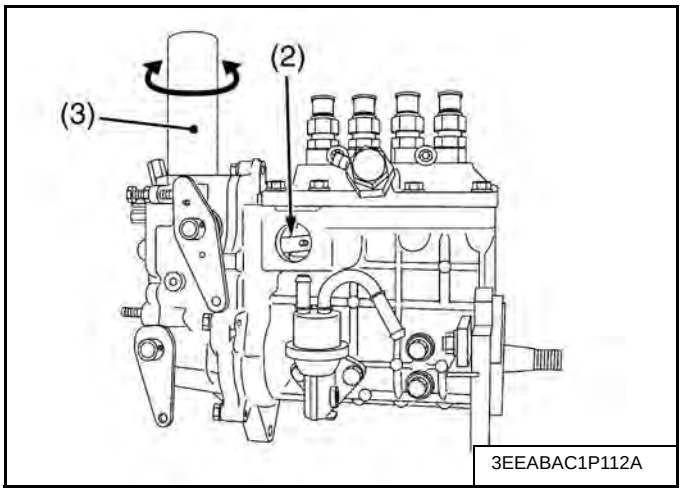


Figure 70-90-44

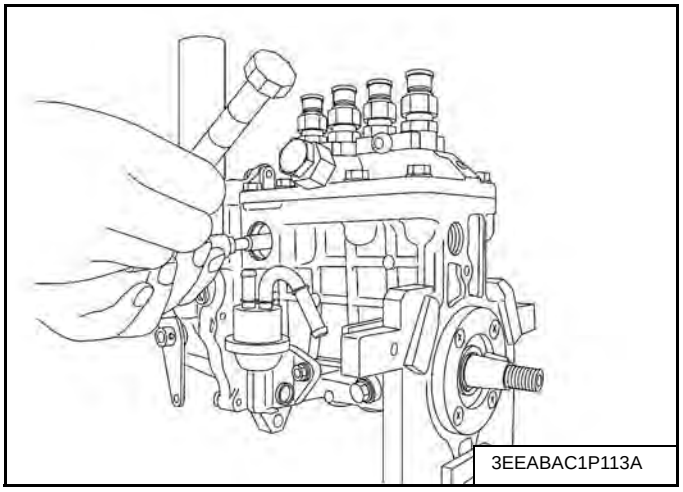
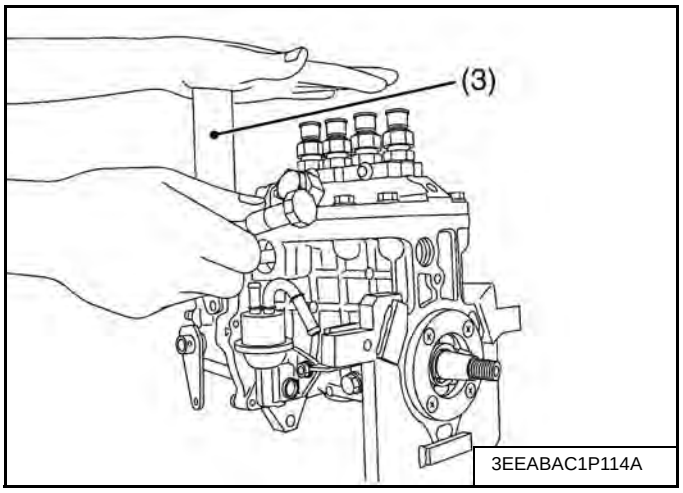


Figure 70-90-45

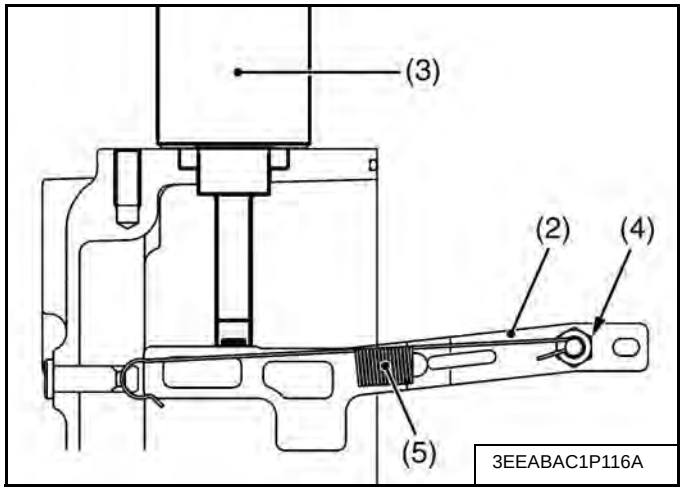


Make sure the permanent magnet at the top of the jig (Item 3) is attracted to the governor connecting rod (Item 2). To do this, turn the jig a little clockwise and counterclockwise and look into the sight cover hole to see if the governor connecting rod (Item 2) **[Figure 70-70-43]** moves right and left accordingly **[Figure 70-90-44]** & **[Figure 70-90-45]**.

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Fuel Injection Pump Removal And Installation (Cont'd)

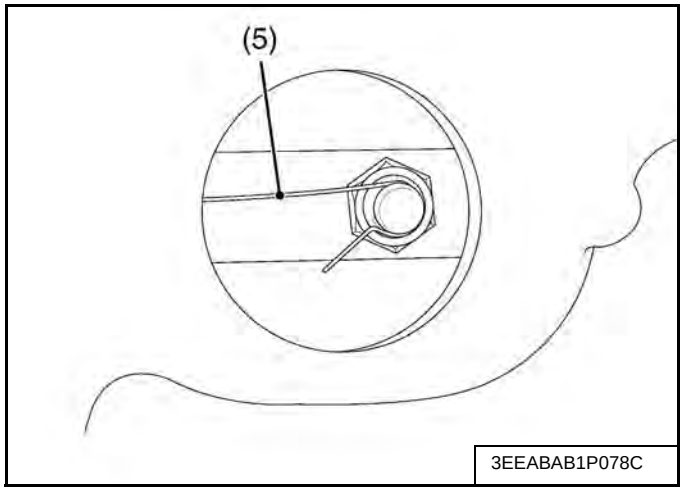
Figure 70-70-46



Slightly tighten the anti-rotation nut (Item 4) **[Figure 70-70-46]** of the governor connecting rod.

Holding down the jig by hand, tighten up the anti-rotation nut to the specified torque.

Figure 70-70-47



Hook the start spring (Item 5) **[Figure 70-70-47]** to the rack pin.

Figure 70-90-48

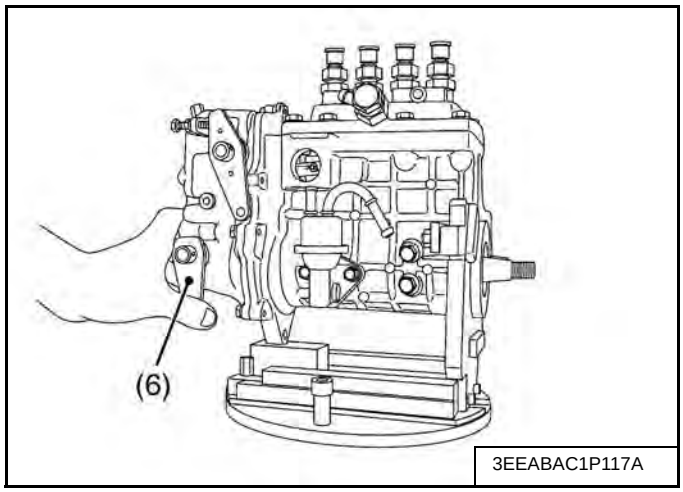
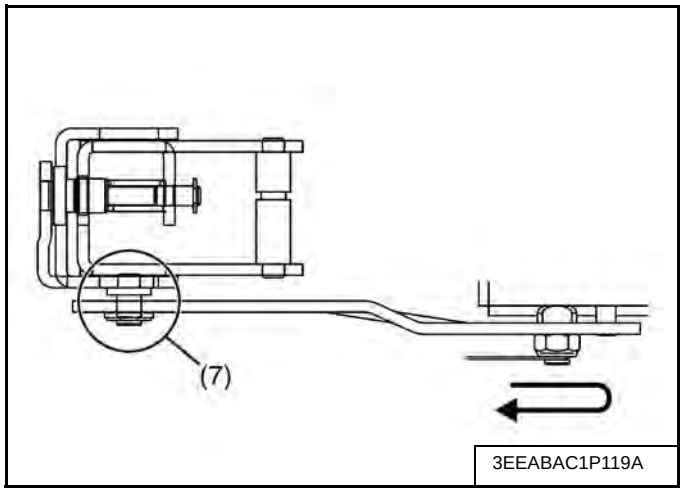


Figure 70-70-49



Move the stop lever (Item 6) **[Figure 70-90-48]** and visually check to see if the fuel injection pump control rack comes smoothly back to the start position by the counter force of the start spring. At the same time, visually check to see if there is no twist in the sliding point (Item 7) **[Figure 70-70-49]** between the governor fork lever and the governor connecting rod from the stop solenoid mounting hole.

If the control rack fails to move back smoothly, remove the start spring and the anti-rotation nut, and go through the above procedure starting with **[Figure 70-70-41]**.

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Fuel Injection Pump Removal And Installation (Cont'd)

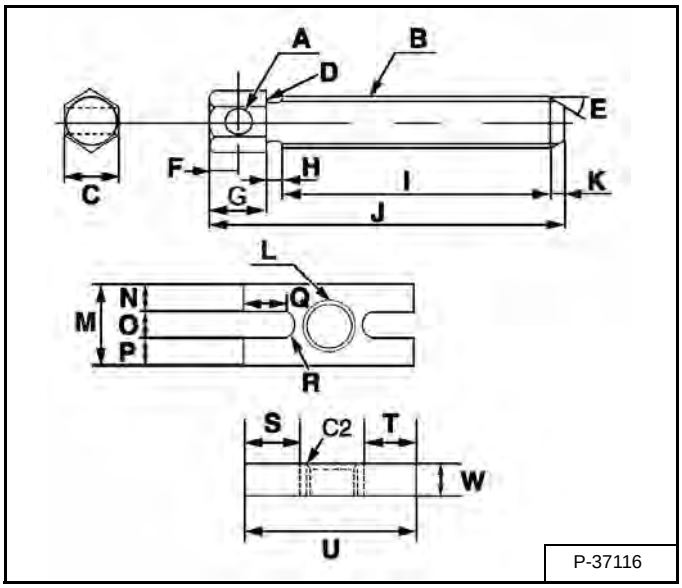
Finally fit the sight cover and the stop solenoid back into place.

Tightening torque	Injection pump mounting bolt and nut	Bolt	23.5 to 27.5 N•m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft.-lb.
		Nut	17.7 to 20.6 N•m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft.-lb.
	Anti-rotation nut		3.43 N•m 0.35 kgf·m 2.5 ft.-lb.

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Fuel Injection Pump Housing Removal

Figure 70-70-50

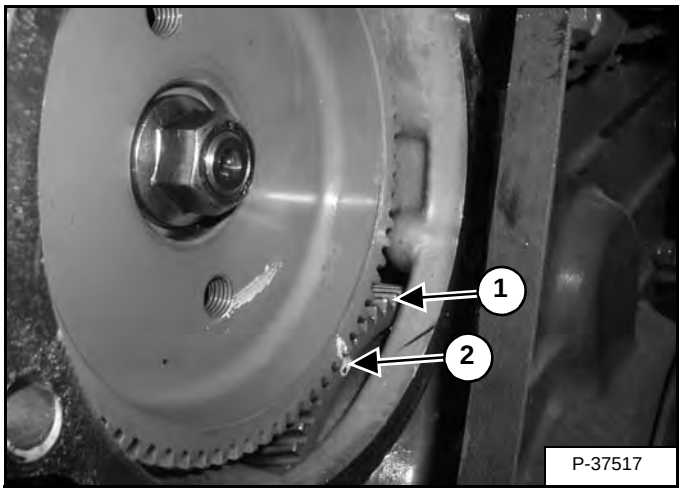


Injection Pump Gear Puller

Application: Use this puller for removing the injection pump gear from the governor shaft.

A	10 mm (0.39 in. dia.)
B	M16 x Pitch 1.5
C	19 mm (0.75 in.)
D	0.5 mm radius (0.02 in. radius)
E	0.89 radius (50°)
F	10 mm dia. (0.39 in.)
G	20 mm (0.79 in.)
H	5 mm (0.20 in.)
I	95 mm (3.74 in.)
J	125 mm (4.93 in.)
K	5 mm (0.20 in.)
L	M16 x Pitch 1.5
M	30 mm (1.18 in.)
N	9.5 mm (0.3740 in.)
O	11 mm (0.4331 in.)
P	9.5 mm (0.3740 in.)
Q	15.5 mm (0.6102 in.)
R	4.5 mm radius (0.18 in. radius)
S	20 mm (0.79 in.)
T	20 mm (0.79 in.)
U	80 mm (3.1496 in.)
W	12 mm (0.47 in.)
C2	Chamfer 2.0 mm (0.079 in.)

Figure 70-70-51



Place the piston of the 4th cylinder at the top dead center in the compression stroke. Fix the flywheel with the flywheel stopper bolt.

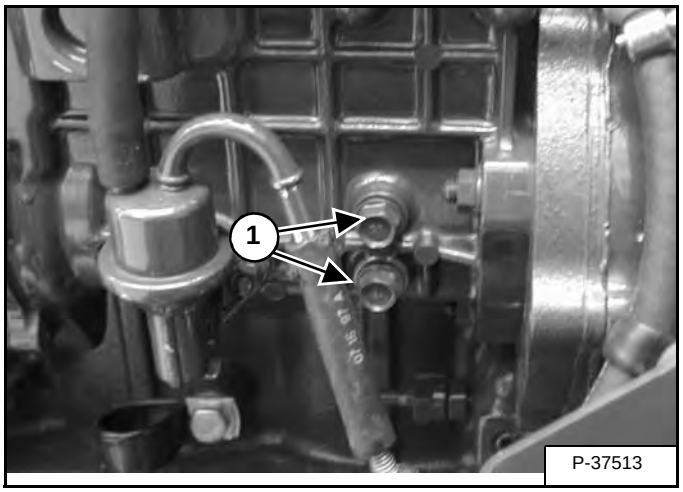
Look for a timing mark on the idler gear (Item 1), if one is not present, mark the engaged tooth (Item 2) **[Figure 70-70-51]** with a white marking pin to aid in reassembly.

If the timing marks are present and aligned the gears do not need to be marked.

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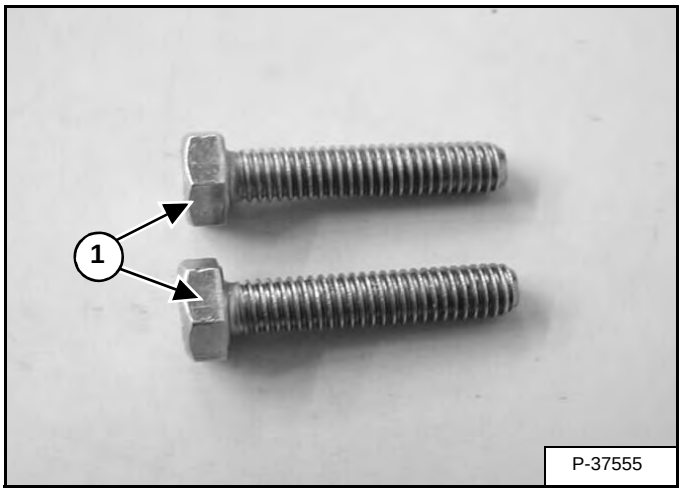
Fuel Injection Pump Housing Removal (Cont'd)

Figure 70-70-52



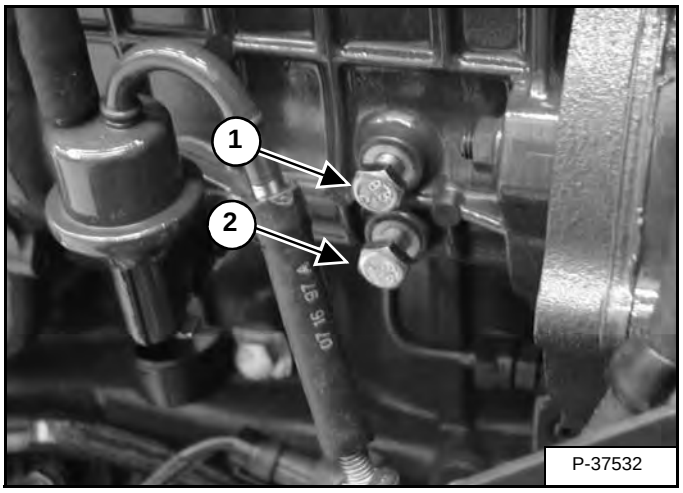
Unscrew the two flange bolts (Item 1) **[Figure 70-70-52]** from the injection pump unit. Have the fuel cam shaft lock bolts at hand.

Figure 70-70-53



The fuel cam shaft lock bolts (Item 1) **[Figure 70-70-53]** are M8 X P1.25 X L30 mm.

Figure 70-70-54

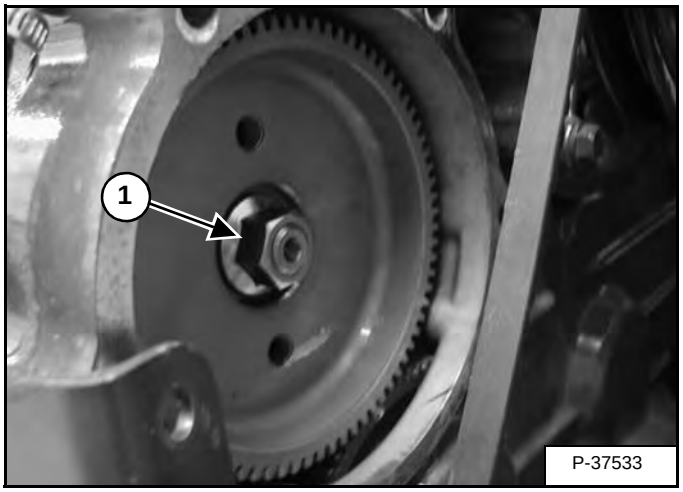


Tighten the upper fuel cam shaft lock bolt (Item 1) **[Figure 70-70-54]** until it comes into contact with the fuel cam shaft. Make sure the cam shaft does not move.

Tighten the lower fuel cam shaft lock bolt (Item 2) **[Figure 70-70-54]** until it comes into contact with the fuel camshaft.

Do not over tighten the lock bolts when they have come in contact with the cam shaft.

Figure 70-70-55

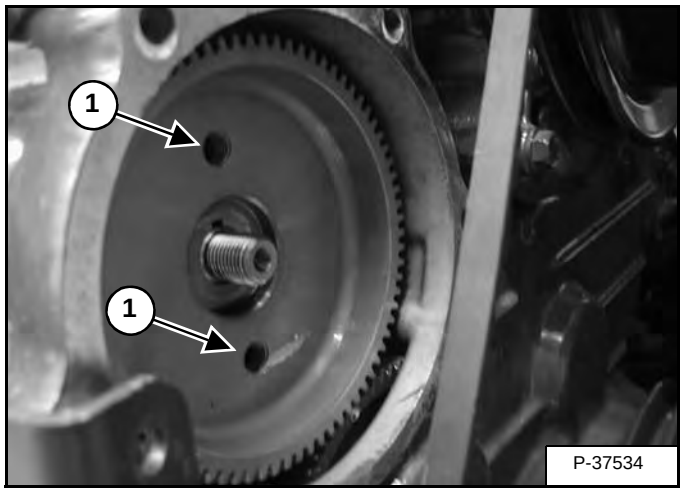


Loosen the injection pump gear mounting nut (Item 1) **[Figure 70-70-55]**.

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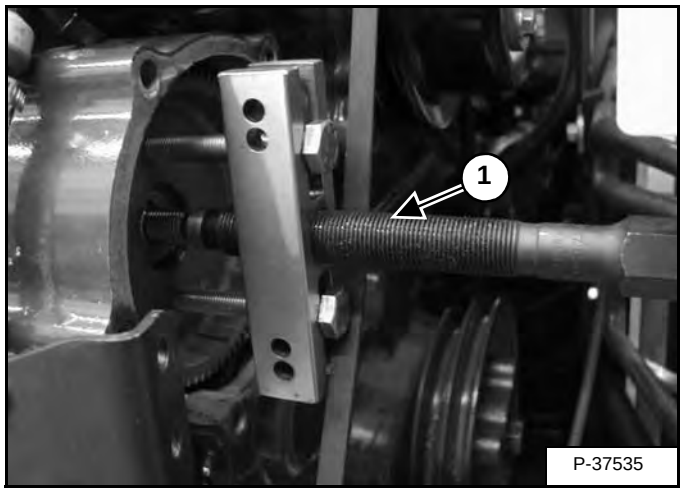
Fuel Injection Pump Housing Removal (Cont'd)

Figure 70-70-56



Install two bolts (M10 X P1.25 X L80 mm) into the two threaded holes (Item 1) **[Figure 70-70-56]** in the injection pump cam gear.

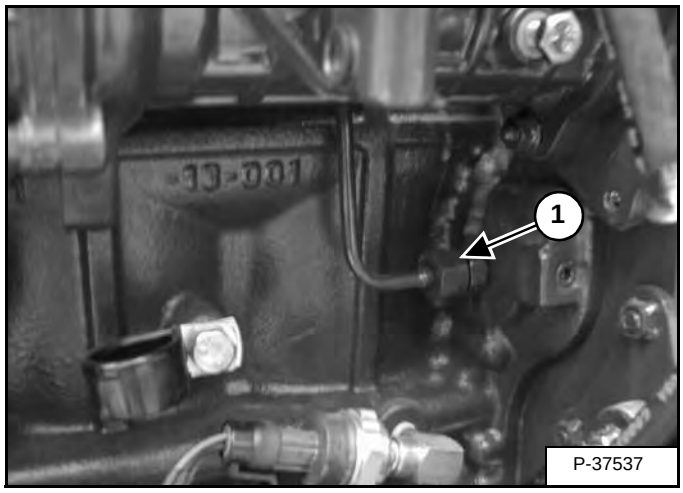
Figure 70-70-57



Install a gear puller (Item 1) **[Figure 70-70-57]** and remove the gear.

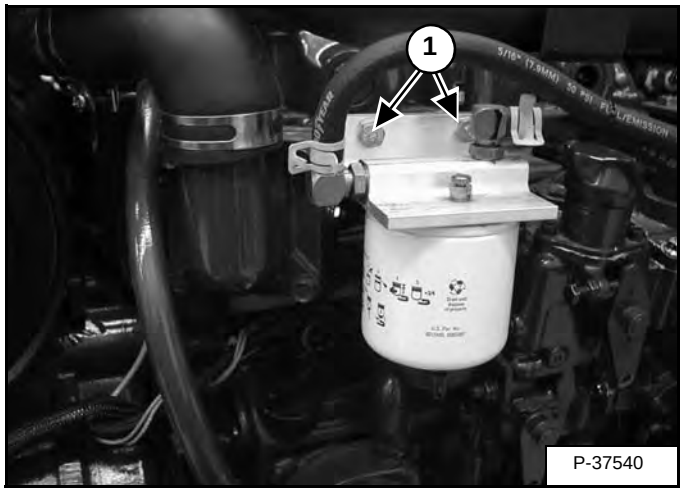
Remove the key from the key way on the injection pump shaft.

Figure 70-70-58



Disconnect the lubricating oil pipe (Item 1) **[Figure 70-70-58]**.

Figure 70-70-59



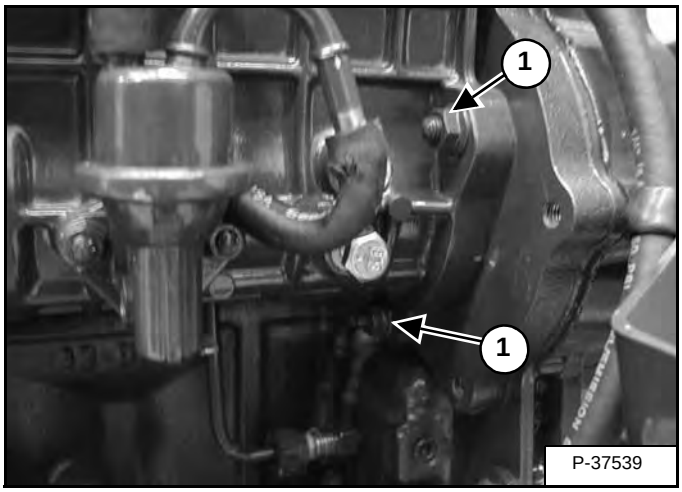
Remove the two mounting bolts (Item 1) **[Figure 70-70-59]** and move the fuel filter, to allow clearance for the injection pump assembly to be removed.

Disconnect the throttle linkage from the injection pump.

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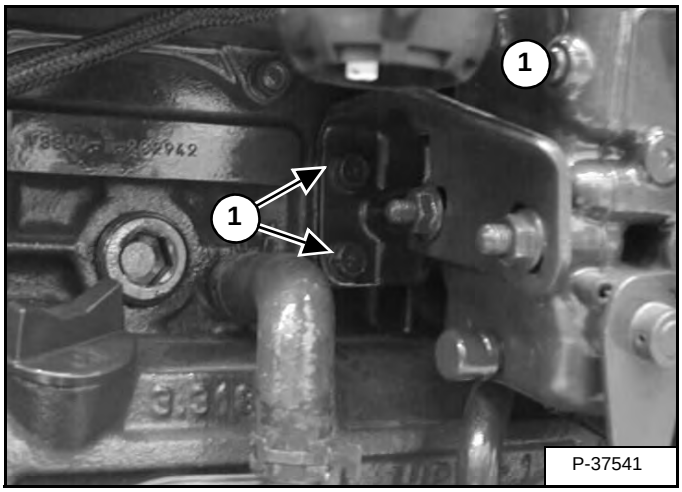
Fuel Injection Pump Housing Removal (Cont'd)

Figure 70-70-60



Remove the three injection pump unit mounting flange nuts (Item 1) **[Figure 70-70-60]**. (Two on the front side and one on the back side of the injection pump.)

Figure 70-70-61



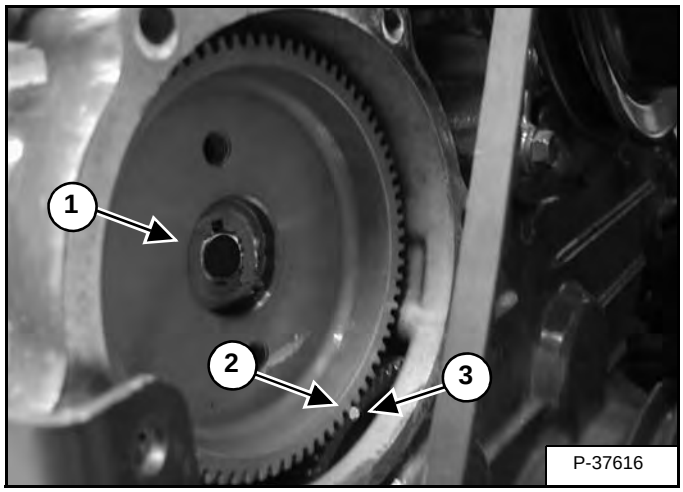
Remove the two injection pump unit support bolts (Item 1) **[Figure 70-70-61]**.

Remove the injection pump unit from the engine.

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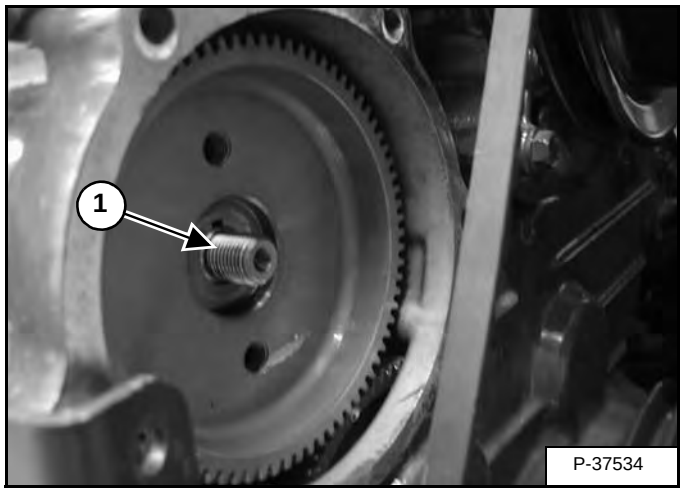
Fuel Injection Pump Housing Installation

Figure 70-70-62



Place the injection pump gear (Item 1) back into the gear case. Align the marks of the injection pump gear (Item 2) and the idle gear (Item 3) **[Figure 70-70-62]**.

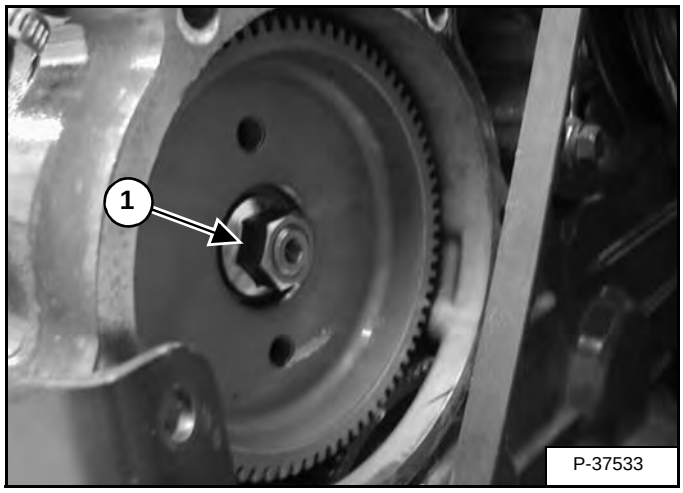
Figure 70-70-63



Install the injection pump unit into the injection pump gear (Item 1) **[Figure 70-70-63]**.

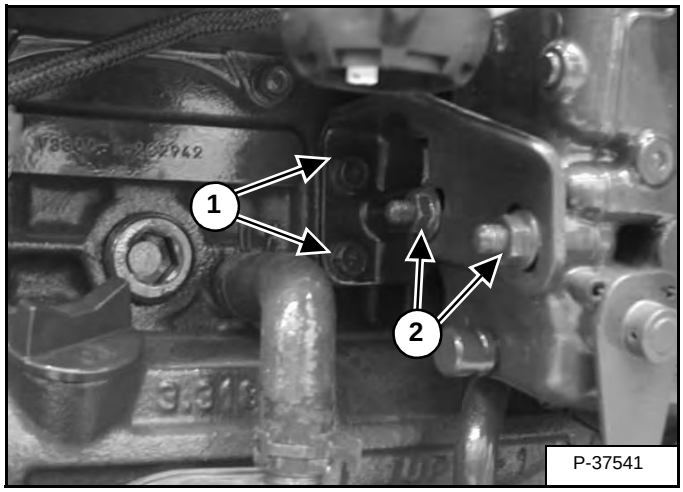
NOTE: When installing the injection pump unit to the injection pump gear, make sure that the key is fit in the keyway of injection pump gear.

Figure 70-70-64



Hand tighten the injection pump gear mounting nut (Item 1) **[Figure 70-70-64]**

Figure 70-70-65



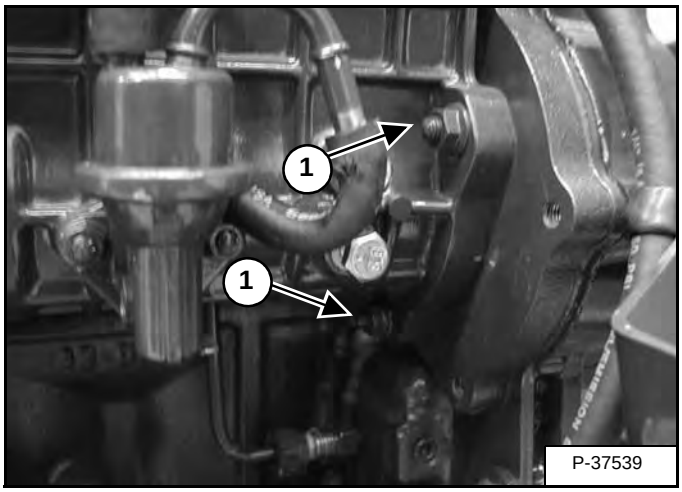
Install the two rear mount bolts (Item 1) **[Figure 70-70-65]** and tighten.

Loosen the two injection pump adjustment bolts (Item 2) **[Figure 70-70-65]**.

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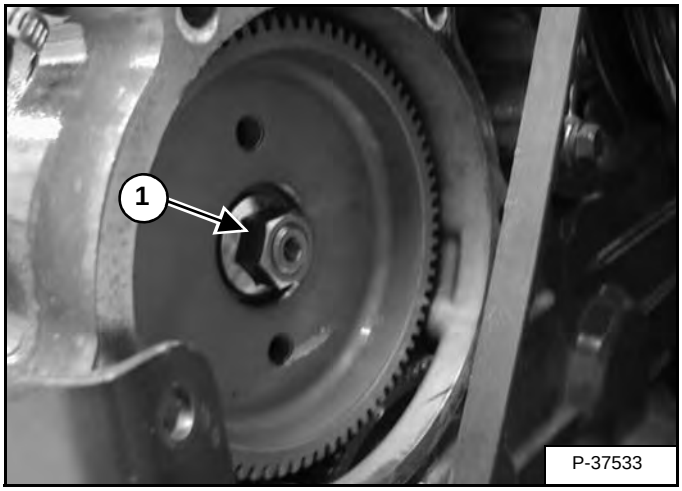
Fuel Injection Pump Housing Installation (Cont'd)

Figure 70-70-66



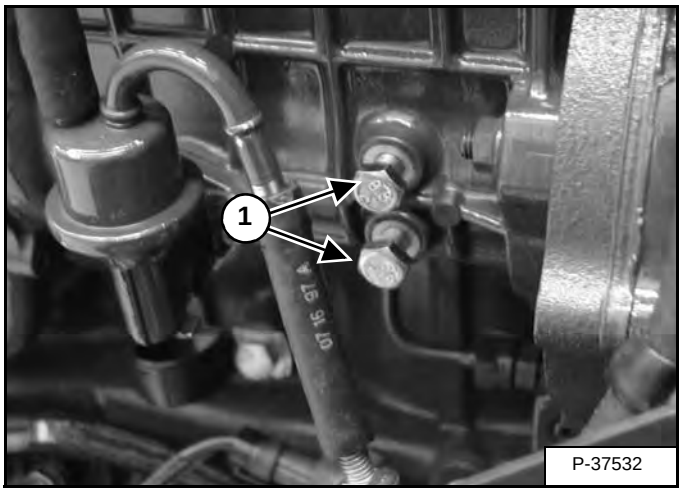
Install the three mounting flange nuts (Item 1) **[Figure 70-70-66]** and finger tighten. (Two on the front side and one on the back side of the injection pump.)

Figure 70-70-67



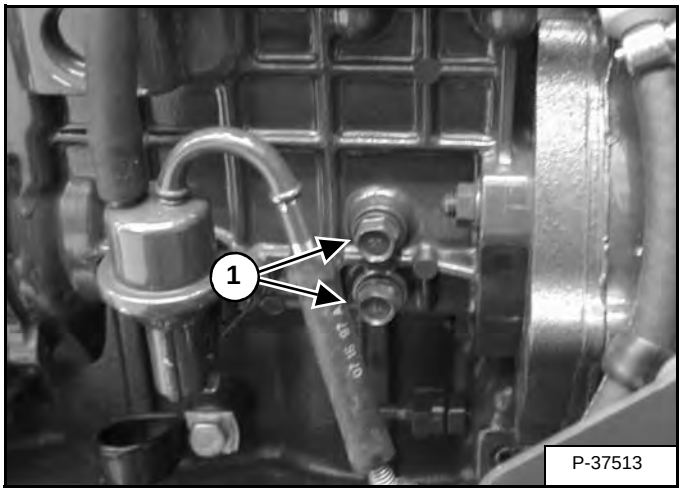
Tighten the injection pump gear nut (Item 1) **[Figure 70-70-67]** to 54 - 62 ft.-lb. (74 - 83 N•m) torque.

Figure 70-70-68



Remove the two fuel camshaft lock bolts (Item 1) **[Figure 70-70-68]**.

Figure 70-70-69

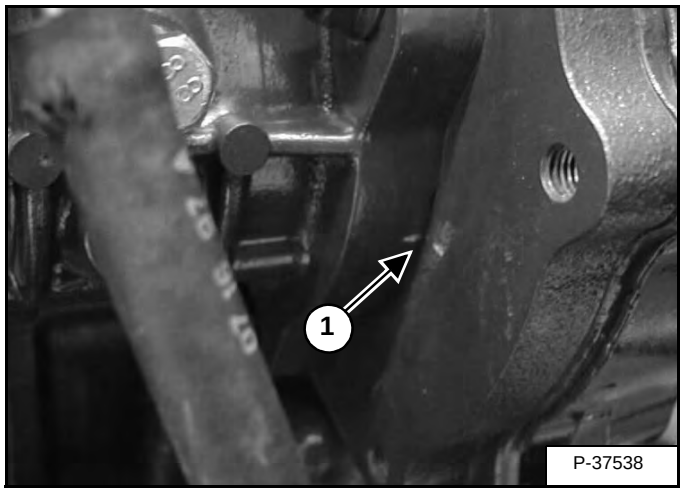


Install the two flange bolts (Item 1) **[Figure 70-70-69]** and tighten to 17-20 ft.-lb. (24-28 N•m) torque.

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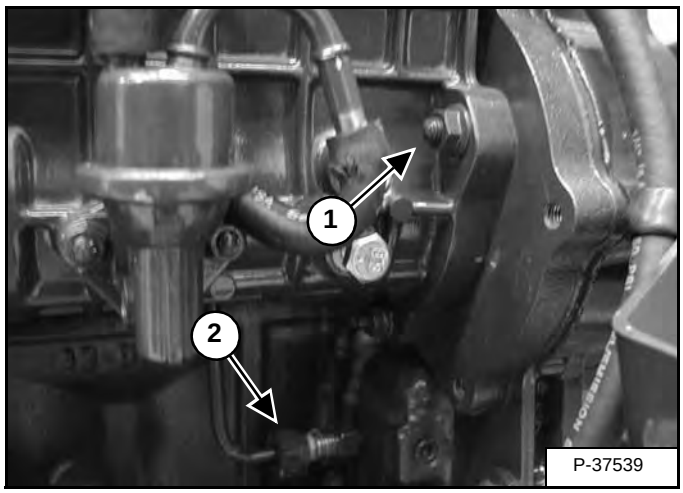
Fuel Injection Pump Housing Installation (Cont'd)

Figure 70-70-70



Move the injection pump unit clockwise (viewed from gearcase side), align the injection timing marks (Item 1) **[Figure 70-70-70]** on the injection pump unit and on the engine gearcase.

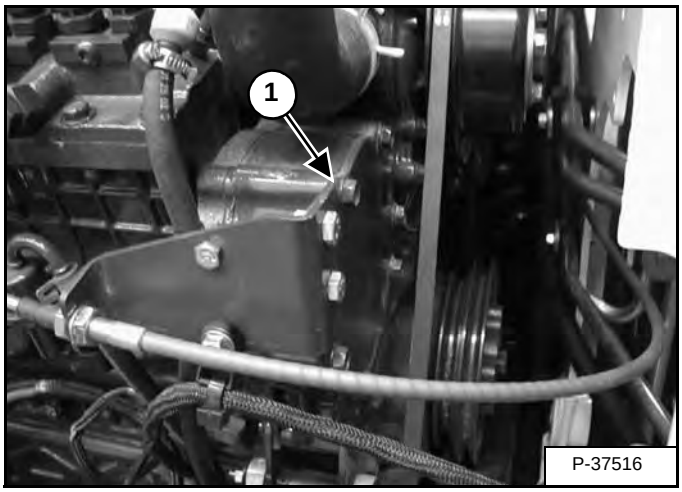
Figure 70-70-71



Tighten the injection pump unit mounting flange nuts (Item 1) **[Figure 70-70-71]** to 17-29 ft.-lb. (24-28 N•m) torque.

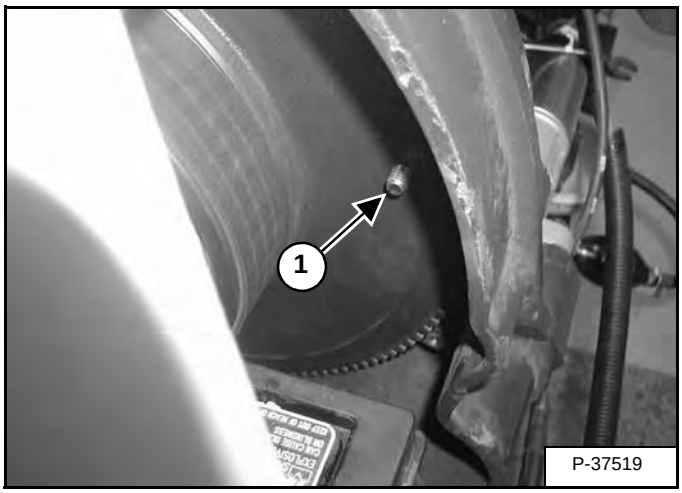
Reconnect the lubricating oil pipe (Item 2) **[Figure 70-70-71]**.

Figure 70-70-72



Install the injection pump gear cover and throttle cable mount bracket, and tighten the eight bolts (Item 1) **[Figure 70-70-72]** to 17- 20 ft.-lb. (24-28 N•m) torque.

Figure 70-70-73



Remove the flywheel pin (Item 1) **[Figure 70-70-73]** from the engine flywheel and flywheel casting.

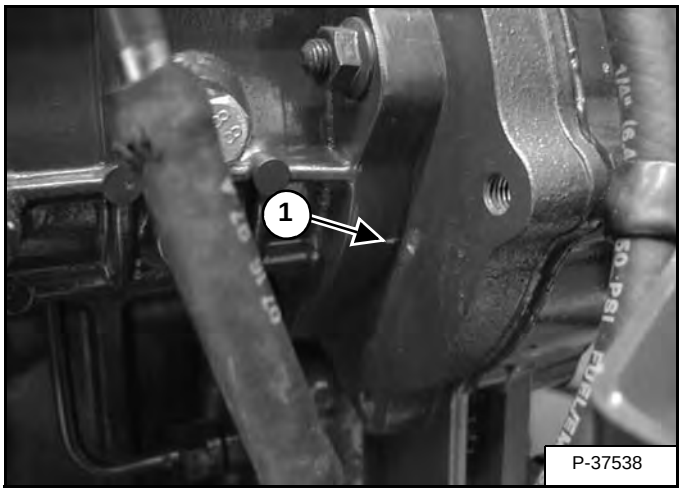
Check the injection timing. (See Injection Pump Timing on Page 70-70-23.)

Install the flywheel cover on the flywheel casting.

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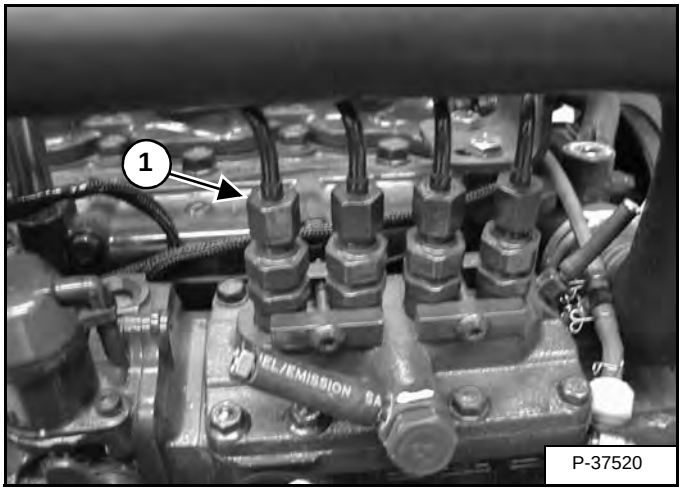
Injection Pump Timing

Figure 70-70-74



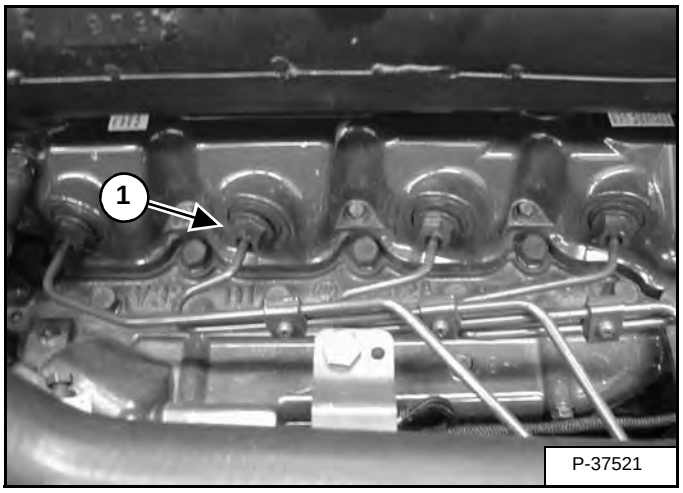
Align the timing mark on the injection pump (Item 1) **[Figure 70-70-74]** with the timing mark on the gearcase housing.

Figure 70-70-75



Disconnect the four injection lines (Item 1) **[Figure 70-70-75]** from the injection pump.

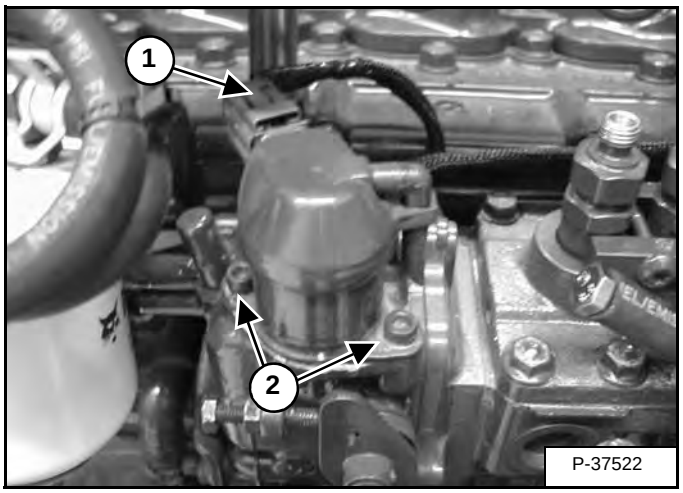
Figure 70-70-76



Disconnect the four injection lines (Item 1) **[Figure 70-70-76]** from the injector.

Remove the injector lines form the engine.

Figure 70-70-77



Disconnect the electrical connector (Item 1) **[Figure 70-70-77]** from the fuel shutoff solenoid.

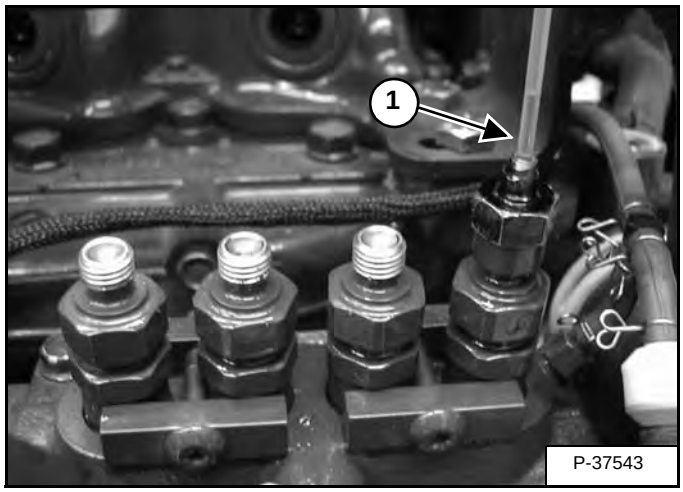
Remove the two mount bolts (Item 2) **[Figure 70-70-77]** from the fuel shutoff solenoid.

Remove the fuel shutoff solenoid from the engine.

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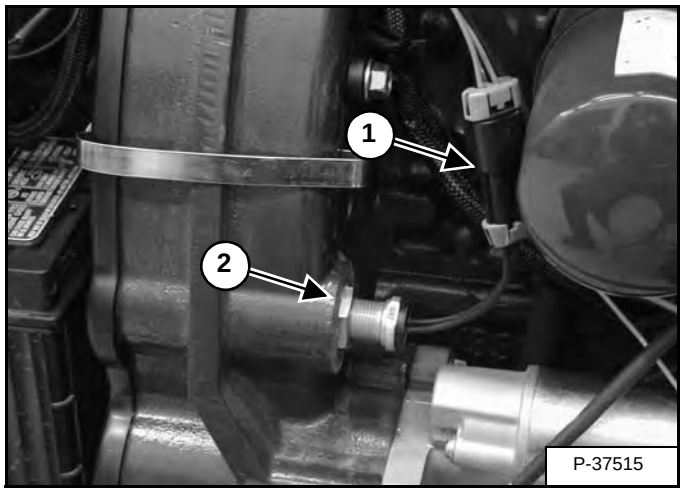
Injection Pump Timing (Cont'd)

Figure 70-70-78



Install a short plastic tube (Item 1) **[Figure 70-70-78]** in the number one cylinder port of the injection pump. The tube should fit securely and point upward.

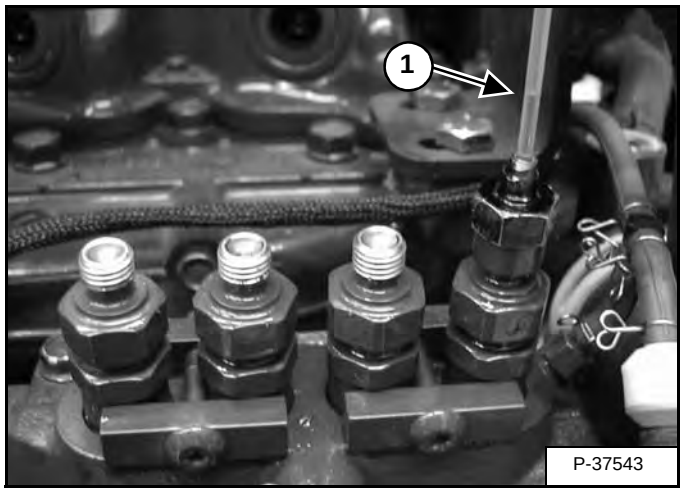
Figure 70-70-79



Disconnect the wiring connector (Item 1) **[Figure 70-70-79]** from the engine speed control sensor.

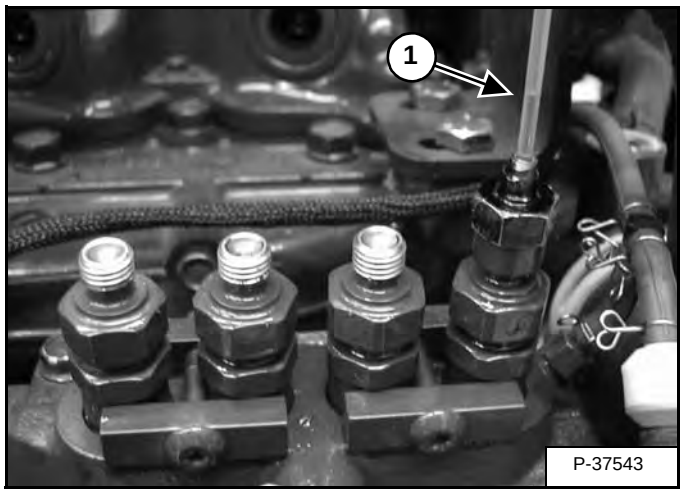
Remove the speed sensor (Item 2) **[Figure 70-70-79]** from the engine.

Figure 70-70-80



Turn the engine counterclockwise (viewed from flywheel end) until the fuel partially fills the plastic tube (Item 1) **[Figure 70-70-80]**.

Figure 70-70-81



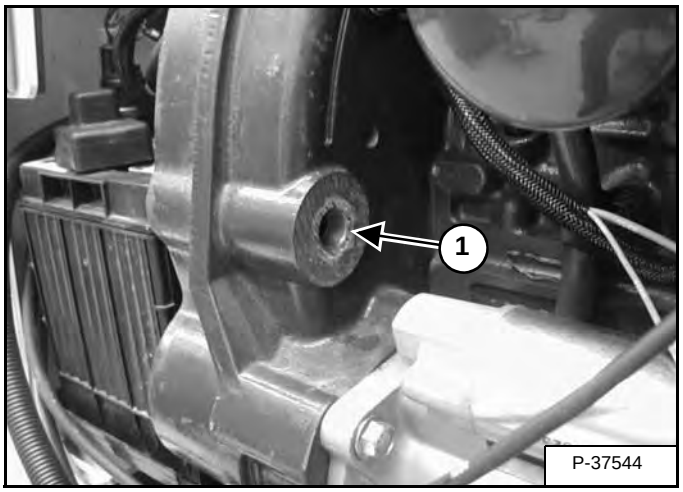
After there is fuel rise seen in the plastic tube, rotate the engine back (clockwise) at least 90 degrees.

Slowly rotate the engine counterclockwise (viewed from flywheel end) and stop turning when the fuel begins to rise in the plastic tube (Item 1) **[Figure 70-70-81]**.

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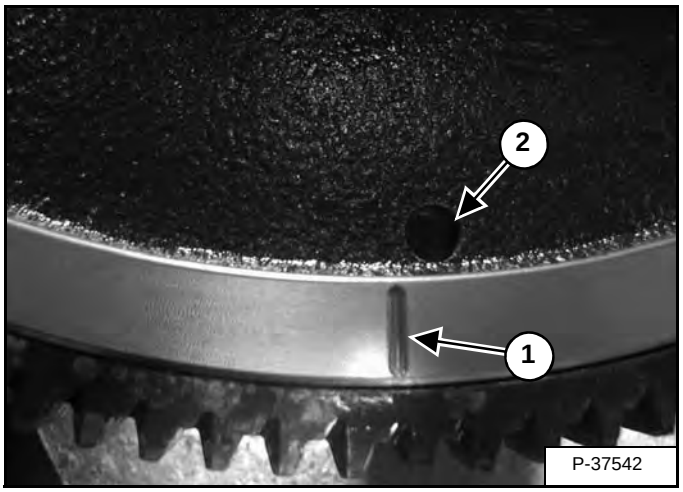
Injection Pump Timing (Cont'd)

Figure 70-70-82



Check the location of the engine timing mark, by looking in the engine speed sensor hole on the engine flywheel casting (Item 1) **[Figure 70-70-82]**.

Figure 70-70-83



The timing mark (Item 1) **[Figure 70-70-83]** should be located in the center of the engine speed sensor hole.

NOTE: The T.D.C. hole (Item 2) [Figure 70-70-83] in the flywheel will not be visible by looking in the speed sensor hole.

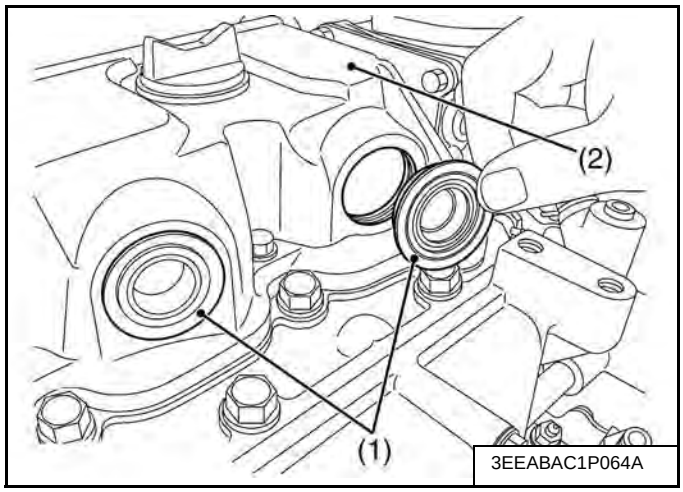
If the timing mark is not located in the center of the hole, rotate the injection pump unit until the injection timing is adjusted.

The injection timing is 12 to 13 degrees before T.D.C. (0.21 to 0.23 rad.).

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Fuel Injector Removal and Installation

Figure 70-70-84

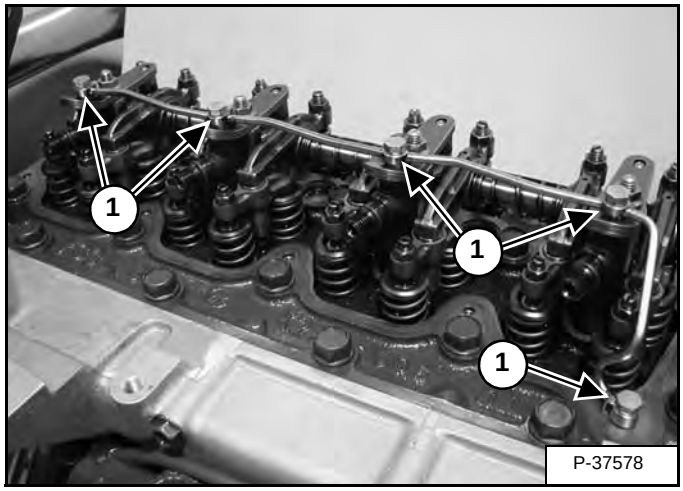


Remove the injection nozzle oil seal (Item 1) from the cylinder head cover (Item 2) **[Figure 70-70-84]**.

Installation: Install new injection nozzle oil seals.

Installation: Tighten the valve cover bolts to 14-20 in.-lb. (1.6 to 2.3 N•m) torque.

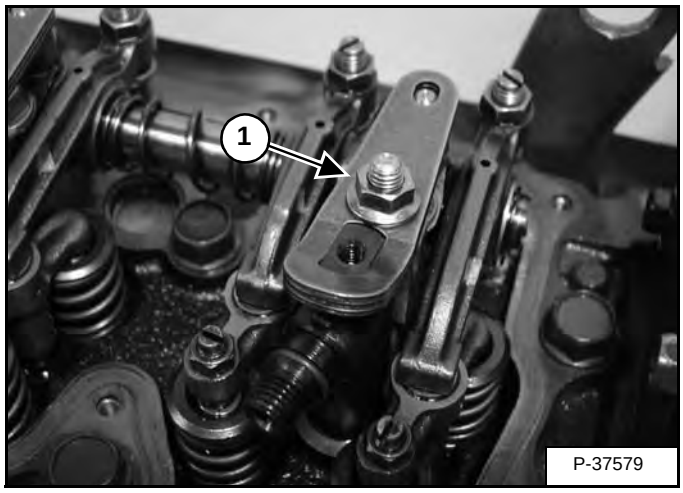
Figure 70-70-85



Remove the five over flow pipe retaining bolts (Item 1) **[Figure 70-70-85]**.

Installation: Tighten the retaining bolts to 85-96 in.-lb. (9,6-10,8 N•m) torque.

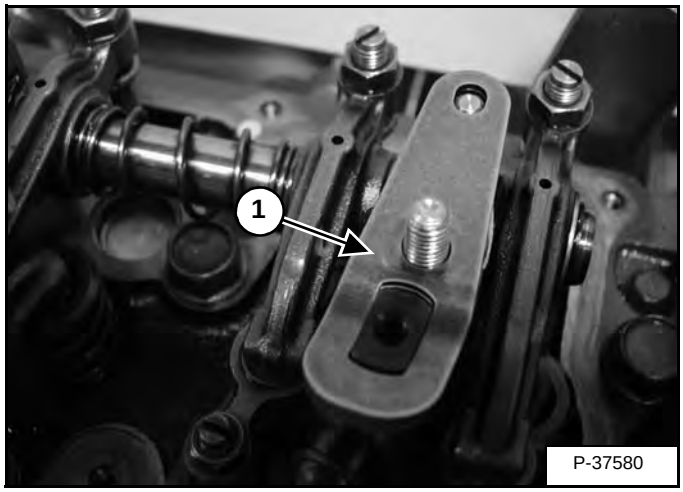
Figure 70-70-86



Remove the nut (Item 1) **[Figure 70-70-86]** from the injector nozzle holder clamp.

Installation: Tighten the injector nozzle holder clamp nut to 13-15 ft.-lb. (18-21 N•m) torque.

Figure 70-70-87

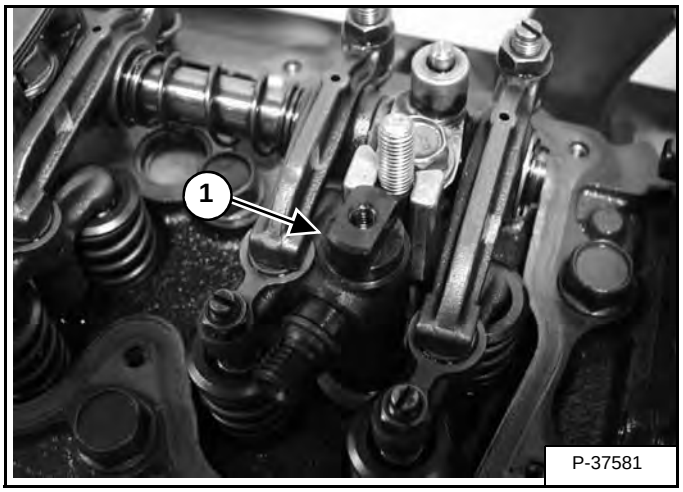


Remove the nozzle holder clamps (Item 1) **[Figure 70-70-87]** from the injector nozzle.

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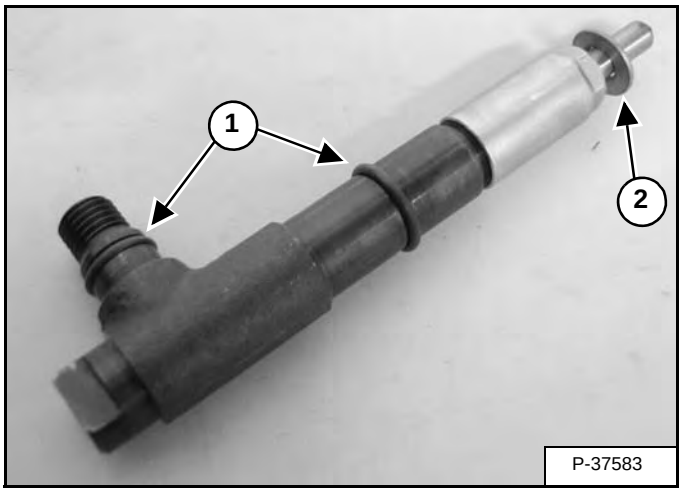
Fuel Injector Removal and Installation (Cont'd)

Figure 70-70-88



Remove the injector nozzle (Item 1) **[Figure 70-70-88]** from the engine.

Figure 70-70-89

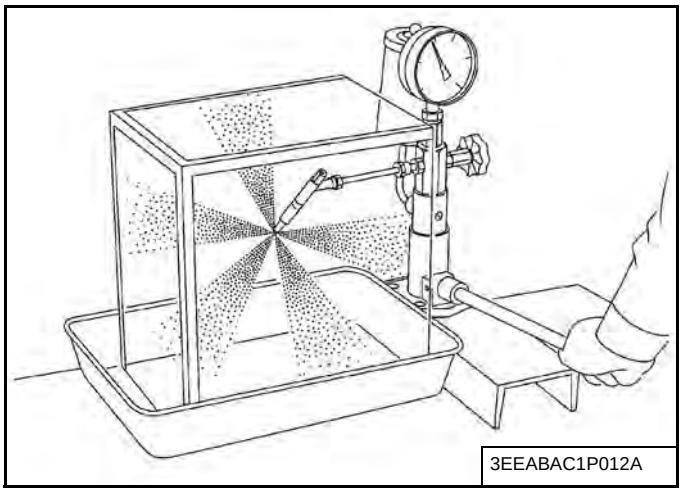


Check the injector nozzle O-rings (Item 1) and nozzle washer (Item 2) **[Figure 70-70-89]**.

Always replace the injector O-rings and washer before installation.

Fuel Injector Nozzle Pressure - Checking

Figure 70-70-90



Set the injection nozzle to the nozzle tester (Code No.: 07909-31361).

Slowly move the tester handle to measure the pressure at which fuel begins jetting out from the nozzle.

If the measurement is not within the factory specifications, replace the injection nozzle assembly or repair at Denso service shop.

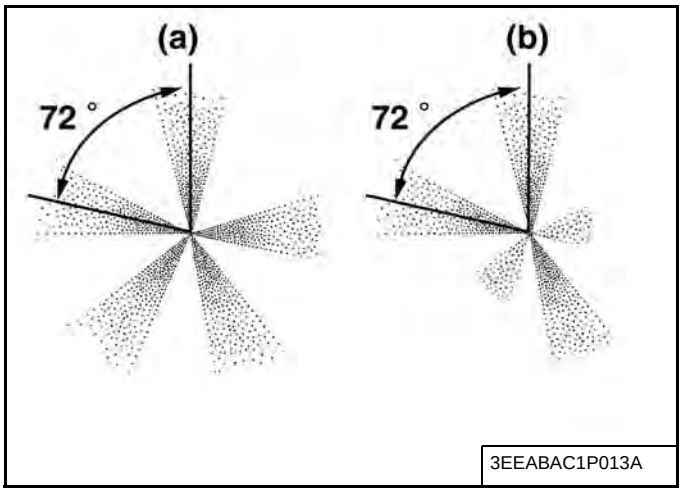
NOTE: Injection nozzle gasket must be replaced when the injection nozzle is removed for checking.

Injection pressure	Factory spec.	1st stage	18.63 to 19.61 MPa 190 to 200 kgf/cm² 2702 to 2845 PSI

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Nozzle Spraying Condition

Figure 70-70-91

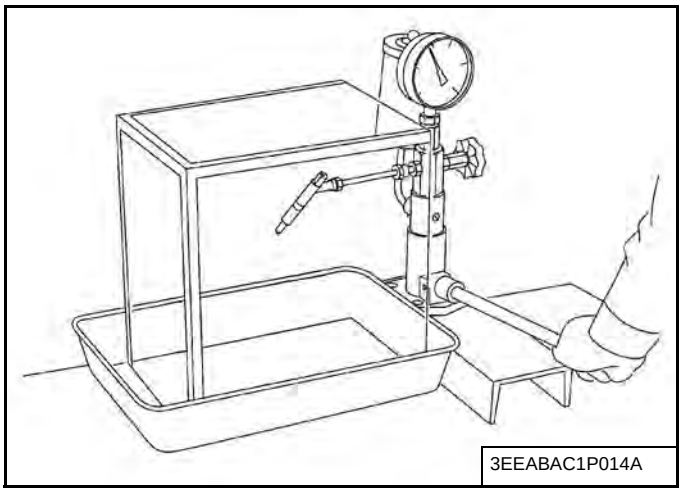


Set the injection nozzle to a nozzle tester (Code No. 07909-31361), and check the nozzle spraying condition.

If the spraying condition is defective, replace the injection nozzle assembly or repair at Denso service shop.

Valve Seat Tightness

Figure 70-70-92



Set the injection nozzle to a nozzle tester (Code No. 07909-31361).

Raise the fuel pressure, and keep at 16.67 MPa (170 kgf/cm², 2418 PSI) for 10 seconds.

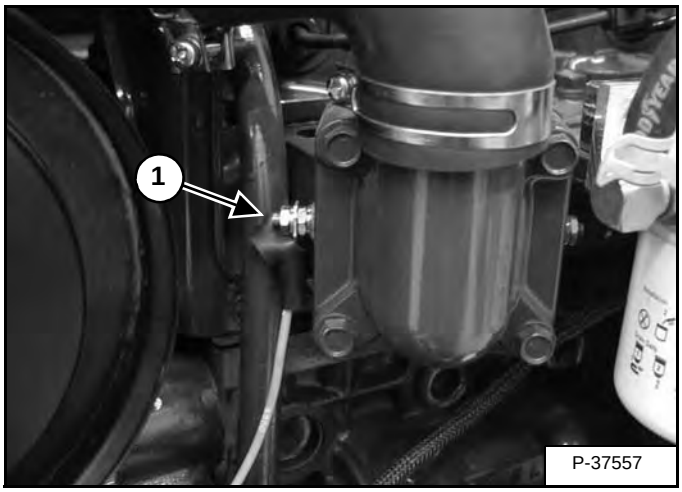
If any fuel leak is found, replace the injection nozzle assembly or repair at Denso service Shop.

Valve seat tightness	Factory spec.	No fuel leak at 16.67 MPa 170 kgf/cm² 2418 PSI

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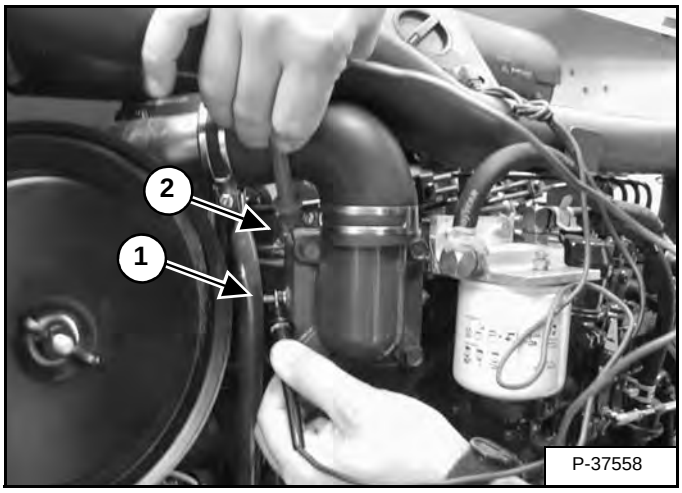
Intake Air Heater - Testing

Figure 70-80-1



Disconnect the electrical wire (Item 1) **[Figure 70-80-1]** from the air intake heater.

Figure 70-80-2



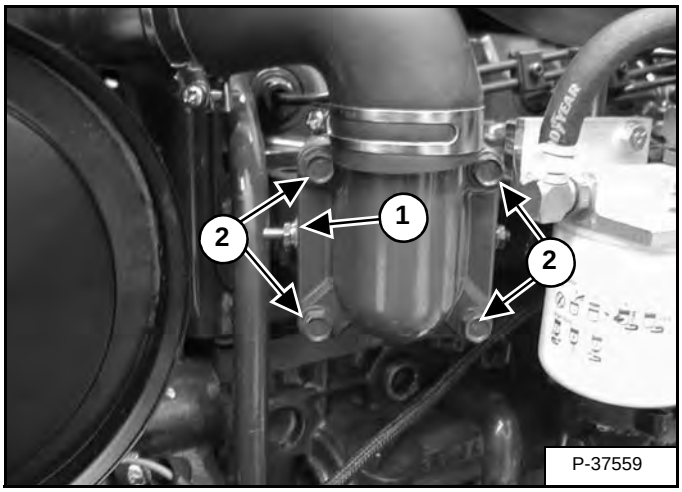
Measure the resistance between + terminal (Item 1) and intake air heater body (Item 2) **[Figure 70-80-2]**.

If the resistance is open, the intake air heater is faulty.

Intake air heater resistance	Factory spec.	Approx. 0.3 Ohms. (At cold occasion)

Intake Air Heater Removal And Installation

Figure 70-80-3

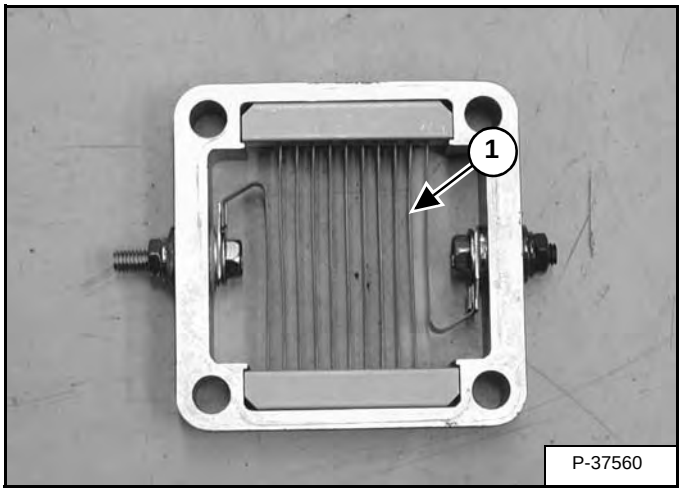


Disconnect the electrical wire from the intake heater lead (Item 1) **[Figure 70-80-3]**

Remove the four mount bolts (Item 2) **[Figure 70-80-3]** from the intake air heater housing.

Installation: Tighten the bolts to 17-20 ft.-lb. (24-28 N•m) torque.

Figure 70-80-4



NOTE: When installing the intake air heater in the housing, install the intake air heater so the heater lines (Item 1) [Figure 70-80-4] are vertical, to prevent a short-circuit in the system.

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Valve Clearance Adjustment

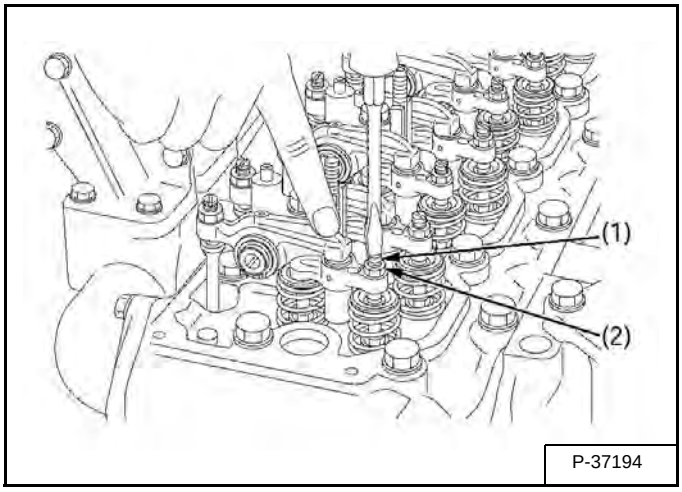
NOTE: Valve clearance must be checked and adjusted when engine is cold.

Remove the high pressure pipes and the head cover.

Put the engine in Top Dead Center. (See Valve Timing - Checking on Page 70-80-3.)

Before adjusting the valve clearance, adjust the bridge to set the height of valves.

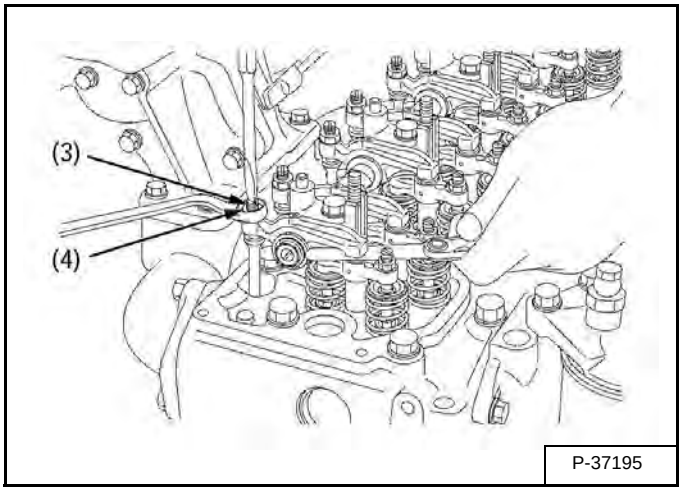
Figure 70-80-5



Loosen the lock nut (Item 2) and return the adjusting screw (Item 1) **[Figure 70-80-5]**.

Push the rocker arm by your fingers and screw in the adjusting screw slowly until you feel the screw touch the top of valve stem, then tighten the lock nut.

Figure 70-80-6



Loosen the lock nut (Item 4) of adjusting screw (Item 3) **[Figure 70-80-6]** (push rod side) and insert the thickness gauge between the rocker arm and the bridge head. Set the adjusting screw to the specified value, then tighten the lock nut.

Valve clearance	Factory spec.	0.23 to 0.27 mm 0.0091 to 0.0106 in.

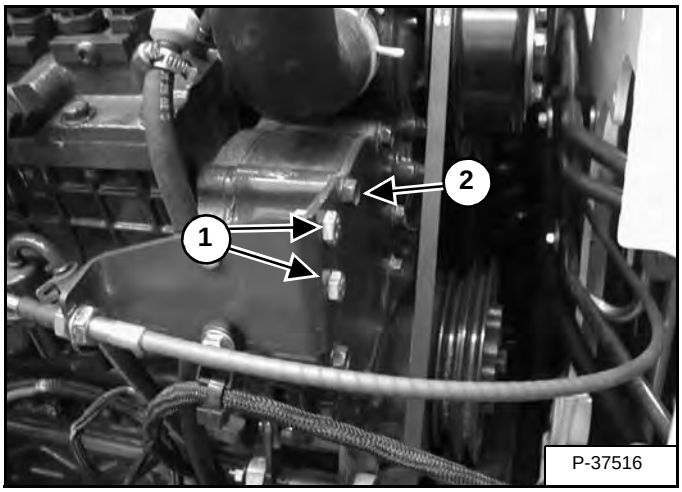
NOTE: After adjusting, tighten the lock nut (Item 4) [Figure 70-80-6] securely.

Valve arrangement Adjustment cylinder Location of piston		IN.	EX.
When No. 1 piston is compression top dead center	1st	*	*
	2nd	*	
	3rd		*
	4th		
When No. 1 piston is overlap position	1st		
	2nd		*
	3rd	*	
	4th	*	*

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Valve Timing - Checking

Figure 70-80-7

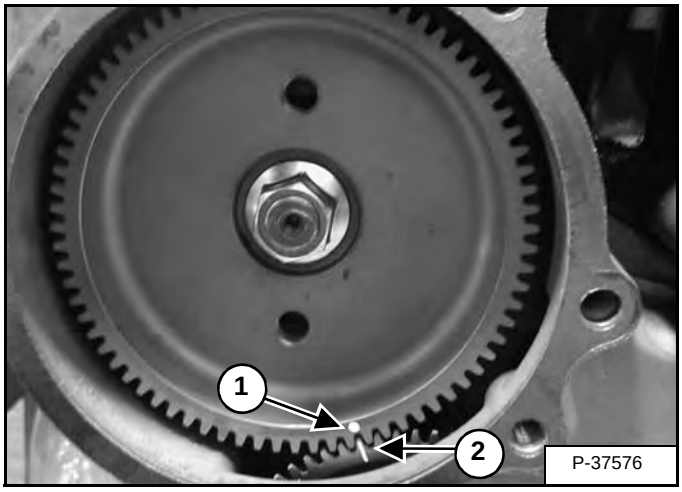


Remove the two bolts (Item 1) **[Figure 70-80-7]** from the throttle linkage mount and the injection pump gear cover.

Remove the six remaining mount bolts (Item 2) **[Figure 70-80-7]** from the injection pump gear cover.

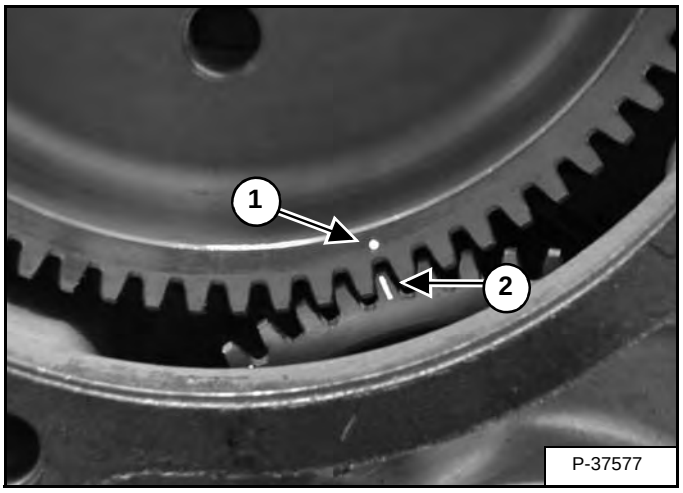
Remove the injection pump gear cover from the engine.

Figure 70-80-8



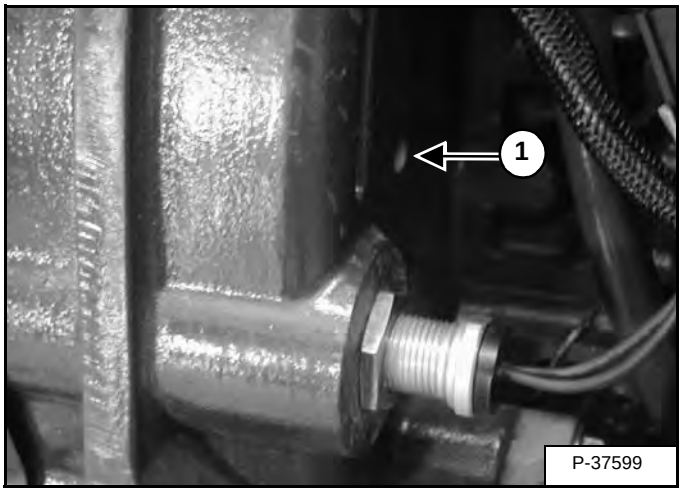
Rotate the engine, until the timing mark on the injection pump fuel cam gear (Item 1) is meshed with the idler gear (Item 2) **[Figure 70-80-8]**.

Figure 70-80-9



Any time the timing mark (Item 1) on the fuel cam gear is meshed with the idler gear (Item 2) **[Figure 70-80-9]** the engine is on top dead center of the compression stroke on number four cylinder.

Figure 70-80-10

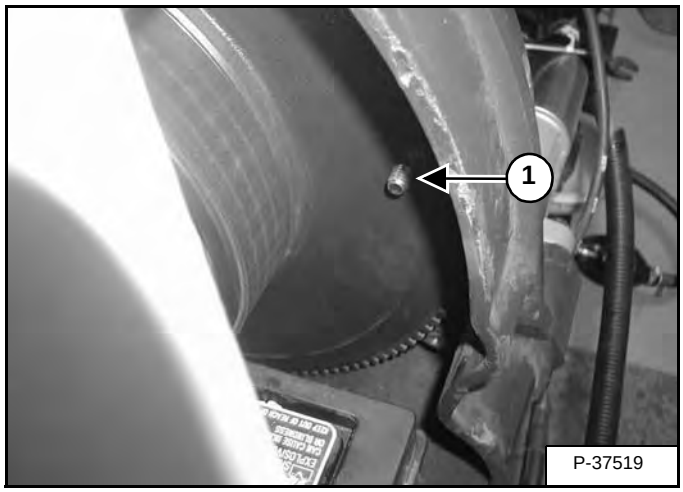


Install a.375 in. (9,525 mm) bolt through the hole in the flywheel casting (Item 1) **[Figure 70-80-10]**.

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Valve Timing - Checking (Cont'd)

Figure 70-80-11



Remove the flywheel cover from the engine flywheel housing.

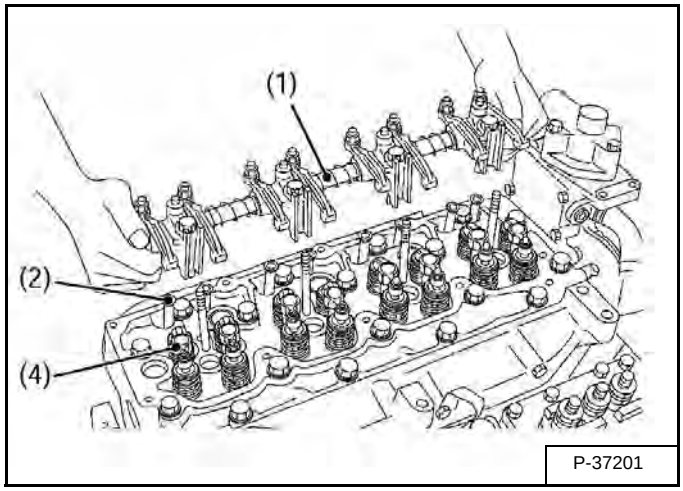
Check to see that the bolt (Item 1) **[Figure 70-80-11]** is completely through the flywheel.

The engine is now pinned on Top Dead Center.

Cylinder Head Removal And Installation

Remove the fuel injectors. (See Fuel Injector Removal and Installation on Page 70-70-26.)

Figure 70-80-12

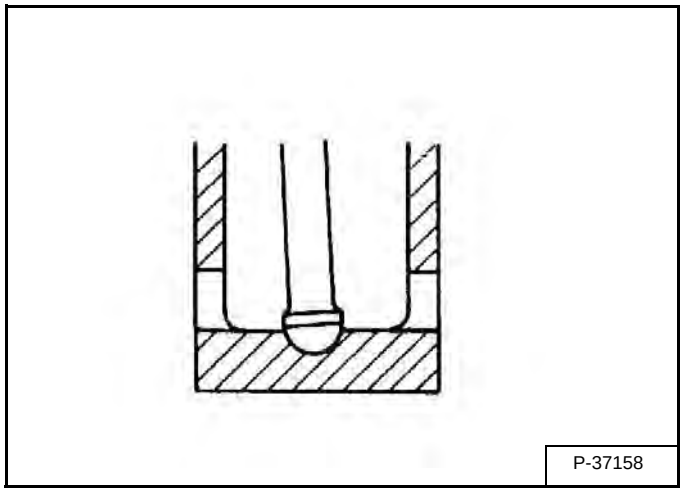


Remove the rocker arm assembly (Item 1) **[Figure 70-80-12]**.

Remove the push rods (Item 2) **[Figure 70-80-12]**.

Remove the bridge arm (Item 4) **[Figure 70-80-12]**.

Figure 70-80-13



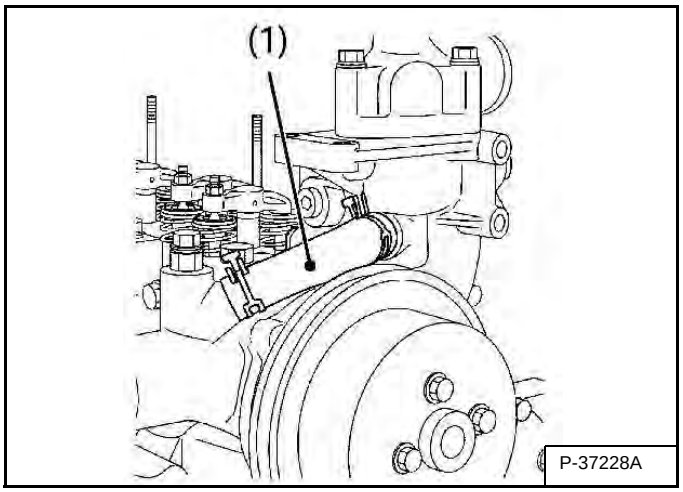
Putting the push rods onto the tappets (Item 3) **[Figure 70-80-13]**, check to see if their ends are properly engaged with the grooves.

NOTE: After reassembling the rocker arm, be sure to adjust the valve clearance.

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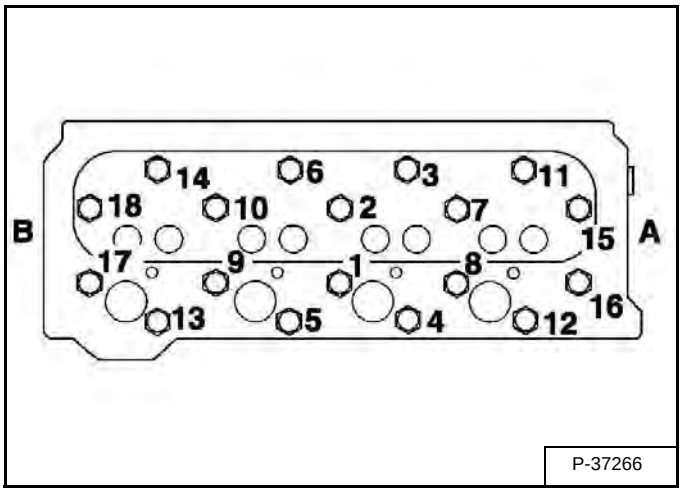
Cylinder Head Removal And Installation (Cont'd)

Figure 70-80-14



Loosen the hose clamps and remove the water return hose (Item 1) **[Figure 70-80-14]**.

Figure 70-80-15



Remove the cylinder head screw in the order of (18) to (1) **[Figure 70-80-15]**, and remove the cylinder head.

Remove the cylinder head gasket. (O-ring is not attached to because of metal type cylinder head gasket.)

The cylinder head should be free of scratches and dust.

Take care for handling the gasket not to damage it.

Install the cylinder head.

Tightening torque	Cylinder head screw	98.1 to 107.9 N•m 10.0 to 11.0 kgf·m 72.3 to 79.6 ft.-lb.

Tighten the cylinder head screw gradually in the order of (1) to (18) after applying engine oil.

Be sure to adjust the valve clearance. (See Valve Clearance Adjustment on Page 70-80-2.)

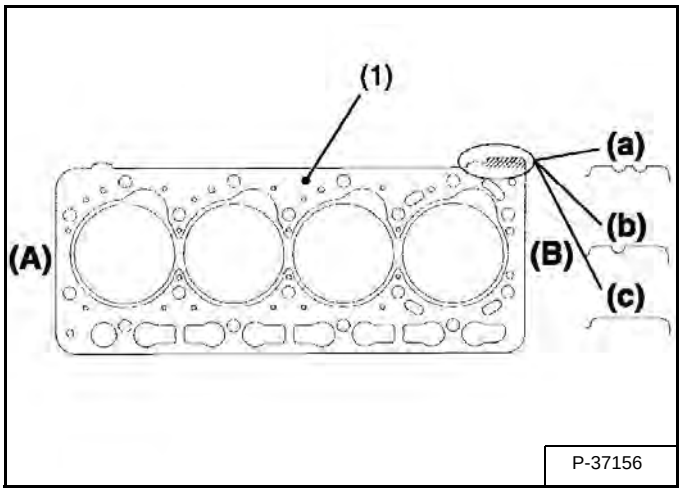
It is not necessary to retighten the cylinder head screw after running the engine for 30 minutes.

NOTE: When replacing the piston, piston pin bushing, connecting rod or crank pin bearing, select the cylinder head gasket thickness to meet with the top clearance.

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Cylinder Head Removal And Installation (Cont'd)

Figure 70-80-16



Make sure to not the notch **(a)**, **(b)** or (**c)** of cylinder head gasket (Item 1) **[Figure 70-80-16]** in advance.

Replace the same notch (a), (b) or (c) as the original cylinder head gasket (Item 1) **[Figure 70-80-16]**.

Select the cylinder head gasket (Item 1) thickness to meet with the top clearance when replacing the piston, piston pin bushing, connecting rod or crank pin bearing.

Figure 70-80-17

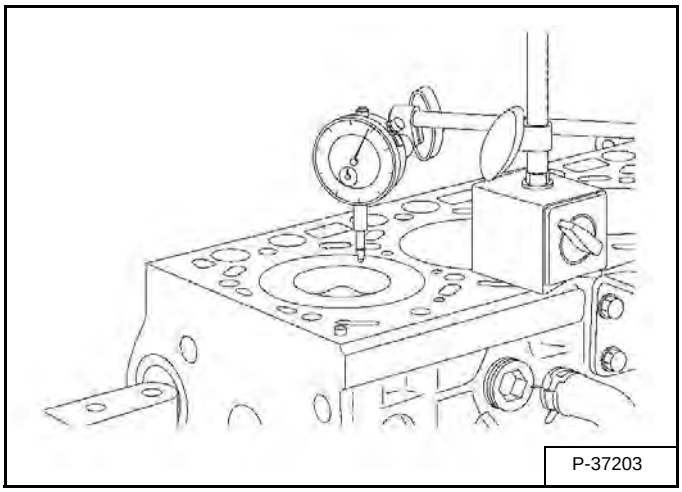
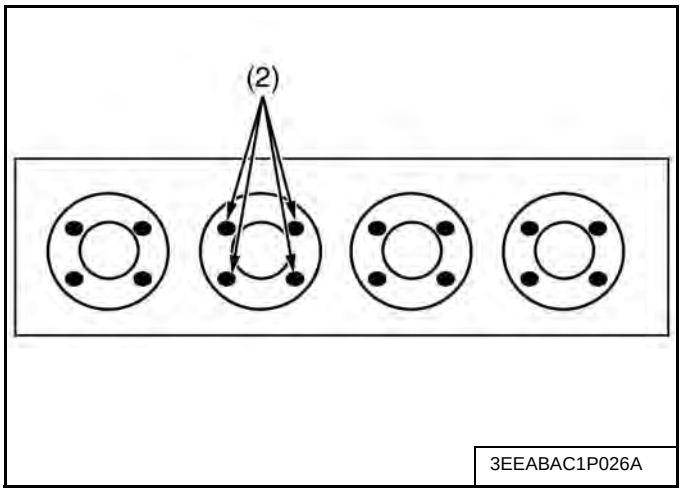


Figure 70-80-18



Measure the piston head's recessing or protrusion from the crankcase cylinder face 4 spots per each piston **[Figure 70-80-18]** and (average of four pistons) using the dial gauge as shown in **[Figure 70-80-17]**.

Select the suitable cylinder head gasket refer to the table below.

Notch of Cylinder Head Gasket	Thickness of cylinder head gasket		Part Code	Piston Head's recessing or protrusion from the level of crankcase cylinder face. (average of 4 pistons)
	Before tightening	After tightening		
2 notches **(a)**	0.90 mm 0.0354 in.	0.80 mm 0.0315 in.	1C020-03310	-0.07 to +0.0490 mm -0.0028 to +0.0019 in.
1 notch **(b)**	1.00 mm 0.0394 in.	0.90 mm 0.0354 in.	1C020-03600	+0.050 to +0.149 mm +0.0020 to +0.0058 in.
Without notch **(c)**	1.05 mm 0.0413 in.	0.95 mm 0.0374 in.	1C020-03610	+0.150 to +0.20 mm +0.0059 to +0.0078 in.

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Cylinder Head Disassembly And Assembly

Figure 70-80-19

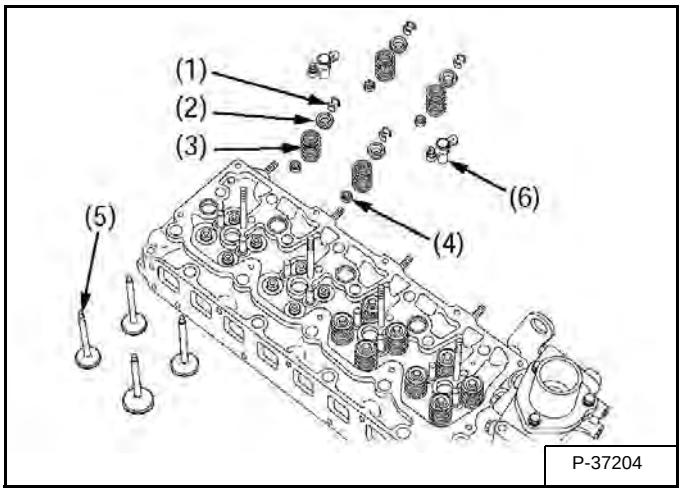
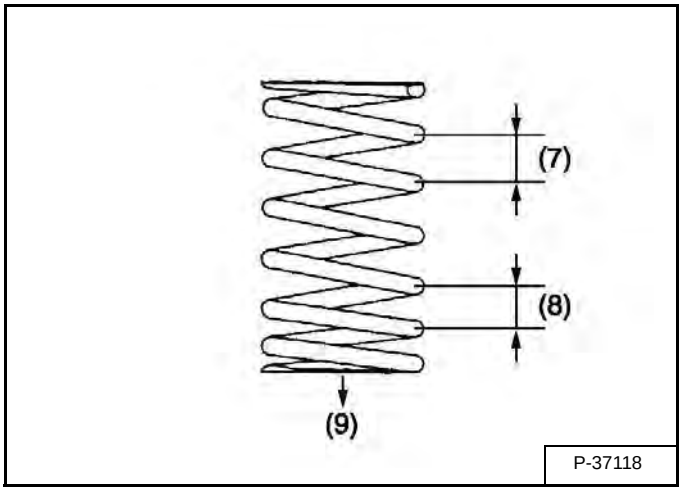


Figure 70-80-20



Remove the valve spring collets (Item 1) after compressing the valve spring (Item 3) with the valve spring retainer (Item 2) **[Figure 70-80-19]**.

Install the valve spring **[Figure 70-80-20]** with its small-pitch end downward (at the head side).

Wash the valve stem and valve guide hole, and apply engine oil sufficiently.

After installing the valve spring collets, lightly tap the stem to assure proper fit with a plastic hammer.

Cylinder Head - Servicing

Figure 70-80-21

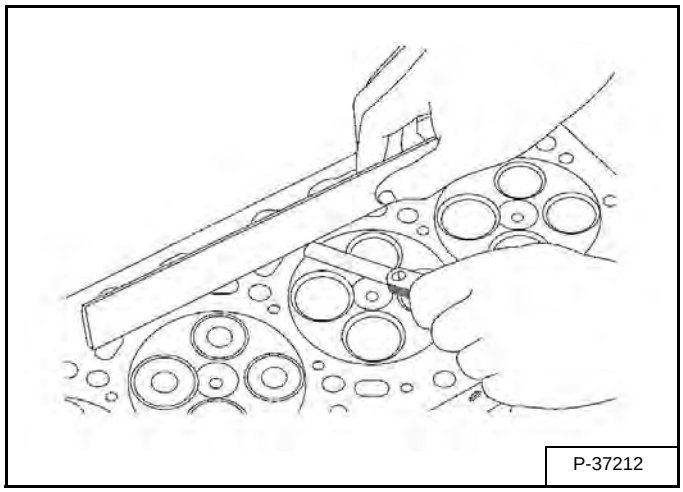
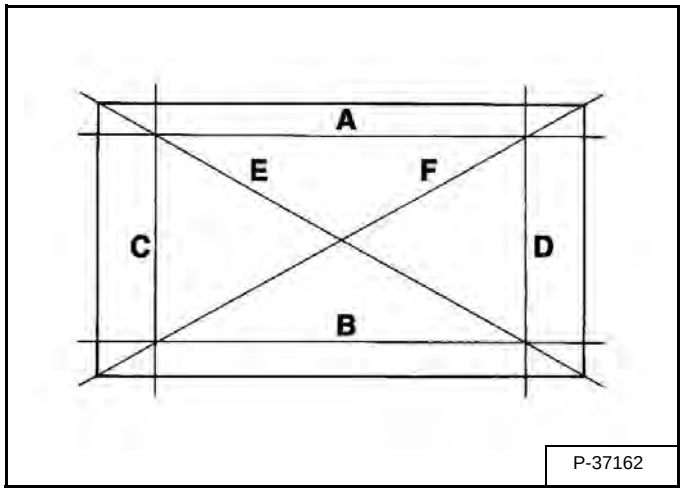


Figure 70-80-22



Thoroughly clean the cylinder head surface.

Place a straightedge on the cylinder head's four sides and two diagonal **[Figure 70-80-22]**. Measure the clearance with a feeler gauge **[Figure 70-80-21]**.

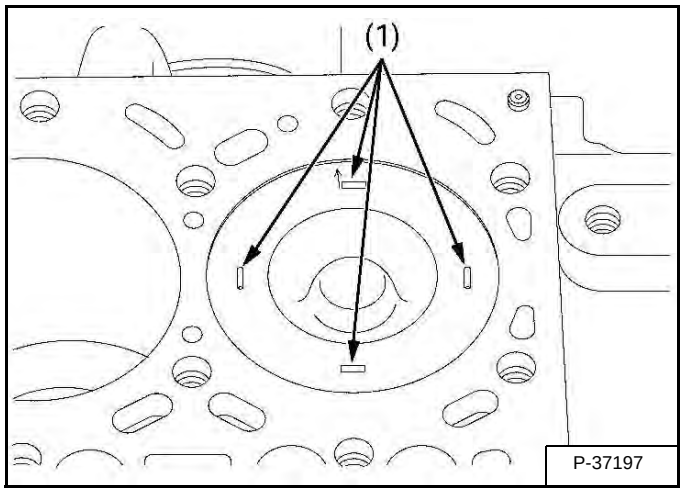
If the measurement exceeds the allowable limit, correct it with a surface grinder. (See Specifications on Page 70-10-2.)

NOTE: Be sure to check the valve recessing after correcting.

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Cylinder Head Top Clearance

Figure 70-80-23



Remove the cylinder head (remove the cylinder head gasket completely).

Bring the piston to its top dead center fasten 1.5 mm dia. 5 to 7 mm long fuse wires to 3 to 4 spots (Item 1) **[Figure 70-80-23]** on the piston top with grease so as to avoid the intake and exhaust valves.

Bring the piston to its middle position, install the cylinder head, and tighten the cylinder head screws to specification. (Head gasket must be changed to new one).

Turn the crankshaft until the piston exceeds its top dead center.

Remove the cylinder head, and measure squeezed fuse wires for thickness.

If the measurement is not within the specified value, check the oil clearance of the crank pin journal and the piston pin.

Top clearance	Factory spec.	0.72 to 0.90 mm 0.0283 to 0.0354 in.
Tightening torque	Cylinder head screw	98.1 to 107.9 N•m 10.0 to 11.0 kgf·m 72.3 to 79.6 ft.-lb.

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Valve Guide - Checking

The tool described below is not provided. The tool is used for inserting and removing the valve guides.Use the dimensions below **[Figure 70-80-24]** and **[Figure 70-80-25]** to make this tool.

Figure 70-80-24

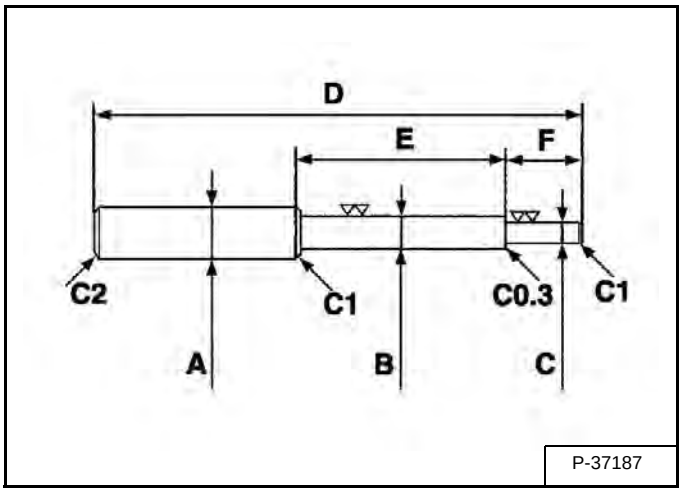
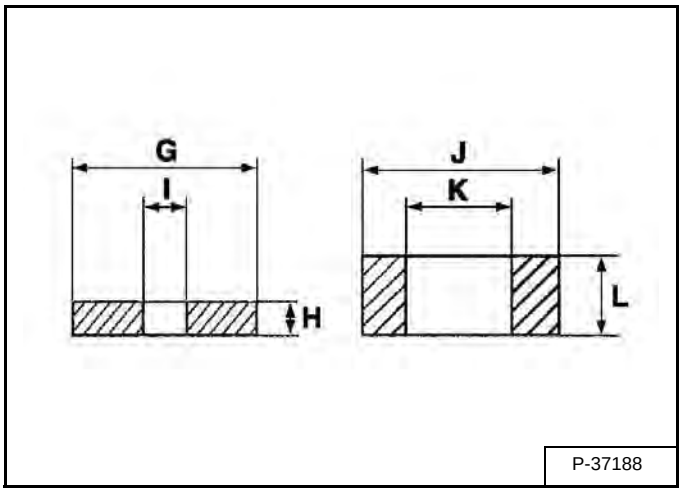


Figure 70-80-25

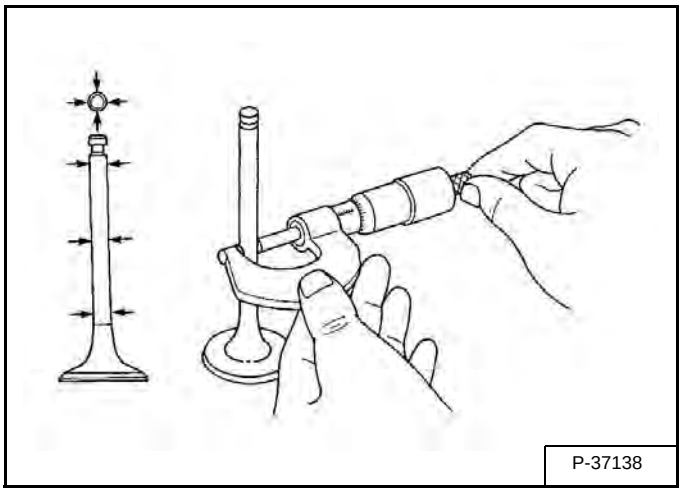


A	20 mm dia. (0.79 in. dia.)
B	11.7 to 11.9 mm dia. (0.460 to 0.468 in. dia.)
C	6.5 to 6.6 mm dia. (0.256 to 0.259 in. dia.)
D	225 mm (8.86 in.)
E	70 mm (2.76 in.)
F	45 mm (1.77 in.)
G	25 mm (0.98 in.)
H	5 mm (0.197 in.)
I	6.7 to 7.0 mm dia. (0.263 to 0.275 in. dia.)
J	20 mm dia. (0.787 in. dia.)
K	12.5 to 12.8 mm dia. (0.492 to 0.504 in. dia.)
L	8.9 to 9.1 mm (0.350 to 0.3578 in. dia.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)
C0.3	Chamfer 0.3 mm (0.012 in.)

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Valve Guide - Checking (Cont'd)

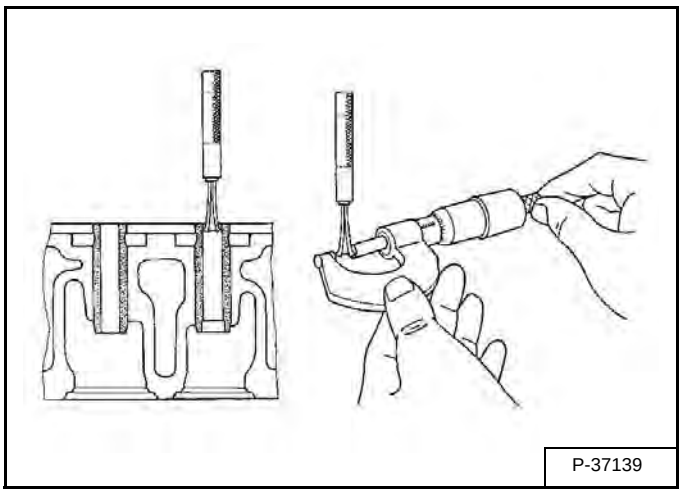
Figure 70-80-26



Remove carbon from the valve guide section.

Measure the valve stem O.D. with an outside micrometer **[Figure 70-80-26]**.

Figure 70-80-27



Measure the valve guide I.D. of the cylinder head at the most wear part as shown in **[Figure 70-80-27]** with a small hole gauge and calculate the clearance.

If the clearance exceeds the allowable limit, replace the valves. If it still exceeds the allowable limit, replace the valve guide.

Clearance between valve stem and guide	Factory spec.	Intake valve	0.055 to 0.085 mm 0.0022 to 0.0033 in.
		Exhaust valve	0.055 to 0.085 mm 0.0022 to 0.0033 in.
	Allowable limit	0.1 mm 0.0039 in.	

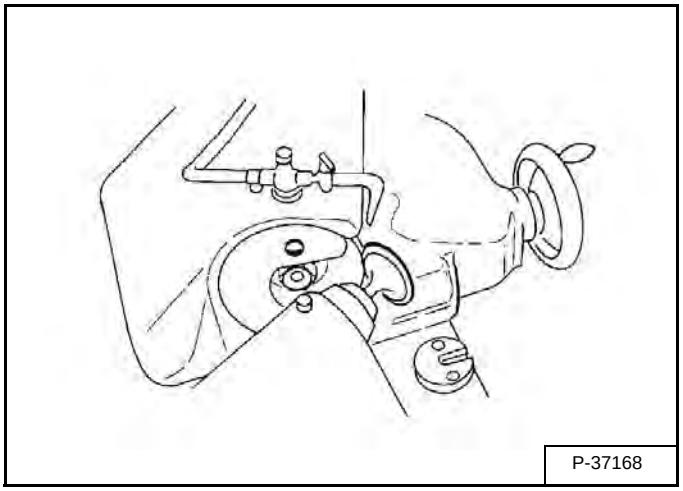
Valve stem O.D.	Factory spec.	Intake valve	6.960 to 6.975 mm 0.2740 to 0.2746 in.
		Exhaust valve	6.960 to 6.975 mm 0.2740 to 0.2746 in.

Valve guide I.D.	Factory spec.	Intake valve	7.030 to 7.045 mm 0.2768 to 0.2774 in.
		Exhaust valve	7.030 to 7.045 mm 0.2768 to 0.2774 in.

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Reconditioning The Valve And Valve Seat

Figure 70-80-28



NOTE: Before correcting the valve and seat, check the valve stem and the I.D. of valve guide section, and repair them if necessary.
After correcting the valve seat, be sure to check the valve recessing [Figure 70-80-28].

Correct the valve with a valve refacer.

Figure 70-80-29

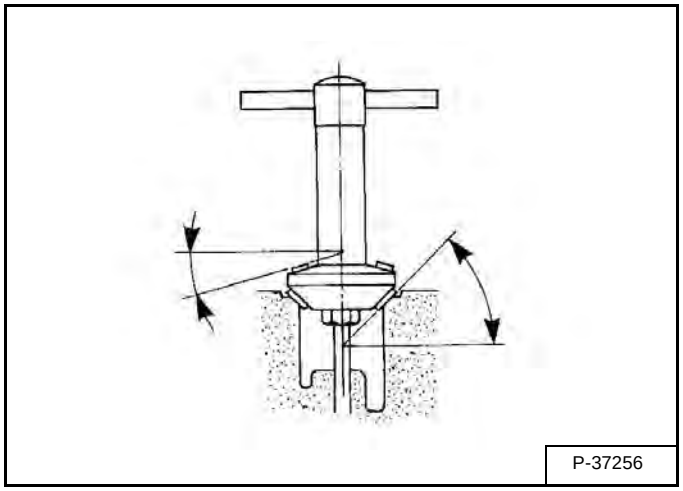
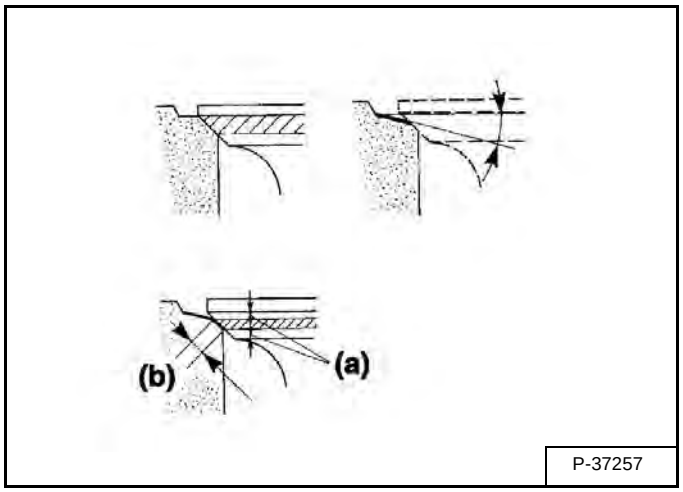


Figure 70-80-30



Slightly correct the seat surface with a 1.047 rad. (60°) (intake valve) or 0.785 rad. (45°) (exhaust valve) seat cutter (Code No. 07909-33102) **[Figure 70-80-29]**.

Resurface the seat surface with a 0.523 rad. (30°) valve seat cutter to intake valve seat and with a 0.262 rad. (15°) valve seat cutter to exhaust valve seat so that the width is close to specified valve seat width (2.12 mm, 0.0835 in.) **[Figure 70-80-30]**.

After resurfacing the seat, inspect for even valve seating, apply a thin film of compound between the valve face and valve seat, and fit them with valve lapping tool.

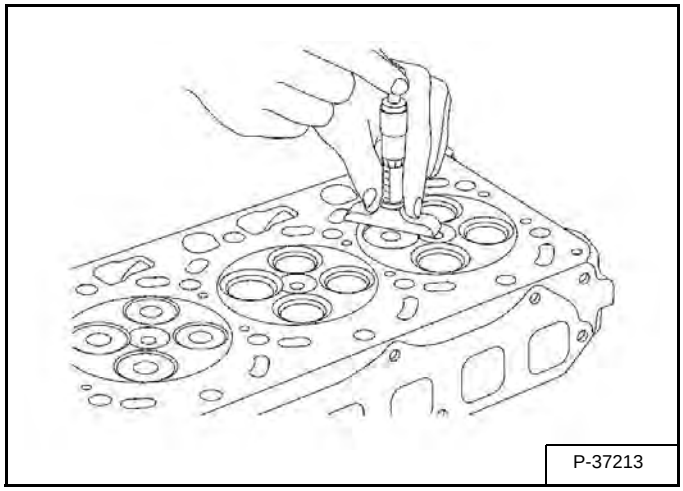
Check the valve seating with prussian blue. The valve seating surface should show good contact all the way around.

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Reconditioning The Valve And Valve Seat (Cont'd)

Valve Recessing

Figure 70-80-31



Clean the cylinder head, the valve face and seat.

Insert the valve into the valve guide.

Measure the valve recessing with a depth gauge **[Figure 70-80-31]**.

If the measurement exceeds the allowable limit, replace the valve.

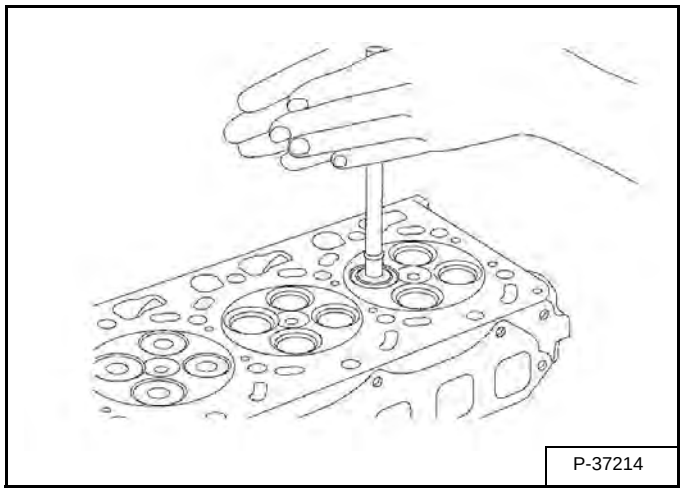
If it still exceeds the allowable limit after replacing the valve, correct the valve seat face of the cylinder head with a valve seat cutter or valve seat grinder.

Then, correct the cylinder head surface with a surface grinder, or replace the cylinder head.

Valve recessing	Factory spec.	Intake valve	(recessing) 0.6 to 0.8 mm (0.0236 to 0.0315 in.)
		Exhaust valve	(recessing) 0.85 to 1.05 mm (0.0335 to 0.0413 in.)
	Allowable limit	(recessing) 1.2 mm (0.0472 in.)	

Valve Lapping

Figure 70-80-32



Apply compound evenly to the valve lapping surface.

Insert the valve into the valve guide. Lap the valve onto its seat with a valve flapper or screwdriver **[Figure 70-80-32]**.

After lapping the valve, wash the compound away and apply oil, then repeat valve lapping with oil.

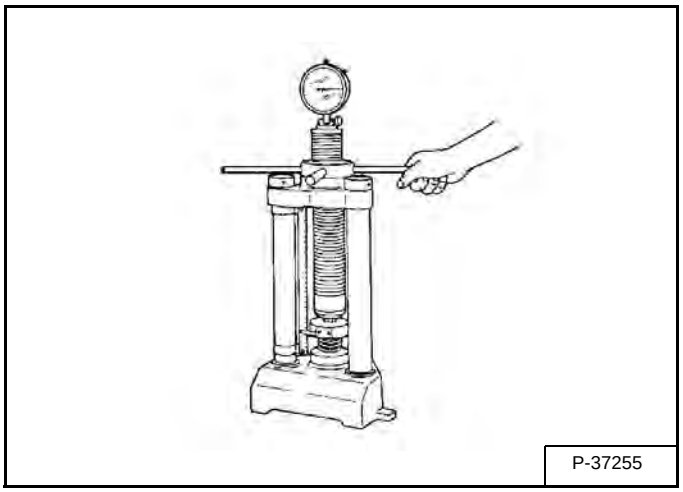
Apply prussian blue to the contact surface to check the seated rate. If it is less than 70%, repeat valve lapping again.

NOTE: When valve lapping is performed, be sure to check the valve recessing and adjust the valve clearance after assembling the valve.

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Valve Spring

Figure 70-80-33



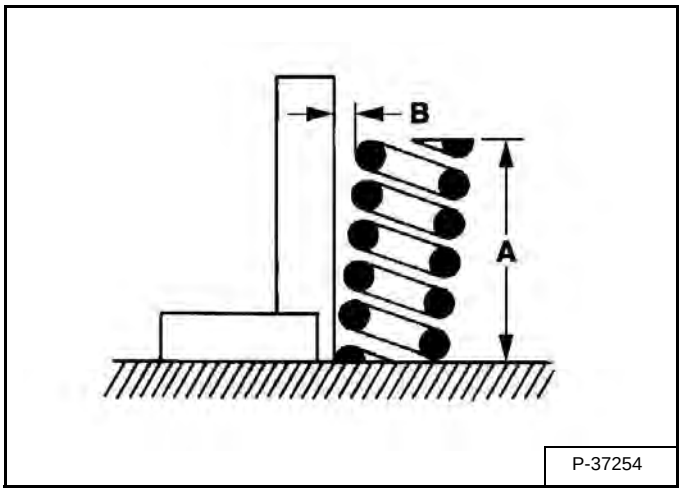
Place the valve spring on a tester and compress it to the same length it is actually compressed in the engine **[Figure 70-80-33]**.

Read the compression load on the gauge.

If the measurement is less than the allowable limit, replace it.

Setting load/ setting length	Factory spec.	Intake valve	63.547 N / 31.5 mm 6.48 kgf / 31.5 mm 14.256 lb. / 1,2401 in.
		Exhaust valve	63.547 N / 31.5 mm 6.48 kgf / 31.5 mm 14.256 lb. / 1,2401 in.
	Allowable limit	Intake valve	45.864 N / 31.5 mm 4.68 kgf / 31.5 mm 10.296 lb. / 1,2401 in.
		Exhaust valve	45.864 N / 31.5 mm 4.68 kgf / 31.5 mm 10.296 lb. / 1,2401 in.

Figure 70-80-34



Measure the free length **(A)** with vernier calipers **[Figure 70-80-34]**. If the measurement is less than the allowable limit, replace it.

Put the spring on a surface plate, place a square on the side of the spring, and check to see if the entire side is contact with the square. Rotate the spring and measure the maximum **(B) [Figure 70-80-34]**. If the measurement exceeds the allowable limit, replace.

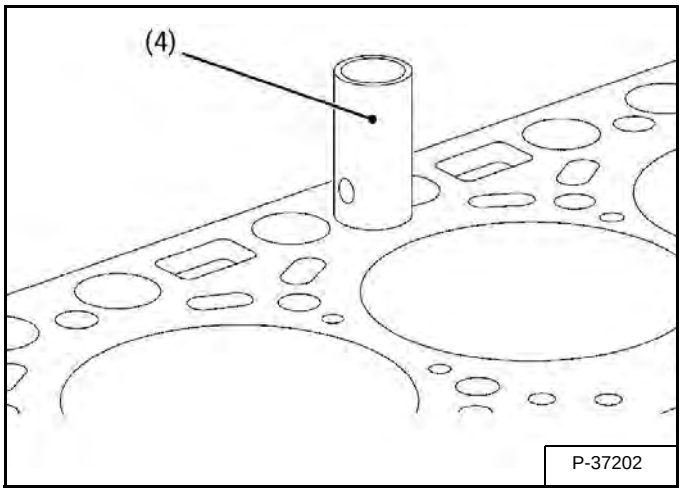
Check the entire surface of the spring for scratches. Replace it, if any.

Free length (A)	Factory spec.	Intake valve	35.1 to 35.6 mm 1.3819 to 1.4016 in.
		Exhaust valve	35.1 to 35.6 mm 1.3819 to 1.4016 in.
	Allowable limit	Intake valve	34.6 mm 1.3622 in.
		Exhaust valve	34.6 mm 1.3622 in.
Tilt (B)	Allowable limit	1.0 mm 0.039 in.	

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Valve Tappets

Figure 70-80-35



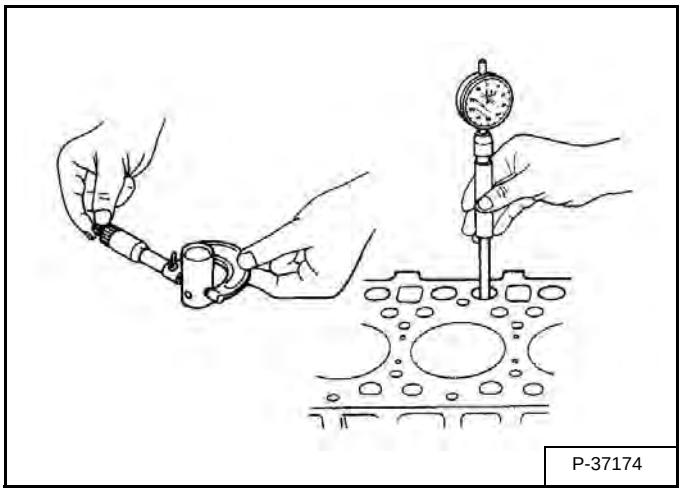
Remove the tappets (Item 4) **[Figure 70-80-35]** from the crankcase.

When reassembling replace the head gasket with a new one.

Before installing the tappets (Item 4) **[Figure 70-80-35]**, apply engine oil thinly around them.

NOTE: Mark the cylinder number to the tappets to prevent interchanging.

Figure 70-80-36



Measure the tappet O.D. with an outside micrometer **[Figure 70-80-36]**.

Measure the I.D. of the tappet guide bore with a cylinder gauge, and calculate the oil clearance **[Figure 70-80-36]**.

If the oil clearance exceeds the allowable limit or the tappet is damaged, replace the tappet.

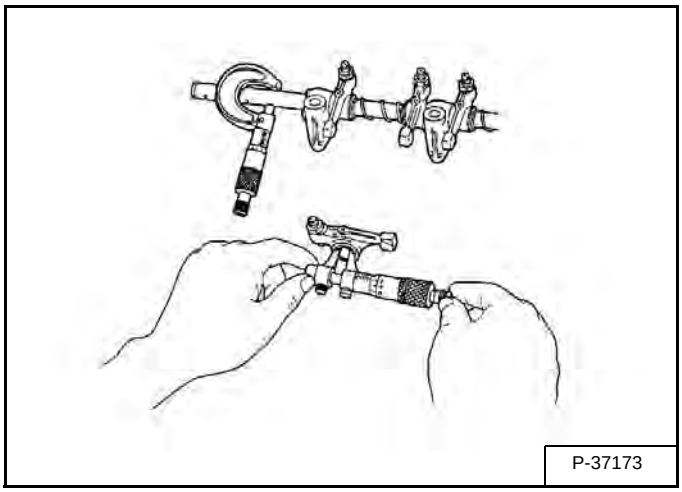
Oil clearance between tappet and guide	Factory spec.	0.020 to 0.062 mm 0.0008 to 0.0024 in.
	Allowable limit	0.07 mm 0.0028 in.

Tappet O.D.	Factory spec.	23.959 to 23.980 mm 0.9433 to 0.9411 in.
Tappet guide I.D.	Factory spec.	24.000 to 24.021 mm 0.9449 to 0.9457 in.

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Rocker Arm And Shaft - Checking

Figure 70-80-37



Measure the rocker arm bearing I.D. with an inside micrometer **[Figure 70-80-37]**.

Measure the rocker arm shaft O.D. with an outside micrometer, and then calculate the oil clearance **[Figure 70-80-37]**.

If the clearance exceeds the allowable limit, replace the rocker arm and measure the oil clearance again. If it still exceeds the allowable limit, replace also the rocker arm shaft.

Oil clearance or rocker arm shaft and bearing	Factory spec.	0.016 to 0.045 mm 0.0006 to 0.0018 in.
	Allowable limit	0.15 mm 0.0059 in.

Rocker arm shaft O.D.	Factory spec.	15.973 to 15.984 mm 0.6289 to 0.6293 in.
Rocker arm I.D. for shaft	Factory spec.	16.000 to 16.018 mm 0.6299 to 0.6306 in.

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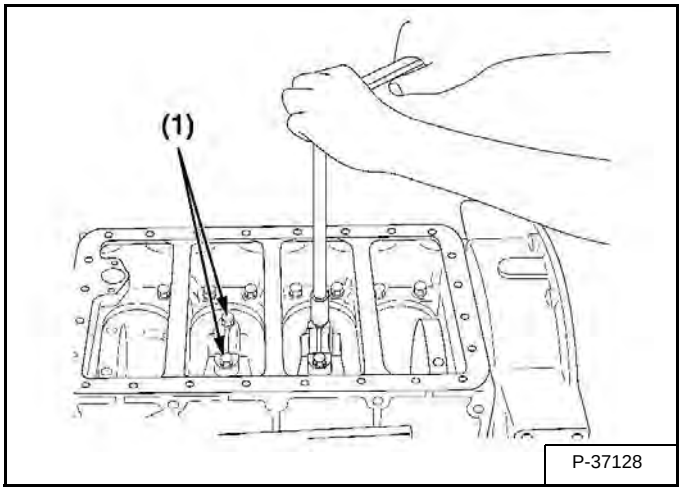
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Piston And Connecting Rod Removal And Installation

Remove the oil pan. (See Oil Pan Removal And Installation on Page 70-60-1.)

Remove the cylinder head. (See Cylinder Head Removal And Installation on Page 70-80-4.)

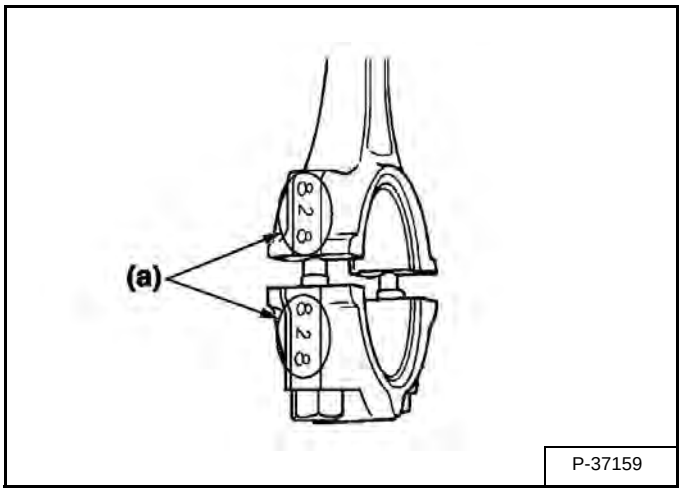
Figure 70-90-1



Remove the connecting rod screws (Item 1) **[Figure 70-90-1]** from connecting rod cap.

Remove the connecting rod caps.

Figure 70-90-2



Align the marks **(a) [Figure 70-90-2]** with each other. **(Face the marks toward the injection pump.)**

Apply engine oil to the connecting rod screws and lightly screw it in by hand, then tighten it to the specified torque. If the connecting rod screw won't be screwed in smoothly, clean the threads. If the connecting rod screw is still hard to screw in, replace it.

When using the existing crank pin metal again, put tally marks on the crank pin metal and the connecting rod in order to keep their positioning.

Fit the crank pin metal in place.

Tightening torque	Connecting rod screw	78.5 to 83.4 N•m 8.0 to 8.5 kgf·m 57.9 to 61.5 ft.-lb.

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Piston And Connecting Rod Removal And Installation (Cont'd)

Figure 70-90-3

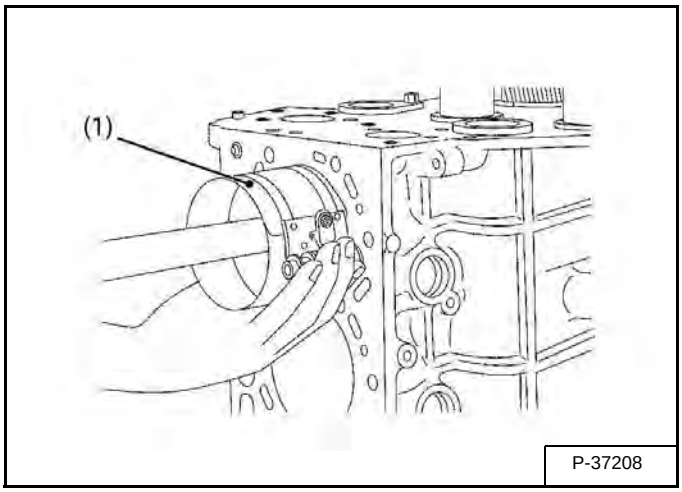


Figure 70-90-4

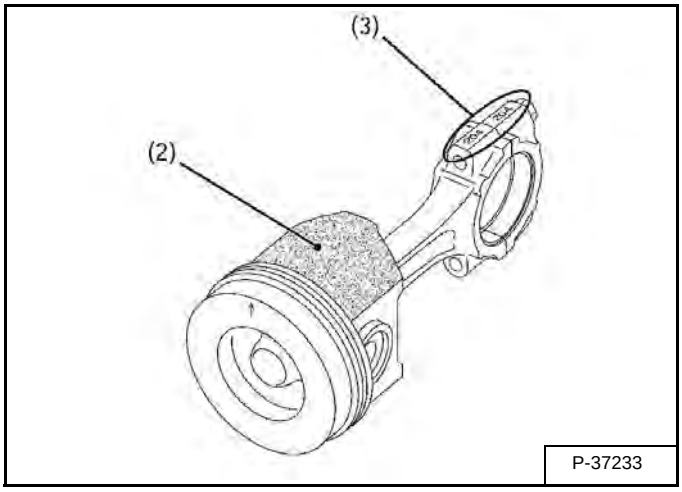
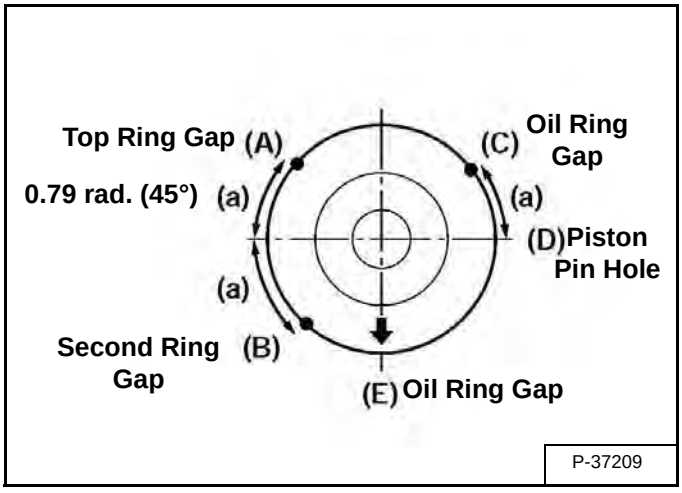


Figure 70-90-5



Completely clean carbon in the cylinders.

Turn the flywheel and set a piston to the top dead center.

Pull out the piston upward by lightly tapping it from the bottom of the crankcase with the grip of a hammer.

Before inserting the piston into the cylinder, apply enough engine oil to the cylinder.

When inserting the piston into the cylinder, face the mark (Item 3) **[Figure 70-90-4]** on the connecting rod to the injection pump.

NOTE: Do not change the combination of cylinder and piston.
Make sure of the position of each piston by marking. For example, mark "1" on the No. 1 position.
When inserting the piston into the cylinder, place the gap of the compression ring 1 on the opposite side of the combustion chamber and stagger the gaps of the compression ring 2 and oil ring marking a right angle from the gap of the compression ring 1.
Carefully insert the pistons using a piston ring compressor (Item 1) [Figure 70-90-3]. Otherwise, their chrome-plated section of piston rings may be scratched, causing trouble inside the liner.

When inserting the piston in place, be careful not to get the molybdenum disulfide coating (Item 2) [Figure 70-90-4] torn off its skirt. This coating is useful in minimizing the clearance with the cylinder liner. Just after the piston pin has been press-fitted, in particular, the piston is still hot and the coating is easy to peel off. Wait until the piston cools down.

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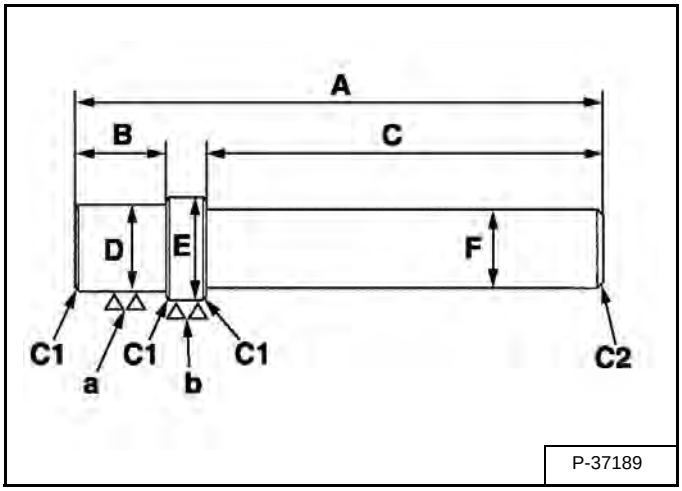
Piston And Connecting Rod - Servicing

The Connecting Rod Alignment Tool is not provided. Order this tool using the code below.

Code No:	07909-31661
Application:	Use for checking the connecting rod alignment.
Application Range:	Connecting rod big end I.D. 30 to 75 mm (1.18 to 2.95 in. dia.) Connecting rod length 65 to 330 mm (2.56 to 12.99 in.)

The Small End Bushing Replacing Tool can be made using the dimensions below. One set of dimensions is for the press out tool and one for press fit.

Figure 70-90-6



Small End Bushing Replacing Tool

Application: Use to press out and to press fit the small end bushing in the connection rod.

(Press out)

A	157 mm dia. (6.181 in.)
B	14.5 mm (0.571 in.)
C	120 mm (4.7244 in.)
D	30.101 to 30.156 mm dia. (1.1851 to 1.187 in. dia.)
E	33.075 to 33.100 mm dia. (1.3021 to 1.3031 in. dia.)
F	20 mm (0.7874 in.)
a	0.0000063 mm (0.00025 in.)
b	0.0000063 mm (0.00025 in.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)

(Press fit)

A	157 mm dia. (6.181 in.)
B	14.5 mm (0.571 in.)
C	120 mm (4.7244 in.)
D	30.101 to 30.156 mm dia. (1.1851 to 1.187 in. dia.)
E	42.000 mm dia. (1.6535 in. dia.)
F	20 mm (0.7874 in.)
a	0.0000063 mm (0.00025 in.)
b	0.0000063 mm (0.00025 in.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)

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Piston And Connecting Rod - Servicing (Cont'd)

Figure 70-90-7

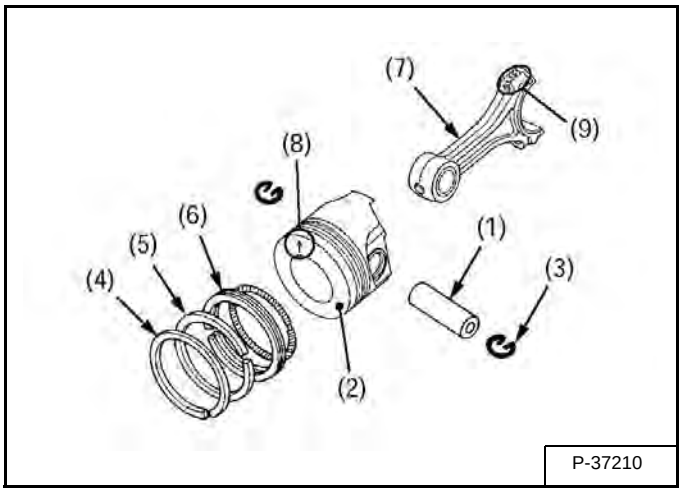
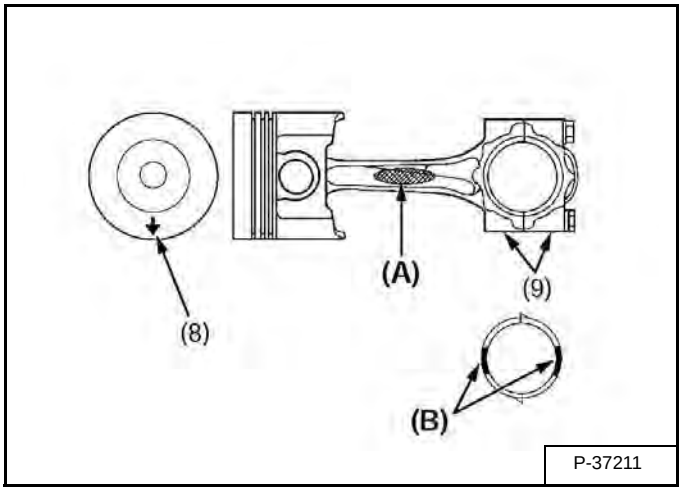


Figure 70-90-8



Remove the piston rings using a piston ring tool.

Remove the piston pin (Item 1), and separate the connecting rod (Item 7) from the piston (Item 2) **[Figure 70-90-7]**.

Be sure to fix the crank pin bearing and the connecting rod are same I.D. colors.

When installing the piston pin, immerse the piston in 80°C (176°F) oil for 10 to 15 minutes and insert the piston pin to the piston.

Figure 70-90-9

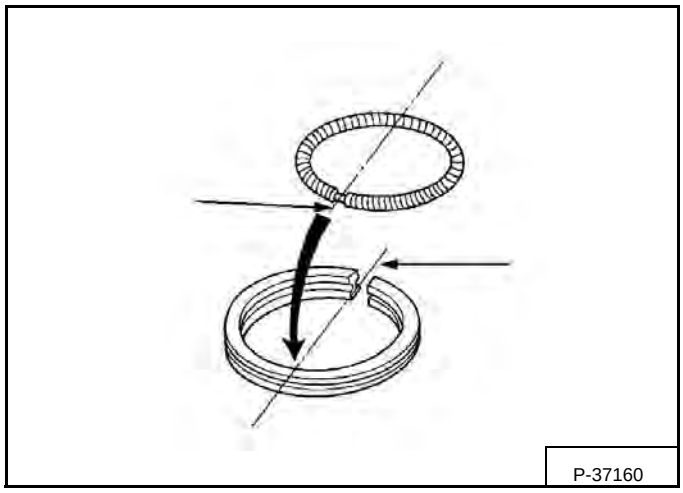
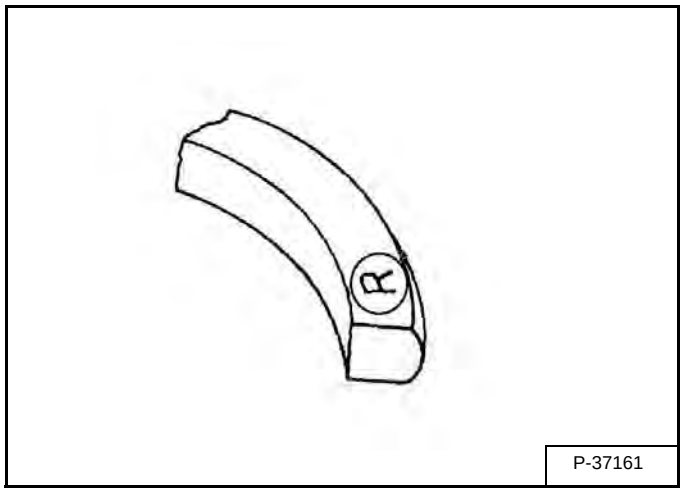


Figure 70-90-10



When installing the ring, assemble the rings so that the manufacture's mark (Item 12) **[Figure 70-90-10]** near the gap faces the top of the piston.

When installing the oil ring onto the piston, place the expander joint (Item 10) on the opposite side of the oil ring gap (Item 11) **[Figure 70-90-9]**.

Apply engine oil to the piston pin (Item 1) **[Figure 70-90-7]**.

Assemble the piston to the connecting rod with the ↑ mark (Item 8) and the connecting rod numbering mark (Item 9) **[Figure 70-90-8]** facing same side.

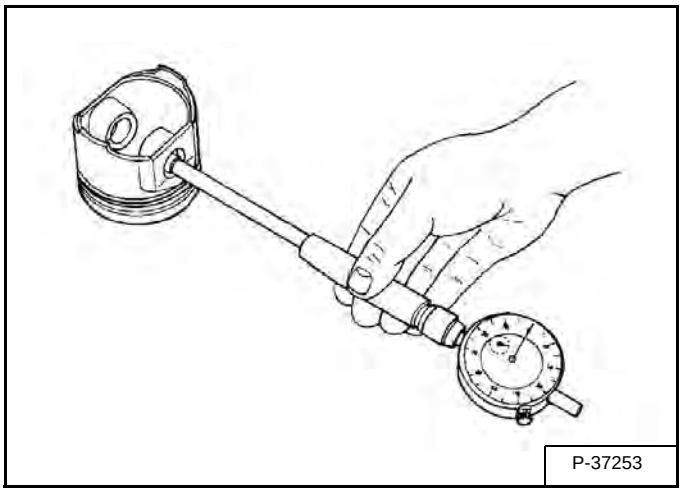
The end faces of the oil ring are plated with hard chrome. In putting the piston into the cylinder, be careful not to get the oil ring scratched by the cylinder. Use the piston ring fitter to tighten up the oil ring. If the ring's planted is scratched, it may get stuck on the cylinder wall, causing a serious trouble.

NOTE: Mark the same number on the connecting rod and the piston so as not to change the combination.

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Piston And Connecting Rod - Servicing (Cont'd)

Figure 70-90-11

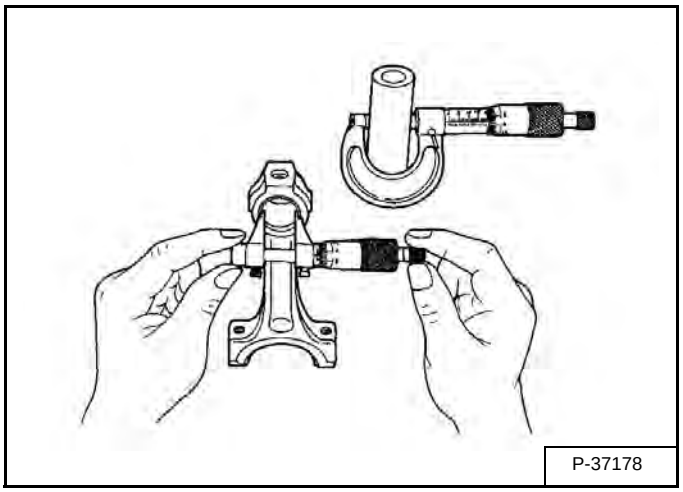


Measure the piston pin bore I.D. in both the horizontal and vertical directions with a cylinder gauge **[Figure 70-90-11]**.

If the measurement exceeds the allowable limit, replace the piston.

Piston pin bore I.D.	Factory spec.	30.000 to 30.013 mm 1.1811 to 1.1816 in.
	Allowable limit	30.05 mm 1.1831 in.

Figure 70-90-12



Measure the O.D. of the piston pin where it contacts the bushing with an outside micrometer **[Figure 70-90-12]**.

Measure the I.D. of the piston pin bushing at the connecting rod small end with a cylinder gauge **[Figure 70-90-12]**.

If the clearance exceeds the allowable limit, replace the bushing. If it still exceeds the allowable limit, replace the piston pin.

Oil clearance between piston pin and small end bushing	Factory spec.	0.020 to 0.040 mm 0.0008 to 0.0016 in.
	Allowable limit	0.15 mm 0.0059 in.

Piston pin O.D.	Factory spec.	30.006 to 30.011 mm 1.1813 to 1.1815 in.
Small end bushing I.D.	Factory spec.	30.031 to 30.046 mm 1.1823 to 1.1829 in.

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Piston And Connecting Rod - Servicing (Cont'd)

Figure 70-90-13

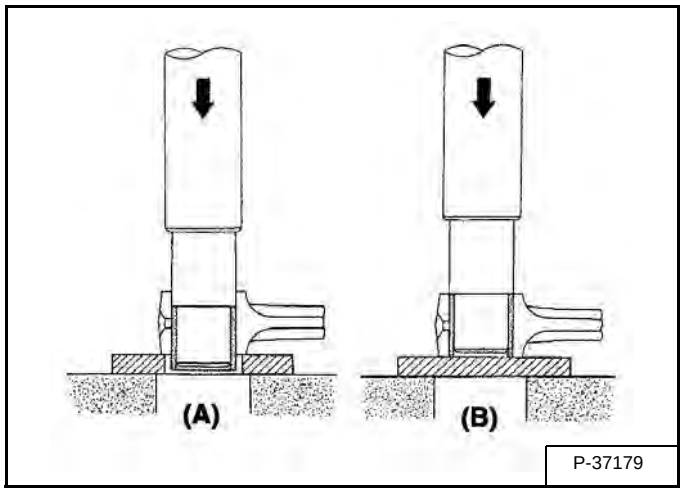
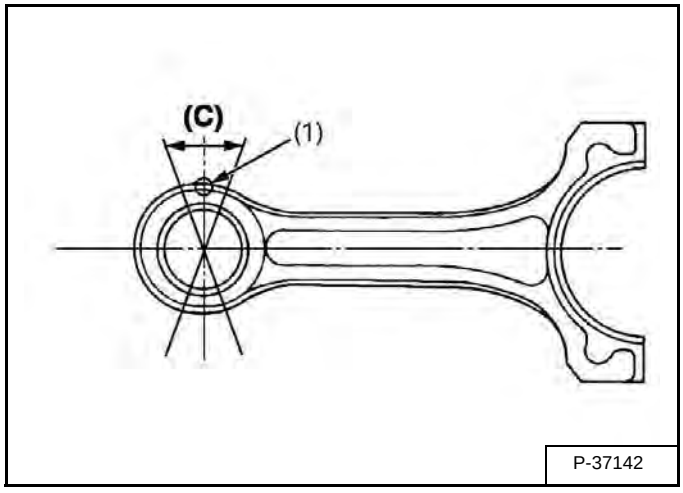


Figure 70-90-14



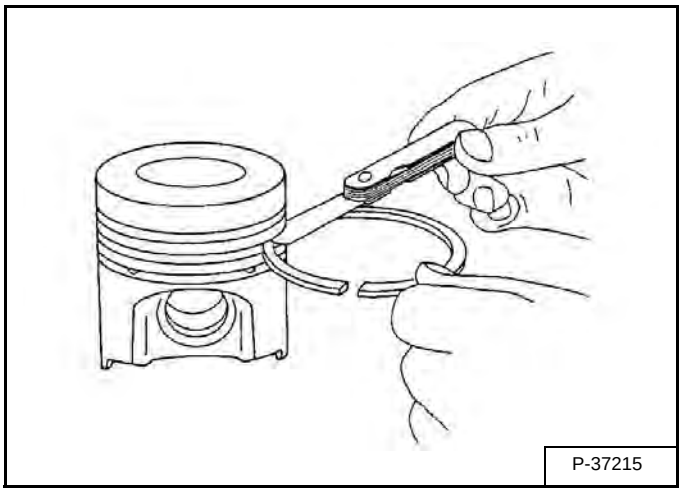
Press out the used bushing using a small end bushing replacing tool **[Figure 70-90-13]**.

Clean a new small end bushing and bore, and apply engine oil to them.

Insert a new bushing onto the tool and press-fit it with a press so that the seam (Item 1) **[Figure 70-90-14]** of the bushing is flush with the connecting rod.

Piston Ring Groove

Figure 70-90-15



Remove carbon from the ring grooves.

Measure the clearance between the ring and the groove with a feeler gauge **[Figure 70-90-15]**.

If the clearance exceeds allowable limit, check the new rings on an old piston and if it is out of spec, replace the piston.

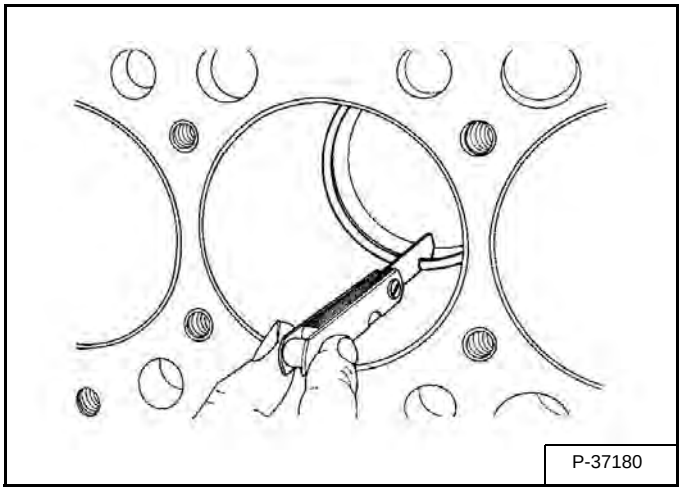
Factory spec.	Compression ring 1	0.05 to 0.07 mm 0.0020 to 0.0028 in.
	Compression ring 2	0.093 to 0.120 mm 0.0037 to 0.0047 in.
	Oil Ring	0.020 to 0.060 mm 0.0008 to 0.0023 in.
Allowable limit	Compression ring 1	0.15 mm 0.0059 in.
	Compression ring 2	0.20 mm 0.0079 in.
	Oil ring	0.15 mm 0.0059 in.

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Piston And Connecting Rod - Servicing (Cont'd)

Piston Ring Gap

Figure 70-90-16



Insert the piston ring into the lower part of the liner (the least worn out part) with the piston.

Measure the ring gap with a feeler gauge **[Figure 70-90-16]**.

If the gap exceeds the allowable limit, replace the piston ring.

Compression ring 1, 2	Factory spec.	0.30 to 0.45 mm 0.0118 to 0.0177 in.
	Allowable limit	1.25 mm 0.0492 in.

Oil Ring	Factory spec.	0.25 to 0.45 mm 0.0098 to 0.0177 in.
	Allowable limit	1.25 mm 0.0492 in.

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Cylinder Bore Checking

Figure 70-90-17

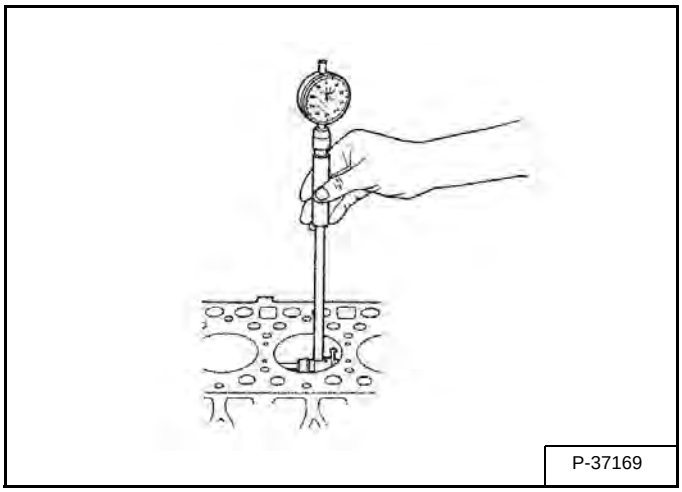
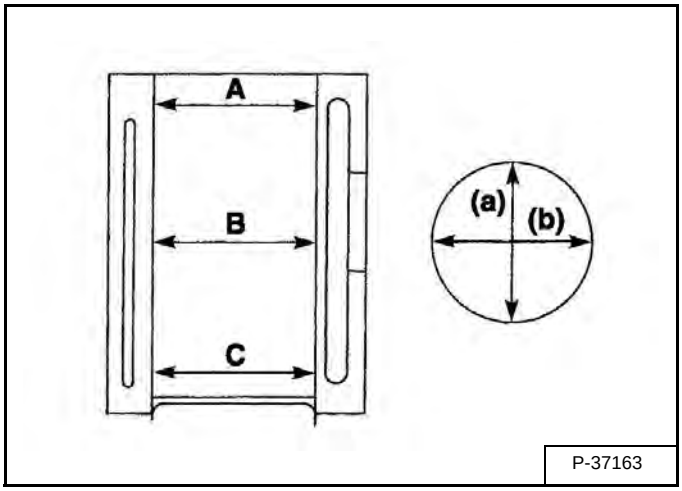


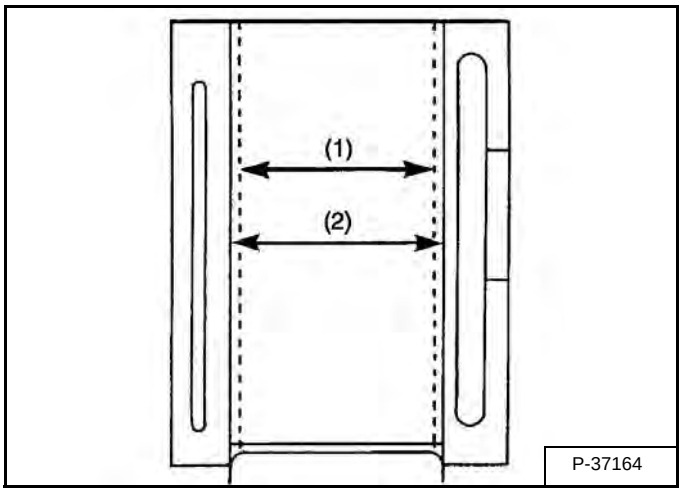
Figure 70-90-18



Measure the six points with a cylinder gauge to find out the maximum wear **[Figure 70-90-17]**. Generally, position (1) in the (**a, b**) direction (at about 20 mm (0.79 in.) from the top) shows the maximum wear **[Figure 70-90-18]**. Since position (3) at the lower part of the bore will show the minimum wear, find these difference.

Cylinder bore I.D.	Factory spec.	98.000 to 98.022 mm 3.8582 to 3.8591 in.
	Allowable limit	98.15 mm 3.8642 in.

Figure 70-90-19



When the cylinder is worn beyond the allowable limit, bore and hone it to the specified dimension **[Figure 70-90-19]**.

Cylinder I.D. (2)	Oversize (+ 0.5 mm) Spec.	98.500 to 98.522 mm 3.8780 to 3.8788 in.
Maximum wear	Allowable limit	98.65 mm 3.8839 in.
Finishing	Hone to 1.2 to 2.0 μR max. (0.000047 to 0.0079 in.R max.	

Replace the piston and piston rings with oversize (0.5 mm) ones.

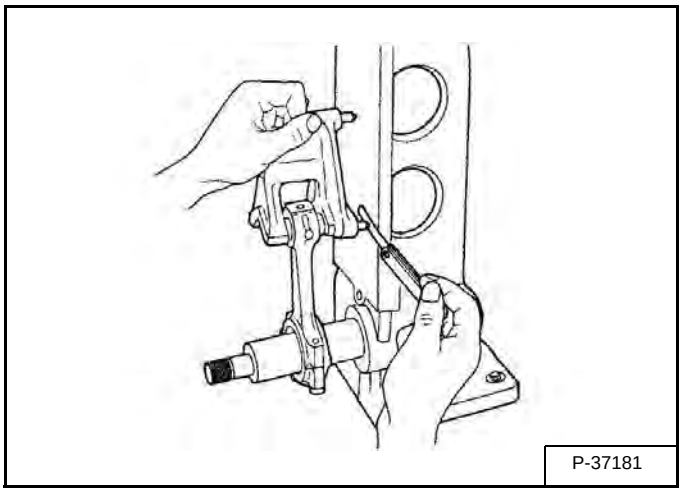
Part Name	Part Code	Marking
Piston	1C050-21910	05 OS
Piston Ring Assembly	1C020-21090	05 OS

NOTE: When the oversize cylinder is worn beyond the allowable limit, replace the cylinder block with a new one.

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Connecting Rod Alignment

Figure 70-90-20



(See Piston And Connecting Rod - Servicing on Page 70-90-3.) for the code to order this tool **[Figure 70-90-20]** from the engine manufacturer.

NOTE: Since the I.D. of the connecting rod small end bushing is the basis of this check, check the bushing for wear beforehand.

Remove the piston pin in the connecting rod.

Install the piston pin in the connecting rod.

Install the connecting rod on the connecting rod alignment tool.

Put a gauge over the piston pin, and move it against the face plate **[Figure 70-90-20]**.

If the gauge does not fit squarely against the face plate, measure the space between the pin of the gauge and the face plate.

If the measurement exceeds the allowable limit, replace the connecting rod.

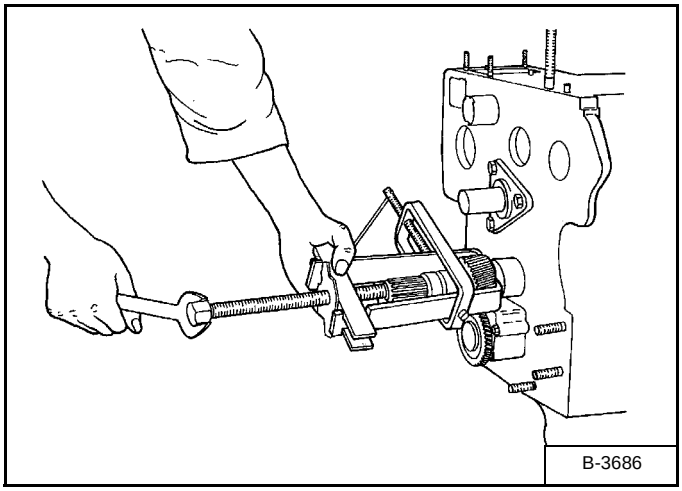
Connecting rod alignment	Allowable limit	0.05 mm 0.0020 in.

Crankshaft Gear Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 70-100-1.)

Remove the idler gear. (See Idle Gear And Shaft Removal And Installation on Page 70-100-5.)

Figure 70-90-21



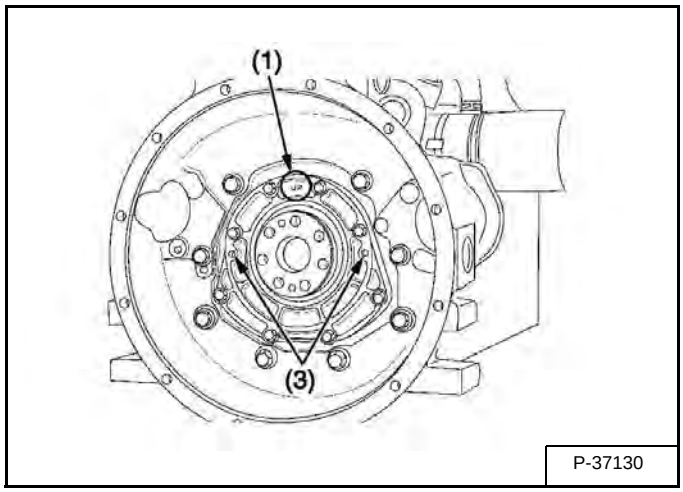
Remove the crankshaft gear with a puller **[Figure 70-90-21]**.

Remove the crankshaft key.

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Crankshaft And Bearings Removal and Installation

Figure 70-90-22

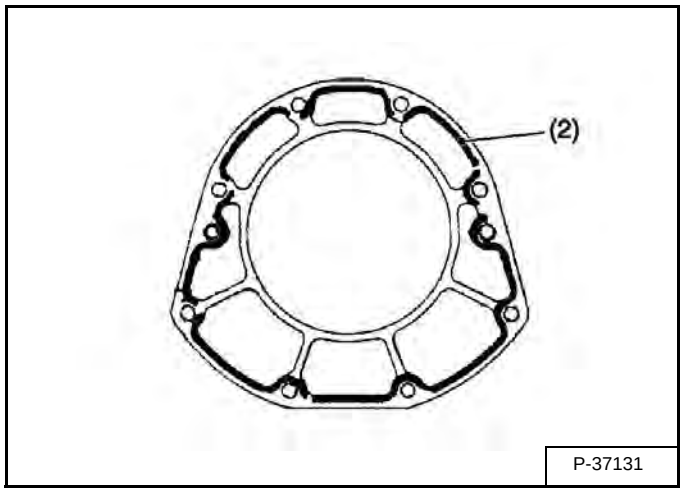


NOTE: Before disassembling, check the side clearance of crankshaft. Also check it during reassembly.

Remove the bearing case cover mounting screws.

Screw two removed screws into the screw hole (Item 3) **[Figure 70-90-22]** of bearing case cover to remove it.

Figure 70-90-23



NOTE: In case of replacing the oil seal, use caution when installing the seal in the bearing case cover as not to install it tilted. The seal should be flush with the cover.
Confirm that the liquid gasket coating surface is free of water, dust and oil in order to maintain sealing effect.
Apply liquid gasket (Item 2) [Figure 70-90-23] to the bearing case cover evenly.

Before installing the bearing case cover / oil seal assembly, lube the seal and be careful not to damage the seal while installing the assembly.
Install the bearing case cover/oil seal assembly to the position the casting mark "UP" on it upward (Item 1) [Figure 70-90-23].

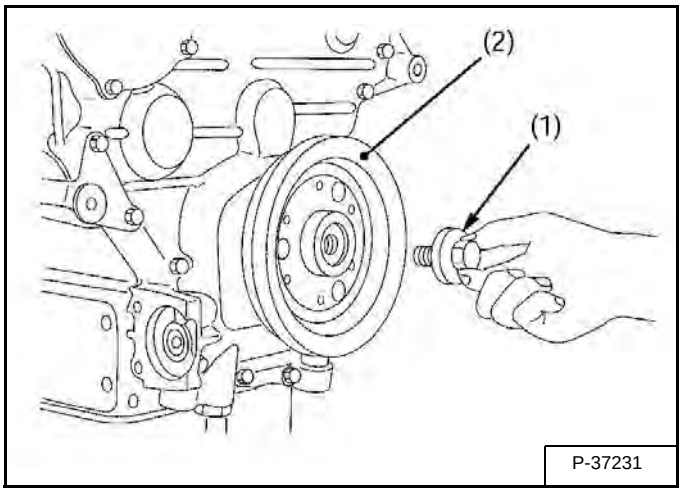
Tighten the bearing case cover mounting screws with even force on the diagonal line.
When mounting the adhesive-applied parts, take care to fit them to the mating parts.
Assemble the adhesive-applied parts within ten minutes.

Tightening torque	Bearing Case Cover mounting screw	23.5 to 27.5 N•m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft.-lb.

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Crankshaft And Bearings Removal and Installation (Cont'd)

Figure 70-90-24



Install the engine flywheel pin.

Remove the crankshaft screw (Item 1) **[Figure 70-90-24]**.

Remove the fan drive pulley (Item 2) **[Figure 70-90-24]**.

NOTE: Clean the crankshaft screw and the alternator drive pulley sleeve surface thoroughly and tighten the screw securely to specified torque.

Tightening torque	Crankshaft screw	255.0 to 274.6 N•m 26.0 to 28.0 kgf·m 188.1 to 202.5 ft.-lb.

Figure 70-90-25

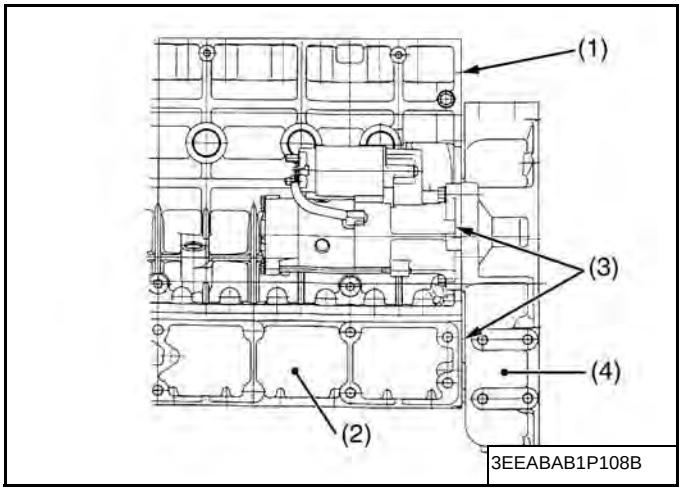
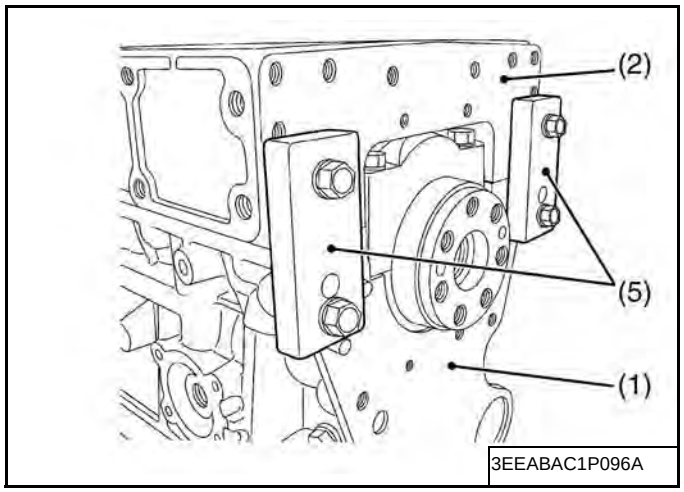


Figure 70-90-26



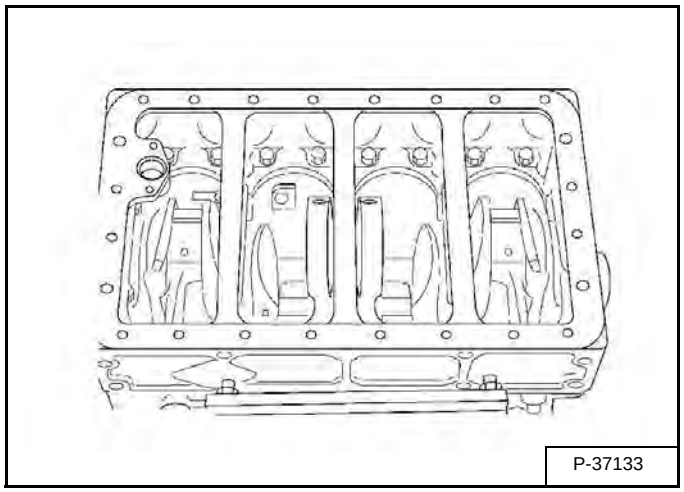
Match the crankcase 1 (Item 1)and crankcase 2 (Item 2), **[Figure 70-90-25]** referring to the flywheel's contoured face.

Tighten the crankcase 2 mounting bolts loosely.

Tighten up the jig (Item 5) **[Figure 70-90-26]** to the specified torque same as the flywheel housing screw (Item 4) **[Figure 70-90-25]**. This helps to minimize the level difference between the crankcase 1 and the crankcase 2 (at the flywheel side) Possible gap must be 0.05 mm or smaller (Item 3) **[Figure 70-90-25]**.

Tightening torque	Crankcase 2 mounting screw	49.0 to 55.9 N•m 5.0 to 5.7 kgf·m 36.2 to 41.3 ft.-lb.
	Flywheel housing screw	77.5 to 90.2 N•m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft.-lb.

Figure 70-90-27

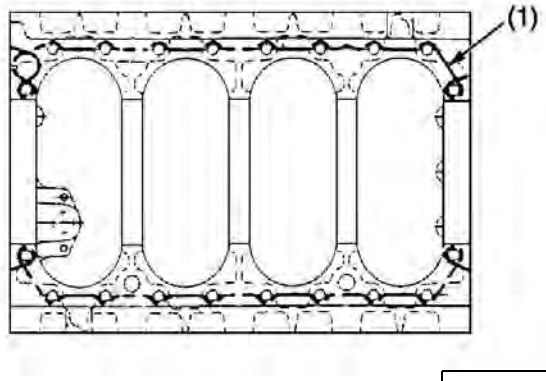


Remove the crankcase 2 **[Figure 70-90-27]**.

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Crankshaft And Bearings Removal and Installation (Cont'd)

Figure 70-90-28

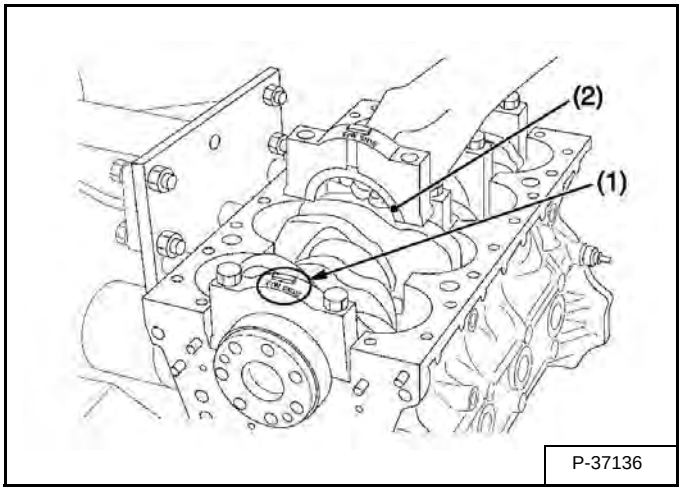


NOTE: Make sure the crankcase 1 and 2 are clean. Apply liquid gasket (Item 1) [Figure 70-90-28] to the crankcase 2 as shown in the figure.

Tighten the crankcase 2 mounting screws with even force on the diagonal line.
Confirm that the liquid gasket coating surface is free of water, dust and oil in order to maintain sealing effect.
Carefully apply the adhesive evenly.

Tightening torque	Crankcase 2 mounting screw	49.0 to 55.9 N•m 5.0 to 5.7 kgf·m 36.2 to 41.3 ft.-lb.

Figure 70-90-29

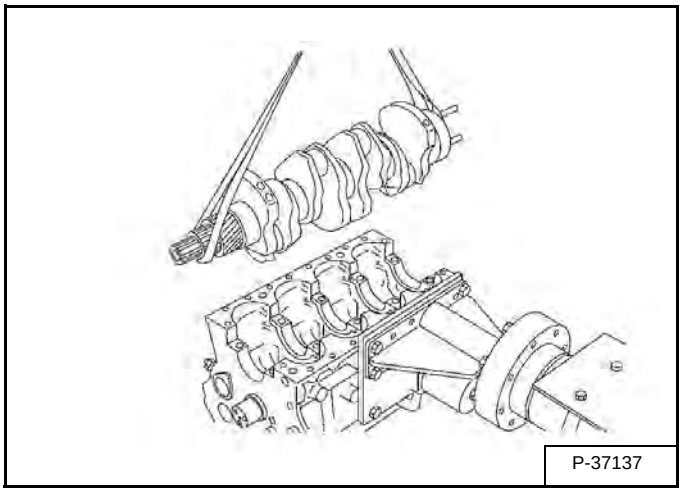


Remove the main bearing case.

Remove the crankshaft.

Reassemble the main bearing case having the same number as the one engraved on the crankcase, and set the casting mark "F / W SIDE" (Item 1) **[Figure 70-90-29]** on the main bearing case facing towards the flywheel side.

Figure 70-90-30



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Crankshaft And Bearings Removal and Installation (Cont'd)

Figure 70-90-31

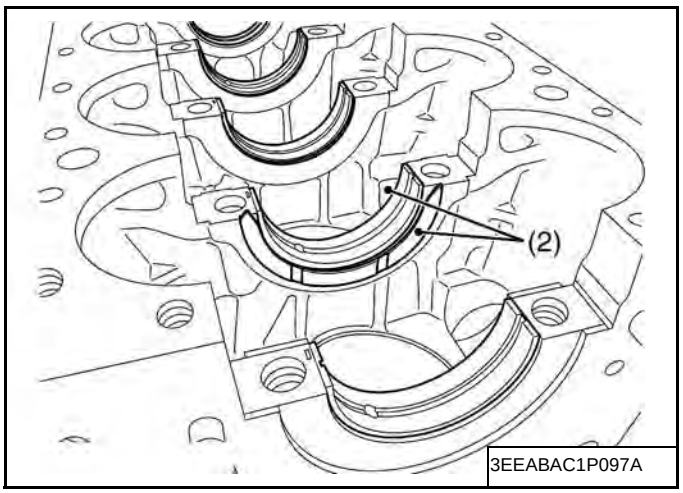


Figure 70-90-32

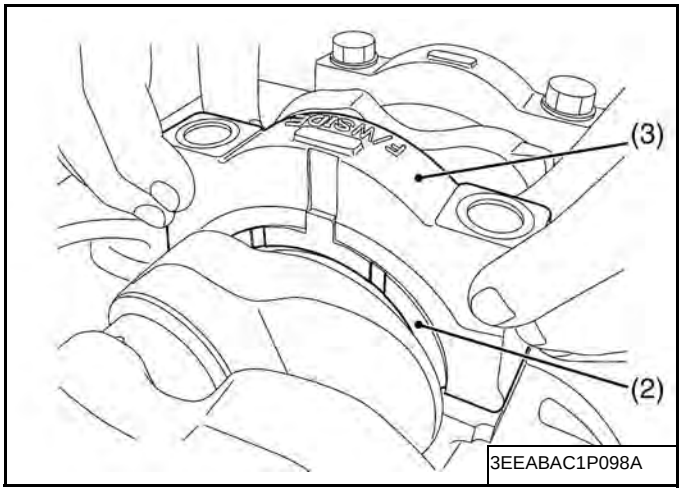
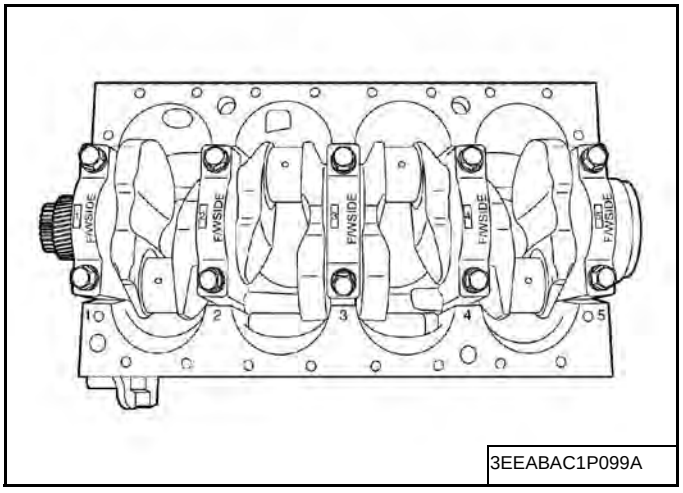


Figure 70-90-33



Reassemble the thrust bearing (Item 2) **[Figure 70-90-31]**, with the oil groove facing outside, into both side of the fourth main bearing case.

Apply oil to the bearing case screws and tighten them to the specified torque.

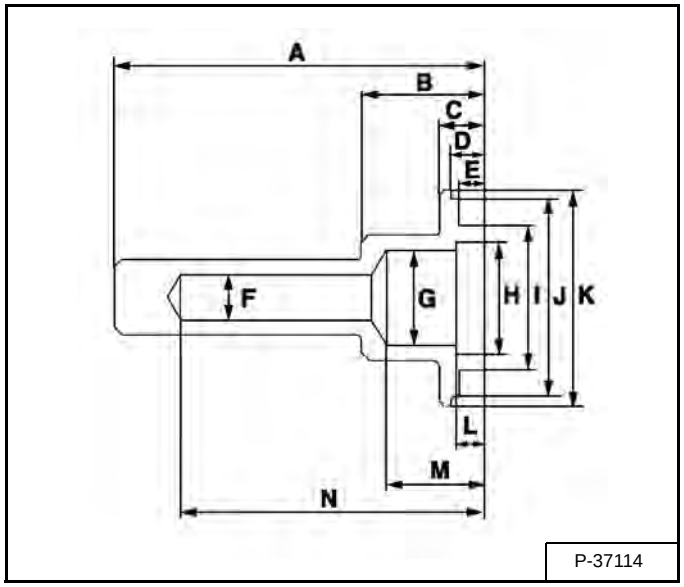
Tightening torque	Main bearing case screw	137.3 to 147.1 N•m 14.0 to 15.0 kgf·m 101.3 to 108.5 ft.-lb.

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Crankshaft And Bearings - Servicing

The following special tools are not provided, so make them referring to **[Figure 70-90-34]**, **[Figure 70-90-35]** & **[Figure 70-90-36]**.

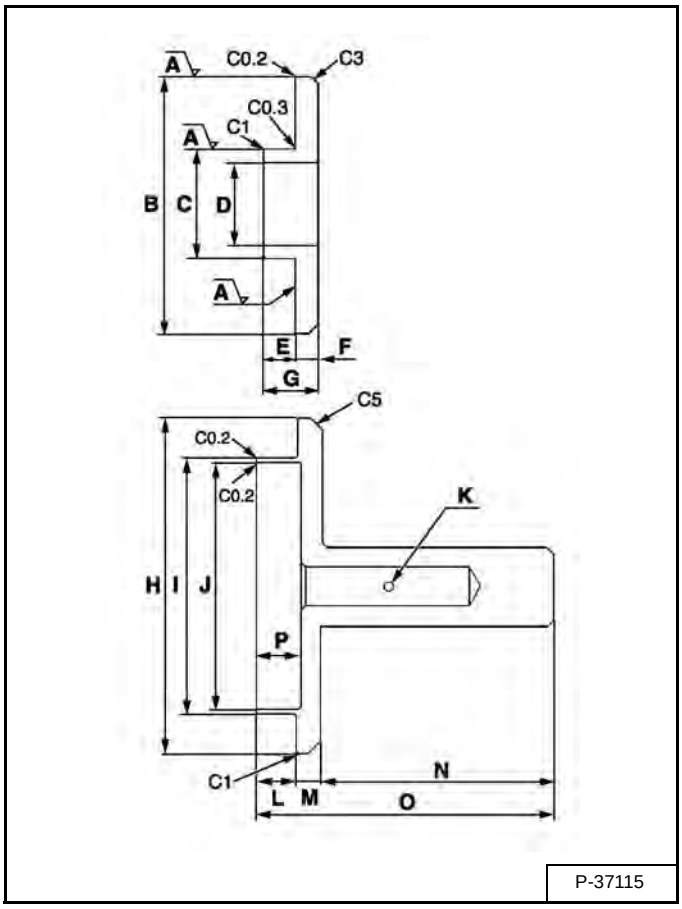
Figure 70-90-34



Gearcase Oil Seal Replacing Tool
Application: Use to press fit the oil seal.

A	148.8 mm (5.8582 in.)
B	50 mm (1.9685 in.)
C	18.8 mm (0.7401 in.)
D	13.7 to 13.9 mm (0.5394 to 0.5472 in.)
E	11 mm (0.433 in.)
F	18 mm dia. (0.7087 in. dia.)
G	38 mm dia. (1.4961 in. dia.)
H	45 mm dia. (1.7716 in. dia.)
I	57.9 to 58.1 mm (2.2795 to 2.2874 in.)
J	79.5 mm dia. (3.1299 in. dia.)
K	87 mm (3.452 in.)
L	12 mm (0.4724 in.)
M	40 mm (1.5748 in.)
N	120 mm (4.7244 in.)

Figure 70-90-35



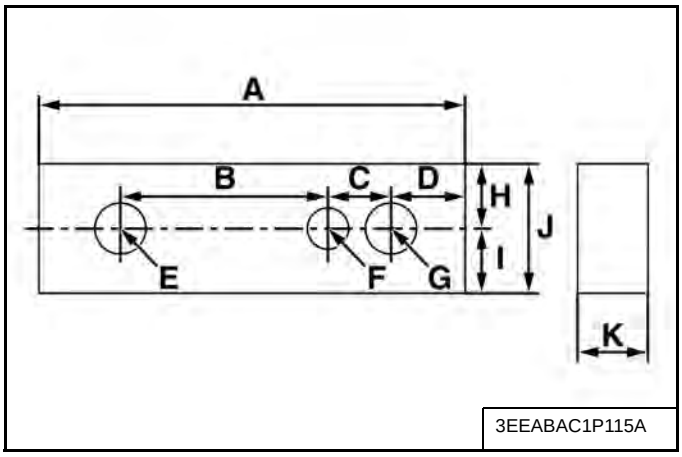
Auxiliary Socket For Fixing Crankshaft Sleeve
Application: Use to fix the crankshaft sleeve of the diesel engine.

A	Rmax = 12.5 S
B	94.5 to 95.0 mm (3.7205 to 3.7402 in.)
C	40 mm (1.5748 in.)
D	30 mm (1.1811 in.)
E	12 mm (0.4724 in.)
F	7.9 to 8.1 mm (0.3110 to 0.3189 in.)
G	20 mm (0.0787 in.)
H	130 mm (5.1181 in.)
I	99.4 to 99.6 mm (3.9134 to 3.9213 in.)
J	95.05 to 95.20 mm (3.7421 to 3.7480 in.)
K	3 mm dia. (0.1181 in. dia.)
L	15 mm (0.5905 in.)
M	10 mm (0.3937 in.)
N	90 mm (3.5433 in.)
O	115 mm (4.5275 in.)
P	16.9 to 17.1 mm (0.6654 to 0.6732 in.)
C1	Chamfer 1.0 mm (0.039 in.)
C3	Chamfer 3.0 mm (0.1181 in.)
C5	Chamfer 5.0 mm (0.1969 in.)
C0.2	Chamfer 0.2 mm (0.0079 in.)
C0.3	Chamfer 0.3 mm (0.0118 in.

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Crankshaft And Bearings - Servicing (Cont'd)

Figure 70-90-36



Application: Use for aligning the crankcase 1 and 2.

A	115 mm (4.5276 in.)
B	56 mm (2.2047 in.)
C	17 mm (0.6693 in.)
D	20 mm (0.7874 in.)
E	f14 mm (0.5512 in. dia.)
F	f11 mm (0.4331 in. dia.)
G	f14 mm (0.5512 in. dia.)
H	17.5 mm (0.6890 in.)
I	17.5 mm (0.6890 in.)
J	35 mm (1.3780 in.)
K	19mm (0.7480 in.)

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Crankshaft And Bearings - Servicing (Cont'd)

Crankshaft Side Clearance

Figure 70-90-37

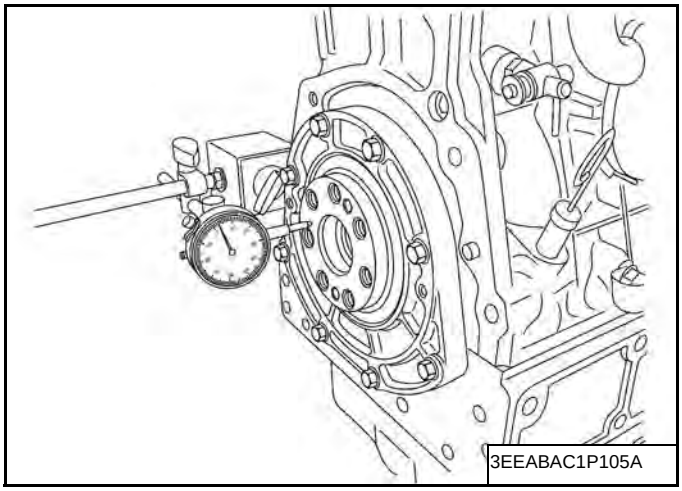
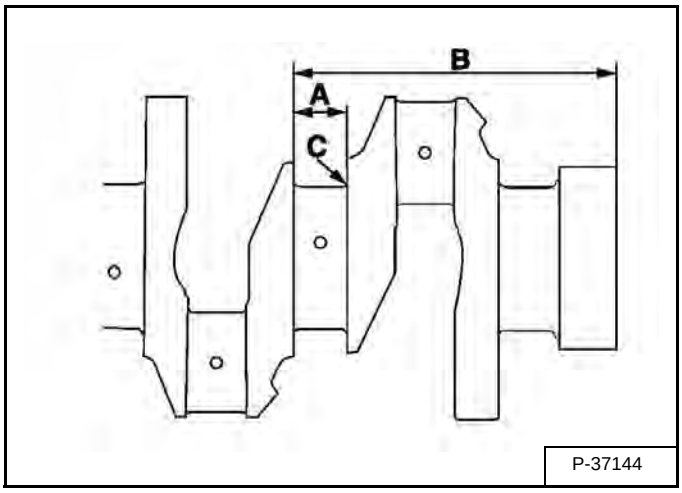


Figure 70-90-38



Set a dial indicator with its tip on the end of the crankshaft **[Figure 70-90-37]**.

Measure the side clearance by moving the crankshaft to the front and rear.

If the measurement exceeds the allowable limit, replace the thrust bearings.

If the same size bearing is useless because of the crankshaft journal wear, replace it with an oversize one referring to the table and **[Figure 70-90-38]**.

Crankshaft side clearance	Factory spec.	0.15 to 0.31 mm 0.0059 to 0.0122 in.
	Allowable limit	0.50 mm 0.0197 in.

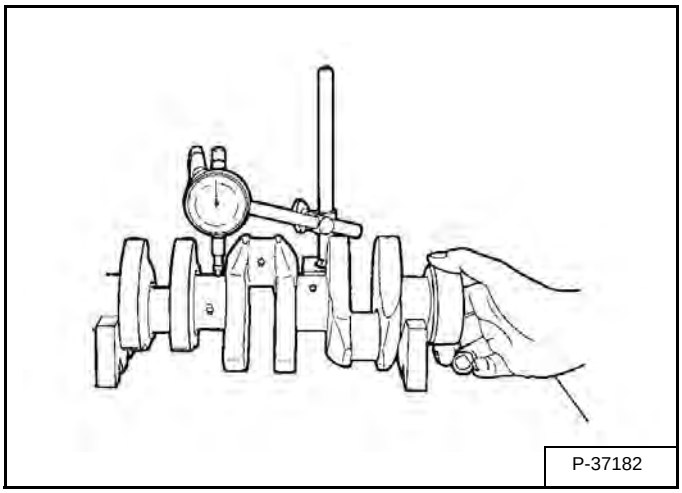
Oversize thrust bearing

Oversize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Thrust bearing 1 02	1C010-23951	020 OS
	Thrust bearing 2 02	1C010-23971	020 OS
0.4 mm 0.016 in.	Thrust bearing 1 04	1C010-23961	040 OS
	Thrust bearing1 04	1C010-23981	040 OS

Oversize dimensions of crankshaft journal.

Oversize	0.2 mm 0.008 in.	0.4 mm 0.016 in.
Dimension A	29.20 to 29.25 mm 1.1496 to 1.1515 in.	29.40 to 29.45 mm 1.1574 to 1.1594 in.
Dimension B	169.1 to 169.15 mm 6.6575 to 6.6594 in.	169.2 to 169.25 mm 6.6614 to 6.6634 in.
Dimension C	2.8 to 3.2 mm radius 0.1102 to 0.1260 in. radius	2.8 to 3.2 mm radius 0.1102 to 0.1260 in. radius
The crankshaft journal must be fine-finished to higher than ———— (0.8-S)		

Figure 70-90-39



Support the crankshaft with V block on the surface plate and set a dial indicator with its tip on the intermediate journal at right angle **[Figure 70-90-39]**.

Rotate the crankshaft on the V block and get the misalignment (half of the measurement).

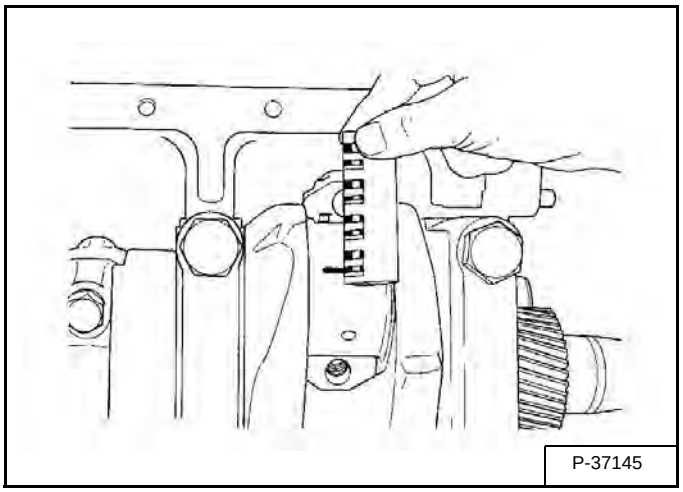
If the misalignment exceeds the allowable limit, replace the crankshaft.

Crankshaft alignment	Allowable limit	0.02 mm 0.00079 in.

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Crankshaft And Bearings - Servicing (Cont'd)

Figure 70-90-40



Clean the crank pin and crank pin bearing.

Put a strip of plastigage (Code No. 07909-30241) **[Figure 70-90-40]** on the center of the crank pin.

Install the connecting rod cap and tighten the connecting rod screws to the specified torque, and remove the cap again.

Measure the amount of the flattening with the scale, and get the oil clearance.

If the oil clearance exceeds the allowable limit, replace the crank pin bearing.

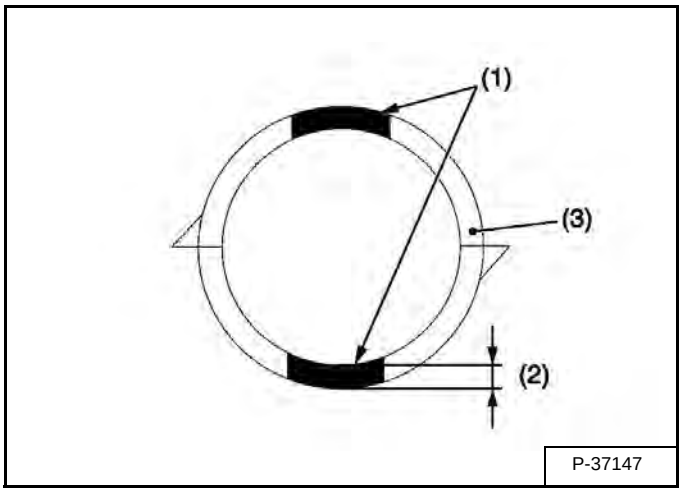
If the same size bearing is useless because of the crank pin wear, replace it with an undersize one referring to the table and figure.

NOTE: Never insert the plastigage into the crank pin oil hole. Be sure not to move the crankshaft while the connecting rod screws are tightened.

Crank pin O.D.	Factory spec.	52.977 to 52.990 mm 2.0857 to 2.0862 in.

Oil clearance between crank pin and crank pin bearing	Factory spec.	0.018 to 0.051 mm 0.0007 to 0.0020 in.
	Allowable limit	0.20 mm 0.0079 in.

Figure 70-90-41



NOTE: STD size crank pin bearing for V3300. To replace it with a specific STD service part, make sure the crank pin bearing has the same ID color as the connecting rod [Figure 70-90-41].

ID Color	Connecting rod	Crank pin bearing		
	Large-end in. dia.	Class	Part code	Center wall thick
Blue	56.01 to 56.02 mm 2.2051 to 2.2055 in.	L	1C020-22311	1.496 to 1.501 mm 0.0589 to 0.0591 in.
Yellow or No Color	56.00 to 56.01 mm 2.2047 to 2.2051 in.	S	1C020-22331	1.491 to 1.496 mm 0.0587 to 0.0589 in.

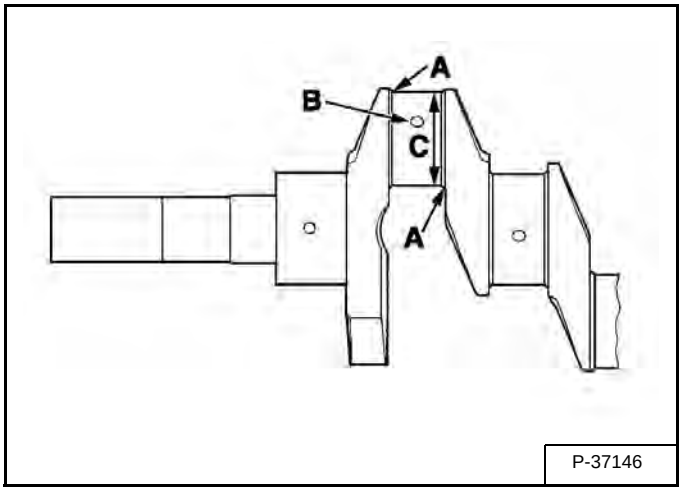
Undersize crank pin bearing.

Undersize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Crank pin bearing 02	1C020-22960	020 US
0.4 mm 0.016 in.	Crank pin bearing 04	1C020-22970	040 US

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Crankshaft And Bearings - Servicing (Cont'd)

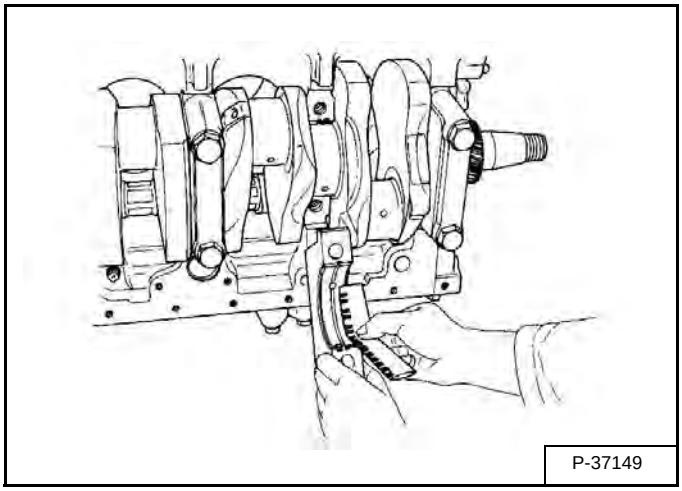
Figure 70-90-42



Undersize dimensions of crank pin.

Undersize	0.2 mm 0.008 in.	0.4 mm 0.016 in.
Dimension A	2.8 to 3.2 mm radius 0.1102 to 0.1260 in. radius	2.8 to 3.2 mm radius 0.1102 to 0.1260 in. radius
Dimension B	1.0 to 1.5 mm radius 0.0394 to 0.0591 in. radius	1.0 to 1.5 mm radius 0.0394 to 0.0591 in. radius
Dimension C	52.777 to 52.790 mm 2.0778 to 2.0783 in.	52.577 to 52.590 mm 2.0700 to 2.0705 in.
The crank pin must be fine-finished to higher than ———— (0.8-S)		

Figure 70-90-43



Clean the crankshaft journal and crankshaft bearing.

Put a strip of press gauge (Code No.: 07909-30241) on the center of the journal **[Figure 70-90-43]**.

NOTE: Never insert the press gauge into the oil hole of the journal.

Install the main bearing case and tighten the screws to the specified torque, and remove the cases again.

Measure the amount of the flattening with the scale and get the oil clearance.

If the clearance exceeds the allowable limit, replace the crankshaft bearing.

Crank pin O.D.	Factory spec.	74.977 to 74.990 mm 2.9518 to 2.9548 in.

Oil clearance between crankshaft journal and crankshaft bearing	Factory spec.	0.018 to 0.062 mm 0.0007 to 0.0020 in.
	Allowable limit	0.20 mm 0.0079 in.

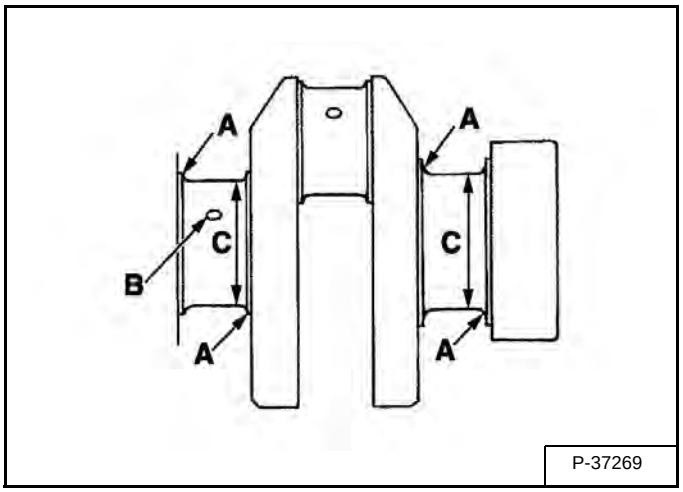
Undersize crank pin bearing.

Undersize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Crankshaft bearing 02	1C020-23910	020 US
0.4 mm 0.016 in.	Crankshaft bearing 04	1C020-22920	040 US

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Crankshaft And Bearings - Servicing (Cont'd)

Figure 70-90-44

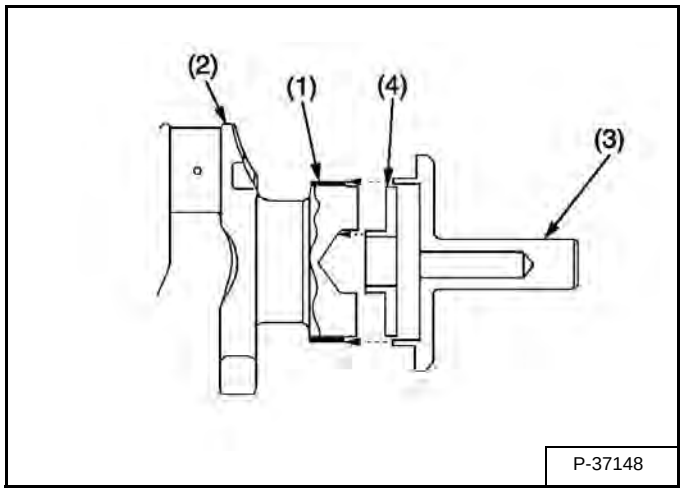


Undersize dimensions of crank pin **[Figure 70-90-44]**.

Undersize	0.2 mm 0.008 in.	0.4 mm 0.016 in.
Dimension A	2.8 to 3.2 mm radius 0.1102 to 0.1260 in. radius	2.8 to 3.2 mm radius 0.1102 to 0.1260 in. radius
Dimension B	1.0 to 1.5 mm radius 0.0394 to 0.0591 in. radius	1.0 to 1.5 mm radius 0.0394 to 0.0591 in. radius
Dimension C	74.777 to 74.790 mm 2.9440 to 2.9445 in.	74.577 to 74.590 mm 2.9361 to 2.9366 in.
The crank pin must be fine-finished to higher than (0.8-S) ————		

Crankshaft Sleeve

Figure 70-90-45



Remove the used crankshaft sleeve (Item 1) **[Figure 70-90-45]** using a special-use puller set (Code No.: 07916-09032).

Set the sleeve guide (Item 4) to the crankshaft (Item 2) **[Figure 70-90-45]**.

Heat a new sleeve to a temperature between 150 and 200°C (302 and 392°F), and fix the sleeve to the crankshaft.

Press fit the sleeve using the auxiliary socket for pushing (Item 3) **[Figure 70-90-45]**.

NOTE: Mount the sleeve with its largely chamfered surface facing outward.

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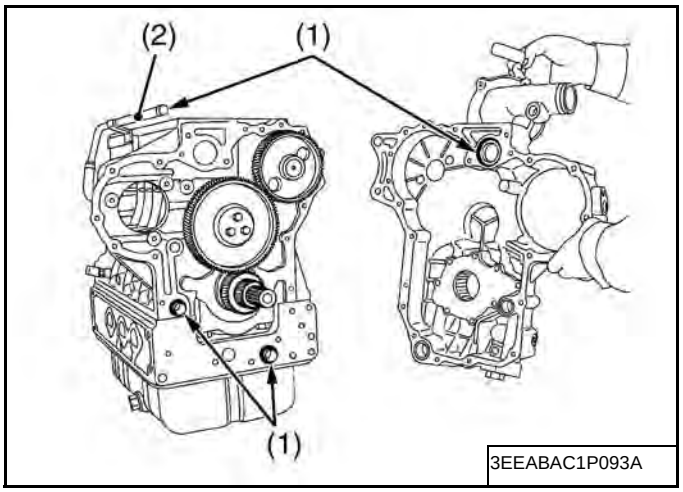


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CAMSHAFT AND TIMING GEARS

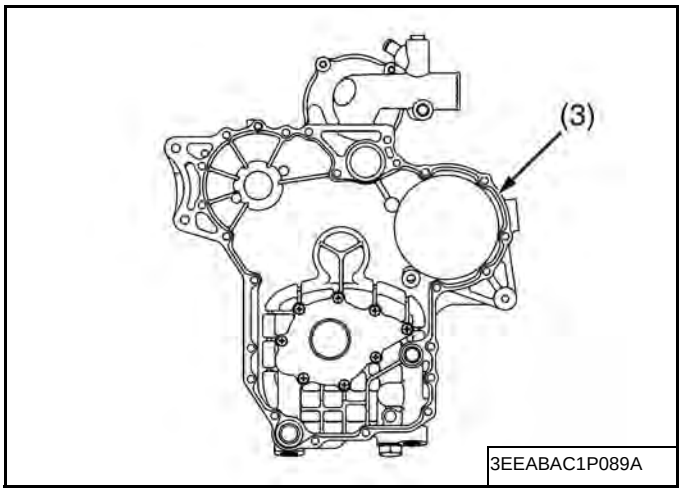
Timing Gearcase Cover Removal And Installation

Figure 70-100-1



Remove the gearcase cover (Item 1) **[Figure 70-100-1]**.

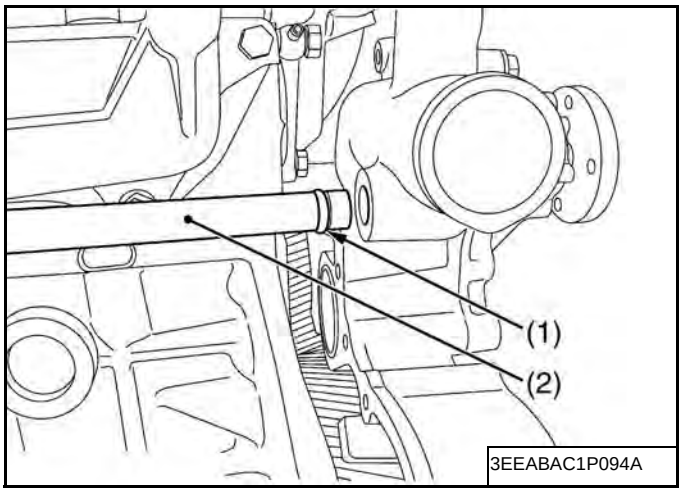
Figure 70-100-2



Confirm that the liquid gasket coating surface is free of water, dust and oil in order to maintain sealing effect.

Carefully apply the adhesive evenly **[Figure 70-100-2]**.

Figure 70-100-3



Be careful not to damage the water pipe (Item 2) **[Figure 70-100-3]**.

NOTE: When mounting the adhesive-applied parts, take care to fit them to the mating parts.

NOTE: Assemble the adhesive-applied parts within ten minutes.

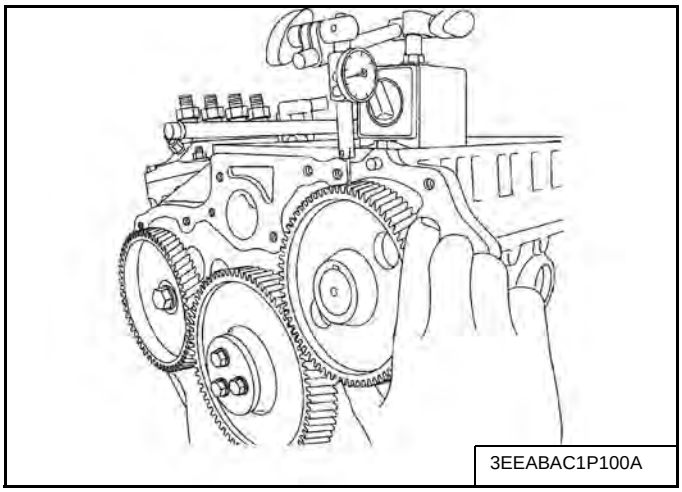
NOTE: Apply a liquid gasket to the gearcase cover.

NOTE: Use the new O-rings when attaching gearcase cover.

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Timing Gears Backlash - Checking

Figure 70-100-4



Set a dial indicator (lever type) with its tip on the gear tooth **[Figure 70-100-4]**.

Move the gear to measure the backlash, holding its mating gear.

If the backlash exceeds the allowable limit, check the oil clearance of the shafts and the gear.

If the oil clearance is proper, replace the gear.

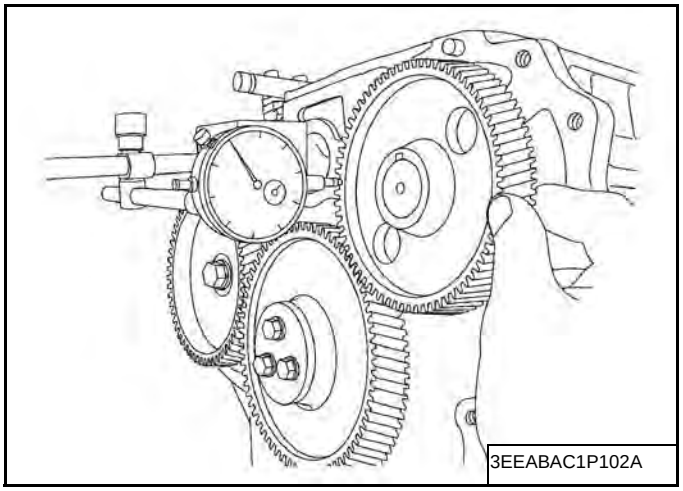
Crank gear Idle gear	Factory spec.	0.049 to 0.193 mm 0.0019 to 0.0076 in.
	Allowable limit	0.22 mm 0.0087 in.
Idle gear Cam gear	Factory spec.	0.049 to 0.189 mm 0.0019 to 0.0074 in.
	Allowable limit	0.22 mm 0.0087 in.
Idle gear 2 Injection pump gear	Factory spec.	0.030 to 0.165 mm 0.0012 to 0.0065 in.
	Allowable limit	0.22 mm 0.0087 in.

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Camshaft - Servicing

Side Clearance

Figure 70-100-5



Set a dial indicator with its tip on the camshaft **[Figure 70-100-5]**.

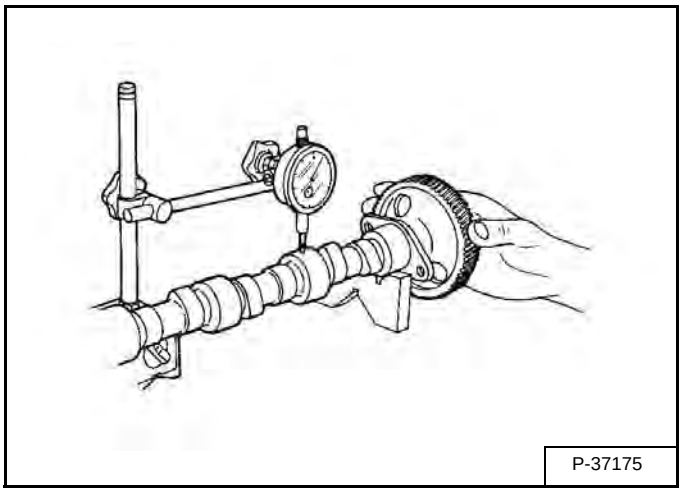
Measure the side clearance by moving the cam gear to the front and rear.

If the measurement exceeds the allowable limit, replace the camshaft stopper.

Side clearance	Factory spec.	0.07 to 0.22 mm 0.0028 to 0.0087 in.
	Allowable limit	0.03 mm 0.0118 in.

Alignment

Figure 70-100-6



Support the camshaft with V block on the surface plate and set a dial indicator with its tip on the intermediate journal at right angle **[Figure 70-100-6]**.

Rotate the camshaft on the V blocks and get the misalignment (half of the measurement).

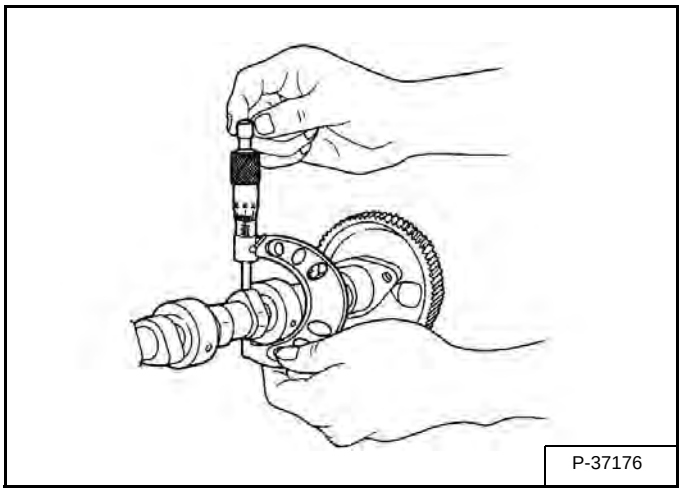
If the misalignment exceeds the allowable limit, replace the camshaft.

Camshaft alignment	Allowable limit	0.01 mm 0.00039 in.

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Camshaft - Servicing (Cont'd)

Figure 70-100-7

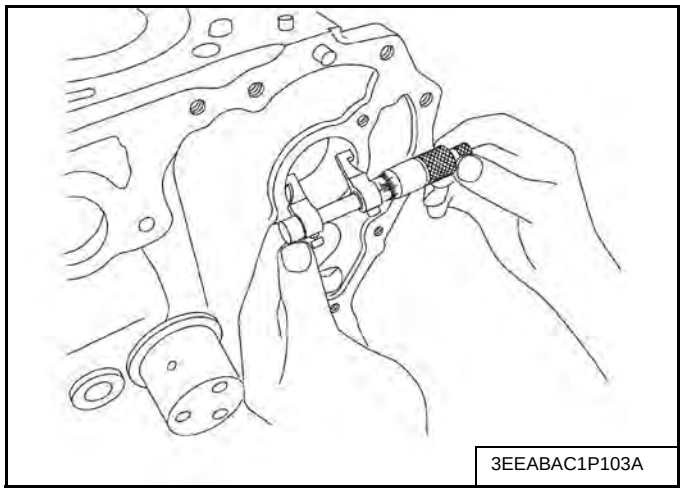


Measure the height of the cam at its highest point with an outside micrometer **[Figure 70-100-7]**.

If the measurement is less than the allowable limit, replace the camshaft.

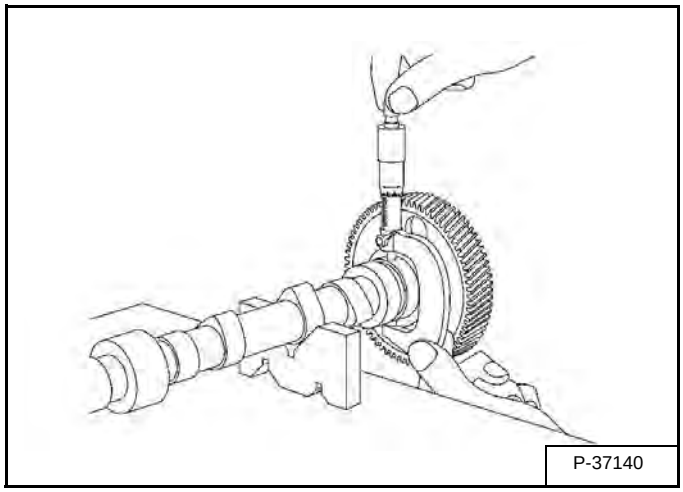
Intake and exhaust cam height	Factory spec.	Intake valve	37.63 mm 1.4815 in.
		Exhaust valve	38.96 mm 1.5338 in.
	Allowable limit	Intake valve	37.13 mm 1.4618 in.
		Exhaust valve	38.46 mm 1.5141 in.

Figure 70-100-8



Measure the cylinder block bore I.D. for camshaft with an inside micrometer **[Figure 70-100-8]**.

Figure 70-100-9



Measure the camshaft journal O.D. with an outside micrometer **[Figure 70-100-9]**.

If the clearance exceeds the allowable limit, replace the camshaft.

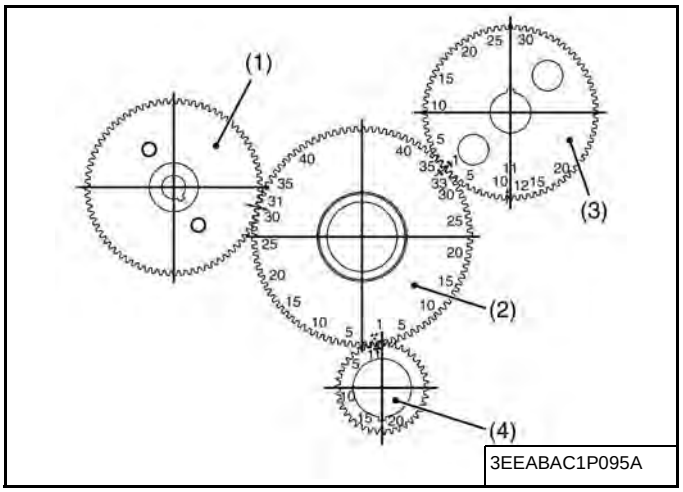
Oil clearance of camshaft journal	Factory spec.	0.050 to 0.091 mm 0.0020 to 0.0035 in.
	Allowable limit	0.15 mm 0.0059 in.

Camshaft journal O.D.	Factory spec.	45.934 to 45.950 mm 1.8084 to 1.8091 in.
Camshaft journal I.D.	Factory spec.	46.000 to 46.025 mm 1.8110 to 1.8120 in.

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Idle Gear And Shaft Removal And Installation

Figure 70-100-10



Remove three set screws of the idle gear and draw out the idle gear 1, 2 **[Figure 70-100-10]**.

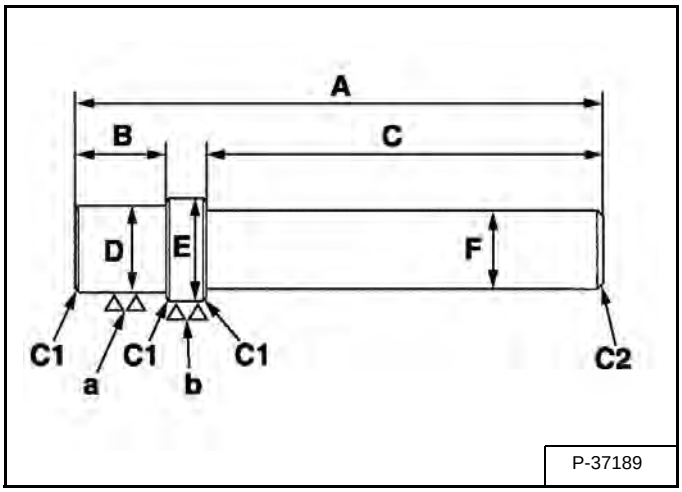
Remove two set screws of the camshaft stopper and draw out the camshaft.

Set the crankshaft at the top dead center of No. 1 and 4 cylinder and the camshaft key to the top position and align the marks of idle gear and cam gear and crank gear to assemble them **[Figure 70-100-10]**.

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Idler Gear And Shaft - Servicing

Figure 70-100-11

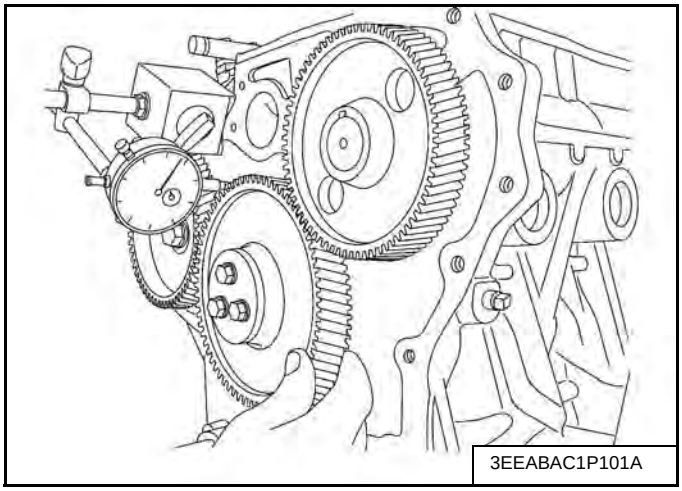


Bushing Replacing Tool
Application: Use to press out and press fit the bushing.
1. For idle gear bushing.

A	196 mm (7.7165 in.)
B	37.5 to 1.476 mm
C	150 mm (5.9055 in.)
D	46.325 to 46.500 mm dia. (1.8238 to 1.8307 in. dia.)
E	48.100 to 48.075 mm dia. (1.8937 to 1.8927 in. dia.)
F	20 mm (0.7874 in.)
a	0.0000063 mm (0.00025 in.)
b	0.0000063 mm (0.00025 in.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)

Side Clearance

Figure 70-100-12



Set a dial indicator with its tip on the idle gear **[Figure 70-100-12]**.

Measure the side clearance by moving the idle gear to the front and rear.

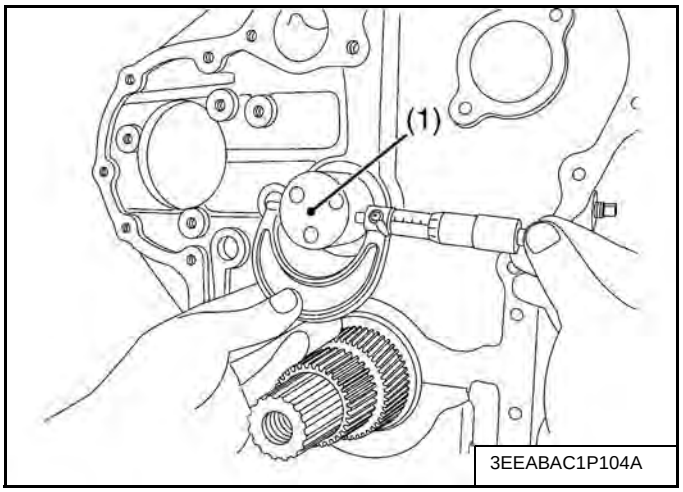
If the measurement exceeds the allowable limit, replace the idle gear collar.

Side clearance	Factory spec.	0.15 to 0.30 mm 0.0059 to 0.0118 in.
	Allowable limit	0.9 mm 0.0354 in.

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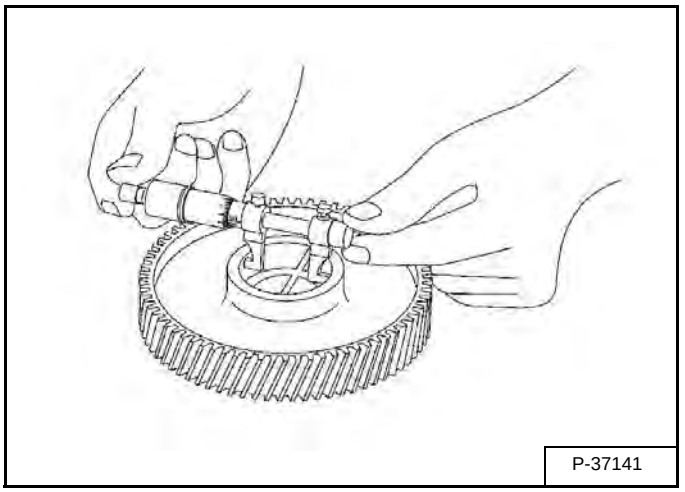
Idler Gear And Shaft Servicing (Cont'd)

Figure 70-100-13



Measure the idle gear shaft O.D. with an outside micrometer **[Figure 70-100-13]**.

Figure 70-100-14



Measure the idle gear bushings I.D. with an inside micrometer, and calculate the oil clearance **[Figure 70-100-14]**.

If the oil clearance exceeds the allowable limit, replace the bushing.

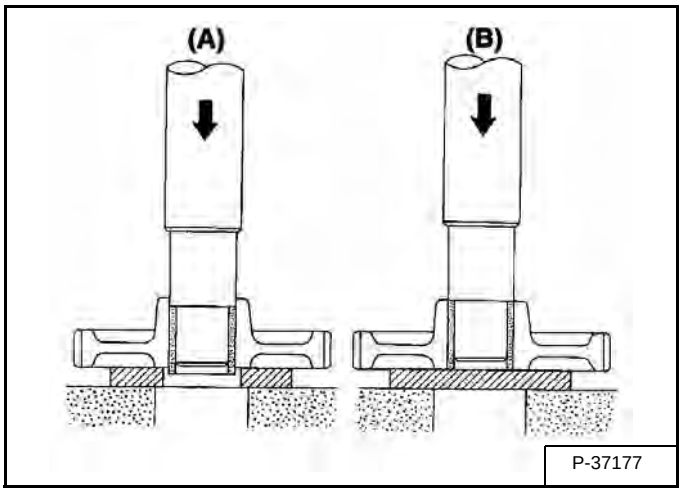
Clearance between idle gear shaft and idle gear bushing	Factory spec.	0.050 to 0.091 mm 0.0020 to 0.0036 in.
	Allowable limit	0.10 mm 0.0039 in.

Idle gear bushing I.D.	Factory spec.	45.025 to 45.050 mm 1.7726 to 1.7736 in.
Idle gear shaft O.D.	Factory spec.	44.959 to 44.945 mm 1.7700 to 1.7707 in.

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Idler Gear And Shaft Servicing (Cont'd)

Figure 70-100-15



Using an idle gear bushing replacing tool, press out the used bushing. (See Idler Gear And Shaft - Servicing on Page 70-100-6.)

Clean a new idle gear bushing and idle gear bore, and apply engine oil to them.

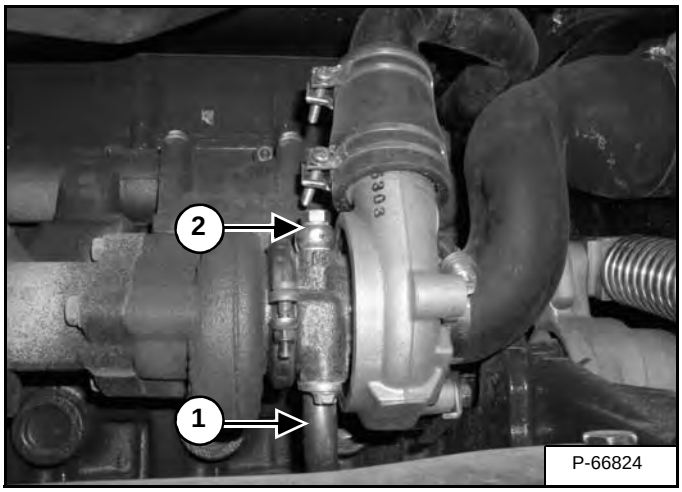
Using an idle gear bushing replacing tool, press in a new bushing (service parts) to the specified dimension **[Figure 70-100-15]**.

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TURBOCHARGER

Description

Figure 70-110-1



The turbocharger is placed between the exhaust and intake manifolds. It is driven by hot exhaust gases and supplies air at more than atmospheric pressure to the intake. It is lubricated by oil from the main galley. The location of the turbo is between the engine and the blower housing.

The oil flows to the turbo by a tubeline (Item 1) and returns to the engine block through another tubeline (Item 2) **[Figure 70-110-1]**.

The turbocharger internal components are not serviceable.

Testing

Inspect the turbine fins and the turbo housing for damage.

Spin turbine by hand. Turbine should spin freely.

If the turbine is damaged replace the turbocharger.

Check the oil tubelines for leaks.

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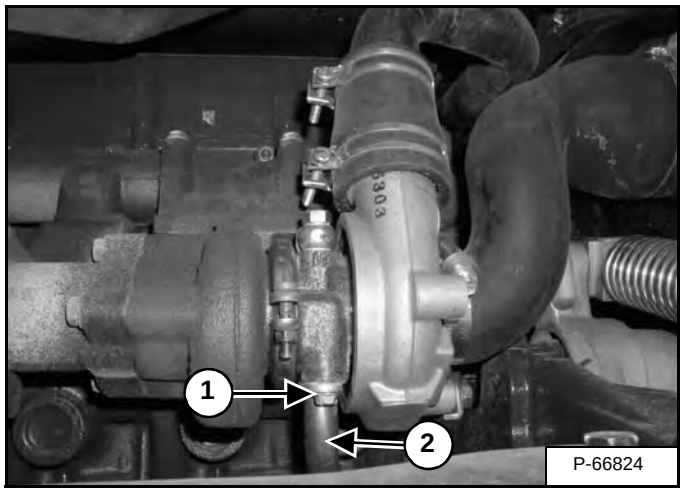
Removal And Installation

WARNING

Turbochargers, operate at high speed and high temperatures. Keep fingers, tools and other objects away from the inlet and outlet ports. Avoid contact with hot surfaces.

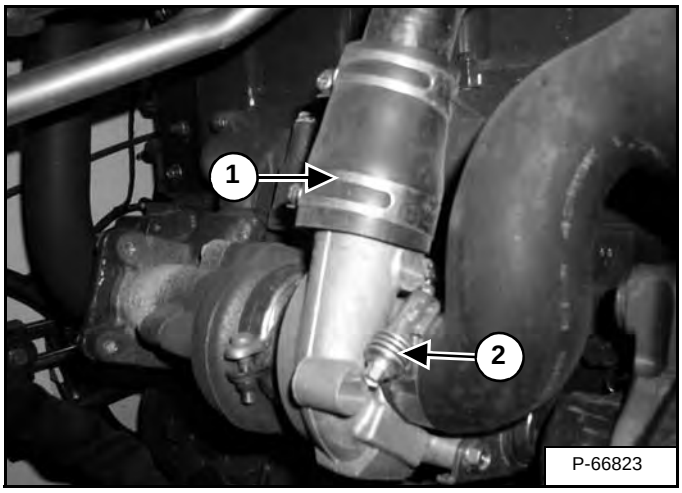
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Figure 70-110-2



Remove the bolts (Item 1) and tubeline **[Figure 70-110-2]**.

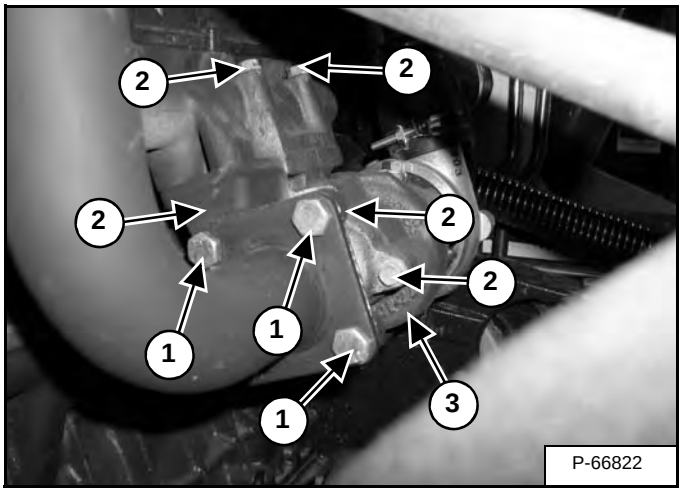
Figure 70-110-3



Loosen the intake hose clamps (Item 1) and remove the intake hose **[Figure 70-110-3]**.

Loosen the air cleaner hose clamps (Item 2) and remove the air cleaner hose **[Figure 70-110-3]**.

Figure 70-110-4



Remove the exhaust four tube bolts (Item 1) **[Figure 70-110-4]**.

Remove the seven turbocharger mounting bolts (Item 2) **[Figure 70-110-4]**.

Take off the turbocharger assembly (Item 3) **[Figure 70-110-4]**.

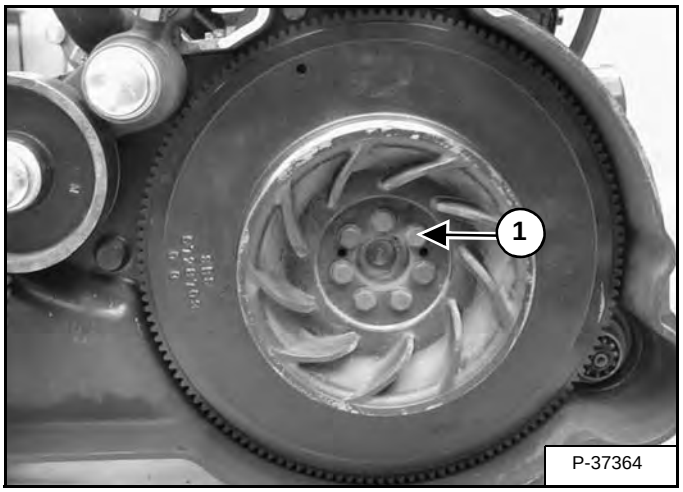
Installation: During installation replace all gaskets with new ones.

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FLYWHEEL AND HOUSING

Flywheel Removal And Installation

Figure 70-120-1



NOTE: To avoid damage to the RPM sensor, remove the RPM sensor before removing the flywheel.

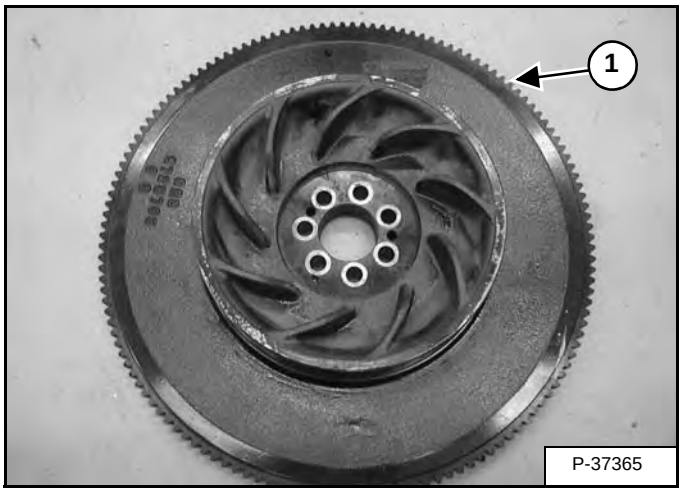
Remove the drive belt. (See Removal And Installation on Page 30-50-2.)

Remove the bolts (Item 1) **[Figure 70-120-1]** from the flywheel.

Installation: Tighten the flywheel bolts to 75-80 ft.-lb. (101,7-108,4 N•m) torque.

Installation: There are two alignment pins on the crankshaft that are used to install the flywheel in the proper position for timing purposes.

Figure 70-120-2



Remove the flywheel from the engine crankshaft **[Figure 70-120-2]**.

Ring Gear Removal And Installation

NOTE: The lead chamfer on ring gear tooth must face the starter.

The ring gear (Item 1) **[Figure 70-120-2]** on the flywheel is an interference fit. Heat the ring gear enough to expand it and hit it with a hammer to remove it evenly.

Clean the outer surface of the flywheel to give it a smooth fit.

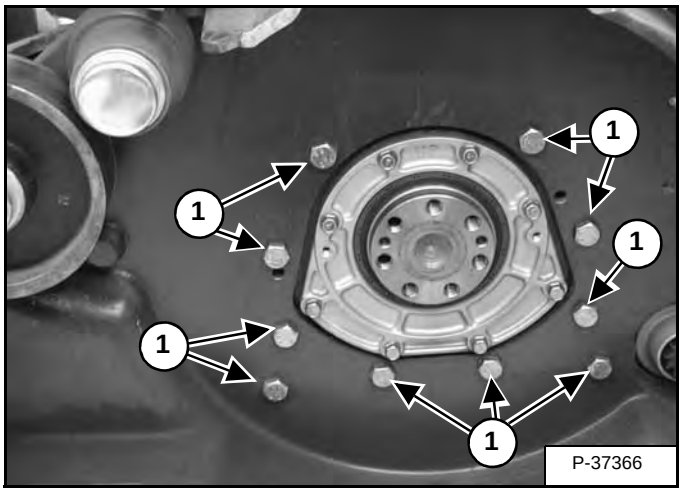
Clean the new ring gear and heat it to a maximum temperature of 428°F (220°C).

Fit the ring gear over the flywheel. Make sure the gear is on the seat correctly.

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Housing Removal And Installation

Figure 70-120-3



Remove the drive belt. (See Removal And Installation on Page 30-50-2.)

Remove the hydrostatic pump. (See Removal And Installation on Page 30-50-2.)

Remove the belt tension pulley assembly. (See Tensioner Pulley Removal And Installation on Page 30-60-3.)

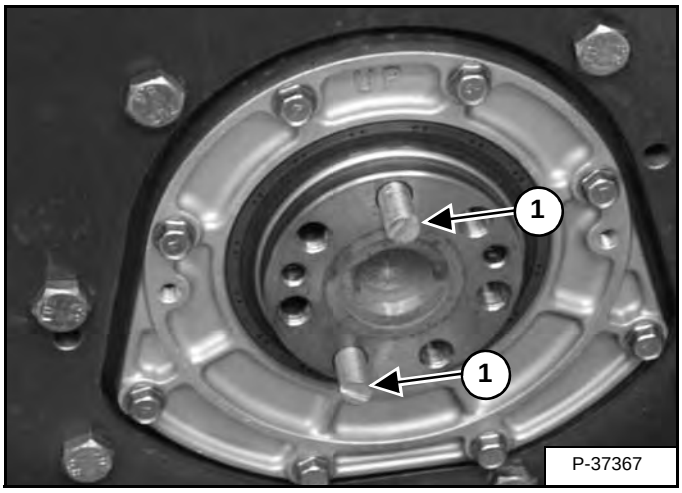
Remove the starter. (See Removal And Installation on Page 60-40-2.)

Remove the ten flywheel housing mounting bolts (Item 1) **[Figure 70-120-3]**.

Installation: Tighten the mounting bolts to 65-75 ft.-lb. (88,1-101,7 N•m) torque.

Remove the flywheel housing from the engine.

Figure 70-120-4



Installation: Install the flywheel housing on the engine.

Install two alignment studs (Item 1) **[Figure 70-120-4]** into the engine crankshaft to help align the flywheel.

The two studs are M12 x 1.25 Pitch x 76 mm (3 in.) long.

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HEATING, VENTILATION, AIR CONDITIONING

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TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.

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AIR CONDITIONING SYSTEM FLOW

Description

In an air conditioning system the refrigerant is circulated under pressure through five major components in a closed circuit. At these five points in the system the refrigerant goes through pressure and temperature changes.

The compressor (Item 1) (See Chart on Page 80-10-3.) takes in heated, low pressure refrigerant gas through the suction valve (low pressure side) and as the name indicates, pressurizes the heated refrigerant and forces it through the discharge valve (high pressure side) on the condenser (Item 2) (See Chart on Page 80-10-3.)

Ambient air passing through the condenser removes the heat from refrigerant resulting in physical state change in the refrigerant from a gas to a liquid.

The liquid refrigerant moves on to the receiver/drier (Item 3) (See Chart on Page 80-10-3.) where impurities such as moisture and dirt are filtered out. The receiver/drier also serves as the storage tank for the liquid refrigerant. The liquid refrigerant (still under high pressure) flows to the expansion valve (Item 4) (See Chart on Page 80-10-3.)

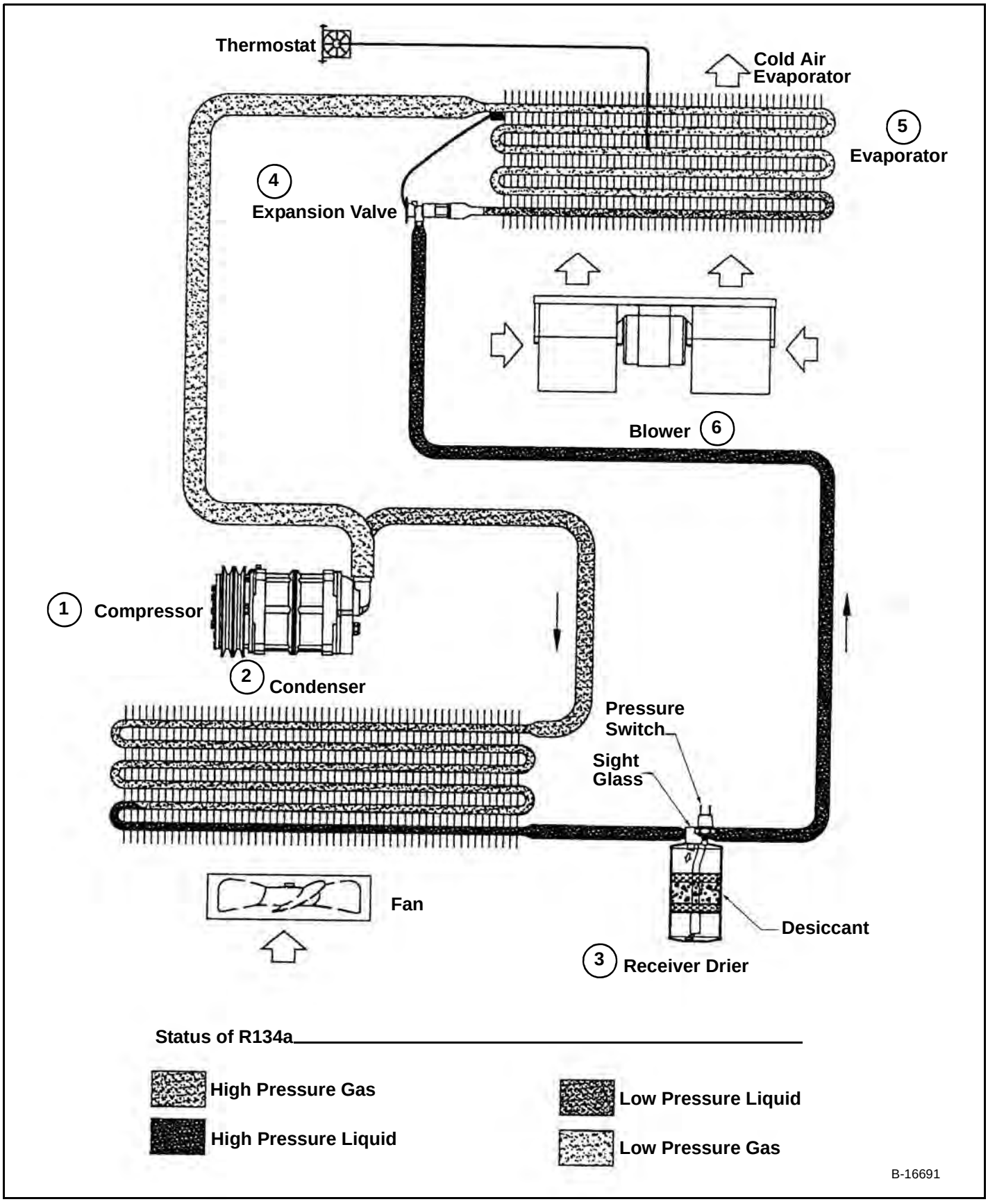
The expansion valve meters the amount of refrigerant into the evaporator coil (Item 5) (See Chart on Page 80-10-3.) As the refrigerant passes through the expansion valve, it again changes its physical state. It becomes a low temperature, low-pressure liquid and saturated vapor. The low pressure liquid immediately starts to boil and vaporize as it enters the evaporator. The hot humid air of the machine's cab is drawn through or blown into the evaporator by the evaporator fan (Item 6) (See Chart on Page 80-10-3.) Since the refrigerant is colder than the air, it absorbs the heat from the air and produces cooled air, which is pushed into the cab by the fan. The moisture in the air condenses on the evaporator coil and drips into the drain pan, which directs the water out of the cab.

The refrigerant cycle is completed when the heated low pressure gas is again drawn into the compressor.

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AIR CONDITIONING SYSTEM FLOW (CONT'D)

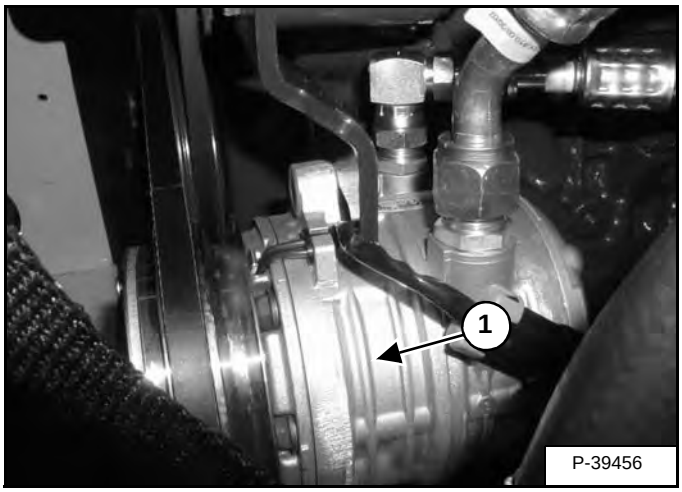
Chart



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Components

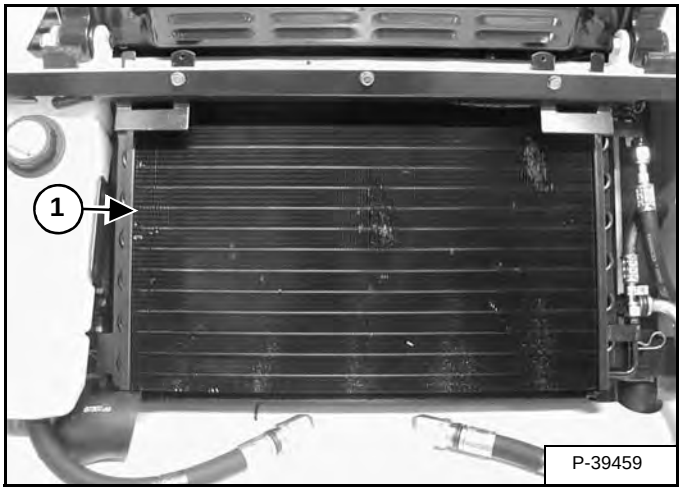
Figure 80-10-1



Compressor: The compressor (Item 1) **[Figure 80-10-1]** is the pump that circulates the refrigerant throughout the system. It raises the pressure of the refrigerant for heat transfer through the condenser and evaporator.

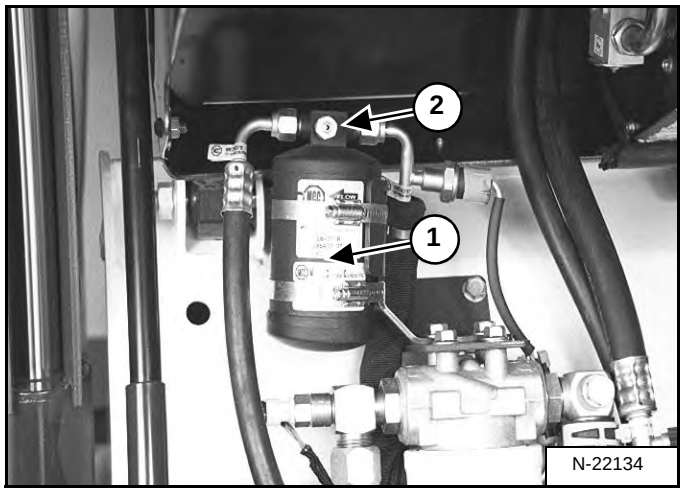
NOTE: The A/C system (Compressor) is recommended to be turned on for at least 5 minutes weekly throughout the year to lubricate the internal components.

Figure 80-10-2



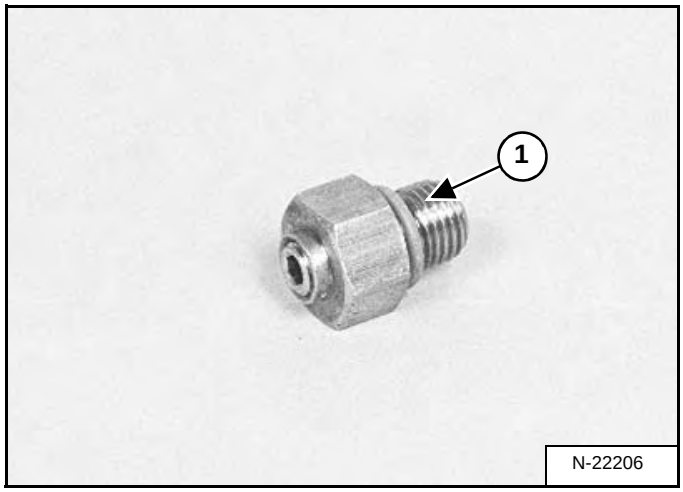
Condenser: The condenser (Item 1) **[Figure 80-10-2]** is the unit that receives the high pressure, high temperature refrigerant vapor from the compressor and condenses it into a high temperature liquid.

Figure 80-10-3



Receiver/Drier: The receiver/drier (Item 1) **[Figure 80-10-3]** is the unit that receives the liquid refrigerant from the condenser and removes moisture and foreign matter from the system. It also serves as a storage tank for the extra liquid refrigerant until it is needed by the evaporator.

Figure 80-10-4

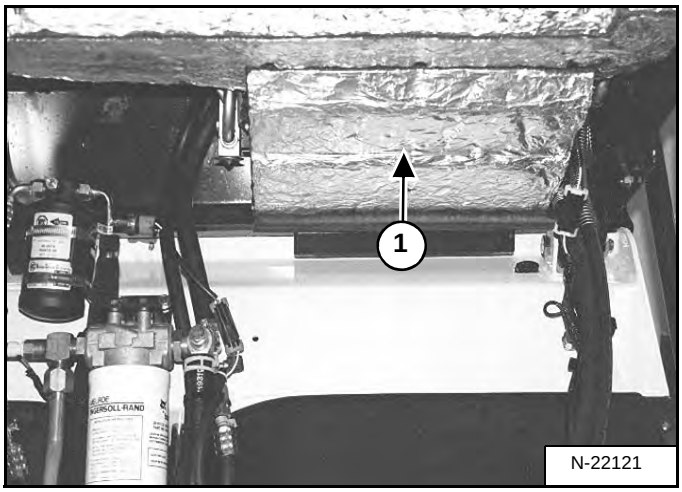


Pressure Relief Valve: The pressure relief valve (Item 2) **[Figure 80-10-3]** is located on the receiver drier assembly. This small brass valve (Item 1) **[Figure 80-10-4]** is a safety feature that is designed to open and release the A/C charge if the pressure reaches 535 PSI.

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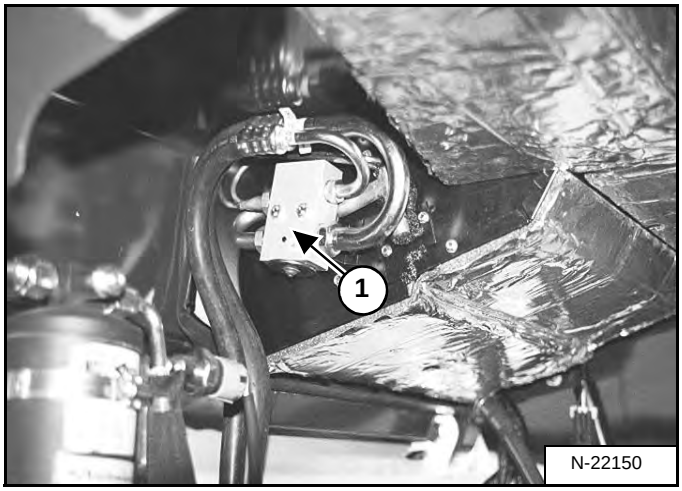
Components (Cont'd)

Figure 80-10-5



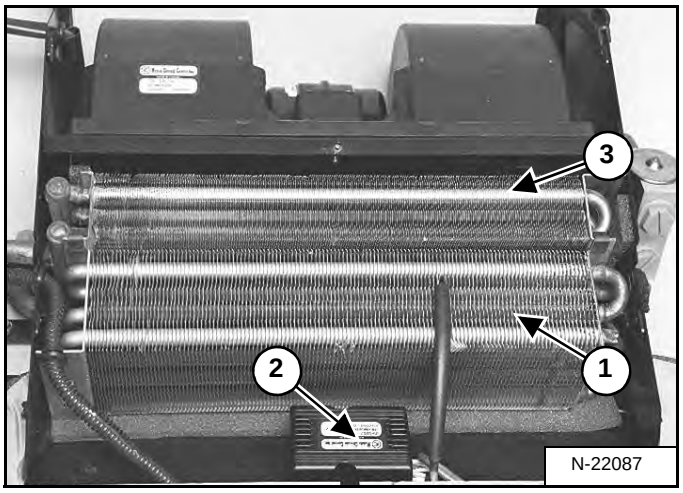
Heater/Evaporator Unit: The heater/evaporator unit (Item 1) **[Figure 80-10-5]** is located behind the loader cab. The unit delivers the cold air for the A/C and warm air for heat into the cab. The unit contains the blower, heat & A/C coils, thermostat and expansion valve.

Figure 80-10-6



Expansion Valve: The expansion valve (Item 1) **[Figure 80-10-6]** controls the amount of refrigerant entering the evaporator coil.

Figure 80-10-7

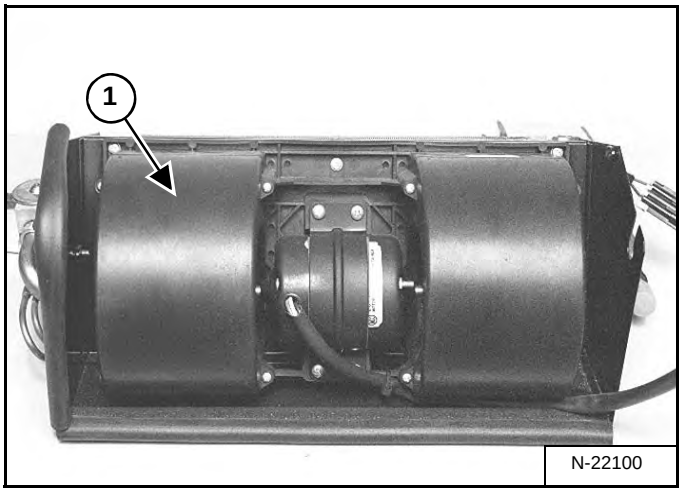


Evaporator Coil: The evaporator coil (Item 1) **[Figure 80-10-7]** cools and dehumidifies the air before it enters the cab.

Thermostat: The thermostat (Item 2) **[Figure 80-10-7]** controls the temperature of the evaporator coil.

Heater Coil: The heater coil (Item 3) **[Figure 80-10-7]** supplies the warm air into the cab by passing air through the coil.

Figure 80-10-8

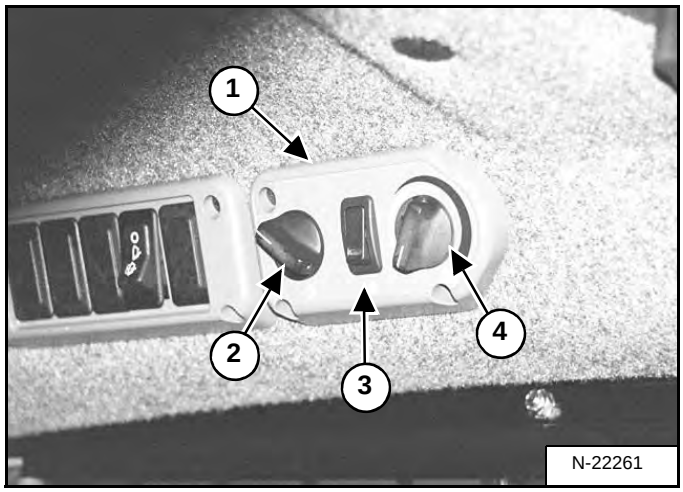


Heater/Evaporator Blower: The blower (Item 1) **[Figure 80-10-8]** is used to push air through the heater and evaporator coils and into the cab.

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Components (Cont'd)

Figure 80-10-9



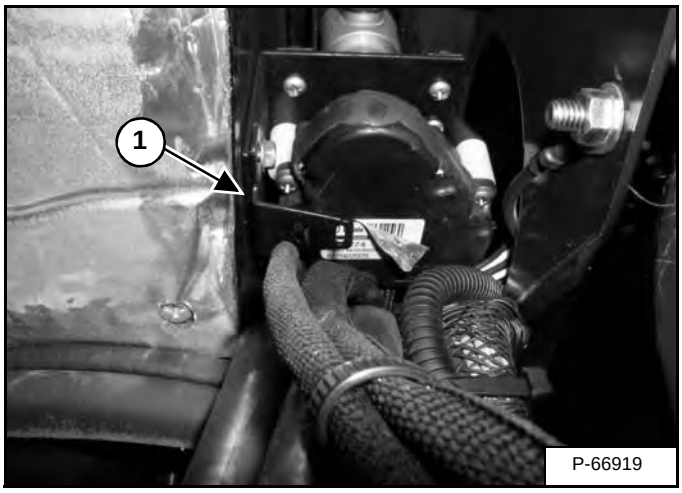
Control Panel: The panel (Item 1) **[Figure 80-10-9]** has three separate components.

Fan Switch: This is a four position rotary switch (Item 2) **[Figure 80-10-9]**. When the fan switch is in the off position the A/C will not engage, but the heat valve will operate, as it is controlled by the ignition power.

A/C Switch: The rocker switch (Item 3) **[Figure 80-10-9]** will be illuminated when the A/C is engaged.

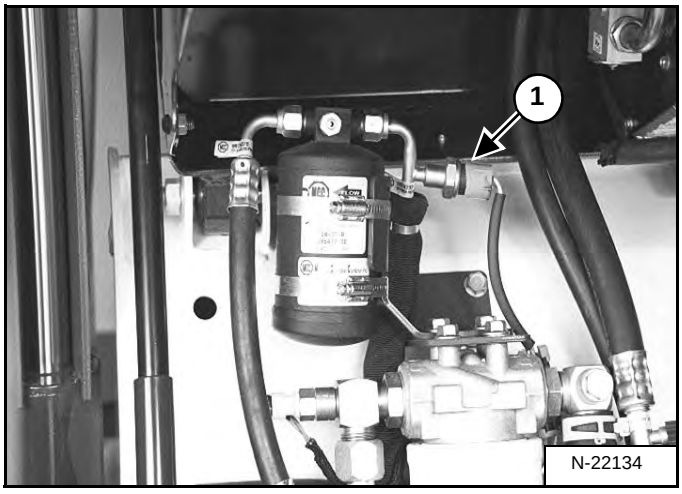
Potentiometer: The potentiometer (Item 4) **[Figure 80-10-9]** controls the Heat Valve from fully Off to fully On. This can be used in conjunction with the A/C for defrost of the windows and temperature control.

Figure 80-10-10



Heater Valve: The heater valve (Item 1) **[Figure 80-10-10]** is used to control the amount of engine coolant that flows to the heater coil.

Figure 80-10-11



Pressure Switch: The pressure switch (Item 1) **[Figure 80-10-11]** will disengage the compressor clutch at high pressure readings over 384 PSI. (2647 kPa) on the high side, or at very low pressure of 28 PSI (193 kPa) or less on the high side, which indicates loss of refrigerant.

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Safety Equipment

Figure 80-10-12

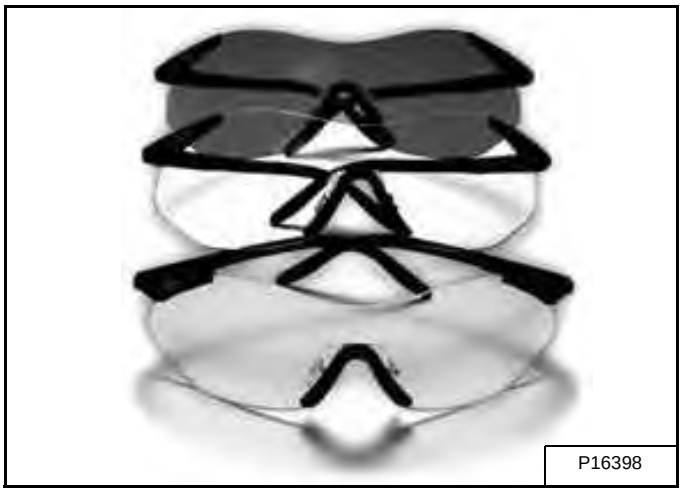


Figure 80-10-13



In servicing A/C and heater systems you will be exposed to high pressures, temperatures and several chemical hazards. Moving belts and pulleys are normal shop hazards.

In addition to exercising caution in your work, **DO WEAR SAFETY GLASSES OR A FACE SHIELD [Figure 80-10-12]** when you are using R-134a or a leak detector, adjusting service valves or the manifold gage set connectors. Safety glasses or a transparent face shield are practical safety items and one or the other is absolutely required.

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R134a refrigerant gives a toxic gas.

W-2371-0500

R-134a inside a canister or in an A/C system is a liquid under pressure. When it escapes or releases into the air, **ITS TEMPERATURE DROPS TO 21.6 F DEGREES "INSTANTLY"**. If it spills on your skin or in your eyes you should flood the area with cool water and **SEEK MEDICAL ATTENTION FAST!** It is a good idea to wear gloves **[Figure 80-10-13]** to prevent frost bite if you should get refrigerant on your hands.

⚠ WARNING

HFC 134A refrigerant can be dangerous if not properly handled. Liquid 134A may cause blindness if it contacts the eyes and may cause serious frostbite if it contacts the skin.

- **Gaseous 134A becomes lethal (phosgene) gas when it contacts open flame or very hot substances.**
- **NEVER SMOKE when there is the possibility of even small amounts of 134A in the air.**

Any servicing work that involves release or addition of 134A to the system must be done by a competent refrigeration dealer who has the proper equipment, knowledge, and experience to service refrigeration equipment.

W-2373-0500

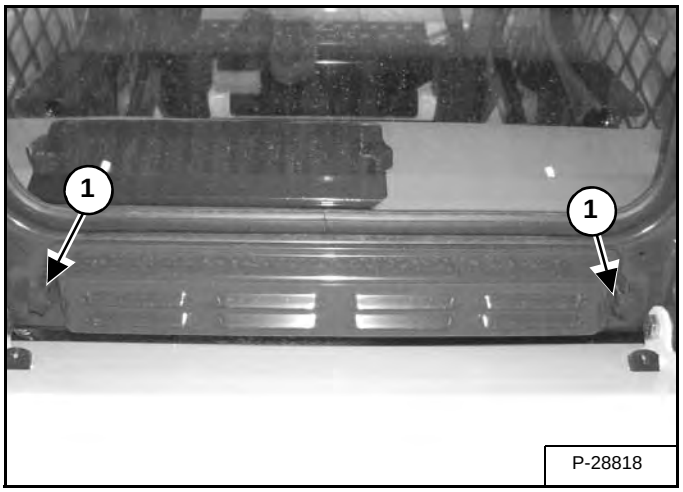
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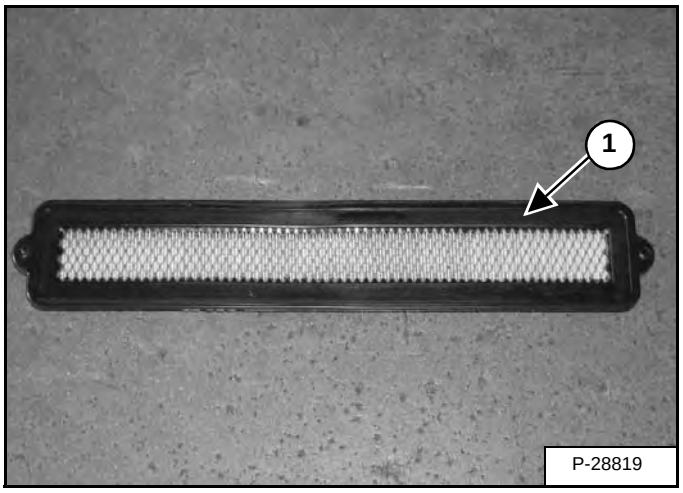
Filter Elements Removal And Installation

Figure 80-20-1



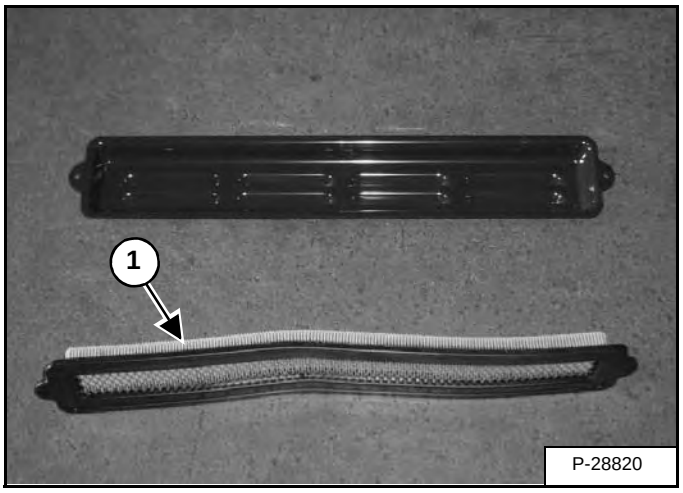
Remove the two retainer knobs (Item 1) **[Figure 80-20-1]** from the fresh air filter cover at the rear of the loader cab.

Figure 80-20-2



Remove the filter cover and filter (Item 1) **[Figure 80-20-2]** from the loader.

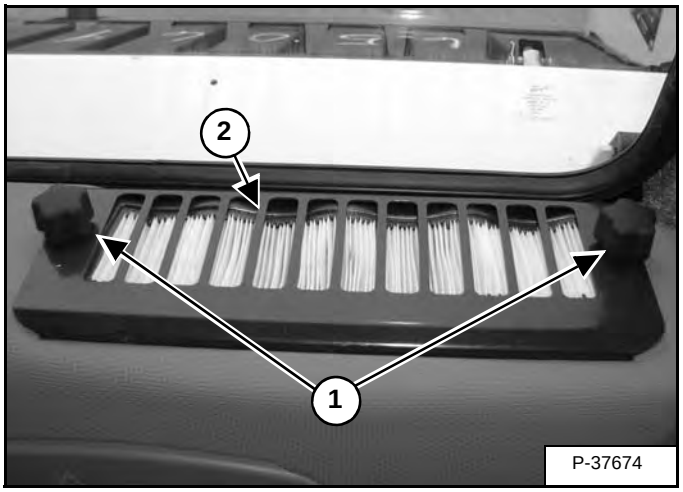
Figure 80-20-3



Remove the filter (Item 1) **[Figure 80-20-3]** from the cover.

The fresh air filter must be cleaned sometimes as often as twice a day, depending on the operating environment. The filter can be cleaned by removing and shaking it. A small amount of air pressure can be used to clean the filter. However the fresh air filter should be changed at least 2-4 times per year in normal conditions. In extremely dusty conditions the fresh air filter may need to be changed weekly.

Figure 80-20-4



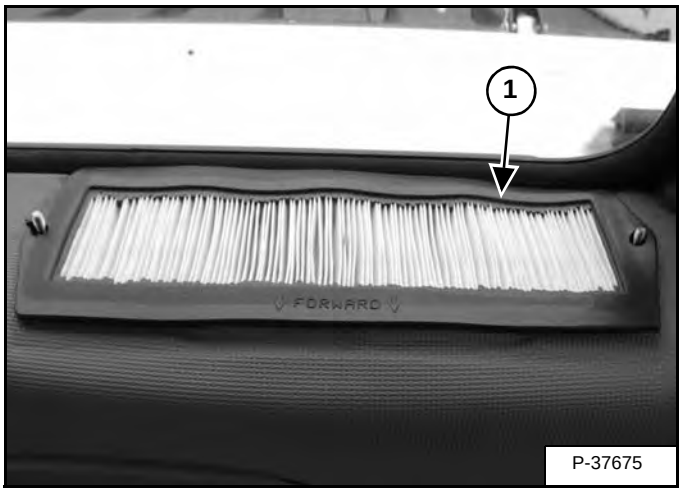
Remove the two retaining knobs (Item 1) **[Figure 80-20-4]** from the recirculating air filter cover, at the back of the cab.

Remove the retaining cover (Item 2) **[Figure 80-20-4]** from the loader cab.

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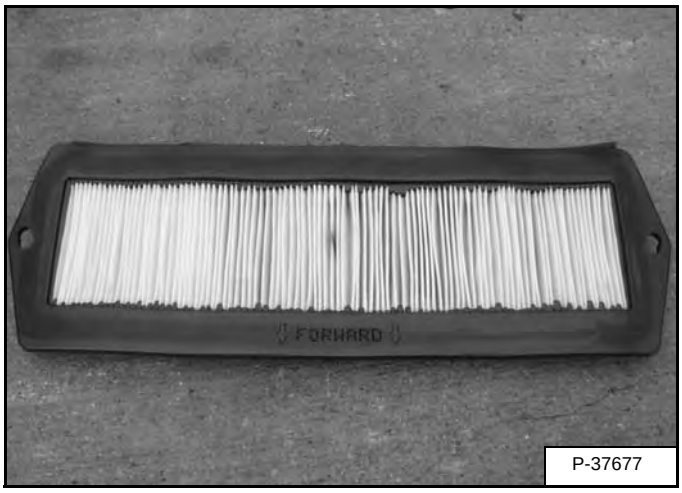
Filter Elements Removal And Installation (Cont'd)

Figure 80-20-5



Remove the recirculating air filter (Item 1) **[Figure 80-20-5]** from the rear of the cab.

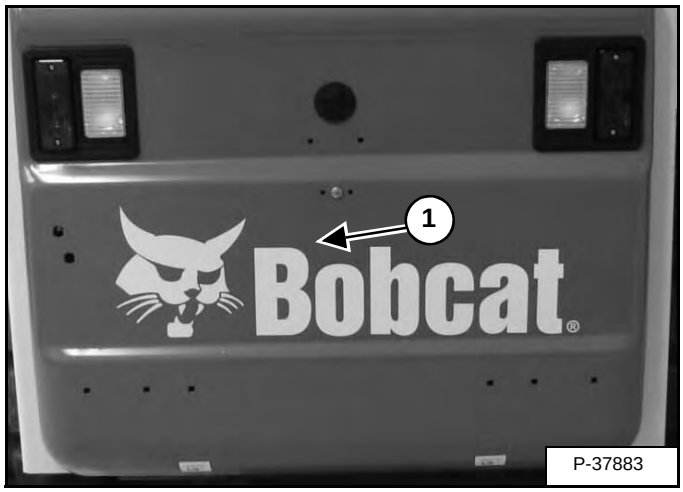
Figure 80-20-6



The recirculating air filter **[Figure 80-20-6]** may be cleaned using low air pressure.

Compressor Drive Belt Inspection

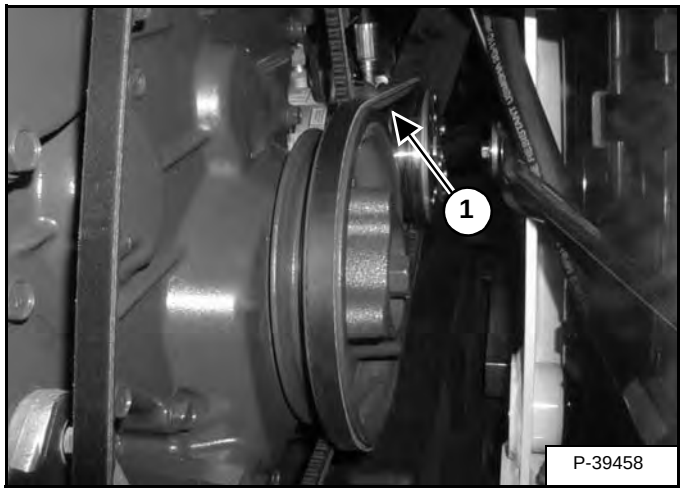
Figure 80-20-7



It is a good rule to regularly inspect (weekly) the compressor drive belt for tension and wear.

Open the rear door (Item 1) **[Figure 80-20-7]**.

Figure 80-20-8

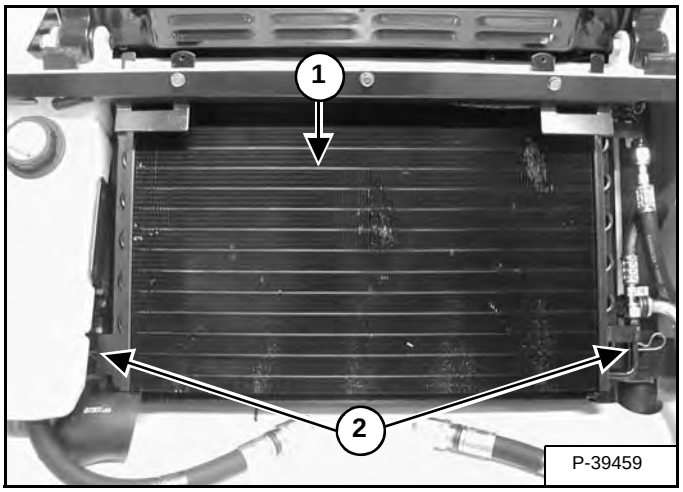


At the lower right side of the engine, check the tension on the compressor belt (Item 1) **[Figure 80-20-8]**.

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Condenser

Figure 80-20-9



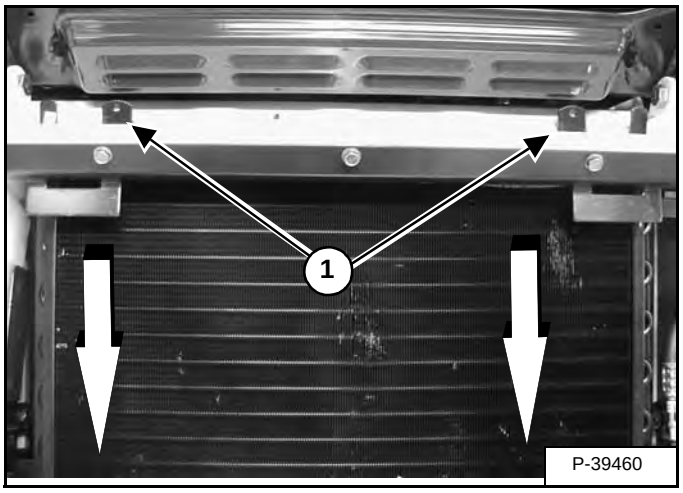
Open the rear door.

Remove the grill on the loader. (See Removal And Installation on Page 50-60-1.)

Check the condenser (Item 1) **[Figure 80-20-9]** for mud or dirt.

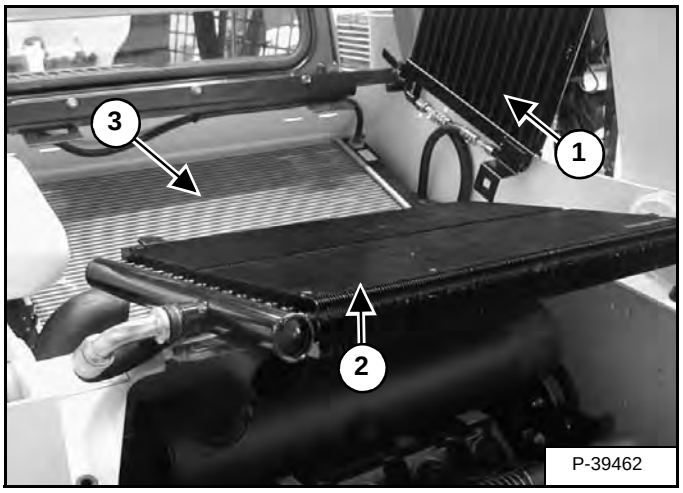
Remove the two retainer clips (Item 2) **[Figure 80-20-9]**.

Figure 80-20-10



Lift the condenser, and slide it toward the rear of the loader until the mounting tabs (Item 1) **[Figure 80-20-10]** clear the frame of the loader.

Figure 80-20-11



Rotate the condenser (Item 1) **[Figure 80-20-11]** up against the right side lift arm.

Slide the hydraulic cooler (Item 2) **[Figure 80-20-11]** toward the rear of the loader.

With water, or air, the condenser (Item 1) the oil cooler (Item 2) and the radiator (Item 3) can be cleaned **[Figure 80-20-11]**.

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Air Conditioning Service Chart

Service Company/Phone Number:
Date:
Machine Model: Machine Dealer:
Machine Serial Number: Customer:
Machine Hours:

Pre Service Conditions	15 Minutes	30 Minutes	Notes
Ambient Temperature:			
Louver Temperature:			
Cab Temperature At Head Position:			
Temperature Into Condenser:			
High Side Pressure			
Low Side Pressure			
Ambient Humidity			
Observations:			

Explain Services Required:

Post Service Conditions	15 Minutes	30 Minutes	Notes
Ambient Temperature:			
Louver Temperature:			
Cab Temperature:			
Temperature Into Condenser:			
High Side Pressure			
Low Side Pressure			
Ambient Humidity			
Observations:			

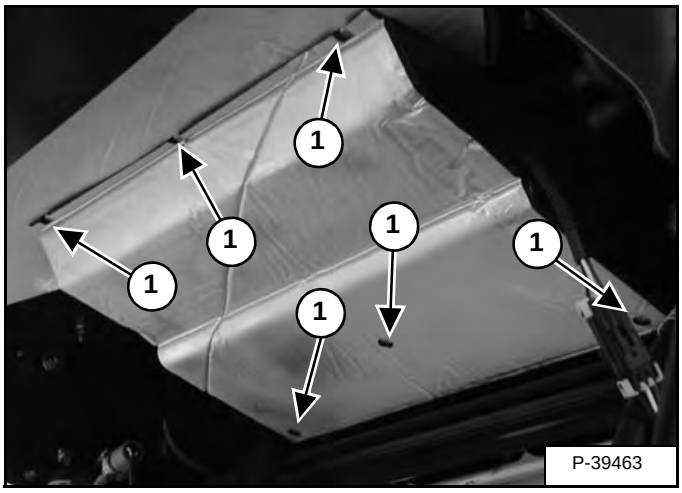
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A/C Evaporator Coil & Heater Coil

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

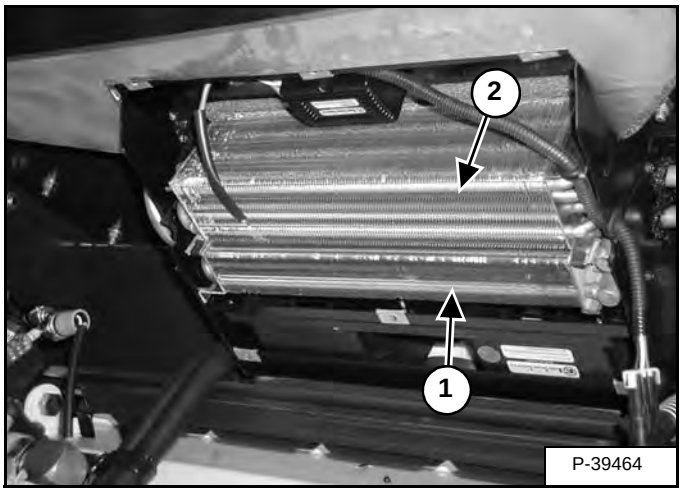
Figure 80-20-12



At the rear of the cab, remove the six mounting bolts (Item 1) **[Figure 80-20-12]** from the access cover on the evaporator/heater unit.

Remove the access cover from the loader.

Figure 80-20-13



With air or water clean the heater coil (Item 1) and the evaporator coil (Item 2) **[Figure 80-20-13]**.

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TROUBLESHOOTING

Blower Motor Does Not Operate

Possible Cause	Inspection	Solution
1. Blown fuse.	Inspect the fuse/wiring.	Replace fuse/repair wiring.
2. Broken wiring or bad connection.	Check the fan motor ground and connectors.	Repair the wiring or connector.
3. Fan motor malfunction.	Check the lead wires form the motor with a circuit tester.	Replace Motor.
4. Resistor malfunction.	Check resistor using a circuit tester.	Replace Resistor.
5. Fan motor switch malfunction.	Check power into and out of the fan switch.	Replace Fan Switch.

Blower Motor Operates Normally, But Air Flow Is Insufficient

Possible Cause	Inspection	Solution
1. Evaporator inlet obstruction.	Check evaporator for plugging.	Remove obstruction and clean evaporator fins with air or water.
2. Air leak.	Check to make sure air hoses are properly hooked to Louvers, and air ducts.	Repair of adjust.
3. Defective thermo. switch (frozen evaporator).	Check thermostat using a circuit tester.	Replace thermostat.
4. Plugged cab filters	Check cab filter condition.	Clean or replace filters.

Insufficient Cooling Although Air Flow And Compressor Operation Are Normal

Possible Cause	Inspection	Solution
1. System low on refrigerant.	The high side pressure will be low and bubbles may be present in sight glass on receiver drier.	Repair any leaks and recharge the refrigerant to the correct level.
2. Excessive refrigerant.	The high pressure side pressure will be high.	Use refrigerant recovery equipment to capture excess refrigerant. Charge to the correct refrigerant level.

The Compressor Does Not Operate At All, Or Operates Improperly

Possible Cause	Inspection	Solution
1. Loose drive belt.	The belt is vibrating or oscillating.	Adjust tension.
2. Internal compressor malfunction.	The compressor is locked up and the belt slips.	Replace compressor.
	Magnetic clutch related	
3. Low battery voltage.	Clutch slips.	Recharge the battery.
4. Faulty coil.	Clutch slips.	Replace the magnetic clutch.
5. Oil on the clutch surface.	Clutch slips.	Replace or clean the clutch surface.
6. Open coil.	Clutch does not engage and there is no reading when a circuit tester is connected between the coil and terminals.	Replace clutch.
7. Broken wiring or poor ground.	Clutch will not engage. Inspect the ground and connections.	Repair.
8. Wiring harness components.	Test the conductance of the pressure switch, thermostat, Relay, etc.	Check operation.

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Gauge Pressure Related Troubleshooting

Normal compressor suction (low side) and discharge (high side) pressure at ambient temperatures of 86-96 degrees F (30-38 degrees C) and compressor speed of approximately 2000 RPM are:

High pressure side pressure: 210-265 PSI

Low pressure side pressure: 15-33 PSI

As a rule of thumb the high side pressure will be around eight times greater then the low side pressure.

Possible Cause	Inspection	Solution
Low pressure side Too high.	The low pressure side pressure normally becomes too high when the high pressure side pressure is too high. As this is explained below, the following inspection is only used when the low pressure side is too high.	
1. Expansion valve opens too far.	Frost is present on the suction hose.	Replace expansion valve.
2. Defective compressor.	The high and low pressure side gauge pressures equalize when the magnetic clutch is engaged.	Replace compressor.
Low pressure side Too low.		
1. Low refrigerant charge.	The high side pressure will be low and bubbles may be present in sight glass on receive drier.	Repair any leaks and recharge the refrigerant to the correct level.
2. Clogged or closed expansion valve.	The expansion valve's inlet side is frosted. Moisture or other Contaminants can be the cause.	Clean or replace the expansion Valve.
3. Restriction between drier and expansion valve.	Frost on the line between drier and expansion valve. A Negative low pressure reading may be shown.	Flush system or replace hose.
4. Thermostat malfunction.	The evaporator is frozen.	Adjust thermostat's temperature setting or probe placement or replace thermostat.
5. Restriction in receiver drier.	Excessive frost on receiver drier.	Replace receiver drier.
High pressure side Too high.		
1. Poor condenser performance.	Dirty or clogged condenser fins. Condenser fans not Operating.	Clean fins, and/or repair the fan.
2. Excessive refrigerant.	The high pressure side pressure will be high.	Use refrigerant recovery equipment to capture excess refrigerant. Charge to the correct refrigerant level.
3. Excessive oil charge.	The high pressure side will be high.	Evacuate system. Remove oil from condenser and compressor. Measure oil from compressor and add correct oil charge back into compressor. Flush system with nitrogen. Replace drier.
4. Air in system.	Pressure is high on both high and low sides.	Evacuate and recharge with Refrigerant.
5. Restriction in drier, condenser or high pressure line.	High pressure side will be high, and low pressure side will be low.	Evacuate and flush system replacing defective parts.

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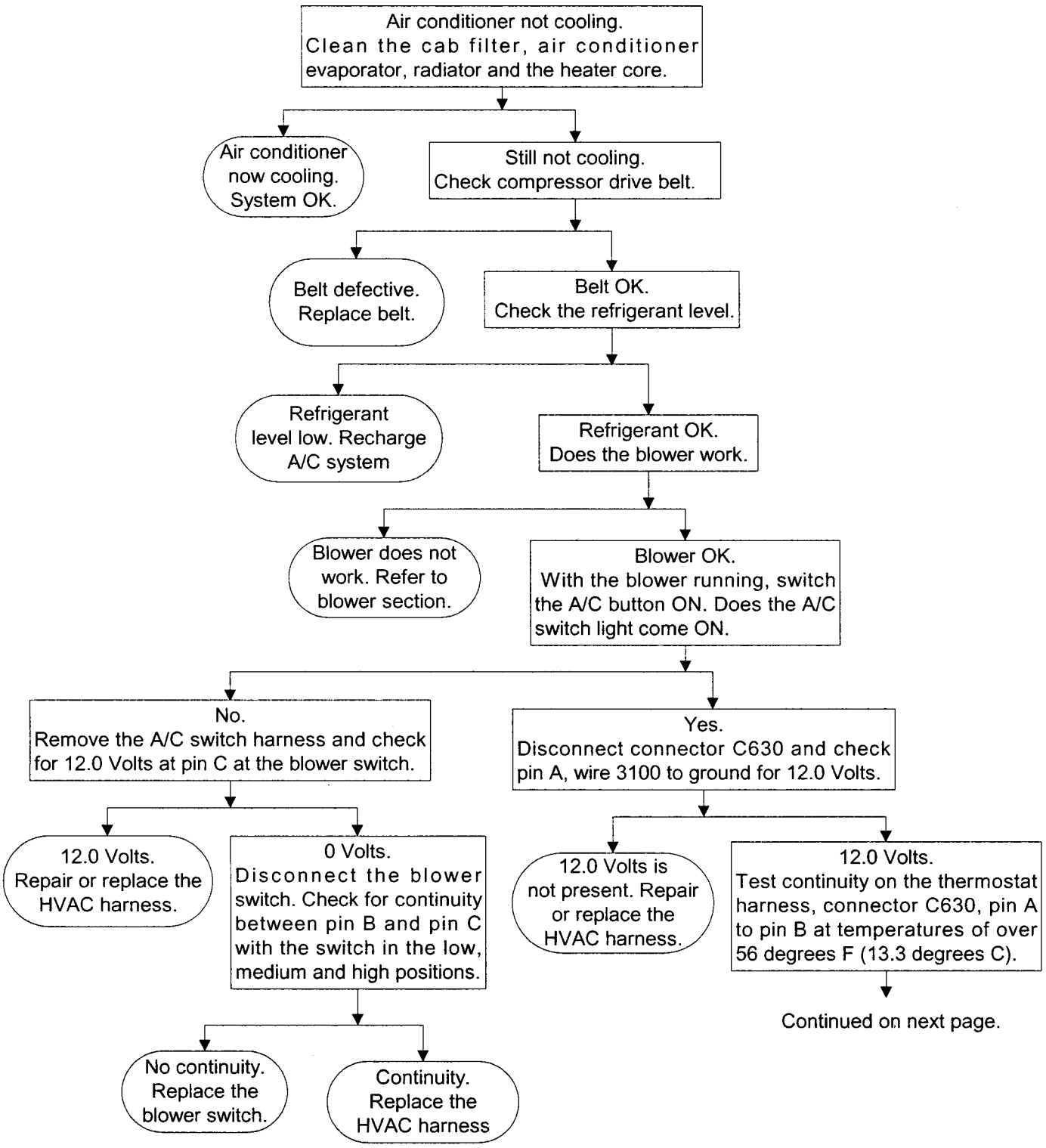
Gauge Pressure Related Troubleshooting (Cont'd)

Possible Cause	Inspection	Solution
High pressure side Too low.		
1. Low refrigerant charge.	The high side pressure will be low and bubbles may be present in sight glass on receive drier.	Repair any leaks and recharge the refrigerant to the correct level.
System pressures Equal		
1. Clutch not operating.	See magnetic clutch related topics above.	
2. Compressor not pumping.	Equal high and low pressures.	Replace compressor.

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Troubleshooting Tree

Air Conditioning



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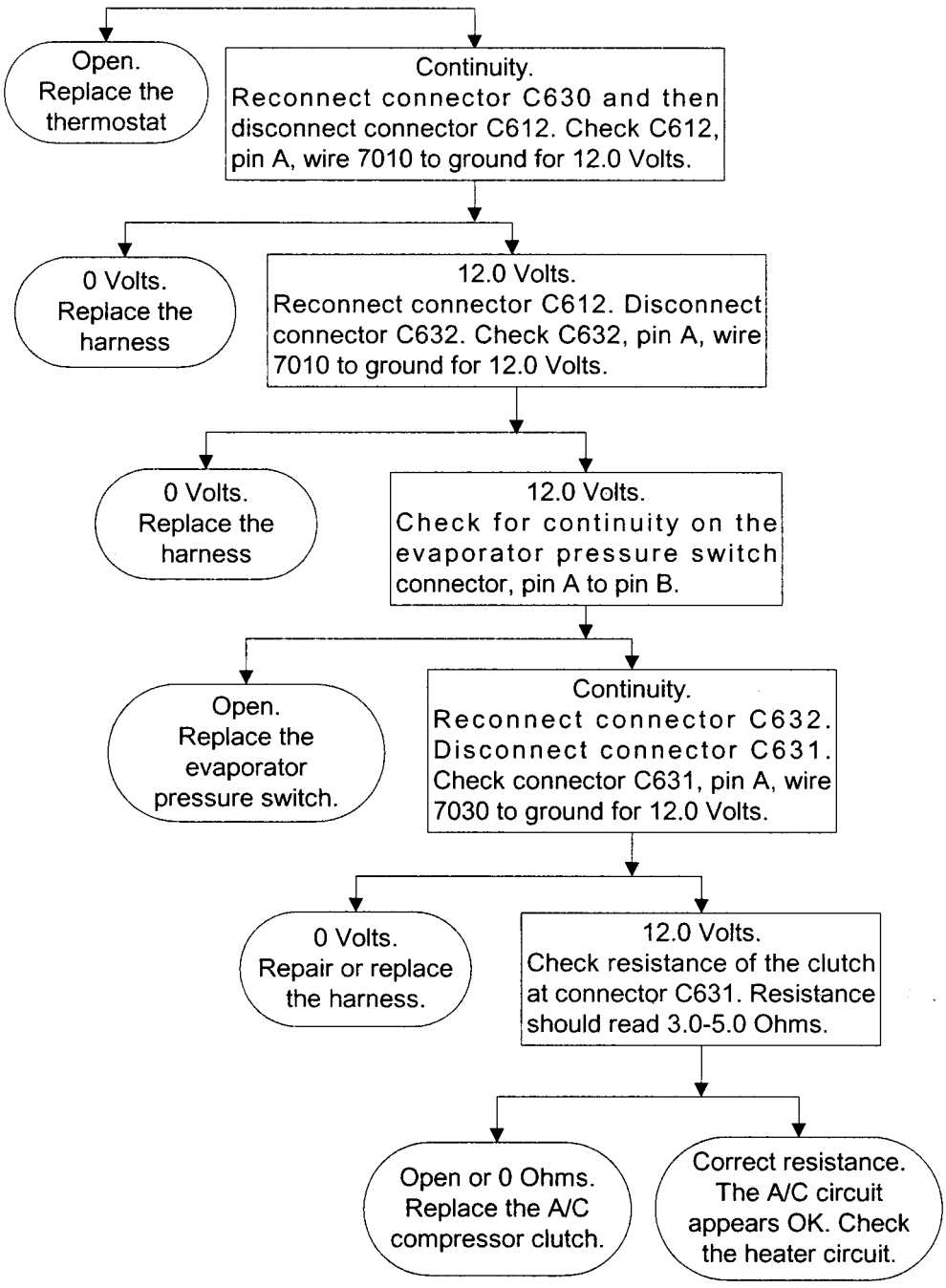
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Troubleshooting Tree (Cont'd)

Air Conditioning

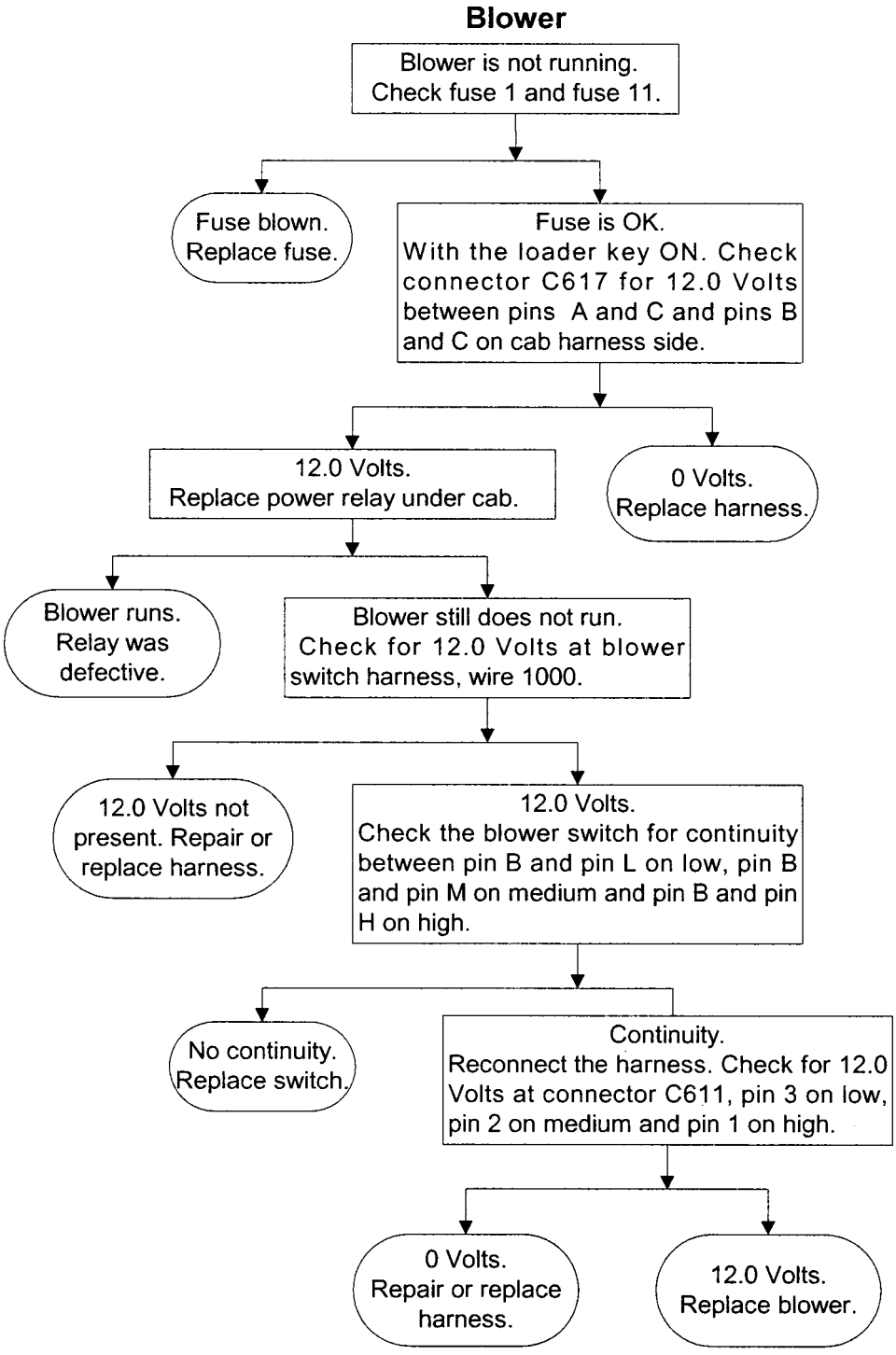
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Troubleshooting Tree (Cont'd)

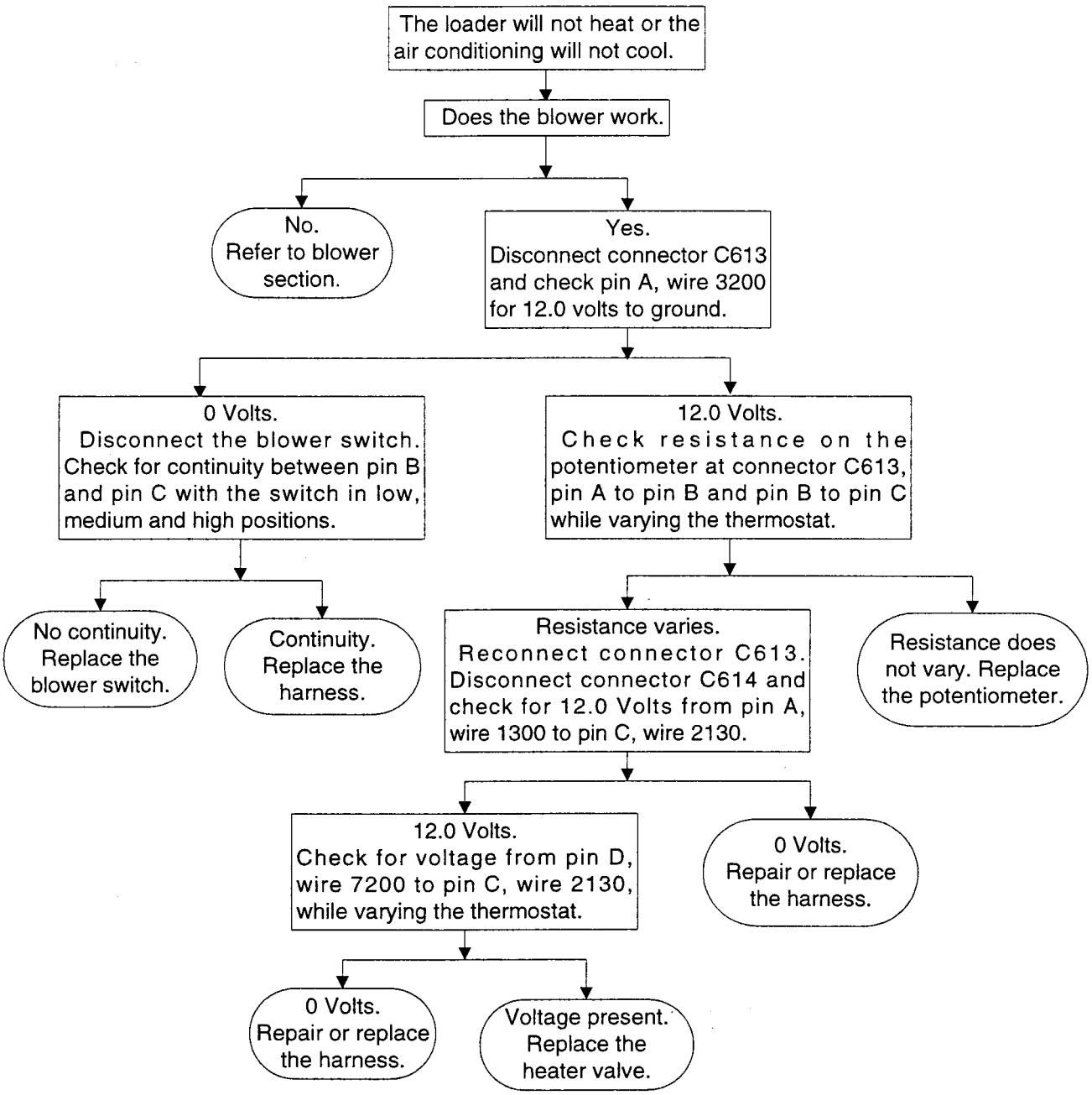


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Troubleshooting Tree (Cont'd)

Heater Valve



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Temperature / Pressure Chart

NORMAL EVAPORATOR RANGE	
TEMP F.	**PSIG**
16	15.69
18	17.04
20	18.43
22	19.87
24	21.35
26	22.88
28	24.47
30	26.10
32	27.79
34	29.52
36	31.32
38	33.17
40	35.07
42	37.03
44	39.05
45	40.09
50	45.48
55	51.27
60	57.47
65	64.10
70	71.19
75	78.75
80	86.80
85	95.40
90	104.40
91	106.30
92	108.20

NORMAL CONDENSER RANGE	
TEMP F.	**PSIG**
93	110.20
94	112.10
95	114.10
100	124.30
102	128.50
104	132.90
106	137.30
108	141.90
110	146.50
112	151.30
114	156.10
116	161.10
118	166.10
120	171.30
122	176.60
124	182.00
126	187.50
128	193.10
130	198.90
135	213.70
140	229.40
145	245.80
150	263.00
155	281.10
160	300.10
165	320.10
170	340.80

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Temperature / Pressure Chart (Cont'd)

Evaporator

Pressures represent gas temperatures inside the coil. not the coil surface. For an estimate of the temperature of the air coming off the coil add 8-10 degrees F. to the temperature on the chart.

Condenser

Temperatures are not ambient temperatures but condensing temperatures. Add 40 degrees F. to the ambient temperature to get the condensing temperature and then refer to the pressure chart to see appropriate pressure for ambient temperature.

Example: Ambient Temperature=90 degrees F.
90 degrees F.
+40 degrees F.
130 degrees F. condenser temperature=200 psig

Conditions and pressures will vary from system to system. Check with MCC for system specifications.

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Poor A/C Performance

Start the loader, lock the park brake, and engage the A/C system with the blower fan on High. Run the loader at full throttle for approximately 15 minutes, with the loader cab door closed.

Figure 80-30-1

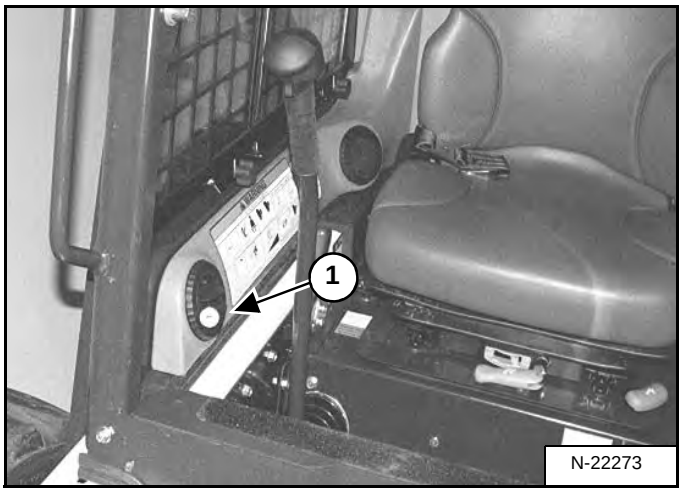
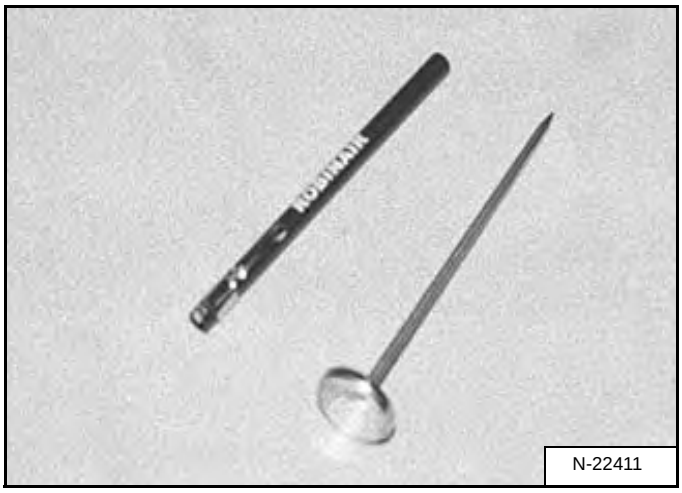


Figure 80-30-2



Check the temperature at the louvers (Item 1) **[Figure 80-30-1]** with a thermometer **[Figure 80-30-2]**.

The louver temperature should be between 45-53° F. (2,2-11,6° C) depending on the amount of humidity in the air and ambient temperature.

If louver temperature is too high. (See Troubleshooting Tree on Page 80-30-4.)

Check the blower for proper operation, or noise, and replace if necessary. (See Removal And Installation on Page 80-130-1.)

Check the belt tension on the A/C compressor. (See Compressor Drive Belt Inspection on Page 80-20-2.)

Check the A/C condenser for dirt or mud and clean if necessary. (See Removal And Installation on Page 80-60-1.)

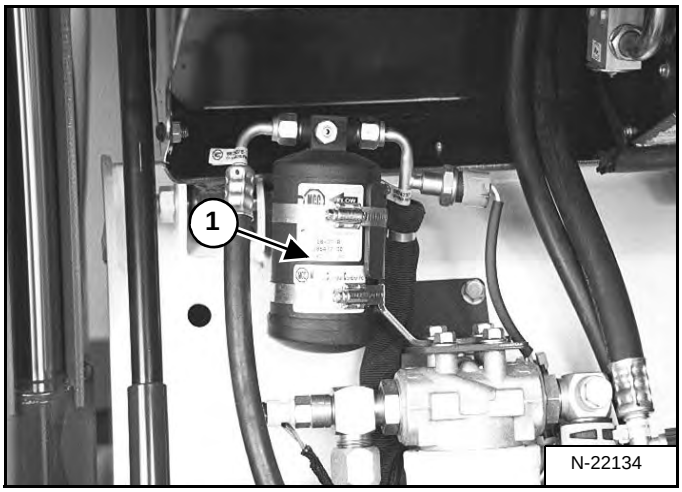
Check the A/C evaporator coil for dirt or mud and clean if necessary. (See Removal And Installation on Page 80-110-1.)

Check the engine coolant to see if it is bypassing the heater valve. (See Engine Coolant Bypassing The Heater Valve on Page 80-30-19.)

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HVAC Repair And Leaks

Figure 80-30-3



Whenever the A/C system is opened to the atmosphere or there has been a leak in the system, the receiver/drier (Item 1) **[Figure 80-30-3]** must be changed.

Never leave hose fittings, compressor fittings or components uncapped while working on the A/C system.

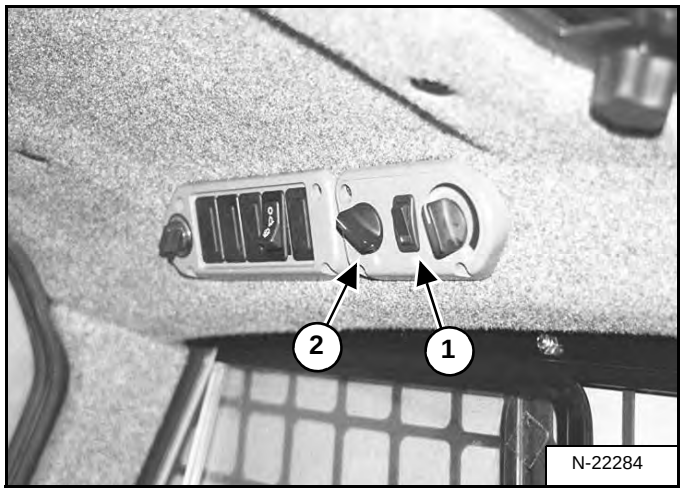
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Electrical System

Check to see if the compressor clutch is engaging.

With an operator in the loader seat and the cab door open, turn the loader key switch to RUN (Standard Panel) OR press the RUN/ENTER Button (Deluxe Panel), without starting the loader.

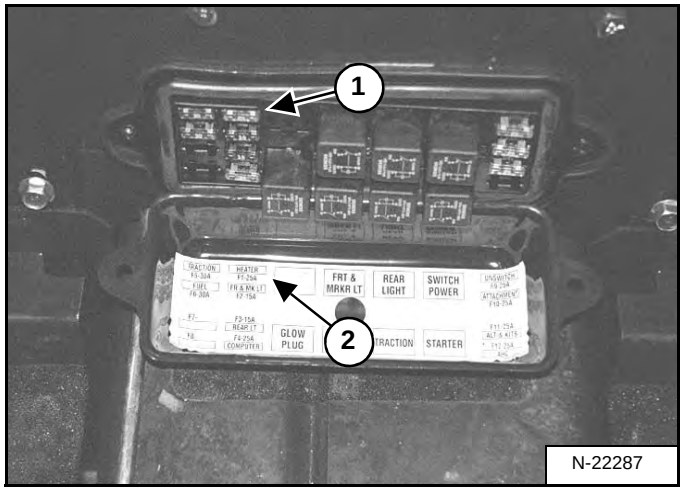
Figure 80-30-4



Push the A/C switch (Item 1) to the ON position. Turn the blower switch (Item 2) **[Figure 80-30-4]** to the first ON position.

The compressor clutch should make a click sound, which indicates the clutch is engaging.

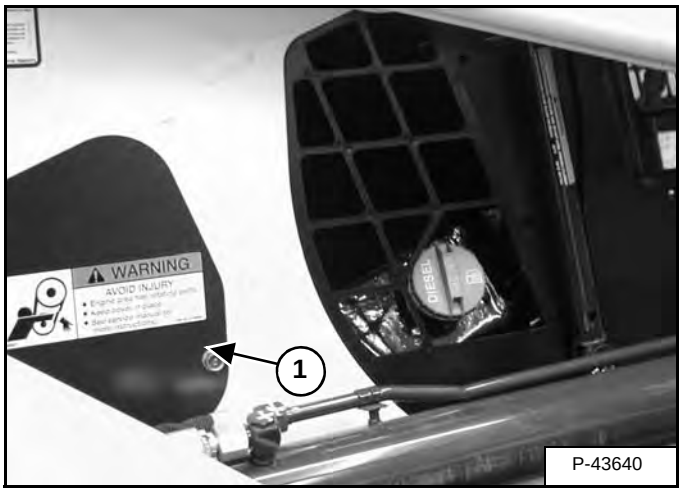
Figure 80-30-5



If the compressor clutch does not engage, check the loader fuse (Item 1) **[Figure 80-30-5]** located on the control panel in the loader cab.

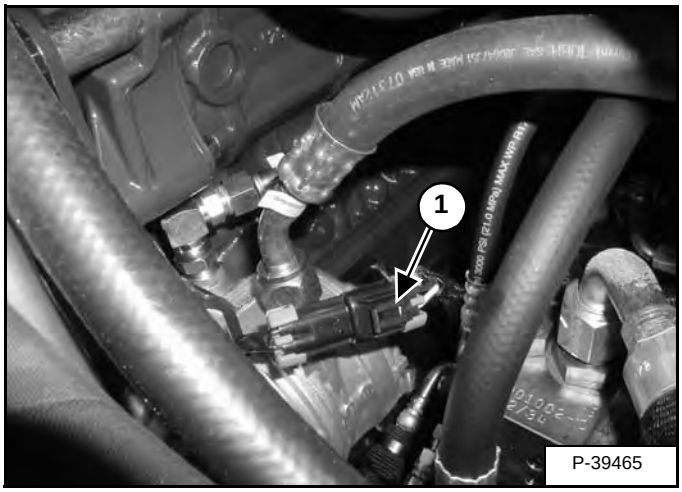
Replace the fuse if burned out.

Figure 80-30-6



Remove the right side access cover (Item 1) **[Figure 80-30-6]**.

Figure 80-30-7

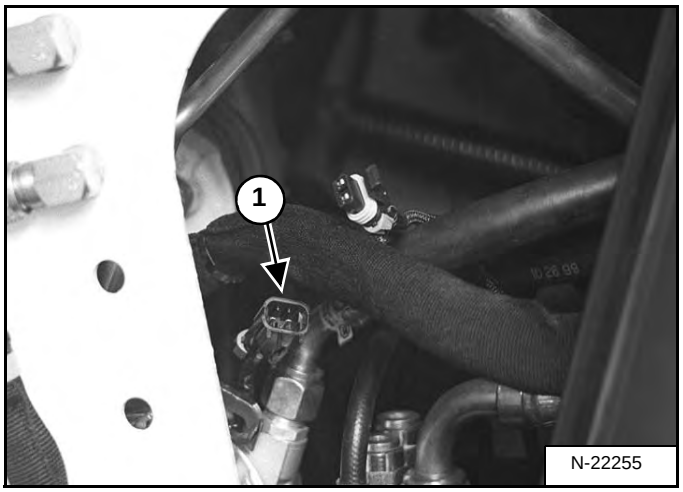


Disconnect the loader harness (Item 1) **[Figure 80-30-7]** from the compressor clutch wire.

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Electrical System (Cont'd)

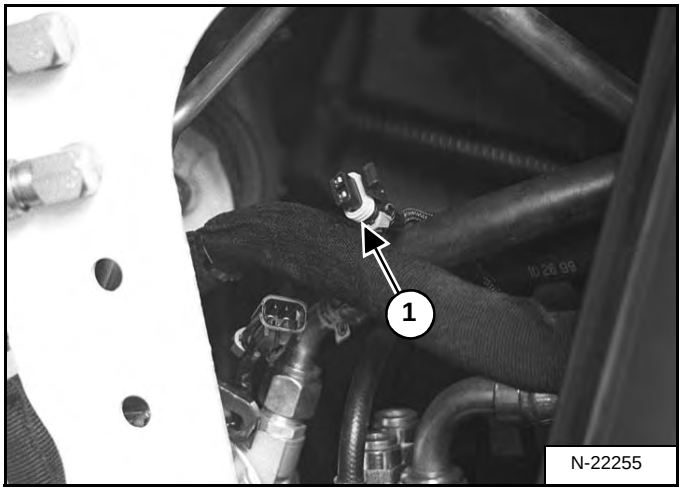
Figure 80-30-8



With a multi meter, check the resistance to the compressor clutch (Item 1) **[Figure 80-30-8]**.

If there is no resistance value, replace the compressor clutch. (See Clutch Disassembly And Assembly on Page 80-50-4.)

Figure 80-30-9



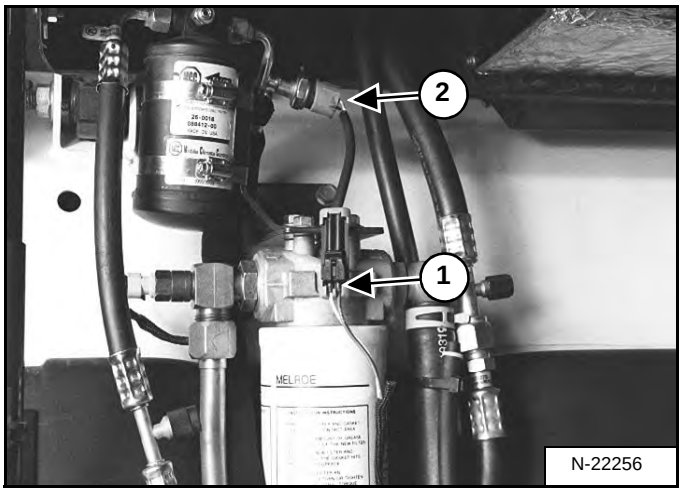
With a multi meter, check the voltage to the compressor clutch at the loader harness (Item 1) **[Figure 80-30-9]**.

The voltage reading should be around 12 volts.

If there is no power at the clutch, check the wiring harness for broken wires.

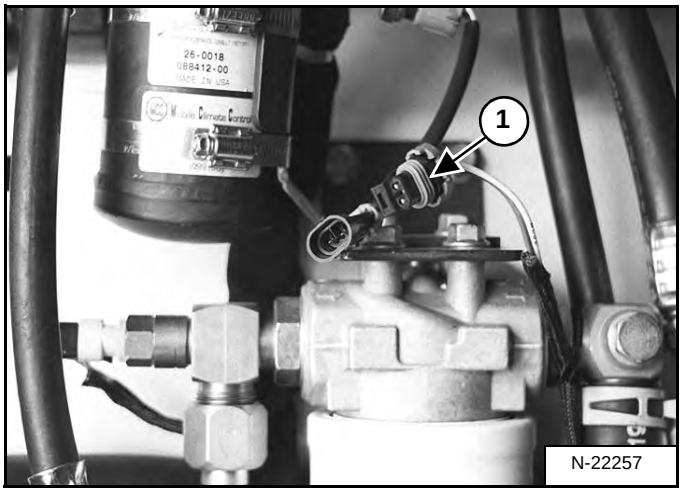
If there is power at the clutch, reconnect the wiring harness to the compressor clutch.

Figure 80-30-10



Disconnect the loader harness (Item 1) from the pressure switch (Item 2) **[Figure 80-30-10]**.

Figure 80-30-11



Using a multi meter check the loader wiring harness (Item 1) **[Figure 80-30-11]** for voltage.

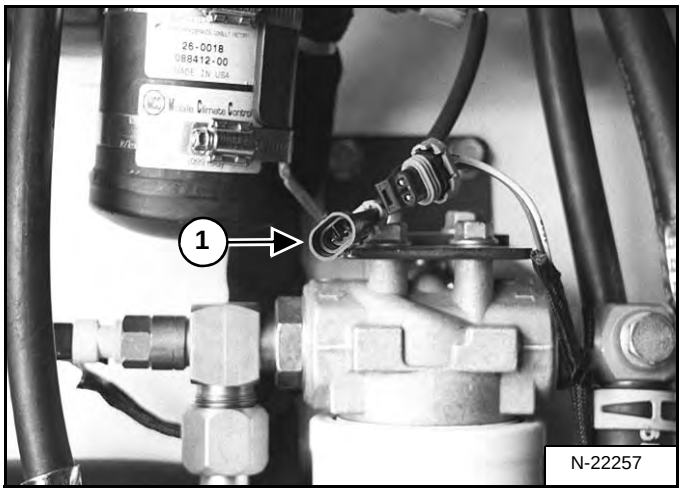
The voltage should be around 12 volts.

If there is no voltage at the wiring harness, check the harness for broken wires.

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Electrical System (Cont'd)

Figure 80-30-12



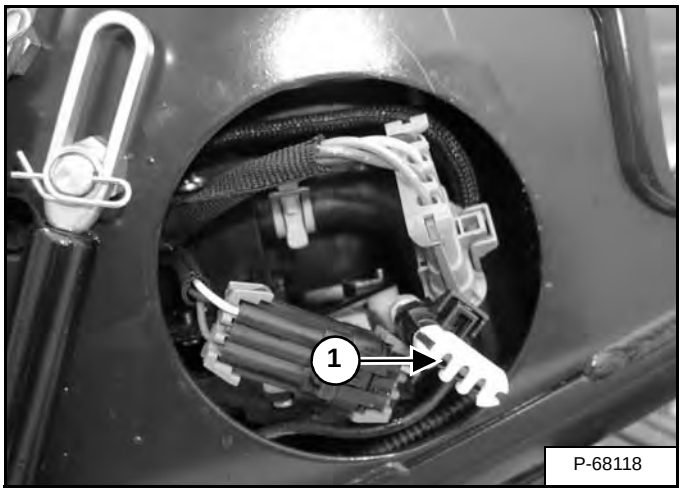
If there is voltage at the harness, check the resistance at the pressure switch (Item 1) **[Figure 80-30-12]**.

If there is no resistance value, check for low refrigerant level. (See Reclamation And Charging With Recovery / Charging Unit on Page 80-40-2.)

If a resistance value is seen, the pressure switch is good.

Reconnect the loader harness to the pressure switch.

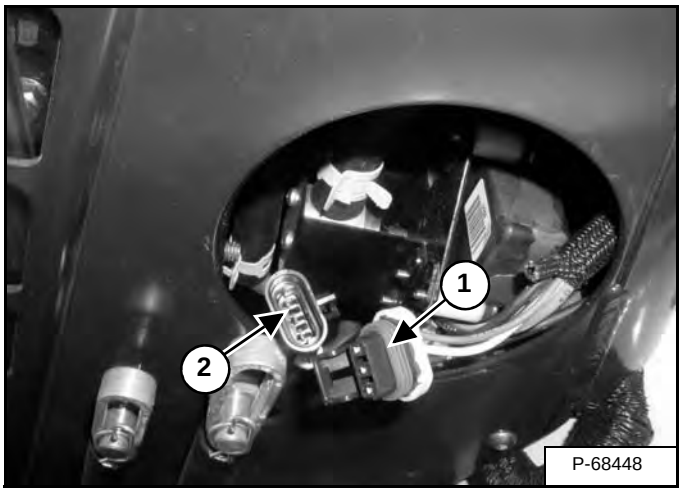
Figure 80-30-13



Remove the operator cab, left side access cover.

Disconnect the thermostat wiring connector (Item 1 **[Figure 80-30-13]** from the loader wiring harness.

Figure 80-30-14



Check the loader harness (Item 1) **[Figure 80-30-14]** for voltage. The voltage should be 12 volts.

If there is no voltage at the wiring harness, check the harness for broken wires.

If there is voltage at the wiring harness, check the thermostat (Item 2) **[Figure 80-30-14]** for resistance.

The resistance value of the thermostat should be 10 Ohms at 68° F (20° C).

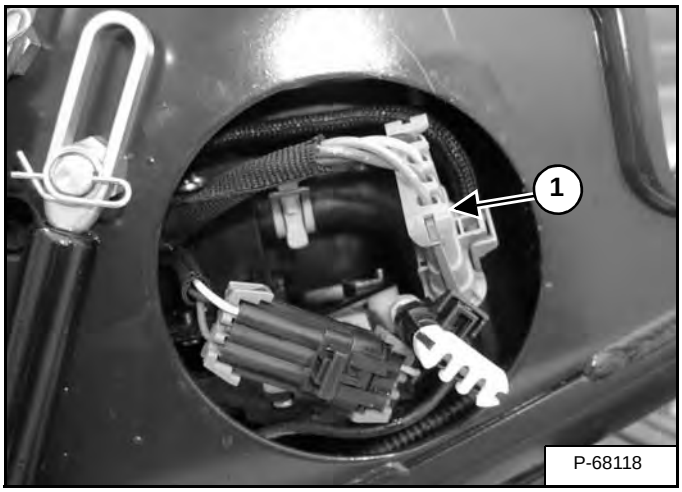
If there is no resistance value, replace the thermostat. (See Removal And Installation on Page 80-90-1.)

If there is a resistance value, check the blower.

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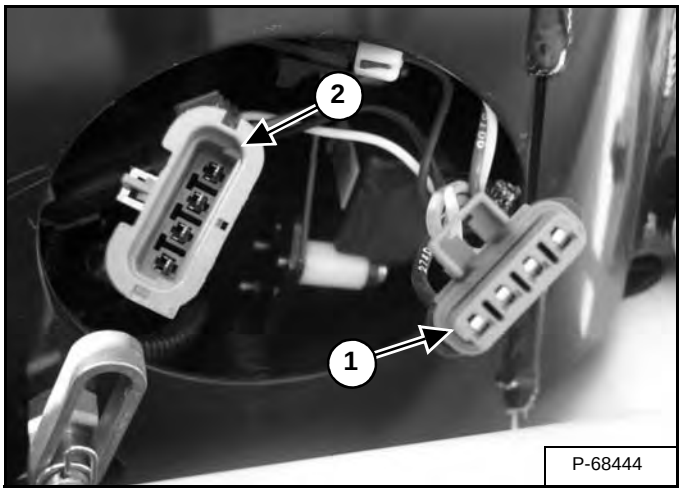
Electrical System (Cont'd)

Figure 80-30-15



Disconnect the blower wiring connector (Item 1) **[Figure 80-30-15]** from the loader wiring harness.

Figure 80-30-16



Check the loader harness (Item 1) **[Figure 80-30-16]** for voltage. The voltage should be 12 volts.

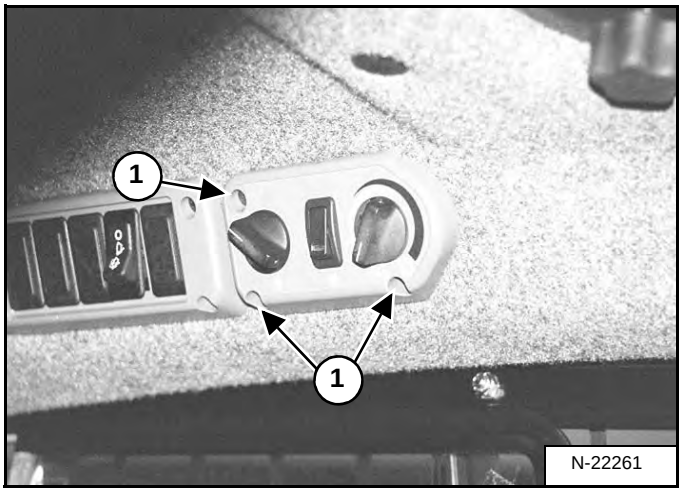
If there is no voltage at the wiring harness, check the harness for broken wires.

If there is voltage at the wiring harness, check the resistance to the blower at the blower wiring connector (Item 2) **[Figure 80-30-16]**.

If there is no resistance value replace the blower. (See Removal And Installation on Page 80-130-1.)

If there is a resistance value check the climate controls at the control panel inside the loader cab.

Figure 80-30-17

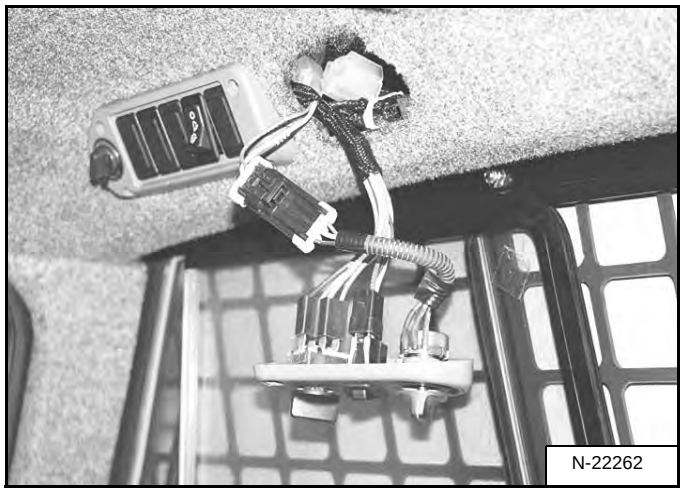


Remove the three mount bolts (Item 1) **[Figure 80-30-17]** from the cab control panel.

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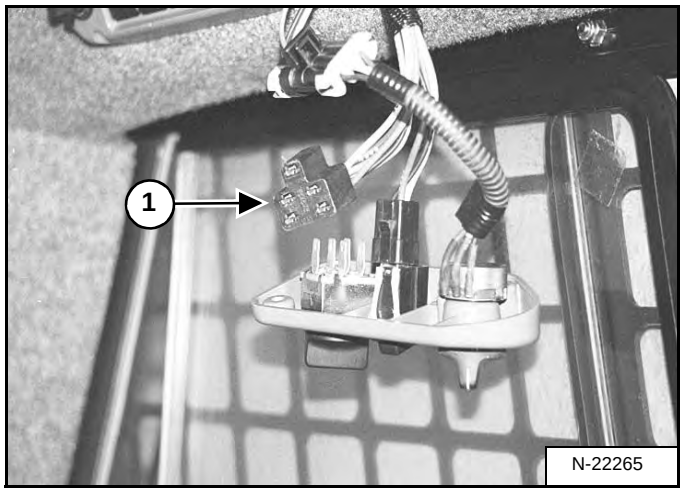
Electrical System (Cont'd)

Figure 80-30-18



Remove the control panel and wiring harness from the cab **[Figure 80-30-18]**.

Figure 80-30-19

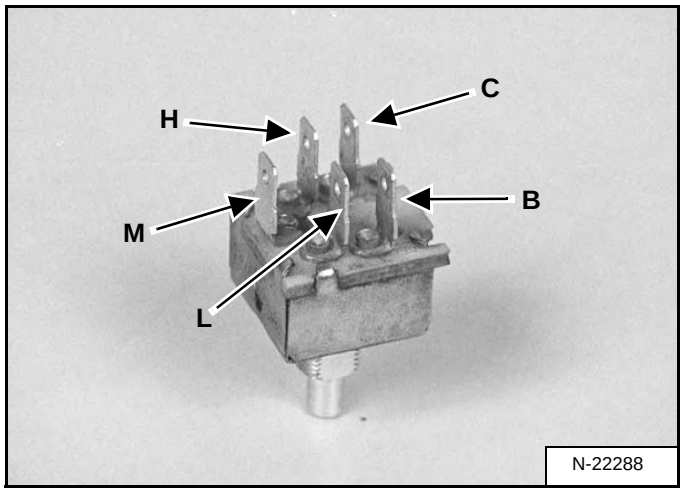


Disconnect the loader wiring harness (Item 1) **[Figure 80-30-19]** from the blower switch.

Check the loader harness for voltage. The voltage should be 12 volts.

If there is no voltage at the wiring harness, check the harness for broken wires.

Figure 80-30-20



If there is voltage at the wiring harness, check the blower switch **[Figure 80-30-20]** for resistance.

With the switch in the **OFF** position, there should be zero resistance between all terminals.

With the switch in the **1** position, there should be resistance between **C** terminal and the **B** terminal. And also between the **C** terminal and the **L** terminal frame **[Figure 80-30-20]**.

With the switch in the **2** position, there should be resistance between **C** terminal and the **B** terminal. And also between the **C** terminal and the M terminal frame **[Figure 80-30-20]**.

With the switch in the **3** position, there should be resistance between **C** terminal and the **B** terminal. And also between the **C** terminal and the **H** terminal frame **[Figure 80-30-20]**.

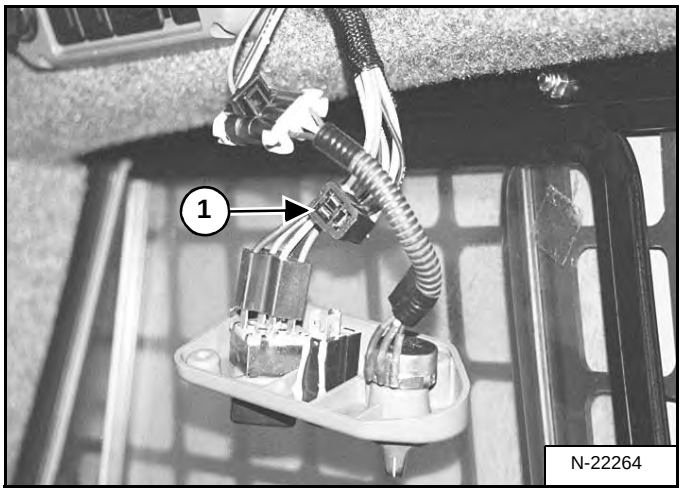
If any of the above resistance tests fail, replace the blower switch.

If the above resistance tests are good, check the A/C switch.

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Electrical System (Cont'd)

Figure 80-30-21

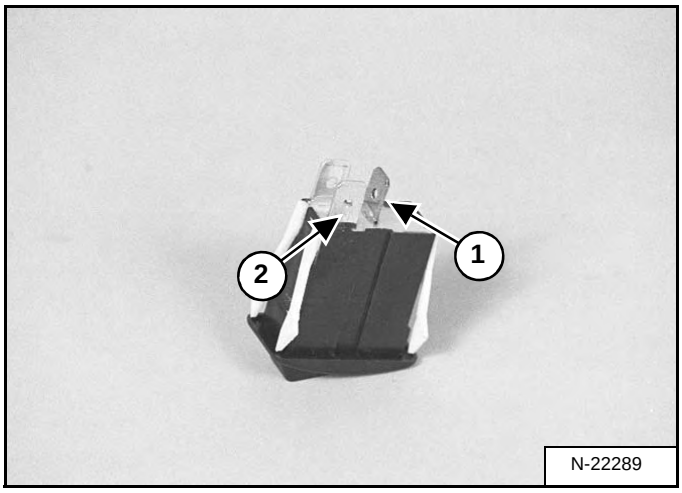


At the loader cab, disconnect the loader harness (Item 1) **[Figure 80-30-21]** from the A/C switch.

Check the harness for voltage. The voltage should be 12 volts.

If there is no voltage at the wiring harness, check the harness for broken wires.

Figure 80-30-22



If there is voltage at the wiring harness, check the A/C switch **[Figure 80-30-22]** for resistance.

With the switch in the OFF position there should be no resistance between any of the three terminals on the A/C switch.

With the switch in the ON position there should be resistance between terminal (Item 1) and terminal (Item 2) **[Figure 80-30-22]**.

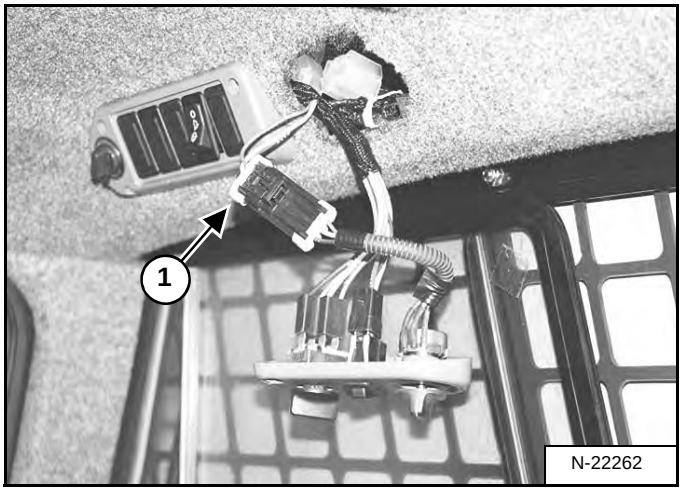
If no resistance value is found, replace the A/C switch.

If a resistance value is found, check the potentiometer.

The potentiometer will effect the A/C system and also effect the operation of the heater.

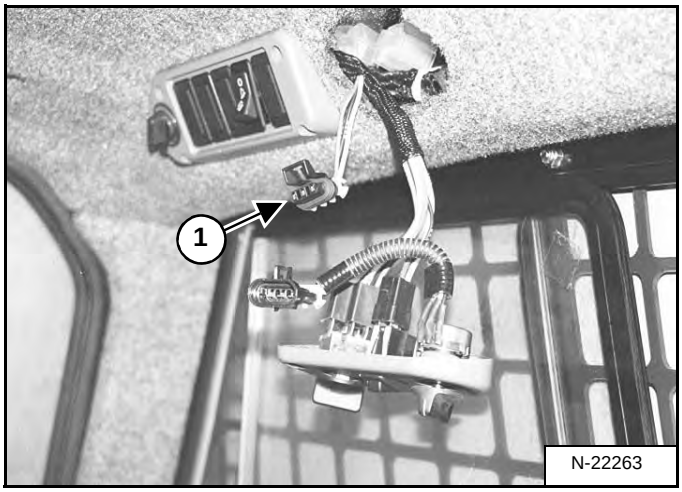
If heater valve does not open, or close, or the A/C does not work, check the potentiometer.

Figure 80-30-23



At the loader cab, disconnect the loader harness (Item 1) **[Figure 80-30-23]** from the potentiometer.

Figure 80-30-24



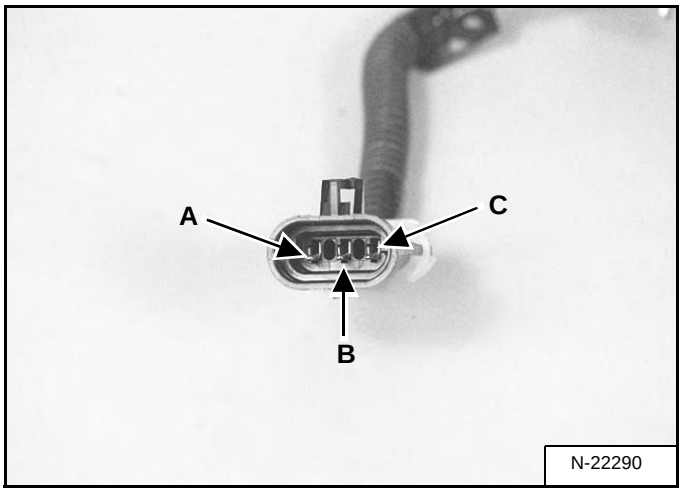
Check the loader harness (Item 1) **[Figure 80-30-24]** for voltage. The voltage should be 12 volts.

If there is no voltage at the wiring harness, check the harness for broken wires.

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Electrical System (Cont'd)

Figure 80-30-25

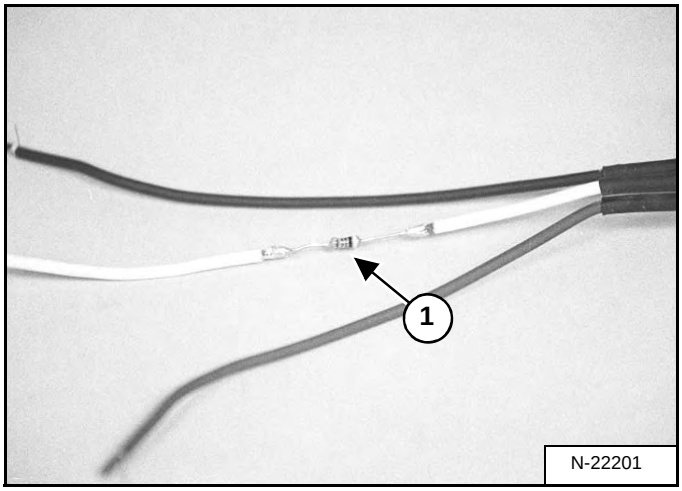


If there is voltage at the wiring harness, check the potentiometer **[Figure 80-30-25]** for resistance.

The resistance should be 10K Ohms between wire pin **A** and wire pin **C** frame **[Figure 80-30-25]**.

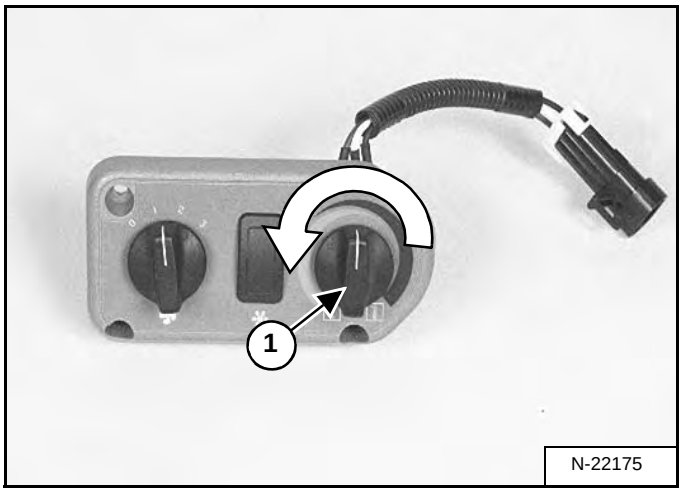
If no resistance is found replace the potentiometer.

Figure 80-30-26



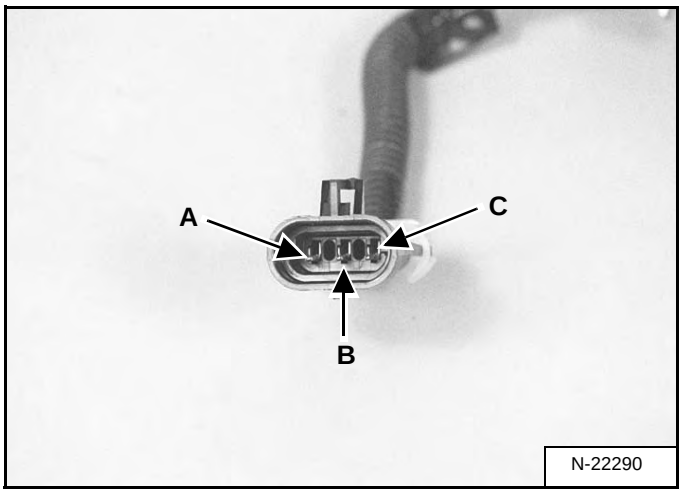
The white wire **B**, (Item 1) **[Figure 80-30-26]**, on the potentiometer, is a resister wire.

Figure 80-30-27



To check the resistance of the white wire, turn the potentiometer control (Item 1) **[Figure 80-30-27]** to the full A/C position.

Figure 80-30-28



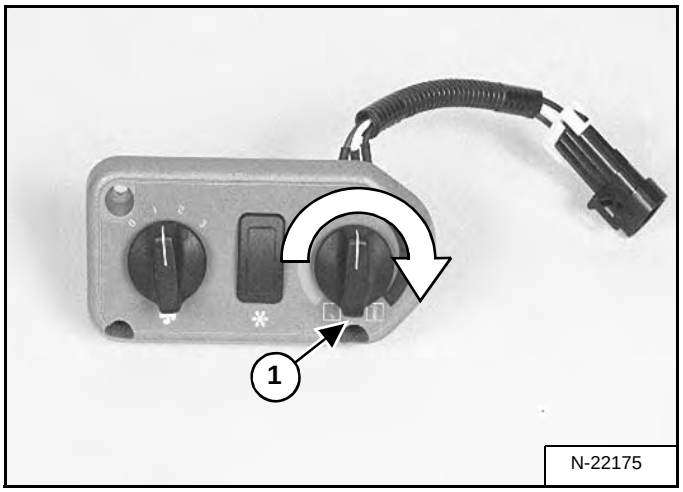
The resistance between the wire terminal **A** and wire terminal **B** frame **[Figure 80-30-28]** should be around 49K Ohms.

Check the resistance between the wire terminal **C** and wire terminal **B** frame **[Figure 80-30-28]** should be around 39K Ohms.

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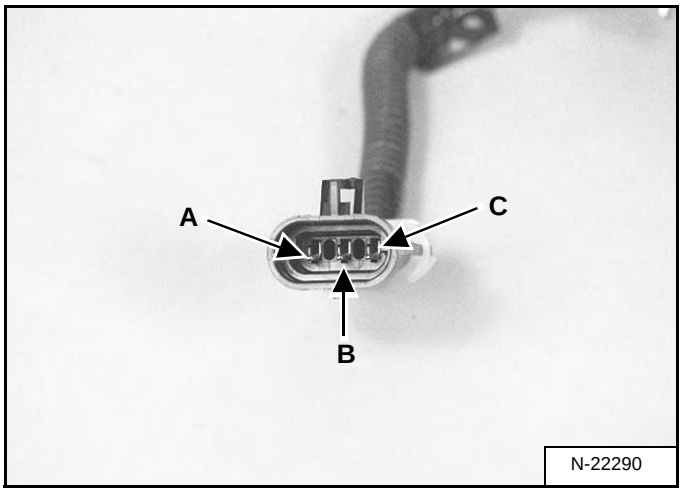
Electrical System (Cont'd)

Figure 80-30-29



To check the resistance of the white wire, turn the potentiometer control (Item 1) **[Figure 80-30-29]** to the full Heater position.

Figure 80-30-30



Check the resistance between the wire terminal **A** and wire terminal **B** frame **[Figure 80-30-30]** should be around 39K Ohms.

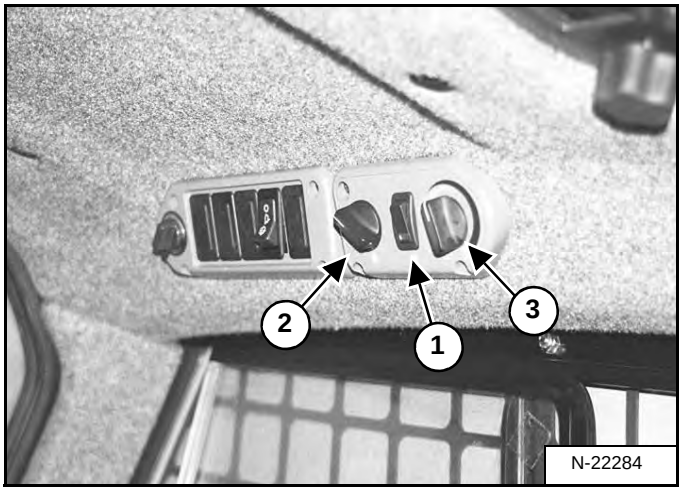
Check the resistance between the wire terminal **C** and wire terminal **B** frame **[Figure 80-30-30]** should be around 49K Ohms.

If the resistance is not found replace the potentiometer.

Engine Coolant Bypassing The Heater Valve

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Figure 80-30-31



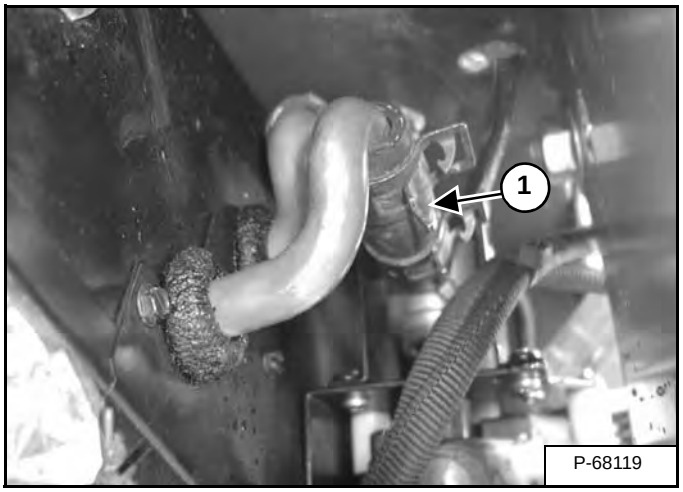
Push the A/C switch (Item 1) to the OFF position, turn the blower switch (Item 2) to position **1**, then turn the temperature control (Item 3) **[Figure 80-30-31]** to the High A/C position, with the loader ignition switch OFF.

Raise the operator cab. (See Raising on Page 10-30-1.)

Connect the remote start tool to the loader. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.)

Start the loader and run at high idle, for ten minutes.

Figure 80-30-32



Check the heater hose (Item 1) **[Figure 80-30-32]** for temperature.

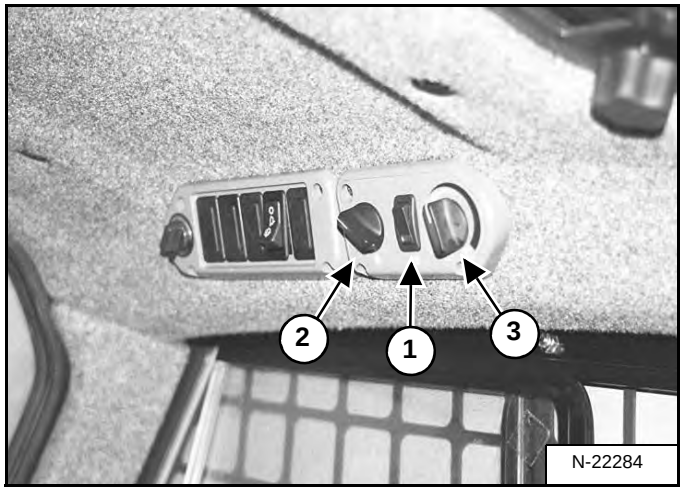
If the hose is hot, the heater valve is leaking by, and needs to be replace.

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Heater Valve Not Opening Or Closing

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Figure 80-30-33

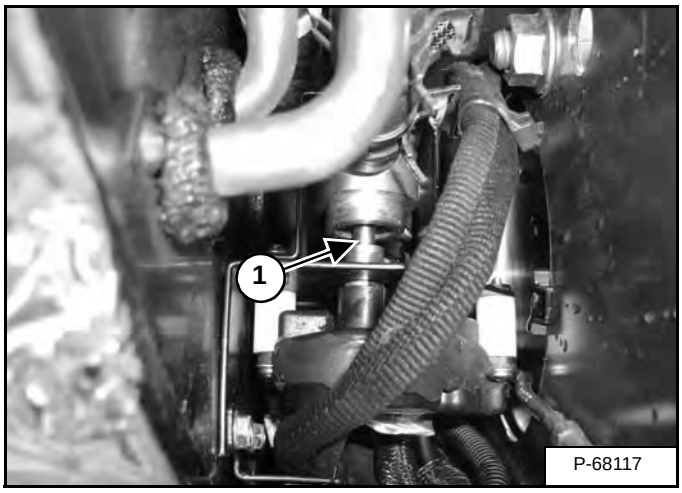


Push the A/C switch (Item 1) to the OFF position, turn the blower switch (Item 2) to position **1** and turn the temperature control (Item 3) **[Figure 80-30-33]** to the High A/C position, with the loader ignition switch OFF.

Raise the operator cab. (See Raising on Page 10-30-1.)

Connect the remote start tool to the loader. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.)

Figure 80-30-34



Place the remote start tool on the left fender of the loader, so the heater valve can be clearly seen. Watch the valve shaft (Item 1) **[Figure 80-30-34]**, as the key of the remote start is turned to the ON position without starting the loader. The heater valve should rotate. Place a mark on the loader shaft.

Turn the remote start key to the OFF position and remove the remote start tool from fender.

Lower operator cab.

Turn the temperature control (Item 3) **[Figure 80-30-33]** to the High Heater position, with the loader ignition switch OFF.

Raise the operator cab.

Place the remote start tool on the left fender of the loader, so the heater valve can be clearly seen. Watch the valve shaft (Item 1) **[Figure 80-30-34]**, as the key of the remote start is turned to the ON position without starting the loader. The heater valve should rotate.

If it does not rotate, check the potentiometer for proper function. (See Electrical System on Page 80-30-12.)

Replace the heater valve. (See Removal and Installation on Page 80-140-1.)

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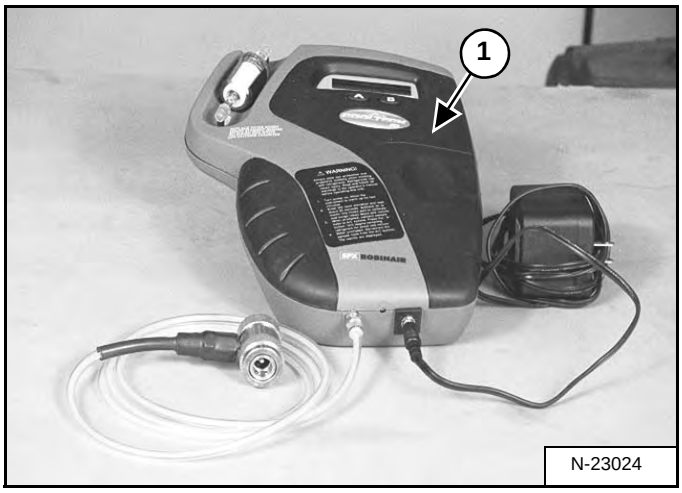
Refrigerant Identification

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R134a refrigerant gives a toxic gas.

W-2371-0500

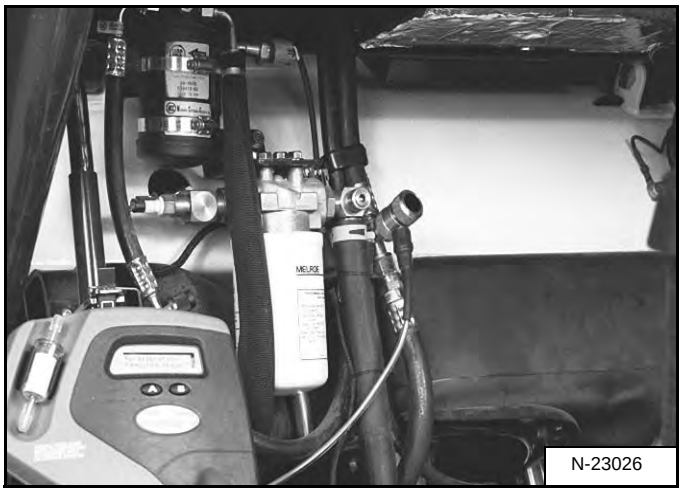
Figure 80-40-1



NOTE: It is recommended to identify the type of refrigerant that is in the A/C system and if it is pure enough to use. The tool MEL1592, Refrigerant Identifier (Item 1) [Figure 80-40-1] will determine, the kind of refrigerant and any possible harmful or dangerous substances that may be present in the system. Thus preventing mixing of dangerous material with your reclaimed R-134a in your reclaimer, and further contamination to other A/C systems that are reclaimed and charged from your MEL1581 Recovery/Recycling/Recharging Machine.

NOTE: This test is run with the loader engine OFF, and the A/C switch in the OFF position.

Figure 80-40-2



Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Connect the Refrigerant Identifier to the low pressure hose **[Figure 80-40-2]**.

Connect the Refrigerant Identifier to its power source.

Follow the steps displayed on the refrigerant identifier screen.

Allow two minutes for the refrigerant identifier to display the type of refrigerant and air content. An alarm will sound if potentially flammable hydrocarbons are present and will also indicate on the visual display.

Disconnect the refrigerant identifier from the loader A/C.

If the refrigerant is dangerous or flammable, it must be evacuated from the A/C system into a separate container and properly and safely disposed of.

If R134a is found, evacuate the system.

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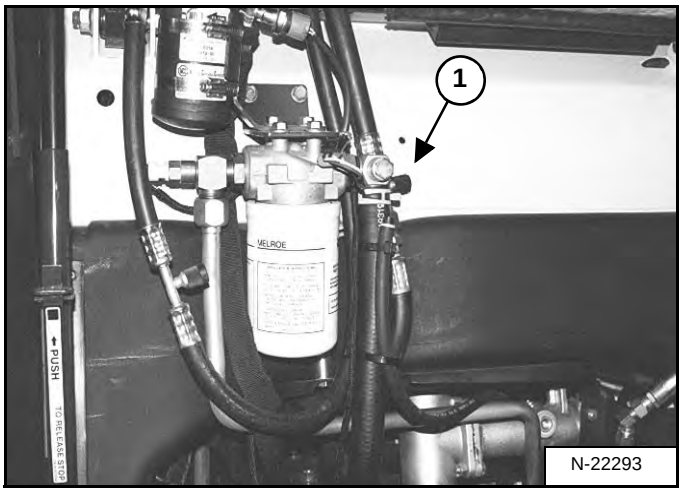
Reclamation And Charging With Recovery / Charging Unit

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R134a refrigerant gives a toxic gas.

W-2371-0500

Figure 80-40-3



Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

NOTE: Only A/C trained technicians should perform the reclaiming and recharging procedure.

Remove the protective cap (Item 1) **[Figure 80-40-3]** from the low pressure hose.

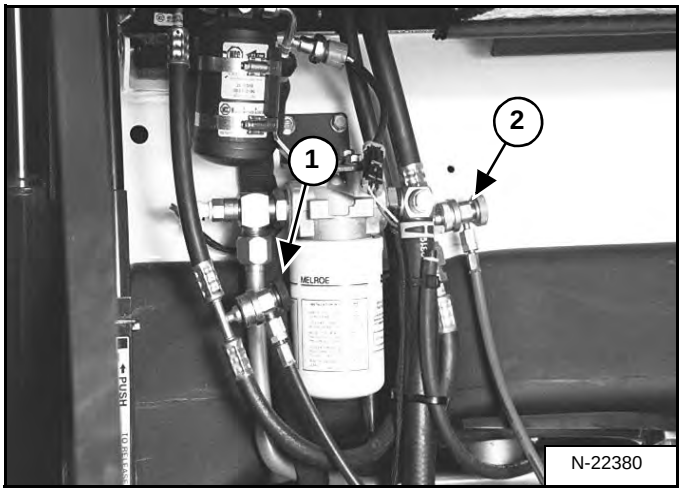
Figure 80-40-4



Use an approved recovery/charging unit **[Figure 80-40-4]** to evacuate the system.

Connect the reclaimer to the loader A/C charge ports.

Figure 80-40-5



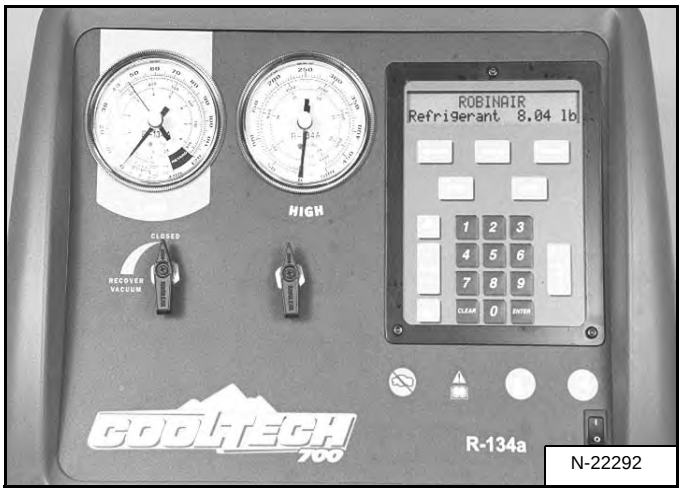
Connect the Red hose (Item 1) **[Figure 80-40-5]** to the high pressure port and open the valve.

Connect the Blue hose (Item 2) **[Figure 80-40-5]** to the low pressure port and open the valve.

Dealer Copy -- Not for Resale

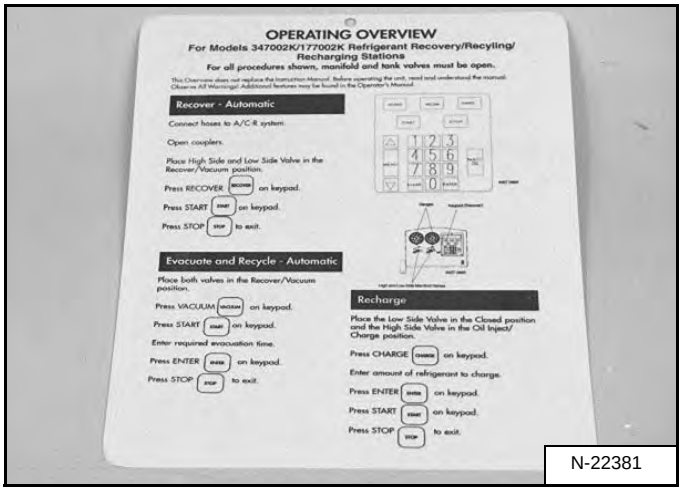
Reclamation And Charging With Recovery / Charging Unit (Cont'd)

Figure 80-40-6



Turn the reclaimer unit **[Figure 80-40-6]** to the ON position and follow the on screen instructions.

Figure 80-40-7



NOTE: The reclaimer unit, has a complete step by step set of instructions [Figure 80-40-7] to follow for reclimation and recharging of the A/C system. A trained technician should follow these instructions as they may very slightly depending on the model and brand of reclaimer used.

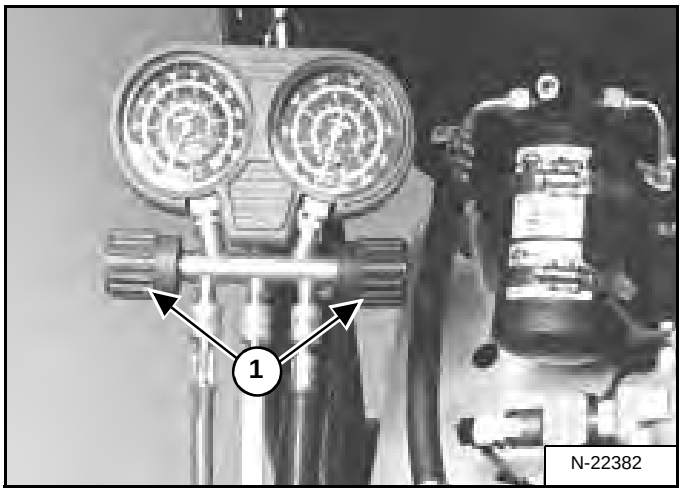
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Charging With A Manifold Gauge Set

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Figure 80-40-8

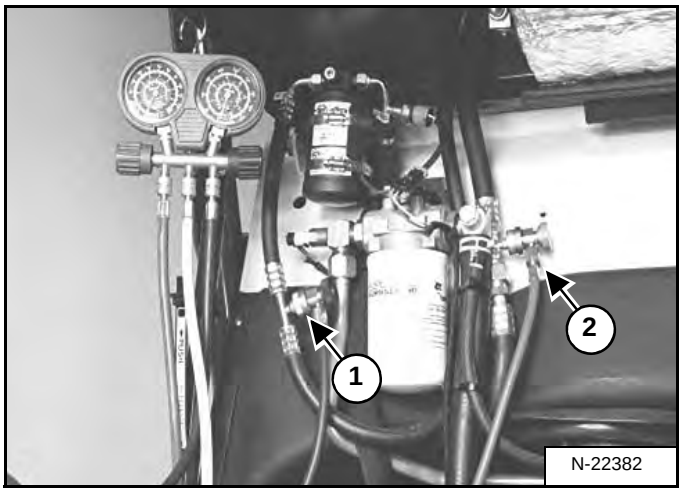


Check to see that the hand valves (Item 1) **[Figure 80-40-8]** are closed on the manifold gauge set.

If there is any refrigerant in the A/C system, it must be recovered by an approved A/C reclamation procedure. (See Reclamation And Charging With Recovery / Charging Unit on Page 80-40-2.)

Connect the gauges to the loader A/C charge ports.

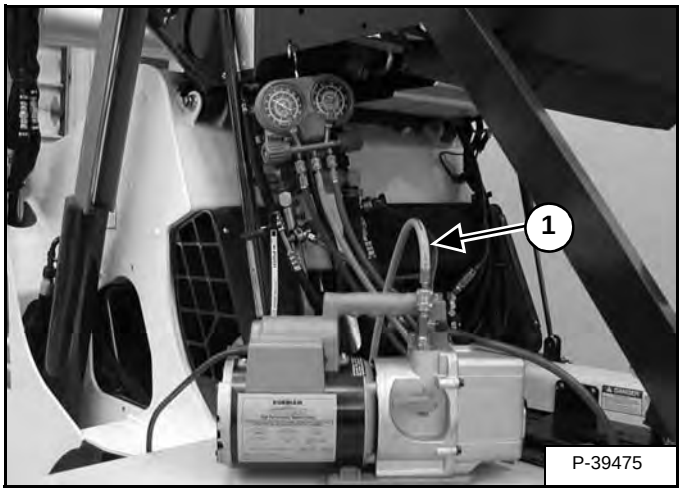
Figure 80-40-9



Connect the Red hose (Item 1) **[Figure 80-40-9]** to the high pressure port and open the valve.

Connect the Blue hose (Item 2) **[Figure 80-40-9]** to the low pressure port and open the valve.

Figure 80-40-10

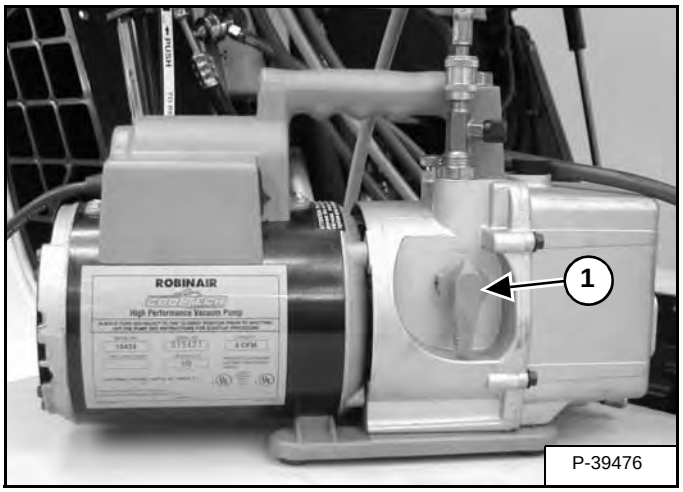


Connect the Yellow hose (Item 1) **[Figure 80-40-10]** to the vacuum pump.

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Charging With A Manifold Gauge Set (Cont'd)

Figure 80-40-11

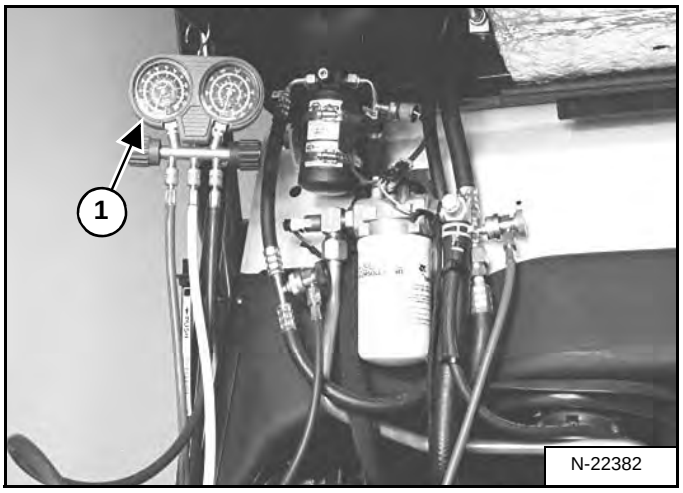


Start the vacuum pump and open Iso-valve (Item 1) **[Figure 80-40-11]** on the vacuum pump.

Run the vacuum pump for at least 5-10 minutes to insure that a vacuum has been pulled on the system.

Close the Iso-valve (Item 1) **[Figure 80-40-11]** (which isolates the vacuum pump from the A/C system) and turn OFF the vacuum pump.

Figure 80-40-12

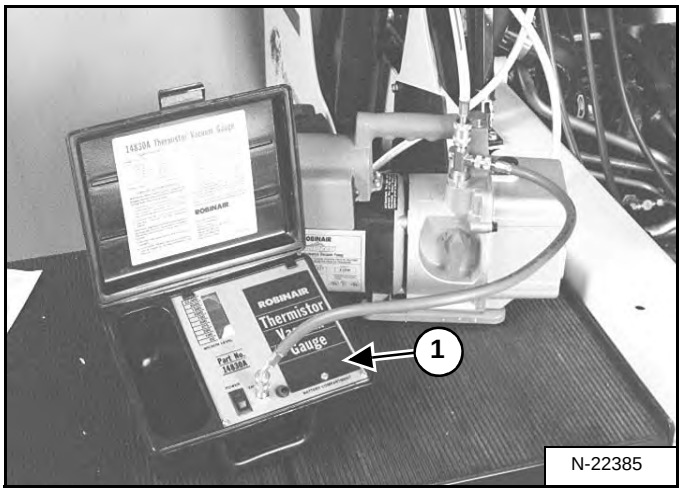


Note vacuum pressure indicated on the low pressure (Blue) gauge (Item 1) **[Figure 80-40-12]**. Let stand for 5-10 min. and recheck the pressure for changes.

If the pressure drops, this may be an indication of a leak in the A/C system.

Determine the problem with the A/C system and repair it.

Figure 80-40-13



A thermistor vacuum gauge (Item 1) **[Figure 80-40-13]** may be necessary to use to determine the critical vacuum level during evacuation. It is a solid state instrument that constantly monitors and visually indicates the vacuum level.

The thermistor vacuum gauge is used with the vacuum pump **[Figure 80-40-13]**.

Start the vacuum pump and open Iso-valve on the vacuum pump.

Be sure that both hand valves, and both charge port valves are open.

Run the vacuum pump for at least 45 minutes to insure that all the moisture is boiled out of the system.

Stop the vacuum pump and close the Iso-valve on the vacuum pump.

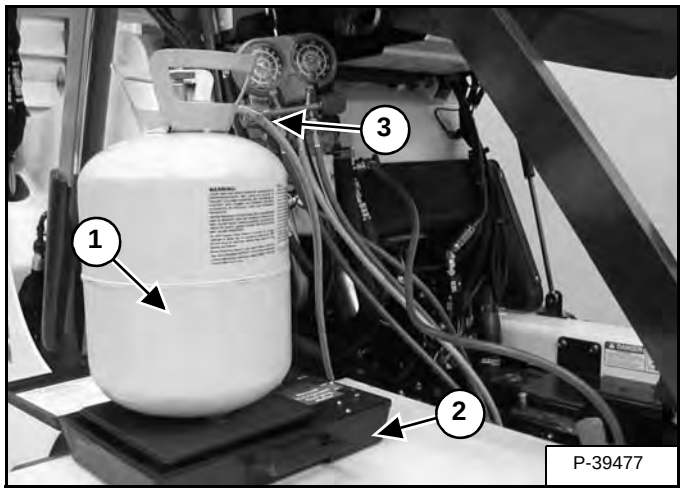
Close both hand valves on the manifold gauge set and remove the yellow hose from the vacuum pump that goes to the manifold gauge set.

Remove the vacuum pump and thermistor vacuum gauge.

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Charging With A Manifold Gauge Set (Cont'd)

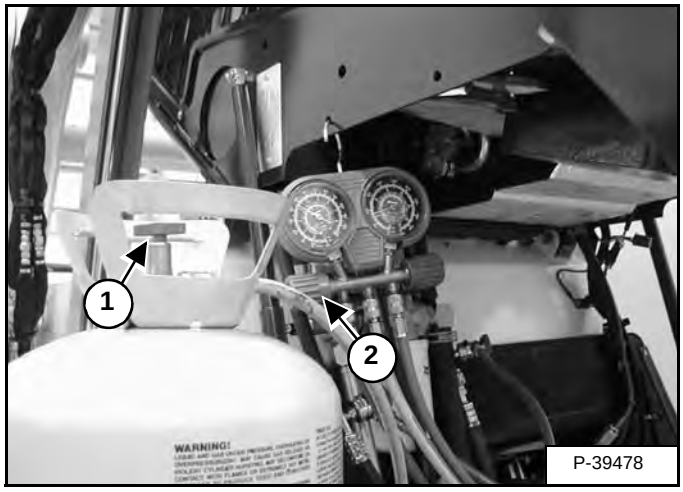
Figure 80-40-14



Place a refrigerant container with R134a (Item 1) on a charging scale (Item 2) **[Figure 80-40-14]** and zero out the scale.

Connect the yellow hose (Item 3) **[Figure 80-40-14]** from the manifold gauge set to the valve on the refrigerant tank.

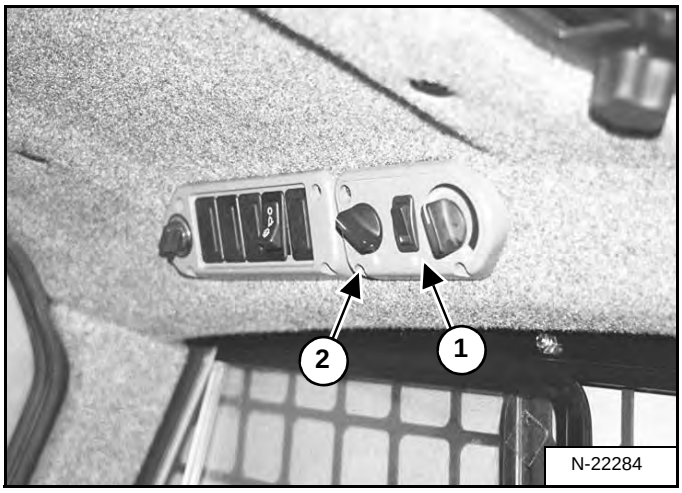
Figure 80-40-15



Open the valve on the refrigerant container (Item 1) and open the low pressure hand valve (Blue) (Item 2) **[Figure 80-40-15]** on the manifold gauge set. Allow the vacuum to pull in the refrigerant until the pressure stabilizes.

Connect the remote start tool to the loader. (See REMOTE START TOOL KIT-MEL1563 on Page 10-60-1.)

Figure 80-40-16



Press the A/C (Item 1) **[Figure 80-40-16]** switch to ON position.

Turn blower switch (Item 2) **[Figure 80-40-16]** to HIGH position.

Raise the operator cab. (See Raising on Page 10-30-1.)

Start loader engine, with the remote start switch, and run at medium speed.

Watch the scale and run system until the predetermined amount of refrigerant is added to the A/C system.

The A/C system holds 2.0 lb. (0.91 kg) of refrigerant.

Turn OFF the valve on the refrigerant container, and hand valves on the manifold gauge set.

Turn OFF the engine, and remove the A/C charging equipment from the loader.

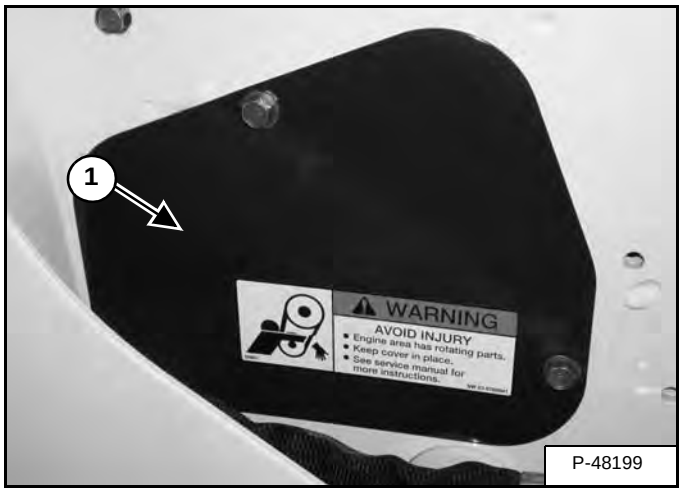
Lower the operator cab. (See Lowering on Page 10-30-2.)

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COMPRESSOR

Belt Adjustment

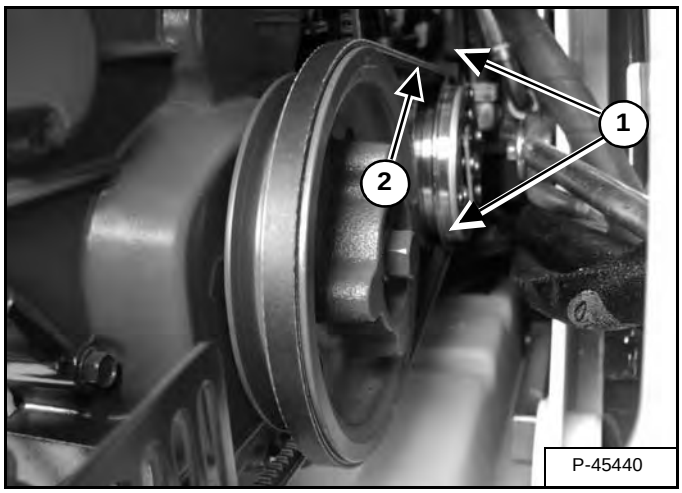
Figure 80-50-1



Stop the engine.

Remove the right side access cover (Item 1) **[Figure 80-50-1]**.

Figure 80-50-2



Loosen the mounting and adjustment bolts (Item 1) **[Figure 80-50-2]**.

Move the air conditioner pump toward the front of machine to tighten the belt.The tension is correct when there is 5/16 in. (8,0 mm) movement at the middle of the belt span (Item 2) **[Figure 80-50-2]** with 15 lb. (66 N) of force.

Removal And Installation

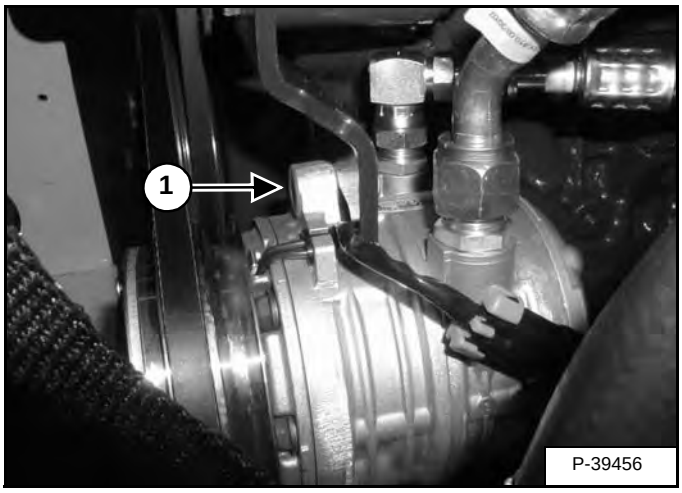
Raise the loader lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

At the right side of the loader, remove the access cover (Item 1) **[Figure 80-50-1]**.

Evacuate the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 80-40-2.)

Figure 80-50-3



Remove the compressor adjustment bolt (Item 1) **[Figure 80-50-3]**.

Installation: Tighten the compressor adjustment bolt to 34 ft.-lb. (46 N•m) torque.

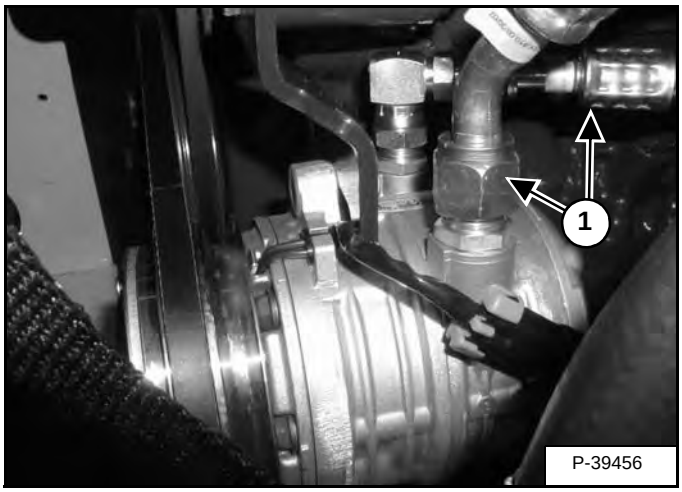
Remove the compressor belt.

Mark the compressor hoses for proper installation.

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Removal And Installation (Cont'd)

Figure 80-50-4

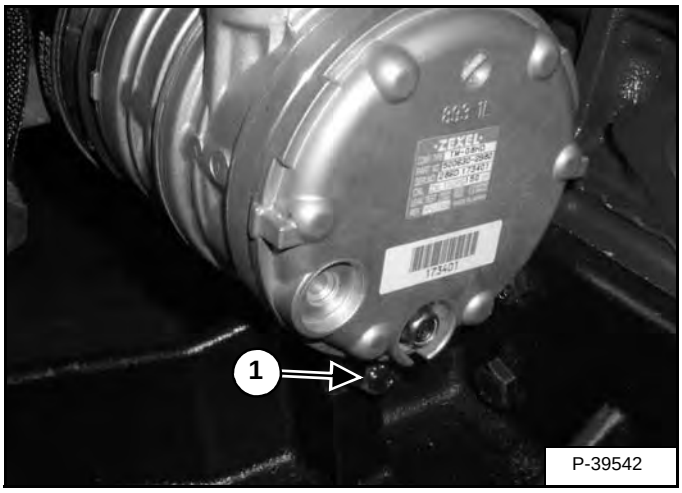


Remove the compressor hoses (Item 1) **[Figure 80-50-4]** from the compressor.

Installation: Tighten the compressor hoses to 22 ft.-lb. (29,8 N•m) torque.

Cap and plug the compressor hoses and the fittings with with the proper A/C caps and plugs.

Figure 80-50-5

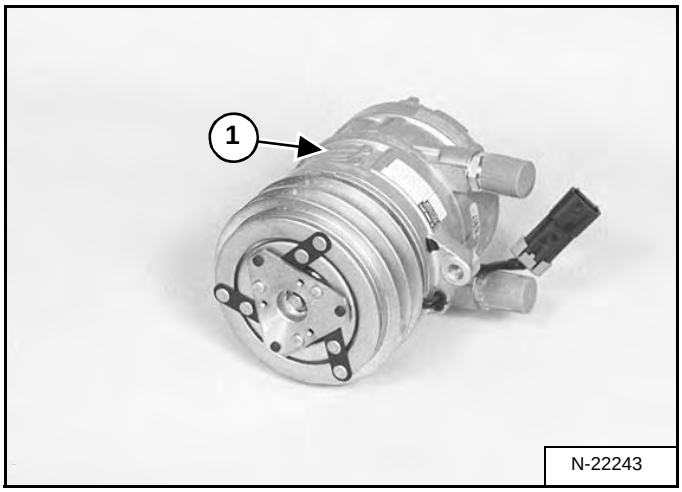


Remove the compressor mount bolt (Item 1) **[Figure 80-50-5]**.

Remove the compressor from the loader.

Oil

Figure 80-50-6



The compressor (Item 1) **[Figure 80-50-6]** is factory filled with **150-170 cc's** of PAG 100 oil (Poly Alkelene Glycol).

Unlike engine oil, it is not necessary to frequently check or change the compressor oil.

It is necessary to check, replenish or replace the compressor oil in the following cases:

When ever the evaporator, condenser or receiver-drier is replaced.

Whenever the refrigerant has leaked from the system.

Whenever the refrigerant is suddenly released from the cooling cycle.

Whenever any oil-related problems occur in the cooling cycle.

When one of the components (the evaporator, condenser or receiver-drier) is replaced, **one ounce** of oil should be added for each component replaced.

If the A/C compressor is changed, no oil should be added to the system, because the compressor comes factory filled with oil.

NOTE: Only PAG 100 oil should be used, and never mix R-12 and R-134a Oils.

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COMPRESSOR (CONT'D)

Oil Check

The compressor oil should be checked as follows when oil is being added to an in service loader.

There is a close affinity between oil and refrigerant. During normal operation, part of the oil circulates with the refrigerant in the system. Therefore, when checking the amount of oil in the system or replacing any system component, the compressor must be run in advance to insure return of oil to the compressor.

If the amount of refrigerant in the system has decreased, charge the system. (See Reclamation And Charging With Recovery / Charging Unit on Page 80-40-2.)

Open the cab door and windows.

Run the blower at maximum speed.

Run the compressor for at least 20 minutes at 800-1200 RPM.

Remove the compressor from the loader. (See Removal And Installation on Page 80-50-1.)

Figure 80-50-7

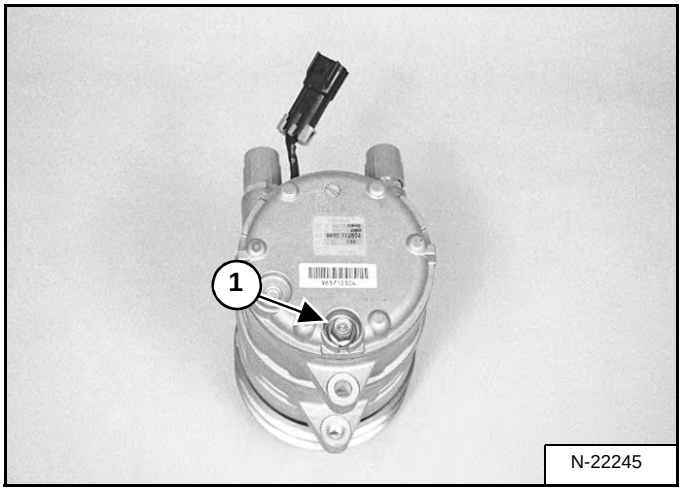
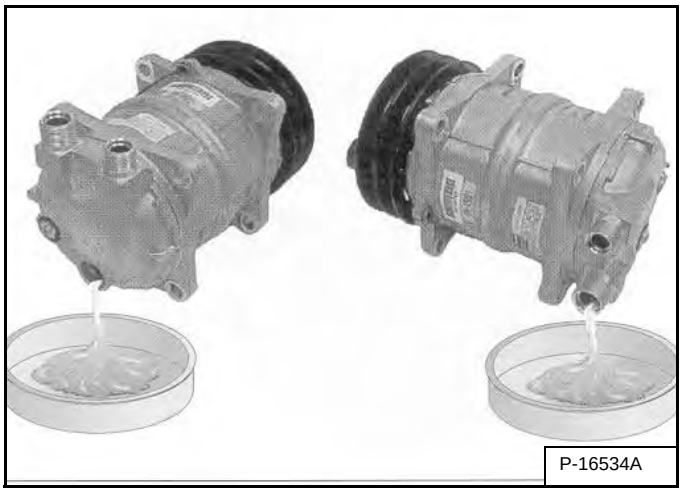


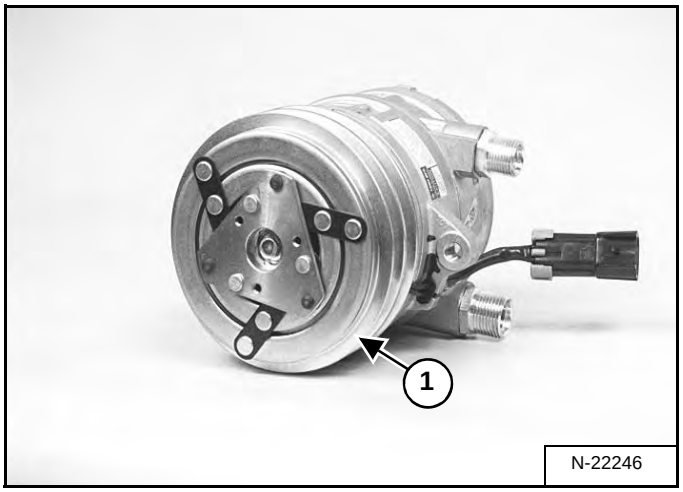
Figure 80-50-8



Remove the oil drain plug (Item 1) **[Figure 80-50-7]** and drain the oil through the connectors and the oil drain hole **[Figure 80-50-8]**.

Installation: Tighten the oil drain plug to 9.4-10.8 ft.-lb. (13-15 N•m) torque.

Figure 80-50-9



NOTE: After draining the oil through the drain hole and the connectors, extract the remaining oil through the discharge-side connector by rotating the drive pulley (Item 1) [Figure 80-50-9] several times by hand.

Measure the drained oil in a measuring cylinder.

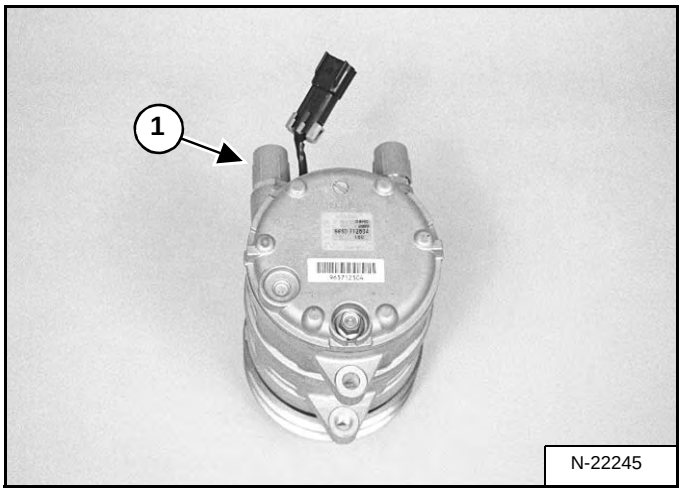
Check the oil for contamination, dirt, metal shavings, or varnish color, discard the oil if contaminated.

NOTE: If metal shavings are found in the compressor oil, replace the complete compressor assembly.

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Oil Check (Cont'd)

Figure 80-50-10



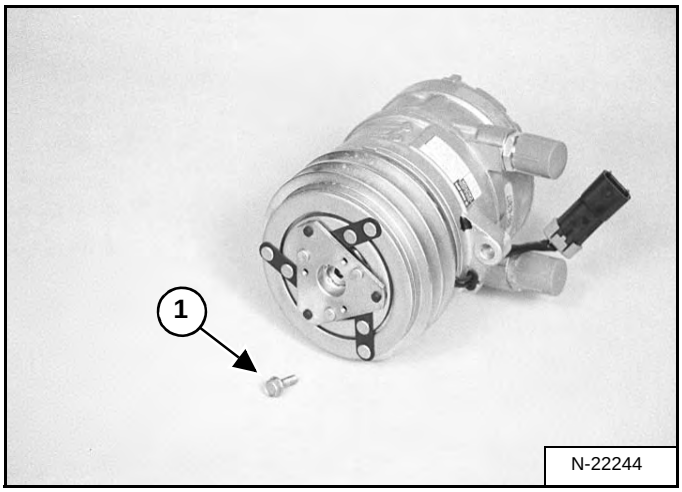
Add new compressor oil through the suction side connector (Item 1) **[Figure 80-50-10]**.

Installation: **Add 150 -170 cc's of PAG 100 oil.**

NOTE: The suction port on the compressor is marked with an S and is the larger port on the compressor.

Clutch Disassembly And Assembly

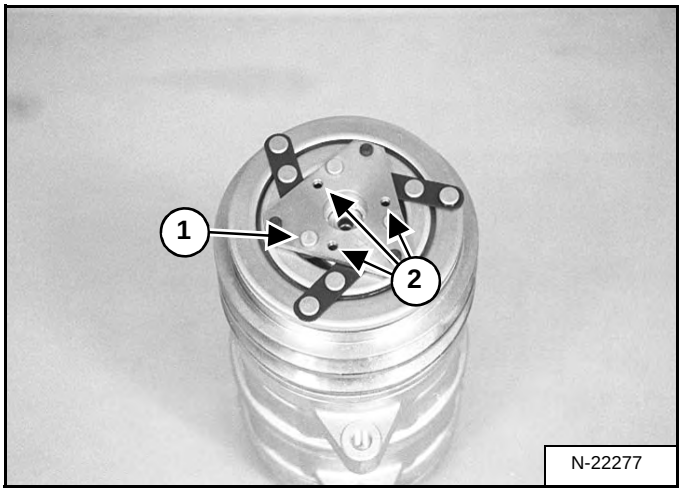
Figure 80-50-11



Remove the center armature bolt (Item 1) **[Figure 80-50-11]**.

Installation: Tighten the armature bolt to 8-10 ft.-lb. (12-14 N•m) torque.

Figure 80-50-12

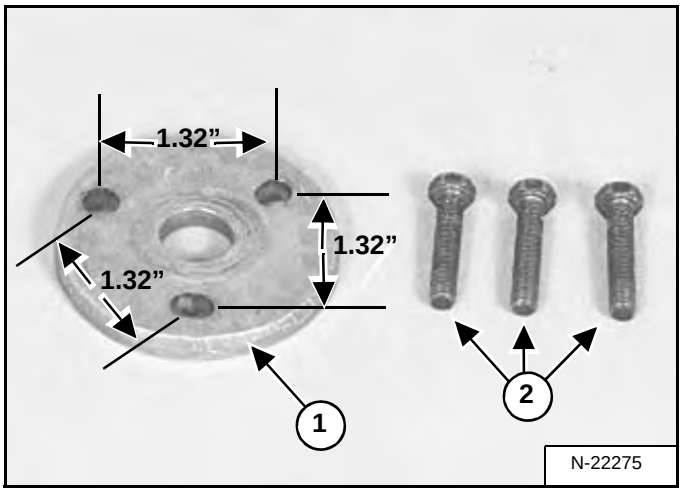


To remove the armature plate (Item 1) **[Figure 80-50-12]** from the clutch face, you must make an armature plate puller.

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Clutch Disassembly And Assembly (Cont'd)

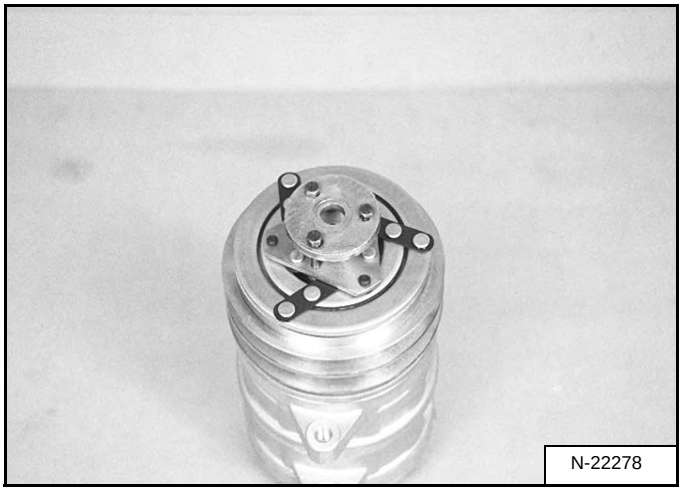
Figure 80-50-13



The armature plate puller, (Item 1) **[Figure 80-50-13]** can be constructed by drilling three 10 mm holes in a flat circular plate, located 1.32 in. apart **[Figure 80-50-13]**.

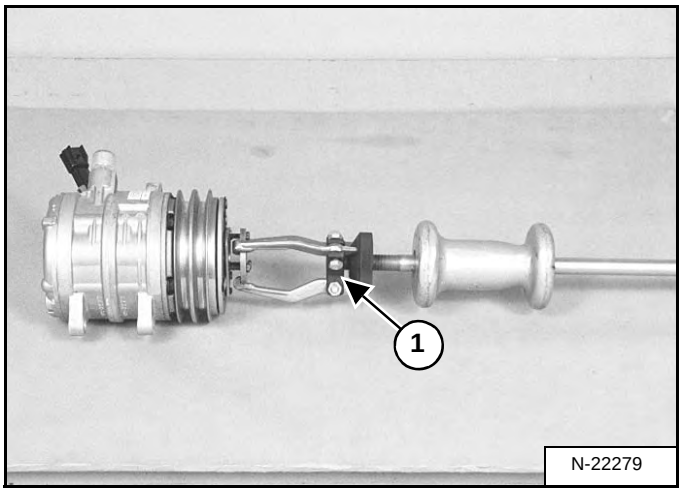
Attach the puller to the armature plate using three 8 mm bolts (Item 2) **[Figure 80-50-13]**.

Figure 80-50-14



Turn the bolts into the three 8 mm holes (Item 2) **[Figure 80-50-12]** on the armature plate as shown in **[Figure 80-50-14]**.

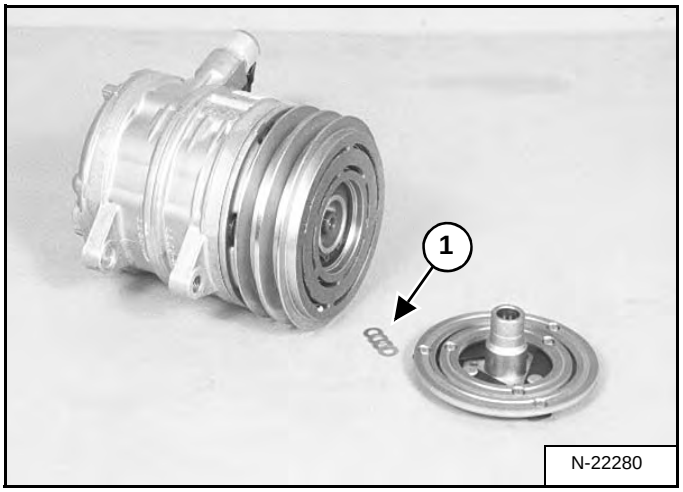
Figure 80-50-15



Attach a slide hammer puller (Item 1) **[Figure 80-50-15]** to the armature puller disk.

Remove the armature plate from the compressor clutch.

Figure 80-50-16



Remove the shims (Item 1) **[Figure 80-50-16]** from either the armature shaft or armature plate.

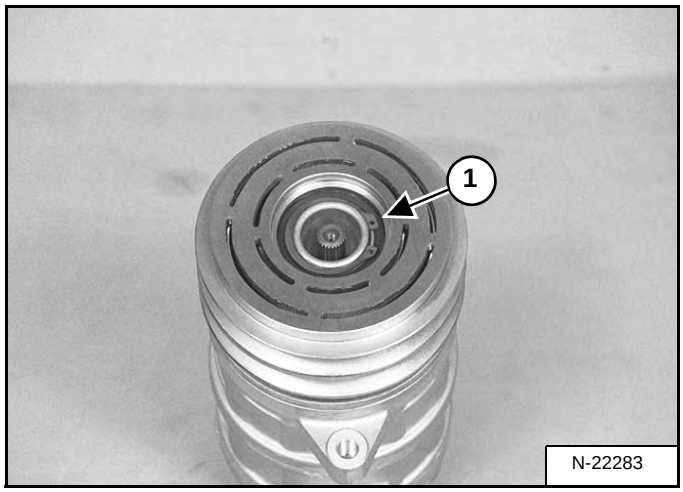
Installation: Insure that the clutch has the correct clearance by adding the shims (Item 1) **[Figure 80-50-16]**.

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Clutch Disassembly And Assembly (Cont'd)

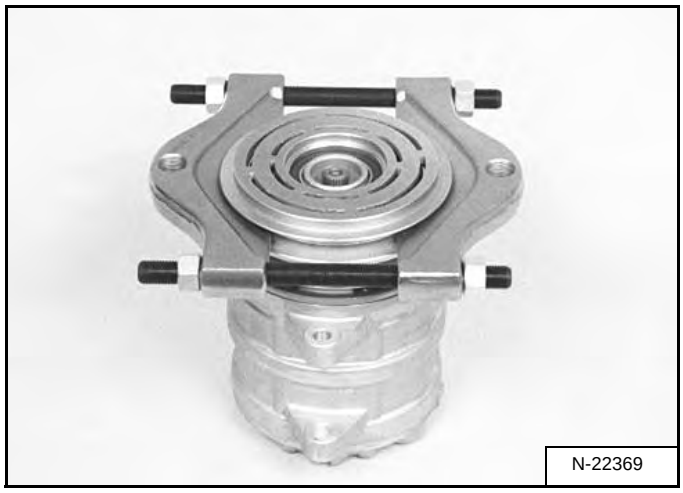
The specified clearance for the clutch is 0.01-0.02 in. (0.3-0.6 mm). Adjusting shims are available in the following thicknesses:
0.0039 in. (0.1 mm)
0.0118 in. (0.3 mm)
0.0197 in. (0.5 mm)

Figure 80-50-17



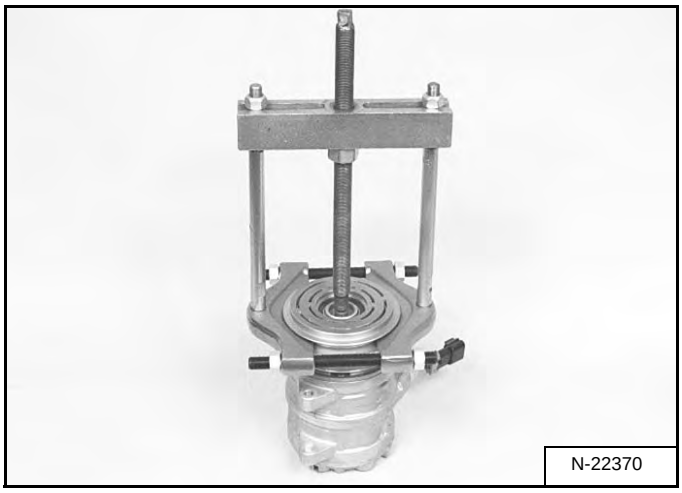
Remove the snap ring (Item 1) **[Figure 80-50-17]** from the pulley assembly.

Figure 80-50-18



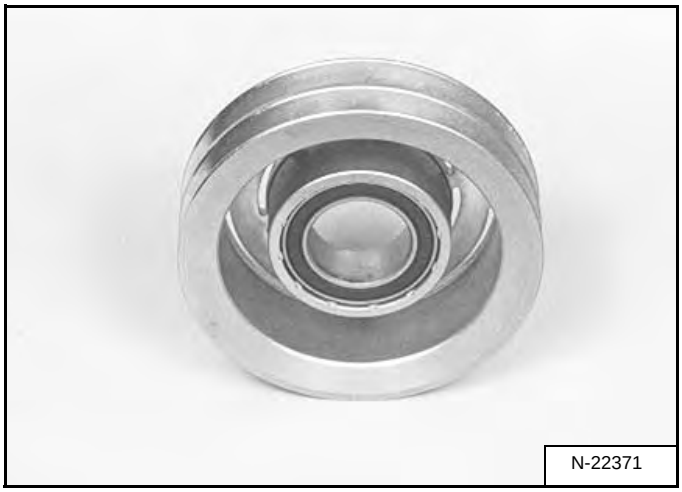
Install the pulley puller tool **MEL1595** on the compressor pulley **[Figure 80-50-18]**.

Figure 80-50-19



Remove the pulley from the compressor **[Figure 80-50-19]**.

Figure 80-50-20

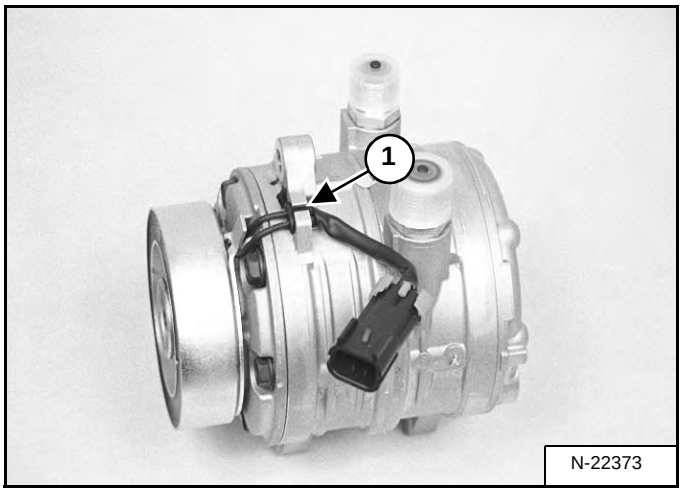


The pulley assembly and bearing **[Figure 80-50-20]** must be replace as a complete unit.

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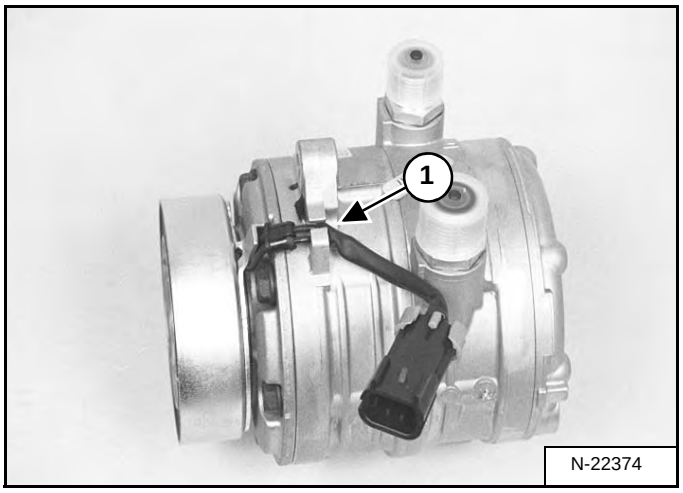
Clutch Disassembly And Assembly (Cont'd)

Figure 80-50-21



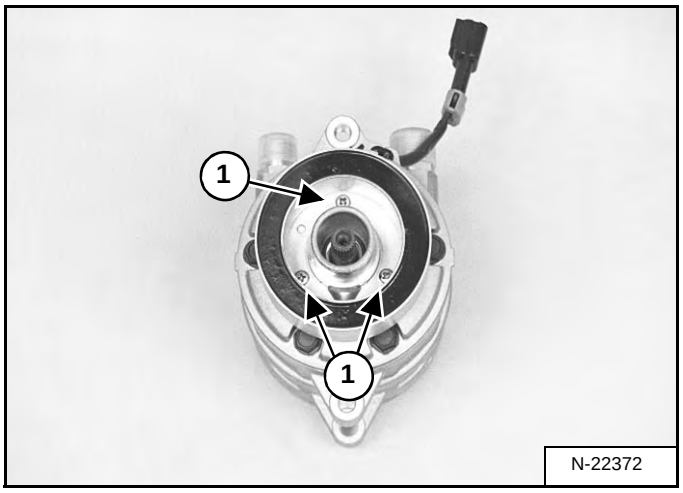
Slide the wire grommet (Item 1) **[Figure 80-50-21]** from the wire holder.

Figure 80-50-22



Remove the coil lead wire (Item 1) **[Figure 80-50-22]** from the wire holder on the compressor.

Figure 80-50-23

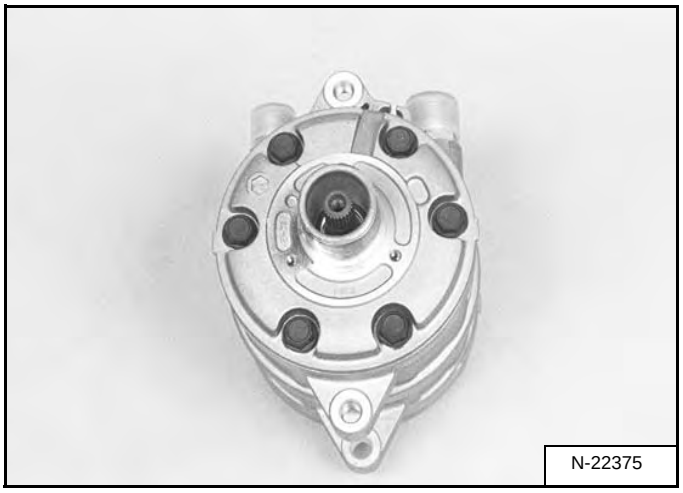


Remove the three coil mount bolts (Item 1) **[Figure 80-50-23]** from the compressor.

Installation: Tighten the mount bolts to 2.9-4.3 ft.-lb. (4-6 N•m) torque.

Remove the coil from the compressor.

Figure 80-50-24



The compressor **[Figure 80-50-24]** must be replaced as a complete unit.

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CONDENSER

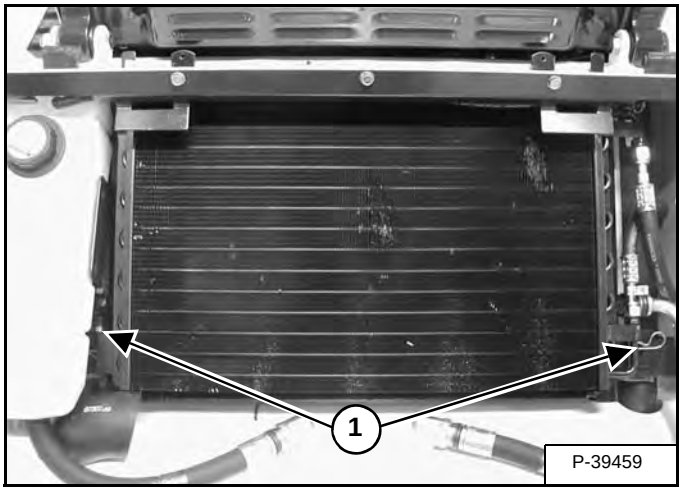
Removal And Installation

Remove the refrigerant from the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 80-40-2.)

Open the rear door of the loader.

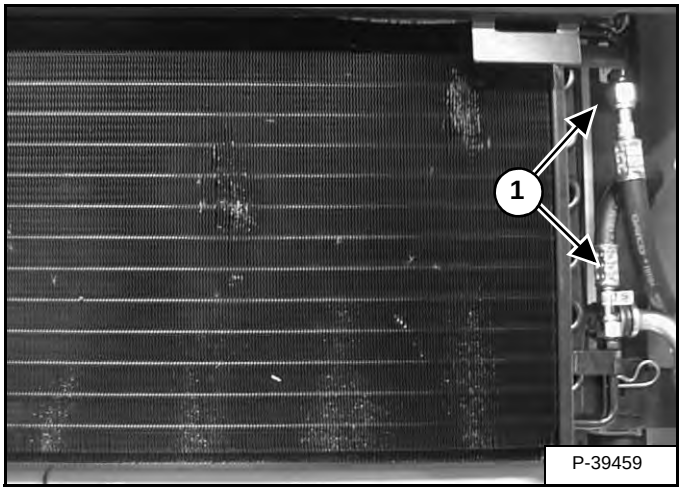
Remove the rear grill from the loader. (See Removal And Installation on Page 50-60-1.)

Figure 80-60-1



Remove the two retaining clips (Item 1) **[Figure 80-60-1]** from the condenser mount bracket.

Figure 80-60-2

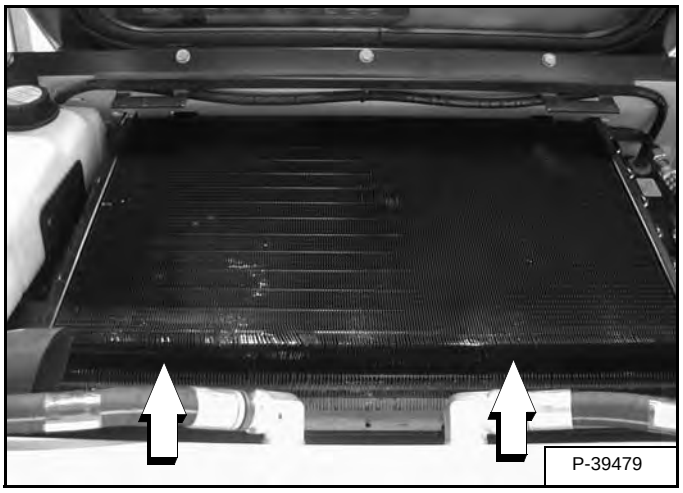


Mark the two A/C hoses (Item 1) **[Figure 80-60-2]** for proper installation.

Disconnect the two hoses from the condenser.

Cap and plug the hoses and the condenser fittings with the proper A/C caps and plugs.

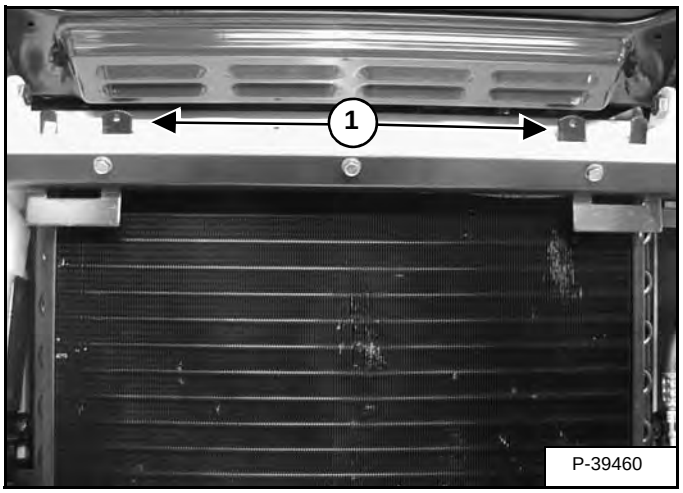
Figure 80-60-3



Lift the rear of the condenser, and pull toward the rear of the loader **[Figure 80-60-3]**.

Remove the condenser from the loader.

Figure 80-60-4



Installation: When installing the condenser, be sure the condenser tabs (Item 1) **[Figure 80-60-4]** are positioned in the slots in the loader frame.

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RECEIVER / DRIER

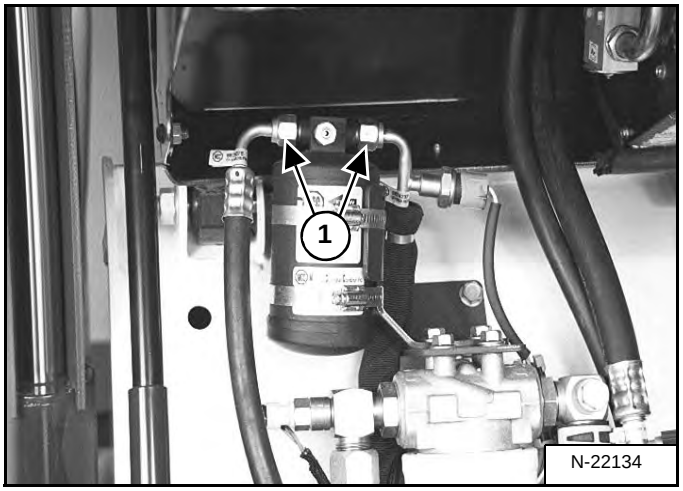
Receiver / Drier Removal And Installation

Raise the loader lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the refrigerant from the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 80-40-2.)

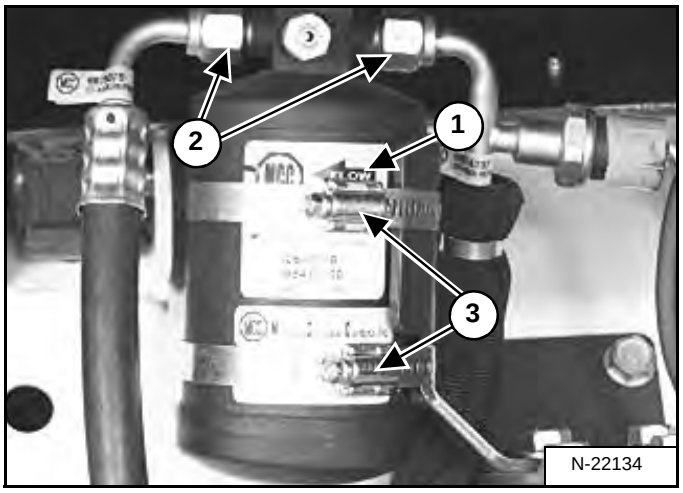
Figure 80-70-1



Mark the A/C hoses (Item 1) **[Figure 80-70-1]** for proper installation.

Both fittings on the drier are the same size, so the hoses can be hooked up incorrectly.

Figure 80-70-2



Note the flow direction on the drier (Item 1) **[Figure 80-70-2]** for proper installation.

Remove the two A/C hoses (Item 2) **[Figure 80-70-2]** from the receiver/drier.

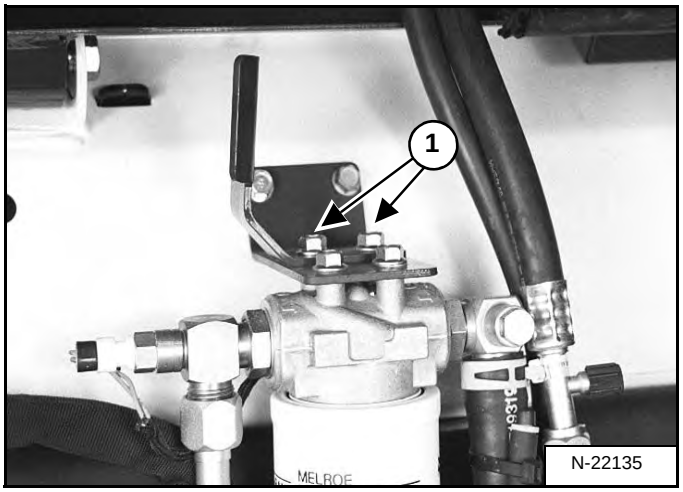
Cap and plug the hoses and the receiver/drier fittings with the proper A/C caps and plugs.

Loosen the hose clamps (Item 3) **[Figure 80-70-2]** that holds the receiver/drier to the mount.

Remove the receiver/drier from the loader.

NOTE: When replacing a receiver/drier in an A/C system 1 fl. oz. (30 cc) of PAG 100 oil must be added to the system when recharging.

Figure 80-70-3



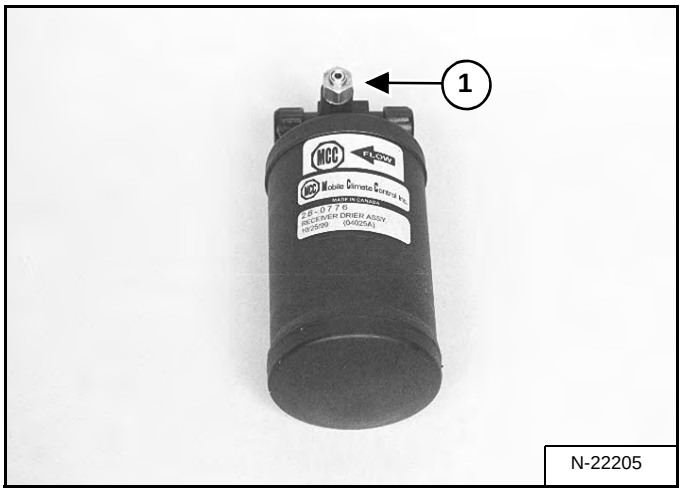
Remove the two mount bolts (Item 1) **[Figure 80-70-3]** from the receiver/drier mount bracket.

Remove the bracket from the top of the hydraulic filter bracket.

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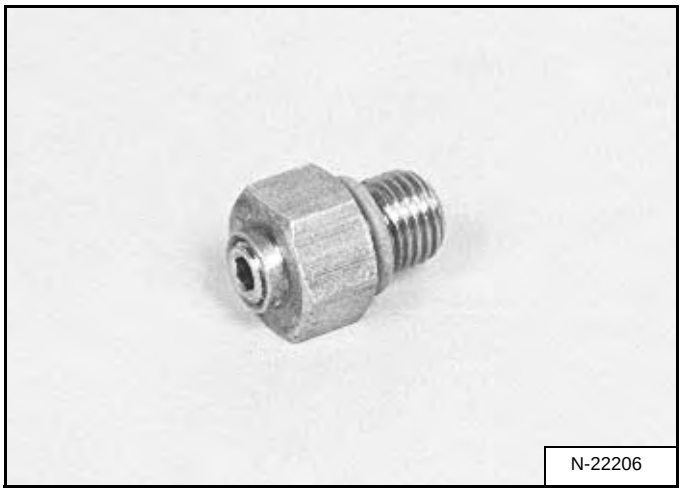
Pressure Relief Valve Removal And Installation

Figure 80-70-4



The pressure relief valve (Item 1) **[Figure 80-70-4]** is located on the drier assembly.

Figure 80-70-5



The pressure relief valve **[Figure 80-70-5]** is designed to open and release the A/C charge if the pressure reaches 535 PSI (3689 kPa).

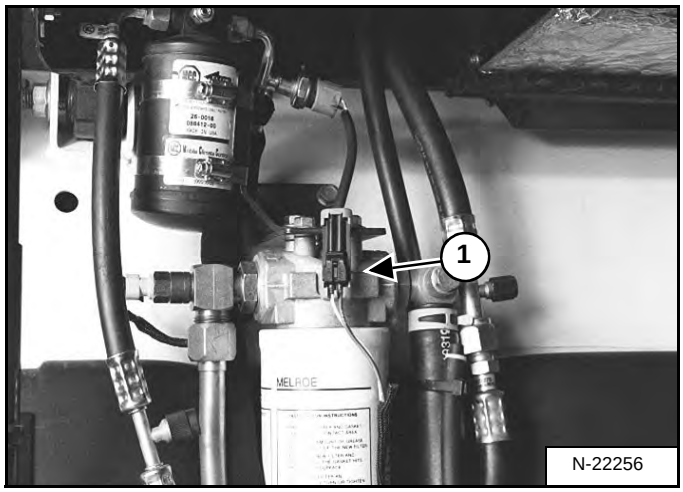
This will cause the A/C system to shut down, saving the compressor.

The Pressure Relief Valve is a secondary protection device in the A/C system, with the Pressure Switch shutting down the system at 384 PSI (2648 kPa).

NOTE: If a Pressure Relief Valve is found open, check the A/C system for problems. Replace the complete receiver/drier unit.

Pressure Switch Removal And Installation

Figure 80-70-6



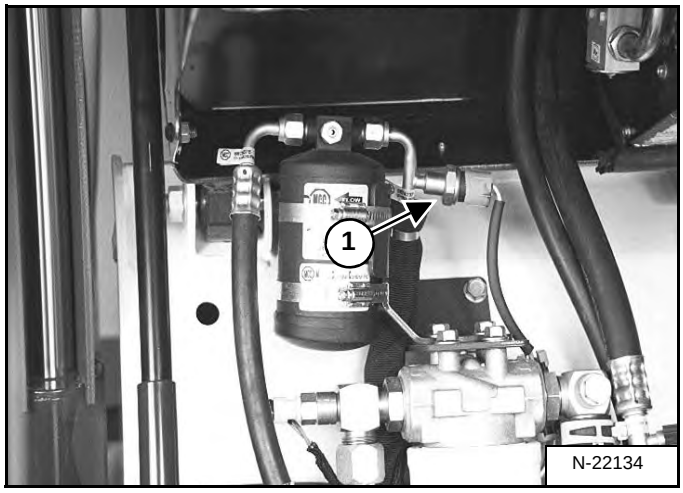
Raise the loader lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Disconnect the loader wire harness (Item 1) **[Figure 80-70-1]** from the pressure switch wire harness.

NOTE: The pressure switch can be changed without evacuating the A/C system.

Figure 80-70-7



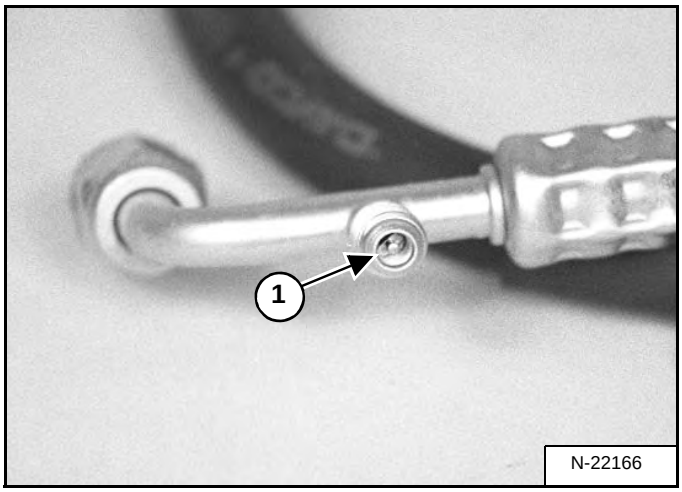
Remove the pressure switch (Item 1) **[Figure 80-70-7]** from the A/C high pressure hose.

Remove the pressure switch from the loader.

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Schraeder Valve Removal And Installation

Figure 80-70-8



The schraeder valve (Item 1) **[Figure 80-70-8]** is located in the A/C high pressure hose and is located under the pressure switch.

Raise the loader lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the refrigerant from the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 80-40-2.)

Remove the pressure switch.

With a tire valve core removal tool, remove the valve core from the hose.

Replace with a new core.

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EVAPORATOR / HEATER UNIT

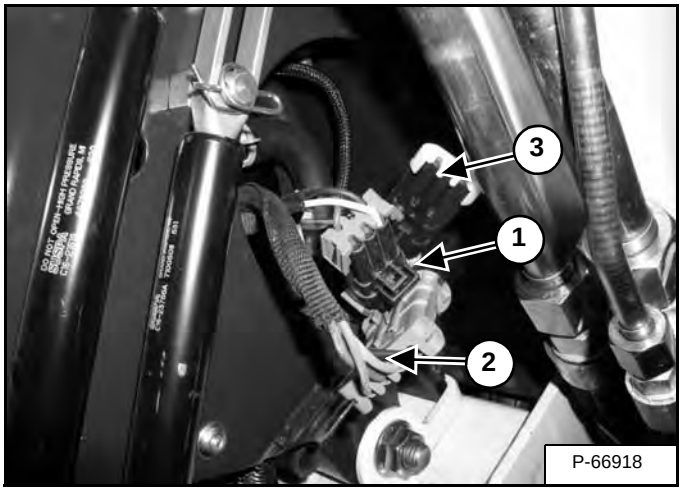
Removal And Installation

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Evacuate the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 80-40-2.)

Figure 80-80-1

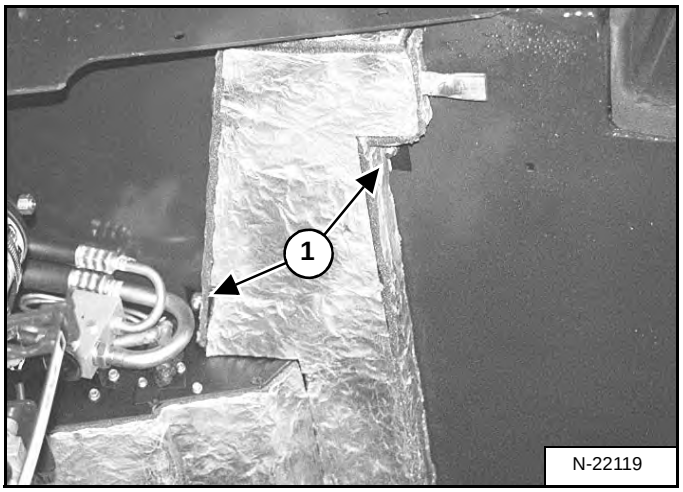


At the rear of the cab, disconnect the heater valve wiring connector (Item 1) **[Figure 80-80-1]**.

Disconnect the blower fan wiring connector (Item 2) **[Figure 80-80-1]** from the loader wiring harness.

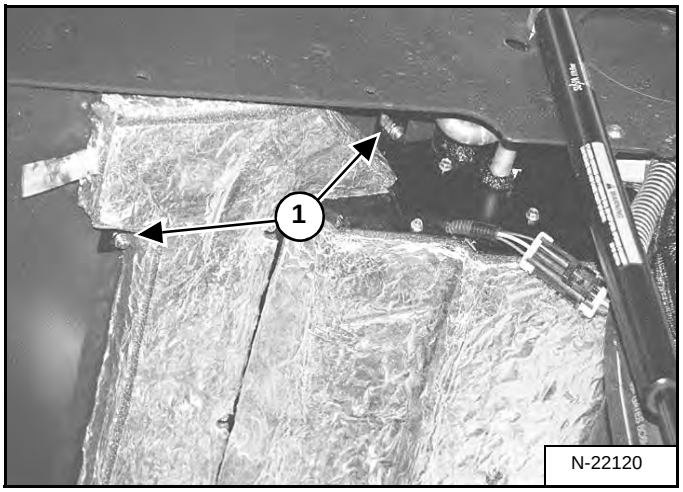
Disconnect the thermostat connector (Item 3) **[Figure 80-80-1]** from the loader wiring harness.

Figure 80-80-2



Remove the two mounting nuts (Item 1) **[Figure 80-80-2]**.

Figure 80-80-3

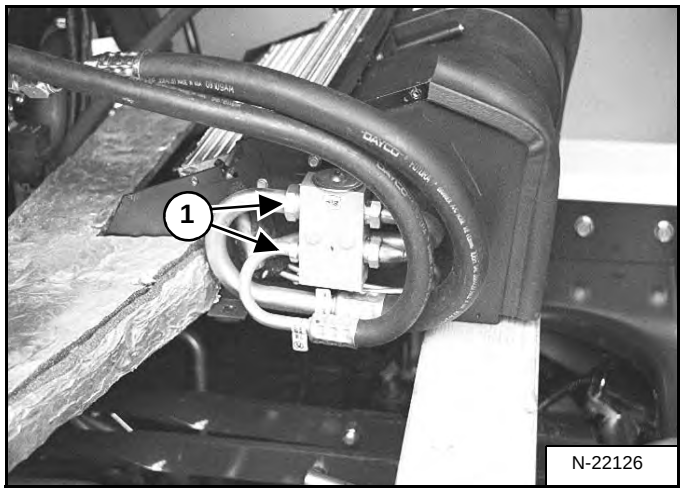


Remove the two mounting nuts (Item 1) **[Figure 80-80-3]**.

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Removal And Installation (Cont'd)

Figure 80-80-4



Remove the Evaporator/Heater Unit from the rear of the cab and place it on the fenders of the loader supported by 2 X 4's **[Figure 80-80-4]**.

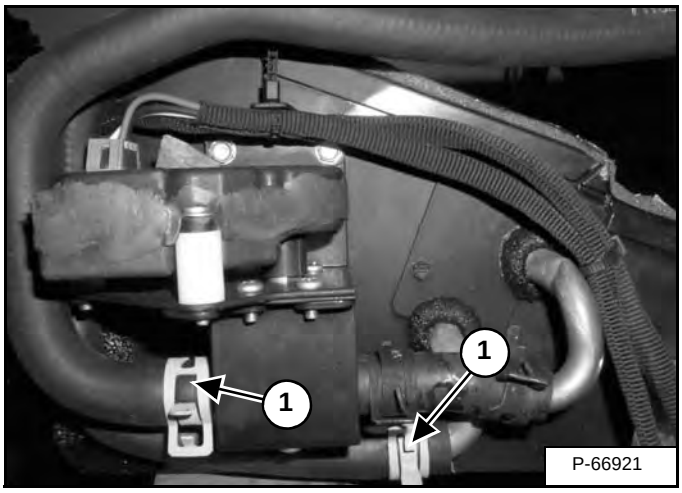
NOTE: Mark the tubelines for correct installation.

Remove the two A/C hoses (Item 1) **[Figure 80-80-4]** from the expansion valve.

Installation: Tighten the A/C hoses to 22 ft.-lb. (29,8 N•m) torque.

Cap and plug the hoses and the expansion valve fittings with the proper A/C caps and plugs.

Figure 80-80-5



Remove the heater hoses (Item 1) **[Figure 80-80-5]** from the heater coil.

Installation: Tighten the Heater hoses to 22 ft.-lb. (29,8 N•m) torque.

Remove the evaporator/heater unit from the loader.

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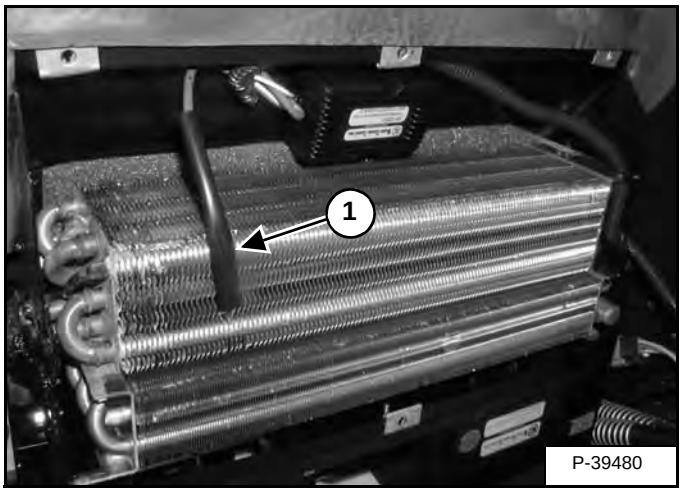
THERMOSTAT

Removal And Installation

NOTE: The thermostat can be changed without evacuating the A/C system, or removing the evaporator/heater unit from the loader.

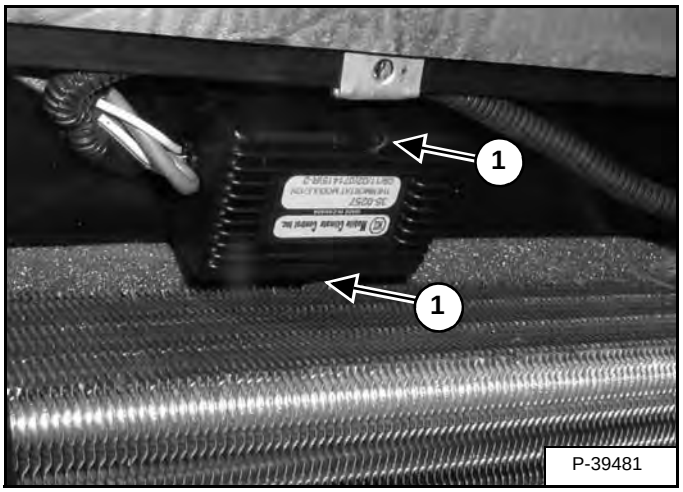
Remove the rear cover from the evaporator/heater unit. (See Removal And Installation on Page 80-80-1.)

Figure 80-90-1



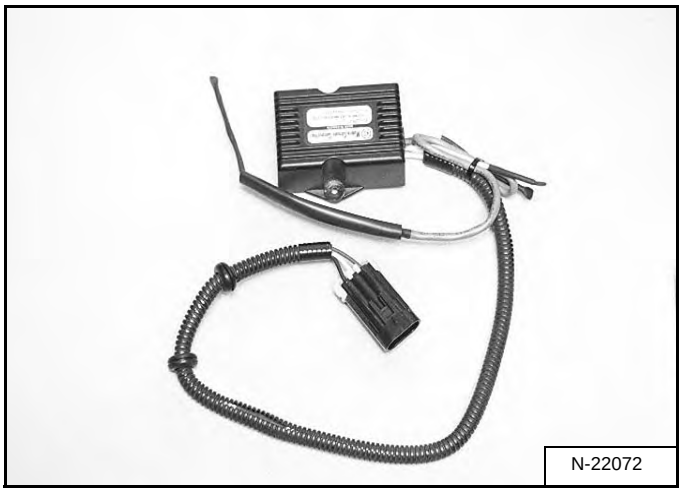
Remove the thermostat probe (Item 1) **[Figure 80-90-1]**, from the A/C evaporator coil.

Figure 80-90-2



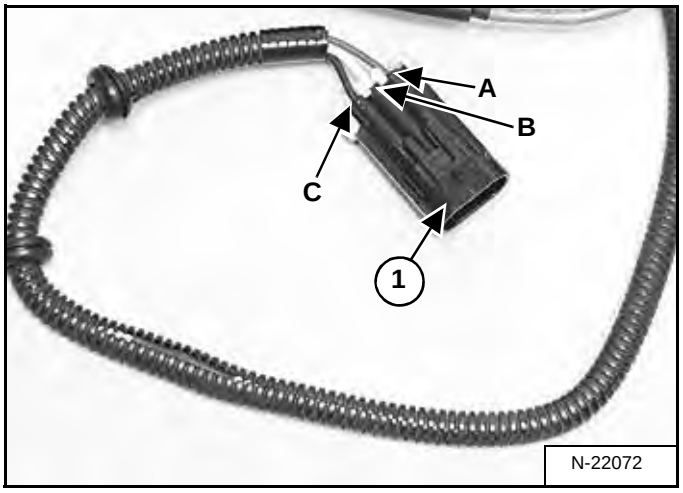
Remove the two thermostat mount bolts (Item 1) **[Figure 80-90-2]** and remove the wiring harness and grommet from the evaporator/heater housing.

Figure 80-90-3



Remove the thermostat from the unit **[Figure 80-90-3]**.

Figure 80-90-4



The wire connector (Item 1) **[Figure 80-90-4]** can be changed. The wiring position and color in the connector is:

A- Blue
B- White
C- Black

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EXPANSION VALVE

Removal And Installation

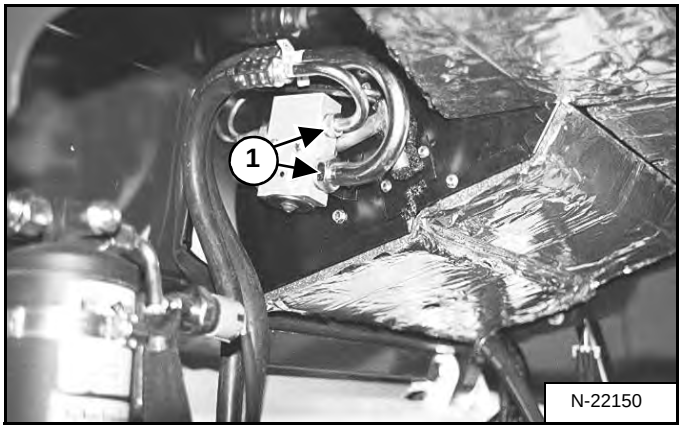
NOTE: The expansion valve can be changed without removing the evaporator/heater unit from the loader.

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Evacuate the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 80-40-2.)

Figure 80-100-1

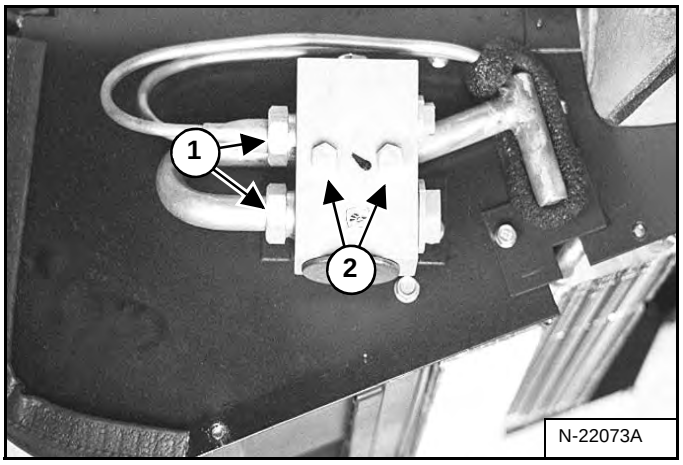


Remove the two A/C hoses (Item 1) **[Figure 80-100-1]** from the expansion valve.

Installation: Tighten the two A/C hose fittings to 22 ft.-lb. (29,8 N•m) torque.

Cap and plug the hoses and the expansion valve fittings with the proper A/C caps and plugs.

Figure 80-100-2



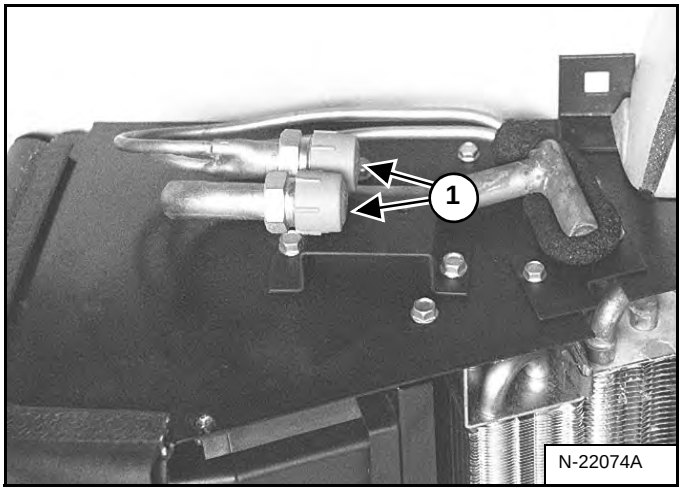
Remove the two evaporator fittings (Item 1) **[Figure 80-100-2]** from the expansion valve.

Installation: Tighten the two evaporator fittings to 22 ft.-lb. (29,8 N•m) torque.

Remove the two mount bolts (Item 2) **[Figure 80-100-2]**.

Remove the expansion valve from the loader.

Figure 80-100-3



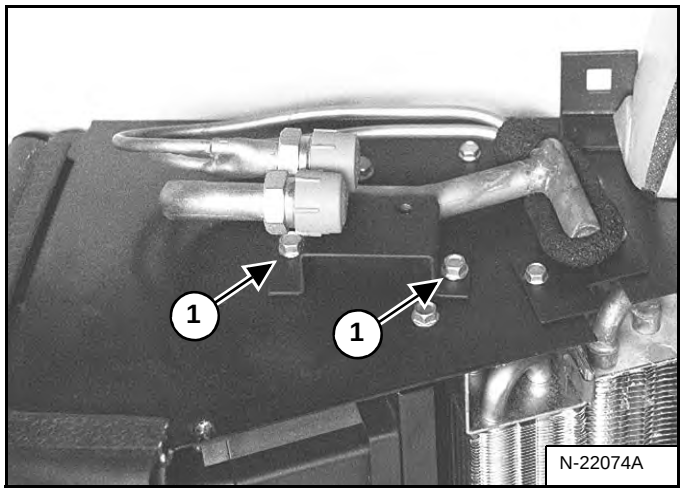
Check the condition of the o-rings and replace as needed. Cap and plug the evaporator tubelines (Item 1) **[Figure 80-100-3]** and the expansion valve fittings with the proper A/C caps and plugs.

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EXPANSION VALVE (CONT'D)

Removal And Installation (Cont'd)

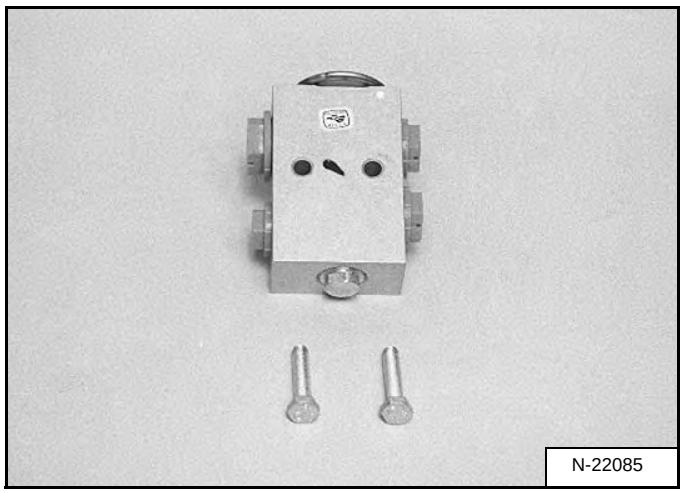
Figure 80-100-4



Remove the two mount bolts (Item 1) **[Figure 80-100-4]** from the expansion valve mount.

Remove the expansion valve mount from the unit.

Figure 80-100-5



The expansion valve **[Figure 80-100-5]** is replaced as a complete unit.

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EVAPORATOR

Removal And Installation

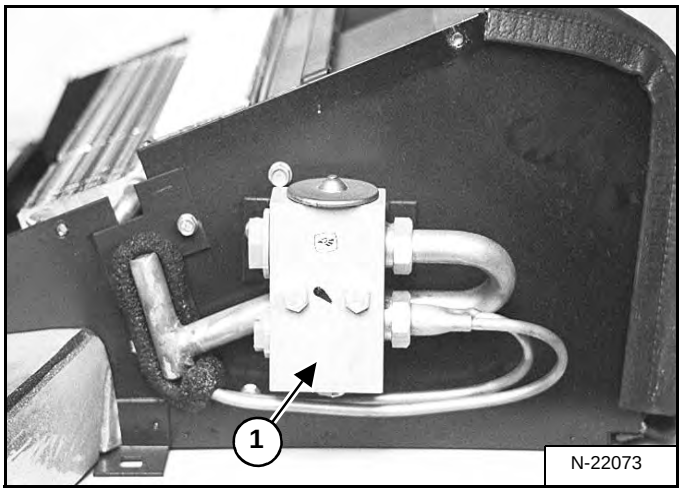
Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Evacuate the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 80-40-2.)

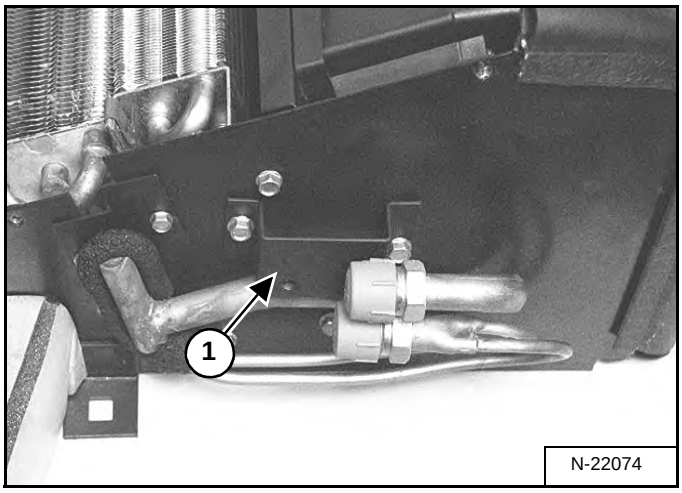
Remove the evaporator/heater unit from the back of the cab. (See Removal And Installation on Page 80-80-1.)

Figure 80-110-1



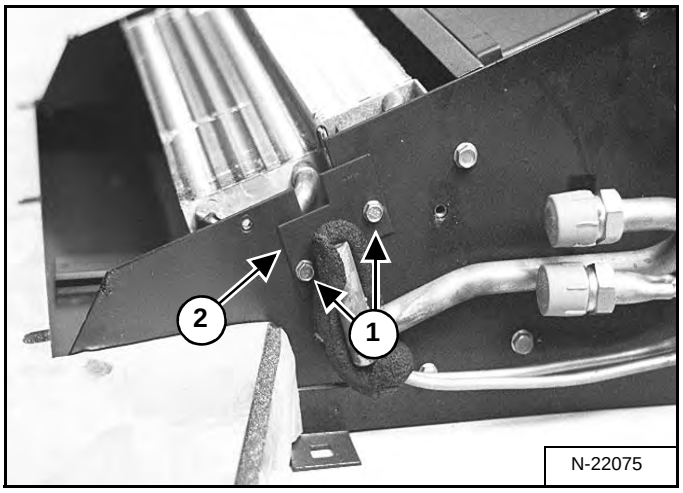
Remove the expansion valve (Item 1) **[Figure 80-110-1]** from the unit. (See Removal And Installation on Page 80-100-1.)

Figure 80-110-2



Remove the expansion valve mount bracket (Item 1) **[Figure 80-110-2]** from the unit.

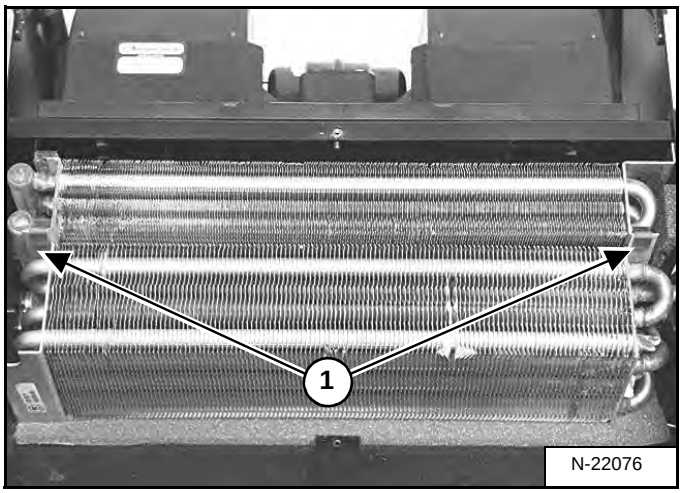
Figure 80-110-3



Remove the two mount bolts (Item 1) from the mount plate (Item 2) **[Figure 80-110-3]**.

Remove the mount plate from the unit.

Figure 80-110-4



Remove the two retaining clips (Item 1) **[Figure 80-110-4]** that connect the evaporator coil, to the heater coil.

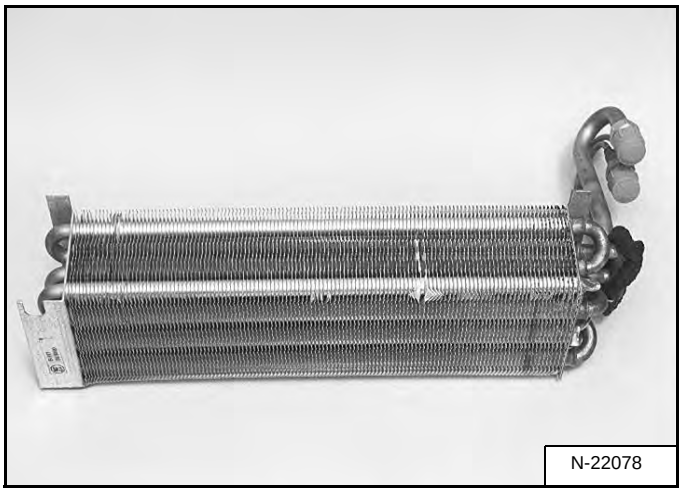
Remove the evaporator coil from the unit.

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EVAPORATOR (CONT'D)

Removal And Installation (Cont'd)

Figure 80-110-5



Inspect the evaporator coil **[Figure 80-110-5]** for leaks, and replace as needed.

Clean with low water or air pressure.

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HEATER COIL

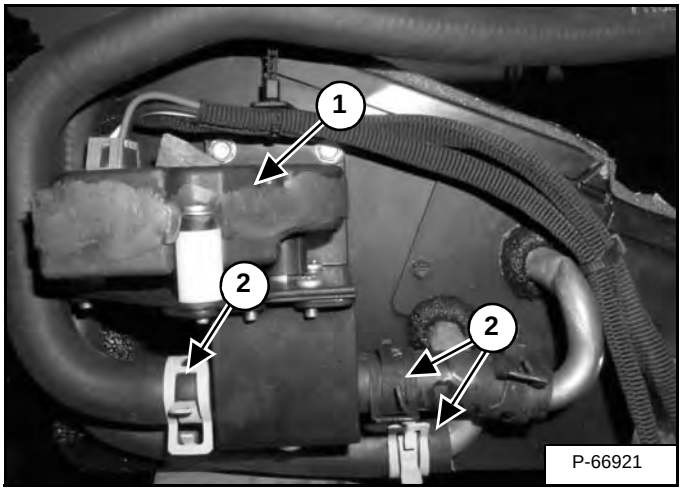
Removal And Installation With A/C

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the heater unit from the back of the cab. (See Removal And Installation on Page 80-80-1.)

Figure 80-120-1



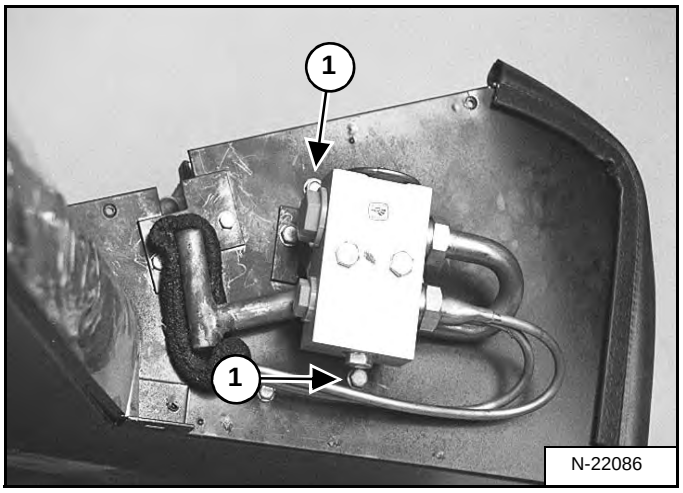
Remove the heater valve (Item 1) **[Figure 80-120-1]**. (See Removal and Installation on Page 80-140-1.)

Mark the heater hoses (Item 2) **[Figure 80-120-1]** for proper installation.

Cap the hoses and the heater coil with hydraulic caps and plugs to prevent oil loss from the system.

Remove the rear cover from the evaporator/heater unit. (See Removal And Installation on Page 80-80-1.)

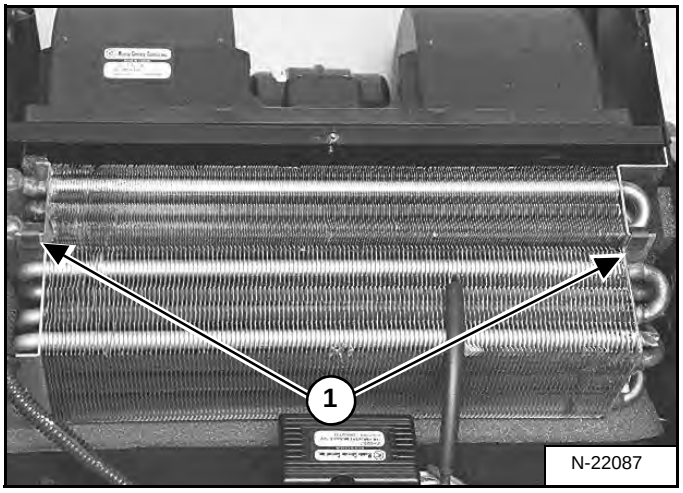
Figure 80-120-2



Remove the rear cover from the evaporator/heater unit. (See Removal And Installation on Page 80-80-1.)

Remove the two mount bolts (Item 1) **[Figure 80-120-2]** from the heater coil at the expansion valve end of the unit.

Figure 80-120-3

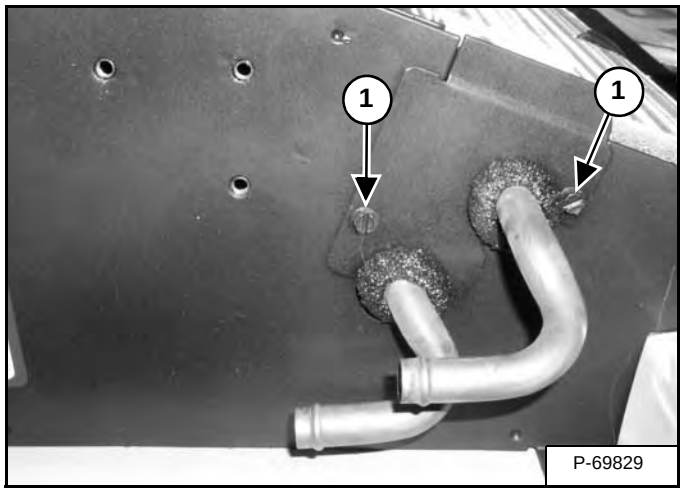


Remove the two retaining clips (Item 1) **[Figure 80-120-3]** that connect the evaporator coil, to the heater coil.

Dealer Copy -- Not for Resale

Removal And Installation With A/C (Cont'd)

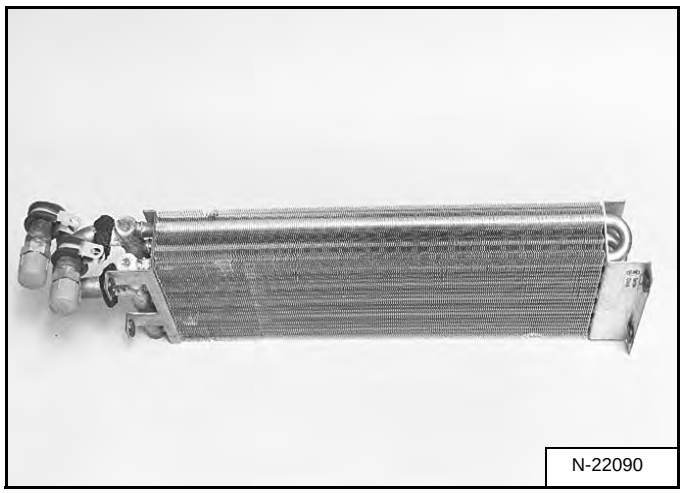
Figure 80-120-4



Remove the mount bolts (Item 1) **[Figure 80-120-4]** and remove the mount plate from the end of the unit.

Remove the heater coil from the unit.

Figure 80-120-5



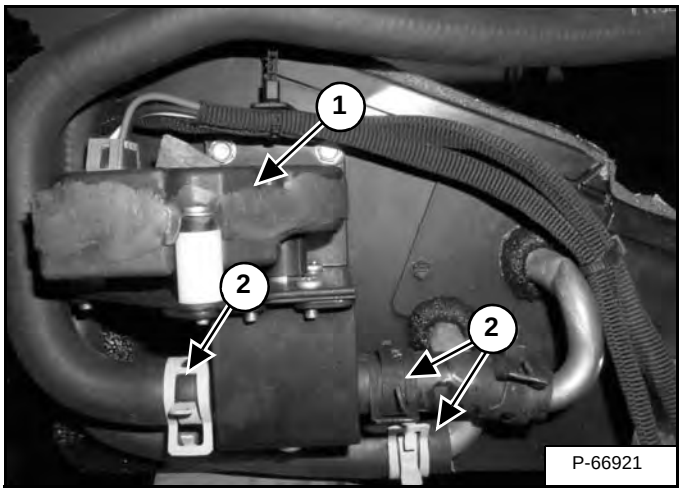
The heater coil **[Figure 80-120-5]** can be cleaned with low air or water pressure.

If the heater coil needs replacement it must be replaced as complete unit.

Dealer Copy -- Not for Resale

Removal And Installation Without A/C

Figure 80-120-6



Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the heater unit from the back of the cab. (See Removal And Installation on Page 80-80-1.)

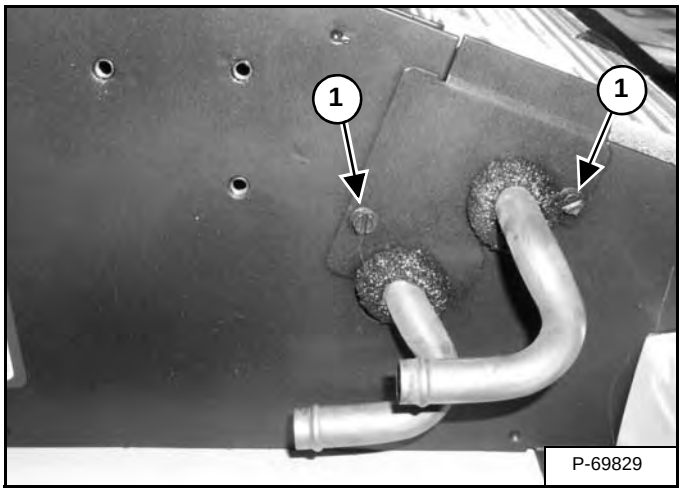
Remove the heater valve (Item 1) **[Figure 80-120-6]**. (See Removal and Installation on Page 80-140-1.)

Mark the heater hoses (Item 2) **[Figure 80-120-6]** for proper installation.

Cap the hoses and the heater coil with hydraulic caps and plugs to prevent oil loss from the system.

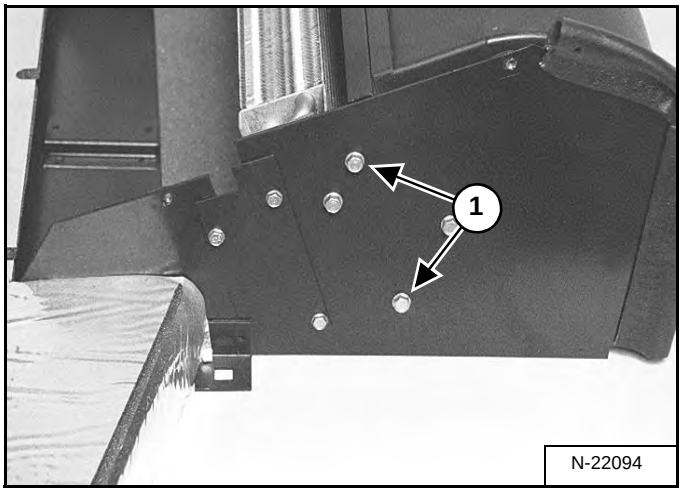
Remove the rear cover from the evaporator/heater unit. (See Removal And Installation on Page 80-80-1.)

Figure 80-120-7



Remove the mount bolts (Item 1) **[Figure 80-120-7]** and remove the mount plate from the end of the unit.

Figure 80-120-8



Remove the two mount bolts (Item 1) **[Figure 80-120-8]** from the heater coil.

Remove the heater coil from the unit.

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Dealer Copy -- Not for Resale

BLOWER FAN

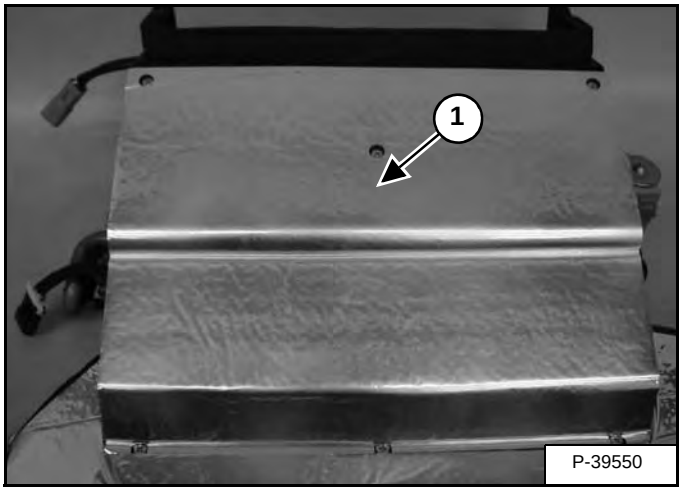
Removal And Installation

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

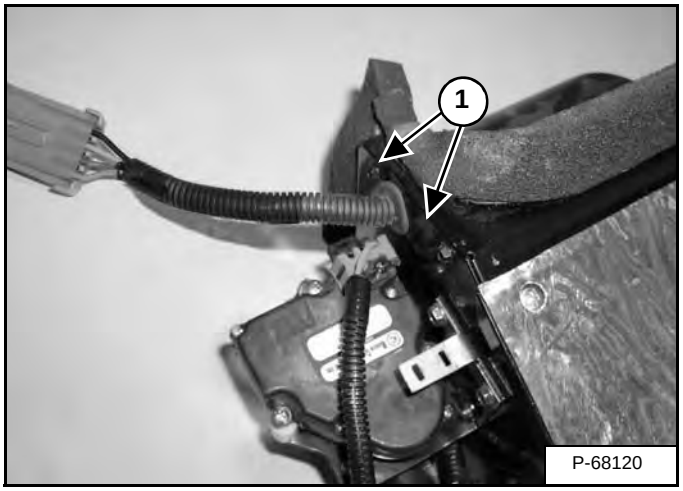
NOTE: The blower fan assembly can be removed from the evaporator/heater unit without disconnecting the heater or A/C plumbing. The unit is remove here for photo clarity.

Figure 80-130-1



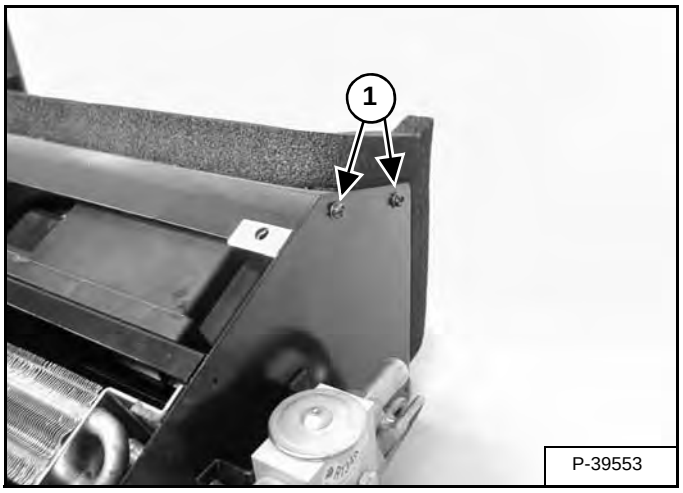
Remove the cover (Item 1) **[Figure 80-130-1]** from the evaporator/heater unit.

Figure 80-130-2



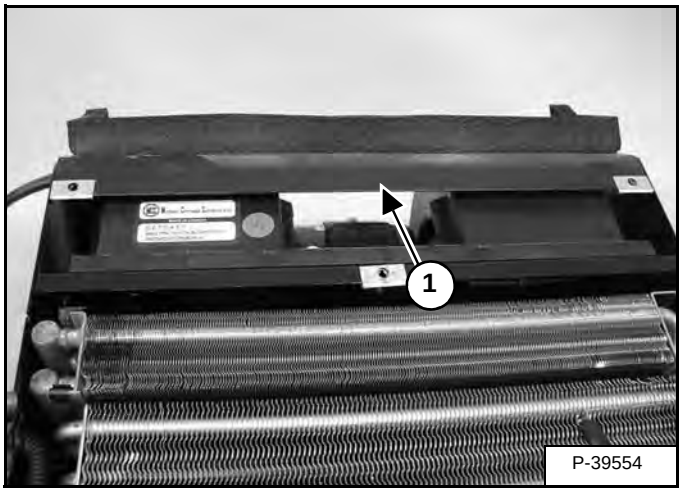
Remove the two flange mount bolts (Item 1) **[Figure 80-130-2]** from the evaporator/heater unit.

Figure 80-130-3



Remove the two flange mount bolts (Item 1) **[Figure 80-130-3]** from the evaporator/heater unit.

Figure 80-130-4

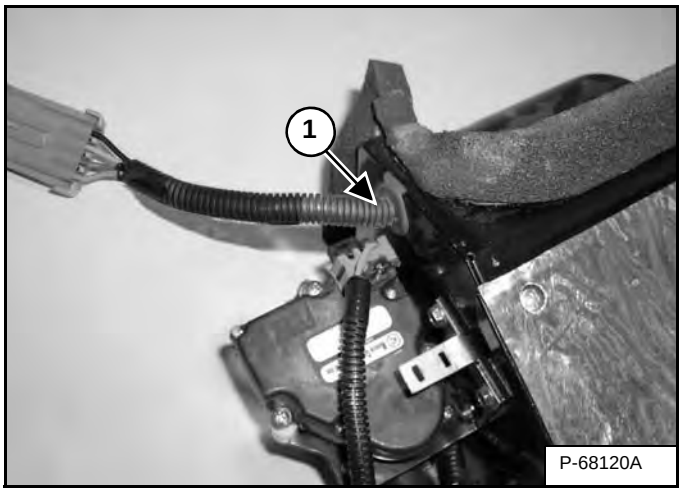


Remove the flange and attached foam (Item 1) **[Figure 80-130-4]** from the unit.

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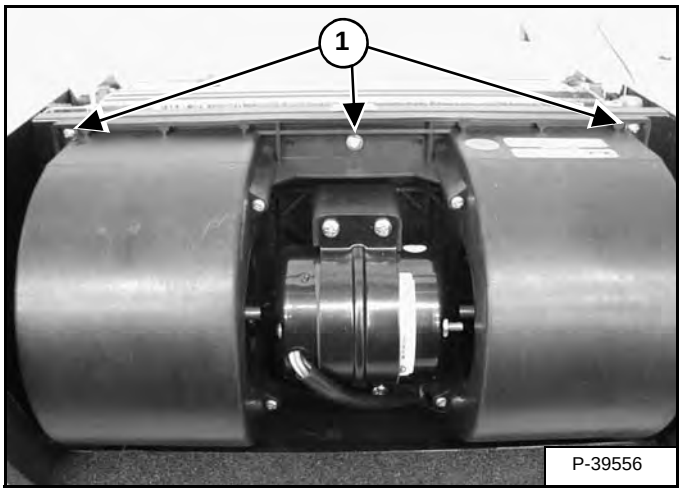
Removal And Installation (Cont'd)

Figure 80-130-5



Remove the blower fan wiring harness and grommet (Item 1) **[Figure 80-130-5]** from the unit.

Figure 80-130-6

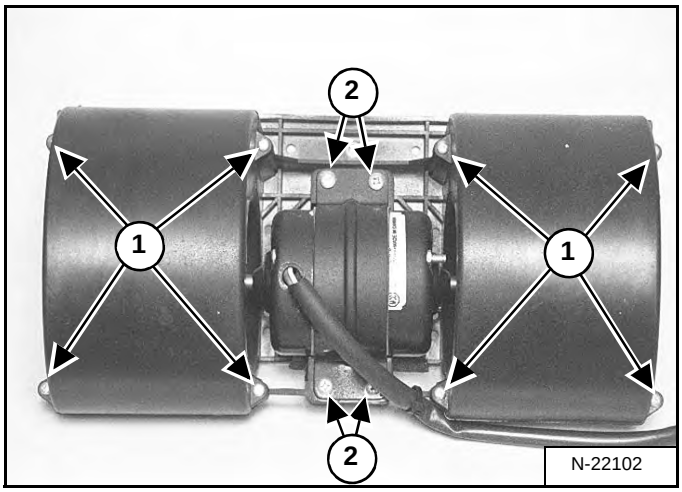


Remove the three mount bolts (Item 1) **[Figure 80-130-6]** from the blower fan housing.

Remove the blower fan housing from the evaporator/ heater unit.

Disassembly And Assembly

Figure 80-130-7



Remove the eight mount bolts (Item 1) **[Figure 80-130-7]** from the blower wheel cover.

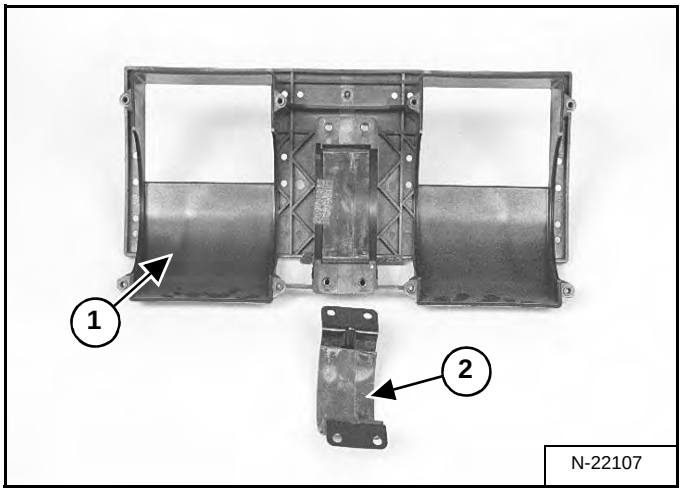
Remove the blower wheel cover from the housings.

Remove the four mount bolts (Item 2) **[Figure 80-130-7]** from the blower motor mount.

Remove the blower motor mount.

Remove the blower motor assembly from the housing.

Figure 80-130-8

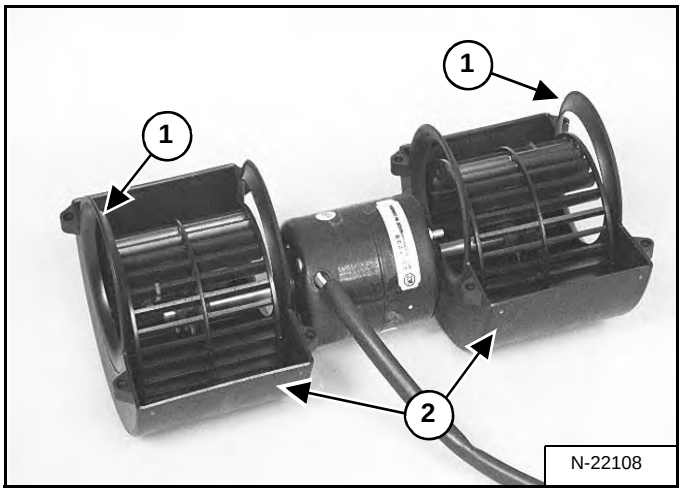


Check the blower housing (Item 1) and blower motor mount (Item 2) **[Figure 80-130-8]** for wear and replace as needed.

Dealer Copy -- Not for Resale

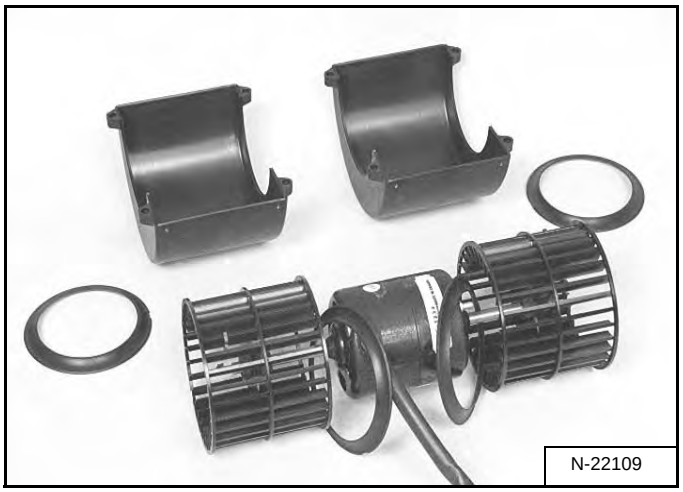
Disassembly And Assembly (Cont'd)

Figure 80-130-9



Remove the outside rings (Item 1) and blower wheel covers (Item 2) **[Figure 80-130-9]** from the blower motor and blower wheels.

Figure 80-130-10



Inspect the end rings and blower wheel covers for wear and replace as needed **[Figure 80-130-10]**.

Figure 80-130-11

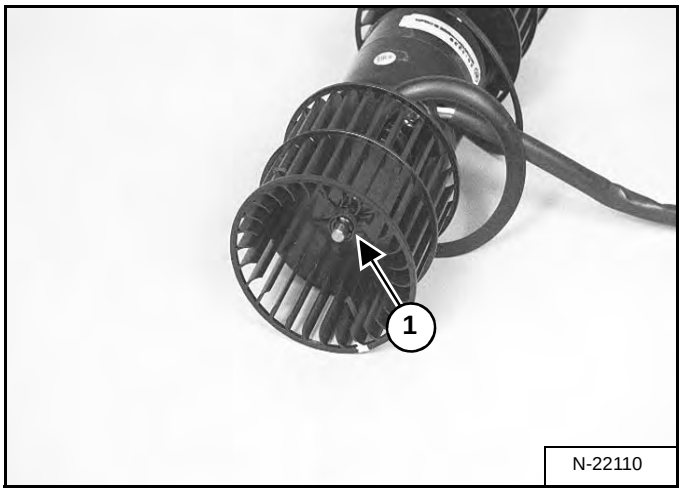
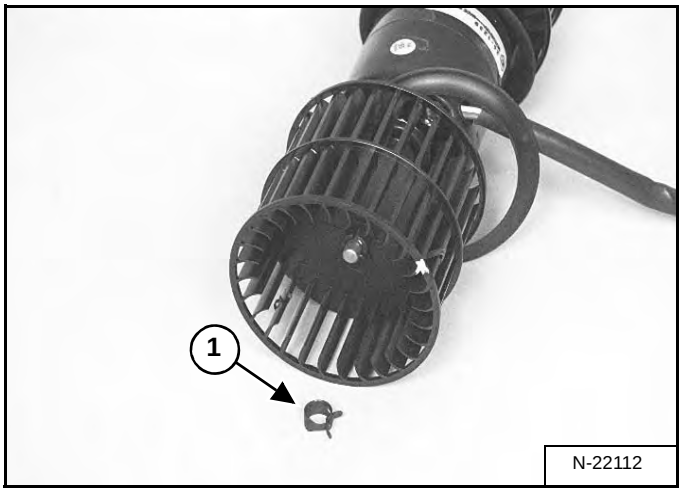


Figure 80-130-12

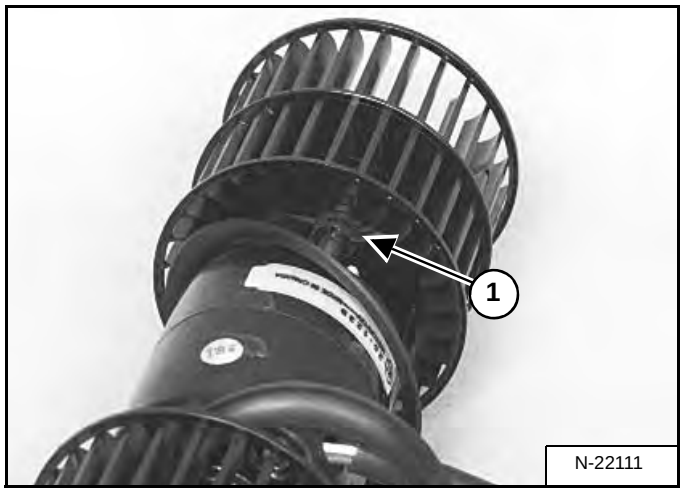


Remove the outside blower wheel clamp (Item 1) **[Figure 80-130-11]** & **[Figure 80-130-12]** from the blower wheel.

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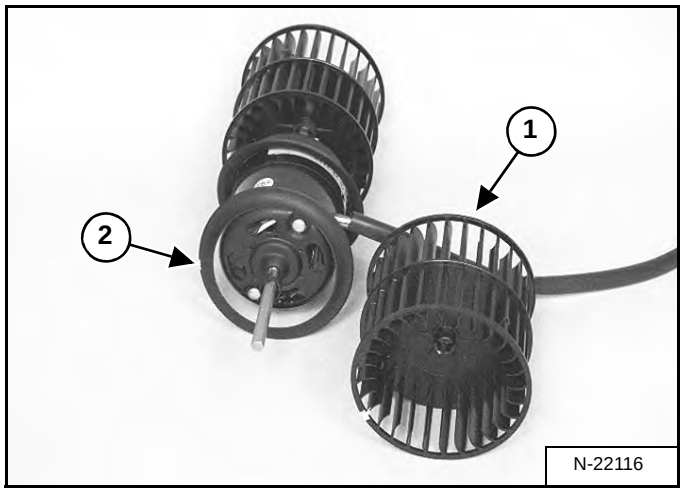
Disassembly And Assembly (Cont'd)

Figure 80-130-13



Remove the inside blower wheel clamp (Item 1) **[Figure 80-130-13]** from the blower wheel.

Figure 80-130-14

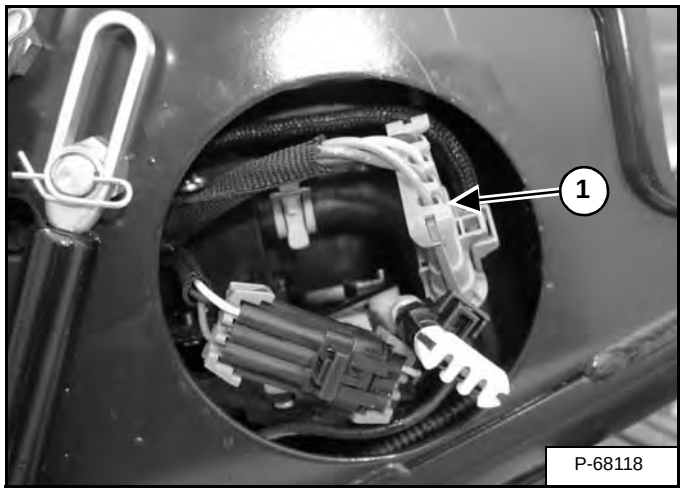


Remove the blower wheel (Item 1) and inside ring (Item 2) **[Figure 80-130-14]** from the blower motor shaft.

Repeat the procedure for the other blower wheel.

Connector Identification

Figure 80-130-15



The wiring code for the blower fan connector (Item 1) **[Figure 80-130-15]** is:

Number on Connector	Wire Color
A	Orange
B	Red
C	Yellow
D	Black

Dealer Copy -- Not for Resale

HEATER VALVE

Removal and Installation

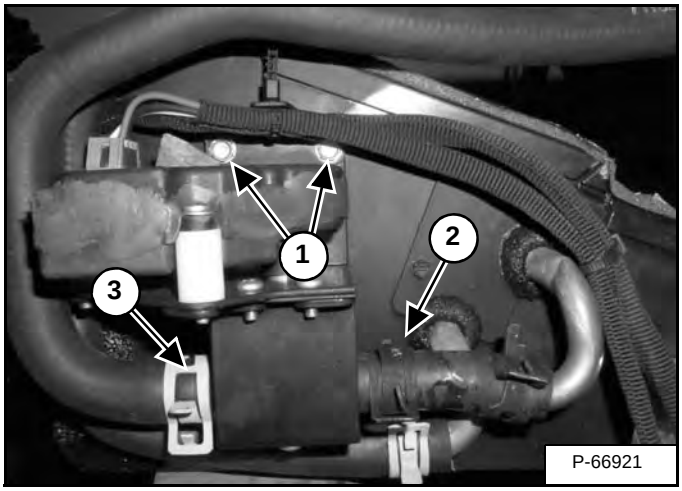
Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-1.)

Remove the Evaporator/Heater Unit from under the cab and place it across the mainframe supported by blocks (See Removal And Installation on Page 80-80-1.)

Remove any tie-straps that hold the heater hoses.

Figure 80-140-1



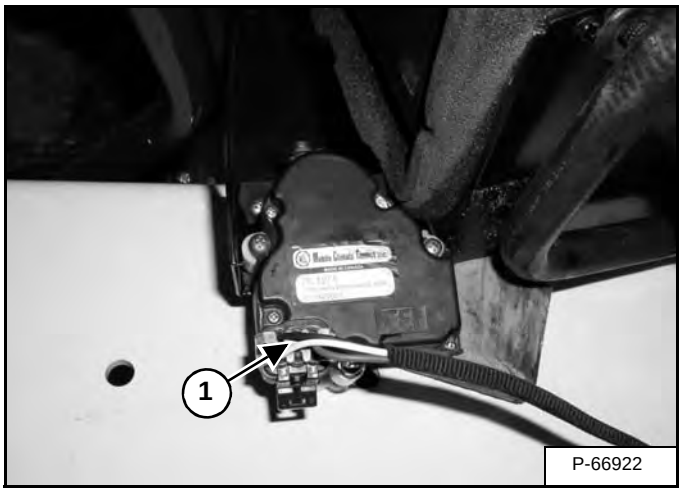
Remove the mount bolts (Item 1) **[Figure 80-140-1]** from the heater valve mount.

Remove the heater hose clamps (Items 2 & 3) **[Figure 80-140-1]**.

Remove the heater hoses from the heater valve.

Cap the heater hoses and the heater valve with plugs to prevent coolant loss from the system.

Figure 80-140-2

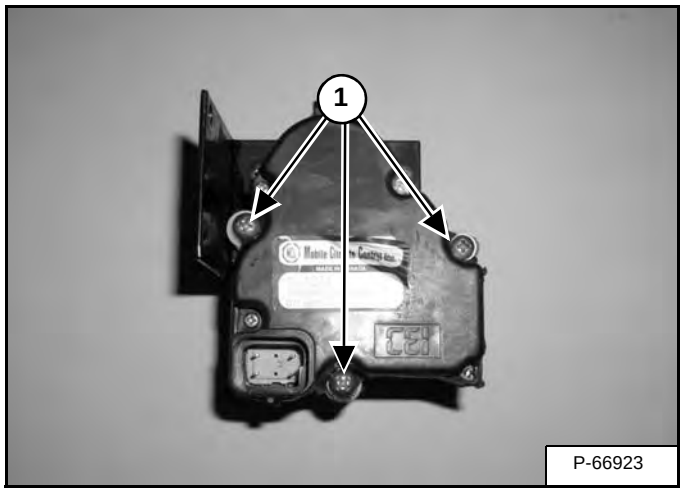


Disconnect the loader wiring harness (Item 1) **[Figure 80-140-2]** from the heater valve.

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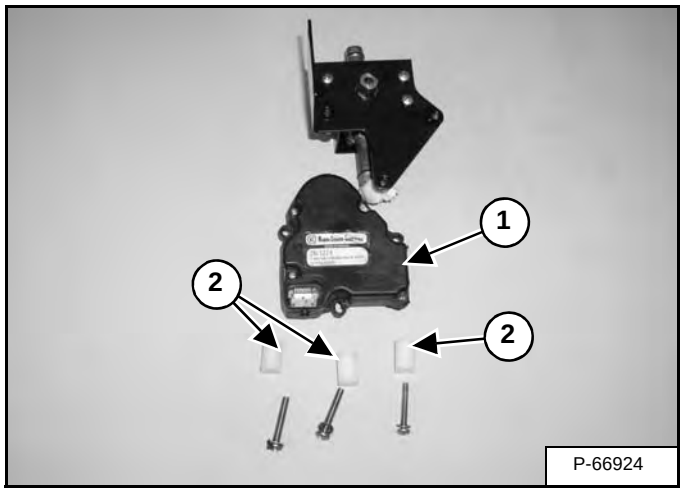
Disassembly And Assembly

Figure 80-140-3



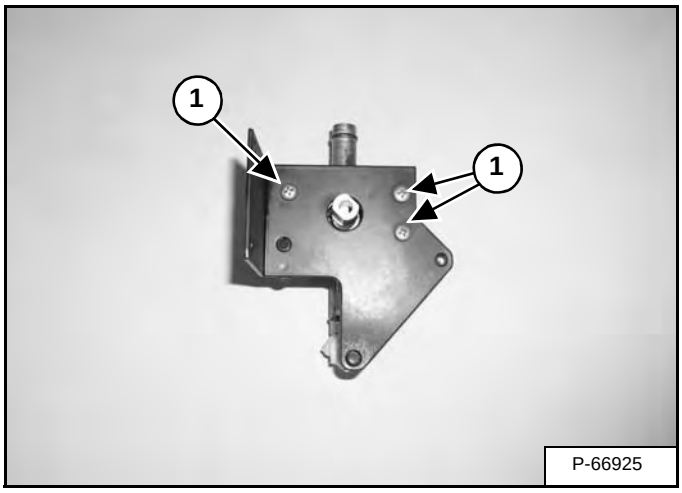
Remove the three mount bolts (Item 1) **[Figure 80-140-3]** from the heater valve actuator.

Figure 80-140-4



Remove the actuator (Item 1) and the three mounting spacers (Item 2) **[Figure 80-140-4]** from the heater valve mount plate.

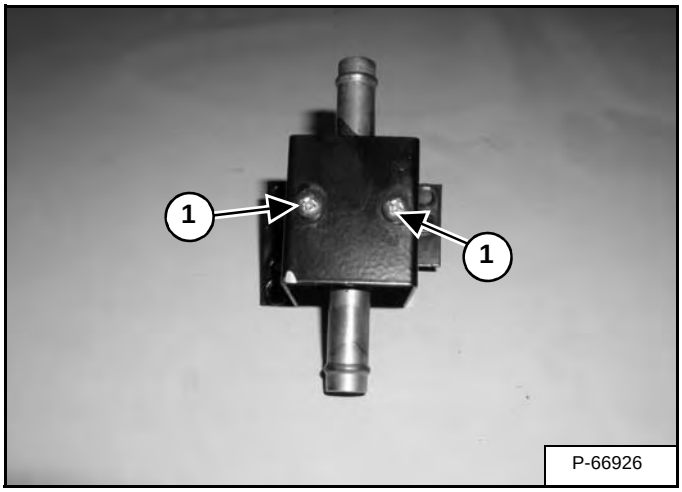
Figure 80-140-5



Remove the three mounting bolts (Item 1) **[Figure 80-140-5]** from the heater valve mount plate.

Remove the mount plate (Item 2) **[Figure 80-140-5]** from the heater valve bracket.

Figure 80-140-6



Remove the two mounting bolts (Item 1) **[Figure 80-140-6]** from the heater valve.

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SPECIFICATIONS

CONVERSIONS SPEC-50-1
Decimal And Millimeter Equivalents. SPEC-50-1
U.S. To Metric Conversion Chart SPEC-50-1

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Flare Fitting SPEC-30-3
O-ring Face Seal Connection. SPEC-30-1
Port Seal Fitting SPEC-30-4
Straight Thread O-ring Fitting SPEC-30-2
Tubelines And Hoses. SPEC-30-2

HYDRAULIC FLUID SPECIFICATIONS SPEC-40-1
Specifications. SPEC-40-1

(S220) LOADER SPECIFICATIONS. SPEC-10-1
Capacities SPEC-10-4
Controls SPEC-10-2
Dimensions SPEC-10-1
Drive System SPEC-10-4
Electrical SPEC-10-3
Engine SPEC-10-2
Hydraulic System. SPEC-10-3
Performance SPEC-10-2
Tires. SPEC-10-4

TORQUE SPECIFICATIONS FOR BOLTS SPEC-20-1
Torque For General Metric Bolts SPEC-20-2
Torque For General SAE Bolts. SPEC-20-1

TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.

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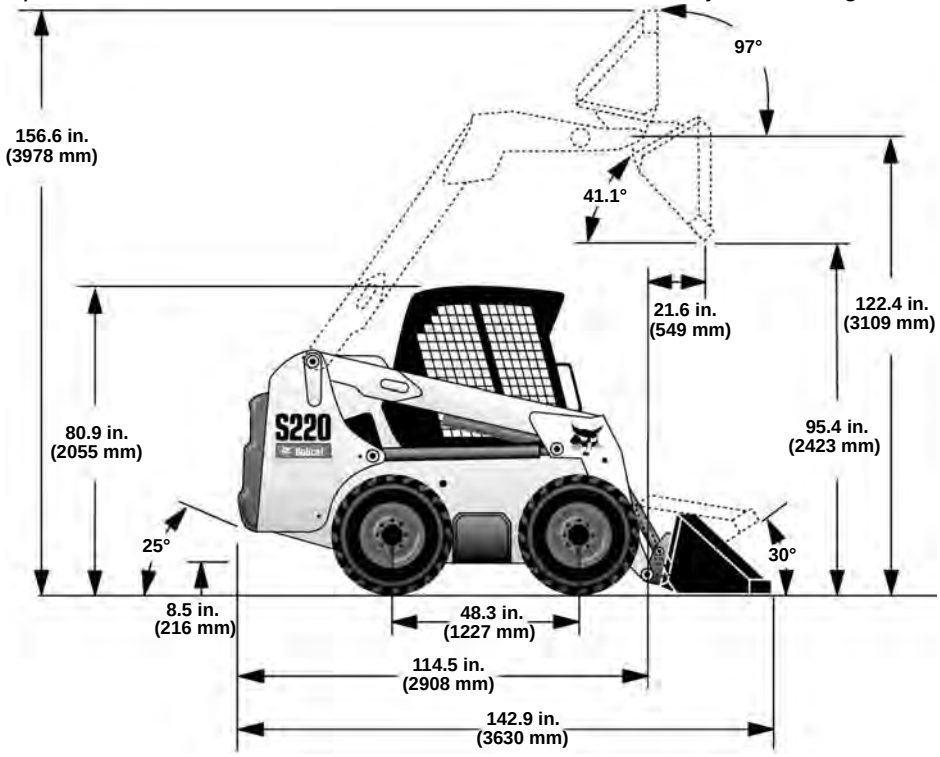


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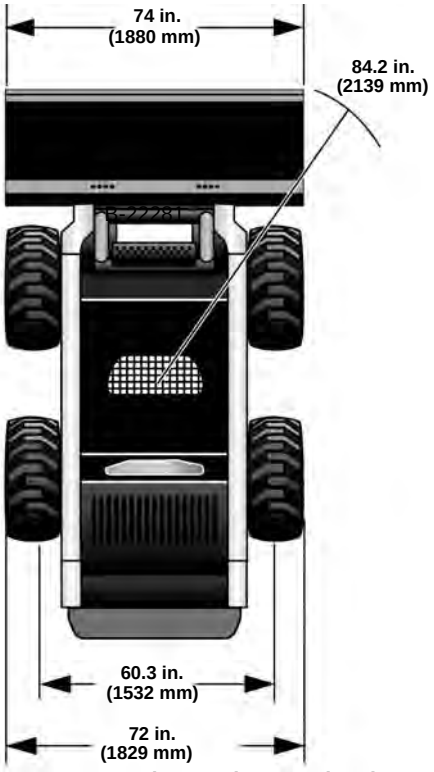
(S220) LOADER SPECIFICATIONS

Dimensions

- Dimensions are given for loader equipped with standard tires and 74 inch Construction & Industrial bucket and may vary with other bucket types. All dimensions are shown in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



B-22281E



B-22282

Changes of structure or weight distribution of the loader can cause changes in control and steering response and can cause failure of the loader parts.

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Performance

Rated Operating Capacity (ISO)	2200 lb. (999 kg)
Rated Operating Capacity (SAE) With Counterweight	2300 lb. (1043 kg)
Tipping Load (ISO Rating)	4561 lb. (2069 kg)
Operating Weight	7483 lb. (3394 kg)
SAE Breakout Force - Lift	4500 lb. (2041 kg)
SAE Breakout Force - Tilt	5000 lb. (2268 kg)
Push Force	4400 lb. (1996 kg)
Travel Speed - Single Speed Loader - Two-Speed Loader (Opt.) Low/High	 6.9 mph (11,1 km/hr.) 6.9 mph (11,1 km/hr.) / 12.0 mph (19,1 km/hr.)

Controls

Vehicle Steering	Direction and speed controlled by two steering levers *or* optional joysticks
Loader Hydraulics - Lift and Tilt - Front Auxiliary (Standard) - Rear Auxiliary (Option)	 Controlled by separate foot pedals *or* optional Advanced Control System (ACS) *or* optional Selectable Joystick Control (SJC) Controlled by electrical switch on Right Hand steering lever or joystick Controlled by electrical switch on Left Hand steering lever or joystick
Auxiliary Pressure Release	Pressure relieved through quick couplers. Push couplers in, hold for 5 seconds.
Engine	Hand lever speed control; key-type starter switch and shutdown (or optional keyless start).
Starting Aid	Intake Air Heater automatically activated as needed by Instrument Panel
Service Brake	Two independent hydrostatic systems controlled by two hand operated steering levers
Secondary Brake	One of the hydrostatic transmissions
Parking Brake (Standard)	Mechanical disc, hand operated rocker switch on instrument panel
Parking Brake (Two-Speed Option)	Spring applied pressure release multi-disk brake activated by rocker switch in instrument panel

Engine

Make / Model	Kubota V3300-DI-T Turbo-Charged
Fuel / Cooling	Diesel / Liquid
Horsepower (SAE Net)	71.7 HP (53,5 kW) @ 2400 RPM
Low Idle RPM	1225 - 1275
High Idle RPM	2525 - 2575
Torque (SAE Net)	197.6 lbf.-ft. (267,9 N•m) @ 1400 RPM
Number of Cylinders	4
Displacement	202.5 cu. in. (3,138 L)
Bore / Stroke	3.86 in. / 4.33 in. (98 mm / 110 mm)
Lubrication	Gear Pump Pressure System with Filter
Crankcase Ventilation	Open Breathing
Air Cleaner	Dry replaceable paper cartridge with safety element
Ignition	Diesel - Compression
Engine Coolant	Propylene Glycol / Water Mixture
Starting Aid	Intake Air Heater

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Hydraulic System

Pump Type	Engine driven, gear type
Pump Capacity - Standard	20.7 GPM (78,4 L/min.) @ 2550 RPM @ 91% Pump Efficiency
Pump Capacity - High-Flow Option	36.7 GPM (138,9 L/min.) @ 2550 RPM @ 91% Pump Efficiency
System Relief at Quick Couplers	3250 - 3350 PSI (224 - 231 bar)
Filter (Hydraulic)	Full flow replaceable, 3-micron synthetic media element
Hydraulic Cylinders Bore Diameter: Lift Cylinder (2) Tilt Cylinder (2) Rod Diameter: Lift Cylinder (2) Tilt Cylinder (2) Stroke: Lift Cylinder (2) Tilt Cylinder (2)	Double-acting; tilt cylinders have cushioning feature on dump and rollback 2.50 in. (63,5 mm) 3.00 in. (76,2 mm) 1.75 in. (44,4 mm) 1.50 in. (38,1 mm) 32.50 in. (825,0 mm) 15.10 in. (384,0 mm)
Control Valve	3-Spool, open center type with spring detent on lift float and electrically controlled auxiliary spool
Fluid Lines	SAE Standard tubelines, hoses and fittings
Fluid Type	BOBCAT FLUID, Hydraulic/Hydrostatic 6903117 - (Two - 2.5 Gal.) 6903118 - (5 Gal.) 6903119 - (55 Gal.)
Hydraulic Function Time: Raise Lift Arms Lower Lift Arms Bucket Dump Bucket Rollback	 3.9 Seconds 2.5 Seconds 2.8 Seconds 2.1 Seconds

Electrical

Alternator	Belt driven, 90 amps, open frame
Battery	12 volts, 950 cold cranking amps @ 0° F (-18° C), 180 Minute reserve capacity @ 25 amps
Starter	12 volts, gear type, 4.02 HP (3,0 kW)
Instrumentation	**Gauges:** Hourmeter, Fuel, Engine Coolant Temperature. **Warning lights:** Fuel Level, Engine Preheat, System Voltage, Seat Belt, Engine Coolant Temperature, Engine Oil Pressure, Hydrostatic Charge Pressure, Hydraulic Oil Temperature, Engine Air Filter & Hydraulic Filter. **Other:** Audible Alarm, BICS Function, Lights, Opt./Accessory Switches. **Optional Deluxe Instrumentation:** *Same gauges and warning lights as standard instrumentation. *Additional bar-type gauges for: Engine Oil Pressure, System Voltage, Hydrostatic Charge Pressure and Hydraulic Oil Temperature. *Additional Features Included: Keyless Start, Clock, Job Clock, Help Screens, Diagnostic Capability, Automatic Shutdown Function.

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Drive System

Main Drive	Fully hydrostatic, 4-wheel drive
Transmission	Infinitely variable tandem hydrostatic piston pumps, driving two fully reversing hydrostatic motors
Final Drive	Pre-stressed #120 HSOC endless roller chain (no master link) and sprockets in sealed chaincase with oil lubrication (Chains do not require periodic adjustments) Two chains per side with no idler sprocket
Axle Size	2.76 in. (70,1 mm), heat treated
Wheel Bolts	Eight - 9/16 inch wheel bolts fixed to axle hubs

Capacities

Fuel	23 Gal. (87,1 L)
Engine Lubrication & Filter	12 qt. (11,4 L)
Engine Cooling System w/o Heater	3.6 Gal. (13,6 L)
Engine Cooling System w/ Heater	4.5 Gal. (17,1 L)
Hydraulic/Hydrostatic Reservoir	4.7 Gal. (17,8 L)
Hydraulic/Hydrostatic System	13 Gal. (49,2 L)
Chaincase Reservoir	11.0 Gal. (41,6 L)

Tires

Standard	12 - 16.5 12 PR Bobcat Heavy Duty
Hippo	33 x 15.5 - 16.5
Bulky Hulk	33 x 15.5 - 16.5
Recommended Pressure	Inflate tires to MAXIMUM pressure shown on the side wall of the tire. DO NOT mix brands of tires used on the same loader.

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TORQUE SPECIFICATIONS FOR BOLTS

Torque For General SAE Bolts

The following table shows standard torque specifications for bolts with zinc phosphate coating. Bolts purchased from Bobcat that have zinc phosphate coating are specified by the letter “H” following the part number.

	THREAD SIZE	SAE GRADE 5	SAE GRADE 8
in.-lb. (N•m)	0.250	80 - 90 (9 - 10)	110 - 120 (13 - 14)
	0.3125	180 - 200 (21 - 23)	215 - 240 (24 - 27)
ft.-lb. (N•m)	0.375	25 - 28 (34 - 38)	35 - 40 (48 - 54)
	0.4375	40 - 45 (54 - 61)	60 - 65 (82 - 88)
	0.500	65 - 70 (88 - 95)	90 - 100 (125 - 135)
	0.5625	90 - 100 (125 - 135)	125 - 140 (170 - 190)
	0.625	125 - 140 (170 - 190)	175 - 190 (240 - 190)
	0.750	220 - 245 (300 - 330)	300 - 330 (410 - 450)
	0.875	330 - 360 (450 - 490)	475 - 525 (645 - 710)
	1.000	475 - 525 (645 - 710)	725 - 800 (985 - 1085)
	1.125	650 - 720 (880 - 975)	1050 - 1175 (1425 - 1600)
	1.250	900 - 1000 (1200 - 1360)	1475 - 1625 (2000 - 2200)
	1.375	1200 - 1350 (1630 - 1830)	2000 - 2200 (2720 - 2980)
	1.500	1500 - 1650 (2040 - 2240)	2600 - 2850 (3530 - 3870)
	1.625	2000 - 2800 (2720 - 2980)	3450 - 3800 (4680 - 5150)
	1.750	2500 - 2750 (3390 - 3730)	4300 - 4800 (5830 - 6500)
	1.875	3150 - 3500 (4270 - 4750)	5500 - 6100 (7450 - 8300)
	2.000	3800 - 4200 (5150 - 5700)	6500 - 7200 (8800 - 9800)

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TORQUE SPECIFICATIONS FOR BOLTS (CONT'D)

Torque For General Metric Bolts

Thread Size (Dia.)	Material		
	8.8	10.9	12.9
M4	2.0 - 2.5 ft.-lb. (2,5 - 3,5 N•m)	2.8 - 3.1 ft.-lb. (3,8 - 4,2 N•m)	3.5 - 3.9 ft.-lb. (4,7 - 5,3 N•m)
M5	4.0 - 5.0 ft.-lb. (5,5 - 6,5 N•m)	5.6 - 6.2 ft.-lb. (8,4 - 7,6 N•m)	6.2 - 7.0 ft.-lb. (8,5 - 9,5 N•m)
M6	7.0 - 7.5 ft.-lb. (9,5 - 10,5 N•m)	9.1 - 10.1 ft.-lb. (12,2 - 13,7 N•m)	10.4 - 11.6 ft.-lb. (14,2 - 15,8 N•m)
M7	11.0 - 12.5 ft.-lb. (15 - 17 N•m)	16.2 - 14.7 ft.-lb. (20 - 22 N•m)	17.5 - 19.5 ft.-lb. (23,7 - 26,3 N•m)
M8	18 - 19 ft.-lb. (24 - 26 N•m)	21.7 - 24.0 ft.-lb. (29,4 - 32,6 N•m)	25.5 - 28.5 ft.-lb. (35 - 39 N•m)
M10	32 - 35 ft.-lb. (43 - 47 N•m)	42.0 - 46.5 ft.-lb. (57 - 63 N•m)	52.5 - 58.5 ft.-lb. (71 - 79 N•m)
M12	55 - 60 ft.-lb. (75 - 85 N•m)	78 - 85 ft.-lb. (105 - 115 N•m)	91 - 110 ft.-lb. (91 - 110 N•m)
M14	100 - 90 ft.-lb. (125 - 140 N•m)	118 - 133 ft.-lb. (118 - 133 N•m)	140 - 155 ft.-lb. (140 - 155 N•m)
M16	140 - 155 ft.-lb. (190 - 210 N•m)	188 - 210 ft.-lb. (255 - 285 N•m)	225 - 245 ft.-lb. (300 - 330 N•m)
M18	190 - 215 ft.-lb. (260 - 290 N•m)	255 - 285 ft.-lb. (345 - 385 N•m)	210 - 340 ft.-lb. (420 - 460 N•m)
M20	275 - 300 ft.-lb. (370 - 410 N•m)	360 - 405 ft.-lb. (490 - 550 N•m)	440 - 490 ft.-lb. (590 - 650 N•m)
M22	370 - 400 ft.-lb. (500 - 550 N•m)	554 - 560 ft.-lb. (740 - 760 N•m)	590 - 650 ft.-lb. (800 - 880 N•m)
M24	470 - 520 ft.-lb. (640 - 700 N•m)	625 - 700 ft.-lb. (850 - 950 N•m)	730 - 830 ft.-lb. (1000 - 1120 N•m)
M27	680 - 760 ft.-lb. (930 - 1030 N•m)	900 - 1000 ft.-lb. (1230 - 1370 N•m)	1100 - 1200 ft.-lb. (1470 - 1630 N•m)
M30	930 - 1030 ft.-lb. (1260 - 1400 N•m)	1250 - 1400 ft.-lb. (1700 - 1900 N•m)	1500 - 1600 ft.-lb. (2000 - 2200 N•m)
M33	1270 - 1400 ft.-lb. (1720 - 1900 N•m)	2300 - 2500 ft.-lb. (2300 - 2500 N•m)	2000 - 2300 ft.-lb. (2700 - 3100 N•m)
M36	1620 - 1800 ft.-lb. (200 - 2450 N•m)	2200 - 2400 ft.-lb. (2900 - 3200 N•m)	2600 - 2900 ft.-lb. (3500 - 3900 N•m)

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HYDRAULIC CONNECTION SPECIFICATIONS

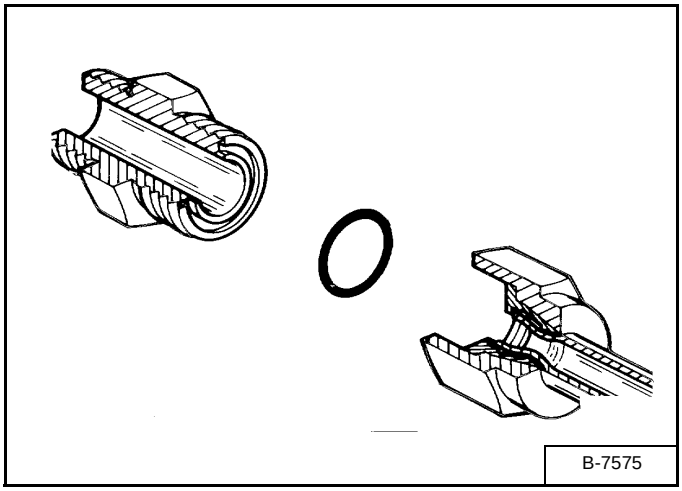
O-ring Face Seal Connection

IMPORTANT

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

I-2003-0888

Figure SPEC-30-1



When the fitting is tightened, you can feel when the fitting is tight to eliminate leakage caused by under or over torqued fittings. Use vaseline petroleum jelly to hold the O-ring in position until the fittings are assembled **[Figure SPEC-30-1]**.

Figure SPEC-30-2

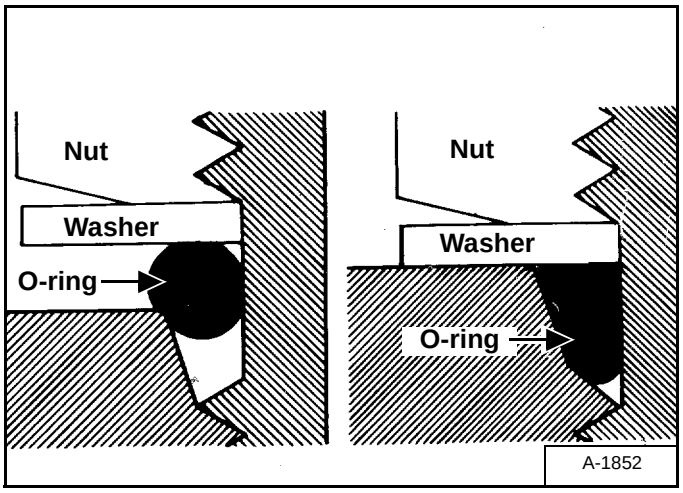
O-ring Face Seal Tightening Torque		
Tubeline Outside Diameter	**Thread Size**	* **TORQUE ft.-lb. (N•m)**
1/4”	9/16” - 18	13 (18)
3/8”	11/16” - 16	22 (30)
1/2”	13/16” - 16	40 (54)
5/8”	1” - 14	60 (81)
3/4”	1-3/16” - 12	84 (114)
7/8”	1-3/16” - 12	98 (133)
1”	1-7/16” - 12	118 (160)
1-1/4”	1-11/16” - 12	154 (209)
1-1/2”	2” - 12	163 (221)

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HYDRAULIC CONNECTION SPECIFICATIONS (CONT'D)

Straight Thread O-ring Fitting

Figure SPEC-30-3



Lubricate the O-ring before installing the fitting. Loosen the jam nut and install the fitting. Tighten the jam nut until the washer is tight against the surface **[Figure SPEC-30-3]**.

Tubelines And Hoses

Replace any tubelines that are bent or flattened. They will restrict flow, which will slow hydraulic action and cause heat.

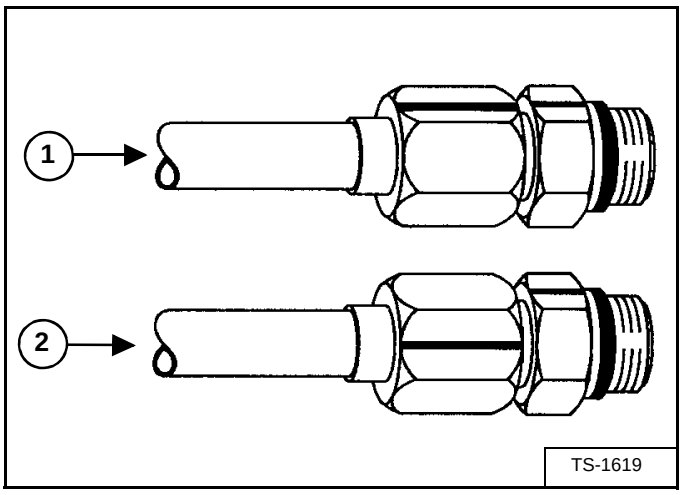
Replace hoses which show signs of wear, damage or weather cracked rubber.

Always use two wrenches when loosening and tightening hose or tubeline fittings.

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Flare Fitting

Figure SPEC-30-4



Use the following procedure to tighten the flare fitting:

Tighten the nut until it makes contact with the seat. Make a mark across the flats of both the male and female parts of the connection (Item 1) **[Figure SPEC-30-4]**

Use the chart **[Figure SPEC-30-5]** to find the correct tightness needed (Item 2) **[Figure SPEC-30-4]**. If the fitting leaks after tightening, disconnect it and inspect the seat area for damage.

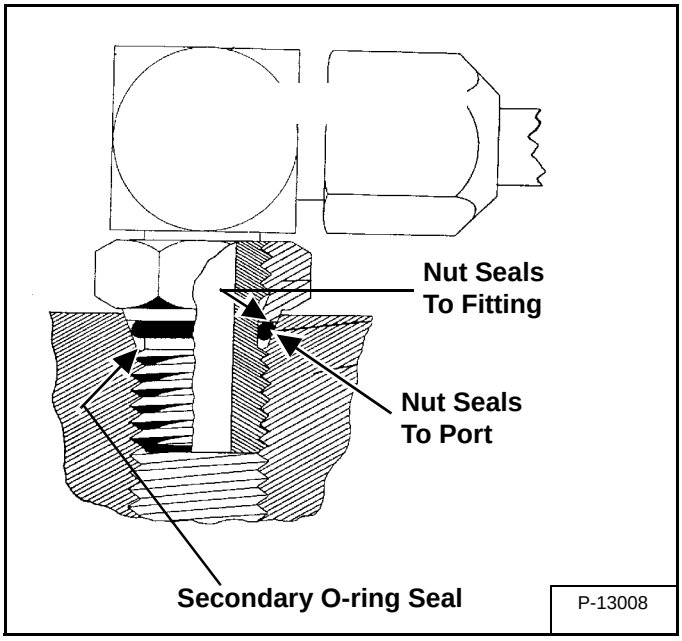
Figure SPEC-30-5

Flare Fitting Tightening Torque		
Tubeline Outside Diameter	**Thread Size**	**TORQUE ft.-lb. (N•m)**
1/4”	7/16” - 20	13 (18)
5/16”	1/2” - 20	17 (23)
3/8”	9/16” - 18	22 (30)
1/2”	3/4” - 16	40 (54)
5/8”	7/8” - 14	60 (81)
3/4”	1-1/16” - 12	84 (114)
7/8”	1-3/16” - 12	98 (133)
1”	1-5/16” - 12	118 (160)
1-1/4”	1-5/8” - 12	154 (209)
1-1/2”	1-7/8” - 12	163 (221)
2”	2-1/2” - 12	252 (342)

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Port Seal Fitting

Figure SPEC-30-6



The nut is the primary seal, the O-ring is the secondary seal and helps absorb vibration and pressure pulses at the connection **[Figure SPEC-30-6]**.

The hex portion of the nut does not contact the surface of the component when the nut is tight.

Figure SPEC-30-7

Port Seal and O-ring Boss Tightening Torque	
Thread Size	**TORQUE ft.-lb. (N•m)**
7/16” - 20	13 18)
9/16” - 18	22 (30)
3/4” -1 6	40 (54)
7/8” - 14	60 (81)
1-1/16” - 12	84 (114)
1-3/16” - 12	98 (133)
1-5/16” - 12	118 (160)
1-7/16” - 12	154 (209)
1-5/8” - 12	163 (221)

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.

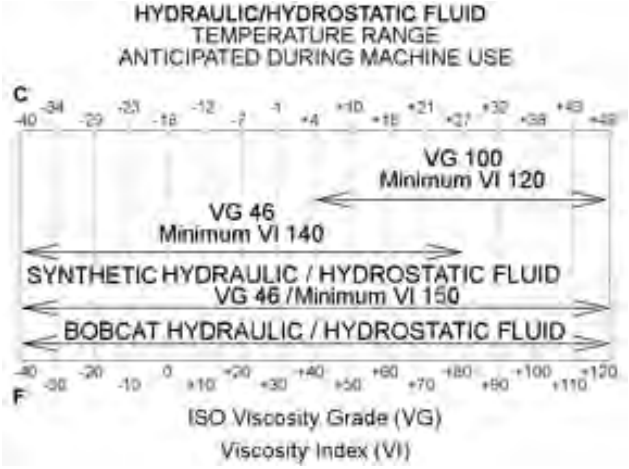
NOTE: Port seal fittings are not recommended in all applications. Use O-ring boss fittings in these applications.

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HYDRAULIC FLUID SPECIFICATIONS

Specifications

Use Bobcat hydraulic fluid (P/N 6903117 - 2, 2-1/2 Gal.), (P/N 6903118 - 5 Gal.), (P/N 6903119 - 55 Gal.).



DO NOT use automatic transmission fluids in the loader or permanent damage to the transmission will result.

WARNING

AVOID INJURY OR DEATH

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

W-2072-0807

When temperatures below zero degree F (-18°C) are common, the loader must be kept in a warm building. Extra warm-up time must be used each time the loader is started during cold temperature conditions. Cold fluid will not flow easily and it makes action on the hydraulic function slower. Loss of fluid flow to the hydrostatic transmission pump (indicated by TRANS light ON) can cause transmission damage in less than 60 seconds.

WARNING

During cold weather (32°F [0°C] and below), do not operate machine until the engine has run for at least five 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 -20°F (-30°C), 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 0°F (-18°C) if possible.

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CONVERSIONS

Decimal And Millimeter Equivalents

FRACTIONS	DECIMALS	MM
1/64	0.015625	0.397
1/32	0.03125	0.794
3/64	0.046875	1.191
1/16	0.0625	1.588
5/64	0.078125	1.984
3/32	0.09375	2.381
7/64	0.109375	2.778
1/8	0.1250	3.175
9/64	0.140625	3.572
5/32	0.15625	3.969
11/64	0.171875	4.366
3/16	0.1876	4.762
13/64	0.203125	5.159
7/32	0.21875	5.556
15/64	0.234375	5.953
1/4	0.2500	6.350
17/64	0.265625	6.747
9/32	0.28125	7.144
19/64	0.296875	7.541
5/16	0.3125	7.938
21/64	0.328125	8.334
11/32	0.34375	8.731
23/64	0.359375	9.128
3/8	0.3750	9.525
25/64	0.390625	9.922
13/32	0.40625	10.319
27/64	0.421875	10.716
7/16	0.4375	11.112
29/64	0.453125	11.509
15/32	0.46875	11.906
31/64	0.484375	12.303
1/2	0.5000	12.700

1 mm = 0.03937”

FRACTIONS	DECIMALS	MM
33/64	0.515625	13.097
17/32	0.53125	13.494
35/64	0.546875	13.891
9/16	0.5625	14.288
37/64	0.578125	14.684
19/32	0.59375	15.081
39/64	0.609375	15.478
5/8	0.6250	15.875
41/64	0.640625	16.272
21/32	0.65625	16.669
43/64	0.671875	17.066
11/16	0.6875	17.462
45/64	0.703125	17.859
23/32	0.71875	18.256
47/64	0.734375	18.653
3/4	0.7500	19.050
49/64	0.765625	19.447
25/32	0.78125	19.844
51/64	0.796875	20.241
13/16	0.8125	20.638
53/64	0.828125	21.034
27/32	0.84375	21.431
55/64	0.859375	21.828
7/8	0.8750	22.225
57/64	0.890625	22.622
29/32	0.90625	23.019
59/64	0.921875	23.416
15/16	0.9375	23.812
61/64	0.953125	24.209
31/32	0.96875	24.606
63/64	0.984375	25.003
1	1.000	25.400

0.001 = 0.0254 mm

U.S. To Metric Conversion Chart

	TO CONVERT	INTO	MULTIPLY BY
LINEAR MEASUREMENT	Miles	Kilometers	1.609
	Yards	Meters	0.9144
	Feet	Meters	0.3048
	Feet	Centimeters	30.48
	Inches	Meters	0.0254
	Inches	Centimeters	2.54
	Inches	Millimeters	25.4
AREA	Square Miles	Square Kilometers	2.59
	Square Feet	Square Meters	0.0929
	Square Inches	Square Centimeters	6.452
	Acre	Hectare	0.4047
VOLUME	Cubic Yards	Cubic Meters	0.7646
	Cubic Feet	Cubic Meters	0.02832
	Cubic Inches	Cubic Centimeters	16.39
WEIGHT	Tons (Short)	Metric Tons	0.9078
	Pounds	Kilograms	0.4536
	Ounces (Avdp.)	Grams	28.3495
PRESSURE	Pounds/Sq. In.	Kilopascal	6.895
WORK	Foot–Pounds	Newton–Meter	1.356
LIQUID VOLUME	Quarts	Liters	0.9463
	Gallons	Liters	3.785
LIQUID FLOW	Gallons/Minute	Liters/Minute	3.785
TEMPERATURE	Fahrenheit	Celsius	1.Subtract 32° 2. Multiply by 5/9

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SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	
SERVICE MANAGER	X
SALES MANAGER	

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: **S220 - 1**
Date: **7 February 2006**
Product: **Bobcat Loader**
Model: **S220**
Manual No: **6904154 (11-05)**

The following Sections are a revision to the above Service Manual.

Take out the existing Sections and put in the new Sections as listed below:

TAKE OUT	PUT IN	REVISION DECRIPTION
Cover	Cover	Revised Logo
10-70	10-70	Revised Text
10-120	10-120	Revised Text
20-01	20-01	Revised Text
20-40	20-40	Revised Text
20-41	20-41	Revised Text
20-50	20-50	Revised Text
20-60	20-60	Revised Text
20-61	20-61	Revised Text
20-70	20-70	Revised Text
20-71	20-71	Revised Text
30-10	30-10	Revised Text
30-30	30-30	Revised Text
40-30	40-30	Revised Text
50-01	50-01	Revised Text
50-31	50-31	Revised Text
ELECTRICAL SCHEMATICS (Printed October 2005)	ELECTRICAL SCHEMATICS (Printed February 2006)	Revised & Added Charts
60-50	60-50	Revised Text
60-160	60-160	Revised Text

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TAKE OUT	PUT IN	REVISION DECRIPTION
70-01	70-01	Revised Text
70-21	70-21	Revised Text
70-50	70-50	Revised Text
70-70	70-70	Revised Text
80-10	80-10	Revised Text
80-30	80-30	Revised Text
80-120	80-120	Revised Text
SPEC-01	SPEC-01	Revised Text
SPEC-30	SPEC-30	Revised Text
SPEC-40	SPEC-40	Revised Text

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SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	
SERVICE MANAGER	X
SALES MANAGER	

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: **S220 - 2**
Date: **6 April 2006**
Product: **Bobcat Loader**
Model: **S220**
Manual No: **6904154 (11-05)**

S220 Service Manual (P/N 6904154) Dated (3-06) contains updated service information which replaces the previous S220 Service Manual (P/N 6904154) Dated (11-05)

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SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	☐
SERVICE MANAGER	X
SALES MANAGER	☐

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: **S220 - 3**
Date: **14 September 2006**
Product: **Bobcat Loader**
Model: **S220**
Manual No: **6904154 (9-06)**

The following Sections are a revision to the above Service Manual.

COVER
ALPHABETICAL INDEX

30-01
30-21
30-30
30-40

50-01
50-112
50-121

ELECTRICAL SCHEMATICS

80-100
80-120

SPEC-10

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SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	☐
SERVICE MANAGER	X
SALES MANAGER	☐

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: **S220 - 4**
Date: **2 October 2006**
Product: **Bobcat Loader**
Model: **S220**
Manual No: **6904154 (10-06)**

The following Sections are a revision to the above Service Manual.

COVER

50-01
50-112

ELECTRICAL SCHEMATICS

70-01
70-50

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SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	☐
SERVICE MANAGER	X
SALES MANAGER	☐

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: **S220 - 5**
Date: **17 July 2007**
Product: **Bobcat Loader**
Model: **S220**
Manual No: **6904154 (7-07)**

The following Sections are a revision to the above Service Manual.

COVER
ALPHABETICAL INDEX
FOREWORD

10-01
10-20
10-30
10-40
10-60
10-61 ADDED
10-70
10-80
10-90
10-100
10-120
10-130
10-141
10-160
10-180
10-200

20-01
20-40
20-41
20-50
20-60
20-70
20-71
20-80
20-120
20-130

30-01
30-22 REMOVED
30-23 REMOVED
30-30
30-31
30-40
30-41 REMOVED
30-50
30-51
30-60
30-70 ADDED

40-20

50-10
50-100
50-101
50-111

60-01
ELECTRICAL SCHEMATICS
60-10
60-20
60-30
60-40
60-50
60-100
60-110

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60-150
60-180 ADDED
60-190 ADDED
60-200 ADDED
60-210 ADDED

70-01
70-10
70-50

80-50
80-70

SPEC-10

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SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	
SERVICE MANAGER	X
SALES MANAGER	

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: **S220 - 6**
Date: **8 August 2007**
Product: **Bobcat Loader**
Model: **S220**
Manual No: **6904154 (8-07)**

The following Sections are a revision to the above Service Manual.

COVER	
20-110	
50-01	
50-100	
50-101	
50-102 ADDED	
50-103 ADDED	

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SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	
SERVICE MANAGER	X
SALES MANAGER	

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: **S220 - 7**
Date: **16 August 2007**
Product: **Bobcat Loader**
Model: **S220**
Manual No: **6904154 (8-07)**

The following Sections are a revision to the above Service Manual.

50-100
50-101
50-102
50-103

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SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	☐
SERVICE MANAGER	X
SALES MANAGER	☐

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: **S220 - 8**
Date: **17 September 2007**
Product: **Bobcat Loader**
Model: **S220**
Manual No: **6904154 (9-07)**

The following Sections are a revision to the above Service Manual.

COVER
ALPHABETICAL INDEX

10-70

30-30
30-31

40-01
40-10
40-11
40-12 ADDED

50-01
50-140 ADDED

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SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	
SERVICE MANAGER	X
SALES MANAGER	

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: **S220 - 9**
Date: **12 November 2007**
Product: **Bobcat Loader**
Model: **S220**
Manual No: **6904154 (11-07)**

The following Sections are a revision to the above Service Manual.

COVER
FOREWORD

10-01
10-60
10-61
10-100
10-120

HYDRAULIC / HYDROSTATIC SCHEMATICS
20-21
20-41
20-60
20-61
20-70
20-71

70-01
70-50

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SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	☐
SERVICE MANAGER	X
SALES MANAGER	☐

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: **S220 - 10**
Date: **10 December 2007**
Product: **Bobcat Loader**
Model: **S220**
Manual No: **6904154 (12-07)**

The following Sections are a revision to the above Service Manual.

COVER
ALPHABETICAL INDEX

20-60
20-61
20-70
20-71

30-01
30-10

60-01
60-160
60-161

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SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	☐
SERVICE MANAGER	X
SALES MANAGER	☐

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: **S220 - 11**
Date: **14 January 2008**
Product: **Bobcat Loader**
Model: **S220**
Manual No: **6904154 (1-08)**

The following Sections are a revision to the above Service Manual.

COVER	
20-120	
70-50	

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SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	☐
SERVICE MANAGER	X
SALES MANAGER	☐

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: **S220 - 12**
Date: **3 March 2009**
Product: **Bobcat Loader**
Model: **S220**
Manual No: **6904154 (3-09)**

The following Sections are a revision to the above Service Manual.

COVER
FOREWORD

10-01

20-01

30-01
30-51

40-01

50-01

60-01

70-01

80-01

SPEC-01

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