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Bobcat®

Service Manual



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E19

Compact Excavator

S/N AWMM11001 & Above
S/N B3LA11001 & Above
S/N B3LB11001 & Above
S/N B4PK11001 & Above

7255013enUS (11-18) (B)

Printed in U.S.A.

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T2 T4-K S5

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MAINTENANCE SAFETY

WARNING

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

W-2003-0807

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

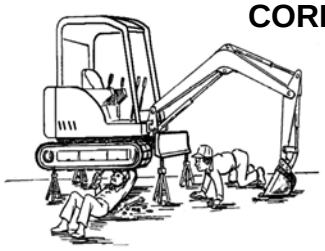
CORRECT



P-90216

Never service the Bobcat Excavator without instructions.

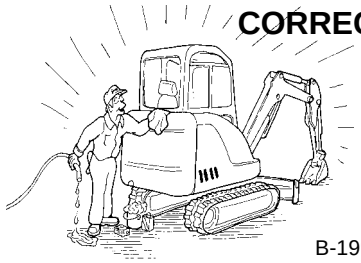
CORRECT



B-19964

Use the correct procedure to lift and support the excavator.

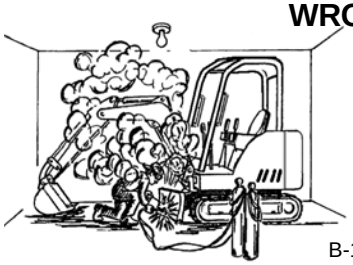
CORRECT



B-19959

Cleaning and maintenance are required daily.

WRONG



B-19965

Have good ventilation when welding or grinding painted parts.

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

WRONG

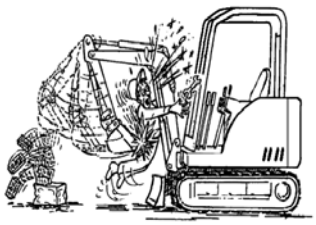


B-19960

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

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

WRONG

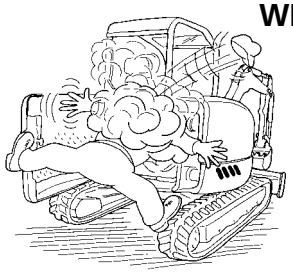


B-19966

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

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

WRONG



B-19962

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

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

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

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

WRONG



B-19958

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

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

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

WRONG



B-19798

Lead-acid batteries produce flammable and explosive gases.

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

Batteries contain acid which burns eyes or skin on contact.

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

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

MSW28-0409

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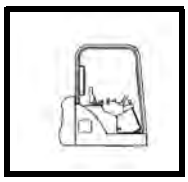
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FOREWORD

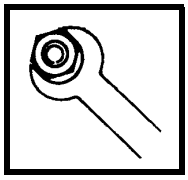
This manual is for the Bobcat excavator mechanic. It provides necessary servicing and adjustment procedures for the Bobcat excavator and its component parts and systems. Refer to the Operation & Maintenance Manual for operating instructions, starting procedure, daily checks, etc.

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

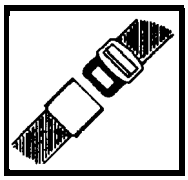
1. Check that the ROPS/TOPS/ FOPS is in good condition and is not modified.



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



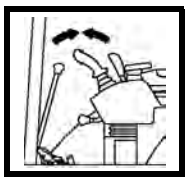
3. The seat belt must be correctly installed, functional and in good condition.



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



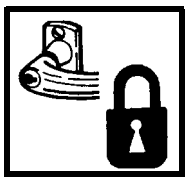
5. Travel levers, control levers and foot pedals must return to neutral. Check that the pedal locks are in working order.



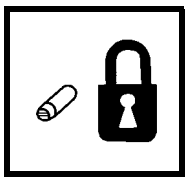
6. Check for correct function of the work lights.



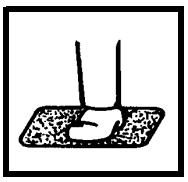
7. Enclosure door latches must open and close freely.



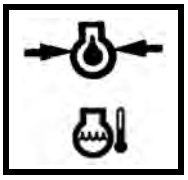
8. Attachment locking pins must function correctly and be in good condition.



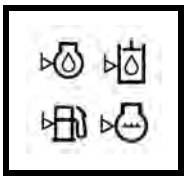
9. Safety treads must be in good condition.



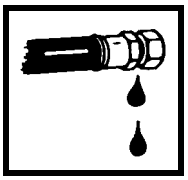
10. Check for correct function of indicator lamps.



11. Check all machine fluid levels.



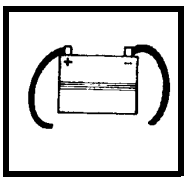
12. Inspect for fuel, oil or hydraulic fluid leaks.



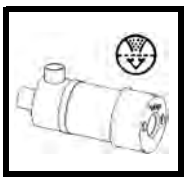
13. Lubricate the excavator.



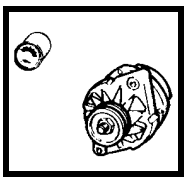
14. Check the condition of the battery and cables.



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



16. Check the electrical charging system.

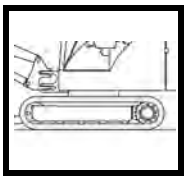


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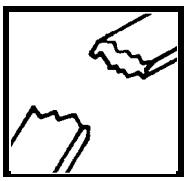
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17. Check tracks for wear and tension. Use only approved tracks.



18. Inspect for loose or broken parts or connections.



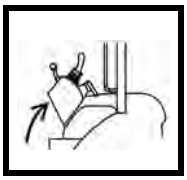
19. Check for any field modification not completed.



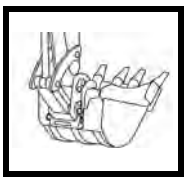
20. Operate the machine and check all functions.



21. Check the control console interlocks for correct function.



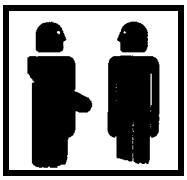
22. Inspect the X-Change™ for wear or damage. Repair or replace damaged parts.



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



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



CALIFORNIA
PROPOSITION 65 WARNING

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

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SAFETY INSTRUCTIONS

Safety Alert Symbol

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

WARNING

AVOID INJURY OR DEATH

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

W-2003-0807

IMPORTANT

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

I-2019-0284

DANGER

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

D-1002-1107

WARNING

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

W-2044-1107

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

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

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.

Avoid Silica Dust



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

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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 petrol or diesel fuel for cleaning parts. Use commercial nonflammable solvents.

Fueling



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

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

Starting

Do not use ether or starting fluids on any engine that has glow plugs 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 Arrester Exhaust System

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

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

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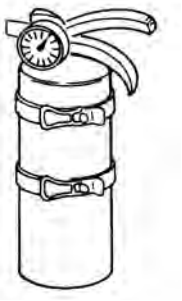
Welding And Grinding

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

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

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

Fire Extinguishers



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

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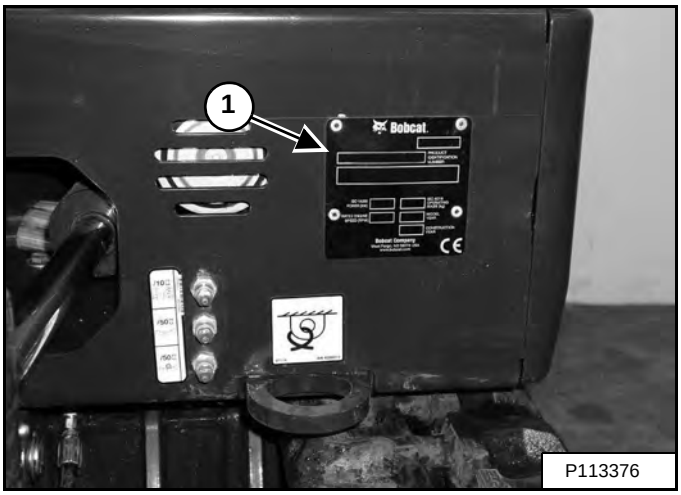
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SERIAL NUMBER LOCATIONS

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

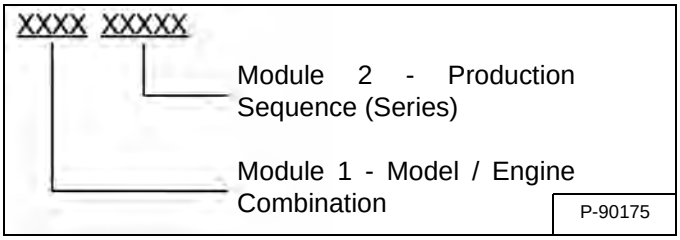
Excavator Serial Number

Figure 1



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

Figure 2



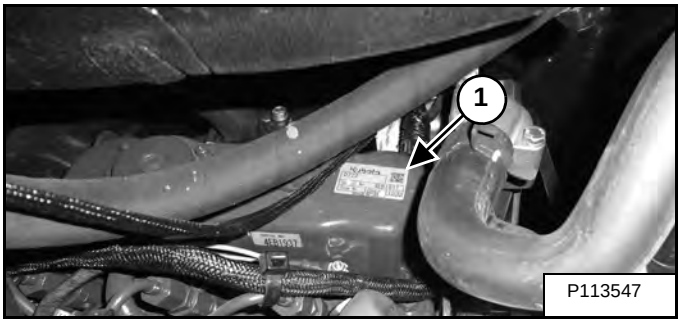
Explanation of excavator Serial Number **[Figure 2]**:

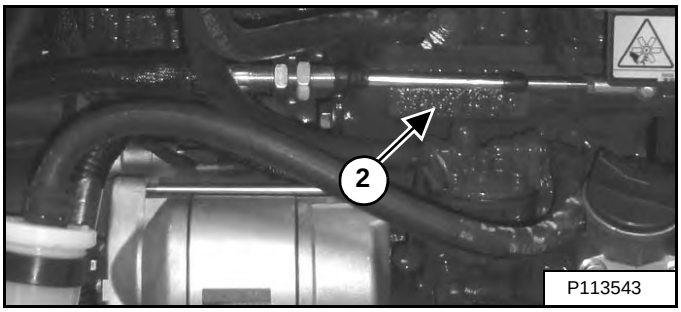
1. The four digit Model / Engine Combination Module number identifies the model number and engine combination.

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

Engine Serial Number

Figure 3





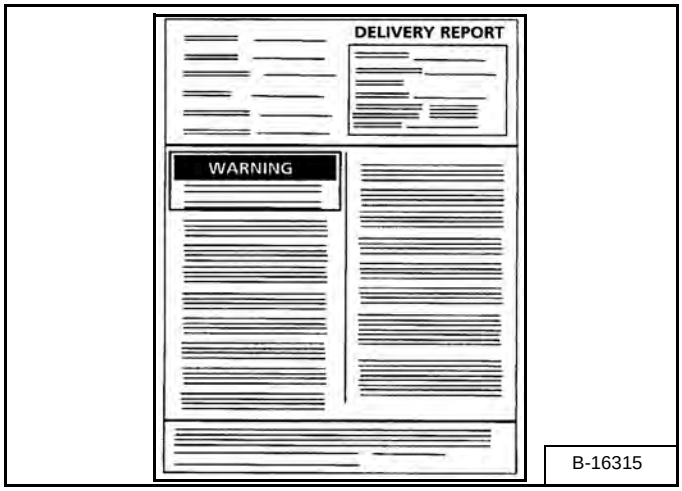
The engine serial number is located on the top cover (Item 1) or on the side of the engine block (Item 2) **[Figure 3]** above the fuel pump.

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DELIVERY REPORT

Figure 4



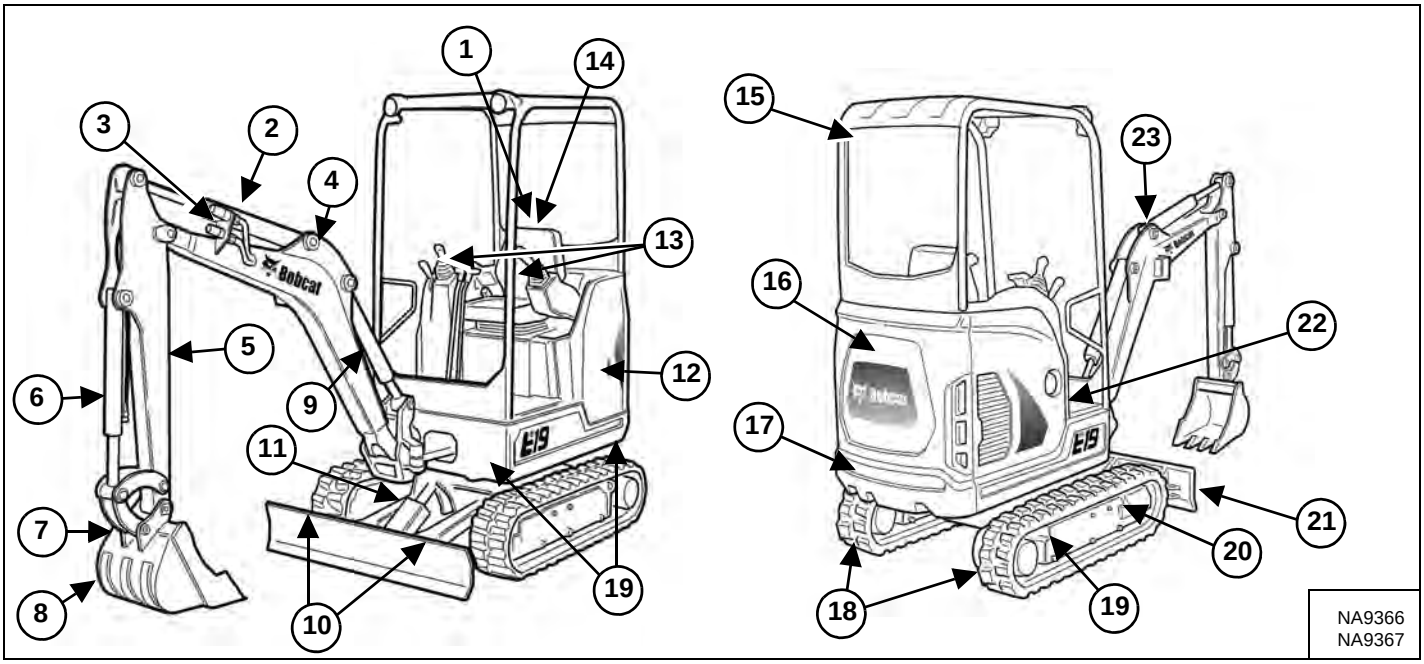
The delivery report **[Figure 4]** contains a list of items that must be explained or shown to the owner or operator by the dealer when the Bobcat excavator is delivered.

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

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EXCAVATOR IDENTIFICATION



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

[A] BUCKET - Several different buckets and other attachments are available for the Bobcat excavator.
[B] ROPS, TOPS - (Roll-Over Protective Structure / Tip-Over Protective Structure) as standard equipment. The ROPS / TOPS meets ISO 12117-2 AND ISO 12117.

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

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

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

OPERATOR CANOPY (ROPS / TOPS) 10-31-1
Description 10-31-1

TRANSPORTING THE EXCAVATOR ON A TRAILER 10-40-1
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LIFTING AND BLOCKING THE EXCAVATOR

Procedure

Always park the machine on a level surface.

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2003-0807

⚠ WARNING

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

W-2218-1195

Figure 10-10-1

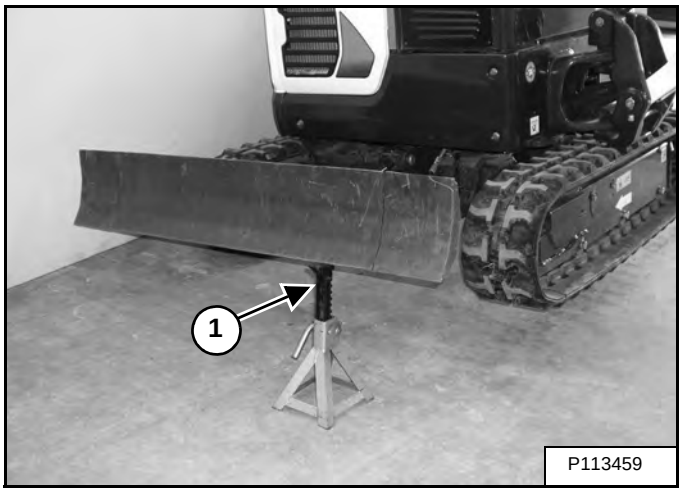
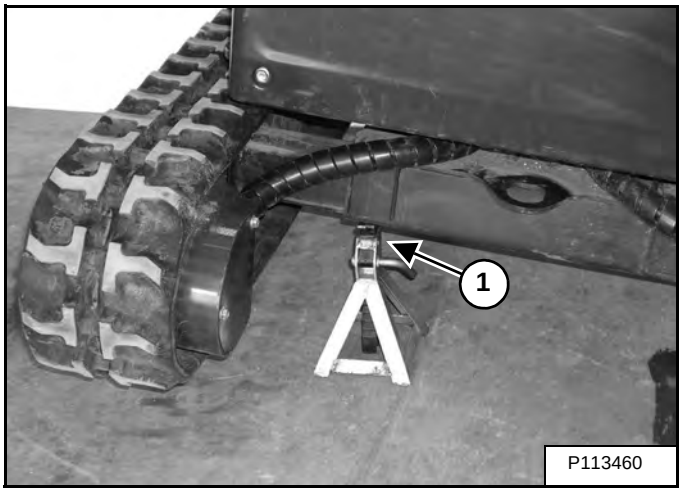


Figure 10-10-2



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

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

Repeat the procedure for the other side.

Stop the engine.

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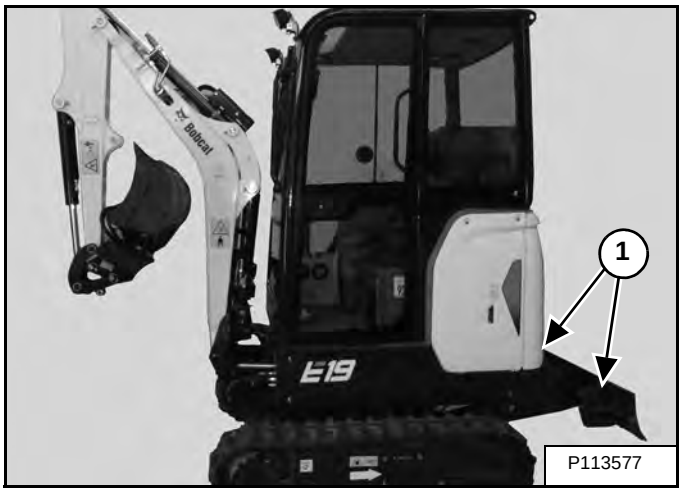
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LIFTING THE EXCAVATOR

Procedure

Figure 10-20-1



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

Raise the blade all the way.

Put all the control levers in NEUTRAL.

WARNING

AVOID INJURY OR DEATH

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

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Figure 10-20-2

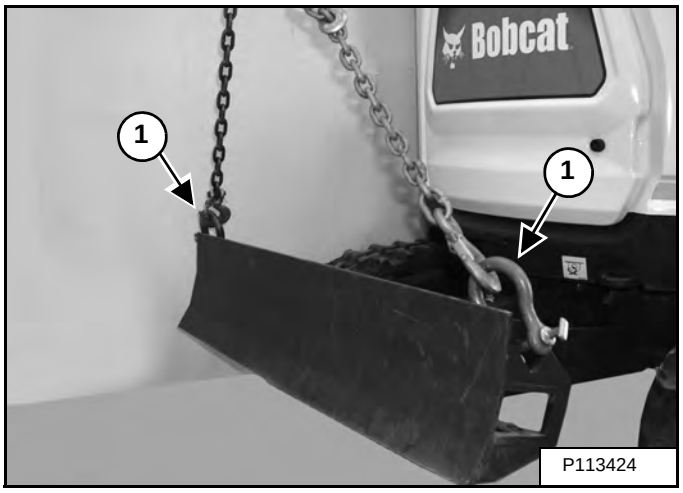
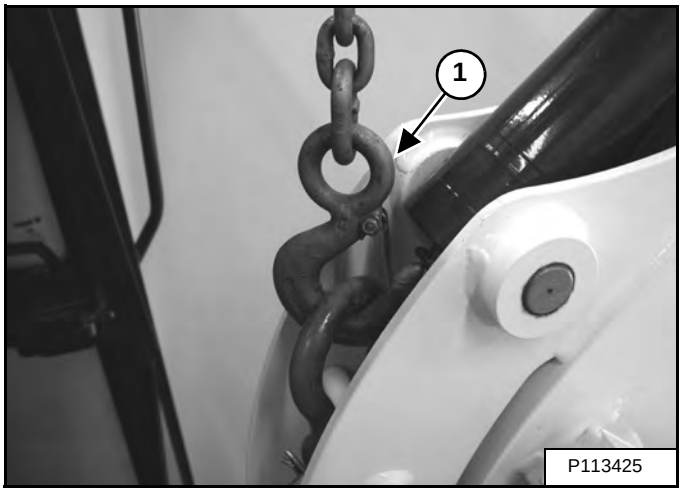


Figure 10-20-3



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

Fasten a chain (Item 1) **[Figure 10-20-3]** from the rod to the lift fixture.

NOTE: Depending on the type of chain hooks, it may be necessary to install a clevis at the lift points and then hook to the clevis.

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OPERATOR CAB (ROPS / TOPS)

Description

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

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

ROPS / TOPS - Roll-Over Protective Structure per ISO 12117-2:2008, and Tip-Over Protective Structure per ISO 12117:2000, EN13531:2001.

⚠ WARNING

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

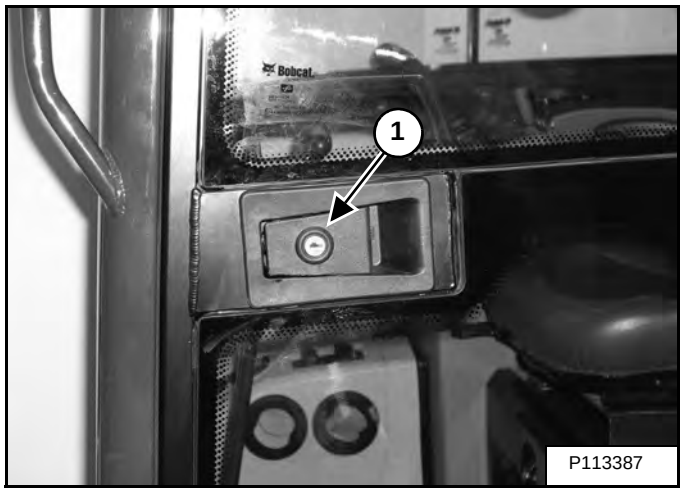
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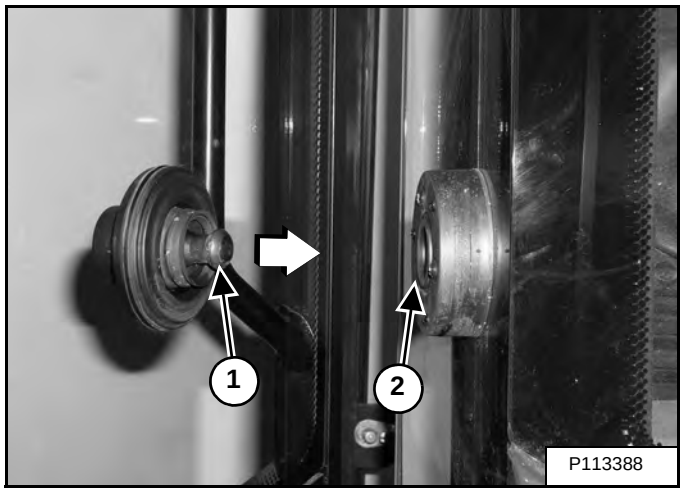
Cab Door

Figure 10-30-1



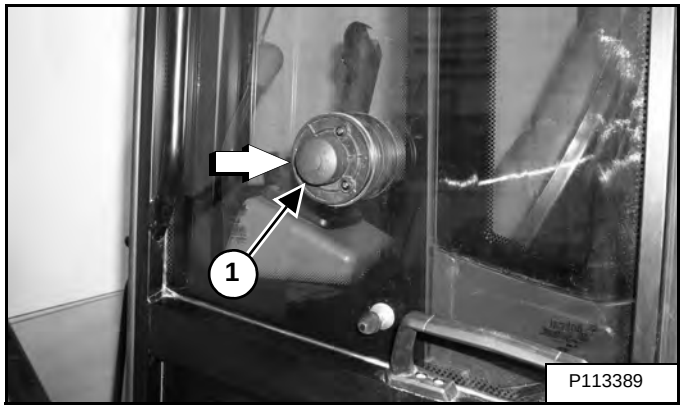
The cab door can be locked (Item 1) **[Figure 10-30-1]** with the same key as the starter switch. Pull on the latch to open the door.

Figure 10-30-2



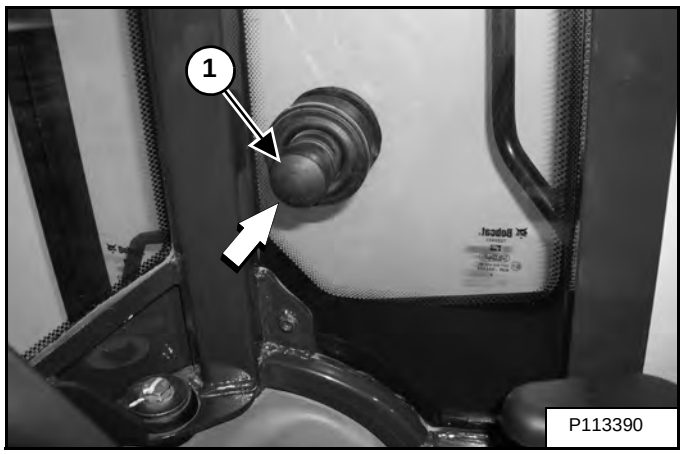
Push the door all the way open until the latch post (Item 1) engages in the latch (Item 2) **[Figure 10-30-2]** to hold the door in the open position.

Figure 10-30-3



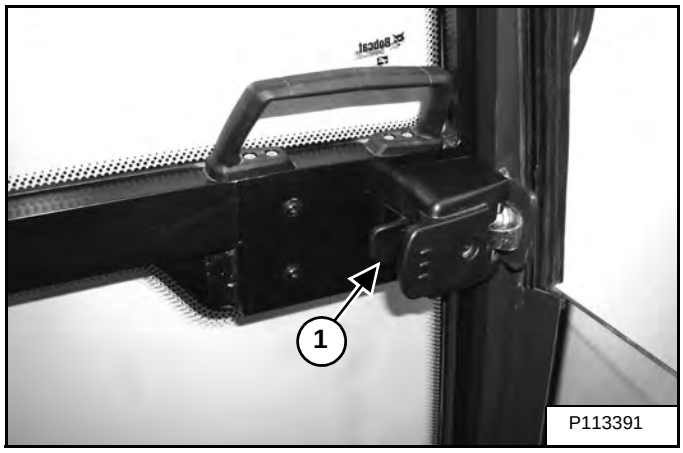
When the door is in the open position, push on the latch (Item 1) **[Figure 10-30-3]** and close the door.

Figure 10-30-4



From inside the cab, push on the latch (Item 1) **[Figure 10-30-4]** and close the door.

Figure 10-30-5



From inside the cab, to open the door, pull on the latch (Item 1) **[Figure 10-30-5]** and open the door.

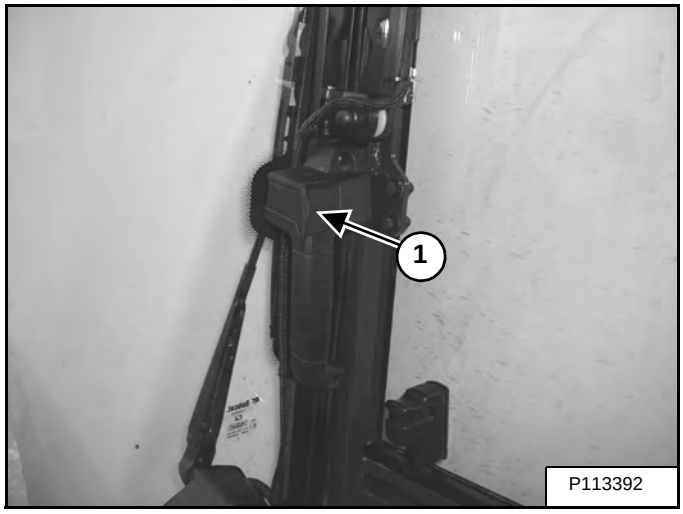
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Front Window

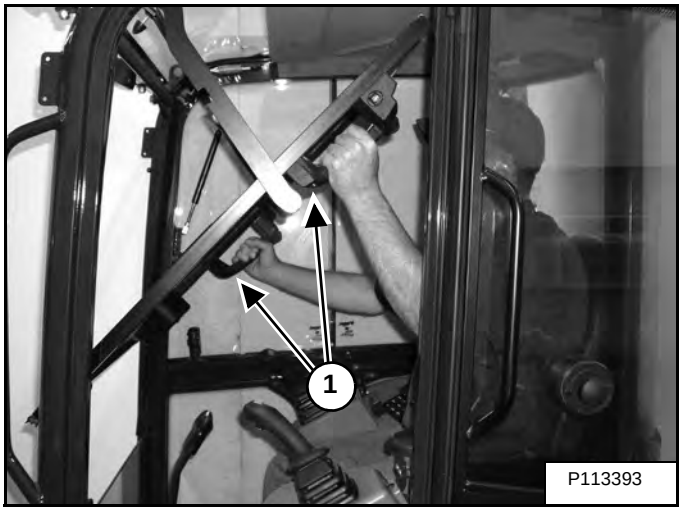
Opening The Front Window

Figure 10-30-6



Press the window latch button (Item 1) **[Figure 10-30-6]** (both sides).

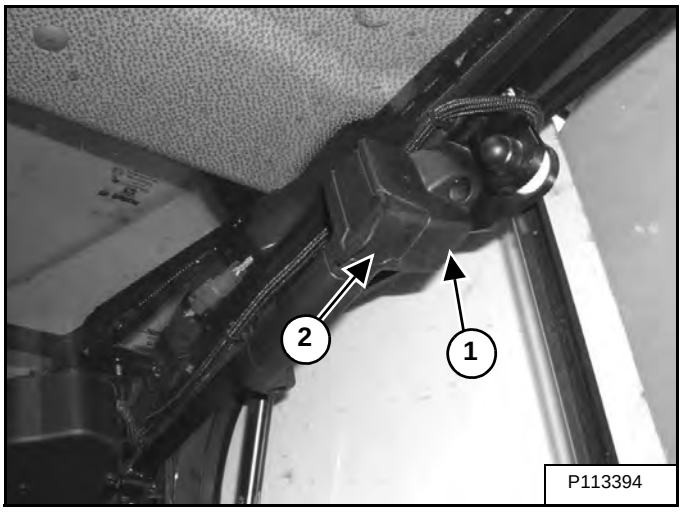
Figure 10-30-7



Use both window grab handles (Item 1) **[Figure 10-30-7]** to pull the top of the window in.

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

Figure 10-30-8



When the window is fully raised, the latch (Item 1) **[Figure 10-30-8]** (both sides) will close on the bracket in the latched position.

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

Closing The Front Window

Use both window grab handles to support the window while pressing the window latch button (Item 2) **[Figure 10-30-8]** (both sides).

Use both window grab handles (Item 1) **[Figure 10-30-7]** to pull the window down fully.

Press the top of the window in until the latch locks into the latched position (both sides) **[Figure 10-30-6]**.

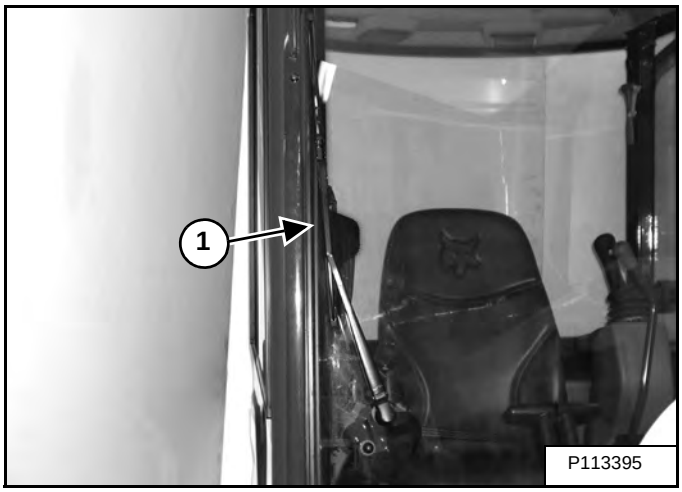
Pull inward and upward slightly on the window to make sure it is fully latched in the closed position.

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Front Wiper

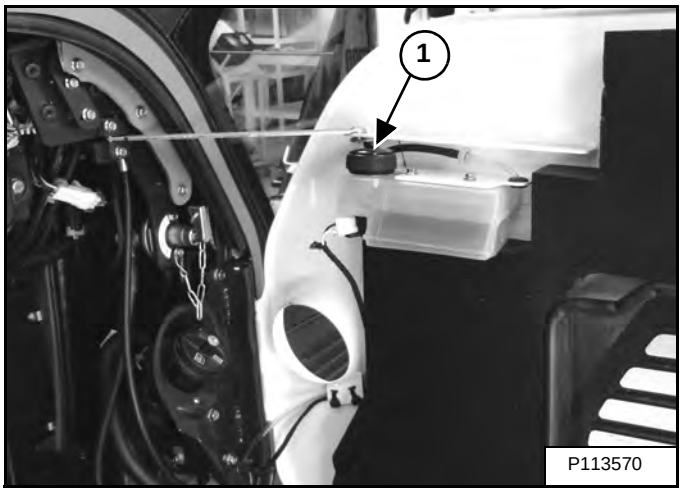
Figure 10-30-9



The front window is equipped with a wiper (Item 1) **[Figure 10-30-9]** and washer.

Window Washer Reservoir

Figure 10-30-10



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

NOTE: When temperatures are to reach below freezing, use a washer fluid that is recommended for use in cold temperatures to avoid damage to the washer reservoir.

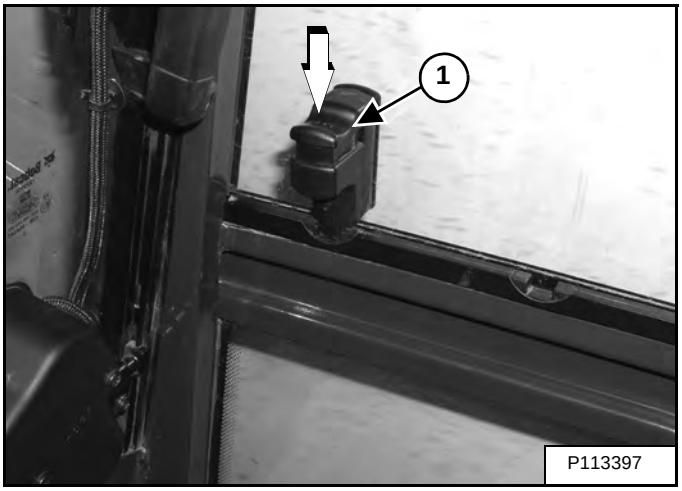
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Right Side Window

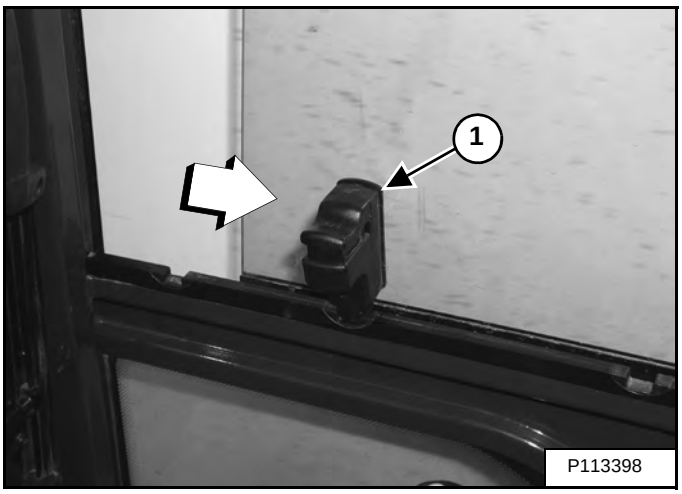
Opening The Right Front Window

Figure 10-30-11



Press down on the latch (Item 1) **[Figure 10-30-11]** located at the front of the front window.

Figure 10-30-12



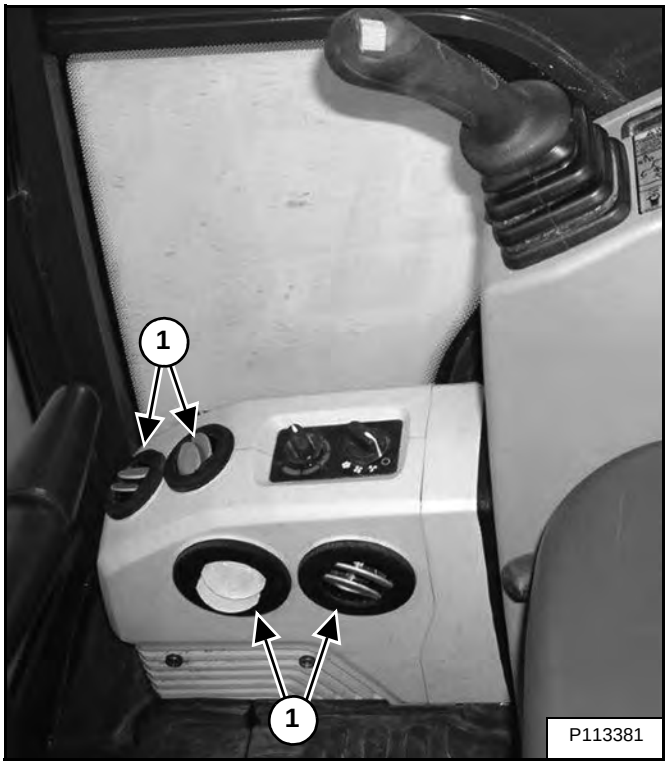
Pull the latch (Item 1) **[Figure 10-30-12]** backward to open the window until the desired stop. Release the latch and latch the window in place.

Closing The Right Front Window

Press down on the latch (Item 1) **[Figure 10-30-11]** and push the latch forward to close the window.

Heating And Ventilation Ducting

Figure 10-30-13



The heating and ventilation louvers (Item 1) **[Figure 10-30-13]** can be positioned as needed to direct the air flow to various areas in the cab.

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OPERATOR CANOPY (ROPS / TOPS)

Description

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

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

ROPS - Roll-Over Protective Structure per ISO 12117-2:2008.

TOPS - Tip-Over Protective Structure per ISO 12117:2000, EN13531:2001.

FOPS - Falling-Object Protective Structure per ISO 10262:1998 - Meets Level 1.

⚠ WARNING

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

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TRANSPORTING THE EXCAVATOR ON A TRAILER

Loading And Unloading

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

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

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

Use metal loading ramps with a slip resistant surface.

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

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

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

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

Figure 10-40-1



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

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

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

Stop the engine and remove the key (if equipped).

Put blocks at the front and rear of the tracks.

Fastening

Figure 10-40-2

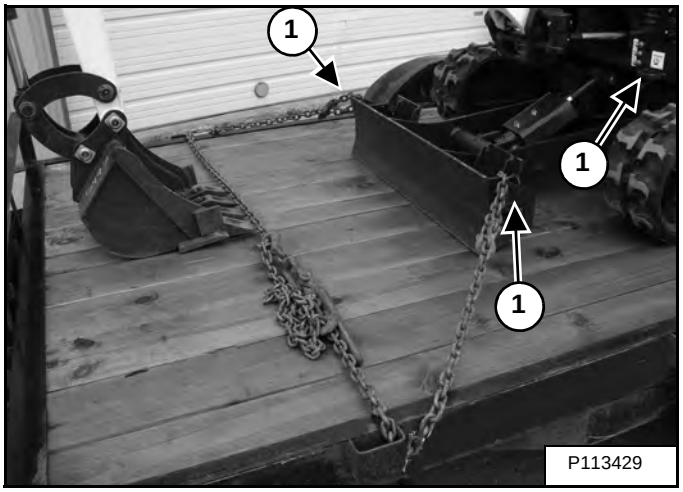
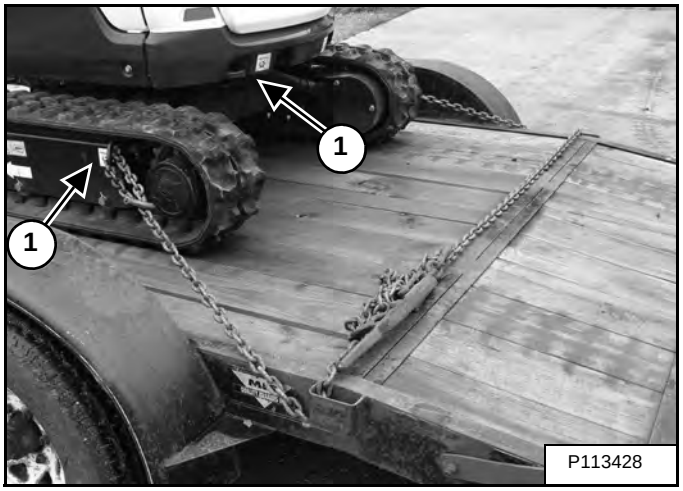


Figure 10-40-3



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

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

WARNING

AVOID SERIOUS INJURY OR DEATH

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

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TAILGATE

Opening And Closing

WARNING

AVOID INJURY OR DEATH

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

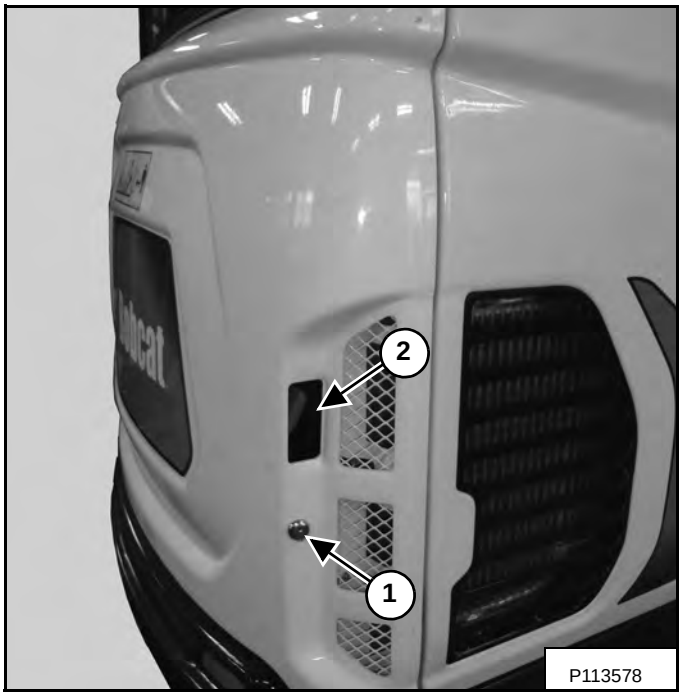
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WARNING

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

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Figure 10-50-1

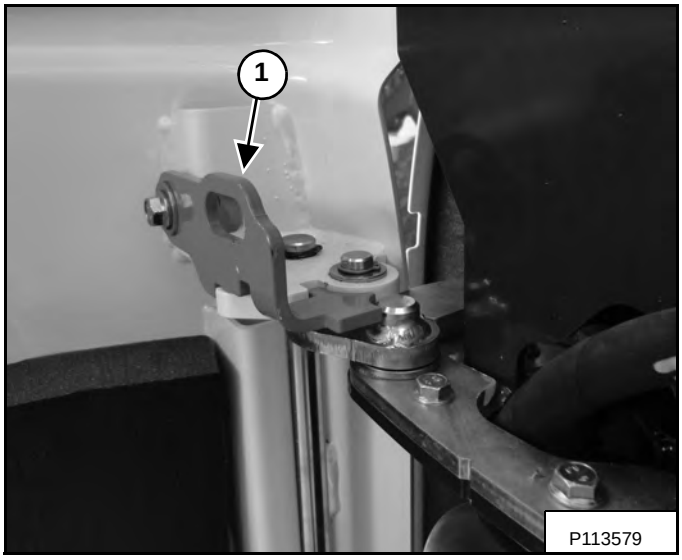


The tailgate can be locked (Item 1) **[Figure 10-50-1]** with the same key as the starter switch.

Pull on the latch (Item 2) **[Figure 10-50-1]** and open the tailgate.

Open the tailgate and rotate outward until it is held open by the latch (Item 1) **[Figure 10-50-2]**.

Figure 10-50-2



To close the tailgate, lift up on the latch (Item 1) **[Figure 10-50-2]** and slowly start to close the tailgate.

Push firmly to close the tailgate.

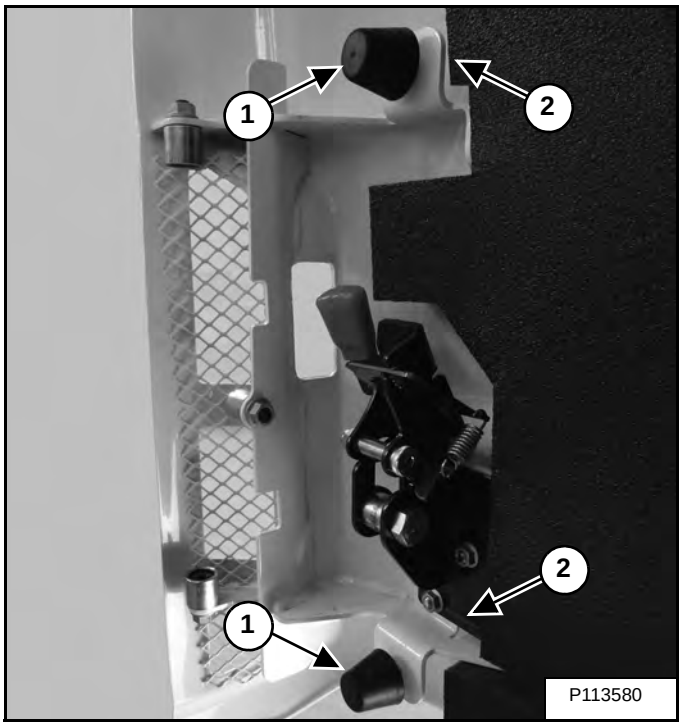
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TAILGATE (CONT'D)

Adjusting The Latch

Figure 10-50-3



The tailgate can be adjusted at the two rubber bumpers (Item 1). Loosen the four nuts (Item 2) **[Figure 10-50-3]** and adjust the bumpers until the tailgate does not vibrate. Tighten the nuts securely after adjustment is completed.

Close the tailgate before operating the excavator.

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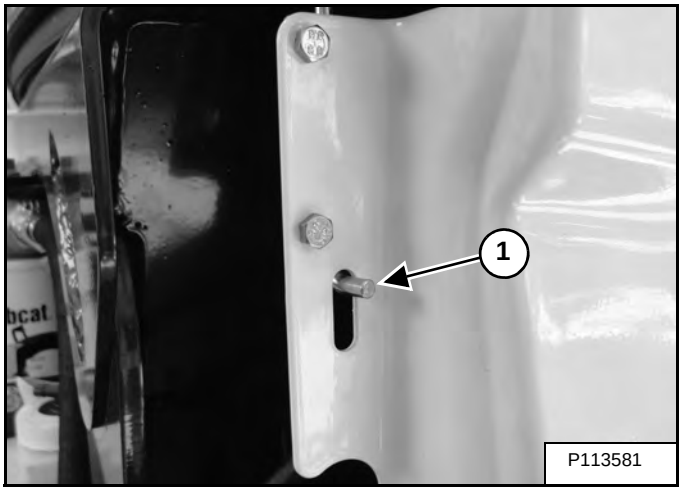
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RIGHT SIDE COVER

Opening And Closing Right Side Cover

Right Side

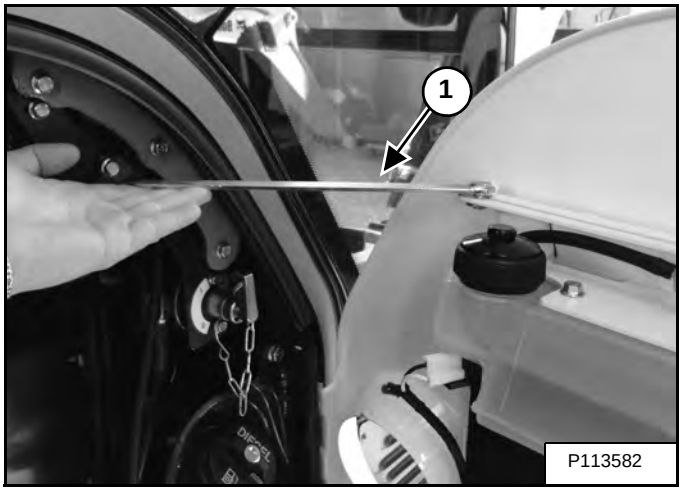
Figure 10-60-4



Open the tailgate to access the right side cover latch (Item 1) **[Figure 10-60-4]**.

Pull out the lever (Item 1) **[Figure 10-60-4]** down and open the right side cover.

Figure 10-60-5



Open the right side cover and rotate forward until it is held open by the latch (Item 1) **[Figure 10-60-5]**.

To close the tailgate, lift up on the latch (Item 1) **[Figure 10-60-5]** and slowly start to close the tailgate.

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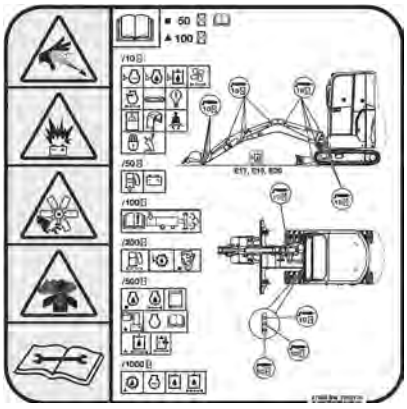
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SERVICE SCHEDULE

Maintenance Intervals

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

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



WARNING

AVOID INJURY OR DEATH

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

W-2003-0807

Every 10 Hours (Before Starting The Excavator)

- **Engine Oil** - Check level and add as needed.
- **Engine Air Filters and Air System** - Check air clearer condition indicator. Service only when required. Check for leaks and damaged components.
- **Engine Cooling System** - Check coolant level COLD and add premixed coolant as needed.
- **Fuel Filters**- Check filters for moisture or contamination. Drain and replace as needed.
- **Hydraulic Fluid** - Check fluid level and add as needed.
- **Seat Belt, Seat Belt Retractors, Seat Belt Mounting hardware** - Check the condition of seat belt and mounting hardware. Clean or replace seat belt retractors as needed. Clean dirt and debris from moving parts.
- **Operator Cab** - Check the cab condition and mounting hardware.
- **Indicators and Lights** - Check for correct operation of all indicators and lights.
- **Safety Signs and Safety Tread** - Check for damaged signs (decals). Replace any signs that are damaged.

- **Console Lockout** - Check console lockout for proper operation.
- **Track Tension** - Check tension and adjust as needed.
- **Pivot Points** - Grease all machinery pivot points. Grease track expansion. Grease clamp (if equipped).

- **Attachment Coupler** - Check for damage or loose parts (if equipped).
- **Motion Alarm** - Check for proper function.
- **Cab Heater Filters** - Clean filters (if equipped).

First 50 Hours

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

Every 50 Hours

- **Swing Bearing** - Grease swing bearing and swing pinion. Service every 10 hours when operating in water.

- **Battery** - Check cables, connections, and electrolyte level; add distilled water as needed.
- **Fuel Tank** - Drain water and sediment from fuel tank and fuel filter.

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Maintenance Intervals (Cont'd)

First 100 Hours

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

Every 100 Hours

- **Spark Arrester** - Empty spark chamber.

Every 250 Hours Or Every 12 Months

- **Fuel Filter** - Replace fuel filter.
- **Travel Motors (Final Drive)** - Check fluid level and add as needed.
- **Drive Belts (Alternator)** - Check condition. Replace as needed, then as scheduled.

Every 500 Hours Or Every 12 Months

- **Engine Oil and Filter** - Replace oil and filter.
- **Cooling System** - Clean debris from radiator / hydraulic fluid cooler.
- **Hydraulic Filter and Hydraulic Reservoir Breather Cap** - Replace the hydraulic filter and the reservoir breather cap.
- **Alternator and Starter** - Check connections.
- **Heater** - Clean housing and coils (if equipped).

Every 1000 Hours Or Every 12 Months

- **Hydraulic Fluid and Filters** - Replace hydraulic fluid and filters.
- **Engine Valves** - Adjust the engine valve clearance.
- **Travel Motors (Final Drive)** - Replace fluid.

Every 24 Months

- **Coolant** - Replace the coolant.

SS EXC E19 E20-0318

Inspection Checkbook

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 the correct maintenance of the Bobcat excavator.

The Inspection Checkbook contains the following information:

- Doosan Bobcat EMEA s.r.o. Warranty Policy
- Doosan Bobcat EMEA s.r.o. Extended Warranty Policy

The inspection checkbook has to be filled in by the Dealer for any maintenance and service work of your Bobcat machine. This book may be required anytime by an authorised dealer or by Bobcat Europe, should be a breakdown occur on the Bobcat equipment.

Your dealer can order the Inspection Checkbook.
Part Number: 7296478.

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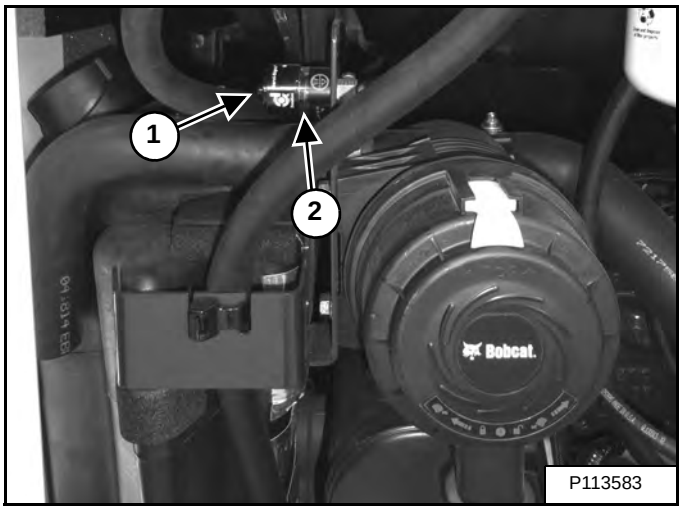
AIR CLEANER SERVICE

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

Daily Check

The air cleaner is located in the engine compartment. Open the tailgate to access the air cleaner for service.

Figure 10-80-1



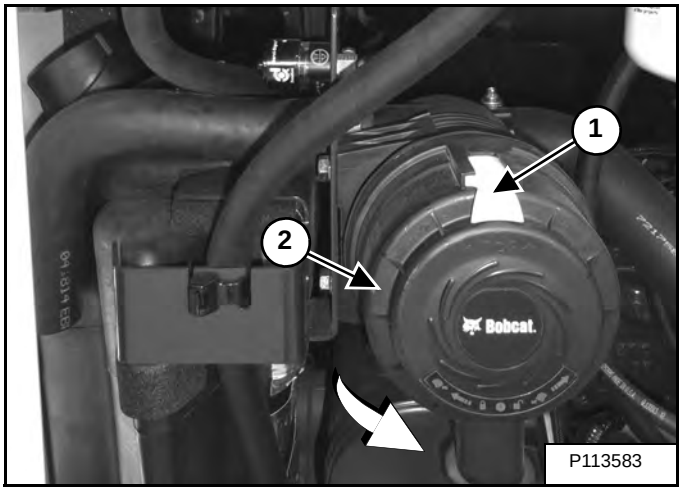
Check the condition indicator (Item 1). If the red ring (Item 2) **[Figure 10-80-1]** shows in the condition indicator, the filter needs to be replaced.

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

Replacing The Filter Elements

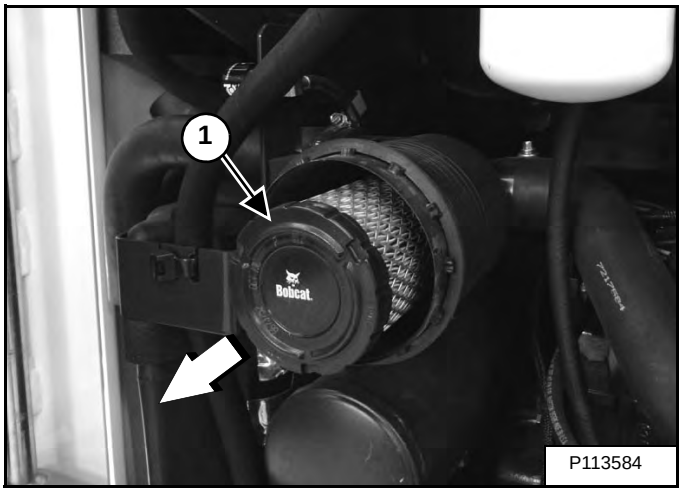
Outer Filter

Figure 10-80-2



Pull out on the latch (Item 1). Rotate the cover counter clockwise and remove the dust cover (Item 2) **[Figure 10-80-2]**.

Figure 10-80-3



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

Check the housing for damage.

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

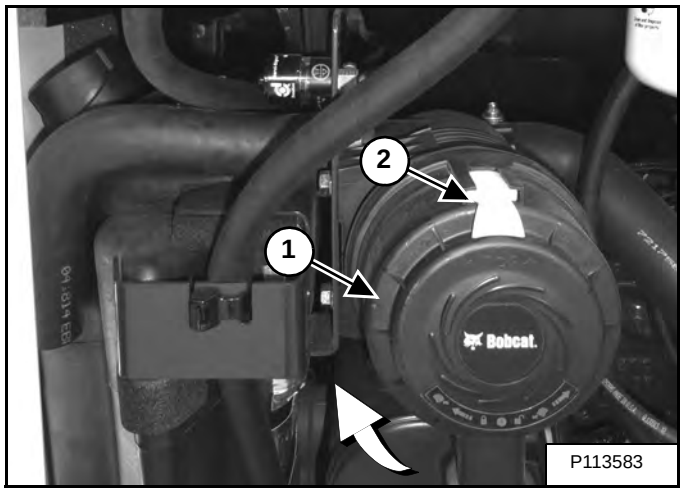
Install a new filter.

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Replacing The Filter Elements (Cont'd)

Figure 10-80-4



Position the dust cover (Item 1) **[Figure 10-80-4]** to the housing. Rotate the housing clockwise until the latch is at the top as shown.

Secure the dust cover (Item 1) by pushing in on the latch (Item 2) **[Figure 10-80-4]**.

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

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

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

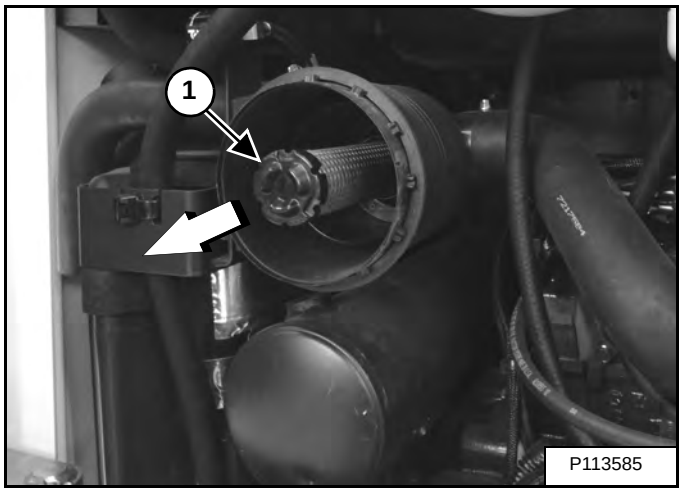
If the red ring (Item 2) **[Figure 10-80-1]** shows in the condition indicator, replace the inner filter.

Inner Filter

Only replace the inner filter under the following conditions:

- Replace the inner filter every *third* time the outer filter is replaced.
- After the outer filter has been replaced, press the button (Item 1) **[Figure 10-80-1]** on the condition indicator and start the engine. Run at full rpm, then reduce engine speed and stop the engine. If the red ring shows in the condition indicator, replace the inner filter.

Figure 10-80-5



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

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

Install the new inner filter.

Install the outer filter and the dust cover.

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

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CAB FILTER

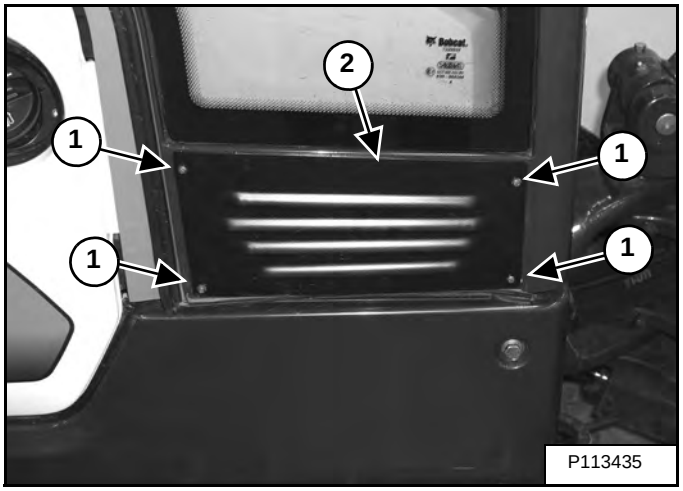
Cleaning And Maintenance

Fresh Air Filter

The fresh air filter must be cleaned regularly. (See AIR CLEANER SERVICE on Page 10-80-1.)

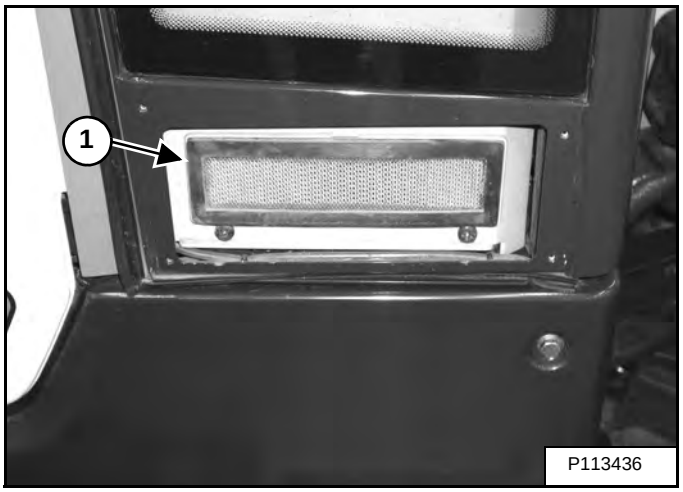
The fresh air filter is located on the right front corner of the cab.

Figure 10-90-1



Remove the four screws (Item 1) and remove the cover (Item 2) **[Figure 10-90-1]**.

Figure 10-90-2



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

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

Reinstall the cover (Item 2) and the four screws (Item 1) **[Figure 10-90-1]**.

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ENGINE COOLING SYSTEM

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

Cleaning

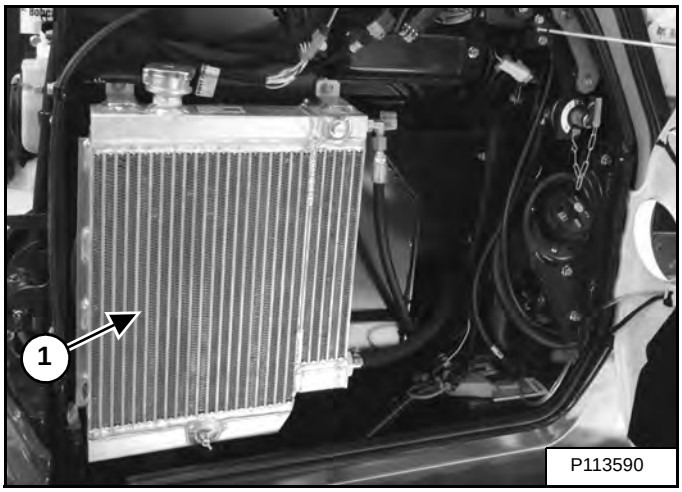
NOTE: This excavator uses a pusher fan so flow through the radiator / oil cooler will be from inside the engine compartment to outside the right cover. When cleaning the radiator, clean both the inside and outside surfaces of the radiator / oil cooler.

Open the tailgate.

Open the right side cover.

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

Figure 10-100-1



Use air pressure or water pressure to clean the radiator / oil cooler (Item 1) **[Figure 10-100-1]** (both inside and outside surfaces). Be careful not to damage fins when cleaning.

Close the right side cover.

Close the tailgate.

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Checking Level

WARNING

AVOID BURNS

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

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WARNING

AVOID INJURY OR DEATH

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

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

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IMPORTANT

AVOID ENGINE DAMAGE

Always use the correct ratio of water to antifreeze.

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

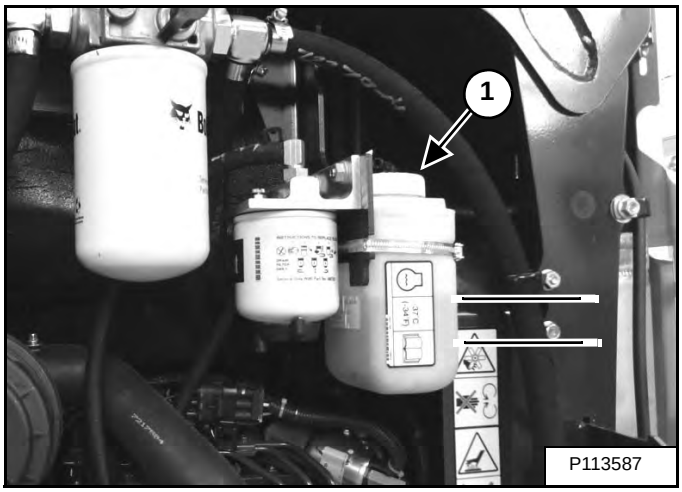
Too little antifreeze reduces the additives which protect the internal engine components; reduces the boiling point and freeze protection of the system.

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

I-2124-0497

Open the tailgate.

Figure 10-100-2



Check the coolant level in the coolant recovery tank (Item 1) **[Figure 10-100-2]**.

The coolant level must be filled so it is within the MAX / MIN line marked the coolant recovery tank.

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

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Removing And Replacing Coolant

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

Stop the engine. Open the right side cover.

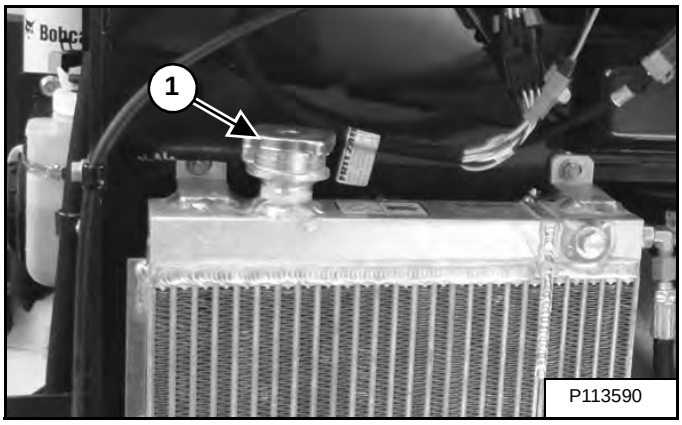
⚠ WARNING

AVOID BURNS

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

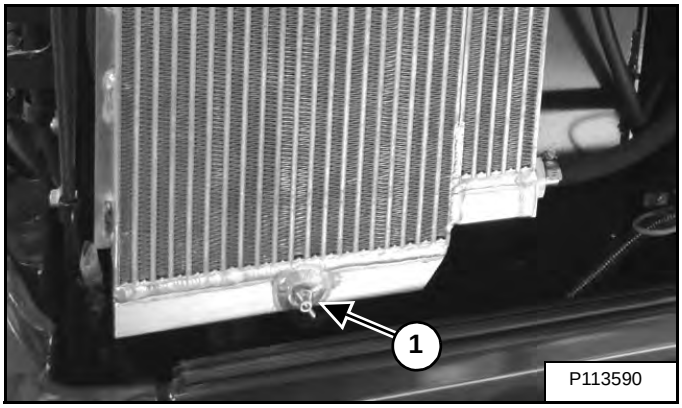
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Figure 10-100-3



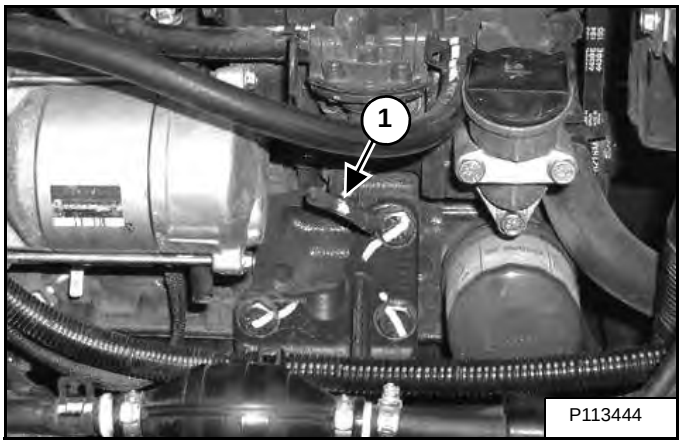
When the engine is cool, loosen and remove the coolant fill cap (Item 1) **[Figure 10-100-3]**.

Figure 10-100-4



Install a hose on the drain valve at the bottom of the radiator. Open the drain valve (Item 1) **[Figure 10-100-4]** and drain the coolant into a container.

Figure 10-100-5



Install a hose on the drain valve located at the engine block by the end of the started. Open the drain valve (Item 1) **[Figure 10-100-5]** and drain the coolant into a container.

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

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

Mix the coolant in a separate container. (See Capacities on Page SPEC-10-23.)

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

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

Add premixed coolant, 47% water and 53% propylene glycol to the coolant tank until the coolant level reaches the lower marker on the tank.

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

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

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

Close the tailgate.

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FUEL SYSTEM

Fuel Specifications

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

U.S. Standard (ASTM D975)

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

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

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

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

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

E.U. Standard (EN590)

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

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

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

Biodiesel Blend Fuel

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

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

Apply the following guidelines if biodiesel blend fuel is used:

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

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

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Filling The Fuel Tank

Figure 10-110-1



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

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

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

Install and tighten the fuel fill cap.

Clean up any spilled fuel.

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

NOTE: When filling the fuel tank, with the left console raised, turn the start switch to the ON position. As fuel is added to the tank, a buzzer will beep and the closer the tank gets to full, the quicker the beeps. When the tank is full, the buzzer will sound continuously. Stop fueling when buzzer sounds continuously. Turn the start switch OFF.

⚠ 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.

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⚠ WARNING

AVOID INJURY OR DEATH

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

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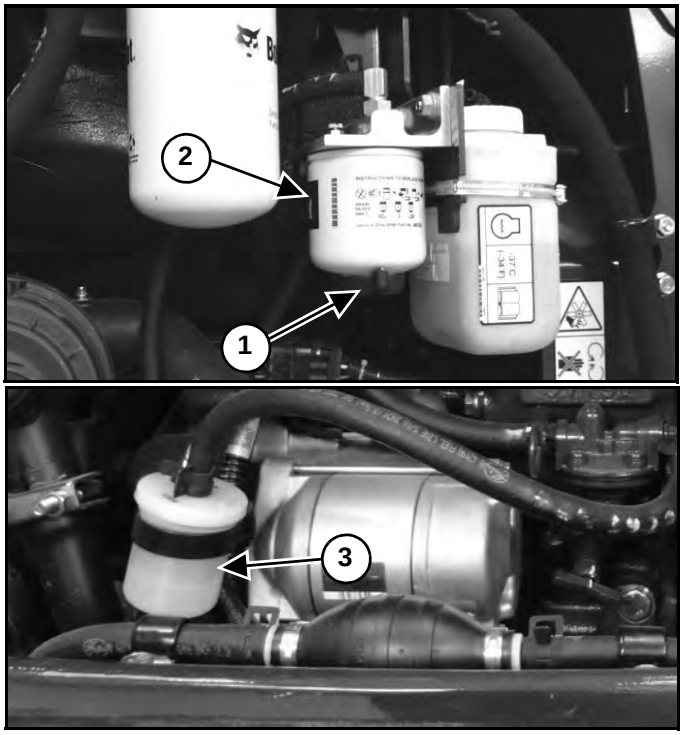
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Fuel Filter

Removing Water

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

Figure 10-110-2



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

Inspect the fuel pre-filter (Item 3) **[Figure 10-110-2]** daily for moisture and contamination. Replace as necessary.

Clean up any spilled fuel.

Replacing Elements

Remove and replace the fuel pre-filter (Item 3) **[Figure 10-110-2]**.

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

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

Remove the air from the fuel system. (See Removing Air From The Fuel System on Page 10-110-5.)

⚠ 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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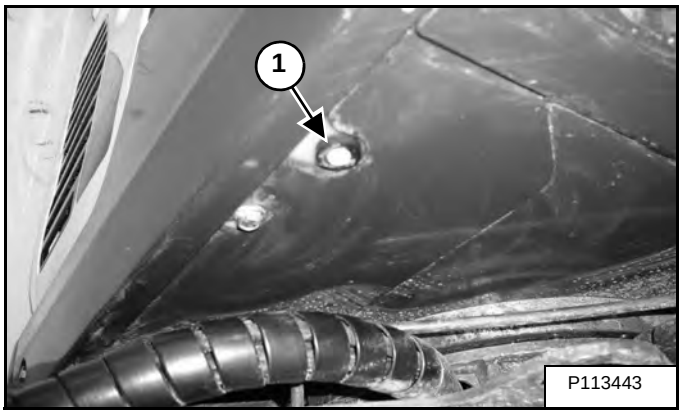
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Draining The Fuel Tank

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

The fuel tank can be drained in several ways. See below.

Figure 10-110-3



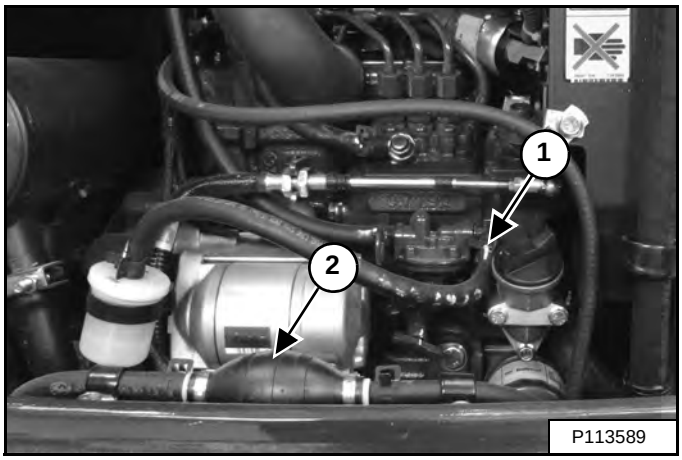
Rotate the upperstructure so the fuel tank drain plug (Item 1) is located between the rear tracks. Remove the drain plug (Item 1) **[Figure 10-110-3]**.

Drain the fuel into the container.

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

Reinstall the drain plug.

Figure 10-110-4



Second option for draining tank. Remove the fuel hose (Item 1) at the fuel pump. Route the hose out of the engine compartment and into a container. Squeeze the primer bulb (Item 2) **[Figure 10-110-4]** to start a siphon and drain the tank.

Reinstall the fuel hose (Item 1) **[Figure 10-110-4]**.

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Removing Air From The Fuel System

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

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

Figure 10-110-5

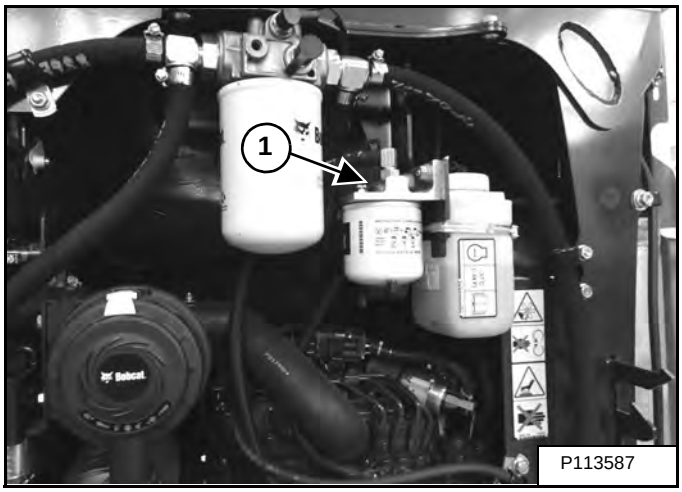
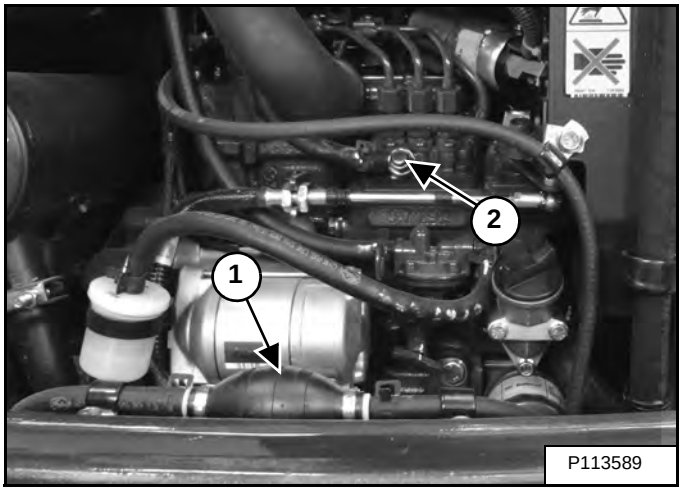


Figure 10-110-6



Open the fuel filter vent (Item 1) **[Figure 10-110-5]** and operate the hand pump (priming bulb) (Item 1) **[Figure 10-110-6]** until the fuel flows from the vent (Item 1) **[Figure 10-110-5]** with no air bubbles.

Close the vent (Item 1) **[Figure 10-110-5]**.

Start the engine. It may be necessary to open the vent (Item 2) **[Figure 10-110-6]** (at the fuel injection pump) briefly until the engine runs smoothly.

⚠ WARNING

AVOID INJURY OR DEATH

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

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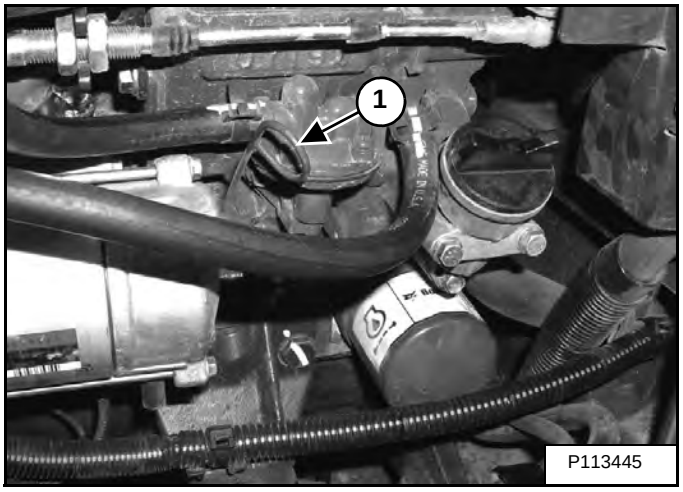
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ENGINE LUBRICATION SYSTEM

Checking And Adding Engine Oil

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

Figure 10-120-1



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

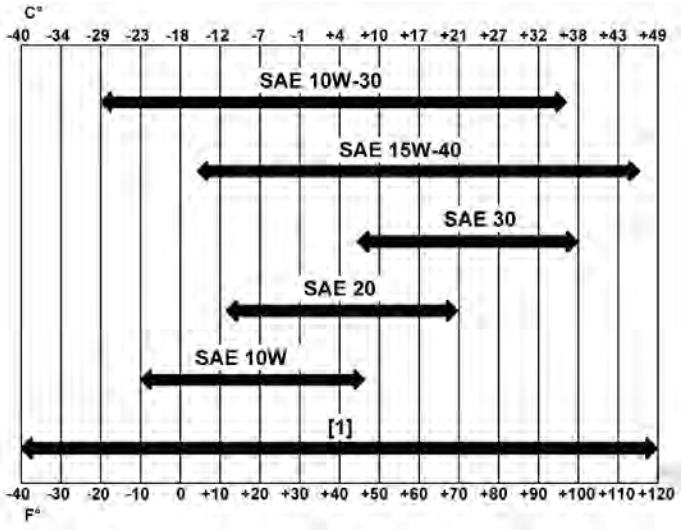
Keep the oil level between the marks on the dipstick.

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

Engine Oil Chart

Figure 10-120-2

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



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

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

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

⚠ WARNING

AVOID INJURY OR DEATH

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

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Removing And Replacing Oil And Filter

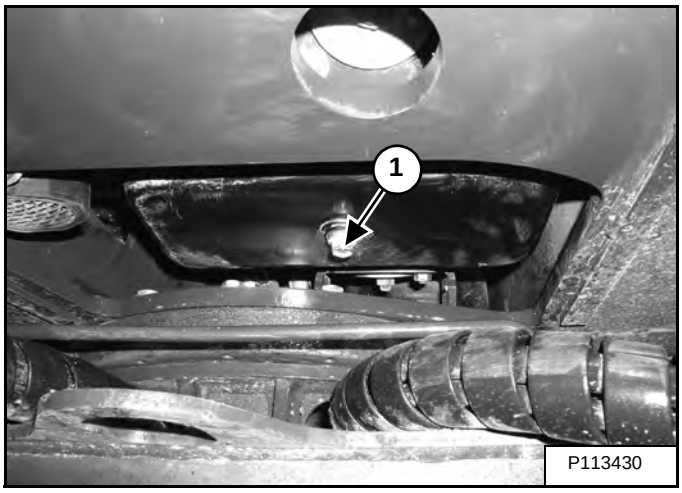
See the service schedule for the service interval for replacing the engine oil and filter. (See AIR CLEANER SERVICE on Page 10-80-1.)

Rotate upperstructure so that the oil drain plug is between the rear tracks.

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

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

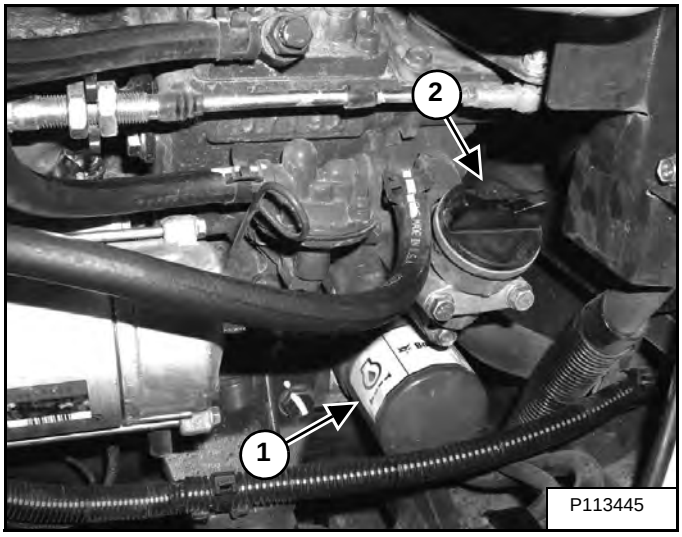
Figure 10-120-3



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

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

Figure 10-120-4



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

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

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

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

Put oil in the engine. (See Checking And Adding Engine Oil on Page 10-120-1.)

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

Start the engine and let it run for several minutes.

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

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

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HYDRAULIC SYSTEM

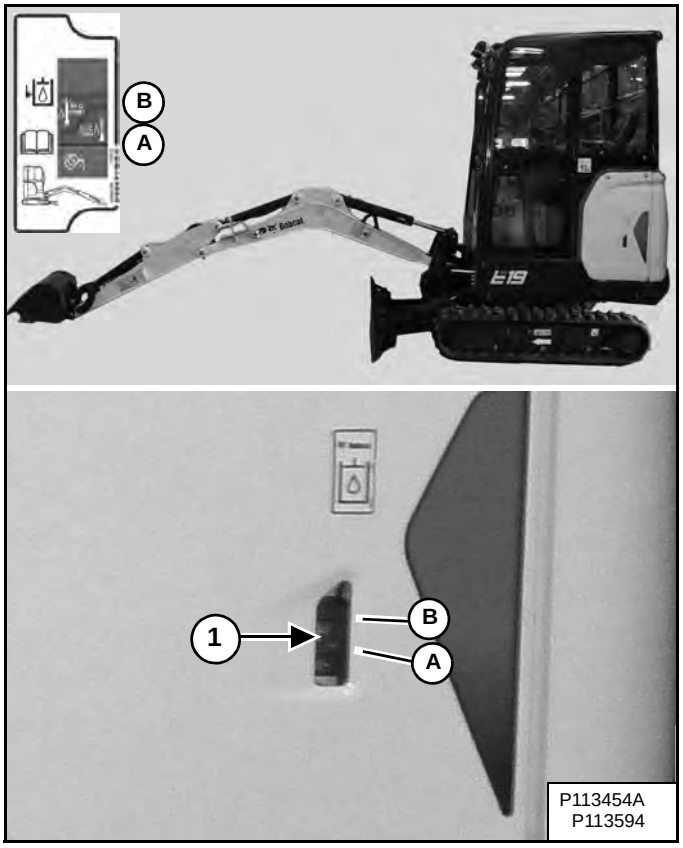
Checking And Adding Hydraulic Fluid

Put the machine on a flat level surface.

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

Open the right side cover. (See Opening And Closing on Page 10-50-1.)

Figure 10-130-1



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

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

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

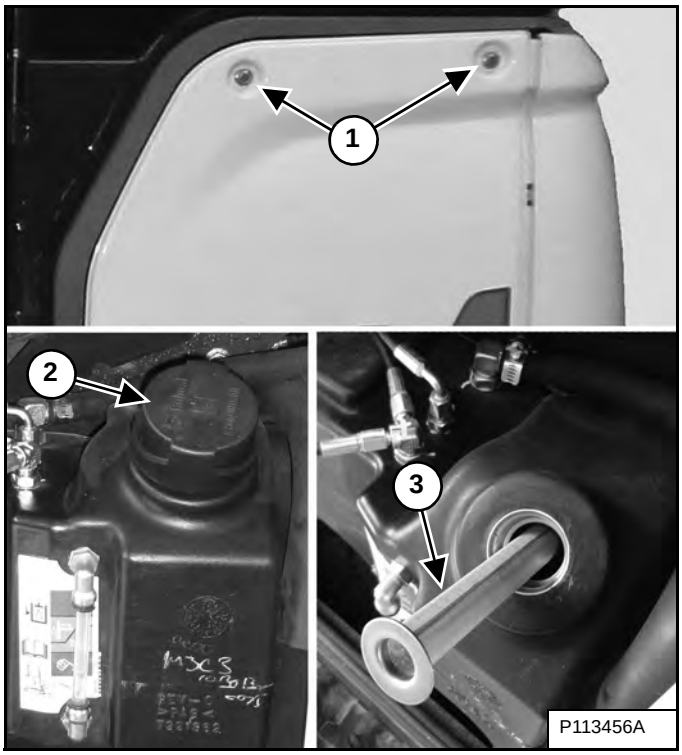
⚠ WARNING

AVOID INJURY OR DEATH

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

W-2103-0508

Figure 10-130-2



Remove the two screws (Item 1) **[Figure 10-130-2]** from the top of the left side cover and remove the cover.

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

Check the condition of the fill strainer screen (Item 3) **[Figure 10-130-2]**. Clean or replace as necessary.

Be sure the screen is installed before adding fluid.

Add the correct fluid to the reservoir until it is visible in the sight gauge.

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

Install the cap.

Close the right side cover and tailgate.

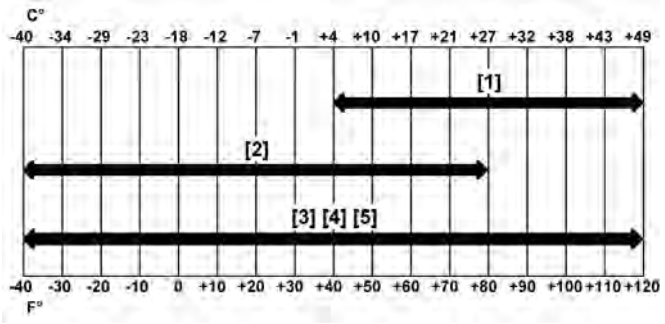
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Hydraulic / Hydrostatic Fluid Chart

Figure 10-130-3

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



TEMPERATURE RANGE ANTICIPATED DURING MACHINE USE

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

Install the fluid fill cap.

Removing And Replacing The Hydraulic Filters

WARNING

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

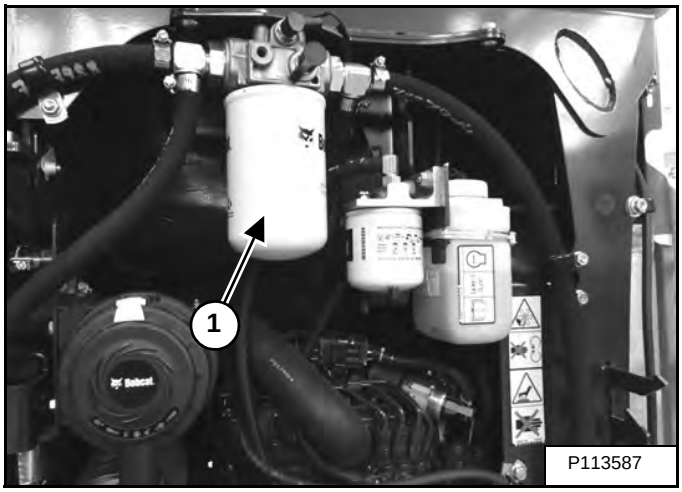
W-2103-0508

Hydraulic Filter

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

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

Figure 10-130-4



Remove the hydraulic filter (Item 1) **[Figure 10-130-4]**.

Clean the housing where the filter gasket makes contact.

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

WARNING

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

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Removing And Replacing The Hydraulic Fluid

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

⚠ WARNING

AVOID INJURY OR DEATH

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

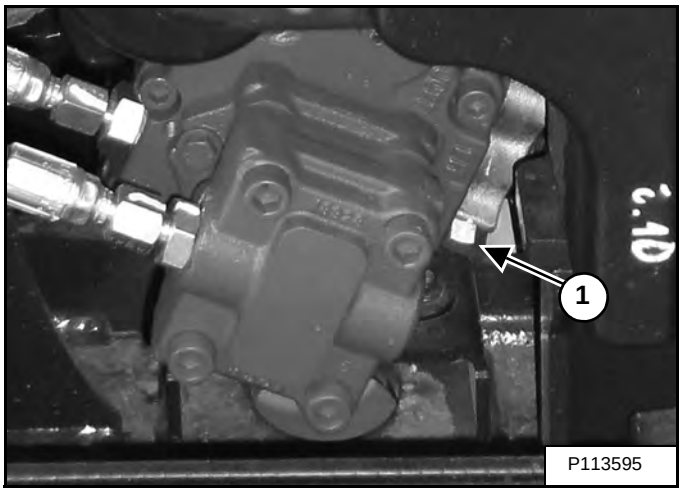
W-2072-0807

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

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

Remove left side cover **[Figure 10-130-2]**.

Figure 10-130-5



The hydraulic fluid drain plug (Item 1) **[Figure 10-130-5]** is located on the hydraulic pump inlet fitting.

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

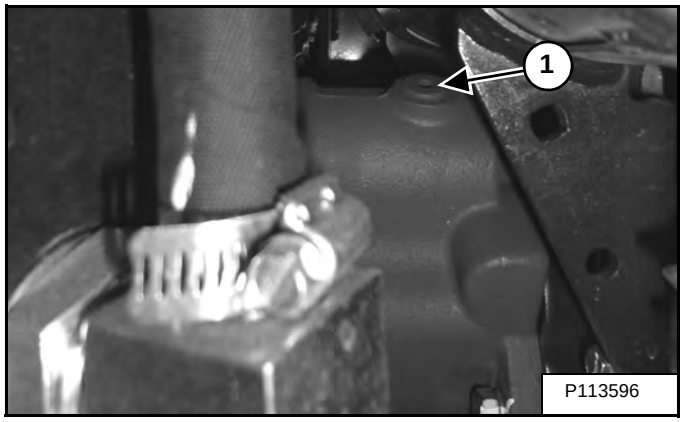
Drain the fluid into a container.

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

Install the plug (Item 1) **[Figure 10-130-5]**.

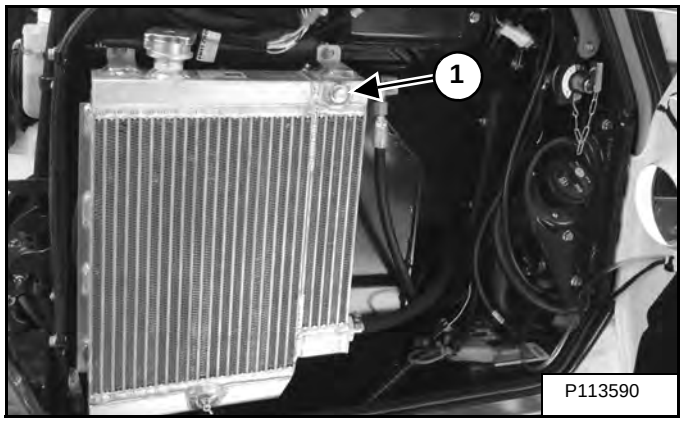
Add Fluid to the reservoir. (See Checking And Adding Hydraulic Fluid on Page 10-130-1.)

Figure 10-130-6



With the engine OFF, loosen the plug (Item 1) **[Figure 10-130-6]** on the hydraulic pump. Tighten the plug after a steady stream of hydraulic fluid, free of any air bubbles, drains from the plug. **DO NOT RUN THE MACHINE WITH THE PLUG OPEN.** Tighten the plug to 30 - 34 N•m (22 - 25 ft-lb) torque.

Figure 10-130-7



There is also a plug (Item 1) **[Figure 10-130-7]**. on the hydraulic cooler fore the bleeding air. Install a container under the plug and slowly loosen the plug until hydraulic fluid, free of air seeps from the plug. Tighten the plug.

Recycle or dispose of fluid in an environmentally safe manner.

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

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LUBRICATING THE EXCAVATOR

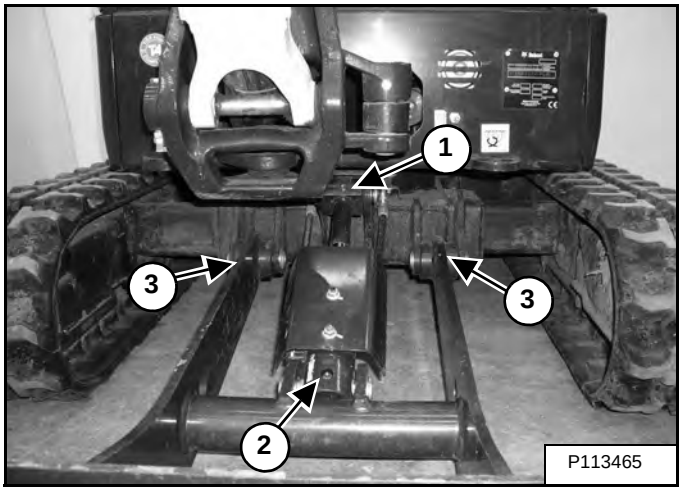
Lubrication Locations

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

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

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

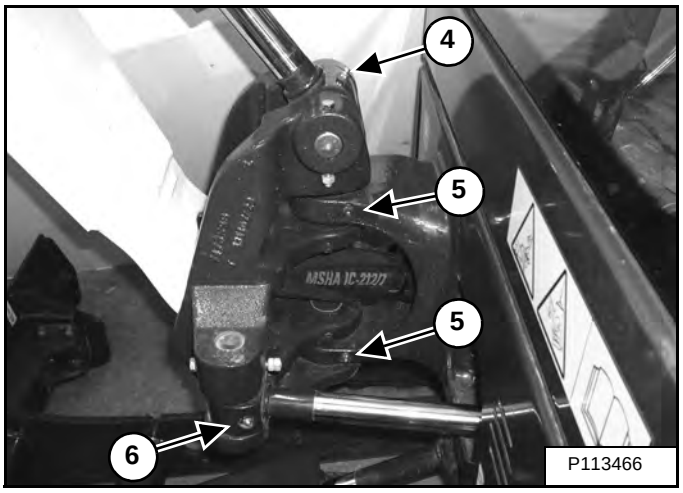
Figure 10-140-1



Ref Description (# of Fittings)

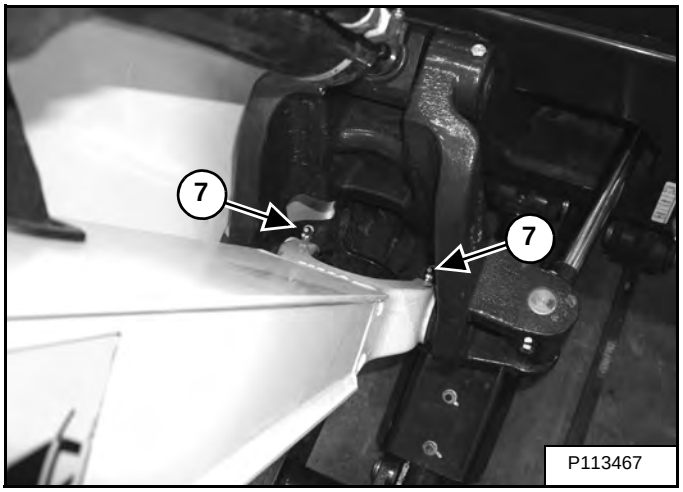
1. Blade Cylinder Rod End (1) **[Figure 10-140-1]**
2. Blade Cylinder Base End (1) **[Figure 10-140-1]**
3. Blade Pivots (2) **[Figure 10-140-1]**

Figure 10-140-2



4. Boom Cylinder Rob End (1) **[Figure 10-140-2]**
5. Boom Swing Pivot (3) **[Figure 10-140-2]**
6. Boom Swing Cylinder Rod End (1) **[Figure 10-140-2]**

Figure 10-140-3



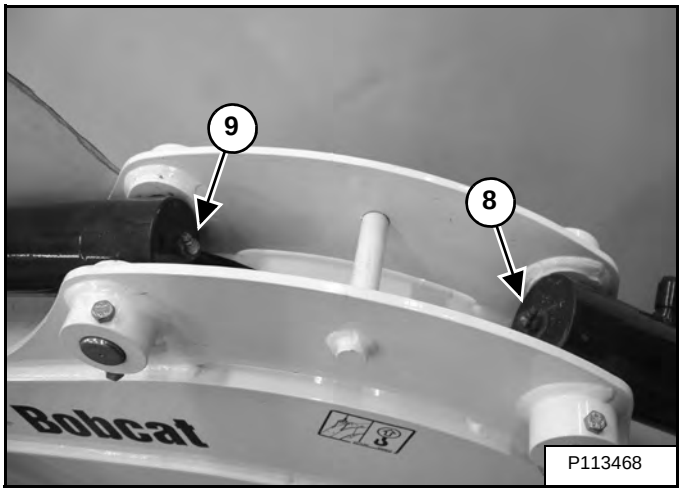
7. Boom Pivot (2) **[Figure 10-140-3]**

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Lubrication Locations (Cont'd)

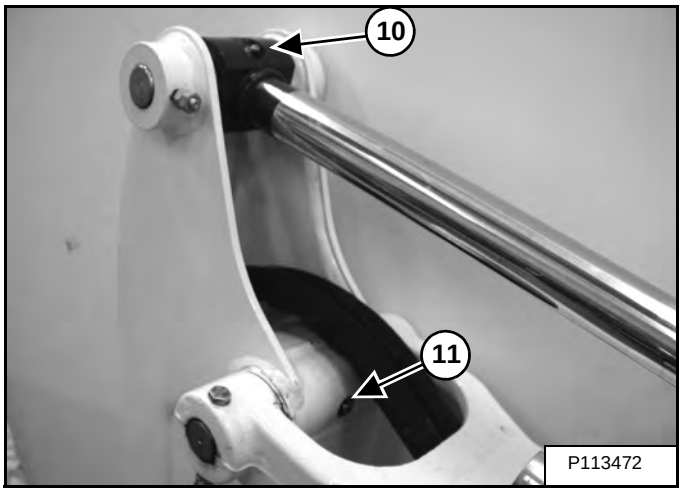
Figure 10-140-4



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

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

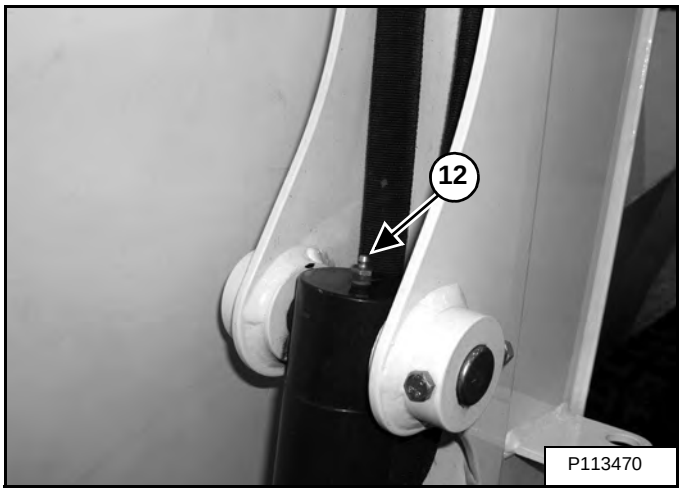
Figure 10-140-5



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

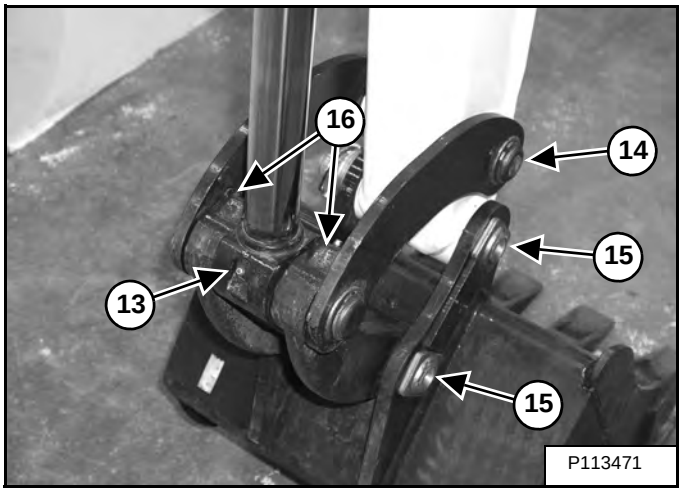
11. Arm Pivot (1) **[Figure 10-140-5]**

Figure 10-140-6



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

Figure 10-140-7



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

14. Bucket Link Pin (1) **[Figure 10-140-7]**

15. Bucket Pivot (2) **[Figure 10-140-7]**

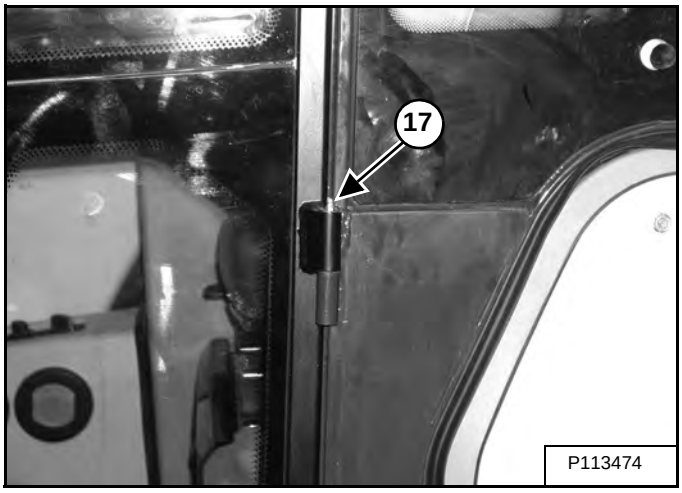
16. Bucket Link (2) **[Figure 10-140-7]**

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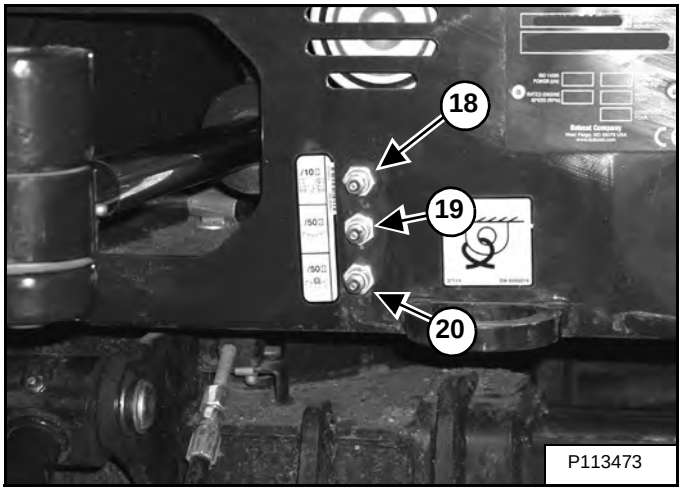
Lubrication Locations (Cont'd)

Figure 10-140-8



17. Cab Door hinges (3) **[Figure 10-140-8]** (If Equipped)

Figure 10-140-9



18. Boom Swing Cylinder Base (1) **[Figure 10-140-9]**

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

19. Slew Circle (1) **[Figure 10-140-9]**

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

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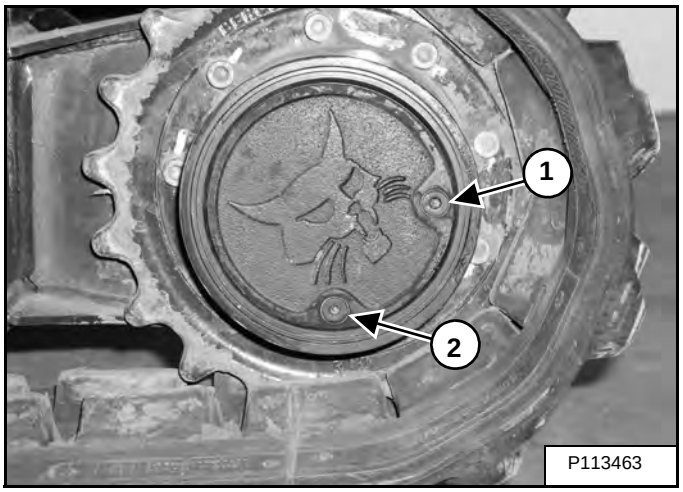
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TRAVEL MOTOR

Checking And Adding Fluid

Figure 10-150-1



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

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

Add lubricant (SAE 80W90) through the hole if the fluid level is low.

Removing And Replacing Fluid

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

Park the excavator on a level surface with plugs (Items 1 and 2) **[Figure 10-150-1]** in the position shown. Remove both plugs and drain the lubricant into a container.

WARNING

AVOID INJURY OR DEATH

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

W-2103-0508

Install the bottom plug (Item 2) **[Figure 10-150-1]**. Add fluid through the center plug hole until the fluid level is at the bottom edge of the hole.

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

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SPARK ARRESTER MUFFLER

Cleaning Procedure

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

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2050-0807

⚠ WARNING

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

W-2011-1285

IMPORTANT

This machine is factory equipped with a spark arrester exhaust system.

The spark arrester muffler, if equipped, must be cleaned to keep it in working condition. The spark arrester muffler must be serviced by dumping the spark chamber every 100 hours of operation.

On some models, the turbocharger functions as the spark arrester and must operate correctly for proper spark arrester function.

If this machine is operated on flammable forest, brush, or grass covered land, a spark arrester attached to the exhaust system may be required and must be maintained in working order. Refer to local laws and regulations for spark arrester requirements.

I-2284-EN-0909

⚠ WARNING

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

W-2068-1285

⚠ WARNING

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

Failure to do so can cause injury or death.

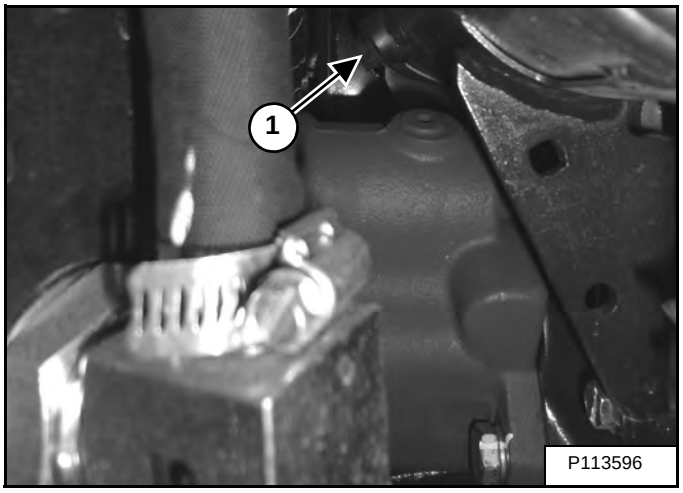
W-2203-0595

Do not operate the excavator with a defective exhaust system.

Stop the engine. Open the tailgate.

Remove the left side cover.

Figure 10-160-1



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

Start the engine and run for about 10 seconds while a second person, wearing safety glasses, holds a piece of wood over the outlet of the muffler. The carbon deposits will be forced out of the muffler plug hole (Item 1) **[Figure 10-160-1]**.

Stop the engine. Install and tighten the plug.

Close the tailgate.

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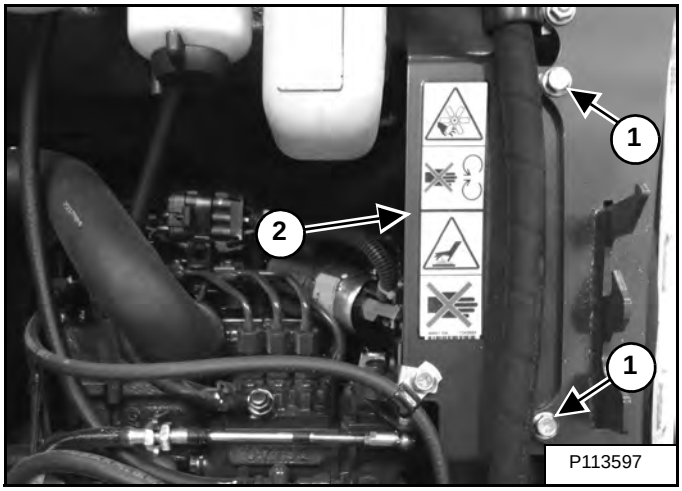
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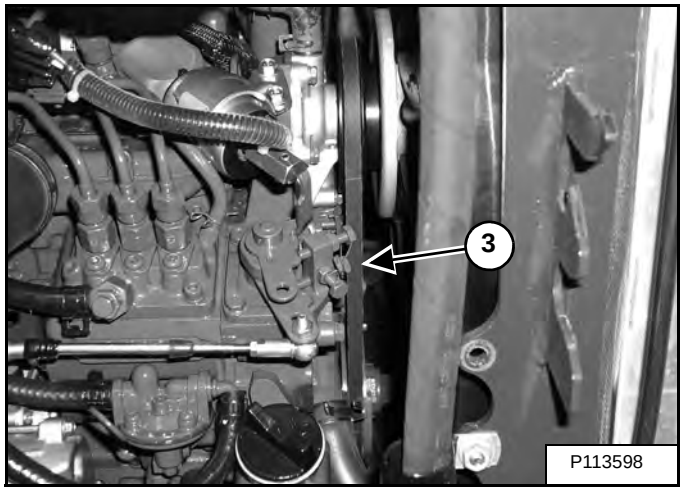
ALTERNATOR BELT

Belt Adjustment

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

Figure 10-170-1





Remove the two bolts (Item 1) and reposition the belt guard (Item 2) **[Figure 10-170-1]** out of the way.

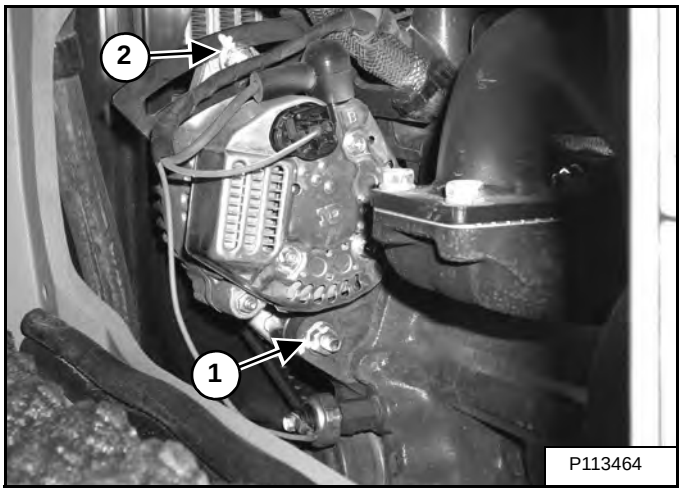
Measure the belt (Item 3) **[Figure 10-170-1]** tension at the middle of the belt span.

If a belt tension tool is available, the correct belt tension is; (new belt = 272 - 292 N [61 - 65 lbf] or used belt = 233 - 252 N [53 - 57 lbf]) tension.

If a belt tension tool is not available, the correct belt tension is; 8,0 mm (5/16 in) movement at the middle of the belt span with 66 N (15 lbf) of force.

Reinstall the belt guard (Item 2) and the two bolts (Item 1) **[Figure 10-170-1]**.

Figure 10-170-2



NOTE: The seat is shown removed for photo clarity. The tool box below the seat can be removed to access the engine from below the seat.

NOTE: The alternator adjusting bolts can be accessed by removing the belt guard (Item 2) [Figure 10-170-1] and reaching around the engine.

If the belt tension is not correct, loosen the bolt and nut (Item 1) and the bolt (Item 2) **[Figure 10-170-2]** until the alternator can be rotated for adjustment.

Adjust belt tension to correct specifications **[Figure 10-170-1]**.

Tighten the mounting and adjustment bolts. Recheck the belt tension to confirm it did not change while tightening the alternator bolts.

Reinstall the belt guard (Item 2) **[Figure 10-170-1]**.

Close the tailgate.

Belt Replacement

Loosen the bolt and nut (Item 1) and the bolt (Item 2) **[Figure 10-170-2]** until the alternator can be moved toward the engine.

Remove the old belt and install a new belt.

Adjust belt tension to correct specifications **[Figure 10-170-1]**.

Tighten the mounting and adjustment bolts. Recheck the belt tension to confirm it did not change while tightening the alternator bolts.

Reinstall the belt guard (Item 2) **[Figure 10-170-1]**.

Close the tailgate.

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SEAT BELT

Inspection And Maintenance

⚠ WARNING

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

W-2466-0703

Check the seat belt daily for correct function.

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

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

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

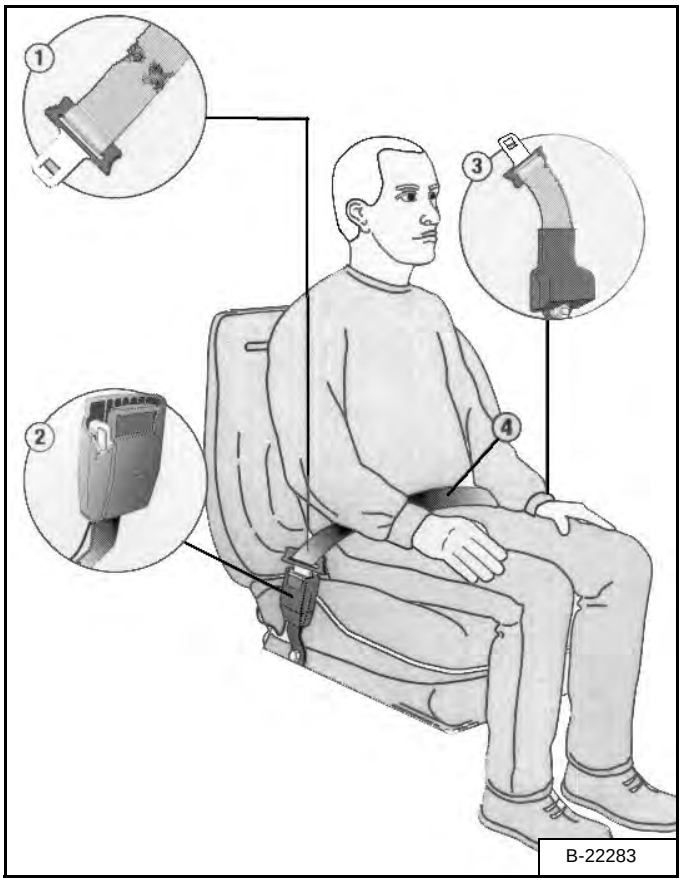
1. Check the webbing. If the system is equipped with a retractor, pull the webbing completely out and inspect the full length of the webbing. Look for cuts, wear, fraying, dirt and stiffness.

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

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

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

Figure 10-180-1



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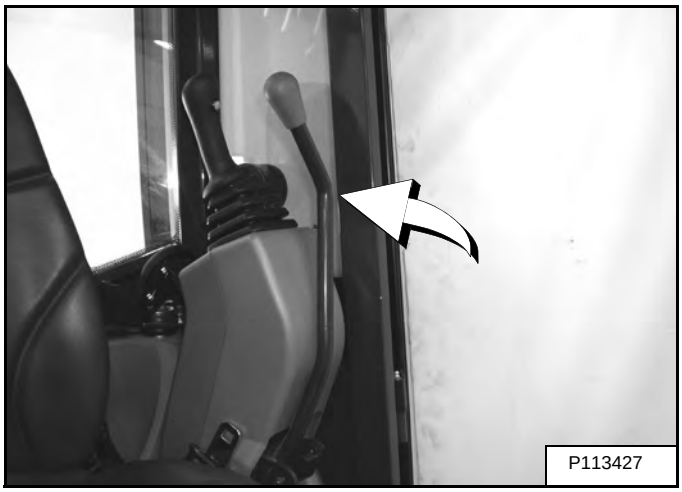
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CONTROL CONSOLE LOCKOUTS

Inspection And Maintenance

Figure 10-190-1



When the left console is raised **[Figure 10-190-1]**, the hydraulic control levers (joysticks) and traction system must not function.

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

Raise the left console **[Figure 10-190-1]**.

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

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

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

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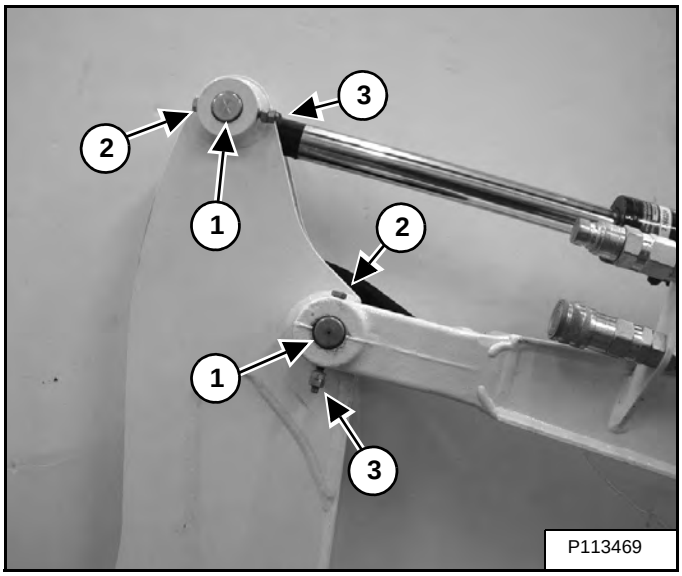
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PIVOT PINS

Inspection And Maintenance

Figure 10-200-1



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

The the two nuts (Item 3) are used as locknuts to hold the bolt (Item 2) with out tightening the bolt (Item 2) to the pin boss. After the nuts (Item 3) are tightened together, the bolt (Item 2) **[Figure 10-200-1]** should be free to spin.

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TOWING THE EXCAVATOR

Procedure

There is not a recommended towing procedure for the excavators.

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

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EXCAVATOR STORAGE AND RETURN TO SERVICE

Storage

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

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

Return To Service

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

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

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STOPPING THE ENGINE AND LEAVING THE EXCAVATOR

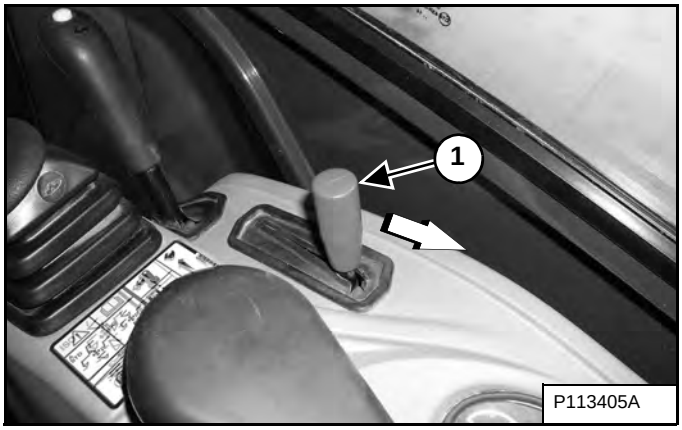
Procedure

Figure 10-230-1



Expand the tracks fully. Stop the machine on level ground. Lower the work equipment and the blade to the ground **[Figure 10-230-1]**.

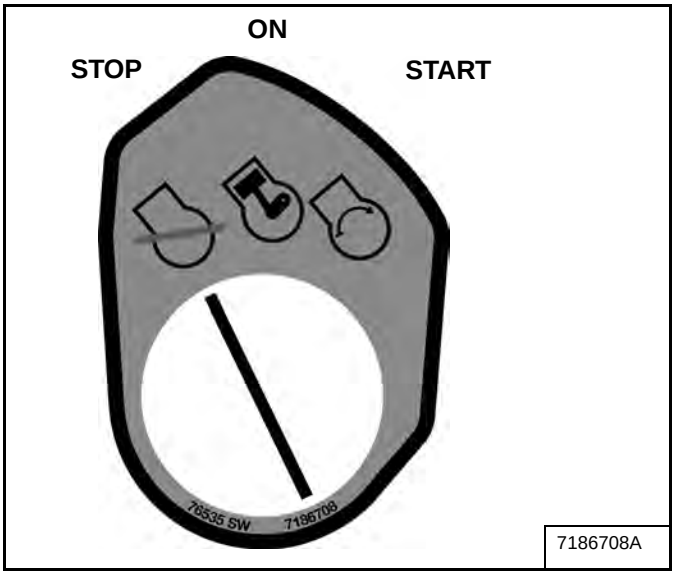
Figure 10-230-2



Move the engine speed control lever (Item 1) **[Figure 10-230-2]** back to low idle.

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

Figure 10-230-3



Turn the switch to STOP **[Figure 10-230-3]**.

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

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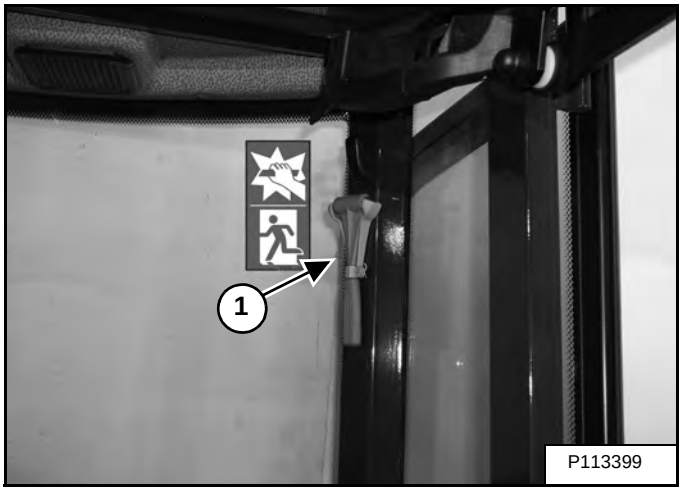
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EMERGENCY EXIT

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

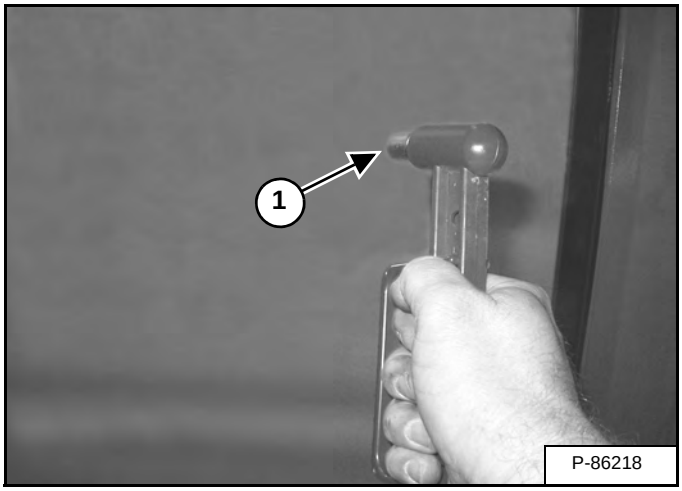
Side Or Rear Window

Figure 10-240-1



If emergency exit requires breaking a window, use the supplied hammer (Item 1) **[Figure 10-240-1]** located on the left rear side of the cab.

Figure 10-240-2



Remove the hammer from the storage position and strike the glass with the pointed end of the hammer **[Figure 10-240-2]**.

Use the hammer to remove broken glass from the edge of the window before exiting.

Front Window

Figure 10-240-3



Open the front window and exit **[Figure 10-240-3]**.

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

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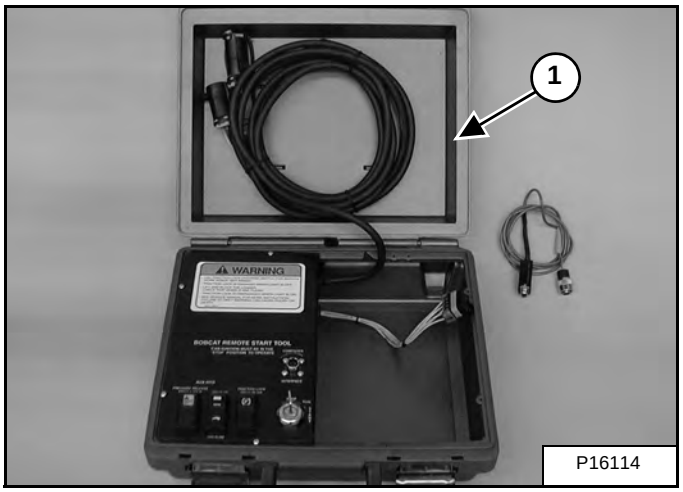
REMOTE START TOOL KIT - MEL1563

Remote Start Tool - MEL1563

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

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

Figure 10-250-1

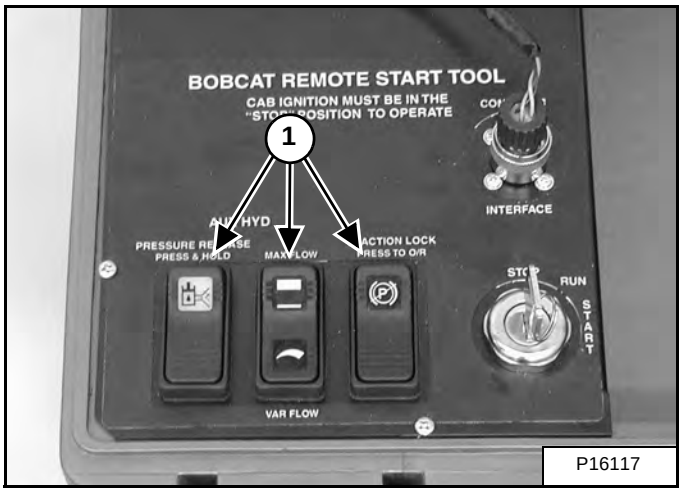


The Remote Start Tool (Item 1) **[Figure 10-250-1]** is used for excavators.

The Remote Start Tool is required when the service technician is checking the service codes.

Remote Start Tool is a link between the excavator and the Service PC.

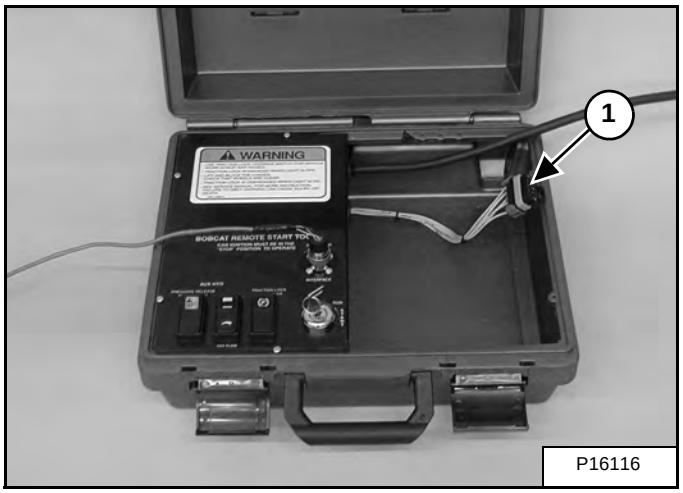
Figure 10-250-2



The three function buttons (Item 1) **[Figure 10-250-2]** are non-functional for excavators.

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

Figure 10-250-3



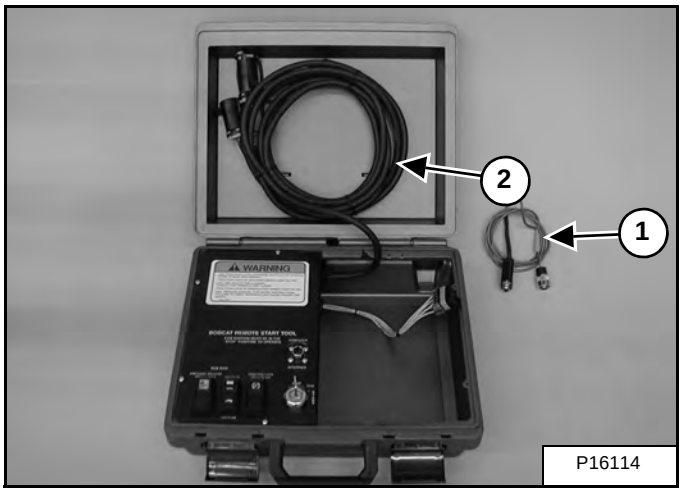
The 10-pin rectangular connector (Item 1) **[Figure 10-250-3]** is not used for an excavator application.

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Remote Start Tool - MEL1563 (Cont'd)

Figure 10-250-4



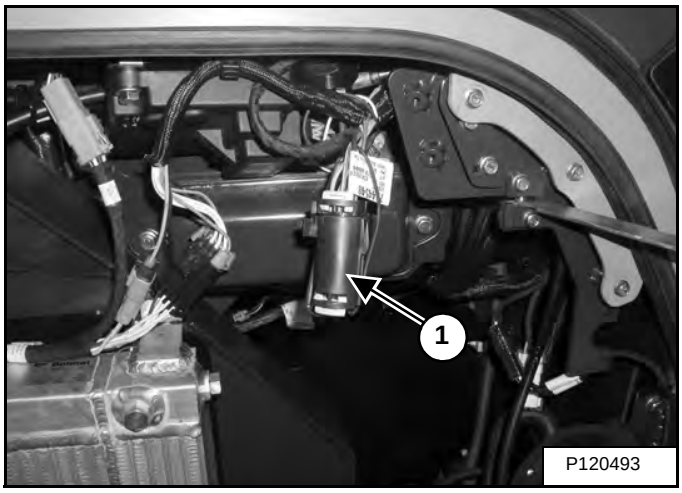
The service tool harness communicator (Item 1) **[Figure 10-250-4]** is used to connect the Remote Start Tool to the Service PC.

Remove the service tool harness (Item 2) **[Figure 10-250-4]** from the cover.

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

Open the right side cover.

Figure 10-250-5



Remove the plug (Item 1) **[Figure 10-250-5]** from the excavator harness connector.

Connect the service tool harness to the excavator harness.

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

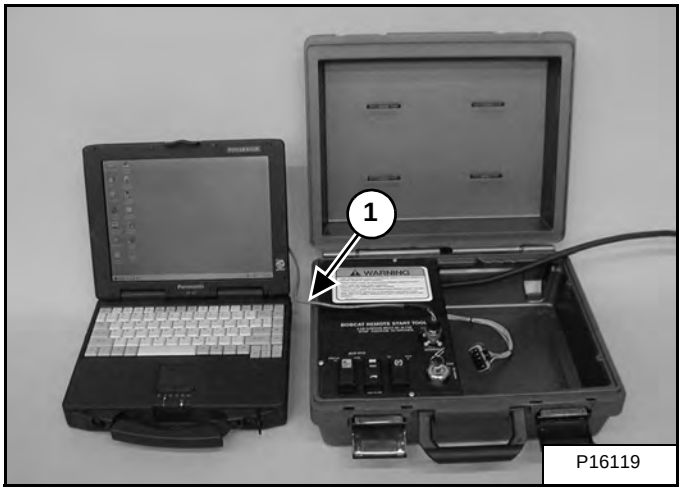
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Service Tool Harness Communicator - MEL1566

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

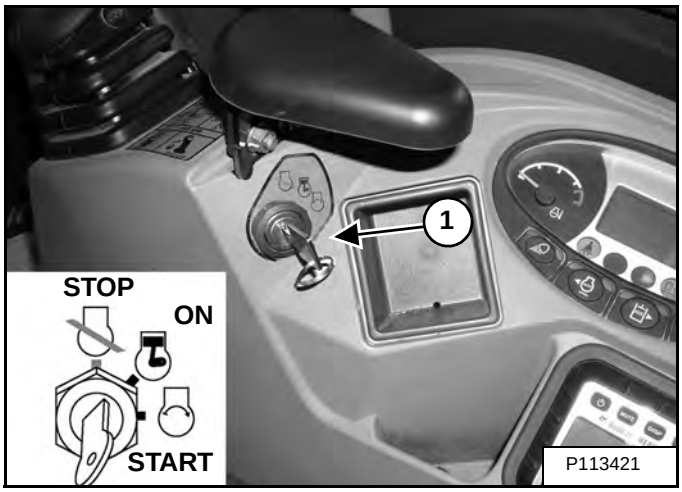
Figure 10-250-6



The Service Tool Harness Communicator (Item 1) **[Figure 10-250-6]** is required to connect the Service PC to the Remote Start Tool.

Key Switch

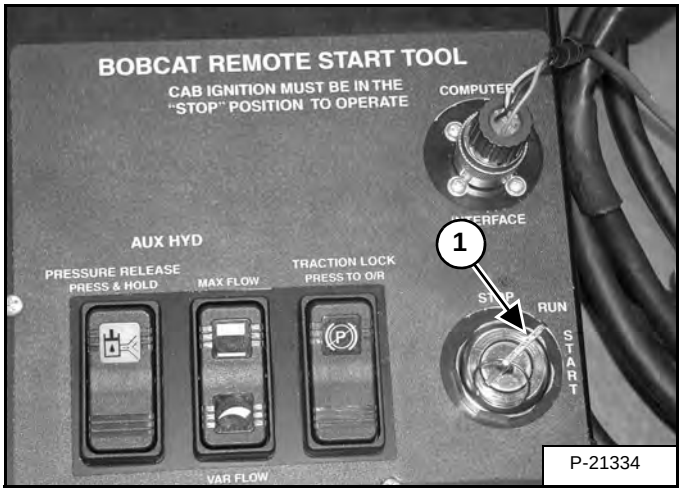
Figure 10-250-7



Turn the key (Item 1) **[Figure 10-250-7]** to the ON position on the excavator.

NOTE: DO NOT start the excavator.

Figure 10-250-8



Turn the key (Item 1) **[Figure 10-250-8]** to the RUN position on the Remote Start Tool.

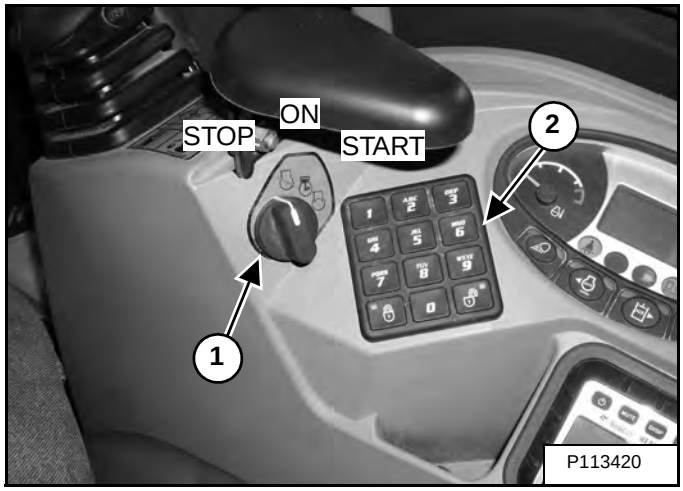
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Service Tool Harness Communicator - MEL1566 (Cont'd)

Keyless Start

Figure 10-250-9

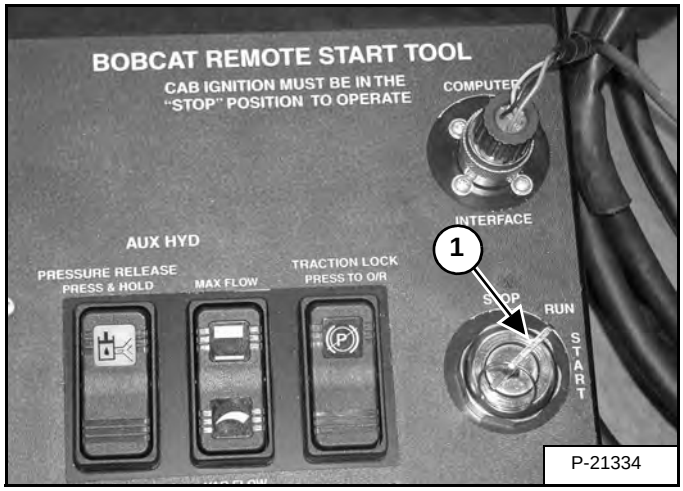


Turn the start switch (Item 1) **[Figure 10-250-9]** to ON. The indicator lights on the instrument panel will come ON briefly and the Instrument Panel / monitoring system will do a self test.

Use the keypad (Item 2) **[Figure 10-250-9]** to enter the password.

NOTE: DO NOT start the excavator.

Figure 10-250-10



Turn the key (Item 1) **[Figure 10-250-10]** to the RUN position on the Remote Start Tool.

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REMOTE START TOOL (SERVICE TOOL) KIT - 7217666

Description

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

The Remote Start Tool (Service Tool) Kit, P/N 7217666, can be used to service excavators using the supplied harness P/N 6689747.

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

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

Remote Start Tool (Service Tool) - 7022042

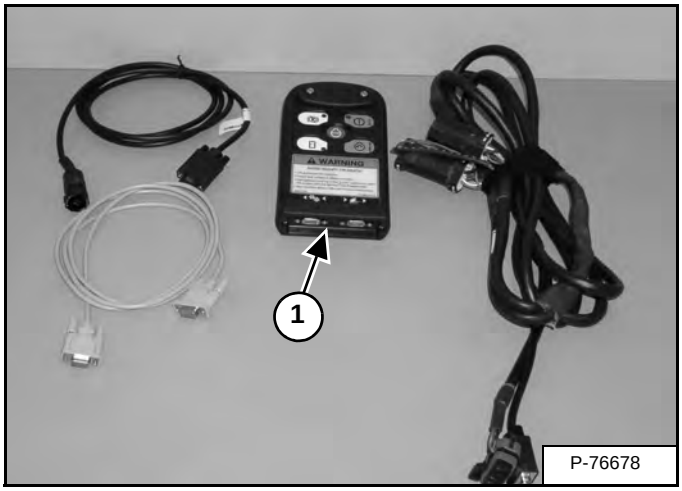
Tools that will be needed to complete the following steps are:

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

Kit Includes:

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

Figure 10-251-1

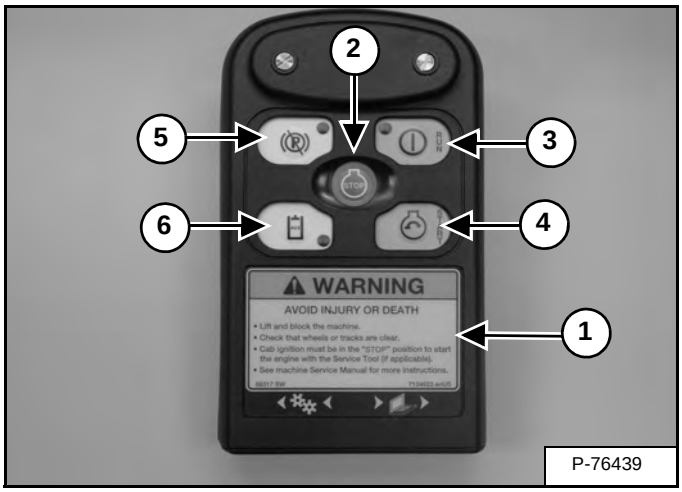


The Remote Start Tool (Item 1) **[Figure 10-251-1]** is used for excavators.

The Remote Start Tool is required when the service technician is checking the service codes.

Remote Start Tool is a link between the excavator and the Service PC.

Figure 10-251-2



The Remote Start Tool (Service Tool) (Item 1) **[Figure 10-251-2]** has five buttons.

The STOP button (Item 2) **[Figure 10-251-2]** is used to stop the Remote Start Tool (Service Tool) from communicating and stop the engine.

The RUN button (item 3) **[Figure 10-251-2]** is used to turn the Remote Start Tool (Service Tool) on and activates the electrical system. The button will illuminate to indicate the service tool is active.

The START button (Item 4 **[Figure 10-251-2]** is used to start the engine.

The traction lock button (Item 5) and the auxiliary button (Item 6) **[Figure 10-251-2]** is not used in excavator applications.

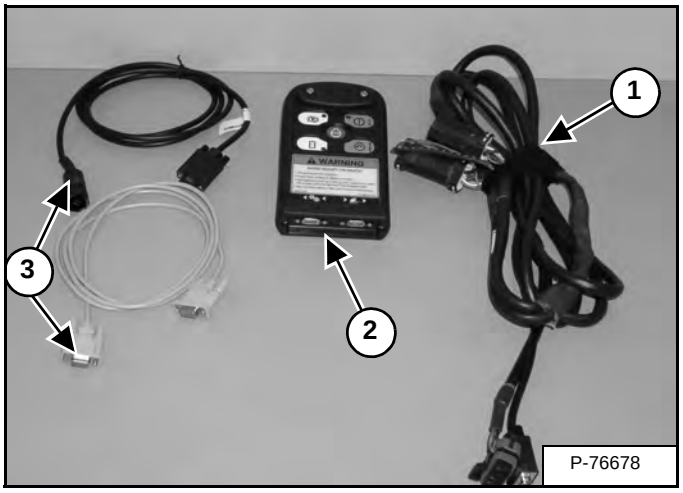
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REMOTE START TOOL (SERVICE TOOL) KIT - 7217666 (CONT'D)

Excavator Service Tool Harness - 6689747

Figure 10-251-3



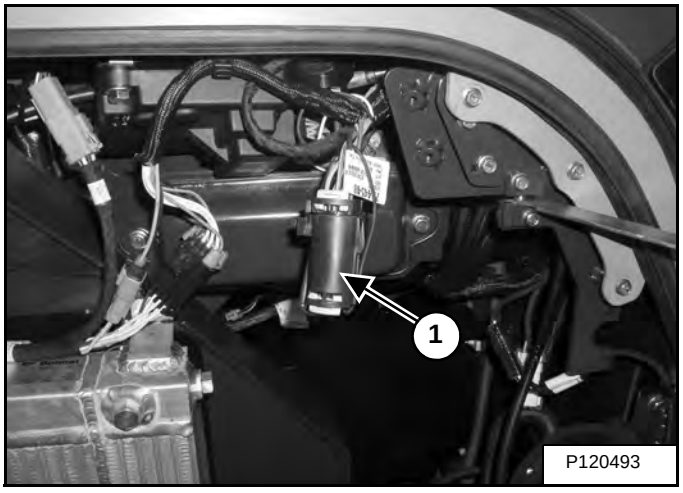
The service tool harness control (Item 1) **[Figure 10-251-3]** is used to connect the Remote Start Tool (Item 2) **[Figure 10-251-3]** to the electrical system on the excavator.

The service tool harness communicator (Item 3) **[Figure 10-251-3]** is used to connect the Remote Start Tool to the Service PC.

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

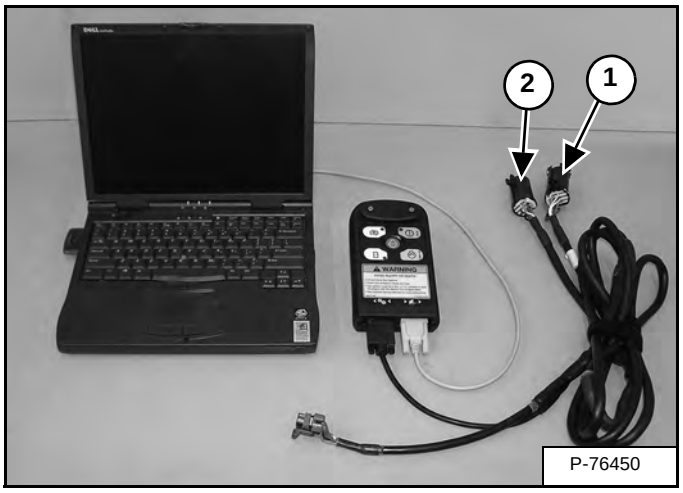
Open the right side cover.

Figure 10-251-4



Remove the plug (Item 1) **[Figure 10-251-4]** from the excavator harness connector.

Figure 10-251-5



NOTE: The Remote Start Tool (Service Tool) connection harness has two connectors (Item 1) and (Item 2). The main connector (Item 1) [Figure 10-251-5] is always used for connection to the excavator harness.

The second connector (Item 2) [Figure 10-251-5] is not used for excavator applications. This connector has a cap attached to it to prevent damage or corrosion when not in use.

Connect the Remote Start Tool (Service Tool) connector (Item 1) **[Figure 10-251-5]** to the excavator harness connector.

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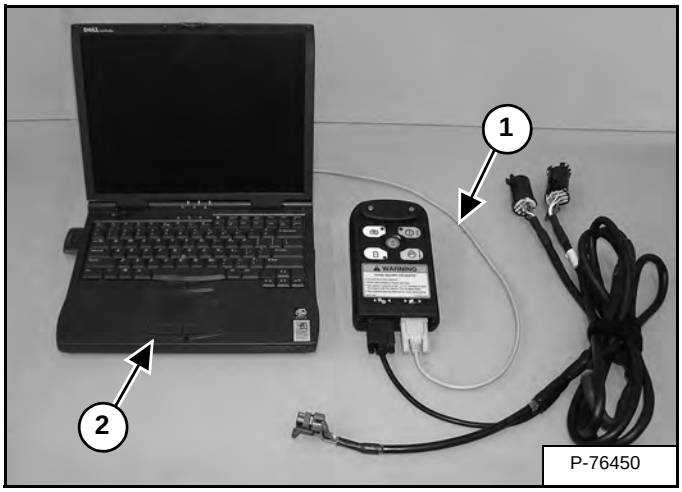
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REMOTE START TOOL (SERVICE TOOL) KIT - 7217666 (CONT'D)

Computer Service Tool Harness - 6689746

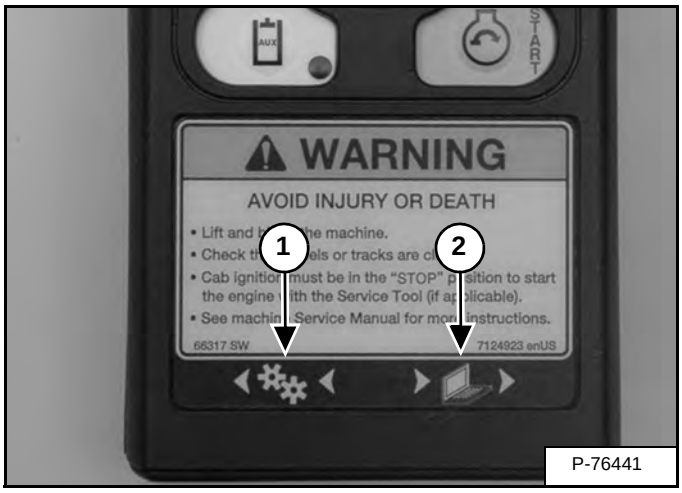
NOTE: To monitor, diagnose or load new software the Service PC must be connected to the Remote Start Tool.

Figure 10-251-6



The Computer Service Tool Harness (Item 1) **[Figure 10-251-6]** is required to connect Remote Start Tool (Service Tool) to the Service PC (Item 2) **[Figure 10-251-6]**.

Figure 10-251-7



The gear icon with the left facing arrows (Item 1) **[Figure 10-251-7]** will illuminate and blink when the excavator key is in the RUN position, excavator keyless panel is ON or the service tool is in the RUN position and the excavator is communicating with the service tool.

NOTE: DO NOT start the excavator.

The computer icon with the right facing arrows (Item 2) **[Figure 10-251-7]** will illuminate and blink when the Remote Start Tool (Service Tool) is transmitting data to and from the computer.

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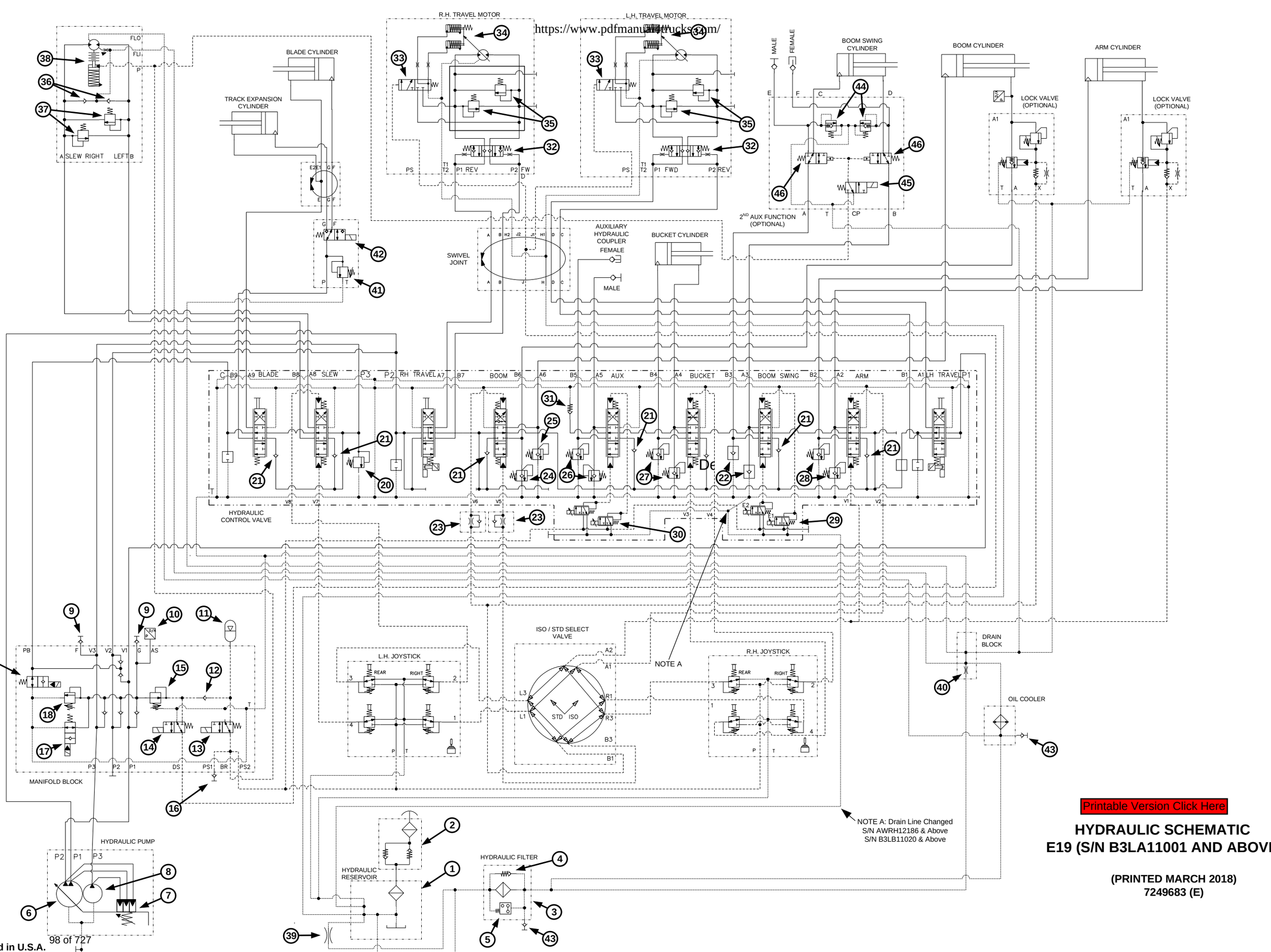
(PRINTED MARCH 2018)
V-1590legend

LEGEND

1. HYDRAULIC RESERVOIR: Pressurized with Fill Strainer
   Reservoir Capacity (at Site Gauge): 14.3 L (15.1 qt)
   System Capacity: 19.0 L (20.0 qt)
2. PRESSURIZED BREATHER/FILL CAP with FILTER:
   600 kPa (0.4 bar) (6 psi) – Outlet
   60 kPa (0.04 bar) (0.6 psi) - Inlet
3. HYDRAULIC FILTER ELEMENT 15 Micron
4. FILTER BY-PASS: 340 kPa (3.4 bar) (50 psi)
5. PRESSURE DIFFERENTIAL SWITCH
6. HYDRAULIC PISTON PUMP (2) . . . . . 15,0 Lpm (4.0 gpm) at High Engine RPM
7. TORQUE LIMITER
8. HYDRAULIC GEAR PUMP . . . . . 11,3 Lpm (3.0 gpm) at High Engine RPM
9. TEST PORT – Hydraulic Gear Pump P3
10. PRESSURE SENSOR – Auto Shift (If Equipped)
11. ACCUMULATOR
12. CHECK VALVE - Accumulator
13. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Work Group Lockout
14. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - Two Speed
15. PRESSURE REDUCING VALVE: 3200 kPa (32 bar) (464 psi)
16. TEST PORT – Pressure Reducing Valve
17. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – System By-Pass
18. RELIEF VALVE: 23100 kPa (231 bar) (3350 psi)
19. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Power Beyond
20. RELIEF VALVE: 20500 kPa (205 bar) (2973 psi)
21. CHECK VALVE
22. ANTI-CAVITATION VALVE
23. CHECK VALVE (2) - With 0,58 mm (0.023 in) Orifice
24. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Boom Cylinder): 25000 kPa (250 bar) (3650 psi)
25. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Boom Cylinder): 21000 kPa (210 bar) (3046 psi)
26. PORT RELIEF VALVE - (With Anti-Cavitation Valve) - (Auxiliary Pressure Port: 18000 kPa (180 bar) (2610 psi)
27. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (BUCKET Cylinder): 25000 kPa (250 bar) (3625 psi)
28. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (ARM Cylinder): 25000 kPa (250 bar) (3625 psi)
29. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Boom Offset
30. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Boom Offset
31. CHECK VALVE – with 1500 kPa (15 bar) (218 psi) spring
32. DRIVE MOTOR SHUTTLE – With 0,8 mm (0.032 in) restrictors
33. VALVE - Two Speed
34. PISTON - Two Speed
35. RELIEF VALVE: 24000 kPa (240 bar) (3480 psi)
36. ANTI-CAVITATION VALVE (2)
37. CROSSPORT RELIEF VALVE: 13700 kPa (137 bar) (1987 psi)
38. ORIFICE: 1,5 mm (0.06 in)
39. ORIFICE: 7,0 mm (0.276 in)
40. ORIFICE: 7,5 mm (0.295 in)
41. RELIEF VALVE (Optional): 24000 kPa 1(240 bar) (4206 psi)
42. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Track / Blade Expansion
43. AIR BLEED PORT

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

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HYDRAULIC SCHEMATIC
E19 (S/N B3LA11001 AND ABOVE)

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E19 HYDRAULIC/HYDROSTATIC SCHEMATIC
S/N B3LB11001 AND ABOVE
S/N AWMM11001 AND ABOVE

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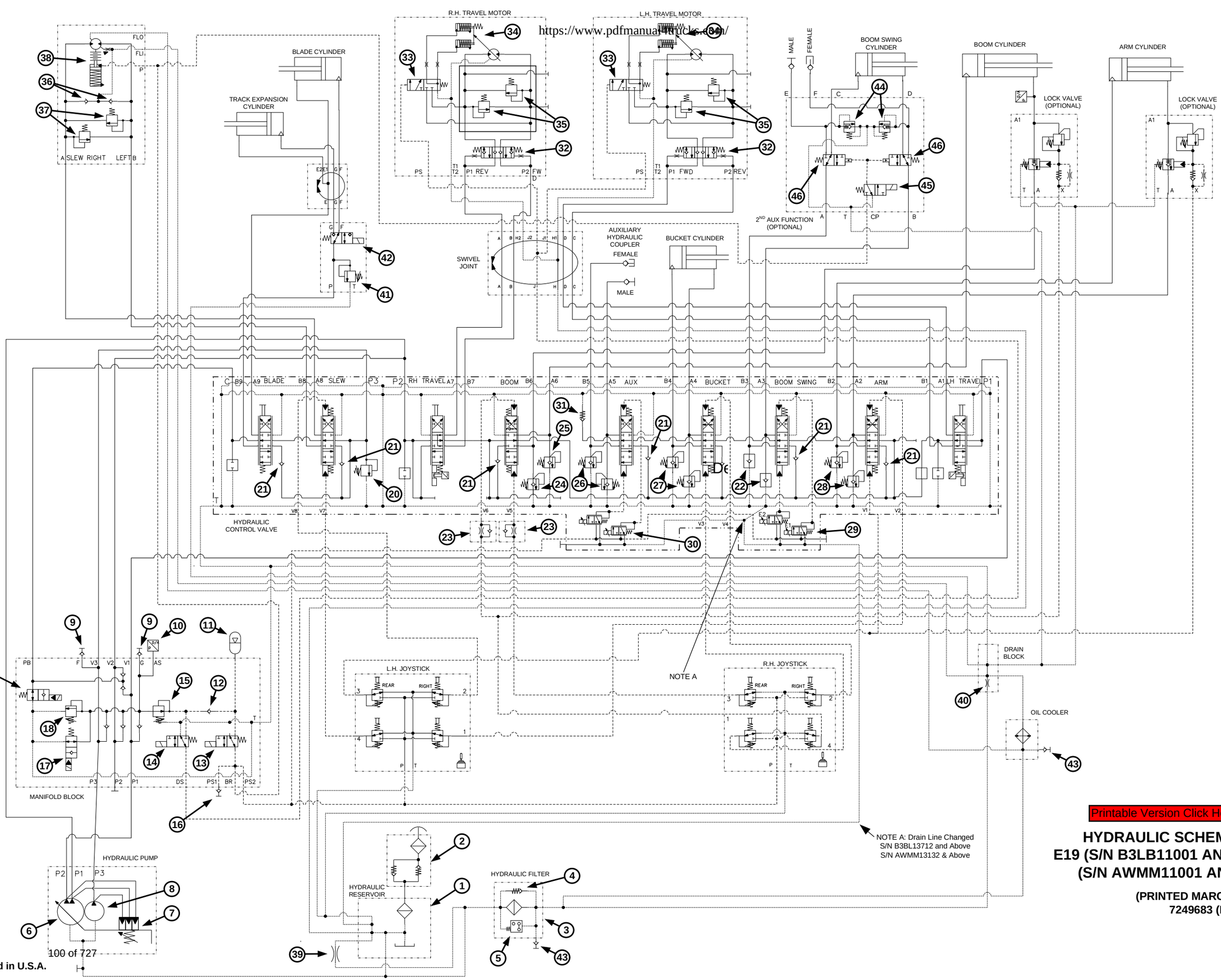
LEGEND

1. HYDRAULIC RESERVOIR: Pressurized with Fill Strainer
   Reservoir Capacity (at Site Gauge): 14.3 L (15.1 qt)
   System Capacity: 19.0 L (20.0 qt)
2. PRESSURIZED BREATHER/FILL CAP with FILTER:
   600 kPa (0.4 bar) (6 psi) – Outlet
   60 kPa (0.04 bar) (0.6 psi) - Inlet
3. HYDRAULIC FILTER ELEMENT 15 Micron
4. FILTER BY-PASS: 340 kPa (3.4 bar) (50 psi)
5. PRESSURE DIFFERENTIAL SWITCH
6. HYDRAULIC PISTON PUMP (2) . . . . . 15,0 Lpm (4.0 gpm) at High Engine RPM
7. TORQUE LIMITER
8. HYDRAULIC GEAR PUMP . . . . . 11,3 Lpm (3.0 gpm) at High Engine RPM
9. TEST PORT – Hydraulic Gear Pump P3
10. PRESSURE SENSOR – Auto Shift (If Equipped)
11. ACCUMULATOR
12. CHECK VALVE - Accumulator
13. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Work Group Lockout
14. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - Two Speed
15. PRESSURE REDUCING VALVE: 3100 kPa (31 bar) (450 psi)
16. TEST PORT – Pressure Reducing Valve
17. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – System By-Pass
18. RELIEF VALVE: 23100 kPa (231 bar) (3350 psi)
19. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Power Beyond
20. RELIEF VALVE: 20500 kPa (205 bar) (2973 psi)
21. CHECK VALVE
22. ANTI-CAVITATION VALVE
23. CHECK VALVE (2) - With 0,58 mm (0.023 in) Orifice
24. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Boom Cylinder): B3LB11001 – B3LB11009, AWMM11001 – AWMM12045; 25000 kPa (250 bar) (3650 psi)
    B3LB11010 & Above, AWMM12046 & Above; 27000 kPa (270 bar) (3915 psi)
25. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (Boom Cylinder): 21000 kPa (210 bar) (3046 psi)
26. PORT RELIEF VALVE - (With Anti-Cavitation Valve) - (Auxiliary Pressure Port: 18000 kPa (180 bar) (2610 psi)
27. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (BUCKET Cylinder): 25000 kPa (250 bar) (3625 psi)
28. PORT RELIEF VALVE (With Anti-Cavitation Valve) - (ARM Cylinder): 25000 kPa (250 bar) (3625 psi)
29. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Boom Offset
30. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Boom Offset
31. CHECK VALVE – with 1500 kPa (15 bar) (218 psi) spring
32. DRIVE MOTOR SHUTTLE – With 0,8 mm (0.032 in) restrictors
33. VALVE - Two Speed
34. PISTON - Two Speed
35. RELIEF VALVE: 24000 kPa (240 bar) (3480 psi)
36. ANTI-CAVITATION VALVE (2)
37. CROSSPORT RELIEF VALVE: 13700 kPa (137 bar) (1987 psi)
38. ORIFICE: 1,5 mm (0.06 in)
39. ORIFICE: 7,0 mm (0.276 in)
40. ORIFICE: 7,5 mm (0.295 in)
41. RELIEF VALVE (Optional): 24000 kPa 1(240 bar) (4206 psi)
42. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – Track / Blade Expansion
43. AIR BLEED PORT
44. RELIEF VALVE – 2nd Aux Option: 14000 kPa (140 bar) (2030 psi)
45. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – 2nd Aux Option
46. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE – 2nd Aux Option

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

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NOTE A: Drain Line Changed
S/N B3BL13712 and Above
S/N AWMM13132 & Above

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(S/N AWMM11001 AND ABOVE)

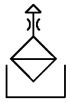
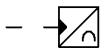
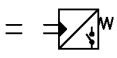
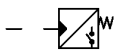
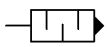
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Glossary Of Hydraulic / Hydrostatic Symbols

GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL	DESCRIPTION
FLOW LINES and CONNECTIONS	
———	WORKING CIRCUITS – Continuous, Solid Line – Working (Main) Line, Return Line (line conducting fluid from working devices to the reservoir) and Feed Line (main line conductor)
— —	PILOT PRESSURE – Dashed Line – Pilot Line (line which conducts control fluid)
- - - - -	DRAIN CIRCUITS – Dotted Line – Drain Line (drain or bleed line – line conducting fluid from a component housing to the reservoir)
———	COMPONENTS – Long Chain Line – Enclosure outline for several components assembled in one unit
═══	MECHANICAL CONNECTIONS – Double Line (Shaft, Lever, Piston Rod)
	CONNECTED JUNCTION OF OIL LINES (Flow Line Connection)
	OIL LINES CROSSING (NOT Connected)
	COUPLER – Quick–Acting Coupling (uncoupled, closed by non–return valve)
BASIC and MISCELLANEOUS SYMBOLS	
	RESTRICTION – Line with Fixed Restriction – Affected by Viscosity (property of resistance to flowing fluid)
	VARIABLE ADJUSTMENT RESTRICTION – Regulated or Variable Restriction
	TEMPERATURE CONTROL – (indication of temperature)
	TEMPERATURE INDICATOR – (temperature measurement – thermometer)
	FILTER (strainer or screen) – For fluid conditioning
	VENTED AND FILTERED RESERVOIR (reservoir open to atmosphere)
	OIL COOLER (heat exchanger) – The arrows in the diamond indicate the extraction of heat (heat dissipation)
	PRESSURE SENSOR – Varies electric signal with pressure
	DIFFERENTIAL PRESSURE SWITCH – Switch activates when pressure difference reaches specified level
	PRESSURE SWITCH – Switch activates when pressure reaches specified level
	MUFFLER (silencer) – Reduces noise

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Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL DESCRIPTION

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



DOUBLE ACTING HYDRAULIC CYLINDER, UNEQUAL DISPLACEMENT – With single piston rod



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

PUMP: To convert mechanical energy into hydraulic energy



FIXED CAPACITY DISPLACEMENT HYDRAULIC PUMP – With one direction of flow



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

MOTOR: To convert hydraulic energy into rotary mechanical energy



FIXED CAPACITY DISPLACEMENT BIDIRECTIONAL HYDRAULIC MOTOR – With two directions of flow (bidirectional)

SYMBOL DESCRIPTION

CONTROL MECHANISMS



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



CONTROL VALVE ACTIVATED BY A PULL BUTTON (manual)



CONTROL VALVE ACTIVATED BY A PUSH–PULL BUTTON (manual)



CONTROL VALVE ACTIVATED BY A LEVER (manual)



CONTROL VALVE ACTIVATED BY A PEDAL (manual)



CONTROL VALVE WITH SPRING RETURN (mechanical)



CONTROL VALVE ACTIVATED BY AN ELECTRIC SOLENOID (electrical)



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

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Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

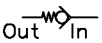
GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL DESCRIPTION

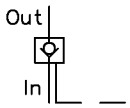
NON–RETURN VALVE, SHUTTLE VALVE: Valve which allows free flow in one direction only



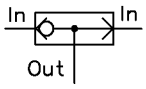
NON–RETURN VALVE (Check Valve) – Used as Replenishing Valve, Load Check Valve or Anticavitation Valve – Opens if the Inlet pressure is higher than the Outlet pressure. Often contains internal spring which has NO significant pressure value



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

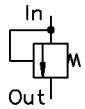


PILOT CONTROLLED NON–RETURN VALVE – It is possible to open the valve by pilot pressure

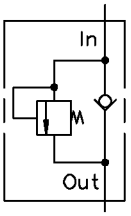


SHUTTLE VALVE – The Inlet port connected to the higher pressure is automatically connected to the Outlet port while the other Inlet port is closed

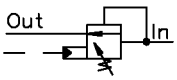
PRESSURE CONTROL VALVE: Valve ensuring the control of pressure



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



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

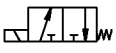


DUAL PRESSURE RELIEF VALVE – When the inlet pressure overcomes the opposing force of the spring, the valve opens permitting flow from the Outlet port. Pilot pressure provides a second pressure value.

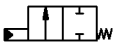
DIRECTIONAL CONTROL VALVE: Valve providing for the opening (fully or restricted) or the closing of one or more flow paths (represented by several squares)



TWO PORTS and CLOSED FLOW PATHS



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



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

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



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



TOW VALVE – Normally in closed position

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Troubleshooting The Hydraulic Circuit

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

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Troubleshooting The Cylinder Circuit

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

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Troubleshooting The Swing (Upperstructure Slew) Circuit

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

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Troubleshooting The Travel Circuit

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

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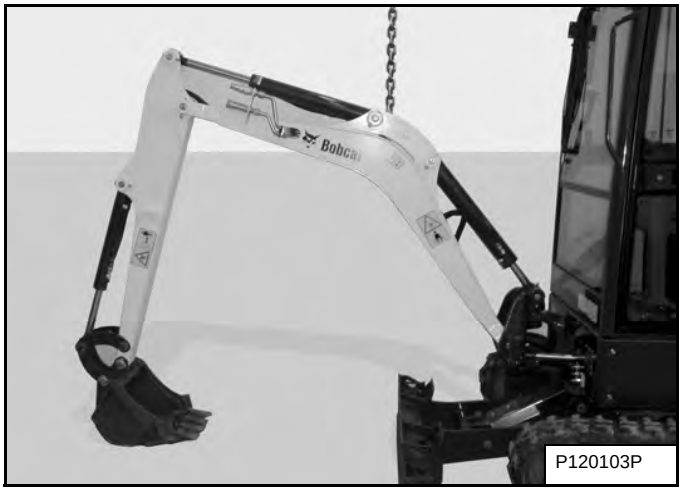
CYLINDER (BOOM)

Testing

Lower the boom / bucket and blade to the ground.

Stop the engine. Raise the control console.

Figure 20-20-1



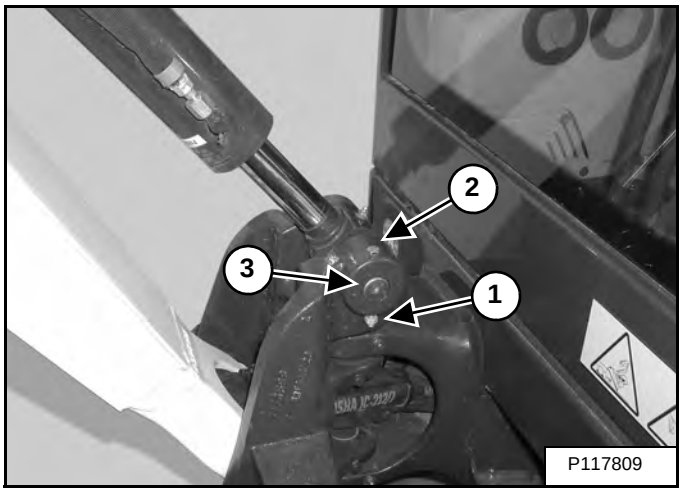
Support the boom using a chain hoist **[Figure 20-20-1]**.

Figure 20-20-2



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

Figure 20-20-3



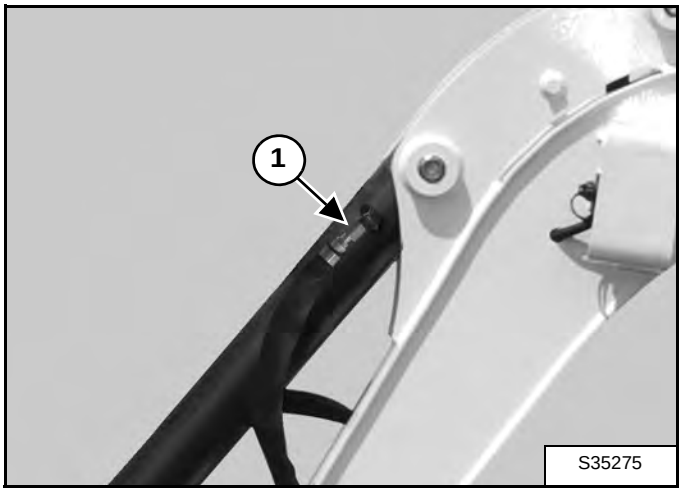
Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-20-3]** from the rod end pivot pin.

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

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

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

Figure 20-20-4



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

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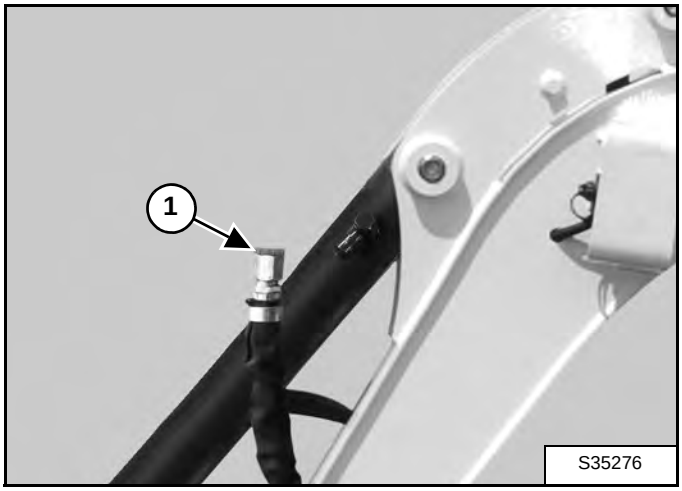
Testing (Cont'd)

⚠ WARNING

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

W-2145-0290

Figure 20-20-5



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

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

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

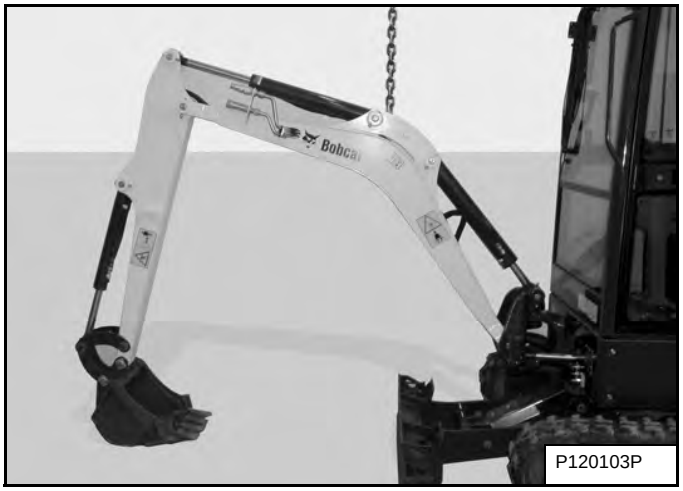
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Removal And Installation

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

Figure 20-20-6



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

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

IMPORTANT

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

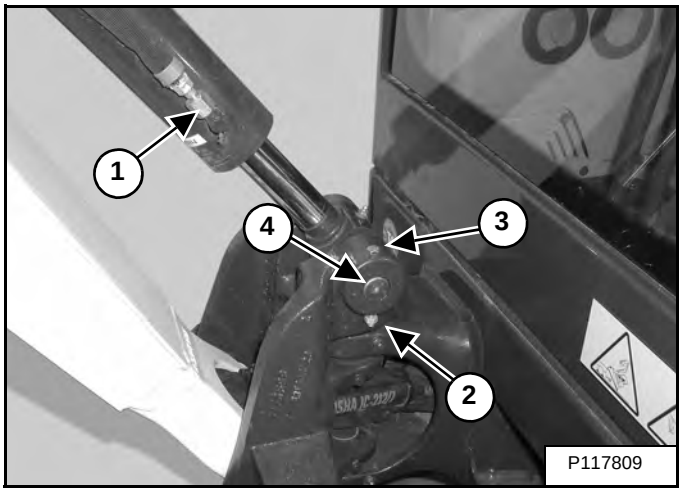
I-2003-0888

Figure 20-20-7



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

Figure 20-20-8



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

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

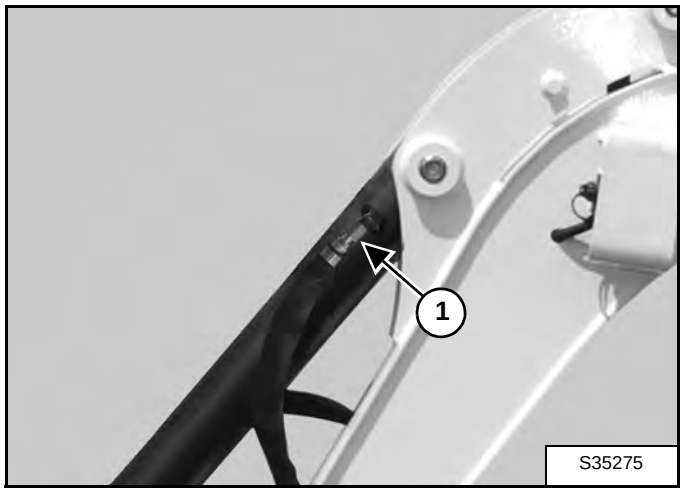
Remove the pivot pin (Item 4) **[Figure 20-20-8]**.

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Removal And Installation (Cont'd)

Figure 20-20-9



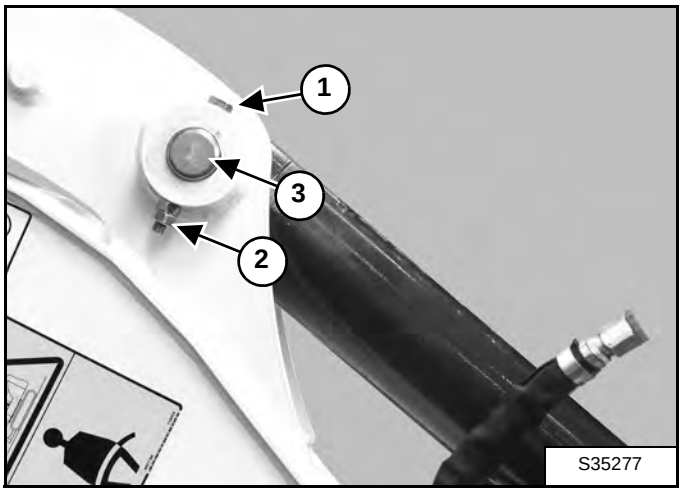
Disconnect the base end hose (Item 1) **[Figure 20-20-9]** from the cylinder.

IMPORTANT

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

I-2003-0888

Figure 20-20-10



Remove the bolt (Item 1) and nuts (Item 2) **[Figure 20-20-10]** from the boom cylinder base end pin.

Remove the boom cylinder base end pin (Item 3) **[Figure 20-20-10]**.

Remove the boom cylinder.

⚠ WARNING

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

W-2145-0290

⚠ WARNING

AVOID INJURY OR DEATH

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

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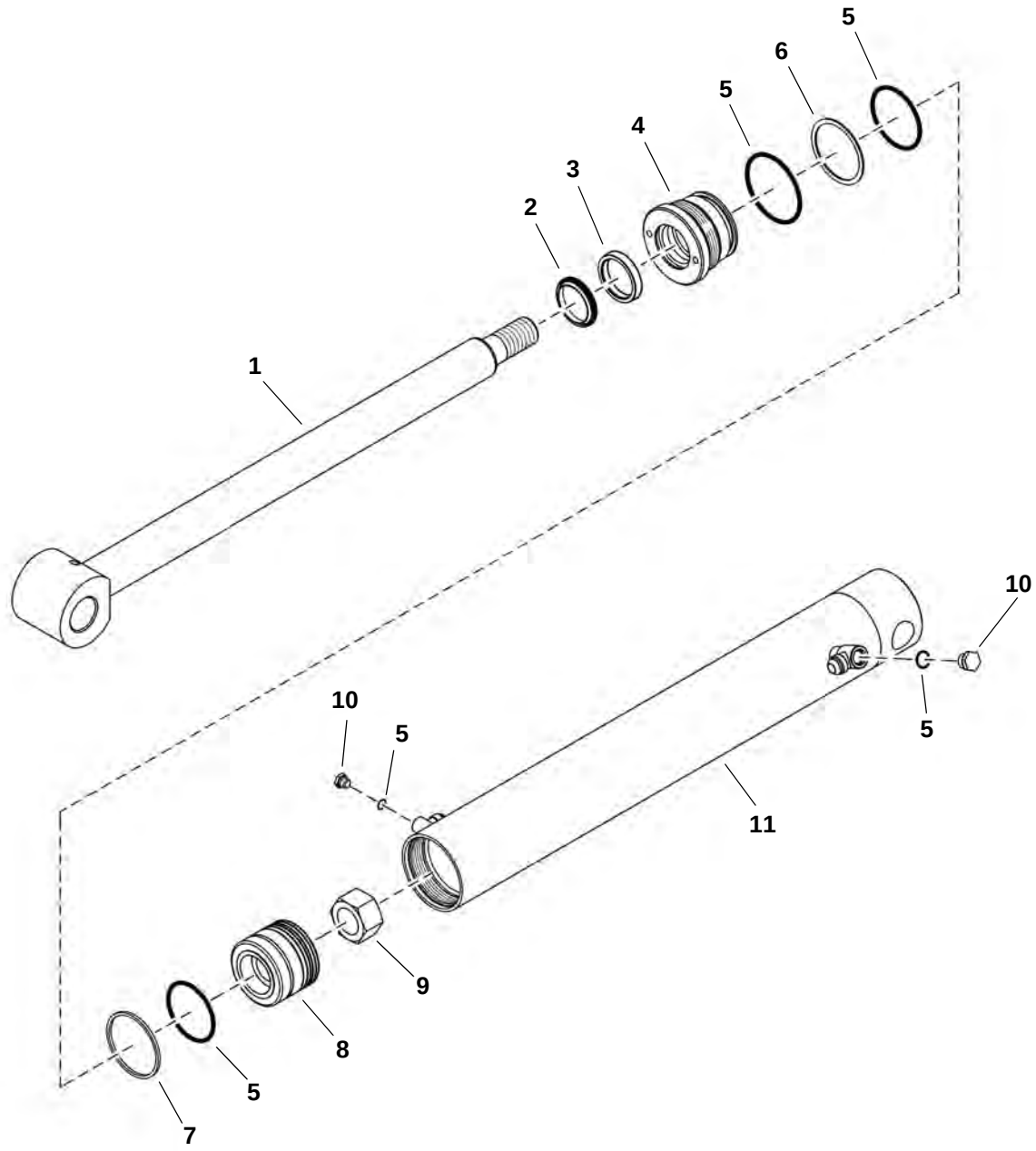
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CYLINDER (BOOM) (CONT'D)

Parts Identification

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



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Disassembly

Clean the outside of the cylinder before disassembly.

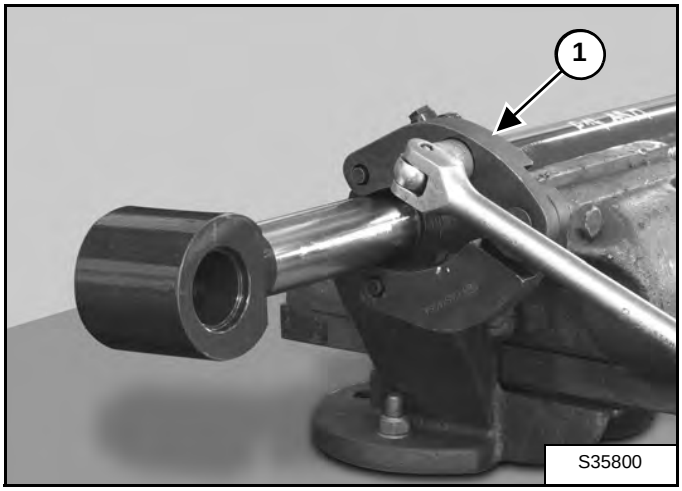
Use the following tools to disassemble the cylinder:

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

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

Put the base end of the cylinder in a vise.

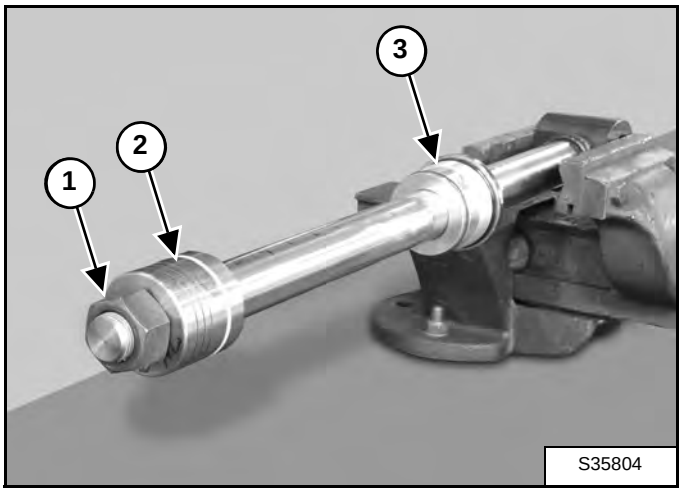
Figure 20-20-11



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

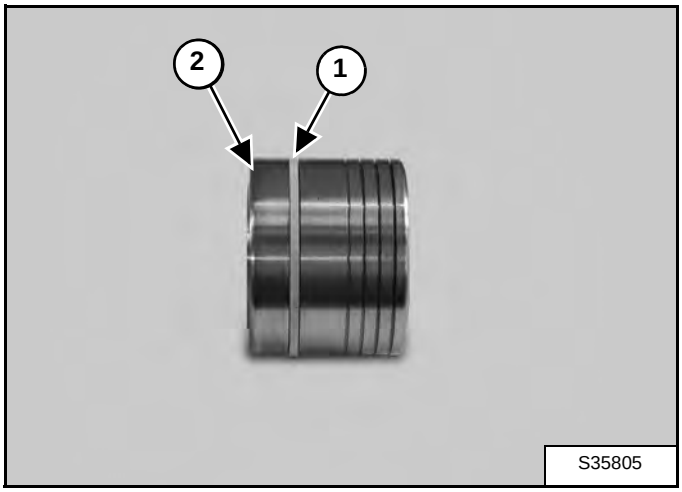
Remove the head and the rod assembly from the cylinder. Put the rod end in a vise.

Figure 20-20-12



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

Figure 20-20-13



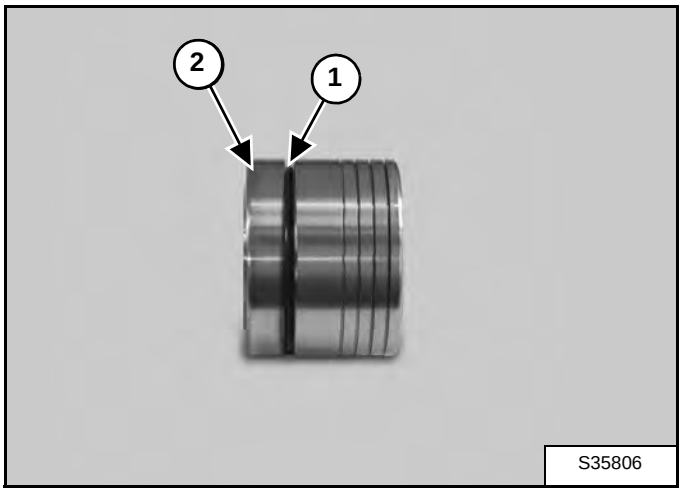
Remove the seal (Item 1) from the piston (Item 2) **[Figure 20-20-13]**.

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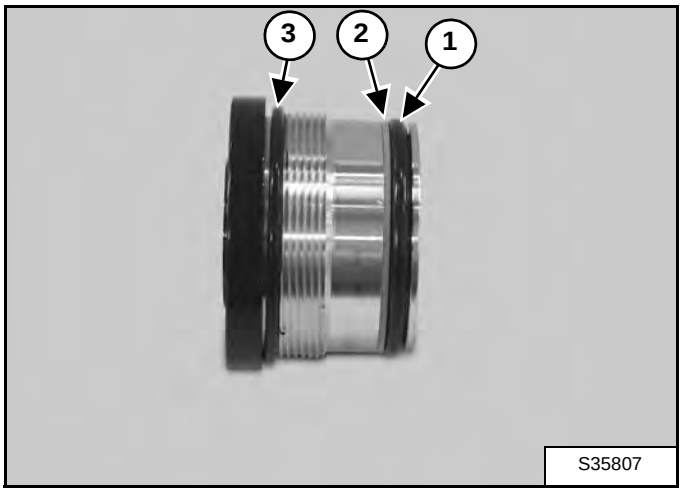
Disassembly (Cont'd)

Figure 20-20-14



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

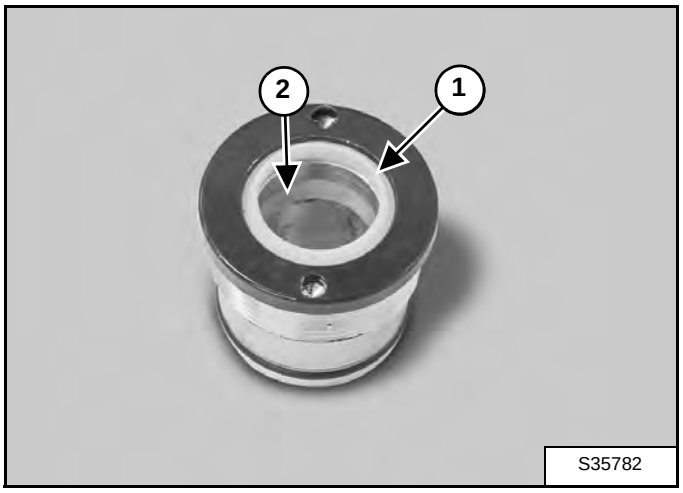
Figure 20-20-15



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

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

Figure 20-20-16



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

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Assembly

Use the following tools to assemble the cylinder:

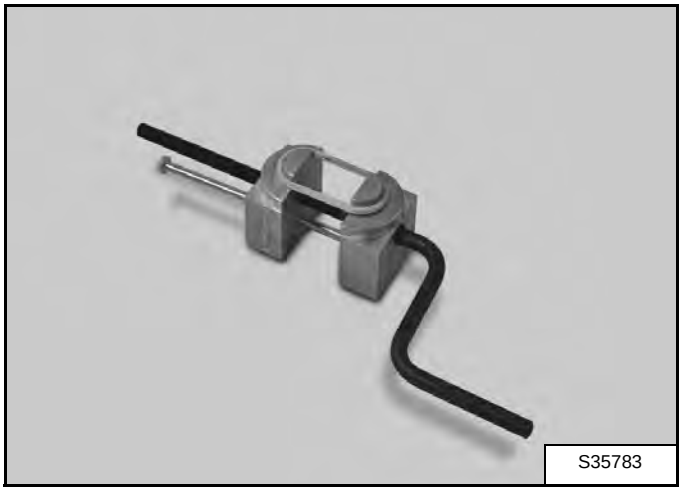
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

Clean all parts in solvent and dry with compressed air.

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

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

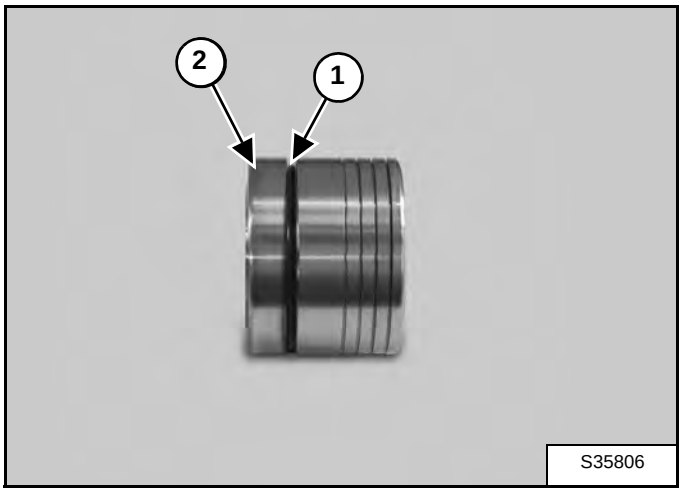
Figure 20-20-17



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

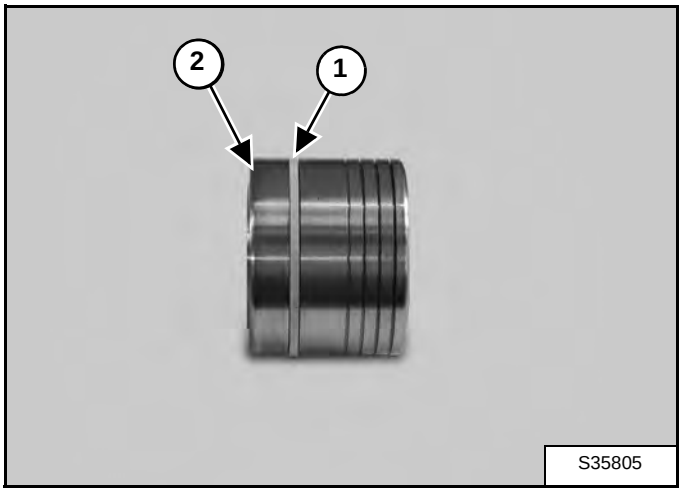
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-20-18



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

Figure 20-20-19



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

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Assembly (Cont'd)

Figure 20-20-20



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

Figure 20-20-21

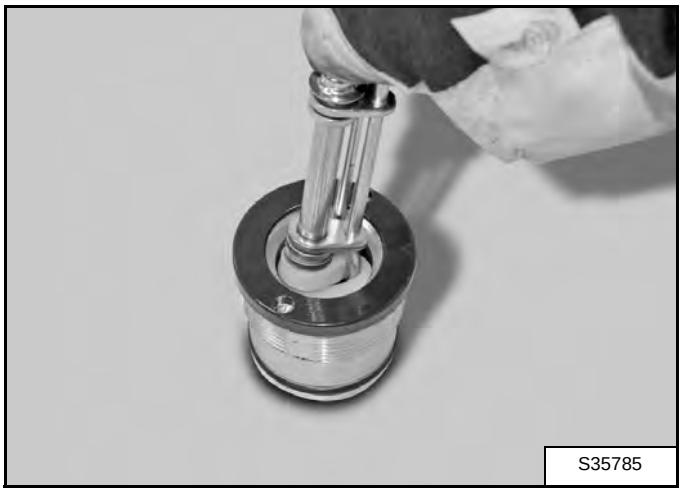


Install the rod seal on the rod seal tool **[Figure 20-20-21]**.

NOTE: Install the spring side of the seal toward the inside of the cylinder.

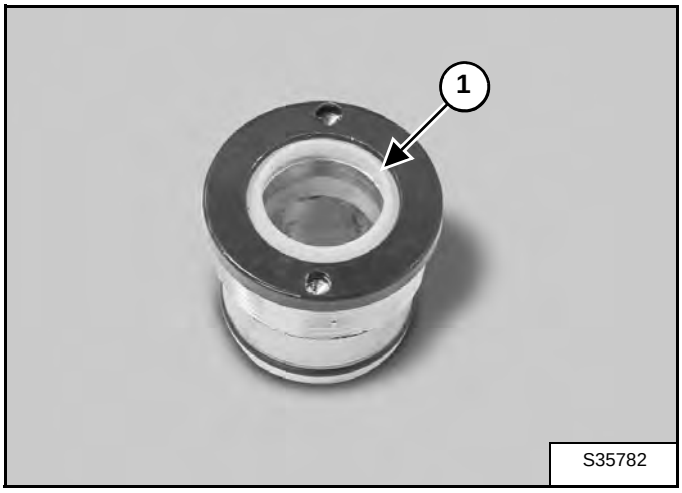
Rotate the handles to collapse the rod seal **[Figure 20-20-21]**.

Figure 20-20-22



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

Figure 20-20-23



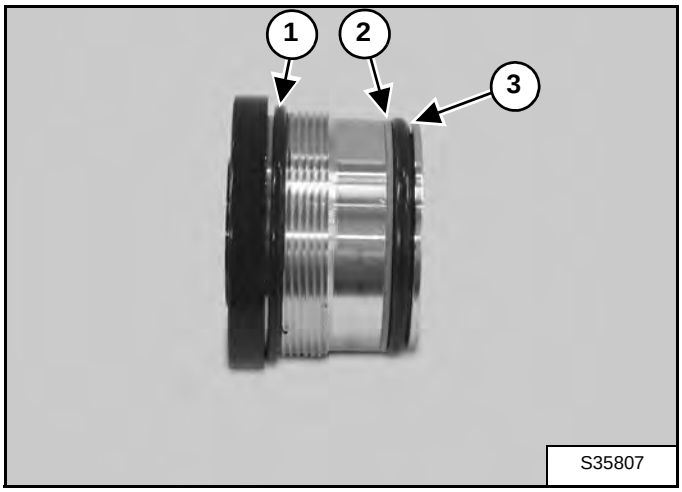
Install the wiper seal with the wiper (Item 1) **[Figure 20-20-23]** toward the outside of the head.

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Assembly (Cont'd)

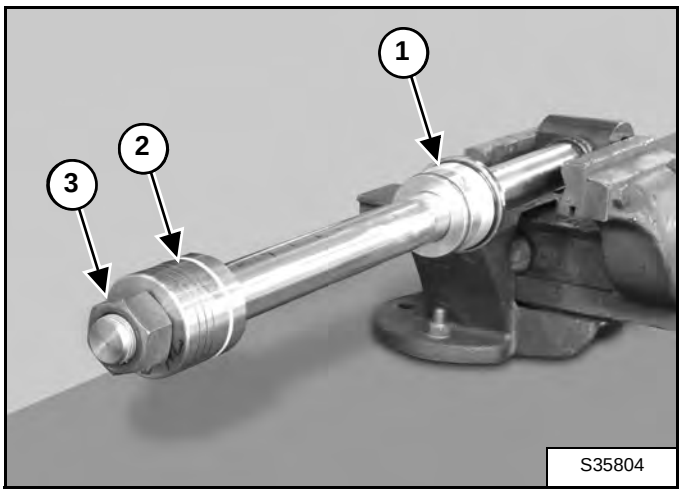
Figure 20-20-24



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

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

Figure 20-20-25



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

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

Provide an adequate support for the cylinder before tightening.

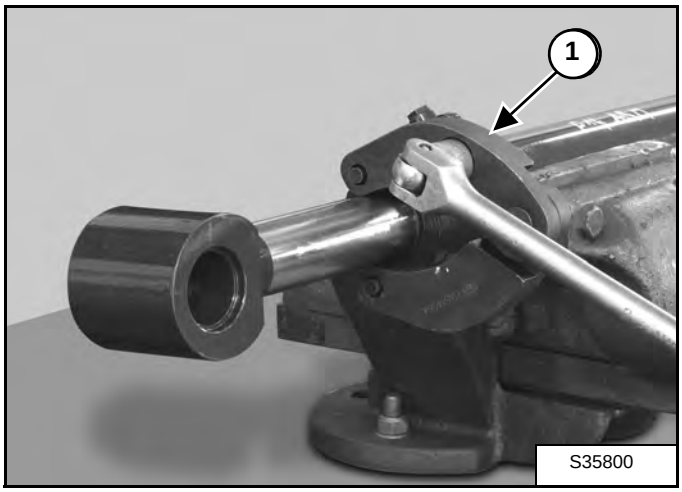
Install the nut (Item 3) **[Figure 20-20-25]**.

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

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

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

Figure 20-20-26



Use the adjustable gland nut wrench (Item 1) **[Figure 20-20-26]** to tighten the head.

Tighten the head to 373 N•m (275 ft-lb) torque.

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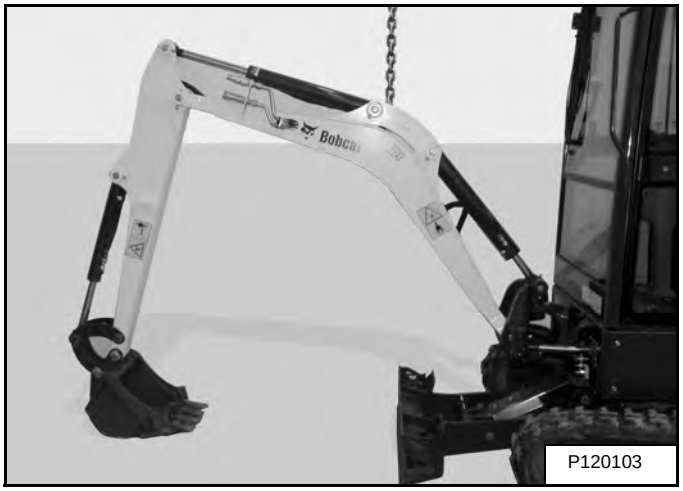
CYLINDER (ARM)

Testing

Lower the boom / bucket and blade to the ground.

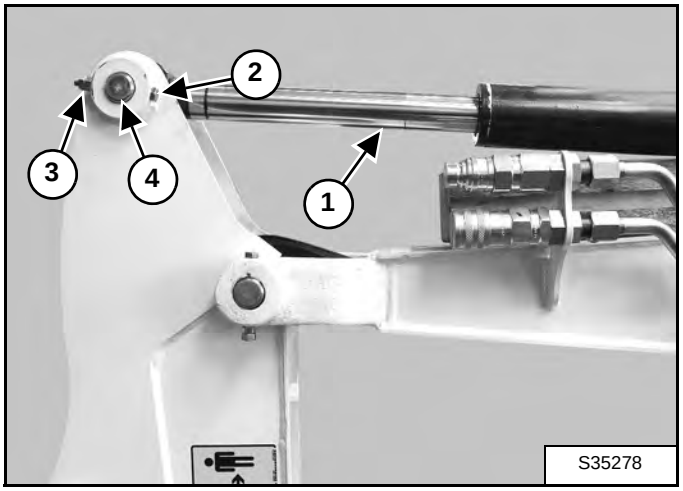
Stop the engine. Raise the control console.

Figure 20-21-1



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

Figure 20-21-2



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

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

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

WARNING

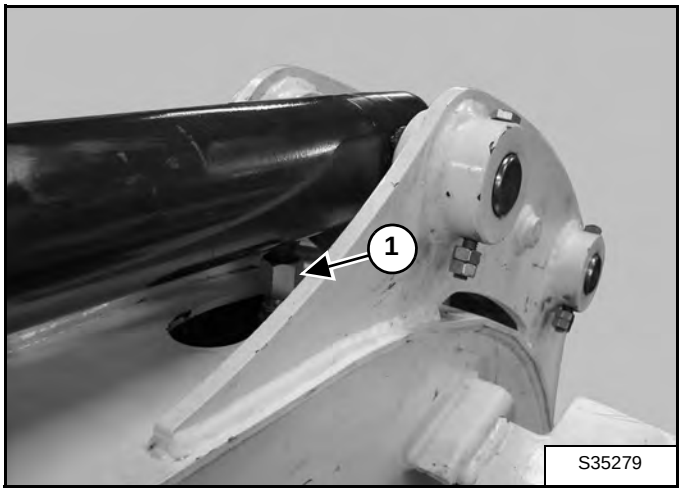
Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possible death if proper medical treatment by a physician familiar with this injury is not received immediately.

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

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

Figure 20-21-3



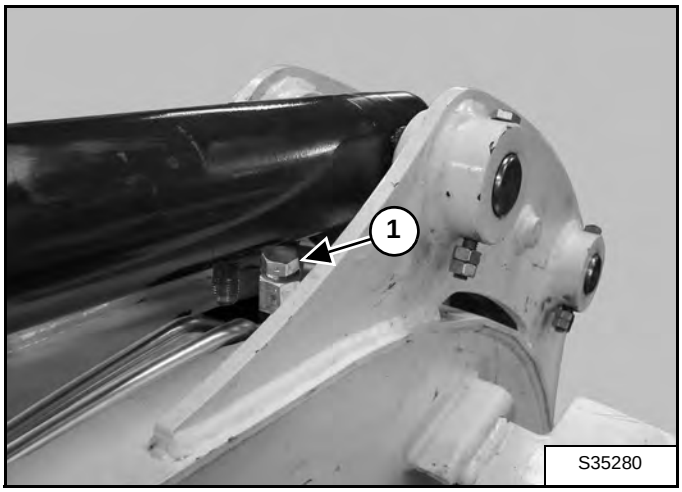
Disconnect the arm cylinder base end hose (Item 1) **[Figure 20-21-3]**.

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Testing (Cont'd)

Figure 20-21-4



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

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

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

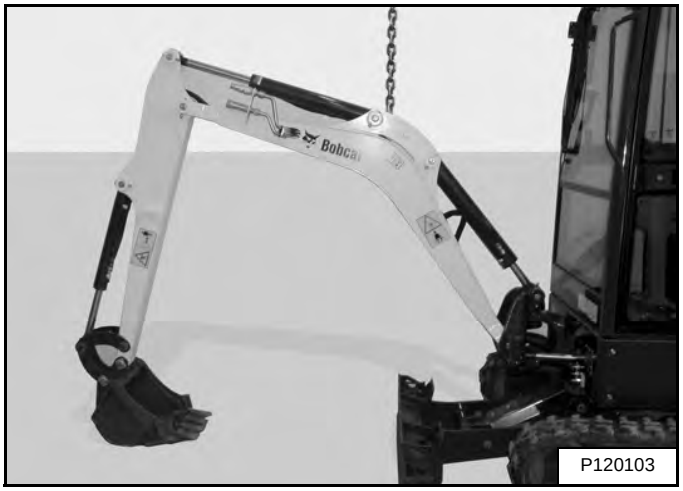
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Removal And Installation

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

Figure 20-21-5



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

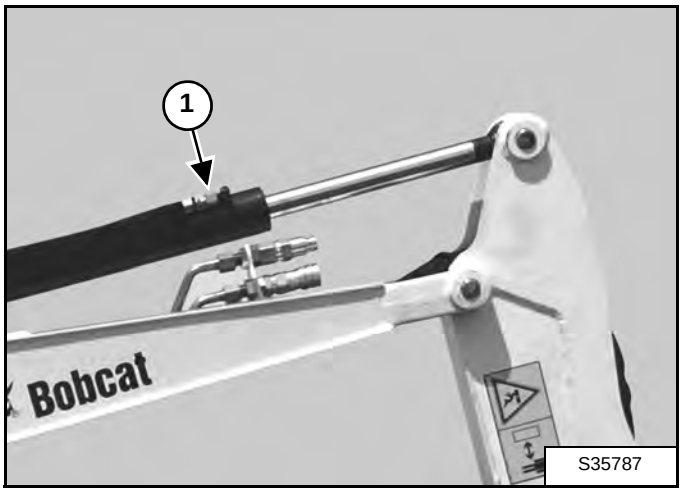
With the key in the ON position, move the hydraulic controls to release the hydraulic pressure.

IMPORTANT

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

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Figure 20-21-6



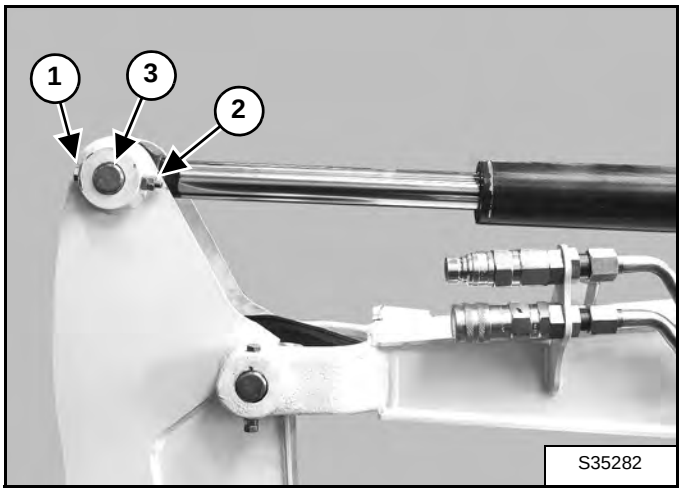
Remove the rod end hose (Item 1) **[Figure 20-21-6]** from the arm cylinder.

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Removal And Installation (Cont'd)

Figure 20-21-7



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

Remove the rod end pin (Item 3) **[Figure 20-21-7]**.

⚠ 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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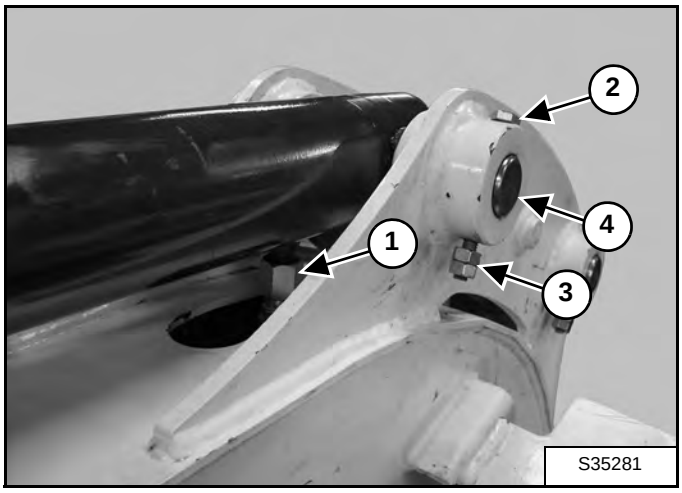
⚠ WARNING

AVOID INJURY OR DEATH

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

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Figure 20-21-8



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

Remove the bolt (Item 2) and nuts (Item 3) **[Figure 20-21-8]** from the base end pivot pin.

Remove the base end pin (Item 4) **[Figure 20-21-8]**.

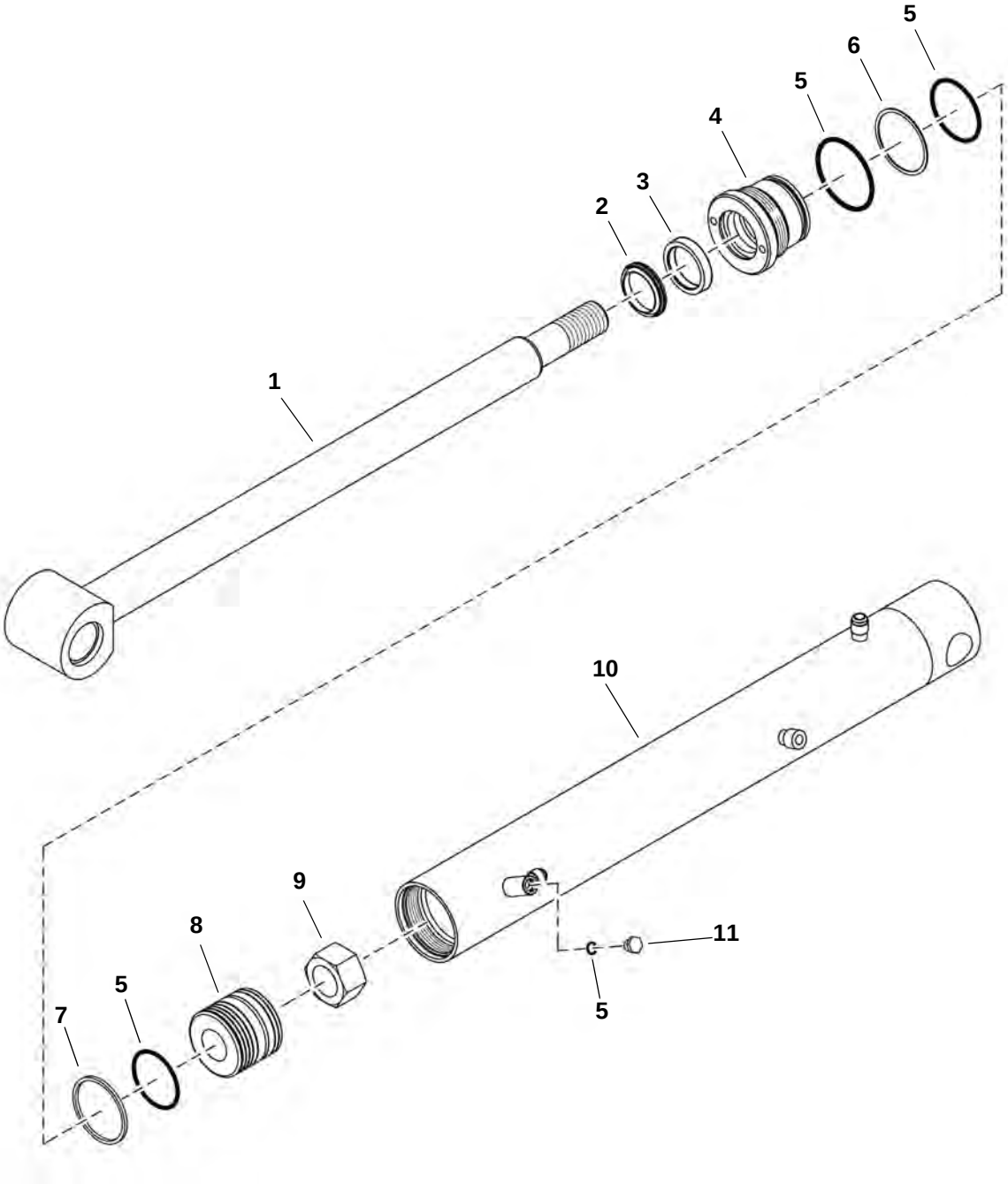
Remove the cylinder from the arm.

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Parts Identification

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



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Disassembly

Clean the outside of the cylinder before disassembly.

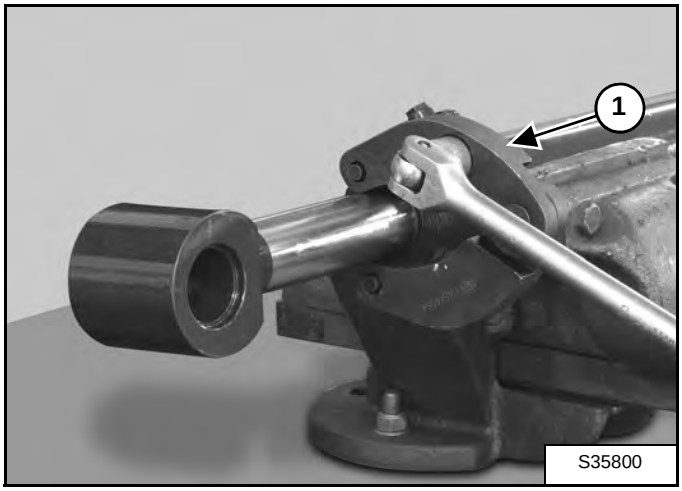
Use the following tools to disassemble the cylinder:

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

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

Put the base end of the cylinder in a vise.

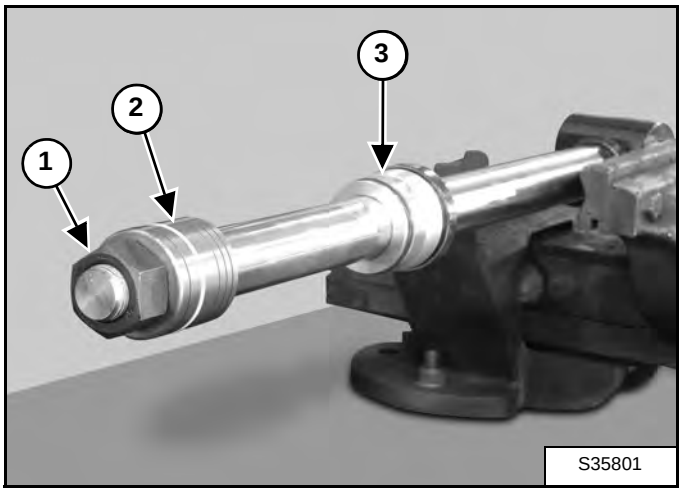
Figure 20-21-9



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

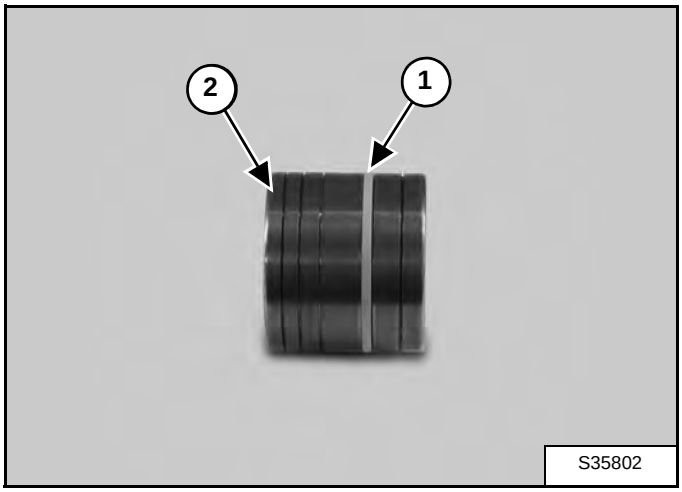
Remove the head and the rod assembly from the cylinder. Put the rod end in a vise.

Figure 20-21-10



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

Figure 20-21-11



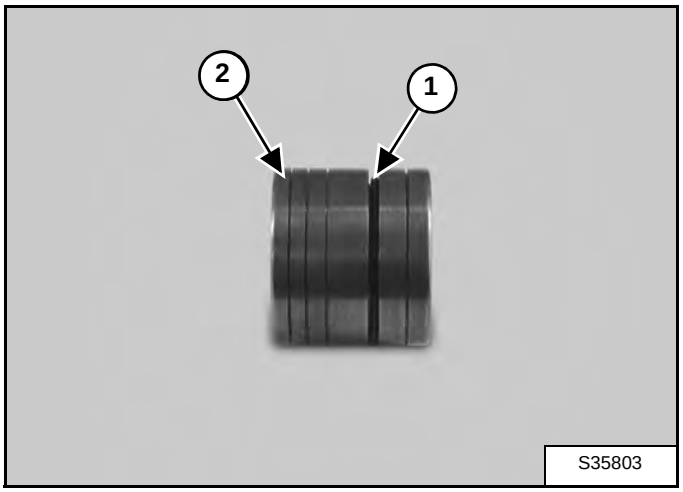
Remove the seal (Item 1) from the piston (Item 2) **[Figure 20-21-11]**.

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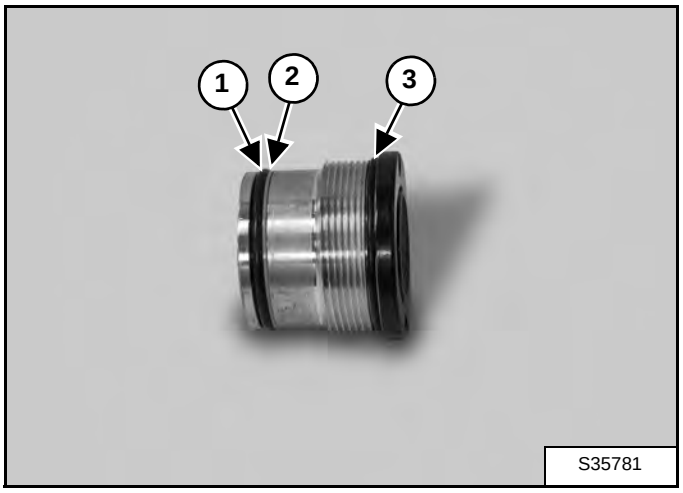
Disassembly (Cont'd)

Figure 20-21-12



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

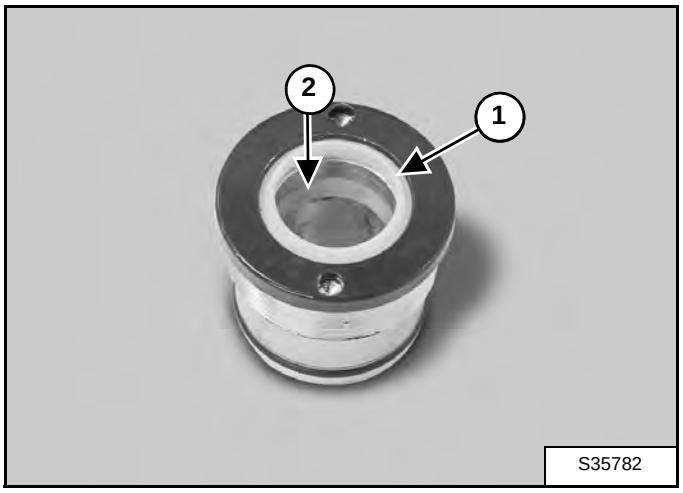
Figure 20-21-13



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

Remove the O-ring (Item 3) **[Figure 20-21-13]**.

Figure 20-21-14



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

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Assembly

Use the following tools to assemble the cylinder:

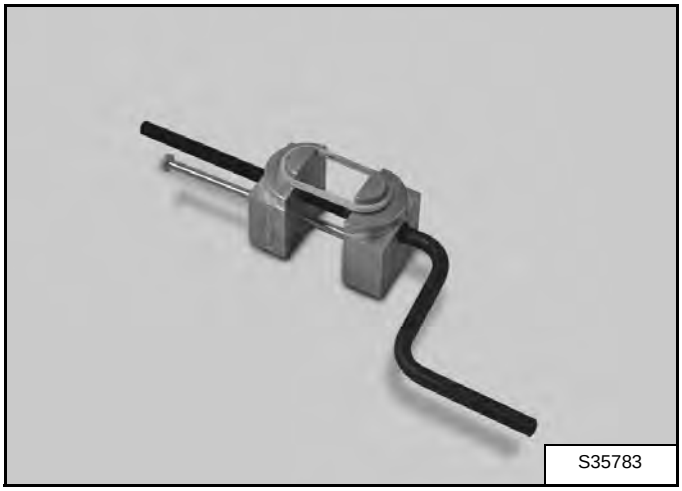
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Offset Pins

Clean all parts in solvent and dry with compressed air.

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

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

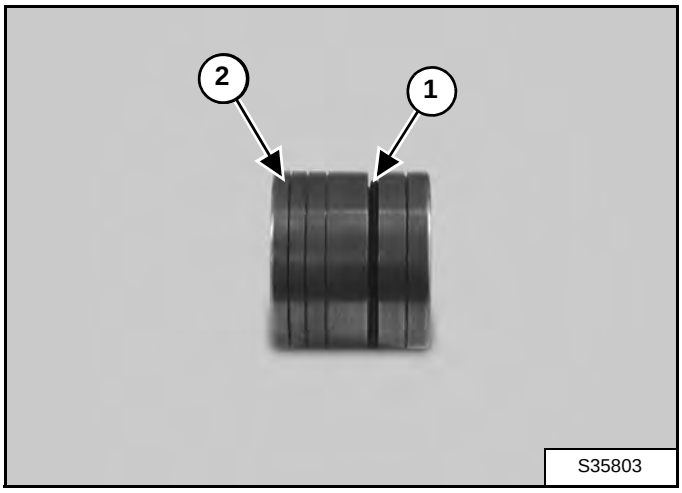
Figure 20-21-15



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

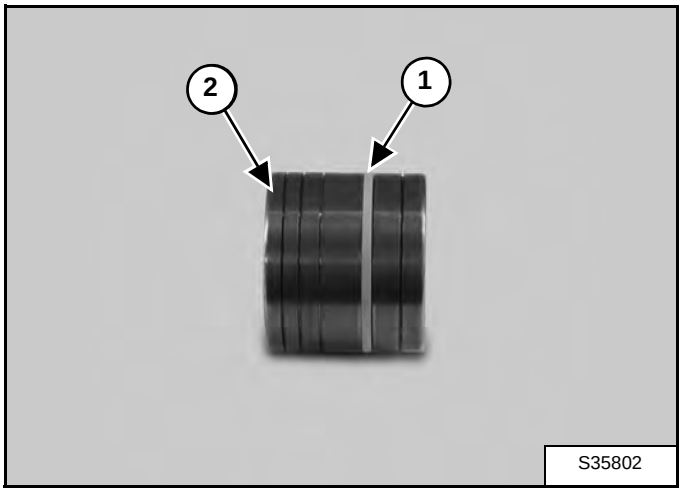
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-21-16



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

Figure 20-21-17



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

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Assembly (Cont'd)

Figure 20-21-18



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

Figure 20-21-19

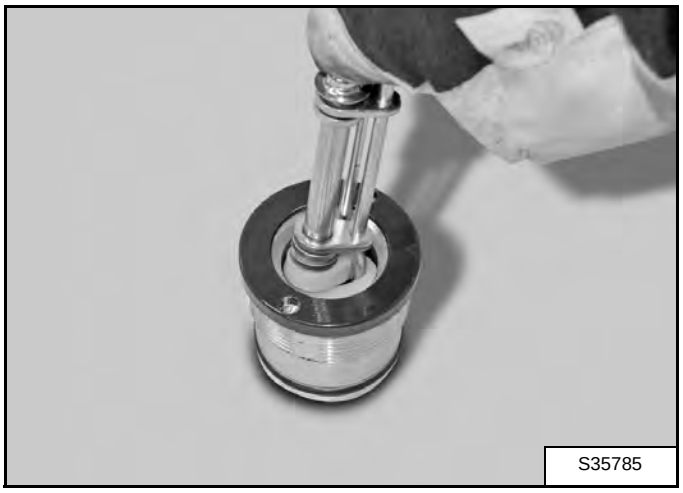


Install the rod seal on the rod seal tool **[Figure 20-21-19]**.

NOTE: Install the spring side of the seal toward the inside of the cylinder.

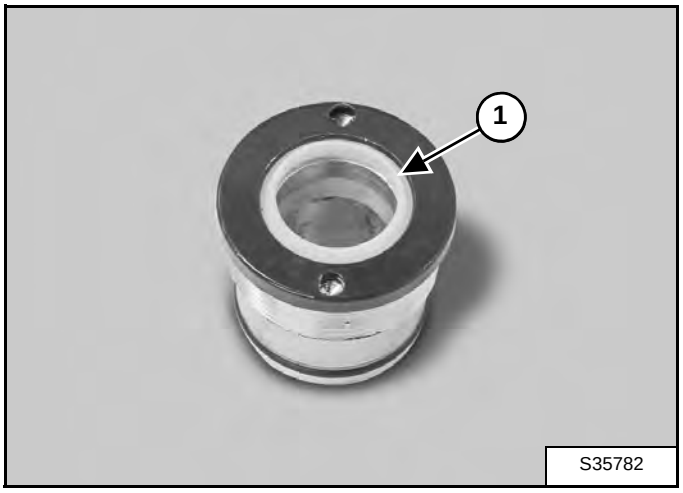
Rotate the handles to collapse the rod seal **[Figure 20-21-19]**.

Figure 20-21-20



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

Figure 20-21-21



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

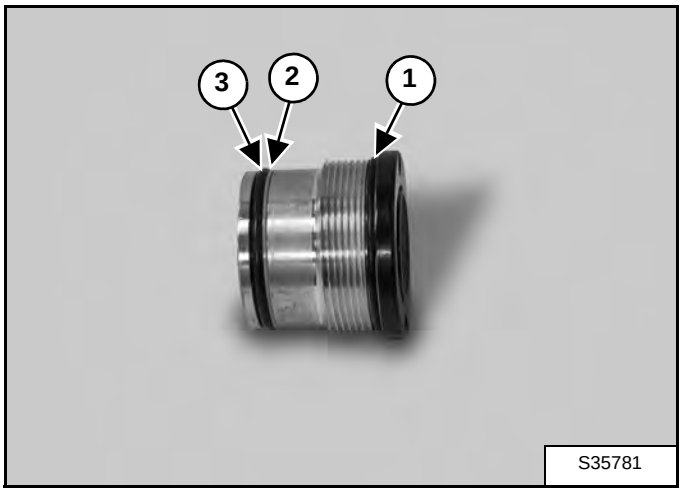
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CYLINDER (ARM) (CONT'D)

Assembly (Cont'd)

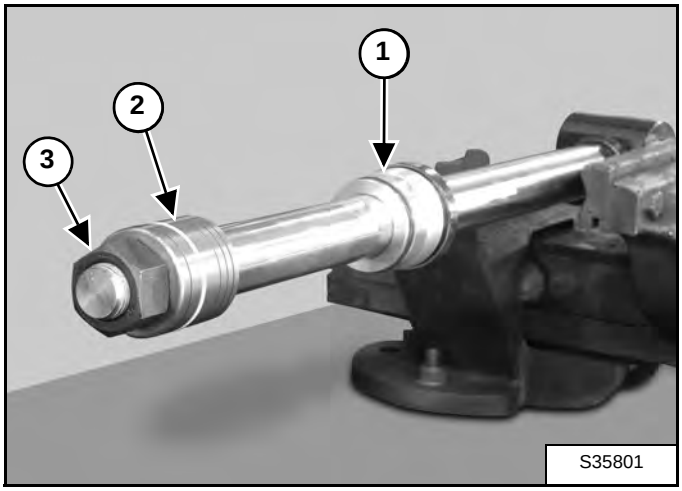
Figure 20-21-22



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

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

Figure 20-21-23



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

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

Provide an adequate support for the cylinder before tightening.

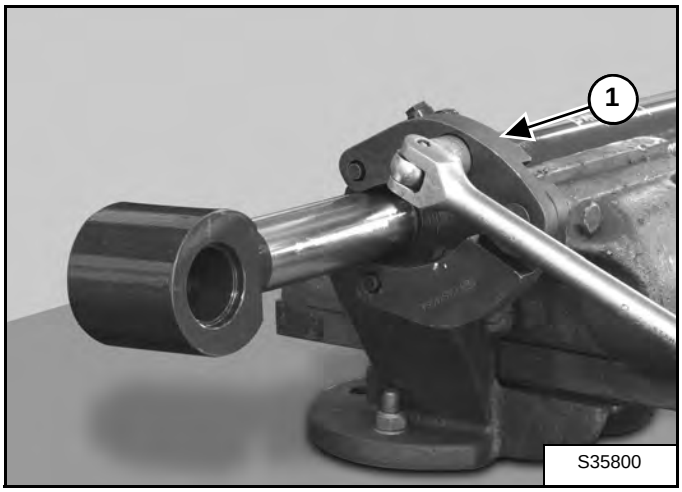
Install the nut (Item 3) **[Figure 20-21-23]**.

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

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

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

Figure 20-21-24



Use the adjustable gland nut wrench (Item 1) **[Figure 20-21-24]** to tighten the head.

Tighten the head to 312 N•m (230 ft-lb) torque.

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CYLINDER (BOOM SWING)

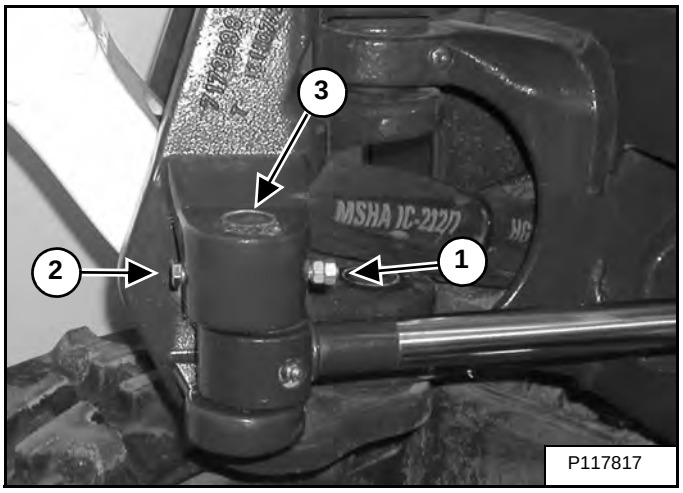
Testing

Swing boom to the right side.

Lower the boom / bucket and blade to the ground.

Stop the engine. Raise the control console.

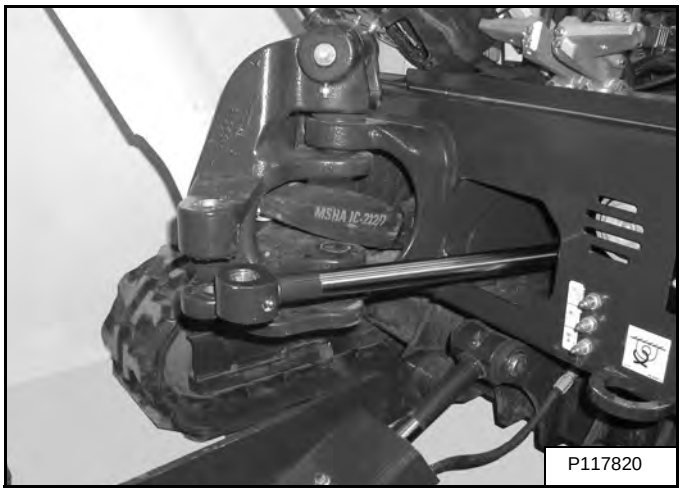
Figure 20-22-1



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

Remove the pivot pin.

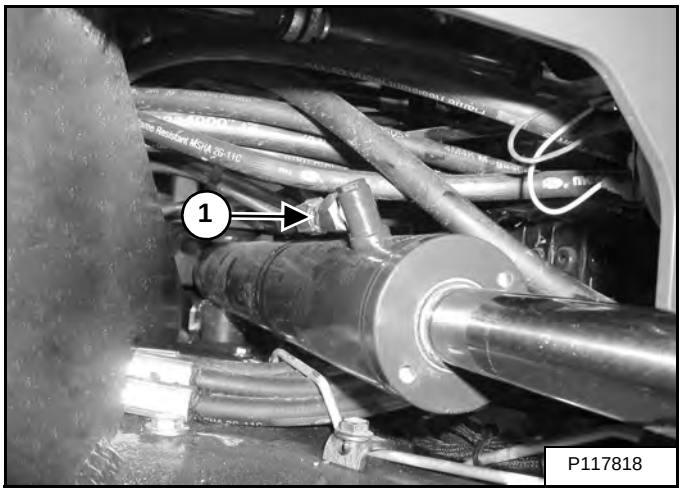
Figure 20-22-2



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

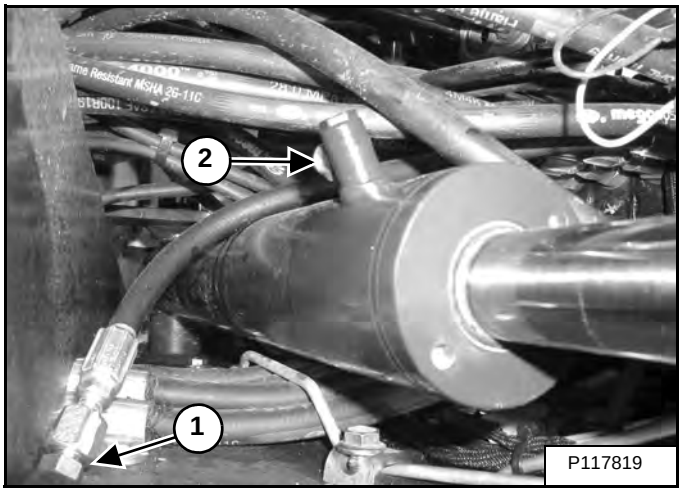
Stop the engine. With the key in the ON position, move the hydraulic controls to release the hydraulic pressure. Raise the control console.

Figure 20-22-3



Remove the rod end hose (Item 1) **[Figure 20-22-3]**.

Figure 20-22-4



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

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

If there is any leakage from the rod end fitting (Item 2) **[Figure 20-22-4]** on the cylinder, remove the cylinder for repair or replacement.

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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

⚠ WARNING

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

W-2145-0290

⚠ WARNING

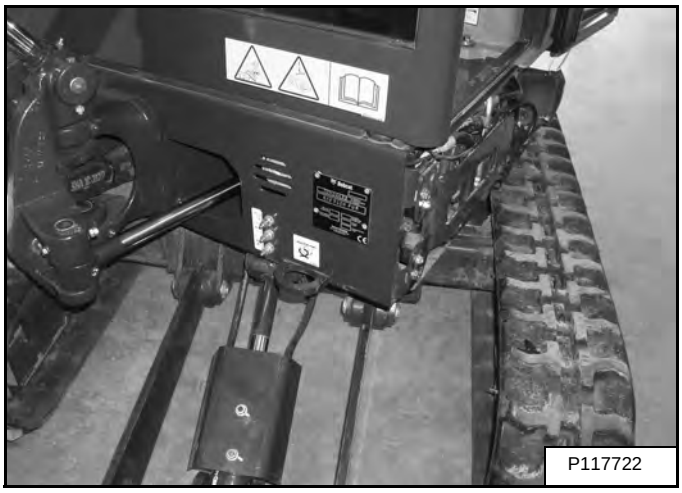
AVOID INJURY OR DEATH

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

W-2103-0508

Remove the left upperstructure covers. (See Removal And Installation on Page 40-60-1.)

Figure 20-22-5



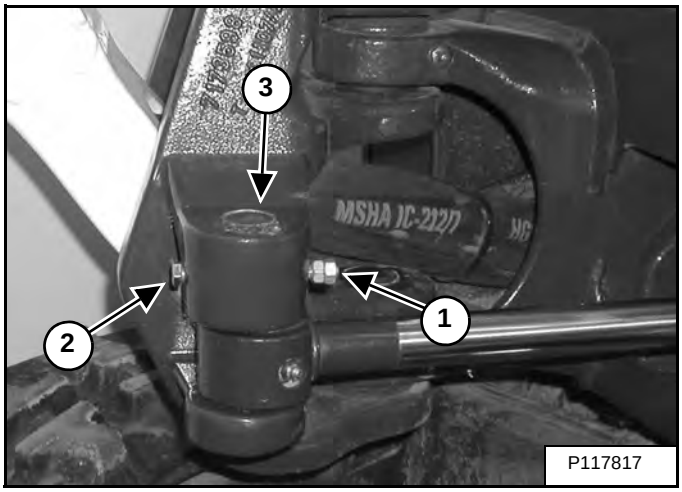
Swing the upperstructure **[Figure 20-22-5]** so the pin in the base end of the cylinder is clear of the track frame.

Offset the boom slightly for additional working space.

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

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

Figure 20-22-6



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-22-6]** from the pivot pin.

Remove the pivot pin (Item 3) **[Figure 20-22-6]**.

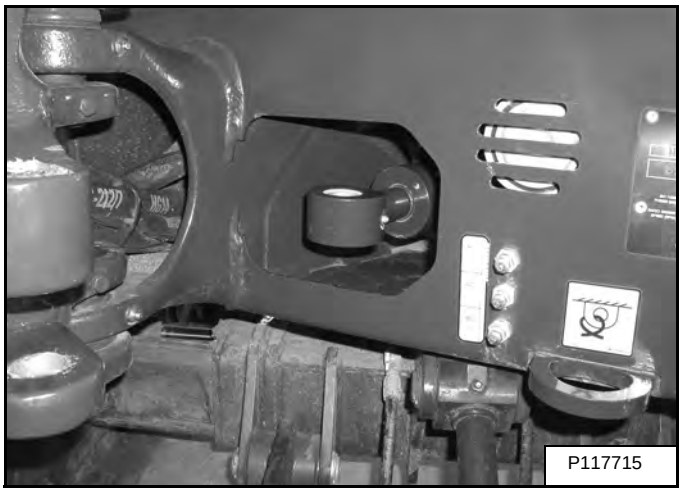
Lower the control console and fasten the seat belt.

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Removal And Installation (Cont'd)

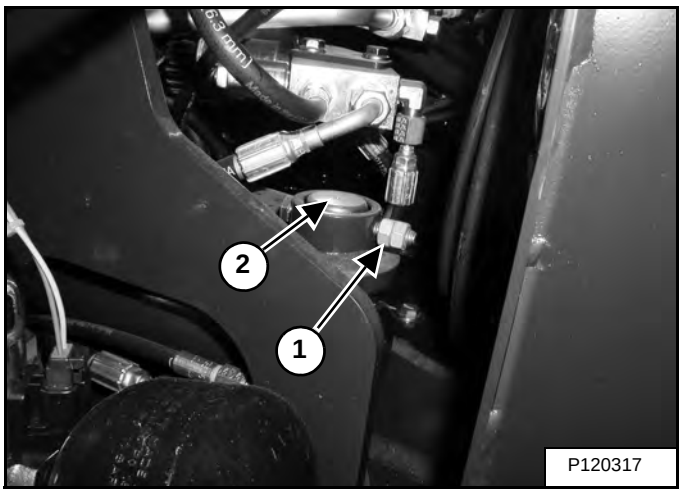
Figure 20-22-7



Start the excavator and fully retract the cylinder **[Figure 20-22-7]**.

Stop the engine.

Figure 20-22-8

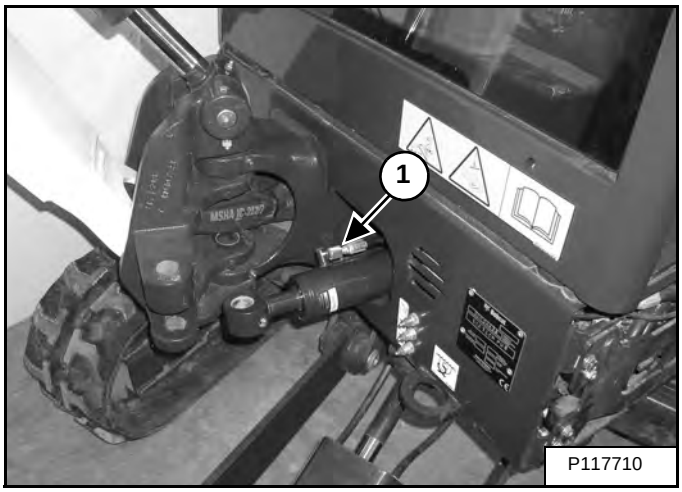


Remove the base end pin nuts and bolt (Item 1) **[Figure 20-22-8]**.

Remove the pivot pin (Item 2) **[Figure 20-22-8]**.

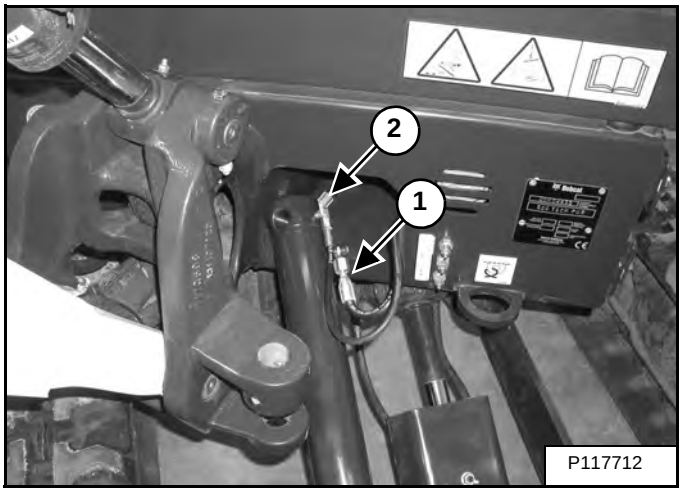
Slide the boom swing cylinder forward.

Figure 20-22-9



Remove the hose (Item 1) **[Figure 20-22-9]** from the rod end of the cylinder.

Figure 20-22-10



Remove the base end hydraulic hose (Item 1) **[Figure 20-22-10]**.

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

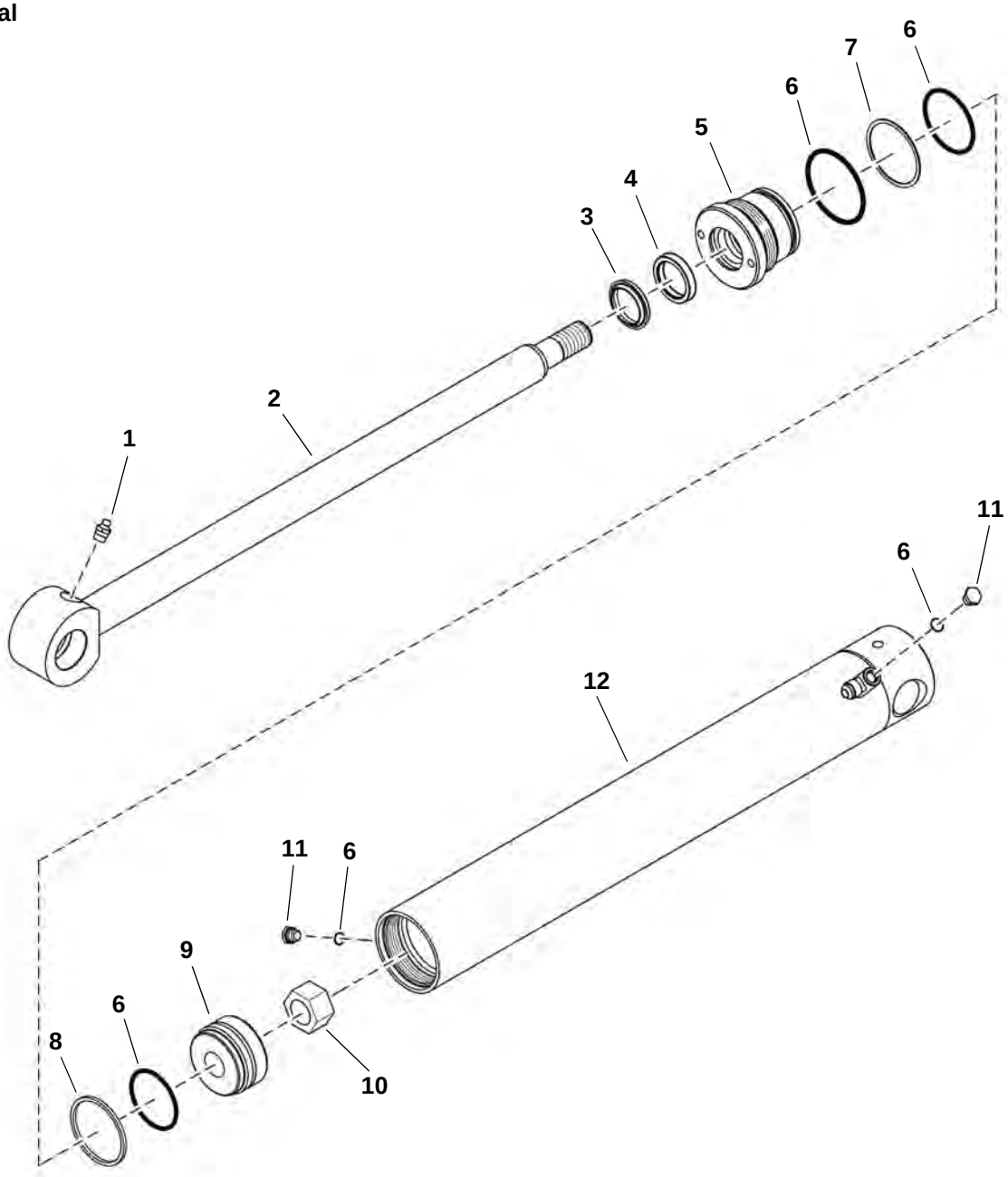
Slide the cylinder out the front of the excavator frame.

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Parts Identification

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



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Disassembly

Clean the outside of the cylinder before disassembly.

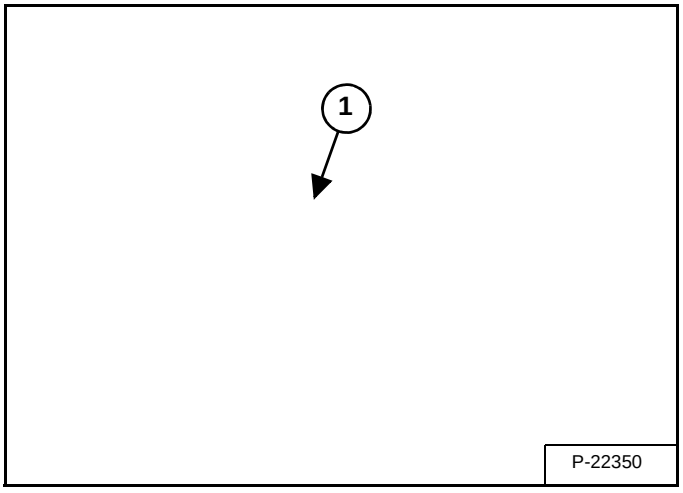
Use the following tools to disassemble the cylinder:

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

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

Put the base end of the cylinder in a vise.

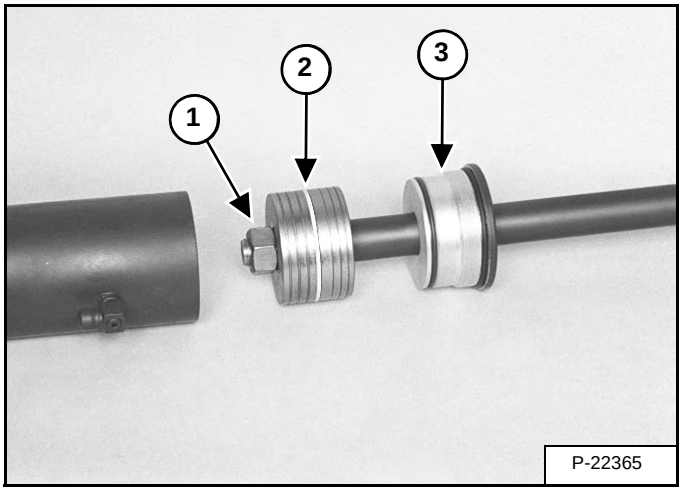
Figure 20-22-11



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

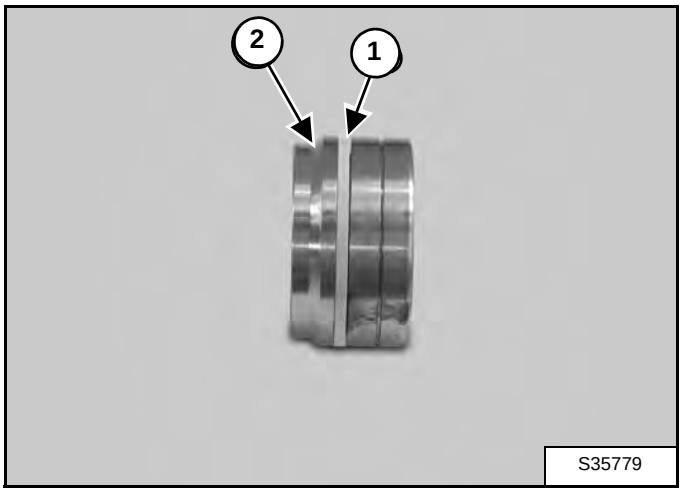
Remove the head and the rod assembly from the cylinder. Put the rod end in a vise.

Figure 20-22-12



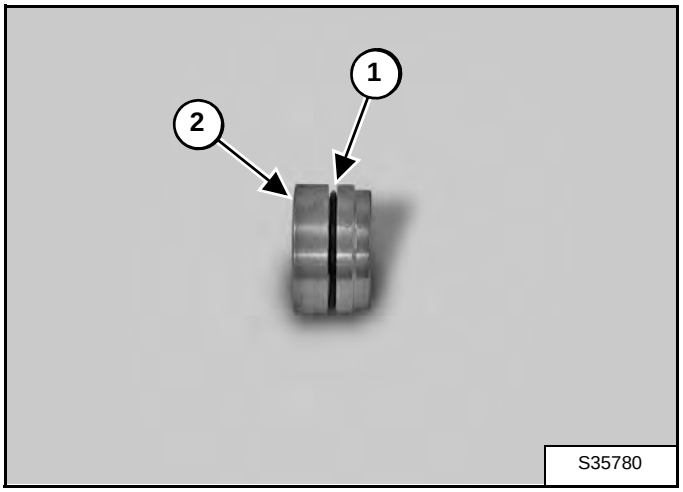
Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-22-12]**.

Figure 20-22-13



Remove the seal (Item 1) from the piston (Item 2) **[Figure 20-22-13]**.

Figure 20-22-14

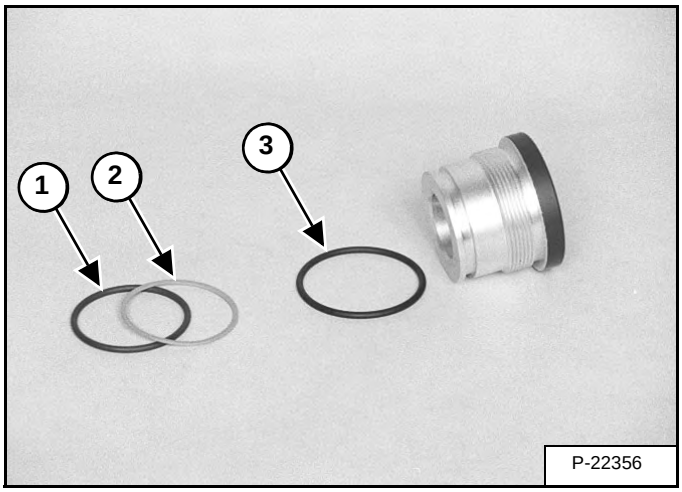


Remove the O-ring (Item 1) from the piston (Item 2) **[Figure 20-22-14]**.

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Disassembly (Cont'd)

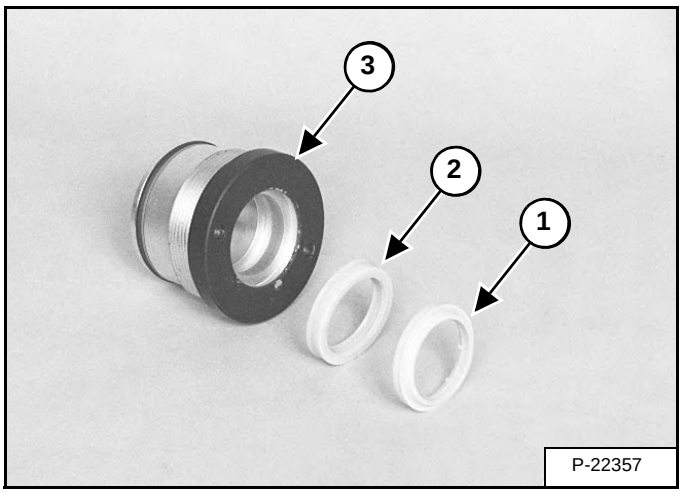
Figure 20-22-15



Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-22-15]**.

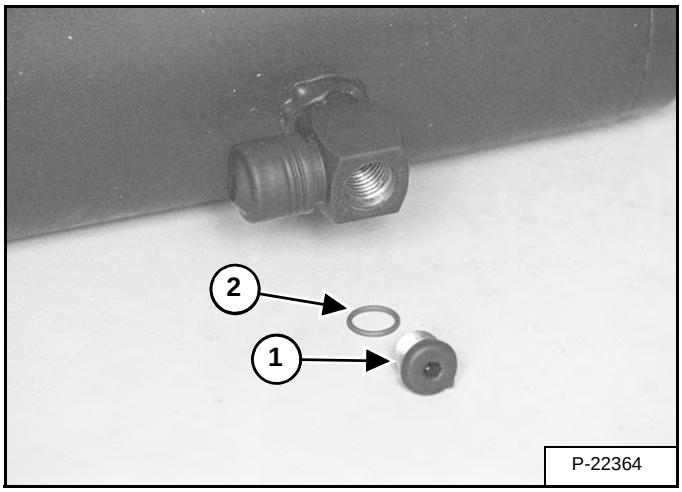
Remove the O-ring (Item 3) **[Figure 20-22-15]**.

Figure 20-22-16



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-22-16]**.

Figure 20-22-17



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

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Assembly

Use the following tools to assemble the cylinder:

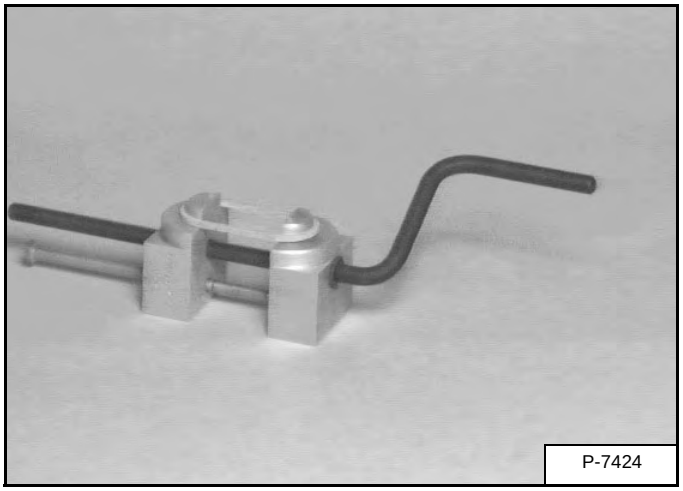
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

Clean all parts in solvent and dry with compressed air.

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

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

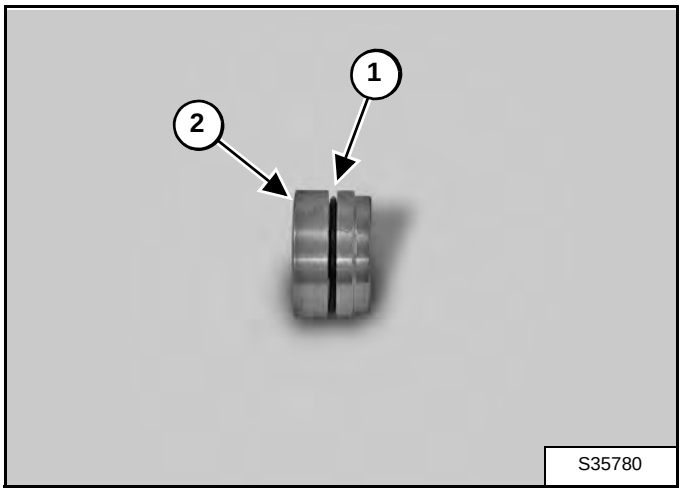
Figure 20-22-18



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-22-18]**.

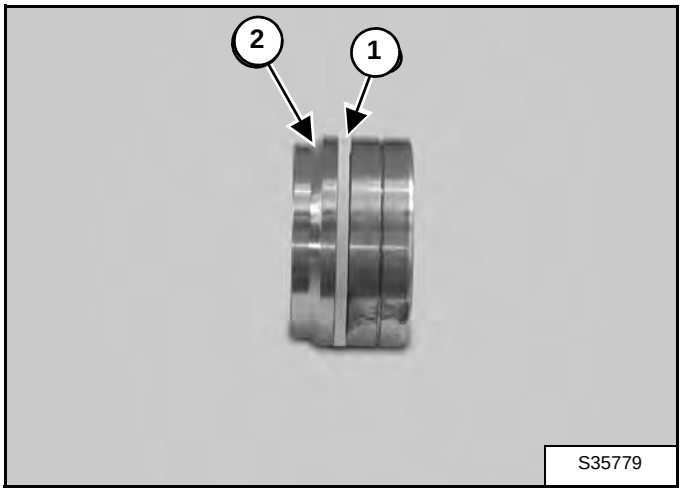
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-22-19



Install the O-ring (Item 1) on the piston (Item 2) **[Figure 20-22-19]**.

Figure 20-22-20



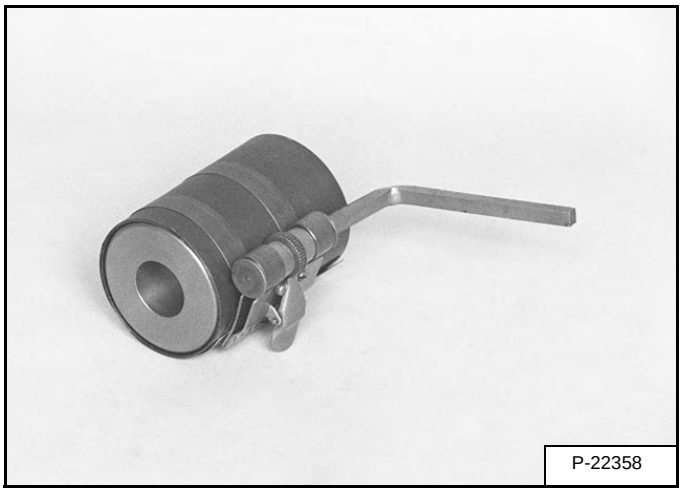
Install the seal (Item 1) on the piston (Item 2) **[Figure 20-22-20]**.

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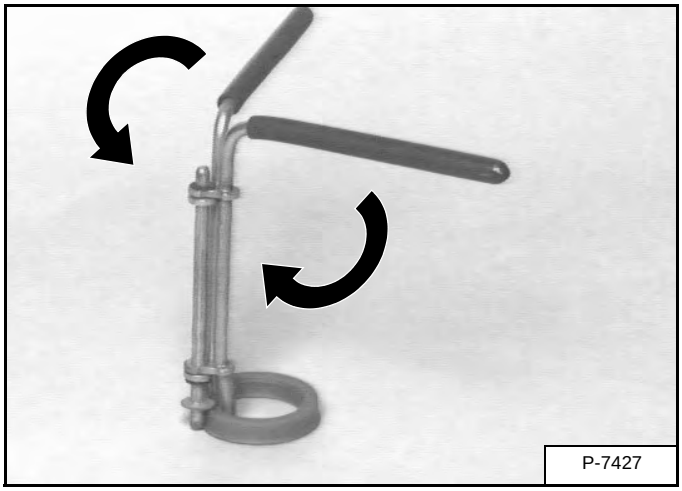
Assembly (Cont'd)

Figure 20-22-21



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-22-21]**.

Figure 20-22-22

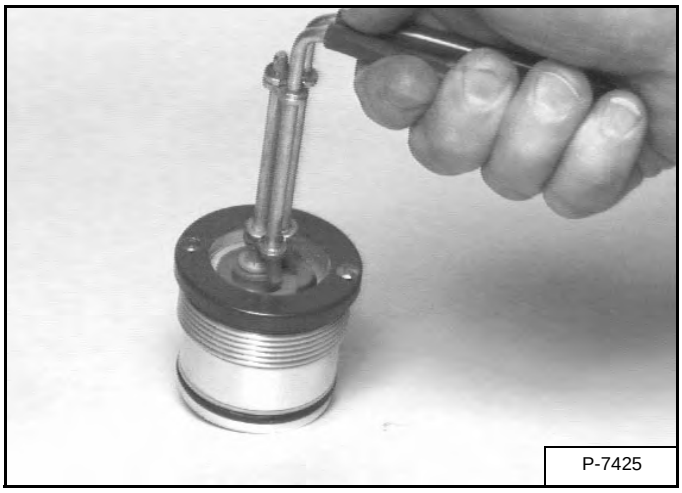


Install the rod seal on the rod seal tool **[Figure 20-22-22]**.

NOTE: Install the spring side of the seal toward the inside of the cylinder.

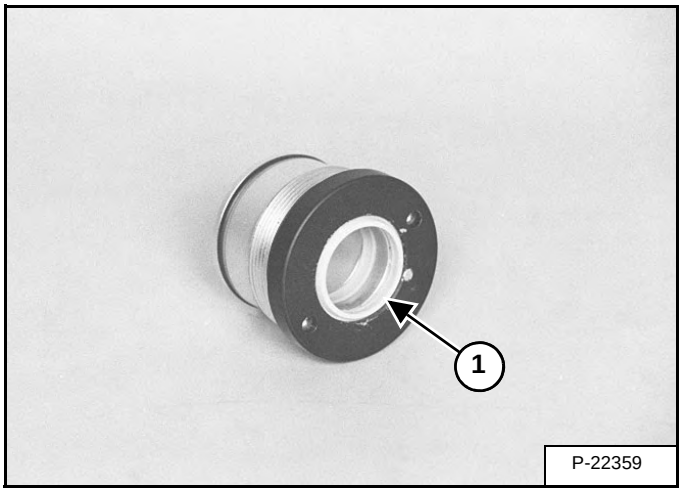
Rotate the handles to collapse the rod seal **[Figure 20-22-22]**.

Figure 20-22-23



Install the rod seal in the head **[Figure 20-22-23]**.

Figure 20-22-24



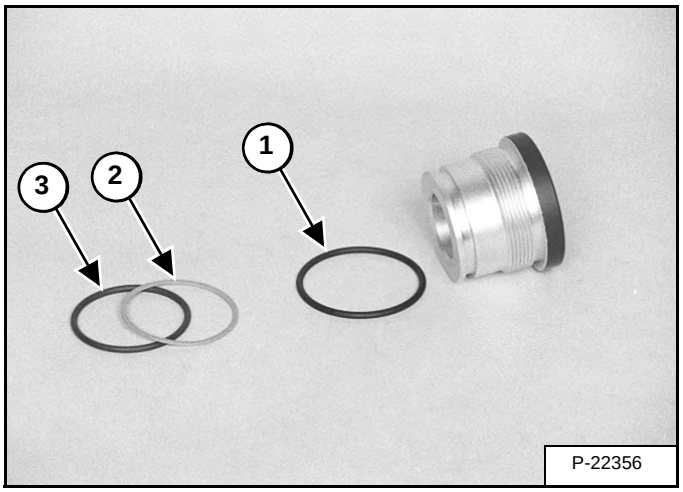
Install the wiper seal with the wiper (Item 1) **[Figure 20-22-24]** toward the outside of the head.

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Assembly (Cont'd)

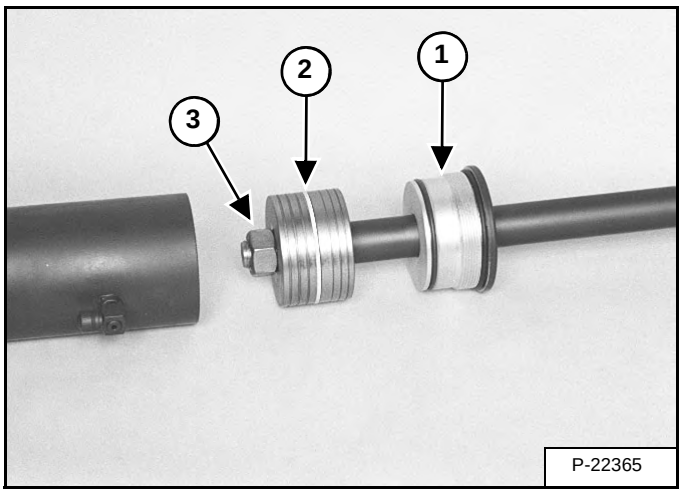
Figure 20-22-25



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

Install the back-up ring (Item 2) and O-ring (Item 3) **[Figure 20-22-25]**.

Figure 20-22-26



Install the head (Item 1) and the piston (Item 2) **[Figure 20-22-26]** on the rod.

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

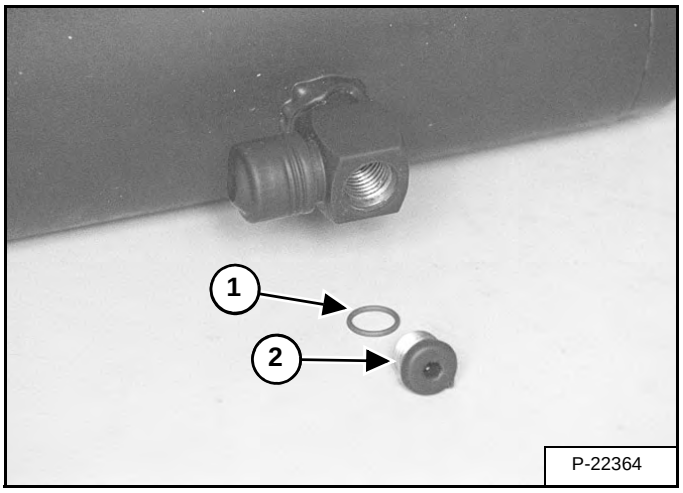
Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-22-26]**.

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

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

Figure 20-22-27

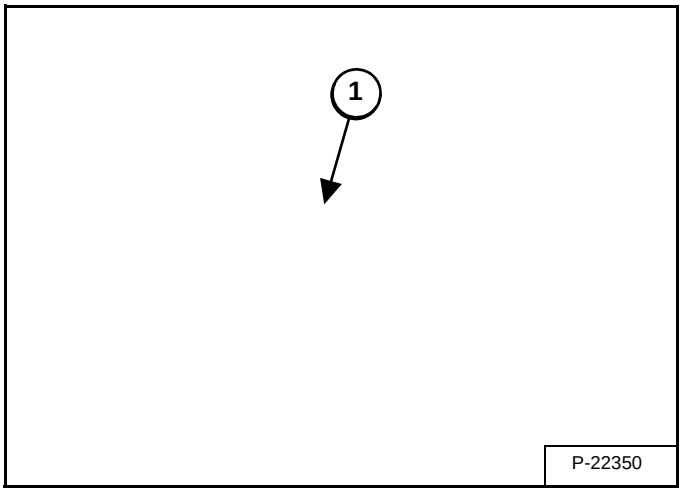


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-22-27]**.

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

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

Figure 20-22-28



Use the adjustable gland nut wrench to tighten the head (Item 1) **[Figure 20-22-28]**.

Tighten the head to 312 N•m (230 ft-lb) torque.

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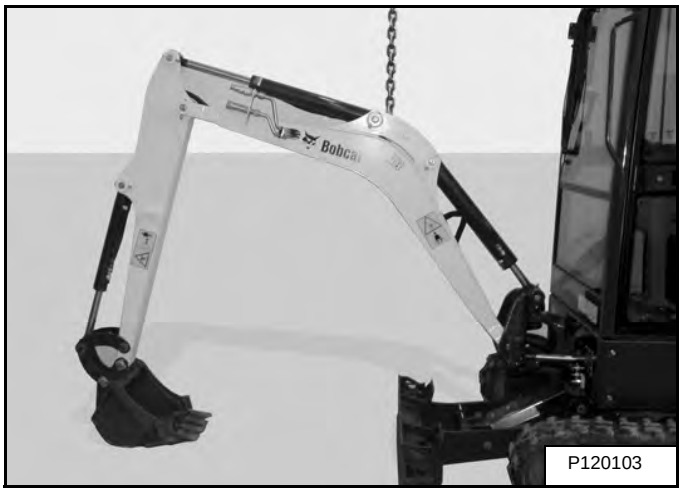
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CYLINDER (BUCKET)

Testing

Figure 20-23-1

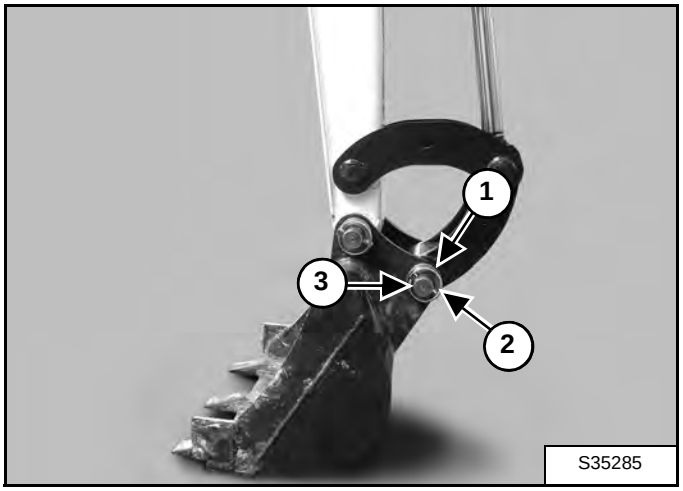


Lower the boom / bucket and blade to the ground **[Figure 20-23-1]**.

Stop the engine. Raise the control console.

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

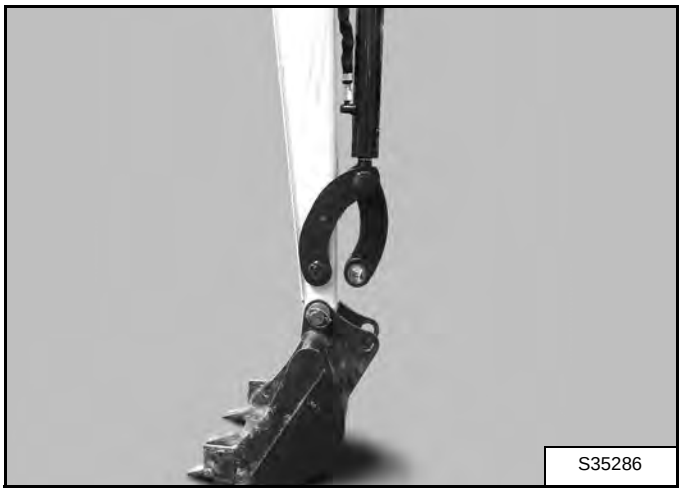
Figure 20-23-2



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

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

Figure 20-23-3



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

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

⚠ WARNING

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

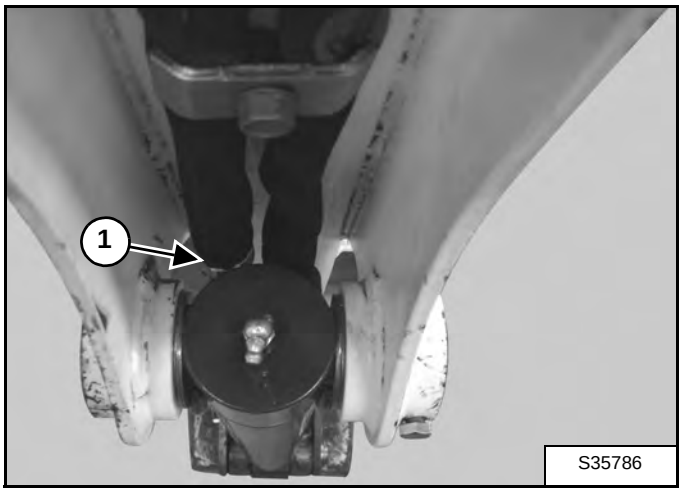
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Testing (Cont'd)

Figure 20-23-4



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

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

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

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CYLINDER (BUCKET) (CONT'D)

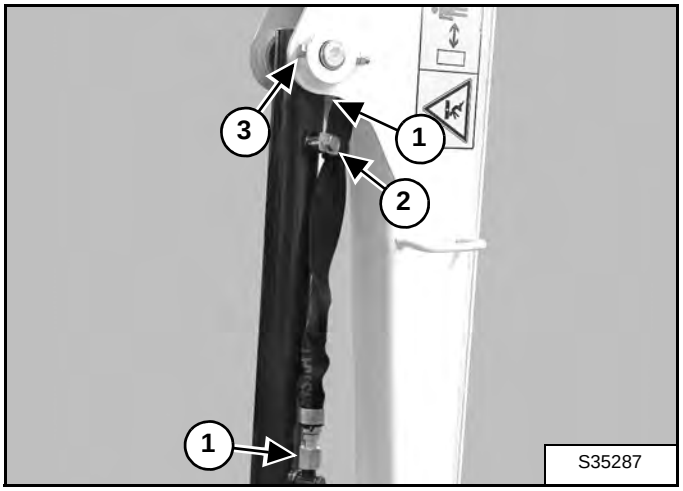
Removal And Installation

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

Support the boom using a chain hoist.

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

Figure 20-23-5



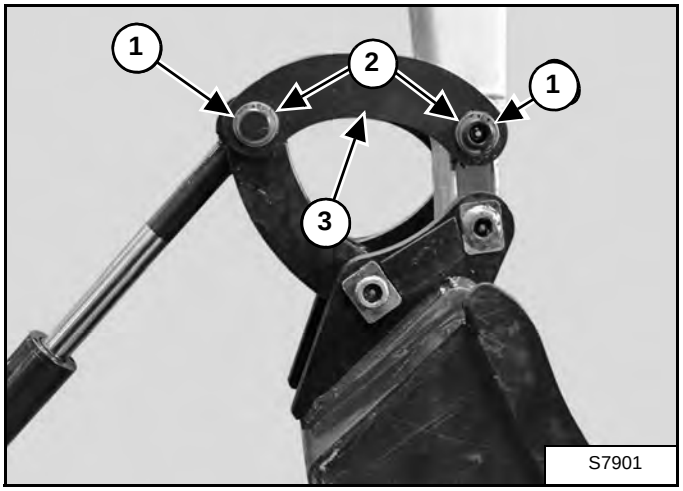
Remove the two hoses (Item 1) **[Figure 20-23-5]** from the bucket cylinder.

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

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

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

Figure 20-23-6



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

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

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

Remove the cylinder.

IMPORTANT

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

I-2003-0888

⚠ WARNING

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

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⚠ WARNING

AVOID INJURY OR DEATH

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

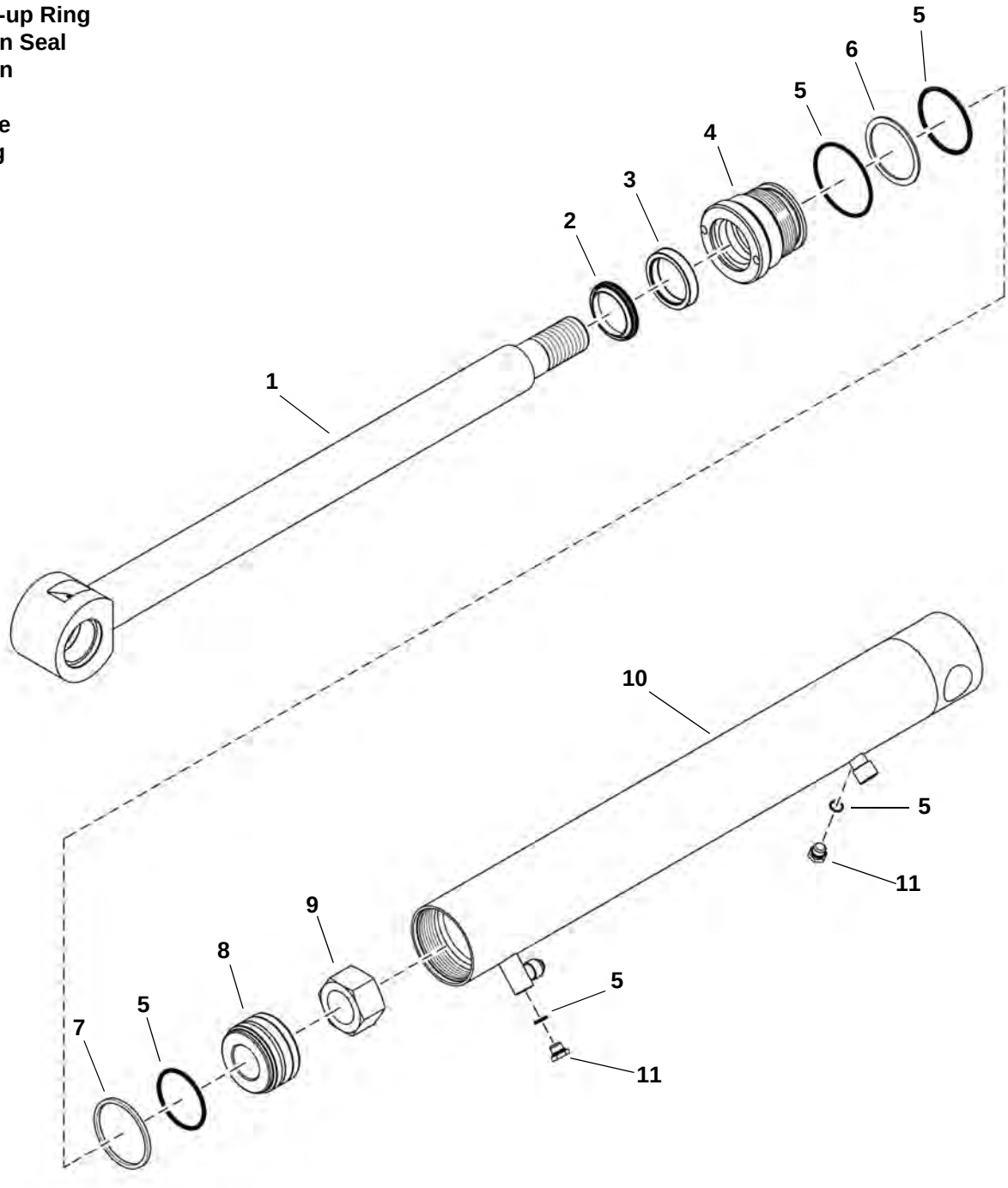
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Parts Identification

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



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Disassembly

Clean the outside of the cylinder before disassembly.

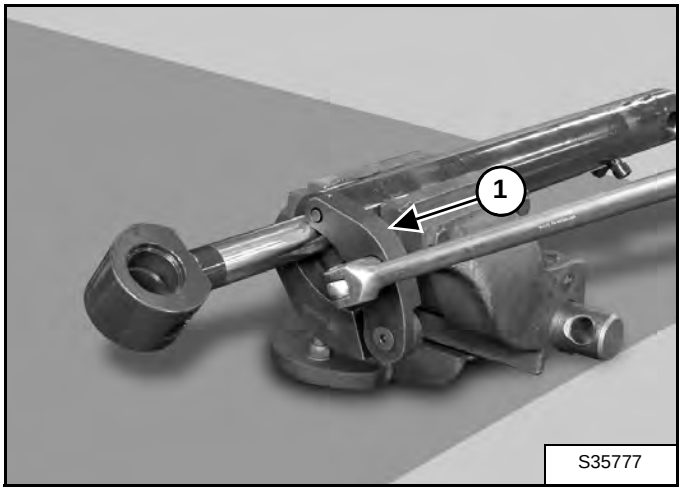
Use the following tools to disassemble the cylinder:

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

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

Put the base end of the cylinder in a vise.

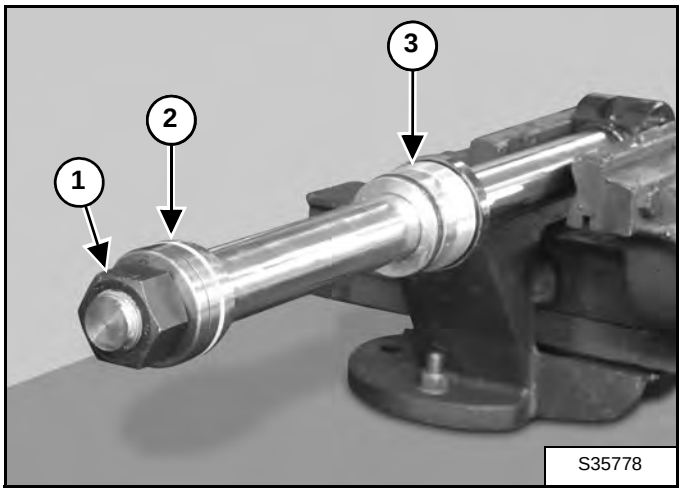
Figure 20-23-7



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

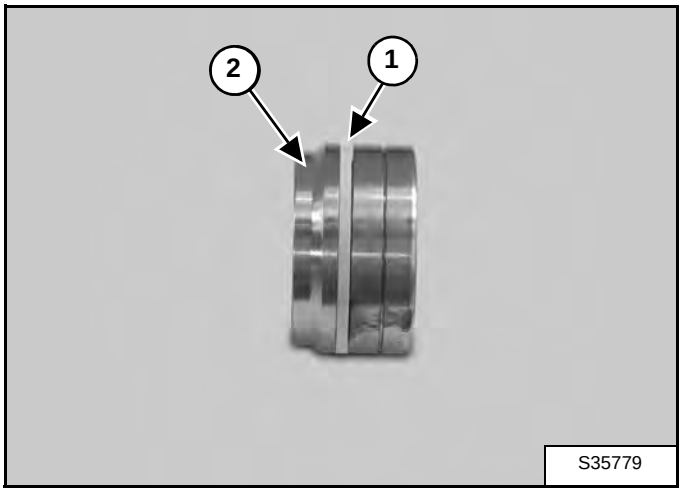
Remove the head and the rod assembly from the cylinder. Put the rod end in a vise.

Figure 20-23-8



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

Figure 20-23-9



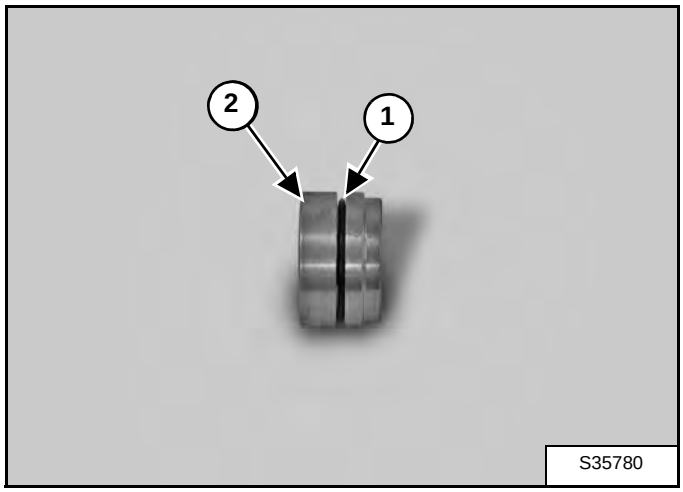
Remove the seal (Item 1) from the piston (Item 2) **[Figure 20-23-9]**.

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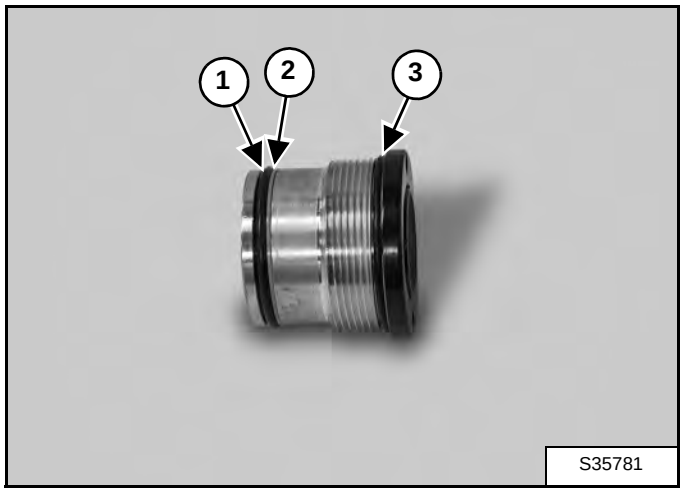
Disassembly (Cont'd)

Figure 20-23-10



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

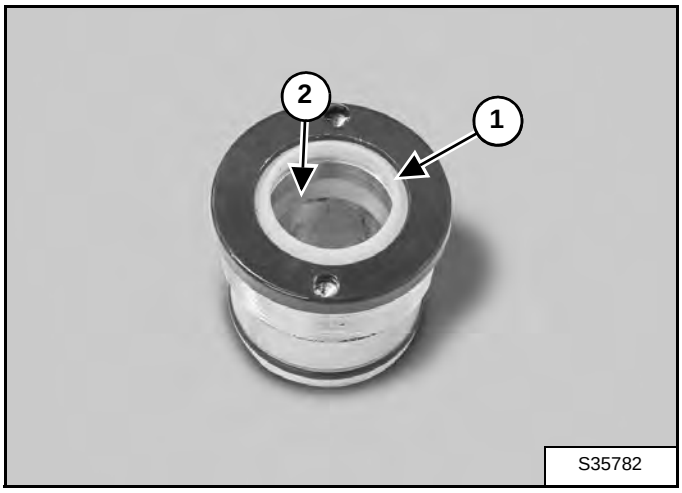
Figure 20-23-11



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

Remove the O-ring (Item 3) **[Figure 20-23-11]**.

Figure 20-23-12



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

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Assembly

Use the following tools to assemble the cylinder:

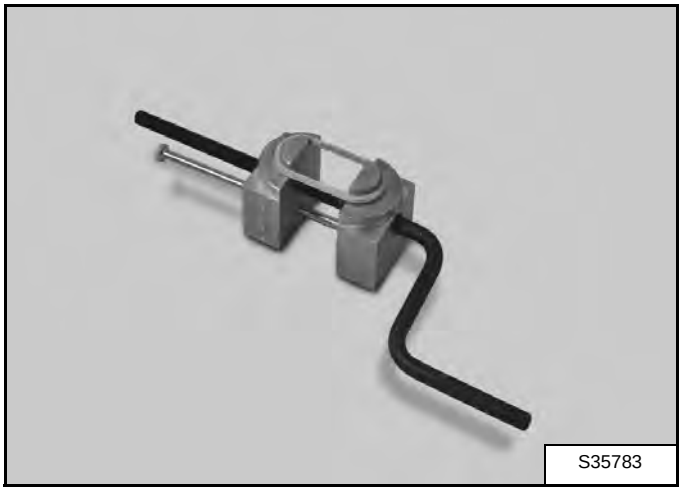
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Offset Pins

Clean all parts in solvent and dry with compressed air.

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

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

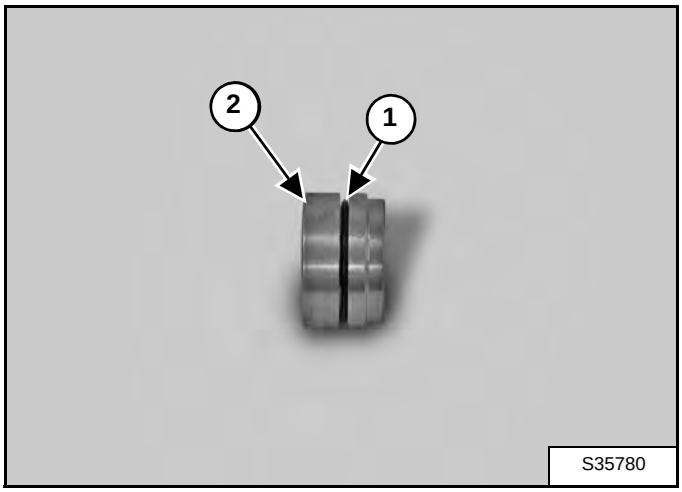
Figure 20-23-13



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

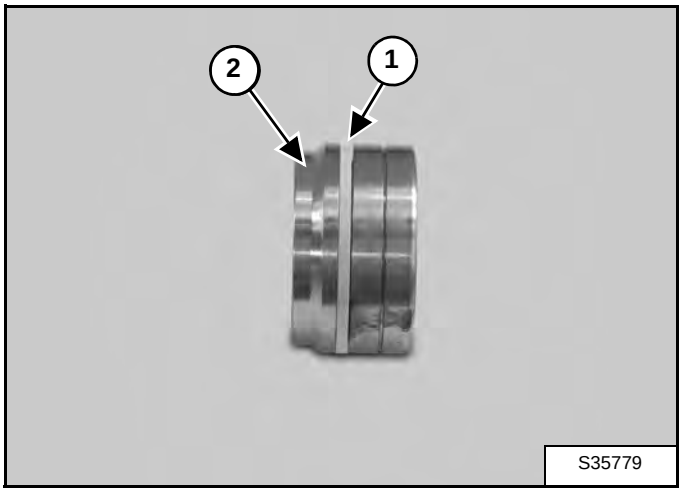
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-23-14



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

Figure 20-23-15



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

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Assembly (Cont'd)

Figure 20-23-16



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

Figure 20-23-17



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

NOTE: Install the spring side of the seal toward the inside of the cylinder.

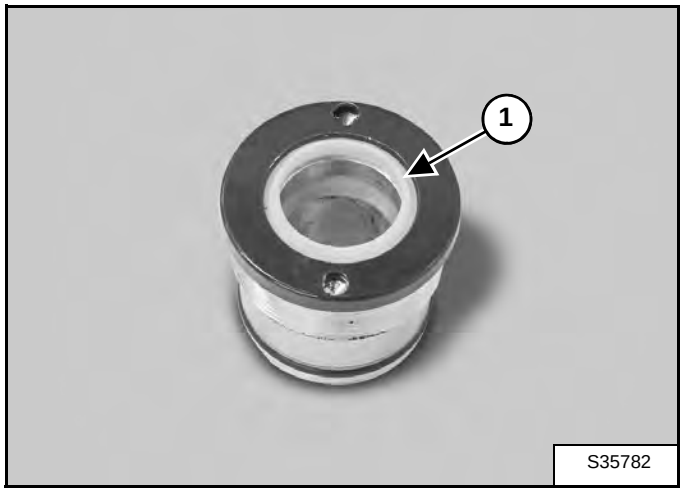
Rotate the handles to collapse the rod seal **[Figure 20-23-17]**.

Figure 20-23-18



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

Figure 20-23-19



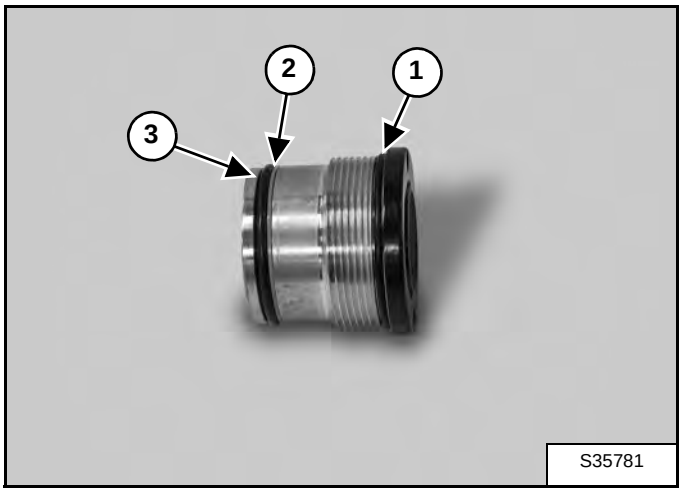
Install the wiper seal with the wiper (Item 1) **[Figure 20-23-19]** toward the outside of the head.

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Assembly (Cont'd)

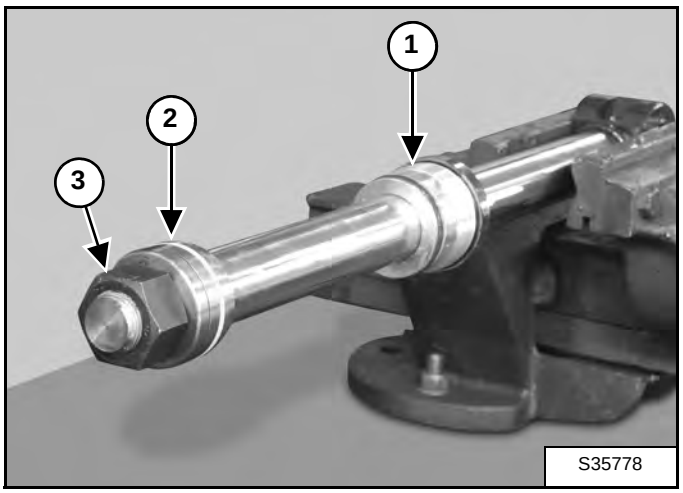
Figure 20-23-20



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

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

Figure 20-23-21



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

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

Provide an adequate support for the cylinder before tightening.

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

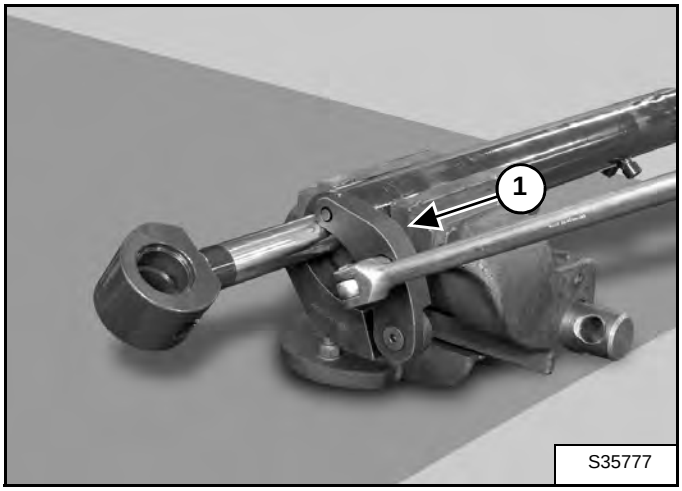
NOTE: Clean and dry the rod threads. Install a NEW NUT from the kit with preapplied Loctite®.

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

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

Be careful no to damage the cylinder tube.

Figure 20-23-22



Use the adjustable gland nut wrench (Item 1) **[Figure 20-23-22]** to tighten the head.

Tighten the head to 271 N•m (200 ft-lb) torque.

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CYLINDER (BLADE)

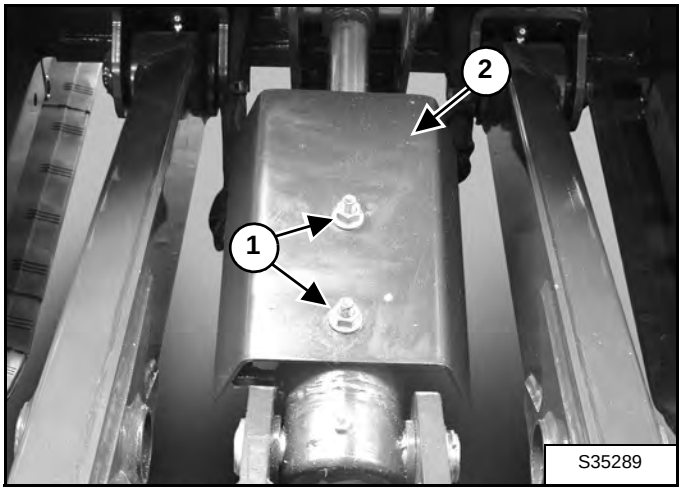
Testing

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

Stop the engine.

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

Figure 20-24-1



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

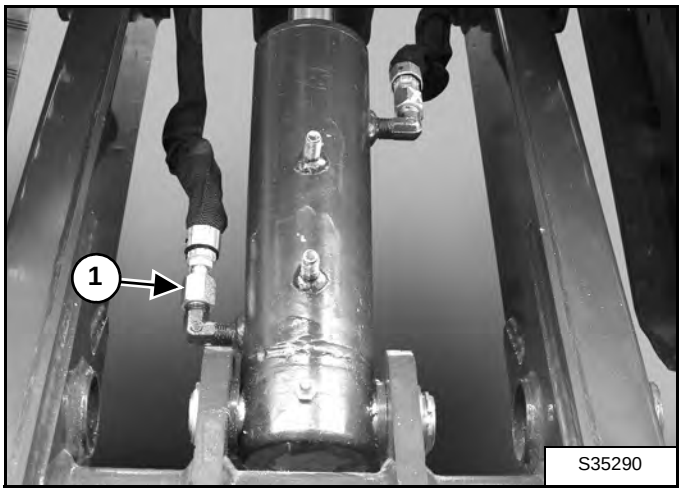
Remove the blade cylinder shield (Item 2) **[Figure 20-24-1]** from the blade cylinder.

⚠ WARNING

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

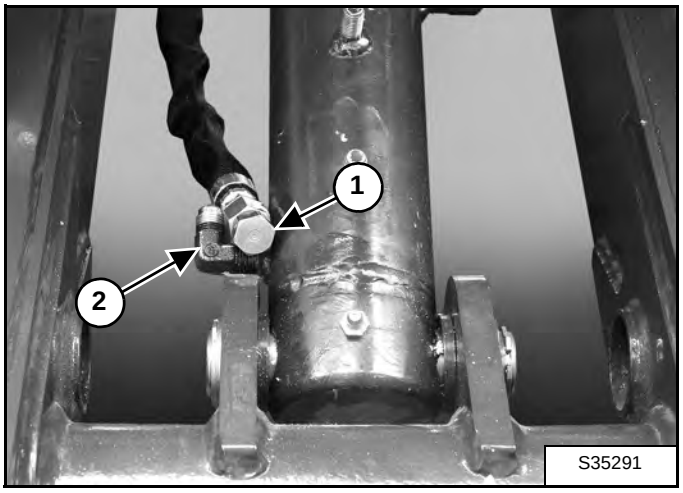
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Figure 20-24-2



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

Figure 20-24-3



Install a plug (Item 1) **[Figure 20-24-3]** on the hose fitting and tighten.

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

If there is any leakage from the base end fitting (Item 2) **[Figure 20-24-3]** on the cylinder, remove the cylinder for repair or replacement.

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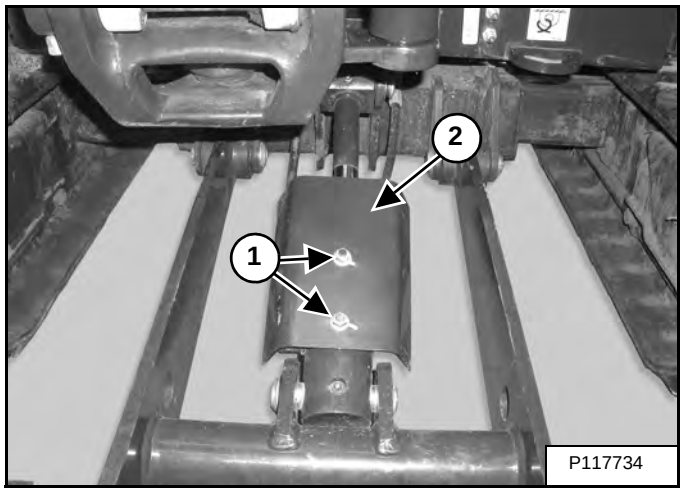
CYLINDER (BLADE) (CONT'D)

Removal And Installation

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

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

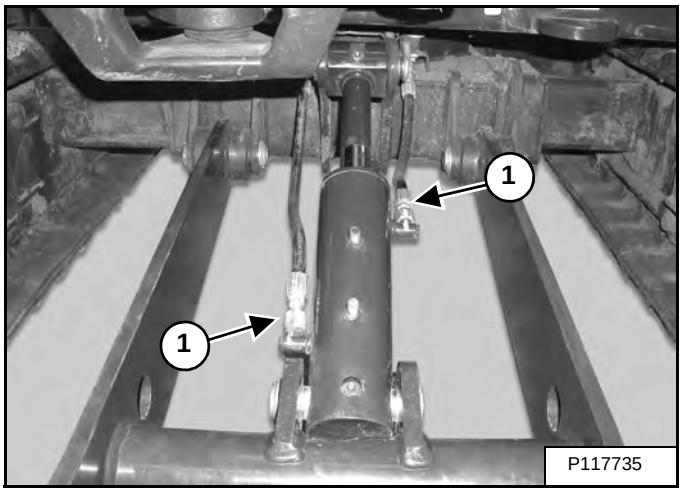
Figure 20-24-4



Remove the two nuts (Item 1) **[Figure 20-24-4]** from the shield.

Remove the blade cylinder shield (Item 2) **[Figure 20-24-4]** from the blade cylinder.

Figure 20-24-5



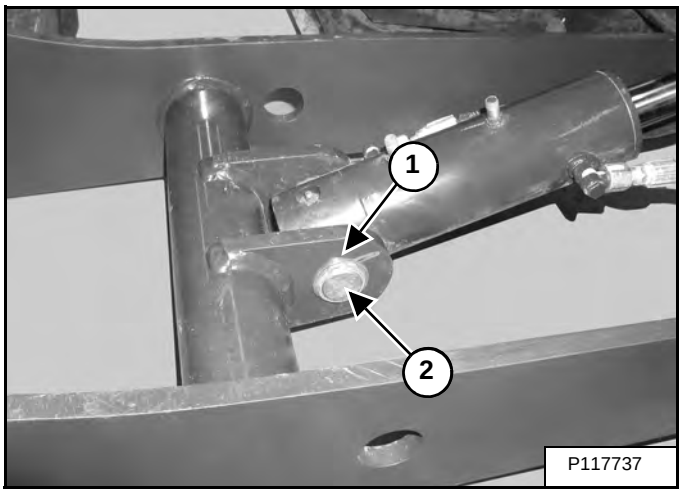
Remove the blade cylinder hoses (Item 1) **[Figure 20-24-5]**.

IMPORTANT

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

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Figure 20-24-6



Remove the snap ring and washer (Item 1) **[Figure 20-24-6]** (Both sides) from the base end pivot pin.

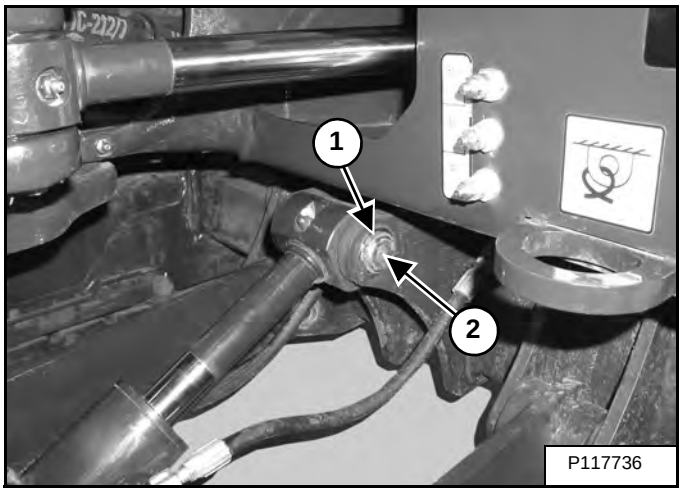
Remove the base end pivot pin (Item 2) **[Figure 20-24-6]**.

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Removal And Installation (Cont'd)

Figure 20-24-7



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

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

Remove the blade cylinder.

⚠ WARNING

AVOID INJURY OR DEATH

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

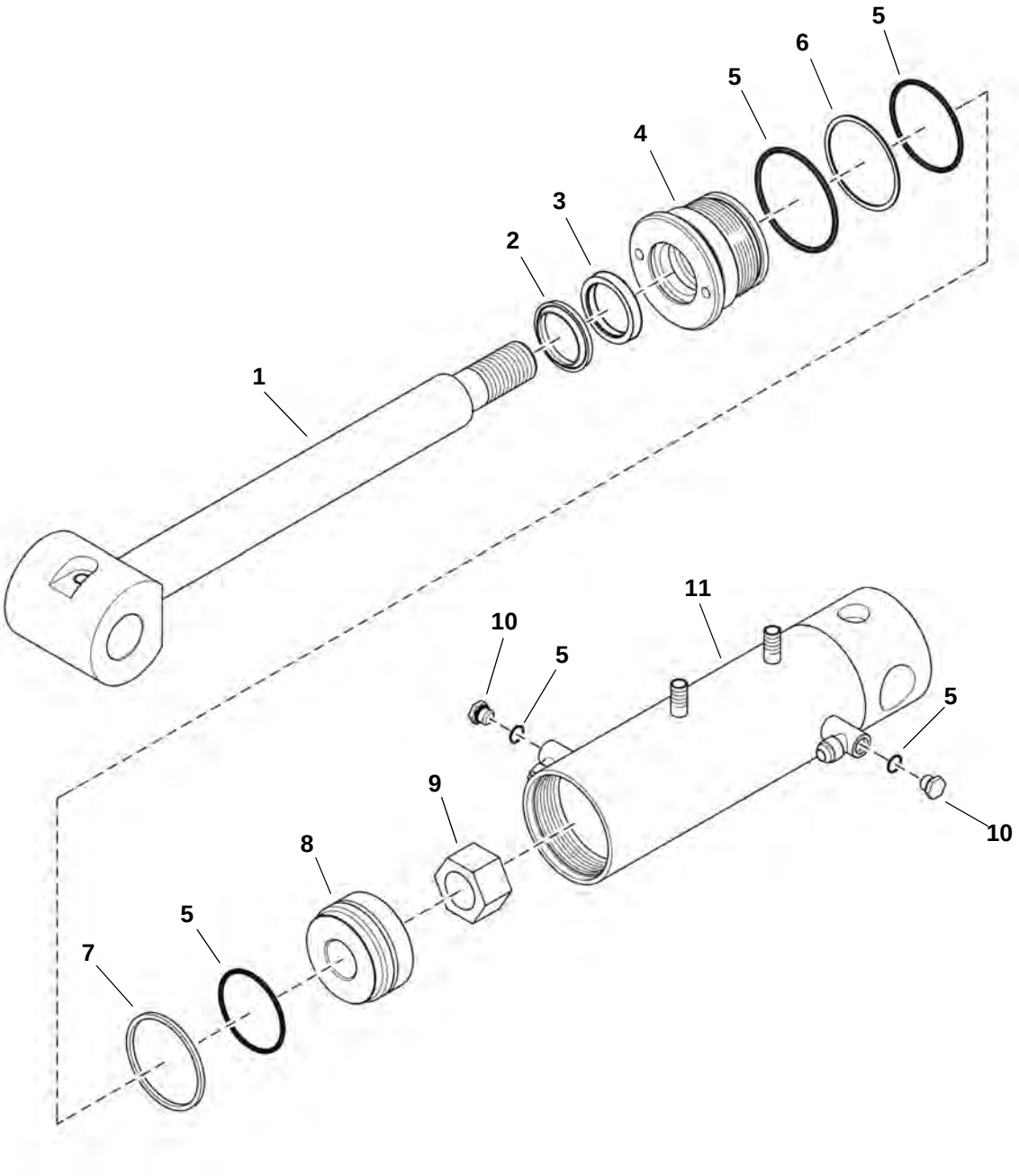
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Parts Identification

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



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Disassembly

Clean the outside of the cylinder before disassembly.

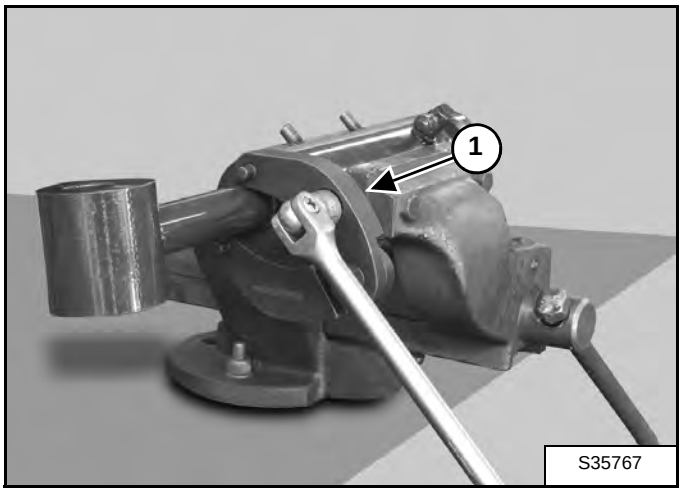
Use the following tools to disassemble the cylinder:

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

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

Put the base end of the cylinder in a vise.

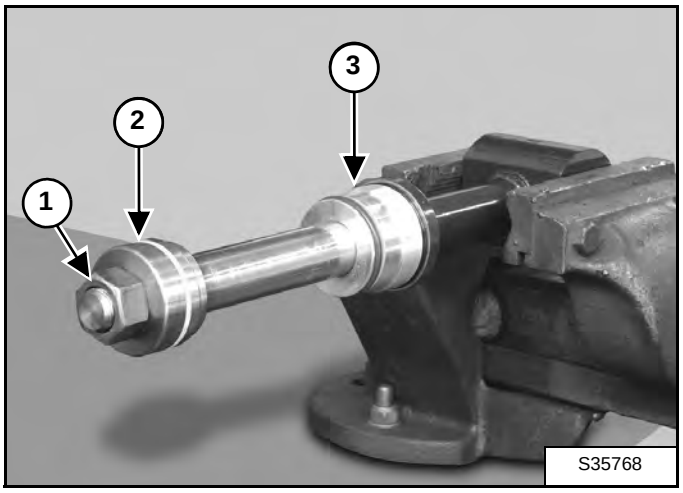
Figure 20-24-8



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

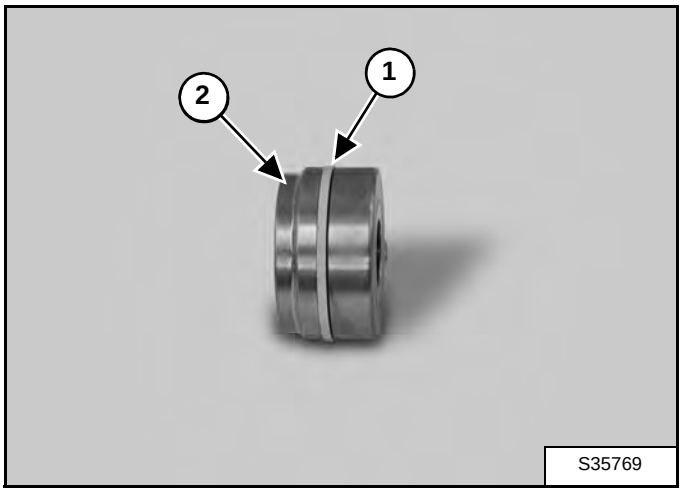
Remove the head and the rod assembly from the cylinder. Put the rod end in a vise.

Figure 20-24-9



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

Figure 20-24-10



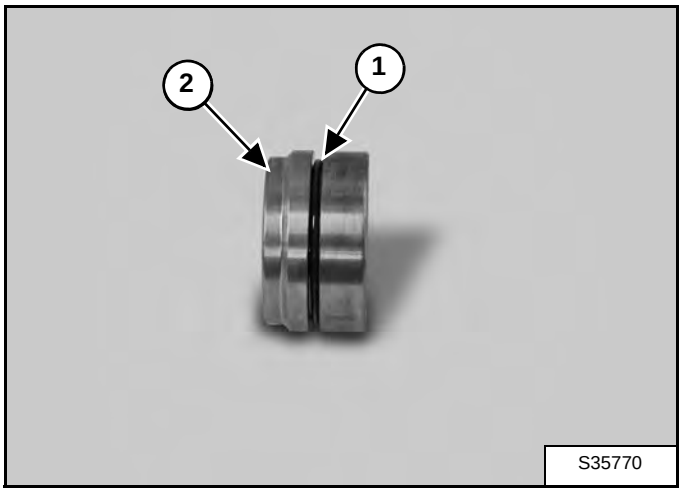
Remove the seal (Item 1) from the piston (Item 2) **[Figure 20-24-10]**.

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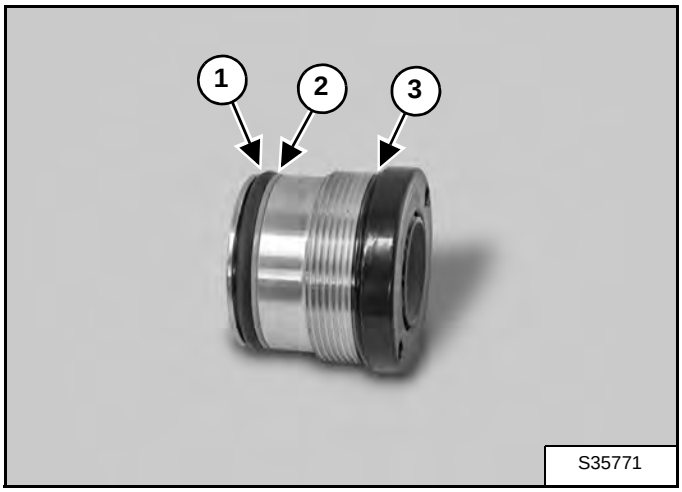
Disassembly (Cont'd)

Figure 20-24-11



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

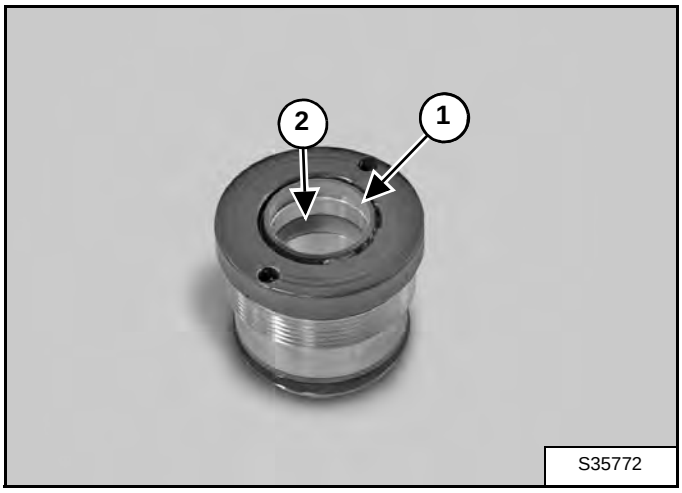
Figure 20-24-12



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

Remove the O-ring (Item 3) **[Figure 20-24-12]**.

Figure 20-24-13



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

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Assembly

Use the following tools to assemble the cylinder:

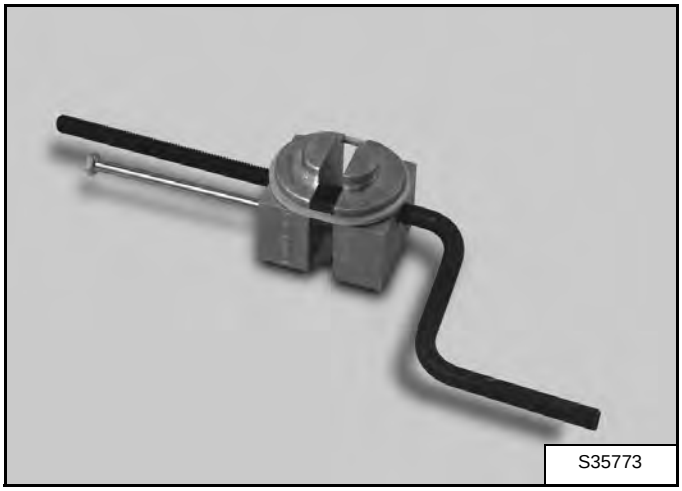
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Offset Pins

Clean all parts in solvent and dry with compressed air.

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

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

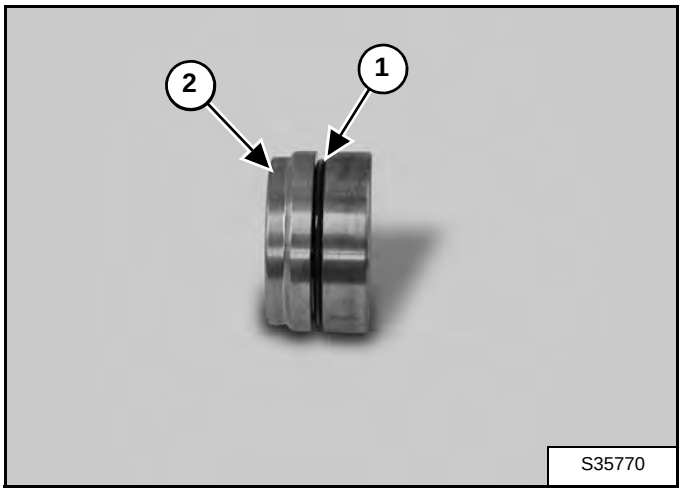
Figure 20-24-14



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

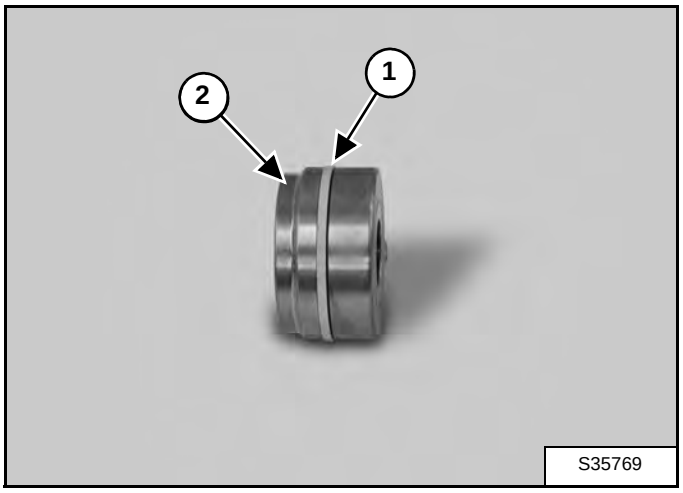
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-24-15



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

Figure 20-24-16



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

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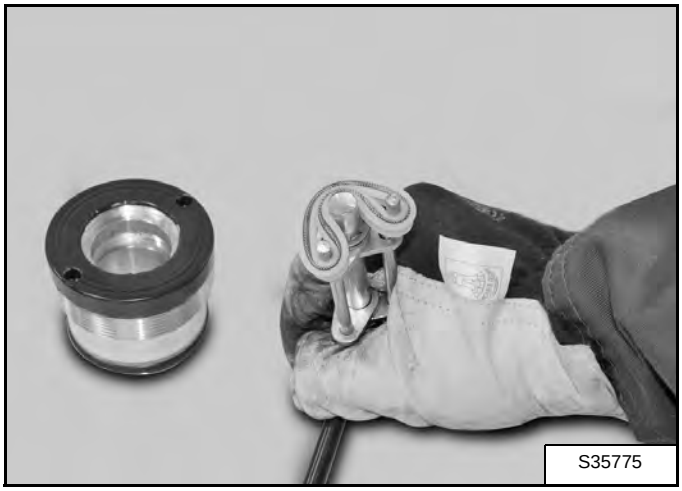
Assembly (Cont'd)

Figure 20-24-17



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

Figure 20-24-18



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

NOTE: Install the spring side of the seal toward the inside of the cylinder.

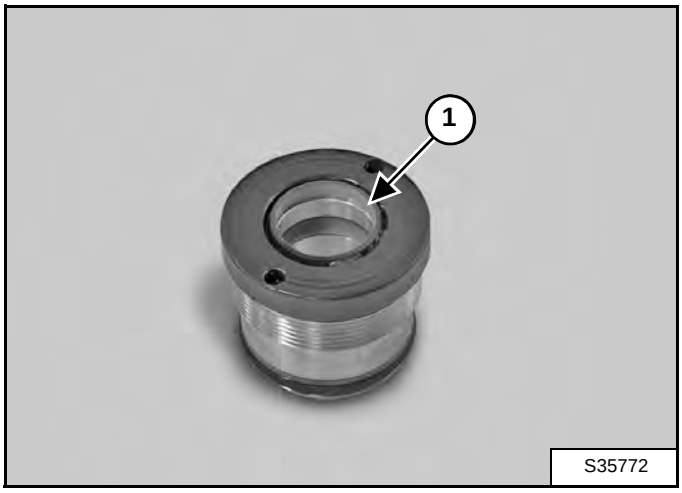
Rotate the handles to collapse the rod seal.

Figure 20-24-19



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

Figure 20-24-20



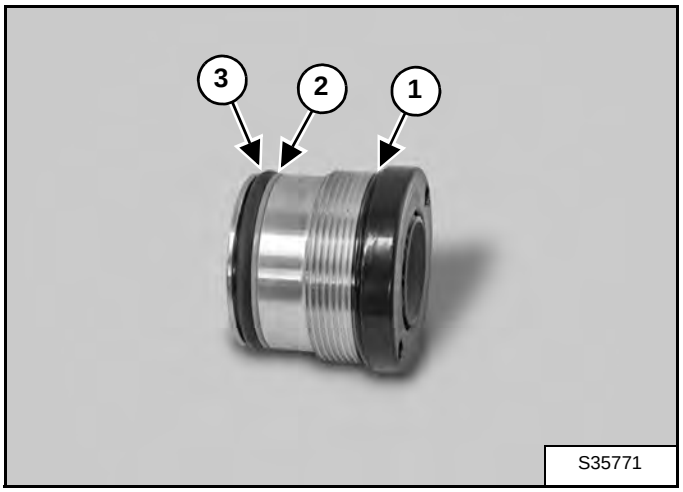
Install the wiper seal with the wiper (Item 1) **[Figure 20-24-20]** toward the outside of the head.

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Assembly (Cont'd)

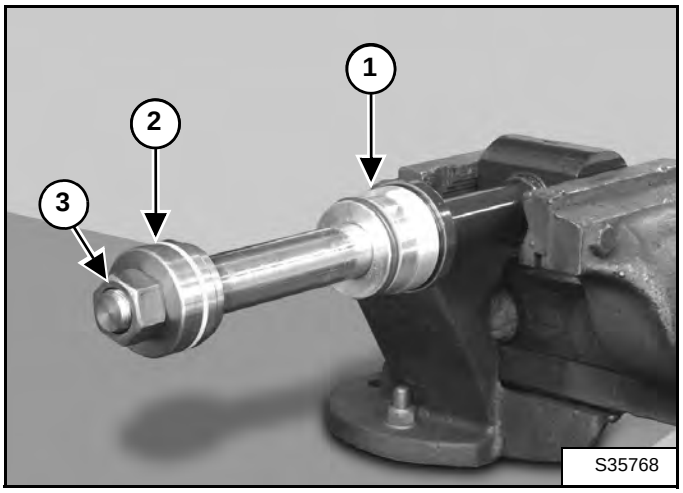
Figure 20-24-21



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

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

Figure 20-24-22



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

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

Provide an adequate support for the cylinder before tightening.

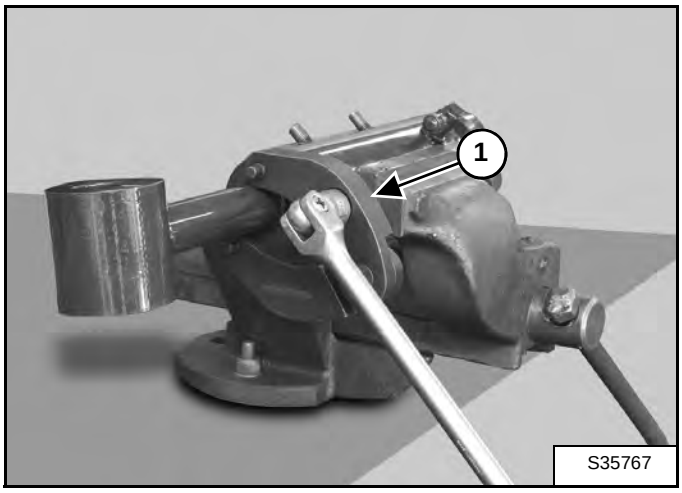
Install the nut (Item 3) **[Figure 20-24-22]**.

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

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

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

Figure 20-24-23



Use the adjustable gland nut wrench (Item 1) **[Figure 20-24-23]** to tighten the head.

Tighten the head to 271 N•m (200 ft-lb) torque.

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CYLINDER (TRACK FRAME EXPANSION)

Testing

Retract the track frame fully.

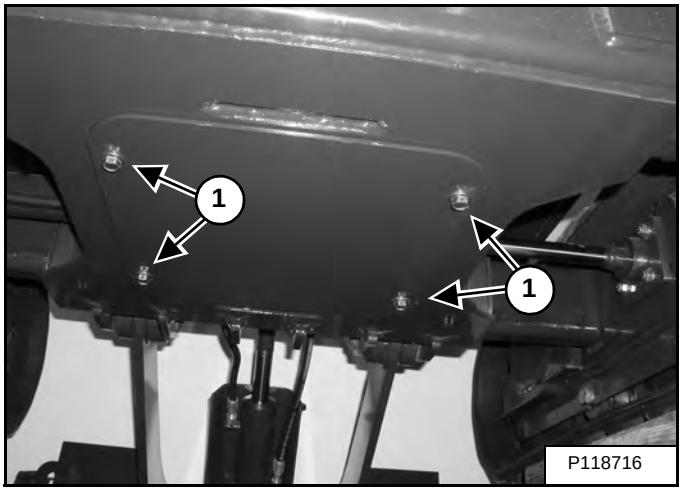
Figure 20-25-1



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

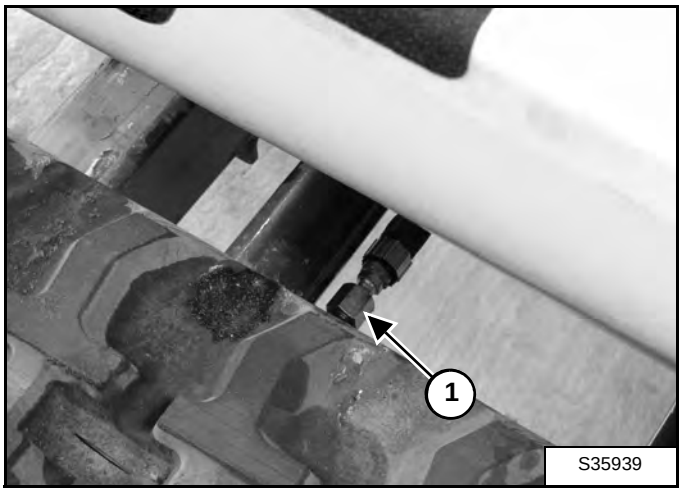
Stop the engine. Raise the control console.

Figure 20-25-2



Remove the four bolts (Item 1) **[Figure 20-25-2]** and remove the cover.

Figure 20-25-3



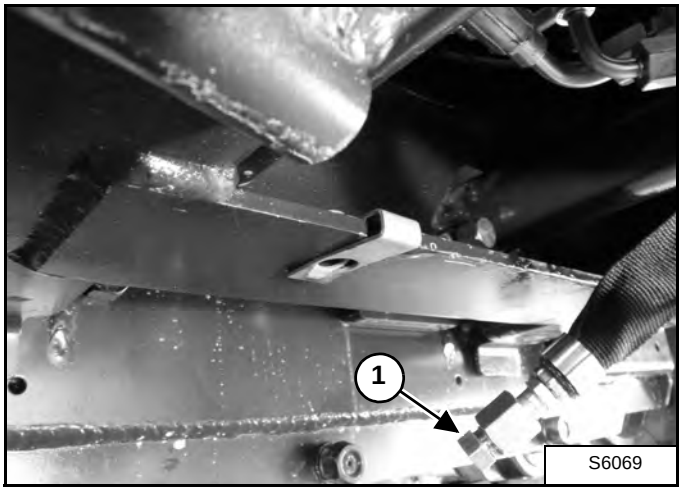
Remove the hose (Item 1) **[Figure 20-25-3]** from the cylinder base end.

⚠ WARNING

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

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Figure 20-25-4



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

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

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

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Removal And Installation

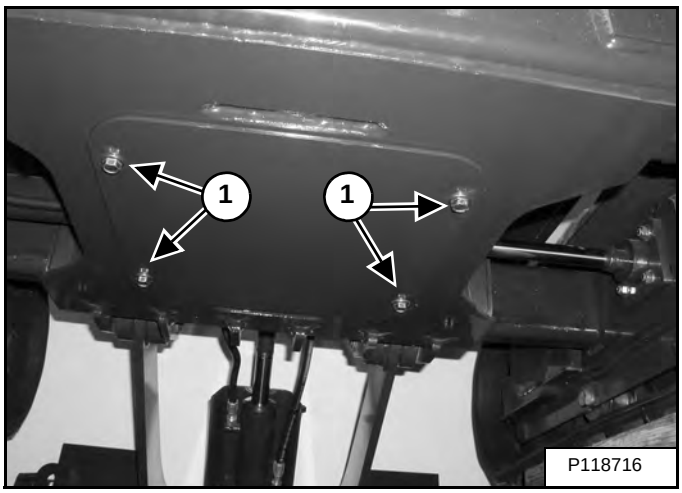
Expand the track frame fully.

Figure 20-25-5



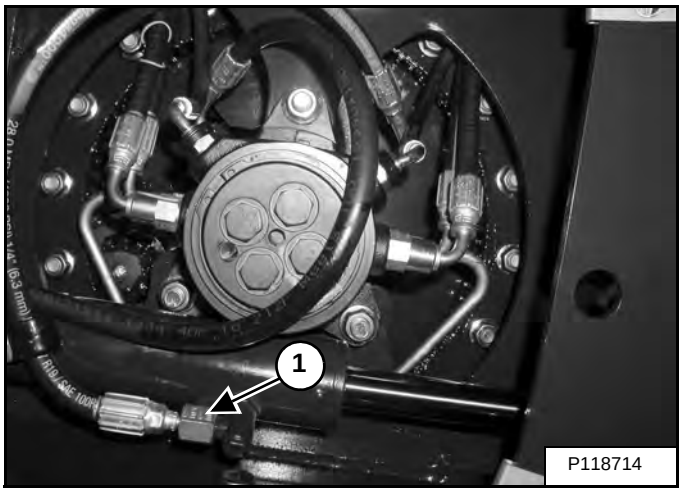
Place blocks under the excavator tracks for increased access to the expansion cylinder **[Figure 20-25-5]**.

Figure 20-25-6



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

Figure 20-25-7



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

IMPORTANT

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

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⚠ WARNING

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

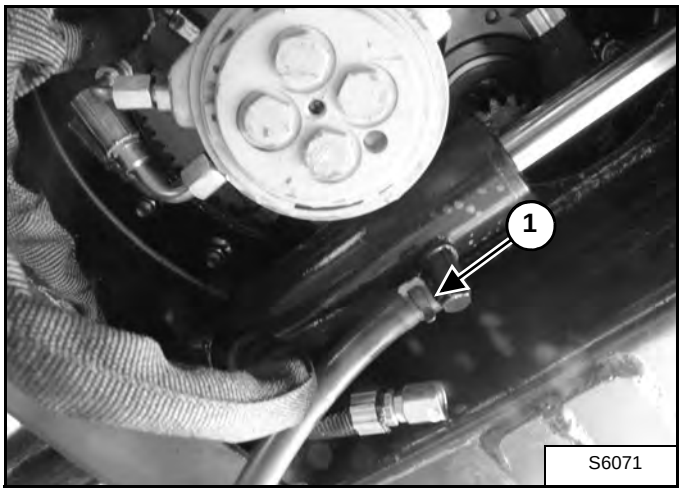
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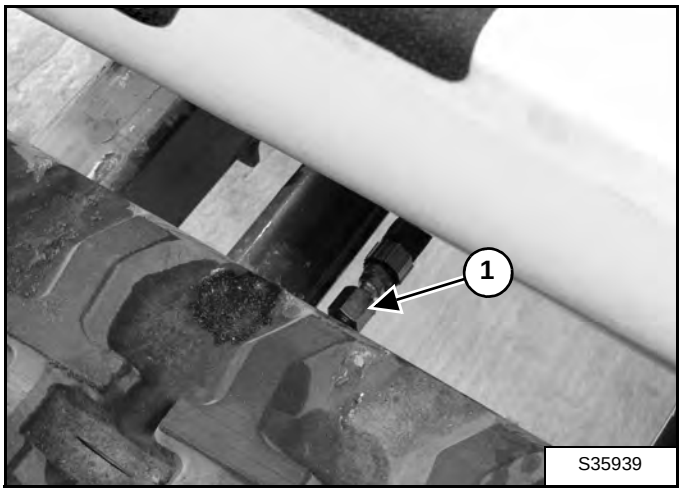
Removal And Installation (Cont'd)

Figure 20-25-8



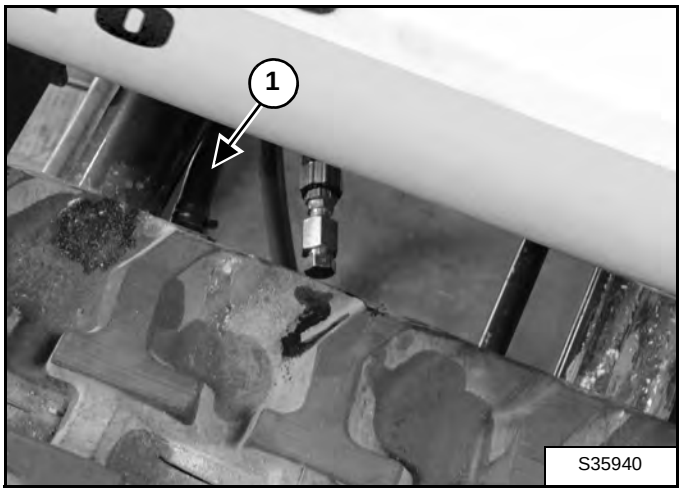
Install a hose (Item 1) **[Figure 20-25-8]** on the cylinder rod end. Place the other end of the hose in a drain pan.

Figure 20-25-9



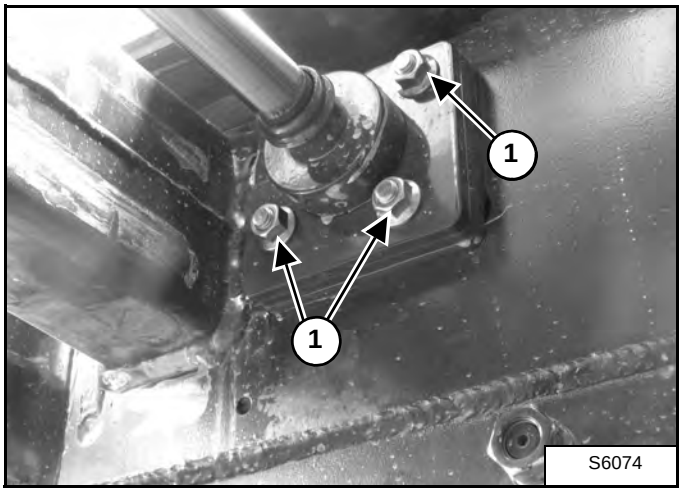
Remove the hose (Item 1) **[Figure 20-25-9]** from the cylinder base end.

Figure 20-25-10



Install a hose (Item 1) **[Figure 20-25-10]** on the cylinder base end. Place the other end of the hose in a drain pan.

Figure 20-25-11



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

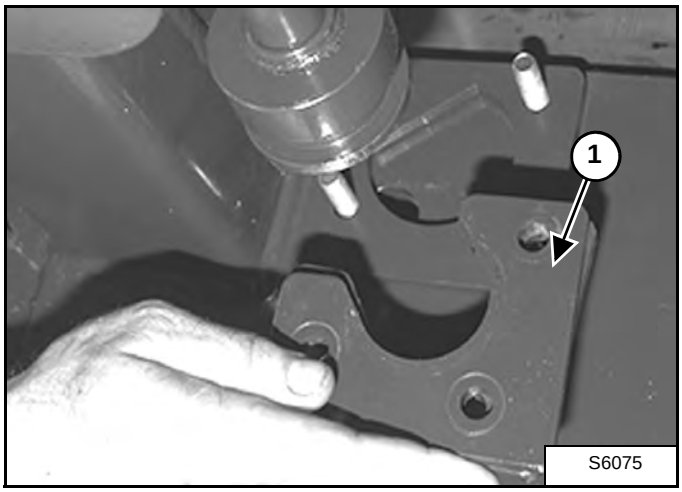
Installation: Tighten the nuts to 43 - 47 N•m (32 - 35 ft-lb) torque.

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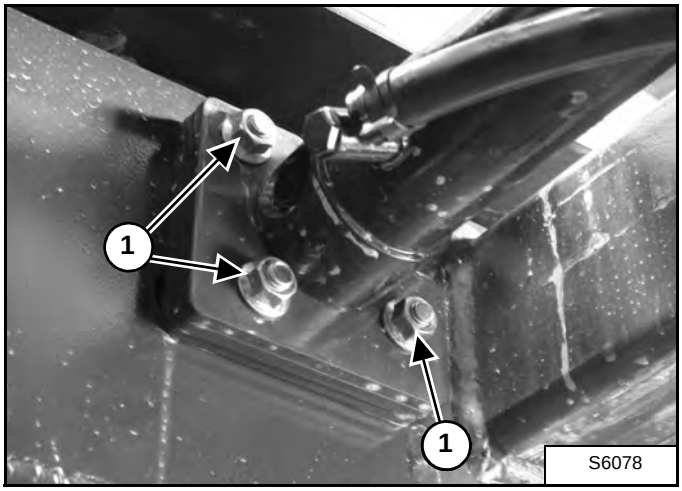
Removal And Installation (Cont'd)

Figure 20-25-12



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

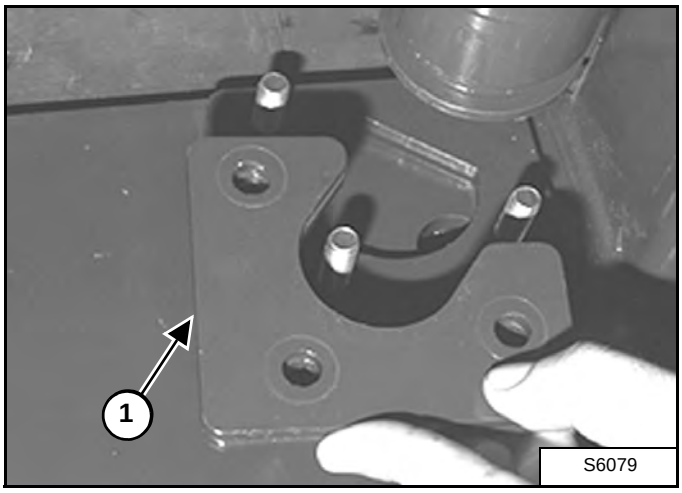
Figure 20-25-13



Remove the three nuts (Item 1) **[Figure 20-25-13]** from the base end of the cylinder.

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

Figure 20-25-14



Pull the cylinder out of the mount. Remove the two plates (Item 1) **[Figure 20-25-14]** from the base end of the cylinder.

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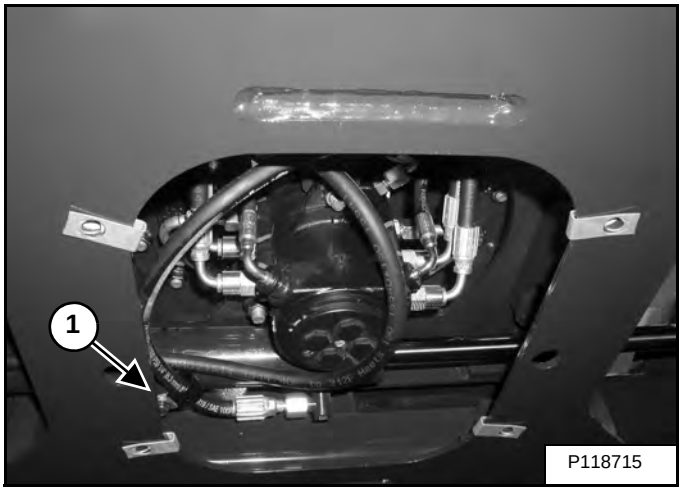
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Removal And Installation (Cont'd)

Compress the cylinder.

Rotate the cylinder until the hose clamp is accessible.

Figure 20-25-15



Remove the bolt (Item 1) **[Figure 20-25-15]**.

Remove the cylinder.

⚠ WARNING

AVOID INJURY OR DEATH

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

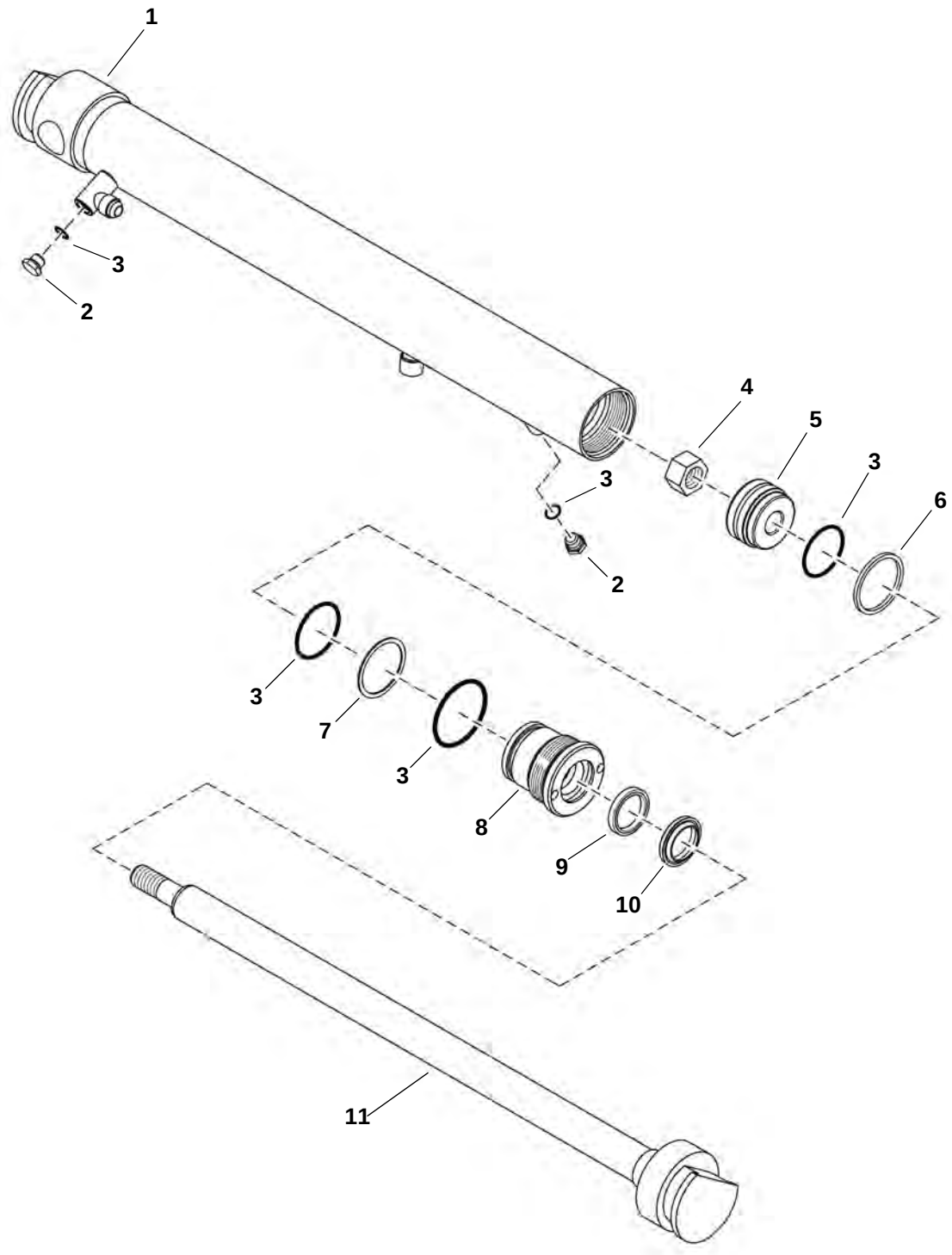
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Parts Identification

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



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Disassembly

Clean the outside of the cylinder before disassembly.

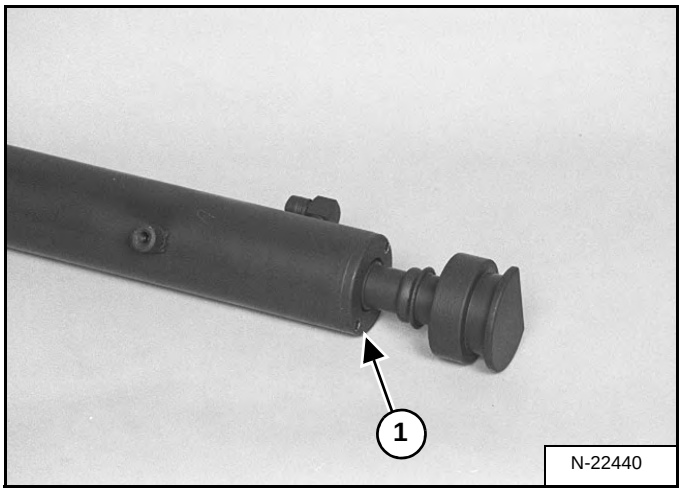
Use the following tools to disassemble the cylinder:

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

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

Put the base end of the cylinder in a vise.

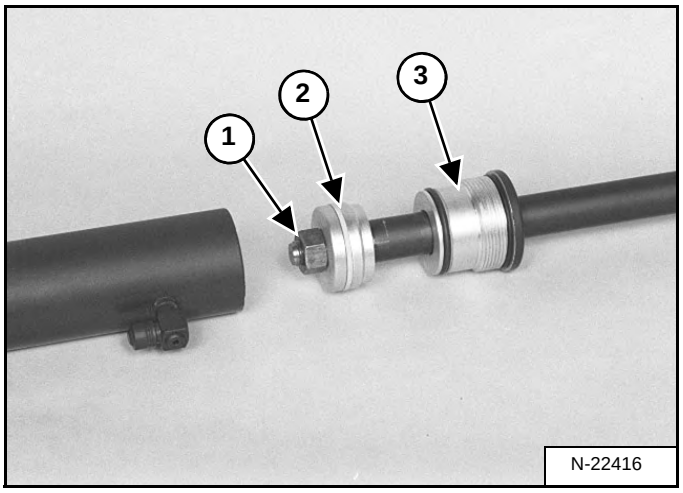
Figure 20-25-16



Use the adjustable gland nut wrench to loosen the head (Item 1) **[Figure 20-25-16]**.

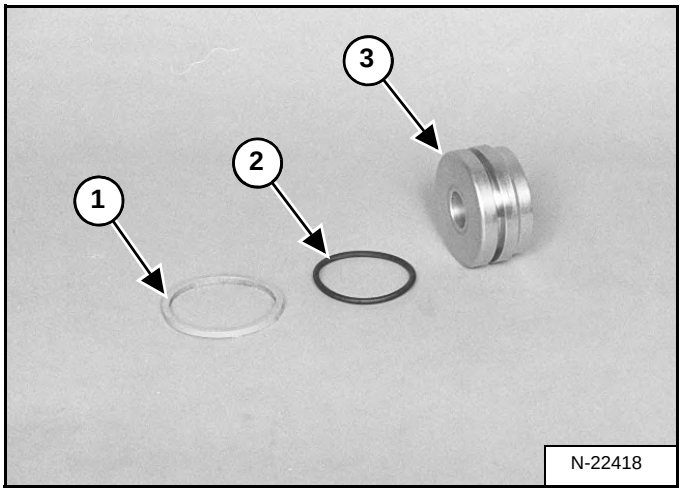
Remove the head and the rod assembly from the cylinder. Put the rod end in a vise.

Figure 20-25-17



Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-25-17]**.

Figure 20-25-18



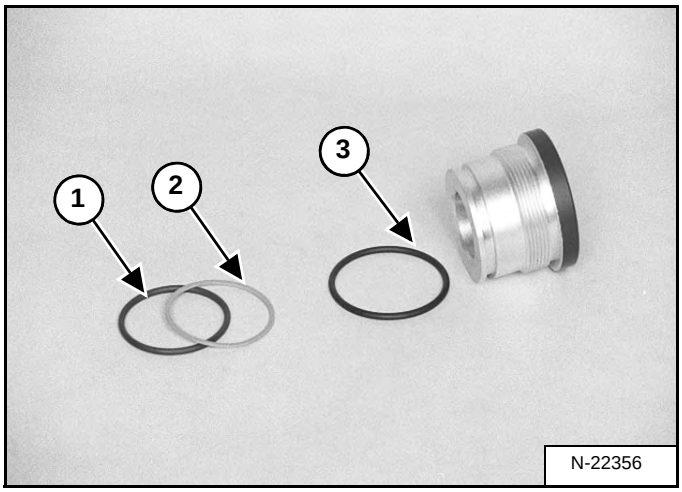
Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-25-18]**.

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Disassembly (Cont'd)

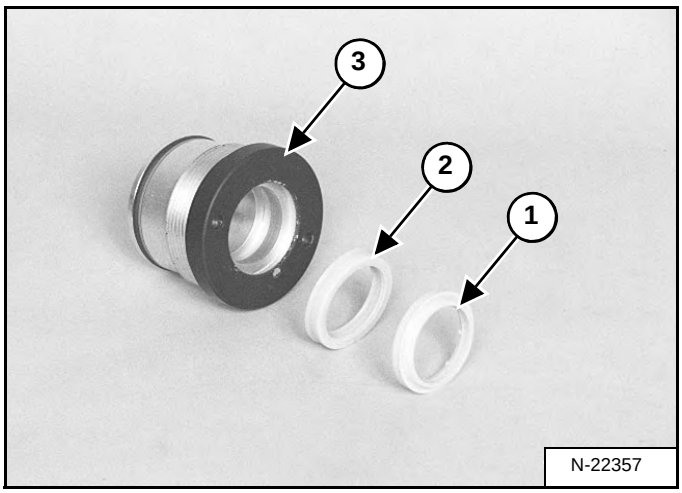
Figure 20-25-19



Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-25-19]** from the head.

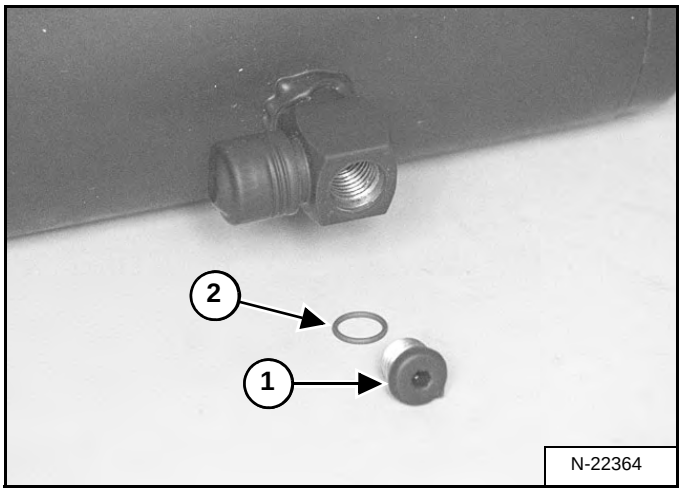
Remove the O-ring (Item 3) **[Figure 20-25-19]**.

Figure 20-25-20



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

Figure 20-25-21



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-25-21]**.

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Assembly

Use the following tools to assemble the cylinder:

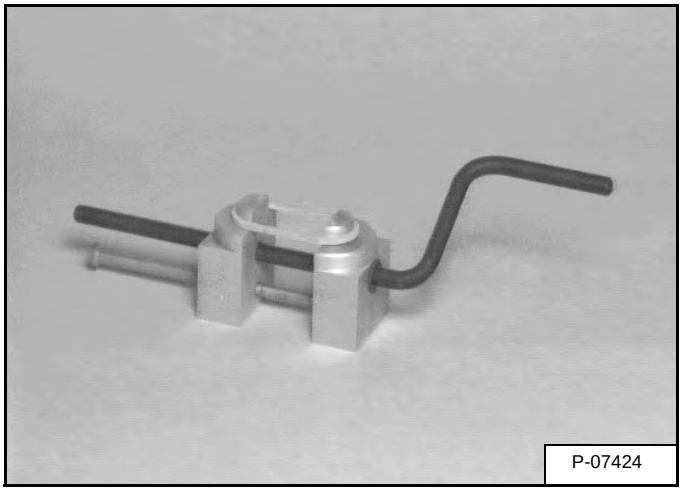
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

Clean all parts in solvent and dry with compressed air.

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

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

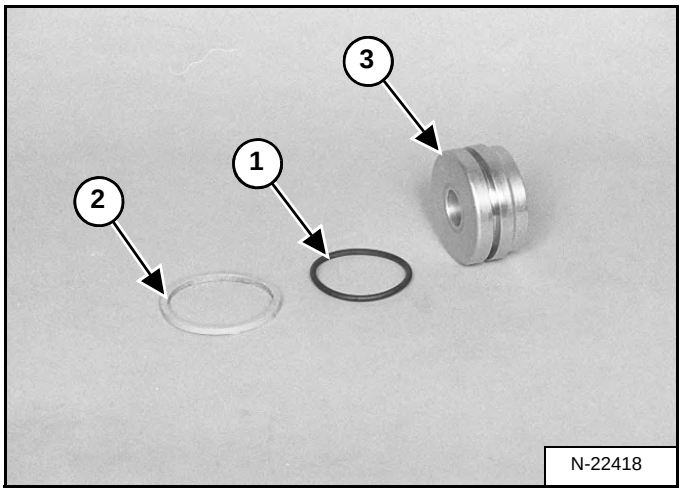
Figure 20-25-22



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-25-22]**.

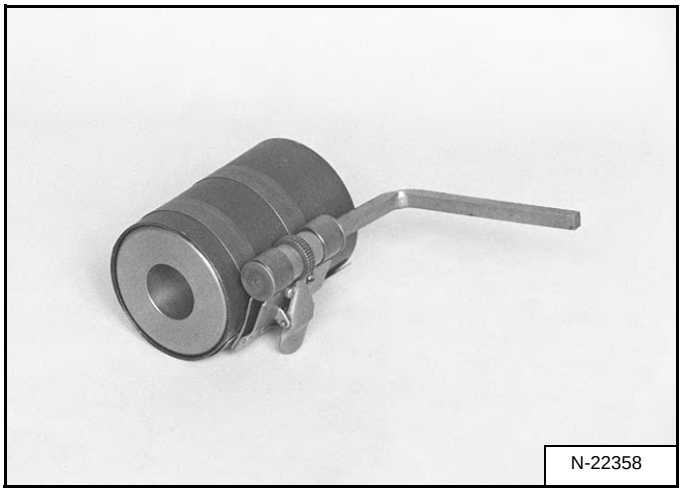
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-25-23



Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-25-23]**.

Figure 20-25-24



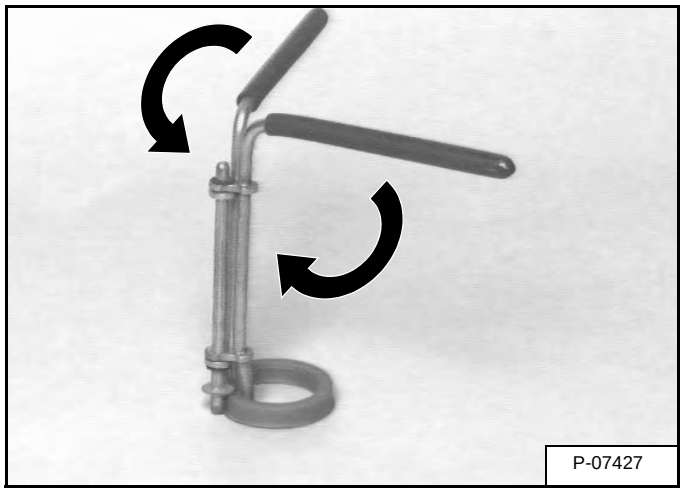
Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-25-24]**.

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Assembly (Cont'd)

Figure 20-25-25

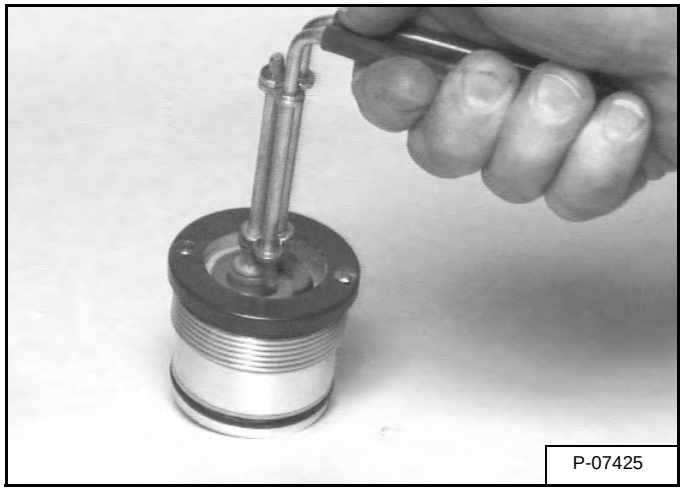


Install the rod seal on the rod seal tool **[Figure 20-25-25]**.

NOTE: Install the spring side of the seal toward the inside of the cylinder.

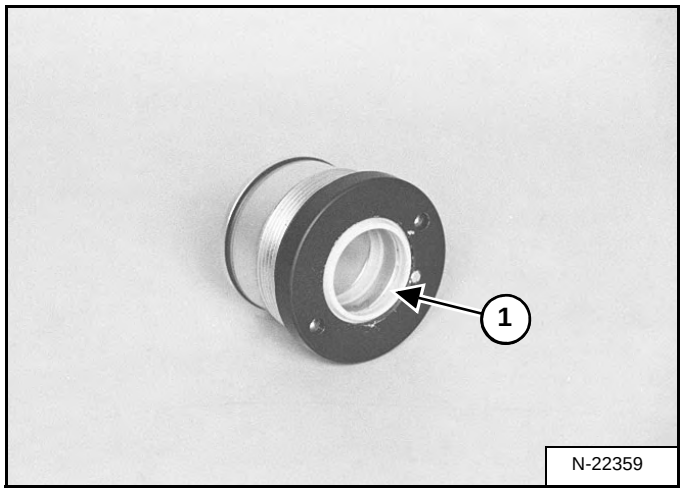
Rotate the handles to collapse the rod seal.

Figure 20-25-26



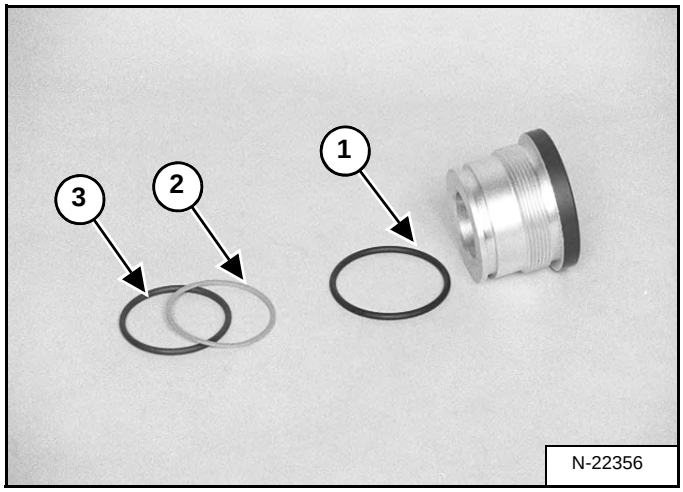
Install the rod seal in the head **[Figure 20-25-26]**.

Figure 20-25-27



Install the wiper seal with the wiper (Item 1) **[Figure 20-25-27]** toward the outside of the head.

Figure 20-25-28



Install the O-ring (Item 1) **[Figure 20-25-28]**.

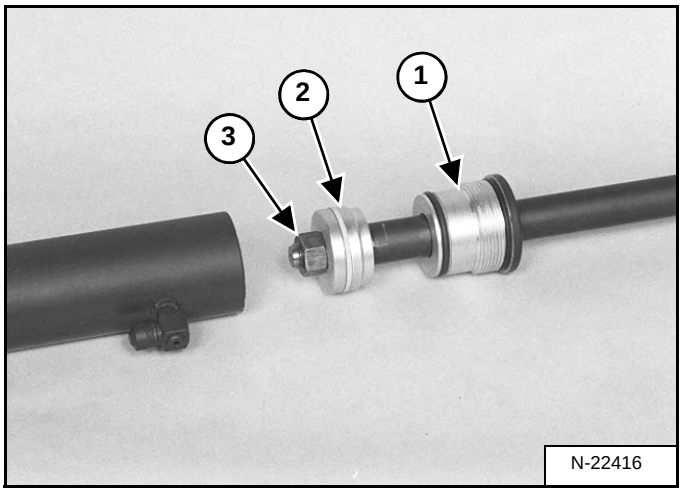
Install the back-up ring (Item 2) and O-ring (Item 3) **[Figure 20-25-28]**.

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Assembly (Cont'd)

Figure 20-25-29



Install the head (Item 1) and the piston (Item 2) **[Figure 20-25-29]** on the rod.

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

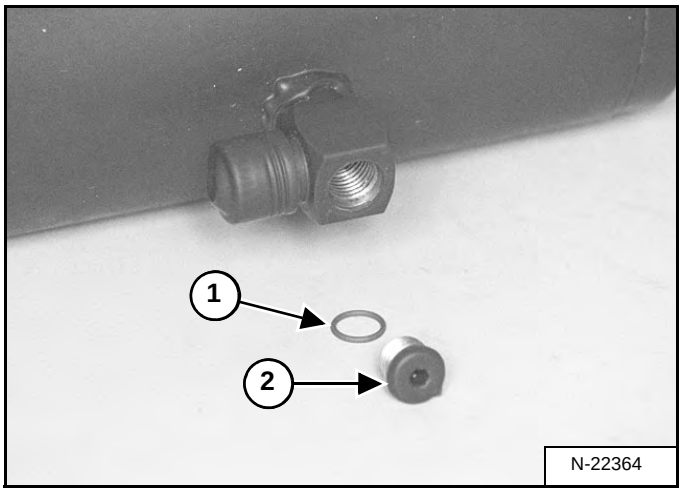
Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-25-29]**.

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

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

Figure 20-25-30

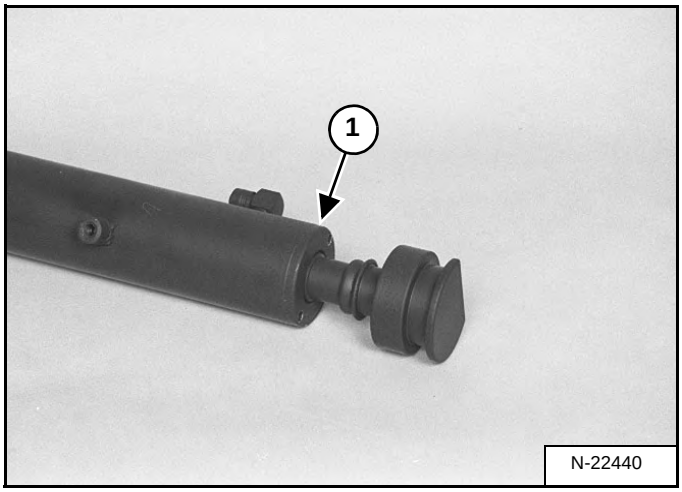


Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-25-30]**.

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

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

Figure 20-25-31



Use the adjustable gland nut wrench to tighten the head (Item 1) **[Figure 20-25-31]**.

Tighten the plug to 183 N•m (135 ft-lb) torque.

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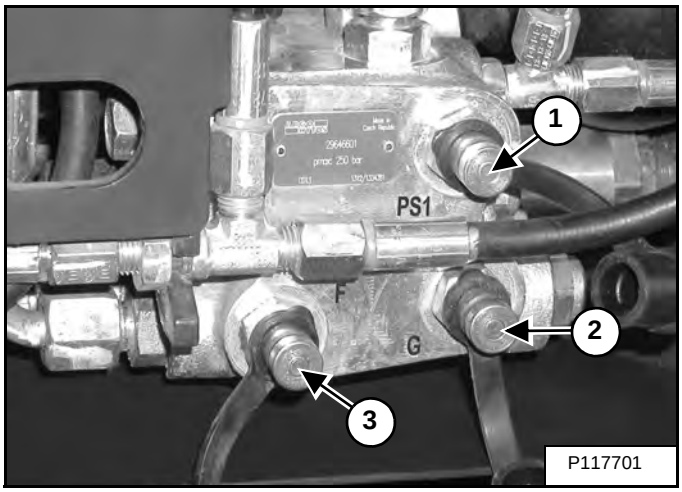
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VALVE (MAIN RELIEF)

Description

Figure 20-30-1



There are three diagnostic couplers on the manifold. Port PS1 (Item 1) is used to test pilot pressure. Port G (Item 2) is used to test main relief valves. Port F (Item 3) **[Figure 20-30-1]** is used in the assembly of the machine.

There are two main reliefs used in the hydraulic system.

One main relief is located in the manifold and is set at 23097 kPa (230,9 bar) (3350 psi) with a range of 22601 kPa - 236601 kPa (227 - 237 bar) (3278 - 3423 psi).

One main relief is located on the hydraulic control valve at the slew valve section and is set to 20594,6 kPa (206 bar) (2987 psi).

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Description (Cont'd)

System Pressure At Gauge Port Specifications

SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET	ACCEPTABLE RANGE
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	PS1	3100 kPa 31 bar 450 psi	3000 - 3300 kPa 30 - 33 bar 436 - 479 psi
SYSTEM BY - PASS	NONE - CONSOLE UP	DUMP TO TANK	G	600 kPa 6 bar 87 psi	MAX ALLOWABLE 1200 kPa MAX ALLOWABLE 12 bar MAX ALLOWABLE 168 psi
MAIN RELIEF ON MANIFOLD BLOCK	BOOM	P2	G	23100 kPa 231 bar 3350 psi	22400 - 23800 kPa 224 - 238 bar 3248 - 3451 psi
MAIN RELIEF ON MANIFOLD BLOCK	ARM	P1 and P2	G	22600 kPa 226 bar 3277 psi	21900 - 23300 kPa 219 - 233 bar 3176 - 3379 psi
MAIN RELIEF ON MANIFOLD BLOCK	BLADE	P3	G	20600 kPa 206 bar 2987 psi	20100 - 21100 kPa 201 - 211 bar 2914 - 3060 psi
SWING MOTOR - CROSS PORT RELIEF	SLEW RIGHT	P3	G	16900 kPa 169 bar 2451 psi	16200 - 17600 kPa 162 - 176 bar 2349 - 2552 psi
SWING MOTOR - CROSS PORT RELIEF	SLEW LEFT	P3	G	16900 kPa 169 bar 2451 psi	16200 - 17600 kPa 162 - 176 bar 2349 - 2552 psi

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Test Conditions

Turn the machine 90° counterclockwise to locate the control valve between the tracks.

Lower the boom / bucket and blade to the ground.

Remove the left upperstructure cover (See Removal And Installation on Page 40-60-1.)

1. Engine High Idle Speed

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

3. Activate function until cylinder movement stops. Hold over relief 5 - 10 Seconds.

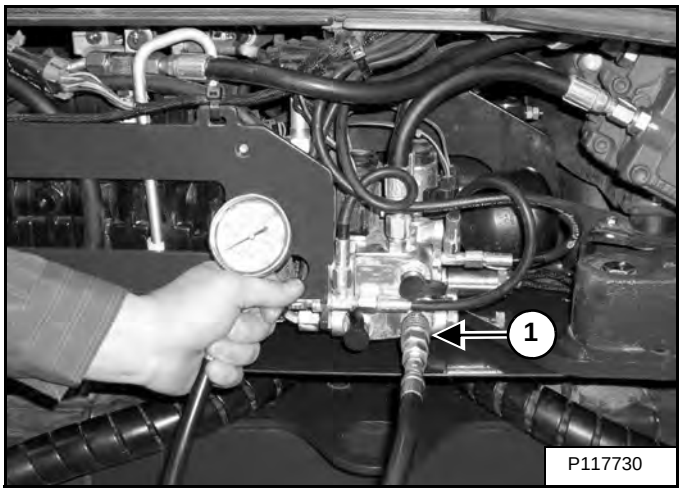
Testing And Adjusting Main Relief At Manifold

All testing is done with the hydraulic fluid at operating temperature and the engine at high idle speed. (See Engine on Page SPEC-10-6.

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

MEL1355 - Test Kit includes the following:
MEL1355-3 - 34,500 kPa (345 bar) (5000 psi) Gauge
MEL1355-12 Coupler
MEL1355-9 Thermometer

Figure 20-30-2



Connect a 34,500 kPa (345 bar) (5000 psi) gauge (Item 1) **[Figure 20-30-2]** on the G diagnostic port.

Lower the control console and fasten the seat belt.

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

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

Operate the following circuit over relief and record the pressure.

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

Boom up:

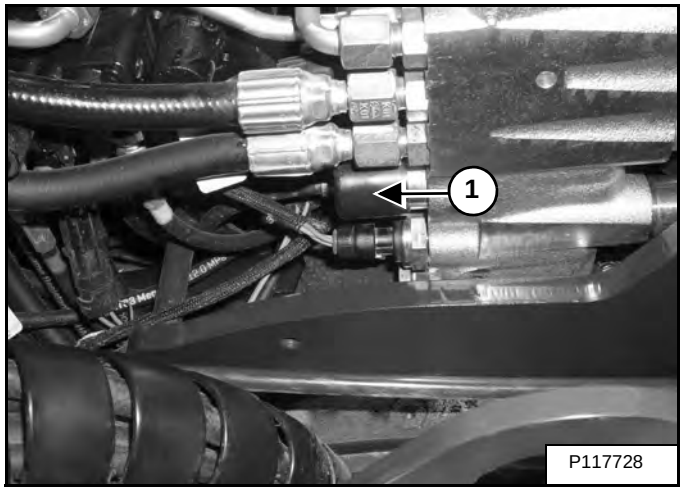
22600 - 23600 kPa (226 - 236 bar) (3278 - 3423 psi).

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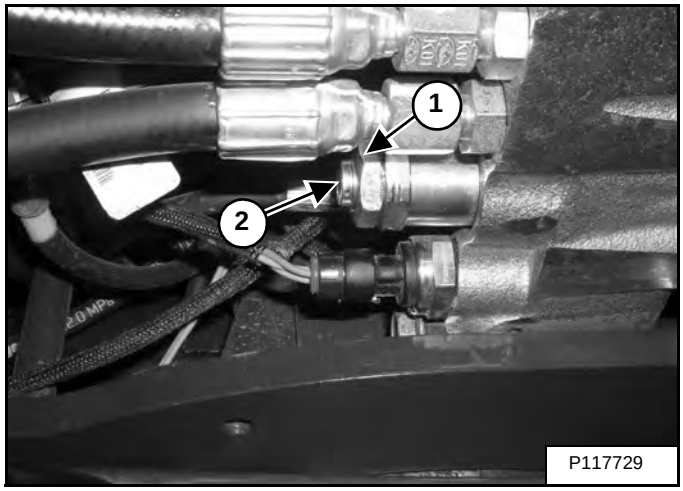
Testing And Adjusting Main Relief At Manifold (Cont'd)

Figure 20-30-3



If adjustment is needed, remove the protective cap (Item 1) **[Figure 20-30-3]**.

Figure 20-30-4



Loosen the nut (Item 1) and turn the adjustment bolt (Item 2) **[Figure 20-30-4]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

Tighten the nut (Item 1) **[Figure 20-30-4]**.

Retest the main relief valve after adjustment.

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Testing And Adjusting Main Relief At Hydraulic Control Valve

Lower the control console and fasten the seat belt.

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

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

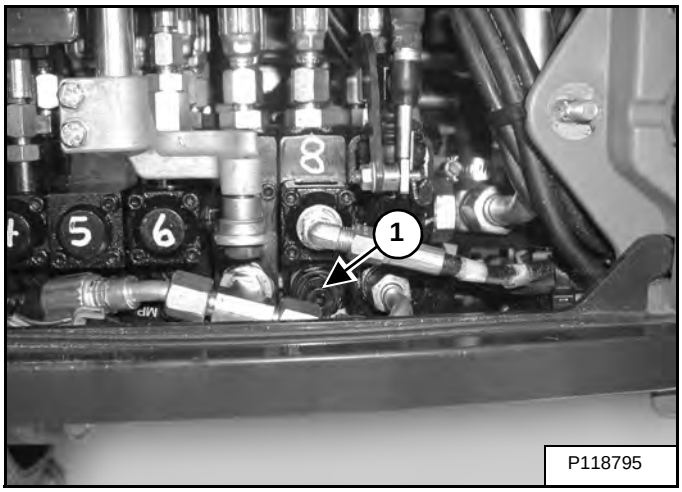
Operate the following circuit over relief and record the pressure.

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

Blade up:

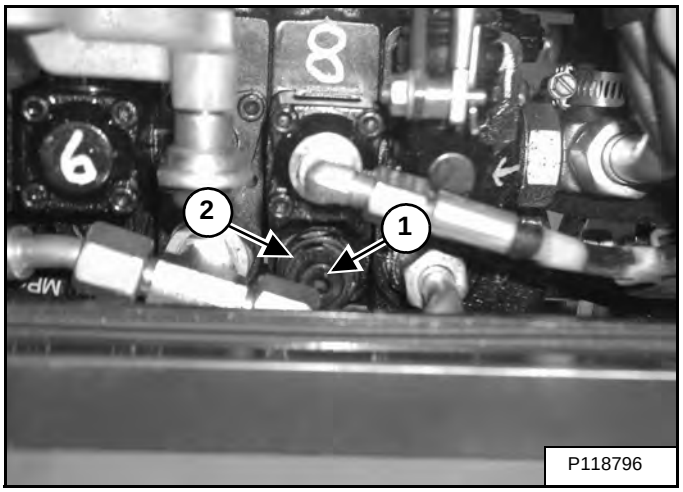
20100 - 21100 kPa (201 - 211 bar) (29141 - 3060 psi)

Figure 20-30-5



If adjustment is needed, loosen the nut (Item 1) **[Figure 20-30-5]**.

Figure 20-30-6



Turn the adjustment screw (Item 1) **[Figure 20-30-6]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

Tighten the nut (Item 2) **[Figure 20-30-6]**.

Retest the main relief valve after adjustment.

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VALVE (PORT RELIEF)

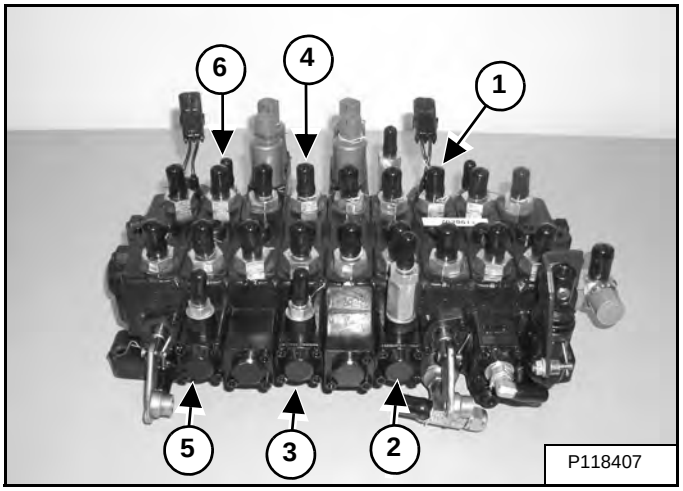
Testing And Adjusting

Turn the machine 90° counterclockwise to locate the control valve between the tracks.

Lower boom / bucket and the blade to the ground.

Remove the left upperstructure cover. (See Removal And Installation on Page 40-60-1.)

Figure 20-31-1



Boom Port Relief set at:

Rod End (Item 1) **[Figure 20-31-1]**	25000 kPa (250 bar) (3625 psi)
Base End (Item 2) **[Figure 20-31-1]**	21001 kPa (210 bar) (3046 psi)

Bucket Port Relief set at:

Rod End (Item 3) **[Figure 20-31-1]**	25000 kPa (250 bar) (3625 psi)
Base End (Item 4) **[Figure 20-31-1]**	25000 kPa (250 bar) (3625 psi)

Arm Port Relief set at:

Rod End (Item 5) **[Figure 20-31-1]**	25000 kPa (250 bar) (3625 psi)
Base End (Item 6) **[Figure 20-31-1]**	25000 kPa (250 bar) (3625 psi)

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

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

Turn the machine 90° counterclockwise to locate the control valve between the tracks.

Lower the boom / bucket and blade to the ground.

Remove the upperstructure cover. (See Removal And Installation on Page 40-60-1.)

Remove floor mats and floor panels

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Testing And Adjusting (Cont'd)

Figure 20-31-2



Install the hand pump hose and a pressure gauge (minimum of 34474 kPa (345 bar) (5000 psi), into the valve section work port in which the port relief valve is located **[Figure 20-31-2]**. Slowly pressurize this section with the hand pump until the port relief valve opens and make a note of the pressure reading.

NOTE: Pumping the hand pump too fast will alter the pressure readings up to 345 kPa (3,4 bar) (50 psi).

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

⚠ WARNING

AVOID INJURY OR DEATH

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

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

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VALVE (CROSS PORT RELIEF)

Testing

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

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

TEST CONDITIONS

1. Engine High Idle Speed
2. Warm fluid over relief function to minimum 66°C (150°F). Cycle all functions during warm up procedure.
   Warm fluid until the pressure build-up valve stabilizes near its target pressure.
3. Activate function until cylinder movement stops. Hold over relief for 5 - 10 seconds.
   Record pressure.

System Pressures At Gauge Port Specifications

SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET kPa (bar) (psi)	ACCEPTABLE RANGE kPa (bar) (psi)
SWING MOTOR - CROSS PORT RELIEF	SLEW RIGHT	P 3	G	16900 (169) (2451)	16200 - 17600 (162 - 176) (2349 - 2552)
SWING MOTOR - CROSS PORT RELIEF	SLEW LEFT	P 3	G	16900 (169) (2451)	16200 - 17600 (162 - 176) (2349 - 2552)

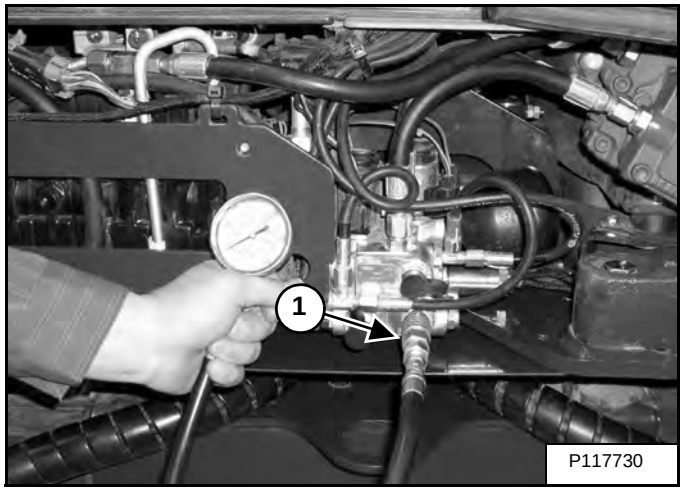
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Testing (Cont'd)

Remove the left upperstructure cover panel. (See Removal And Installation on Page 40-60-1.)

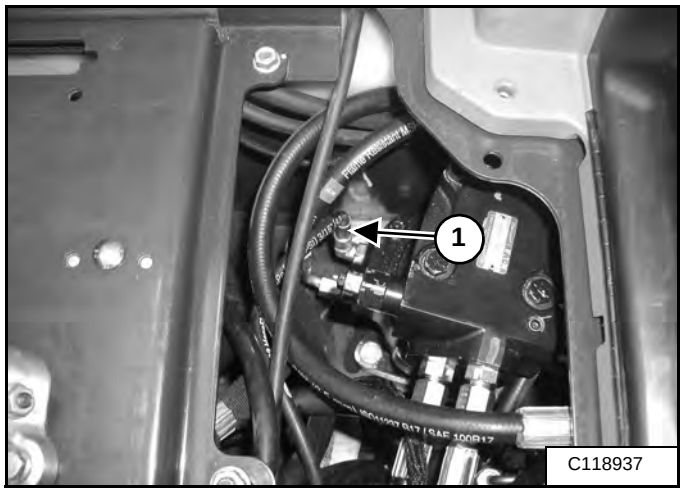
Figure 20-32-1



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

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

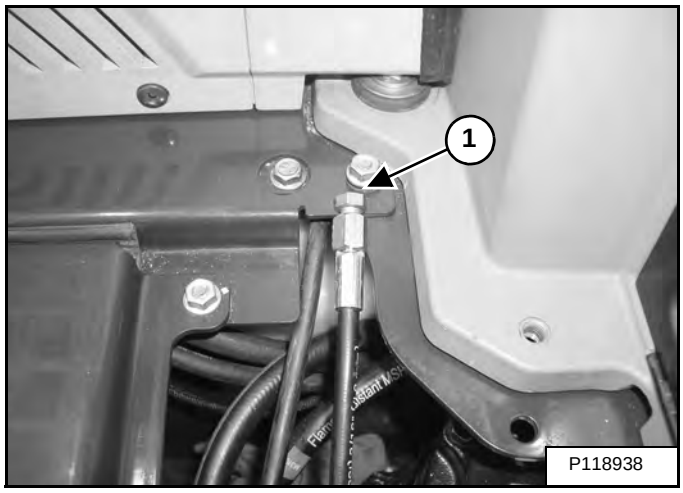
Figure 20-32-2



Disconnect the pilot hose for the swing brake (Item 1) **[Figure 20-32-2]** to the swing motor.

NOTE: This will keep the swing brake disc engaged when the swing function is activated.

Figure 20-32-3



Install a plug and cap (Item 1) **[Figure 20-32-3]** on the hose and the fitting.

Lower the control console and fasten the seat belt.

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

Engage the upperstructure slew right function. Record the pressure on the gauge.

Engage the upperstructure slew left function. Record the pressure on the gauge.

The crossport relief valve pressure should be as follows:

A target pressure of 16900 kPa (169 bar) (2451 psi) with an acceptable range of 16200 - 17600 kPa (162 - 176 bar) (2349 - 2552 psi).

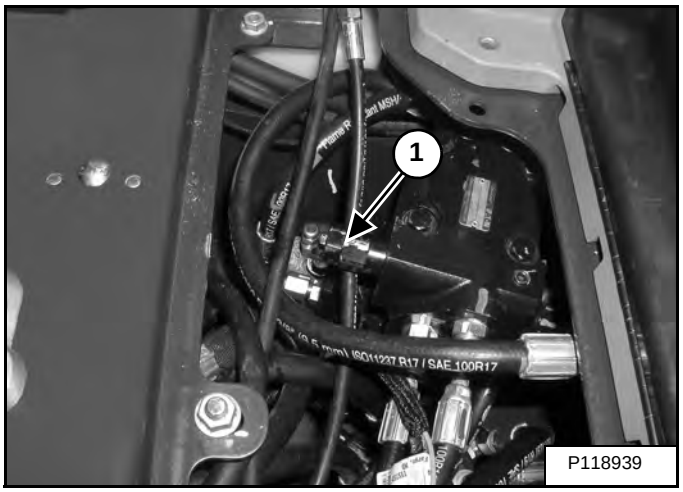
Stop the engine.

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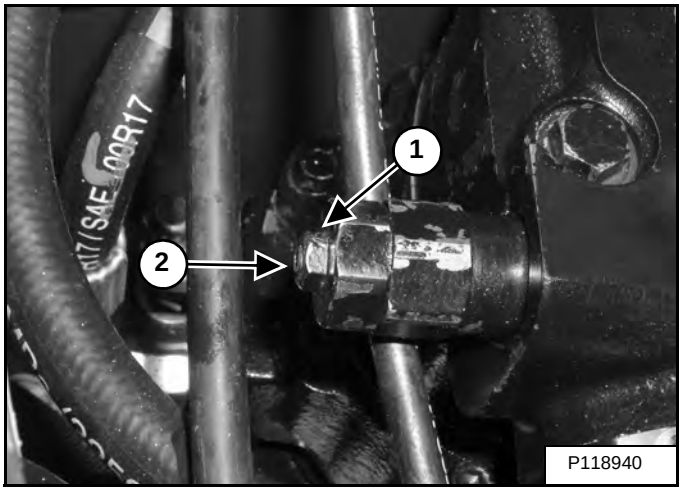
Testing (Cont'd)

Figure 20-32-4



If the crossport relief valve (Item 1) **[Figure 20-32-4]** does not meet specifications, remove, clean and inspect the valve. Reinstall the valve and retest. If the valve still does not meet specifications, adjust the crossport relief valve.

Figure 20-32-5



Loosen the locknut (Item 1) and turn the adjusting screw (Item 2) clockwise to increase pressure and counterclockwise to reduce pressure.

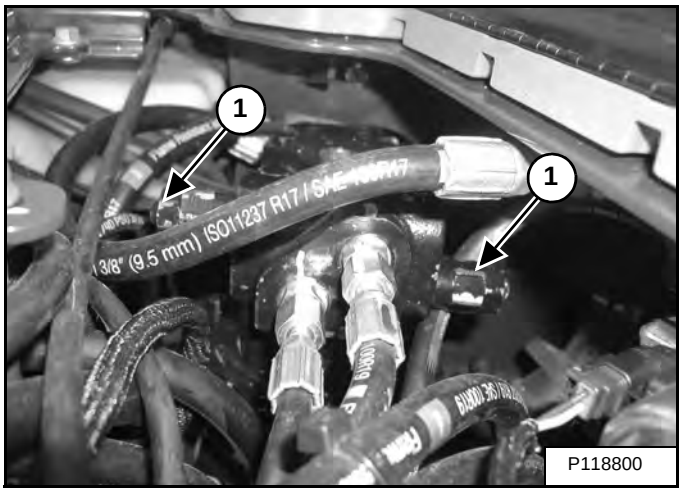
1/4 turn equals 100 psi change in pressure.

Removal And Installation

Drain the hydraulic reservoir. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

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

Figure 20-32-6



Mark and remove the crossport relief valves (Item 1) **[Figure 20-32-6]**.

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VALVE (PRESSURE REDUCING)

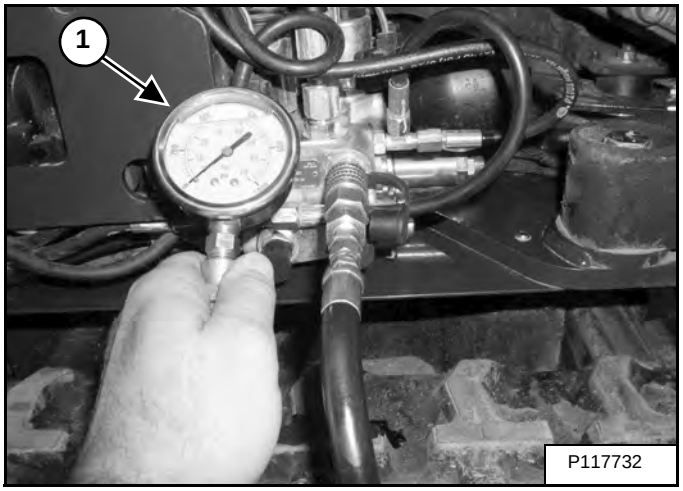
Testing And Adjusting

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

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

Remove the left upperstructure cover. (See Removal And Installation on Page 40-60-1.)

Figure 20-33-1



Locate the test port (PS1) on the manifold and install a 6895 kPa (69 bar) (1000 psi) gauge (Item 1) **[Figure 20-33-1]** on the test port (PS1).

Lower control console and fasten seat belt.

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

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

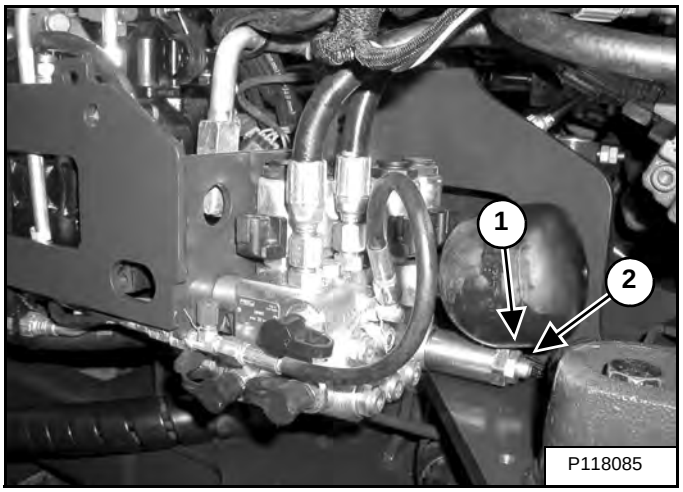
Operate the circuit over relief and record the pressure.

The pressure reducing valve pressure at the test port (PS1) should be as follows:

3000 - 3300 kPa (30 - 33 bar) (436 - 479 psi)

Stop the engine.

Figure 20-33-2



If adjustment is needed, loosen the nut (Item 1) **[Figure 20-33-2]**.

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

Tighten the nut (Item 1) **[Figure 20-33-2]**.

Retest the pressure reducing valve after adjustment.

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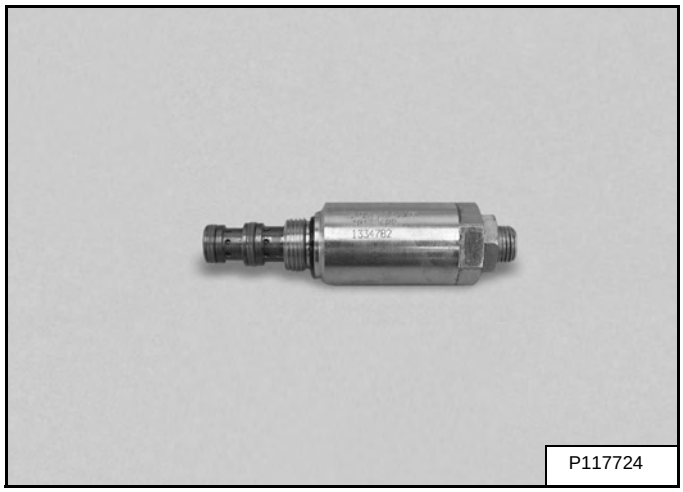
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Testing And Adjusting (Cont'd)

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

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

Figure 20-33-3



Inspect the O-rings and back-up rings on the pressure reducing valve (Item 1). If O-rings and back-up rings are worn or damaged, replace O-rings and back-up rings **[Figure 20-33-3]**.

Install the pressure reducing valve in the manifold assembly.

Repeat pressure reducing valve test.

If the O-rings and back-up rings were not worn or damaged and the pressures at the test port can not be achieved, replace pressure reducing valve.

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HYDRAULIC CONTROL VALVE

Description

The hydraulic control valve is a nine section open center system and has 24994 kPa (250 bar) (3625 psi) work port relief valves for the bucket, arm and boom (rod end) sections. The hydraulic control valve has 20995 kPa (210 bar) (3045 psi) work port relief valve for the boom (base end) section.

Removal And Installation

Turn the machine counterclockwise 90° for access to the bottom of the valve.

Lower the boom / bucket and blade to the ground.

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

IMPORTANT

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

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Remove the cab. (See Removal And Installation on Page 40-30-1.)

Remove the left upperstructure covers. (See Removal And Installation on Page 40-60-1.)

Drain the hydraulic reservoir. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

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

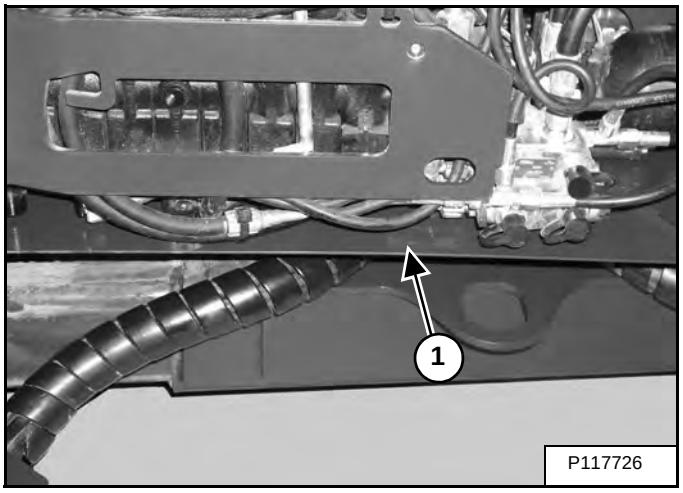
Remove the travel control assembly. (See Removal And Installation on Page 40-110-1.)

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.

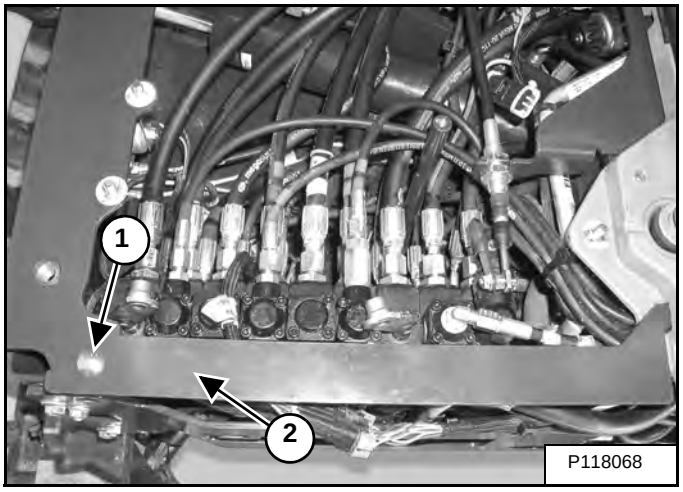
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Figure 20-40-1



Remove the three bolts and the lower plate (Item 1) **[Figure 20-40-1]** under the valve.

Figure 20-40-2



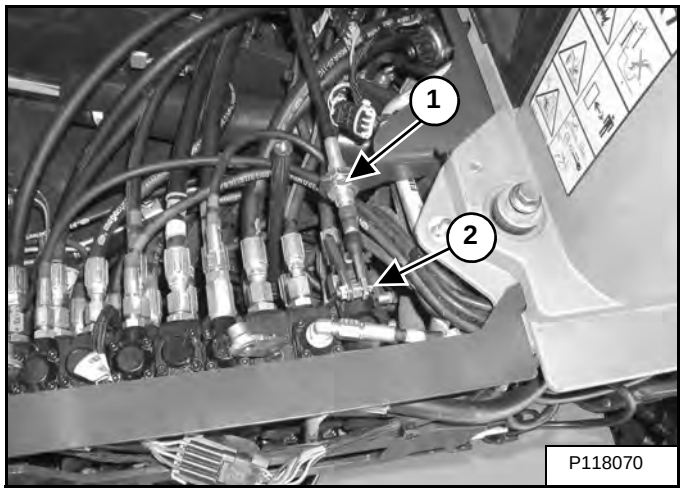
Loosen the bolt (Item 1) and remove the bracket (Item 2) **[Figure 20-40-2]**.

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Removal And Installation (Cont'd)

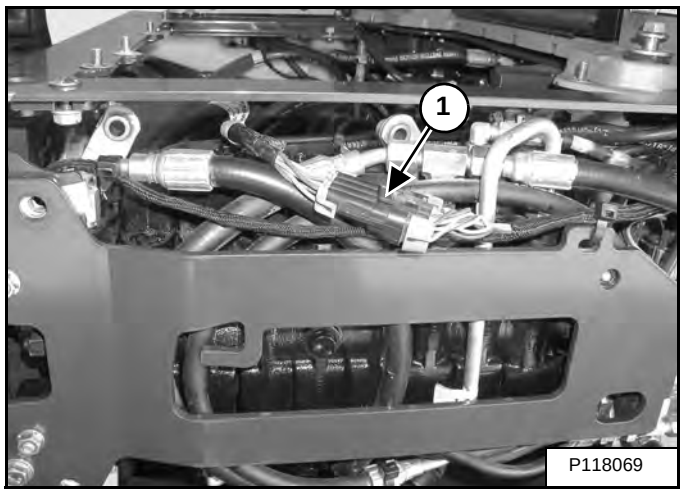
Figure 20-40-3



Loosen the track extension cable nuts (Item 1) and remove the pin (Item 2) **[Figure 20-40-3]**.

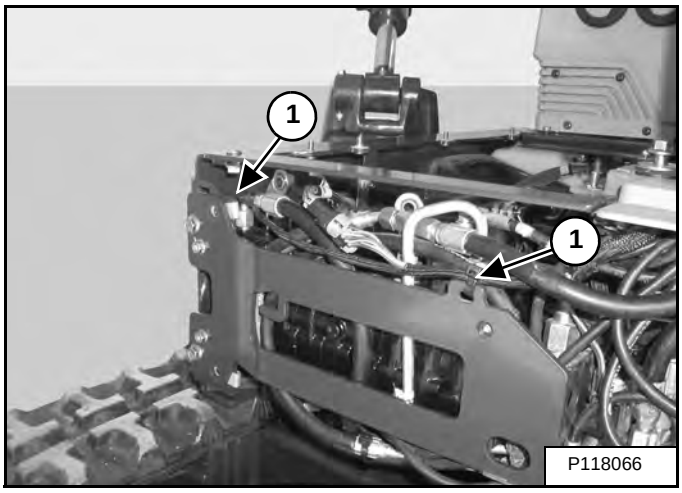
Set cable to the side.

Figure 20-40-4



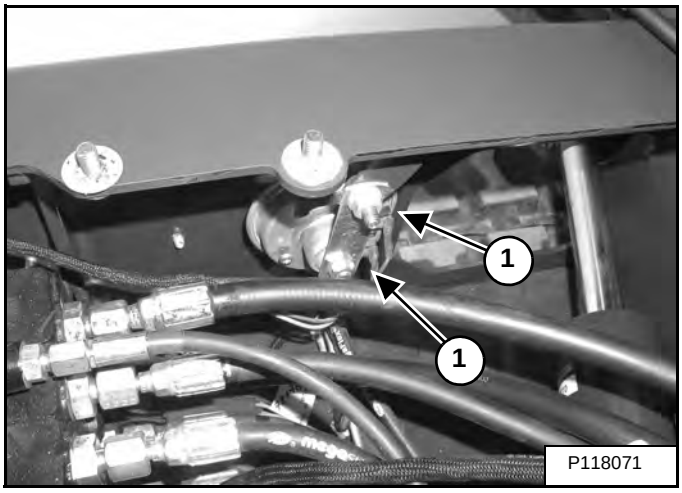
Disconnect the wire harness (Item 1) **[Figure 20-40-4]**.

Figure 20-40-5



Remove the two cable ties (Item 1) **[Figure 20-40-5]**.

Figure 20-40-6



Remove the horn wires (Item 1) and set harness to the side **[Figure 20-40-6]**.

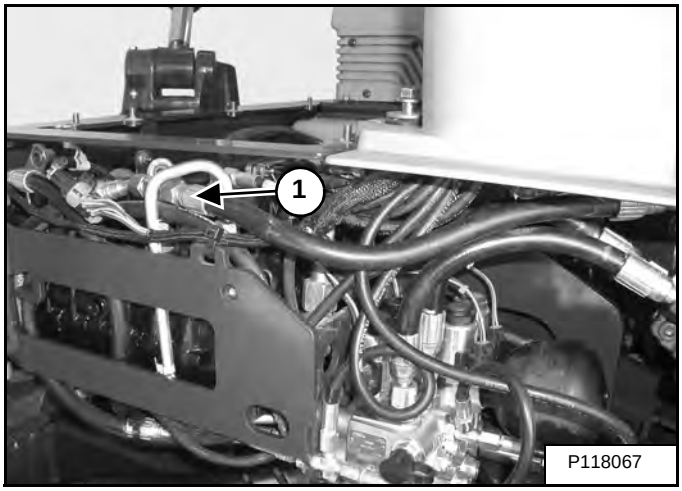
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Removal And Installation (Cont'd)

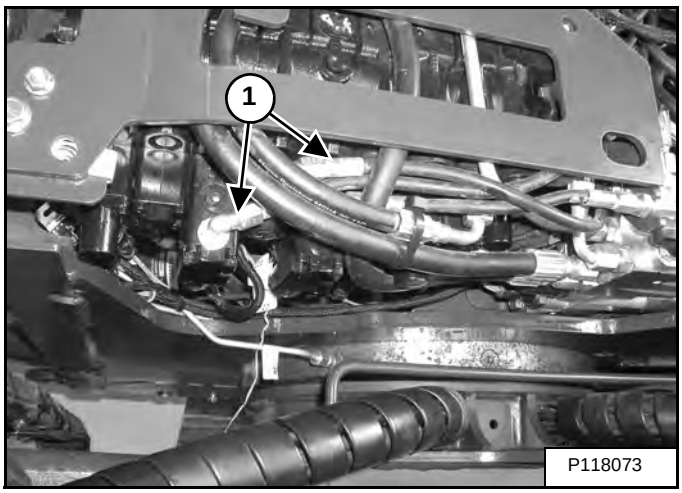
NOTE: Mark all hoses for aid in installation.

Figure 20-40-7



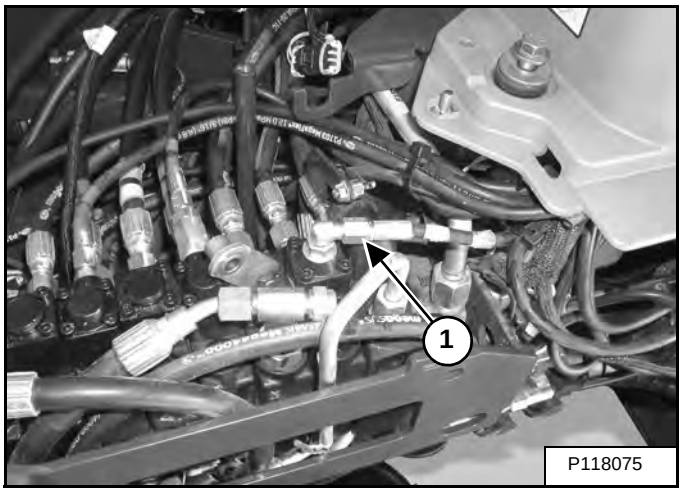
Remove the hose (Item 1) **[Figure 20-40-7]** to the hydraulic pump.

Figure 20-40-8



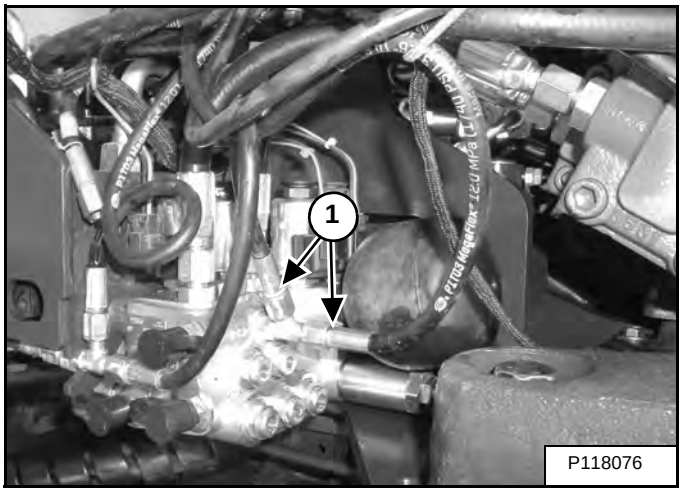
Remove the two lower pilot hoses (Item 1) **[Figure 20-40-8]**.

Figure 20-40-9



Remove the upper pilot hose (Item 1) **[Figure 20-40-9]**.

Figure 20-40-10



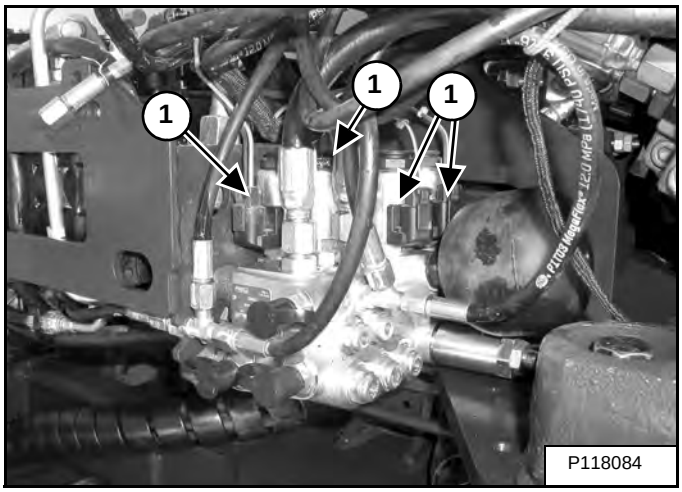
Remove the two manifold pilot hoses (Item 1) **[Figure 20-40-10]**.

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Removal And Installation (Cont'd)

Figure 20-40-11



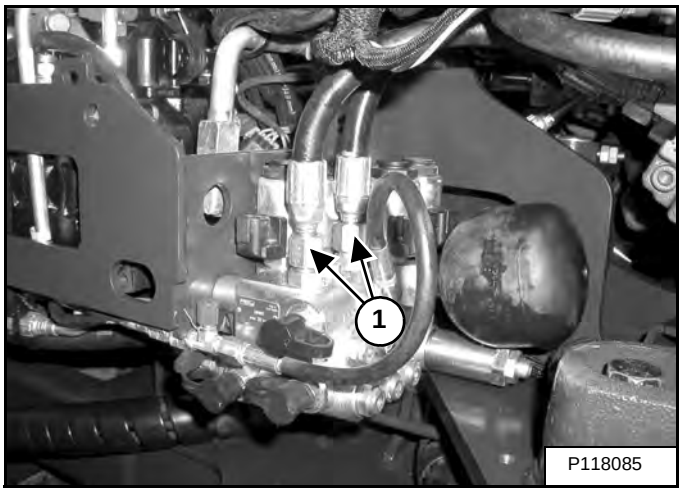
Remove the four solenoid wire harness connectors (Item 1) **[Figure 20-40-11]**.

Installation: The harness and the solenoids have color coded tie straps for correct installation of the harness connectors:

- Yellow
- Green
- Orange
- None

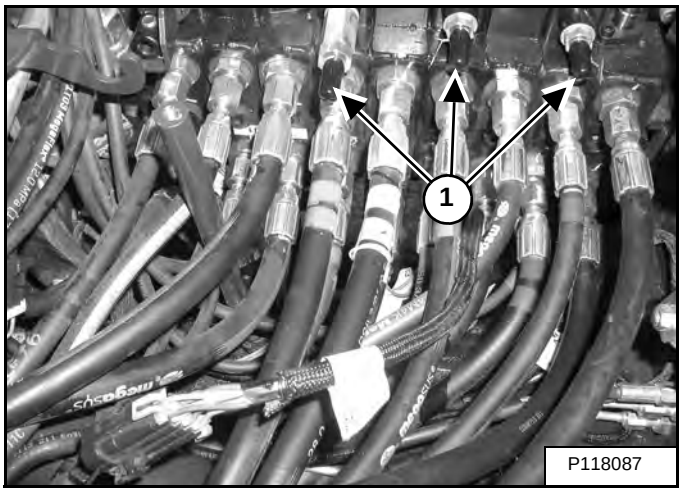
If any tie straps are missing, mark the connectors for ease of installation.

Figure 20-40-12



Remove the two hydraulic pump hoses (Item 1) **[Figure 20-40-12]**.

Figure 20-40-13



Remove the three pilot hoses (Item 1) **[Figure 20-40-13]**.

Figure 20-40-14

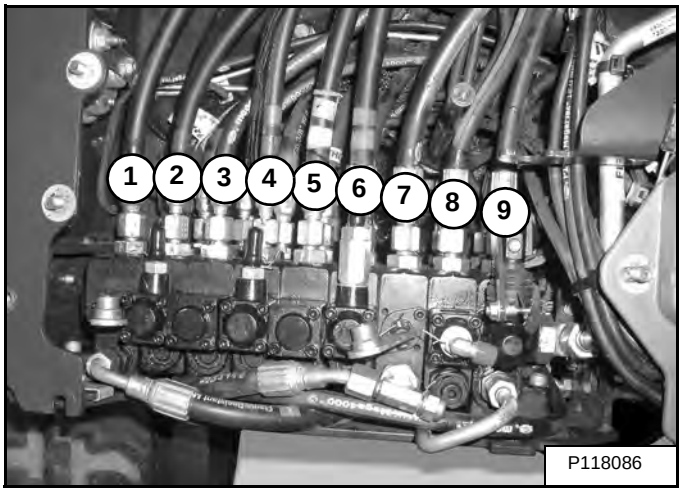
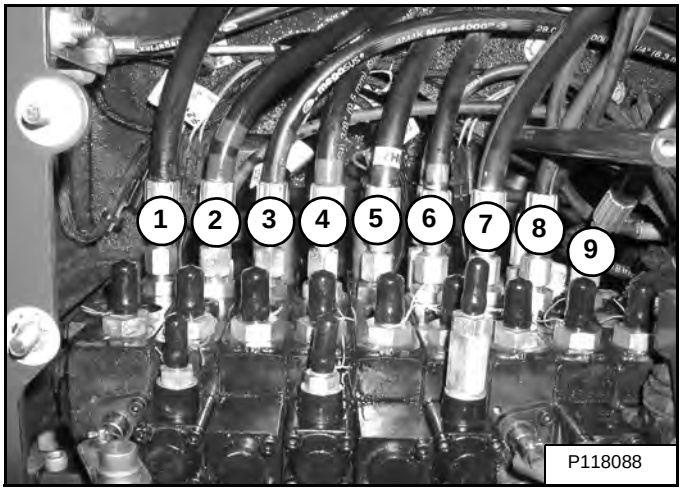


Figure 20-40-15



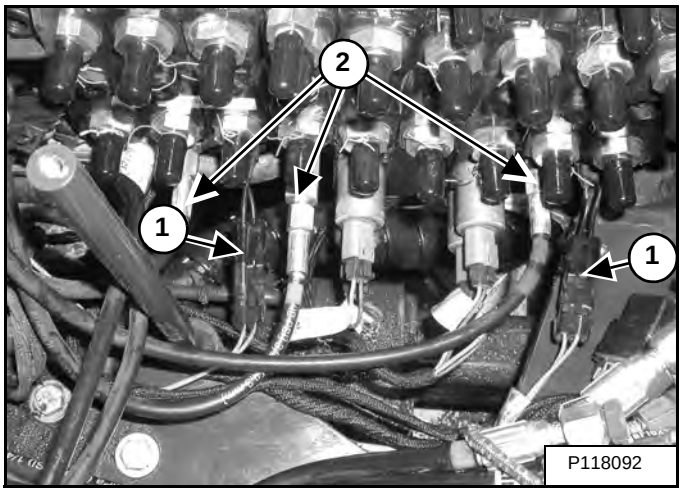
Remove the eighteen hydraulic control valve hoses **[Figure 20-40-14]** upper and **[Figure 20-40-15]** lower.

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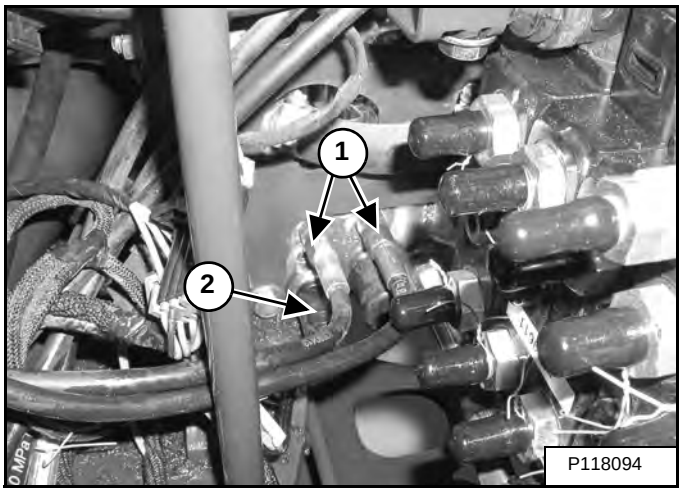
Removal And Installation (Cont'd)

Figure 20-40-16



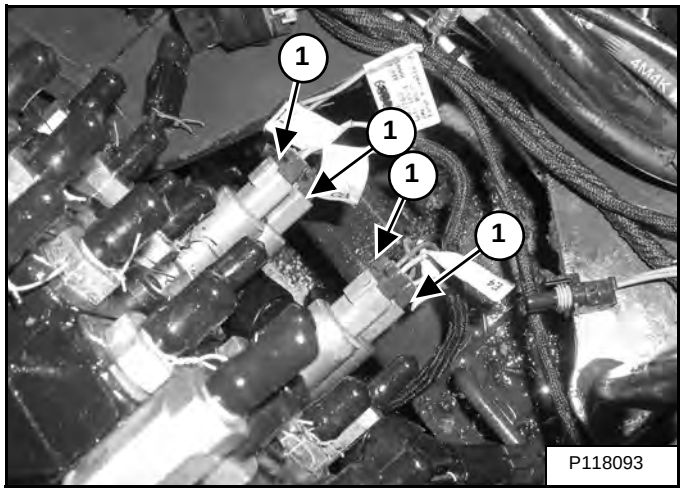
Disconnect the two wire harness connectors (Item 1) and remove the three pilot hoses (Item 2) **[Figure 20-40-16]**.

Figure 20-40-17



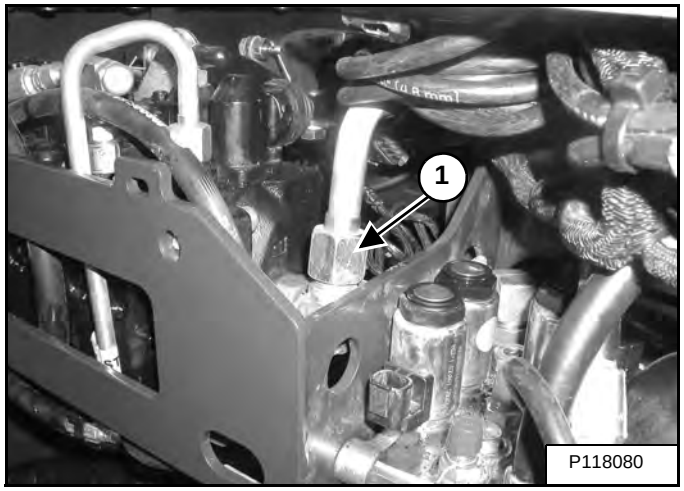
Remove the two manifold pilot hoses (Item 1) and disconnect the switch harness (Item 2) **[Figure 20-40-17]**.

Figure 20-40-18



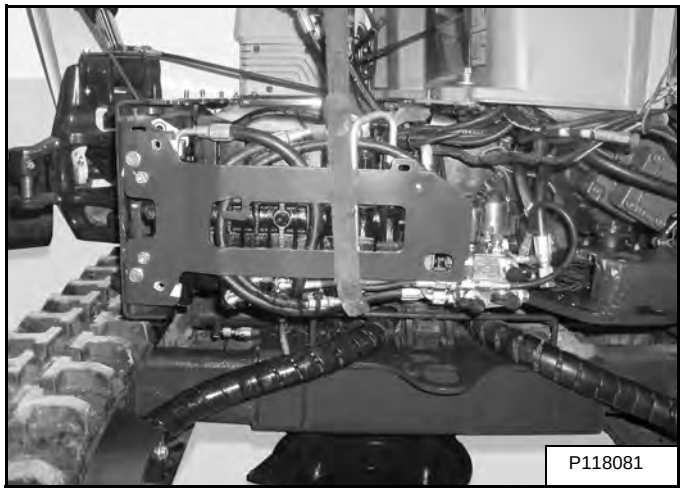
Mark and disconnect the four solenoid wire connectors (Item 1) **[Figure 20-40-18]**.

Figure 20-40-19



Remove the hydraulic line (Item 1) **[Figure 20-40-19]**.

Figure 20-40-20



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

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Removal And Installation (Cont'd)

Figure 20-40-21

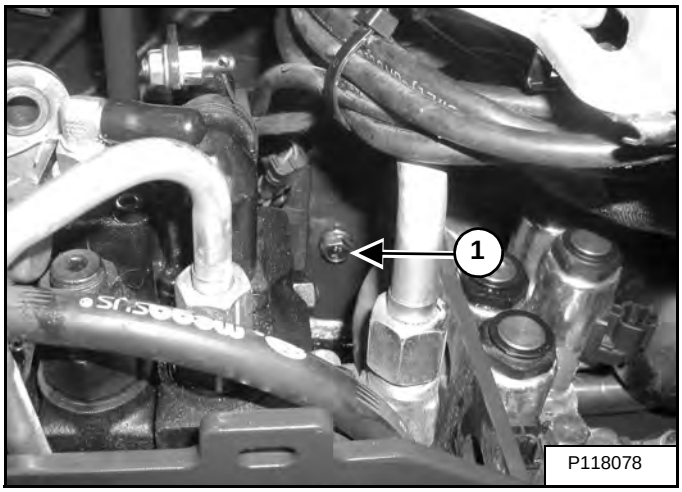
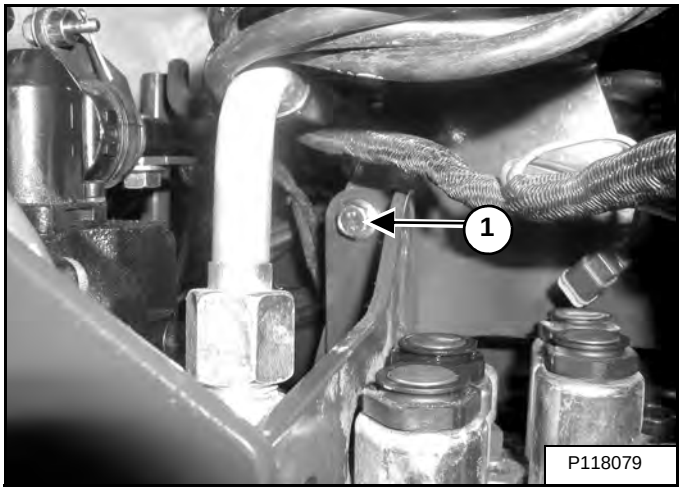
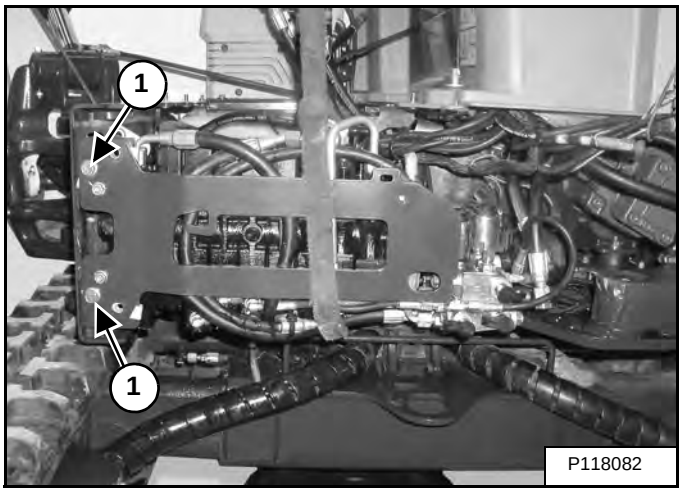


Figure 20-40-22



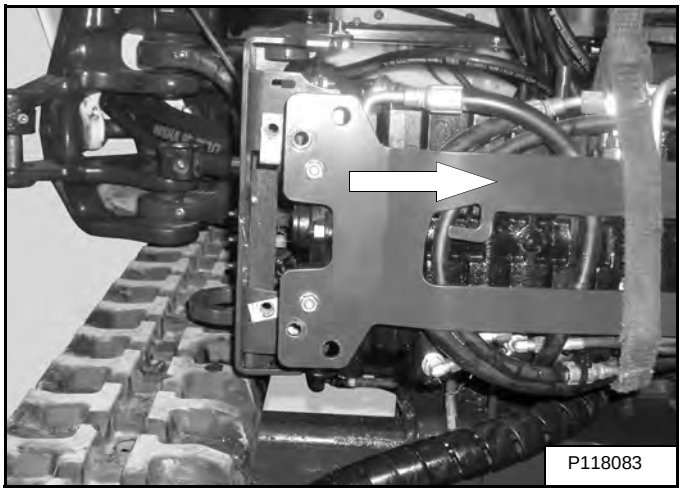
Remove the two bolts (Item 1) **[Figure 20-40-21]** and **[Figure 20-40-22]** at the mounting bracket.

Figure 20-40-23



Remove the two bolts at the front (Item 1) **[Figure 20-40-23]**.

Figure 20-40-24



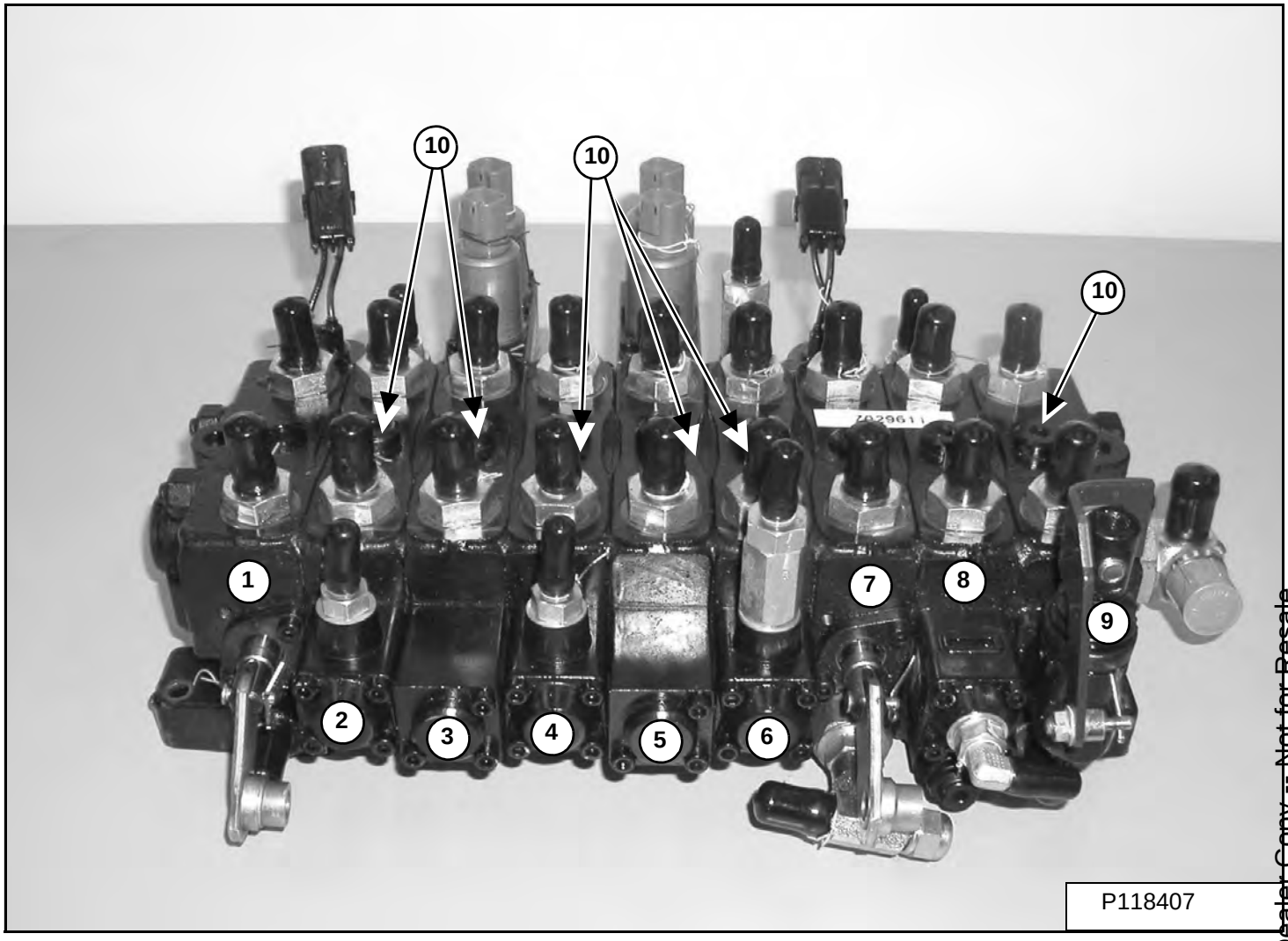
Slide the assembly back enough to clear the frame **[Figure 20-40-24]**.

Remove the hydraulic control valve and manifold assembly.

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Parts Identification



1. RIGHT TRAVEL SECTION
2. ARM SECTION
3. BOOM SWING SECTION
4. BUCKET SECTION
5. AUXILIARY SECTION
6. BOOM SECTION
7. LEFT TRAVEL SECTION
8. SLEW SECTION
9. BLADE SECTION
10. LOAD CHECK VALVE

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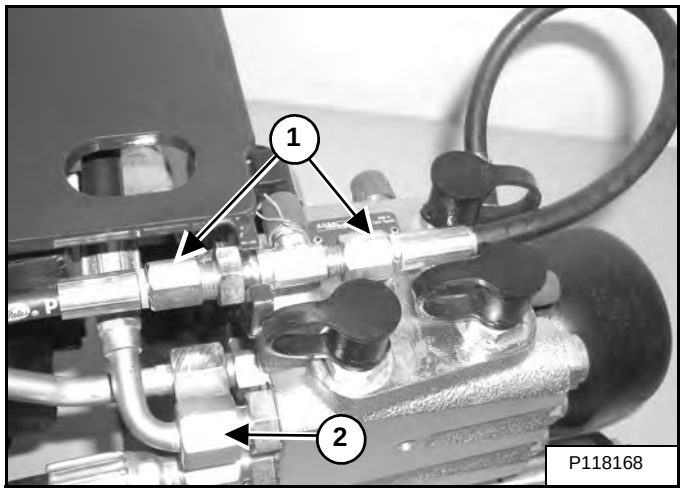
https://www.pdfmanual4trucks.com/

Disassembly

Clean the outside of the hydraulic control valve / manifold assembly before disassembling.

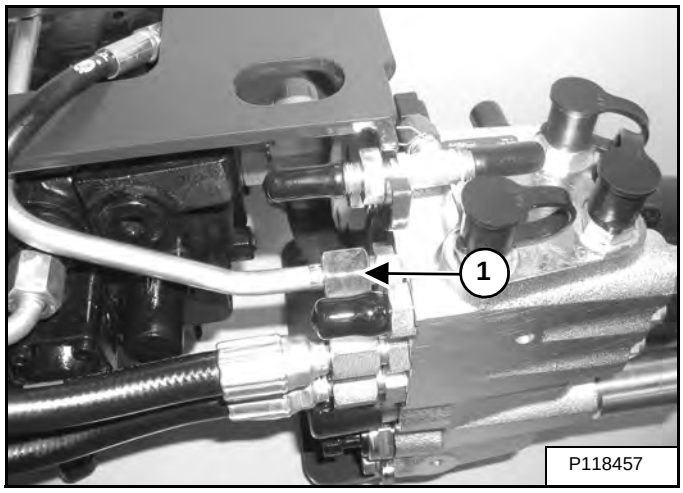
NOTE: Mark all hoses, tubelines and wire harness connectors for correct installation.

Figure 20-40-25



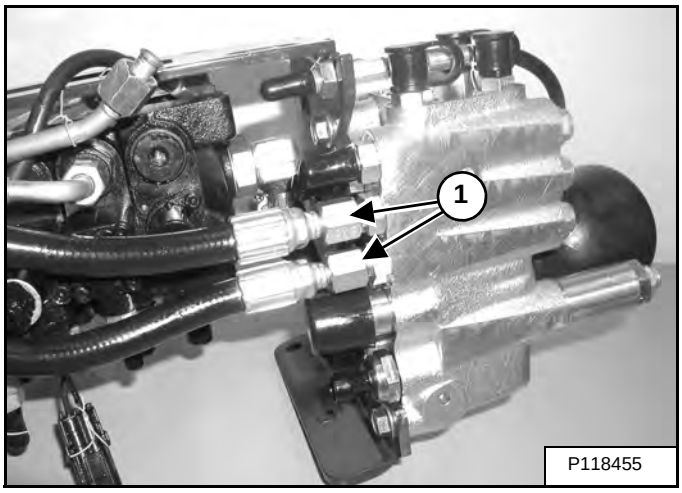
Remove the two pilot hoses (Item 1) from the tee fitting and the 90° elbow hose (Item 2) **[Figure 20-40-25]**.

Figure 20-40-26



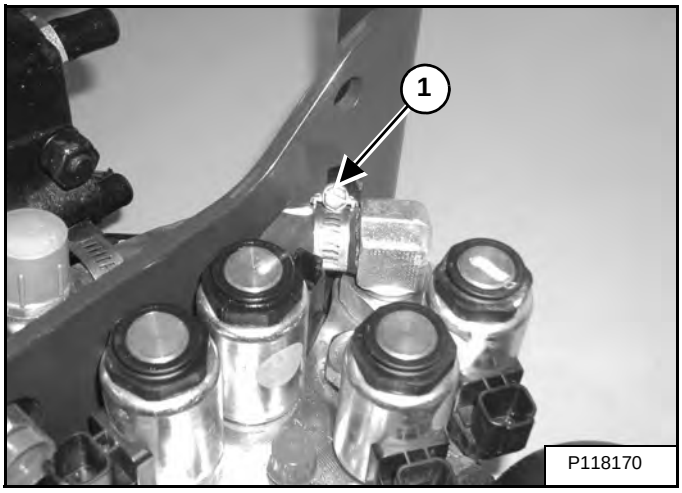
Remove the tubeline (Item 1) **[Figure 20-40-26]**.

Figure 20-40-27



Remove the two hoses (Item 1) **[Figure 20-40-27]**.

Figure 20-40-28



Loosen the hose clamp (Item 1) **[Figure 20-40-28]** at the manifold valve.

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Disassembly (Cont'd)

Figure 20-40-29

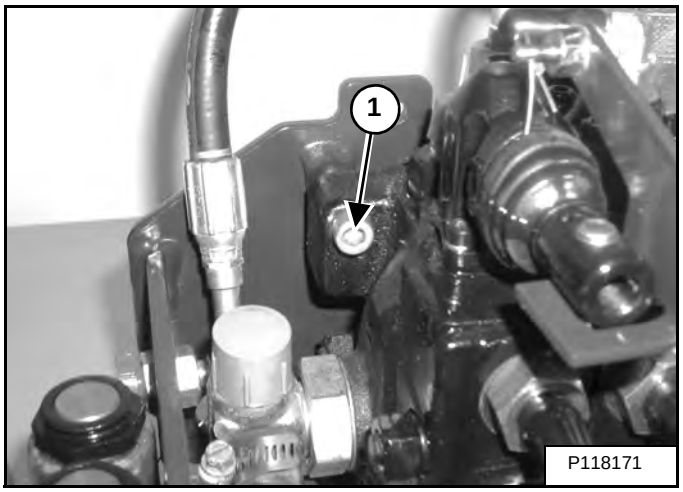
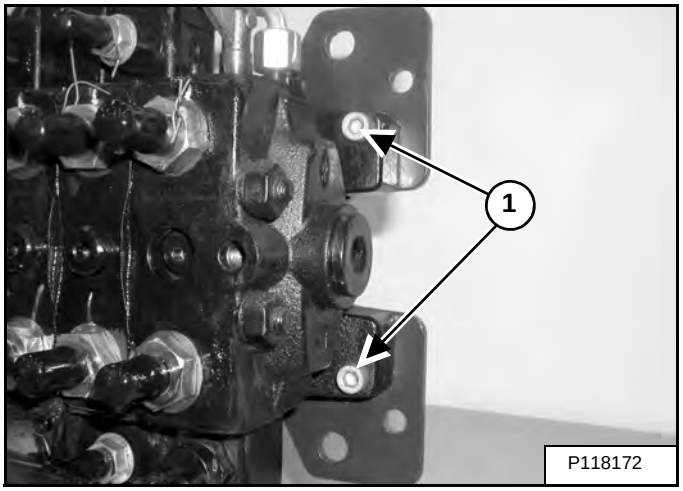


Figure 20-40-30



Remove the three control valve mounting bolts (Item 1) **[Figure 20-40-29]** and **[Figure 20-40-30]**.

Installation: Use Loctite® 242 on bolt threads.

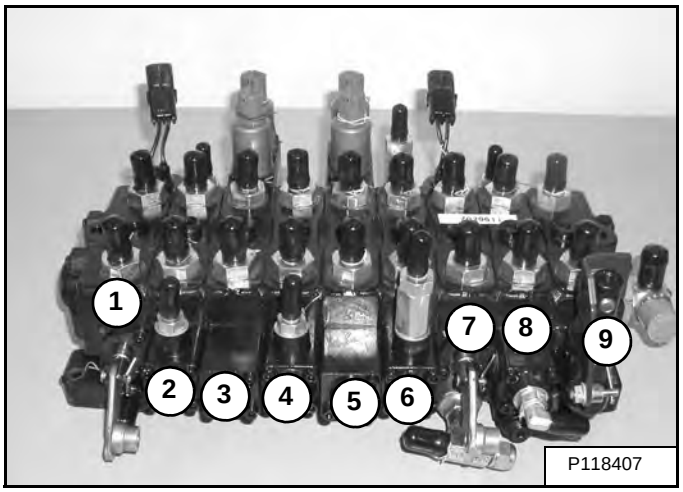
Remove the hydraulic control valve from the mounting plate.

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.

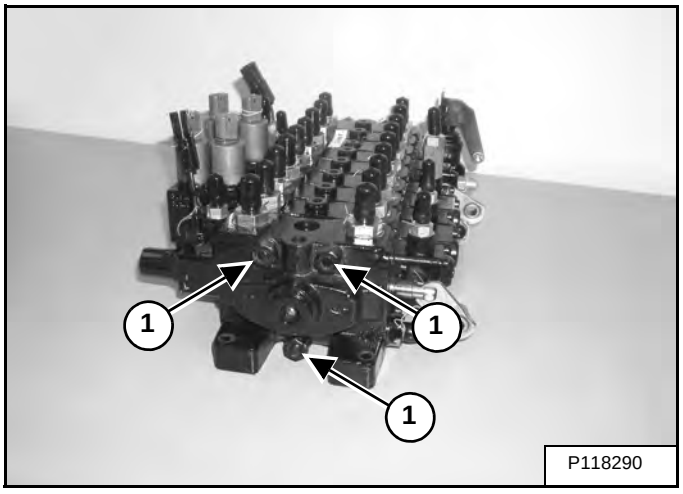
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Figure 20-40-31



Mark the valve section for aid in assembly **[Figure 20-40-31]**.

Figure 20-40-32



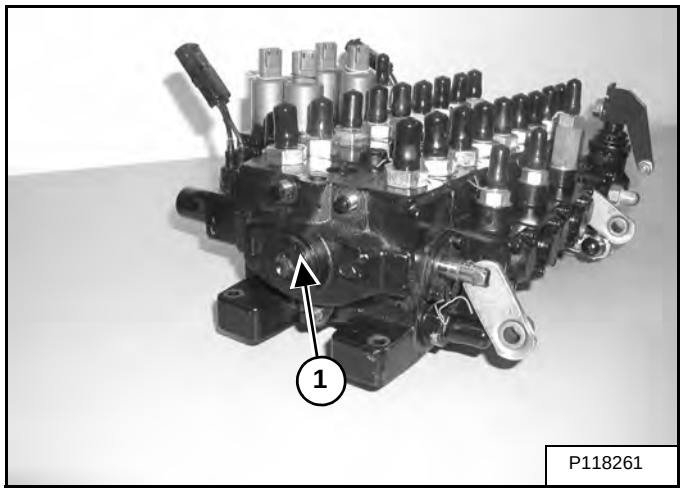
Remove the three nuts (Item 1) **[Figure 20-40-32]**.

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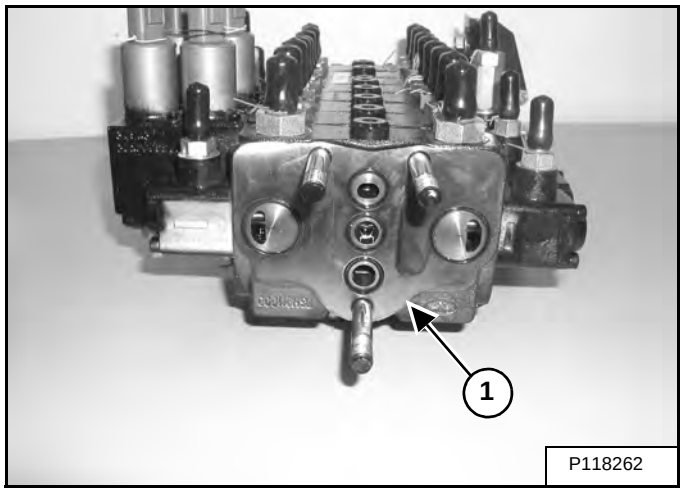
Disassembly (Cont'd)

Figure 20-40-33



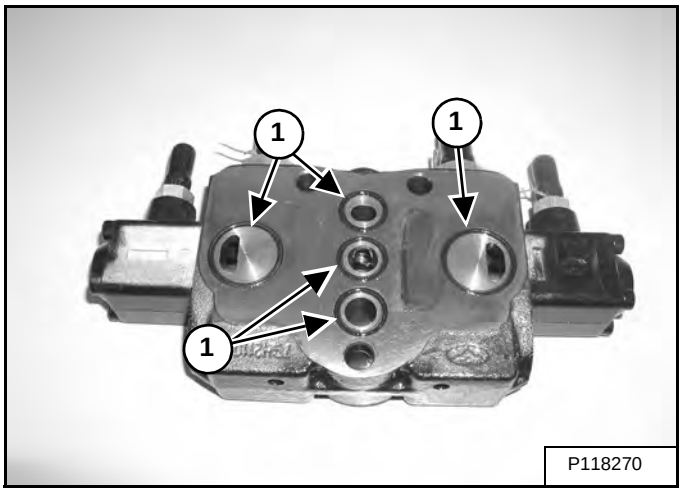
Remove the right travel section (Item 1) **[Figure 20-40-33]**.

Figure 20-40-34



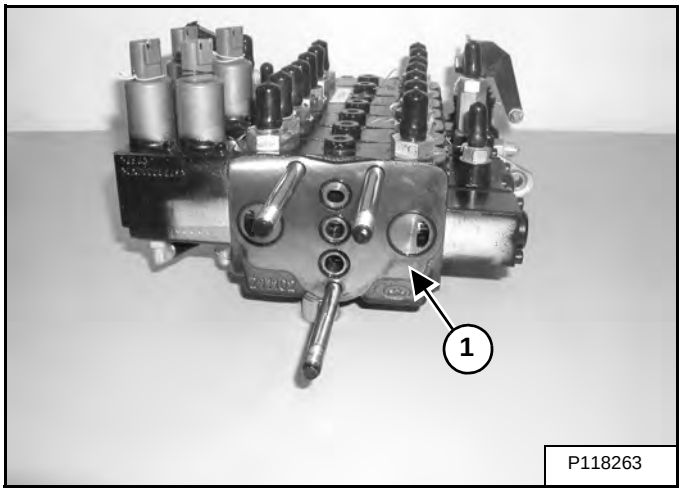
Remove the arm valve section (Item 1) **[Figure 20-40-34]**.

Figure 20-40-35



Remove the five O-rings (Item 1) **[Figure 20-40-35]**.

Figure 20-40-36



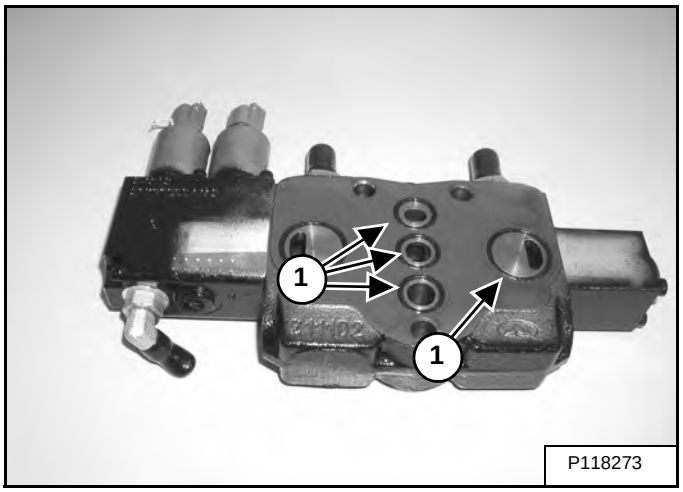
Remove the blade valve section (Item 1) **[Figure 20-40-36]**.

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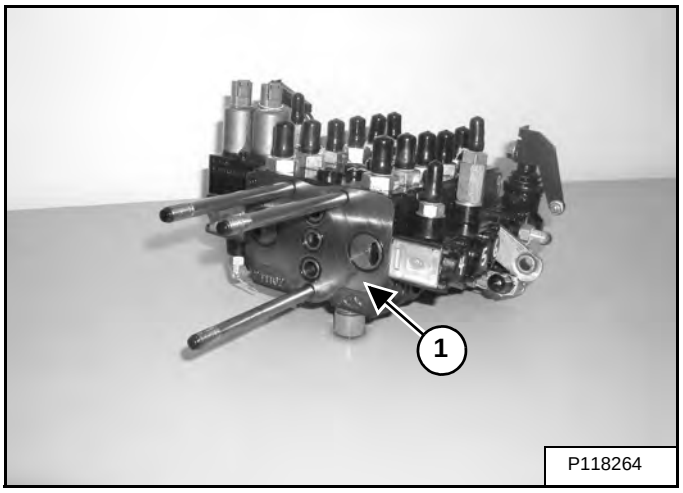
Disassembly (Cont'd)

Figure 20-40-37



Remove the five O-rings (Item 1) **[Figure 20-40-37]**.

Figure 20-40-38



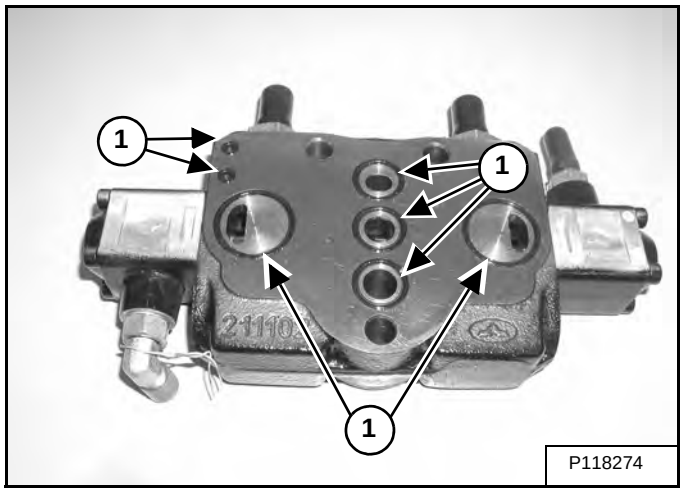
Remove the bucket valve section (Item 1) **[Figure 20-40-38]**.

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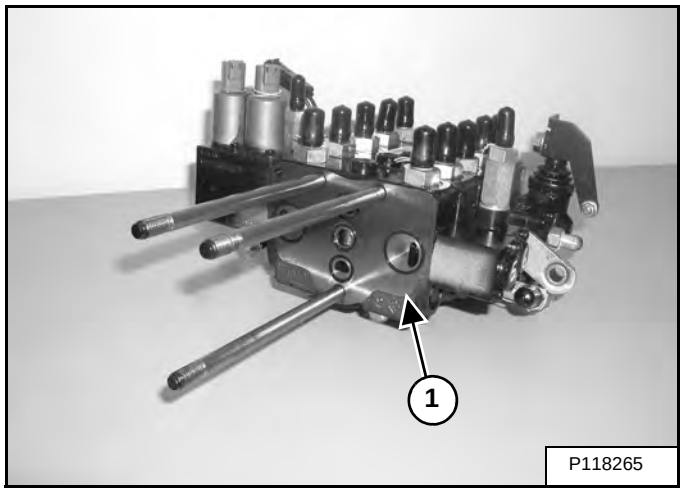
Disassembly (Cont'd)

Figure 20-40-39



Remove the seven O-rings (Item 1) **[Figure 20-40-39]**.

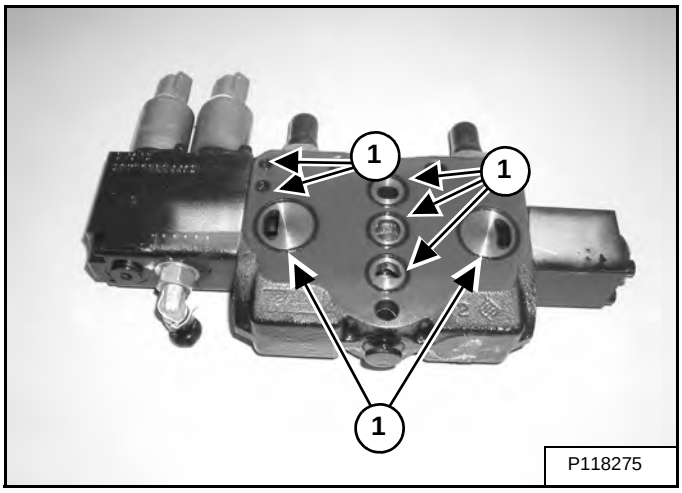
Figure 20-40-40



Remove the auxiliary valve section (Item 1) **[Figure 20-40-40]**.

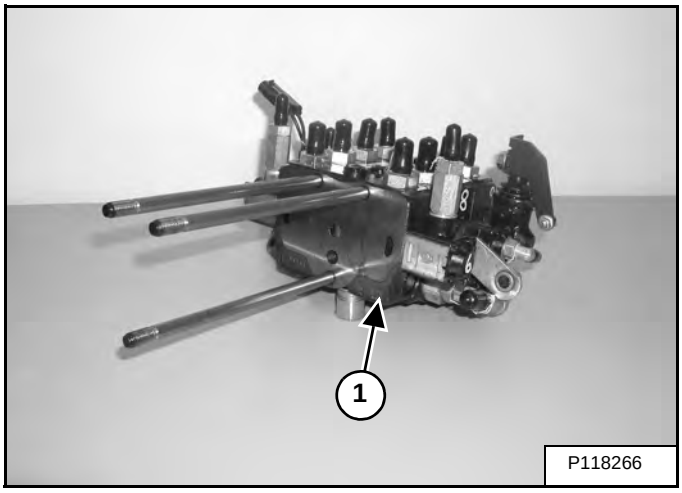
NOTE: O-rings on both sides of auxiliary valve section.

Figure 20-40-41



Remove the seven O-rings (Item 1) **[Figure 20-40-41]**.

Figure 20-40-42



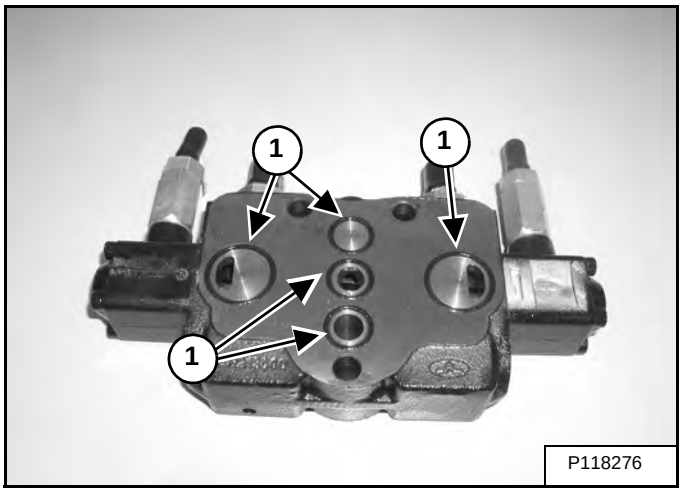
Remove the boom valve section (Item 1) **[Figure 20-40-42]**.

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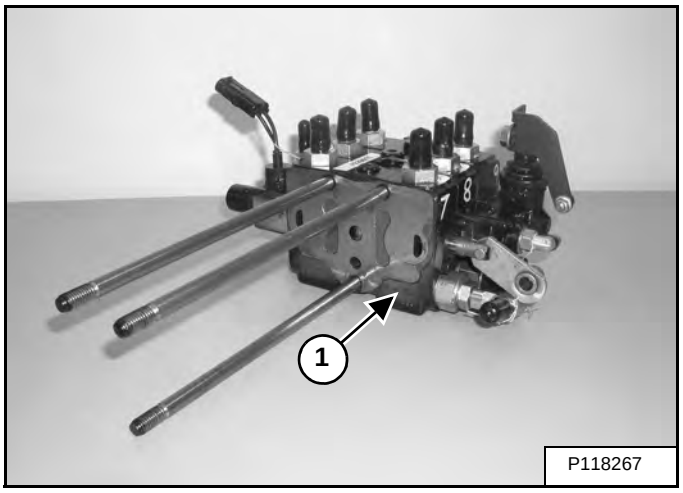
Disassembly (Cont'd)

Figure 20-40-43



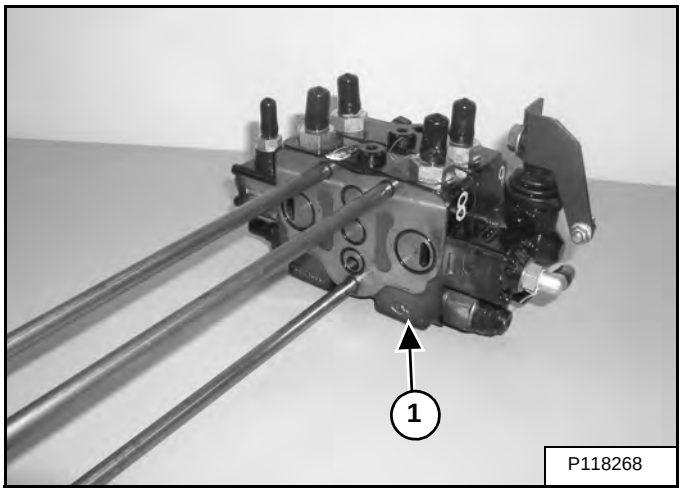
Remove the five O-rings (Item 1) **[Figure 20-40-43]**.

Figure 20-40-44



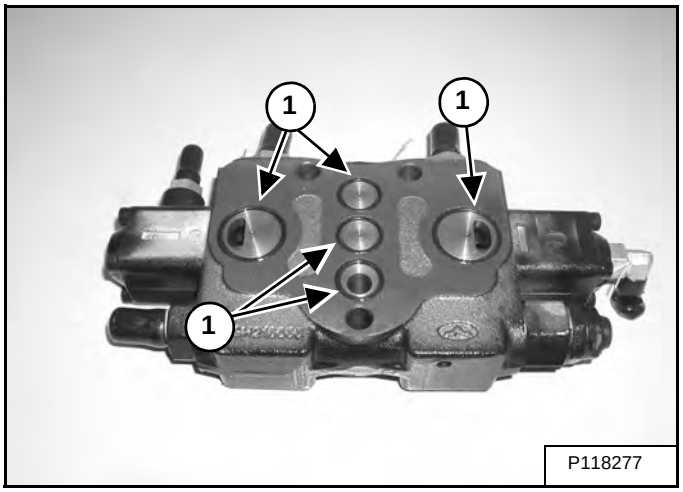
Remove the left hand valve section (Item 1) **[Figure 20-40-44]**.

Figure 20-40-45



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

Figure 20-40-46



Remove the five O-rings (Item 1) **[Figure 20-40-46]**.

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Assembly

IMPORTANT

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

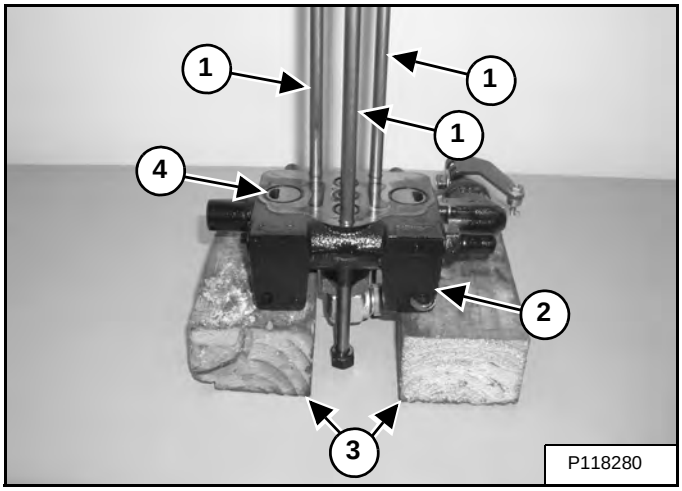
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Clean all parts in solvent and dry with compressed air.

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

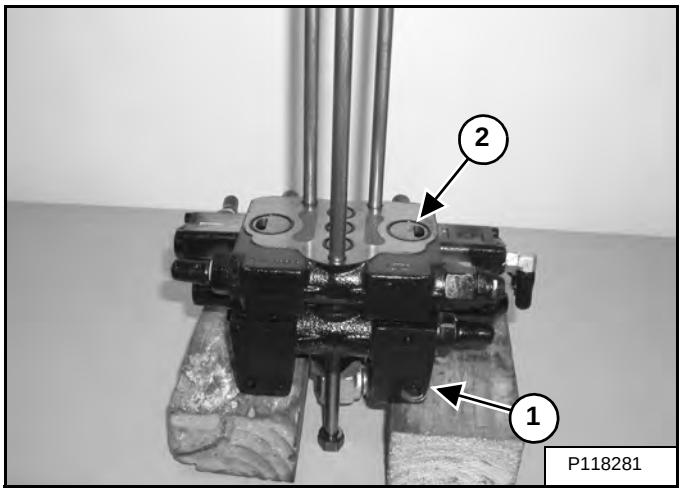
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-47



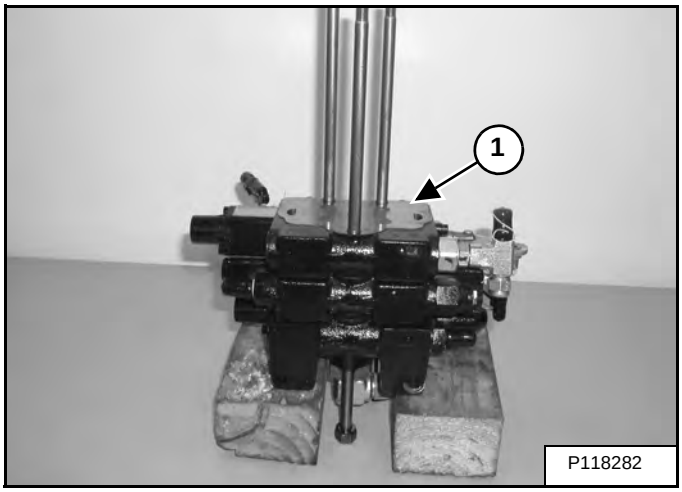
Install the tie rods (Item 1) through the blade valve section (Item 2). Place the valve (Item 2) on end and use spacers (Item 3) to level the valve. Install the five O-rings (Item 4) **[Figure 20-40-47]**.

Figure 20-40-48



Install the slew valve section (Item 1). Install the five O-rings (Item 2) **[Figure 20-40-48]**.

Figure 20-40-49



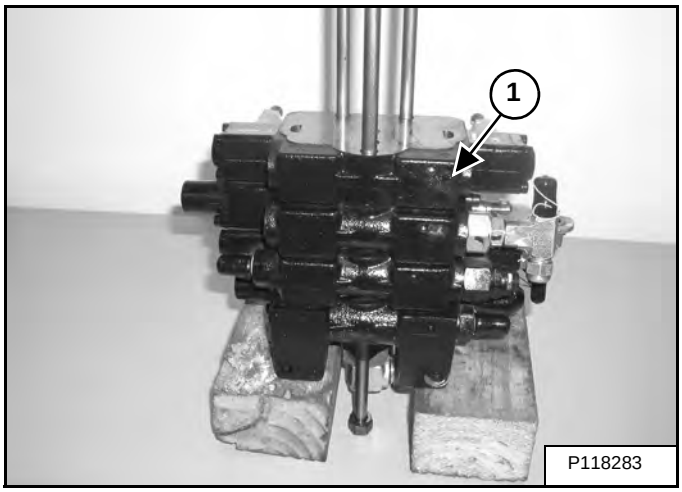
Install the left hand travel valve section (Item 1) **[Figure 20-40-49]**.

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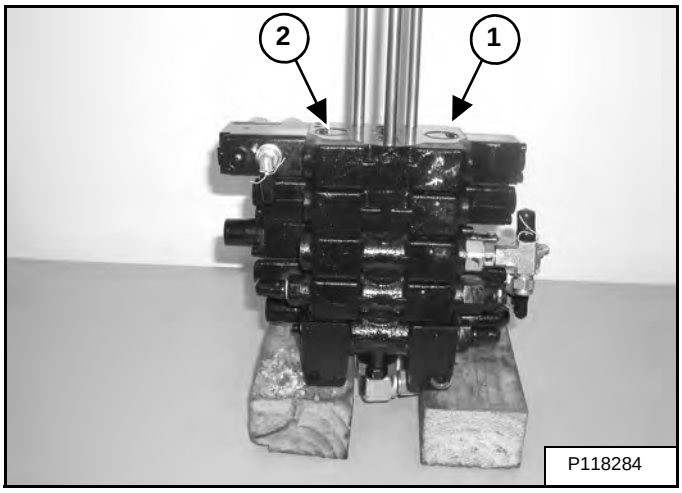
Assembly (Cont'd)

Figure 20-40-50



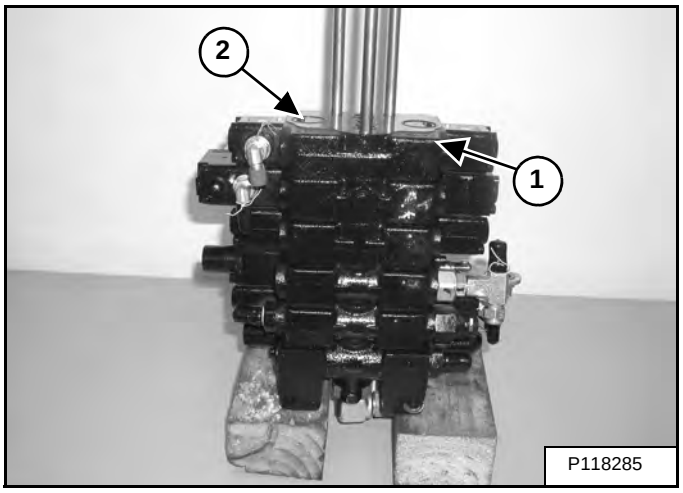
Install the boom valve section (Item 1). Install the O-rings **[Figure 20-40-50]**.

Figure 20-40-51



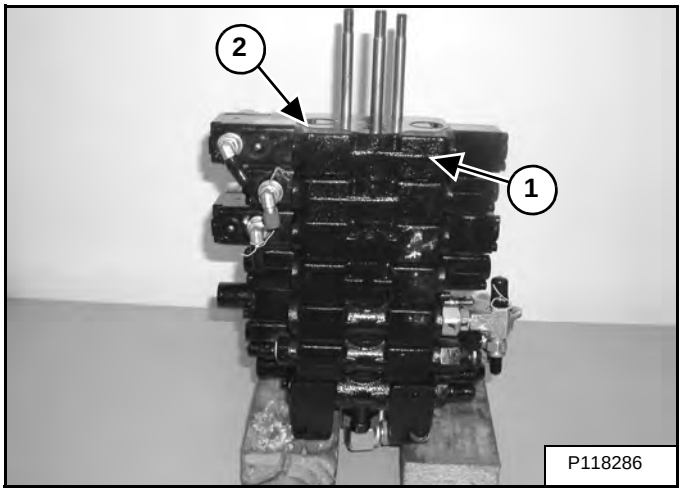
Install the auxiliary valve section (Item 1). Install the seven O-rings (Item 2) **[Figure 20-40-51]**.

Figure 20-40-52



Install the bucket valve section (Item 1). Install the five O-rings (Item 2) **[Figure 20-40-52]**.

Figure 20-40-53



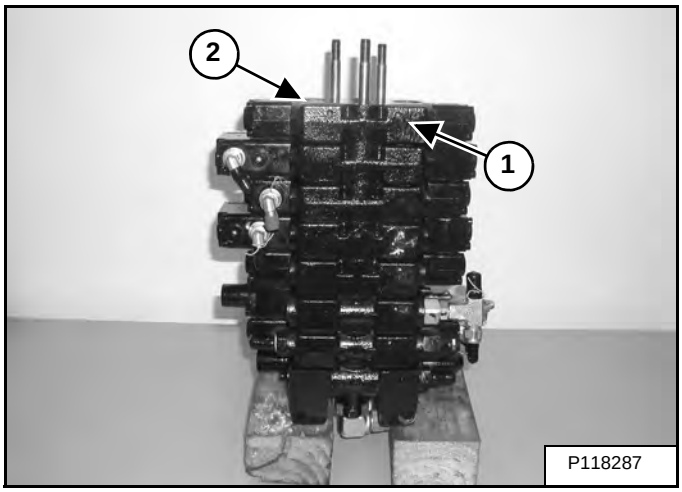
Install the boom swing valve section (Item 1) and five O-rings (Item 2) **[Figure 20-40-53]**.

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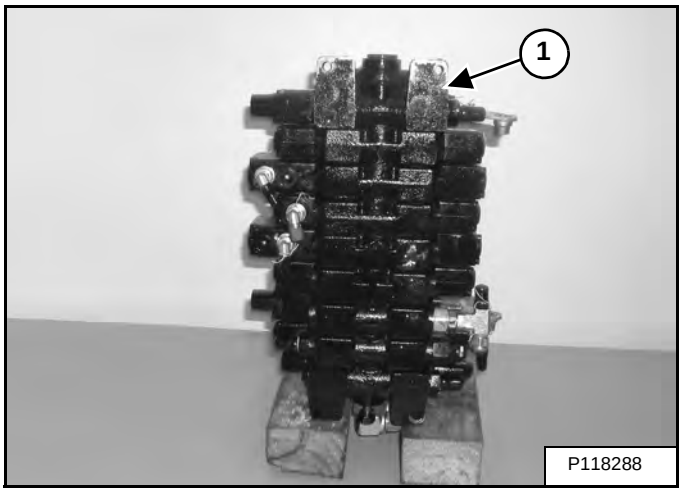
Assembly (Cont'd)

Figure 20-40-54



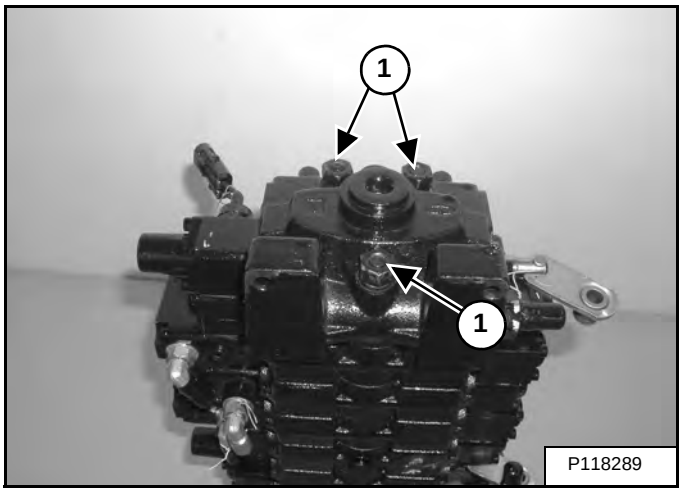
Install the arm valve section (Item 1). Install the five O-rings (Item 4) **[Figure 20-40-54]**.

Figure 20-40-55



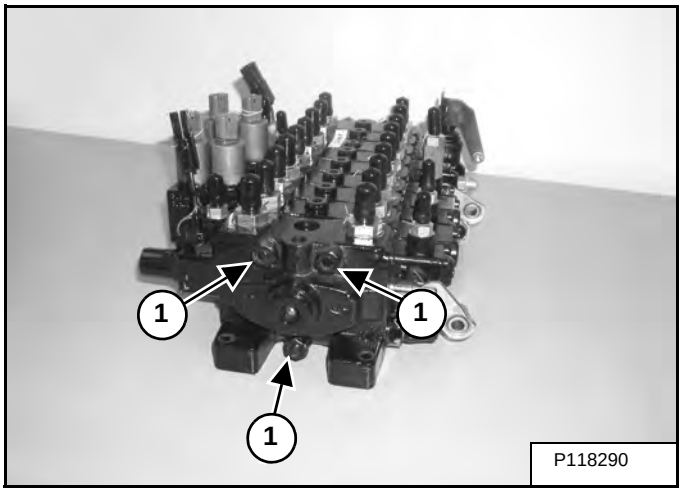
Install the right hand travel valve section (Item 1) **[Figure 20-40-55]**.

Figure 20-40-56



Install the three nuts (Item 1) **[Figure 20-40-56]**.

Figure 20-40-57



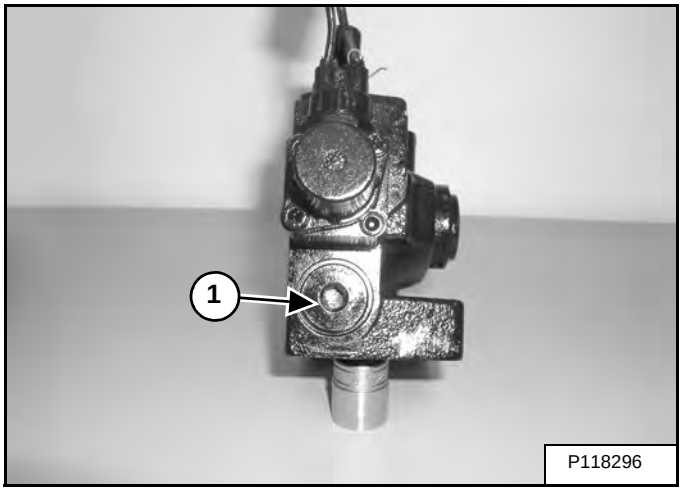
Position the valve as shown and tighten the nuts (Item 1) **[Figure 20-40-57]** to 19 N•m (14 ft-lb) torque.

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Right And Left Travel Valve Section Disassembly And Assembly

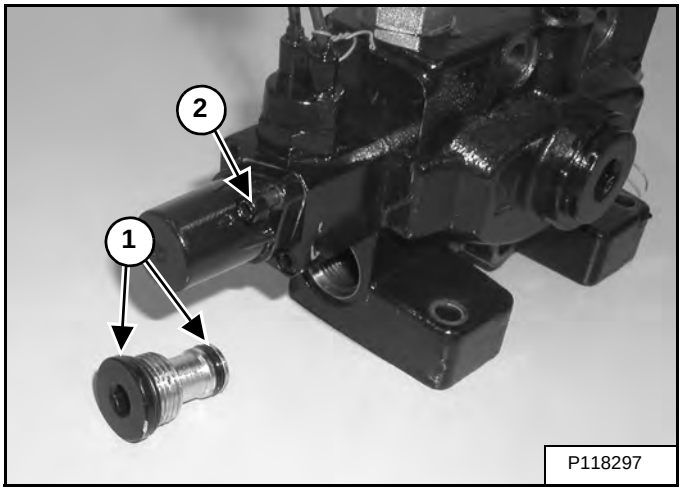
Figure 20-40-58



Remove the plug (Item 1) **[Figure 20-40-58]**.

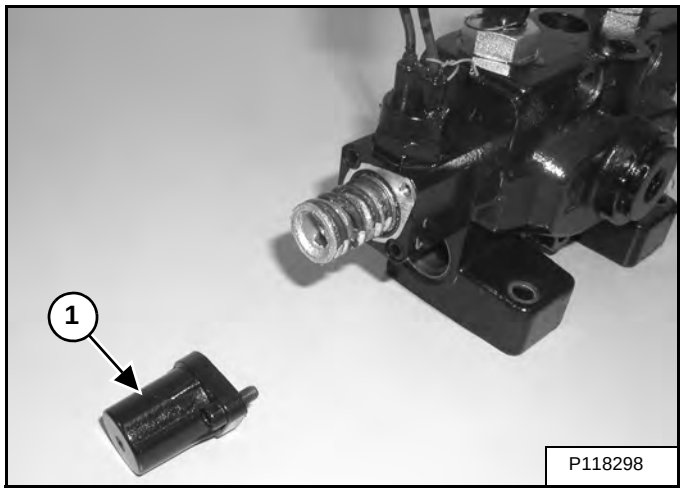
Installation: Tighten the fitting to 28,5 - 30 N•m (21 - 22 ft-lb) torque.

Figure 20-40-59



Remove the O-rings (Item 1) and the two bolts (Item 2) **[Figure 20-40-59]**.

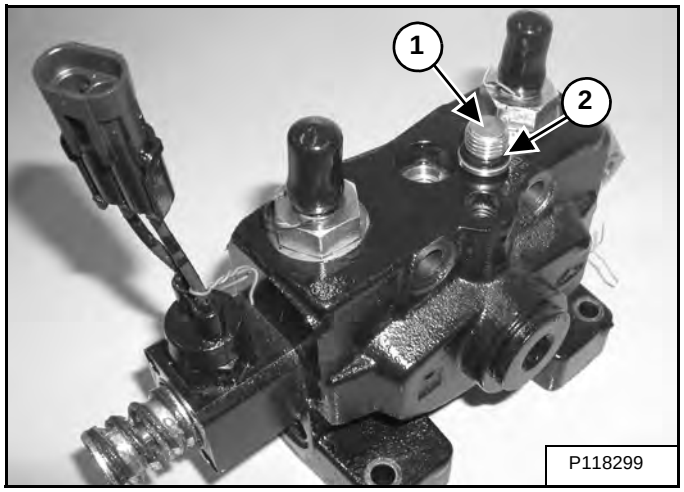
Figure 20-40-60



Remove the cap (Item 1) **[Figure 20-40-60]**.

Installation: Tighten the plug to 9 - 11 N•m (6 - 8 ft-lb) torque.

Figure 20-40-61



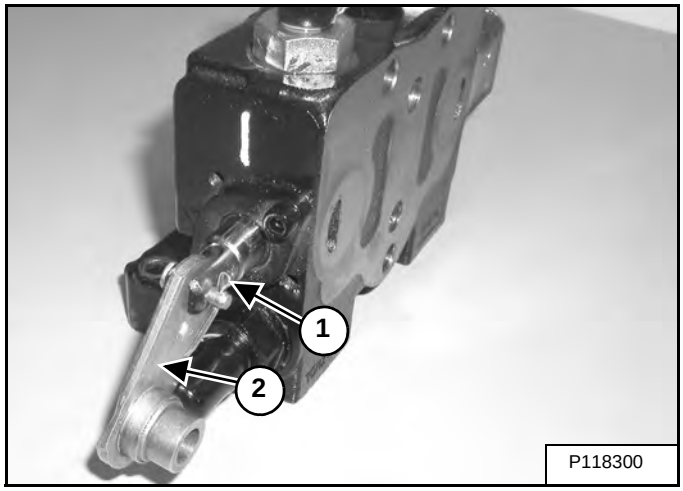
Remove the plug (Item 1) and remove the O-ring (Item 2) **[Figure 20-40-61]** from the plug.

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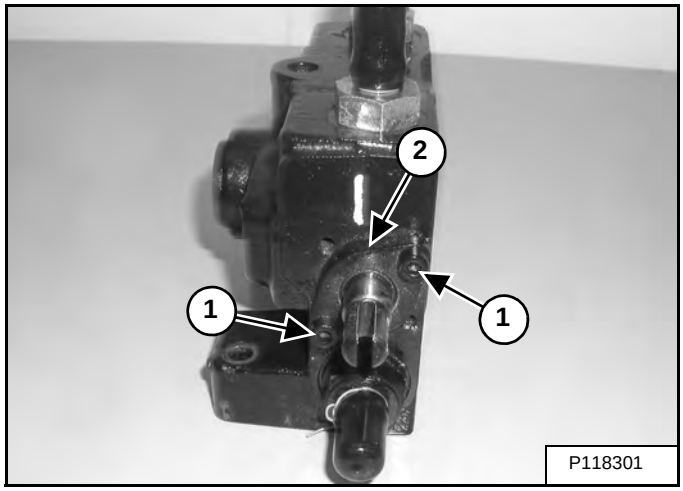
Right And Left Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-62



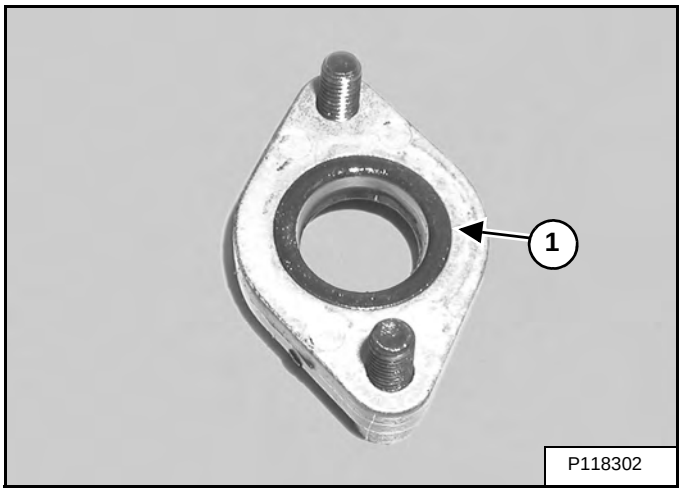
Remove the travel linkage cotter pin (Item 1) and lever (Item 2) **[Figure 20-40-62]**.

Figure 20-40-63



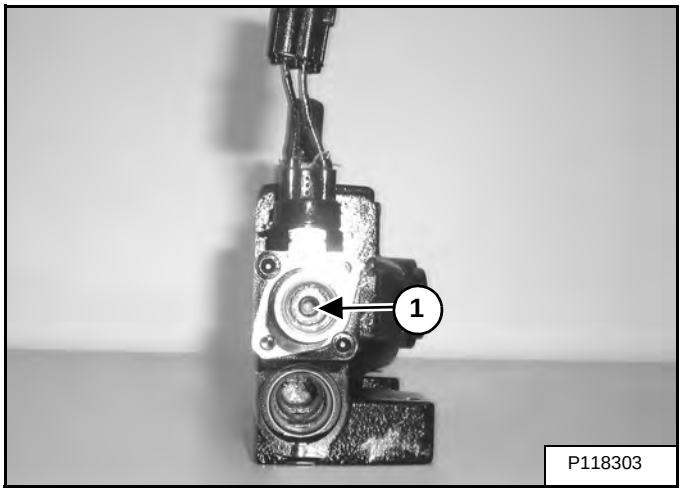
Remove the two bolts (Item 1) for spool retainer (Item 2) **[Figure 20-40-63]**.

Figure 20-40-64



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

Figure 20-40-65



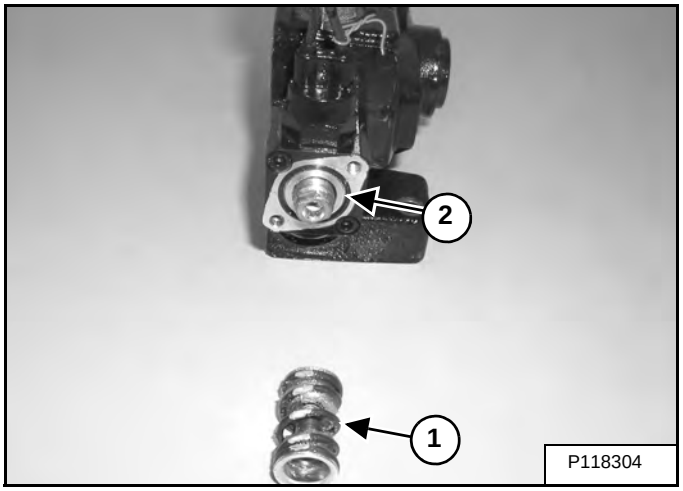
Remove the spring retainer nut (Item 1) **[Figure 20-40-65]**.

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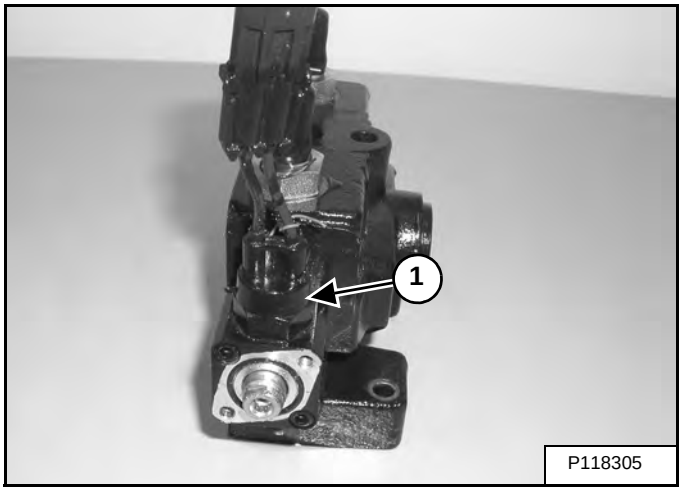
Right And Left Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-66



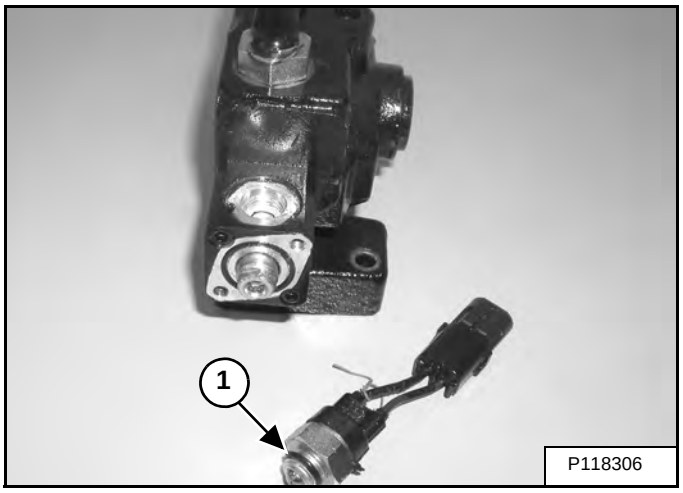
Remove the spring assembly (Item 1) and O-ring (Item 2) **[Figure 20-40-66]**.

Figure 20-40-67



Remove the switch (Item 1) **[Figure 20-40-67]**.

Figure 20-40-68



Remove the O-ring (Item 1) **[Figure 20-40-68]**.

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

Figure 20-40-69

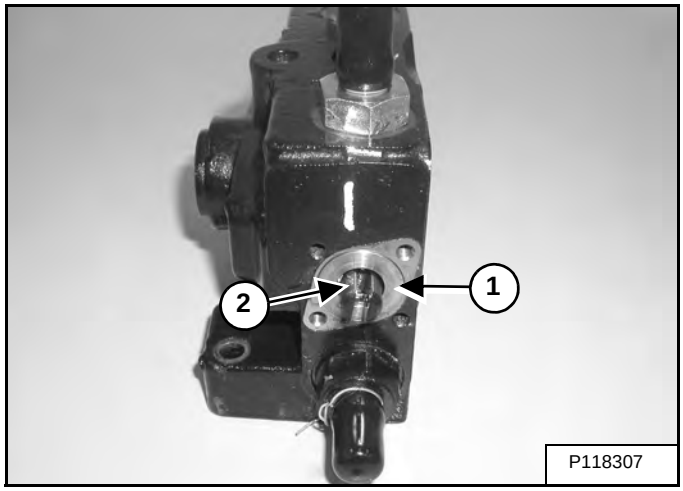
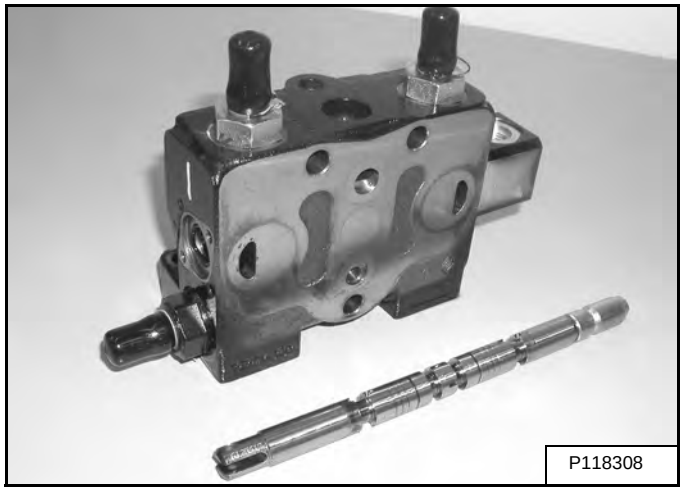
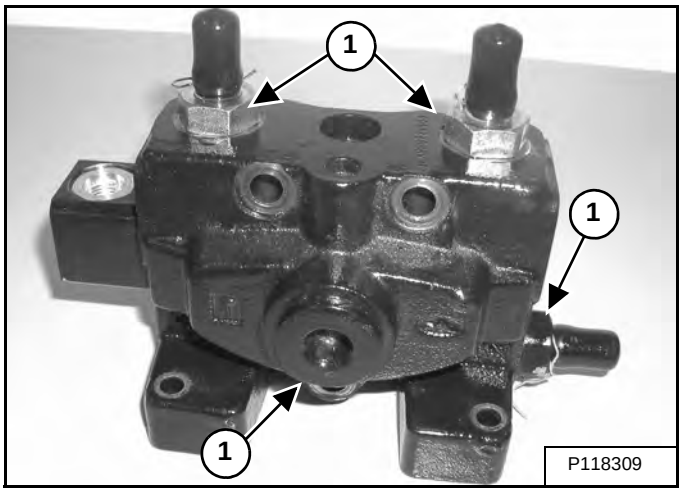


Figure 20-40-70



Remove the washer (Item 1) and spool (Item 2). **[Figure 20-40-69]** and **[Figure 20-40-70]**.

Figure 20-40-71



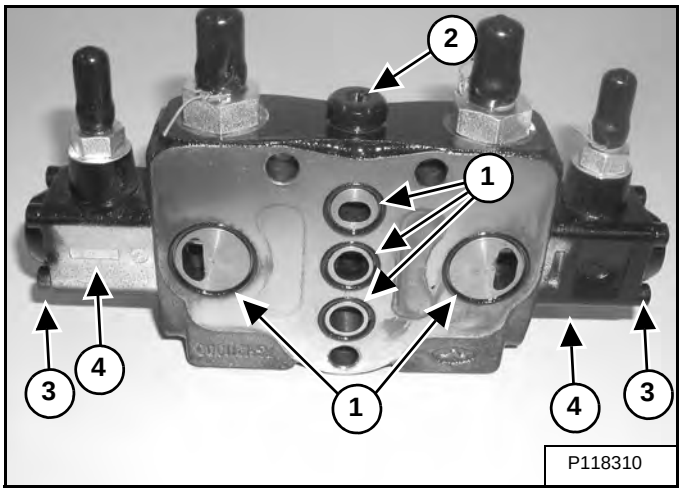
Remove remaining four O-rings from fittings and plug (Item 1) **[Figure 20-40-71]**.

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Arm And Bucket Valve Section Disassembly And Assembly

Figure 20-40-72



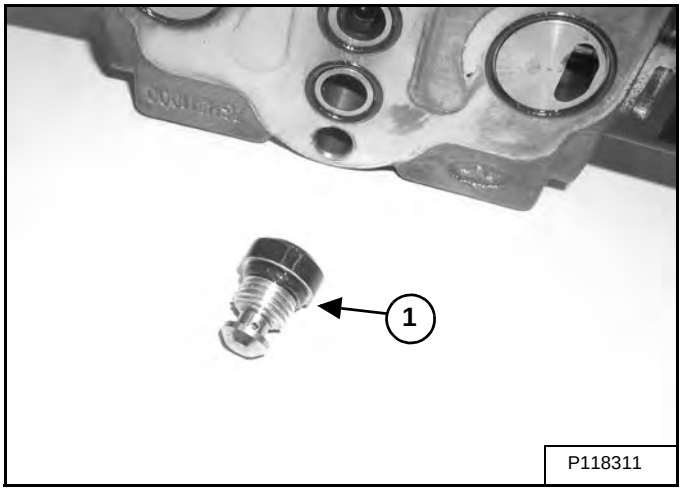
Remove the five O-rings (Item 1) and remove the check valve (Item 2) **[Figure 20-40-72]**.

Remove the four screws (Item 3) **[Figure 20-40-72]** from both end caps.

Remove the end caps (Item 4) **[Figure 20-40-72]**

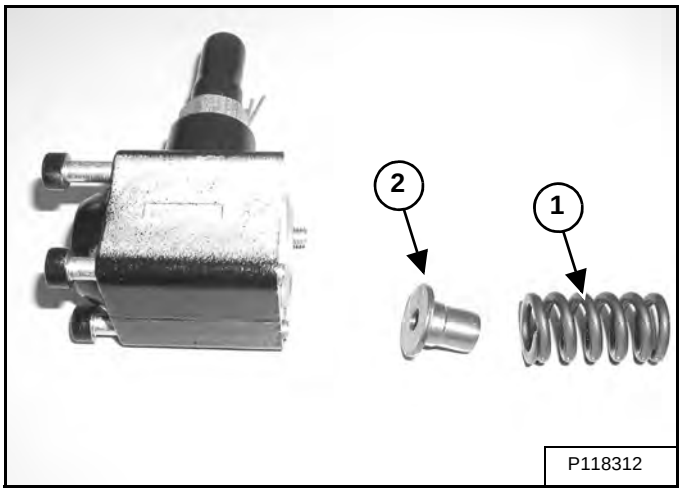
Installation: Tighten the screws to 7,5 N•m (5.5 ft-lb) torque.

Figure 20-40-73



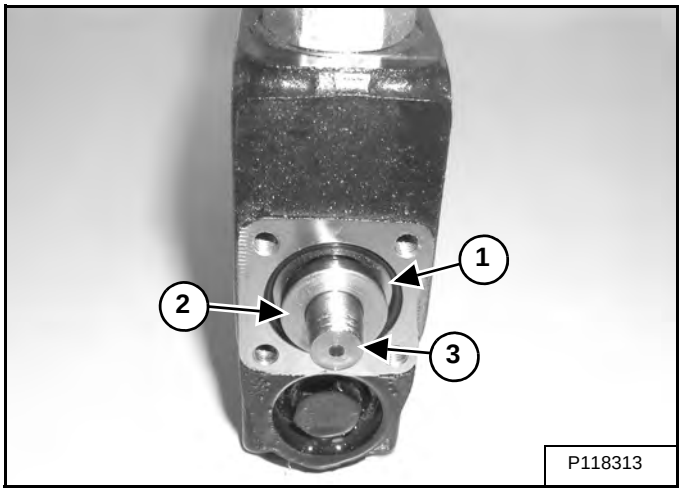
Remove the O-ring (Item 1) **[Figure 20-40-73]**.

Figure 20-40-74



Remove spring (Item 1) and retainer (Item 2) **[Figure 20-40-74]**.

Figure 20-40-75



Remove the O-ring (Item 1) and washer (Item 2) from both ends of the valve. Remove the spool (Item 3) **[Figure 20-40-75]**.

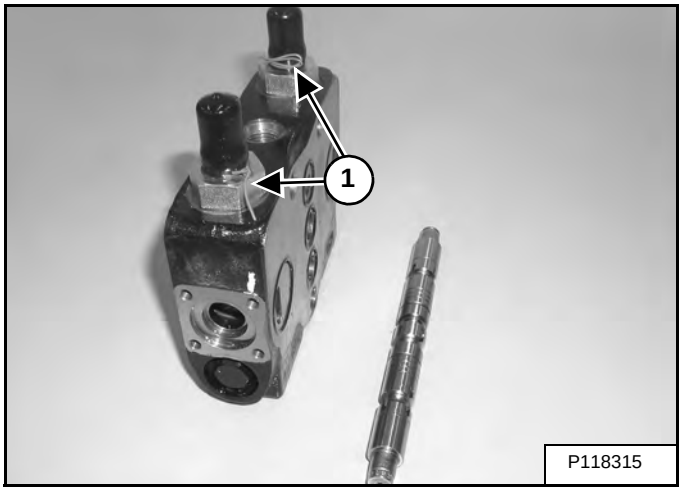
NOTE: The spool is not symmetrical. Incorrect spool installation will cause poor hydraulic valve performance.

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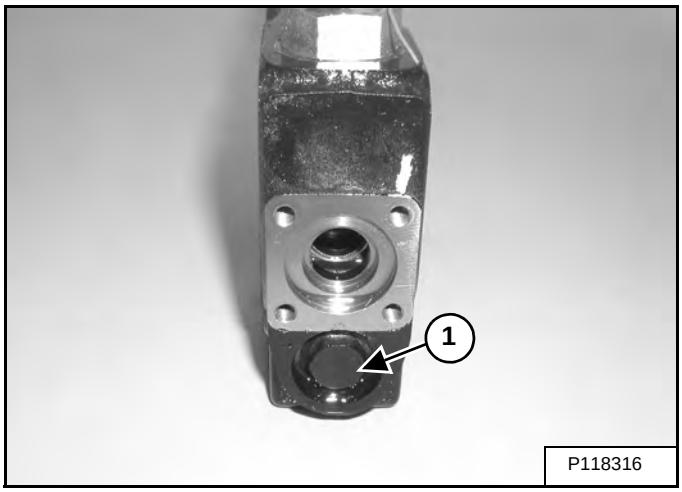
Arm And Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-76



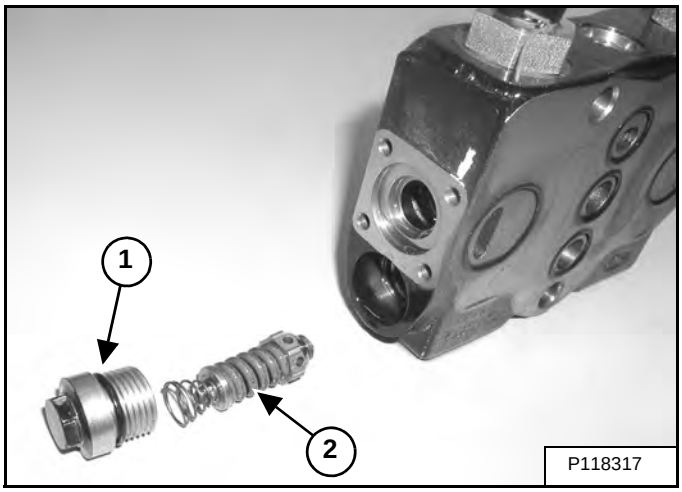
Remove O-rings from fittings (Item 1) **[Figure 20-40-76]**.

Figure 20-40-77



Remove the relief valve (Item 1) **[Figure 20-40-77]** on both sides.

Figure 20-40-78



Remove the O-ring (Item 1) and inspect relief valve (Item 2) **[Figure 20-40-78]**.

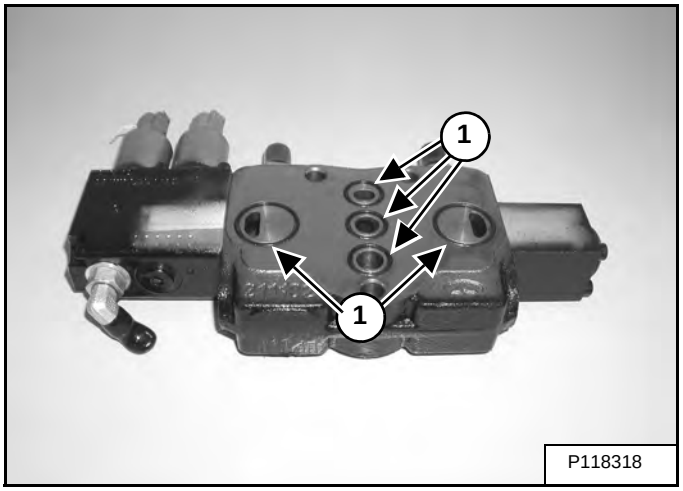
Installation: Tighten the relief valve to 69 - 79 N•m (51 - 58 ft-lb) torque.

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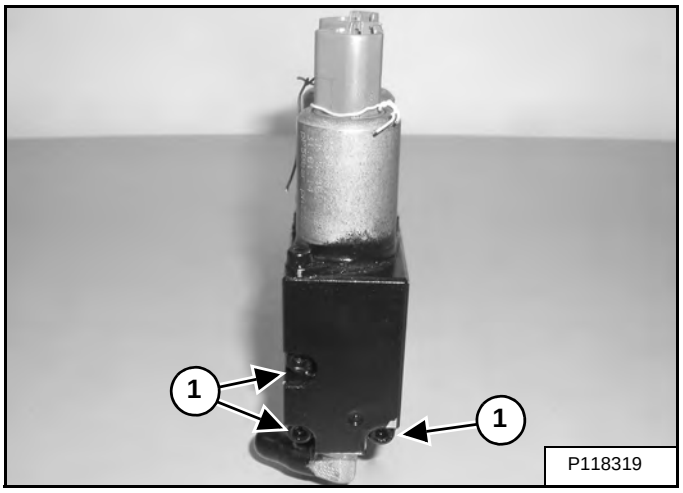
Boom Swing And Auxiliary Valve Section Disassembly And Assembly

Figure 20-40-79



Remove the five O-rings (Item 1) **[Figure 20-40-79]**.

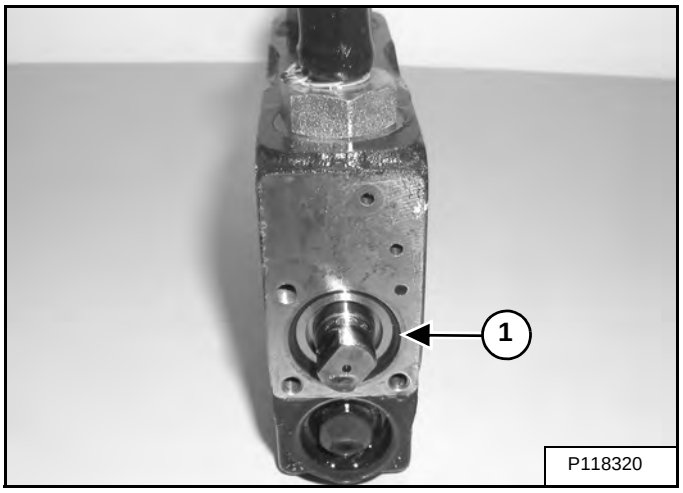
Figure 20-40-80



Remove the three screws (Item 1) from the valve body **[Figure 20-40-80]**.

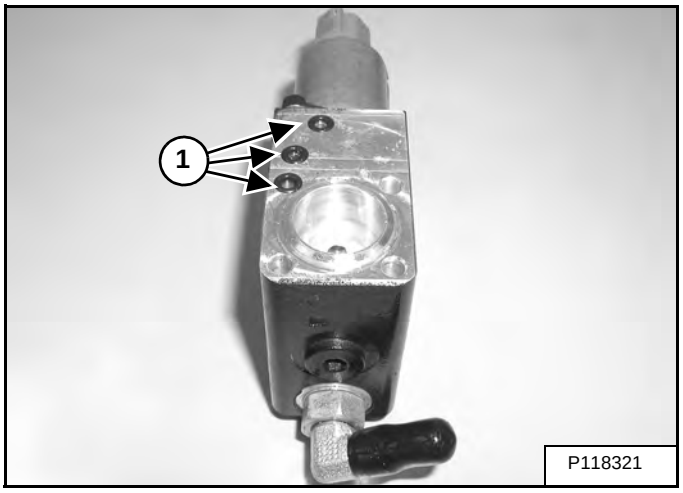
Installation: Tighten the screws to 7,5 N•m (5.5 ft-lb) torque.

Figure 20-40-81



Remove the O-ring (Item 1) **[Figure 20-40-81]**.

Figure 20-40-82



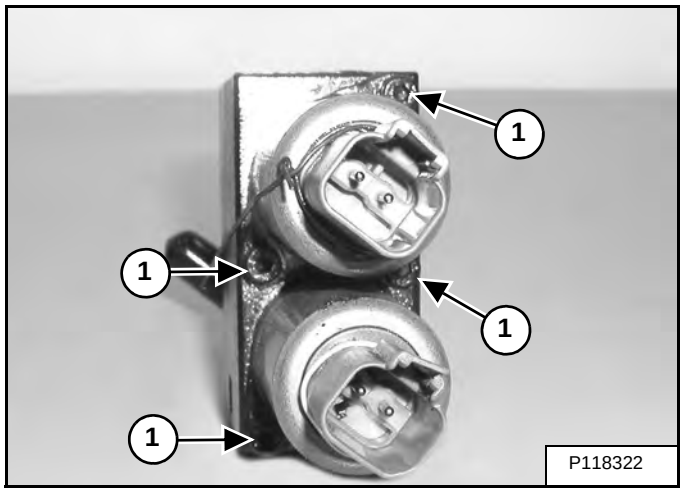
Remove the three O-rings (Item 1) from end cap **[Figure 20-40-82]**.

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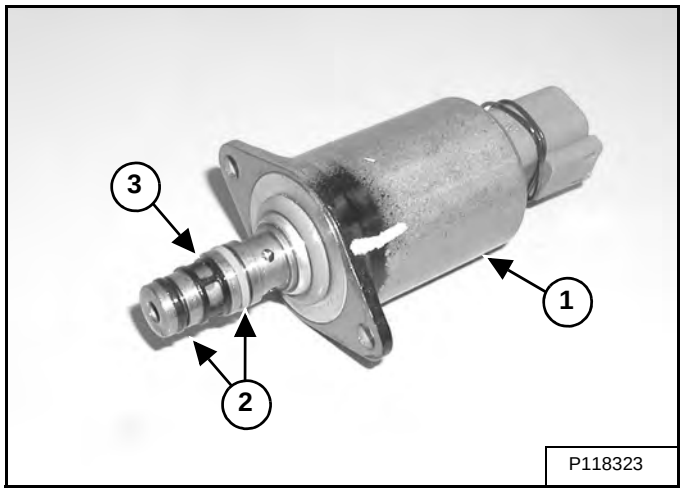
Boom Swing And Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-83



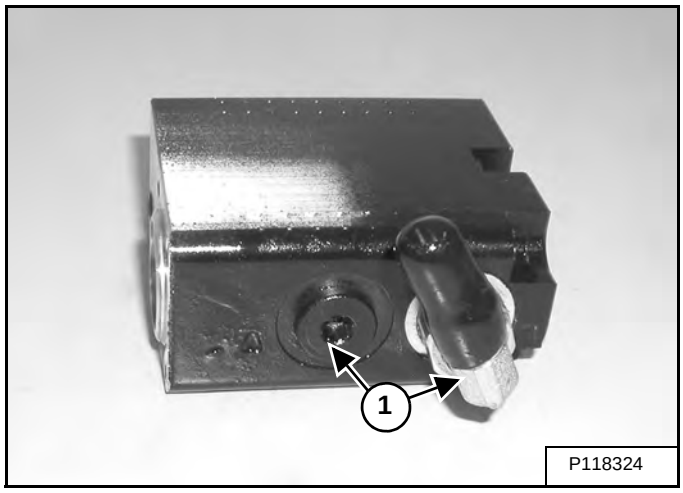
Remove four solenoid screws (Item 1) **[Figure 20-40-83]**.

Figure 20-40-84



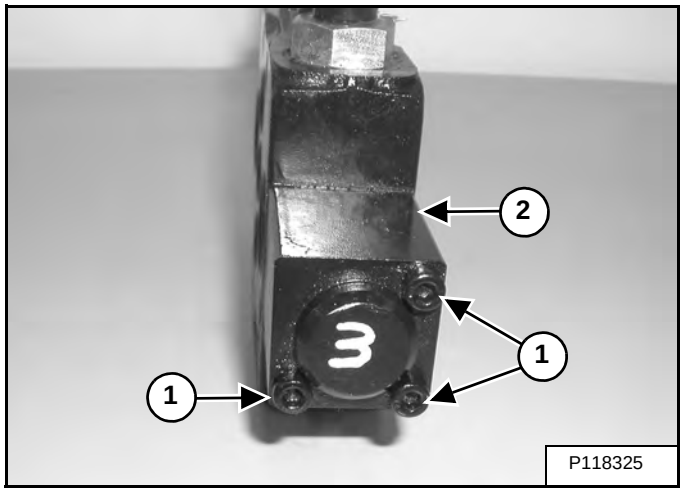
Mark and remove both solenoids (Item 1) and remove the O-rings (Item 2) and inspect the screen (Item 3) **[Figure 20-40-84]**.

Figure 20-40-85



Remove O-ring on plug and fitting (Item 1) **[Figure 20-40-85]**.

Figure 20-40-86



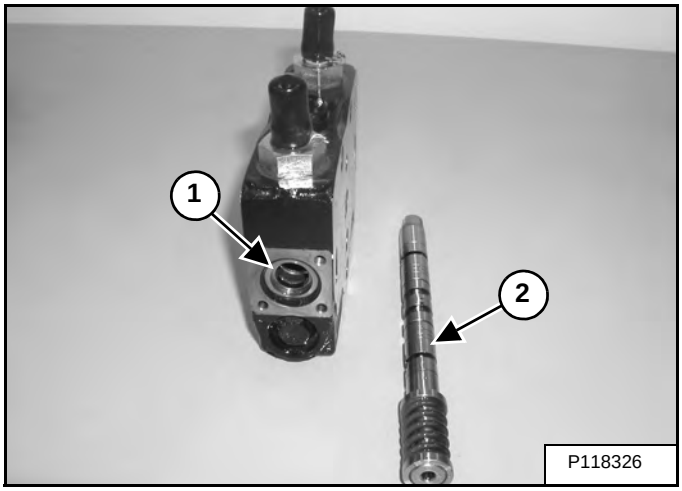
Remove the three cover screws (Items 1) and remove the cover (Item 2) **[Figure 20-40-86]**.

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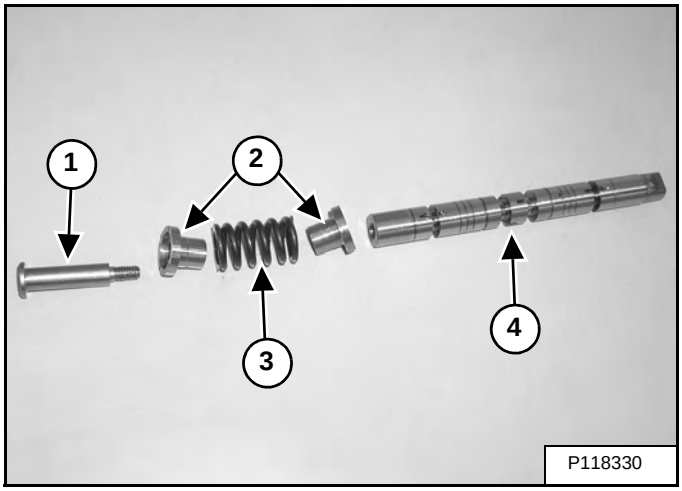
Boom Swing And Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-87



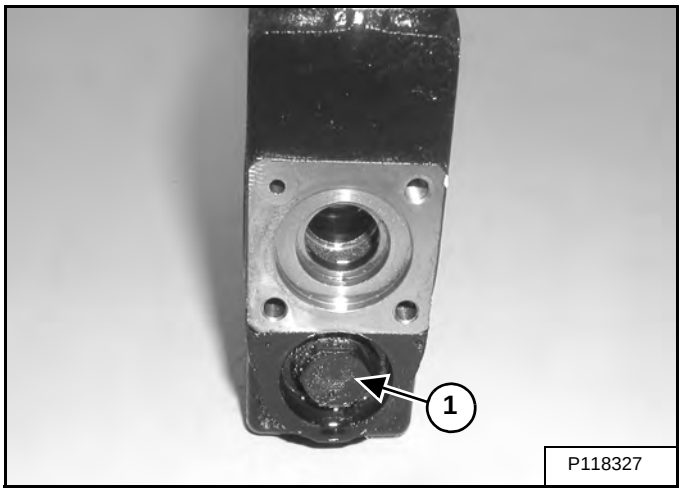
Remove the O-ring (Item 1) and spool assembly (Item 2) **[Figure 20-40-87]**.

Figure 20-40-88



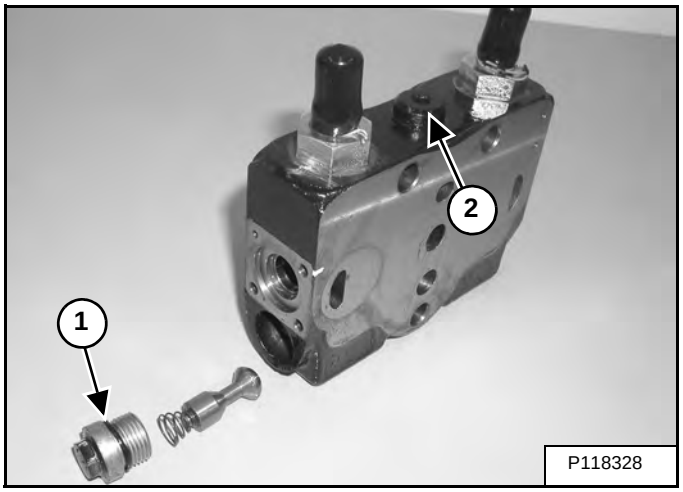
Remove bolt (Item 1), retainers (Item 2), spring (Item 3) from spool (Item 4) **[Figure 20-40-88]**.

Figure 20-40-89



Remove the plug (Item 1) on both sides **[Figure 20-40-89]**.

Figure 20-40-90



Remove the O-ring (Item 1) from both plugs and remove the check valve (Item 2) **[Figure 20-40-90]**.

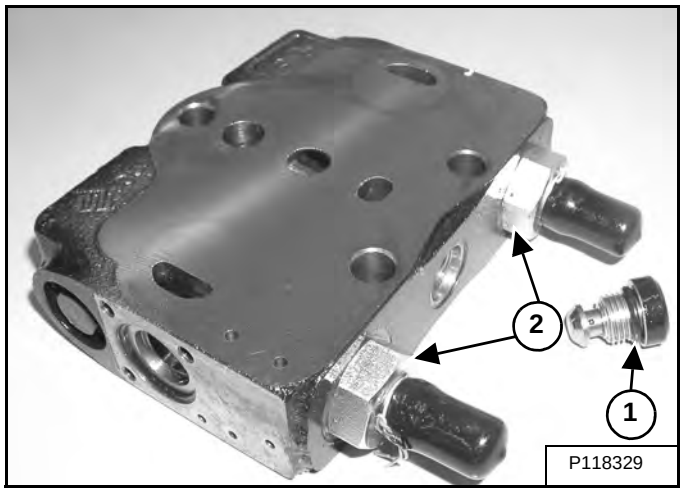
Installation: Tighten the plug to 69 - 78 N•m (51 - 58 ft-lb) torque.

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Boom Swing And Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-91



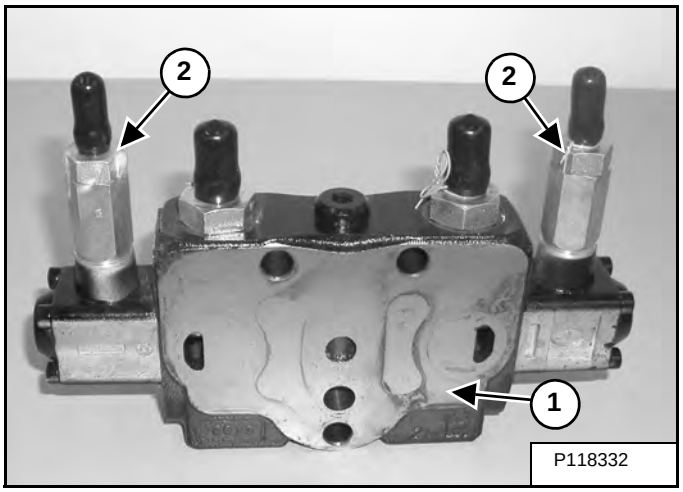
Remove the O-ring (Item 1) and the O-rings on the fittings (Item 2) **[Figure 20-40-91]**.

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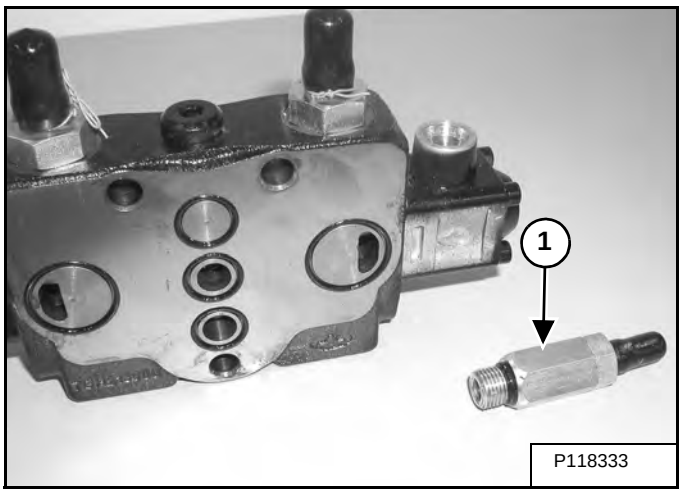
Boom Valve Section Disassembly And Assembly

Figure 20-40-92



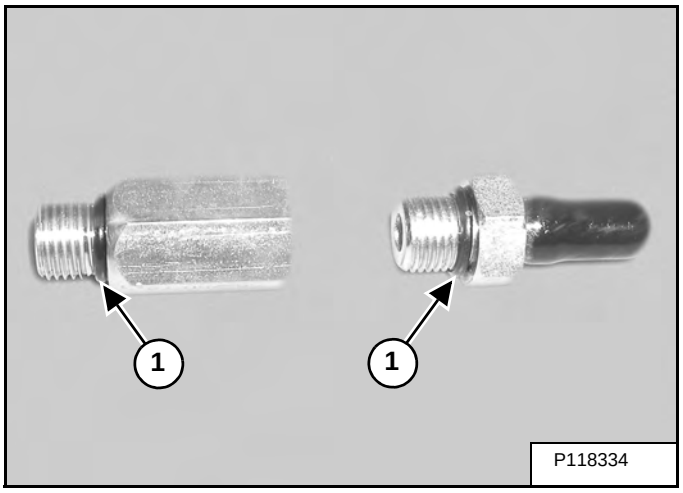
The boom valve section (Item 1) is the same as the arm and bucket valve sections with the addition of the orifice valves (Item 2) for the pilot hose connection **[Figure 20-40-92]**.

Figure 20-40-93



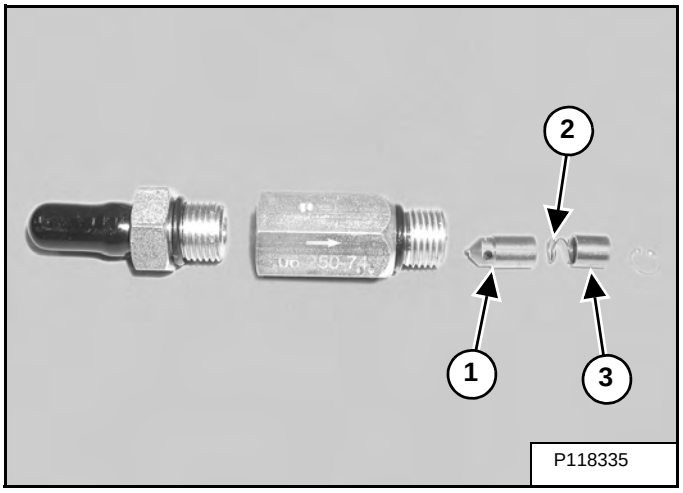
Remove the valve assembly (Item 1) **[Figure 20-40-93]**.

Figure 20-40-94



Remove the O-rings (Item 1) **[Figure 20-40-94]**.

Figure 20-40-95



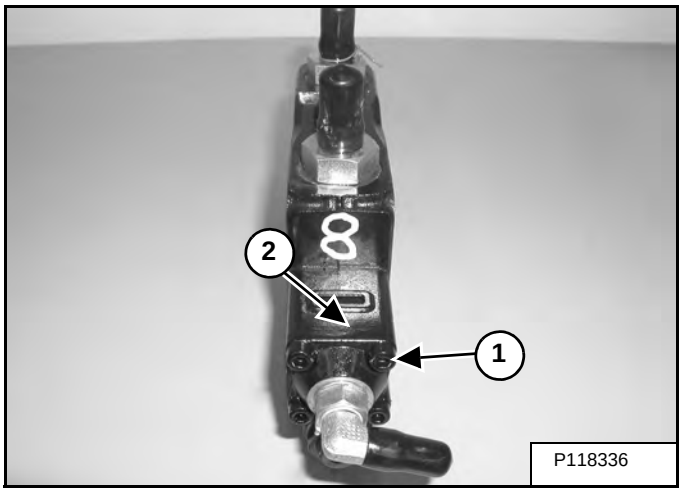
Remove the valve (Item 1), spring (Item 2) and retainer (Item 3) **[Figure 20-40-95]**.

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Slew Valve Section Disassembly And Assembly

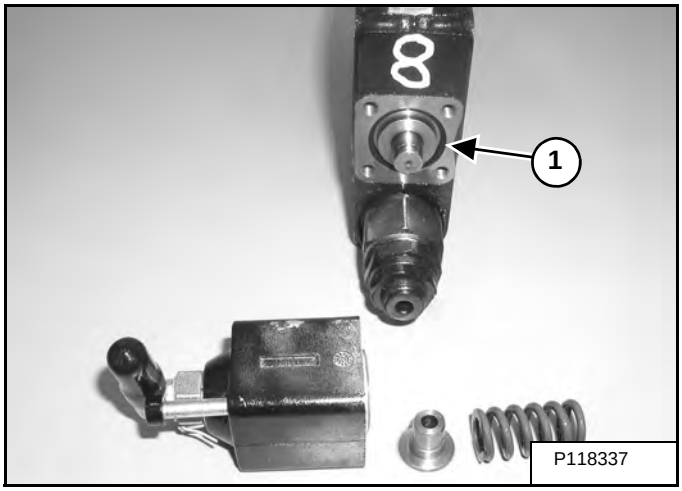
Figure 20-40-96



Remove the four screws (Item 1) and end cap (Item 2) **[Figure 20-40-96]** on both sides.

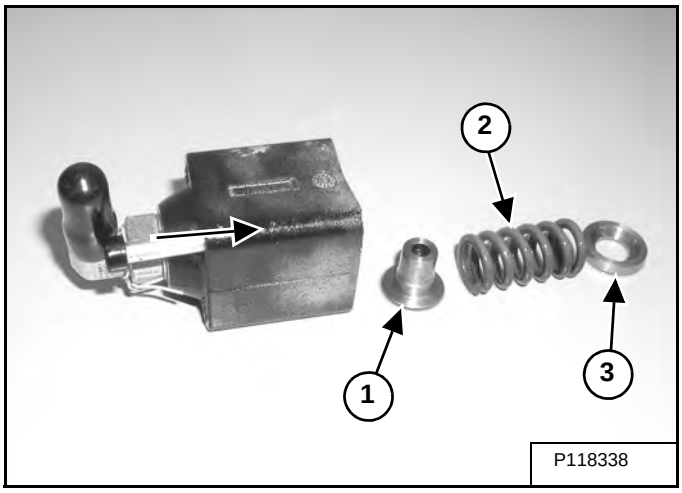
Installation: Tighten the screws to 7,5 N•m (5.5 ft-lb) torque.

Figure 20-40-97



Remove the O-ring (Item 1) **[Figure 20-40-97]**.

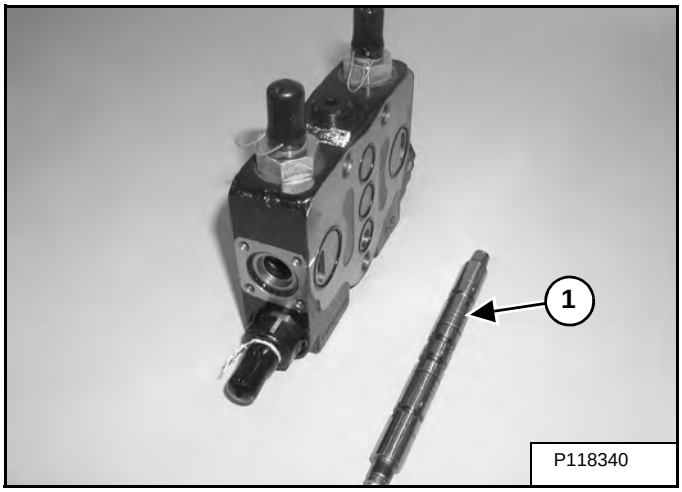
Figure 20-40-98



Remove the spring seat (Item 1), spring (Item 2), and spring seat (Item 3) **[Figure 20-40-98]**.

Installation: Tighten the screws to 9 - 11 N•m (7 - 8 ft-lb) torque.

Figure 20-40-99



Remove the spool (Item 1) **[Figure 20-40-99]**.

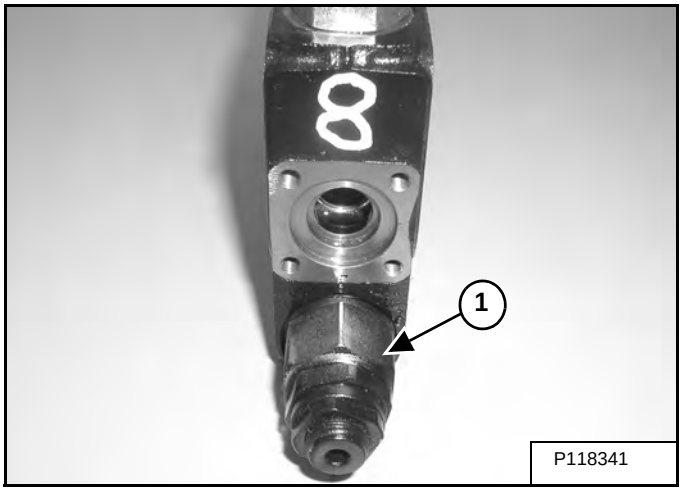
NOTE: The spool is not symmetrical. Incorrect spool installation will cause poor hydraulic valve performance.

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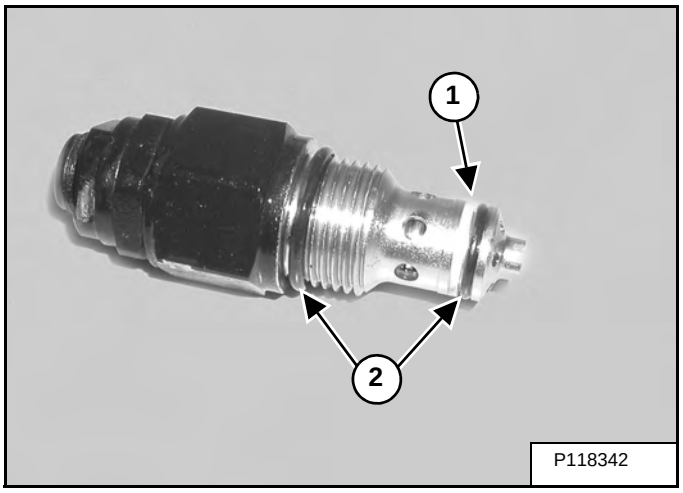
Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-100



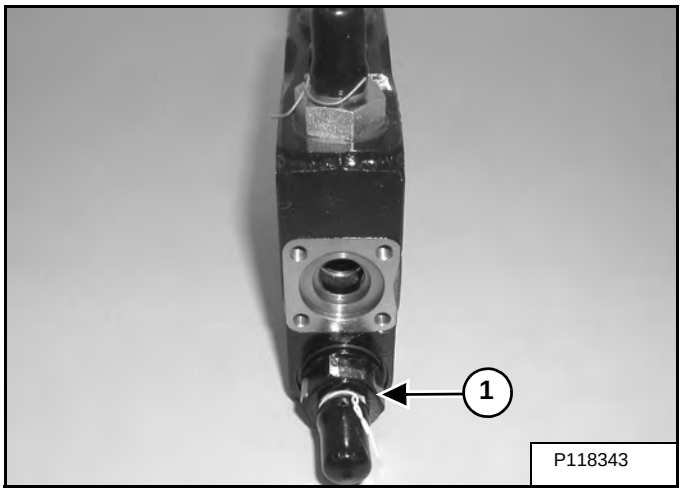
Remove the relief valve (Item 1) **[Figure 20-40-100]**.

Figure 20-40-101



Remove the back-up ring (Item 1) and O-rings **[Figure 20-40-101]**.

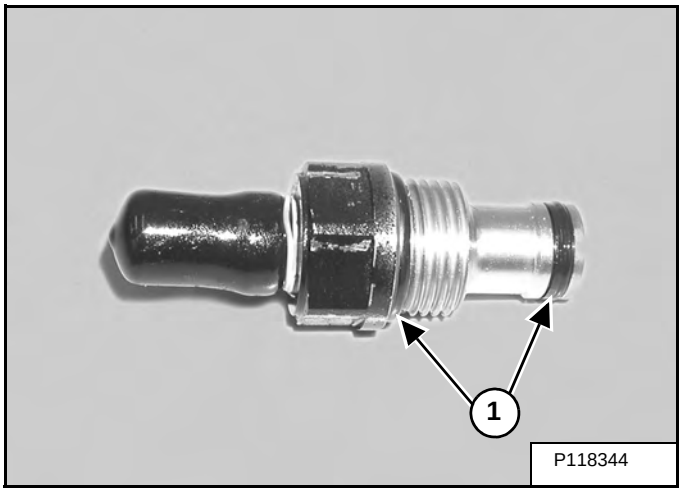
Figure 20-40-102



Remove the plug (Item 1) **[Figure 20-40-102]**.

Installation: Tighten the plug to 69 - 78 N•m (51 - 58 ft-lb) torque.

Figure 20-40-103



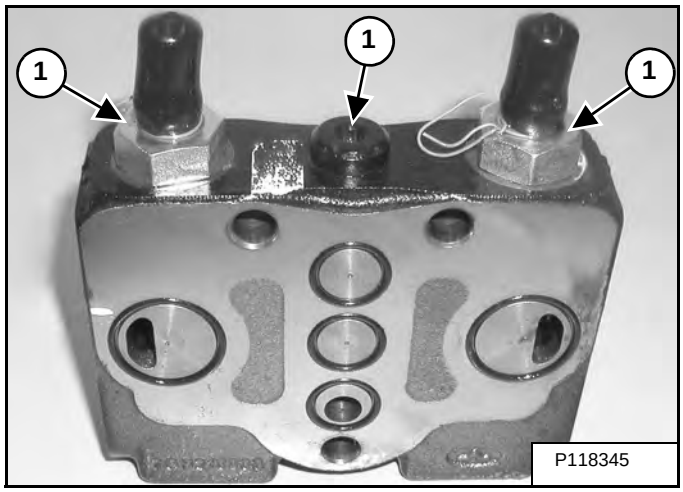
Remove the O-rings (Item 1) **[Figure 20-40-103]**.

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Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-104



Remove the O-rings from the fittings (Item 1) **[Figure 20-40-104]**.

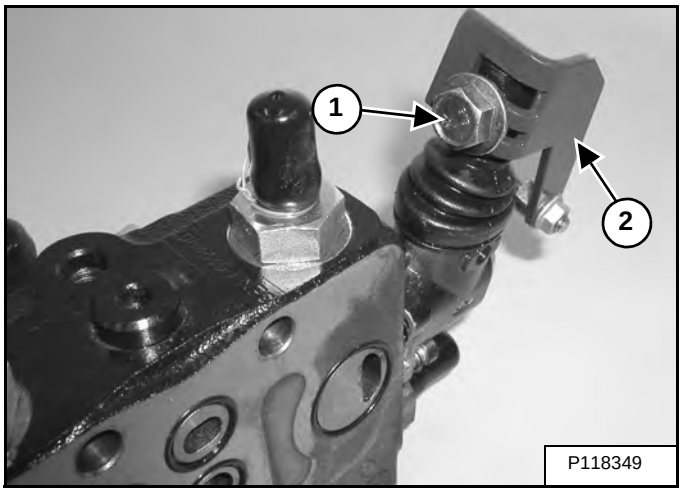
Installation: Tighten the fitting to 69 - 78 N•m (51 - 58 ft-lb) torque.

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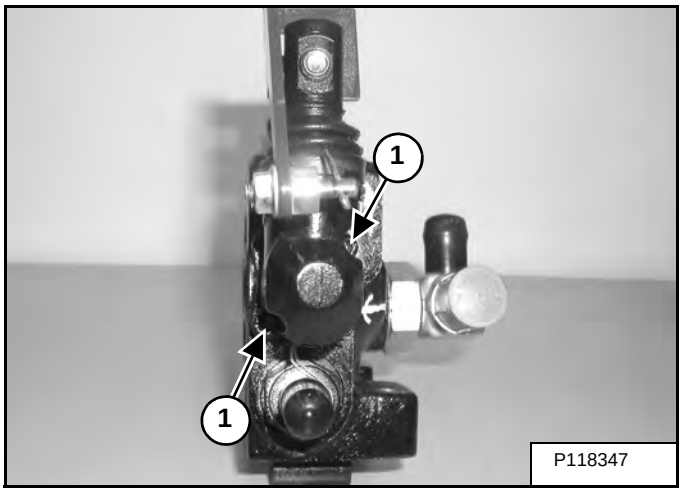
Blade Valve Section Disassembly And Assembly

Figure 20-40-105



Remove the bolt (Item 1) and linkage bracket (Item 2) **[Figure 20-40-105]**.

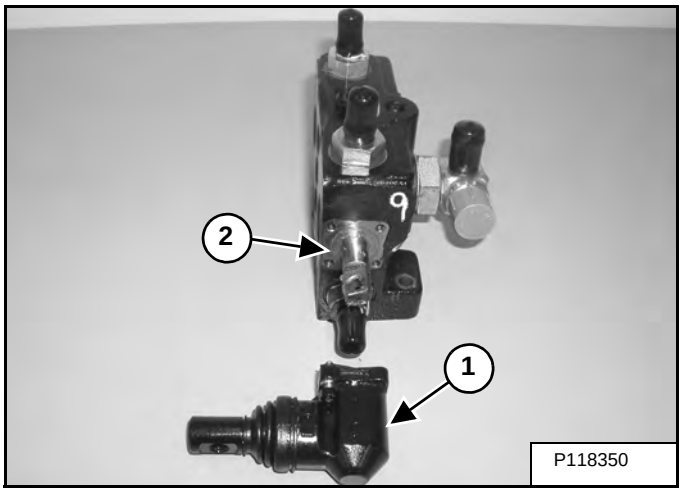
Figure 20-40-106



Remove the screws (Item 1) **[Figure 20-40-106]**.

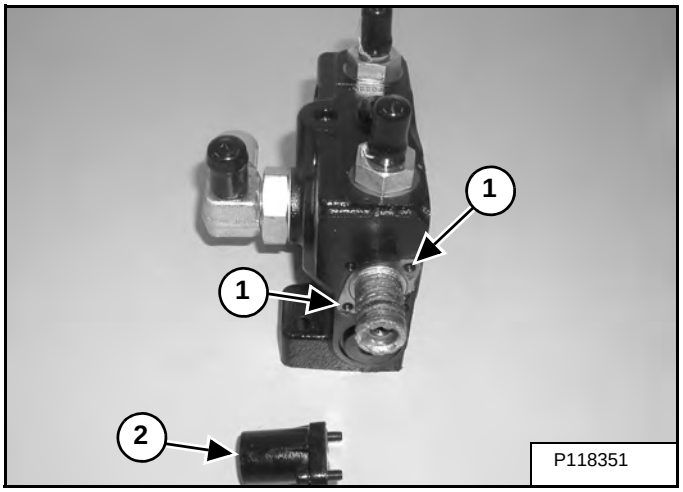
Installation: Use Loctite® 242 on threads. Tighten the screws to 7,5 N•m (5.5 ft-lb) torque.

Figure 20-40-107



Remove the cover assembly (Item 1) and O-ring (Item 2) **[Figure 20-40-107]**.

Figure 20-40-108



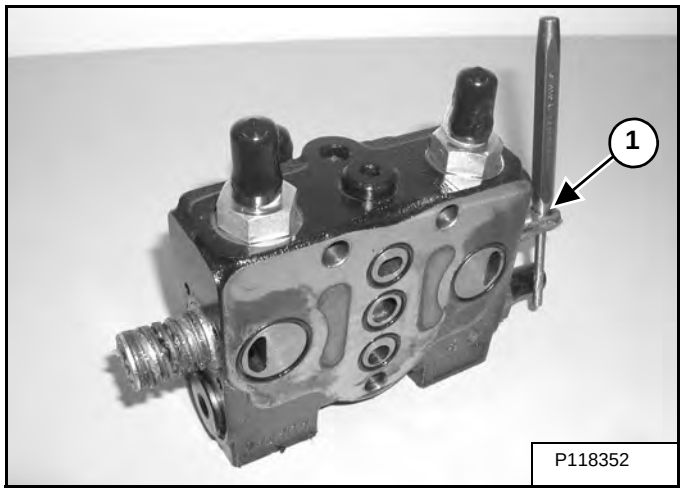
Remove the two screws (Item 1) and cover (Item 2) **[Figure 20-40-108]**.

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Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-109



Hold the linkage end of spool (Item 1) **[Figure 20-40-109]**. Remove the spring retainer nut (Item 1) **[Figure 20-40-110]**.

Figure 20-40-110

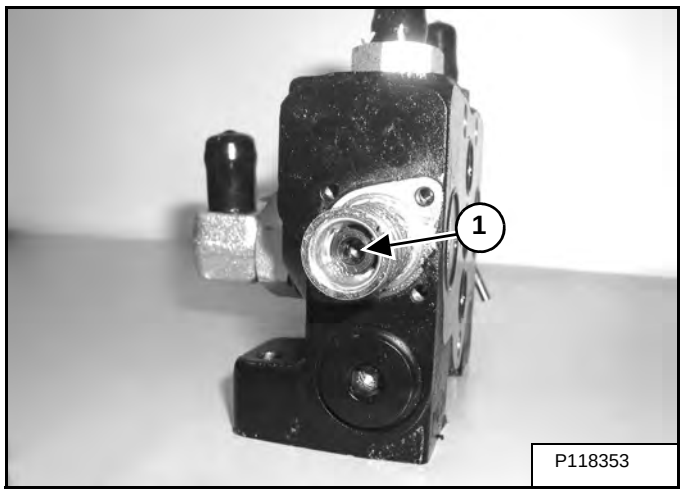
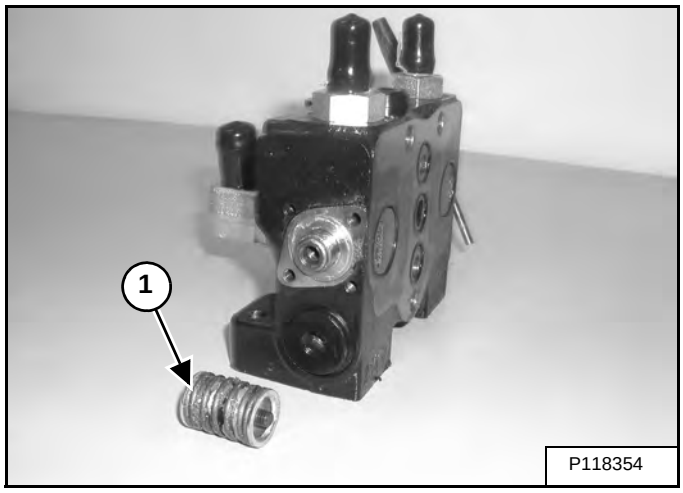
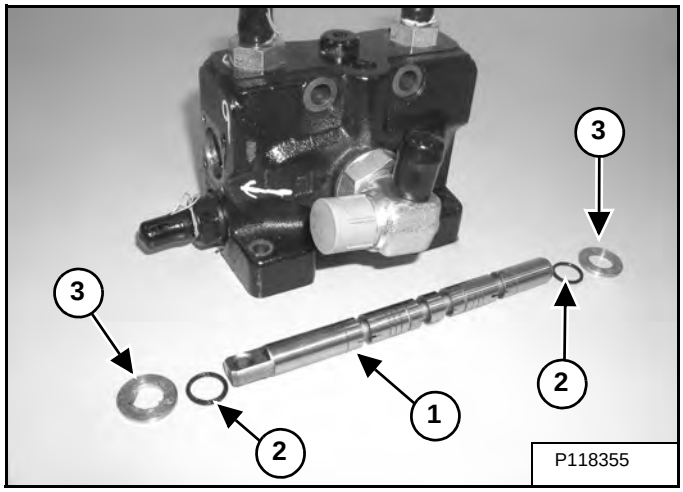


Figure 20-40-111



Remove the spring assembly (Item 1) **[Figure 20-40-111]**.

Figure 20-40-112



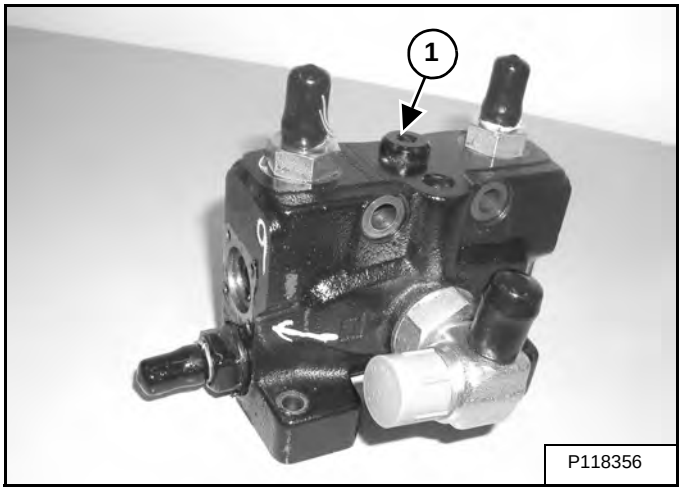
Remove spool (Item 1), O-rings (Item 2) and washers (Item 3) **[Figure 20-40-112]**.

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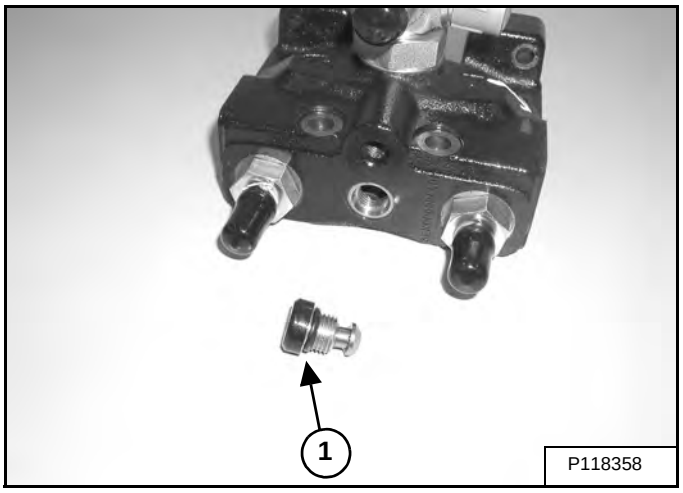
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-113



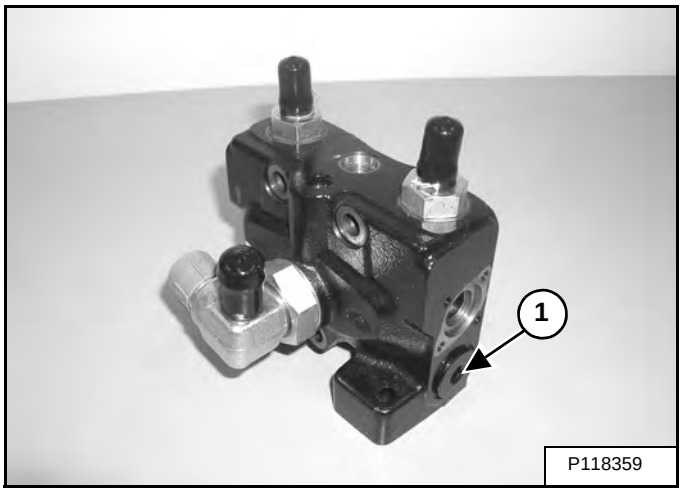
Remove the check valve (Item 1) **[Figure 20-40-113]**.

Figure 20-40-114



Remove the O-ring (Item 1) **[Figure 20-40-114]**.

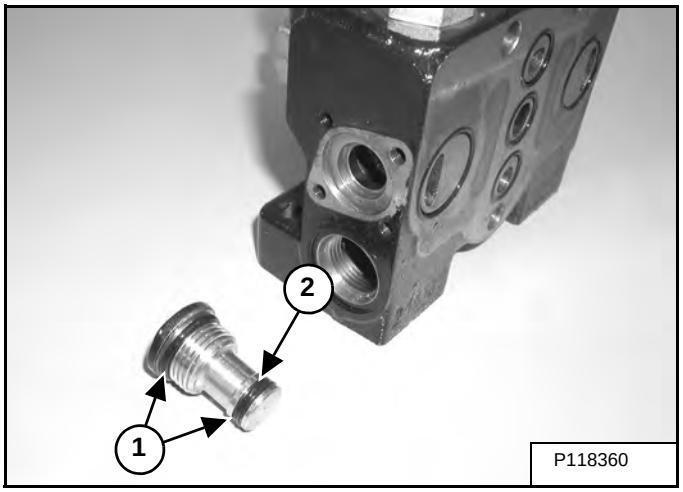
Figure 20-40-115



Remove the plug (Item 1) **[Figure 20-40-115]**.

Installation: Tighten the plug to 28,5 - 30 N•m (21 - 22 ft-lb) torque.

Figure 20-40-116



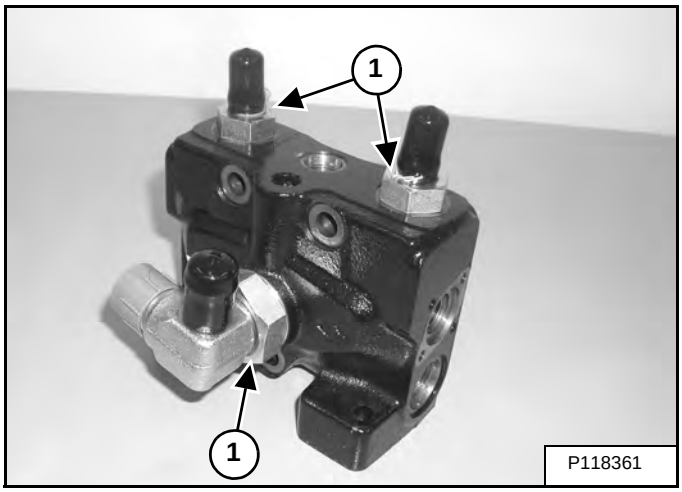
Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-116]** from the plug.

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Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-117



Remove the three O-rings (Item 1) **[Figure 20-40-117]**.

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HYDRAULIC PUMP

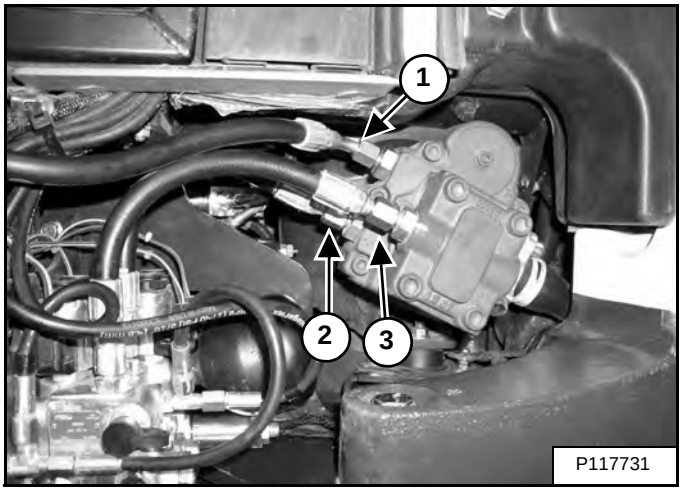
Description

IMPORTANT

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

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Figure 20-50-1



Pump outlet one (Item 1) **[Figure 20-50-1]** provides hydraulic fluid to the right hand travel and boom valve sections.

Pump outlet two (Item 2) **[Figure 20-50-1]** provides hydraulic fluid to the left hand travel section.

Hydraulic fluid from pump one and two combine to provide flow to the arm, boom swing, bucket and auxiliary valve sections.

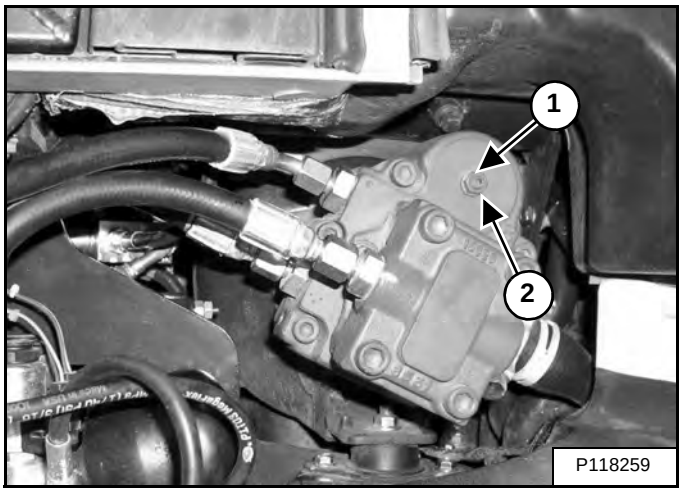
Pump outlet three (gear pump) (Item 3) **[Figure 20-50-1]** provides hydraulic fluid to the upperstructure swing and blade valve sections.

Torque Adjustment

Prior to making any torque adjustment, all piston and gear pump tests must be completed and at rated specifications. (See the following pages for pump tests.)

Prior to making any torque adjustment, make sure the no load engine rpm is correct.

Figure 20-50-2



The adjustment screw (Item 1) **[Figure 20-50-2]** is used to match the maximum hydraulic horsepower of the pump to the maximum rated engine horsepower.

Remove any auxiliary hydraulic attachments from the excavator.

Start the engine and move the speed control to the high rpm position.

Engage the following hydraulic functions, and continue to engage the functions.

Engage the auxiliary hydraulics.
Extend the bucket cylinder.
Extend the arm cylinder.
Extend the boom cylinder.
Extend the boom swing cylinder.

With all the above hydraulic functions engaged, the engine speed must maintain 2500 rpm.

To adjust the hydraulic pump torque, loosen the locknut (Item 2) **[Figure 20-50-2]** and turn the adjustment screw clockwise to increase pump torque or counterclockwise to decrease pump torque.

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Torque Adjustment (Cont'd)

Tighten the locknut and retest the pump.

Increase or decrease pump torque until correct engine rpm is maintained.

Testing The Piston Pump

All pump testing is done with the hydraulic fluid at operating temperature and with the engine at the high rpm setting.

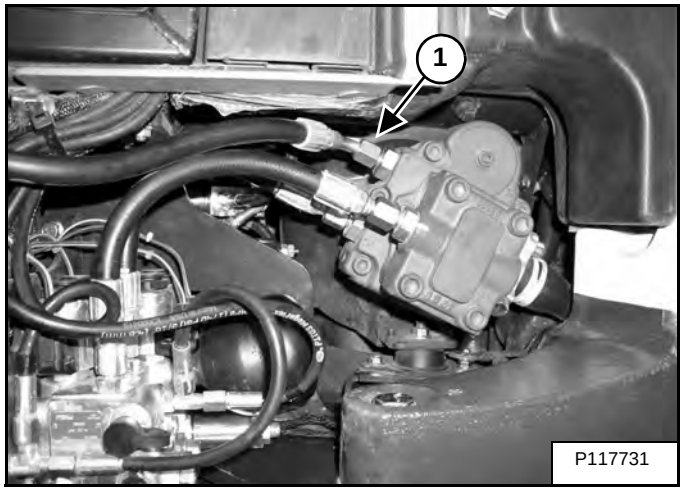
The following tool will be needed for the hydraulic pump test:

MEL10003 - Hydraulic Tester

Stop the engine.

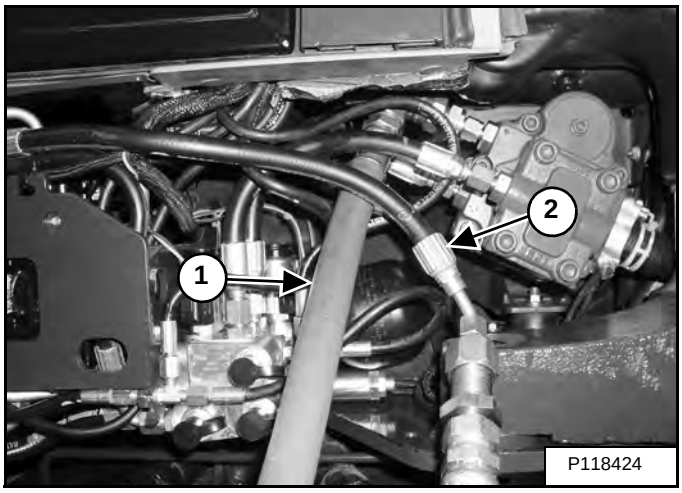
Remove the left upperstructure cover. (See Removal And Installation on Page 40-60-1.)

Figure 20-50-3



Remove the outlet hose (Item 1) **[Figure 20-50-3]** from the hydraulic pump being tested.

Figure 20-50-4



Connect the inlet (Item 1) **[Figure 20-50-4]** of the tester to the pump.

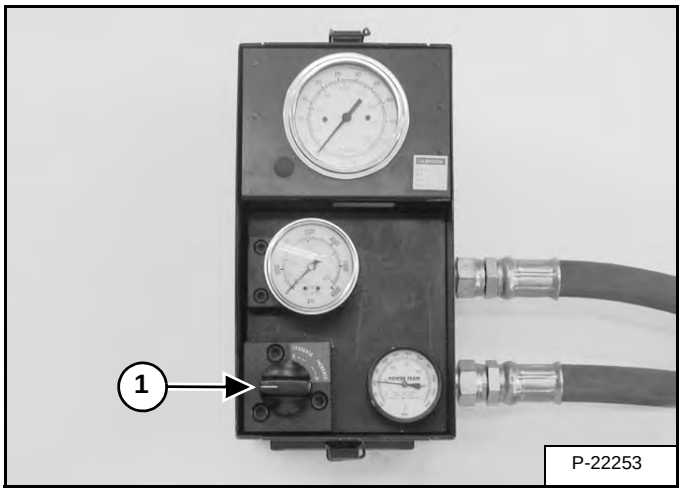
Connect the outlet of the tester to the hose (Item 2) **[Figure 20-50-4]** that was removed from the pump.

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Testing The Piston Pump (Cont'd)

Figure 20-50-5



NOTE: Open the flow control knob (Item 1) [Figure 20-50-5] fully to prevent pump damage. This is a direct pump test. There is no relief valve in the system.

Start the engine and run at low rpm. Make sure the tester is connected correctly. If no flow is indicated at the tester, the hoses are connected wrong.

Increase the engine speed to full rpm. Warm the hydraulic fluid to 66°C (150°F) by turning the restrictor valve until the gauge reads about 6895 kPa (69 bar) (1000 psi). Do not exceed system pressure.

After the temperature is correct, open the restrictor valve fully.

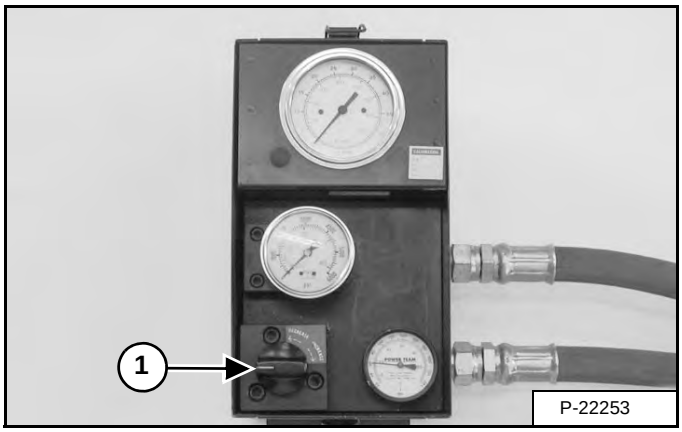
Record the pump free flow L/min (U.S. gpm).

Pump flow on a new piston pump is 15,0 L/min (3.96 U.S. gpm) @ 2500 rpm.

Repeat the procedure for pump outlet two.

The pump flow must be equal between outlet one and two.

Figure 20-50-6



Close the flow control knob (Item 1) **[Figure 20-50-6]** slowly to 689 kPa (7 bar) (100 psi) below the relief valve setting 22753 kPa (228 bar) (3300 psi).

Record the pump high pressure flow L/min (U.S. gpm).

NOTE: The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (L/min [U.S. gpm])}}{\text{FREE FLOW (L/min [U.S. gpm])}} x100$$

If the high pressure flow is less than 80% of free flow, remove the hydraulic pump for repair or replacement.

Repeat the procedure for pump outlet two.

The pump flow must be equal between outlet one and two.

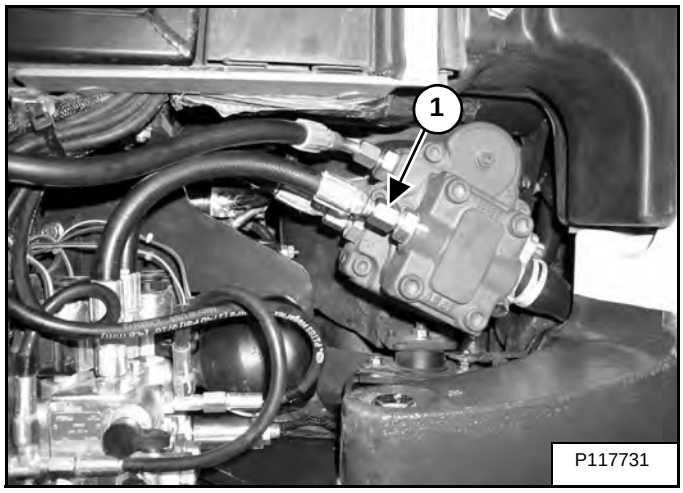
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Testing The Gear Pump

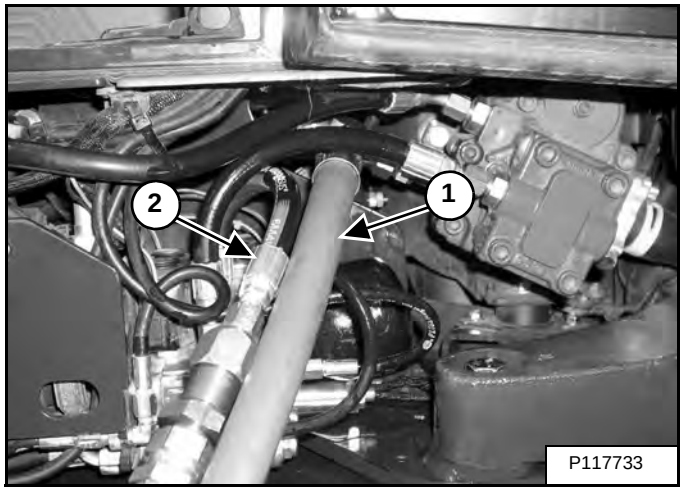
All pump testing is done with the hydraulic fluid at operating temperature and with the engine at the high rpm setting.

Figure 20-50-7



Remove the outlet hose (Item 1) **[Figure 20-50-7]** from the gear pump section.

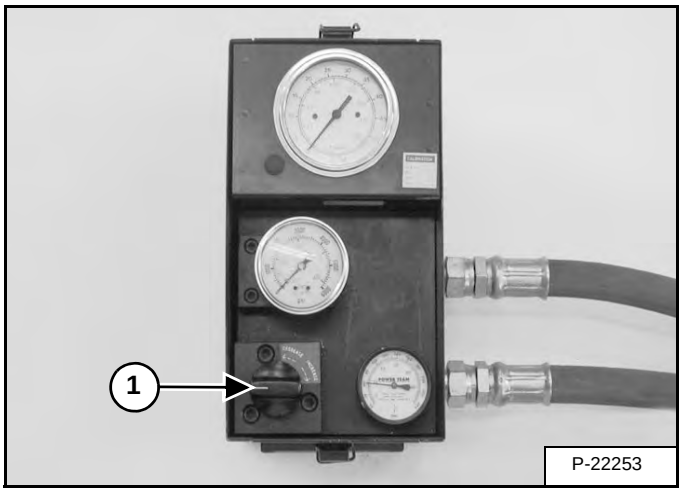
Figure 20-50-8



Connect the inlet (Item 1) **[Figure 20-50-8]** of the tester to the pump.

Connect the outlet of the tester to the hose (Item 2) **[Figure 20-50-8]** that was removed from the pump.

Figure 20-50-9



NOTE: Open the flow control knob (Item 1) [Figure 20-50-9] fully to prevent pump damage. This is a direct pump test. There is no relief valve in the system.

Start the engine and run at low rpm. Make sure the tester is connected correctly. If no flow is indicated at the tester, the hoses are connected wrong.

Increase the engine speed to full rpm. Warm the hydraulic fluid to 66°C (150°F) by turning the restrictor valve until the gauge reads about 6895 kPa (69 bar) (1000 psi). Do not exceed system pressure.

After the temperature is correct, open the restrictor valve fully.

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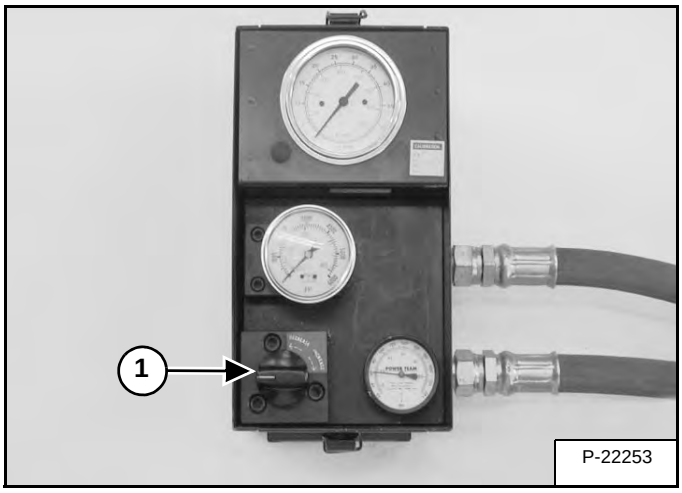
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Testing The Gear Pump (Cont'd)

Record the pump free flow L/min (U.S. gpm).

Pump flow on a new gear pump is 11,0 L/min (3 U.S. gpm) @ 2500 rpm.

Figure 20-50-10



Close the flow control knob (Item 1) **[Figure 20-50-10]** slowly to 689 kPa (6,9 bar) (100 psi) below the relief valve setting 22753 kPa (228 bar) (3300 psi).

Record the pump high pressure flow L/min (U.S. gpm).

NOTE: The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (L/min [U.S. gpm])}}{\text{FREE FLOW (L/min [U.S. gpm])}} \text{x100}$$

If the high pressure flow is less than 80% of free flow, remove the hydraulic pump for repair or replacement.

Testing Auxiliary Hydraulic Flow

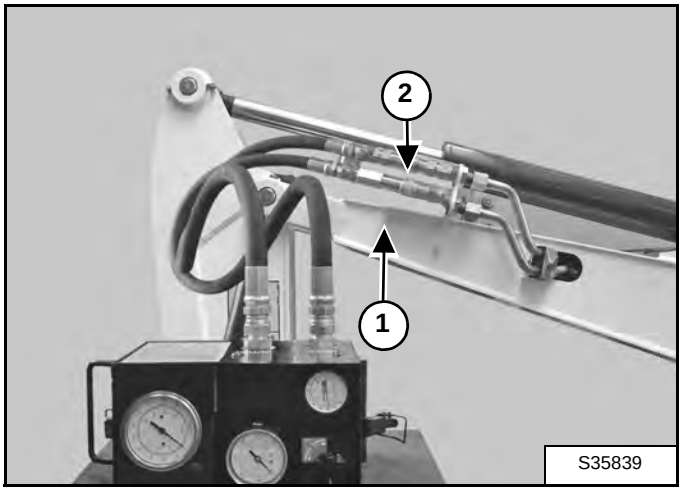
All testing is done with the hydraulic oil at operating temperature and the engine high speed setting.

The following tool will be needed for the auxiliary hydraulic flow test:

MEL10003 - Hydraulic Tester.

Stop the engine.

Figure 20-50-11



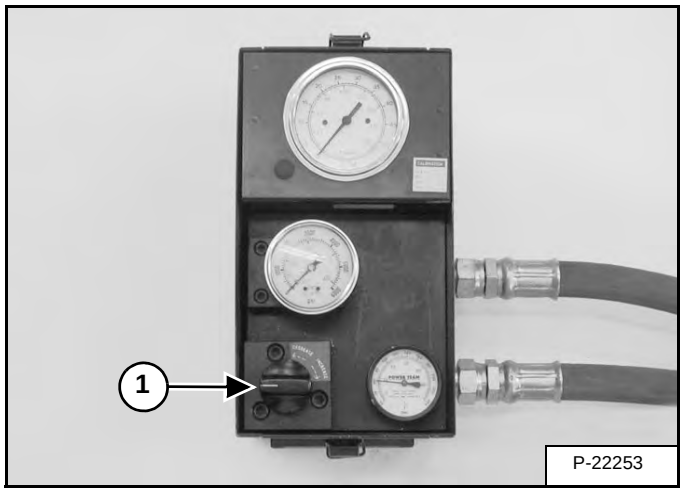
Connect the inlet side of the tester to the female coupler (Item 1). Connect the outlet side of the tester to the male coupler (Item 2) **[Figure 20-50-11]**.

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Testing The Auxiliary Hydraulic Flow (Cont'd)

Figure 20-50-12



NOTE: Open the flow control knob (Item 1) [Figure 20-50-12] fully.

Start the engine, and run at low rpm. Engage the auxiliary hydraulic circuit.

NOTE: When engaging the auxiliary hydraulic circuit, make sure the female coupler is pressure and the male coupler is return.

Make sure the tester is connected correctly. If no flow is indicated at the tester, the hoses are connected wrong.

Increase the engine speed to full rpm. Warm the hydraulic fluid to 66°C (150°F) by turning the restrictor valve until the gauge reads about 6895 kPa (69 bar) (1000 psi). Do not exceed system pressure.

After the temperature is correct, open the restrictor valve fully.

Record the auxiliary hydraulic free flow L/min (U.S. gpm).

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Removal And Installation

Lower the boom / bucket and blade to the ground.

Relieve hydraulic pressure.

Drain the hydraulic reservoir. (See Removal And Installation on Page 20-130-1.)

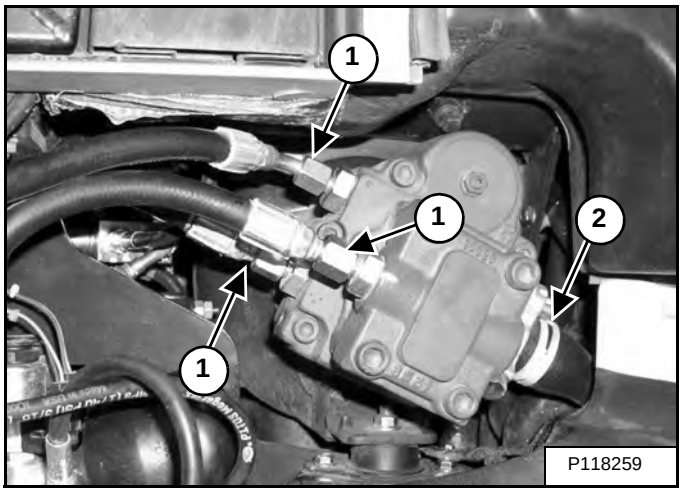
Remove the left upperstructure cover. (See Removal And Installation on Page 40-60-1.)

IMPORTANT

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

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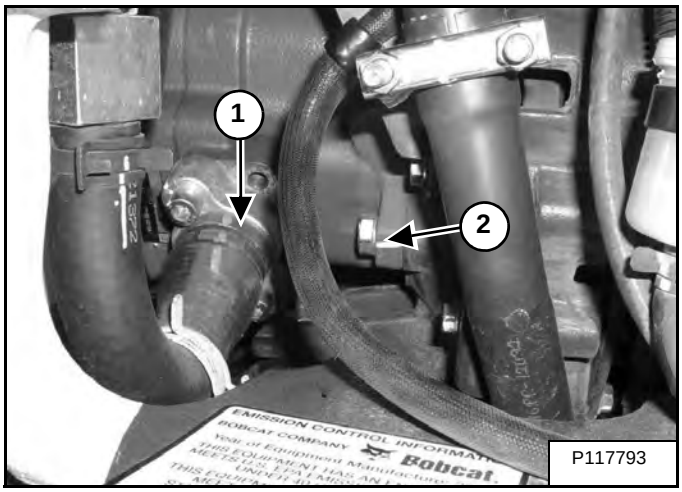
Figure 20-50-13



Mark and remove the hoses (Item 1) **[Figure 20-50-13]**.

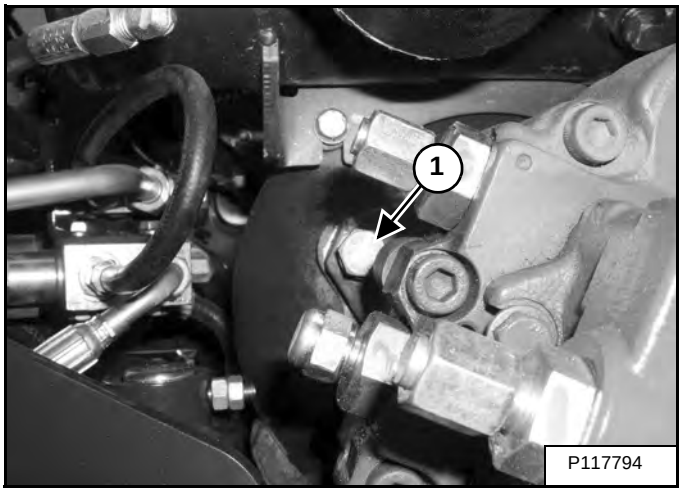
Move the clamp (Item 2) **[Figure 20-50-13]** back.

Figure 20-50-14



Remove the hose (Item 1) and bolt (Item 2) **[Figure 20-50-14]**.

Figure 20-50-15



Remove the bolt (Item 1) **[Figure 20-50-15]**.

Installation: Tighten bolts to 105 - 115 N•m (78 - 85 ft-lb) torque.

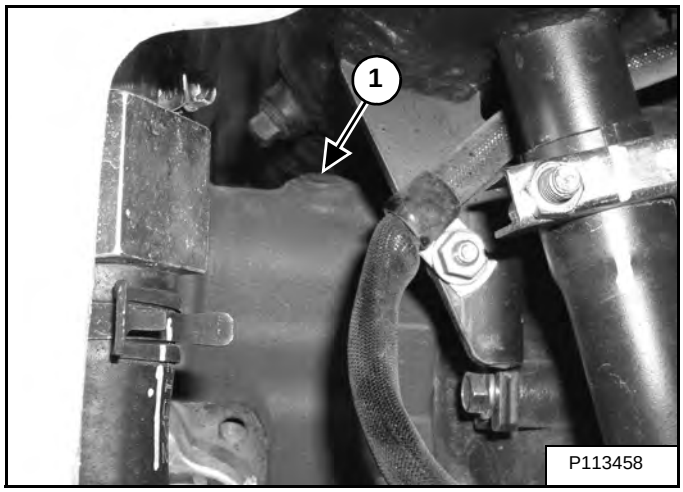
Remove the pump from the excavator.

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Removal And Installation (Cont'd)

Figure 20-50-16



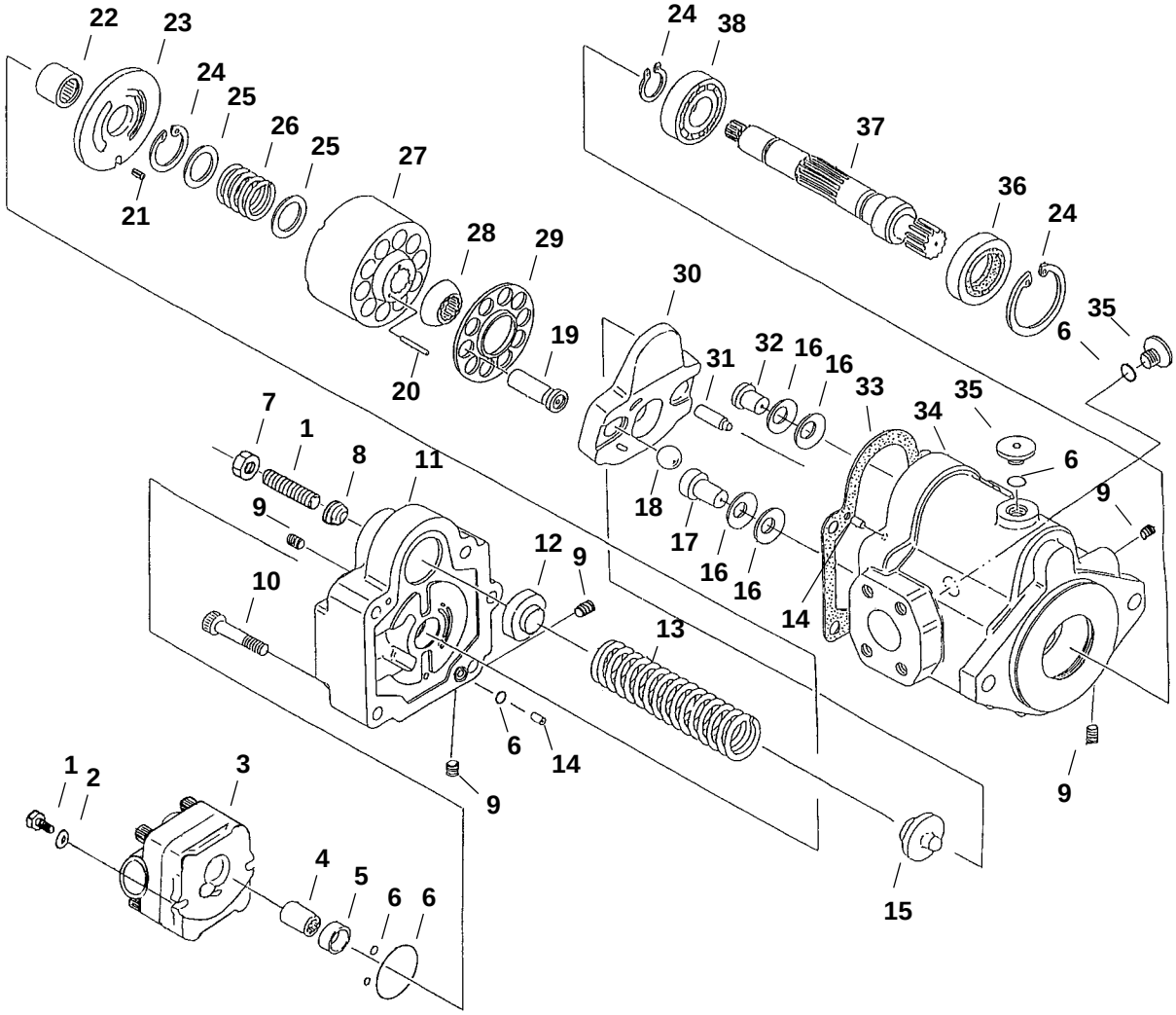
Installation: Remove the plug (Item 1) **[Figure 20-50-16]** from the hydraulic pump. Install the plug after a steady stream of hydraulic fluid free of any air drains from the hydraulic pump. Tighten plug to 30 - 34 N•m (22 - 25 ft-lb) torque.

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Parts Identification

1. Screw
2. Washer
3. Gear Pump
4. Coupler
5. Collar
6. O-ring
7. Nut
8. Seal Washer
9. Plug
10. Bolt
11. Face Plate
12. Spring Guide
13. Spring
14. Pin
15. Spring Holder
16. Dish Washer
17. Stopper Pin B
18. Ball
19. Piston
20. Pin
21. Spring Pin
22. Bearing
23. Port Plate
24. Snap Ring
25. Washer
26. Spring
27. Cylinder Block
28. Retainer
29. Retainer Plate
30. Swash Plate
31. Rod
32. Piston
33. Gasket
34. Housing
35. Plug
36. Oil Seal
37. Shaft
38. Bearing



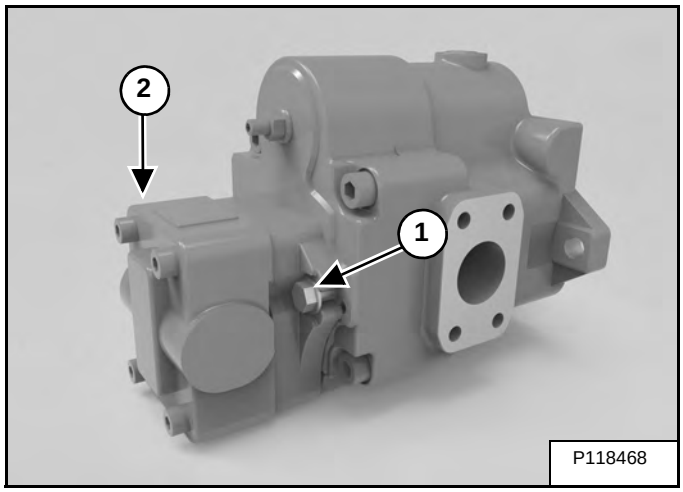
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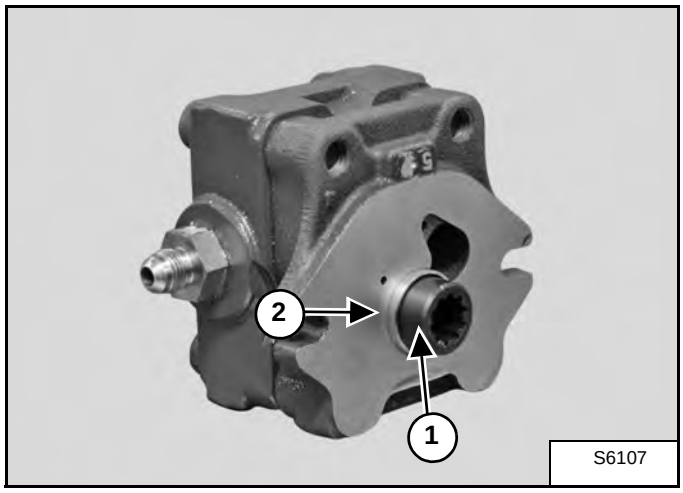
Disassembly And Assembly

Figure 20-50-17



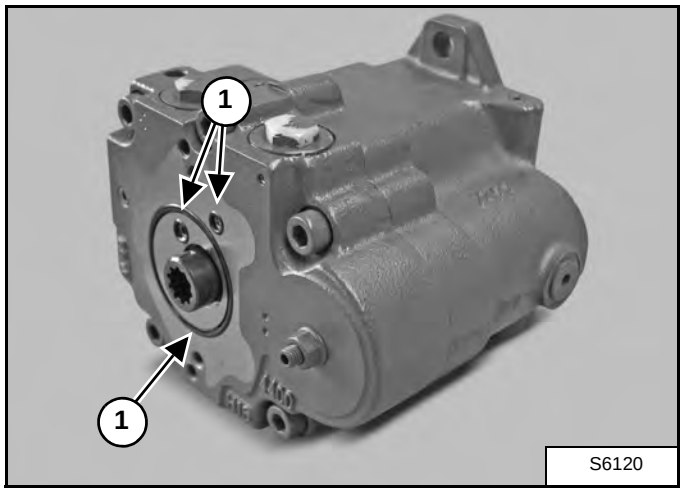
Remove the bolts (Item 1) and remove the gear pump (Item 2) **[Figure 20-50-17]** from the piston pump.

Figure 20-50-18



Remove the coupler (Item 1) and collar (Item 2) **[Figure 20-50-18]** from the gear pump.

Figure 20-50-19



Remove the O-rings (Item 1) **[Figure 20-50-19]**.

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Gear Pump Disassembly

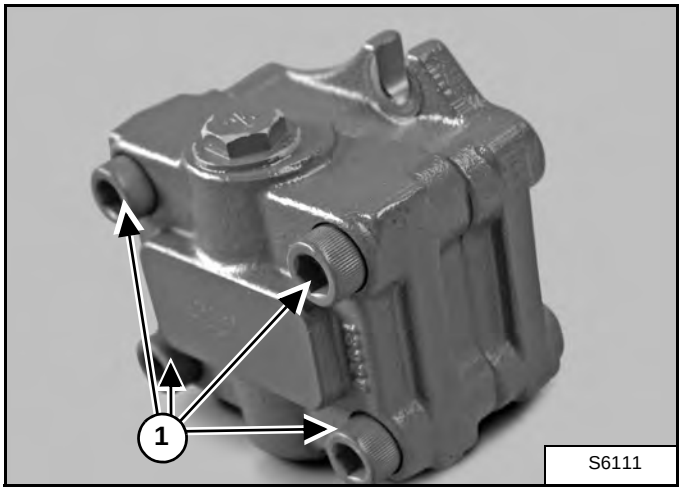
IMPORTANT

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

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Mark the halves of the gear pump to aid in the assembly process.

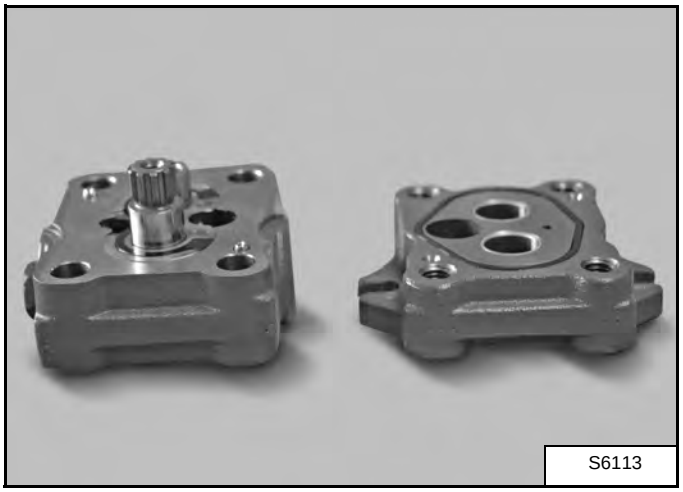
Figure 20-50-20



Remove the four bolts (Item 1) **[Figure 20-50-20]** from the gear pump.

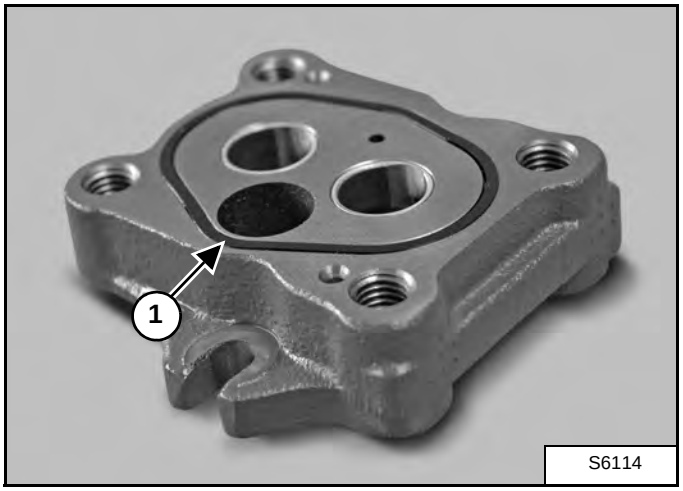
NOTE: The seals for the gear pump are the only serviceable parts in the gear pump.

Figure 20-50-21



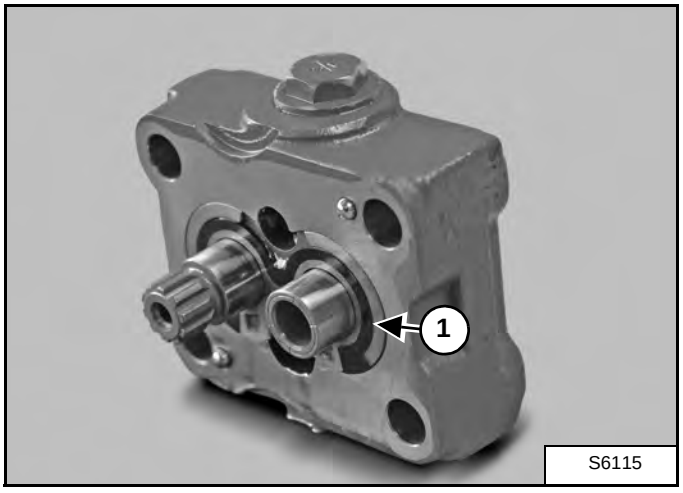
Separate the two halves of the gear pump **[Figure 20-50-21]**.

Figure 20-50-22



Remove the seal (Item 1) **[Figure 20-50-22]**.

Figure 20-50-23



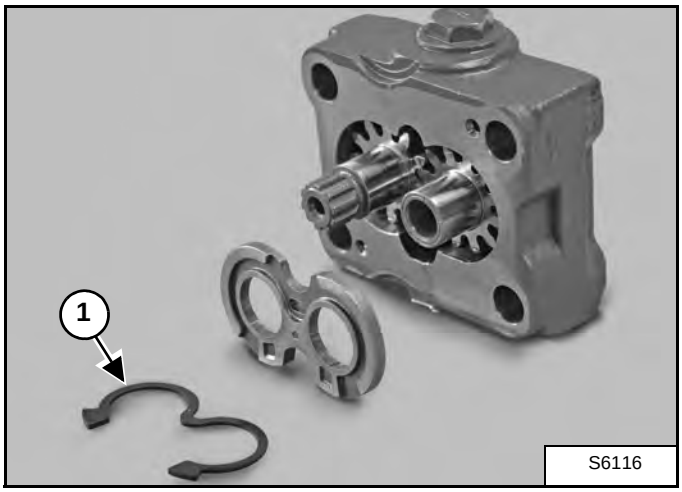
Remove the bearing (Item 1) **[Figure 20-50-23]**.

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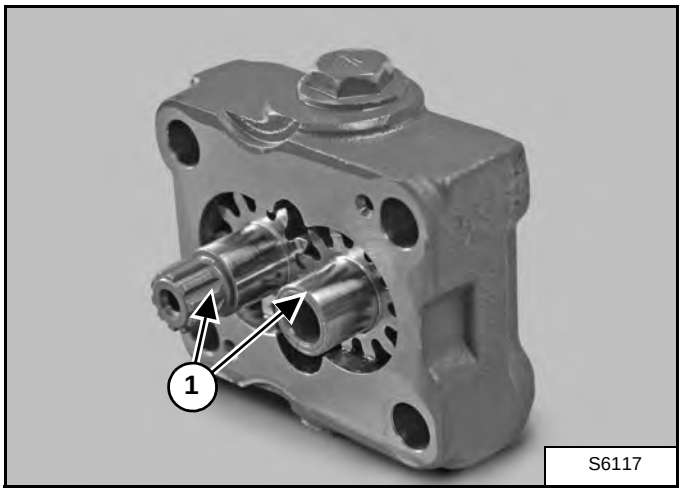
Gear Pump Disassembly (Cont'd)

Figure 20-50-24



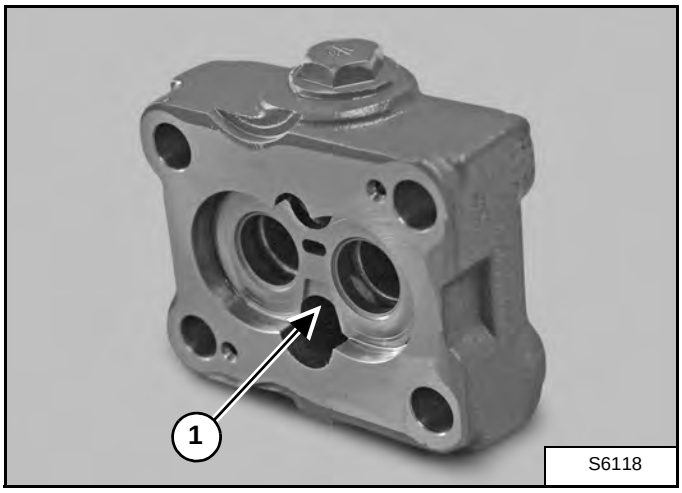
Remove the seal (Item 1) **[Figure 20-50-24]**.

Figure 20-50-25



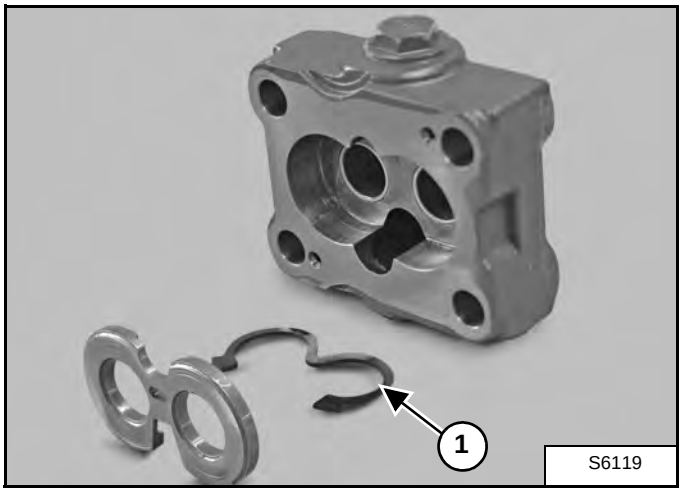
Remove the drive and idler gears (Item 1) **[Figure 20-50-25]**.

Figure 20-50-26



Remove the bearing (Item 1) **[Figure 20-50-26]**.

Figure 20-50-27



Remove the seal (Item 1) **[Figure 20-50-27]**.

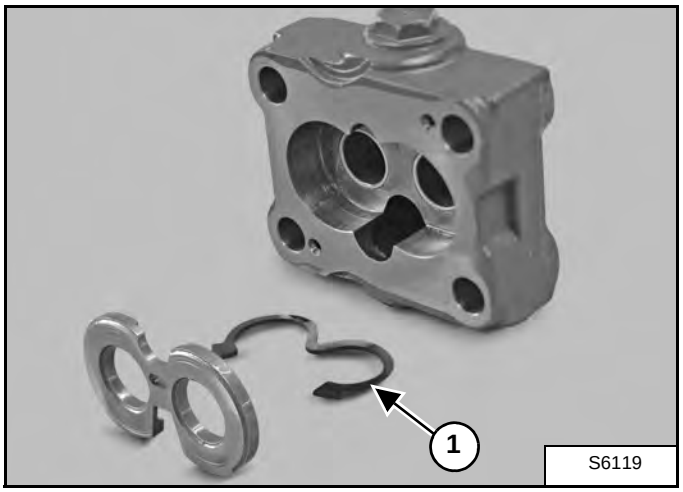
NOTE: The gear housing, two bearings, drive and idler gears are not serviced separately. If any part is damaged, the entire gear pump must be replaced.

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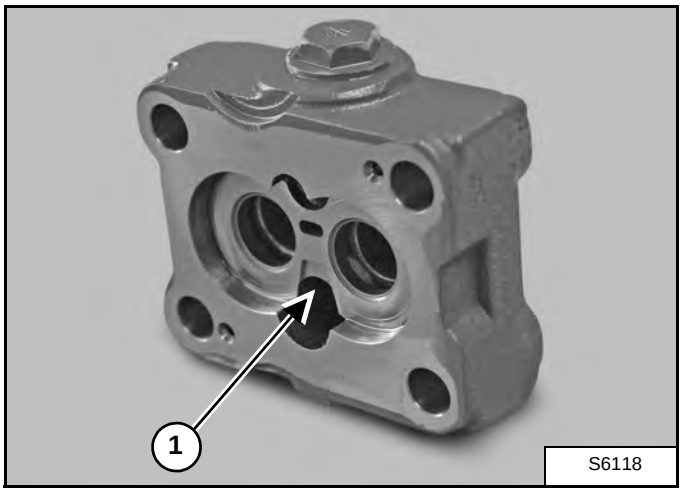
Gear Pump Assembly

Figure 20-50-28



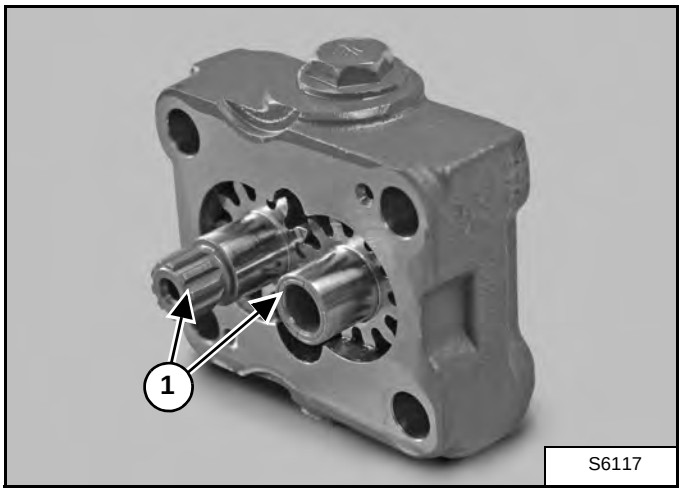
Install the seal (Item 1) **[Figure 20-50-28]** on the bearing.

Figure 20-50-29



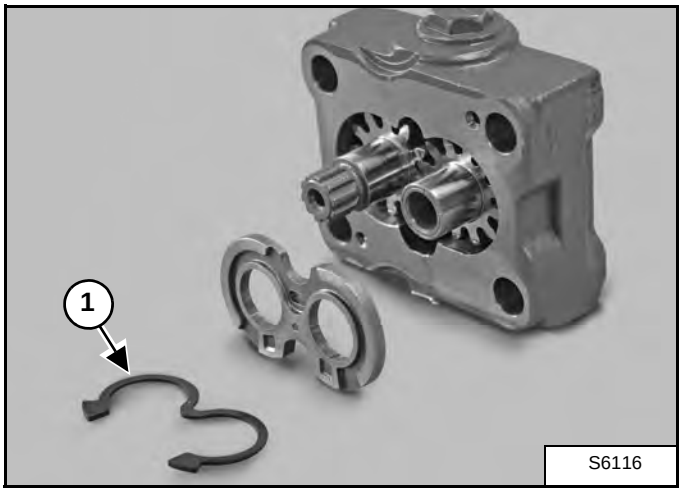
Install the bearing (Item 1) **[Figure 20-50-29]**.

Figure 20-50-30



Install the drive and idler gears (Item 1) **[Figure 20-50-30]**.

Figure 20-50-31



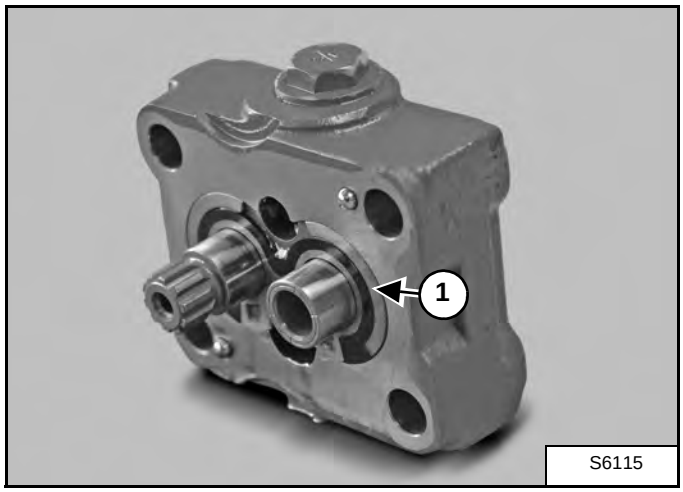
Install the seal (Item 1) **[Figure 20-50-31]** on the bearing.

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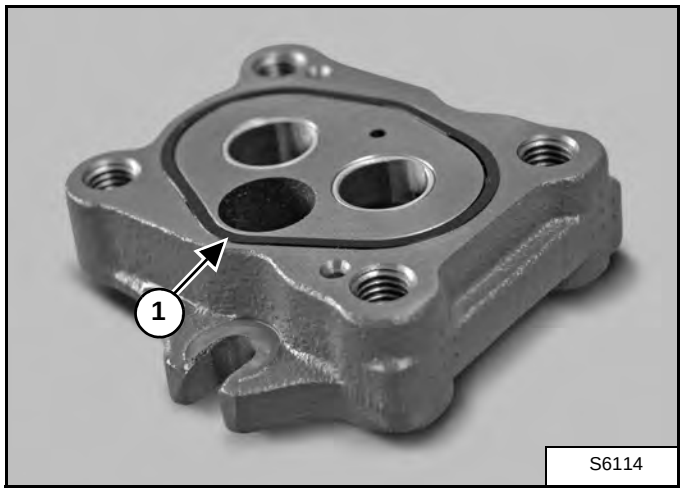
Gear Pump Assembly (Cont'd)

Figure 20-50-32



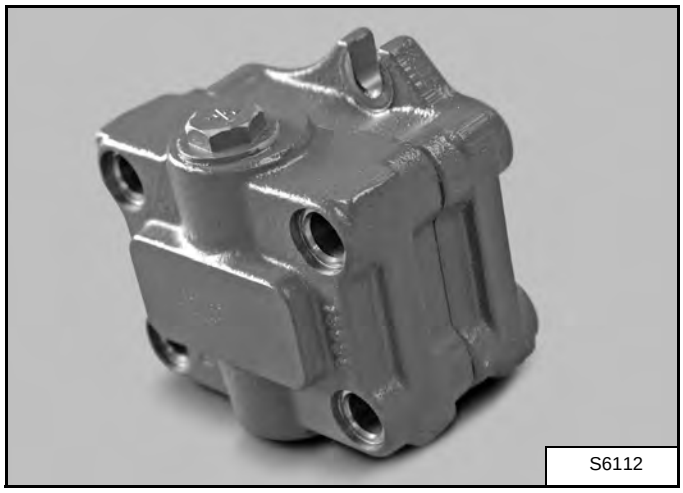
Install the bearing (Item 1) **[Figure 20-50-32]**.

Figure 20-50-33



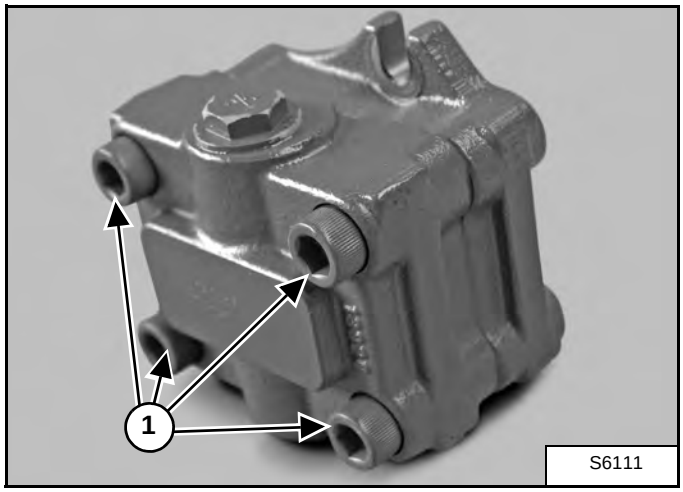
Install the seal (Item 1) **[Figure 20-50-33]**.

Figure 20-50-34



Assemble the two halves of the gear pump **[Figure 20-50-34]**.

Figure 20-50-35



Install the four bolts (Item 1) **[Figure 20-50-35]** in the gear pump.

Tighten the bolts to 88,3 - 93,1 N•m (65.1 - 68.7 ft-lb) torque.

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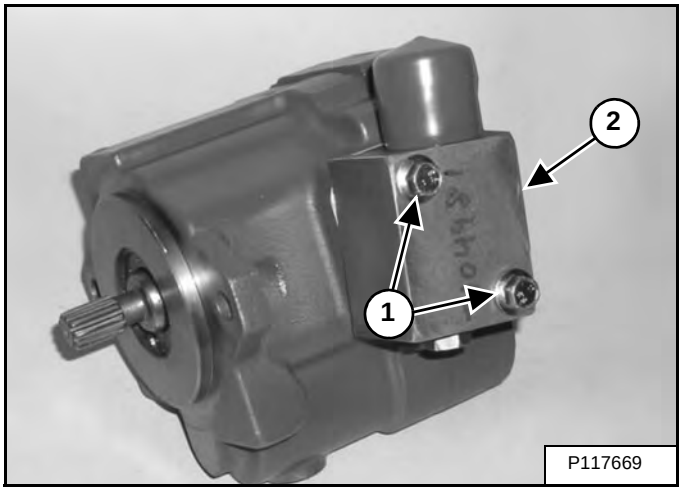
Piston Pump Disassembly

IMPORTANT

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

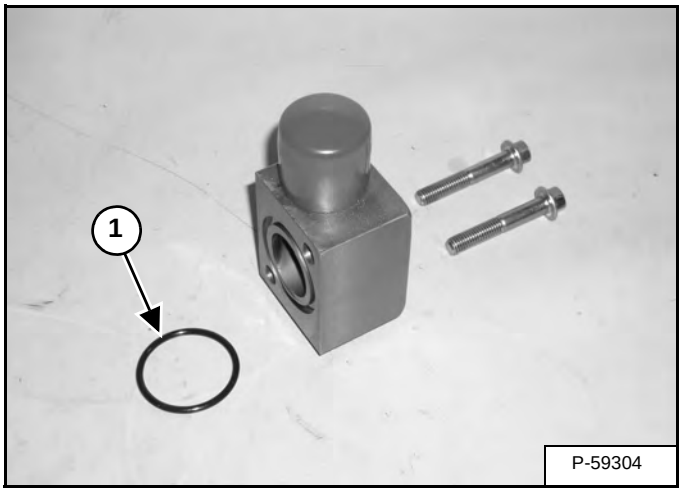
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Figure 20-50-36



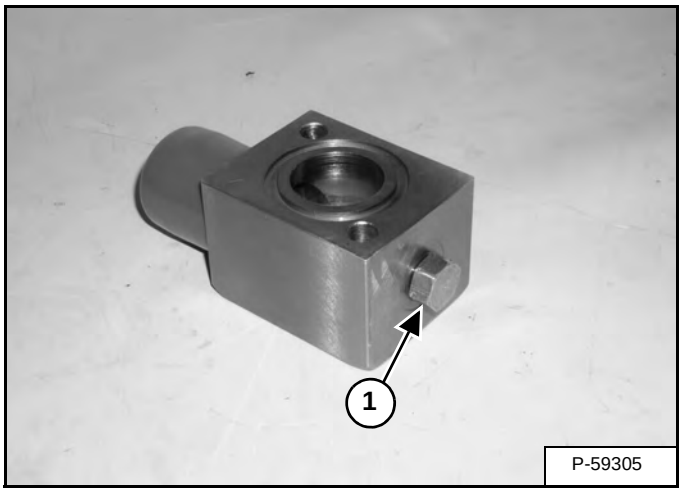
Remove the two bolts (Item 1) and inlet fitting (Item 2) **[Figure 20-50-36]**.

Figure 20-50-37



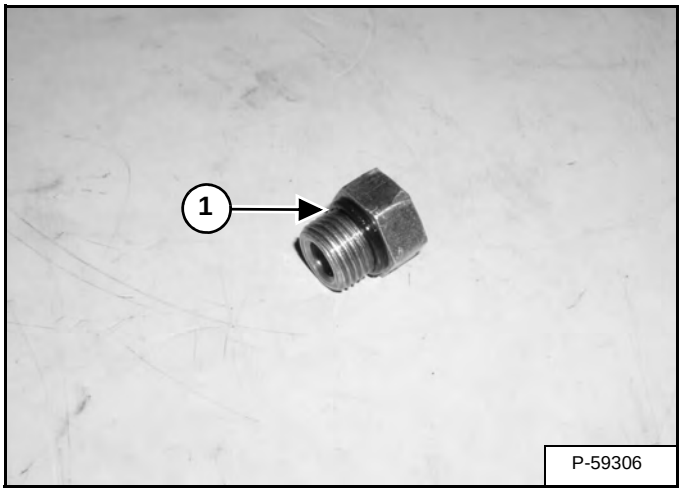
Remove the O-ring (Item 1) **[Figure 20-50-37]**.

Figure 20-50-38



Remove the plug (Item 1) **[Figure 20-50-38]** from the pump block.

Figure 20-50-39



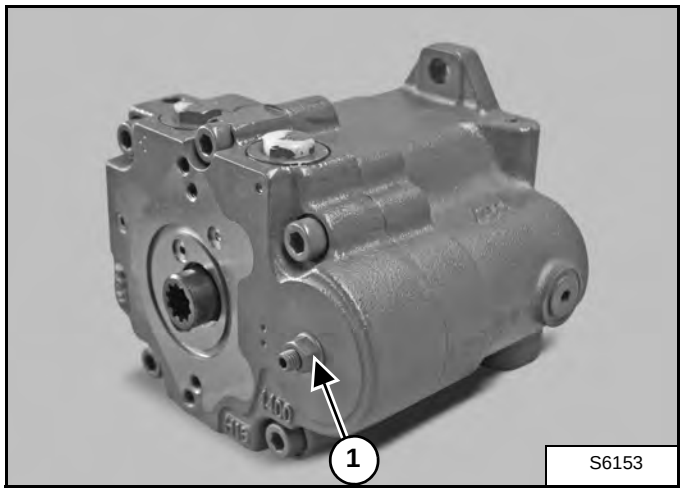
Remove the O-ring (Item 1) **[Figure 20-50-39]** from the plug.

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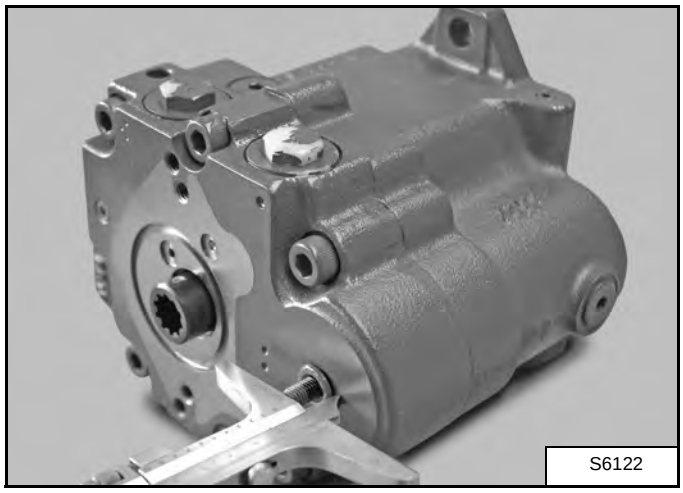
Piston Pump Disassembly (Cont'd)

Figure 20-50-40



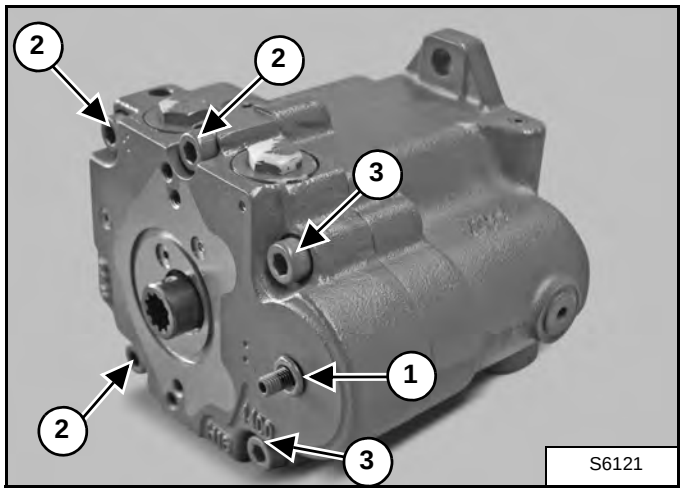
Remove the pressure adjustment nut (Item 1) **[Figure 20-50-40]** from the pump housing.

Figure 20-50-41



Measure the outside length of the pressure adjustment screw **[Figure 20-50-41]** for aid in adjustment after re-assembly.

Figure 20-50-42

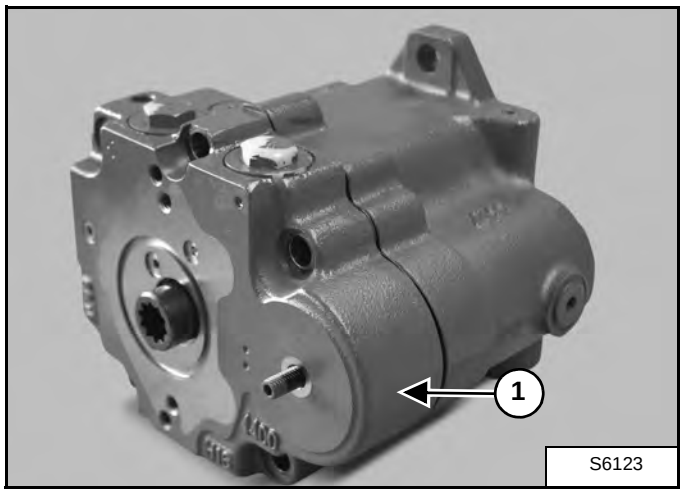


Remove the seal washer (Item 1) **[Figure 20-50-42]** from the pump housing.

Remove the three bolts (Item 2) **[Figure 20-50-42]** from the pump housing.

Remove the two bolts (Item 3) **[Figure 20-50-42]** from either side of the pressure adjusting spring in the pump housing.

Figure 20-50-43



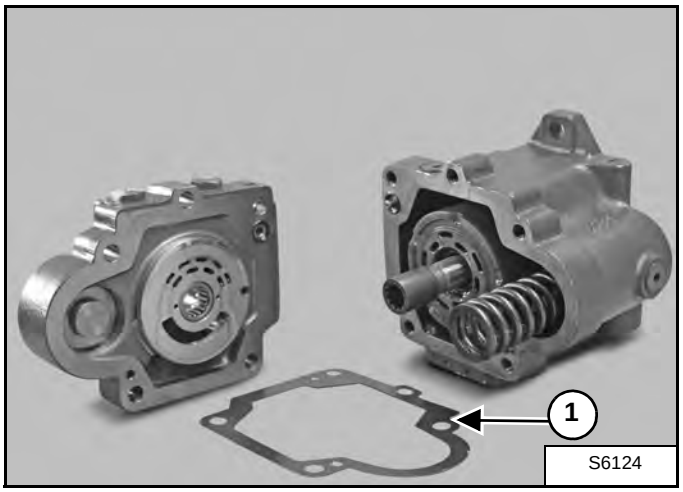
Remove the face plate (Item 1) **[Figure 20-50-43]**.

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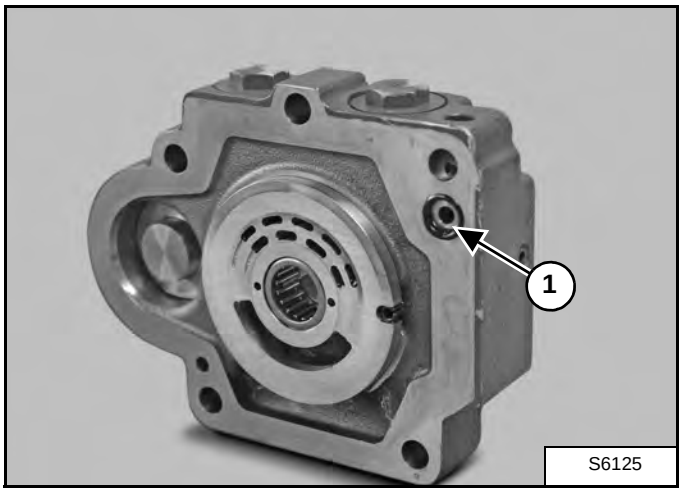
Piston Pump Disassembly (Cont'd)

Figure 20-50-44



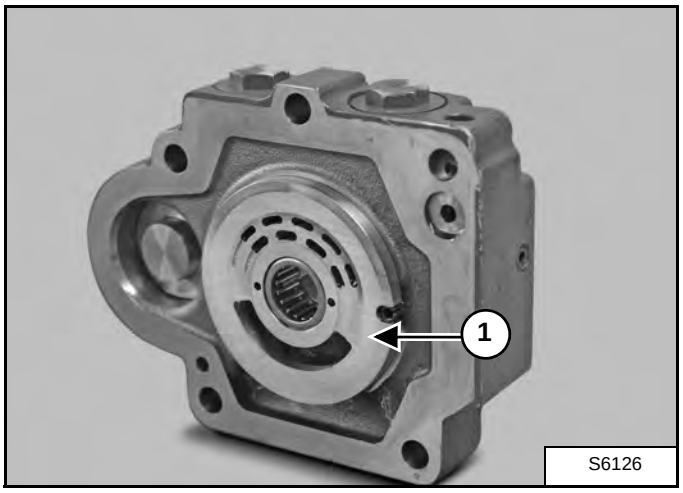
Remove the gasket (Item 1) **[Figure 20-50-44]**.

Figure 20-50-45



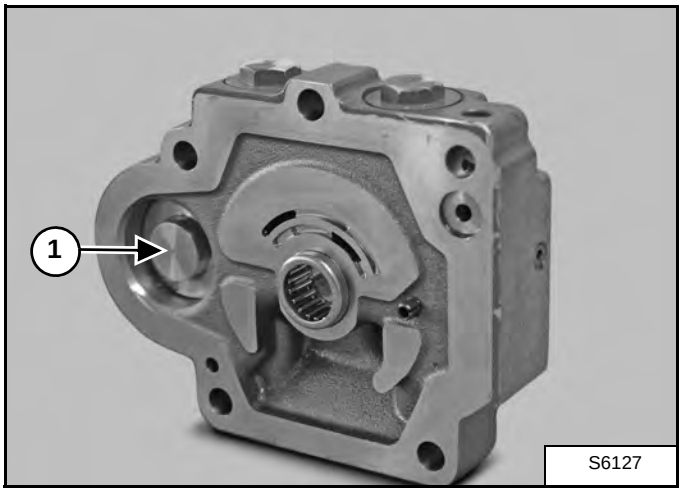
Remove the O-ring (Item 1) **[Figure 20-50-45]**.

Figure 20-50-46



Remove the port plate (Item 1) **[Figure 20-50-46]**.

Figure 20-50-47



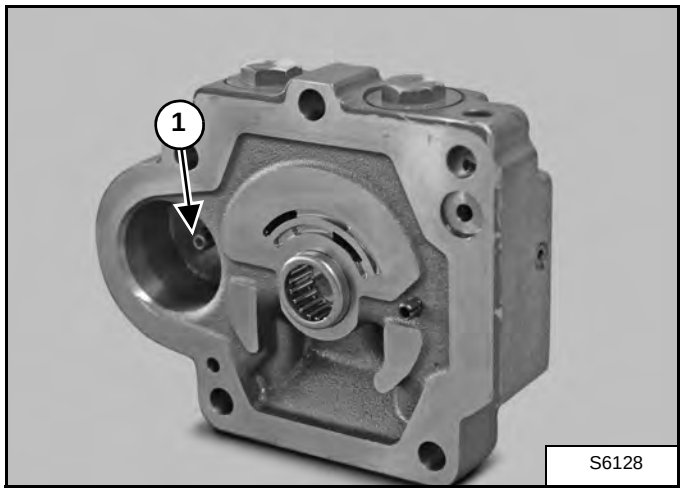
Remove the spring guide (Item 1) **[Figure 20-50-47]**.

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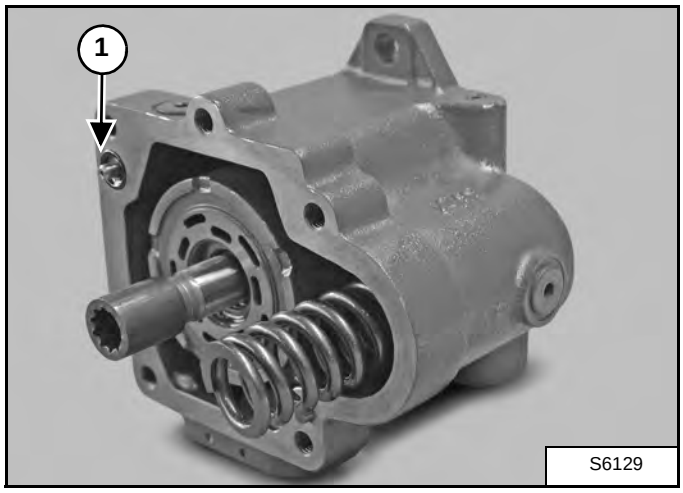
Piston Pump Disassembly (Cont'd)

Figure 20-50-48



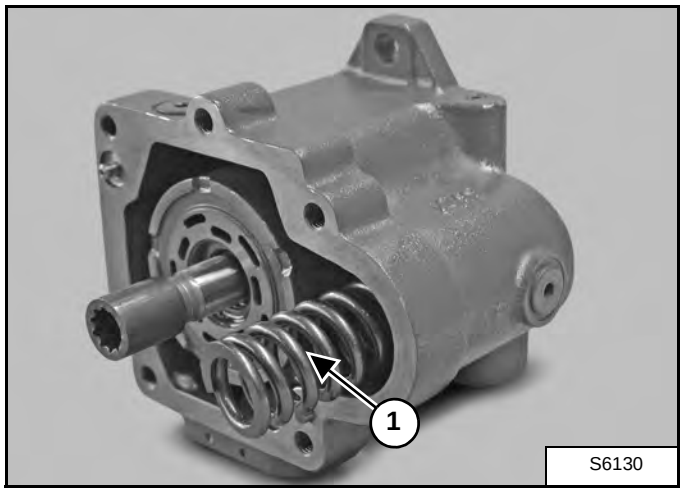
Remove the screw (Item 1) **[Figure 20-50-48]**.

Figure 20-50-49



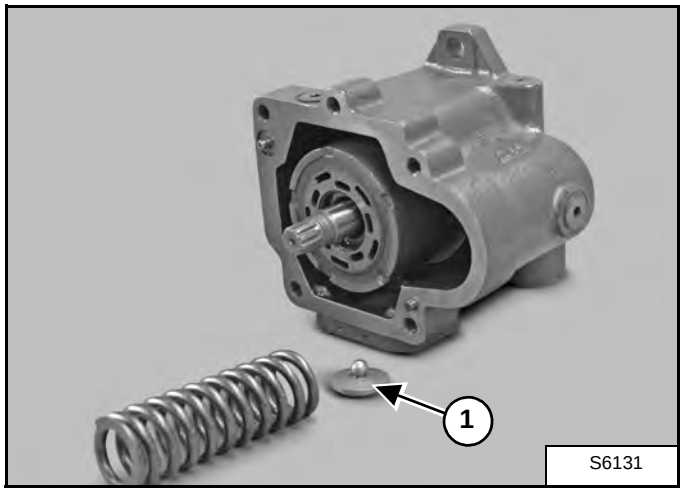
Remove the O-ring (Item 1) **[Figure 20-50-49]**.

Figure 20-50-50



Remove the spring (Item 1) **[Figure 20-50-50]**.

Figure 20-50-51



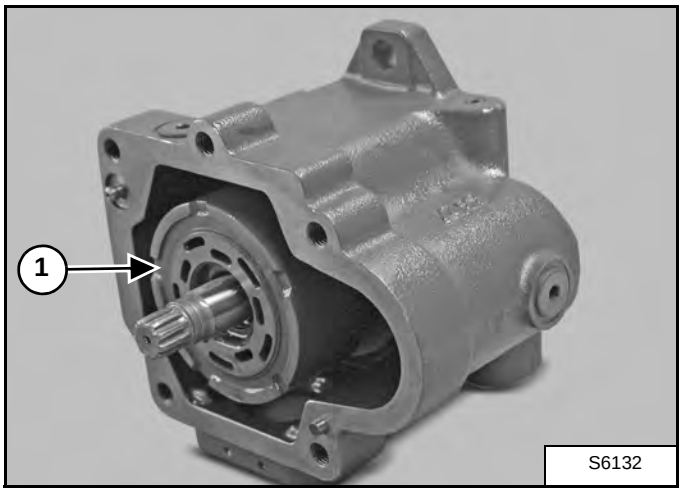
Remove the spring seat (Item 1) **[Figure 20-50-51]**.

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Piston Pump Disassembly (Cont'd)

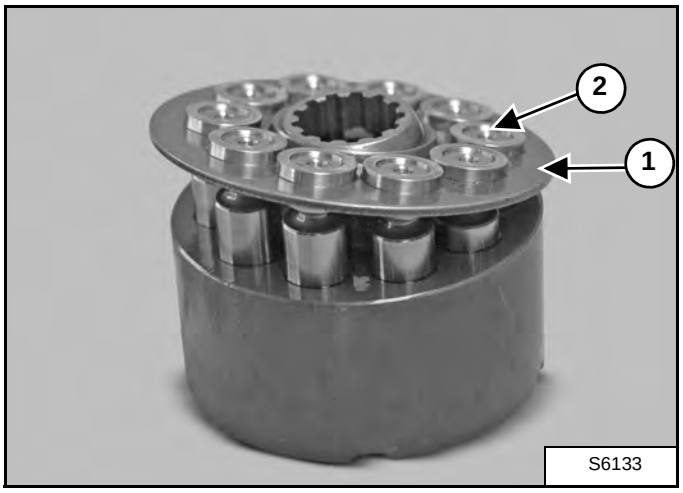
Figure 20-50-52



Remove the cylinder block assembly (Item 1) **[Figure 20-50-52]**.

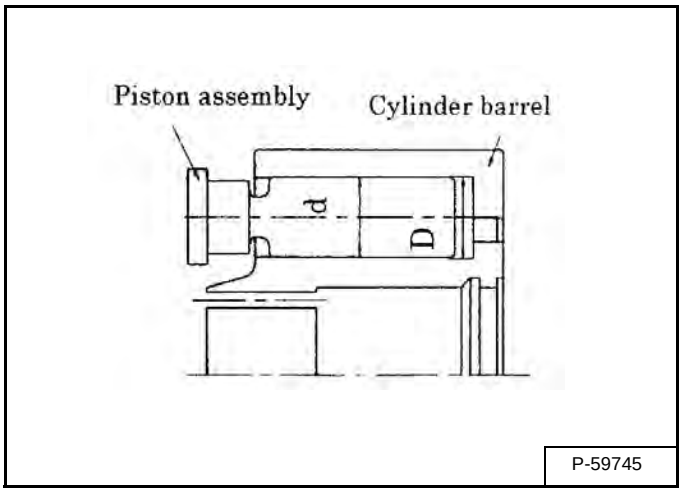
NOTE: The following procedure shown is to disassemble the rotating group for inspection only. The rotating group parts cannot be ordered separately and must be ordered as an assembly.

Figure 20-50-53



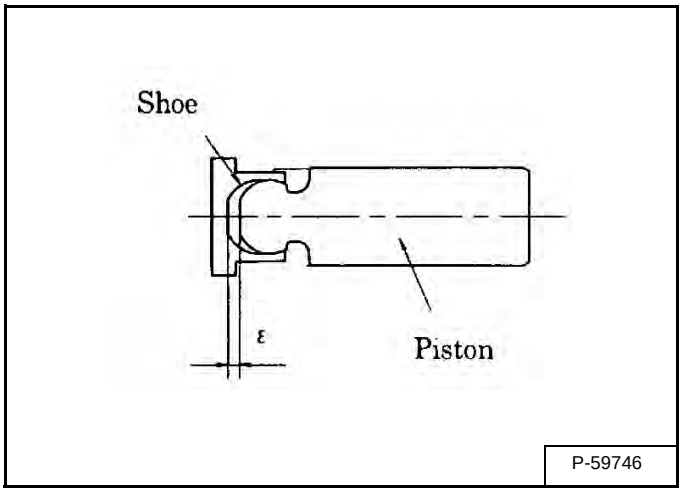
Remove the retainer plate (Item 1) and pistons (Item 2) **[Figure 20-50-53]** from the cylinder block.

Figure 20-50-54



Inspect the difference between the inner diameter of cylinder block (D) and the outer diameter of piston (d) **[Figure 20-50-54]**. The difference should be less than 0,05 mm (0.002 in).

Figure 20-50-55



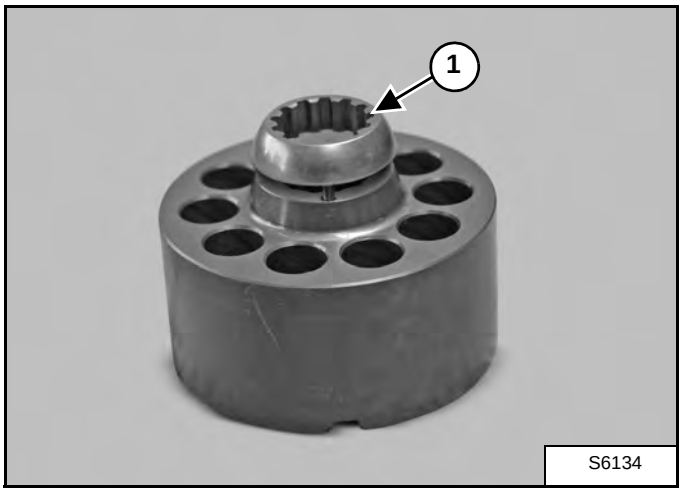
The clearance between the piston and shoe **[Figure 20-50-55]** should be less than 0,2 mm (0.008 in).

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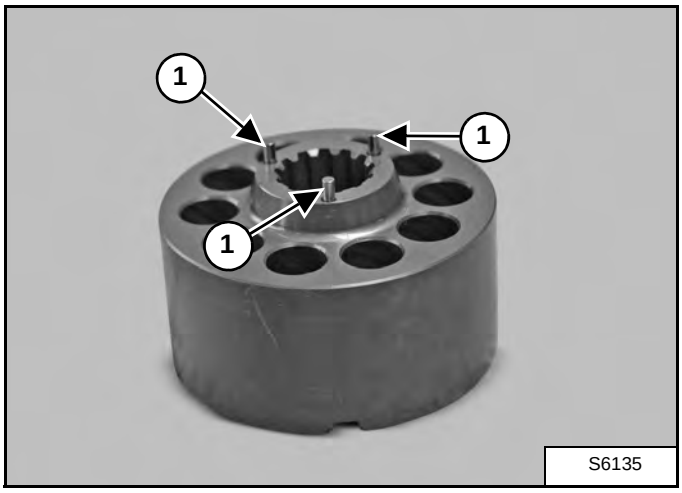
Piston Pump Disassembly (Cont'd)

Figure 20-50-56



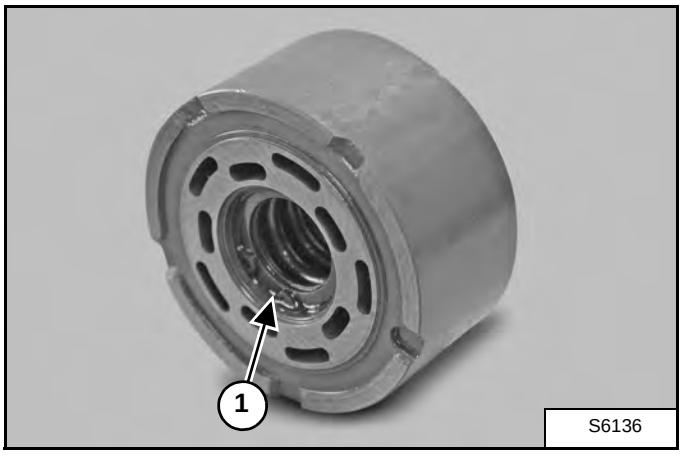
Remove the retainer (Item 1) **[Figure 20-50-56]**.

Figure 20-50-57



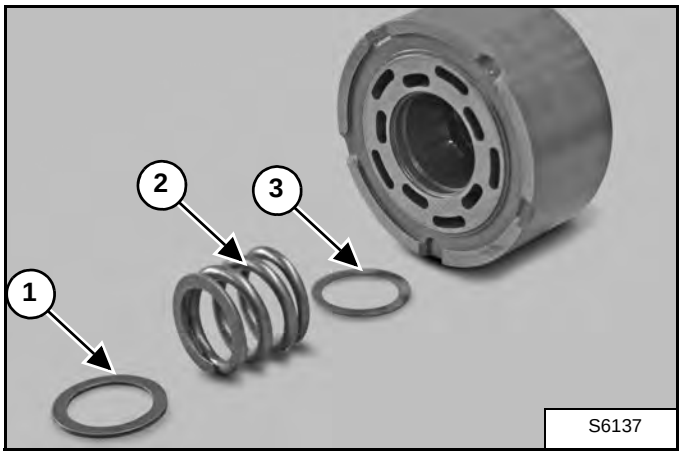
Remove the three pins (Item 1) **[Figure 20-50-57]**.

Figure 20-50-58



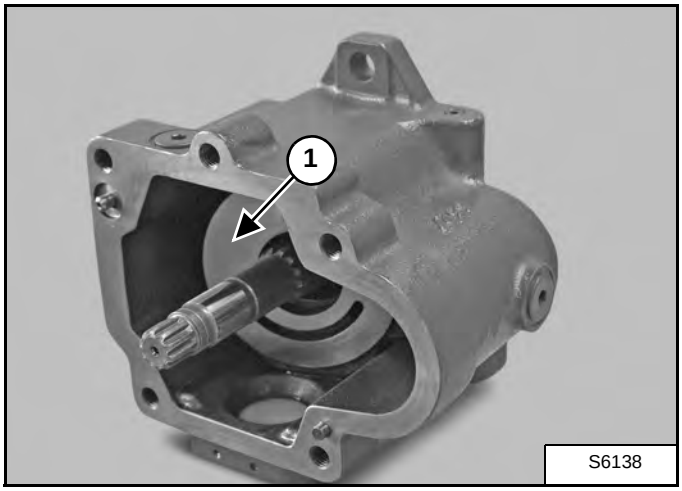
Remove the snap ring (Item 1) **[Figure 20-50-58]** in the cylinder block.

Figure 20-50-59



Remove the retainer (Item 1), spring (Item 2) and retainer (Item 3) **[Figure 20-50-59]**.

Figure 20-50-60



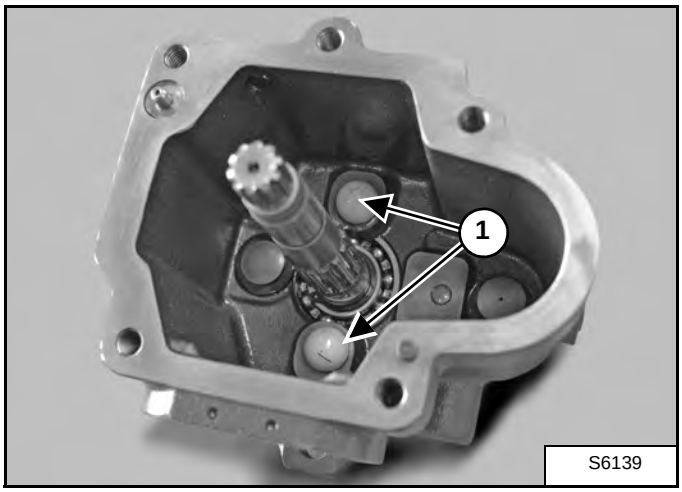
Remove the swash plate (Item 1) **[Figure 20-50-60]**.

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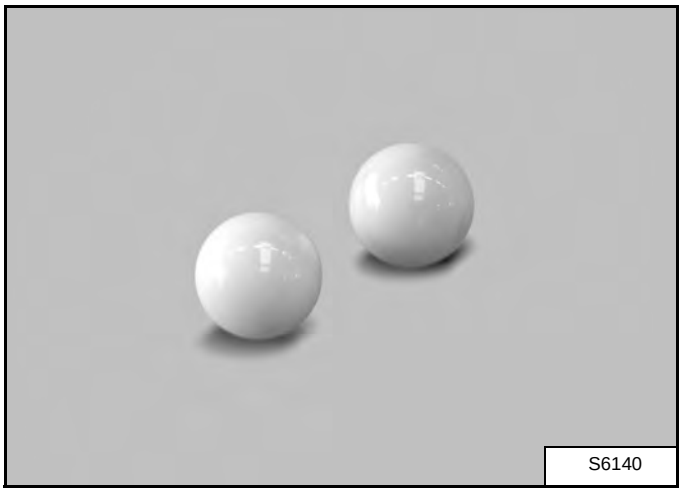
Piston Pump Disassembly (Cont'd)

Figure 20-50-61



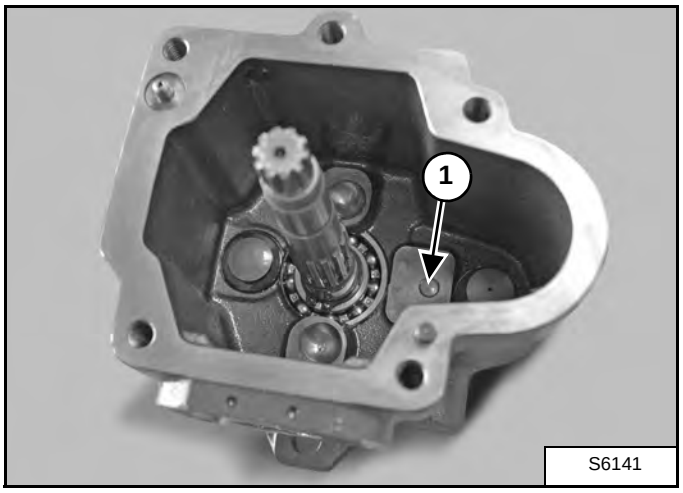
Remove the balls (Item 1) **[Figure 20-50-61]**.

Figure 20-50-62



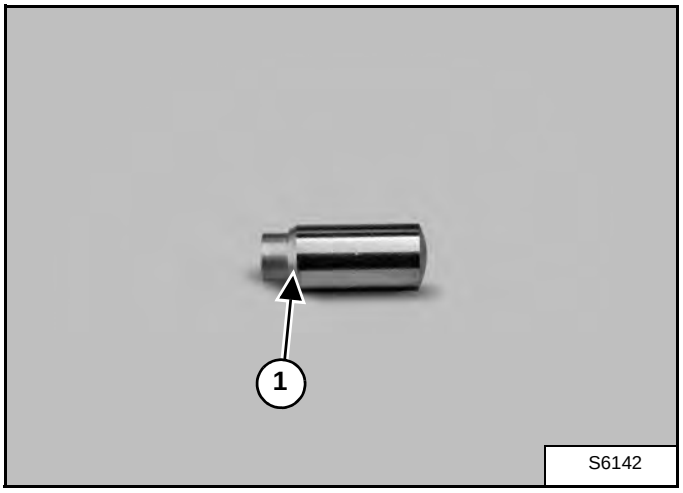
Visually inspect the balls for scratches, abnormal wear or damage **[Figure 20-50-62]**.

Figure 20-50-63



Remove the rod (Item 1) **[Figure 20-50-63]**.

Figure 20-50-64



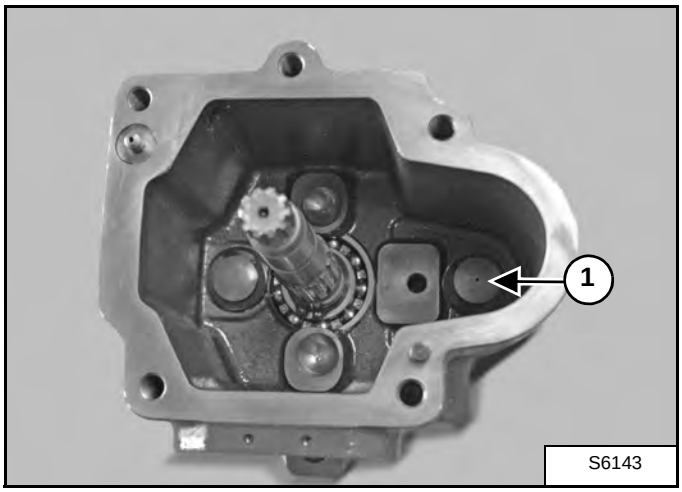
The step in the rod (Item 1) **[Figure 20-50-64]** must be inserted into the pump housing first.

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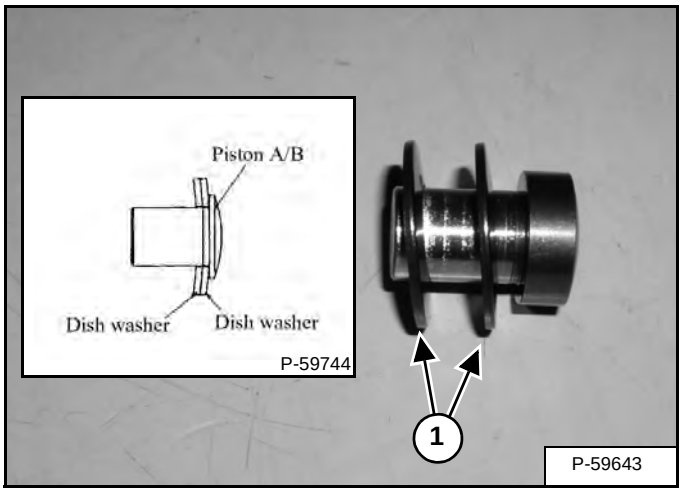
Piston Pump Disassembly (Cont'd)

Figure 20-50-65



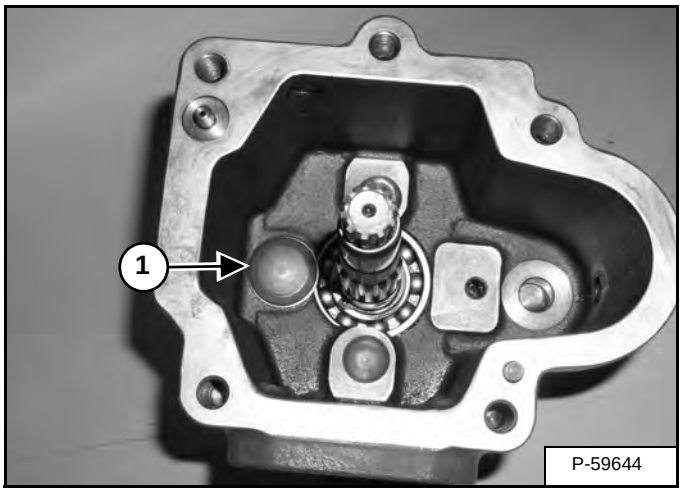
Remove the piston A (Item 1) **[Figure 20-50-65]**.

Figure 20-50-66



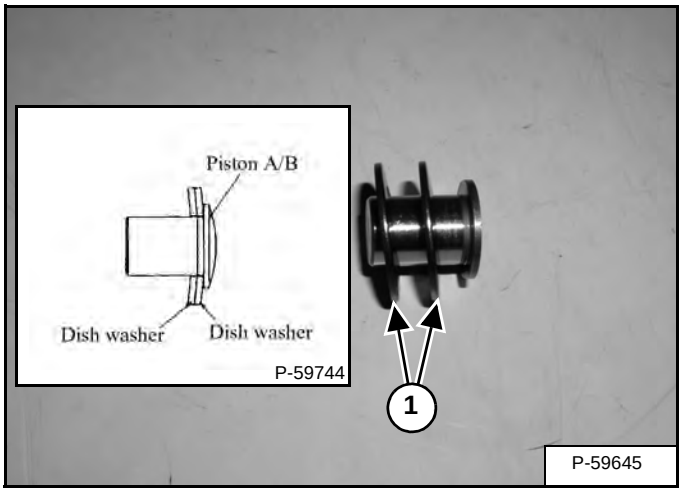
Remove the two dish washers (Item 1) **[Figure 20-50-66]**.

Figure 20-50-67



Remove the piston B (Item 1) **[Figure 20-50-67]**.

Figure 20-50-68



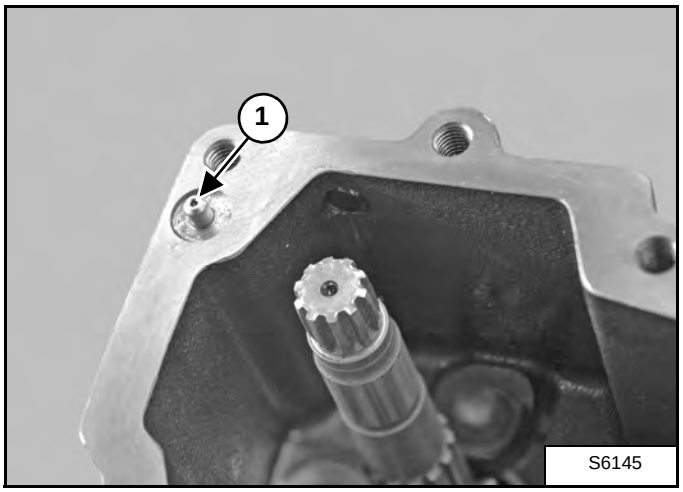
Remove the two dish washers (Item 1) **[Figure 20-50-68]**.

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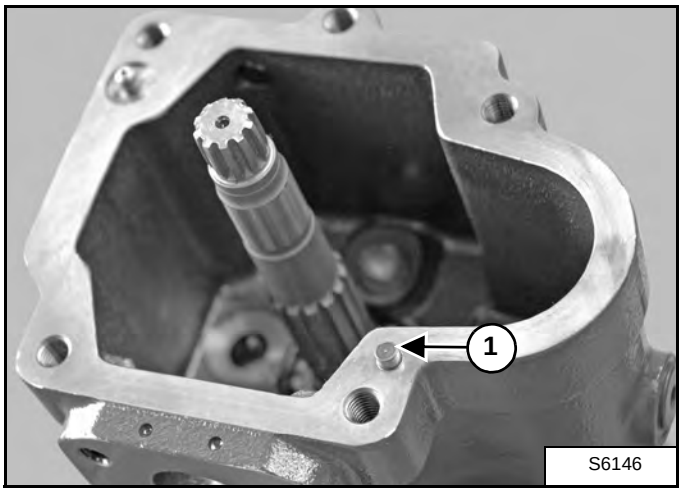
Piston Pump Disassembly (Cont'd)

Figure 20-50-69



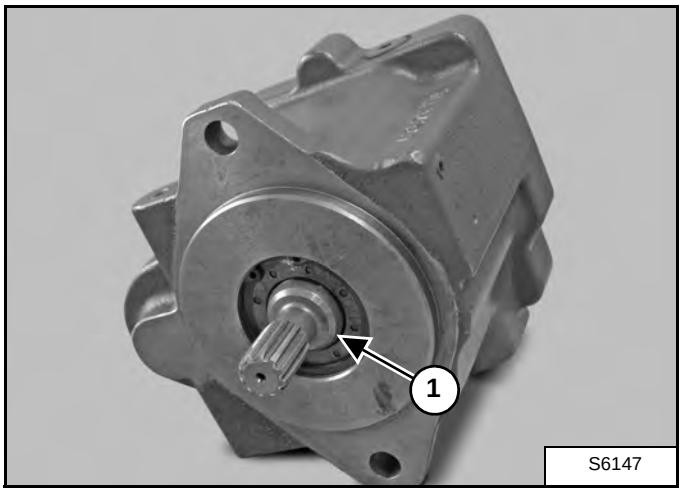
Remove the pin (Item 1) **[Figure 20-50-69]**.

Figure 20-50-70



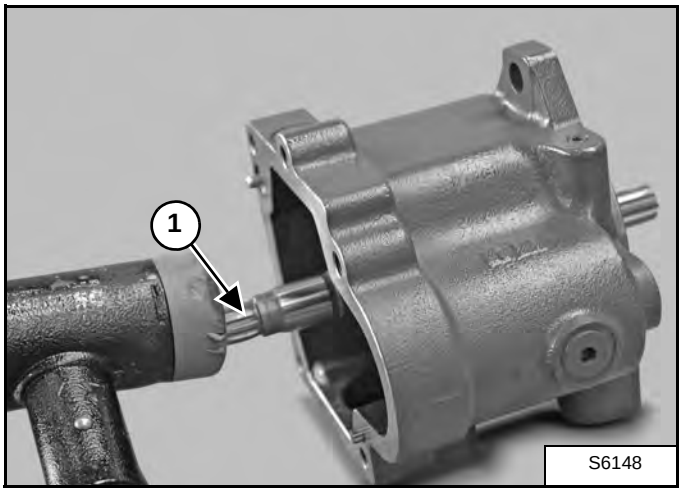
Remove the pin (Item 1) **[Figure 20-50-70]**.

Figure 20-50-71



Remove the snap ring (Item 1) **[Figure 20-50-71]**.

Figure 20-50-72



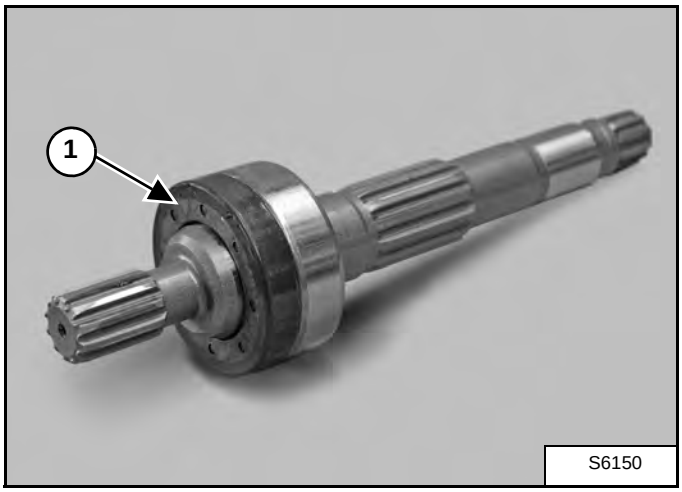
Remove the shaft and bearing assembly (Item 1) **[Figure 20-50-72]** from the pump housing by tapping the other end of the shaft.

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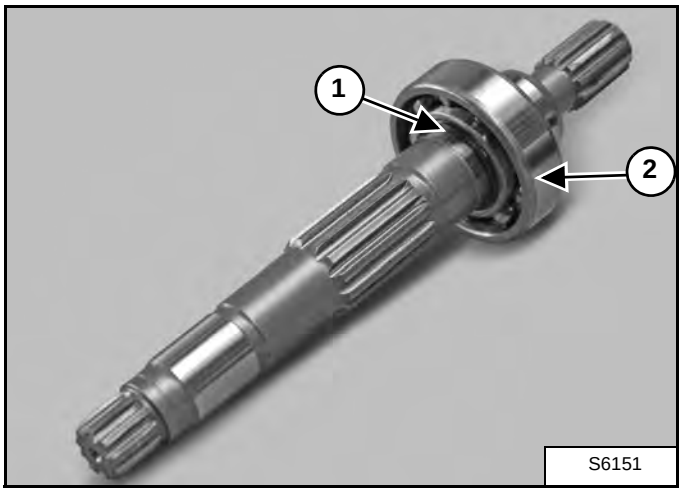
Piston Pump Disassembly (Cont'd)

Figure 20-50-73



Remove the oil seal (Item 1) **[Figure 20-50-73]** from the shaft.

Figure 20-50-74



Remove the snap ring (Item 1) **[Figure 20-50-74]** from the shaft.

Remove the bearing (Item 2) **[Figure 20-50-74]** from the shaft.

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Piston Pump Assembly

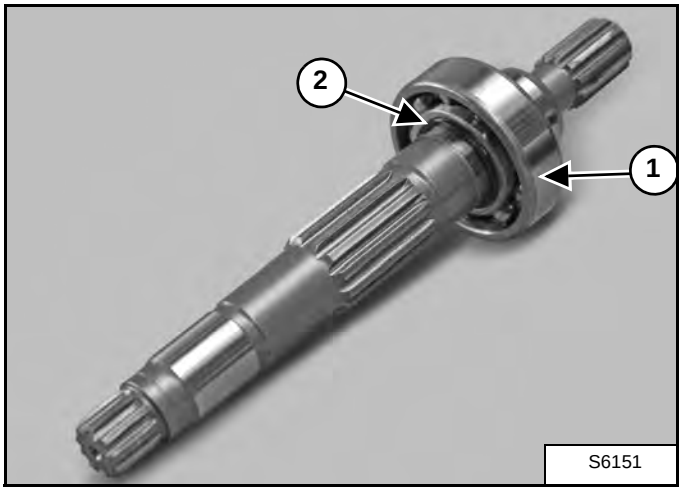
Clean all parts in solvent and dry with compressed air. Do not use compressed air to dry the bearings.

Inspect all parts for wear and damage. Replace all worn and damaged parts.

Always install new seals and O-rings.

Apply a thin coat of hydraulic fluid to all components before assembly.

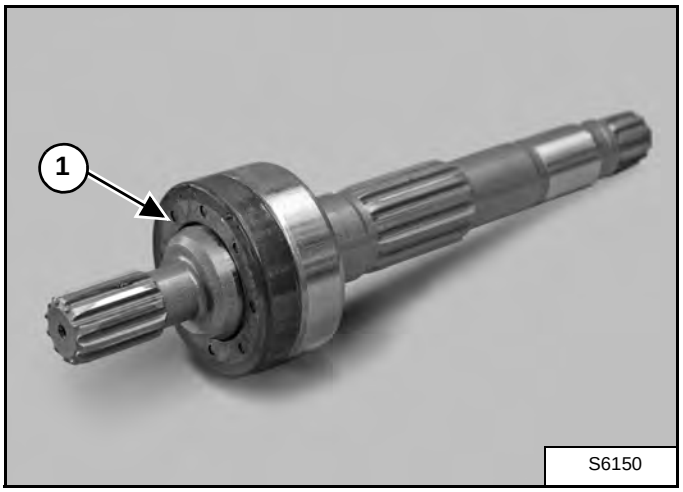
Figure 20-50-75



Install the bearing (Item 1) **[Figure 20-50-75]** on the shaft.

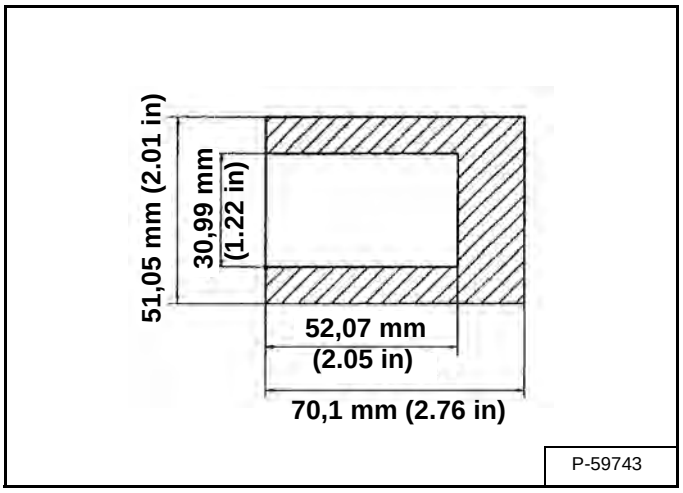
Install the snap ring (Item 2) **[Figure 20-50-75]** on the shaft.

Figure 20-50-76



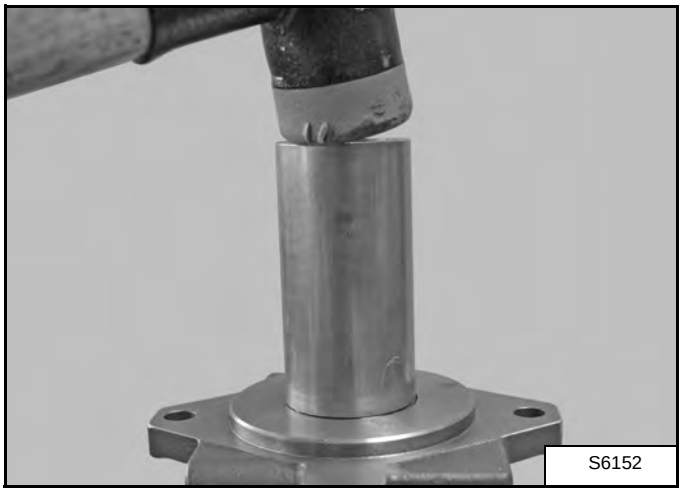
Install the oil seal (Item 1) **[Figure 20-50-76]** on the shaft.

Figure 20-50-77



Manufacture the special tool **[Figure 20-50-77]** needed to install the oil seal into the pump housing.

Figure 20-50-78



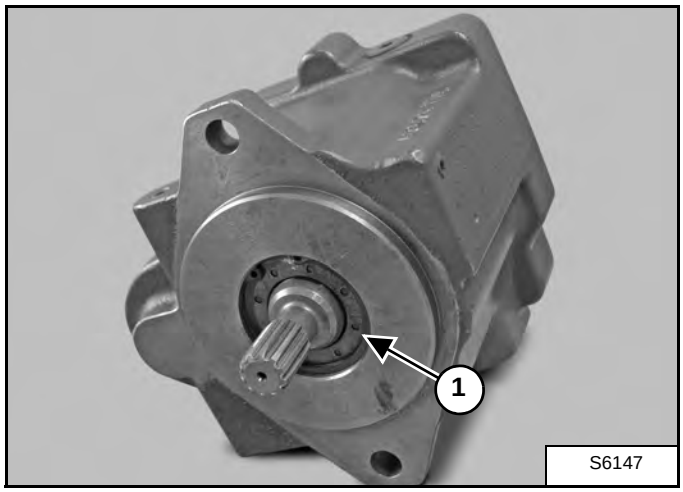
Install the shaft, bearing, and oil seal assembly **[Figure 20-50-78]** into the pump housing by using the special tool.

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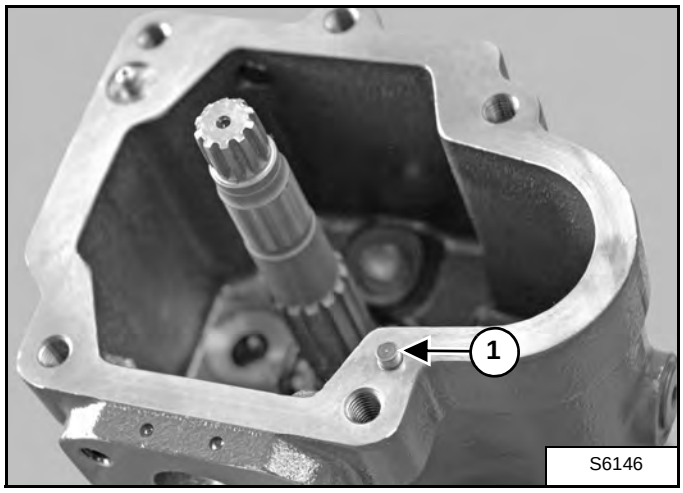
Piston Pump Assembly (Cont'd)

Figure 20-50-79



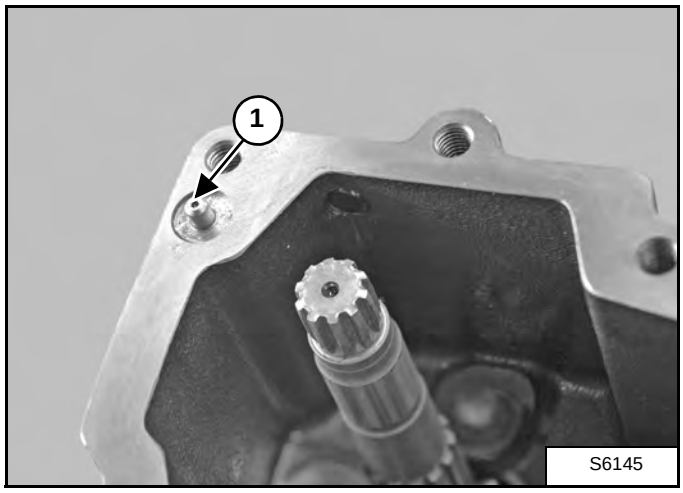
Install the snap ring (Item 1) **[Figure 20-50-79]**.

Figure 20-50-80



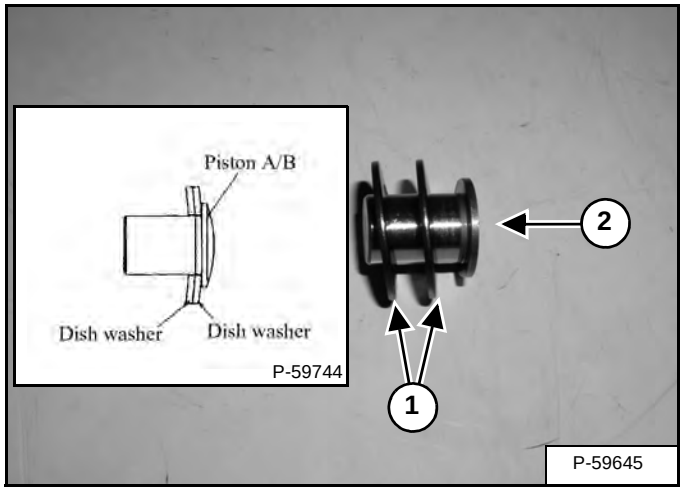
Install the pin (Item 1) **[Figure 20-50-80]**.

Figure 20-50-81



Install the pin (Item 1) **[Figure 20-50-81]**.

Figure 20-50-82



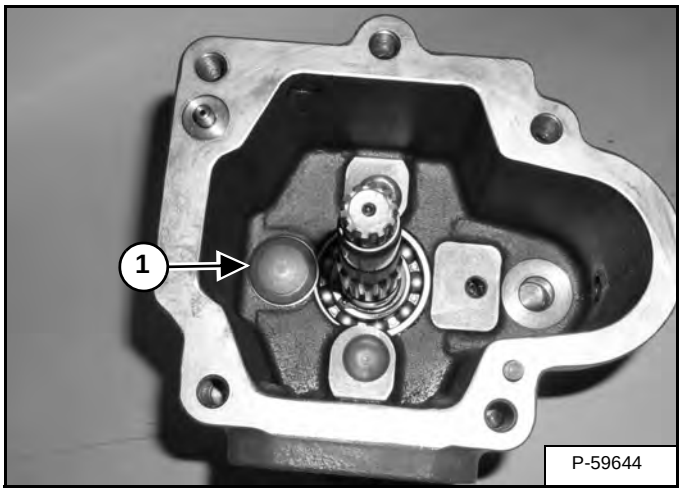
Install the two dish washers (Item 1) on the piston B (Item 2) **[Figure 20-50-82]**.

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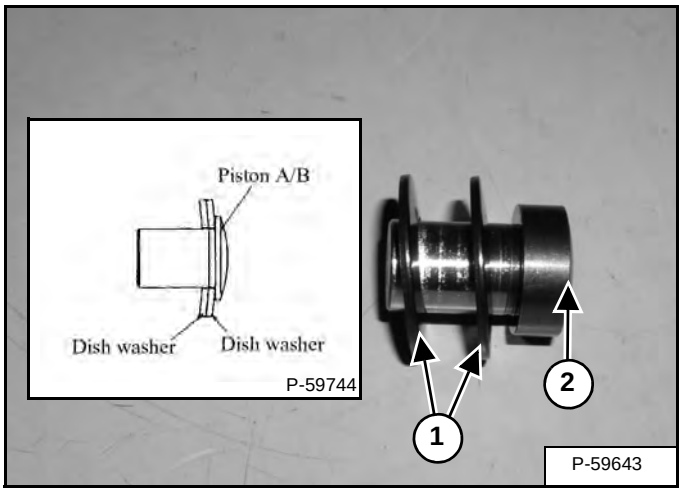
Piston Pump Assembly (Cont'd)

Figure 20-50-83



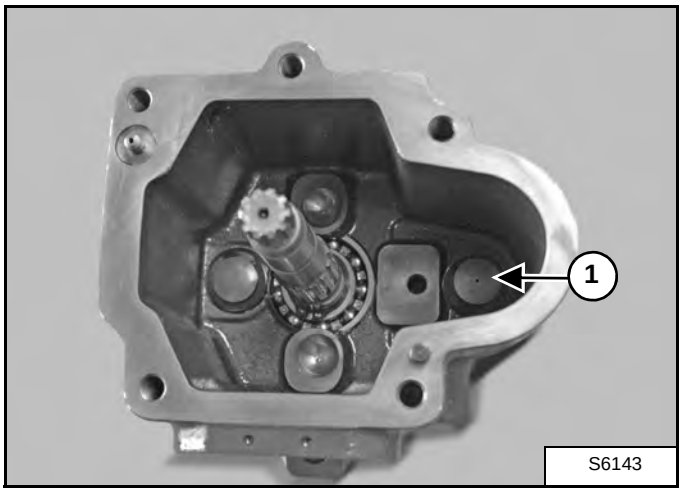
Install piston B and washers (Item 1) **[Figure 20-50-83]**.

Figure 20-50-84



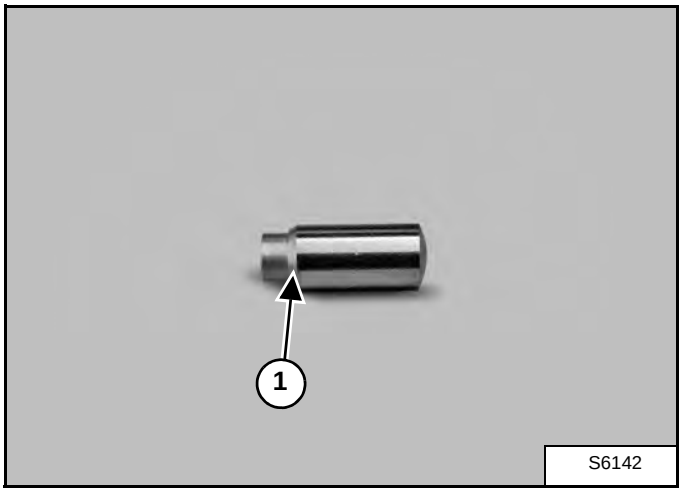
Install the two dish washers (Item 1) on the piston A (Item 2) **[Figure 20-50-84]**.

Figure 20-50-85



Install piston A and washers (Item 1) **[Figure 20-50-85]**.

Figure 20-50-86



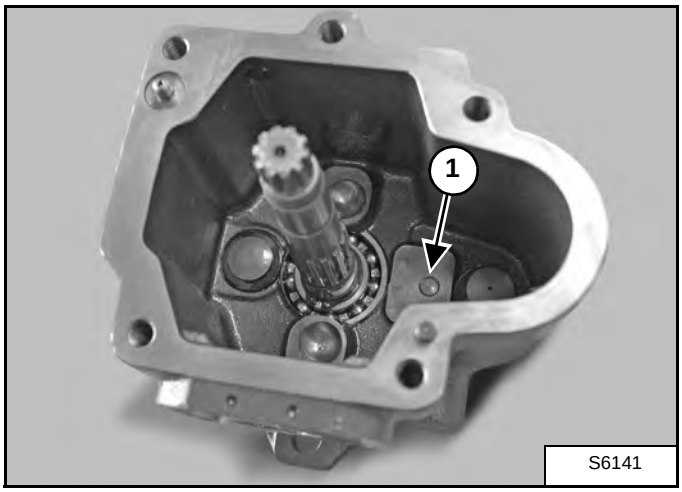
The step in the rod (Item 1) **[Figure 20-50-86]** must be installed into the pump housing first.

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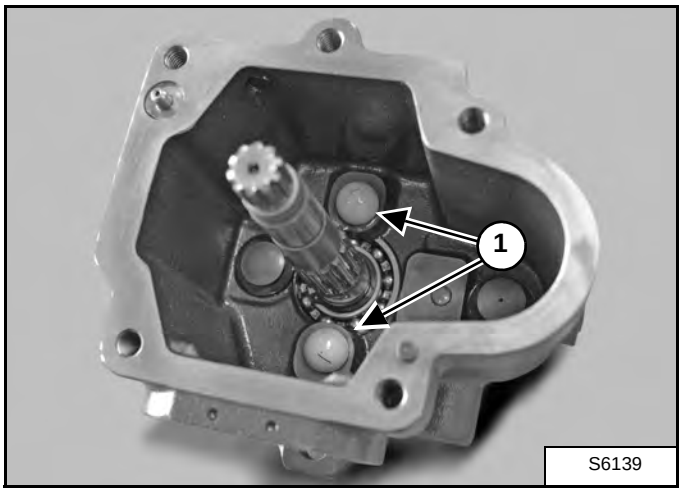
Piston Pump Assembly (Cont'd)

Figure 20-50-87



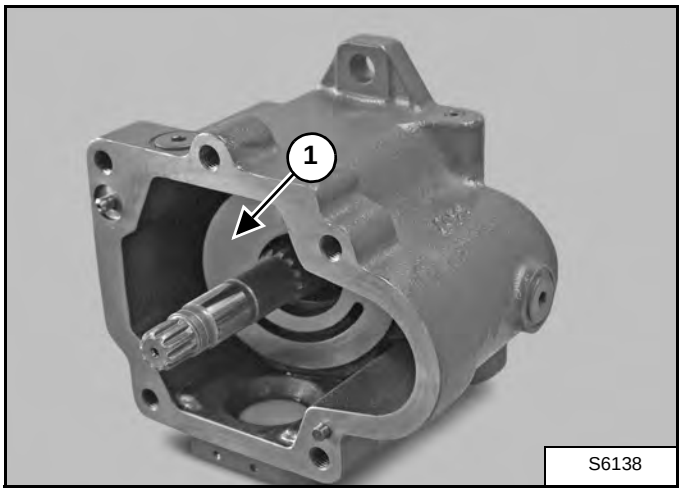
Install the rod (Item 1) **[Figure 20-50-87]**.

Figure 20-50-88



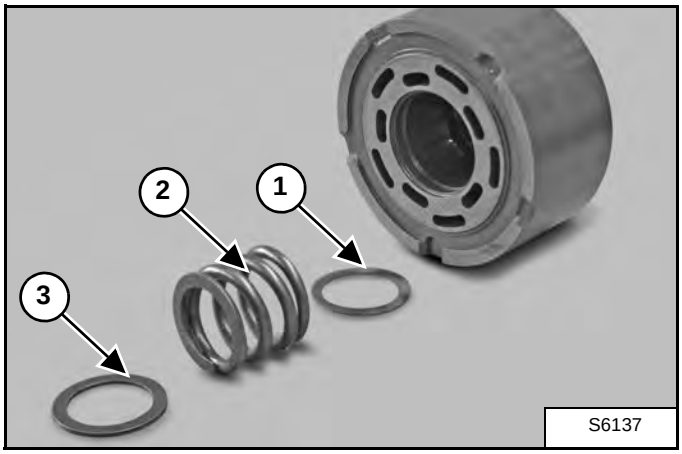
Install the balls (Item 1) **[Figure 20-50-88]**.

Figure 20-50-89



Install the swash plate (Item 1) **[Figure 20-50-89]**.

Figure 20-50-90



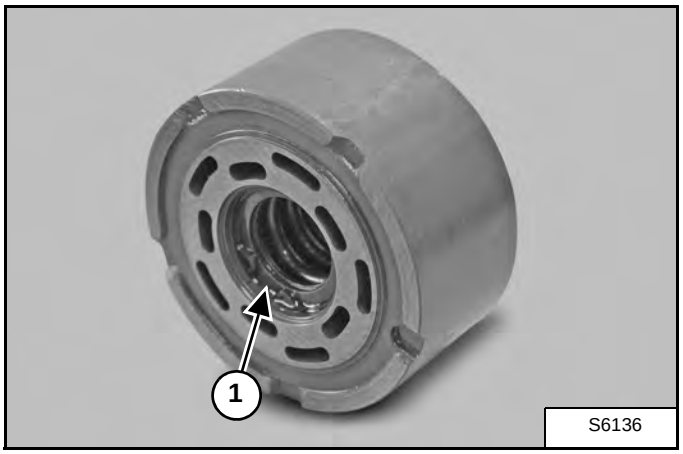
Install the retainer (Item 1), spring (Item 2) and retainer (Item 3) **[Figure 20-50-90]**.

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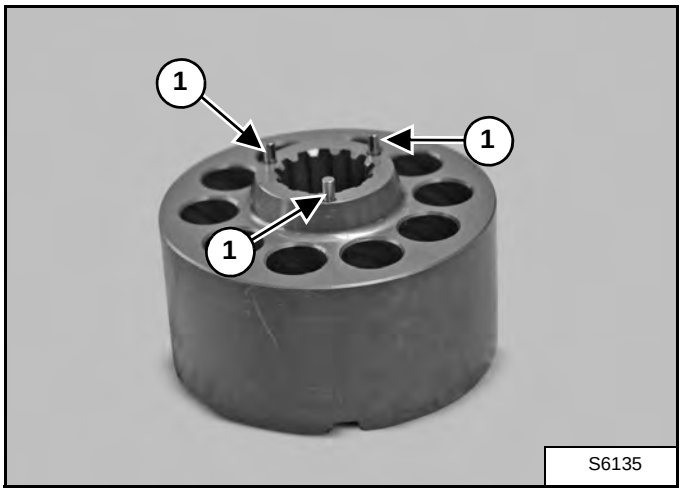
Piston Pump Assembly (Cont'd)

Figure 20-50-91



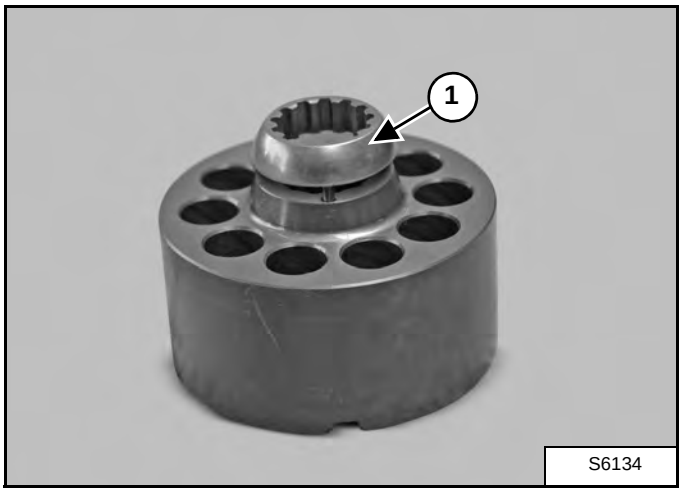
Install the snap ring (Item 1) **[Figure 20-50-91]** in the cylinder block.

Figure 20-50-92



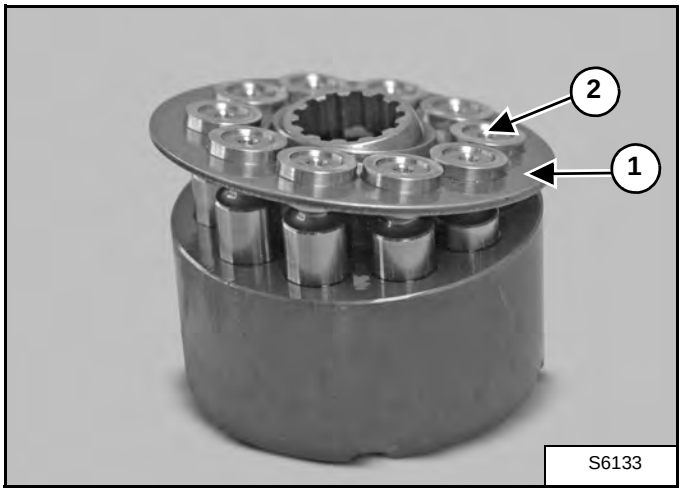
Install the three pins (Item 1) **[Figure 20-50-92]**.

Figure 20-50-93



Install the retainer (Item 1) **[Figure 20-50-93]**.

Figure 20-50-94



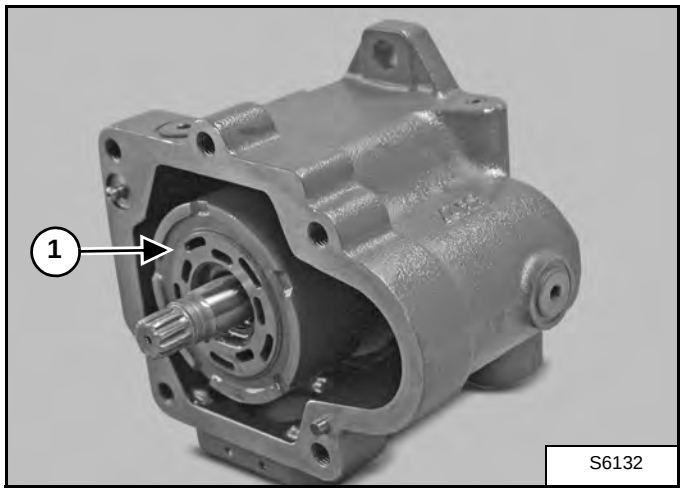
Install the retainer plate (Item 1) and piston assemblies (Item 2) **[Figure 20-50-94]** into the cylinder block.

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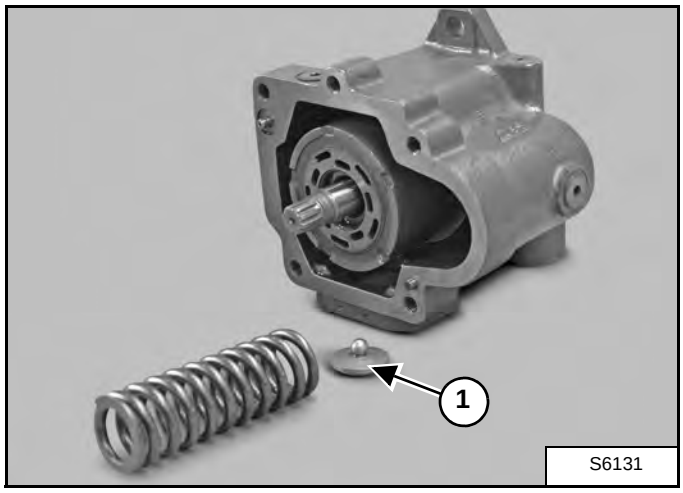
Piston Pump Assembly (Cont'd)

Figure 20-50-95



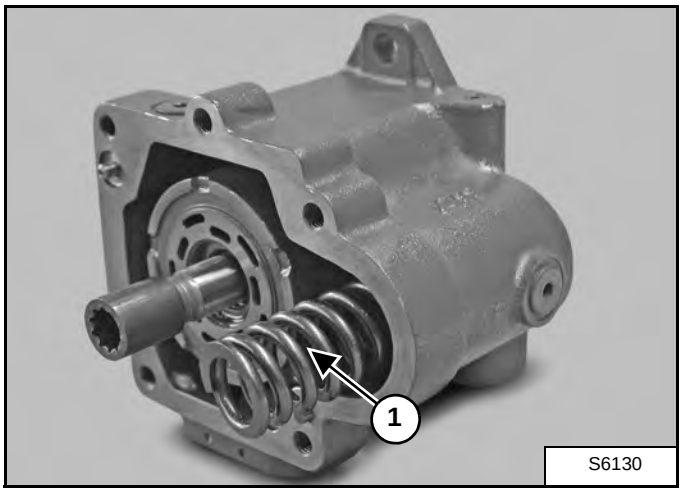
Install the cylinder block assembly (Item 1) **[Figure 20-50-95]**.

Figure 20-50-96



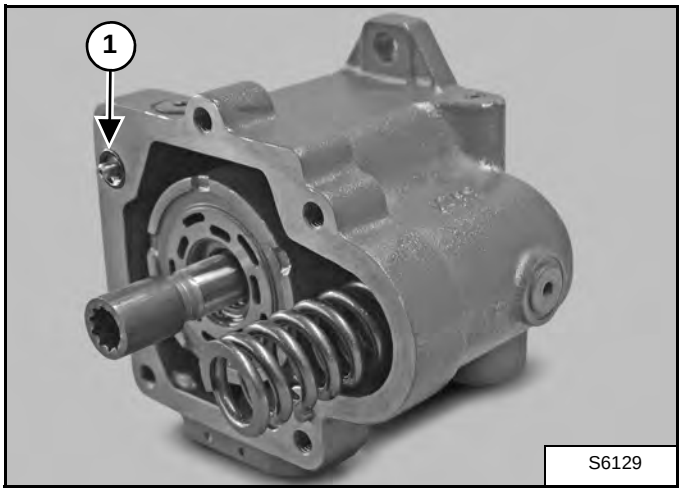
Install the spring seat (Item 1) **[Figure 20-50-96]**.

Figure 20-50-97



Install the spring (Item 1) **[Figure 20-50-97]**.

Figure 20-50-98



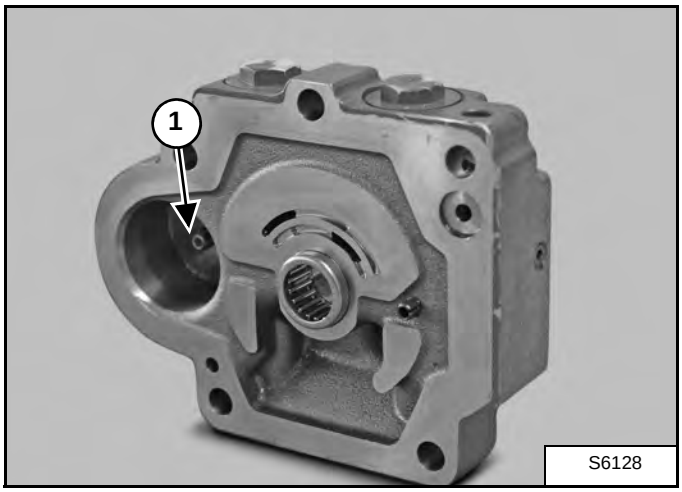
Install the O-ring (Item 1) **[Figure 20-50-98]**.

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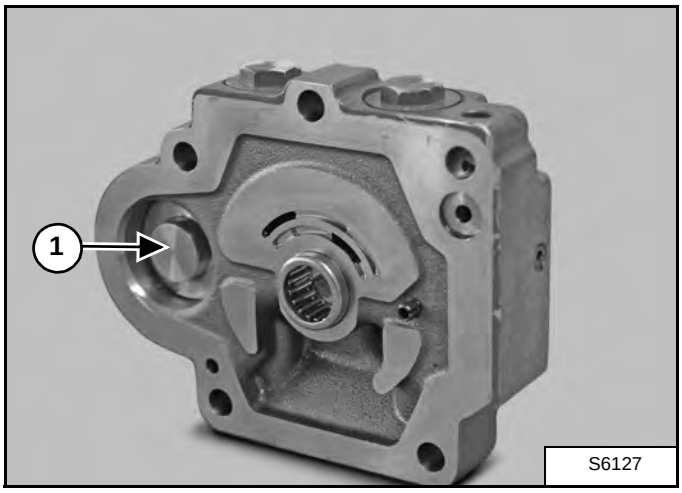
Piston Pump Assembly (Cont'd)

Figure 20-50-99



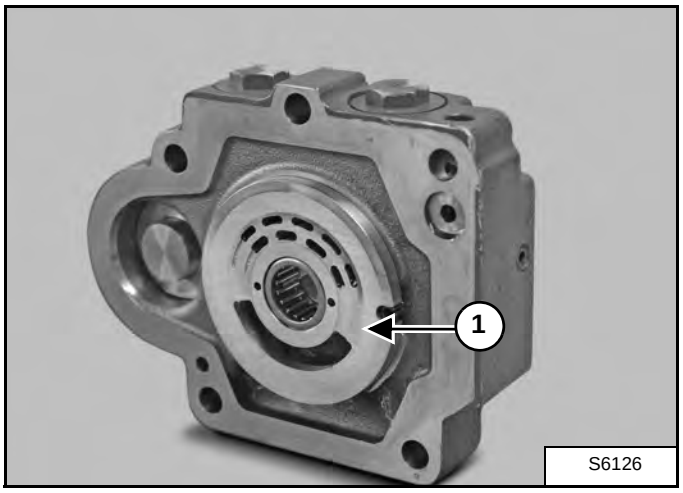
Install the screw (Item 1) **[Figure 20-50-99]** in the face plate.

Figure 20-50-100



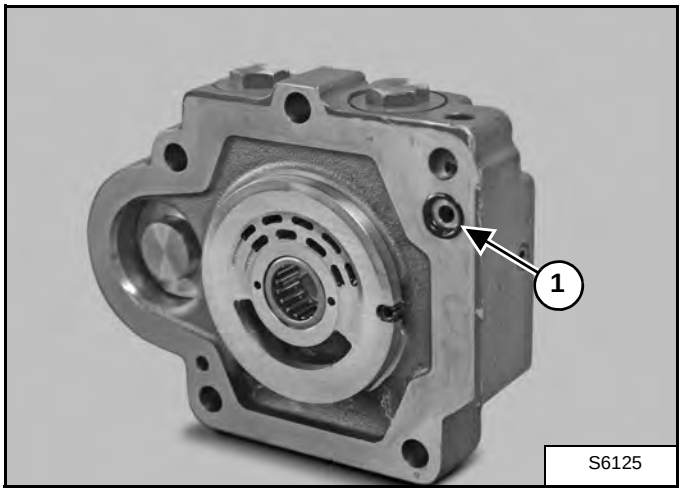
Install the spring guide (Item 1) **[Figure 20-50-100]**.

Figure 20-50-101



Install the port plate (Item 1) **[Figure 20-50-101]**.

Figure 20-50-102



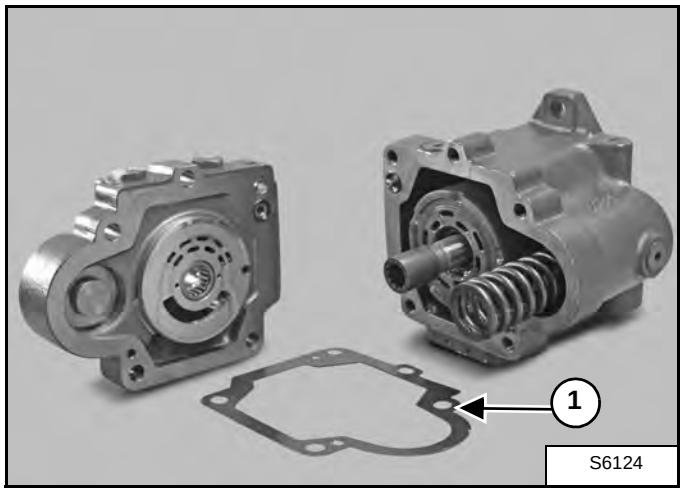
Install the O-ring (Item 1) **[Figure 20-50-102]**.

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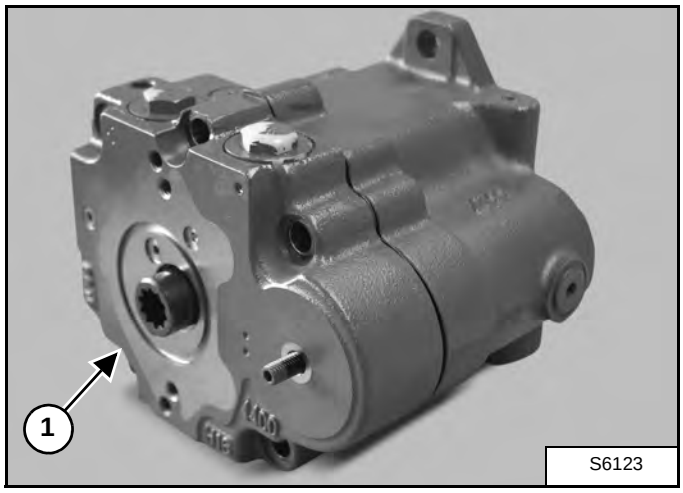
Piston Pump Assembly (Cont'd)

Figure 20-50-103



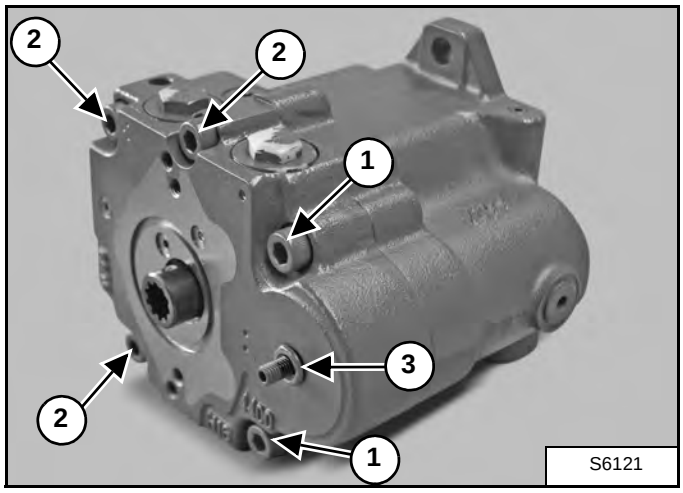
Install the gasket (Item 1) **[Figure 20-50-103]** in between the pump housing and face plate.

Figure 20-50-104



Install the face plate (Item 1) **[Figure 20-50-104]**.

Figure 20-50-105



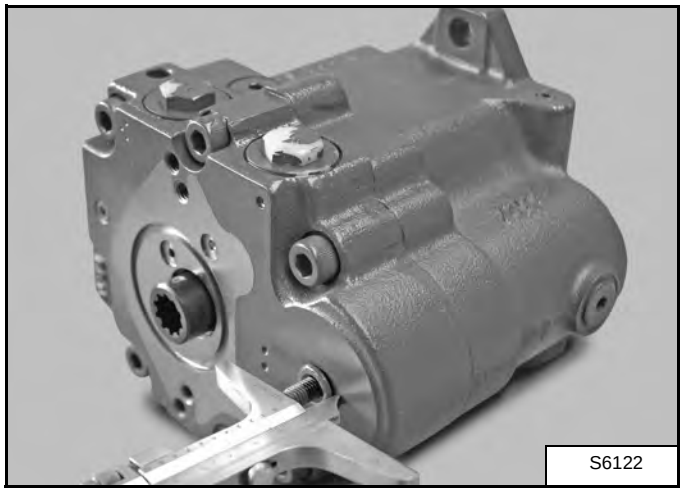
Install the two bolts (Item 1) **[Figure 20-50-105]** on either side of the pressure adjusting spring in the pump housing. Alternate tightening each bolt until both pump housings are assembled.

Install the remaining three bolts (Item 2) **[Figure 20-50-105]** in the pump housing.

Installation: Tighten bolts to 54 - 63,7 N•m (39.8 - 47.0 ft-lb) torque.

Install the seal washer (Item 3) **[Figure 20-50-105]** on the pump housing.

Figure 20-50-106



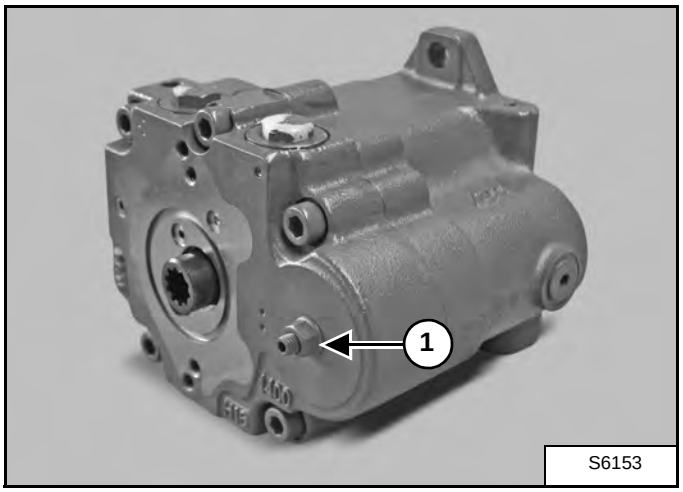
Set the measurement of the outside length of the pressure adjustment screw taken before disassembly. Final adjustment may need to be made after installation in excavator **[Figure 20-50-106]**.

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Piston Pump Assembly (Cont'd)

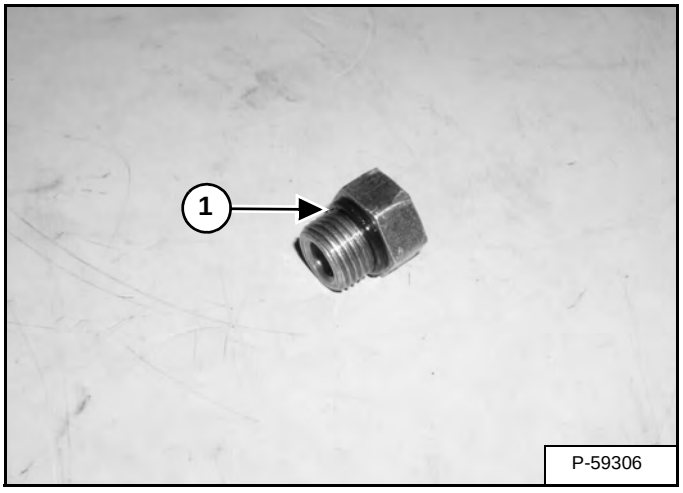
Figure 20-50-107



Install the pressure adjustment nut (Item 1) **[Figure 20-50-107]** on the pump housing.

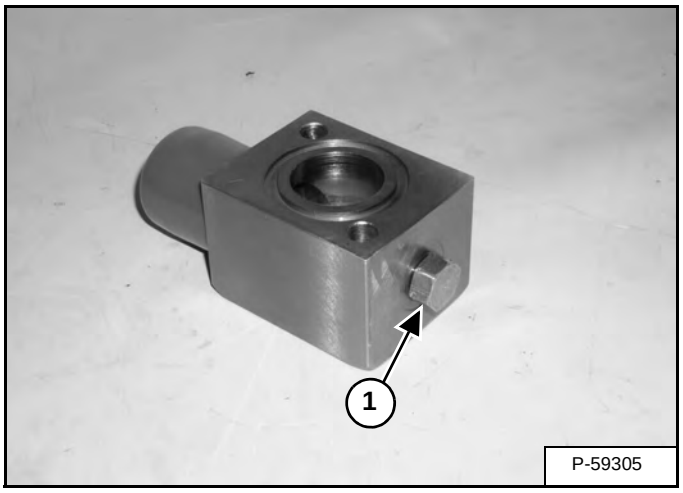
Installation: Tighten the nut to 14,8 - 19,7 N•m (10.9 - 14.5 ft-lb) torque.

Figure 20-50-108



Install the O-ring (Item 1) **[Figure 20-50-108]** on the plug.

Figure 20-50-109



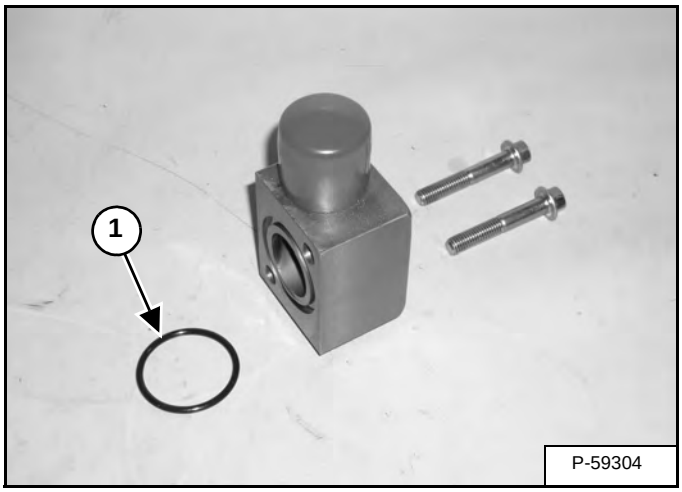
Install the plug (Item 1) **[Figure 20-50-109]** in the pump block.

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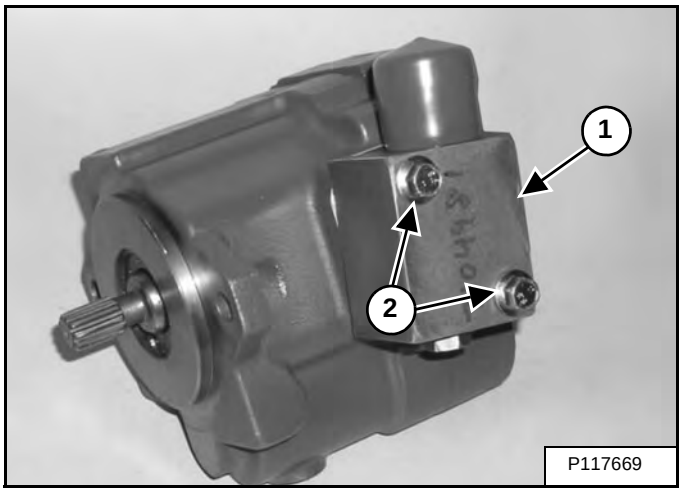
Piston Pump Assembly (Cont'd)

Figure 20-50-110



Install the O-ring (Item 1) **[Figure 20-50-110]** on the pump block.

Figure 20-50-111



Install pump block (Item 1) and the two bolts (Item 2) **[Figure 20-50-111]**.

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MANIFOLD ASSEMBLY / ACCUMULATOR

Description

The manifold body contains a two-speed solenoid valve, a system bypass valve, a console (joystick) lockout solenoid, a pressure reducing valve and a safety relief valve.

The body is connected to the accumulator.

The manifold supplies 2999 kPa (30 bar) (435 psi) to the joystick function with the engine off and the key in the ON position.

The accumulator provides a short term reserve pressure for joystick function with the engine off and the key in ON position.

Removal And Installation

Turn the machine counterclockwise 90° for access to the bottom of the valve.

Lower the boom / bucket and blade to the ground.

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

IMPORTANT

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

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⚠ WARNING

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

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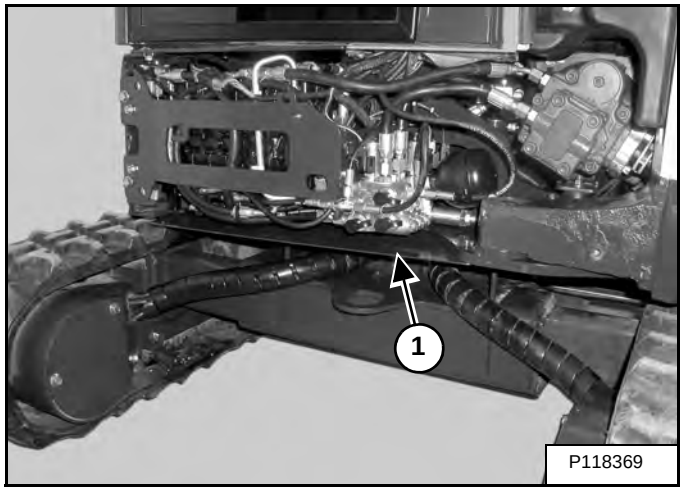
Removal And Installation (Cont'd)

Mark the hoses and wire harness for correct installation.

Remove the left upperstructure covers. (See Removal And Installation on Page 40-60-1.)

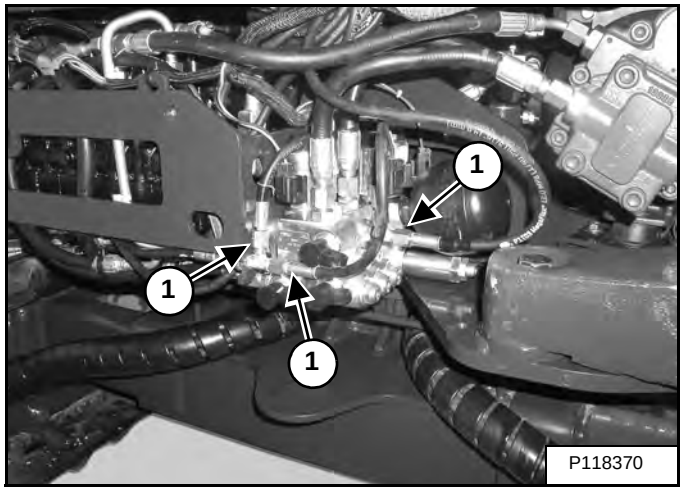
Drain the hydraulic reservoir. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

Figure 20-60-1



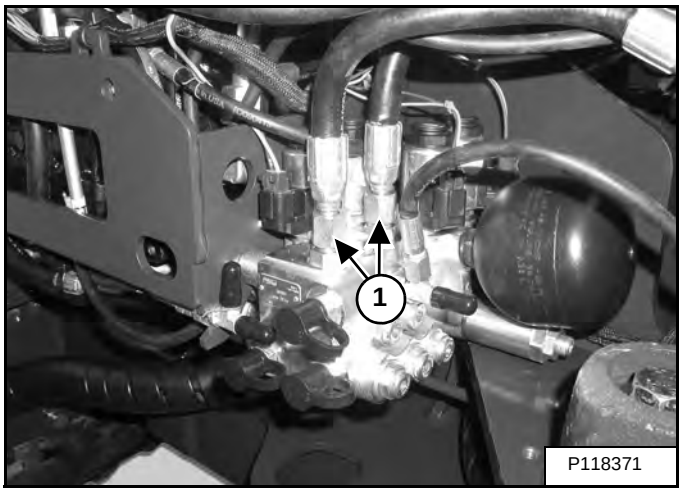
Remove the three bolts from the bottom plate (Item 1) **[Figure 20-60-1]**.

Figure 20-60-2



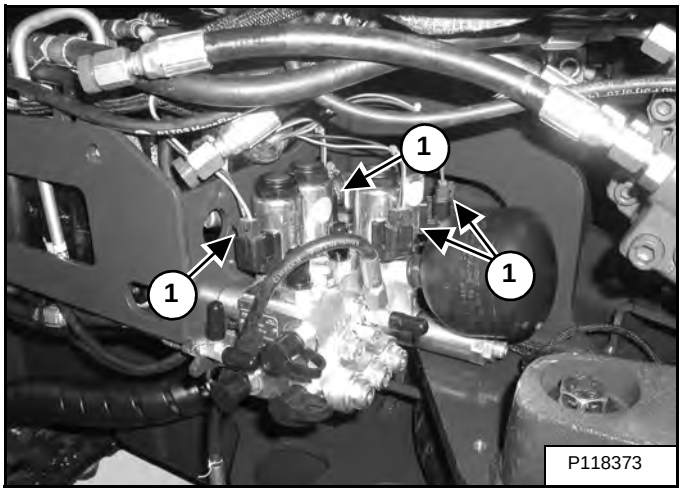
Remove the three pilot hoses (Item 1) **[Figure 20-60-2]**.

Figure 20-60-3



Remove the two hydraulic pump hoses (Item 1) **[Figure 20-60-3]**.

Figure 20-60-4



Remove the four solenoid wire connectors (Item 1) **[Figure 20-60-4]**.

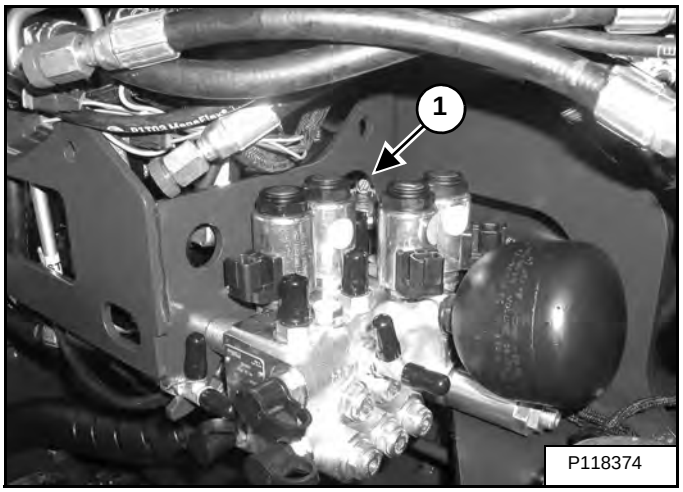
NOTE: The wires are marked with colored cable ties to the solenoid it plugs into. If the cable ties are missing, mark the connectors to match them to the solenoids.

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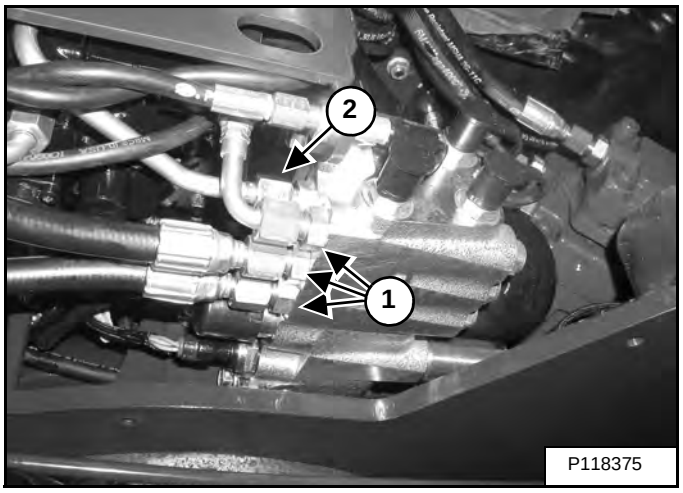
Removal and Installation (Cont'd)

Figure 20-60-5



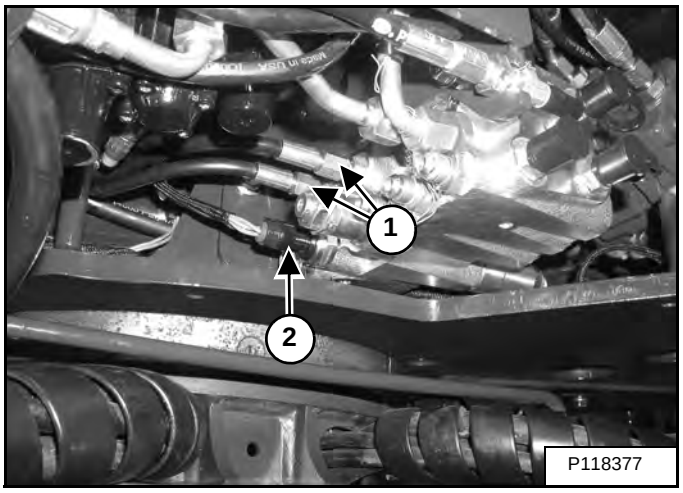
Loosen the hose clamp (Item 1) **[Figure 20-60-5]**.

Figure 20-60-6



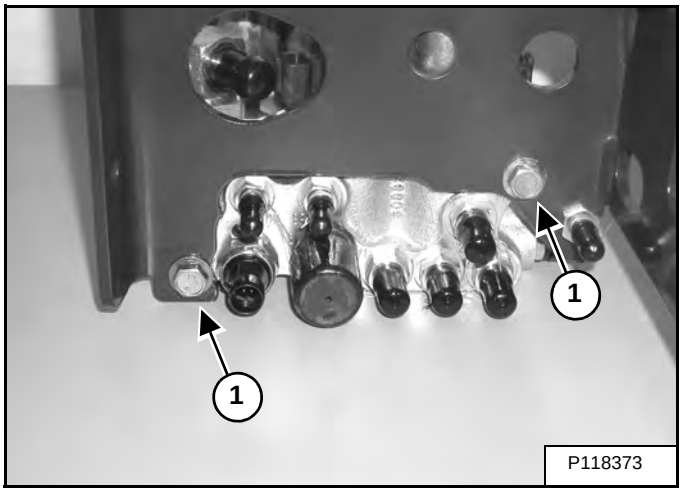
Remove the three hoses (Item 1) and the hydraulic line (Item 2) **[Figure 20-60-6]**.

Figure 20-60-7



Remove the two pilot hoses (Item 1) and disconnect wire harness (Item 2) **[Figure 20-60-7]**.

Figure 20-60-8



Remove the two mounting bolts (Item 1) **[Figure 20-60-8]**.

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

Mounting bracket removed from the machine for photo clarity.

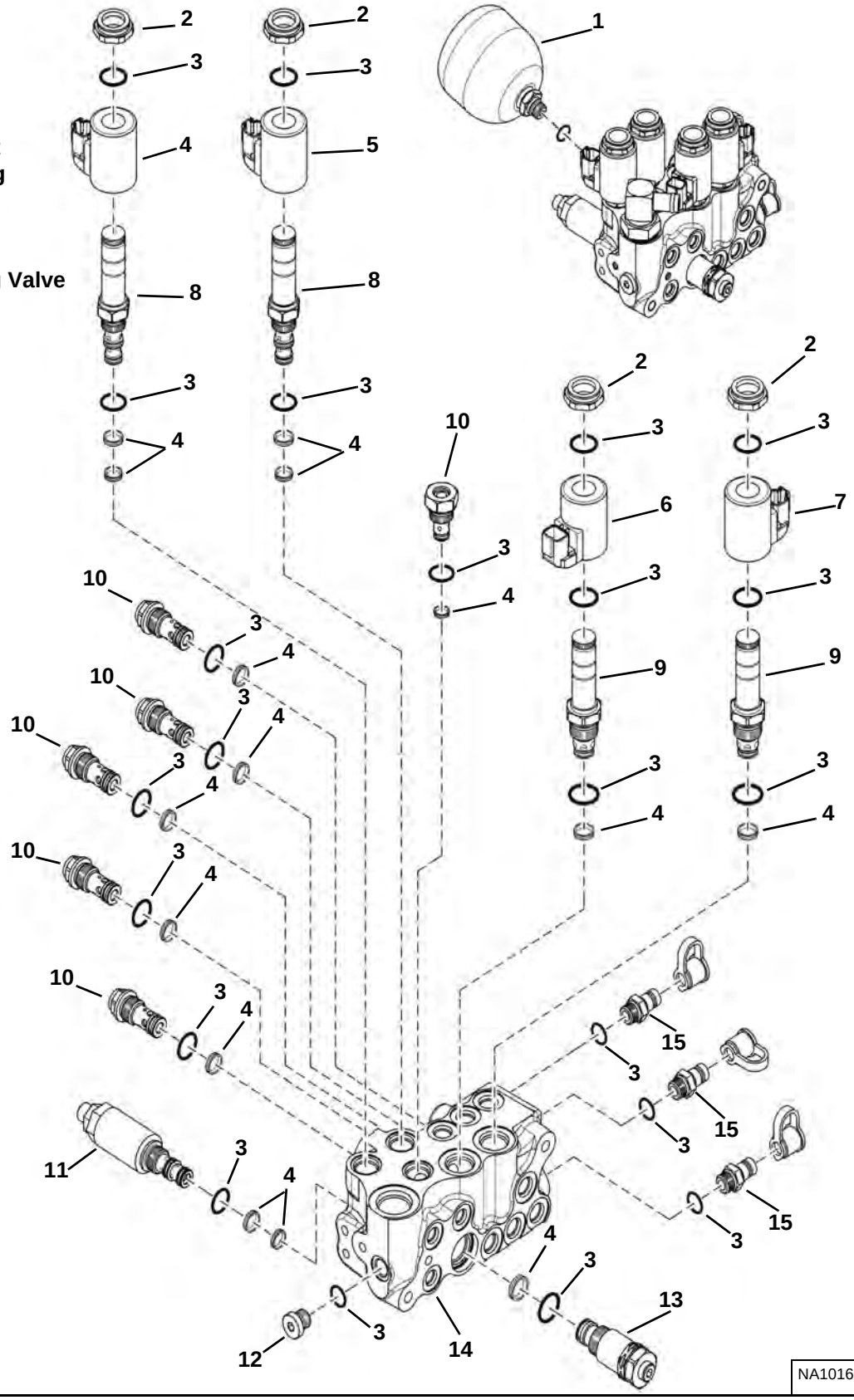
Remove the manifold from the machine.

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Parts Identification

1. Accumulator
2. Nut
3. O-ring
4. Coil with yellow dot
5. Coil with green dot
6. Coil with orange dot
7. Coil with no marking
8. Solenoid Stem
9. Solenoid Stem
10. Check Valve
11. Pressure Reducing Valve
12. Plug
13. Main Relief Valve
14. Valve Body
15. Test Fitting



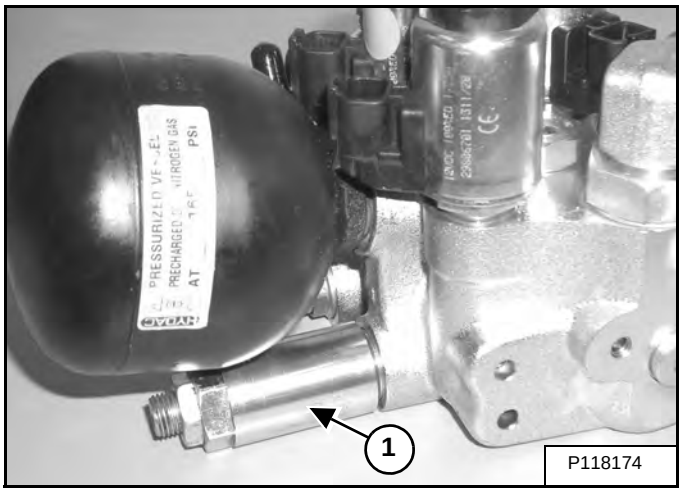
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MANIFOLD ASSEMBLY / ACCUMULATOR

Disassembly And Assembly

Figure 20-60-9

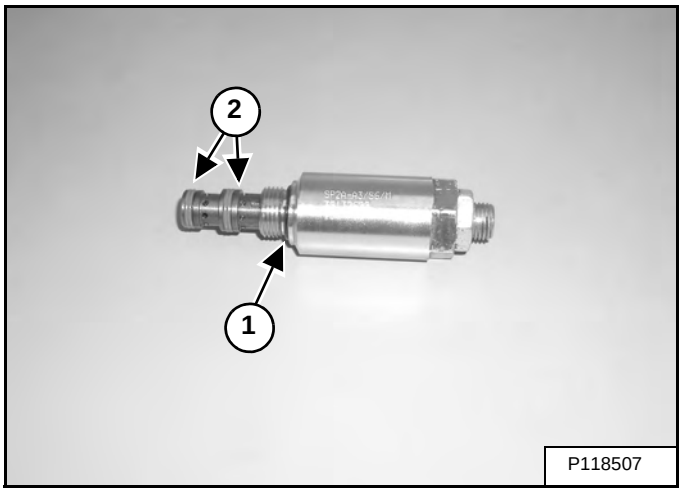


Clean the outside of the manifold assembly / accumulator before disassembly.

Remove the pressure reducing valve (Item 1) **[Figure 20-60-9]**.

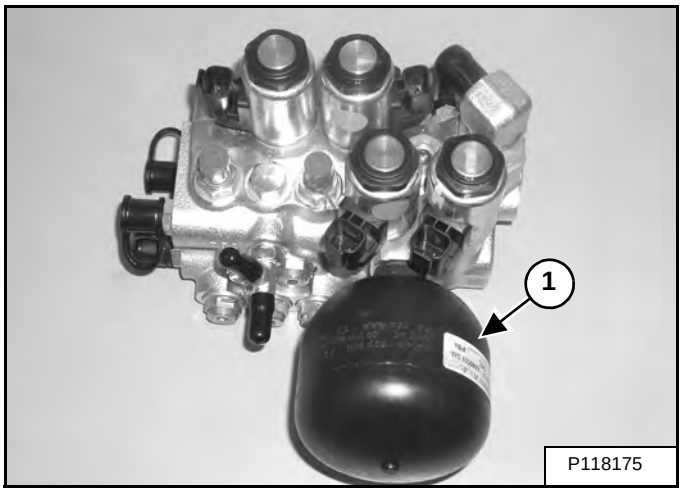
Installation: Tighten the valve to 30 N•m (22 ft-lb) torque.

Figure 20-60-10



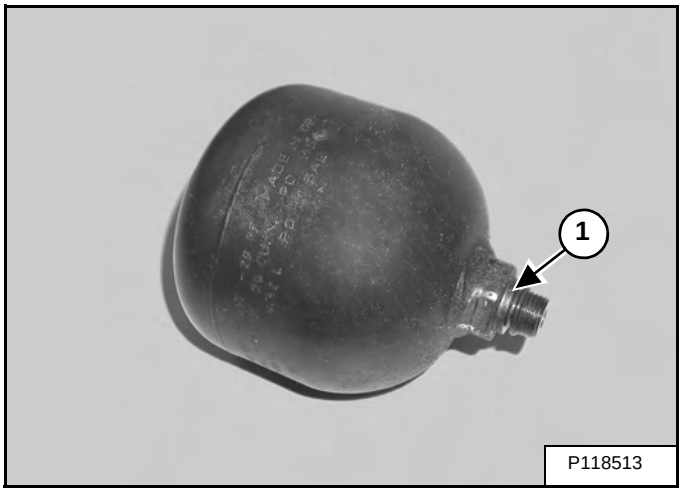
Remove the O-ring (Item 1) and the two seals (Item 2) **[Figure 20-60-10]**.

Figure 20-60-11



Remove the accumulator (Item 1) **[Figure 20-60-11]**.

Figure 20-60-12



Remove the O-ring (Item 1) **[Figure 20-60-12]** from the accumulator.

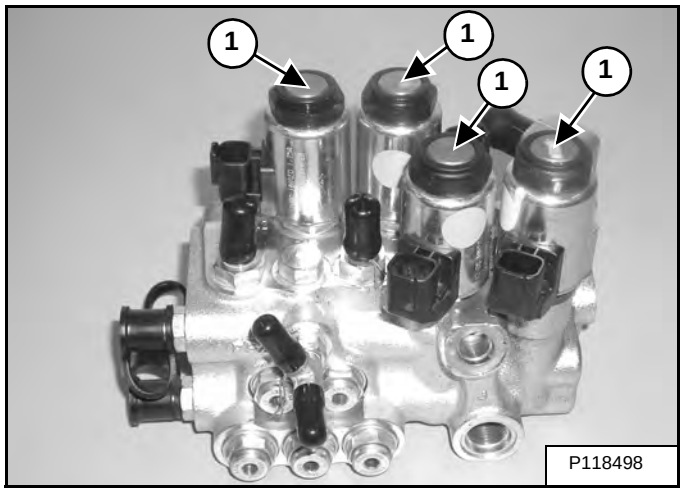
Installation: Tighten the accumulator to 29 - 33 N•m (22 - 24 ft-lb) torque.

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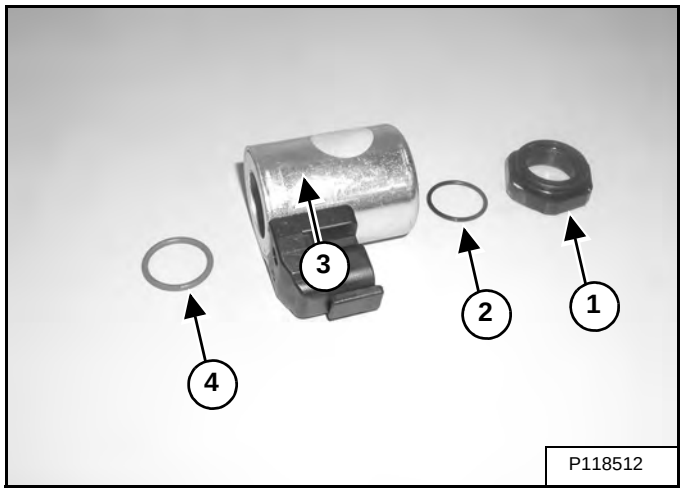
Disassembly And Assembly (Cont'd)

Figure 20-60-13



Mark and remove the four solenoids (Item 1) **[Figure 20-60-13]**.

Figure 20-60-14

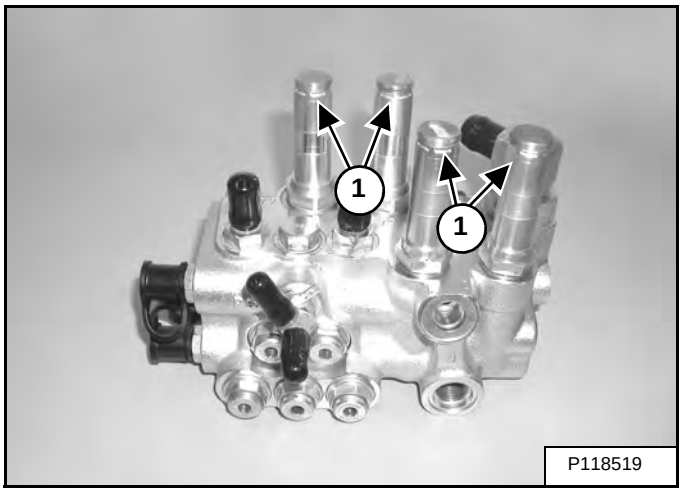


Remove the nut (Item 1), O-ring (Item 2), solenoid coil (Item 3) and the O-ring (Item 4) **[Figure 20-60-14]**.

Installation: Tighten the nut for the coil to 3 N•m (2.2 ft-lb) torque.

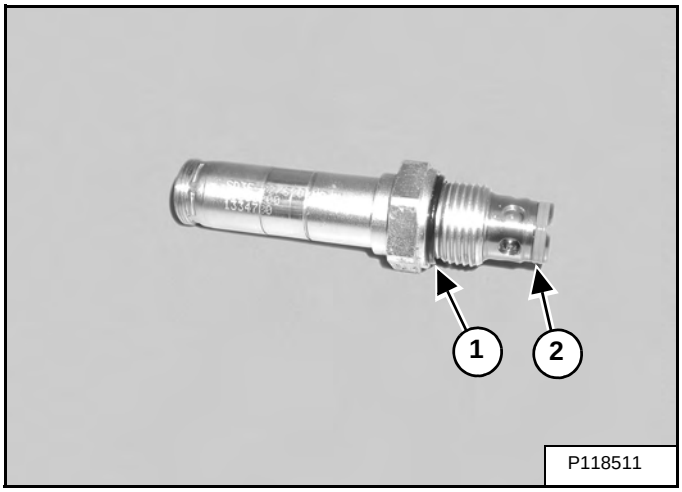
NOTE: The unmarked coil and the coil with the orange mark are the only coils equipped with the bottom O-ring (Item 4) [Figure 20-60-14].

Figure 20-60-15



Mark and remove the four solenoid stems (Item 1) **[Figure 20-60-15]**.

Figure 20-60-16



Remove the O-ring (Item 1) and the seal (Item 2) **[Figure 20-60-16]**.

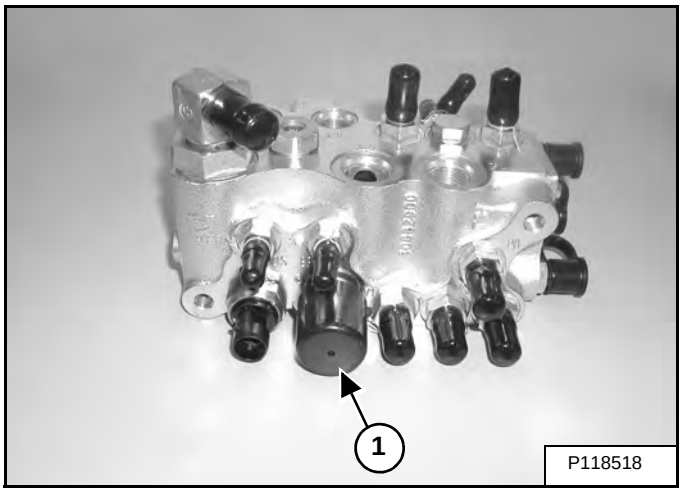
NOTE: The coil stems with the yellow and green marks are longer and have two seals (Item 2) [Figure 20-60-16] installed.

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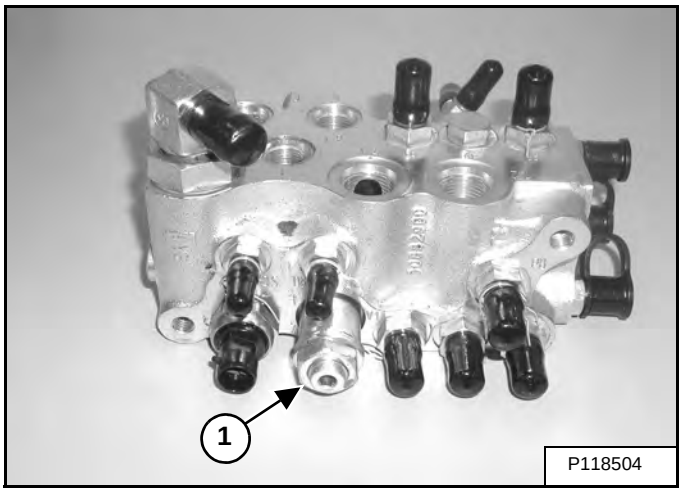
Disassembly And Assembly (Cont'd)

Figure 20-60-17



Remove the cap (Item 1) **[Figure 20-60-17]**.

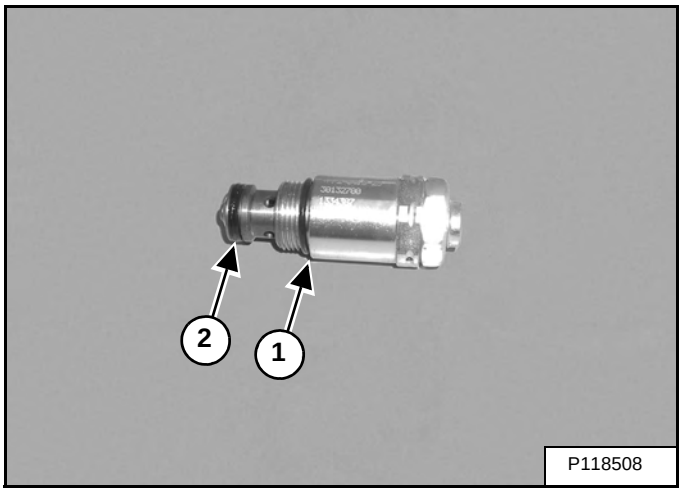
Figure 20-60-18



Remove the main relief valve (Item 1) **[Figure 20-60-18]**.

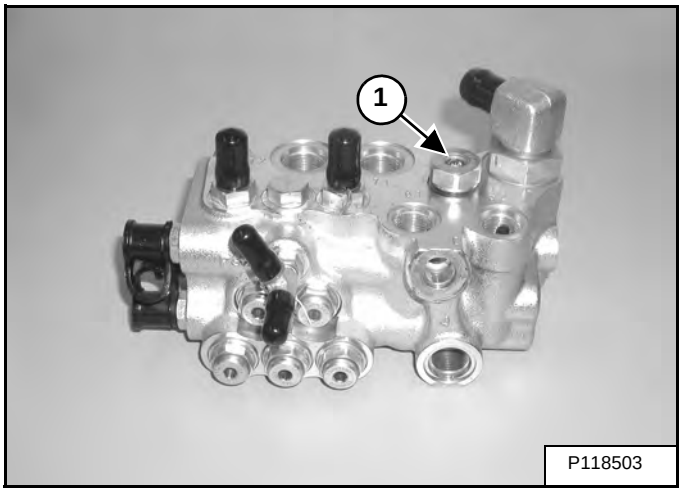
Installation: Tighten the relief valve to 30 N•m (22 ft-lb) torque.

Figure 20-60-19



Remove the O-ring (Item 1) and the seal (Item 2) **[Figure 20-60-19]**.

Figure 20-60-20



Remove the check valve (Item 1) **[Figure 20-60-20]**.

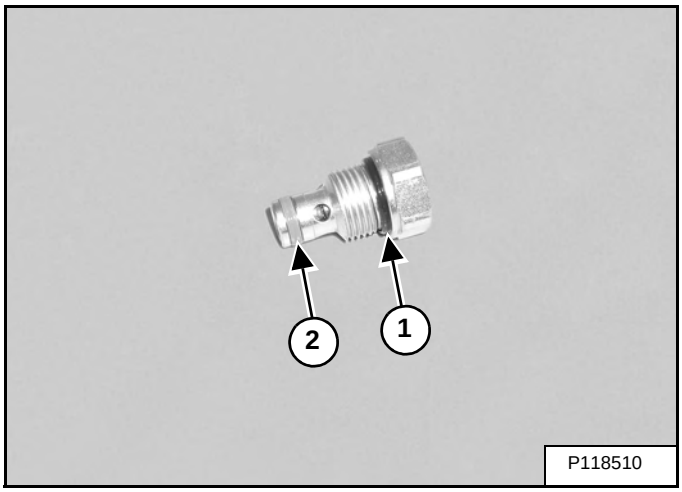
Installation: Tighten the check valve to 30 N•m (22 ft-lb) torque.

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Disassembly And Assembly (Cont'd)

Figure 20-60-21



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-60-21]**.

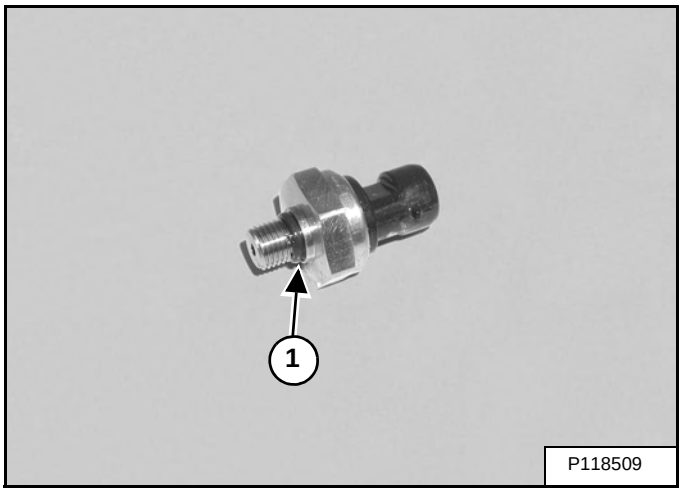
Figure 20-60-22



Remove the switch (Item 1) **[Figure 20-60-22]**.

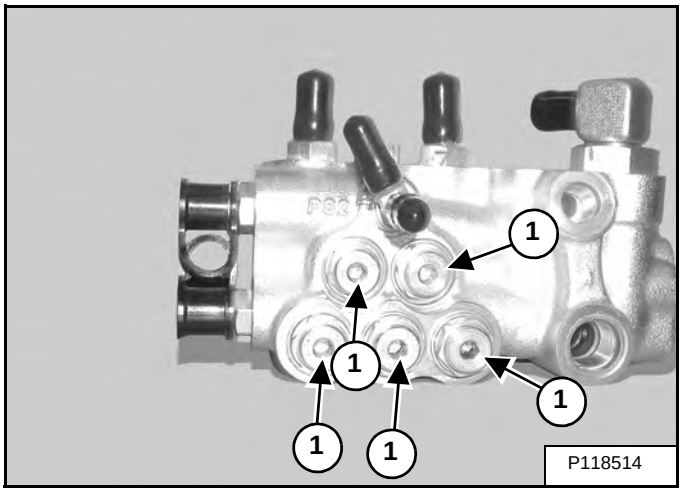
Installation: Tighten the switch to 16 N•m (12 ft-lb) torque.

Figure 20-60-23



Remove the O-ring (Item 1) **[Figure 20-60-23]**.

Figure 20-60-24



Remove the five check valves (Item 1) **[Figure 20-60-24]**.

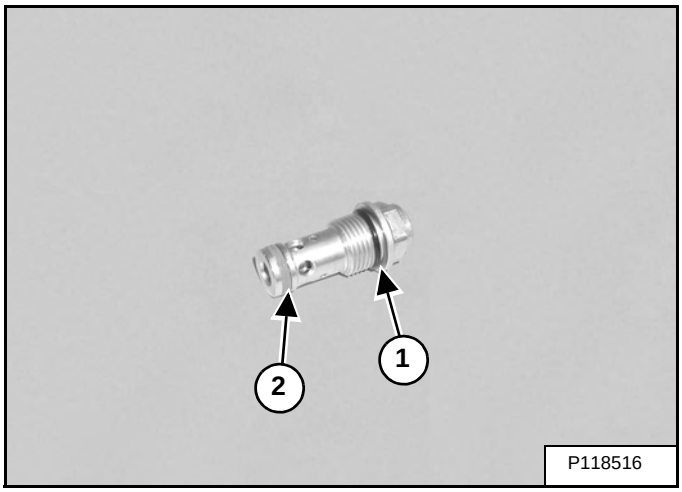
Installation: Tighten the check valve to 40 N•m (30 ft-lb) torque.

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Disassembly and Assembly (Cont'd)

Figure 20-60-25



Remove the O-ring (Item 1) and the seal (Item 2) **[Figure 20-60-25]**.

Clean all parts in solvent and dry with compressed air.

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

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

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ACCUMULATOR

Removal And Installation

Lower the boom / bucket and blade to the ground.

WARNING

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

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IMPORTANT

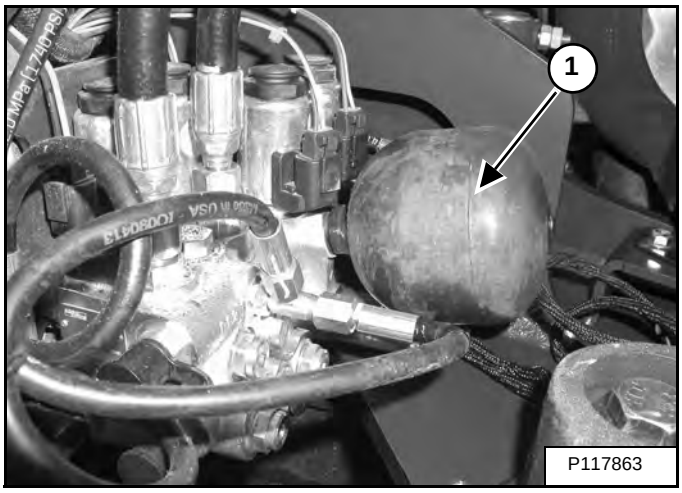
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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From the operator's seat, drain the residual pressure from the accumulator by stroking a function with the engine off and the key in the run position.

Remove left upperstructure covers. (See Removal And Installation on Page 40-60-1.)

Figure 20-70-1



Remove the accumulator (Item 1) **[Figure 20-70-1]** at the manifold.

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TRAVEL MOTOR (SINGLE SPEED)

Description

The travel motor is a hydraulic motor which receives hydraulic fluid from the hydraulic pump through the hydraulic control valve. The speed that the travel motor rotates is related to the amount of hydraulic fluid it receives.

Removal And Installation

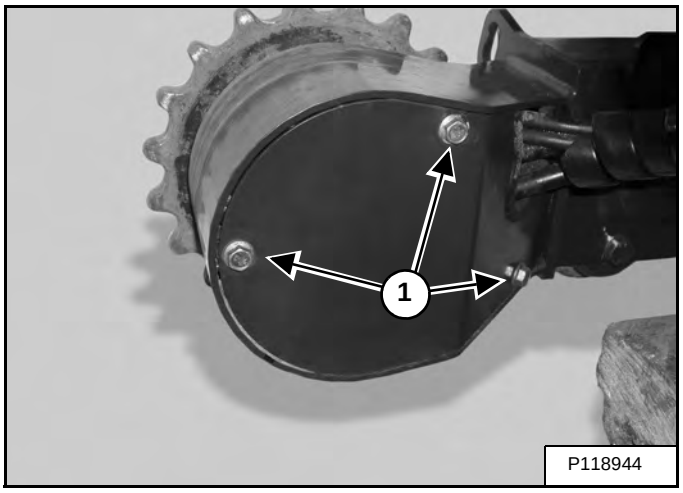
Remove the track. (See Track Removal And Installation on Page 30-20-5.)

IMPORTANT

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

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Figure 20-80-1



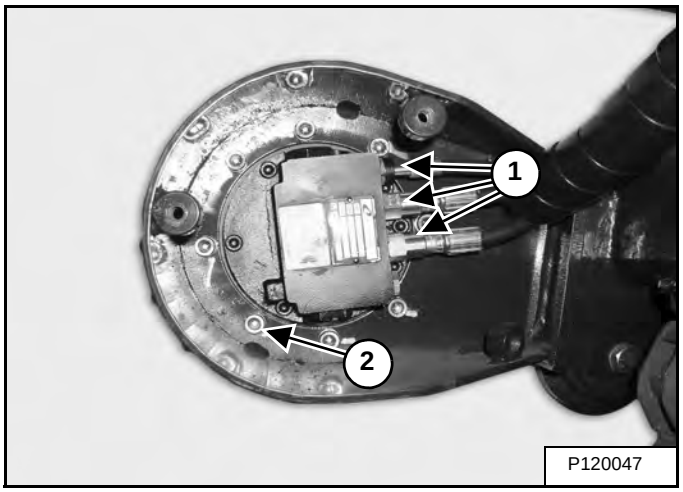
Remove the bolts (Item 1) **[Figure 20-80-1]** from the track frame cover.

Installation: Tighten the bolts to 20 - 25 N•m (15 - 18 ft-lb) torque.

Remove the cover.

Mark the hoses for correct installation.

Figure 20-80-2



Remove the hoses (Item 1) **[Figure 20-80-2]** from the travel motor.

Remove the travel motor mounting bolts (Item 2) **[Figure 20-80-2]**.

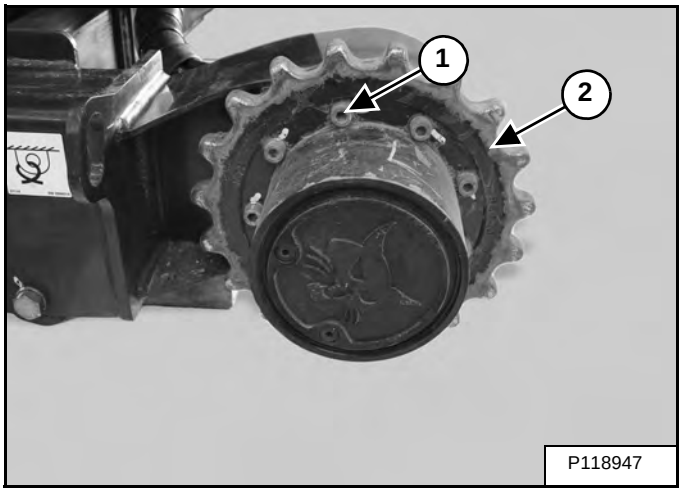
Installation: Tighten the bolts to 40 - 50 N•m (29 - 37 ft-lb) torque.

Remove the travel motor.

The drive sprocket can be removed without removing the travel motor.

If removing the sprocket from a travel motor that has been removed from the track frame, clamp the motor in a vise.

Figure 20-80-3



Remove the sprocket bolts (Item 1). Remove the sprocket (Item 2) **[Figure 20-80-3]**.

Installation: Tighten the bolts to 65 - 75 N•m (48 - 55 ft-lb) torque.

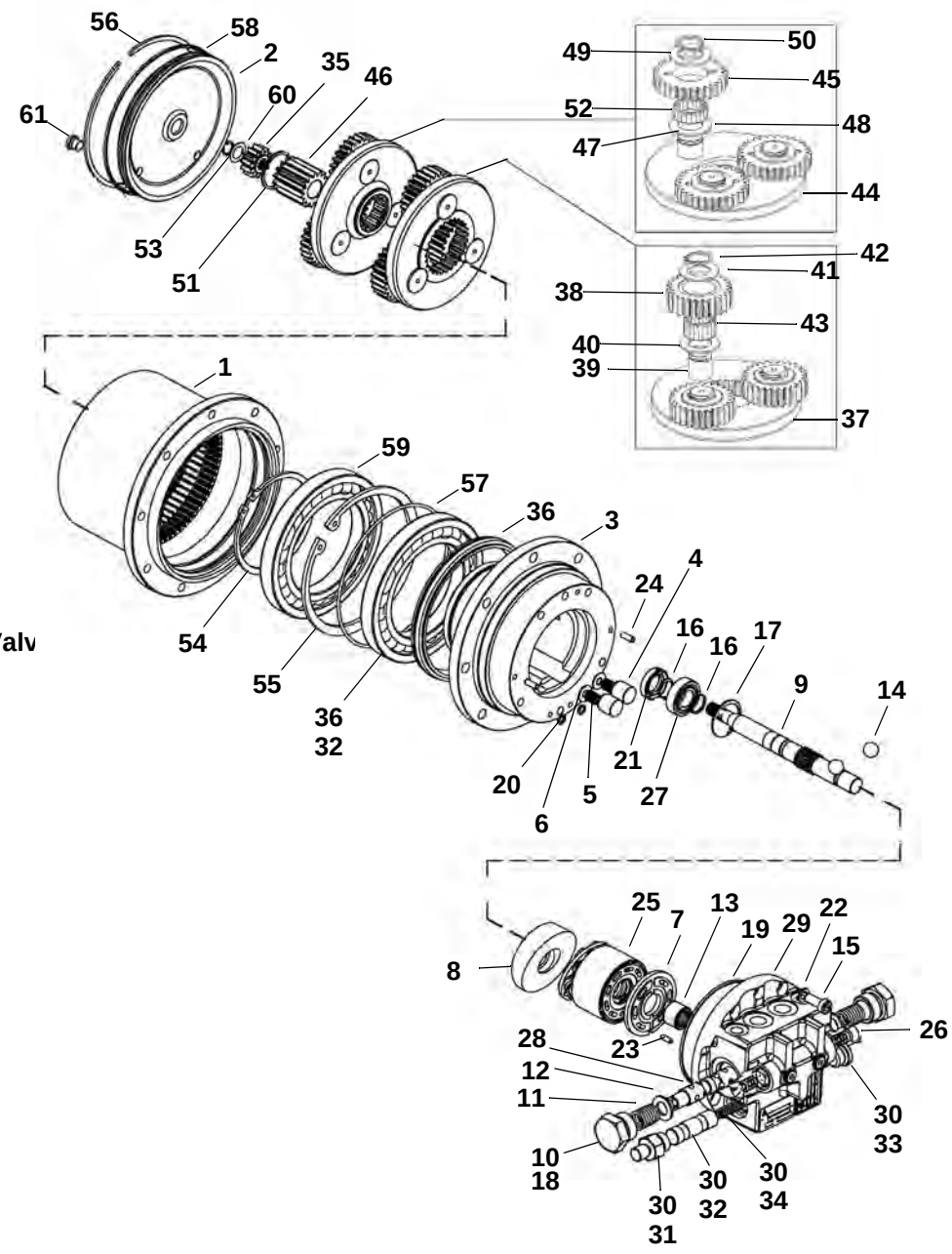
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TRAVEL MOTOR (SINGLE SPEED) (CONT'D)

Parts Identification

1. Housing
2. Cover
3. Hub
4. Change Disposition Piston
5. Change Disposition Spring
6. Change Disposition Washer
7. Distributor
8. Swash Plate
9. Motor Shaft
10. Plug
11. Spring
12. Washer
13. Needle Bearing
14. Sphere
15. Screw
16. Retaining Ring
17. Retaining Ring
18. O-ring
19. O-ring
20. O-ring
21. Seal
22. Washer
23. Pin
24. Pin
25. Rotating Pump Assy
26. Shockproof Valve
27. Ball Bearing
28. Counterbalance Valve
29. Cover
30. Change Displacement Valv
31. Fitting
32. Valve Piston
33. Plug
34. Spring
35. Gear
36. Bearing and Seal
37. Planetary Carrier
38. Planet Gear
39. Pin
40. Washer
41. Anti-Rotation Washer
42. Retaining Ring
43. Needle Bearing
44. Planetary Carrier
45. Planetary Gear
46. Sun Gear
47. Pin
48. Washer
49. Anti-Rotation Washer
50. Retaining Ring
51. Snap Ring
52. Needle Bearing
53. Retaining Ring
54. Retaining Ring
55. Retaining Ring
56. Snap Ring
57. O-ring
58. O-ring
59. Ball Bearing
60. Shim
61. Plug



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Disassembly

IMPORTANT

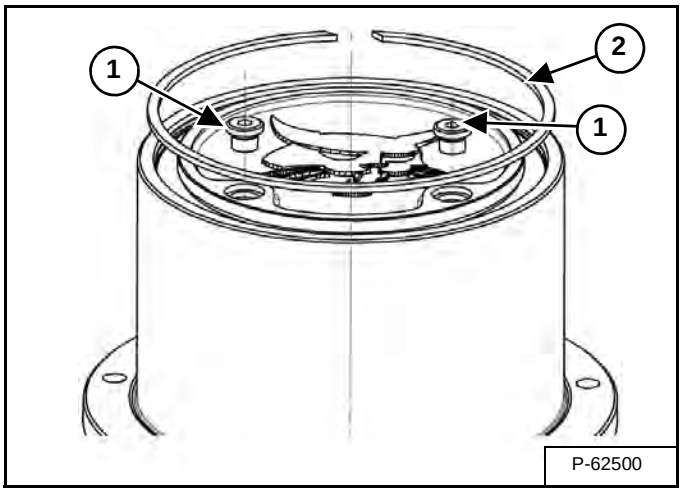
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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Clean the outside of the travel motor before disassembly.

Drain the lubricant from the travel motor.

Figure 20-80-4



Remove the drain plugs (Item 1) and snap ring (Item 2) **[Figure 20-80-4]** securing the reduction gear cover.

Drain the excess oil into a container.

Figure 20-80-5

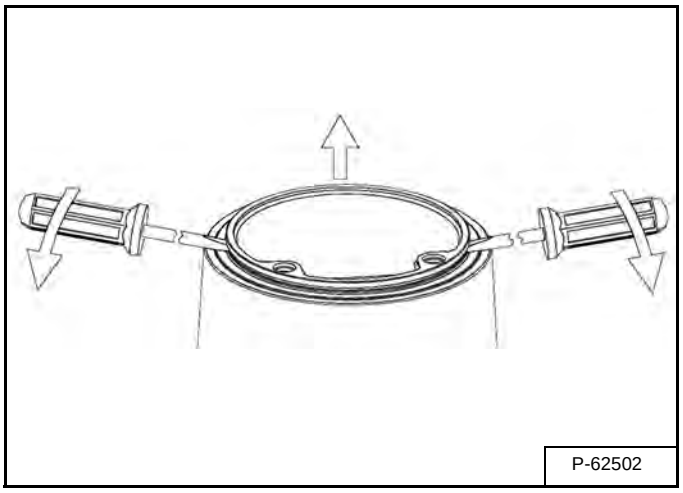
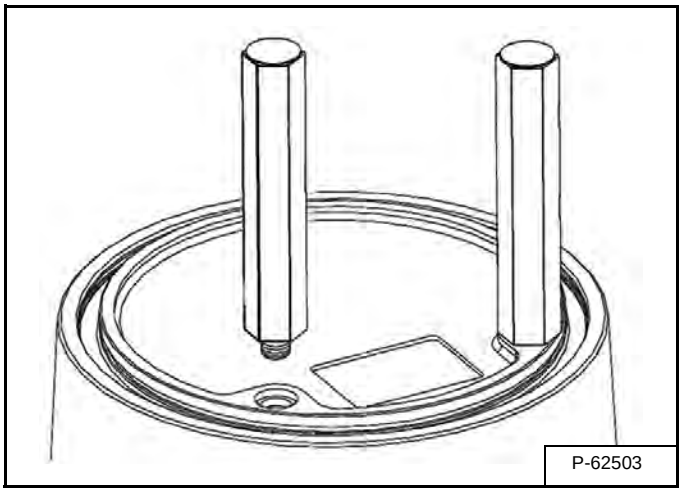


Figure 20-80-6



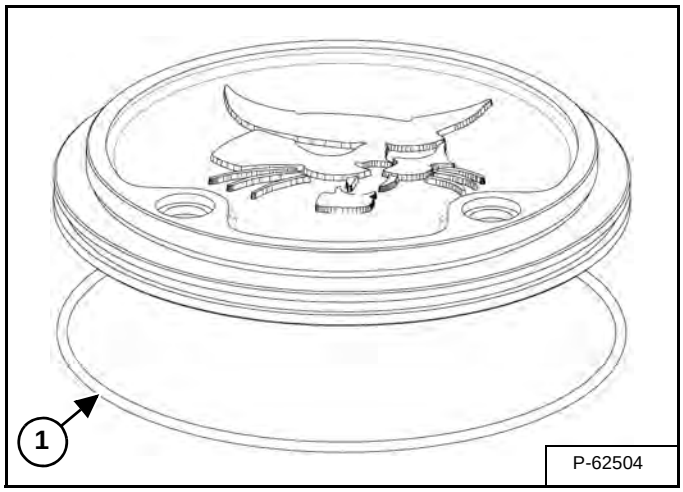
To remove the cover, lift the cover up using screwdrivers in the upper groove **[Figure 20-80-5]** or install two threaded pins in the drain holes and lift the cover off **[Figure 20-80-6]**.

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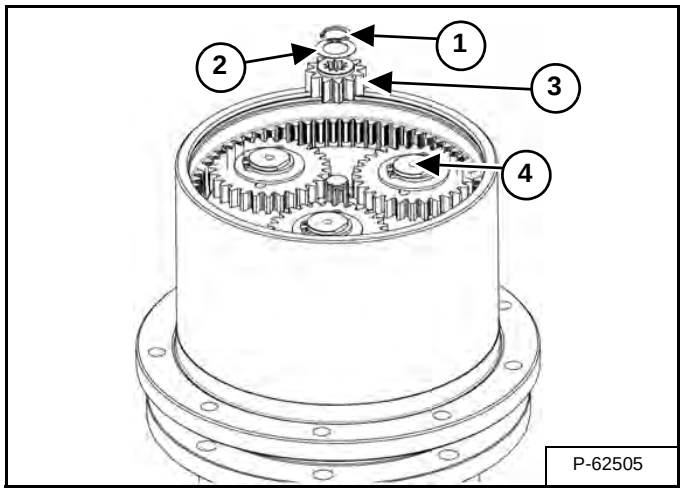
Disassembly (Cont'd)

Figure 20-80-7



Remove the O-Ring (Item 1) **[Figure 20-80-7]** from the cover.

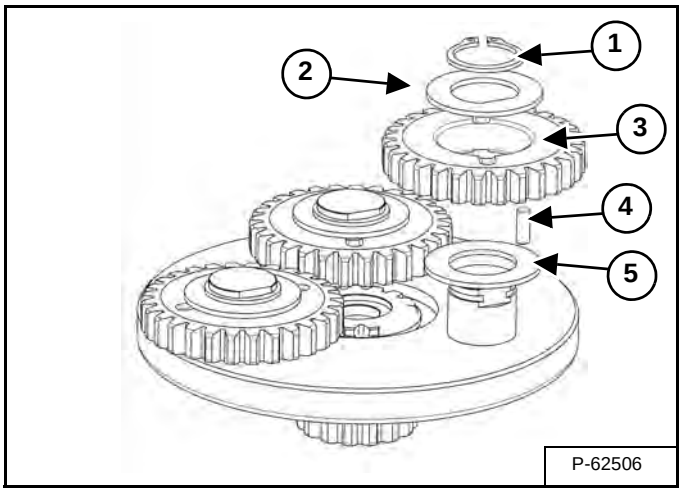
Figure 20-80-8



Remove the retaining ring (Item 1), shims (Item 2) and sun gear (Item 3) **[Figure 20-80-8]**.

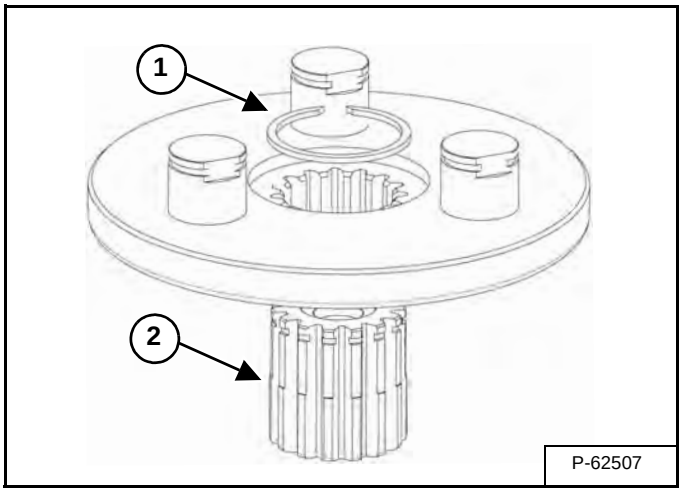
Remove the first stage planetary carrier (Item 4) **[Figure 20-80-8]** using your hands.

Figure 20-80-9



Remove the retaining rings (Item 1), anti-rotation washer (Item 2), planetary gears (Item 3), needle bearings (Item 4) and thrust washer (Item 5) **[Figure 20-80-9]** from the first stage planetary carrier assembly.

Figure 20-80-10



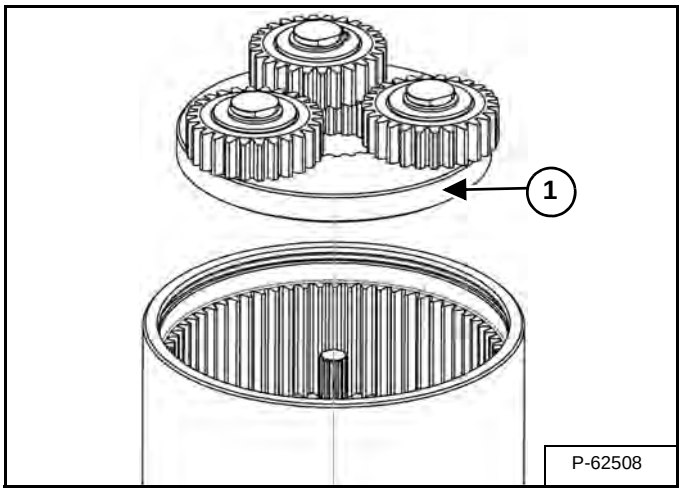
Remove the retaining ring (Item 1) from the second reduction sun gear (Item 2) **[Figure 20-80-10]** and push the gear down to remove from planetary carrier.

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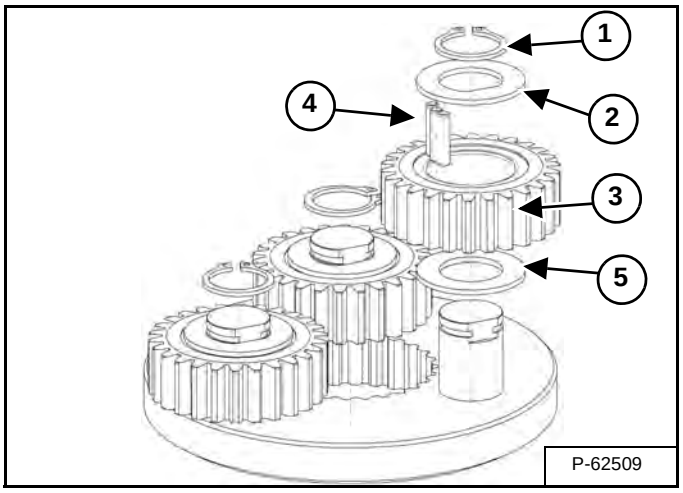
Disassembly (Cont'd)

Figure 20-80-11



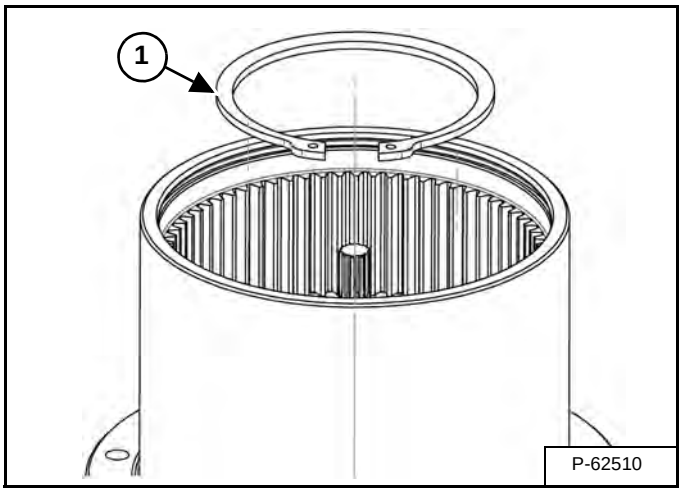
Remove the second stage planetary carrier (Item 1) **[Figure 20-80-11]** using your hands.

Figure 20-80-12



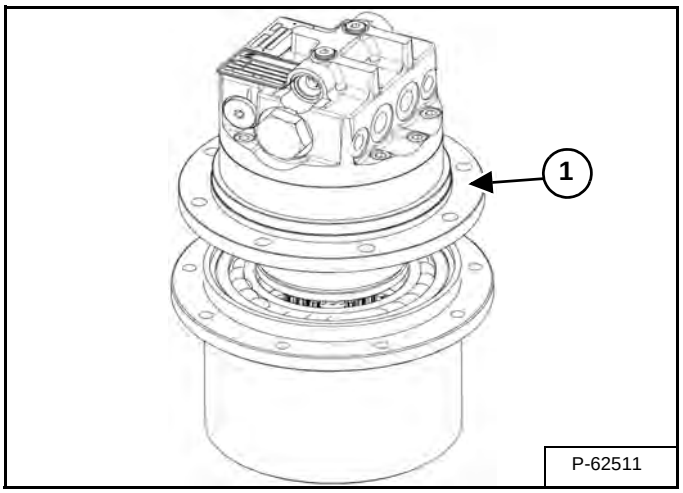
Remove the retaining rings (Item 1), anti-rotation washer (Item 2), planetary gears (Item 3), needle bearings (Item 4) and thrust washer (Item 5) **[Figure 20-80-12]** from the first stage planetary carrier assembly.

Figure 20-80-13



Remove the retaining ring (Item 1) **[Figure 20-80-13]** from the hub to free the two bearings, ring gear and motor.

Figure 20-80-14



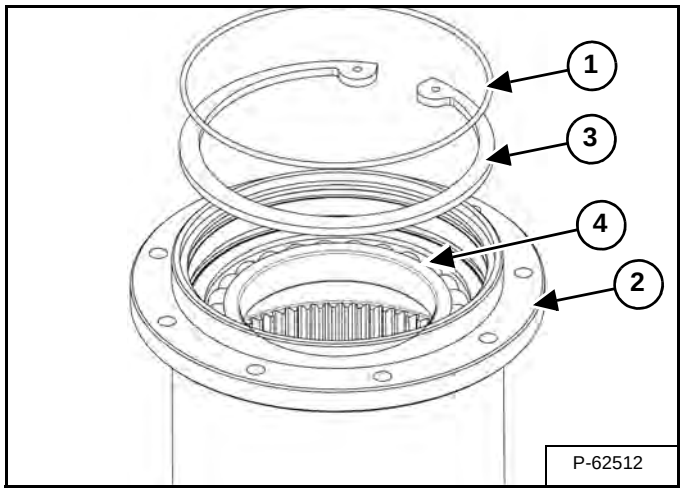
Remove the hub (Item 1) **[Figure 20-80-14]** from the ring gear.

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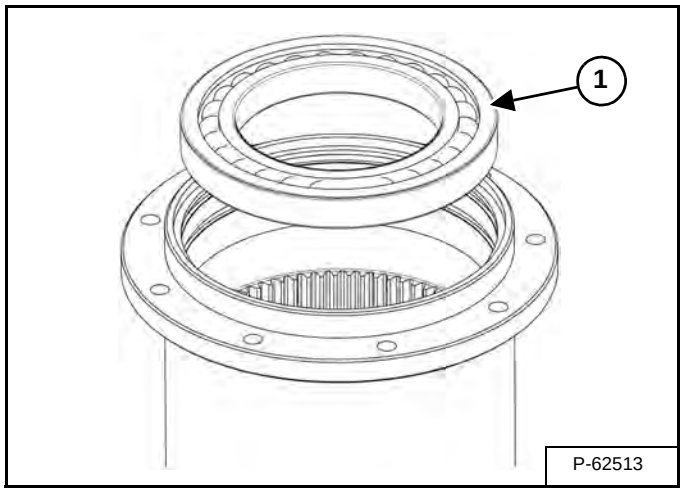
Disassembly (Cont'd)

Figure 20-80-15



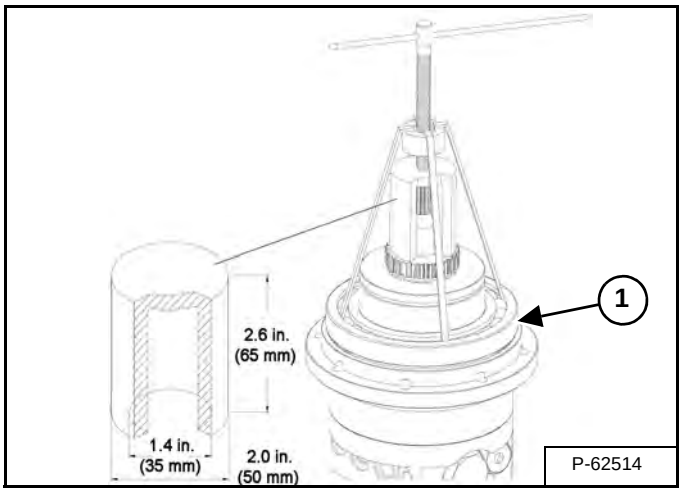
Remove the O-Ring (Item 1) from the ring gear (Item 2) and the retaining ring (Item 3) securing the bearing (Item 4) **[Figure 20-80-15]**.

Figure 20-80-16



Remove the ball bearing (Item 1) **[Figure 20-80-16]** by pushing from underneath.

Figure 20-80-17

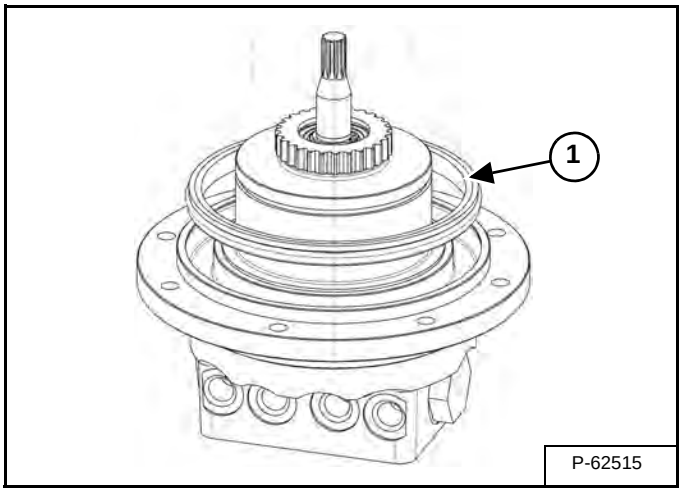


Remove the lapped bearing / front seal (Item 1) **[Figure 20-80-17]**.

NOTE: Be careful not to damage the bottom polished / lapped surface of the bearing [Figure 20-80-17].

NOTE: A commercial bearing extractor and supporting cap, as shown, will be required for bearing removal [Figure 20-80-17]. Be careful not to damage the bottom polished / lapped surface of the bearing.

Figure 20-80-18



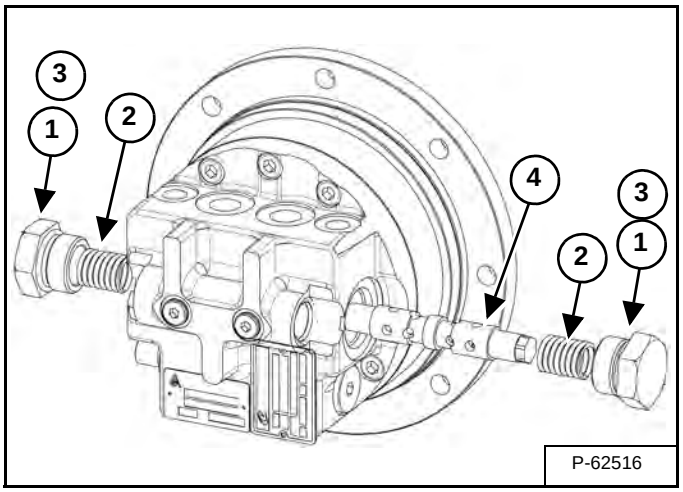
Remove the front seal ring (Item 1) **[Figure 20-80-18]**.

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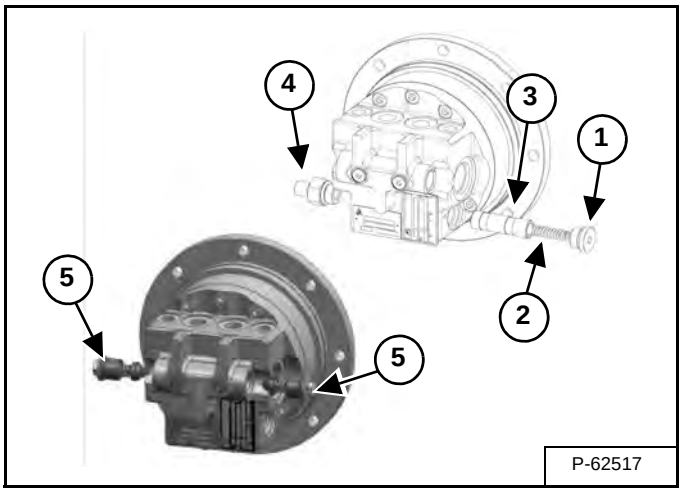
Disassembly (Cont'd)

Figure 20-80-19



Remove the plugs (Item 1), springs (Item 2), washers (Item 3) and counterbalance valve (Item 4) **[Figure 20-80-19]**.

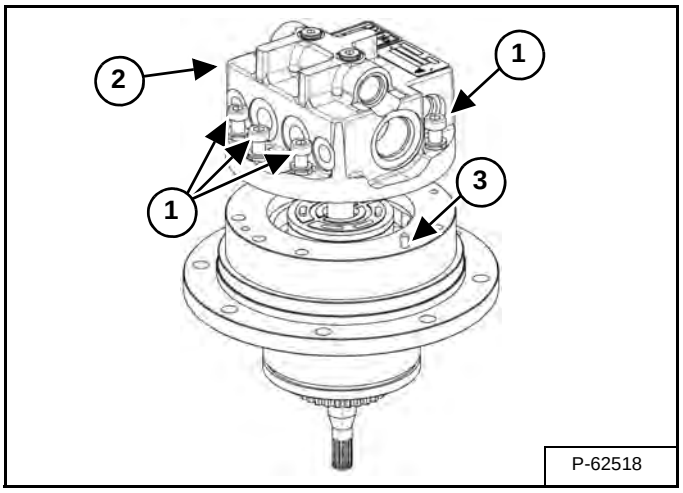
Figure 20-80-20



Remove the plug (Item 1), springs (Item 2), piston valve (Item 3) and plug (Item 4) **[Figure 20-80-20]**.

Remove the valves (Item 5) **[Figure 20-80-20]** from the motor cover.

Figure 20-80-21

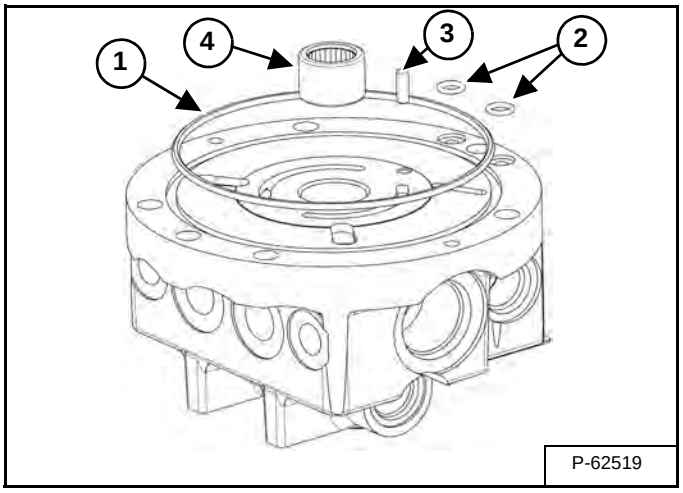


Remove the six screws and washers (Item 1) **[Figure 20-80-21]**.

Remove the cover (Item 2) **[Figure 20-80-21]**.

NOTE: Removal of pin (Item 3) [Figure 20-80-21] is optional.

Figure 20-80-22



Remove large O-Ring (Item 1), small O-Rings (Item 2), pin (Item 3) and needle bearing (Item 4) **[Figure 20-80-22]** from the cover.

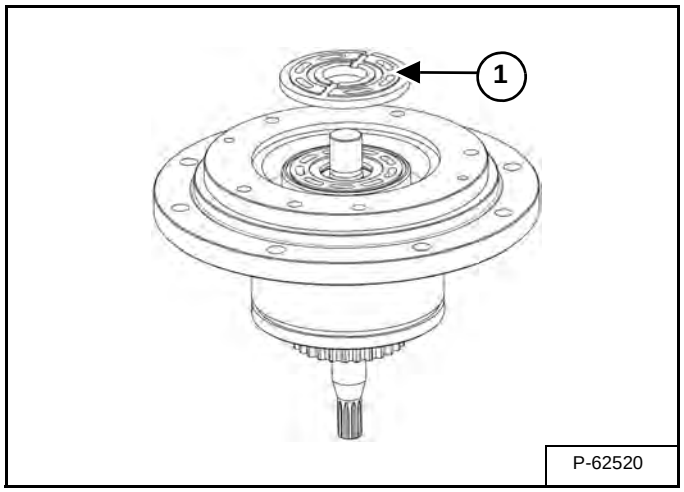
NOTE: Removal of pin (Item 3) [Figure 20-80-22] is optional.

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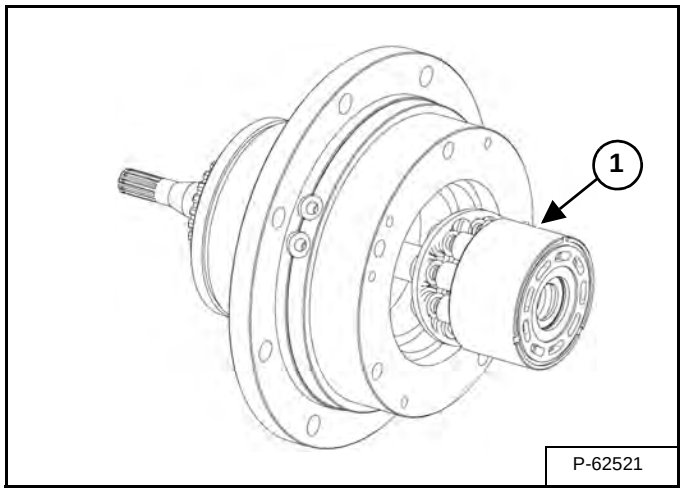
Disassembly (Cont'd)

Figure 20-80-23



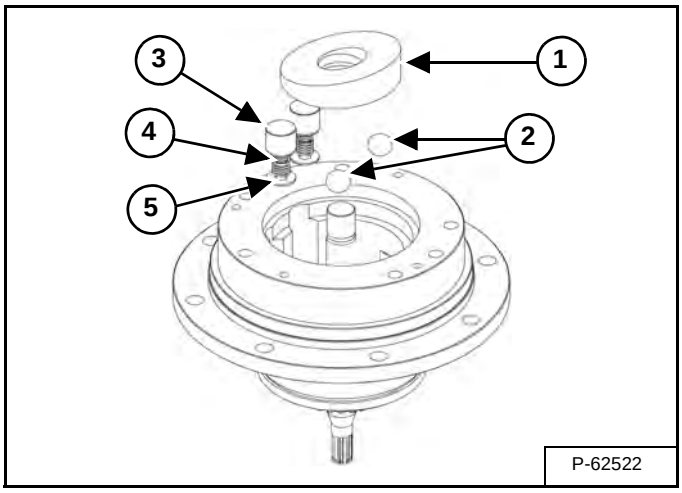
Remove the valve plate (Item 1) **[Figure 20-80-23]**.

Figure 20-80-24



Remove the rotating pump assembly (Item 1) **[Figure 20-80-24]**.

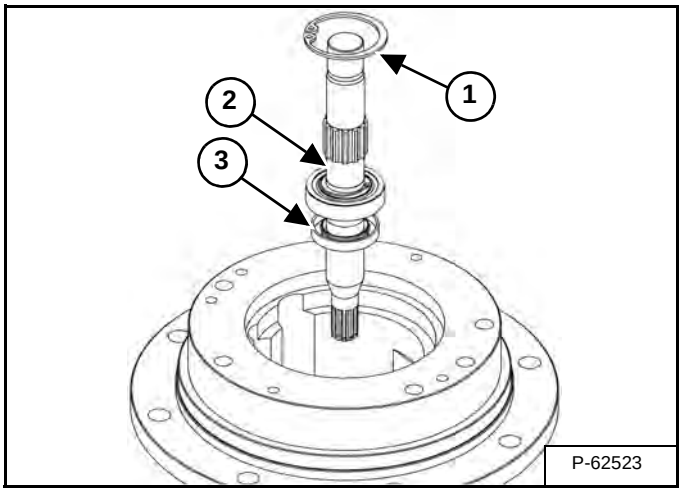
Figure 20-80-25



Remove the swash plate (Item 1) **[Figure 20-80-25]**.

Remove the sphere (Item 2), pistons (Item 3), springs (Item 4) and washers (Item 5) **[Figure 20-80-25]**.

Figure 20-80-26



Remove the retaining ring (Item 1) and bearing / drive shaft assembly (Item 2) **[Figure 20-80-26]**.

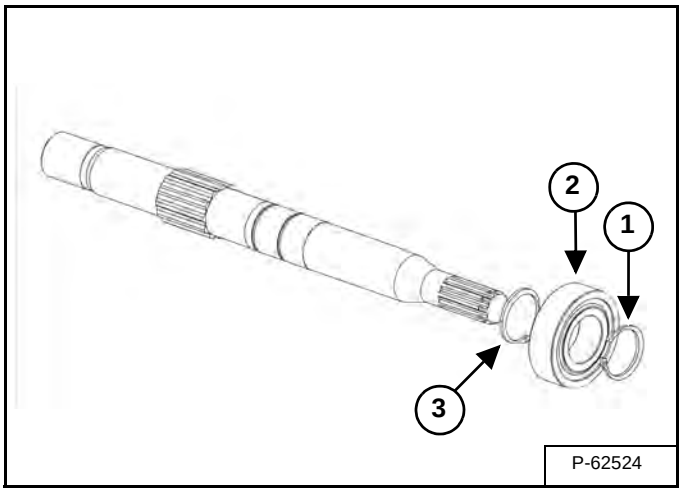
Remove the oil seal (Item 3) **[Figure 20-80-26]**.

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Disassembly (Cont'd)

Figure 20-80-27



Remove the retaining ring (Item 1), ball bearing (Item 2) and the second retaining ring (Item 3) **[Figure 20-80-27]**.

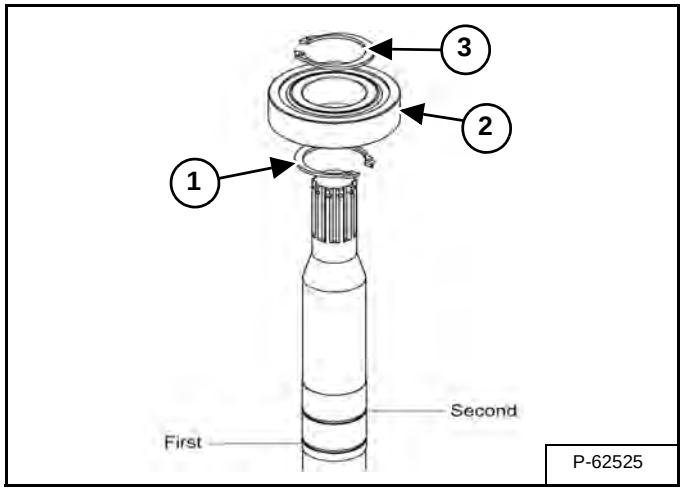
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Assembly

Clean all parts in solvent and dry with compressed air. Inspect all parts and replace any that are damaged. If any of the planetary gears (first or second) are damaged, replace the damaged planetary stage assembly (first or second) complete with the sun gear that the damaged gear is from. One damaged gear can cause microscopic fatigue cracks in mating gear teeth and cause premature failure after servicing. Apply oil to all O-rings and light grease to the ball and roller bearings before installation.

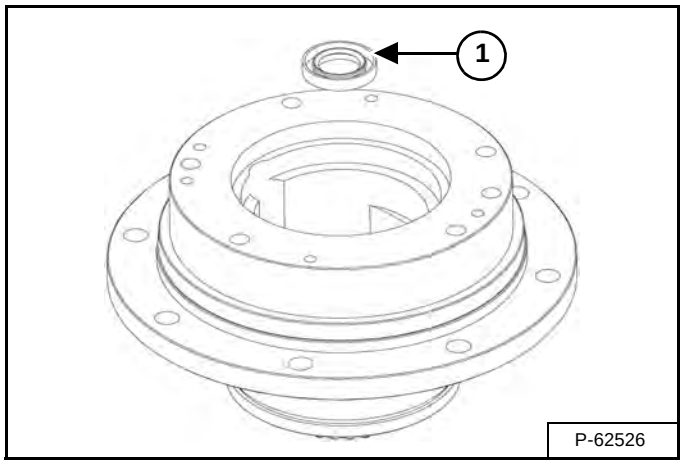
Figure 20-80-28



Install the retaining ring (Item 1) **[Figure 20-80-28]** on the drive shaft.

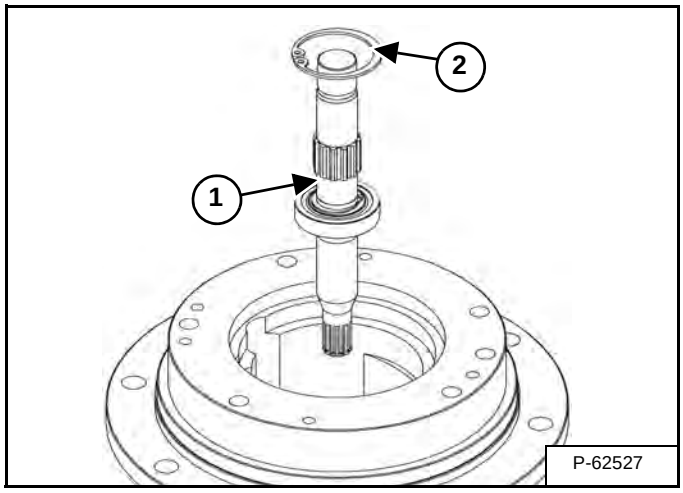
Install the ball bearing (Item 2) and the retaining ring (Item 3) **[Figure 20-80-28]**.

Figure 20-80-29



Install the oil seal (Item 1) **[Figure 20-80-29]** in the hub.

Figure 20-80-30



Install the bearing / drive shaft assembly (Item 1) **[Figure 20-80-30]**.

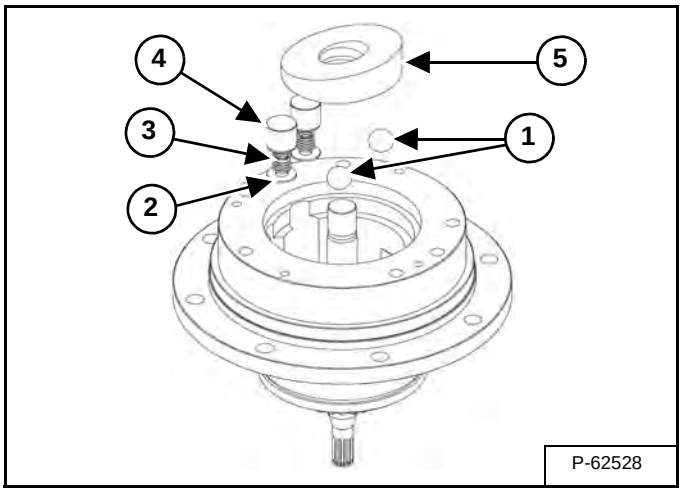
Install the retaining ring (Item 2) **[Figure 20-80-30]**.

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Assembly (Cont'd)

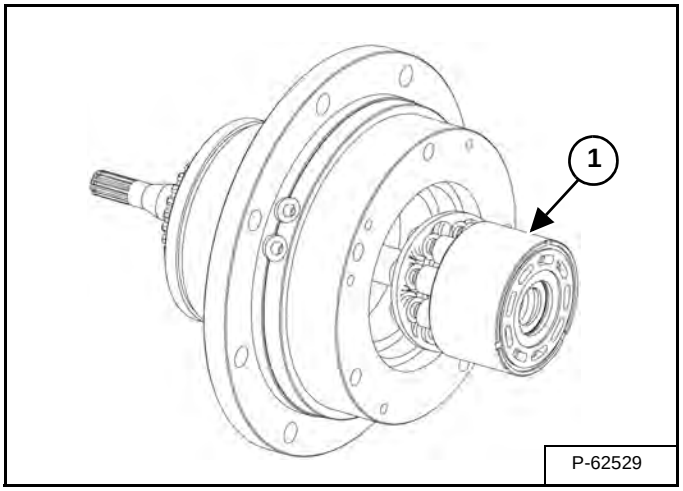
Figure 20-80-31



Install the sphere (Item 1), washers (Item 2), springs (Item 3) and pistons (Item 4) **[Figure 20-80-31]**.

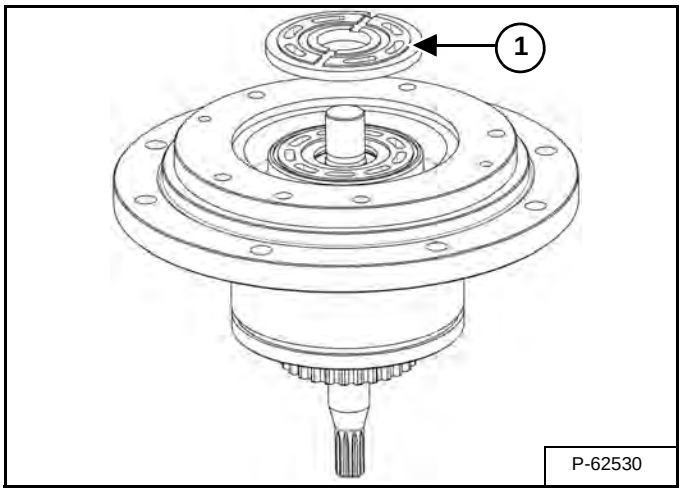
Install the swash plate (Item 5) **[Figure 20-80-31]**.

Figure 20-80-32



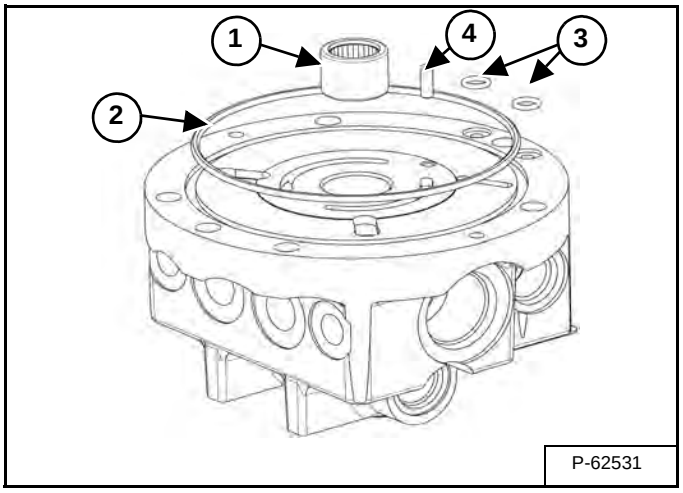
Install the rotating pump assembly (Item 1) **[Figure 20-80-32]**.

Figure 20-80-33



Install the valve plate (Item 1) **[Figure 20-80-33]**.

Figure 20-80-34



Install the needle bearing (Item 1) **[Figure 20-80-34]** in the cover so the bearing edge extends from the face of the cover 0.98 - 0.110 in. (2,5 - 2,8 mm).

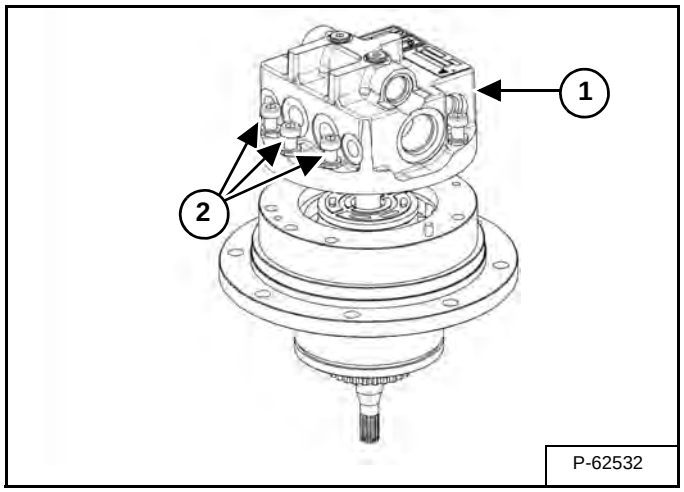
Install the large O-ring (Item 2), small O-rings (Item 3) and pin (Item 4) **[Figure 20-80-34]** in the cover.

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Assembly (Cont'd)

Figure 20-80-35

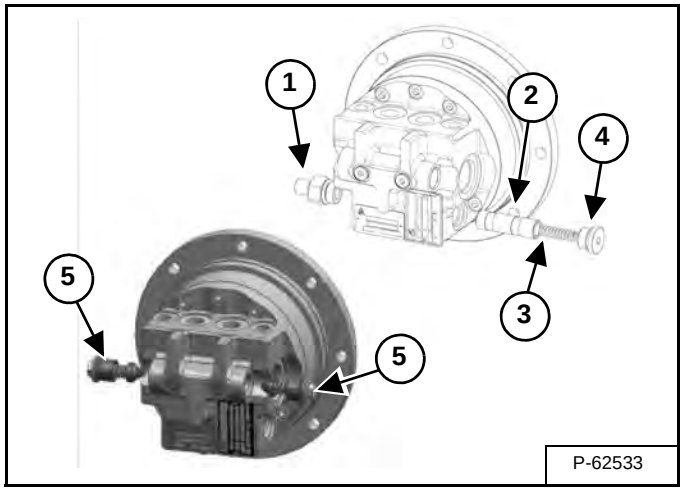


Install the cover (Item 1) **[Figure 20-80-35]**.

Install the six screws and washers (Item 2) **[Figure 20-80-35]**.

Tighten the screws in a crisscross manner to 40 - 50 N•m (30 - 37 ft-lb) torque.

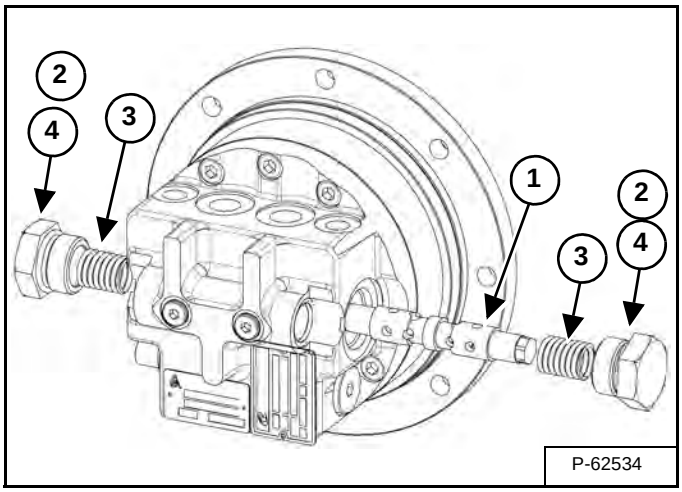
Figure 20-80-36



Install the plug (Item 1), piston valve (Item 2), springs (Item 3) and plug (Item 4) **[Figure 20-80-36]**.

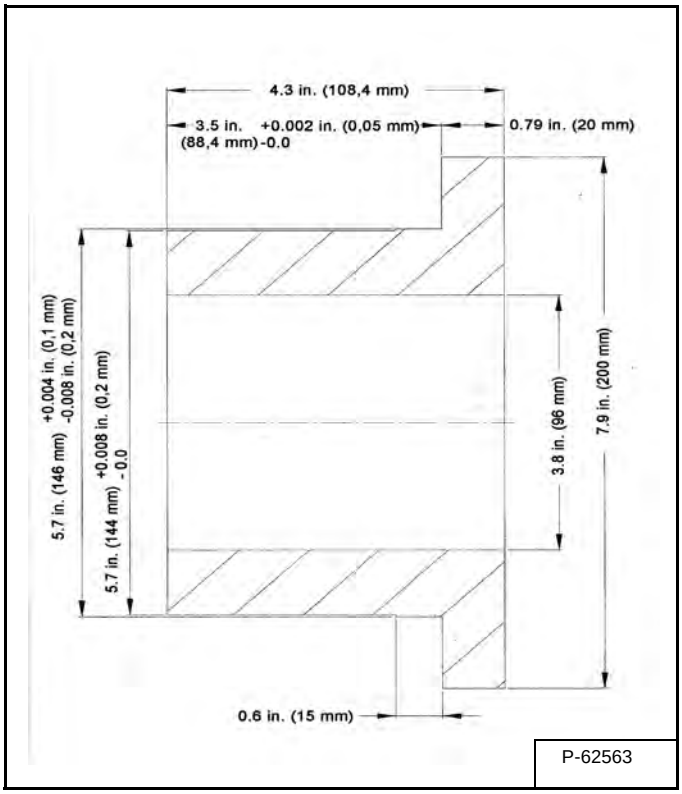
Install the valves (Item 5) **[Figure 20-80-36]** in the motor cover.

Figure 20-80-37



Install the counterbalance valve (Item 1), washers (Item 2), springs (Item 3) and plugs (Item 4) **[Figure 20-80-37]**.

Figure 20-80-38

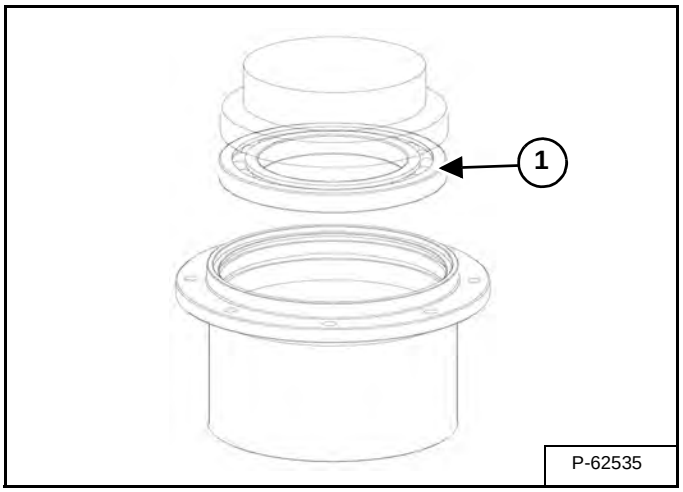


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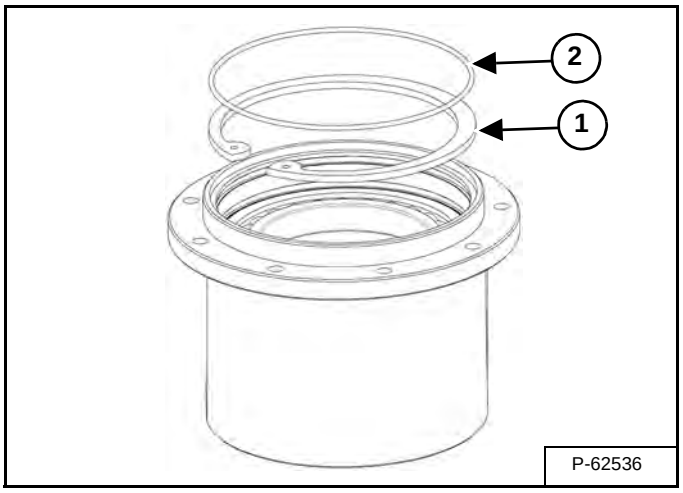
Assembly (Cont'd)

Figure 20-80-39



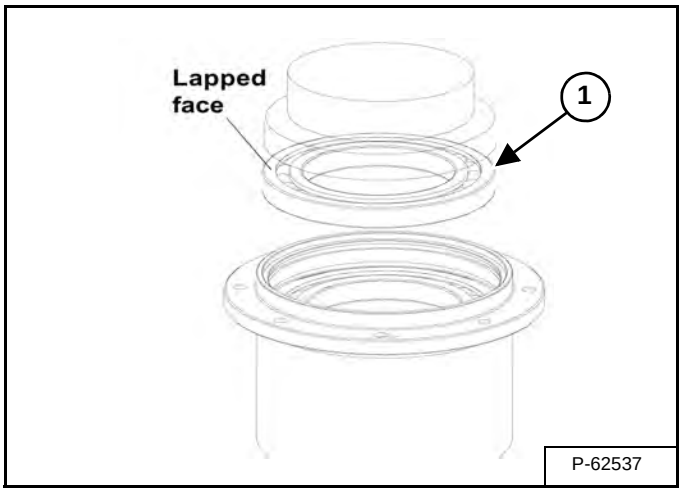
Install the ball bearing (Item 1) **[Figure 20-80-39]** using the bearing installation tool **[Figure 20-80-38]**.

Figure 20-80-40



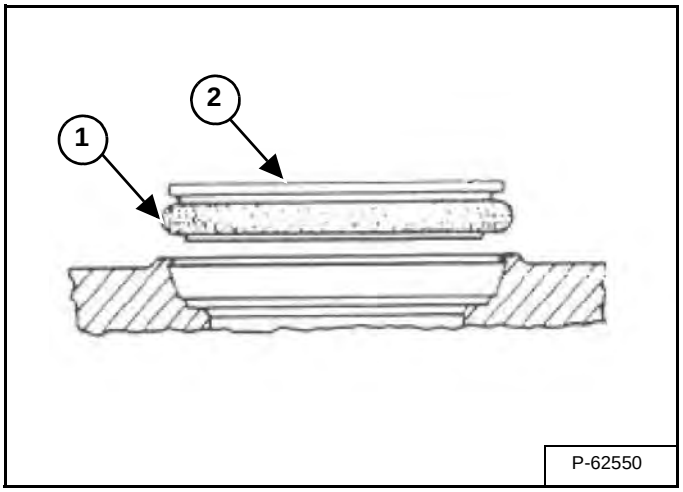
Install the retaining ring (Item 1) and O-Ring (Item 2) **[Figure 20-80-40]**.

Figure 20-80-41



Using the bearing installation tool **[Figure 20-80-38]**, install the second bearing (Item 1) **[Figure 20-80-41]** keeping the lapped face up. Use extreme care not to damage the lapped face of the bearing.

Figure 20-80-42



Install the O-ring (Item 1) **[Figure 20-80-42]** on the seal ring (Item 2) **[Figure 20-80-42]**.

NOTE: Inspect the seal ring for burrs before installing the O-ring. Install the seal ring making sure it is not twisted. To remove any twists, gently pull a section of the O-ring and let it snap back.

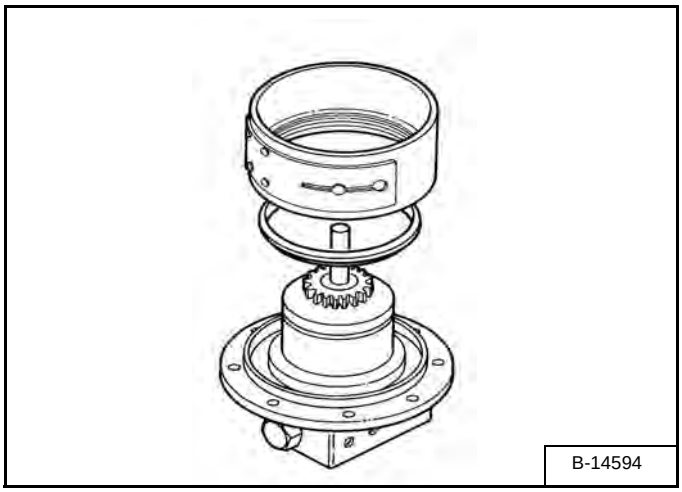
The O-ring, seal ring and motor assembly must be clean and free of any dust, oil film or foreign matter.

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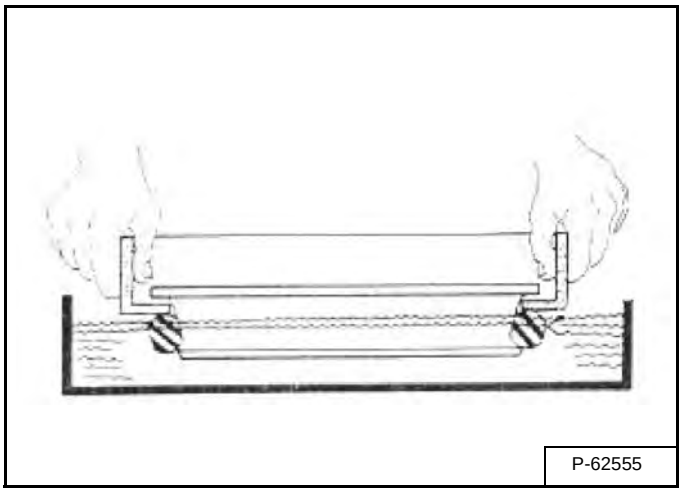
Assembly (Cont'd)

Figure 20-80-43



Install the seal seating tool (MEL1468) on the seal ring **[Figure 20-80-43]**.

Figure 20-80-44



The seal ring assembly **[Figure 20-80-44]** must be lubricated with alcohol, so the O-ring will slip past the housing retaining ring and seal uniform in the motor housing radius.

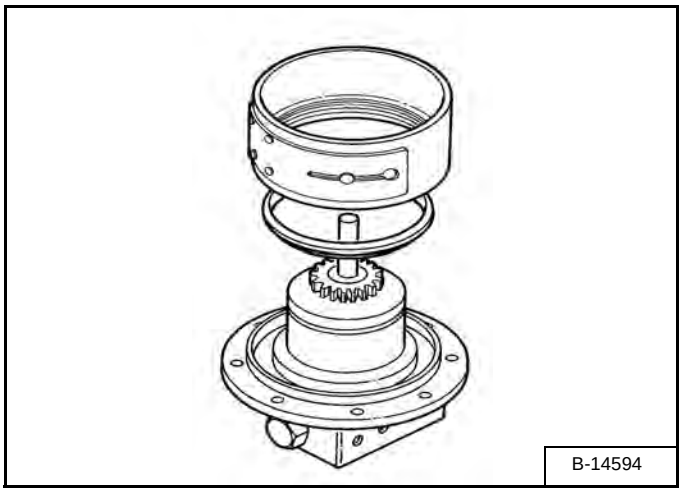
The O-ring **[Figure 20-80-44]** on the seal ring assembly must be lubricated with alcohol.

This will allow the O-ring to slide on the motor housing sealing surface without twisting.

Dip the O-ring **[Figure 20-80-44]** and seal ring assembly in a pan of alcohol.

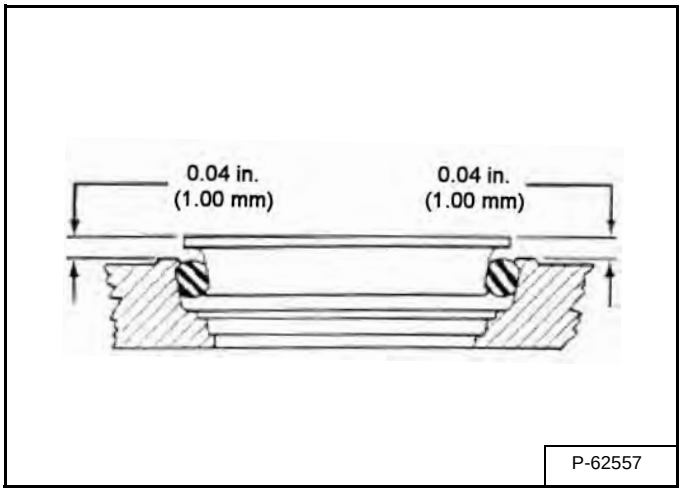
Shake off the excess alcohol and install the seal ring assembly on the motor **[Figure 20-80-44]**.

Figure 20-80-45



Use firm even pressure on the installation tool (MEL1468) to pop the O-ring into the motor housing **[Figure 20-80-45]**.

Figure 20-80-46



After the seal ring is installed, check the stand out height **[Figure 20-80-46]** in four places, 90° apart.

The stand out height is 1,00 mm (0.04 in).

NOTE: If the seal ring does not meet the height specifications inspect the torque ring for twists or obvious bulges.

Apply a light film of oil to the seal ring and lapped face of the bearing.

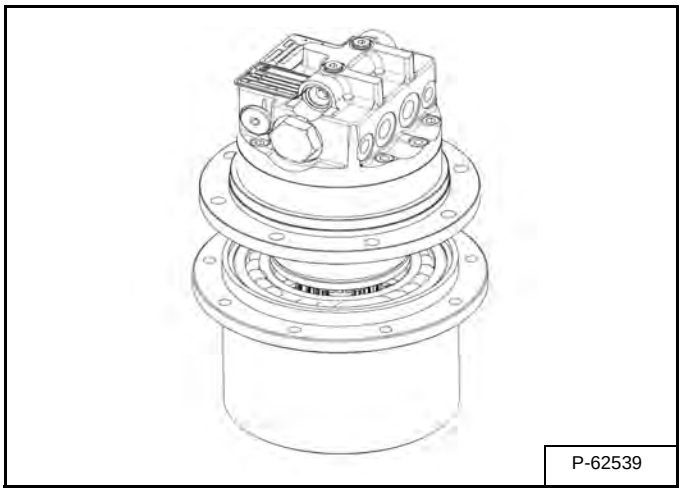
NOTE: Do not get any oil on the O-ring.

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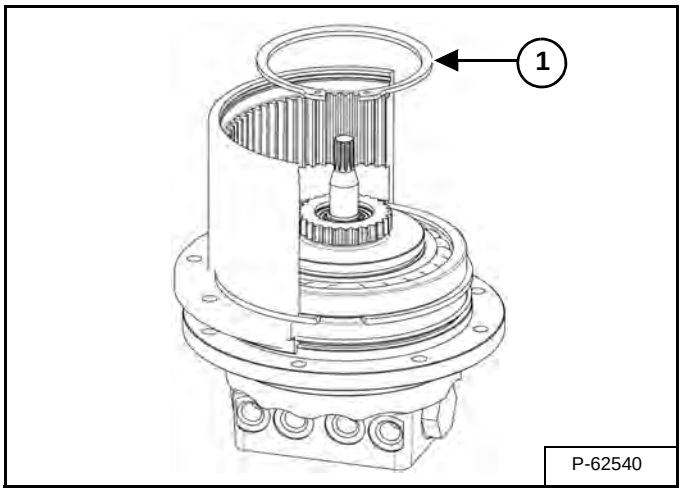
Assembly (Cont'd)

Figure 20-80-47



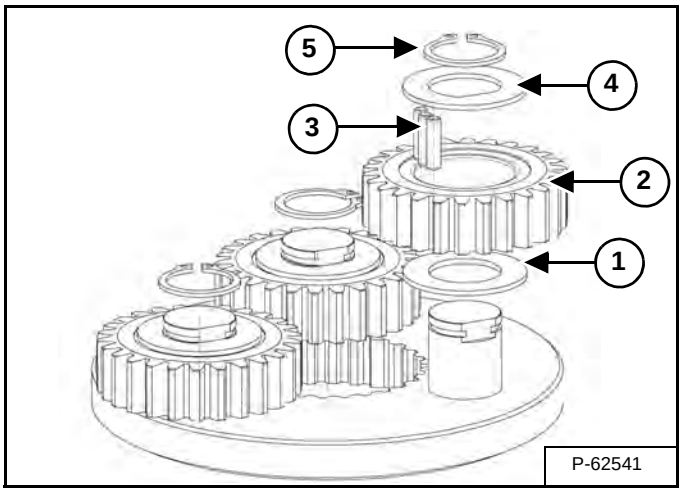
Press the reduction unit and motor assembly into the seat of the bearings **[Figure 20-80-47]**.

Figure 20-80-48



Install the external snap ring (Item 1) **[Figure 20-80-48]** in the motor reduction unit.

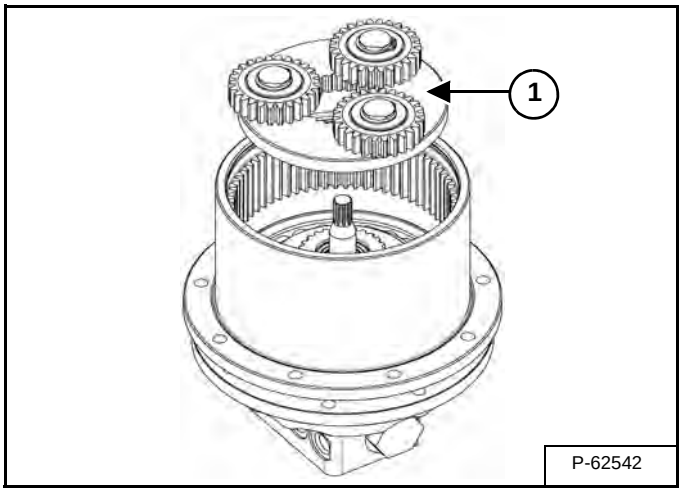
Figure 20-80-49



Install the thrust washers (Item 1), planetary gears (Item 2), needle bearing (Item 3) anti-rotation washers (Item 4) and external snap rings (Item 5) **[Figure 20-80-49]**.

NOTE: Install the snap rings so the opening of the snap ring is towards the outside.

Figure 20-80-50



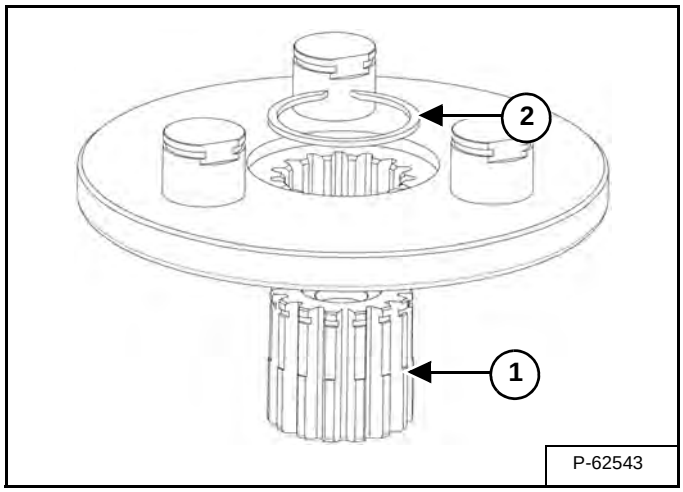
Install the planetary assembly (Item 1) **[Figure 20-80-50]**.

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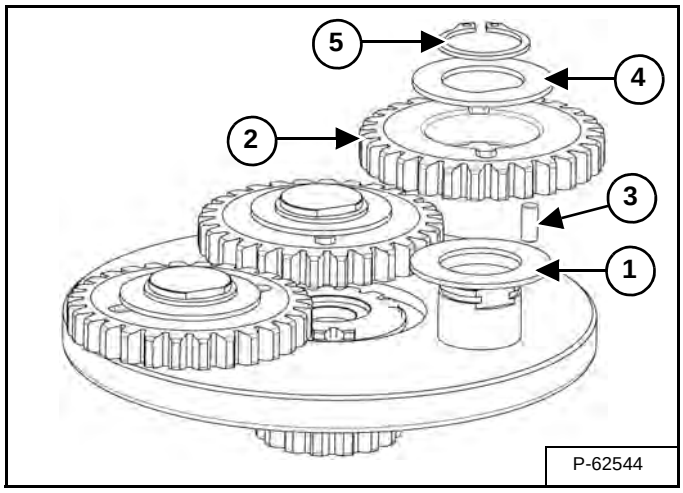
Assembly (Cont'd)

Figure 20-80-51



Install the sun gear (Item 1) into the planetary carrier and lock with the retaining ring (Item 2) **[Figure 20-80-51]**.

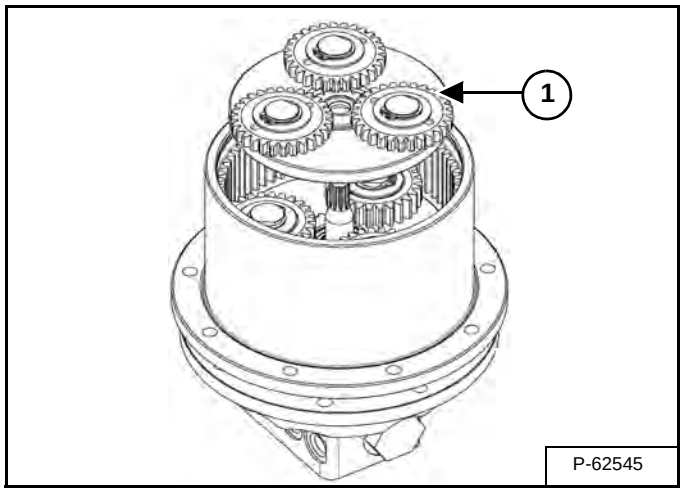
Figure 20-80-52



Install the thrust washers (Item 1), planetary gears (Item 2), needle bearings (Item 3), anti-rotation washers (Item 4) and external snap rings (Item 5) **[Figure 20-80-52]**.

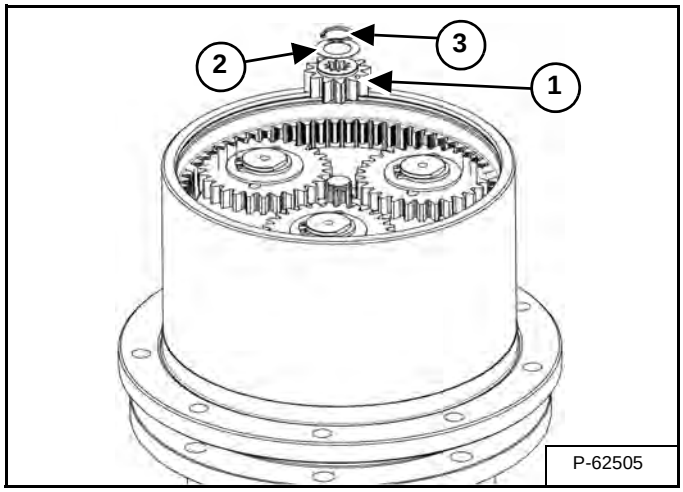
NOTE: Install the snap rings so the opening of the snap ring is towards the outside.

Figure 20-80-53



Install the outer planetary assembly (Item 1) **[Figure 20-80-53]**.

Figure 20-80-54



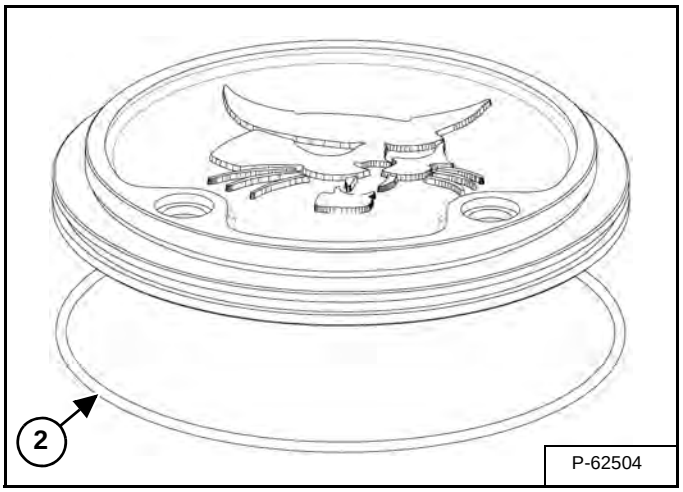
Install the sun gear (Item 1), shims (theoretical shimming 0,5 mm (0.02 in) (Item 2) and retaining ring (Item 3) **[Figure 20-80-54]**.

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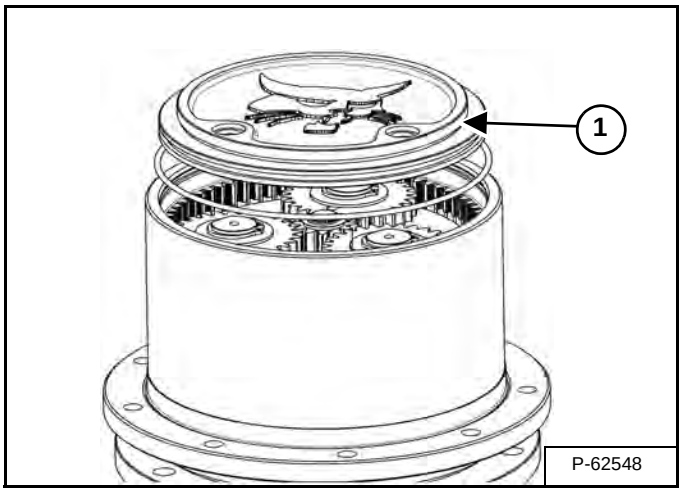
Assembly (Cont'd)

Figure 20-80-55



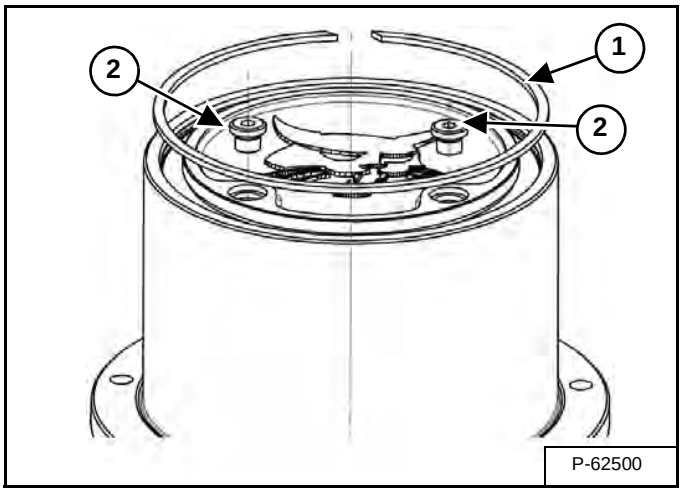
Install the O-ring (Item 1) **[Figure 20-80-55]** on the cover.

Figure 20-80-56



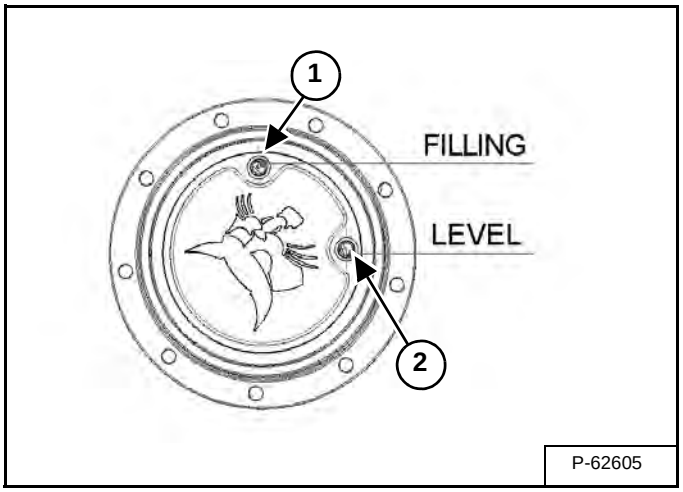
Install the cover (Item 1) **[Figure 20-80-56]** in the housing.

Figure 20-80-57



Install the snap ring (Item 1) **[Figure 20-80-57]** securing the reduction gear cover.

Figure 20-80-58



Add 0,4 L (0.42 qt) of gear lube 90W to the top plug hole (Item 1) until the gear lube is at the bottom of the plug hole (Item 2) **[Figure 20-80-58]**.

Install and tighten the two plugs (Item 2) **[Figure 20-80-57]**.

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TRAVEL MOTOR (TWO SPEED)

Description

The travel motor is a hydraulic motor which receives hydraulic fluid from the hydraulic pump through the hydraulic control valve. The speed that the travel motor rotates is related to the amount of hydraulic fluid it receives.

Removal And Installation

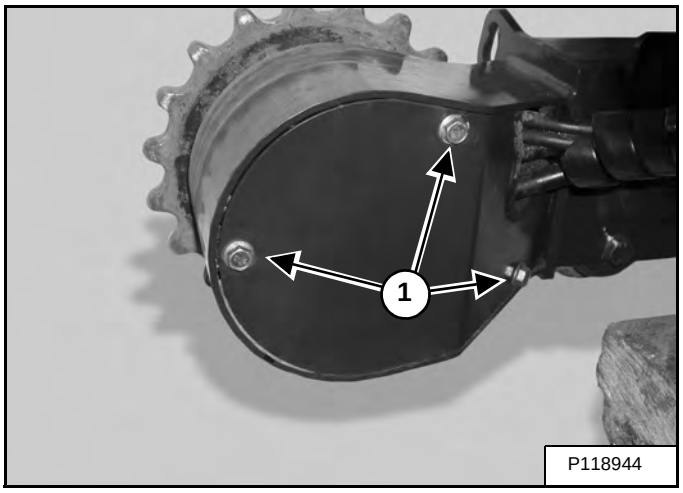
Remove the track. (See Track Removal And Installation on Page 30-20-5.)

IMPORTANT

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

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Figure 20-81-1



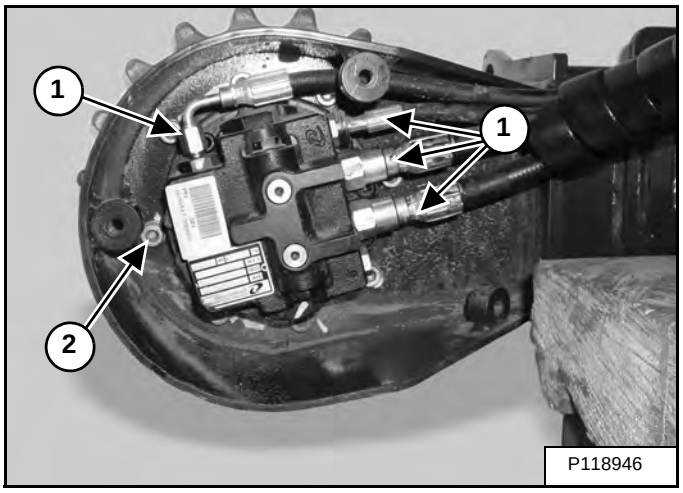
Remove the bolts (Item 1) **[Figure 20-81-1]** from the track frame cover.

Installation: Tighten the bolts to 20 - 25 N•m (15 - 18 ft-lb) torque.

Remove the cover.

Mark the hoses for correct installation.

Figure 20-81-2



Remove the hoses (Item 1) **[Figure 20-81-2]** from the travel motor.

Remove the travel motor mounting bolts (Item 2) **[Figure 20-81-2]**.

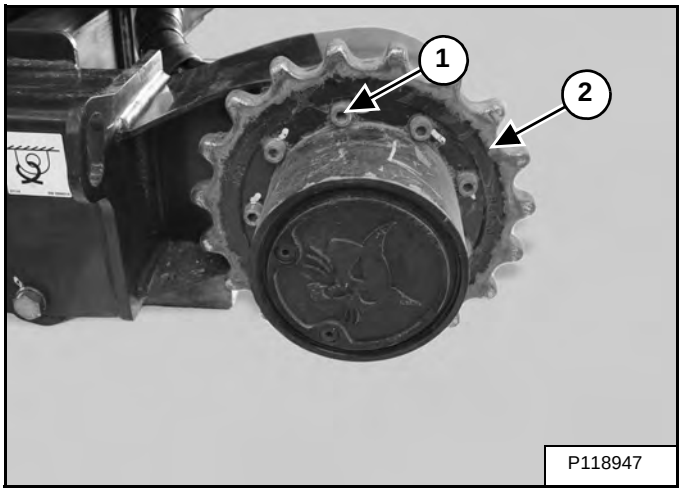
Installation: Tighten the bolts to 40 - 50 N•m (29 - 37 ft-lb)torque.

Remove the travel motor.

The drive sprocket can be removed without removing the travel motor.

If removing the sprocket from a travel motor that has been removed from the track frame, clamp the motor in a vise.

Figure 20-81-3



Remove the sprocket bolts (Item 1). Remove the sprocket (Item 2) **[Figure 20-81-3]**.

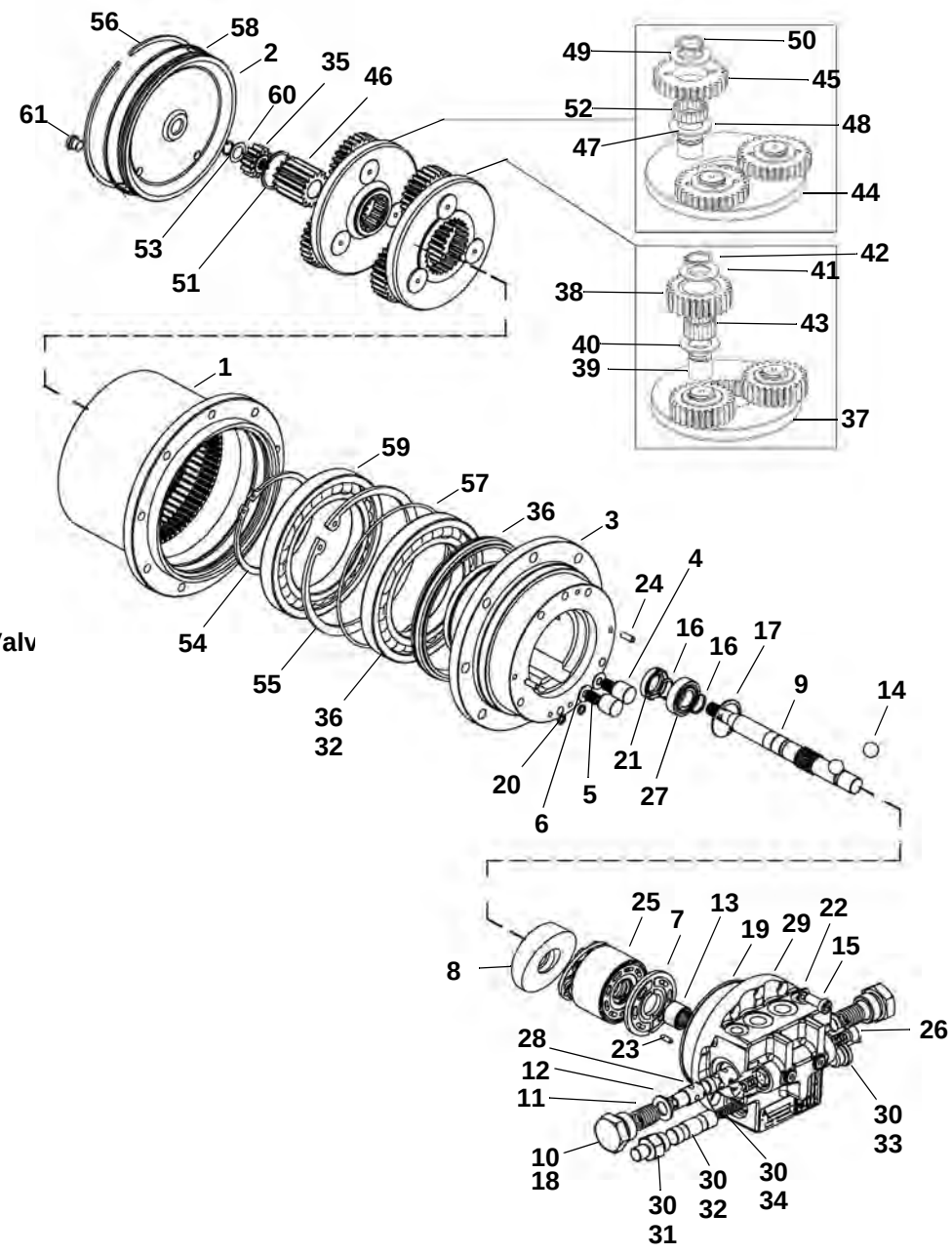
Installation: Tighten the bolts to 65 - 75 N•m (48 - 55 ft-lb) torque.

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Parts Identification

1. Housing
2. Cover
3. Hub
4. Change Disposition Piston
5. Change Disposition Spring
6. Change Disposition Washer
7. Distributor
8. Swash Plate
9. Motor Shaft
10. Plug
11. Spring
12. Washer
13. Needle Bearing
14. Sphere
15. Screw
16. Retaining Ring
17. Retaining Ring
18. O-ring
19. O-ring
20. O-ring
21. Seal
22. Washer
23. Pin
24. Pin
25. Rotating Pump Assy
26. Shockproof Valve
27. Ball Bearing
28. Counterbalance Valve
29. Cover
30. Change Displacement Valv
31. Fitting
32. Valve Piston
33. Plug
34. Spring
35. Gear
36. Bearing and Seal
37. Planetary Carrier
38. Planet Gear
39. Pin
40. Washer
41. Anti-Rotation Washer
42. Retaining Ring
43. Needle Bearing
44. Planetary Carrier
45. Planetary Gear
46. Sun Gear
47. Pin
48. Washer
49. Anti-Rotation Washer
50. Retaining Ring
51. Snap Ring
52. Needle Bearing
53. Retaining Ring
54. Retaining Ring
55. Retaining Ring
56. Snap Ring
57. O-ring
58. O-ring
59. Ball Bearing
60. Shim
61. Plug



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Disassembly

IMPORTANT

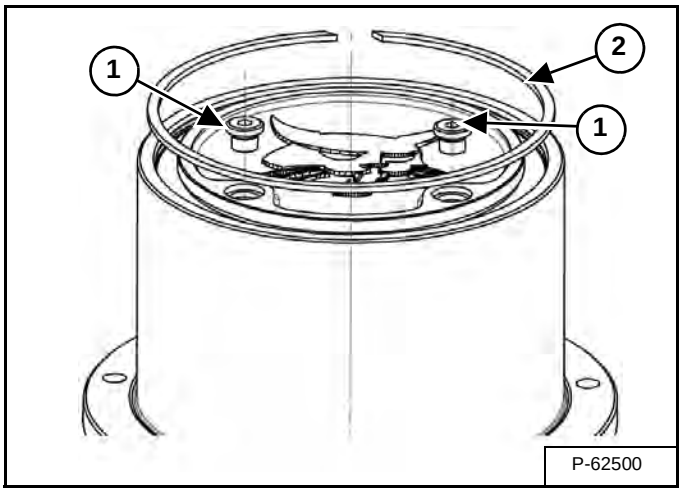
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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Clean the outside of the travel motor before disassembly.

Drain the lubricant from the travel motor.

Figure 20-81-4



Remove the drain plugs (Item 1) and snap ring (Item 2) **[Figure 20-81-4]** securing the reduction gear cover.

Drain the excess oil into a container.

Figure 20-81-5

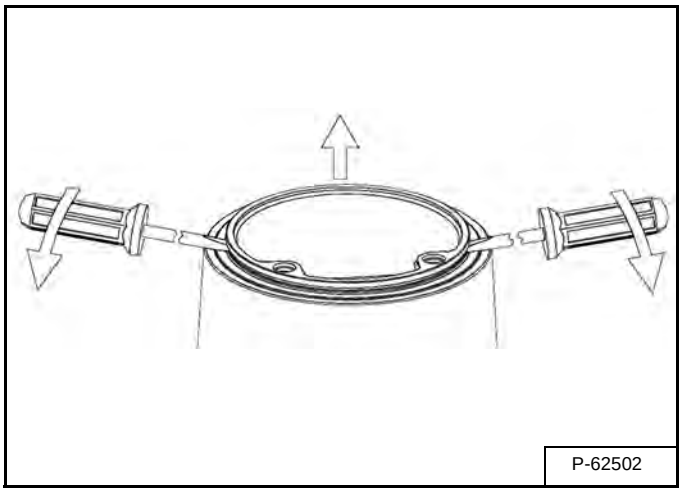
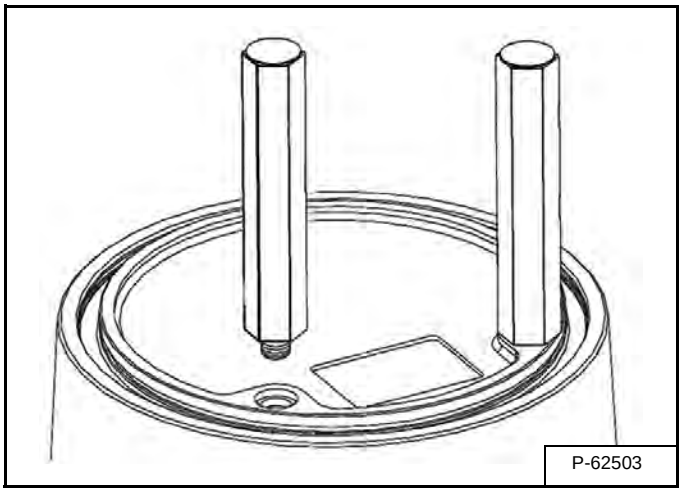


Figure 20-81-6



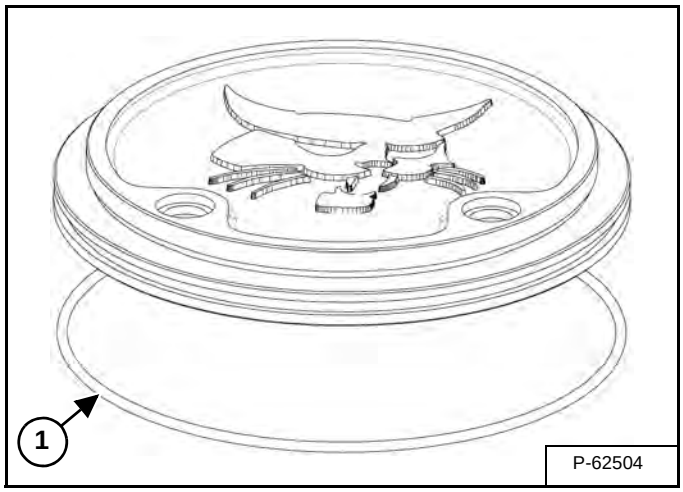
To remove the cover, lift the cover up using screwdrivers in the upper groove **[Figure 20-81-5]** or install two threaded pins in the drain holes and lift the cover off **[Figure 20-81-6]**.

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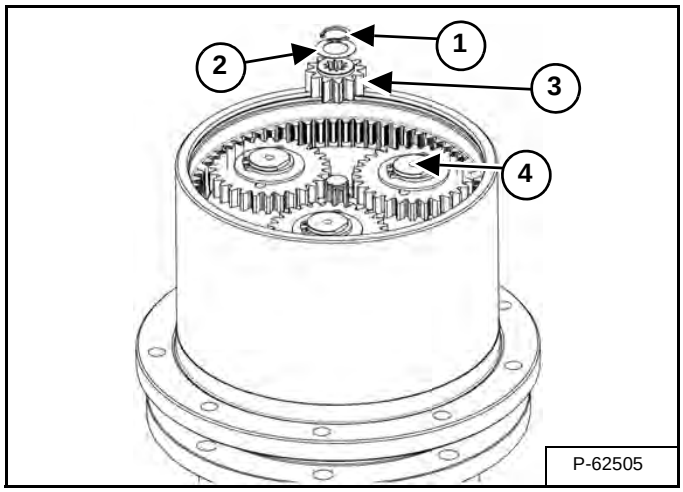
Disassembly (Cont'd)

Figure 20-81-7



Remove the O-ring (Item 1) **[Figure 20-81-7]** from the cover.

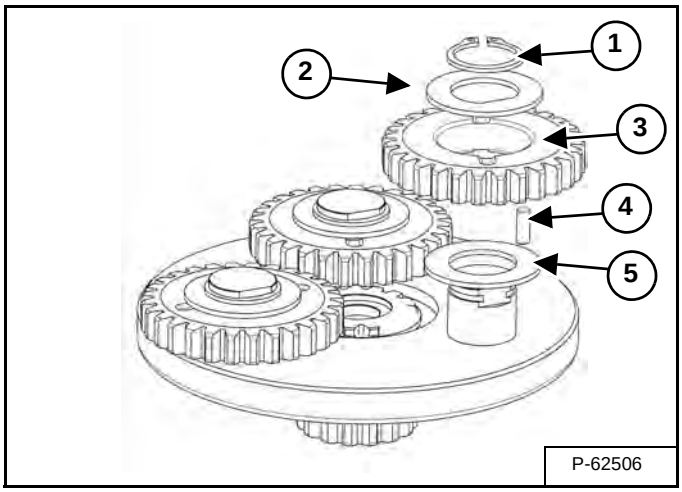
Figure 20-81-8



Remove the retaining ring (Item 1), shims (Item 2) and sun gear (Item 3) **[Figure 20-81-8]**.

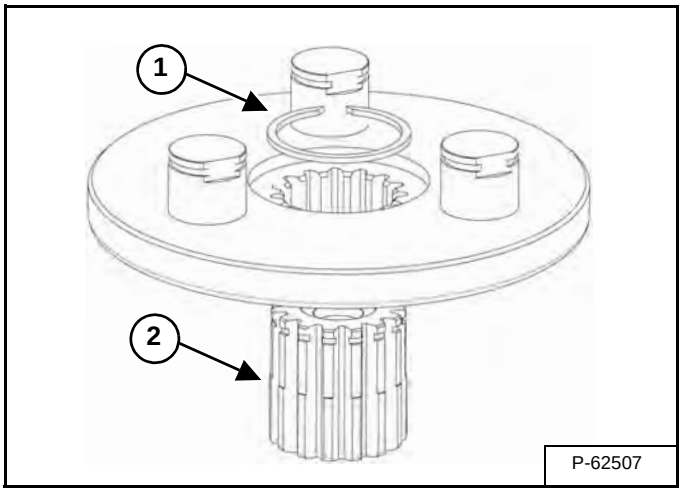
Remove the first stage planetary carrier (Item 4) **[Figure 20-81-8]** using your hands.

Figure 20-81-9



Remove the retaining rings (Item 1), anti-rotation washer (Item 2), planetary gears (Item 3), needle bearings (Item 4) and thrust washer (Item 5) **[Figure 20-81-9]** from the first stage planetary carrier assembly.

Figure 20-81-10



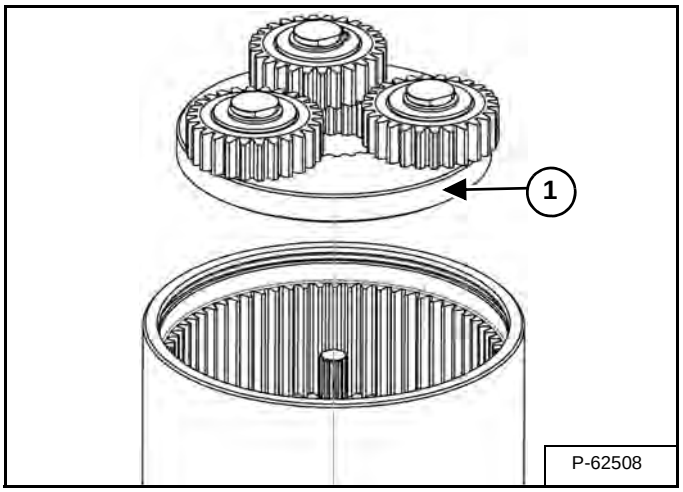
Remove the retaining ring (Item 1) from the second reduction sun gear (Item 2) **[Figure 20-81-10]** and push the gear down to remove from planetary carrier.

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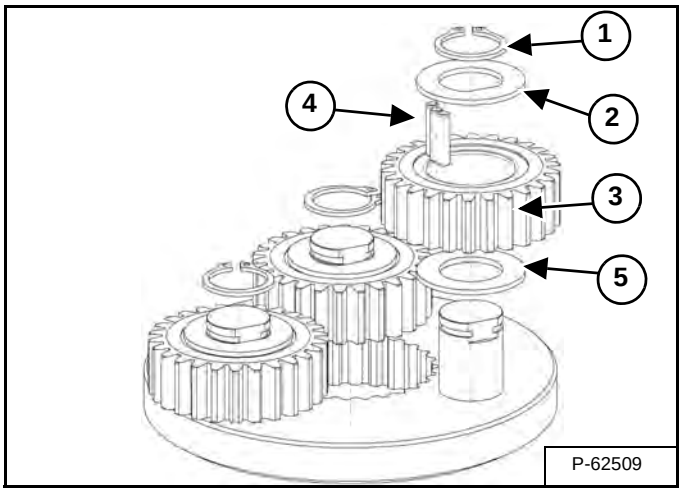
Disassembly (Cont'd)

Figure 20-81-11



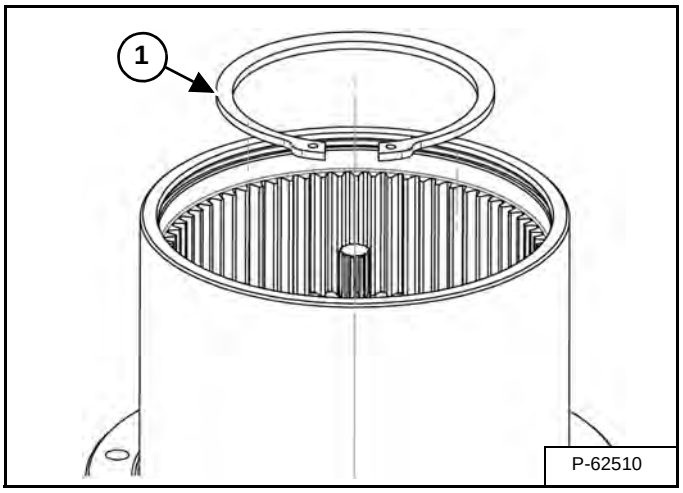
Remove the second stage planetary carrier (Item 1) **[Figure 20-81-11]** using your hands.

Figure 20-81-12



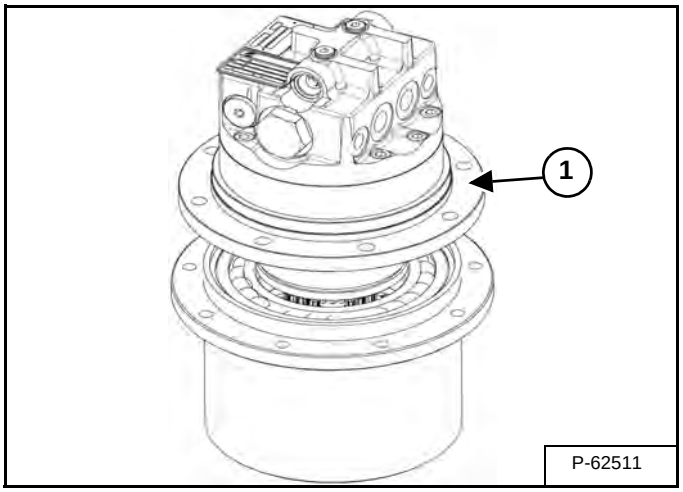
Remove the retaining rings (Item 1), anti-rotation washer (Item 2), planetary gears (Item 3), needle bearings (Item 4) and thrust washer (Item 5) **[Figure 20-81-12]** from the first stage planetary carrier assembly.

Figure 20-81-13



Remove the retaining ring (Item 1) **[Figure 20-81-13]** from the hub to free the two bearings, ring gear and motor.

Figure 20-81-14



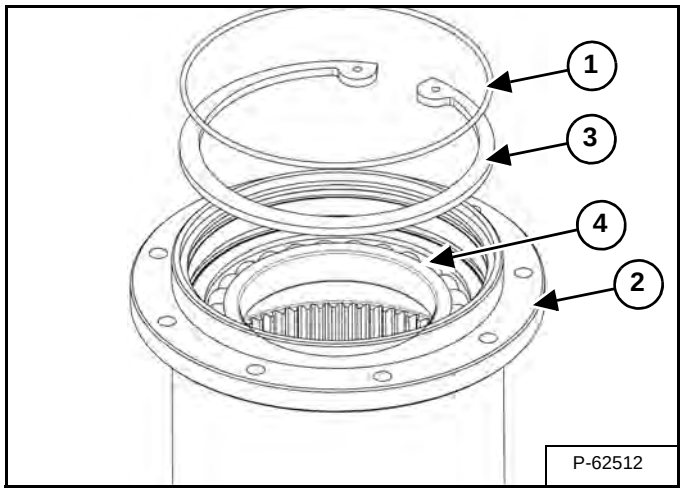
Remove the hub (Item 1) **[Figure 20-81-14]** from the ring gear.

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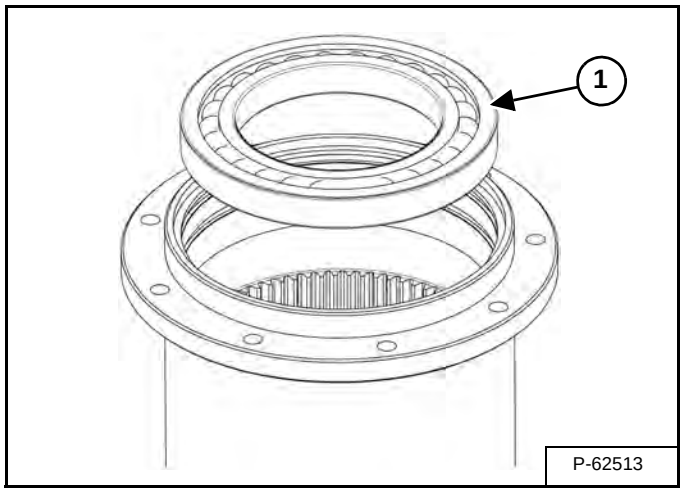
Disassembly (Cont'd)

Figure 20-81-15



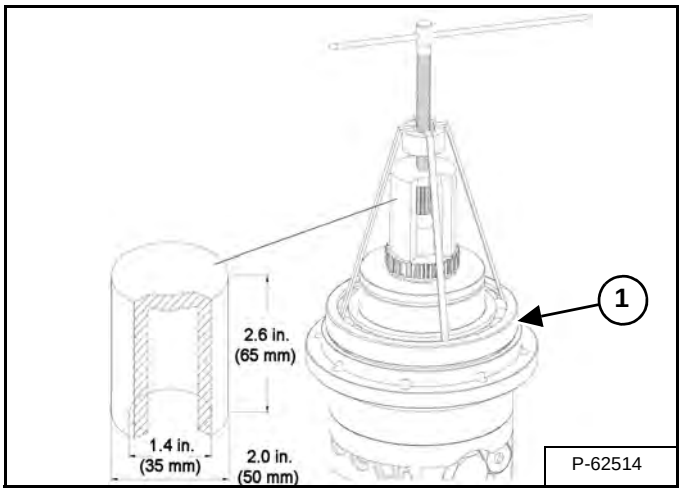
Remove the O-ring (Item 1) from the ring gear (Item 2) and the retaining ring (Item 3) securing the bearing (Item 4) **[Figure 20-81-15]**.

Figure 20-81-16



Remove the ball bearing (Item 1) **[Figure 20-81-16]** by pushing from underneath.

Figure 20-81-17

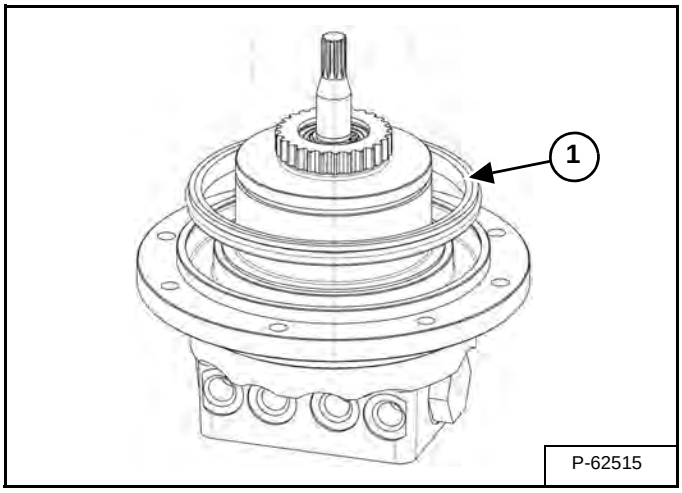


Remove the lapped bearing / front seal (Item 1) **[Figure 20-81-17]**.

NOTE: Be careful not to damage the bottom polished / lapped surface of the bearing [Figure 20-81-17].

NOTE: A commercial bearing extractor and supporting cap, as shown, will be required for bearing removal [Figure 20-81-17]. Be careful not to damage the bottom polished / lapped surface of the bearing.

Figure 20-81-18



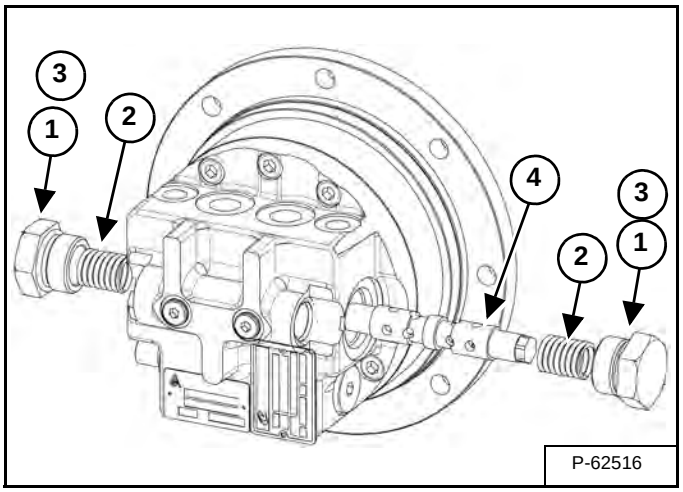
Remove the front seal ring (Item 1) **[Figure 20-81-18]**.

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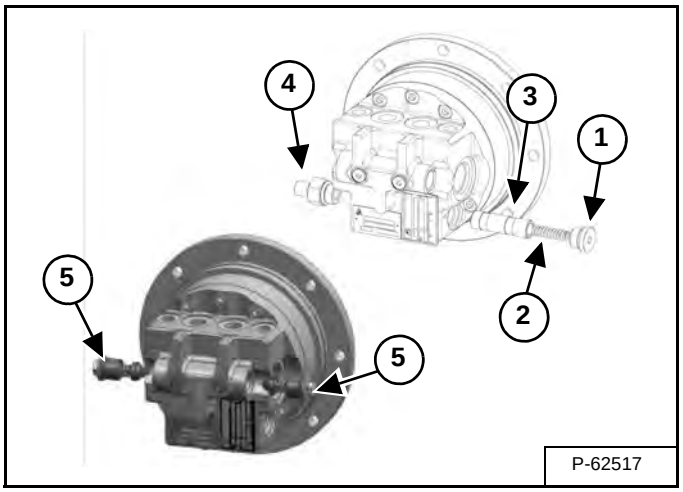
Disassembly (Cont'd)

Figure 20-81-19



Remove the plugs (Item 1), springs (Item 2), washers (Item 3) and counterbalance valve (Item 4) **[Figure 20-81-19]**.

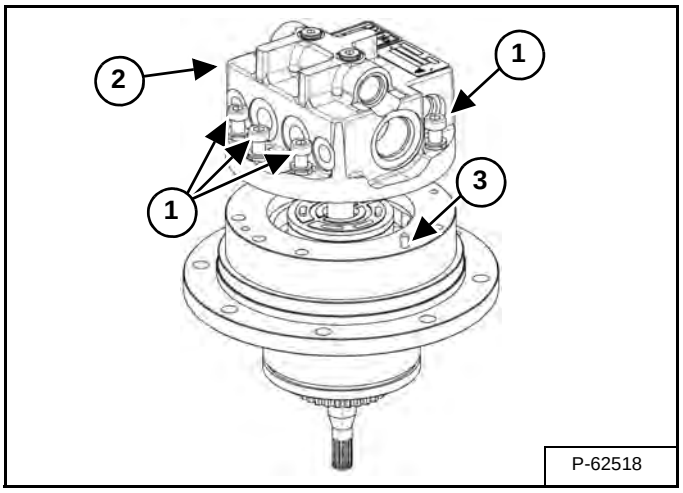
Figure 20-81-20



Remove the plug (Item 1), springs (Item 2), piston valve (Item 3) and plug (Item 4) **[Figure 20-81-20]**.

Remove the valves (Item 5) **[Figure 20-81-20]** from the motor cover.

Figure 20-81-21

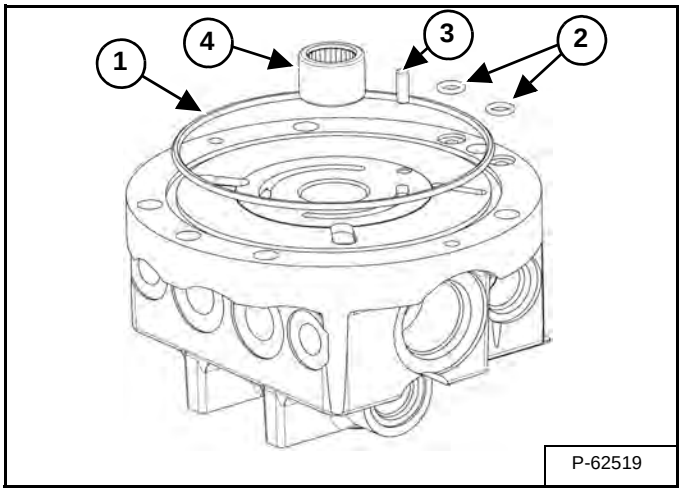


Remove the six screws and washers (Item 1) **[Figure 20-81-21]**.

Remove the cover (Item 2) **[Figure 20-81-21]**.

NOTE: Removal of pin (Item 3) [Figure 20-81-21] is optional.

Figure 20-81-22



Remove large O-ring (Item 1), small O-rings (Item 2), pin (Item 3) and needle bearing (Item 4) **[Figure 20-81-22]** from the cover.

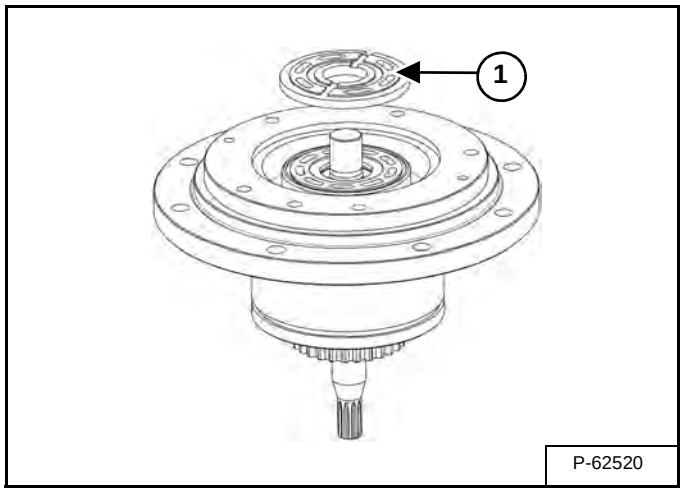
NOTE: Removal of pin (Item 3) [Figure 20-81-22] is optional.

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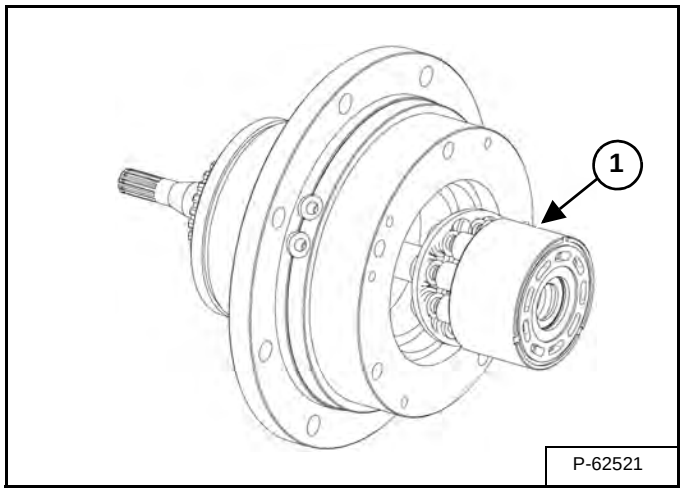
Disassembly (Cont'd)

Figure 20-81-23



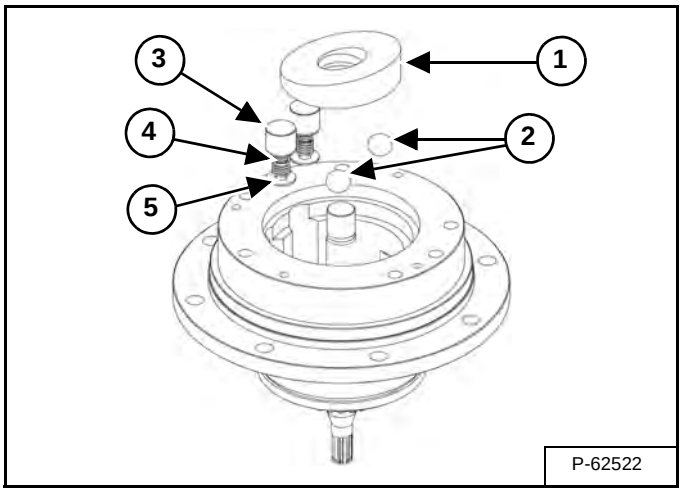
Remove the valve plate (Item 1) **[Figure 20-81-23]**.

Figure 20-81-24



Remove the rotating pump assembly (Item 1) **[Figure 20-81-24]**.

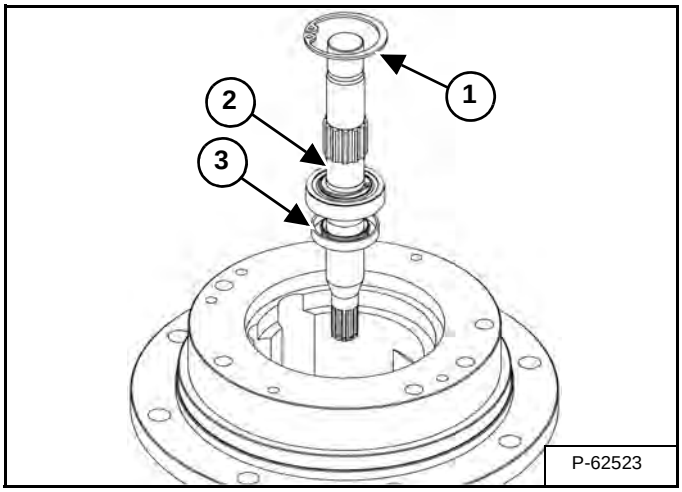
Figure 20-81-25



Remove the swash plate (Item 1) **[Figure 20-81-25]**.

Remove the sphere (Item 2), pistons (Item 3), springs (Item 4) and washers (Item 5) **[Figure 20-81-25]**.

Figure 20-81-26



Remove the retaining ring (Item 1) and bearing / drive shaft assembly (Item 2) **[Figure 20-81-26]**.

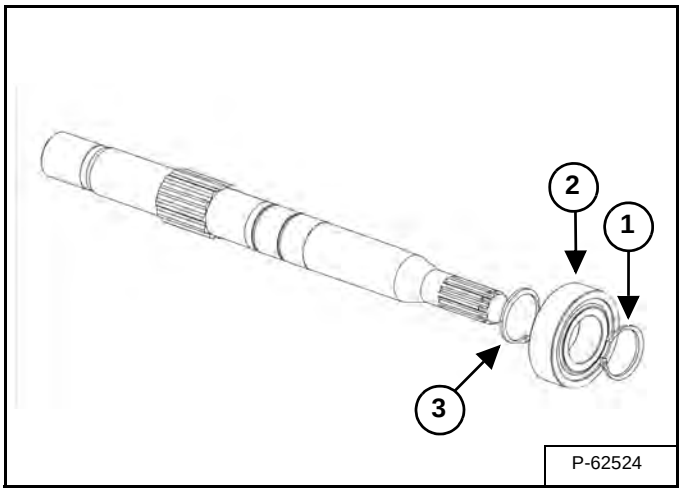
Remove the oil seal (Item 3) **[Figure 20-81-26]**.

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Disassembly (Cont'd)

Figure 20-81-27



Remove the retaining ring (Item 1), ball bearing (Item 2) and the second retaining ring (Item 3) **[Figure 20-81-27]**.

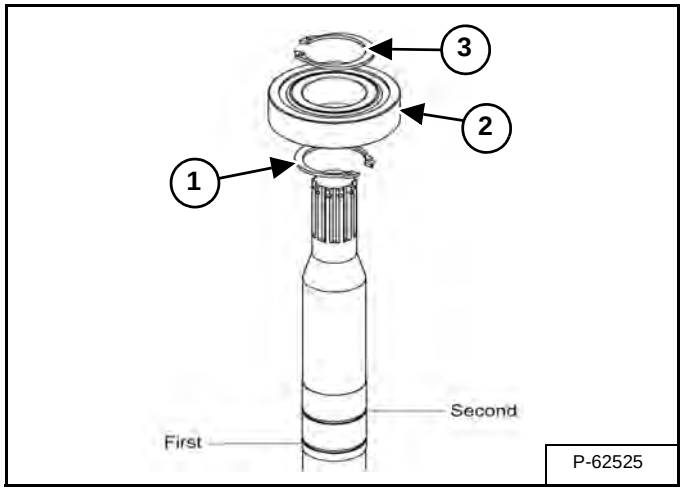
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Assembly

Clean all parts in solvent and dry with compressed air. Inspect all parts and replace any that are damaged. If any of the planetary gears (first or second) are damaged, replace the damaged planetary stage assembly (first or second) complete with the sun gear that the damaged gear is from. One damaged gear can cause microscopic fatigue cracks in mating gear teeth and cause premature failure after servicing. Apply oil to all O-rings and light grease to the ball and roller bearings before installation.

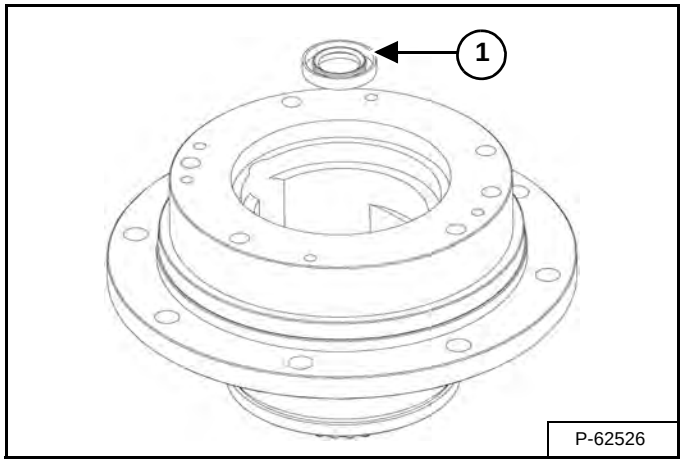
Figure 20-81-28



Install the retaining ring (Item 1) **[Figure 20-81-28]** on the drive shaft.

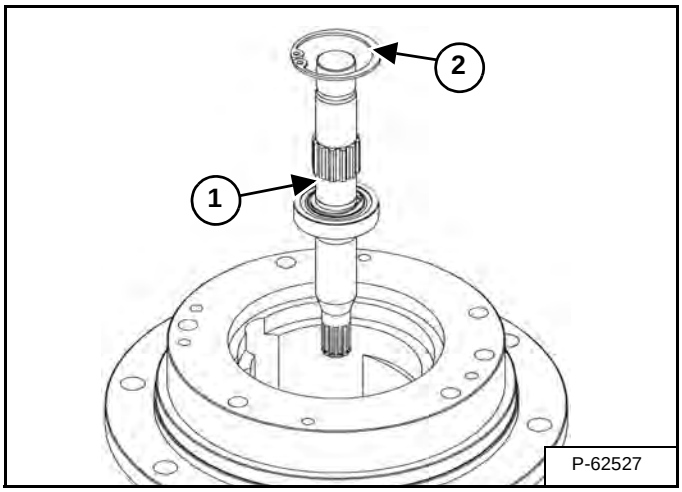
Install the ball bearing (Item 2) and the retaining ring (Item 3) **[Figure 20-81-28]**.

Figure 20-81-29



Install the oil seal (Item 1) **[Figure 20-81-29]** in the hub.

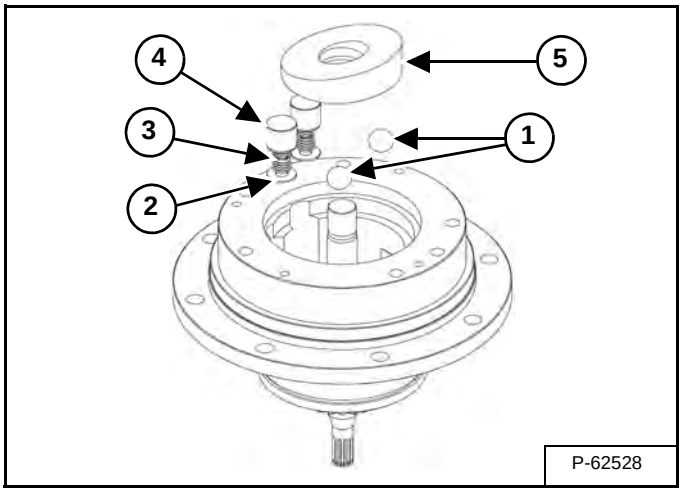
Figure 20-81-30



Install the bearing / drive shaft assembly (Item 1) **[Figure 20-81-30]**.

Install the retaining ring (Item 2) **[Figure 20-81-30]**.

Figure 20-81-31



Install the sphere (Item 1), washers (Item 2), springs (Item 3) and pistons (Item 4) **[Figure 20-81-31]**.

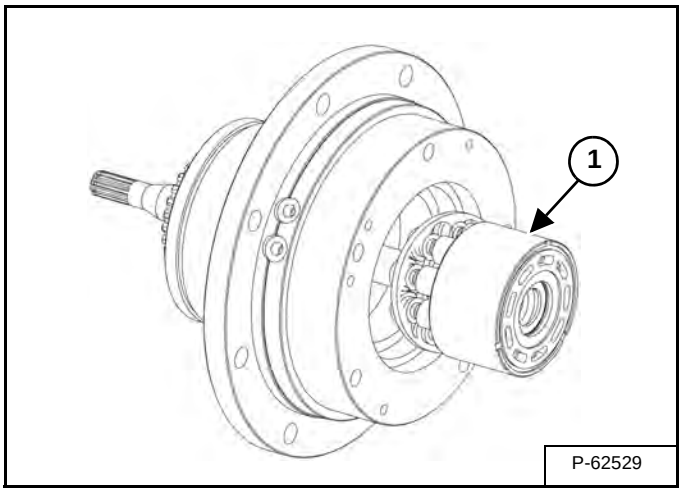
Install the swash plate (Item 5) **[Figure 20-81-31]**.

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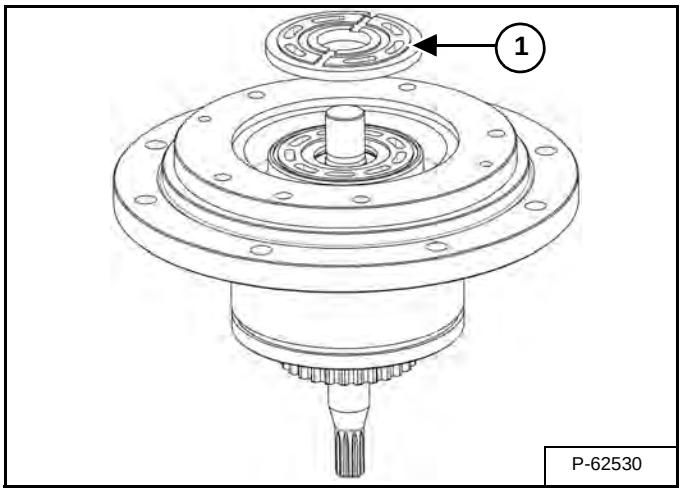
Assembly (Cont'd)

Figure 20-81-32



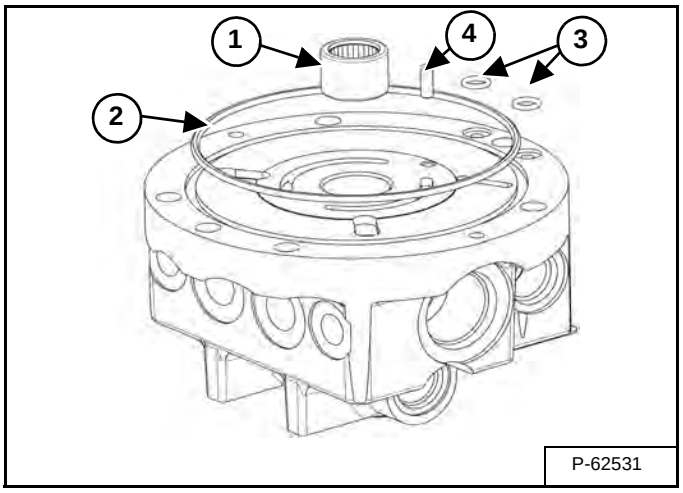
Install the rotating pump assembly (Item 1) **[Figure 20-81-32]**.

Figure 20-81-33



Install the valve plate (Item 1) **[Figure 20-81-33]**.

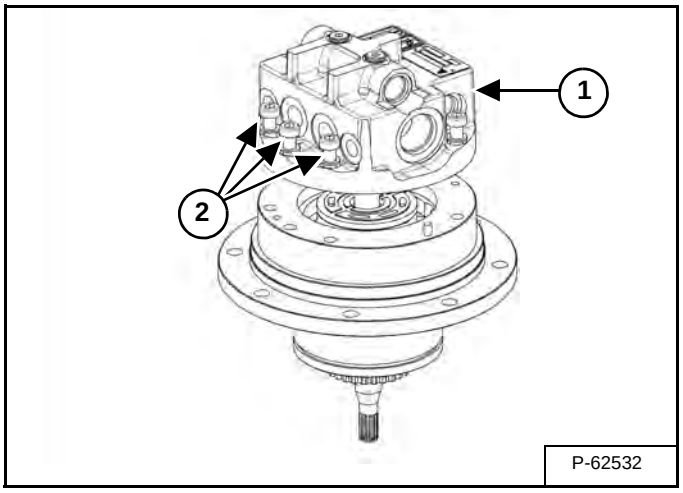
Figure 20-81-34



Install the needle bearing (Item 1) **[Figure 20-81-34]** in the cover so the bearing edge extends from the face of the cover 2,5 - 2,8 mm (0.98 - 0.110 in).

Install the large O-ring (Item 2), small O-rings (Item 3) and pin (Item 4) **[Figure 20-81-34]** in the cover.

Figure 20-81-35



Install the cover (Item 1) **[Figure 20-81-35]**.

Install the six screws and washers (Item 2) **[Figure 20-81-35]**.

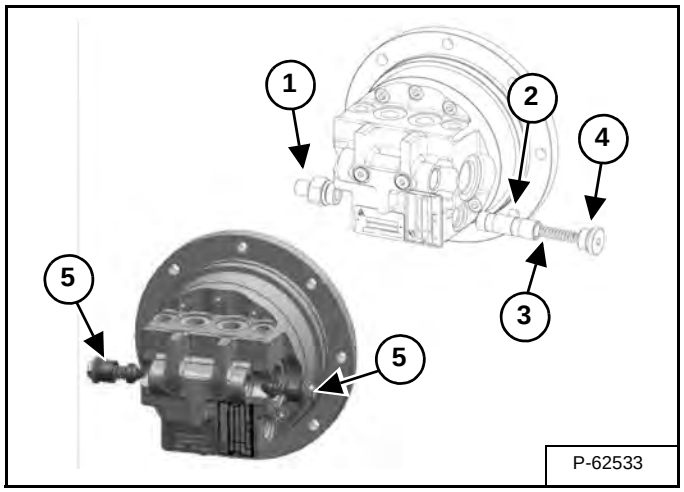
Tighten the screws in a crisscross manner to 40 - 50 N•m (30 - 37 ft-lb) torque.

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Assembly (Cont'd)

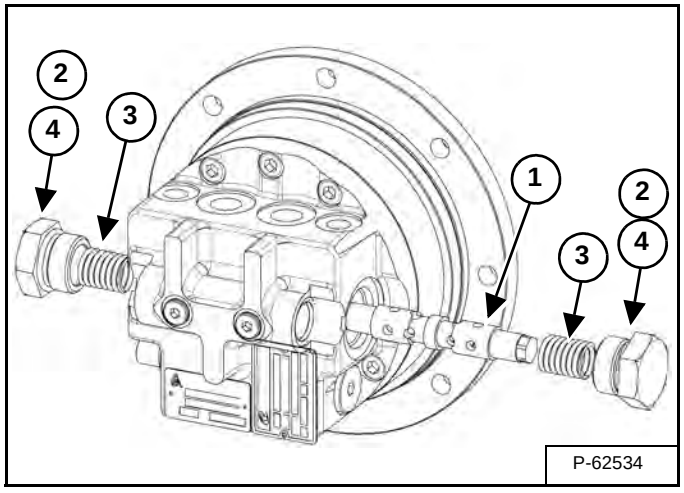
Figure 20-81-36



Install the plug (Item 1), piston valve (Item 2), springs (Item 3) and plug (Item 4) **[Figure 20-81-36]**.

Install the valves (Item 5) **[Figure 20-81-36]** in the motor cover.

Figure 20-81-37



Install the counterbalance valve (Item 1), washers (Item 2), springs (Item 3) and plugs (Item 4) **[Figure 20-81-37]**.

Figure 20-81-38

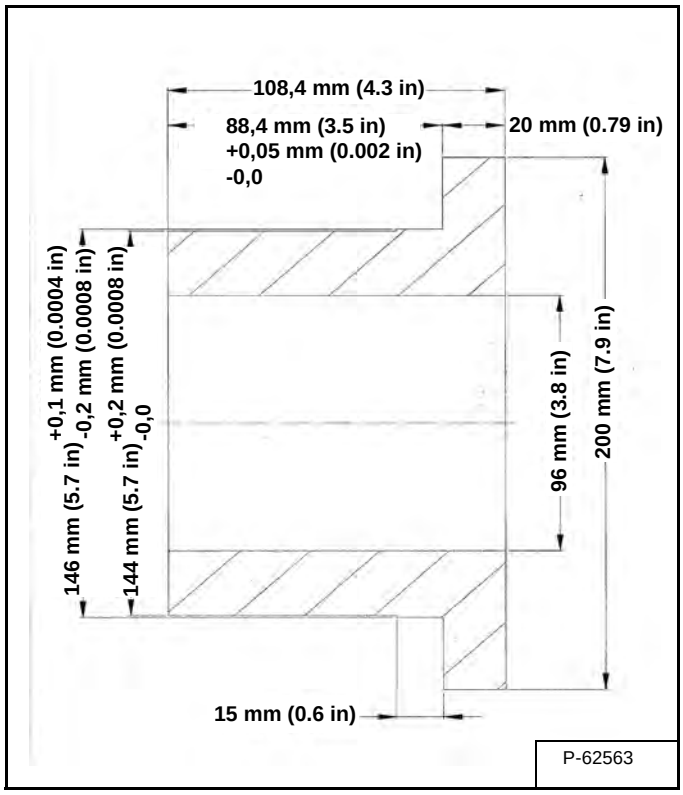
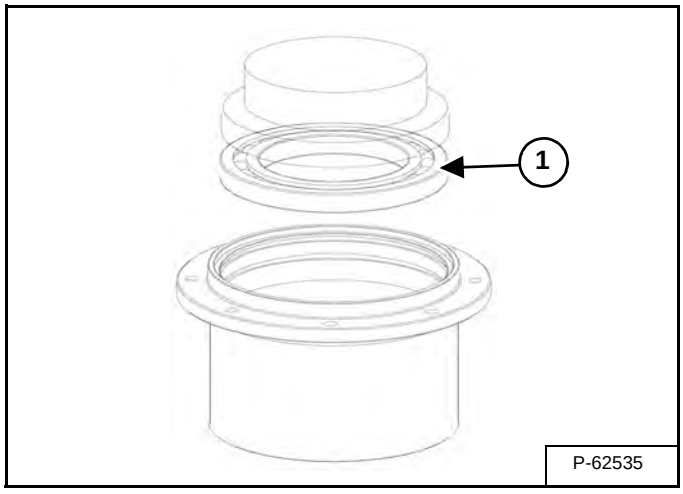


Figure 20-81-39



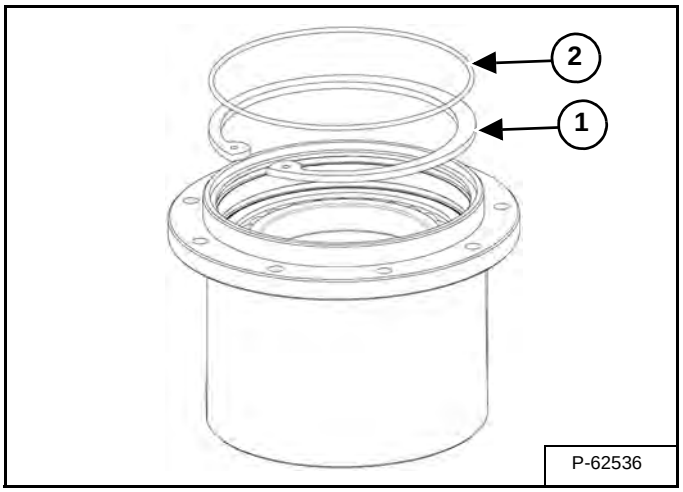
Install the ball bearing (Item 1) **[Figure 20-81-39]** using the bearing installation tool **[Figure 20-81-38]**.

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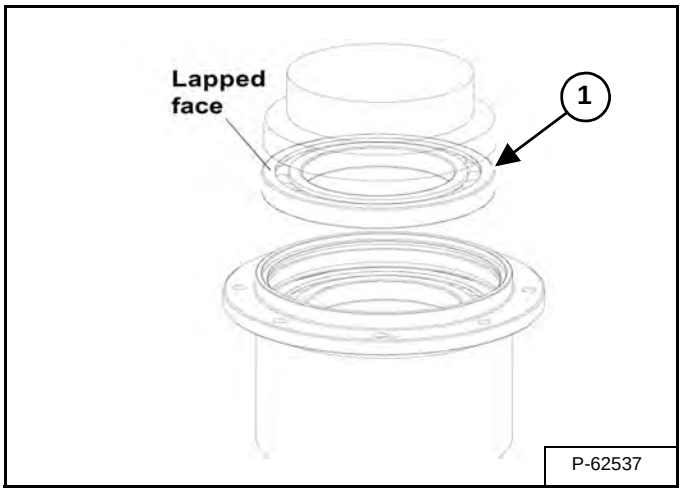
Assembly (Cont'd)

Figure 20-81-40



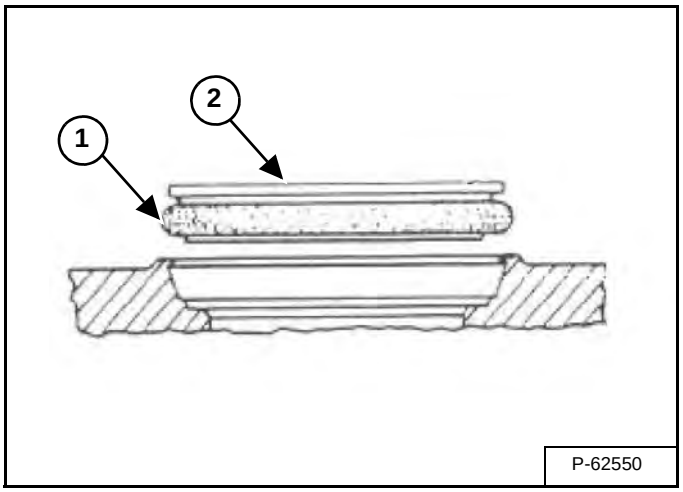
Install the retaining ring (Item 1) and O-ring (Item 2) **[Figure 20-81-40]**.

Figure 20-81-41



Using the bearing installation tool **[Figure 20-81-38]**, install the second bearing (Item 1) **[Figure 20-81-41]** keeping the lapped face up. Use extreme care not to damage the lapped face of the bearing.

Figure 20-81-42

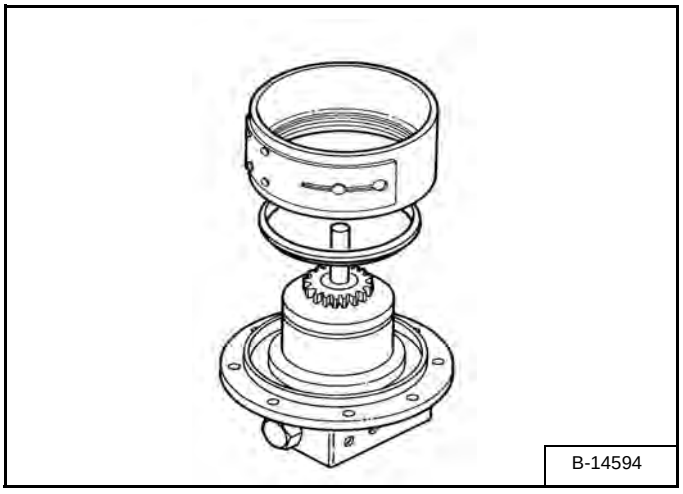


Install the O-ring (Item 1) **[Figure 20-81-42]** on the seal ring (Item 2) **[Figure 20-81-42]**.

NOTE: Inspect the seal ring for burrs before installing the O-ring. Install the seal ring making sure it is not twisted. To remove any twists, gently pull a section of the O-ring and let it snap back.

The O-ring, seal ring and motor assembly must be clean and free of any dust, oil film or foreign matter.

Figure 20-81-43



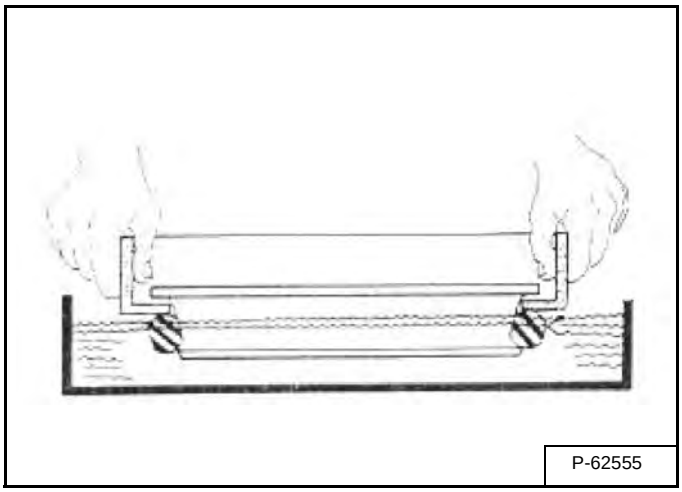
Install the seal seating tool (MEL1468) on the seal ring **[Figure 20-81-43]**.

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Assembly (Cont'd)

Figure 20-81-44



The seal ring assembly **[Figure 20-81-44]** must be lubricated with alcohol, so the O-ring will slip past the housing retaining ring and seal uniform in the motor housing radius.

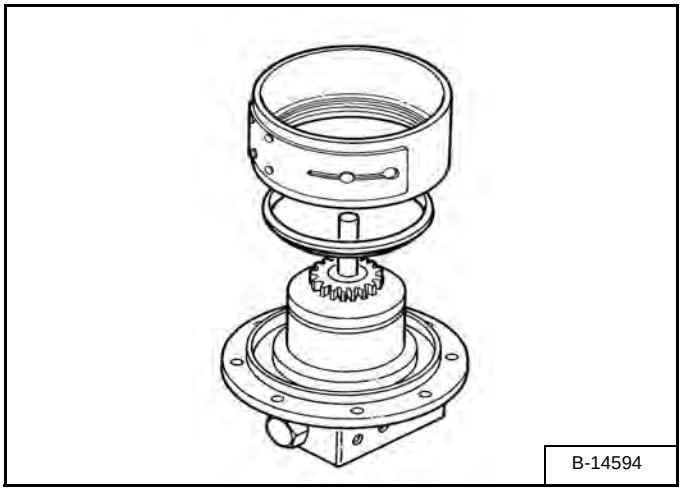
The O-ring **[Figure 20-81-44]** on the seal ring assembly must be lubricated with alcohol.

This will allow the O-ring to slide on the motor housing sealing surface without twisting.

Dip the O-ring **[Figure 20-81-44]** and seal ring assembly in a pan of alcohol.

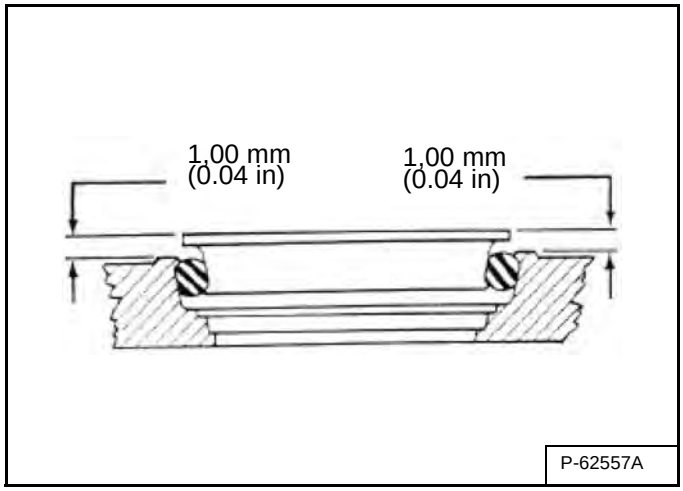
Shake off the excess alcohol and install the seal ring assembly on the motor **[Figure 20-81-44]**.

Figure 20-81-45



Use firm even pressure on the installation tool (MEL1468) to pop the O-ring into the motor housing **[Figure 20-81-45]**.

Figure 20-81-46



After the seal ring is installed, check the stand out height **[Figure 20-81-46]** in four places, 90° apart.

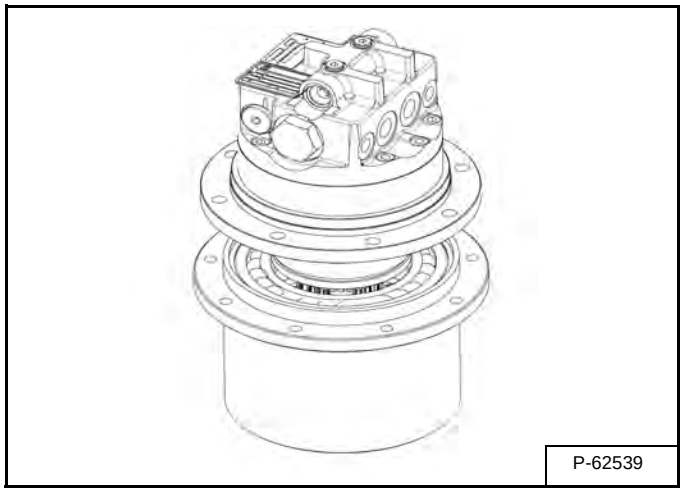
The stand out height is 1,00 mm (0.04 in).

NOTE: If the seal ring does not meet the height specifications inspect the torque ring for twists or obvious bulges.

Apply a light film of oil to the seal ring and lapped face of the bearing.

NOTE: Do not get any oil on the O-ring.

Figure 20-81-47



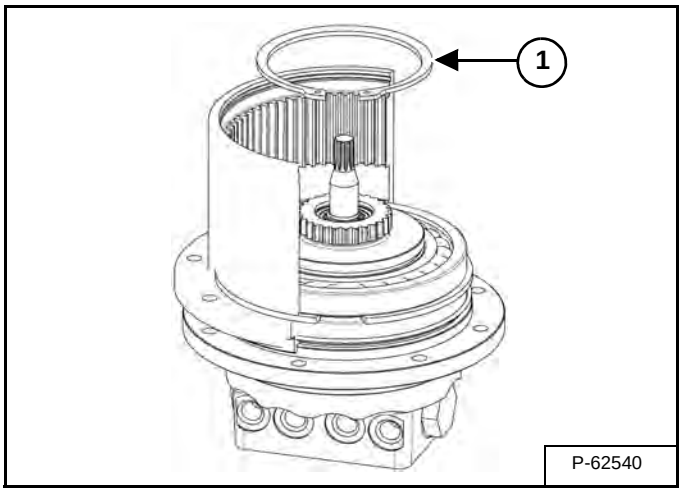
Press the reduction unit and motor assembly into the seat of the bearings **[Figure 20-81-47]**.

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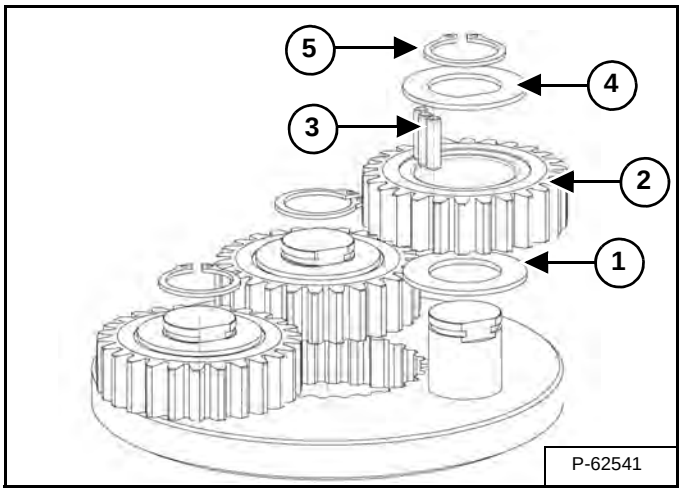
Assembly (Cont'd)

Figure 20-81-48



Install the external snap ring (Item 1) **[Figure 20-81-48]** in the motor reduction unit.

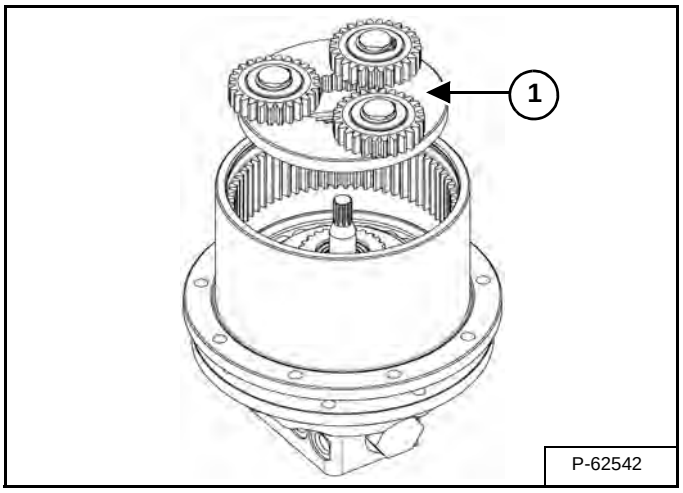
Figure 20-81-49



Install the thrust washers (Item 1), planetary gears (Item 2), needle bearing (Item 3) anti-rotation washers (Item 4) and external snap rings (Item 5) **[Figure 20-81-49]**.

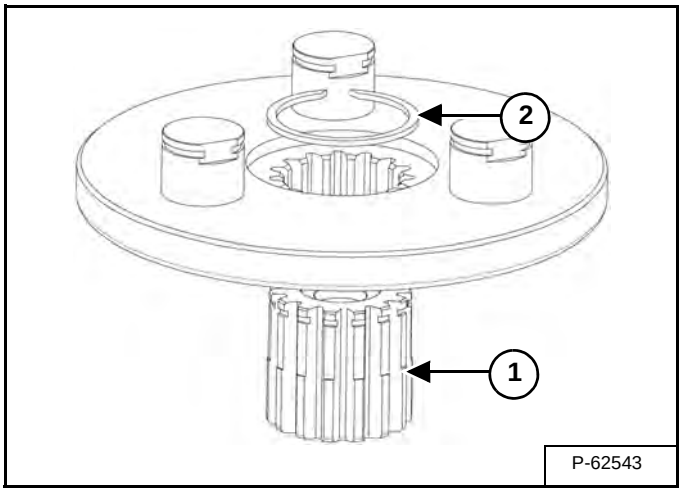
NOTE: Install the snap rings so the opening of the snap ring is towards the outside.

Figure 20-81-50



Install the planetary assembly (Item 1) **[Figure 20-81-50]**.

Figure 20-81-51



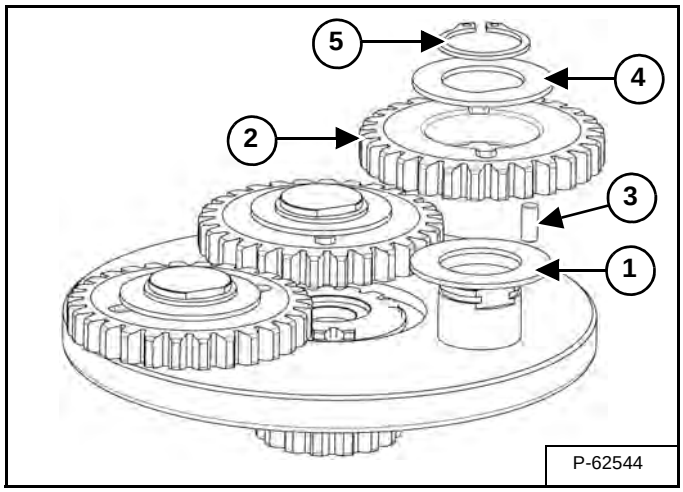
Install the sun gear (Item 1) into the planetary carrier and lock with the retaining ring (Item 2) **[Figure 20-81-51]**.

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Assembly (Cont'd)

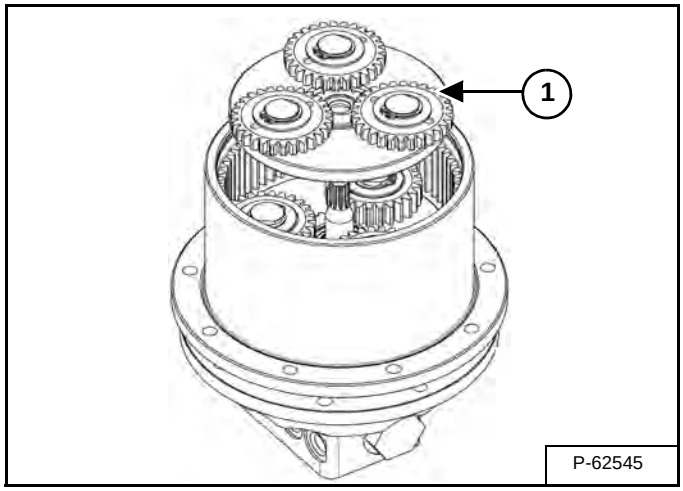
Figure 20-81-52



Install the thrust washers (Item 1), planetary gears (Item 2), needle bearings (Item 3), anti-rotation washers (Item 4) and external snap rings (Item 5) **[Figure 20-81-52]**.

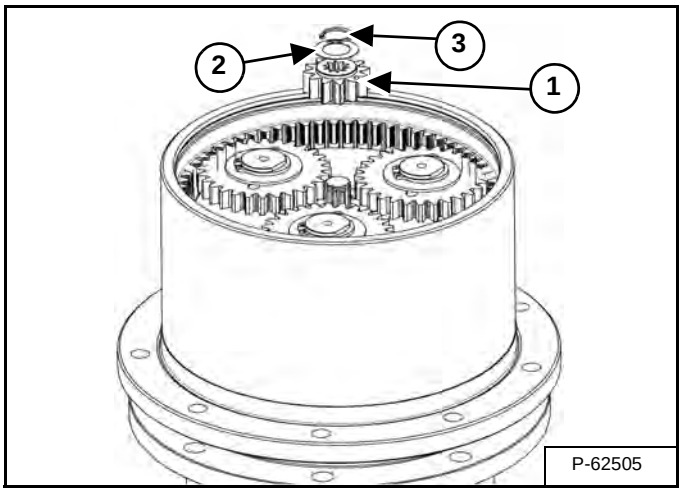
NOTE: Install the snap rings so the opening of the snap ring is towards the outside.

Figure 20-81-53



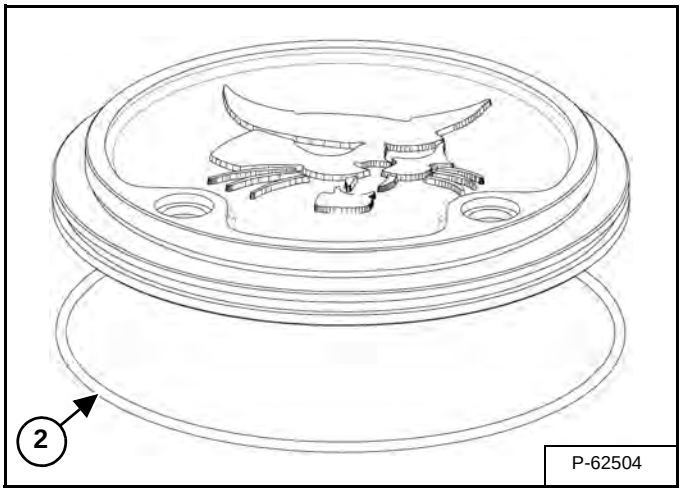
Install the outer planetary assembly (Item 1) **[Figure 20-81-53]**.

Figure 20-81-54



Install the sun gear (Item 1), shims (theoretical shimming 0,5 mm (0.02 in) (Item 2) and retaining ring (Item 3) **[Figure 20-81-54]**.

Figure 20-81-55



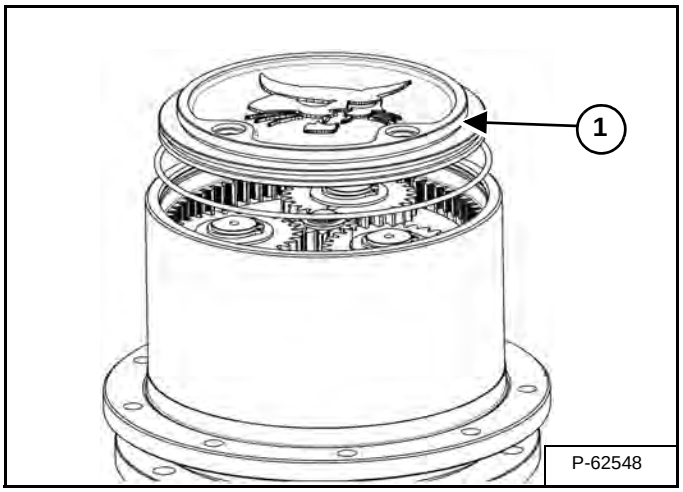
Install the O-ring (Item 1) **[Figure 20-81-55]** on the cover.

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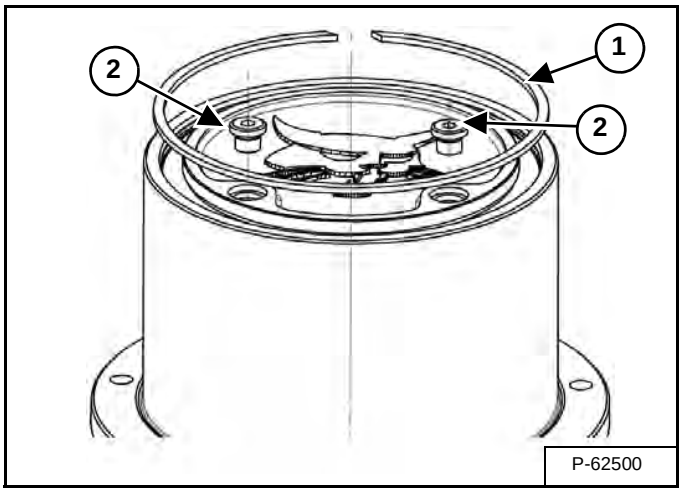
Assembly (Cont'd)

Figure 20-81-56



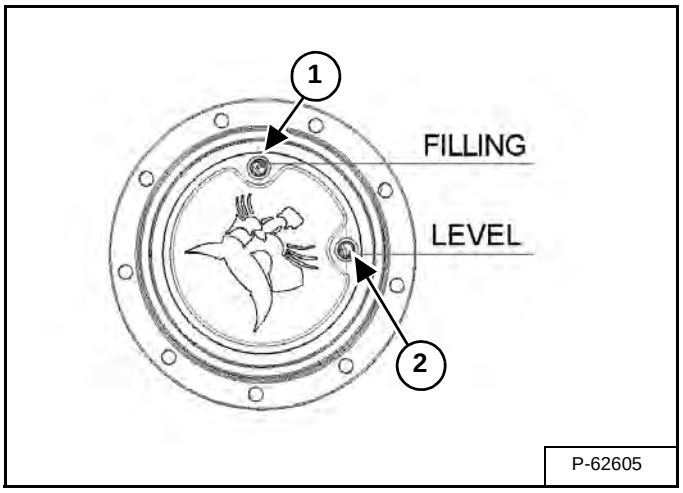
Install the cover (Item 1) **[Figure 20-81-56]** in the housing.

Figure 20-81-57



Install the snap ring (Item 1) **[Figure 20-81-57]** securing the reduction gear cover.

Figure 20-81-58



Add 0,4 L (0.42 qt) of gear lube 90W to the top plug hole (Item 1) until the gear lube is at the bottom of the plug hole (Item 2) **[Figure 20-81-58]**.

Install and tighten the two plugs (Item 2) **[Figure 20-81-57]**.

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SWIVEL JOINT

Description

The swivel joint is located under the floor panels and mounted to the upperstructure. The swivel joint directs hydraulic fluid to the undercarriage components while allowing the upperstructure to rotate.

Removal And Installation

Expand the track frame fully.

Figure 20-90-1



Place blocks under the excavator tracks **[Figure 20-90-1]**.

Lower the boom / bucket and blade to the ground.

Relieve hydraulic pressure.

Remove the seat and seat mount. (See Removal And Installation on Page 40-40-1.)

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

Drain the hydraulic reservoir. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

⚠ WARNING

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

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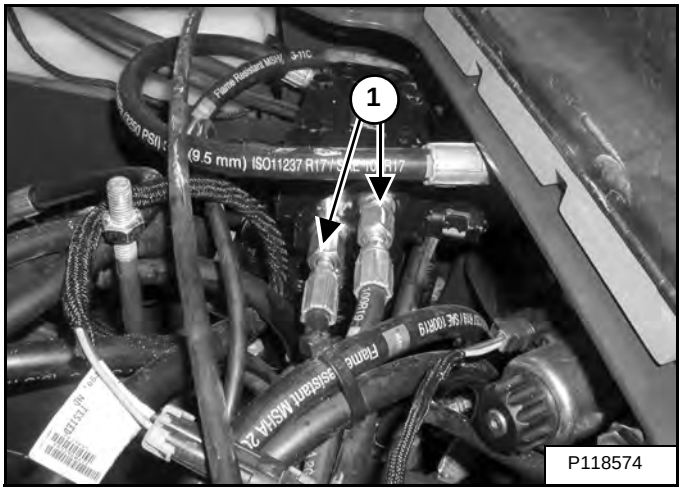
IMPORTANT

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

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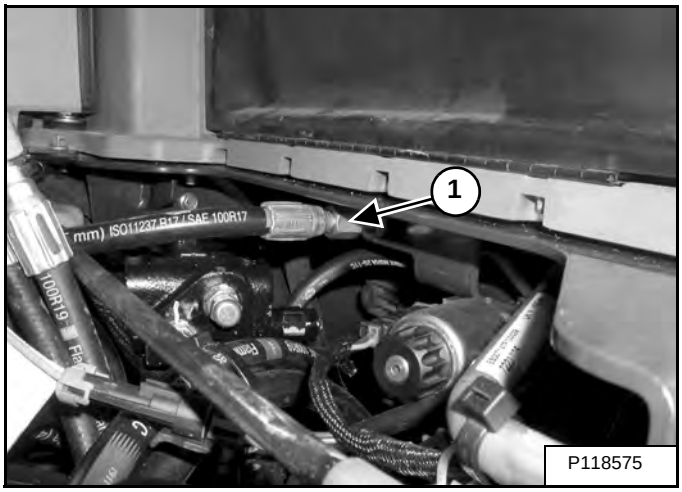
Mark all hoses and tubelines for ease of assembly.

Figure 20-90-2



Remove the two hoses (Item 1) **[Figure 20-90-2]** from the swing motor.

Figure 20-90-3



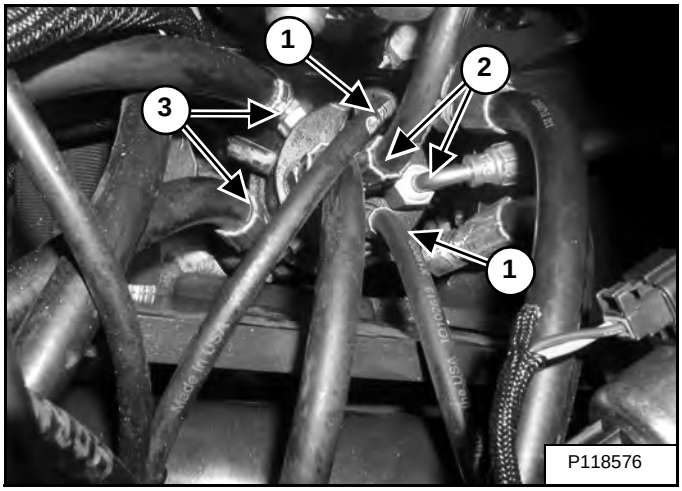
Remove the hose (Item 1) **[Figure 20-90-3]** from the case drain manifold block.

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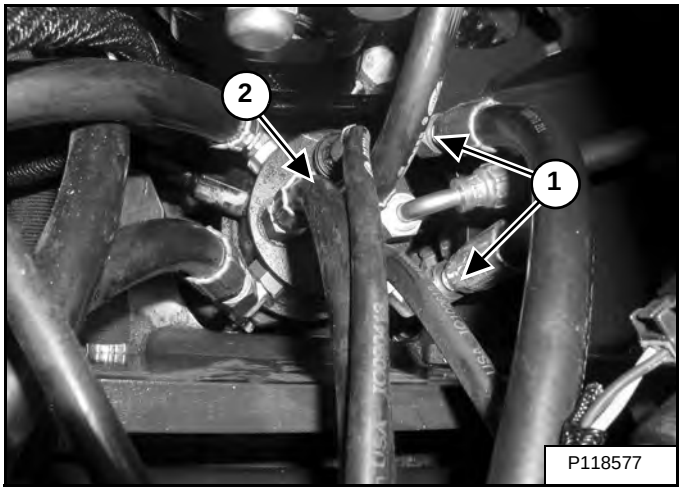
Removal And Installation (Cont'd)

Figure 20-90-4



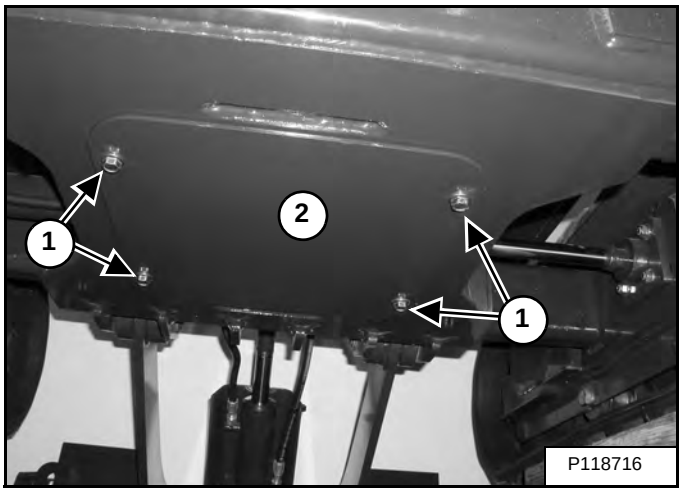
Remove the two pilot hoses (Item 1), the two blade / track expansion valve hoses (Item 2), the two RH travel hoses (Item 3) **[Figure 20-90-4]**.

Figure 20-90-5



Remove the two LH travel hoses (Item 1) and the blade hose (Item 2) **[Figure 20-90-5]**.

Figure 20-90-6



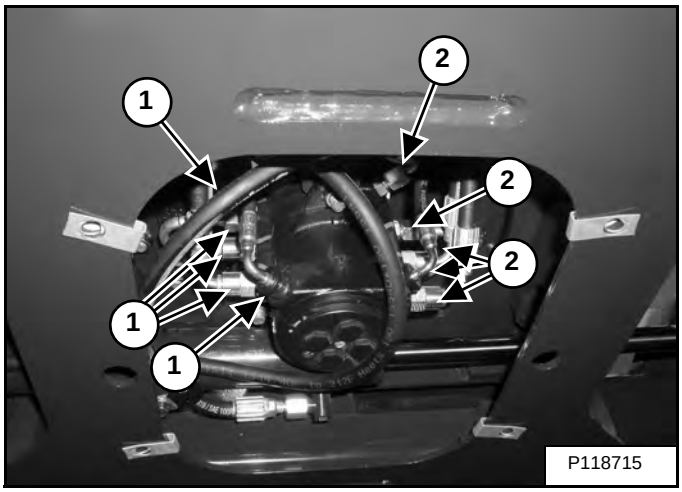
Remove the bolts (Item 1) and the access plate (Item 2) **[Figure 20-90-6]** from the bottom side of the excavator.

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Removal And Installation (Cont'd)

Figure 20-90-7

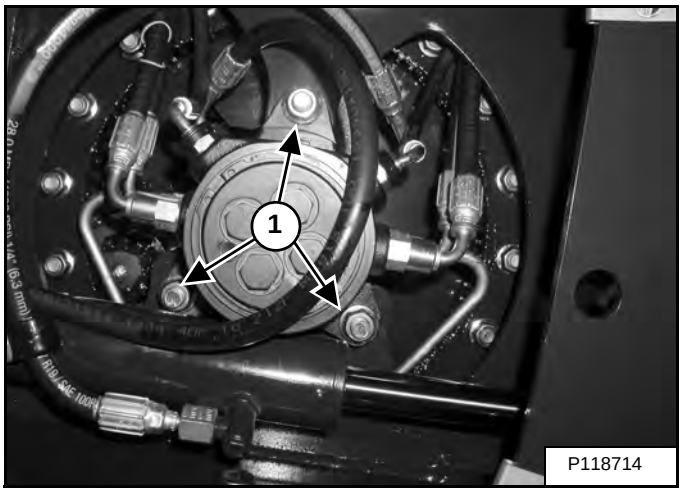


Remove the five hoses (Item 1) **[Figure 20-90-7]** from the left side of the swivel joint.

Remove the five hoses (Item 2) **[Figure 20-90-7]** from the right side of the swivel joint.

NOTE: Support the swivel joint on the bottom side of the excavator to prevent the swivel joint from falling when the three nuts are being removed.

Figure 20-90-8



Remove the three nuts (Item 1) **[Figure 20-90-8]** and slide the swivel joint out through the bottom of the excavator.

Installation: Tighten bolts to 75 - 85 N.m (55 - 60 ft-lb) torque.

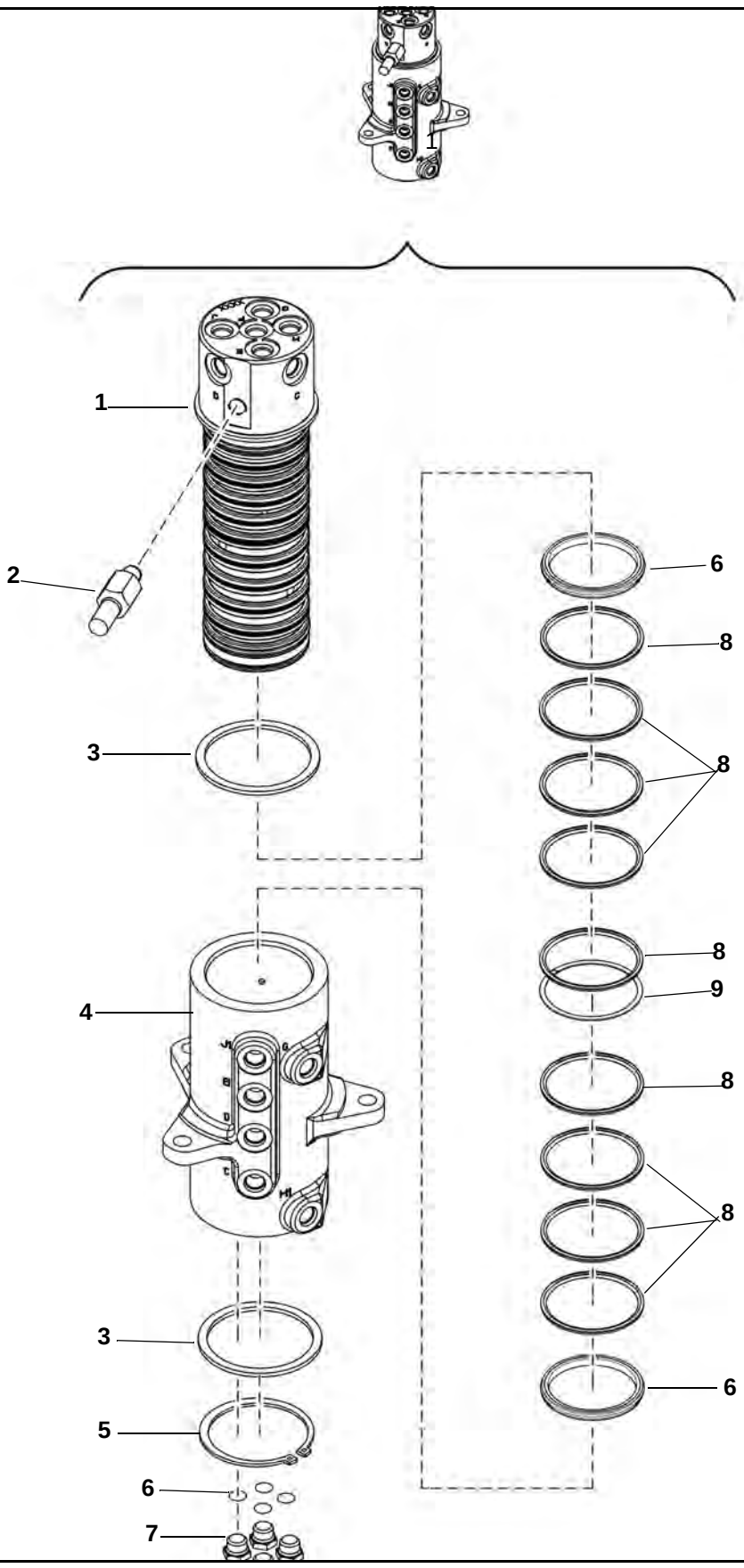
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SWIVEL JOINT (CONT'D)

Parts Identification

1. Rotor
2. Stop
3. Washer
4. Housing
5. Snap Ring
6. O-ring
7. Plug
8. Seal
9. Back-up Ring

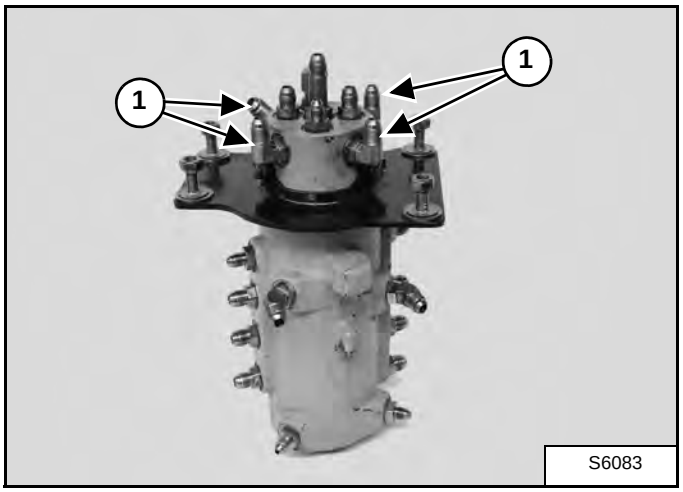


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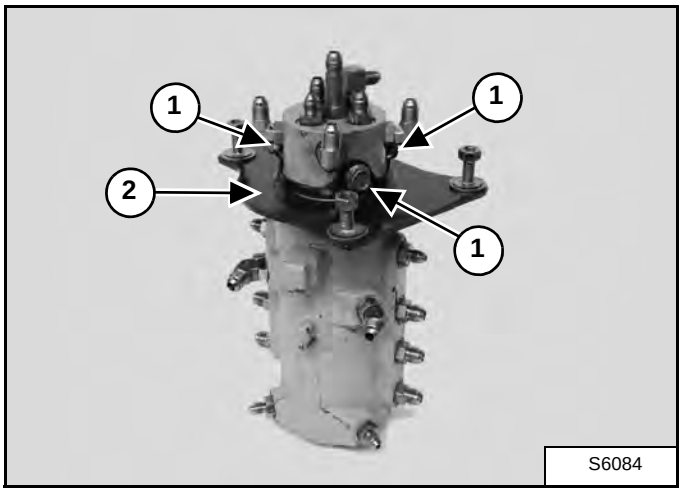
Disassembly

Figure 20-90-9



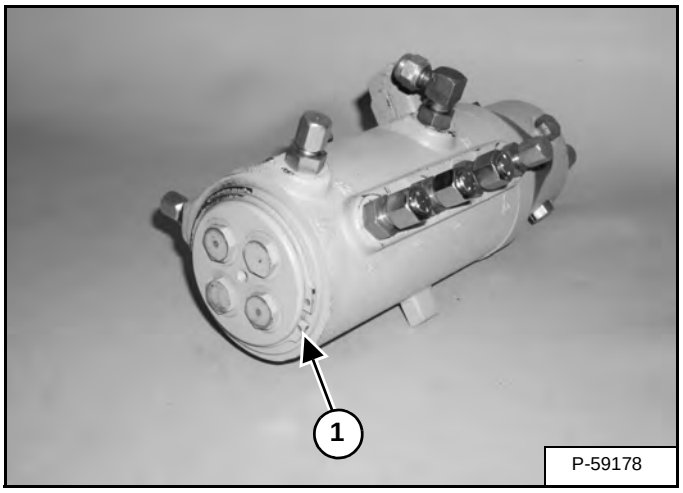
Mark fitting orientation. Remove the fittings (Item 1) **[Figure 20-90-9]**.

Figure 20-90-10



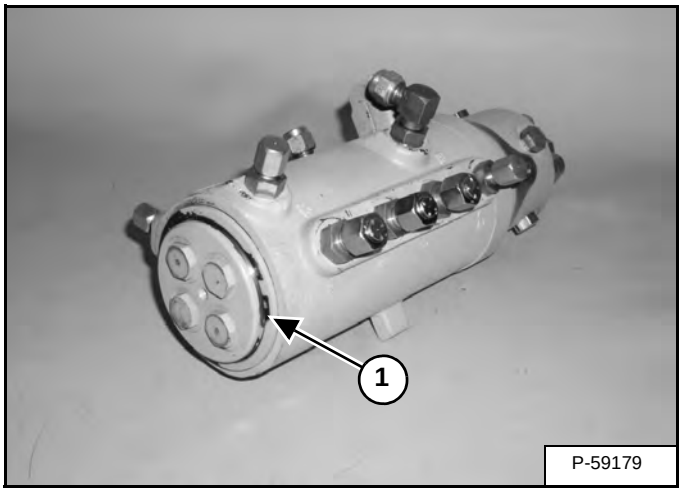
Remove the three bolts (Item 1). Remove the mount (Item 2) **[Figure 20-90-10]**.

Figure 20-90-11



Remove the snap ring (Item 1) **[Figure 20-90-11]** from the bottom of the swivel joint.

Figure 20-90-12



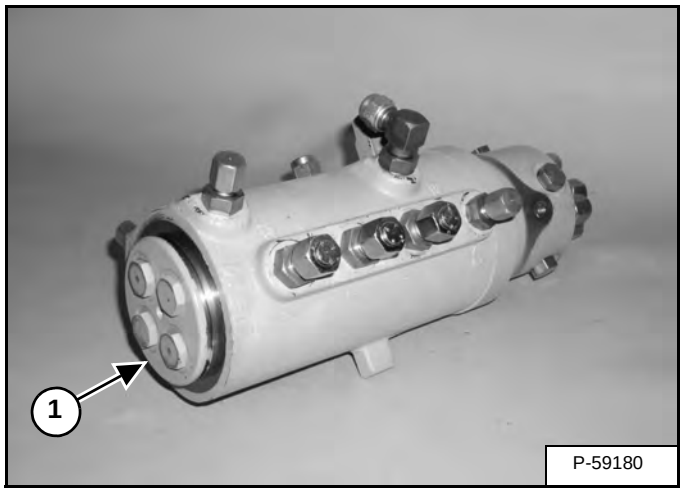
Remove the nylon washer (Item 1) **[Figure 20-90-12]**.

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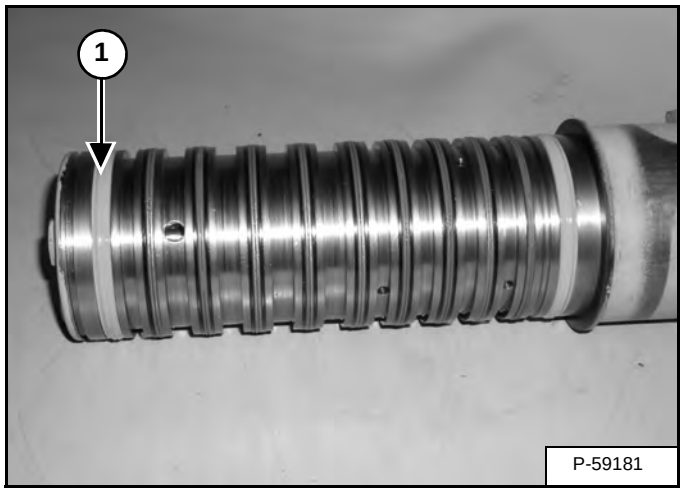
Disassembly (Cont'd)

Figure 20-90-13



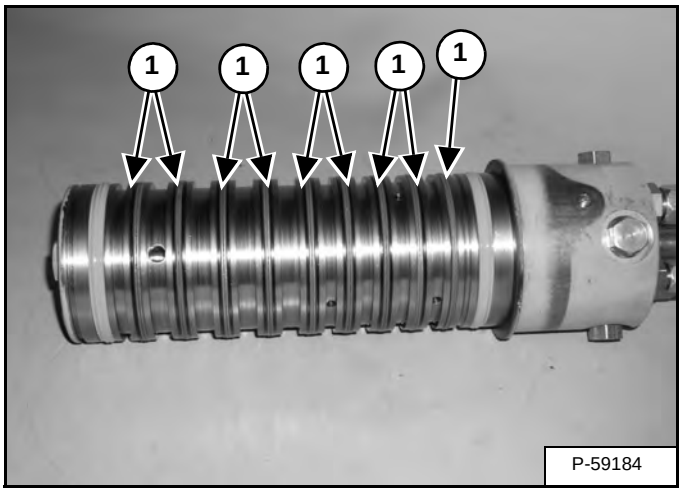
Tap the end of the rotor (Item 1) **[Figure 20-90-13]** with a rubber mallet to drive the rotor out of the housing.

Figure 20-90-14



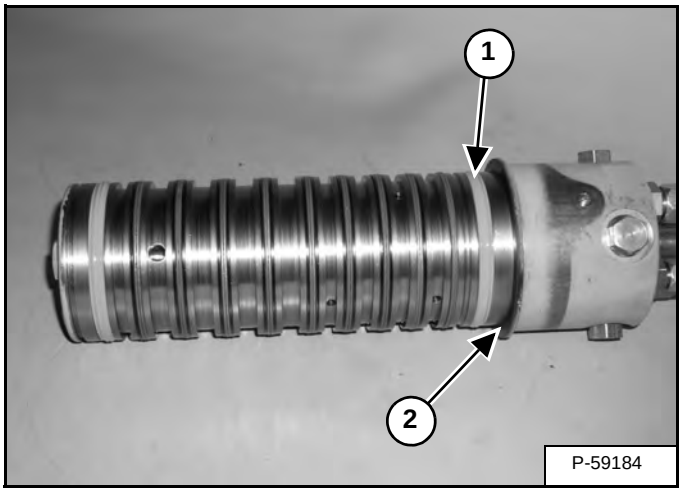
Remove the outer and inner seals (Item 1) **[Figure 20-90-14]**.

Figure 20-90-15



Remove the seals, back-up seals and O-rings (Item 1) **[Figure 20-90-15]**.

Figure 20-90-16



Remove the outer and inner seals (Item 1). Remove the nylon washer (Item 2) **[Figure 20-90-16]**.

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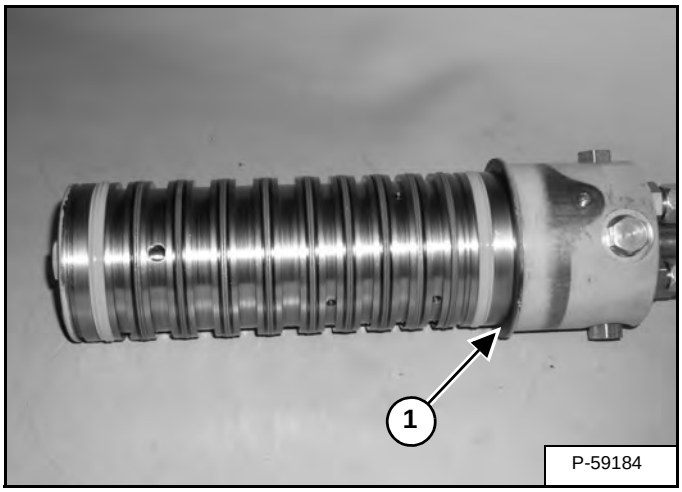
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Assembly

Clean all parts in solvent and dry with compressed air.

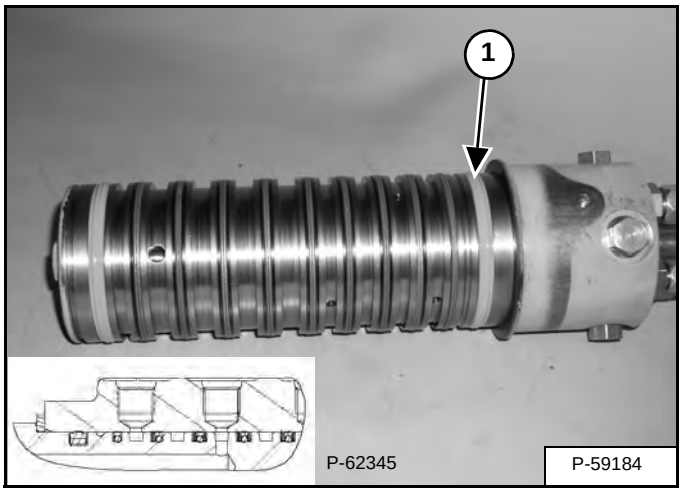
Inspect the rotor and housing for scratches or wear that could cause internal leakage. Always install new seals and back-up seals. Lubricate all seals and back-up seals with clean hydraulic fluid before installation.

Figure 20-90-17



Install the nylon washer (Item 1) **[Figure 20-90-17]**.

Figure 20-90-18

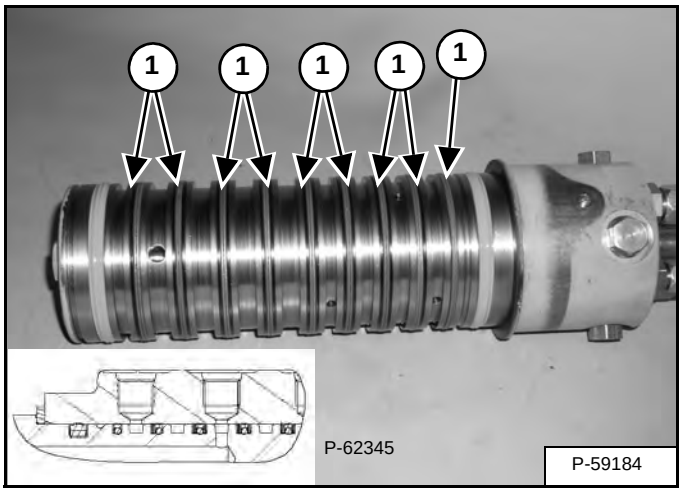


Heat the seals in hydraulic fluid for three minutes at 54°C (130°F).

Install the inner and outer seals (Item 1) **[Figure 20-90-18]**.

NOTE: The inner and outer seal are serviceable as one part number.

Figure 20-90-19



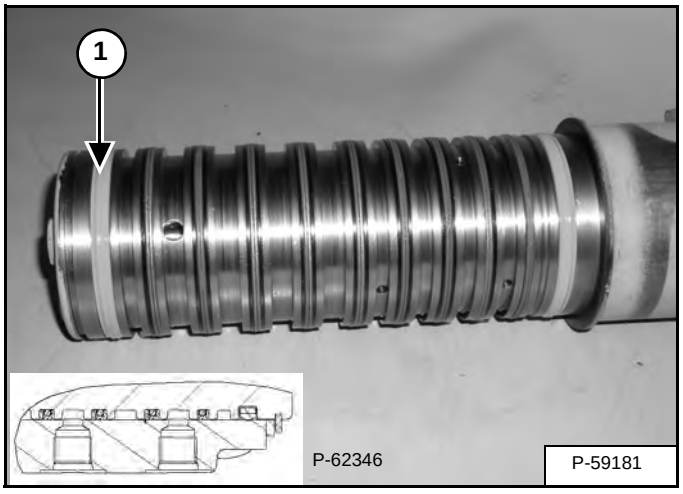
Install the O-rings under the seals (Item 1) **[Figure 20-90-19]**.

Heat the seals in hydraulic fluid for three minutes at 54°C (130°F).

Install the seals and back-up seals (Item 1) **[Figure 20-90-19]**.

NOTE: The seal and O-ring are serviceable as one part number.

Figure 20-90-20



Heat the seals in hydraulic fluid for three minutes at 54°C (130°F).

Install the inner and outer seals (Item 1) **[Figure 20-90-20]**.

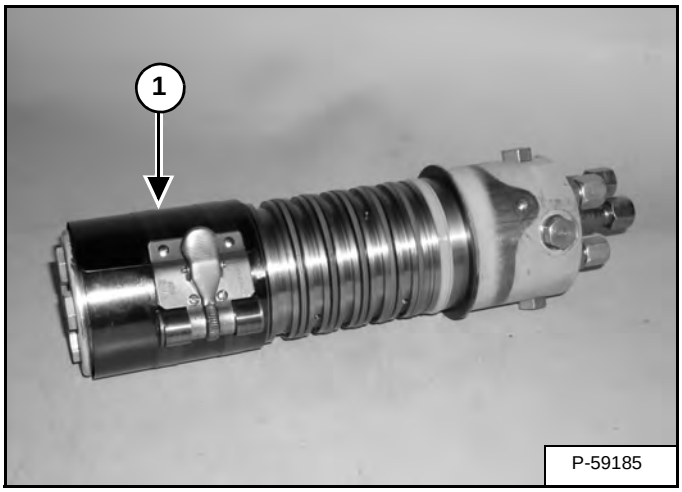
NOTE: The inner and outer seal are serviceable as one part number.

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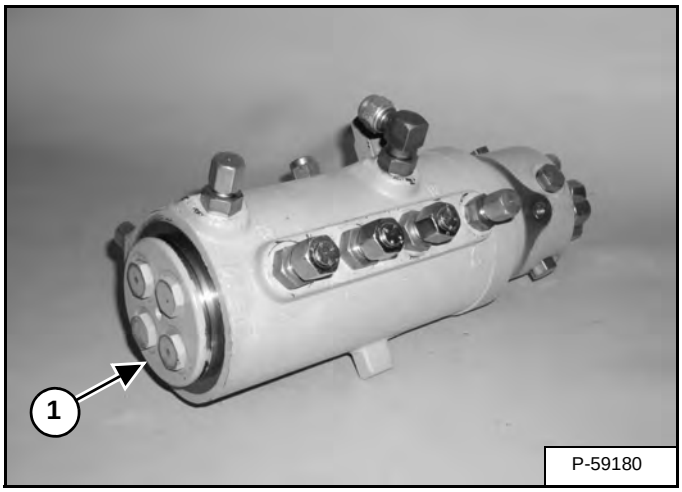
Assembly (Cont'd)

Figure 20-90-21



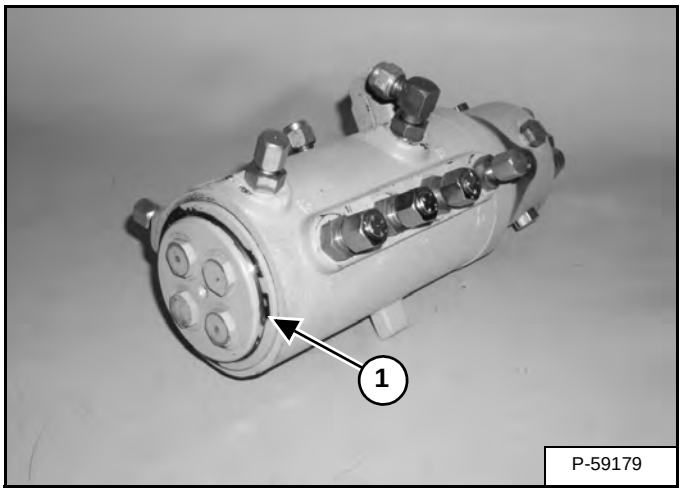
NOTE: A ring compressor (Item 1) [Figure 20-90-21] may be used to fit the seals into the seal grove. Compress the seals for three minutes.

Figure 20-90-22



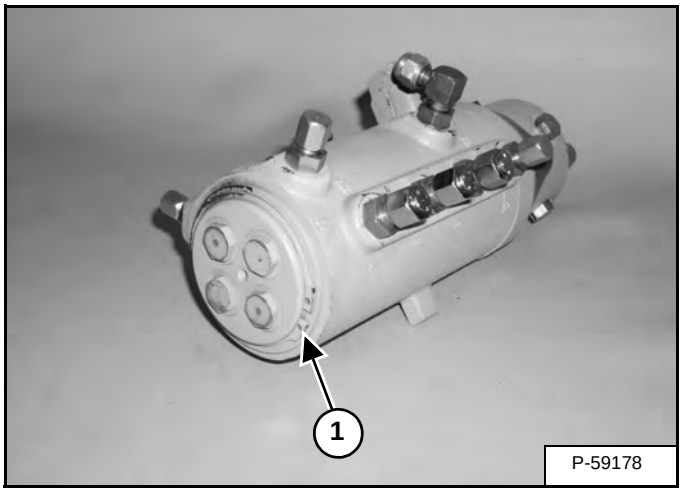
Apply hydraulic fluid to the rotor. Install the rotor (Item 1) **[Figure 20-90-22]** in the housing.

Figure 20-90-23



Install the nylon washer (Item 1) **[Figure 20-90-23]**.

Figure 20-90-24



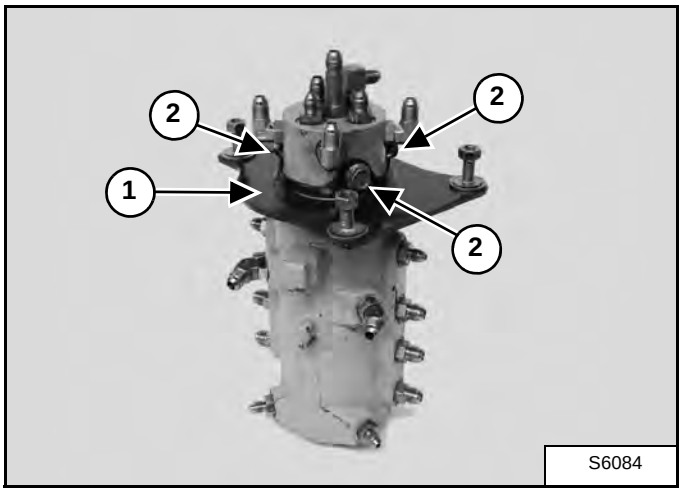
Install the snap ring (Item 1) **[Figure 20-90-24]**.

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Assembly (Cont'd)

Figure 20-90-25

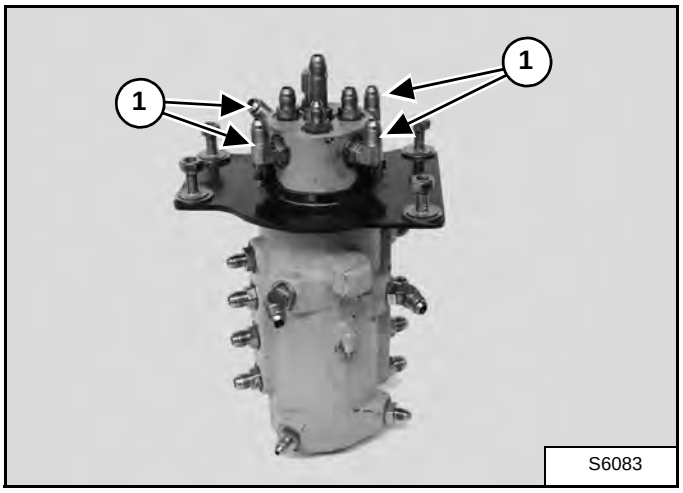


Install the mount (Item 1) **[Figure 20-90-25]** on the swivel joint.

Apply Loctite® 242 to each bolt (Item 2) **[Figure 20-90-25]**.

Install the bolts (Item 2) **[Figure 20-90-25]**. Tighten the bolts to 43 - 47 N•m (32 - 35 ft-lb) torque.

Figure 20-90-26



Install the fittings (Item 1) **[Figure 20-90-26]** and orientate accordingly.

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SWING MOTOR

Description

The swing motor is a hydraulic motor that receives hydraulic fluid from the gear pump through the control valve to swing the upperstructure left or right. The speed that the swing motor rotates is related to the amount of hydraulic fluid it receives.

The swing motor is equipped with an internal brake that is spring applied and releases with hydraulic pressure.

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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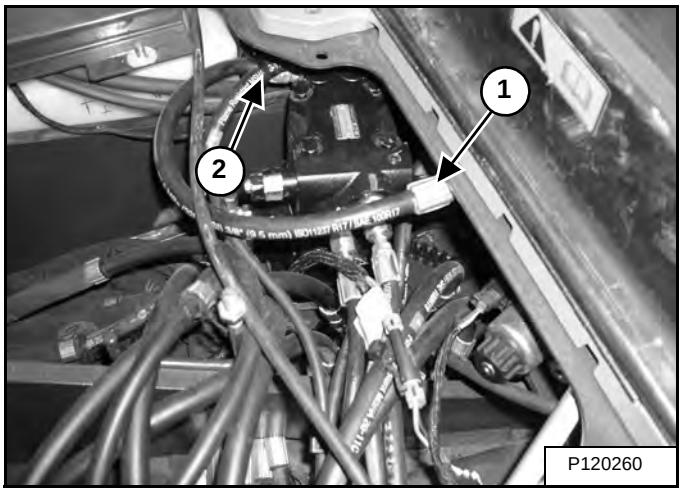
Remove the battery. (See Removing And Installing The Battery on Page 50-20-5.)

Drain the hydraulic fluid. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

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

Remove the travel controls. (See Removal And Installation on Page 40-110-1.)

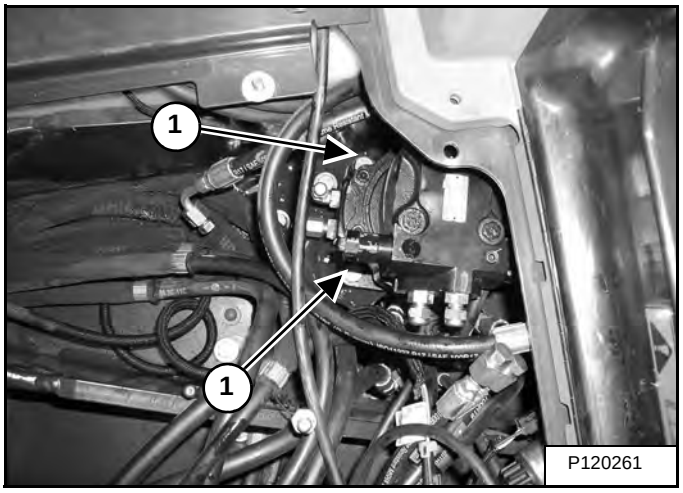
Figure 20-100-1



Remove the hose (Item 1) from the drain manifold. Cut and remove the cable tie (Item 2) **[Figure 20-100-1]**.

Remove the hoses from the swing motor **[Figure 20-100-1]**.

Figure 20-100-2



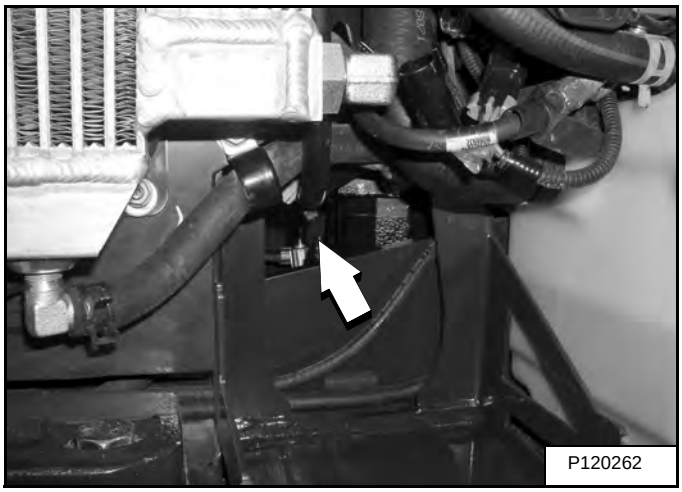
Remove the four bolts (Item 1) **[Figure 20-100-2]**. (Front two shown.)

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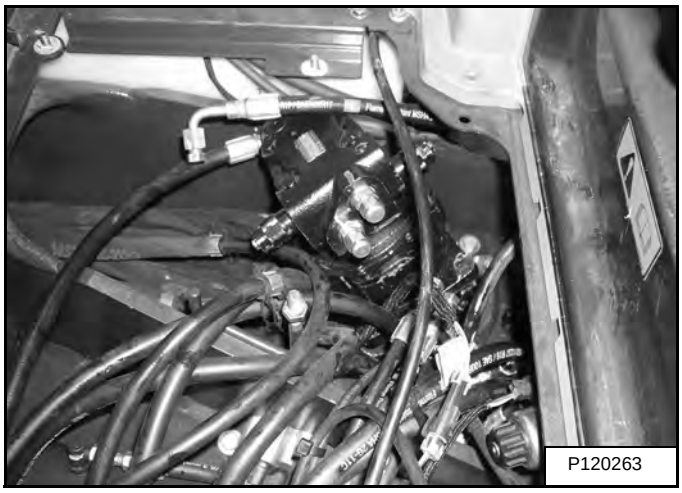
Removal And Installation (Cont'd)

Figure 20-100-3



The right rear bolt is accessible through the right side of the excavator upperstructure **[Figure 20-100-3]**.

Figure 20-100-4



Remove the swing motor **[Figure 20-100-4]**.

Installation: Apply thread adhesive (Loctite® 271) to the bolt threads. Tighten the bolts to 115 N•m (85 ft-lb) torque.

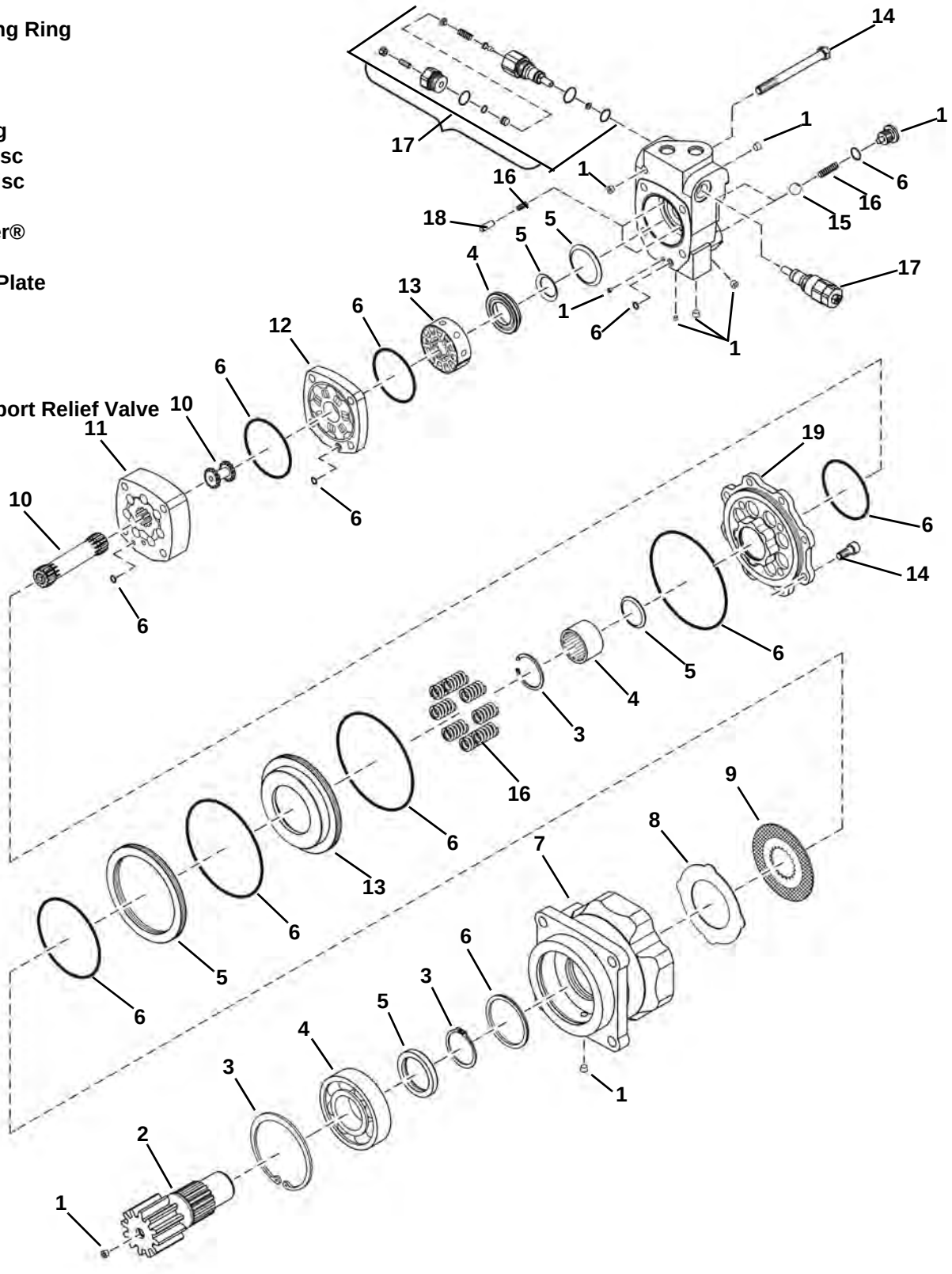
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SWING MOTOR (CONT'D)

Parts Identification

1. Plug
2. Shaft
3. Retaining Ring
4. Bearing
5. Seal
6. O-ring
7. Housing
8. Steel Disc
9. Fiber Disc
10. Drive
11. Geroler®
12. Valve Plate
13. Valve
14. Bolt
15. Ball
16. Spring
17. Crossport Relief Valve
18. Pin
19. Plate



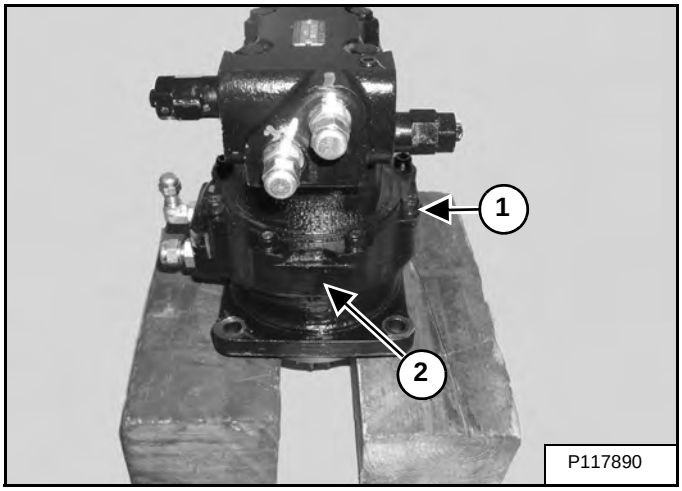
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Motor Disassembly

Clean the outside of the swing motor before disassembly.

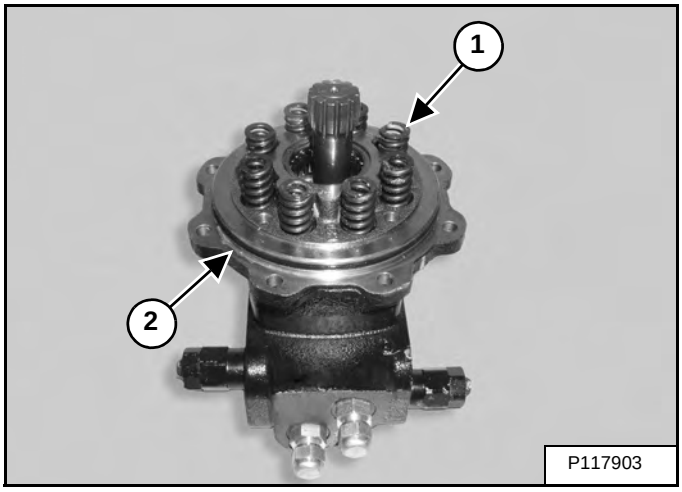
Figure 20-100-5



Remove the bolts (Item 1), mark and remove the swing motor from the brake carrier assembly (Item 2) **[Figure 20-100-5]**.

Installation: Apply thread adhesive Loctite® 242 to the bolt threads. Tighten the bolts 34,3 N•m (46.5 ft-lb) torque.

Figure 20-100-6



Remove the springs (Item 1) and O-ring (Item 2) **[Figure 20-100-6]** from the motor.

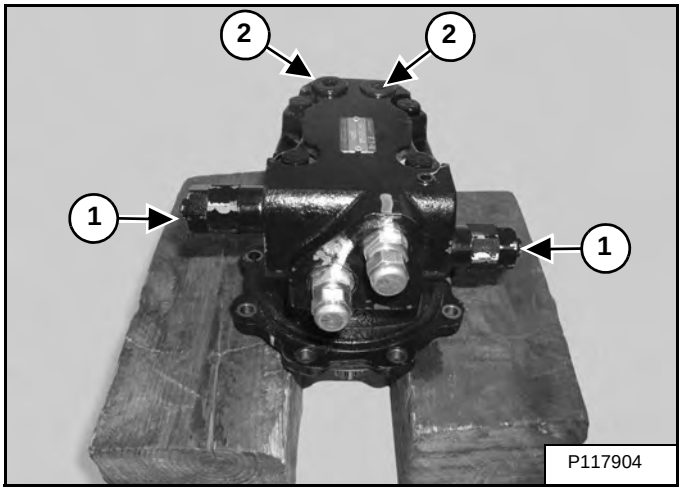
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Motor Disassembly (Cont'd)

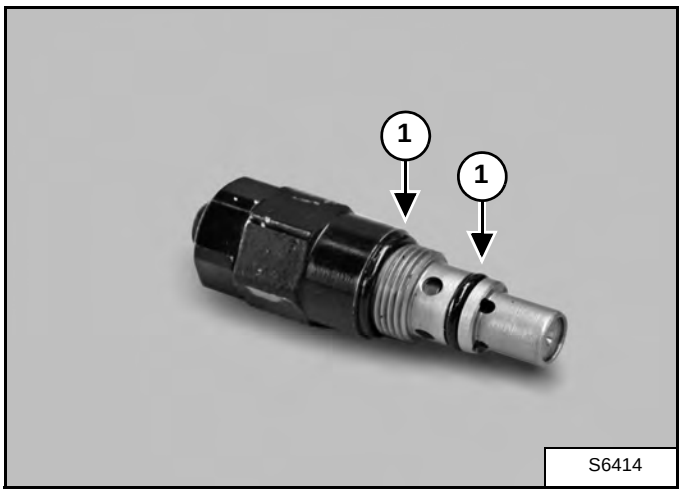
Mark the outside of the swing motor for ease of assembly.

Figure 20-100-7



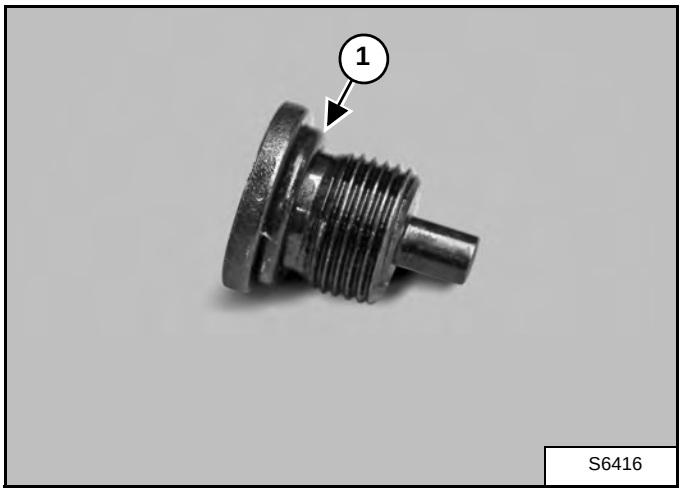
Remove the crossport relief valves (Item 1). Remove the plugs (Item 2) **[Figure 20-100-7]**.

Figure 20-100-8



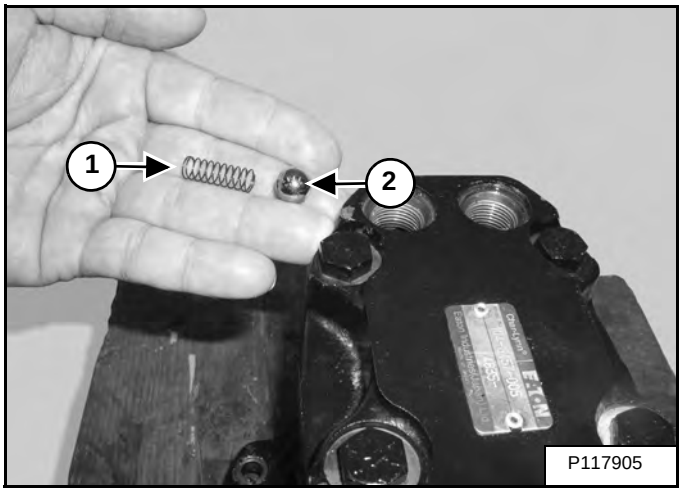
Remove the O-rings (Item 1) **[Figure 20-100-8]** from the crossport relief valves.

Figure 20-100-9



Remove the O-ring (Item 1) **[Figure 20-100-9]** from the plug.

Figure 20-100-10



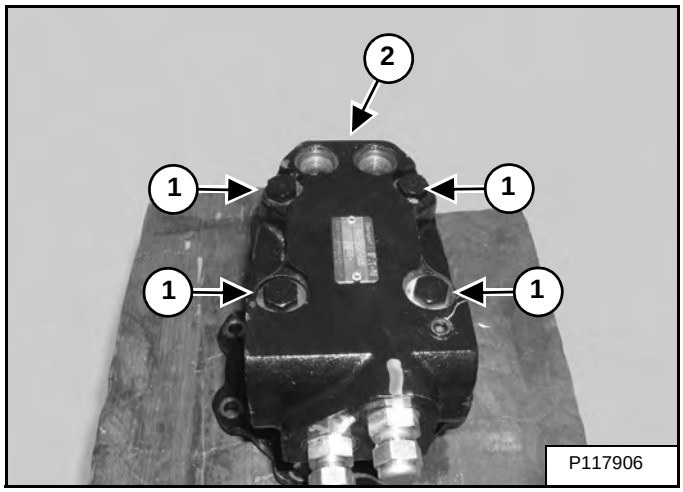
Remove the springs (Item 1) and balls (Item 2) **[Figure 20-100-10]**.

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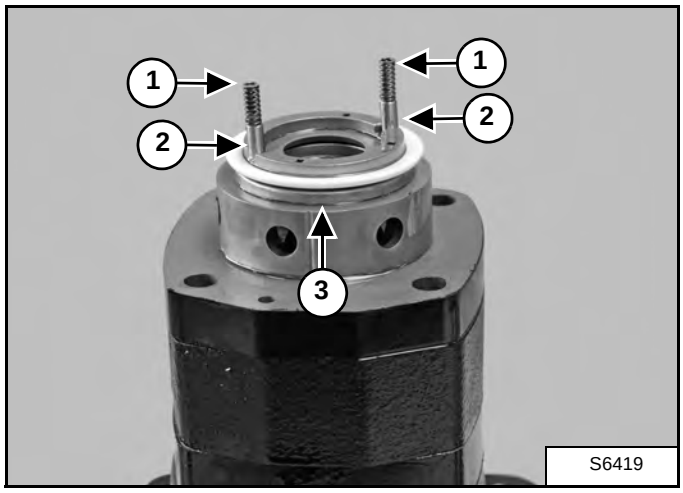
Motor Disassembly (Cont'd)

Figure 20-100-11



Remove the bolts (Item 1) **[Figure 20-100-11]**.

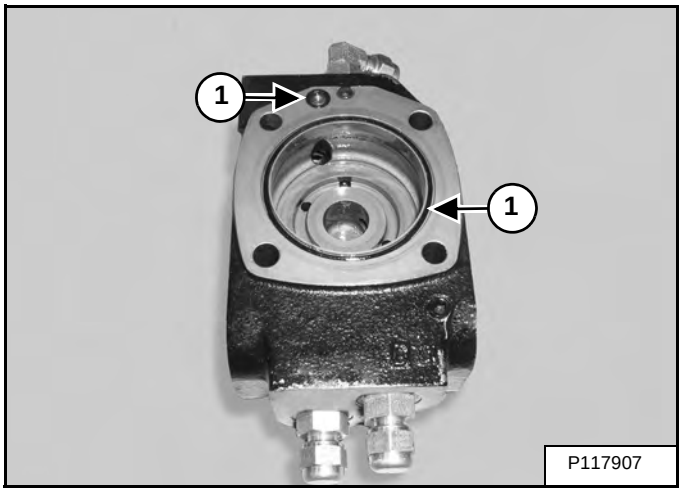
Figure 20-100-12



Remove the top of the motor (Item 2) **[Figure 20-100-11]** by lifting straight up. If done carefully, the springs (Item 1), pins (Item 2) and balance ring assembly (Item 3) **[Figure 20-100-12]** will remain on the valve for easy removal.

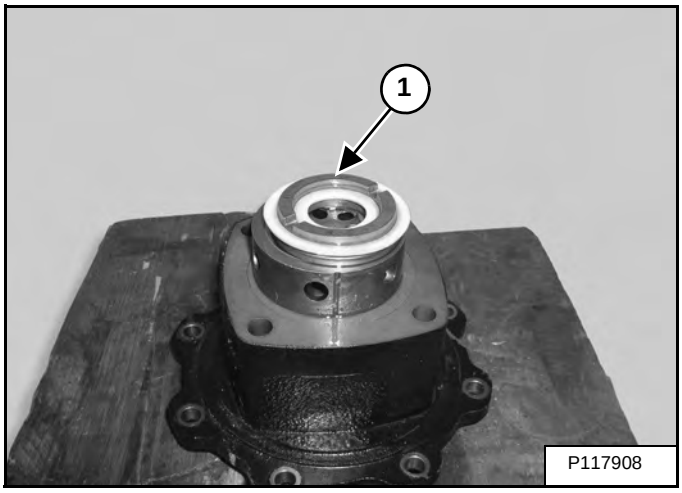
Remove the springs (Item 1) and pins (Item 2) **[Figure 20-100-12]**.

Figure 20-100-13



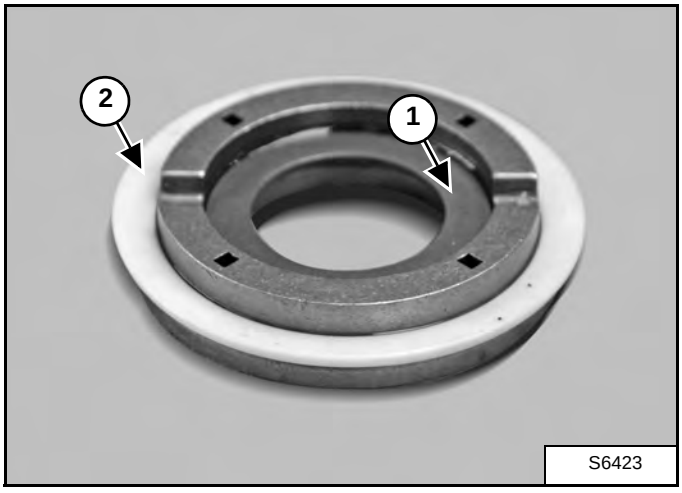
Remove the O-rings (Item 1) **[Figure 20-100-13]**.

Figure 20-100-14



Remove the balance ring (Item 1) **[Figure 20-100-14]**.

Figure 20-100-15



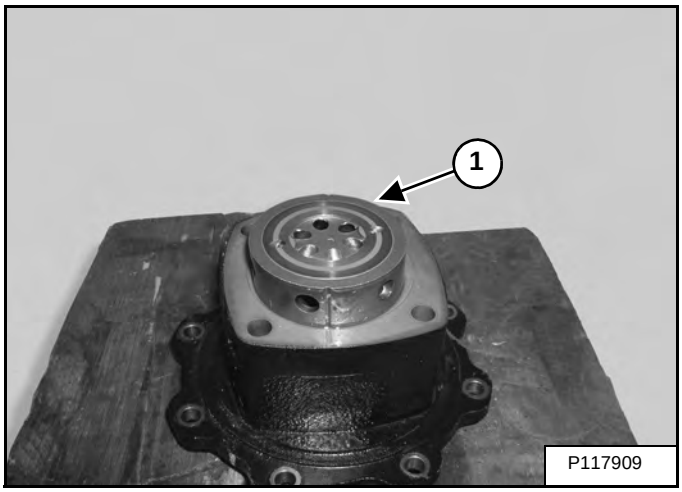
Remove the inner seal (Item 1) and outer seal (Item 2) **[Figure 20-100-15]**.

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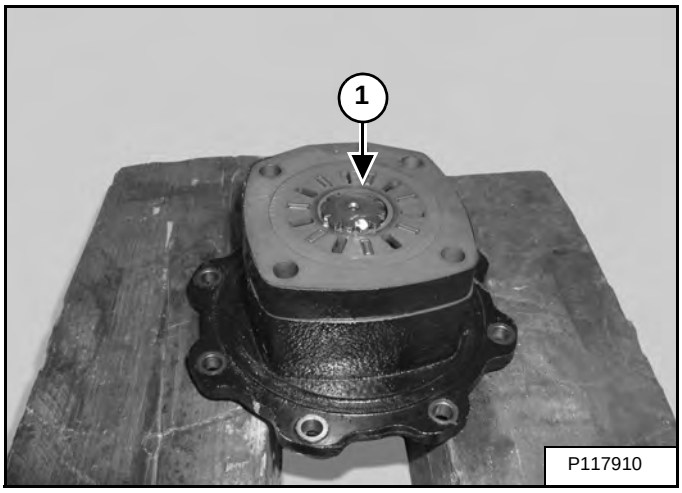
Motor Disassembly (Cont'd)

Figure 20-100-16



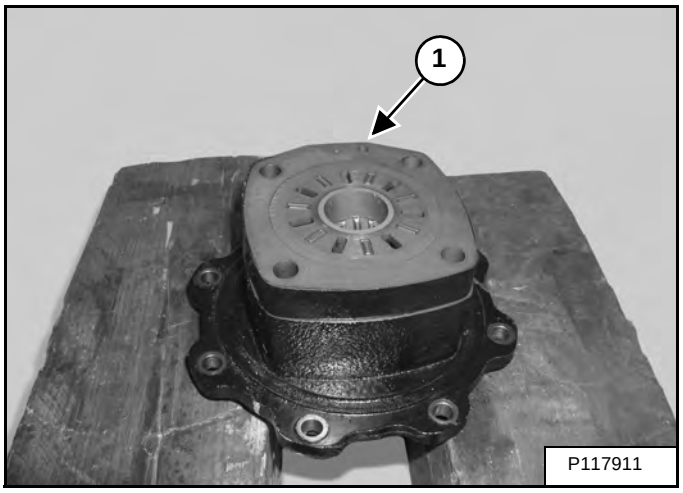
Remove the valve (Item 1) **[Figure 20-100-16]**.

Figure 20-100-17



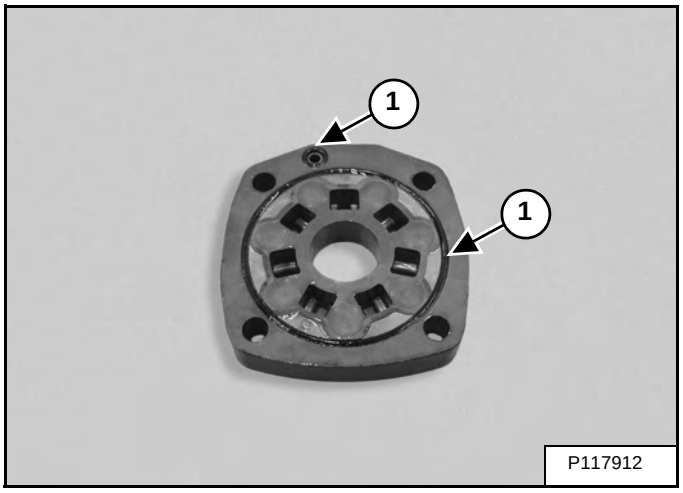
Remove the drive (Item 1) **[Figure 20-100-17]**.

Figure 20-100-18



Remove the valve plate (Item 1) **[Figure 20-100-18]**.

Figure 20-100-19



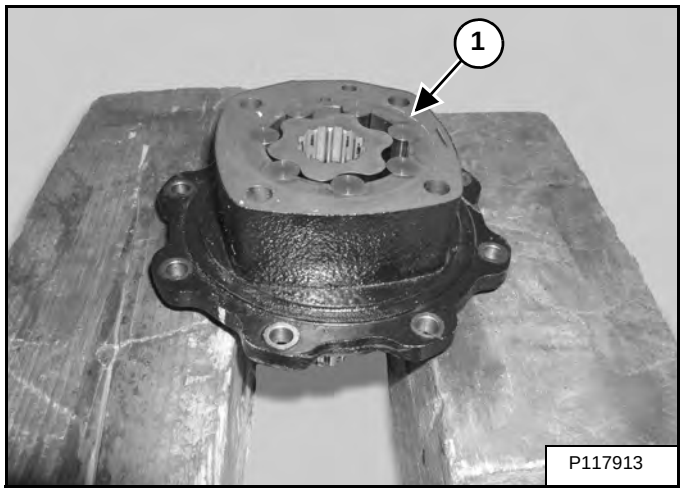
Remove the O-rings (Item 1) **[Figure 20-100-19]** from the valve plate.

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Motor Disassembly (Cont'd)

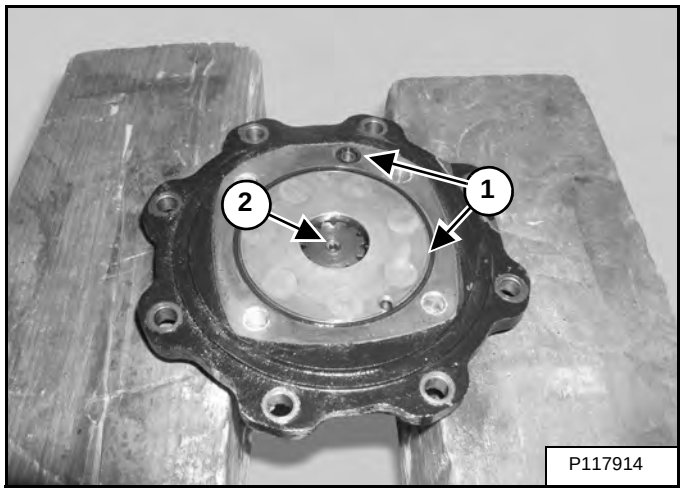
Figure 20-100-20



Remove the Geroler® (Item 1) **[Figure 20-100-20]**.

NOTE: Do not disassemble the Geroler®.

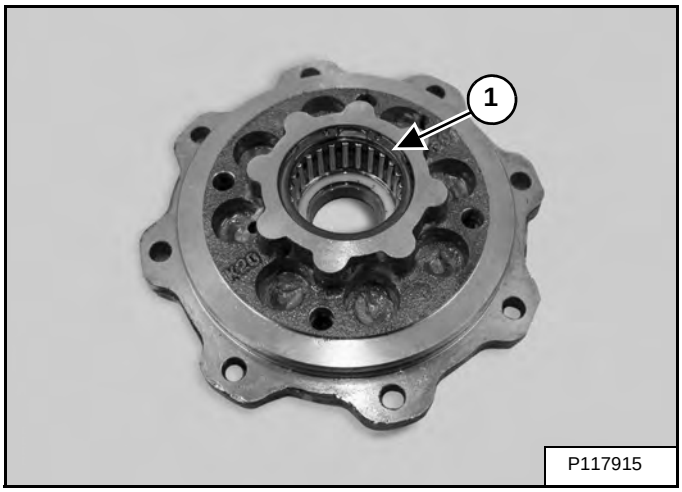
Figure 20-100-21



Remove the O-rings (Item 1) **[Figure 20-100-21]**.

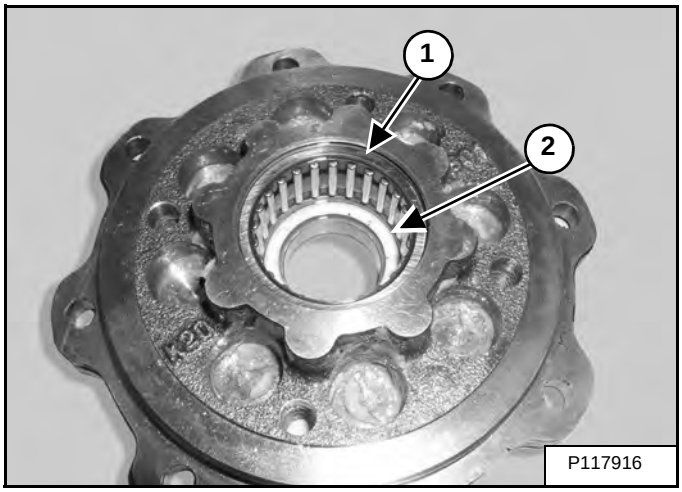
Remove the drive (Item 2) **[Figure 20-100-21]**.

Figure 20-100-22



Turn the housing over and remove the snap ring (Item 1) **[Figure 20-100-22]**.

Figure 20-100-23



Remove the bearing (Item 1) and remove the seal (Item 2) **[Figure 20-100-23]**.

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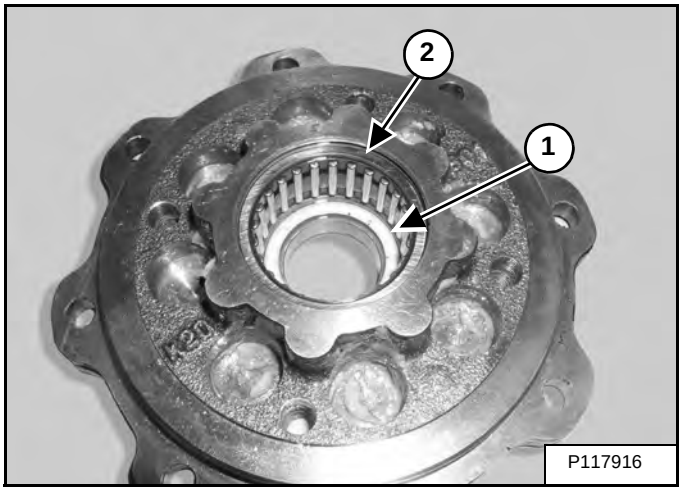
Motor Assembly

Clean all parts in solvent and dry with compressed air.

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

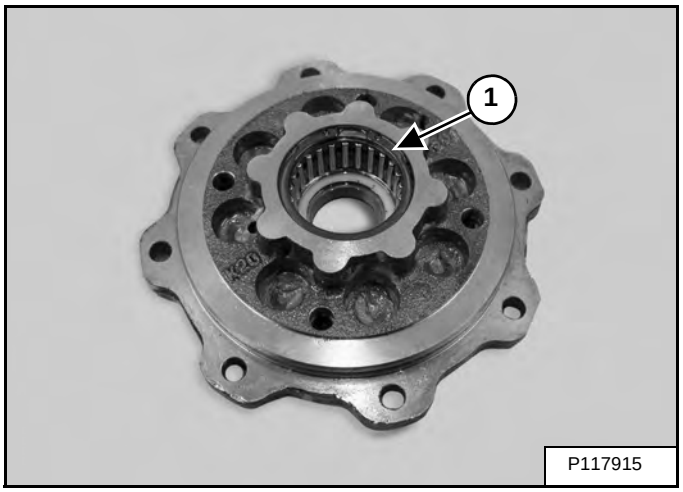
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-100-24



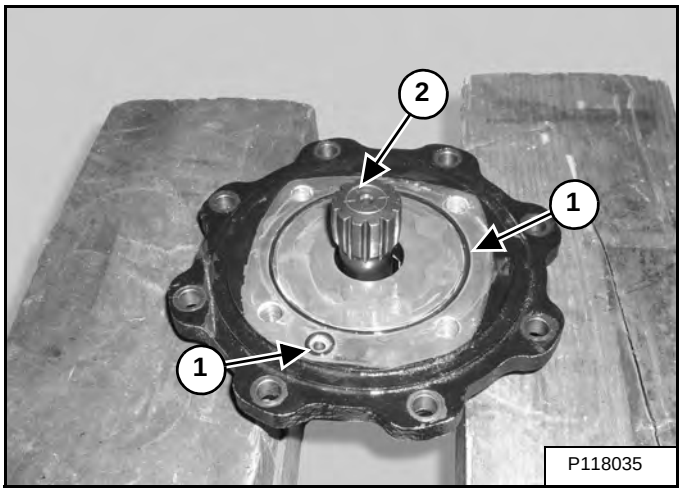
Install the seal (Item 1) and bearing (Item 2) **[Figure 20-100-24]** in the housing.

Figure 20-100-25



Install the snap ring (Item 1) **[Figure 20-100-25]**.

Figure 20-100-26



Turn the housing over and install the O-rings (Item 1) **[Figure 20-100-26]**.

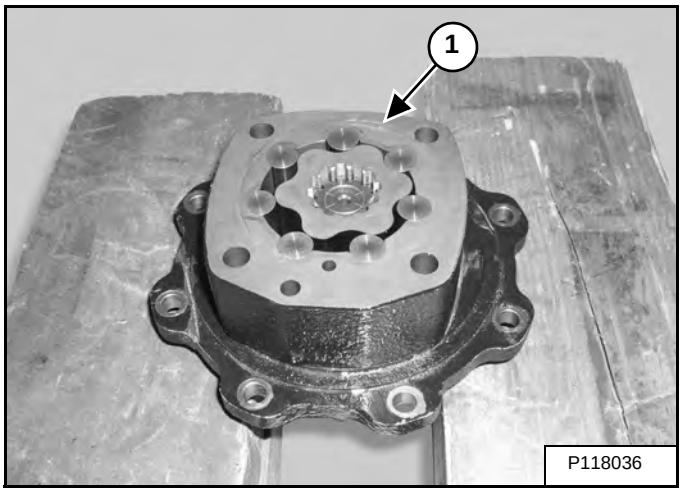
Install the drive (Item 2) **[Figure 20-100-26]**.

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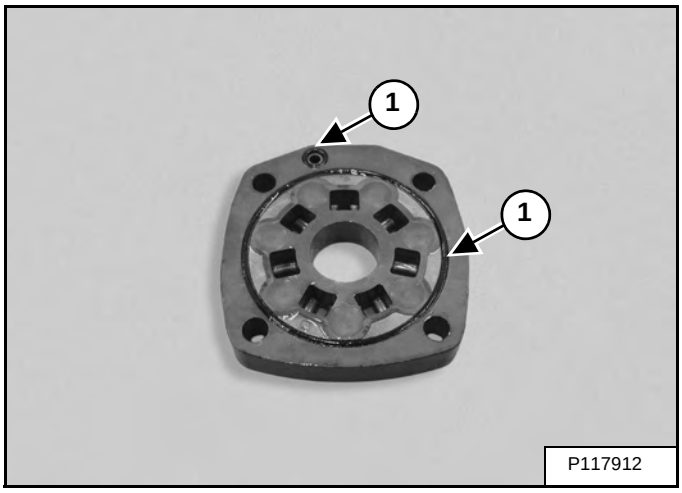
Motor Assembly (Cont'd)

Figure 20-100-27



Install the Geroler® (Item 1) **[Figure 20-100-27]**.

Figure 20-100-28



Install the O-rings (Item 1) **[Figure 20-100-28]** on the valve plate.

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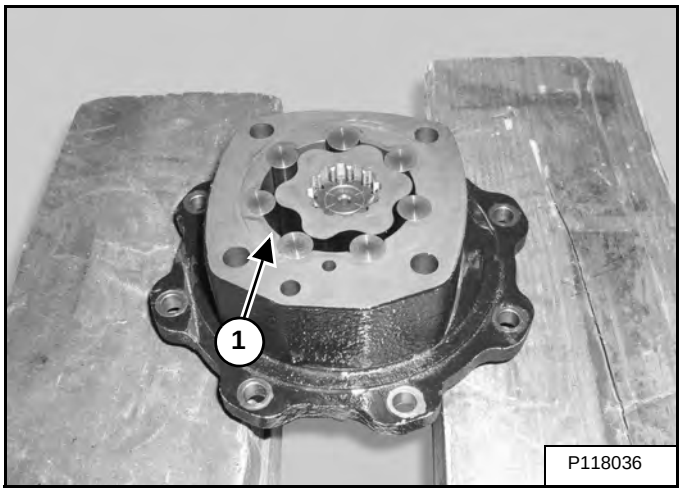
https://www.pdfmanual4trucks.com/

Motor Assembly (Cont'd)

Motor Timing

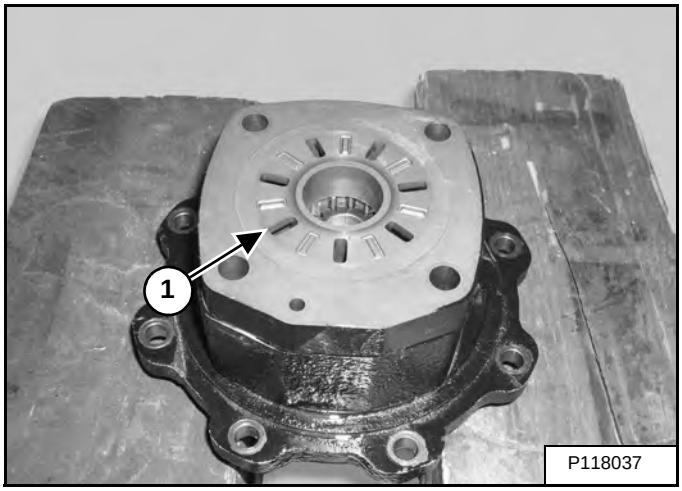
The direction that the output shaft rotates is determined by timing. Time the motor as follows:

Figure 20-100-29



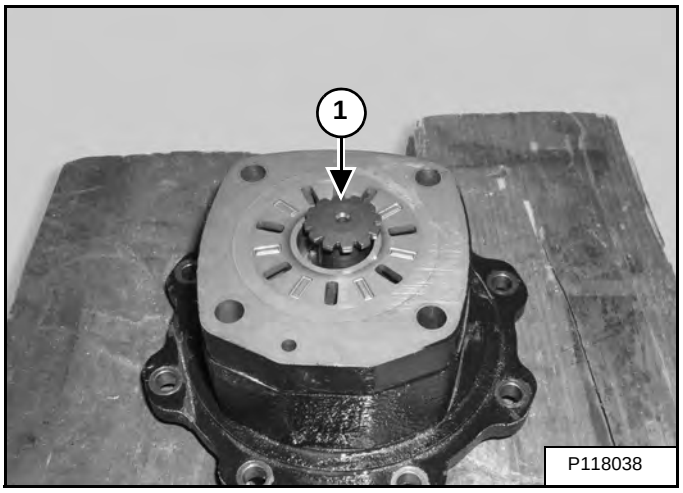
Locate the largest open pocket in the Geroler® (Item 1) **[Figure 20-100-29]**.

Figure 20-100-30



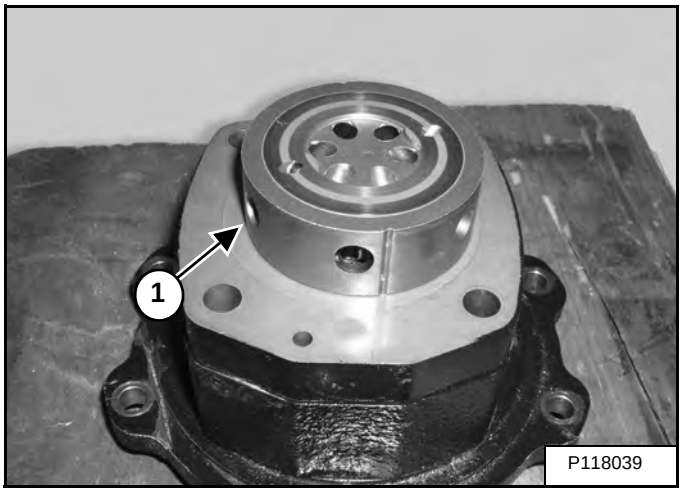
Install the valve plate and locate the open slot (Item 1) **[Figure 20-100-30]** that is over the largest open Geroler® pocket.

Figure 20-100-31



Install the drive (Item 1) **[Figure 20-100-31]**.

Figure 20-100-32



Align one of the side openings (Item 1) **[Figure 20-100-32]** in the valve with the valve plate slot that is over the largest open Geroler® pocket.

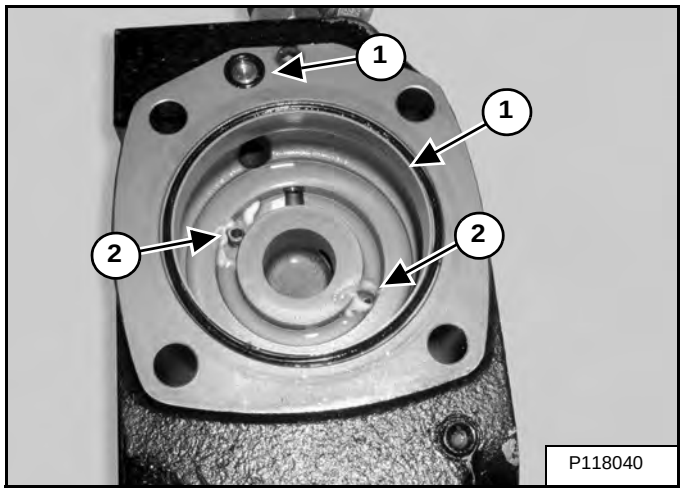
Engage the valve with the valve drive by rotating it clockwise until the spline teeth mesh.

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Motor Assembly (Cont'd)

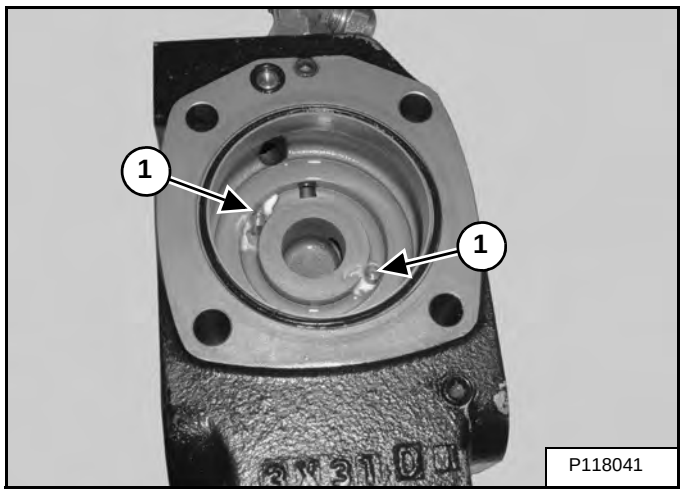
Figure 20-100-33



Install the O-rings (Item 1) **[Figure 20-100-33]**.

Apply assembly lube to the springs, and install the springs (Item 2) **[Figure 20-100-33]**.

Figure 20-100-34



Install the pins (Item 1) **[Figure 20-100-34]**.

Figure 20-100-35

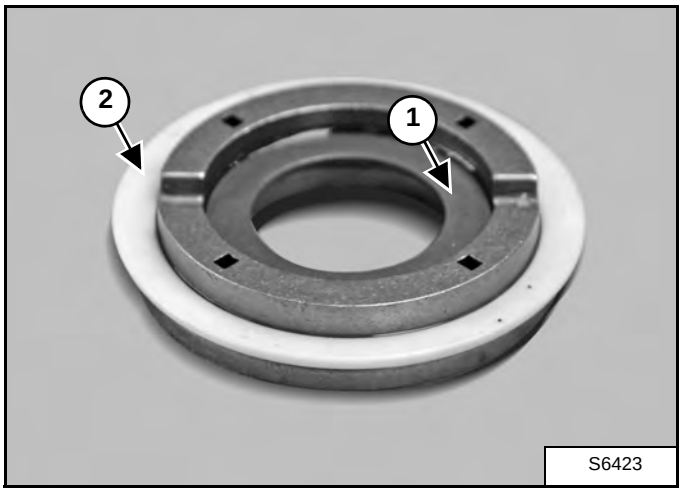
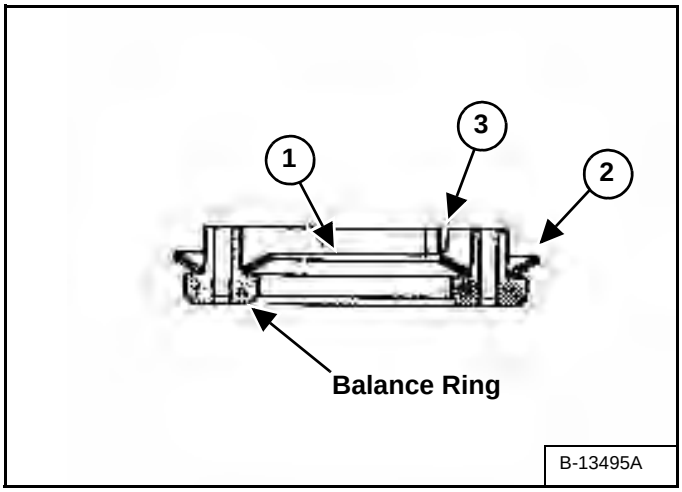


Figure 20-100-36



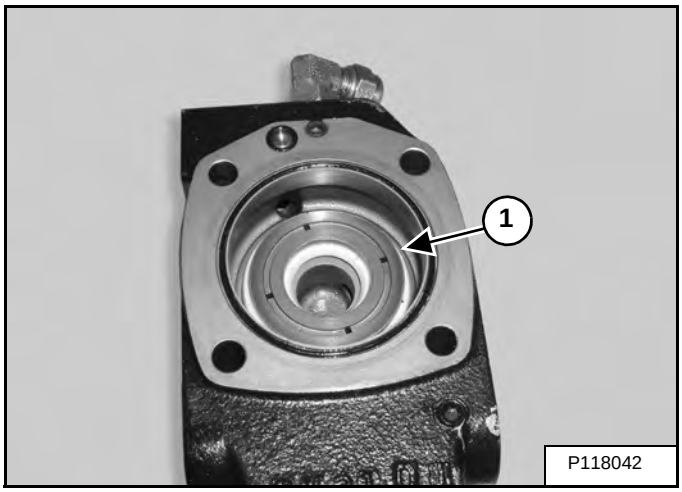
Install the inner (Item 1) and outer (Item 2) **[Figure 20-100-35]** and **[Figure 20-100-36]** face seals on the balance ring as shown.

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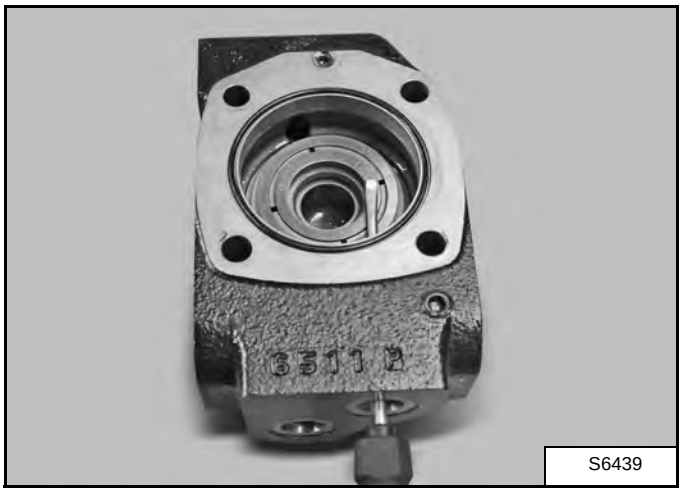
Motor Assembly (Cont'd)

Figure 20-100-37



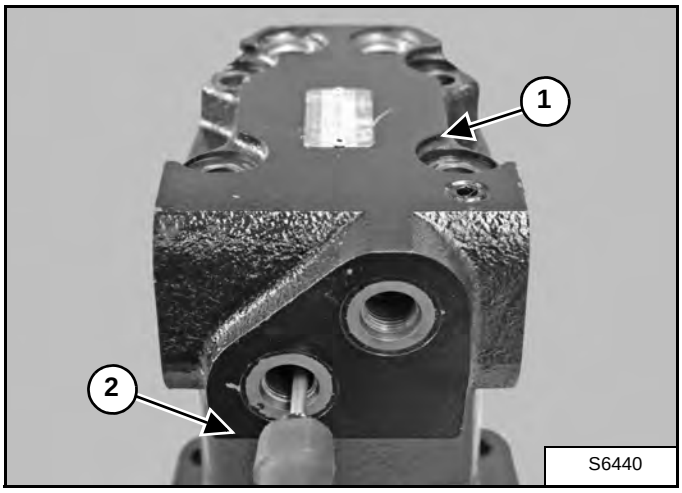
Install the balance ring (Item 1) **[Figure 20-100-37]**. The pins must engage the pin notches (Item 3) **[Figure 20-100-36]** in the balance ring.

Figure 20-100-38



Insert a small screw driver through the port in the housing. Apply pressure to the side of the balance ring assembly until the valve housing is in place **[Figure 20-100-38]**.

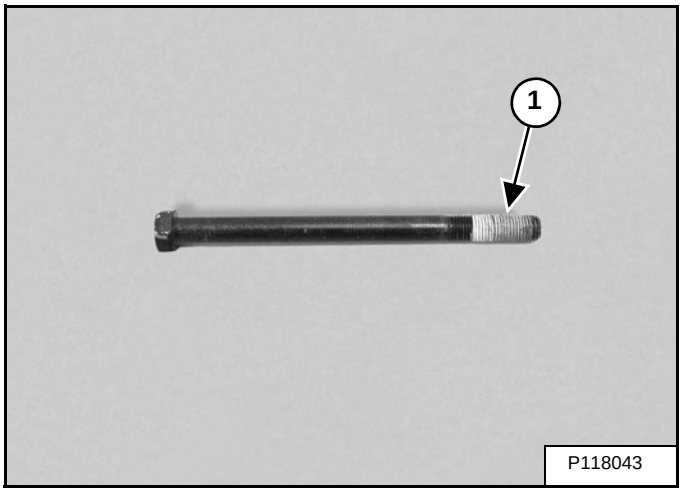
Figure 20-100-39



Install the housing (Item 1) **[Figure 20-100-39]** on the motor.

Remove the screwdriver (Item 2) **[Figure 20-100-39]**.

Figure 20-100-40



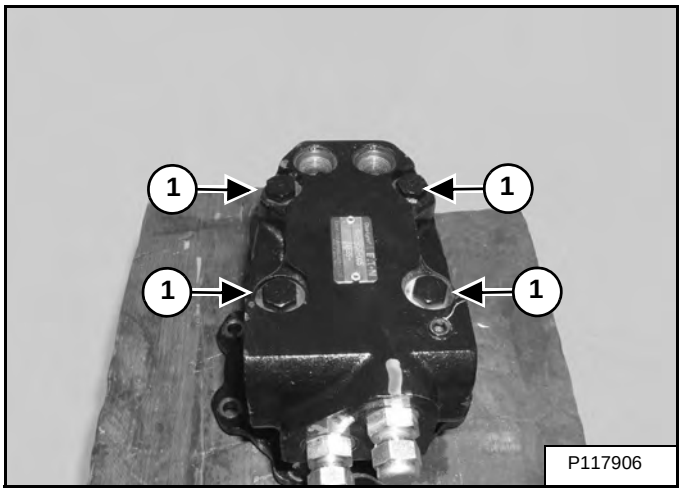
Apply thread sealant to the bolt threads (Item 1) **[Figure 20-100-40]**.

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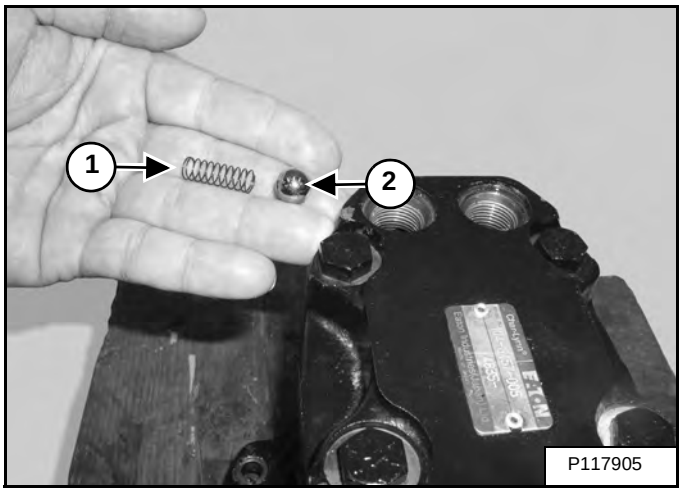
Motor Assembly (Cont'd)

Figure 20-100-41



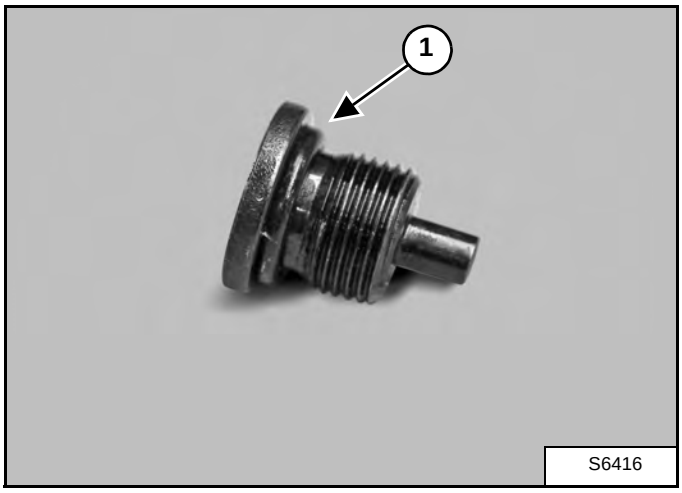
Install the bolts (Item 1) **[Figure 20-100-41]**. Tighten the bolts to 50 N•m (37 ft-lb) torque in a crisscross pattern.

Figure 20-100-42



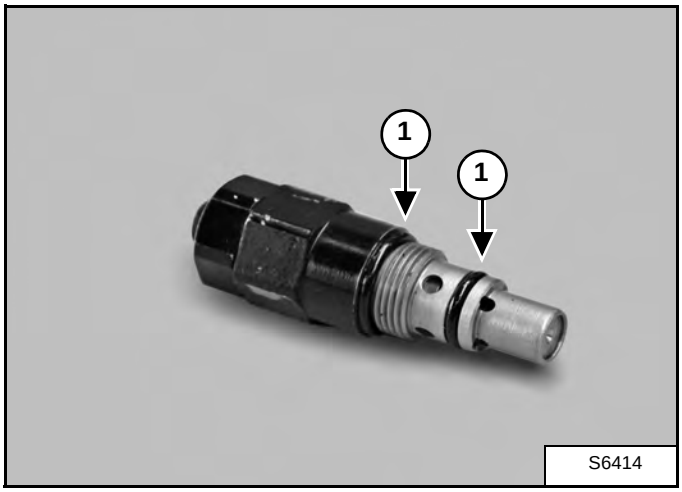
Install the balls (Item 1) and springs (Item 2) **[Figure 20-100-42]**.

Figure 20-100-43



Install the O-ring (Item 1) **[Figure 20-100-43]** on the plugs.

Figure 20-100-44



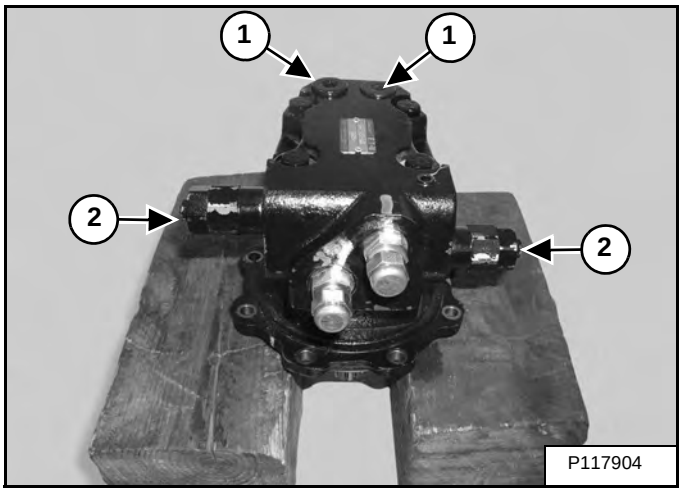
Install the O-rings (Item 1) **[Figure 20-100-44]** on the crossport relief valves.

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Motor Assembly (Cont'd)

Figure 20-100-45

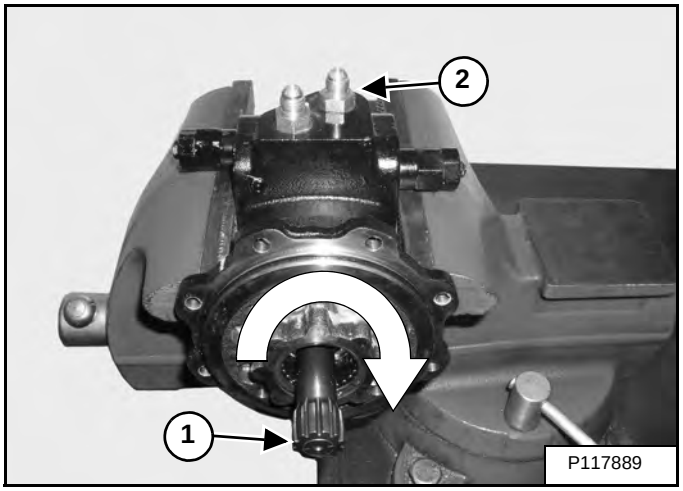


Install the plugs (Item 1) **[Figure 20-100-45]**. Tighten the plugs to 59 N•m (43.5 ft-lb) torque.

Install the relief valves (Item 2) **[Figure 20-100-45]**. Tighten the valves to 98 N•m (72 ft-lb) torque.

Clamp the motor in a vise.

Figure 20-100-46



Turn the shaft (Item 1) **[Figure 20-100-46]** in a clockwise direction.

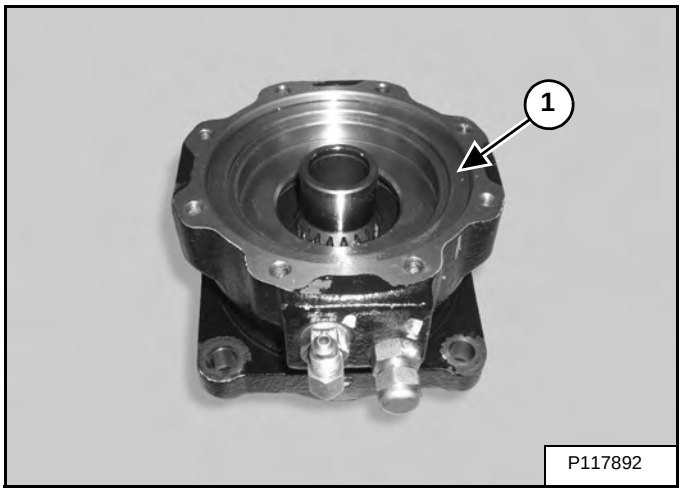
If the motor is correctly timed, there will be suction at the top port (Item 2) **[Figure 20-100-46]**.

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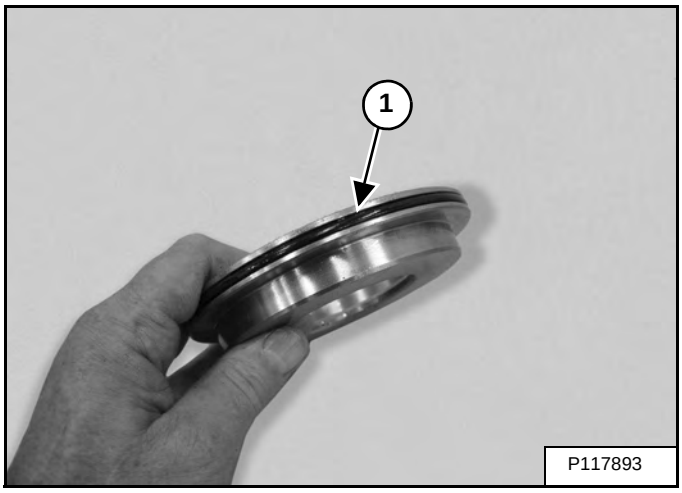
Brake Carrier Disassembly And Assembly

Figure 20-100-47



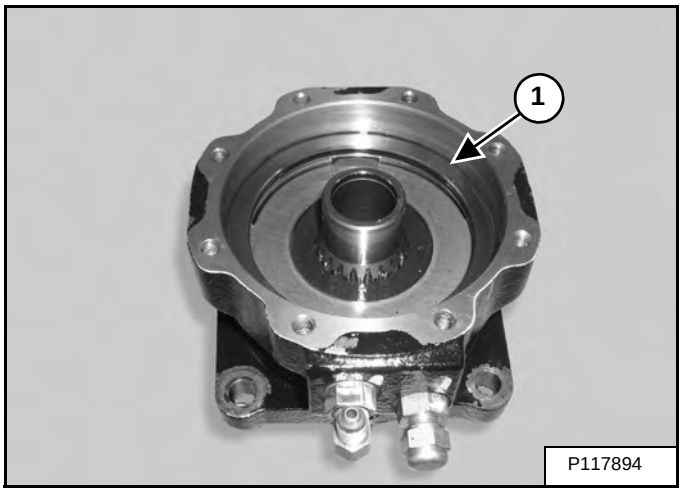
Remove the brake piston (Item 1) **[Figure 20-100-47]**.

Figure 20-100-48



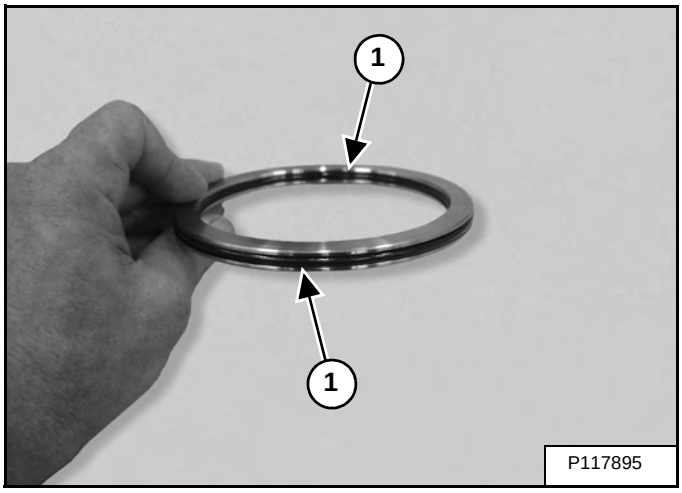
Remove the O-ring (Item 1) **[Figure 20-100-48]**.

Figure 20-100-49



Remove the ring (Item 1) **[Figure 20-100-49]**.

Figure 20-100-50



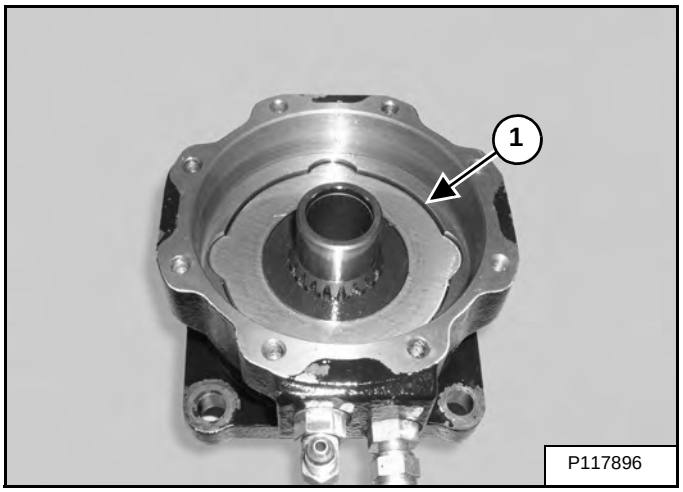
Remove the inner and outer O-ring (Item 1) **[Figure 20-100-50]**.

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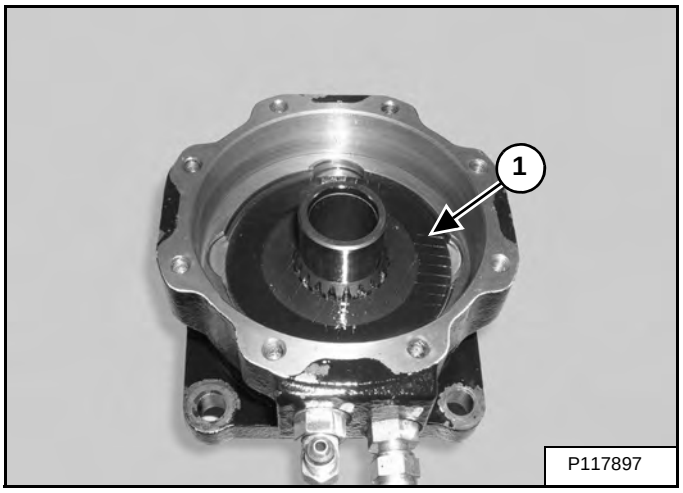
Brake Carrier Disassembly And Assembly (Cont'd)

Figure 20-100-51



Remove the plate (Item 1) **[Figure 20-100-51]**.

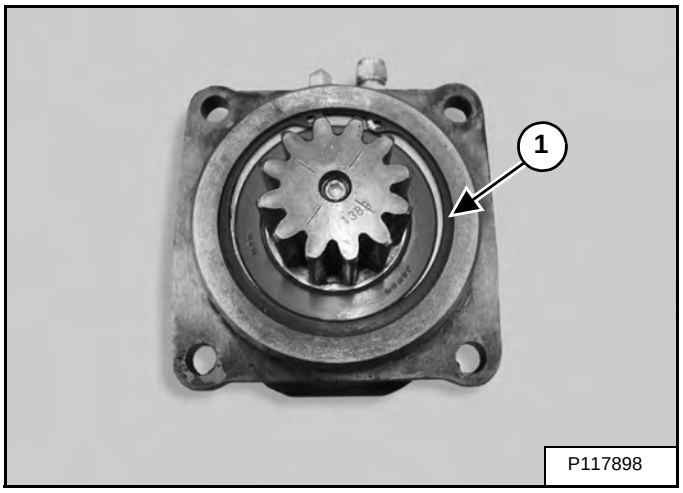
Figure 20-100-52



Remove the friction disk (Item 1) **[Figure 20-100-52]**.

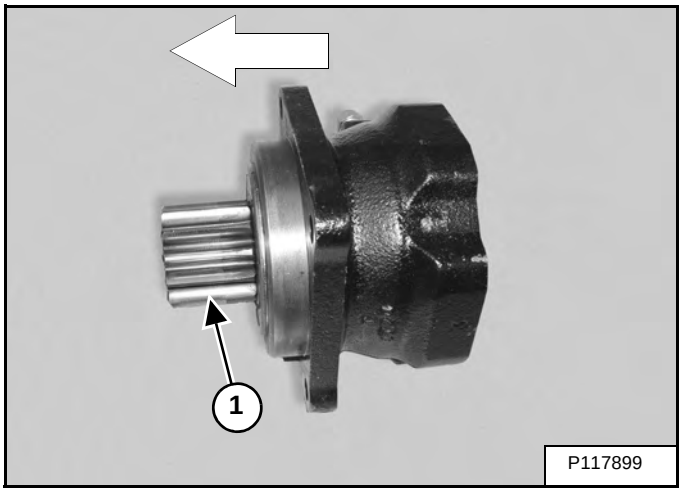
Continue to remove the plates and friction disks.

Figure 20-100-53



Turn the housing over and remove the snap ring (Item 1) **[Figure 20-100-53]**.

Figure 20-100-54



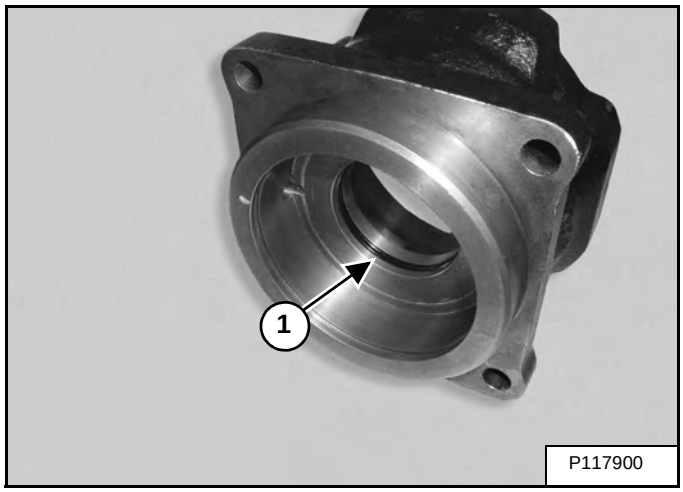
Tap the shaft assembly (Item 1) **[Figure 20-100-54]** out of the bottom of the housing.

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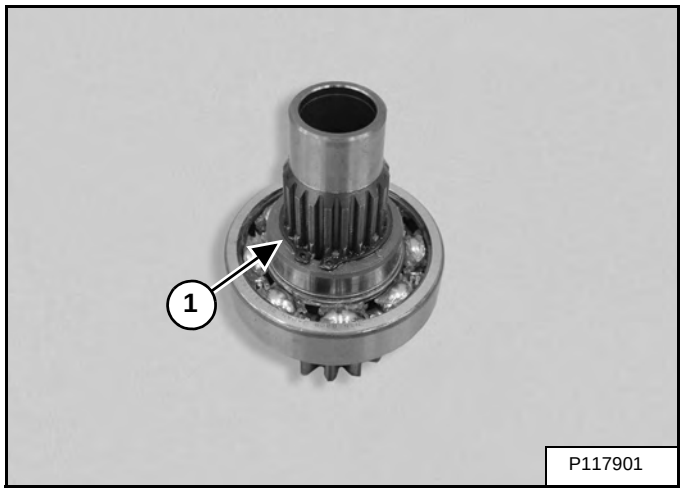
Brake Carrier Disassembly And Assembly (Cont'd)

Figure 20-100-55



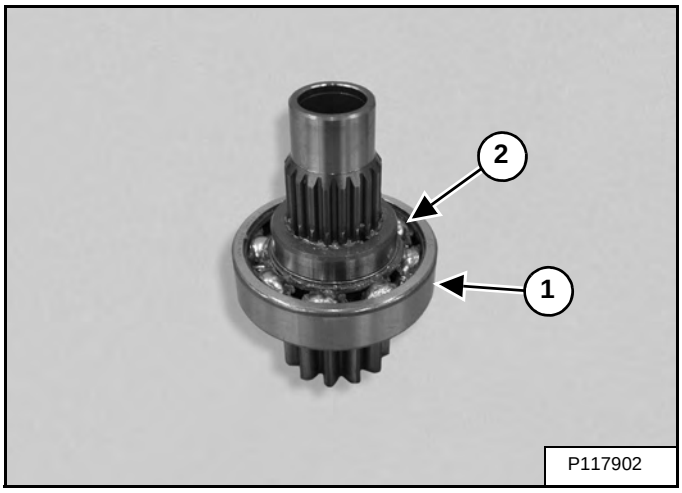
Remove the seal (Item 1) **[Figure 20-100-55]** from the housing.

Figure 20-100-56



Remove the snap ring (Item 1) **[Figure 20-100-56]**.

Figure 20-100-57



Press the collar (Item 1) and bearing (Item 2) **[Figure 20-100-57]** off the shaft.

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CONTROL LEVER (JOYSTICK) (RIGHT)

Testing

Test the pressure reducing valve for the correct pressure. (See Testing And Adjusting on Page 20-33-1.)

The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

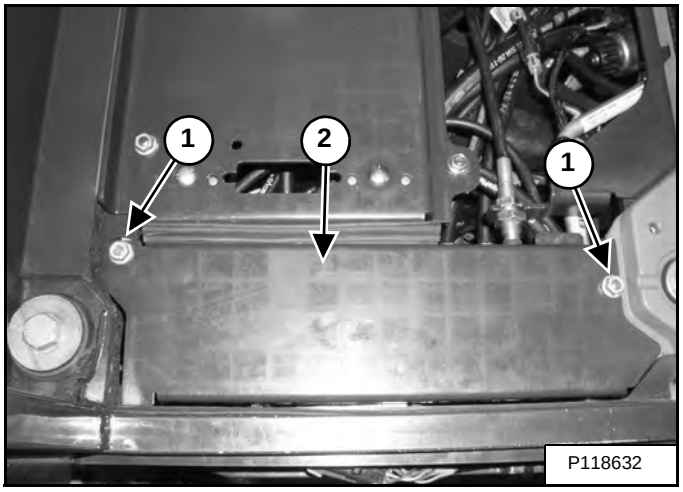
Remove the floor mat and floorplate. (See Removal And Installation on Page 40-140-1.)

IMPORTANT

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

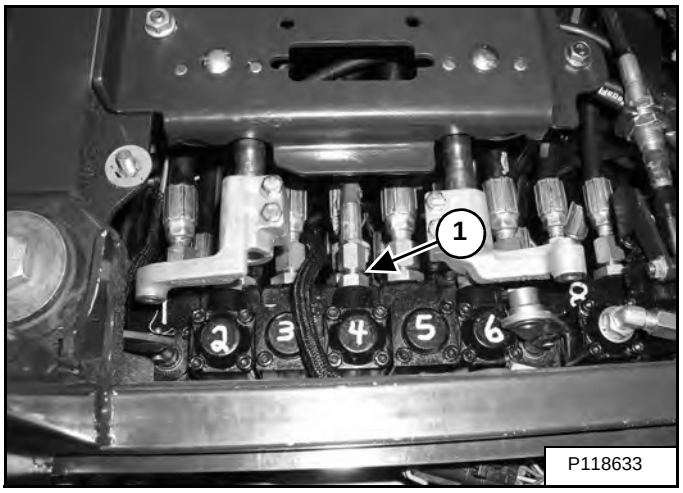
I-2003-0888

Figure 20-110-1



Remove the nuts (Item 1) and floorplate (Item 2) **[Figure 20-110-1]**.

Figure 20-110-2



At the control valve assembly (Item 1) **[Figure 20-110-2]** find the pilot line of the control lever (joystick) that is to be tested. (Boom, Arm, Slew, Bucket).

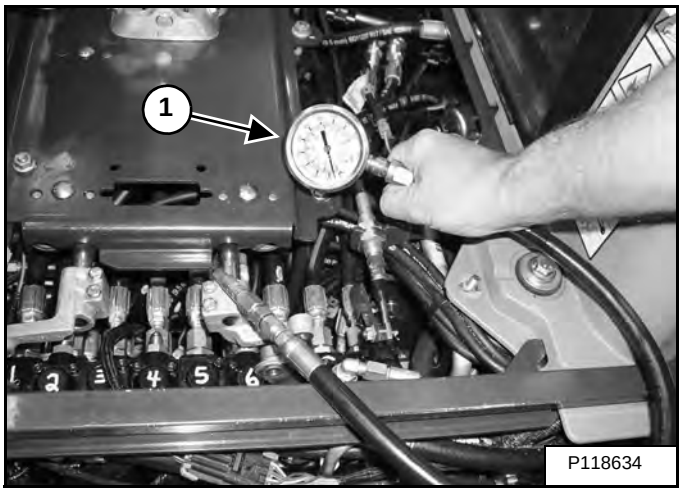
Disconnect the hose from the control valve.

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Testing (Cont'd)

Figure 20-110-3



From the test kit install a 3447 kPa (35 bar) (500 psi) gauge (Item 1) **[Figure 20-110-3]** on the pilot line. Start the excavator, and warm the hydraulic fluid to operating temperature.

Engage the circuit to be tested. Record the operating pressure.

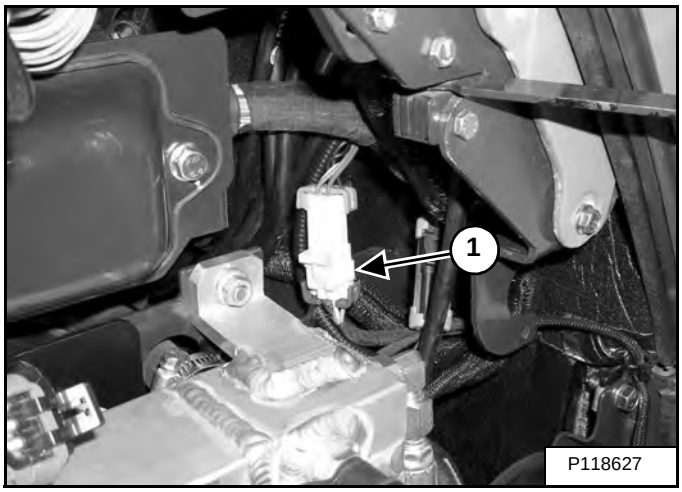
The operating pressure should be approximately 3000 - 3303 kPa (30 - 33 bar) (435 - 479 psi).

If the operating pressure is correct, inspect the valve section spool for proper operation. If the operating pressure is incorrect, remove the pilot pressure relief valve, clean, install and retest. (See Testing And Adjusting on Page 20-33-1.)

If the pressure is still incorrect replace the pilot pressure relief valve. (See Testing And Adjusting on Page 20-33-1.)

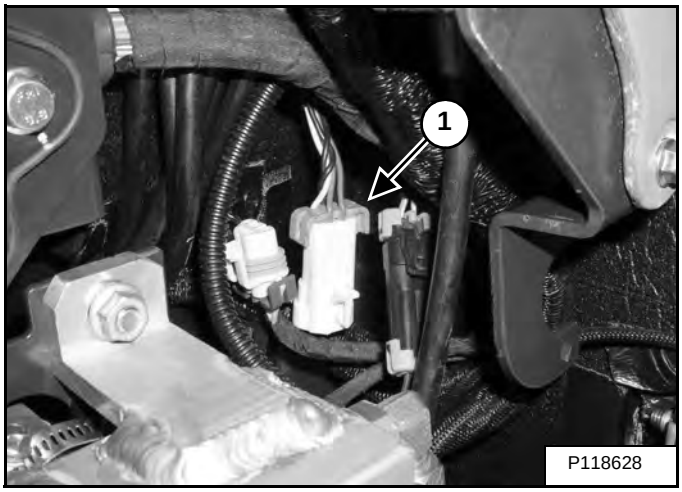
Handle Removal And Installation

Figure 20-110-4



Open the right side cover and disconnect the joystick wire harness (Item 1) **[Figure 20-110-4]**.

Figure 20-110-5



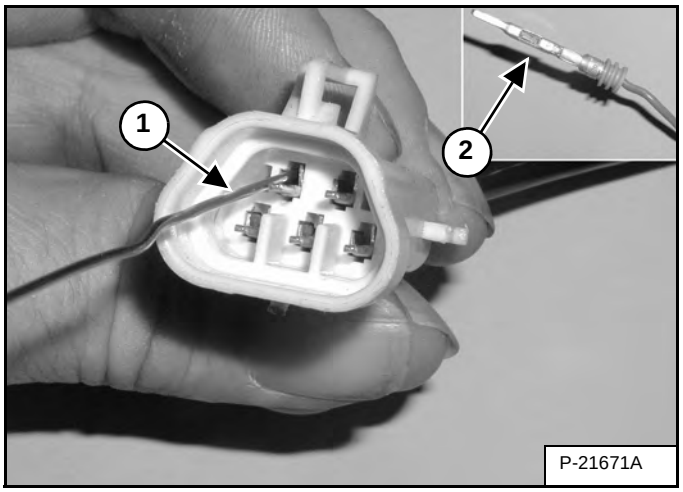
Remove the lock (Item 1) **[Figure 20-110-5]** from the wire harness.

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Handle Removal And Installation (Cont'd)

Figure 20-110-6

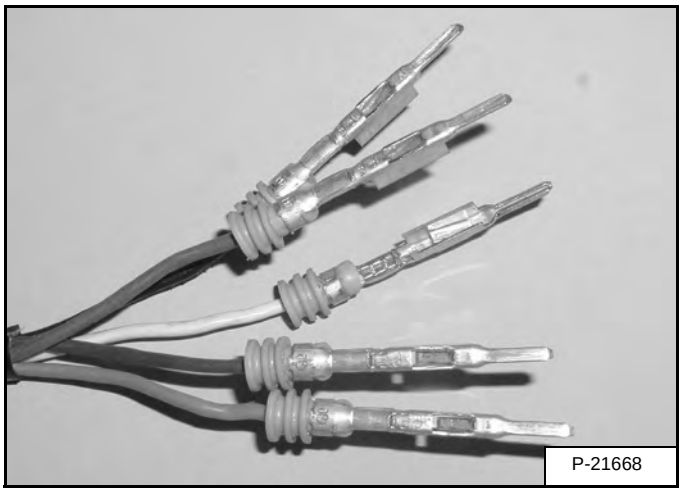


With a small piece of wire (Item 1), depress the wire terminal tabs (Item 2) **[Figure 20-110-6]**.

Carefully remove the individual wires from the back of the electrical connector.

Installation: Use a small piece of wire and re-bend the tab (Item 1) **[Figure 20-110-6]** on each wire before installing the electrical connector.

Figure 20-110-7



Installation: The wires **[Figure 20-110-7]** must be installed in the proper locations in the wire connector, listed below.

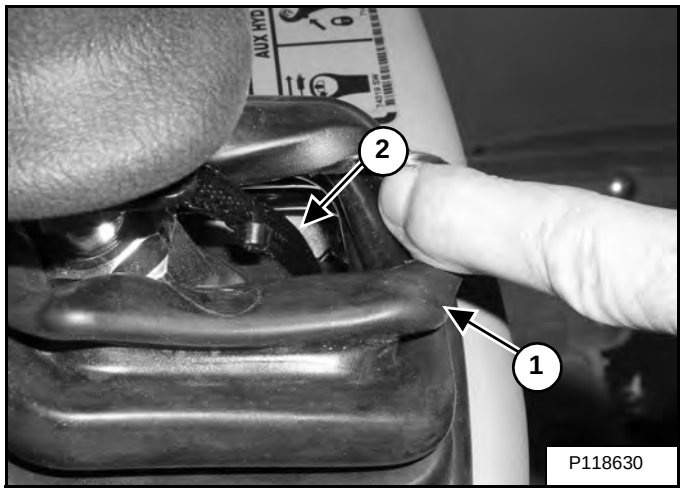
A	**Yellow**
B	**Black**
C	**Black**
D	**Red**
E	**Brown**

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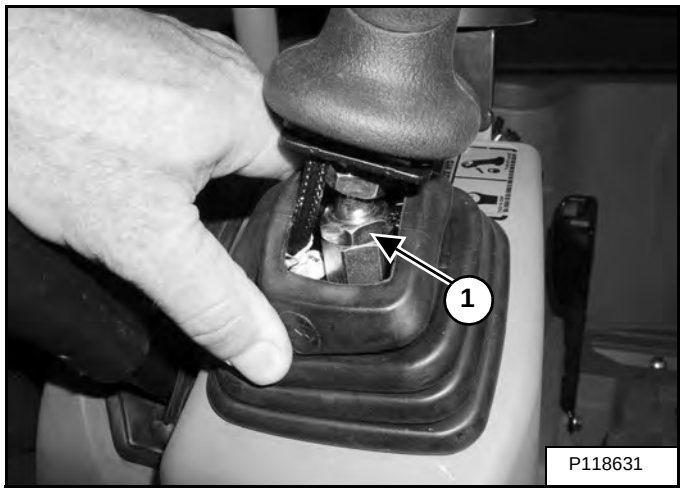
Handle Removal And Installation (Cont'd)

Figure 20-110-8



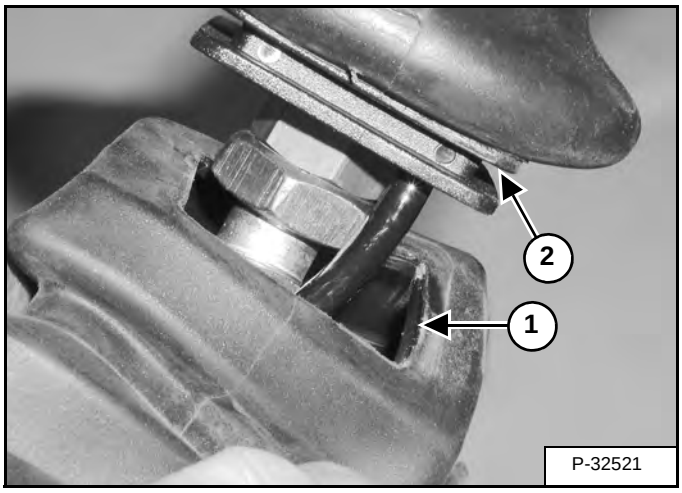
Pull the boot (Item 1) down and pull the wire harness (Item 2) **[Figure 20-110-8]** out of the housing.

Figure 20-110-9



Pull the boot down. Loosen the nut (Item 1) **[Figure 20-110-9]** and remove the handle.

Figure 20-110-10



Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-110-10]**.

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Joystick Assembly Removal And Installation

Open the right side door.

⚠ WARNING

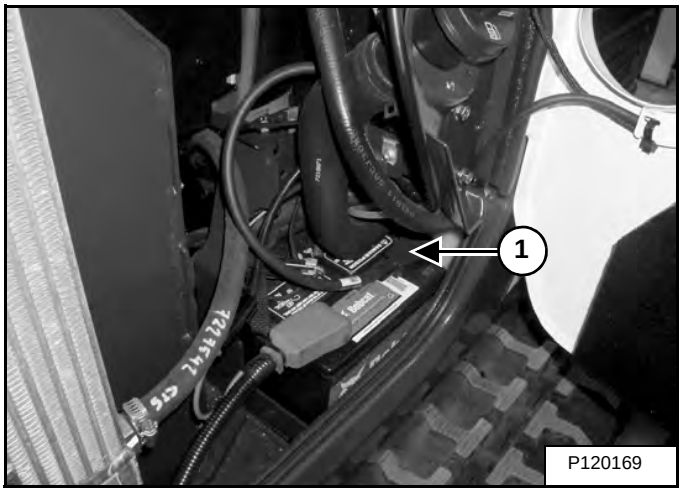
AVOID INJURY OR DEATH

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

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

W-2019-0907

Figure 20-110-11



Disconnect the negative (-) cable (Item 1) **[Figure 20-110-11]** from the battery.

Remove the key switch. (See Removal And Installation on Page 50-110-1.)

⚠ WARNING

AVOID INJURY OR DEATH

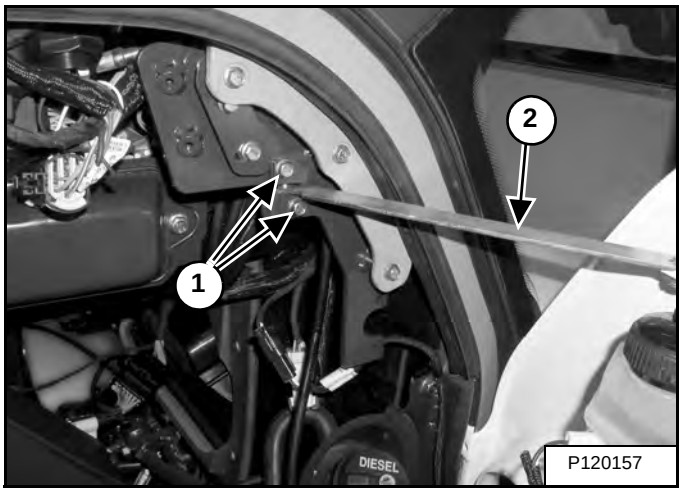
Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

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

Figure 20-110-12



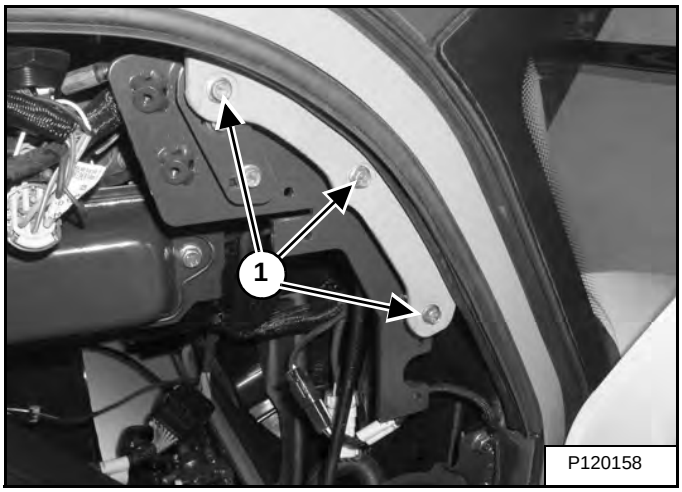
Remove the bolts (Item 1) and disconnect the door stop bracket (Item 2) **[Figure 20-110-12]**.

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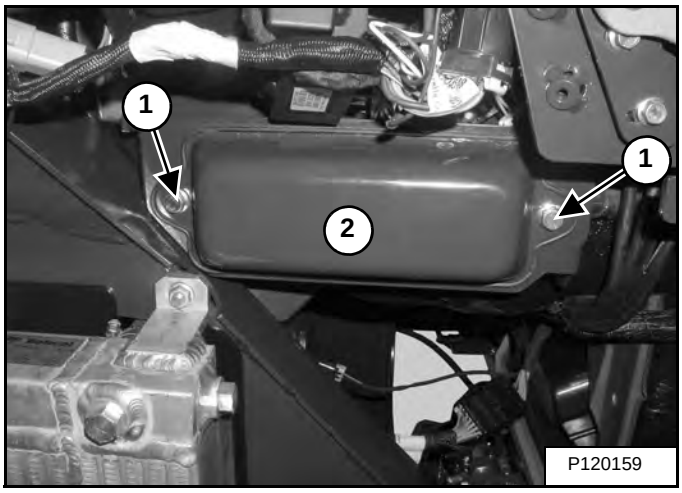
Joystick Assembly Removal And Installation (Cont'd)

Figure 20-110-13



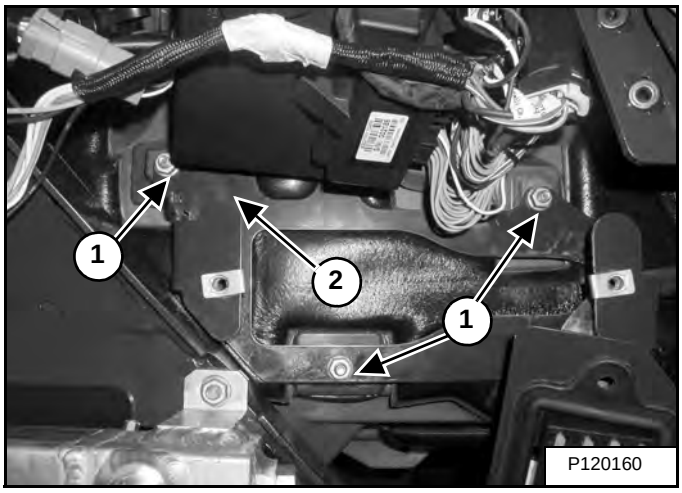
Remove the three bolts (Item 1) **[Figure 20-110-13]**.

Figure 20-110-14



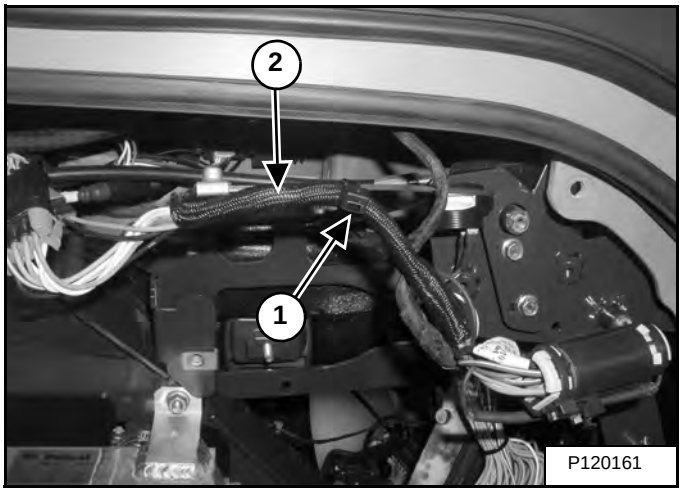
Remove the two bolts (Item 1) from the fuse relay center (Item 2) **[Figure 20-110-14]** and place fuse center out of the way.

Figure 20-110-15



Remove the three nuts (Item 1) from the ECU/fuse relay bracket (Item 2) **[Figure 20-110-15]** and set to the side.

Figure 20-110-16



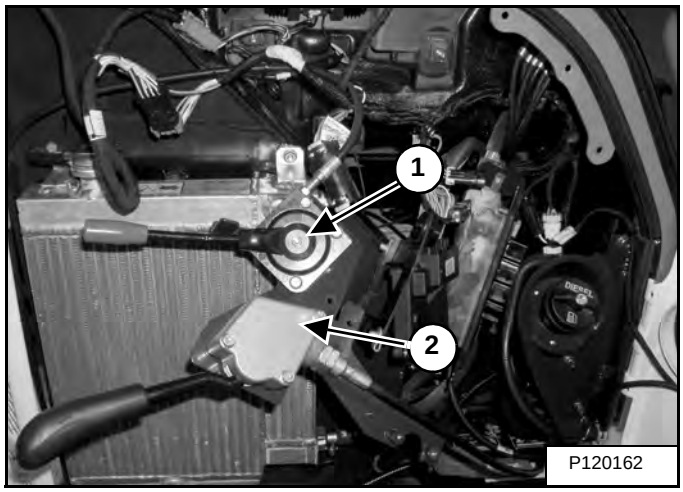
Cut the cable tie (Item 1) from the wire harness (Item 2) **[Figure 20-110-16]**.

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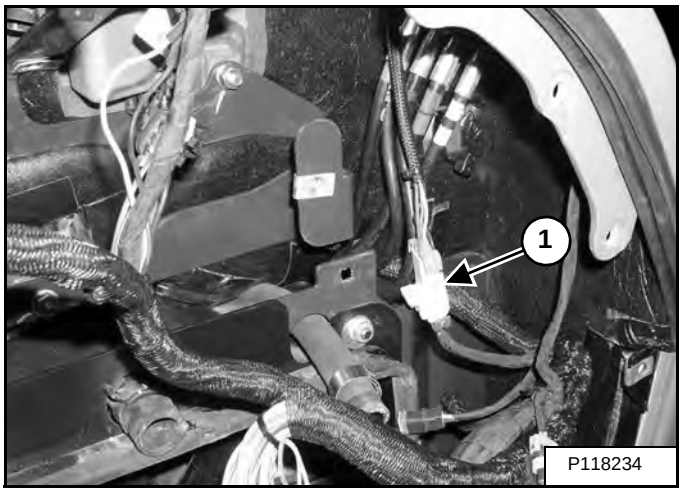
Joystick Assembly Removal And Installation (Cont'd)

Figure 20-110-17



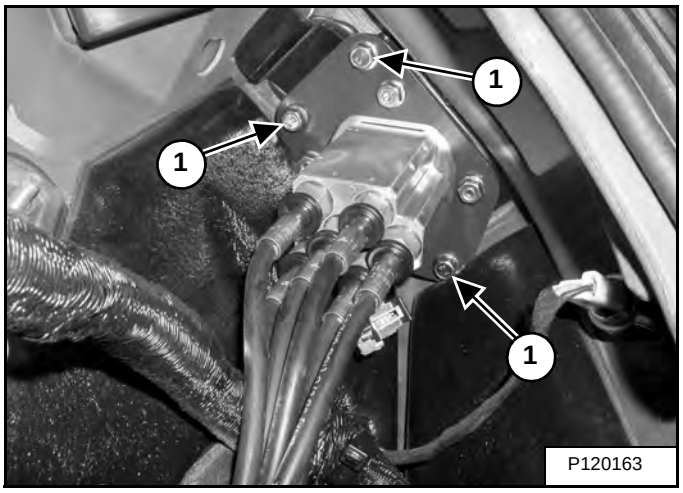
Remove the throttle control (Item 1) and the blade control (Item 2) **[Figure 20-110-17]** lever assemblies.

Figure 20-110-18



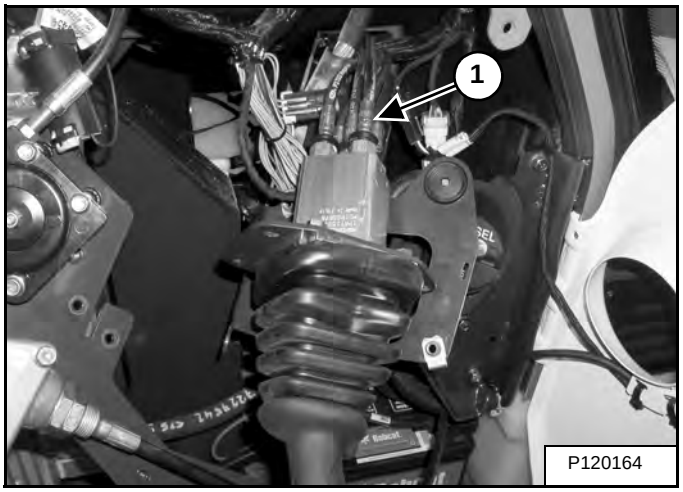
Disconnect the joystick wires (if equipped) (Item 1) **[Figure 20-110-18]**.

Figure 20-110-19



Remove the three mounting bolts (Item 1) **[Figure 20-110-19]**.

Figure 20-110-20



Lower the joystick, mark and remove the hoses (Item 1) **[Figure 20-110-20]**.

IMPORTANT

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

I-2003-0888

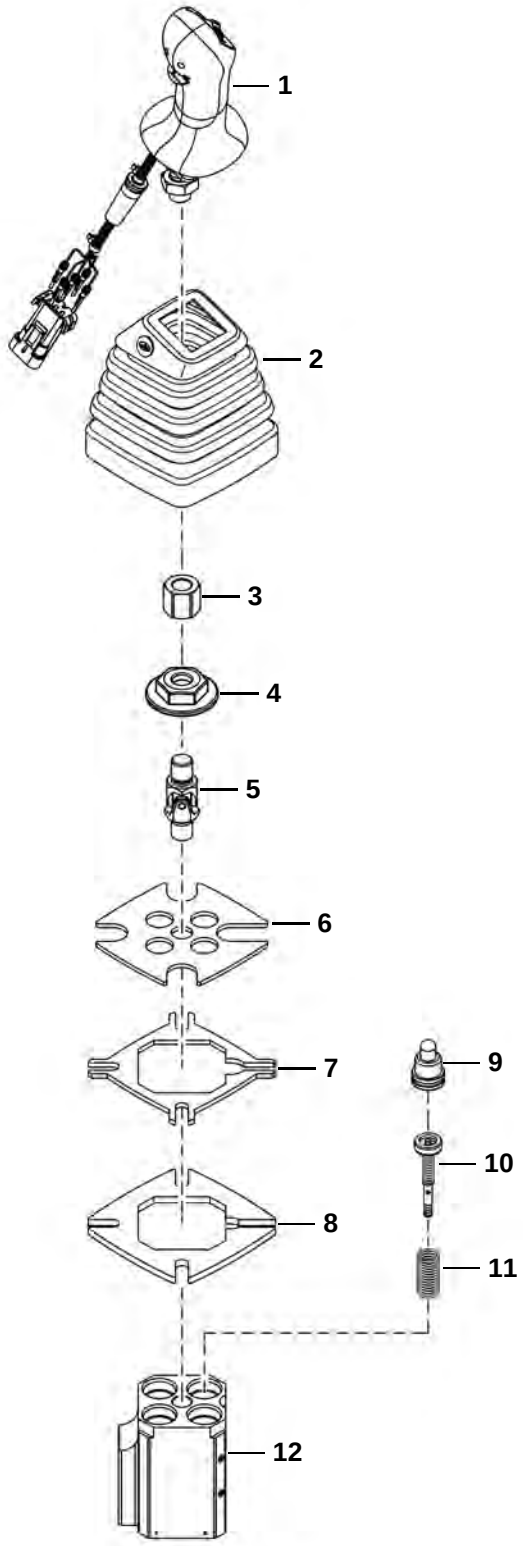
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CONTROL LEVER (JOYSTICK) (RIGHT) (CONT'D)

Parts Identification

1. Handle
2. Dust Boot
3. Coupler
4. Actuator Control Plate
5. U-Joint
6. Top Plate
7. Intermediate Plate
8. Bottom Plate
9. Plunger Assembly
10. Spool
11. Spring
12. Housing



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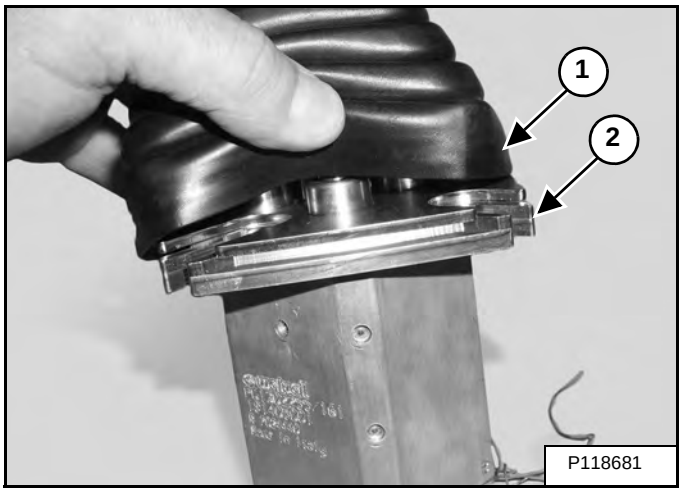
https://www.pdfmanual4trucks.com/

Disassembly

Remove the left handle. (See Handle Removal And Installation on Page 20-110-2.)

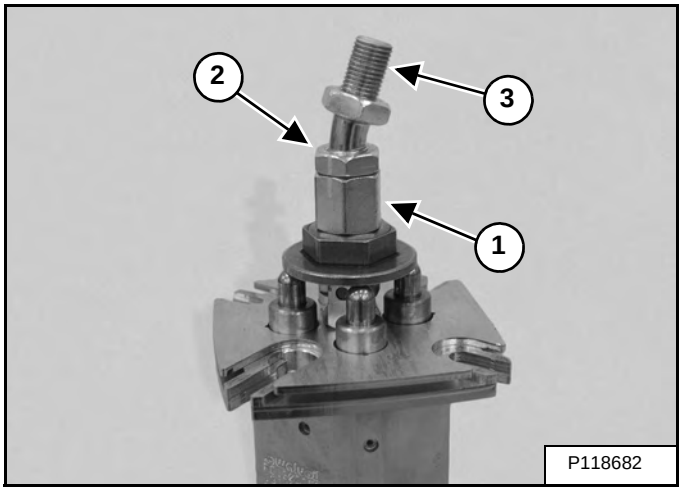
Clean the outside of the control lever before disassembly.

Figure 20-110-21



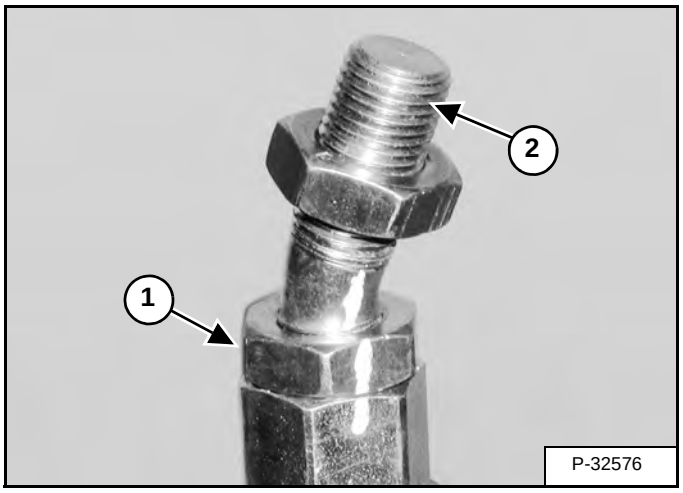
Remove the boot (Item 1) from the control lever (joystick) (Item 2) **[Figure 20-110-21]**.

Figure 20-110-22



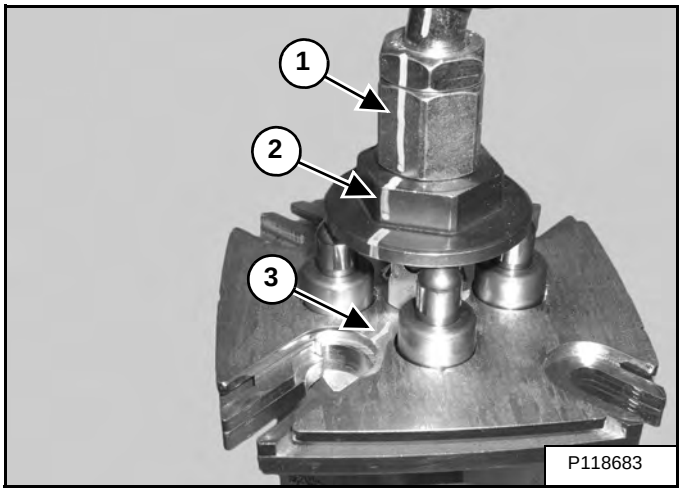
Mark the coupler (Item 1) nut (Item 2), and connector (Item 3) **[Figure 20-110-22]** for correct assembly.

Figure 20-110-23



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-110-23]**.

Figure 20-110-24



Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-110-24]** for correct installation.

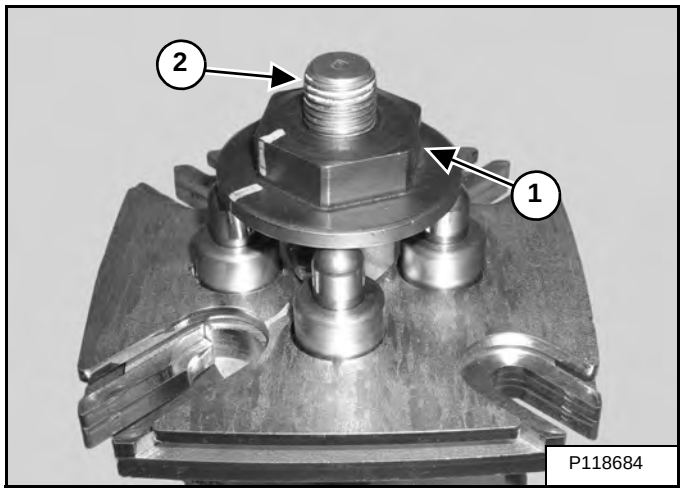
Remove the coupler from the control plate.

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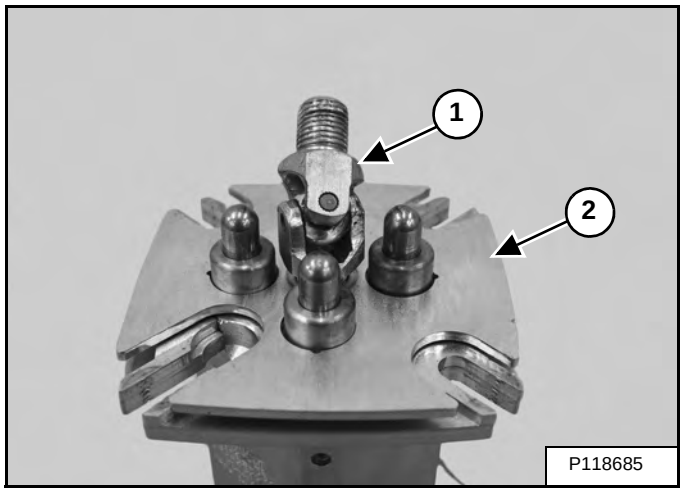
Disassembly (Cont'd)

Figure 20-110-25



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-110-25]**.

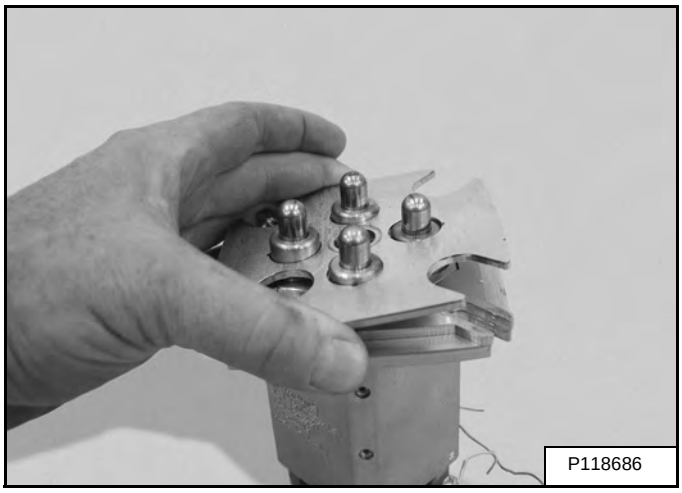
Figure 20-110-26



Mark the top plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-110-26]**.

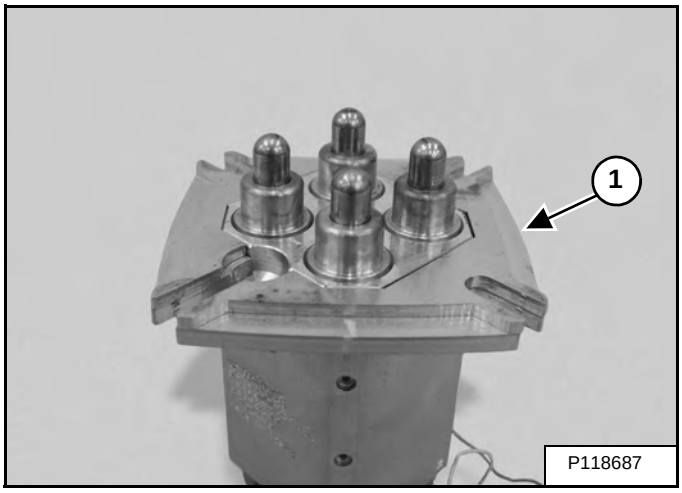
NOTE: The top plate (Item 2) [Figure 20-110-26] is spring loaded and will come up as the U-Joint is removed.

Figure 20-110-27



Remove the top plate (Item 1) **[Figure 20-110-27]**.

Figure 20-110-28



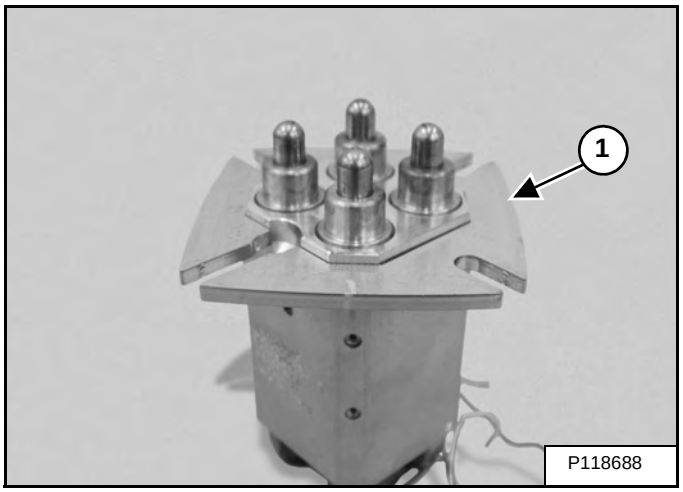
Remove the intermediate plate (Item 1) **[Figure 20-110-28]**.

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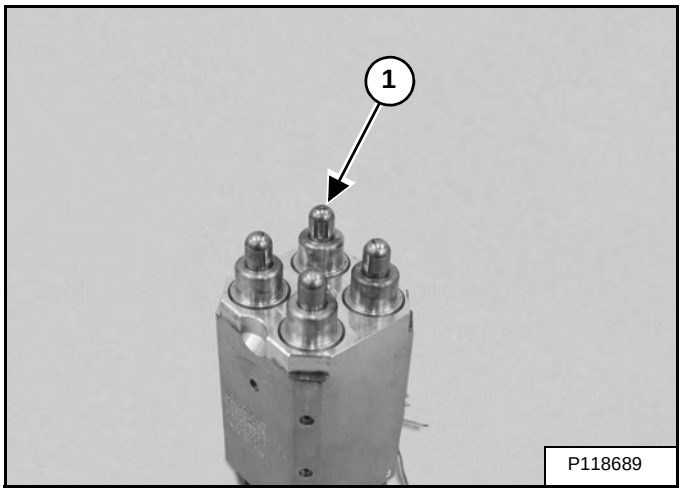
Disassembly (Cont'd)

Figure 20-110-29



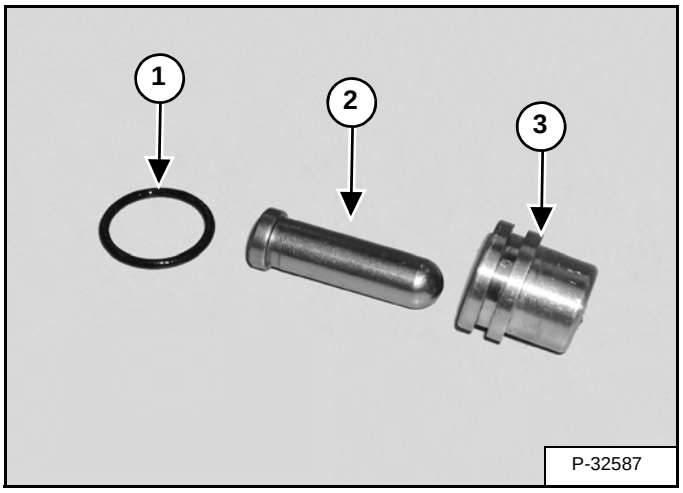
Remove the bottom plate (Item 1) **[Figure 20-110-29]**.

Figure 20-110-30



Remove the plunger assemblies (Item 1) **[Figure 20-110-30]**.

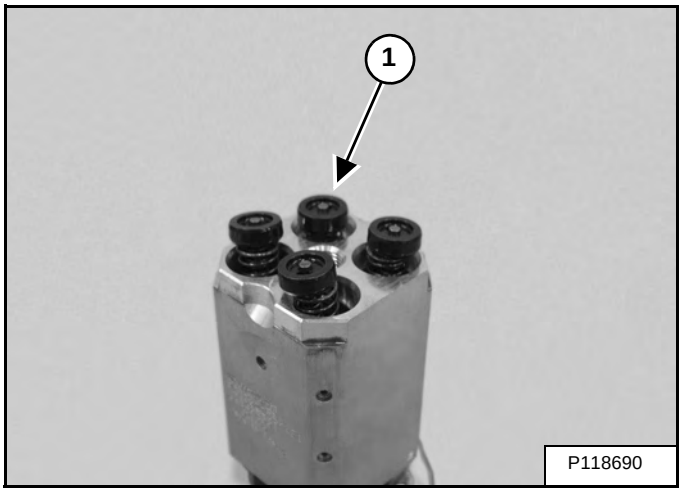
Figure 20-110-31



Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-110-31]**.

NOTE: Mark the spool assemblies for installation in their original location.

Figure 20-110-32



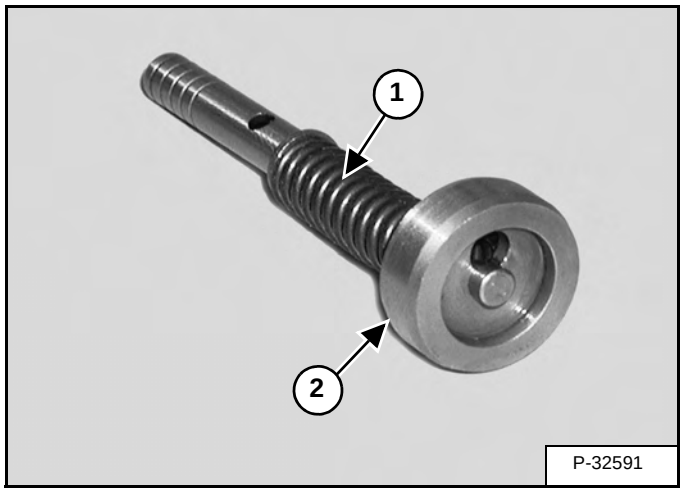
Remove the spool assemblies (Item 1) **[Figure 20-110-32]**.

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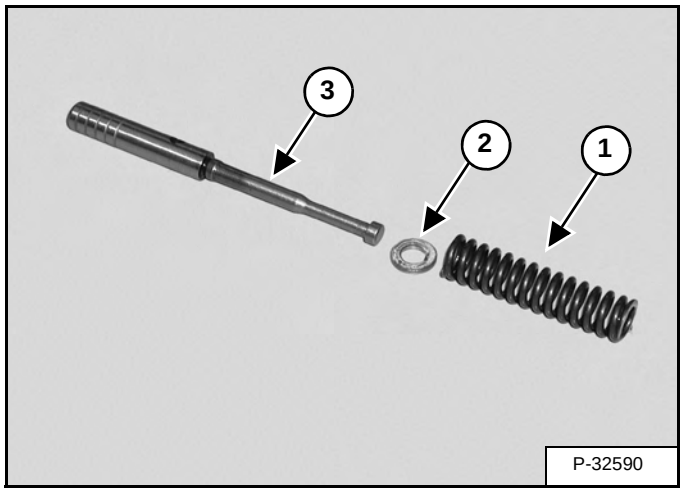
Disassembly (Cont'd)

Figure 20-110-33



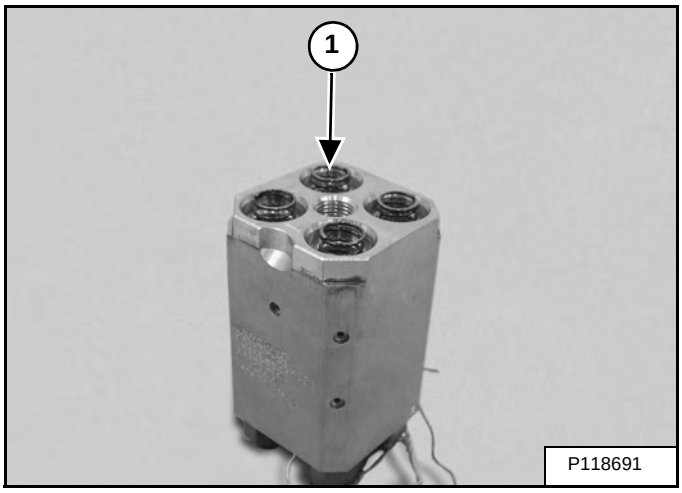
Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-110-33]**.

Figure 20-110-34



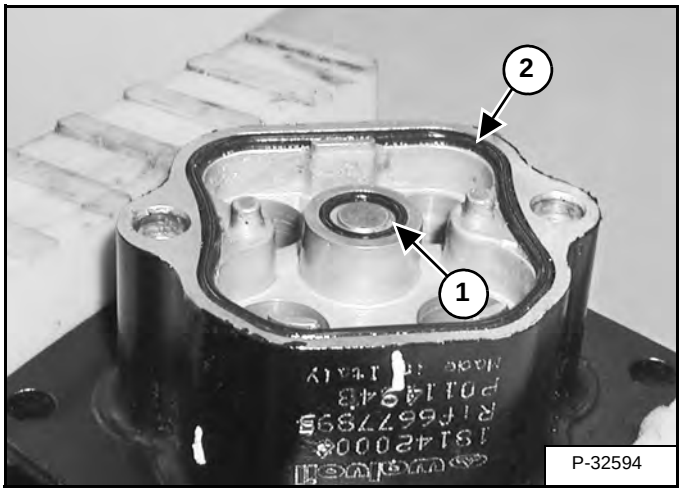
Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-110-34]**.

Figure 20-110-35



Remove the springs (Item 1) **[Figure 20-110-35]** from the housing.

Figure 20-110-36



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-110-36]**.

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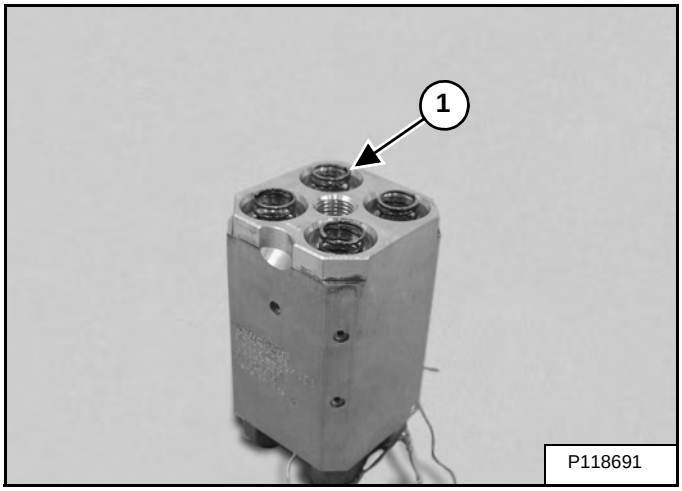
Assembly

Clean all parts in solvent and dry with compressed air.

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

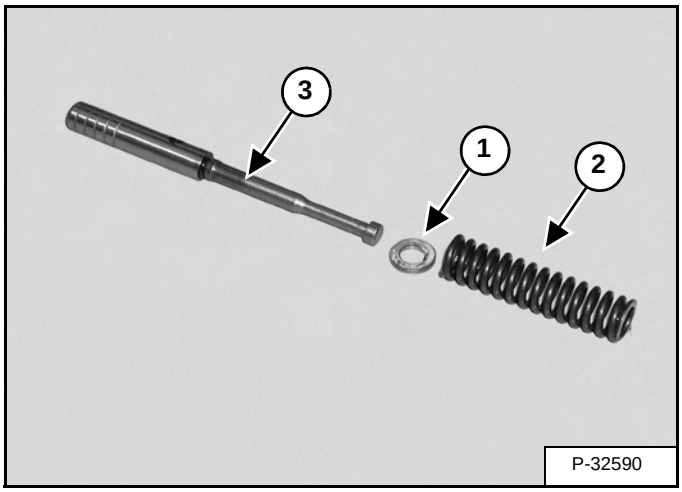
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-110-37



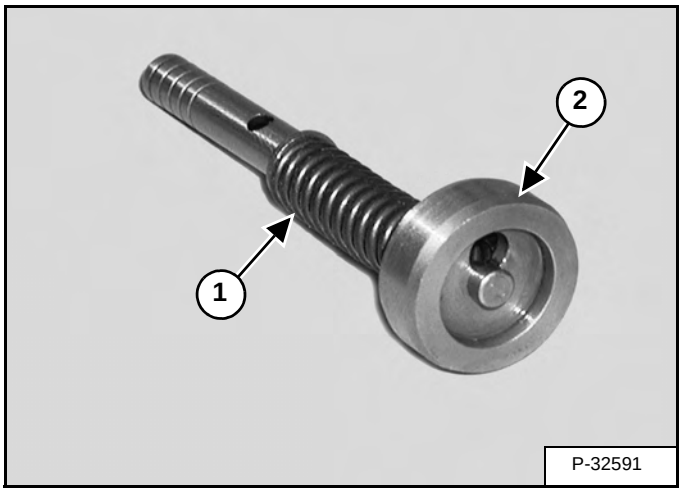
Install the springs (Item 1) **[Figure 20-110-37]**.

Figure 20-110-38



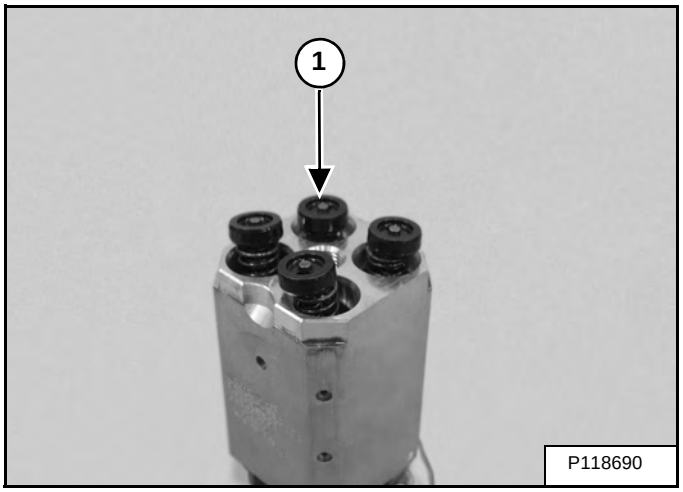
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-110-38]**.

Figure 20-110-39



Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-110-39]**.

Figure 20-110-40



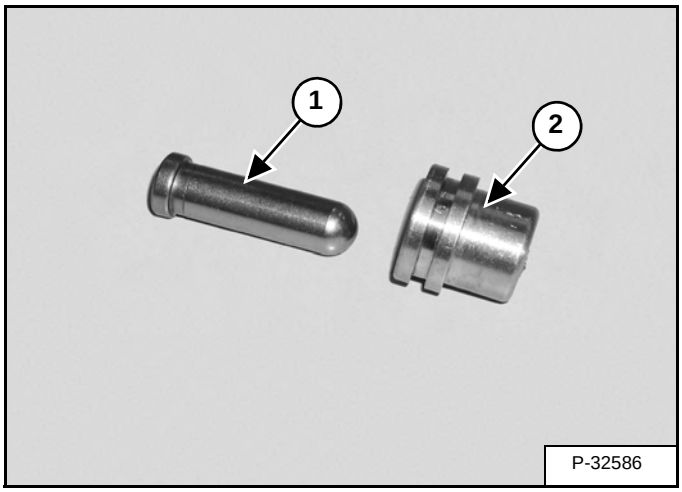
Install the spool assemblies (Item 1) **[Figure 20-110-40]** into the housing.

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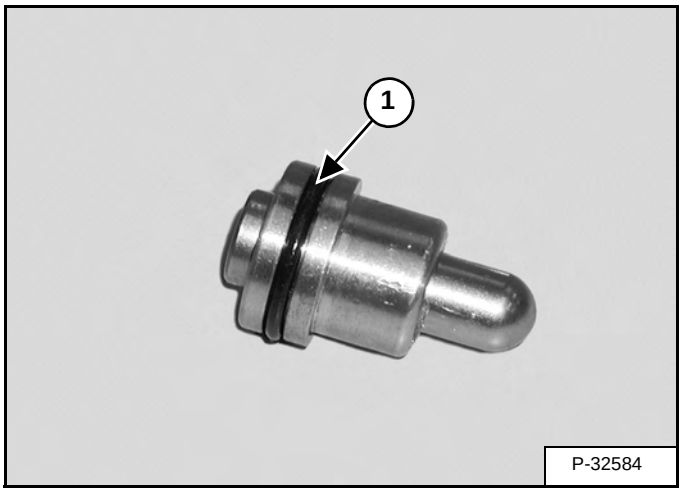
Assembly (Cont'd)

Figure 20-110-41



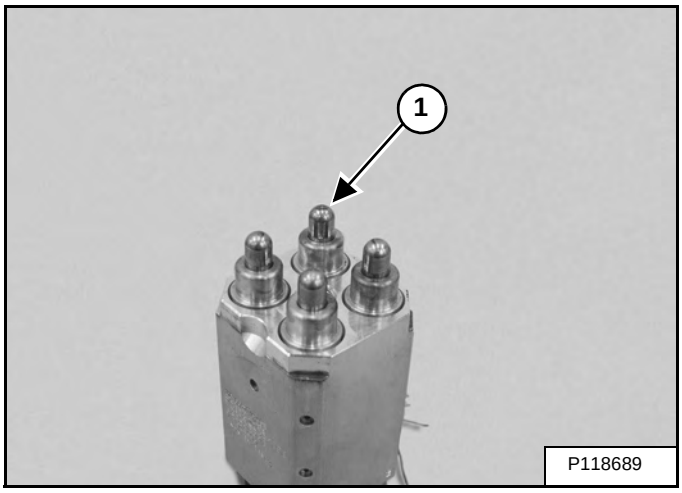
Install the plunger (Item 1) into the bushing (Item 2) **[Figure 20-110-41]**.

Figure 20-110-42



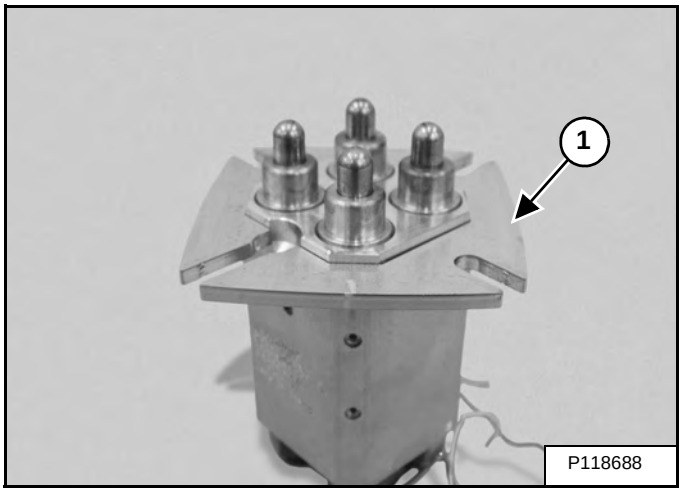
Install the O-ring (Item 1) **[Figure 20-110-42]** on the bushing.

Figure 20-110-43



Install the plunger assemblies (Item 1) **[Figure 20-110-43]** into the housing.

Figure 20-110-44



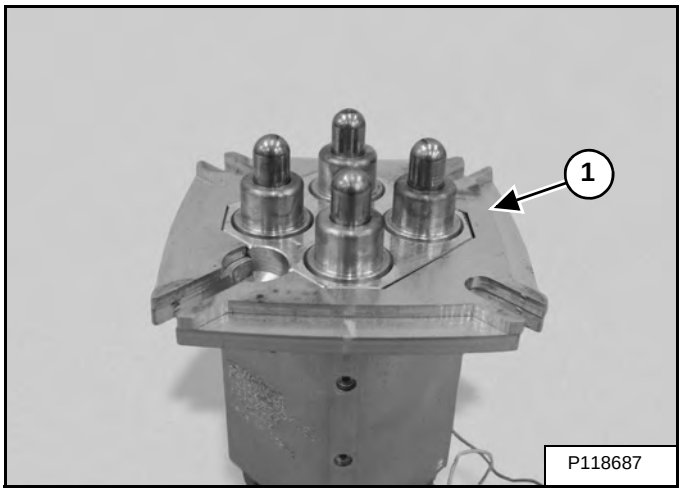
Install the bottom plate (Item 1) **[Figure 20-110-44]**.

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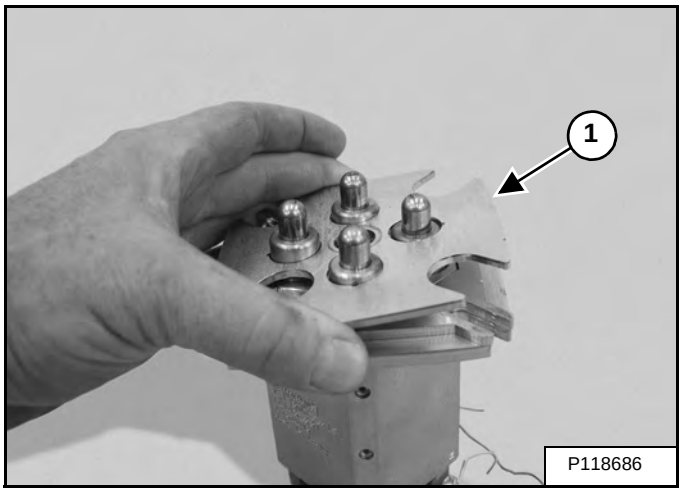
Assembly (Cont'd)

Figure 20-110-45



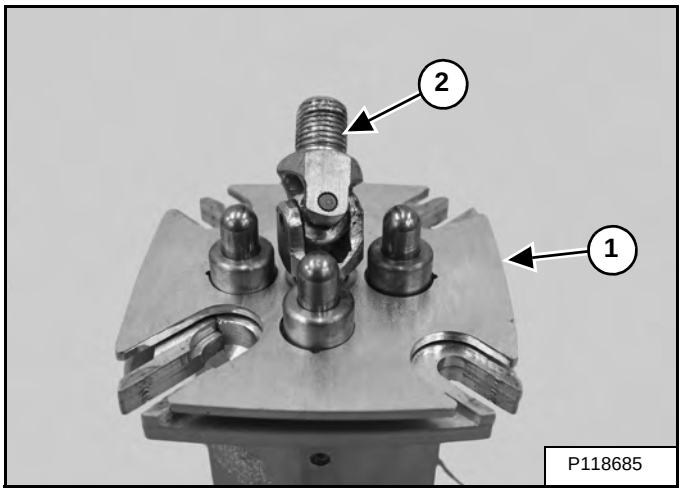
Install the intermediate plate (Item 1) **[Figure 20-110-45]**.

Figure 20-110-46



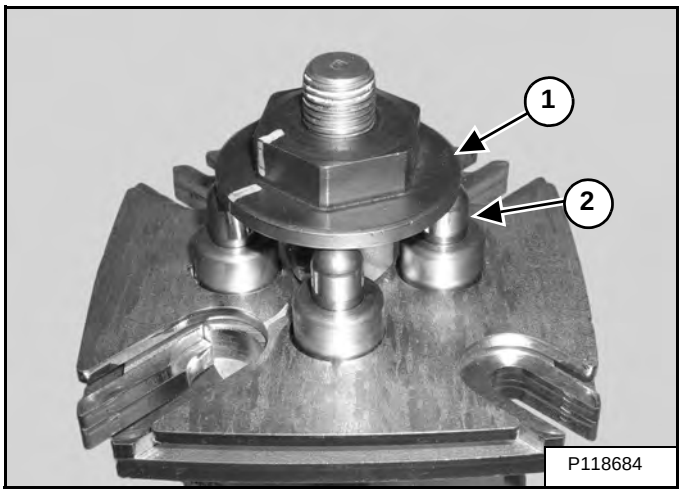
Install the top plate (Item 1) **[Figure 20-110-46]**.

Figure 20-110-47



Press down on the plates (Item 1) to seat the plunger assemblies. Install the U-Joint (Item 2) **[Figure 20-110-47]**.

Figure 20-110-48



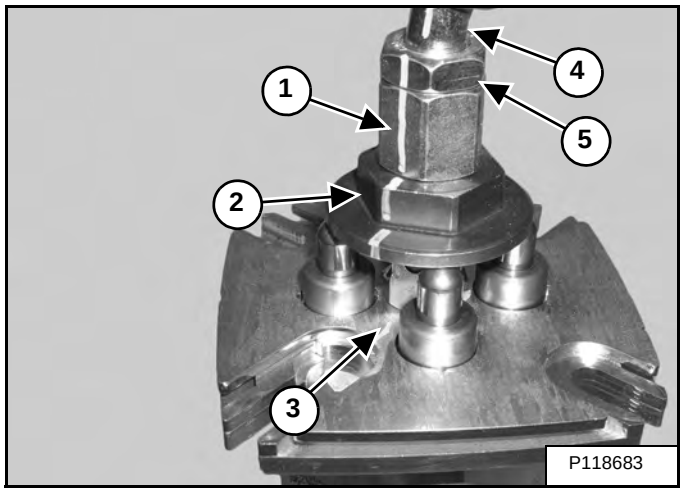
Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-110-48]**.

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Assembly (Cont'd)

Figure 20-110-49

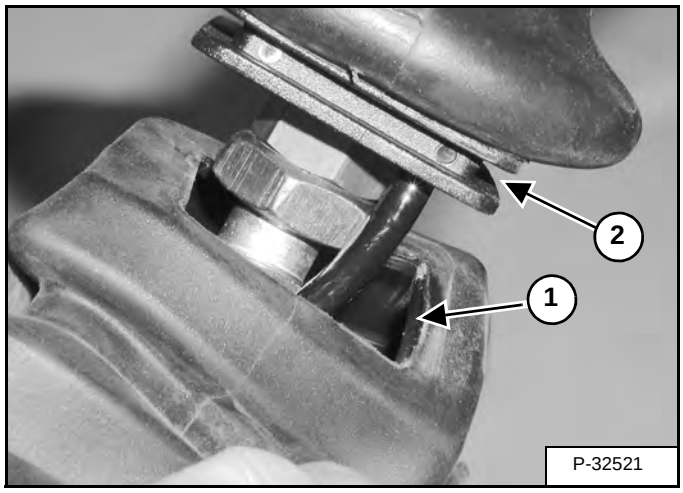


Align the coupler (Item 1) with the control plate (Item 2) and the top plate (Item 3) **[Figure 20-110-49]**. Tighten the coupler.

Install the connector (Item 4) **[Figure 20-110-49]**

Align the connector with the coupler (Item 1) and tighten the nut (Item 5) **[Figure 20-110-49]**.

Figure 20-110-50



Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-110-50]**.

Install the handle. (See Handle Removal And Installation on Page 20-110-2.)

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CONTROL LEVER (JOYSTICK) (LEFT)

Testing

Test the pressure reducing valve for the correct pressure. (See Testing And Adjusting on Page 20-33-1.)

The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

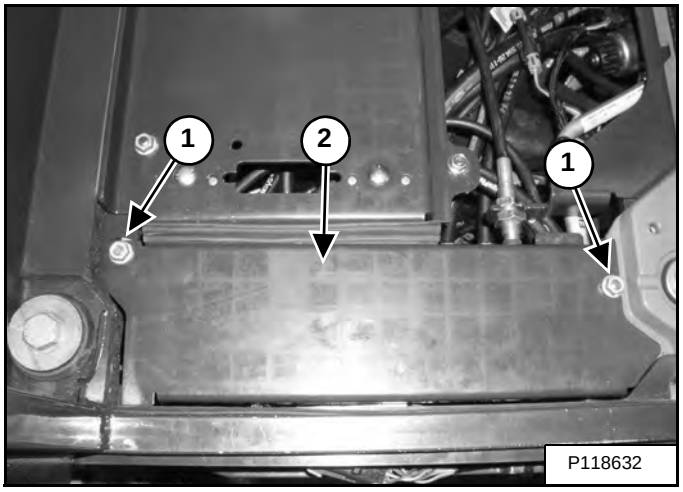
Remove the floor mat and floorplate. (See Removal And Installation on Page 40-140-1.)

IMPORTANT

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

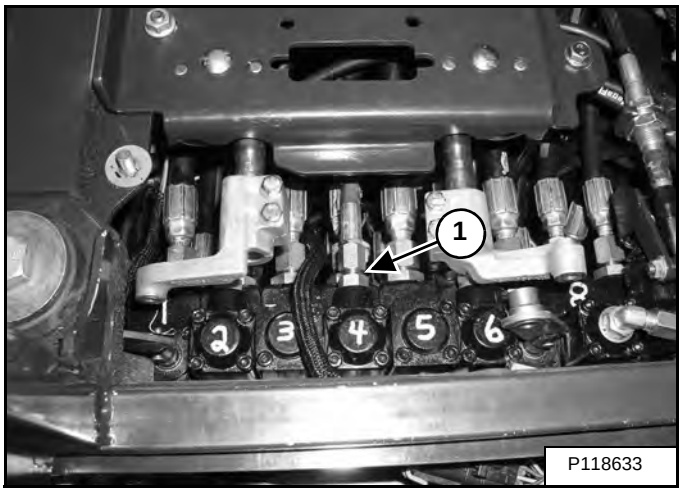
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Figure 20-111-1



Remove the nuts (Item 1) and the floorplate (Item 2) **[Figure 20-111-1]**.

Figure 20-111-2



At the control valve assembly (Item 1) **[Figure 20-111-2]** find the pilot line of the control lever (joystick) that is to be tested. (Boom, Arm, Slew, Bucket).

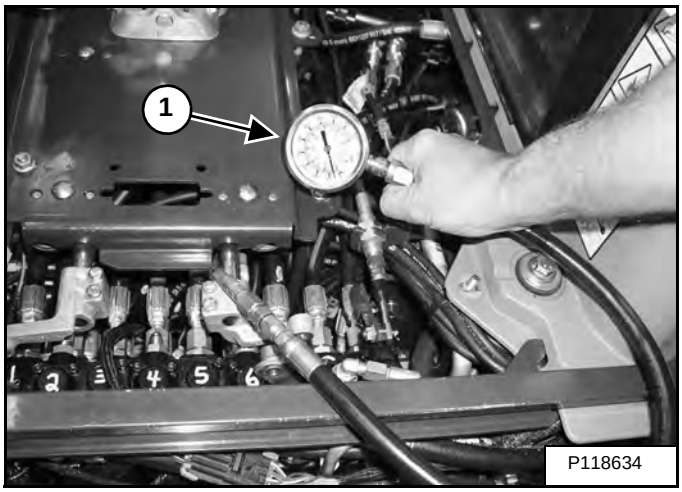
Disconnect the hose from the control valve.

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Testing (Cont'd)

Figure 20-111-3



From the test kit install a 3447 kPa (35 bar) (500 psi) gauge (Item 1) **[Figure 20-111-3]** on the pilot line. Start the excavator, and warm the hydraulic fluid to operating temperature.

Engage the circuit to be tested. Record the operating pressure.

The operating pressure should be approximately 3000 - 3303 kPa (30 - 33 bar) (436 - 479 psi).

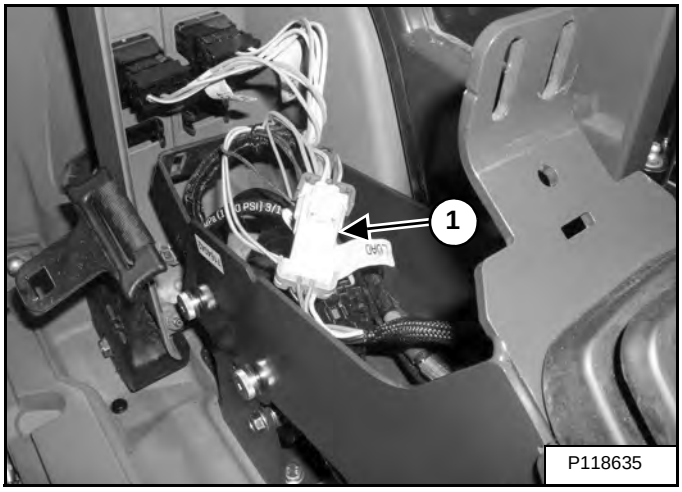
If the operating pressure is correct, inspect the valve section spool for proper operation. If the operating pressure is incorrect, remove the pilot pressure relief valve, clean, install and retest. (See Testing And Adjusting on Page 20-33-1.)

If the pressure is still incorrect replace the pilot pressure relief valve. (See Testing And Adjusting on Page 20-33-1.)

Handle Removal And Installation

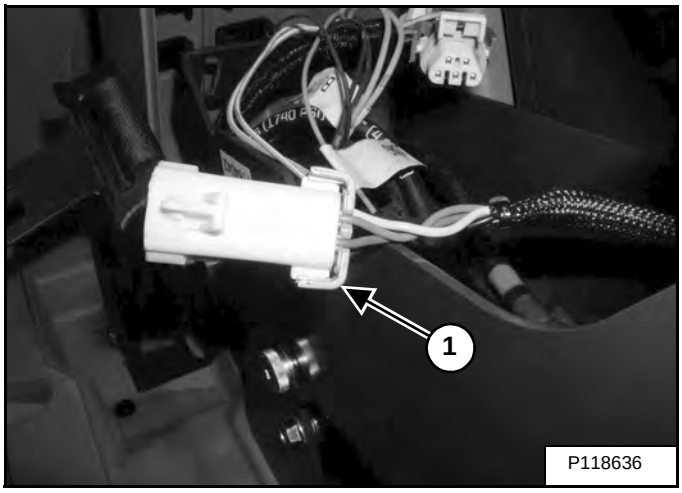
Remove the left console cover. (See Removal And Installation on Page 40-60-1.)

Figure 20-111-4



Disconnect the wire harness (Item 1) **[Figure 20-111-4]**.

Figure 20-111-5



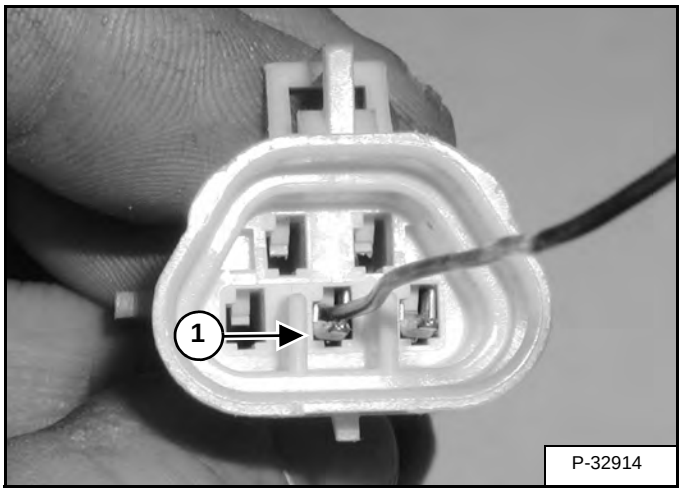
Remove the lock (Item 1) **[Figure 20-111-5]** from the electrical connector.

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Handle Removal And Installation (Cont'd)

Figure 20-111-6



Using a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 20-111-6]**.

Carefully remove the individual wires from the back of the electrical connector.

Remove the control handle (joystick) assembly from the excavator.

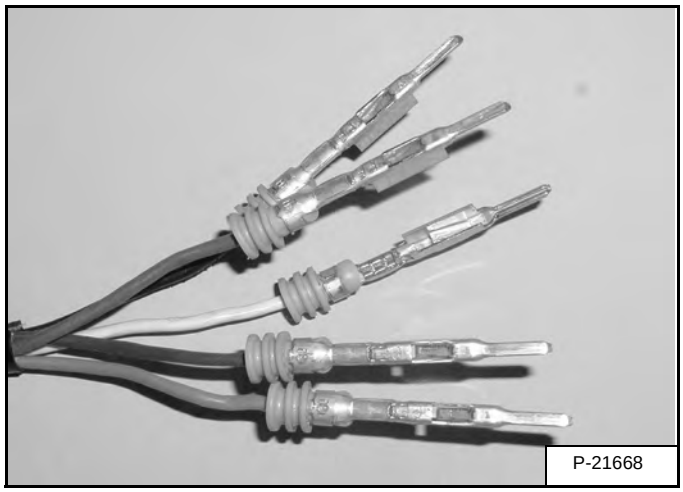
Installation: Use a small piece of wire and rebend the tab on each wire before installing it in the electrical connector.

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Handle Removal And Installation (Cont'd)

Figure 20-111-7

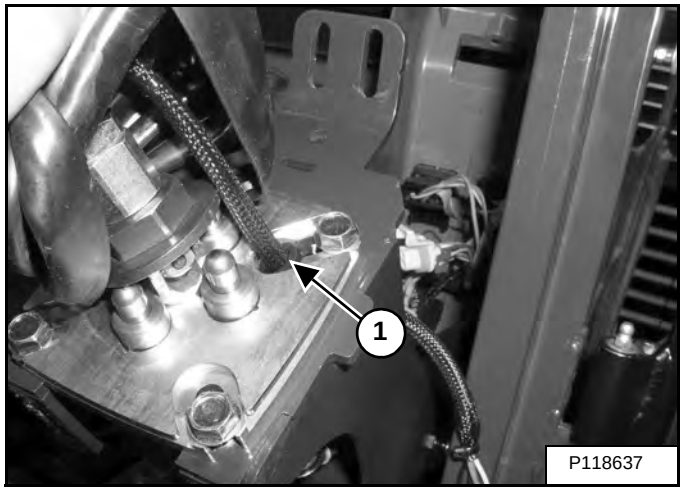


Installation: The wires **[Figure 20-111-7]** must be installed in the proper locations in the wire connector, listed below.

A Yellow
B Black
C Black
D Red
E Brown

Check each wire to be certain the tab locks into position.

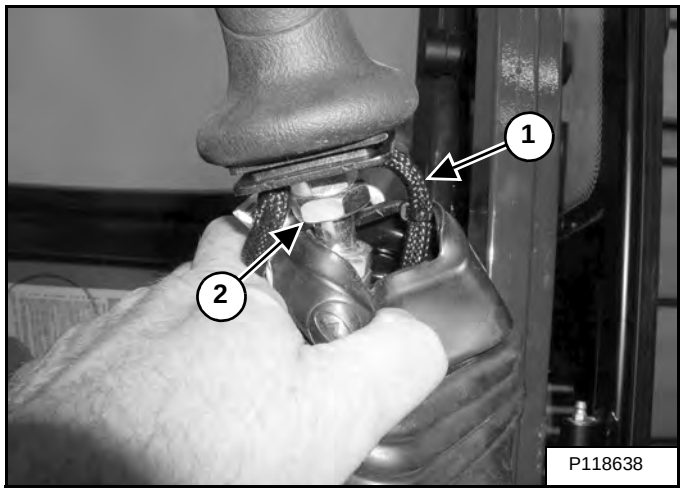
Figure 20-111-8



Raise the boot and pull the grommet (Item 1) **[Figure 20-111-8]** out of the housing.

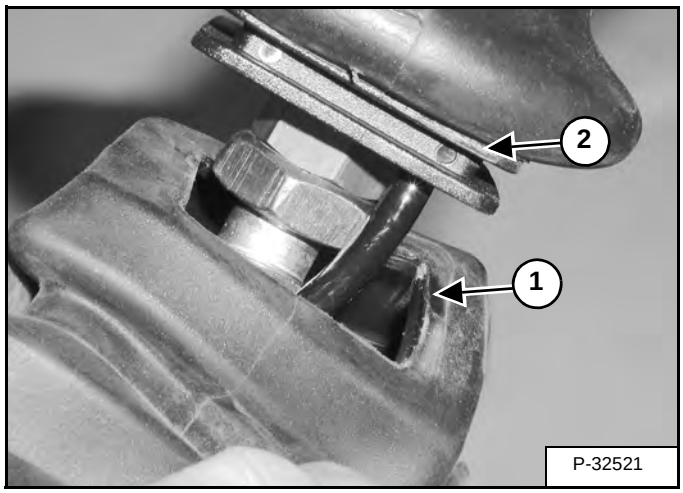
Remove the wire and grommet.

Figure 20-111-9



Pull the boot down and pull the wire harness (Item 1) out of the boot. Loosen the nut (Item 2) **[Figure 20-111-9]** and remove the handle.

Figure 20-111-10



Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-111-10]**.

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Joystick Assembly Removal and Installation

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

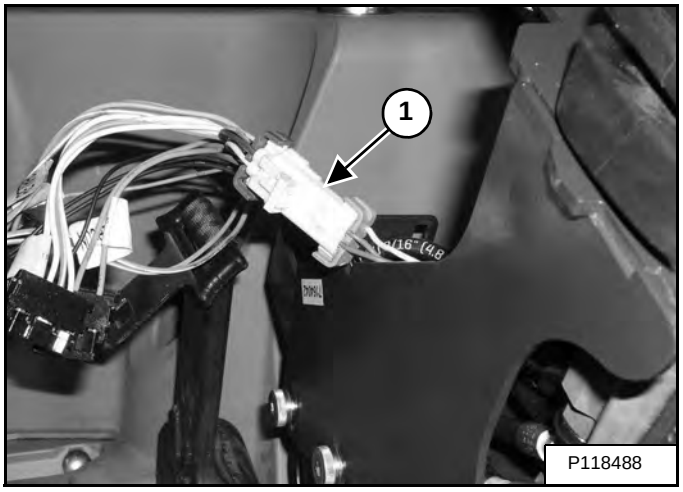
Remove the left console cover. (See Removal And Installation on Page 40-60-1.)

IMPORTANT

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

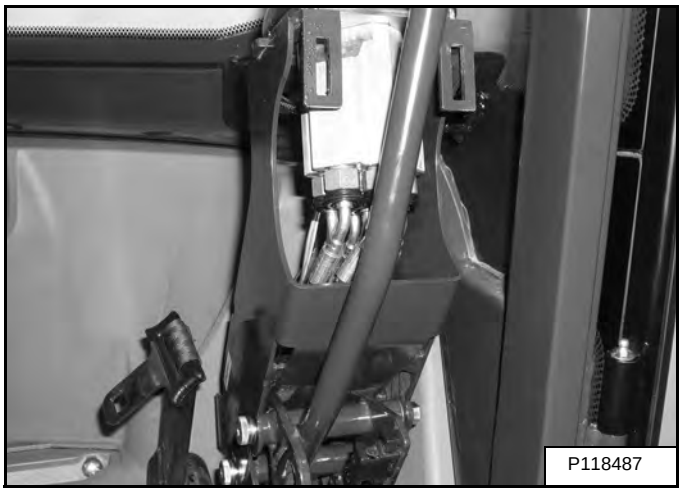
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Figure 20-111-11



Disconnect the wire harness (Item 1) **[Figure 20-111-11]**.

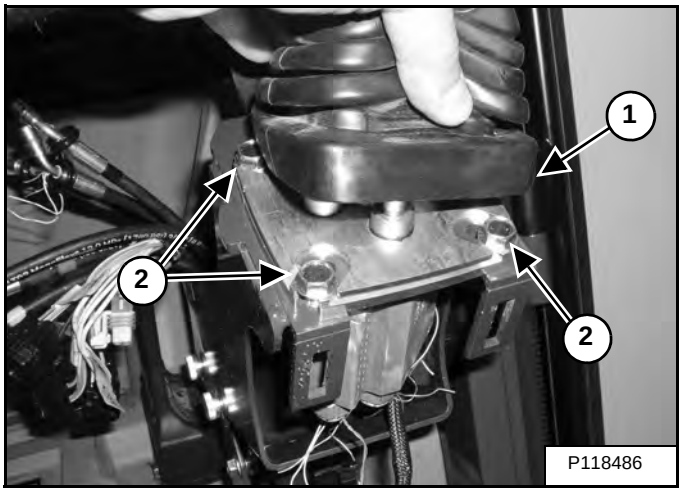
Figure 20-111-12



Mark and remove the hoses **[Figure 20-111-12]**.

Remove the hoses while the control lever (joystick) is bolted to the console **[Figure 20-111-12]**.

Figure 20-111-13



Pull the boot (Item 1) **[Figure 20-111-13]** up from the plate.

Remove the bolts (Item 2) **[Figure 20-111-13]**.

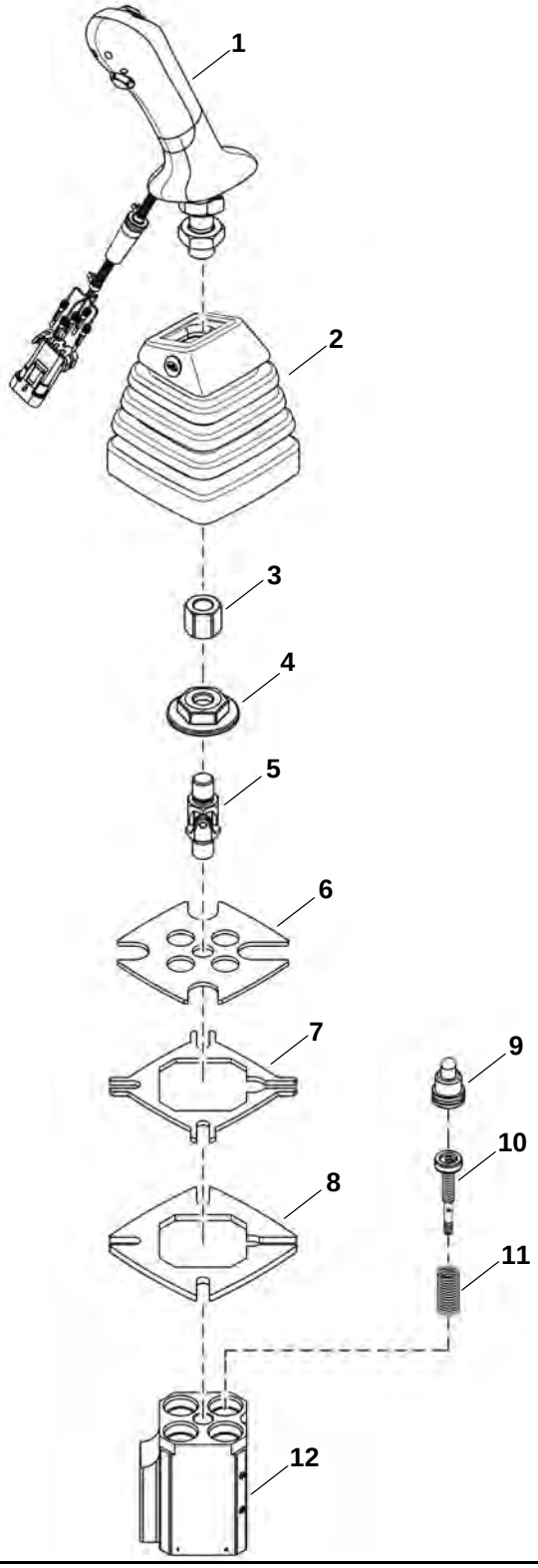
Remove the joystick assembly.

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Parts Identification

1. Handle
2. Dust Boot
3. Coupler
4. Actuator Control Plate
5. U-Joint
6. Top Plate
7. Intermediate Plate
8. Bottom Plate
9. Plunger Assembly
10. Spool
11. Spring
12. Housing



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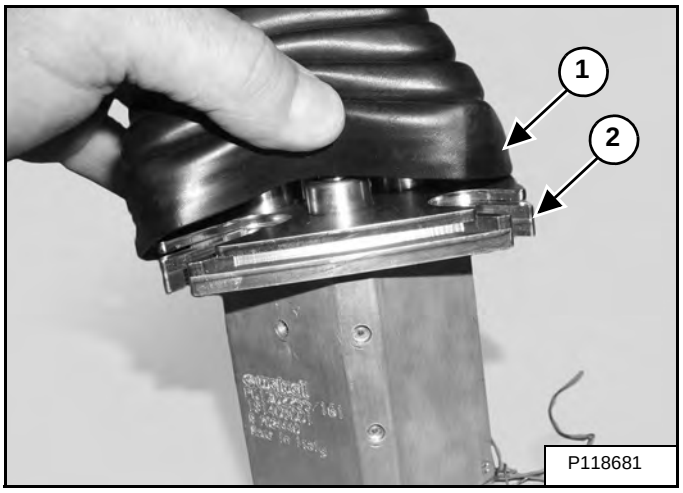
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Disassembly

Remove the left handle. (See Handle Removal And Installation on Page 20-111-2.)

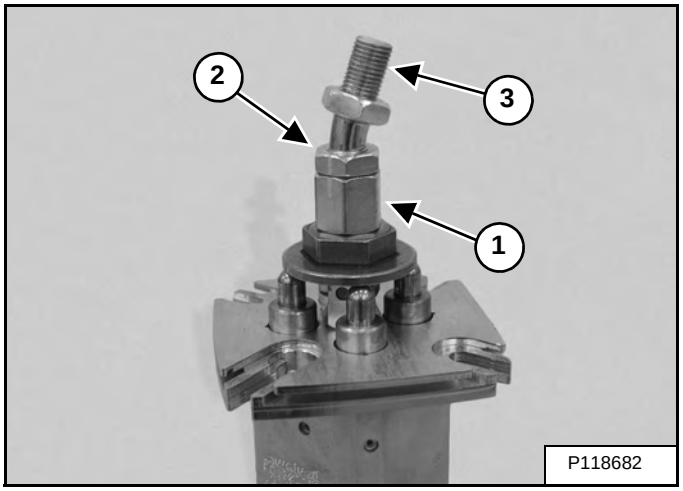
Clean the outside of the control lever before disassembly.

Figure 20-111-14



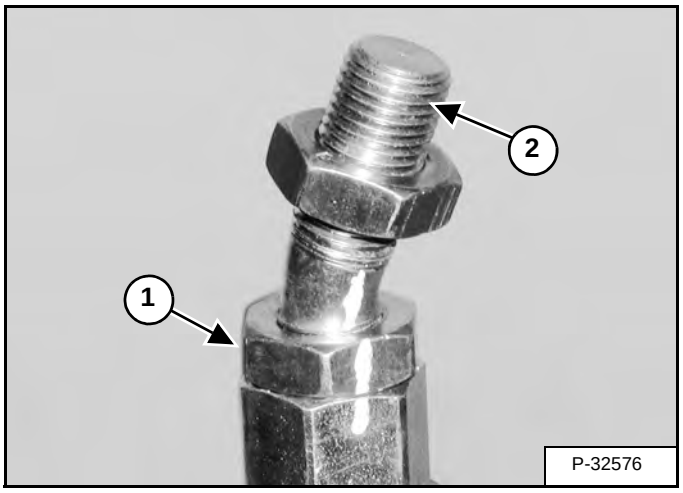
Remove the boot (Item 1) from the control lever (joystick) (Item 2) **[Figure 20-111-14]**.

Figure 20-111-15



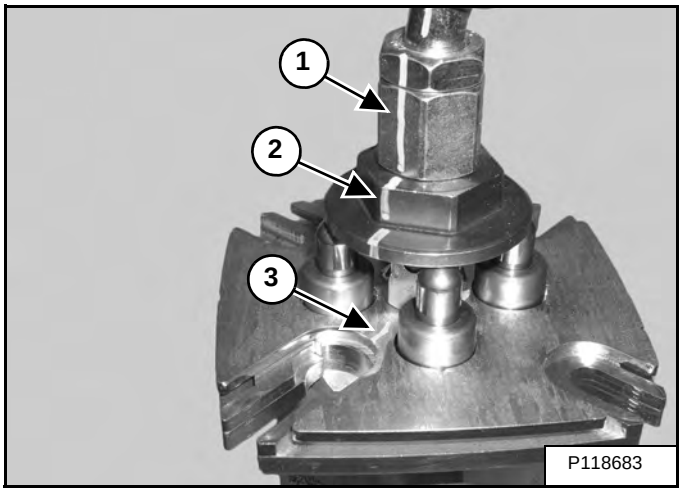
Mark the coupler (Item 1) nut (Item 2), and connector (Item 3) **[Figure 20-111-15]** for correct assembly.

Figure 20-111-16



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-111-16]**.

Figure 20-111-17



Mark the coupler (Item 1), control plate (Item 2), and top plate (Item 3) **[Figure 20-111-17]** for correct installation.

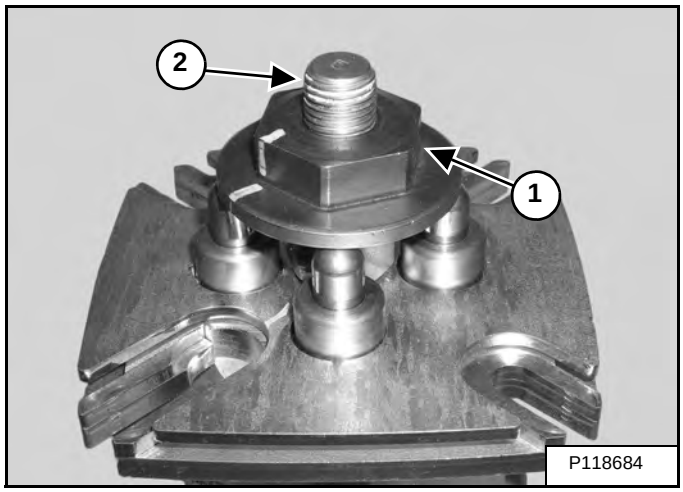
Remove the coupler from the control plate.

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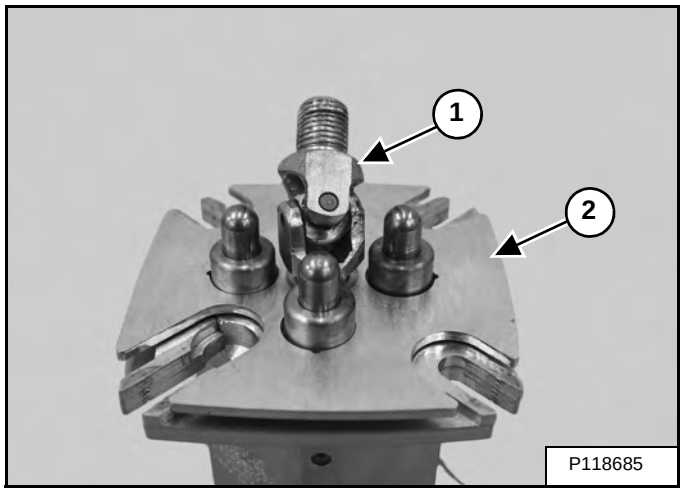
Disassembly (Cont'd)

Figure 20-111-18



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-111-18]**.

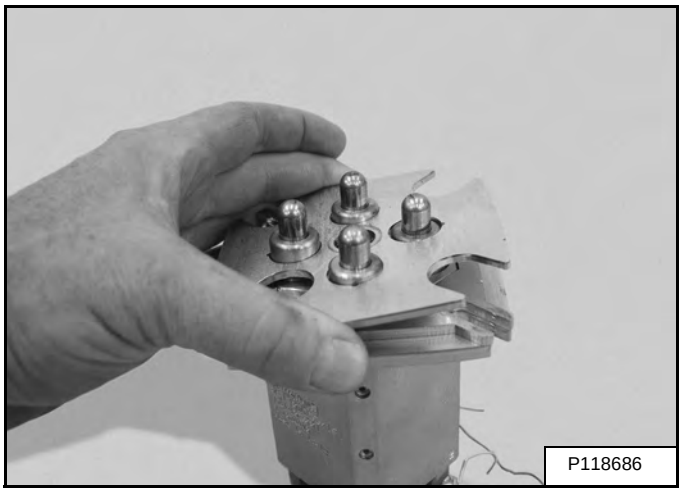
Figure 20-111-19



Mark the top plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-111-19]**.

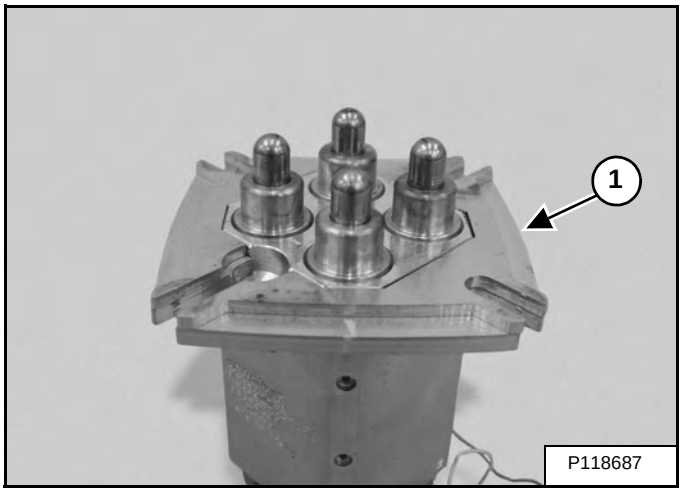
NOTE: The top plate (Item 2) [Figure 20-111-19] is spring loaded and will come up as the U-joint is removed.

Figure 20-111-20



Remove the top plate (Item 1) **[Figure 20-111-20]**.

Figure 20-111-21



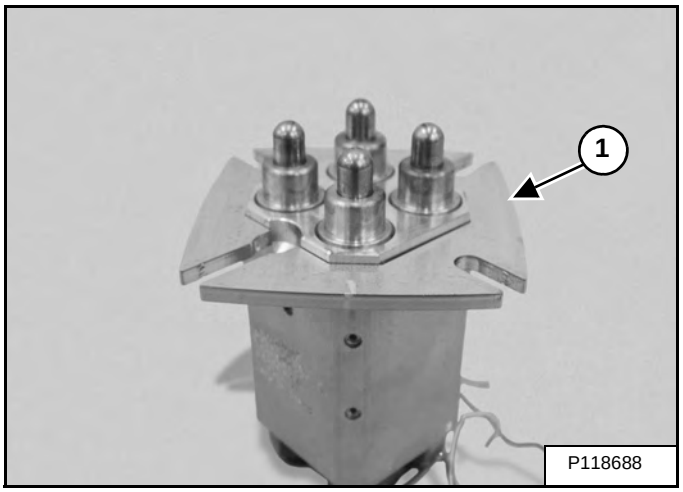
Remove the intermediate plate (Item 1) **[Figure 20-111-21]**.

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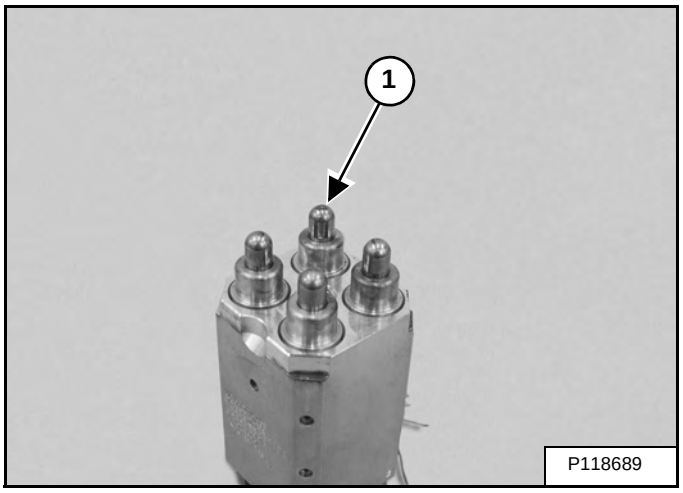
Disassembly (Cont'd)

Figure 20-111-22



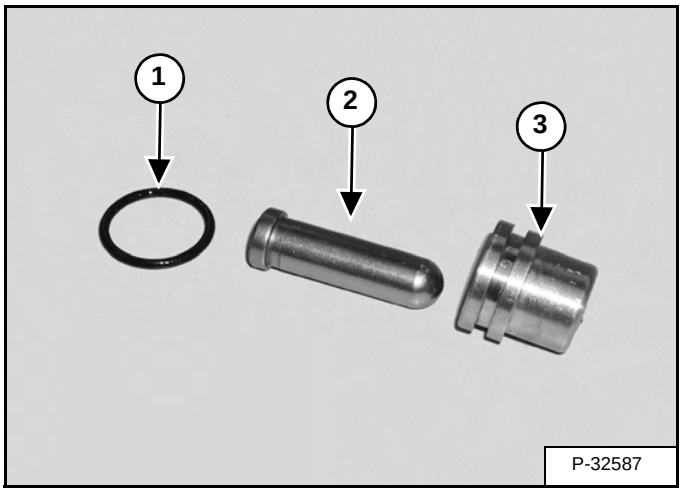
Remove the bottom plate (Item 1) **[Figure 20-111-22]**.

Figure 20-111-23



Remove the plunger assemblies (Item 1) **[Figure 20-111-23]**.

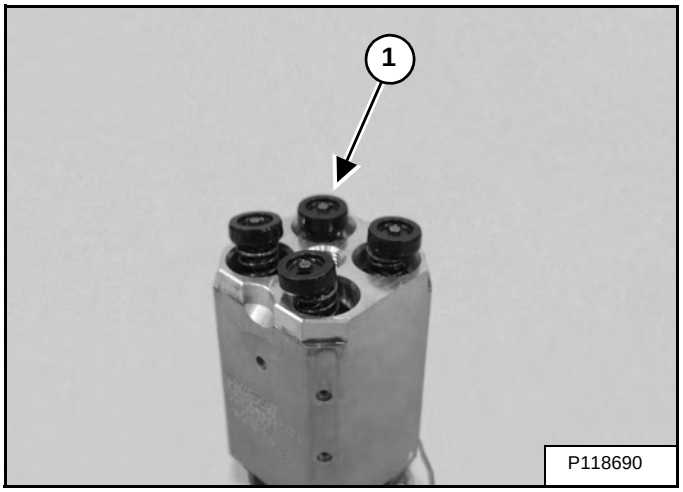
Figure 20-111-24



Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-111-24]**.

NOTE: Mark the spool assemblies for installation in their original location.

Figure 20-111-25



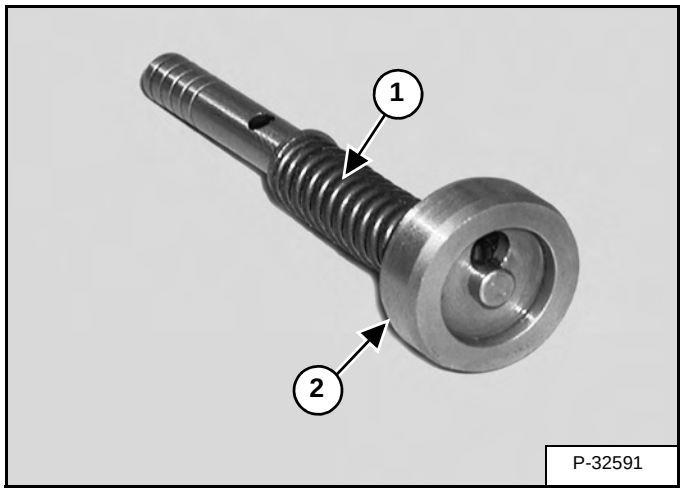
Remove the spool assemblies (Item 1) **[Figure 20-111-25]**.

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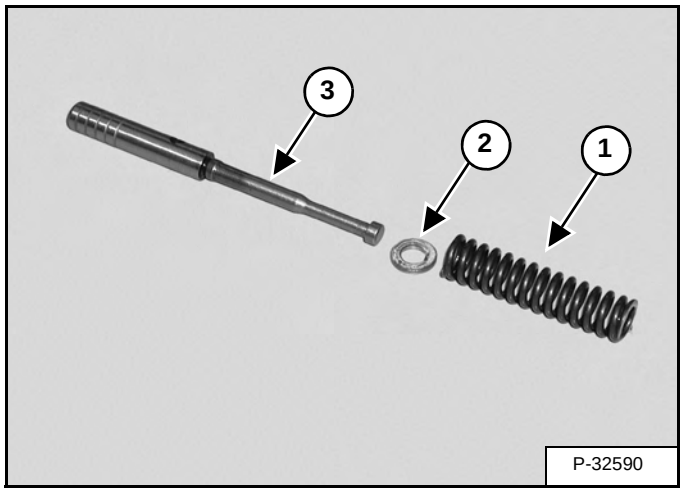
Disassembly (Cont'd)

Figure 20-111-26



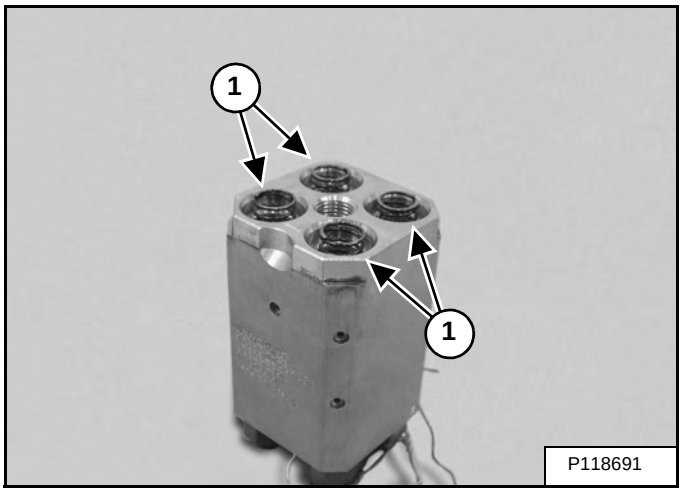
Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-111-26]**.

Figure 20-111-27



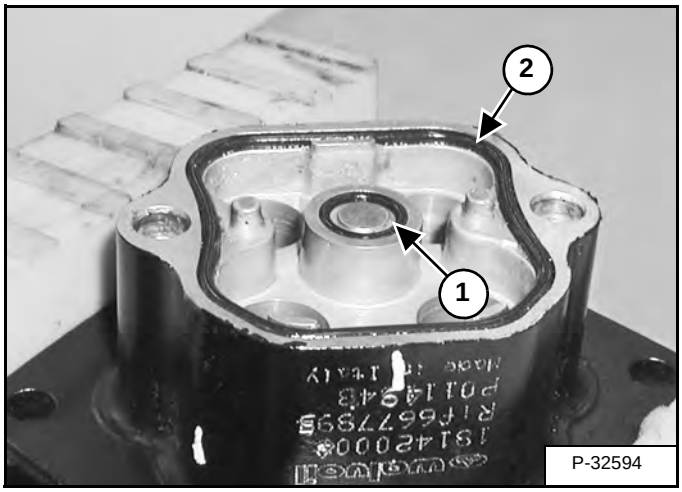
Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-111-27]**.

Figure 20-111-28



Remove the springs (Item 1) **[Figure 20-111-28]** from the housing.

Figure 20-111-29



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-111-29]**.

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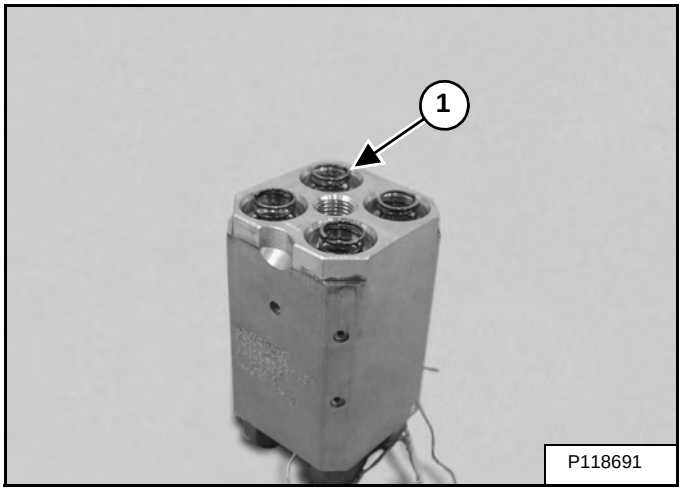
Assembly

Clean all parts in solvent and dry with compressed air.

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

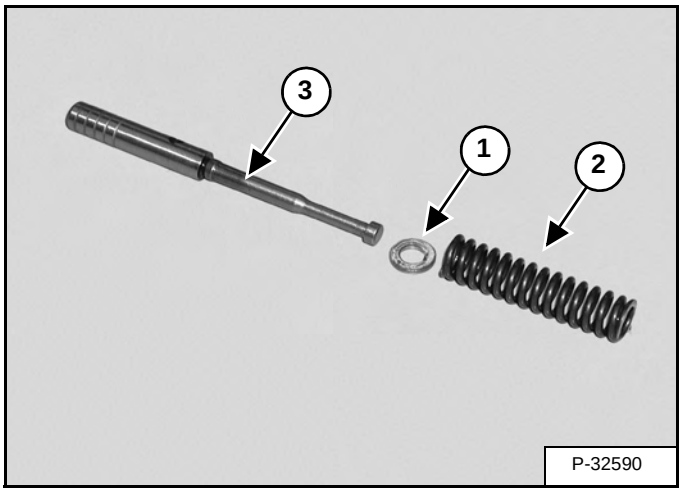
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-111-30



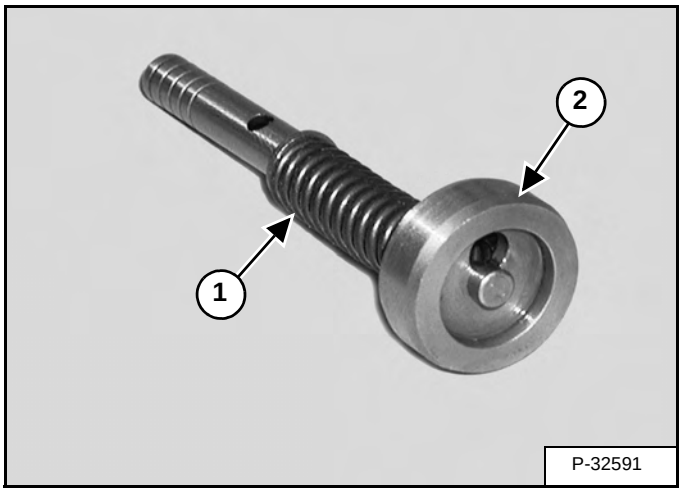
Install the springs (Item 1) **[Figure 20-111-30]**.

Figure 20-111-31



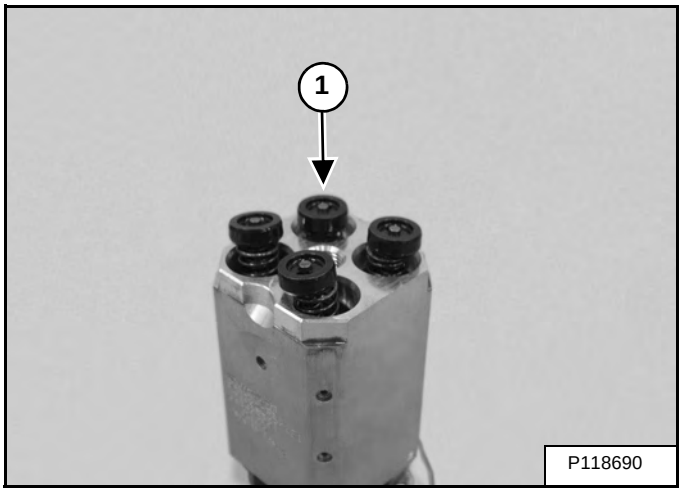
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-111-31]**.

Figure 20-111-32



Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-111-32]**.

Figure 20-111-33



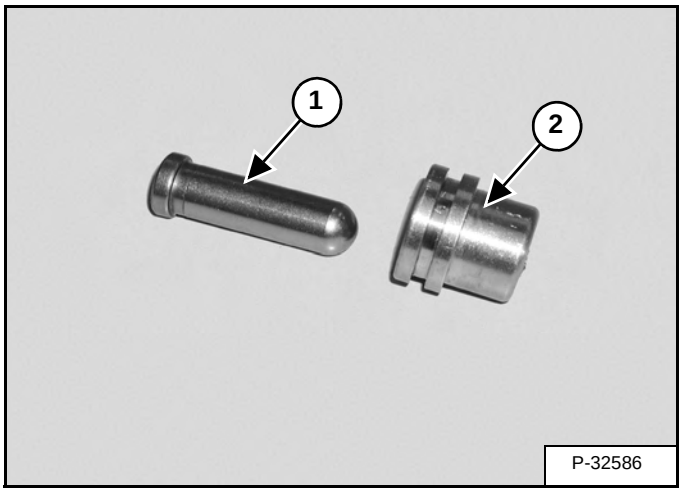
Install the spool assemblies (Item 1) **[Figure 20-111-33]** into the housing.

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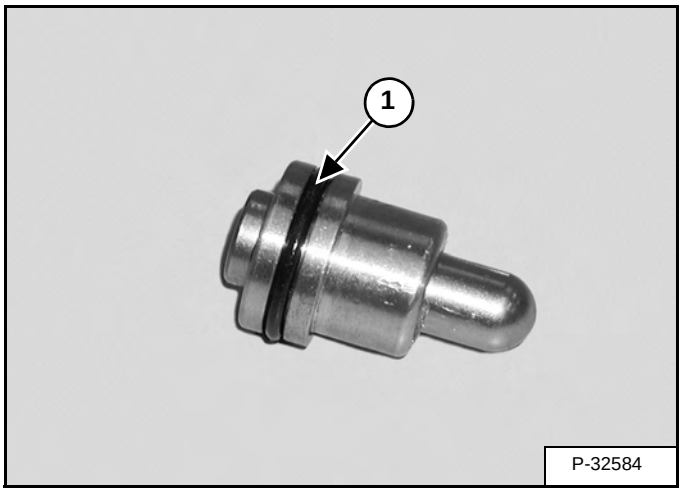
Assembly (Cont'd)

Figure 20-111-34



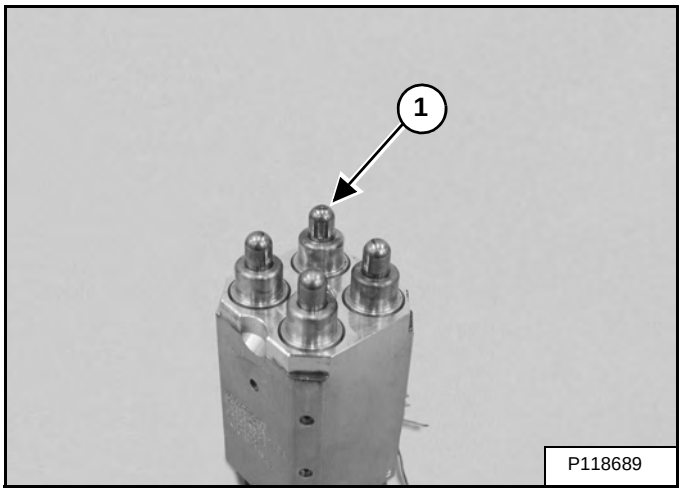
Install the plunger (Item 1) into the bushing (Item 2) **[Figure 20-111-34]**.

Figure 20-111-35



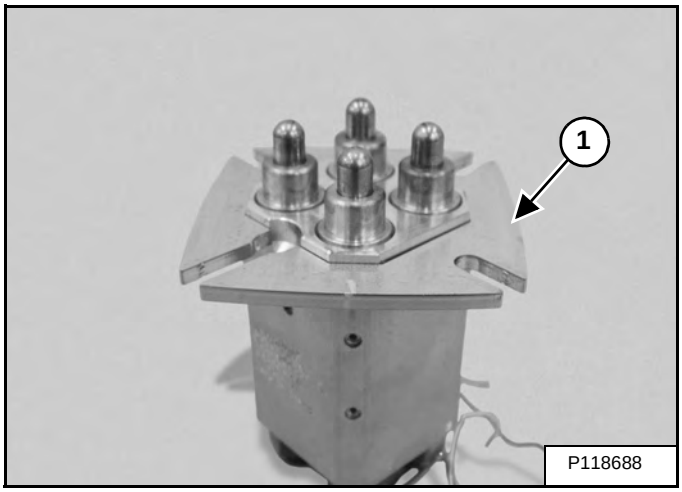
Install the O-ring (Item 1) **[Figure 20-111-35]** on the bushing.

Figure 20-111-36



Install the plunger assemblies (Item 1) **[Figure 20-111-36]** into the housing.

Figure 20-111-37



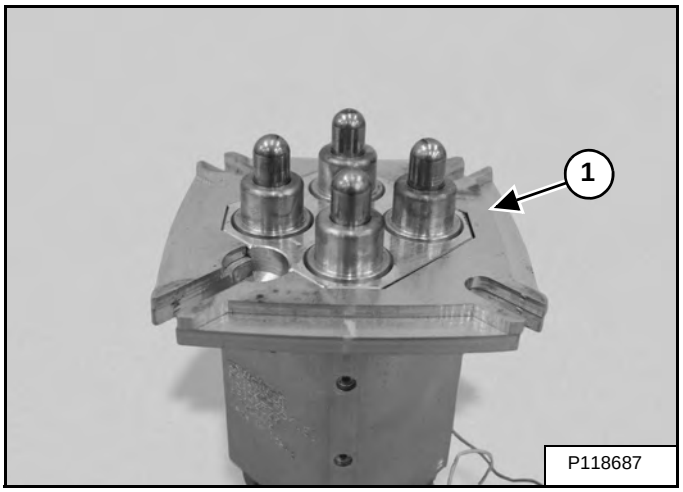
Install the bottom plate (Item 1) **[Figure 20-111-37]**.

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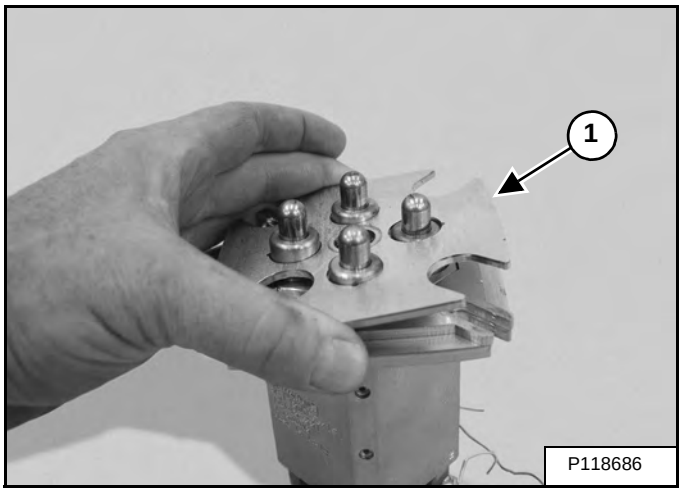
Assembly (Cont'd)

Figure 20-111-38



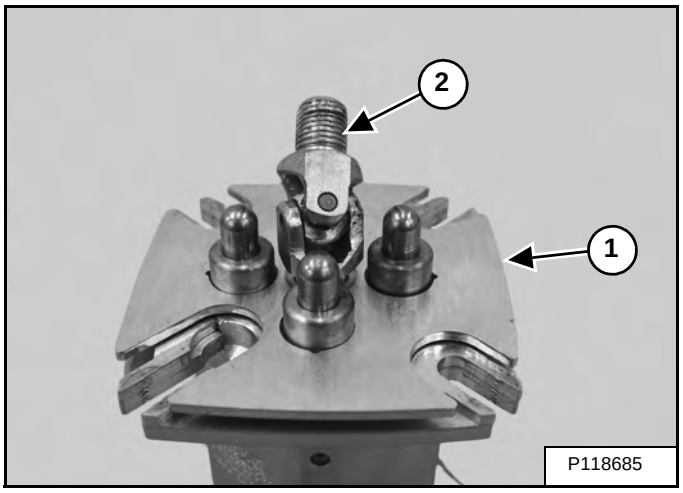
Install the intermediate plate (Item 1) **[Figure 20-111-38]**.

Figure 20-111-39



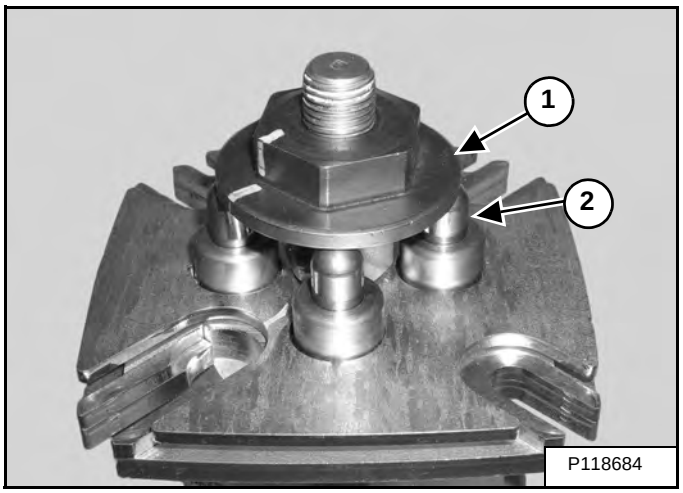
Install the top plate (Item 1) **[Figure 20-111-39]**.

Figure 20-111-40



Press down on the plates (Item 1) to seat the plunger assemblies. Install the U-Joint (Item 2) **[Figure 20-111-40]**.

Figure 20-111-41



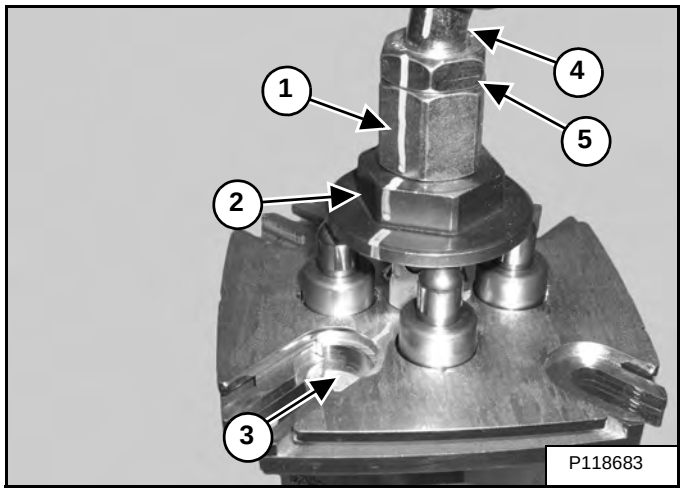
Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-111-41]**.

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Assembly (Cont'd)

Figure 20-111-42

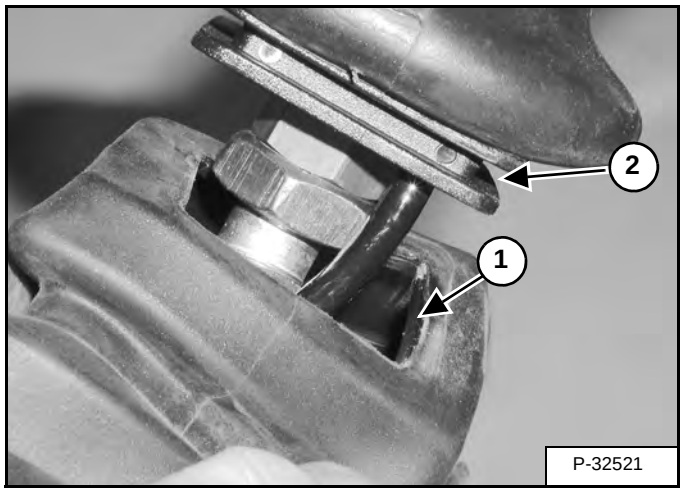


Align the coupler (Item 1) with the control plate (Item 2) and the top plate (Item 3) **[Figure 20-111-42]**. Tighten the coupler.

Install the connector (Item 4) **[Figure 20-111-42]**

Align the connector with the coupler (Item 1) and tighten the nut (Item 5) **[Figure 20-111-42]**.

Figure 20-111-43



Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-111-43]**.

Install the handle. (See Handle Removal And Installation on Page 20-111-2.)

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HYDRAULIC FILTER MOUNT

Description

The hydraulic filter removes contaminants from the hydraulic fluid when the hydraulic systems are operating.

The hydraulic filter system consists of one main hydraulic filter located behind the tailgate and removes the contaminants after the oil cooler.

Removal And Installation

IMPORTANT

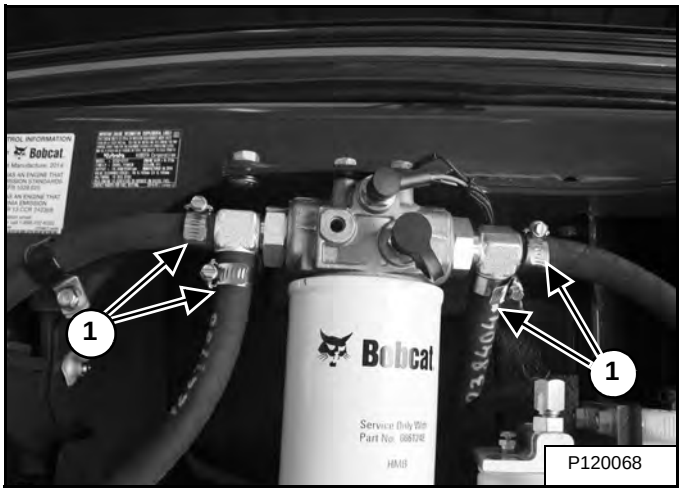
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

Open the tailgate.

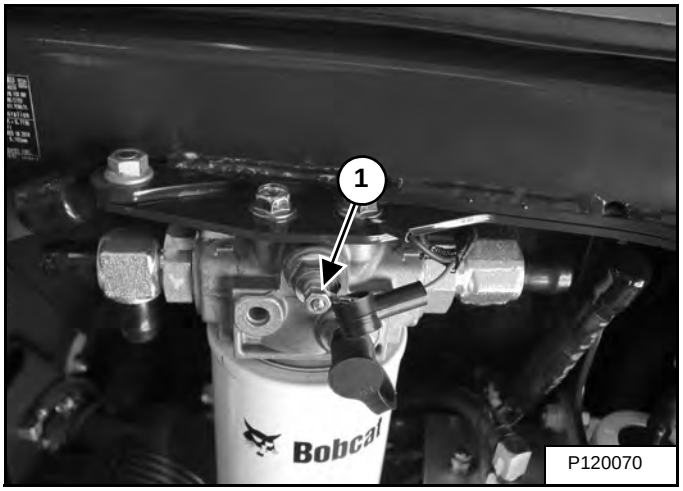
Drain hydraulic reservoir. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

Figure 20-120-1



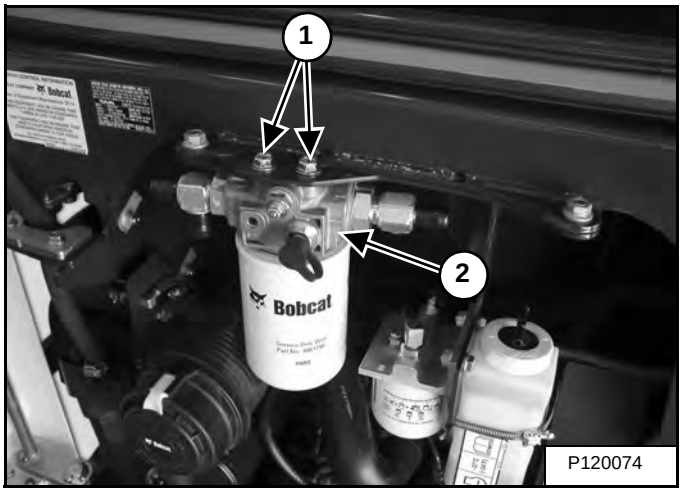
Remove the hoses (Item 1) **[Figure 20-120-1]**.

Figure 20-120-2



Remove the wire connector (Item 1) **[Figure 20-120-2]**.

Figure 20-120-3



Remove the two bolts (Item 1) and remove the hydraulic filter mount (Item 2) **[Figure 20-120-3]**.

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HYDRAULIC RESERVOIR

Description

The hydraulic reservoir is a storage container for the excavators hydraulic fluid. The reservoir contains a vented fill cap with a fluid screen to prevent contaminants from entering the reservoir while adding fluid.

The hydraulic reservoir is located on the left side of the excavator.

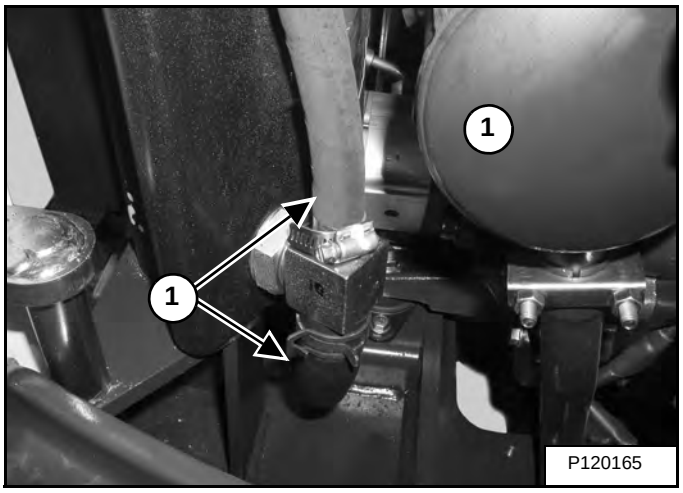
Removal And Installation

Remove the left upperstructure covers. (See Removal And Installation on Page 40-60-1.)

Open tailgate.

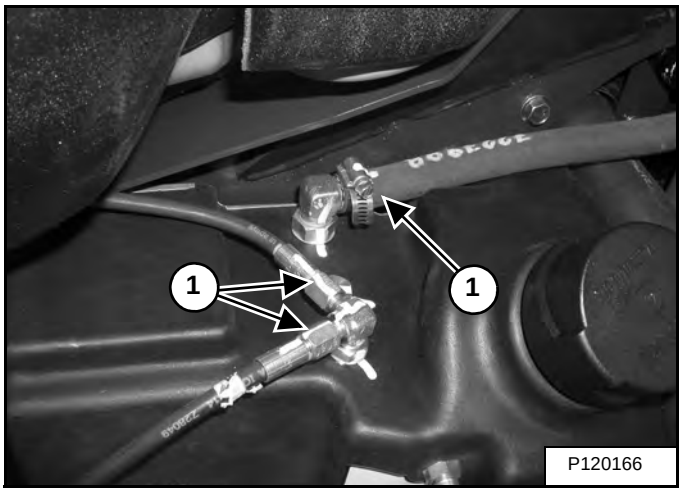
Drain hydraulic reservoir. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

Figure 20-130-1



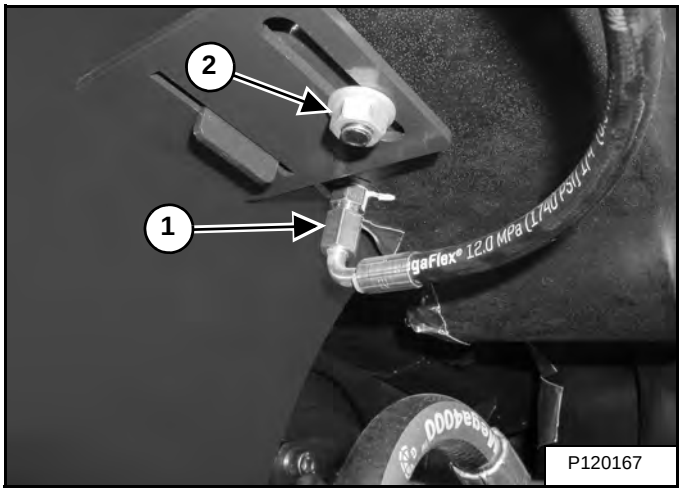
Remove the hoses (Item 1) **[Figure 20-130-1]** from the hydraulic reservoir tee fitting.

Figure 20-130-2



Remove the hoses (Item 1) **[Figure 20-130-2]** from the top of the hydraulic reservoir.

Figure 20-130-3



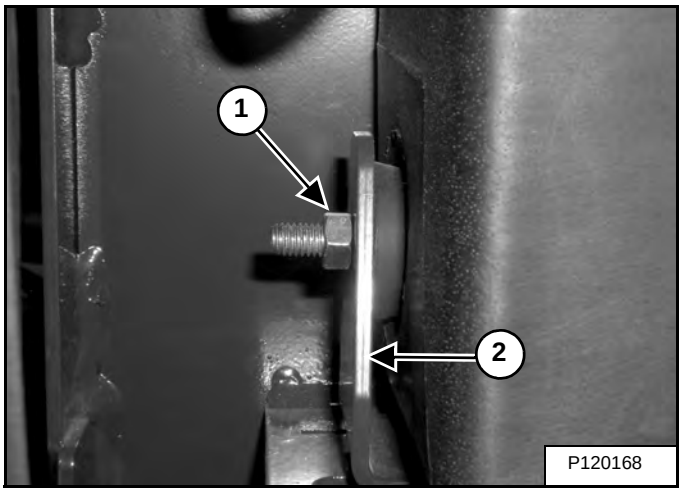
Remove the hose (Item 1) from the bottom of the hydraulic reservoir and remove the nut (Item 2) **[Figure 20-130-3]** from the mounting bracket.

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Removal And Installation (Cont'd)

Figure 20-130-4



Remove the mounting tab nut (Item 1) and the mounting bracket (Item 2) **[Figure 20-130-4]**.

Remove the hydraulic reservoir from the machine.

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OIL COOLER

Removal And Installation

The radiator and oil cooler are removed from the excavator as a unit. (See Radiator / Oil Cooler Removal And Installation on Page 60-40-1.)

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BLADE / TRACK EXPANSION SOLENOID BLOCK

Description

The blade / track expansion solenoid block diverts hydraulic fluid to either the blade or track expansion function with the switch on the right hand console.

The blade / track expansion solenoid block is located under the floor mat and floor panels on the right side of the excavator.

Block Removal And Installation

Lower the boom / bucket and blade to the ground.

With the engine off, turn the start key to the ON position and move blade lever to relieve hydraulic pressure.

IMPORTANT

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

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

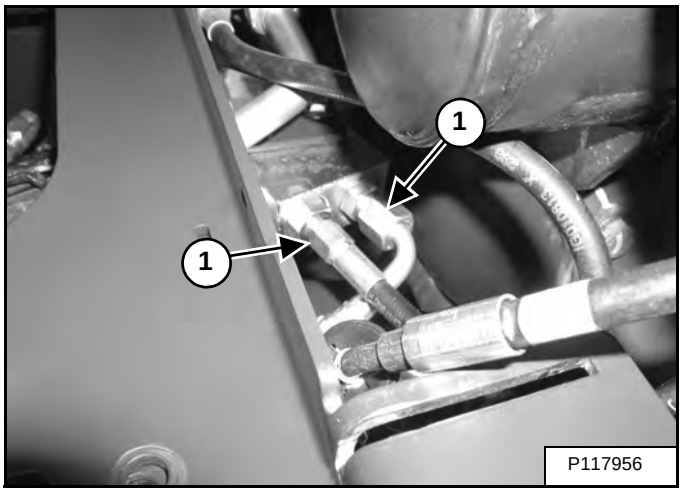
⚠ WARNING

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

W-2145-0290

NOTE: Bonnet removed for photo clarity.

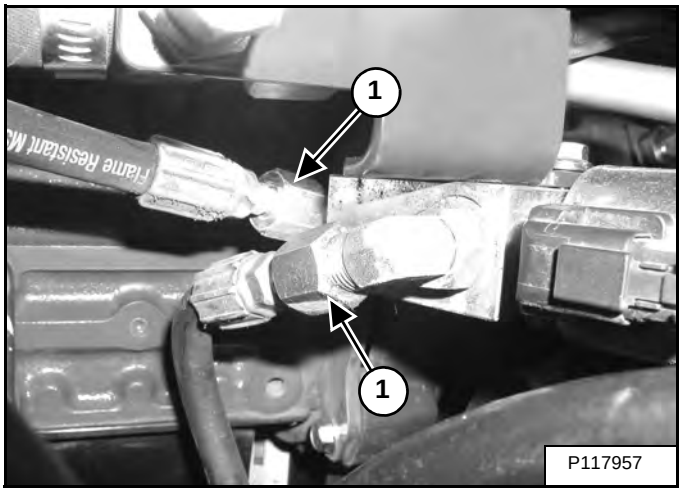
Figure 20-150-1



Mark all tubelines / hoses for ease of assembly.

Disconnect the tubelines / hoses (Item 1) **[Figure 20-150-1]** and **[Figure 20-150-2]** from the block.

Figure 20-150-2

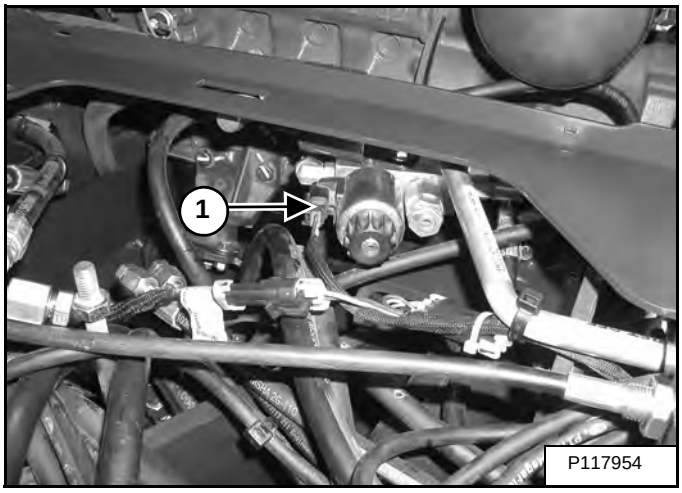


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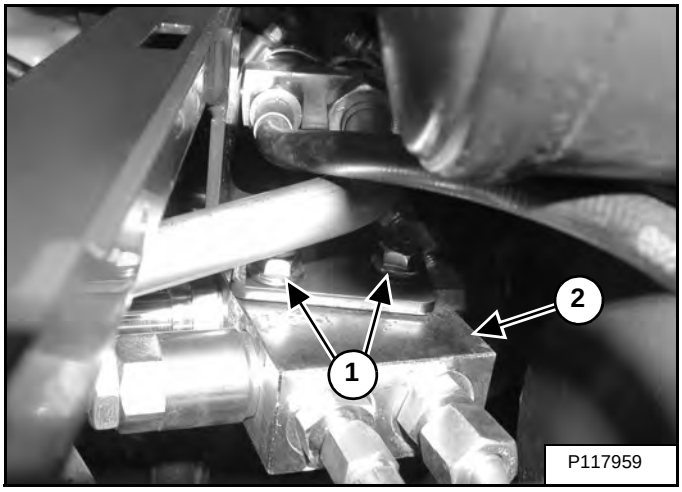
Block Removal And Installation (Cont'd)

Figure 20-150-3



Disconnect the wire harness (Item 1) **[Figure 20-150-3]** from the solenoid.

Figure 20-150-4



Remove the bolts (Item 1) **[Figure 20-150-4]**.

Remove the blade / track expansion solenoid block (Item 2) **[Figure 20-150-4]** from the excavator.

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BLADE / TRACK EXPANSION SOLENOID BLOCK (CONT'D)

Solenoid Removal And Installation

Lower the boom / bucket and blade to the ground.

With the engine off, turn the start key to the ON position and move blade lever to relieve hydraulic pressure.

IMPORTANT

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

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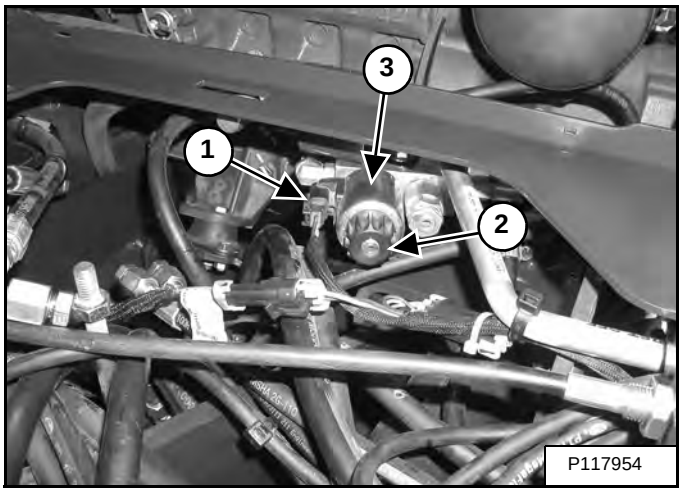
Remove the floor mat and floor panel. (See Removal And Installation on Page 40-140-1.)

⚠ WARNING

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

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Figure 20-150-5

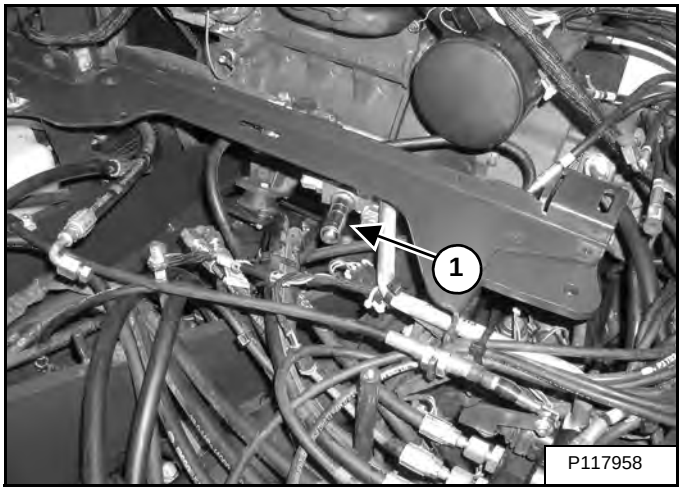


Disconnect the wire harness (Item 1) **[Figure 20-150-5]** from the solenoid.

Remove the solenoid nut (Item 2) **[Figure 20-150-5]**.

Remove the coil (Item 3) **[Figure 20-150-5]** from the solenoid stem.

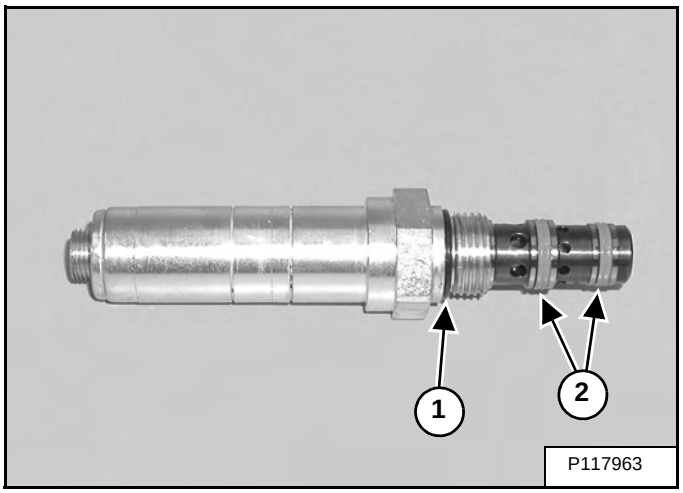
Figure 20-150-6



Remove the solenoid stem (Item 1) **[Figure 20-150-6]**.

Installation: Tighten the solenoid stem to 50 N•m (37 ft-lb) torque.

Figure 20-150-7



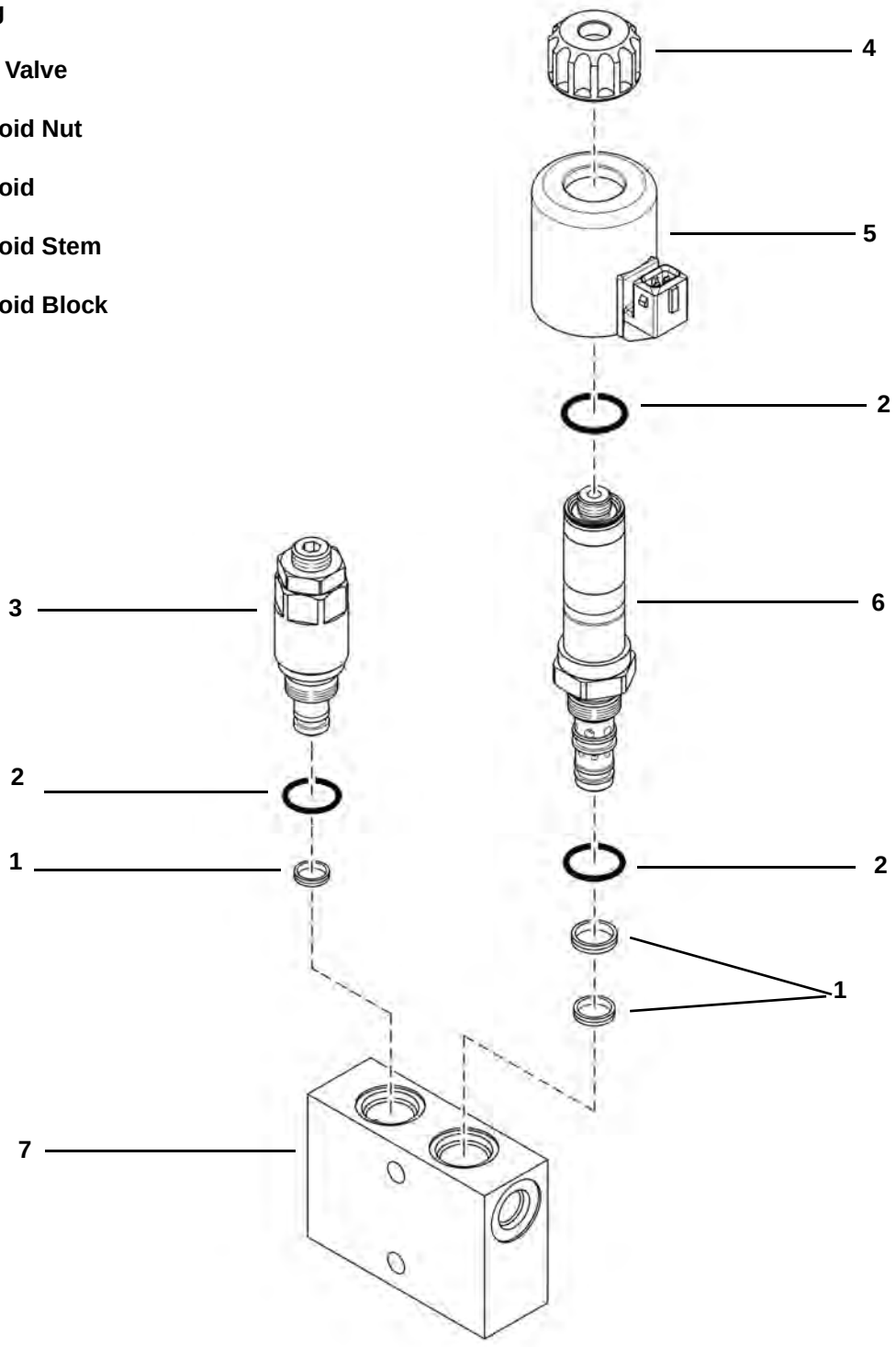
Remove the O-ring (Item 1) and seals (Item 2) **[Figure 20-150-7]** from the solenoid stem.

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Parts Identification

1. Seal
2. O-ring
3. Relief Valve
4. Solenoid Nut
5. Solenoid
6. Solenoid Stem
7. Solenoid Block



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Block Disassembly And Assembly

IMPORTANT

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

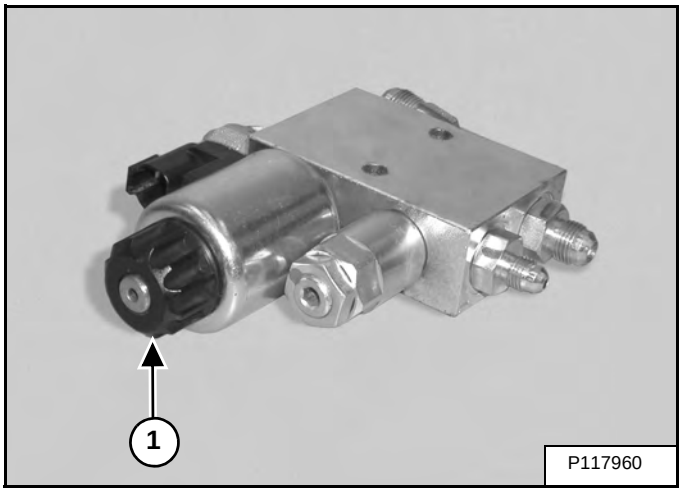
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Clean all parts in solvent and dry with compressed air.

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

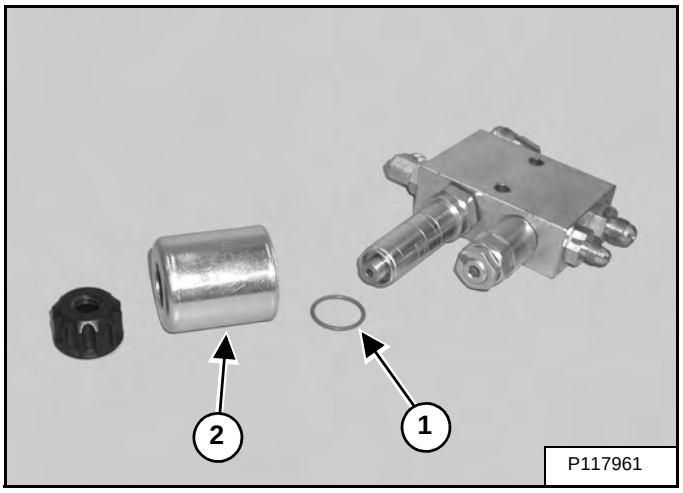
Always install new O-rings, back-up rings and seals. Lubricate all O-rings and back-up rings with clean hydraulic fluid before installation.

Figure 20-150-8



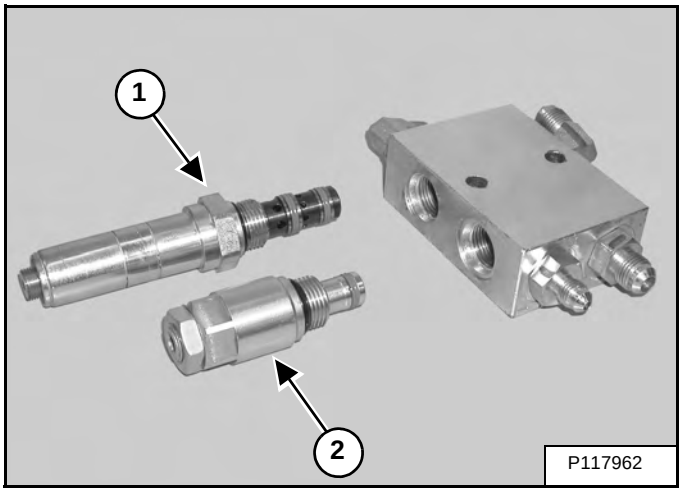
Remove the nut (Item 1) **[Figure 20-150-8]** from the solenoid.

Figure 20-150-9



Remove the O-ring (Item 1) and solenoid (Item 2) **[Figure 20-150-9]**.

Figure 20-150-10



Remove the solenoid stem (Item 1) and the blade relief valve (Item 2) **[Figure 20-150-10]**.

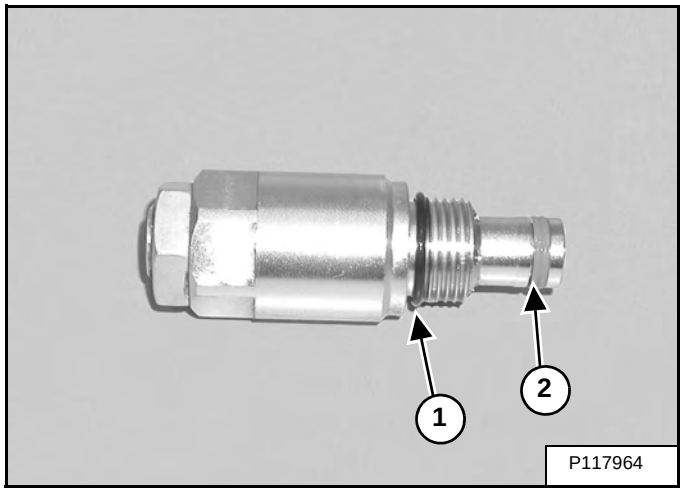
Installation: Tighten the solenoid stem to 50 N•m (37 ft-lb) torque.

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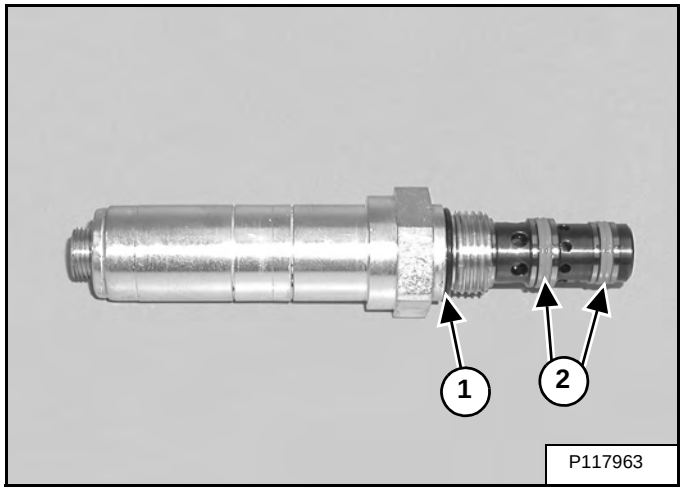
Block Disassembly And Assembly (Cont'd)

Figure 20-150-11



Remove the O-ring (Item 1) and seals (Item 2) **[Figure 20-150-11]**.

Figure 20-150-12



Remove the O-ring (Item 1) and seals (Item 2) **[Figure 20-150-12]**.

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UNDERCARRIAGE

BLADE 30-10-1
Description 30-10-1
Extension Removal And Installation 30-10-1
Blade Removal And Installation 30-10-2

TRACK UNDERCARRIAGE COMPONENTS 30-20-1
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Checking Tension 30-20-2
Adjusting Tension 30-20-3
Track Removal And Installation 30-20-5
Idler Removal And Installation 30-20-6
Track Tensioner Removal And Installation 30-20-6
Track Tensioner Disassembly & Assembly 30-20-7
Roller Removal And Installation 30-20-8
Sprocket Removal And Installation 30-20-8
Removal And Installation Of Expandable Track Frame 30-20-10

TRACK MAINTENANCE 30-30-1
Track Damage Identification 30-30-1

SWING CIRCLE GEAR 30-40-1
Removal And Installation 30-40-1

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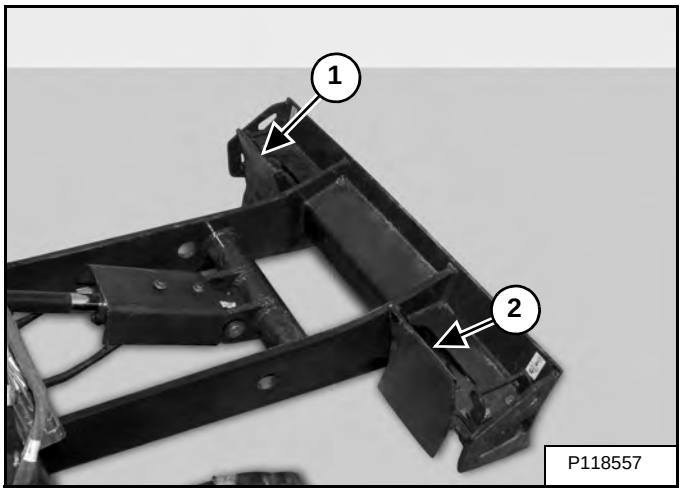
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BLADE

Description

The blade extensions are used to match the blade width to the track width. Secure the blade extensions in the retracted position when transporting the excavator or when narrow operating width is needed. Under normal operating conditions, the blade width should match the track width.

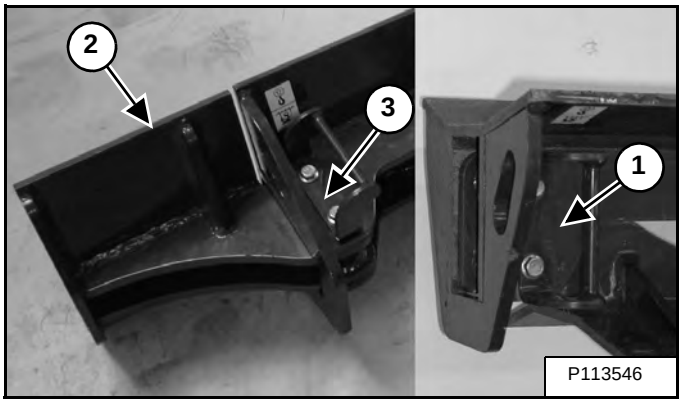
Figure 30-10-1



The blade extensions (Items 1 and 2) **[Figure 30-10-1]** are located on the blade.

Extension Removal And Installation

Figure 30-10-2



Raise the blade sightly and place a block under the blade. Lower the blade fully.

Remove the blade retainer pin assembly (Item 1) **[Figure 30-10-2]**.

Remove and reposition the blade extension (Item 2) **[Figure 30-10-2]** to the outside blade position.

Reinstall the blade retainer pin assembly (Item 3) **[Figure 30-10-2]**.

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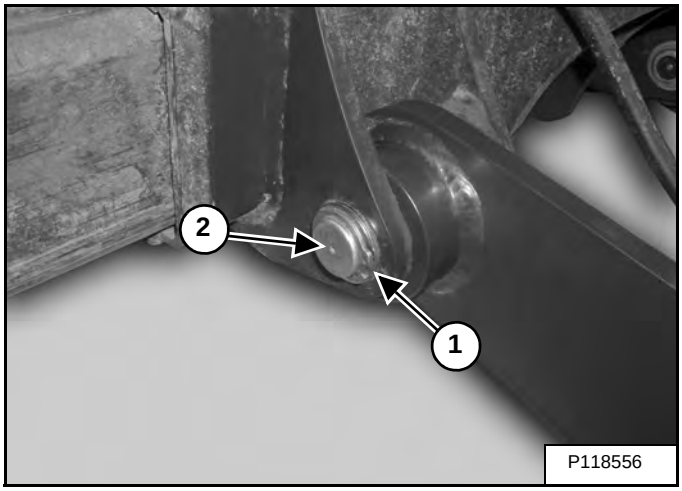
Blade Removal And Installation

Expand the tracks. (See the Operation & Maintenance Manual for the Proper procedure.)

Lower the blade to the ground.

Remove the blade cylinder. (See Removal And Installation on Page 20-24-2.)

Figure 30-10-3



Remove the snap ring (Item 1) **[Figure 30-10-3]** and washer from the blade arm pivot pins (both sides).

Remove the blade arm pivot pins (Item 2) **[Figure 30-10-3]** (both sides).

Remove the blade from the excavator.

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TRACK UNDERCARRIAGE COMPONENTS

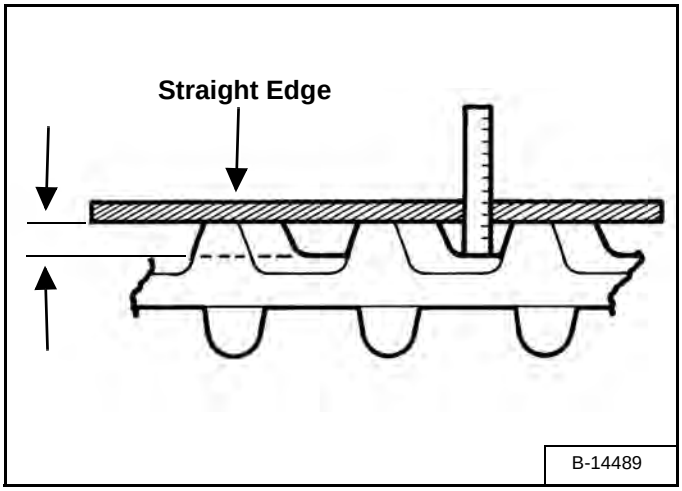
Description

The track undercarriage components consist of the front idler, bottom rollers, drive motor and track frame.

Track Lug Height

The lug height of a new rubber track is 23,0 mm (0.9 in).

Figure 30-20-1



To find the percentage of wear on a excavator track, measure the height of the lug by placing a straight edge across the top of three lugs and measure the distance from the base of the track to the bottom of the straight edge **[Figure 30-20-1]**.

Divide this measurement by the new track height and multiply by 100. This will give the percentage of track lug left.

Example: lug height 20,0 mm (0.787 in)

$$\frac{18,0\ (0.7)}{23,0\ (0.9)} \times 100 = 78$$

78% of the track lug is remaining with 22% wear on the track lugs.

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Checking Tension

NOTE: The wear of the pins and bushings on the undercarriage vary with the working conditions and the different types of soil conditions. It is necessary to inspect track tension and maintain the correct tension. See SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-70-1.)

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

Figure 30-20-2

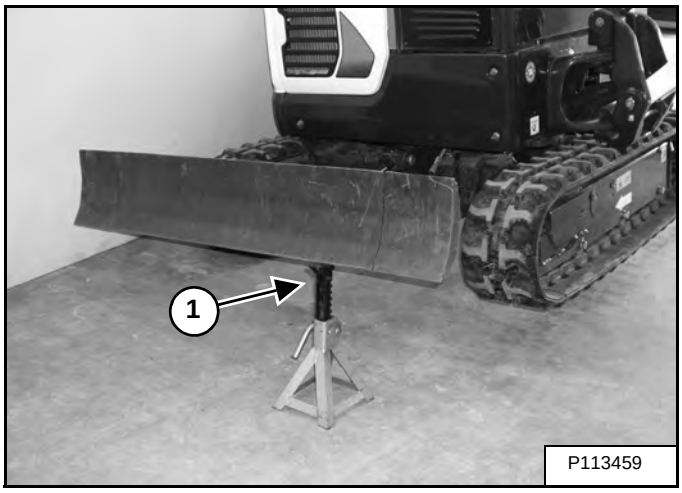
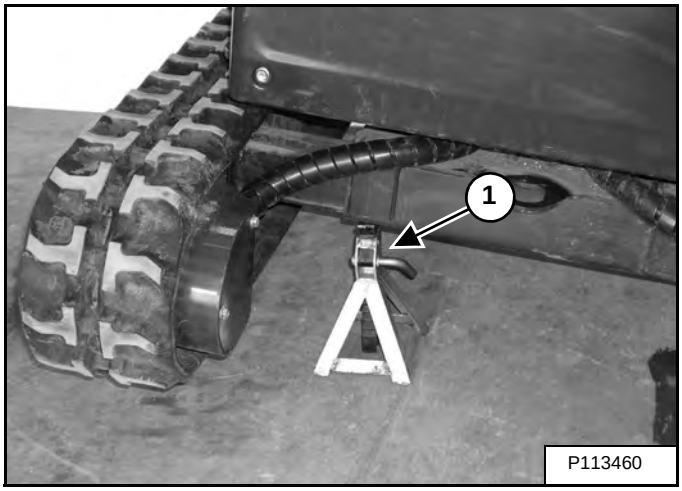


Figure 30-20-3



Raise the blade fully and install the jackstands under the blade and track frame (Item 1) **[Figure 30-20-2]** and **[Figure 30-20-3]**. Raise the boom until all machine weight is on the jackstands.

Stop the engine.

⚠ WARNING

AVOID INJURY

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

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Track Clearance

Figure 30-20-4

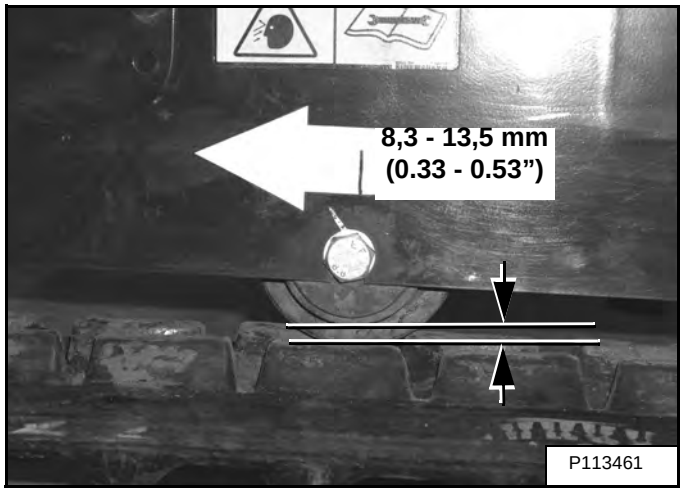
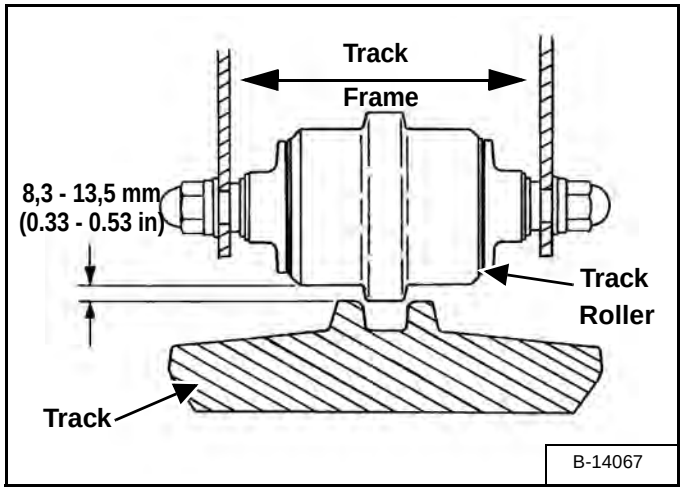


Figure 30-20-5



Measure the clearance at the middle track roller. Do not get fingers into pinch points between the track and the track roller. Use a bolt or a dowel of the appropriate size to check the gap between the contact edge of the roller and the top edge of the track guide **[Figure 30-20-4]** and **[Figure 30-20-5]**.

Track Clearance	8,3 - 13,5 mm (0.33 - 0.53 in)

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Adjusting Tension

WARNING

AVOID INJURY

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

W-2142-0903

Figure 30-20-6

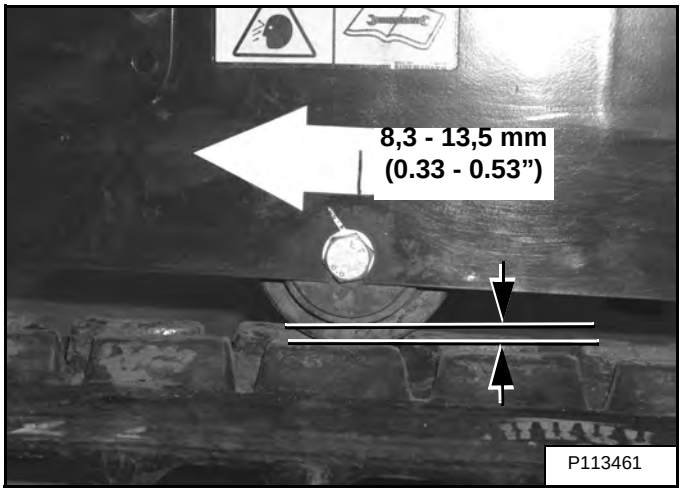
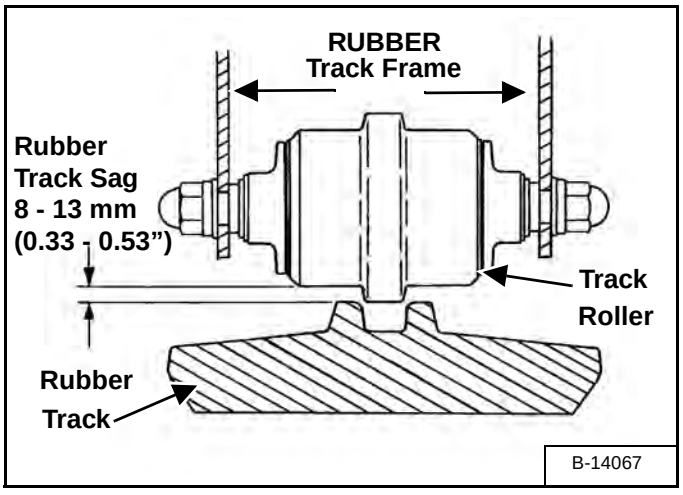
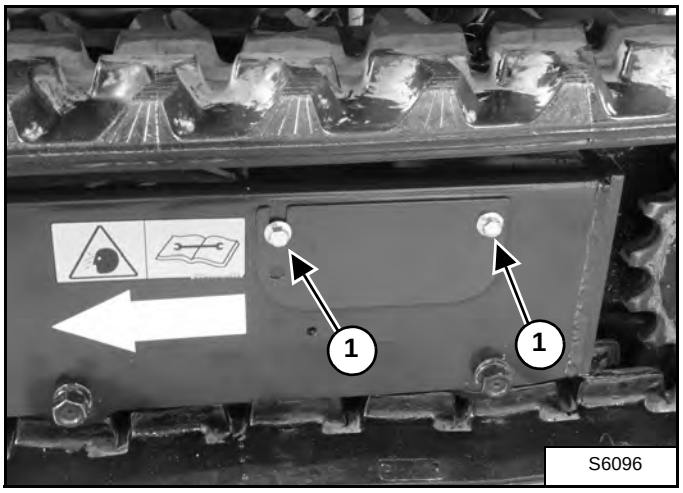


Figure 30-20-7



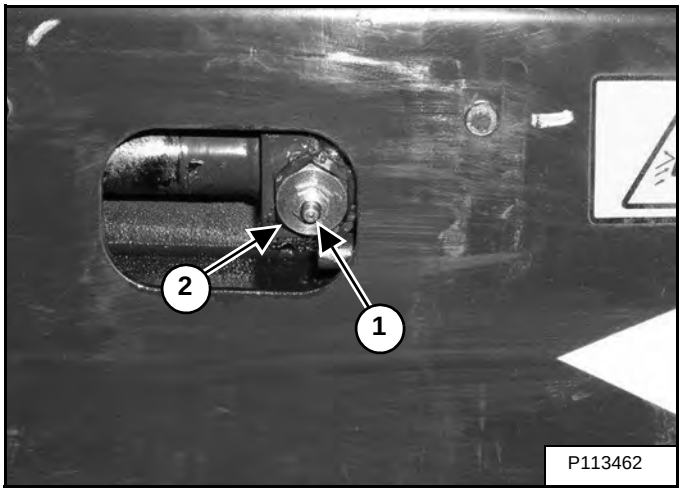
Measure the clearance at either middle track roller. DO not get fingers into pinch points between the track and the track roller. Use a bolt or a dowel of the appropriate size to check the gap between the contact edge of the roller and the top edge of the track guide **[Figure 30-20-6]** and **[Figure 30-20-7]**.

Figure 30-20-8



Loosen the two bolts (Item 1) **[Figure 30-20-8]** on the cover. Pivot the cover downward.

Figure 30-20-9



Increase Track Tension

Add grease to the fitting (Item 1) **[Figure 30-20-9]** until the track tension is correct.

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Adjusting Tension (Cont'd)

Decrease Track Tension

⚠ WARNING

AVOID INJURY OR DEATH

If grease fitting is removed before pressure is released, the fitting can come off with great force and cause serious injury or death.

W-2490-0104

Pressure must be released from the grease cylinder to decrease track tension.

Loosen the bleed fitting (Item 2) **[Figure 30-20-9]** (NOT the grease fitting) and release pressure until the track tension is correct.

NOTE: DO NOT loosen the bleed fitting (Item 2) [Figure 30-20-9] for more than eight turns.

Tighten the bleed fitting to 80 - 100 N•m (59 - 74 ft-lb) torque.

Pivot the access cover closed and tighten the access cover bolts.

Repeat the procedure for the other side.

Dispose of grease in an environmentally safe manner.

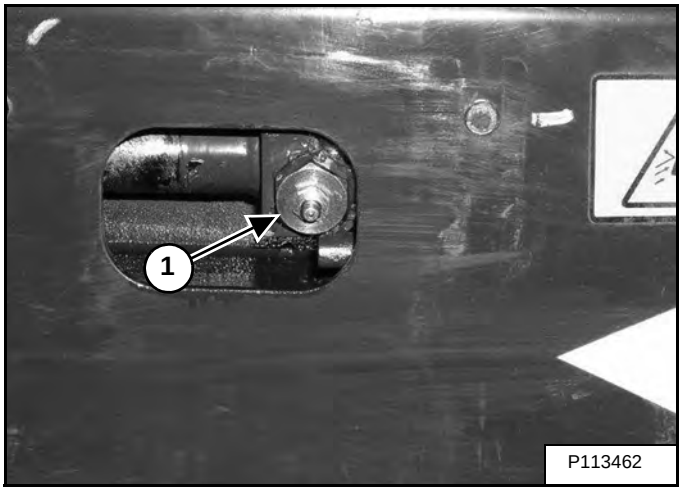
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Track Removal And Installation

Lift and block the side of the machine where the track will be removed.

Figure 30-20-10

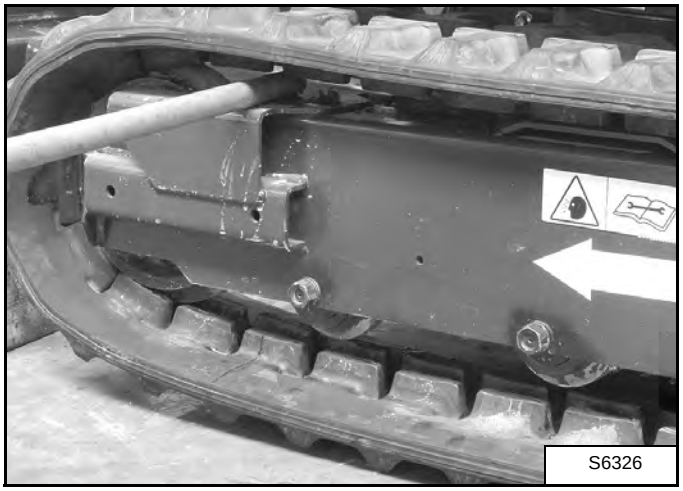


Slowly loosen the bleed screw fitting (Item 1) **[Figure 30-20-10]** to remove track tension.

NOTE: DO NOT loosen the bleed fitting (Item 1) [Figure 30-20-10] for more than eight turns.

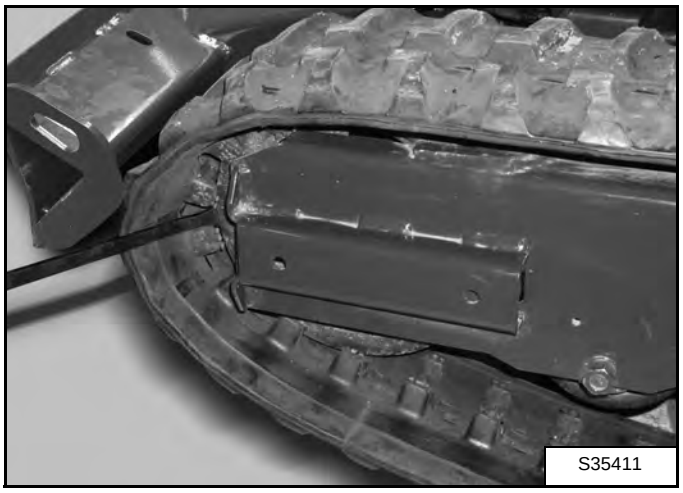
NOTE: Apply additional pressure to the track by standing on the lower track span so all the tension is released from the grease cylinder for easier removal of the track.

Figure 30-20-11



Install a round bar (approximately 30 mm [1.25 in]) diameter) between the drive lugs **[Figure 30-20-11]**.

Figure 30-20-12



Turn the track until the bar contacts the frame **[Figure 30-20-12]**.

Pry the track off the idler wheel.

Remove the track from the drive sprocket.

To install the rubber track:

Put the track over the rear drive sprocket lugs.

Put the front of the track onto the front idler wheel.

See Track Tension Adjustment for adding grease to the grease spring and for checking track tension. (See Checking Tension on Page 30-20-2.)

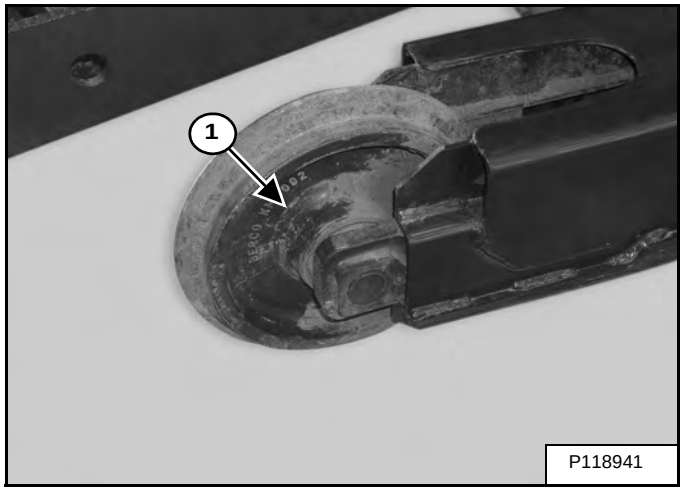
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Idler Removal And Installation

Remove the track. (See Track Removal And Installation on Page 30-20-5.)

Figure 30-20-13



Slide the track idler (Item 1) **[Figure 30-20-13]** out of the track frame.

Track Tensioner Removal And Installation

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 1) **[Figure 30-20-14]**.

⚠ WARNING



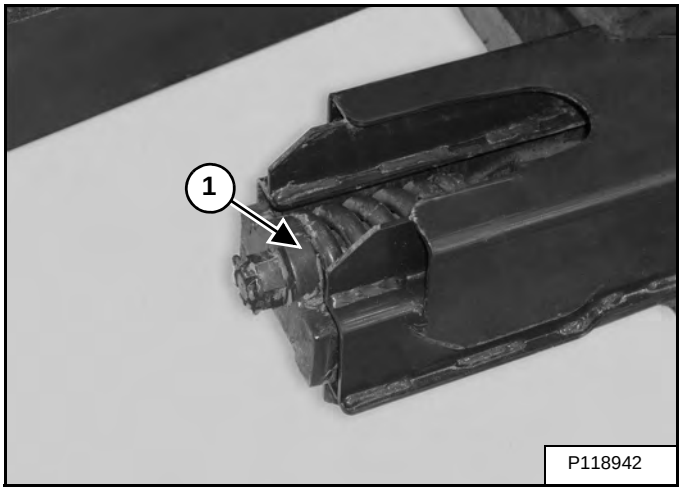
P-62574

AVOID INJURY OR DEATH

- **Spring loaded components under pressure can cause serious injury or death.**
- **Do not disassemble the coil spring assembly**

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Figure 30-20-14



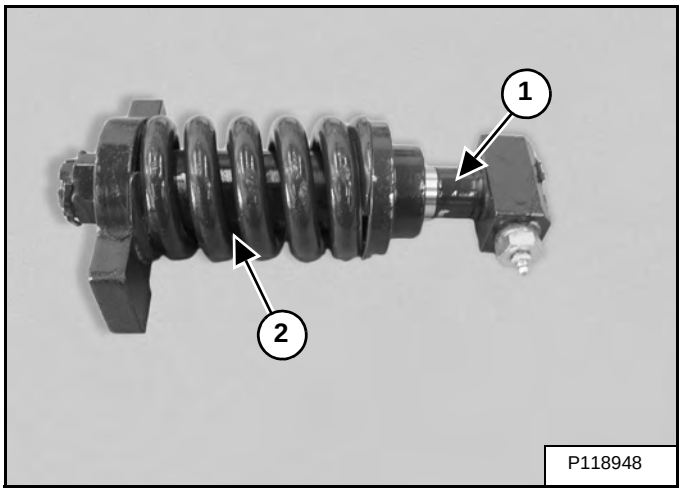
Remove the track tensioner assembly (Item 1) **[Figure 30-20-14]**.

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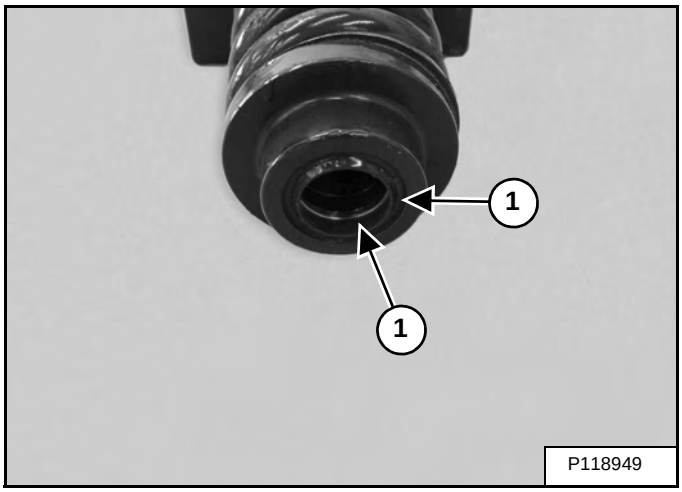
Track Tensioner Disassembly & Assembly

Figure 30-20-15



Remove the cylinder (Item 1) from the track tensioner assembly (Item 2) **[Figure 30-20-15]**.

Figure 30-20-16



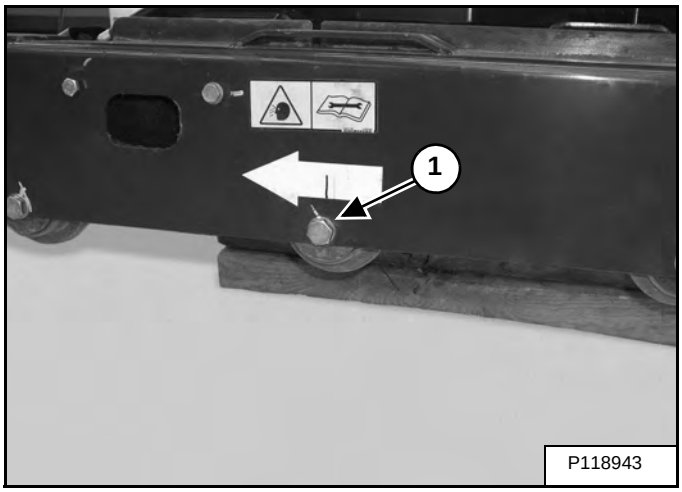
Remove the seals (Item 1) **[Figure 30-20-16]**.

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Roller Removal And Installation

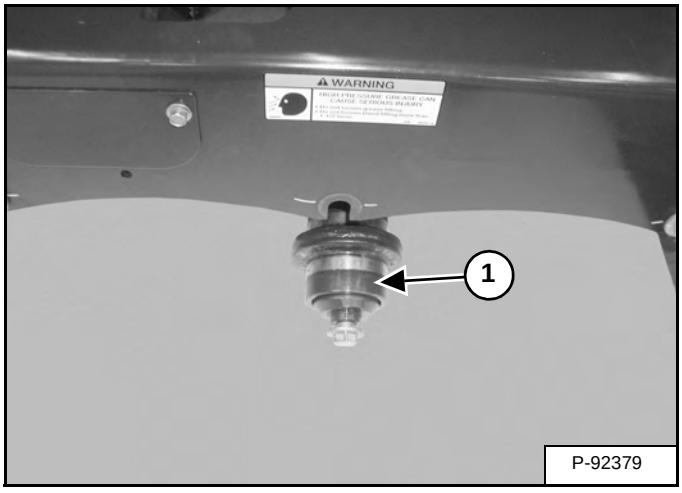
Figure 30-20-17



Loosen the bolts (Item 1) **[Figure 30-20-17]** on the track roller on both sides of the track frame.

Installation: Tighten the bolts to 190 - 210 N•m (140 - 155 ft-lb) torque.

Figure 30-20-18

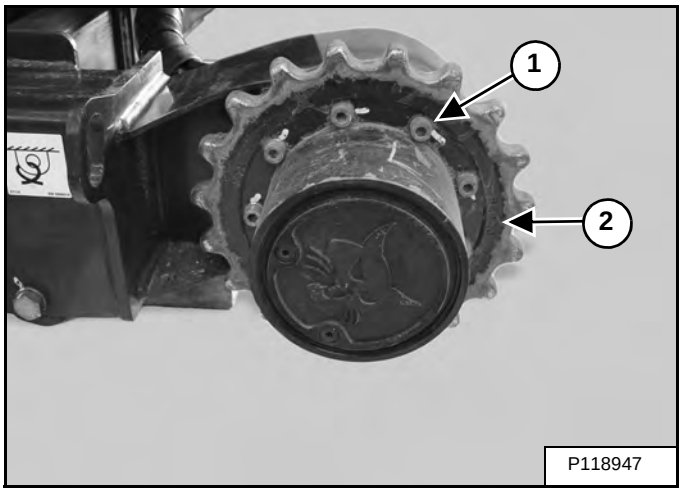


Remove the bottom roller (Item 1) **[Figure 30-20-18]**.

NOTE: The rollers are not serviceable. Replace the roller if it is damaged.

Sprocket Removal And Installation

Figure 30-20-19



Remove the drive sprocket bolts (Item 1) **[Figure 30-20-19]**.

Installation: Put thread adhesive (Loctite® 242) on the bolts and tighten to 108 N•m (80 ft-lb) torque.

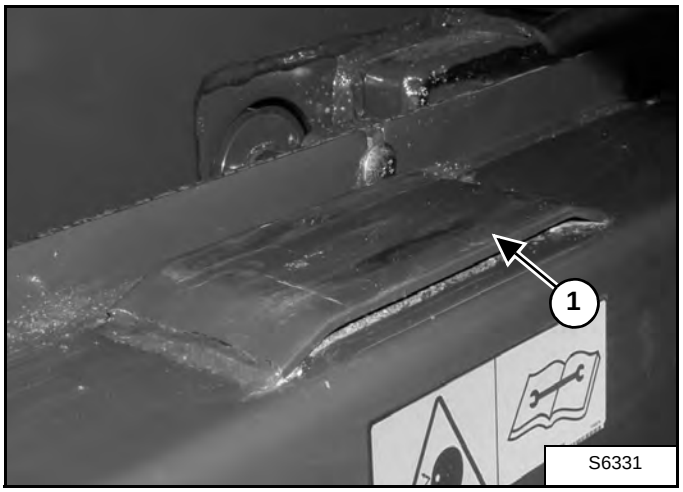
Remove the drive sprocket (Item 2) **[Figure 30-20-19]** from the travel motor.

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Track Frame Guide Inspection

Figure 30-20-20



Inspect the track guide (Item 1) **[Figure 30-20-20]** for wear or damage.

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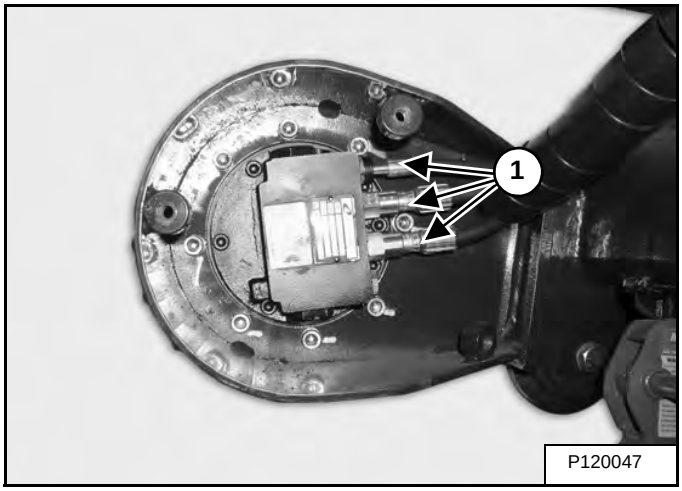
Removal And Installation Of Expandable Track Frame

Lift and block the track frame.

Remove the track. (See Track Removal And Installation on Page 30-20-5.)

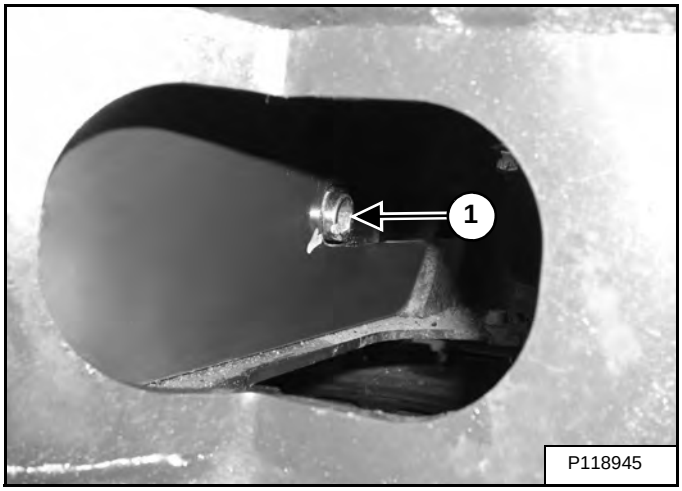
Remove the track frame expansion cylinder. (See Removal And Installation on Page 20-25-2.)

Figure 30-20-21



Remove the travel motor cover. Remove the hoses (Item 1) **[Figure 30-20-21]** from the travel motor.

Figure 30-20-22

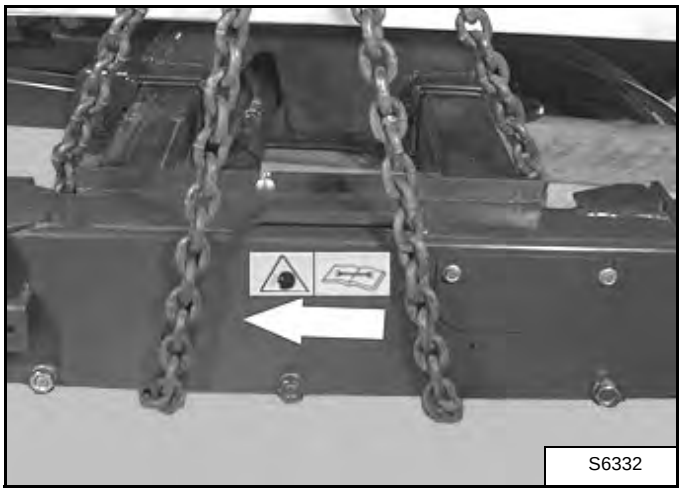


Remove the stop bolt (Item 1) **[Figure 30-20-22]** from the track expansion frame.

NOTE: Front stop bolt shown is for the left track frame. Rear stop bolt is for the right side.

Installation: Apply thread locking adhesive Loctite® 242.

Figure 30-20-23



Install a chain hoist on the track frame **[Figure 30-20-23]**. Lift the frame a small amount while pulling the frame away from the excavator.

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Track Damage Identification

Cutting Of The Steel Cords

Damage:

Figure 30-30-1

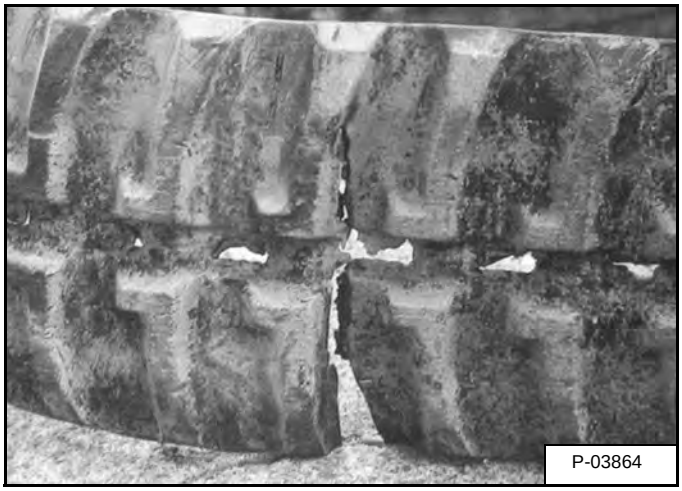
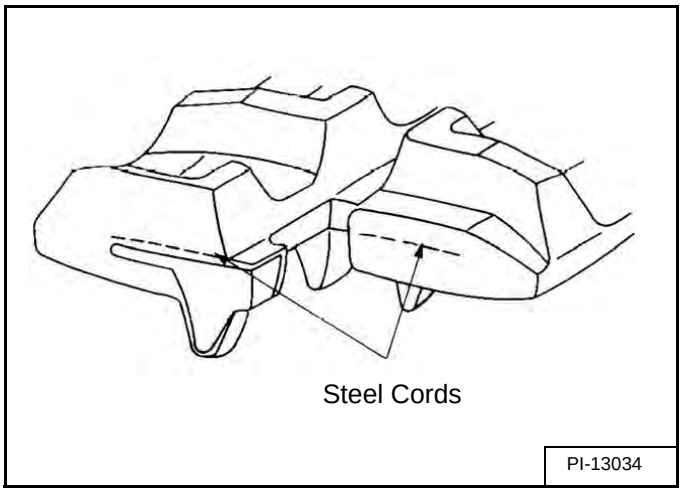


Figure 30-30-2



Embedded steel cords are cut off **[Figure 30-30-1]** and **[Figure 30-30-2]**.

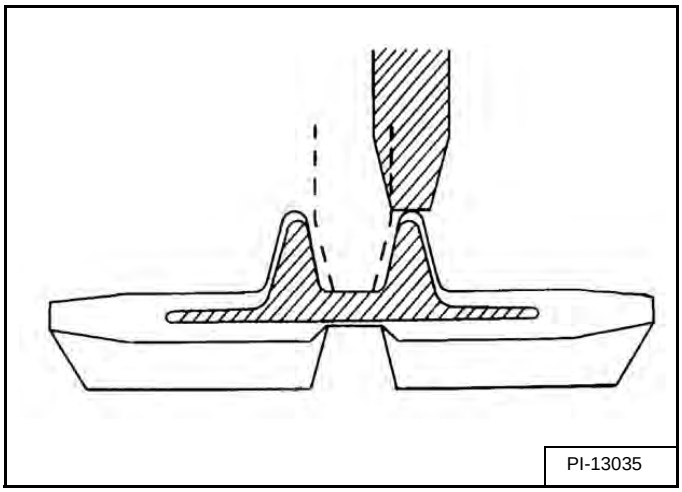
Replacement:

Replacement is required **[Figure 30-30-1]** and **[Figure 30-30-2]**.

Causes Of The Damage

When applied to rubber tracks under the following circumstances, tension in excess of the breaking strength of the embedded steel cords causes steel cords to be cut:

Figure 30-30-3



When the rubber track is detracking, the idler or sprocket rides on the projections of the embedded metal **[Figure 30-30-3]**.

When the rubber track is detracted, projections of rubber tracks get stuck between the frame of the undercarriage.

The rubber track is clogged with stones or foreign obstacles.

When moisture penetrates through a cut on the lug side rubber surface, the embedded steel cords will corrode. The deterioration of the design strength may lead to the breaking off of the steel cords.

Prevention

The following preventions should be taken to minimize the risk of this damage:

Periodically check on site, recommended track tension. (See Checking Tension on Page 30-20-2.)

Avoid quick turns on bumpy and rocky fields.

Drive carefully to avoid having stones and other articles clog the rubber tracks.

Avoid driving over sharp objects. If this is impossible, do not make turns while driving over sharp objects.

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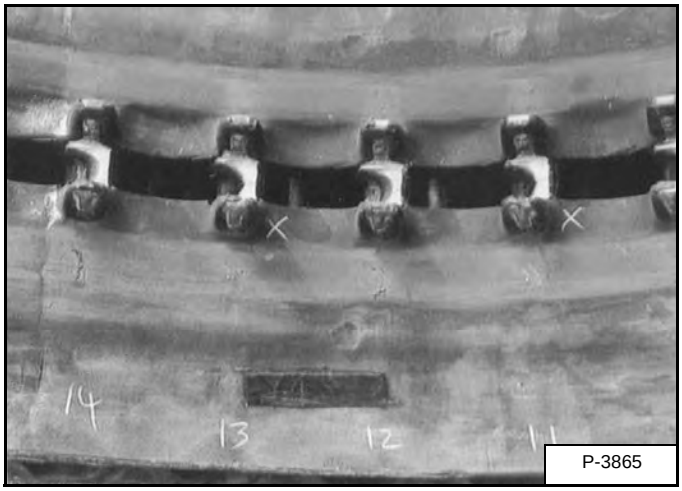
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Track Damage Identification (Cont'd)

Abrasion Of Embedded Metals

Damage:

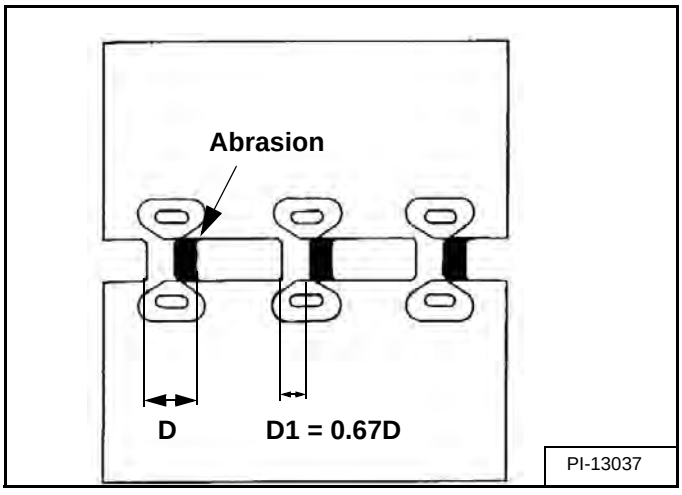
Figure 30-30-4



In proportion to the service time, embedded metals will gradually wear away by friction **[Figure 30-30-4]**.

Replacement:

Figure 30-30-5



Replacement is required when the width of the embedded metals (D1) becomes 67% of their original width (D) **[Figure 30-30-5]**.

Causes Of The Damage

When the track rollers, sprockets and idler gears roll over the embedded metals, abrasion of embedded metals is inevitable. The following cases sometimes accelerate rubber track abrasion:

Rubber tracks are driven with an extraordinary heavy load on them.

Rubber tracks are used on sandy fields.

Prevention

As long as rubber tracks are used under normal operating conditions, abnormal abrasion is unlikely to occur. The level of abrasion should be carefully checked when the machines are used for dozing which generate a heavy load for rubber tracks, and when they are operated under a sandy field condition for a long time.

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Track Damage Identification (Cont'd)

Separation Of Embedded Metals

Damage:

Figure 30-30-6



Extraordinary outer forces applied to embedded metals cause their separation from the rubber track's body **[Figure 30-30-6]**.

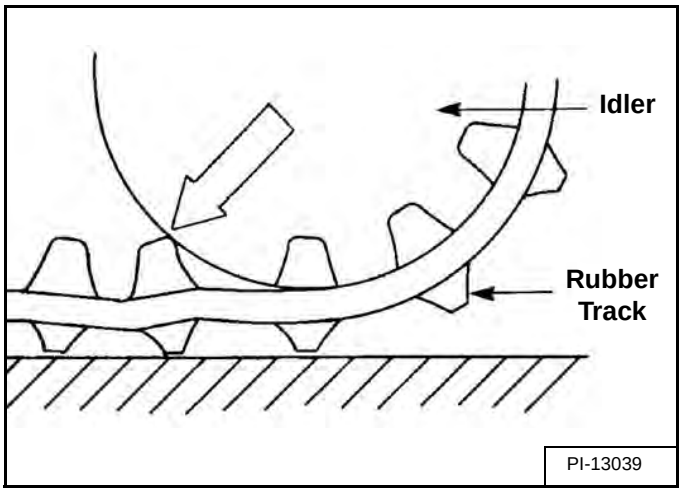
Replacement:

Even a partial separation of embedded metals requires replacement of the track.

Causes Of The Damage:

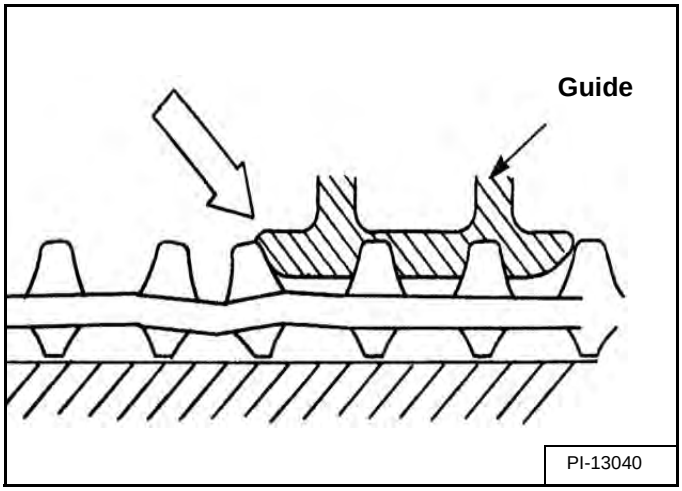
Embedded metals adhere between the steel cords and the rubber body. The following cases generate external forces greater than the adhesion strength, causing separation of the embedded metals:

Figure 30-30-7



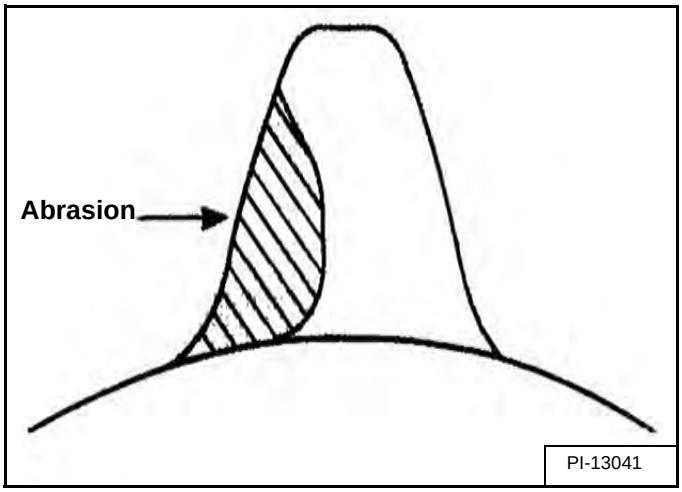
When the idler continually rides on the projections of embedded metals, the embedded metals will eventually peel off **[Figure 30-30-7]**.

Figure 30-30-8



When a rubber track is detracted, it becomes stuck between the guide or the undercarriage frame, causing the separation of embedded metals **[Figure 30-30-8]**.

Figure 30-30-9



Abnormally worn sprockets as shown will pull embedded metals out **[Figure 30-30-9]**.

Prevention:

Similar to the prevention against the cutting of the steel cords:

Periodically check on site, recommended track tension. (See Checking Tension on Page 30-20-2.)

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Track Damage Identification (Cont'd)

Separation Of Embedded Metals (Cont'd)

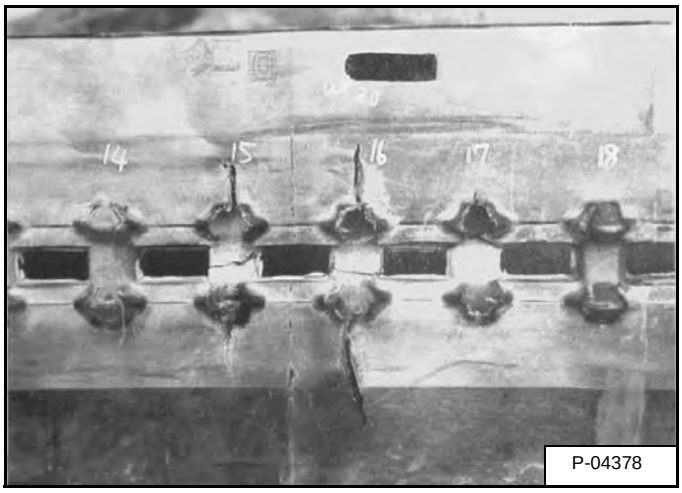
Quick turns on bumpy and rocky fields should be avoided.

If abnormal wear of sprockets is observed, they should be immediately replaced.

Separation Of Embedded Metals Due To Corrosion

Damage:

Figure 30-30-10



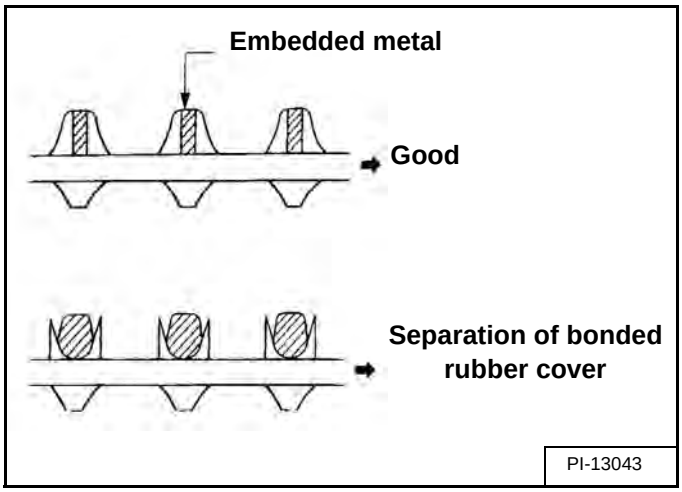
Due to corrosion of embedded metals, the adhesion to the rubber body deteriorates, resulting in complete separation **[Figure 30-30-10]**.

Replacement:

Even a partial separation of embedded metals requires a rubber track replacement.

Causes Of The Damage

Figure 30-30-11



Embedded metals are bonded to the rubber body. The following operating conditions cause embedded metals to corrode, causing deterioration of the bonding, and finally resulting in separation of the embedded metals from the rubber body **[Figure 30-30-11]**.

Excessively salty fields, like the sea shore.

Strong acidic or alkali soil conditions

Compost spread grounds

On tracks that are out of adjustment, the track rollers, idlers and sprockets will gradually wear the rubber surface at track roller side, causing exposure of the embedded metals. Consequently the embedded metals will corrode resulting in their separation from the rubber body.

Prevention:

If rubber tracks are used under such field conditions as described under (Causes Of The Damage), they should be washed with plenty of water. After being completely dried, they should be stored correctly.

When the bonded rubber cover is separated from the embedded metal projections and the metals in the rubber body become loose, it is time to consider replacement of the rubber track.

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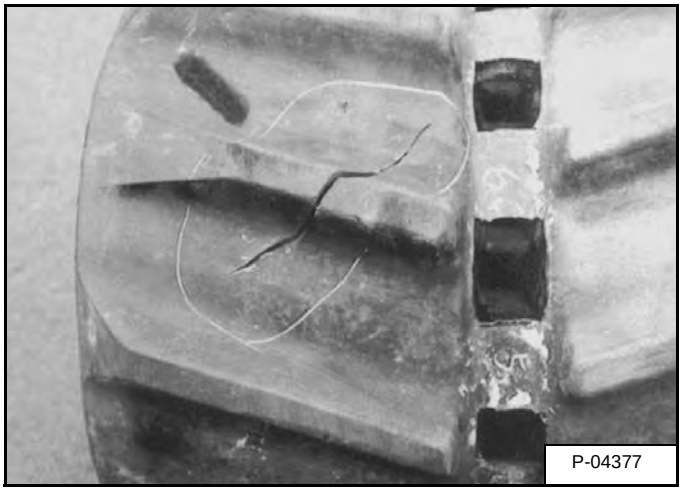
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Track Damage Identification (Cont'd)

Cuts On The Lug Side Rubber

Damage:

Figure 30-30-12



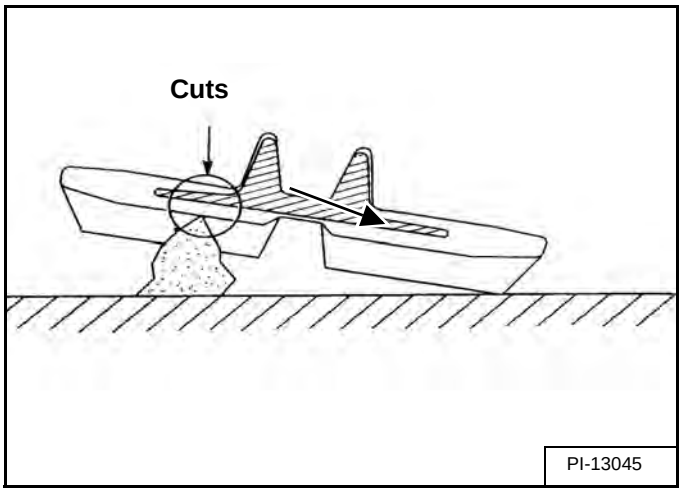
Cuts on the lug side rubber often occurs as one of the most typical failure modes **[Figure 30-30-12]**

Replacement:

When a cut on the lug side rubber reaches the embedded steel cords, it should be immediately repaired with cold vulcanization rubber.

Causes Of The Damage:

Figure 30-30-13



When rubber tracks drive over projections or sharp stones in the fields, the concentrated forces applied cause cuts on the lug side rubber surface. In case of making turns on projections, the lug side rubber surface will have an even higher chance to be cut. If the cuts run through the embedded steel cords, it might result in the breakage of steel cords due to corrosion. It is highly recommended to repair the cuts with cold vulcanization rubber as soon as they are observed **[Figure 30-30-13]**.

Prevention:

Machine operators should drive with great attention to the ground surface, especially in terrains of the following type:

Construction sites

Demolition sites

Paths covered with rocks and wood

Concrete ridges

Stumpy fields

When operating on terrains as mentioned above, quick high speed turns and overloading should be avoided.

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Track Damage Identification (Cont'd)

Cracks On The Lug Side Rubber Due To Fatigue

Damage:

Figure 30-30-14

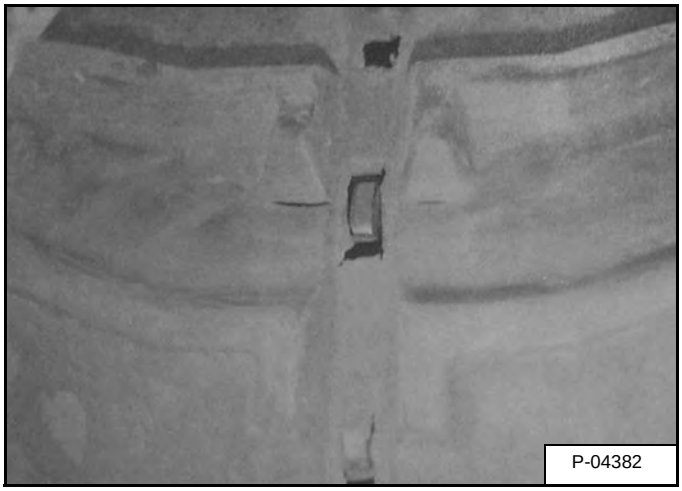
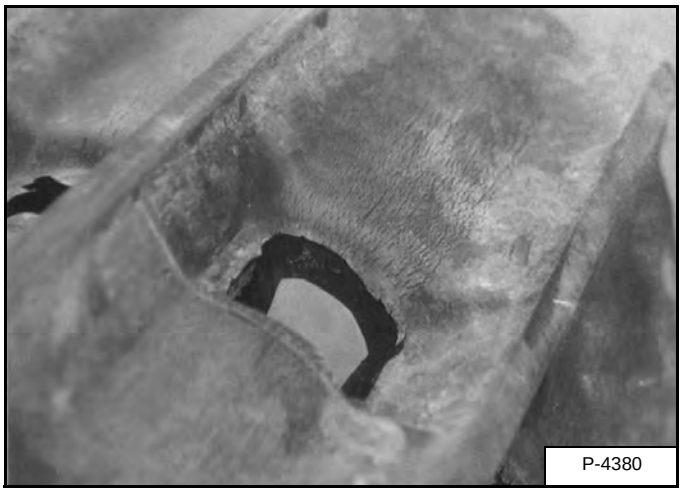


Figure 30-30-15



Small cracks around the root of the lug are a result from operation fatigue **[Figure 30-30-14]** and **[Figure 30-30-15]**

Replacement:

When the cracks become deep enough to expose the steel cords, track replacement is required.

Causes Of The Damage:

Because of wound stress applied to rubber tracks around the undercarriage parts during operation, the fatigue especially causes cracks on the lug side rubber surface. Once the cracks occur, they gradually deteriorate with even small external cracks.

Also when operating near seashores or under cold temperatures, rubber tracks are more likely to suffer from ozone cracks.

Prevention:

Rubber tracks are designed with special rubber compounds to prevent cracks due to fatigue. However, external damage on the lug side rubber, increases the possibility of cracking. Machine operators should observe soil conditions when driving, to prevent external damage to the lug side rubber. In order to minimize the occurrence of ozone cracks, follow these maintenance instructions:

Avoid exposing stored tracks to direct sun light.

Avoid exposing stored tracks to direct rain and snowfall.

Store tracks in well ventilated warehouses.

Use the tracks at least once a month.

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Track Damage Identification (Cont'd)

Lug Abrasion

Damage:

Figure 30-30-16

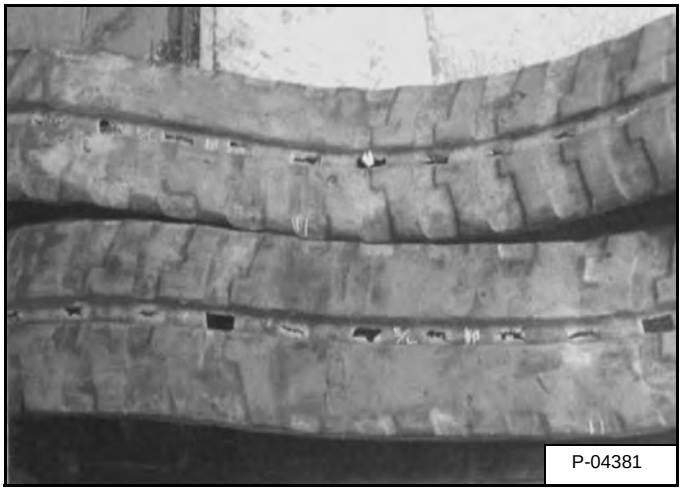
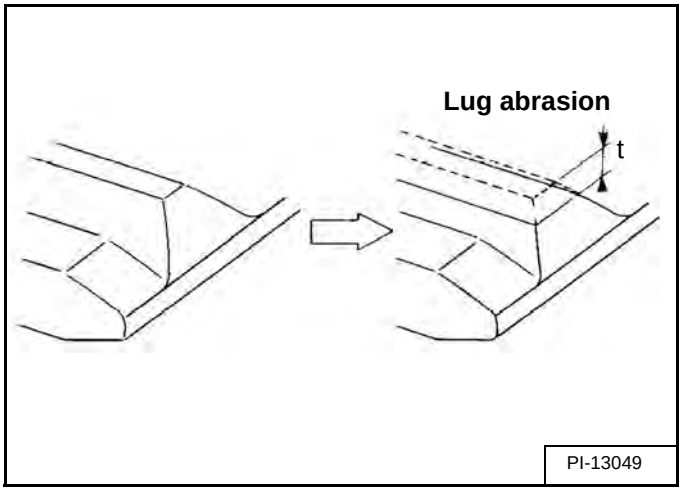


Figure 30-30-17



As operation time increases, the lug side undergoes abrasion **[Figure 30-30-16]** and **[Figure 30-30-17]**.

Replacement:

No replacement is required.

Causes Of The Damage:

Lug abrasion will occur as operation time increases. Even as lug abrasion increases, the rubber track can be used. However, as the traction performance deteriorates, it is highly recommended to replace the abraded tracks with new ones when the lug height becomes less than 5 mm.

Prevention:

In order to prevent the rubber track from abnormal or premature abrasion, the following operating conditions should be avoided:

Making quick and repeated turns on concrete and asphalt roads.

Driving up and down hilly paths with slippage.

Making frequent turns on paths covered with rocks and wood.

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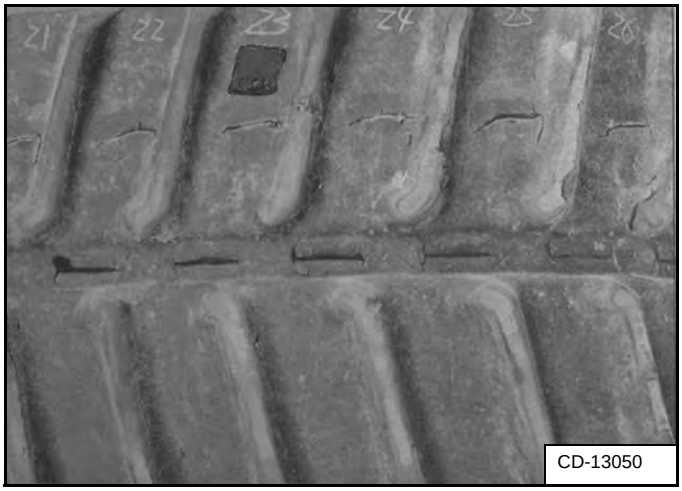
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Track Damage Identification (Cont'd)

Cracks And Cuts On The Lug Side Rubber

Damage:

Figure 30-30-18



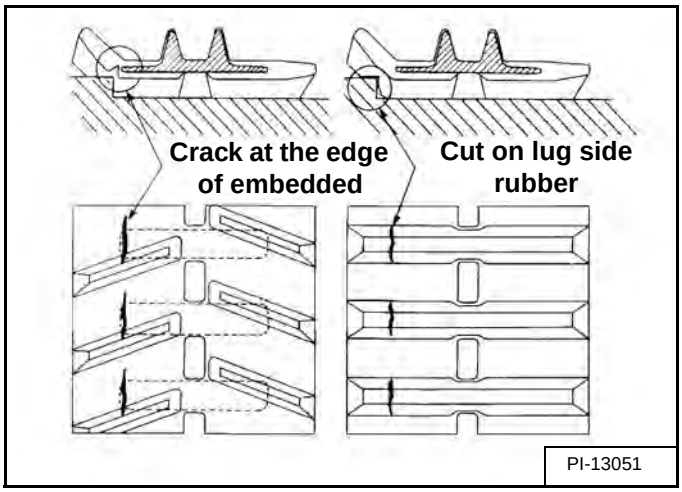
Sometimes cracks and cuts on the lug side rubber at the edges of the embedded metals can be observed **[Figure 30-30-18]**.

Replacement:

Basically, no replacement is required unless the cuts on the lug side rubber are discovered all around the edges of the embedded metals, as this will result in a complete cut off.

Causes Of The Damage:

Figure 30-30-19



When rubber tracks drive over sharp projections, intensive stress is applied to the lug side rubber surface, especially at the edges of embedded metals, causing cracks and cuts in the area around the embedded metals **[Figure 30-30-19]**.

Prevention:

To avoid extensive stress applied to the lug root where metals are embedded, machine operators should avoid driving over stumps and ridges.

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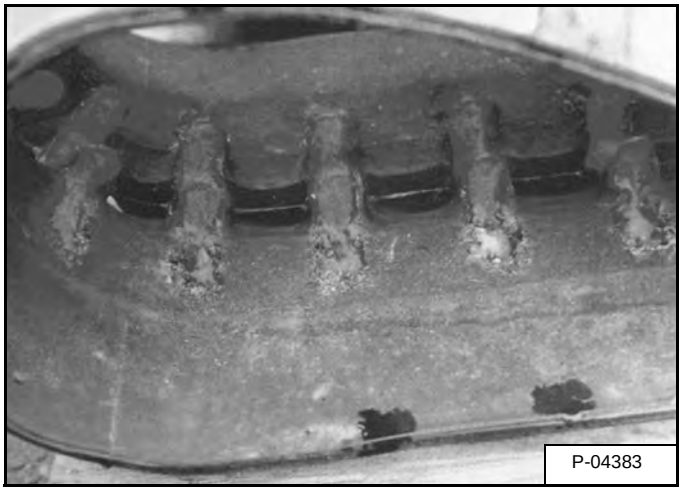
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Track Damage Identification (Cont'd)

Abrasion Of The Track Roller Side

Damage:

Figure 30-30-20



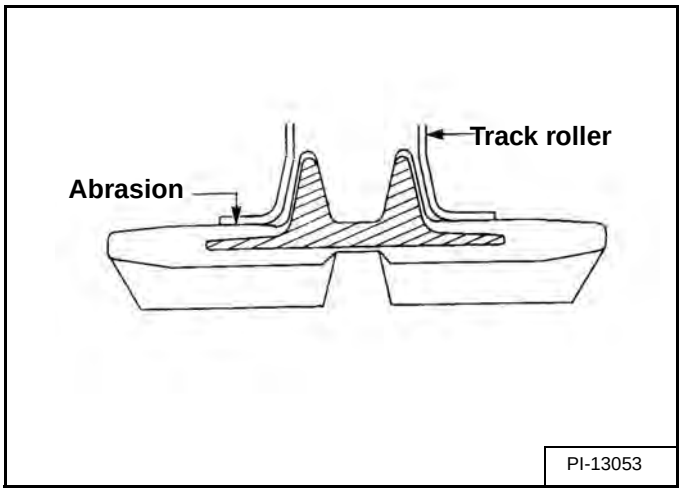
The rubber surface on which track rollers run is gradually abraded. It will result in the exposure of the embedded metals **[Figure 30-30-20]**.

Replacement:

It is recommended to replace the rubber track when more than half of the embedded metals are completely exposed.

Causes Of The Damage:

Figure 30-30-21



The abrasion of the track roller side rubber surface occurs because of sand and gravel being clogged between the rubber and the outside surface of the track rollers. The stress pushes the sand and gravel against the side of the rubber track to cause the abrasion **[Figure 30-30-21]**.

The level of abrasion is highly dependent on terrain conditions. A higher level of abrasion will occur when the rubber tracks are operated in fields covered with many stones and gravel. Small stones hardened with mud, stuck to the track rollers increase the abrasion level. After an extended period of abrasion, it will be more likely for exposed embedded metals to catch moisture through the inside steel cords, which can cause breakage of steel cords and separation of the metals from the rubber body.

Prevention:

After operation in wet fields containing many small stones, wash off the mud that is stuck to the track rollers completely. When operating on gravel paths and stony grounds, machines should be driven slowly and the turning radius should be big enough to prevent stones and gravel from getting stuck to the track roller side rubber.

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Track Damage Identification (Cont'd)

Cuts On The Edges Of The Track Roller Side

Damage:

Figure 30-30-22

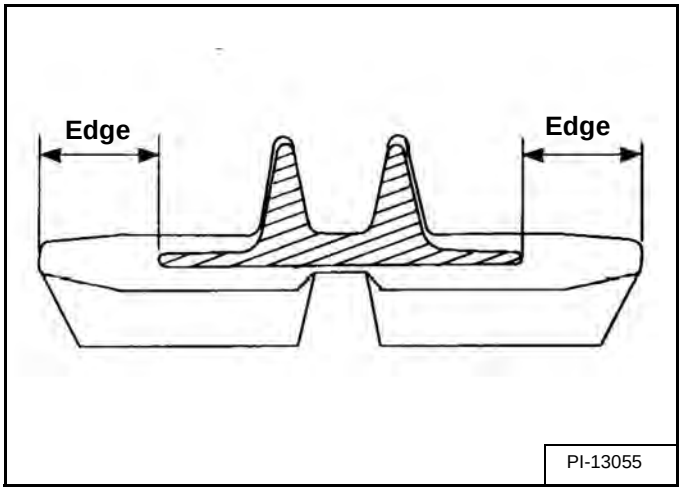


Figure 30-30-23

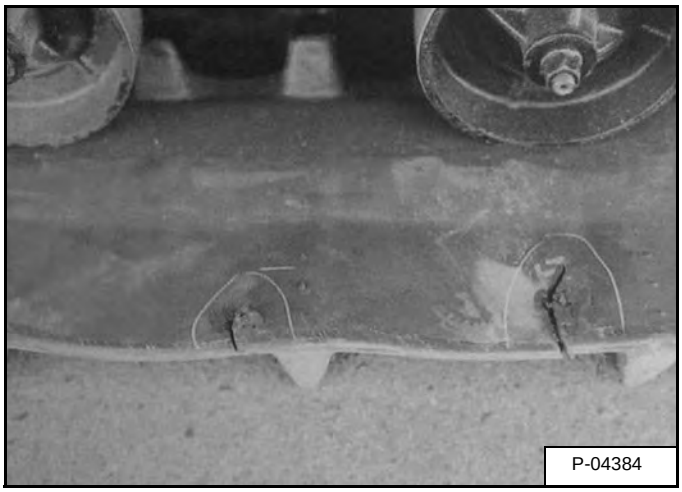
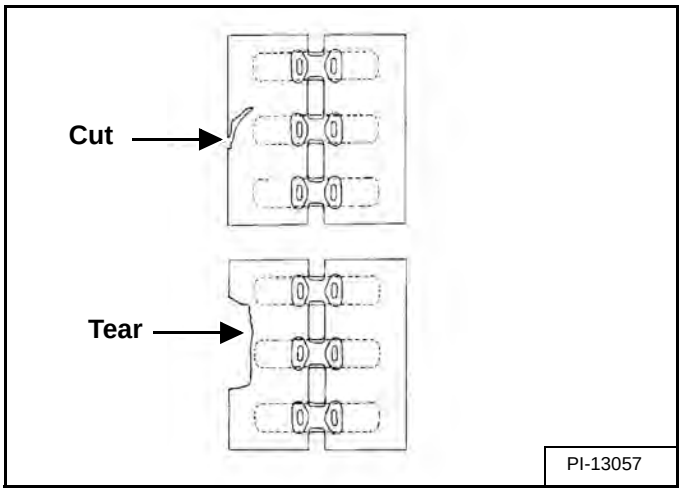


Figure 30-30-24



Both edges of a rubber track **[Figure 30-30-22]** have no special reinforcement. During operation the edges may become cut or torn off **[Figure 30-30-23]** and **[Figure 30-30-24]**.

Replacement:

In such case, the rubber track does not have to be replaced.

Causes Of The Damage:

This damage is caused by objects on the ground or by interference with the machine frame.

In case of damage by objects on the operating ground:

The edges of rubber track are often deformed largely due to a bumpy ground surface, stones and other objects. This causes extensive stress on the edges resulting in the damage.

When driving a machine over concrete ridges, this type of damage easily occurs.

In case of damage by interference with the machine frame.

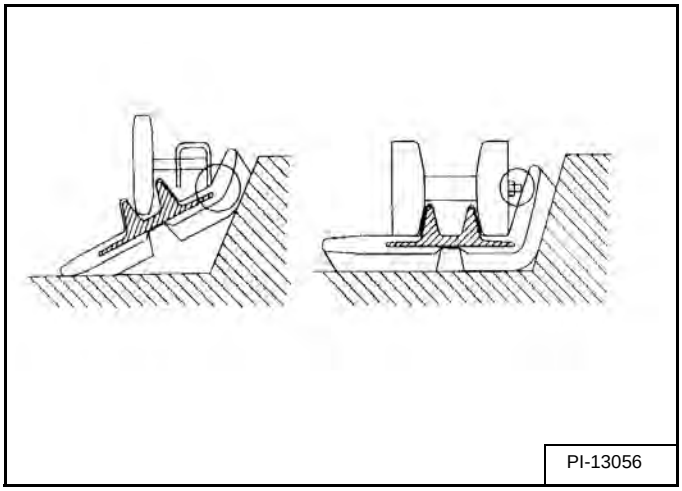
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Track Damage Identification (Cont'd)

Cuts On The Edges Of The Track Roller Side (Cont'd)

Figure 30-30-25



If a machine continues operating with rubber tracks being detracked, the rubber tracks may get caught up in the machine frame or undercarriage parts resulting in damage. Furthermore, when a machine travels along side slopes, the rubber tracks are deformed so much that they come into contact with the machine frame and undercarriage parts, which causes cutting, gouging and rubbing of rubber tracks in the end **[Figure 30-30-25]**.

Prevention:

When traveling, a machine operator should be careful not to drive over any projections on the ground. He should also prevent rubber tracks from coming into contact with concrete walls, ditches and ridges. If rubber tracks are detracked, the machine should be stopped immediately for retracking.

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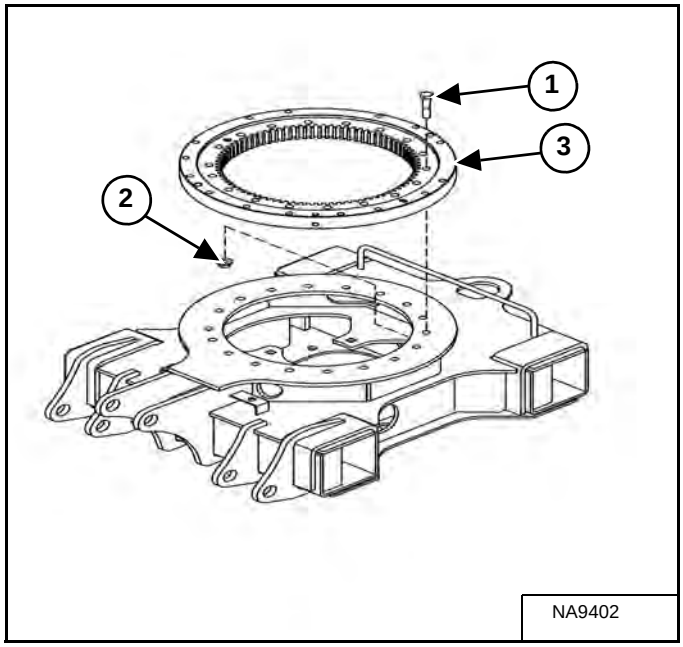
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SWING CIRCLE GEAR

Removal And Installation

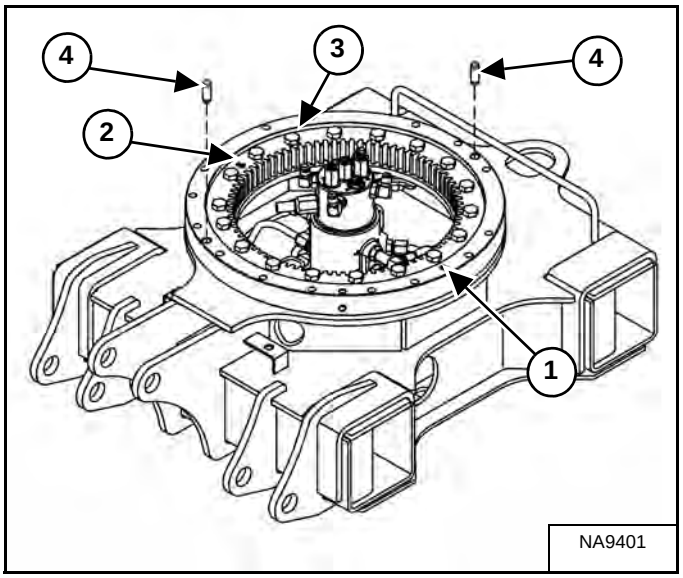
Remove the upperstructure from the swing circle gear. (See Removal on Page 40-10-1.)

Figure 30-40-1



Remove the bolts (Item 1) and (Item 2) nuts **[Figure 30-40-1]**. Remove the swing bearing (Item 3) **[Figure 30-40-1]** from the track frame.

Figure 30-40-2



Install the swing bearing with the outer soft zone (Item 1) located to the left side of the track frame and the inner soft zone (Item 2) **[Figure 30-40-2]** located to the right side of the track frame.

Install the bolts (Item 3) **[Figure 30-40-2]** and nuts. Tighten the bolts to 105 - 115 N•m (78 - 85 ft-lb) torque.

Install the dowel pins (Item 4) **[Figure 30-40-2]** in the swing bearing.

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UPPERSTRUCTURE

Description

The upperstructure includes all the components in or attached to the frame and connects to the slew bearing. The slew bearing divides the upperstructure from the undercarriage, which includes the track frame components.

Removal

Fully extend the cylinders of the bucket and arm. Fully retract the cylinder of the boom.

Lower the blade to the ground.

Remove the battery. (See Removing And Installing The Battery on Page 50-20-5.)

Remove the cab or canopy. (See Removal And Installation on Page 40-30-1.)

Remove the operator bonnet. (See Removal And Installation on Page 40-230-1.)

Drain the hydraulic reservoir. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

Remove the seat and seat mount. (See Removal And Installation on Page 40-40-1.)

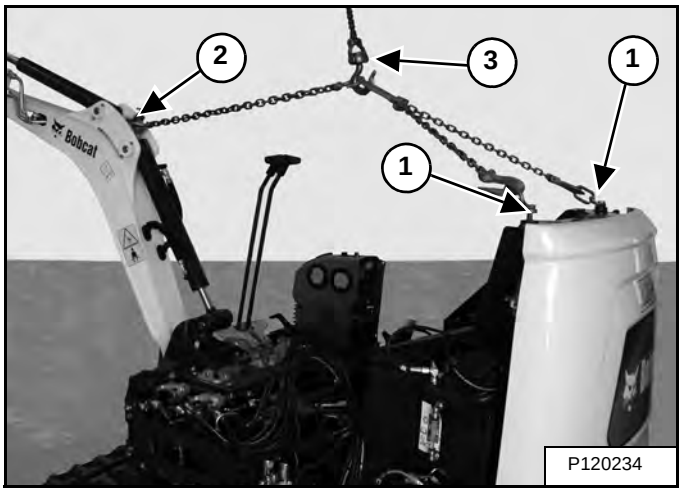
Remove the floor mat and floor panels. (See Removal And Installation on Page 40-140-1.)

Remove the control linkage assembly. (See Disassembly And Assembly on Page 40-120-1.)

Remove the hydraulic control valve. (See Removal And Installation on Page 20-40-1.)

Remove the swing motor. (See Removal And Installation on Page 20-100-1.)

Figure 40-10-1



Install lifting brackets (Item 1) **[Figure 40-10-1]** in the rear cab / canopy mounts.

Fasten the chain to the pin (Item 2) **[Figure 40-10-1]** in the top of the boom.

Install the front and rear lifting chains to a lifting fixture (item 3) **[Figure 40-10-1]** above the excavator.

WARNING

AVOID INJURY OR DEATH

- **Use a lifting fixture with sufficient capacity for the weight of the excavator plus any added attachments.**
- **Maintain center of gravity and balance when lifting.**
- **Do not swing boom or upperstructure. Engage the upperstructure slew lock.**
- **Never lift with operator on machine.**

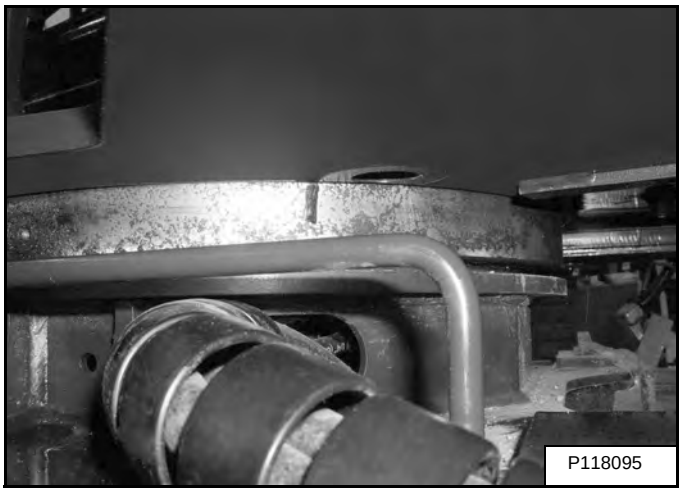
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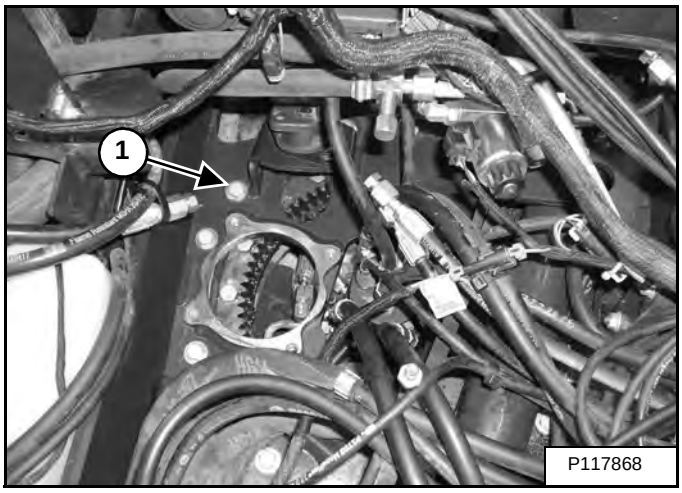
Removal (Cont'd)

Figure 40-10-2



Mark the upperstructure to the swing bearing and to the track frame for ease of assembly **[Figure 40-10-2]**.

Figure 40-10-3



Remove the hoses from the top of the swivel joint **[Figure 40-10-3]**.

Remove the bolts (Item 1) **[Figure 40-10-3]** from the upperstructure.

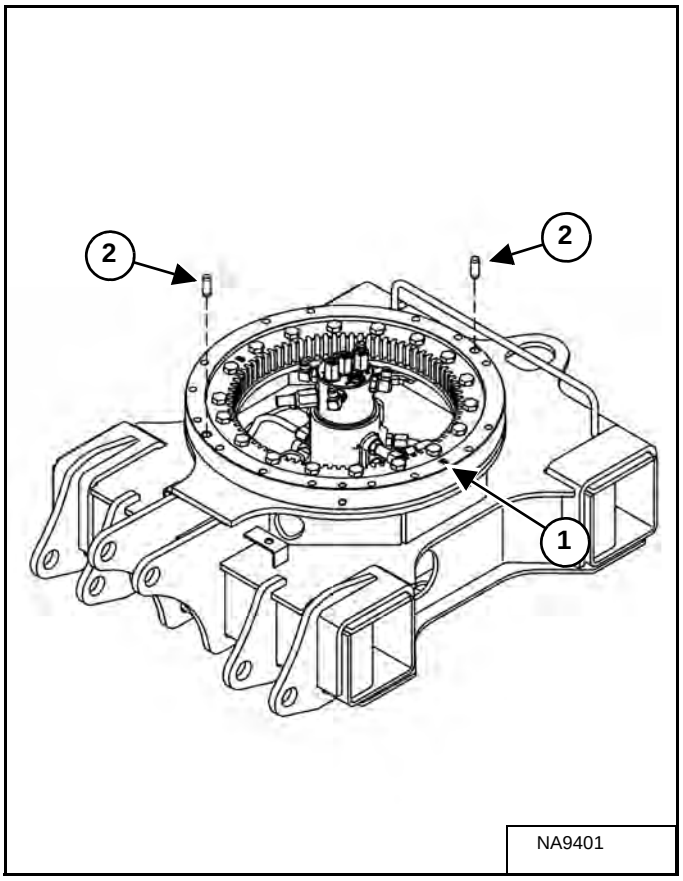
Lift the upperstructure off the swing bearing. Position the upperstructure onto supporting stands or blocks.

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Installation

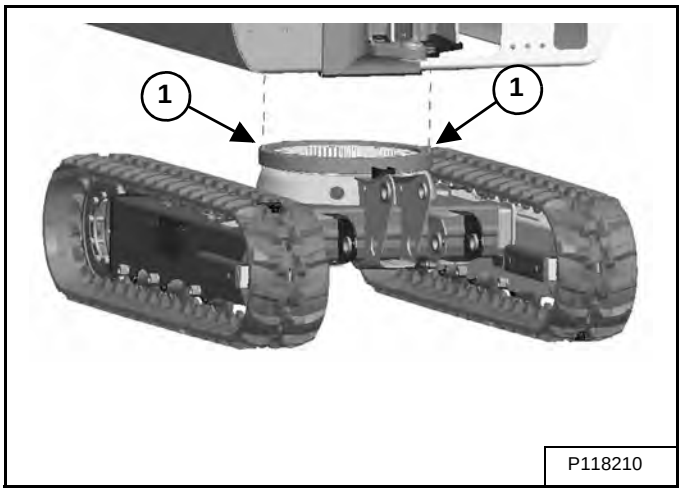
Figure 40-10-4



Position the swing bearing with the soft zone (Item 1) **[Figure 40-10-4]** located to the left side of the track frame.

Install the dowel pins (Item 2) **[Figure 40-10-4]** in the swing bearing.

Figure 40-10-5



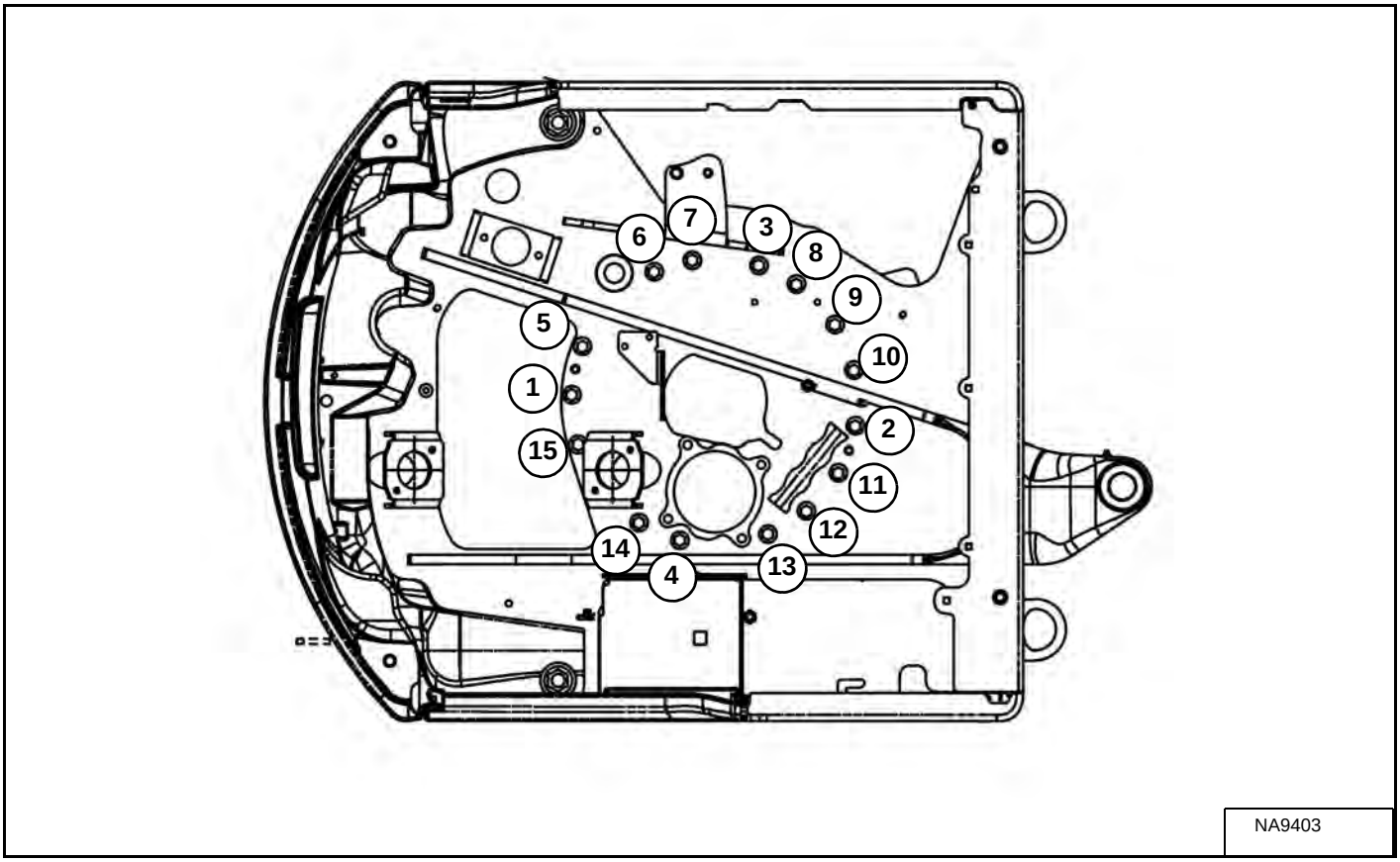
Lower the upperstructure frame onto the swing bearing aligning the two pins (Item 1) **[Figure 40-10-5]**. Maintain a slight amount of weight on the hoist.

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Installation (Cont'd)

Figure 40-10-6



Install and tighten the bolts as shown. Torque bolts 1-4 first, than torque all other bolts. After the initial torque is applied to all the bolts, re-torque bolts 1 - 4 **[Figure 40-10-6]**. Tighten bolts to 57 - 63 N•m (42 - 46 ft-lb) torque.

Install the swing motor. (See Removal And Installation on Page 20-100-1.)

Install the operator bonnet. (See Removal And Installation on Page 40-230-1.)

Install the control linkage assembly. (See Disassembly And Assembly on Page 40-120-1.)

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

Install the seat and seat mount. (See Removal And Installation on Page 40-40-1.)

Fill the hydraulic reservoir. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

Install the battery. (See Removing And Installing The Battery on Page 50-20-5.)

Install the cab or canopy. (See Removal And Installation on Page 40-30-1.)

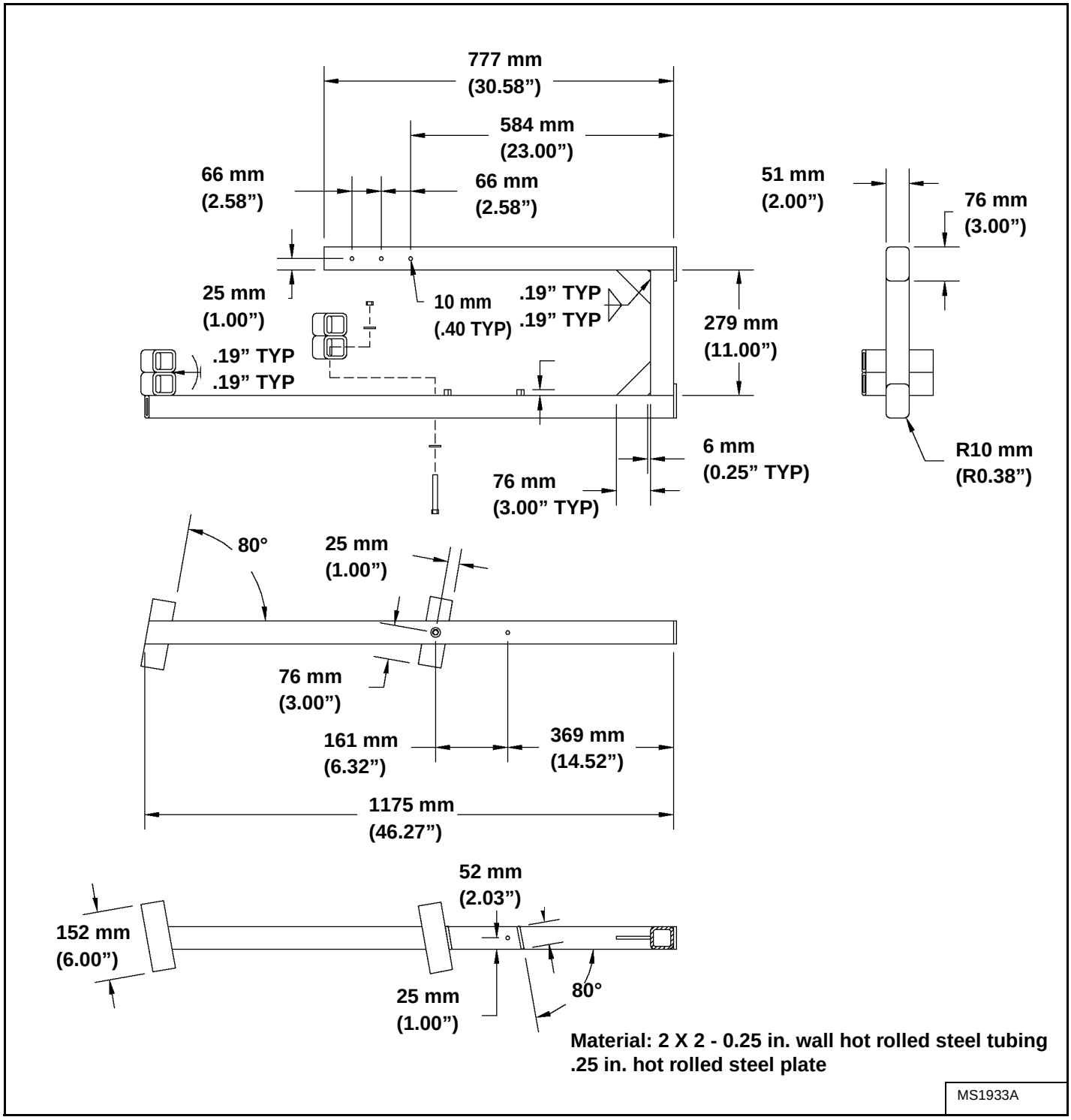
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ROPS CANOPY

Removal And Installation

Figure 40-20-1



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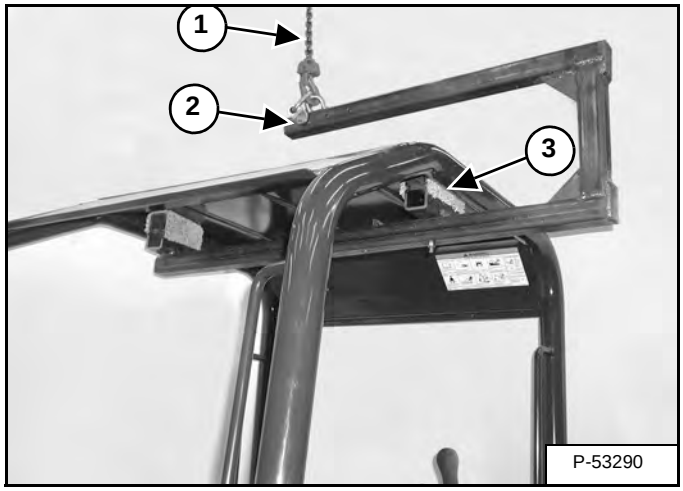
Build the service lifting bracket used to remove and install the ROPS canopy. Use the dimensions shown in **[Figure 40-20-1]** to build the service lifting bracket.

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Removal And Installation (Cont'd)

Remove the upperstructure light. (See Cab Light Removal And Installation on Page 50-50-2.)

Figure 40-20-2



Install the chain hoist (Item 1) in the end hole of the lifting bracket (Item 2) **[Figure 40-20-2]**.

Install the cab / canopy service lifting bracket on the cab **[Figure 40-20-2]**.

NOTE: Use a lifting device of sufficient capacity.

Adjust the lifting bracket to the proper width by moving the bracket (Item 3) **[Figure 40-20-2]**.

⚠ WARNING

Never use the cab / canopy service lifting bracket to lift the excavator. The bracket is not strong enough and can fail causing serious injury or death.

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Figure 40-20-3

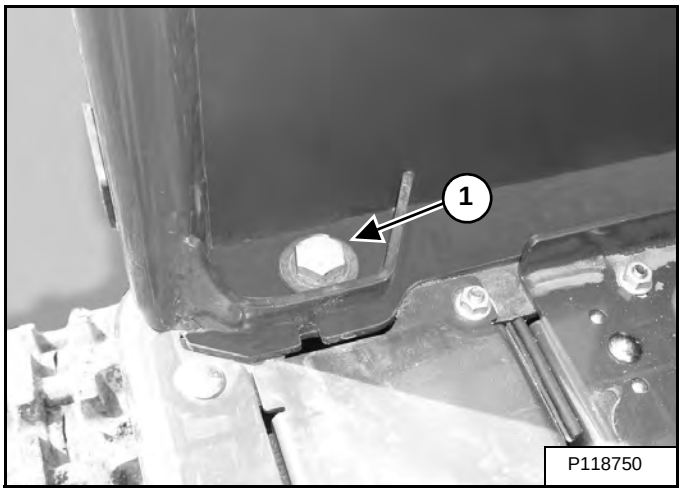
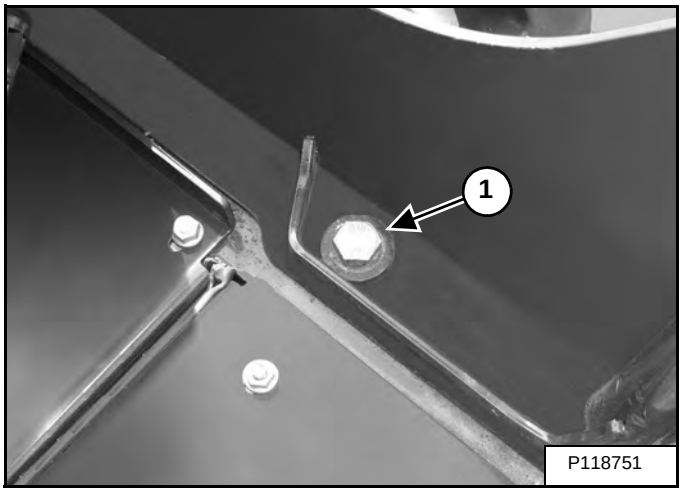


Figure 40-20-4



Remove the bolts, nuts and washers (Item 1) **[Figure 40-20-3]** and **[Figure 40-20-4]** from the front of the canopy.

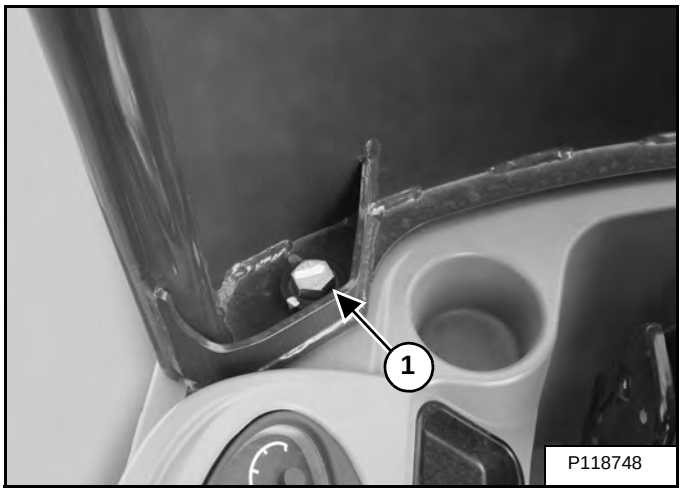
Installation: Tighten the bolts to 160 - 180 N•m (118 - 133 ft-lb) torque.

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Removal And Installation (Cont'd)

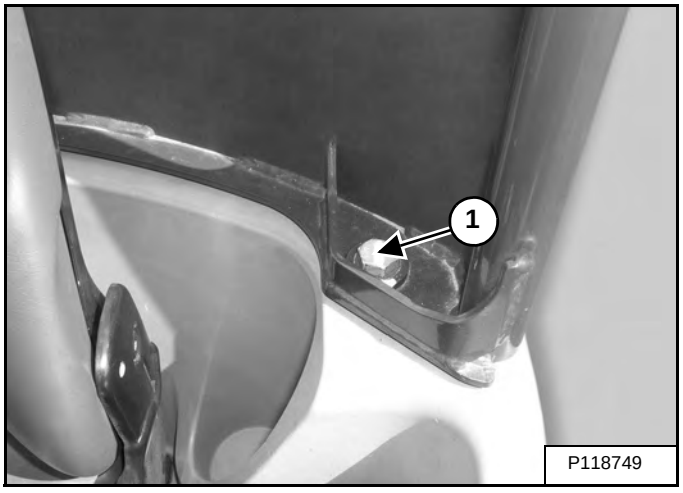
Figure 40-20-5



Remove the bolt and washer (Item 1) **[Figure 40-20-5]** from the right rear of the canopy.

Installation: Tighten the bolt to 160 - 180 N•m (118 - 133 ft-lb) torque.

Figure 40-20-6



Remove the bolt and washer (Item 1) **[Figure 40-20-6]** from the left rear of the canopy.

Installation: Tighten the bolt to 160 - 180 N•m (118 - 133 ft-lb) torque.

Remove the canopy from the upperstructure.

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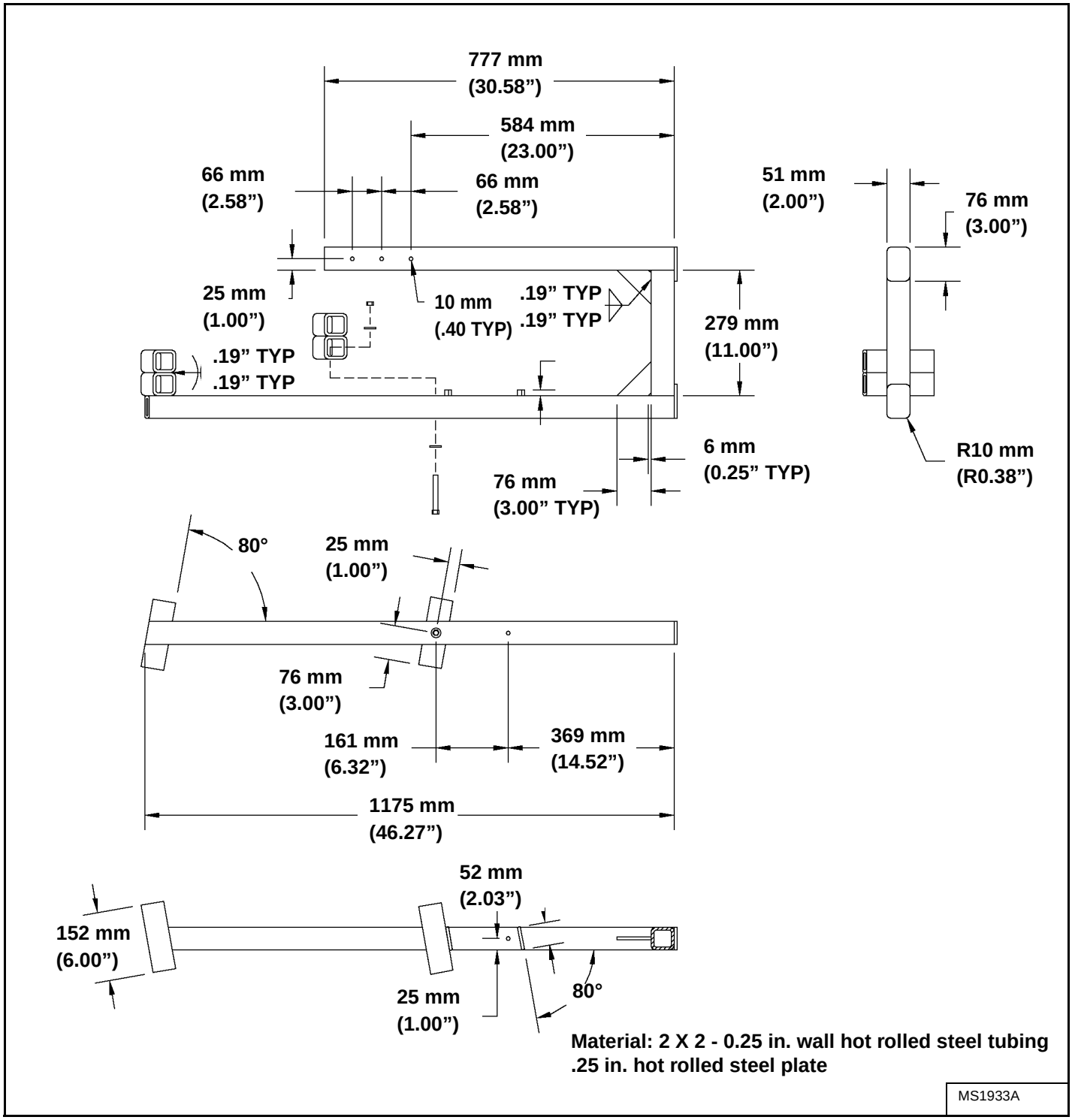
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CAB

Removal And Installation

Figure 40-30-1



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Build the service lifting bracket used to remove and install the ROPS canopy. Use the dimensions shown in **[Figure 40-30-1]** to build the service lifting bracket.

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Removal And Installation (Cont'd)

Figure 40-30-2



Install the chain hoist (Item 1) in the end hole of the lifting bracket (Item 2) **[Figure 40-30-2]**.

Install the cab / canopy service lifting bracket on the cab **[Figure 40-30-2]**.

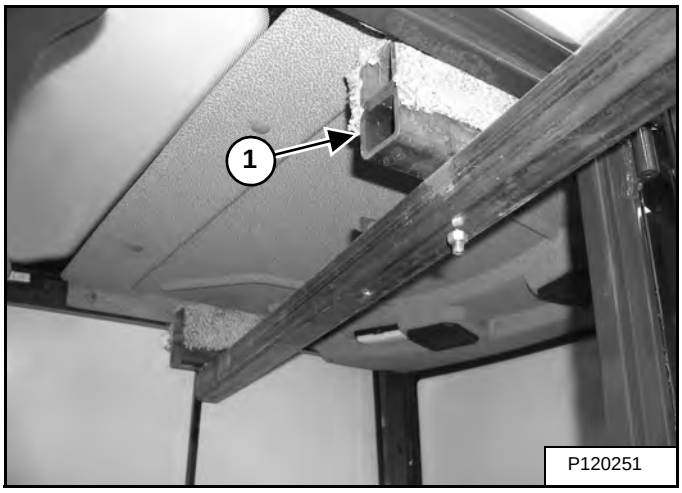
NOTE: Use a chain hoist of sufficient capacity.

⚠ WARNING

Never use the cab / canopy service lifting bracket to lift the excavator. The bracket is not strong enough and can fail causing serious injury or death.

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Figure 40-30-3



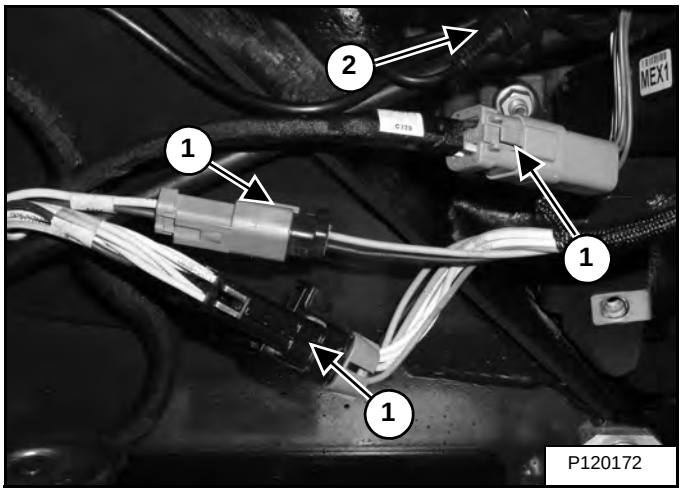
Adjust the lifting bracket to the proper width by moving the bracket (Item 1) **[Figure 40-30-3]**.

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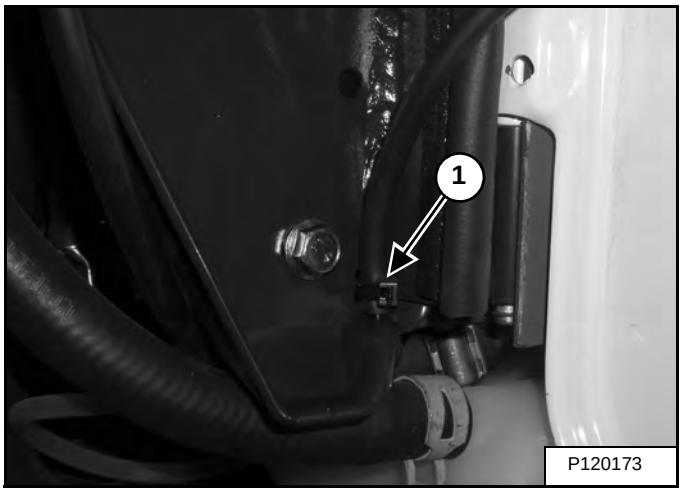
Removal And Installation (Cont'd)

Figure 40-30-4



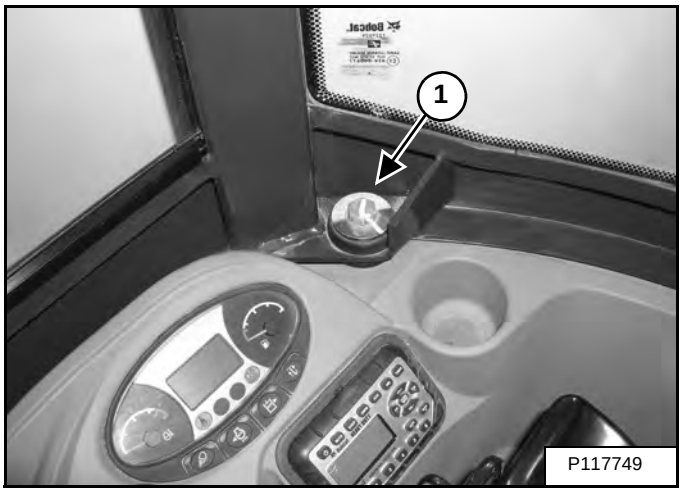
Disconnect the wire connectors (Item 1) and antenna cable (Item 2) **[Figure 40-30-4]**.

Figure 40-30-5



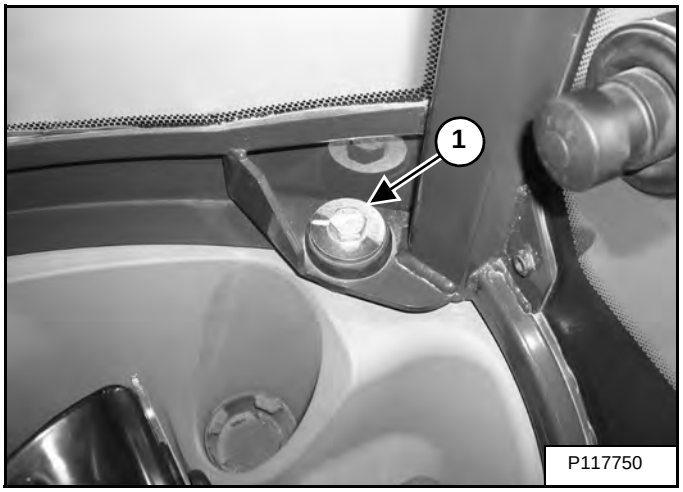
Remove the windshield washer hose (Item 1) **[Figure 40-30-5]** from the nozzle.

Figure 40-30-6



Remove the bolt and washer (Item 1) **[Figure 40-30-6]** from the right rear of the cab.

Figure 40-30-7



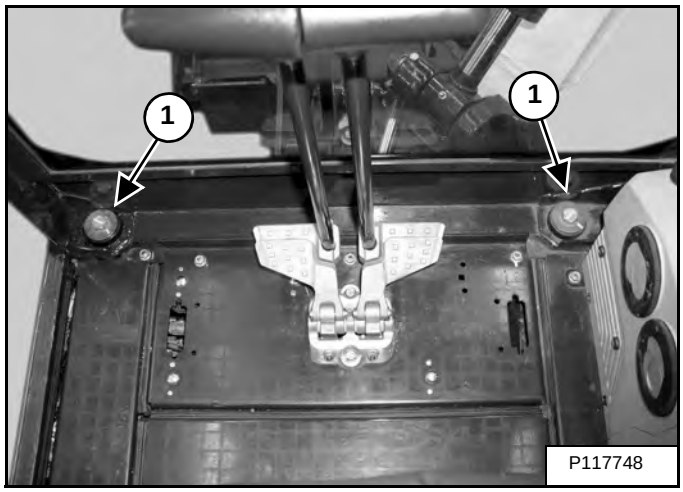
Remove the bolt and washer (Item 1) **[Figure 40-30-7]** from the left rear of the cab.

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Removal And Installation (Cont'd)

Figure 40-30-8



Remove the bolts, nuts and washers (Item 1) **[Figure 40-30-8]** from the front of the cab.

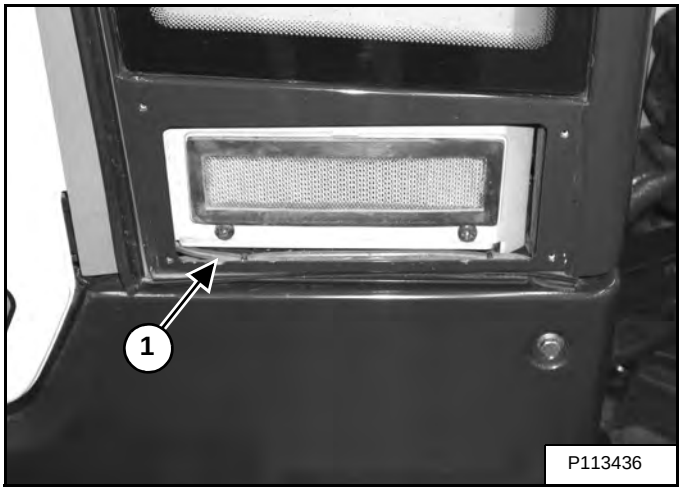
Installation: Tighten the bolts to 160 - 180 N•m (118 - 133 ft-lb) torque.

Figure 40-30-9



Raise the hoist **[Figure 40-30-9]**.

Figure 40-30-10



Move the cab to the right to provide clearance from the heater box (Item 1) **[Figure 40-30-10]**.

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Door Removal And Installation

Figure 40-30-11



The door can be removed from the cab by slowly swinging the door back and forth while lifting up on the door **[Figure 40-30-11]**.

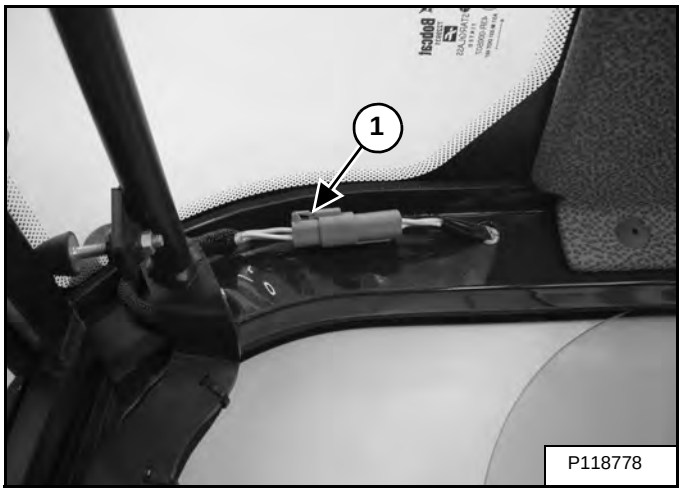
Installation: Align the hinges and swing the door back and forth until the door weight settles the hinges to full engagement.

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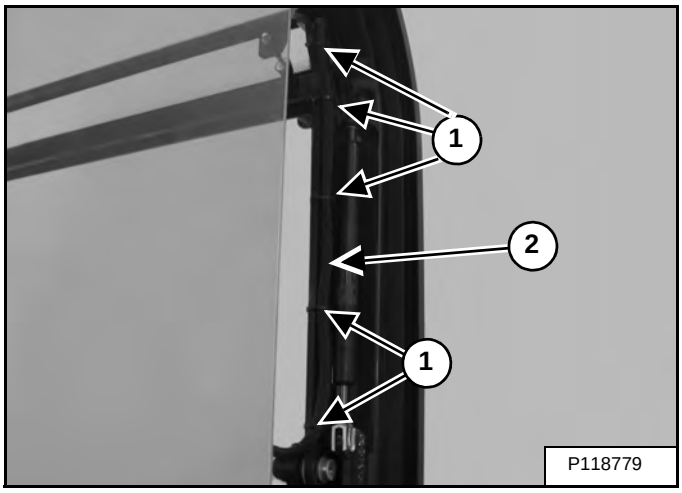
Front Window Removal And Installation

Figure 40-30-12



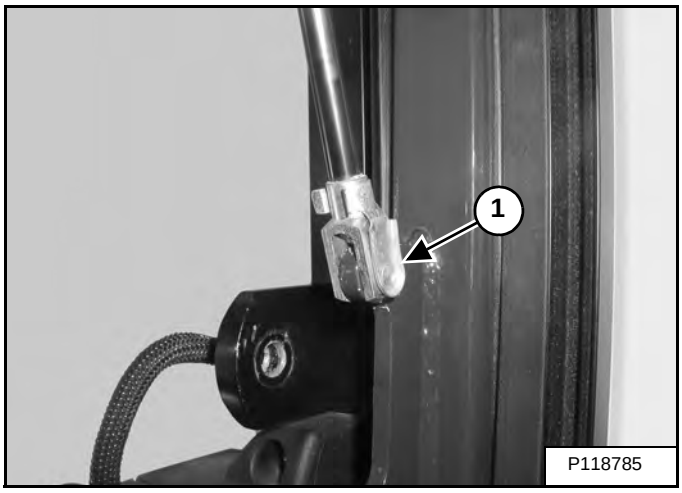
Disconnect the wire harness (Item 1) **[Figure 40-30-12]**.

Figure 40-30-13



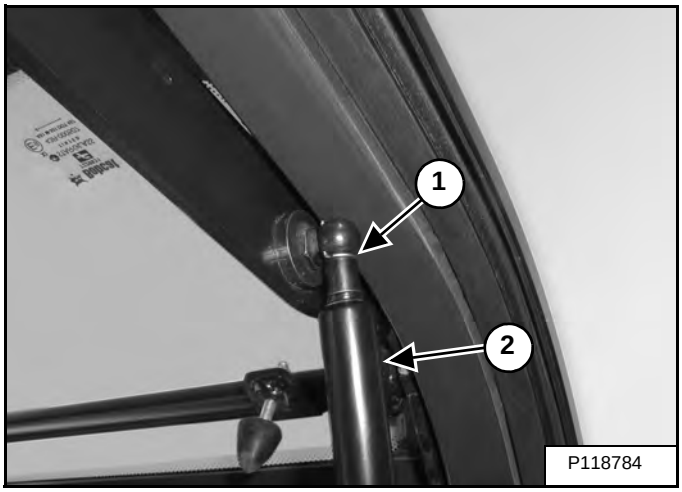
Cut the cable ties (Item 1) and remove the wire harness (Item 2) **[Figure 40-30-13]** from the arm.

Figure 40-30-14



Raise the window and remove the lower pin (Item 1) **[Figure 40-30-14]**.

Figure 40-30-15



Remove the clip (Item 1) and remove the gas strut (Item 2) **[Figure 40-30-15]**.

Installation: The pivot linkage must be in the raised position and the window removed to install the gas strut.

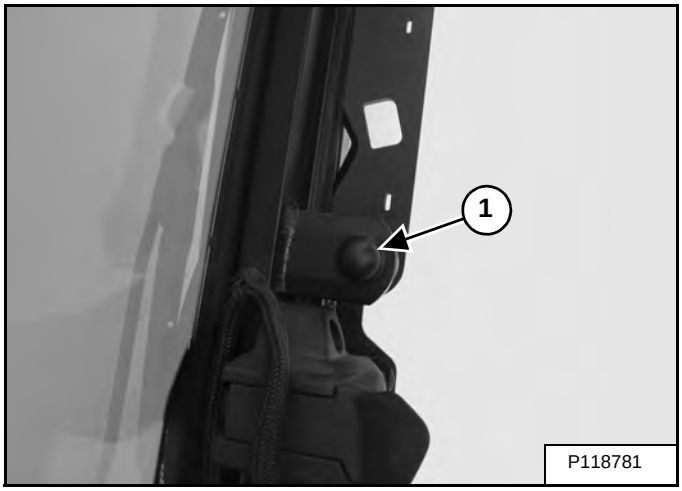
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Front Window Removal And Installation (Cont'd)

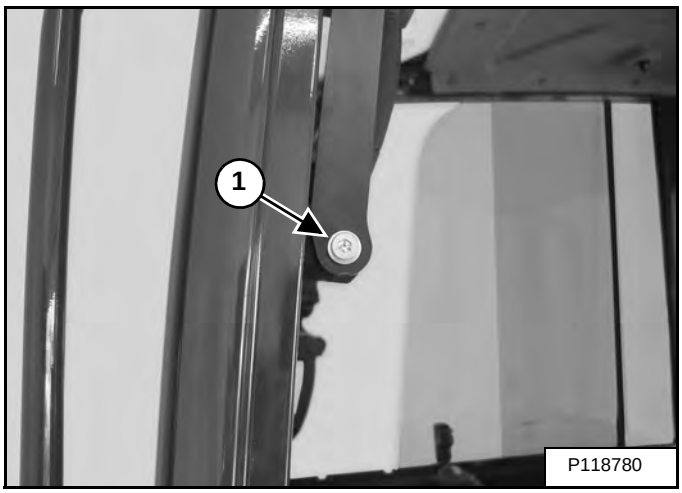
Lower the window.

Figure 40-30-16



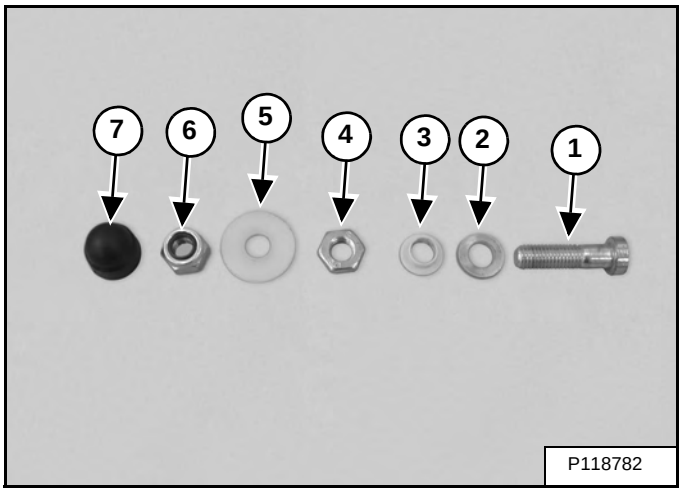
Remove the cap on the pivot bolt nut (Item 1) **[Figure 40-30-16]** (both sides).

Figure 40-30-17



Remove the pivot bolt assembly (Item 1) **[Figure 40-30-17]** (both sides).

Figure 40-30-18



1. Pivot bolt
2. Washer
3. Bushing
4. Locknut
5. Nylon washer
6. Locknut
7. Cap

Figure 40-30-19



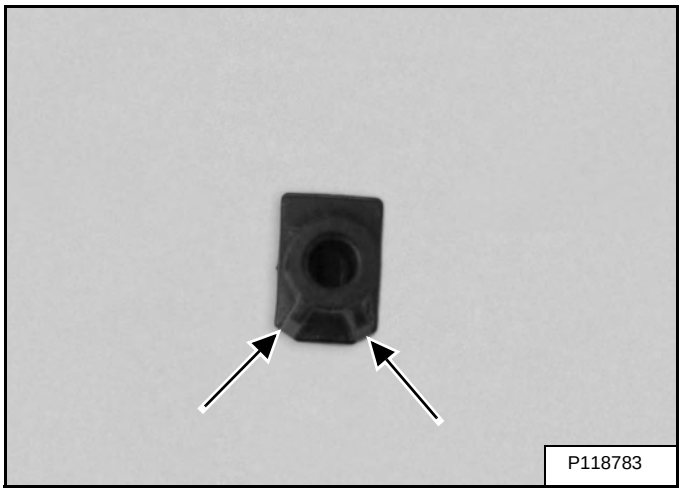
Tilt the front window (Item 1) **[Figure 40-30-19]**. Remove the front window from the cab.

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Front Window Removal And Installation (Cont'd)

Figure 40-30-20



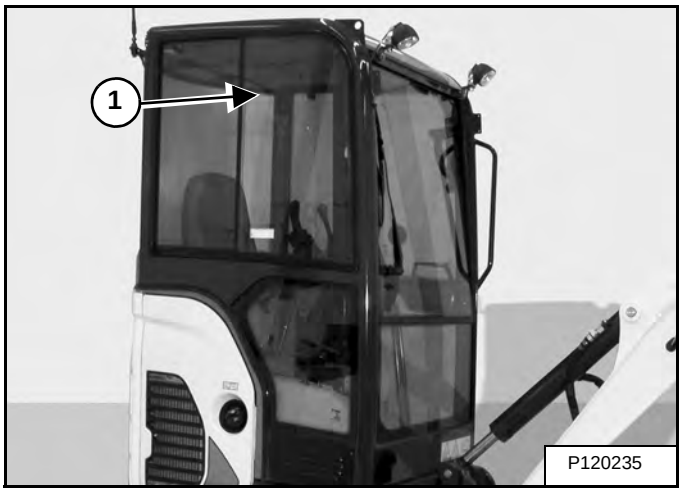
Installation: When installing the window check to see that the guide is positioned as shown. The pivot hole is offset and the ribs should be down **[Figure 40-30-20]**.

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Right Side Sliding Window Removal And Installation

Figure 40-30-21

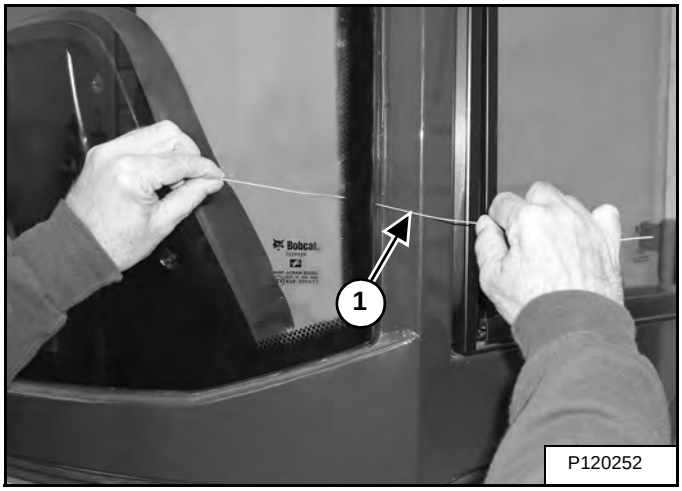


The right side sliding window must be ordered as an assembly **[Figure 40-30-21]**.

Glass Removal

Use the following procedure to remove the glass from the rear of the cab and right side window assembly.

Figure 40-30-22



Push a small diameter wire (Item 1) **[Figure 40-30-22]** through the adhesive. Pull the wire around the perimeter of the glass to cut the adhesive.

Remove the glass.

NOTE: The right side window frame is aluminum and will be destroyed when removed.

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Glass Installation

Rear And Front Lower Glass

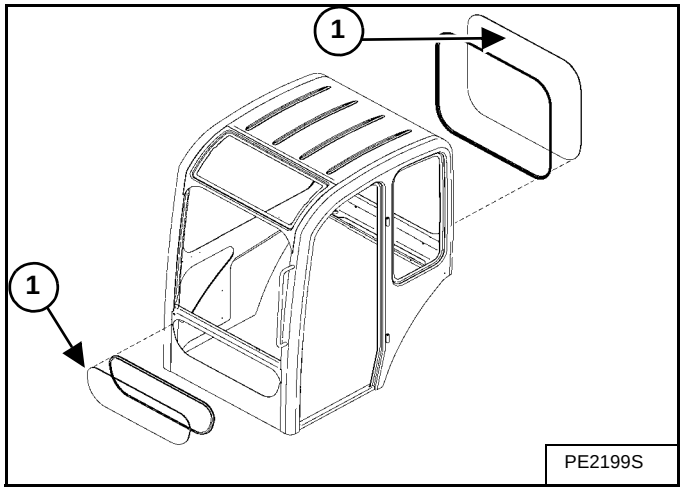
Remove the majority of the old urethane adhesive from the perimeter of the cab.

NOTE: Leave a thin film of the old urethane on the cab frame, fresh urethane will bond to the remaining film.

Prime and paint any bare metal or scratches.

Clean the metal surfaces with general purposes adhesive cleaner. Clean the glass surface with glass cleaner.

Figure 40-30-23

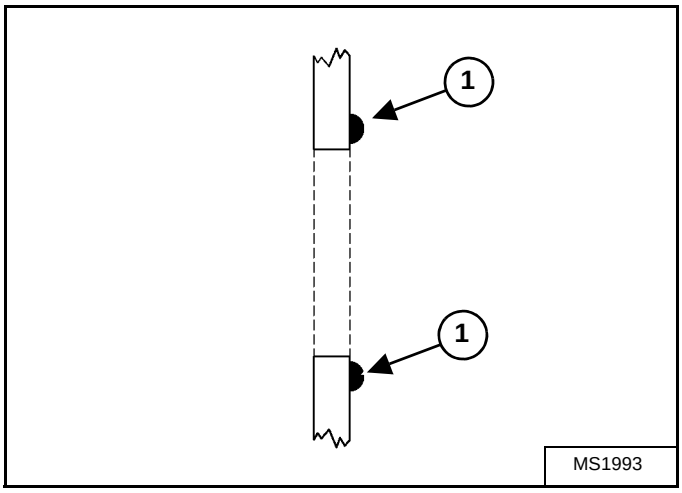


Apply the combo primer to the perimeter of the cab and glass (Item 1) **[Figure 40-30-23]**. Apply the primer in one direction only, using a dauber. Do not dip the dauber in the primer more than once. Use multiple daubers if needed.

Allow the combo primer to dry for 5 minutes. Dry time doubles if the primer is applied in two coats.

Cut the tip of the adhesive tube to the desired shape and size to provide a bead height sufficient to give good contact with the glass around the entire perimeter.

Figure 40-30-24



Apply a 0.3 x 0.25 in bead of urethane adhesive (Item 1) **[Figure 40-30-24]** to the perimeter of the cab.

Allow 2 hours for curing at normal conditions (65°F, 75% relative humidity).

Remove the tape after the adhesive is cured.

Top, Right And Left Side Glass

Remove the majority of the old urethane adhesive from the perimeter of the cab.

NOTE: Leave a thin film of the old urethane on the cab frame, fresh urethane will bond to the remaining film.

Prime and paint any bare metal or scratches.

Clean the metal surfaces with general purposes adhesive cleaner. Clean the glass surface with glass cleaner.

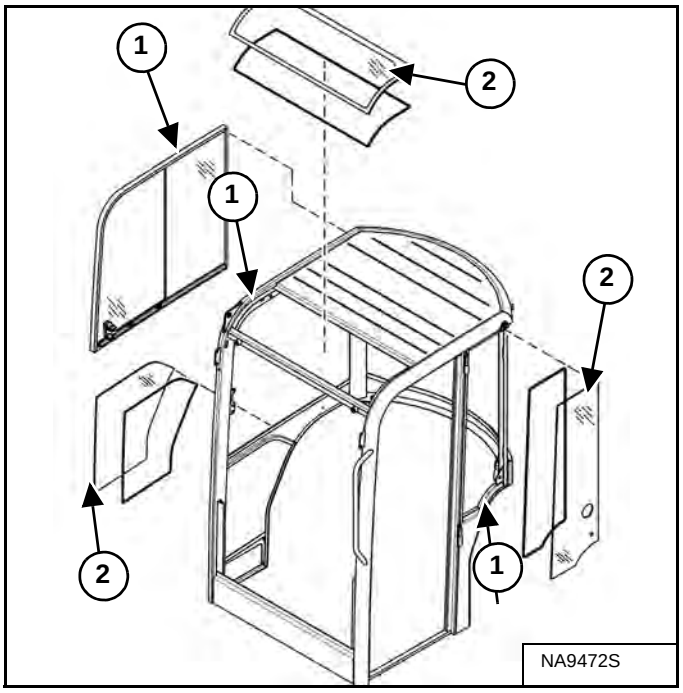
Shake the combo primer for 1 minute.

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Glass Installation (Cont'd)

Figure 40-30-25

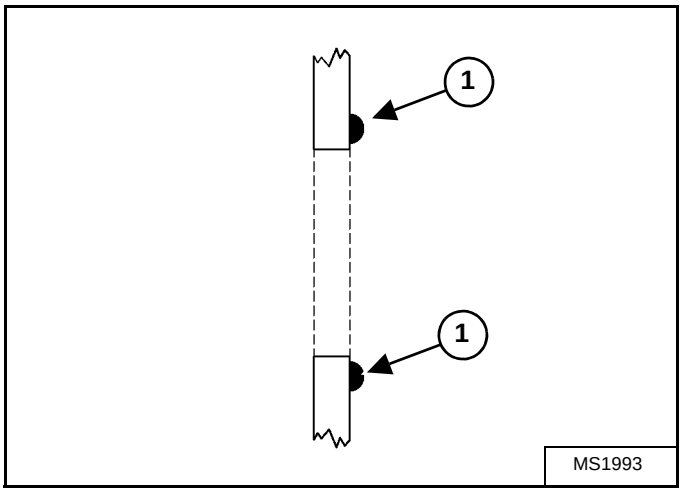


Apply combo primer to the perimeter of the cab (Item 1) and glass (Item 2) **[Figure 40-30-25]**. Apply the primer in one direction only, using a dauber. Do not dip the dauber in the primer more than once. Use multiple daubers if needed.

Allow the combo primer to dry for 5 minutes. Dry time doubles if the primer is applied in two coats.

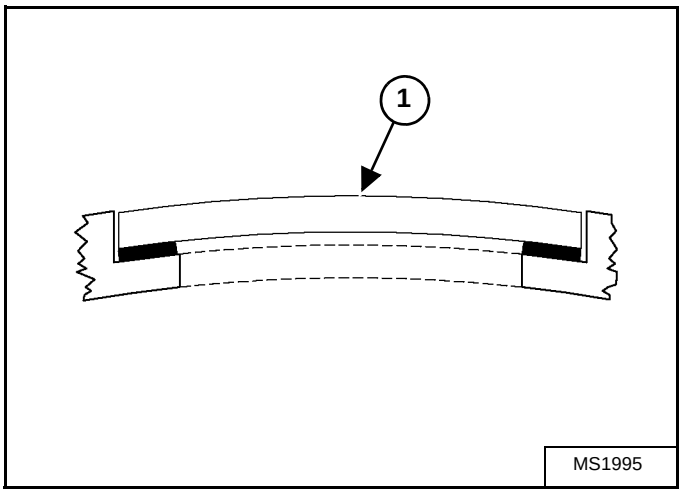
Cut the tip of the adhesive tube to the desired shape and size to provide a bead height sufficient to give good contact with the glass around the entire perimeter.

Figure 40-30-26



Apply a 7,6 x 6,4 mm (0.3 x 0.25 in) bead of urethane adhesive (Item 1) **[Figure 40-30-26]** to the perimeter of the cab.

Figure 40-30-27



Install the glass (Item 1) **[Figure 40-30-27]**. Press the glass into the cab to make complete contact with the adhesive. Tape the glass in place.

Allow 2 hours for curing at normal conditions (65°F, 75% relative humidity).

Remove the tape after the adhesive is cured.

Right Side Sliding Window, Door And Front Window Glass

The right side sliding window, door and front window glass are not available separately.

Order and install the right side sliding window, door or front window frame and glass assembly.

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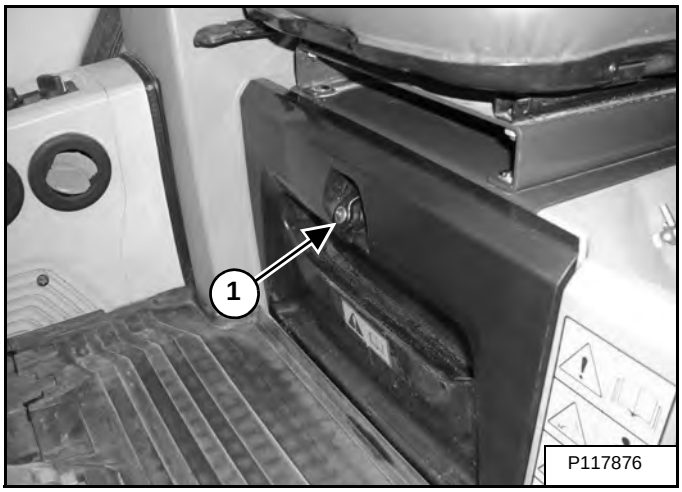
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SEAT AND SEAT MOUNT

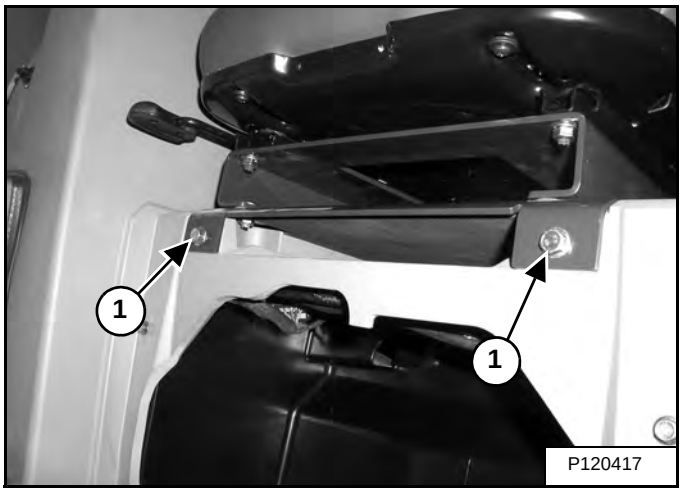
Removal And Installation

Figure 40-40-1



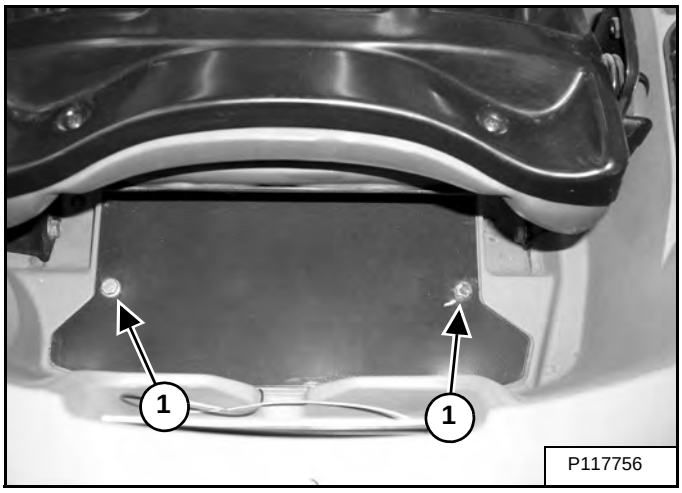
Open the access cover (Item 1) **[Figure 40-40-1]**.

Figure 40-40-2



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

Figure 40-40-3



Slide the seat forward and remove the two bolts (Item 1) **[Figure 40-40-3]**.

Remove the seat and seat mount.

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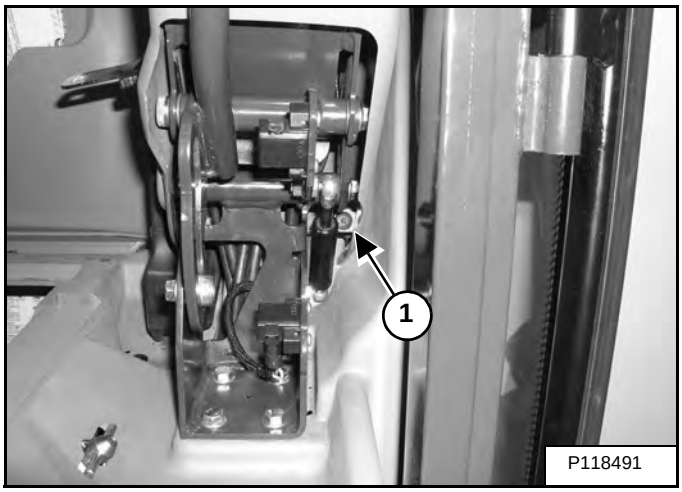
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LEFT CONSOLE

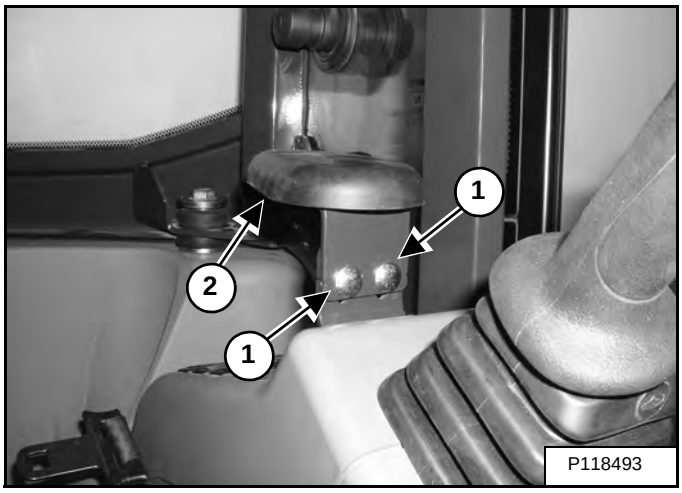
Console Cover Removal And Installation

Figure 40-50-1



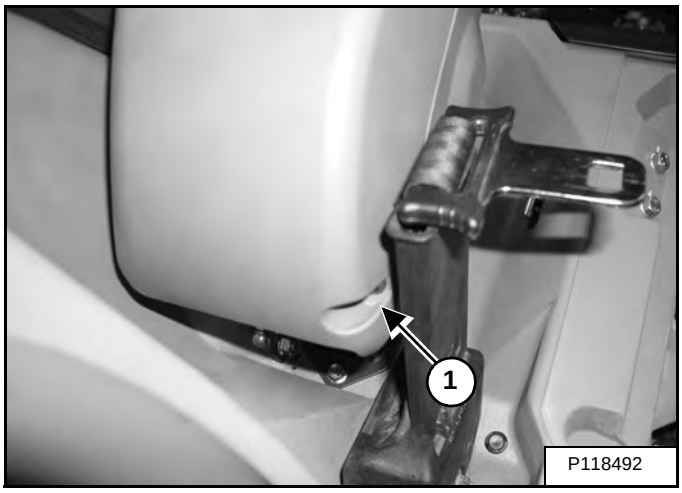
Remove the screw (Item 1) **[Figure 40-50-1]**.

Figure 40-50-2



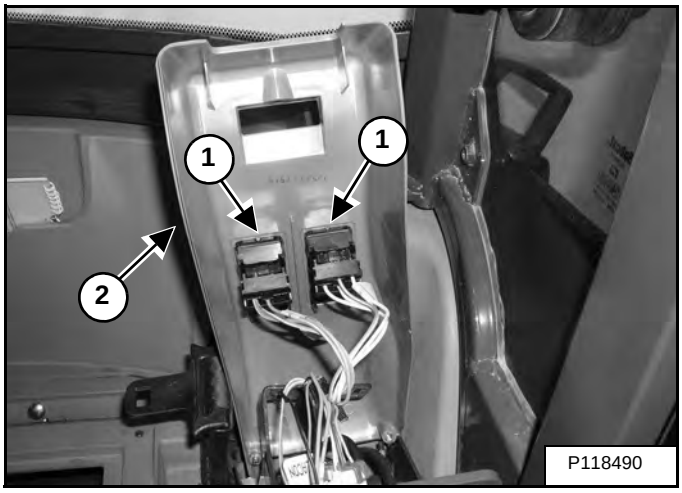
Lower the console. Remove the nuts and bolts (Item 1). Remove the armrest (Item 2) **[Figure 40-50-2]**.

Figure 40-50-3



Remove the screw (Item 1) **[Figure 40-50-3]**.

Figure 40-50-4



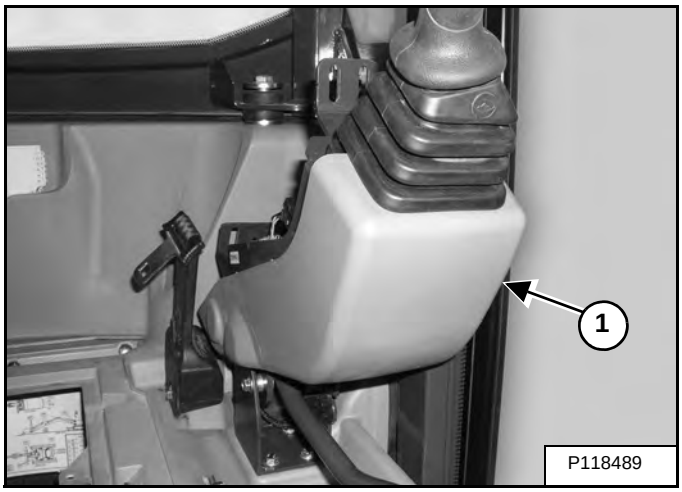
Raise the top cover, mark and disconnect the wire harness (Item 1). Remove the cover (Item 2) **[Figure 40-50-4]**.

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Console Cover Removal And Installation (Cont'd)

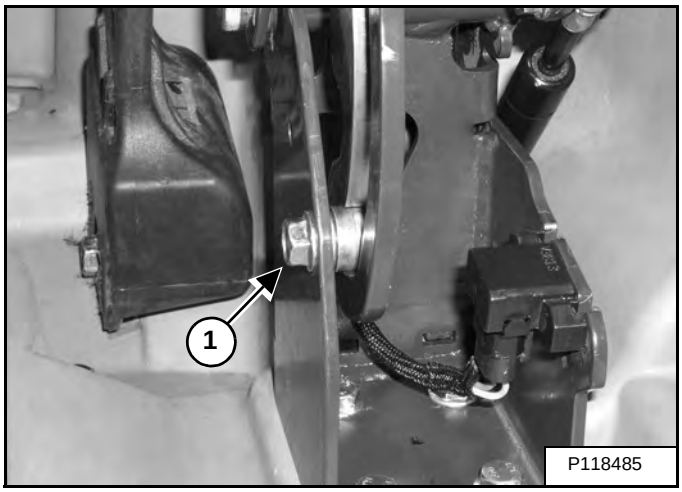
Figure 40-50-5



Pull down on the bottom cover (Item 1) **[Figure 40-50-5]** and remove the cover from the console.

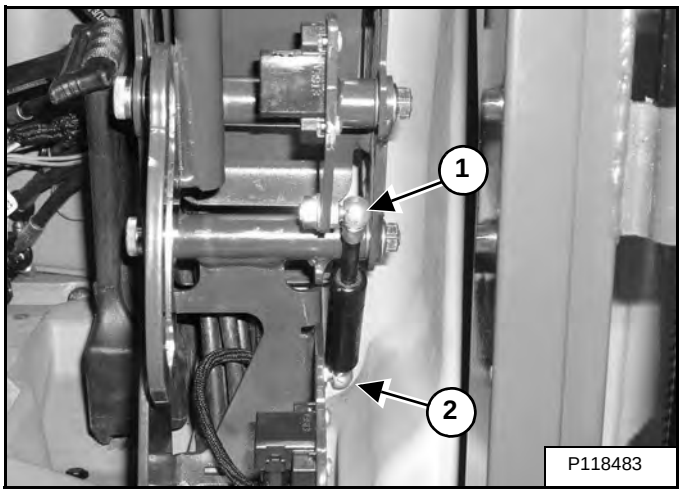
Gas Spring Removal And Installation

Figure 40-50-6



Remove the bolt (Item 1) **[Figure 40-50-6]** and roller.

Figure 40-50-7



Support the console and remove the clip and gas spring (Item 1) **[Figure 40-50-7]** from the stud.

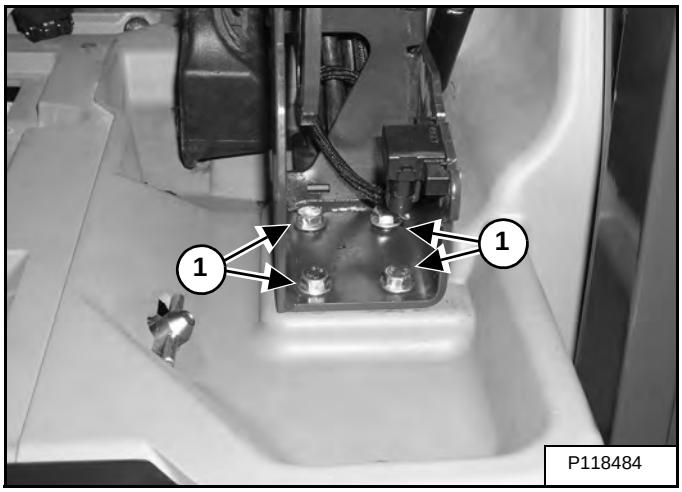
Remove the nut and gas spring / stud assembly (Item 2) **[Figure 40-50-7]**.

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Gas Spring Removal And Installation (Cont'd)

Figure 40-50-8



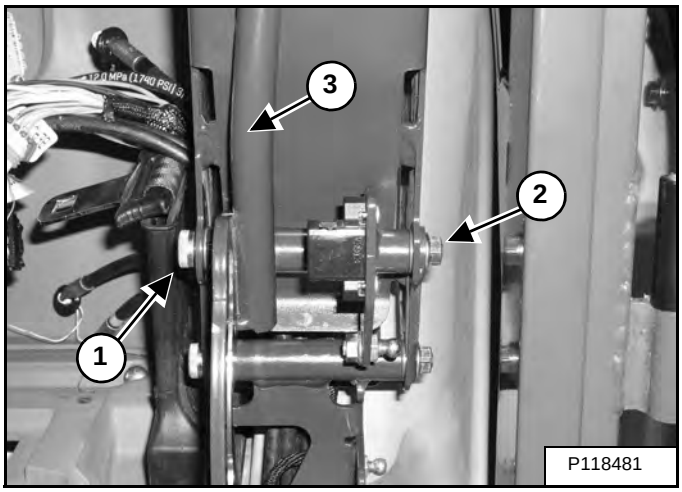
NOTE: Loosen the bolts (Item 1) [Figure 40-50-8] and shift the console base to provide clearance to install the gas spring / stud assembly.

Lock Lever Removal And Installation

Remove the gas spring. (See Gas Spring Removal And Installation on Page 40-50-2.)

Remove the console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

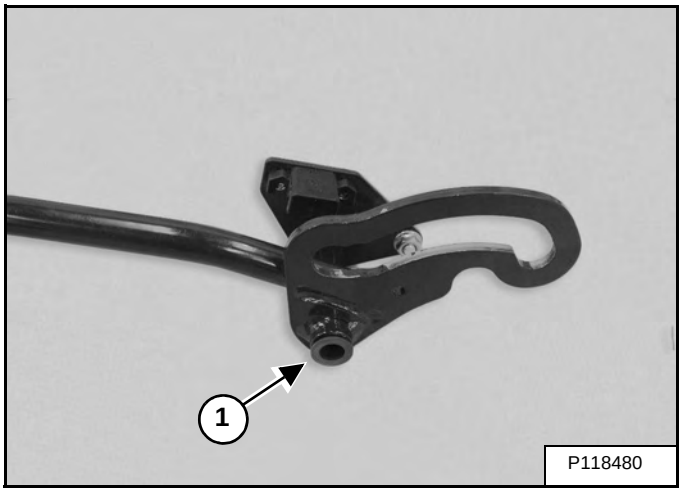
Figure 40-50-9



Remove the bolt (Item 1), nut (Item 2) and lever (Item 3) **[Figure 40-50-9]**.

Installation: Apply thread adhesive (Loctite® 242) to the bolt threads.

Figure 40-50-10



Remove the bushings (Item 1) **[Figure 40-50-10]** from both sides of the lever.

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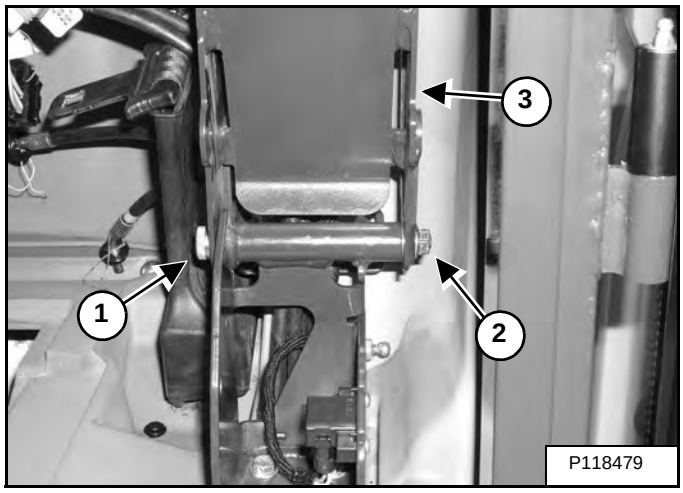
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Console Removal And Installation

Remove the joystick. (See Joystick Assembly Removal and Installation on Page 20-111-5.)

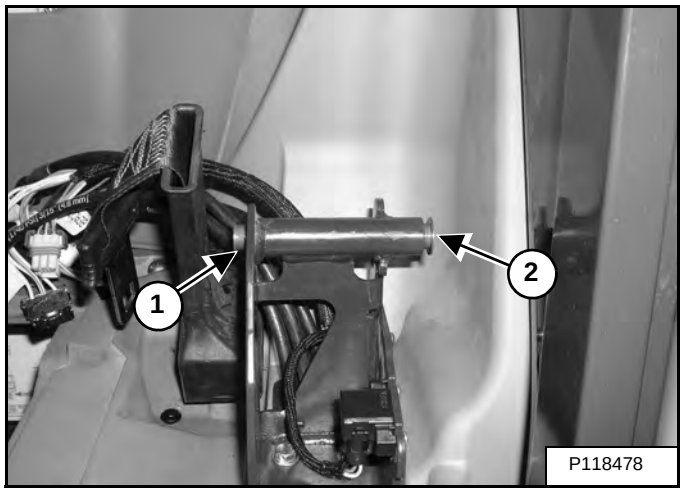
Remove the lock lever. (See Lock Lever Removal And Installation on Page 40-50-3.)

Figure 40-50-11



Remove the bolt (Item 1) and nut (Item 2). Remove the console (Item 3) **[Figure 40-50-11]** from the console base.

Figure 40-50-12



Remove the bushings (Item 1) **[Figure 40-50-12]** from the console base.

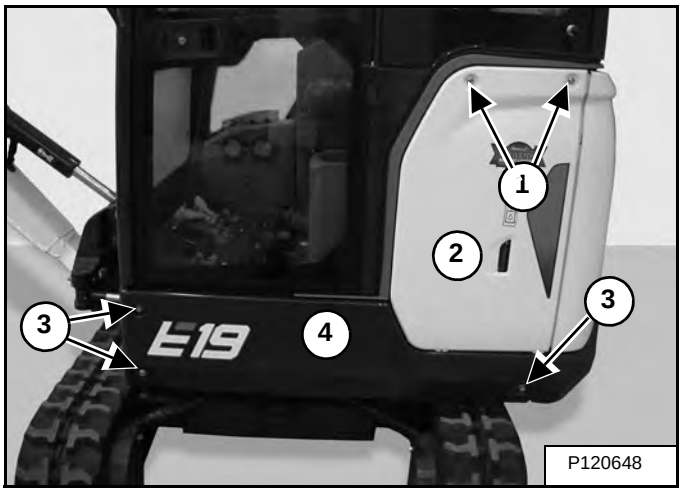
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LEFT UPPERSTRUCTURE COVER

Removal And Installation

Figure 40-60-1



Remove the bolts (Item 1) and cover (Item 2) **[Figure 40-60-1]**.

Remove the three bolts (Item 3) and remove the cover (Item 4) **[Figure 40-60-1]**.

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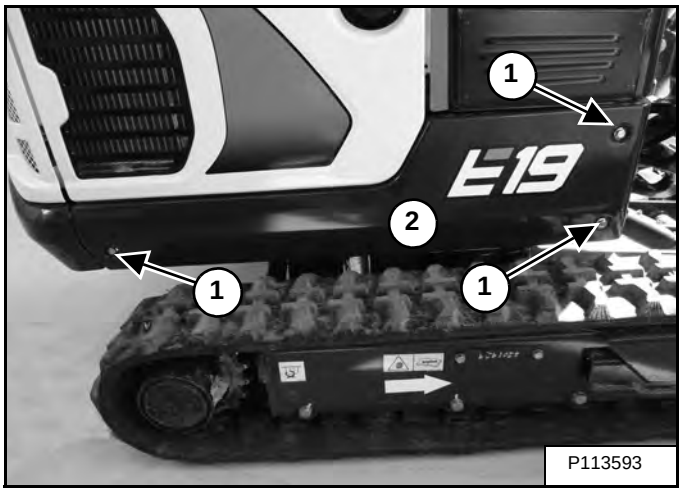
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RIGHT UPPERSTRUCTURE COVER

Removal And Installation

Figure 40-70-1



Remove the three bolts (Item 1) and remove the right upperstructure cover (Item 2) **[Figure 40-70-1]**.

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ENGINE SPEED CONTROL

Removal And Installation

WARNING

AVOID INJURY OR DEATH

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

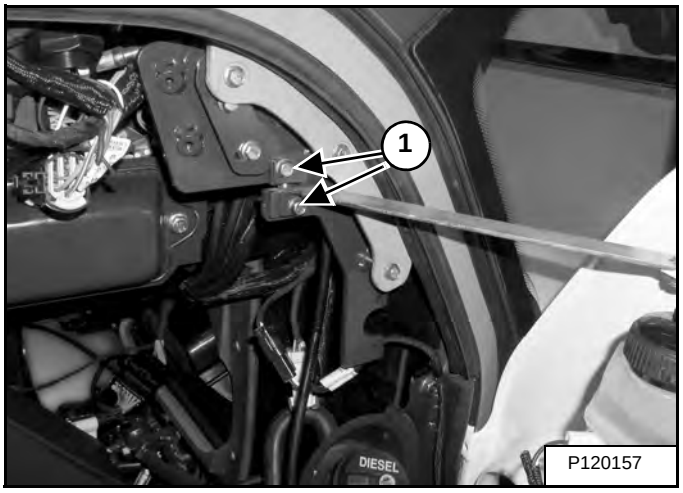
- **When fluids are under pressure.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

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

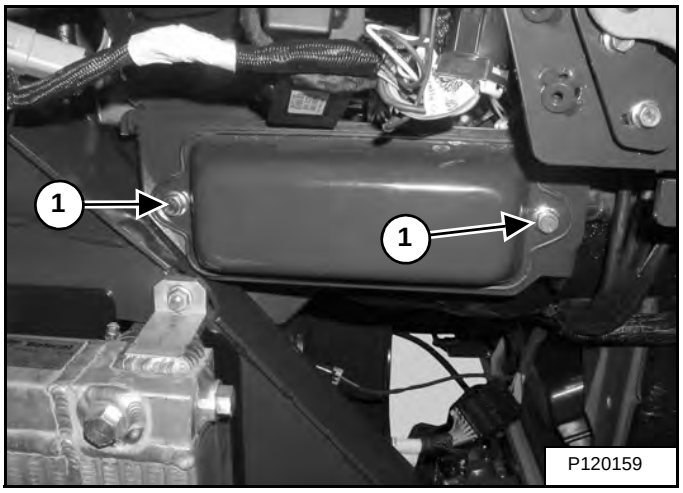
Open the right side cover.

Figure 40-80-1



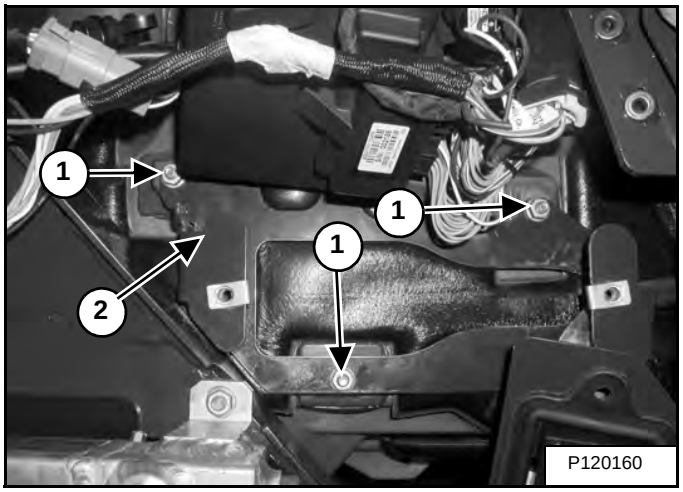
Remove the two bolts (Item 1) **[Figure 40-80-1]**.

Figure 40-80-2



Remove the two mounting bolts (Item 1) **[Figure 40-80-2]** and set the fuse panel to the side.

Figure 40-80-3



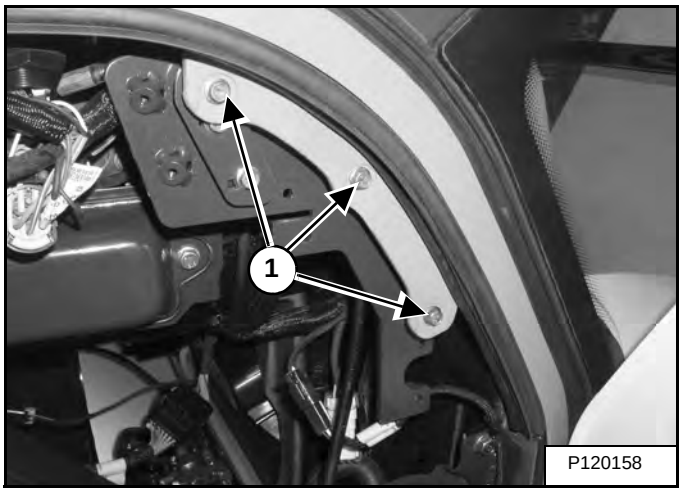
Remove the three nuts (Item 1) **[Figure 40-80-3]** and set the ECU / fuse panel mounting bracket (Item 2) to the side.

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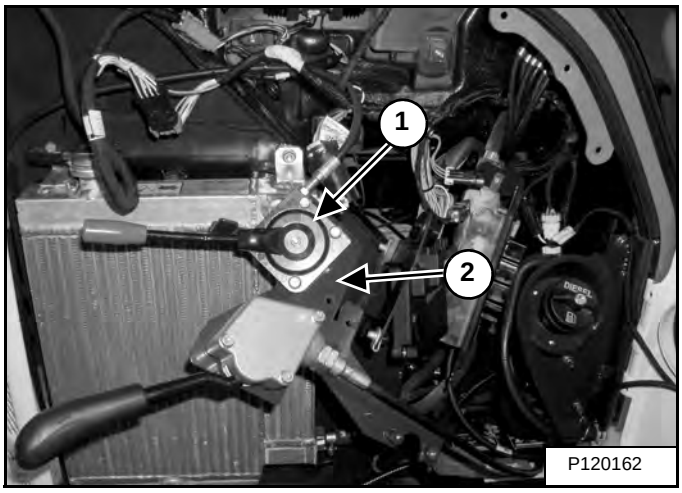
Removal And Installation (Cont'd)

Figure 40-80-4



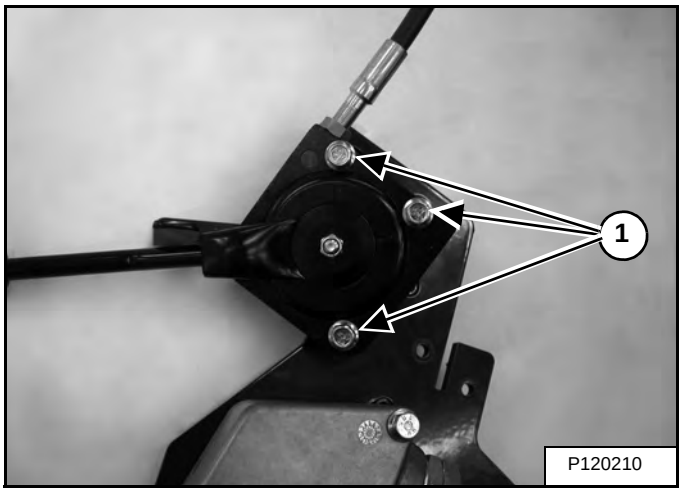
Remove the three bolts (Item 1) **[Figure 40-80-4]**

Figure 40-80-5



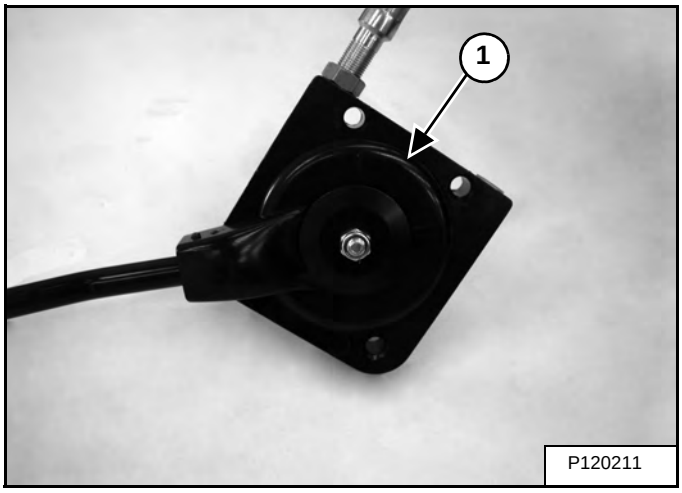
Remove the engine speed control assembly (Item 1) and the blade control mounting bracket (Item 2) **[Figure 40-80-5]**.

Figure 40-80-6



Remove the three bolts (Item 1) **[Figure 40-80-6]**.

Figure 40-80-7



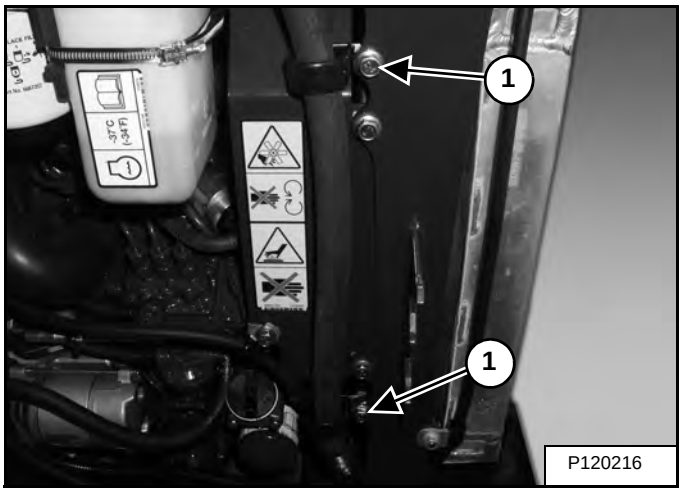
Remove the engine speed control assembly (Item 1) **[Figure 40-80-7]** from the mounting bracket.

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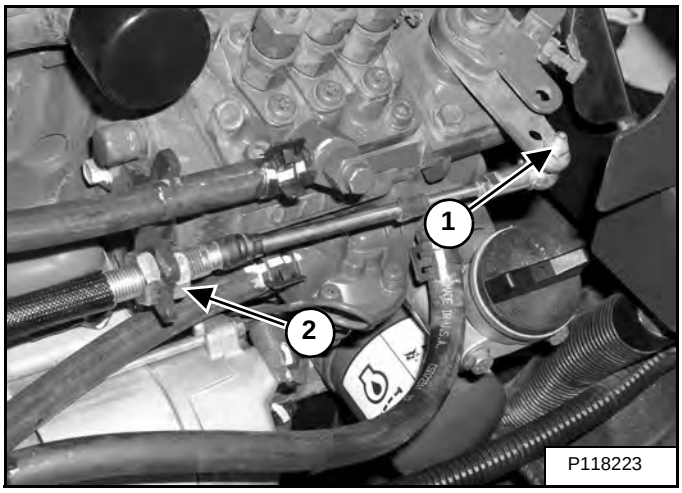
Removal And Installation (Cont'd)

Figure 40-80-8



Remove the bolts / clamps (Item 1) **[Figure 40-80-8]**.

Figure 40-80-9



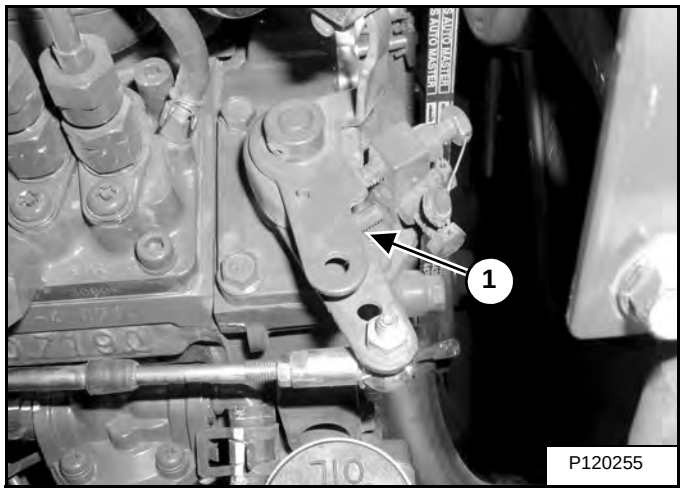
Remove the nut (Item 1), loosen the locknuts (Item 2) **[Figure 40-80-9]** and remove the engine speed control assembly from the machine.

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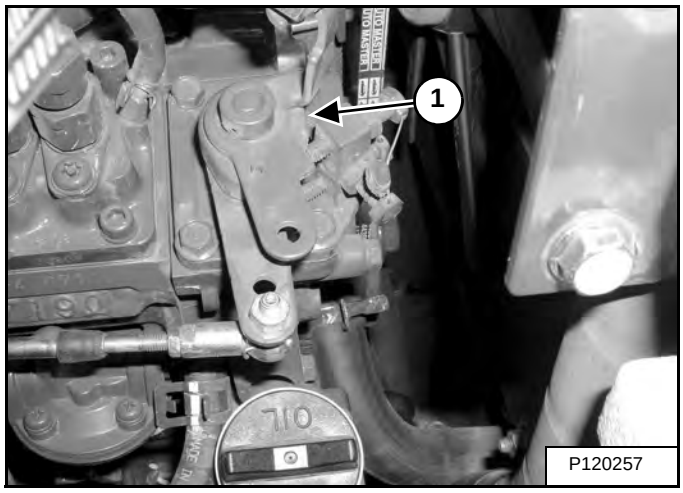
Cable Adjustment

Figure 40-80-10



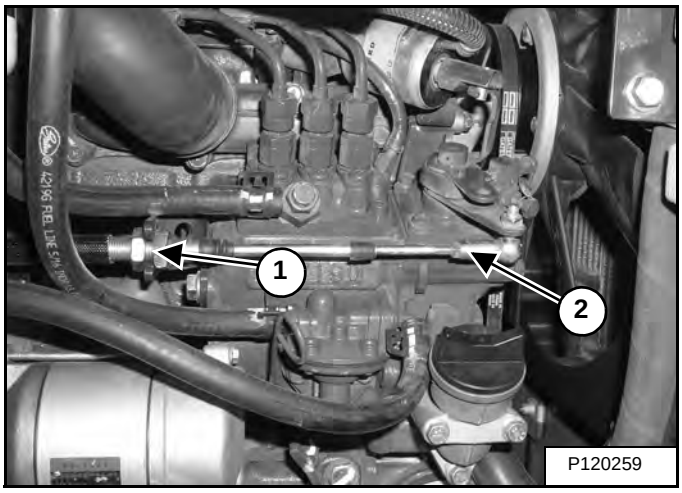
Move control lever to the idle position, the lever must contact the stop (Item 1) **[Figure 40-80-10]**.

Figure 40-80-11



Move control lever to the high idle position, the lever must contact the stop (Item 1) **[Figure 40-80-11]**.

Figure 40-80-12



[Figure 40-80-12]If adjustment is required, move the locknuts (Item 1) at the mounting bracket or the cable end (Item 2) to adjust.

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BLADE CONTROL

Removal And Installation

WARNING

AVOID INJURY OR DEATH

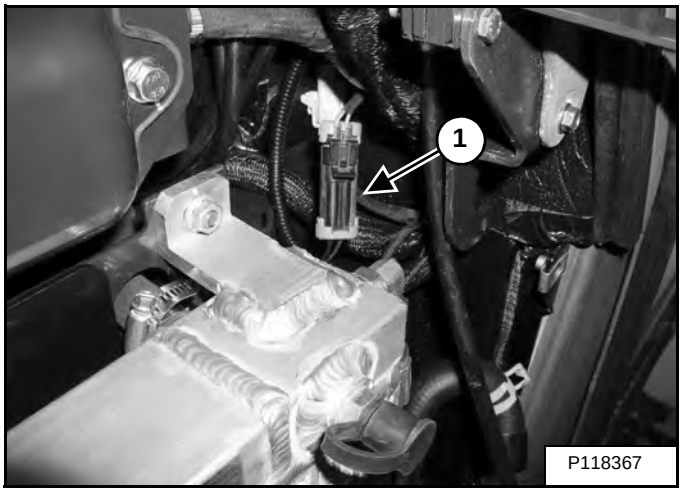
Wear safety glasses to prevent eye injury when any of the following conditions exist:

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

W-2019-0907

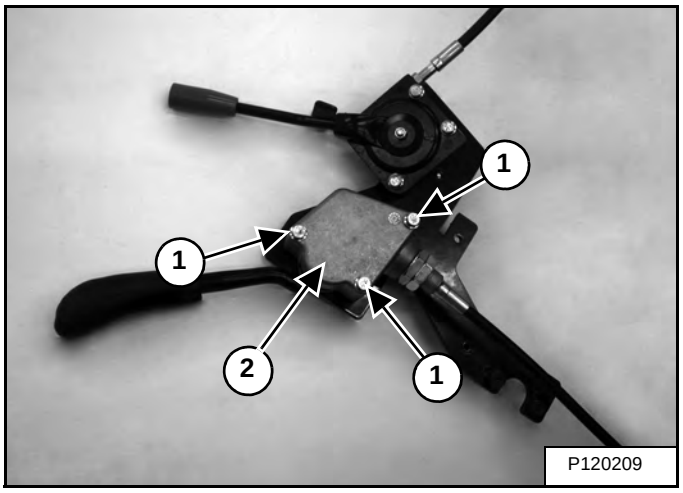
Remove engine speed control. (See Removal And Installation on Page 40-80-1.)

Figure 40-90-1



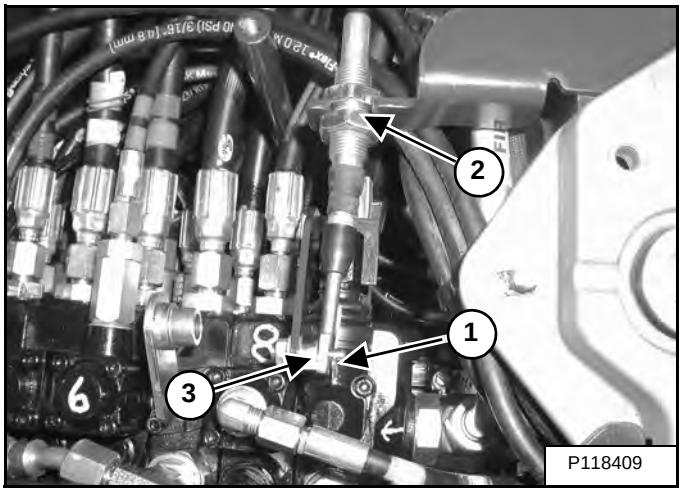
Disconnect the blade control wires (Item 1) **[Figure 40-90-1]** (If equipped).

Figure 40-90-2



Remove the three bolts (Item 1) from the blade control housing (Item 2) **[Figure 40-90-2]**.

Figure 40-90-3



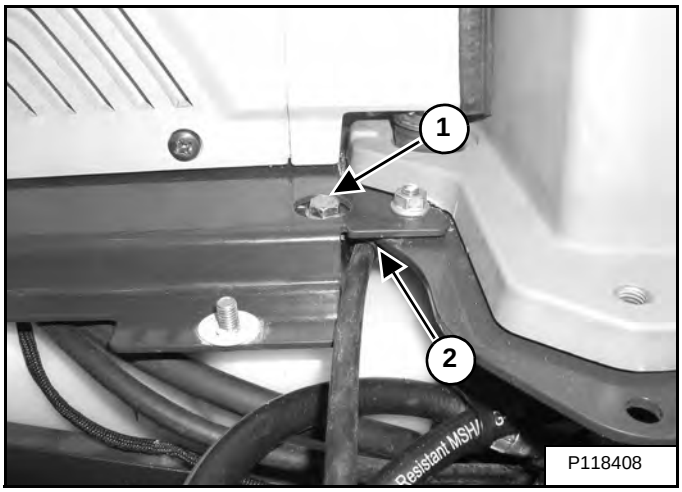
Remove the cotter pin (Item 1), loosen the locknuts (Item 2) and remove the cable end (Item 3) **[Figure 40-90-3]** from the control valve linkage.

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Removal And Installation (Cont'd)

Figure 40-90-4



Remove the nut / bolt (Item 1) that is securing the cable clamp (Item 2) **[Figure 40-90-4]**.

Remove the blade control assembly from the machine.

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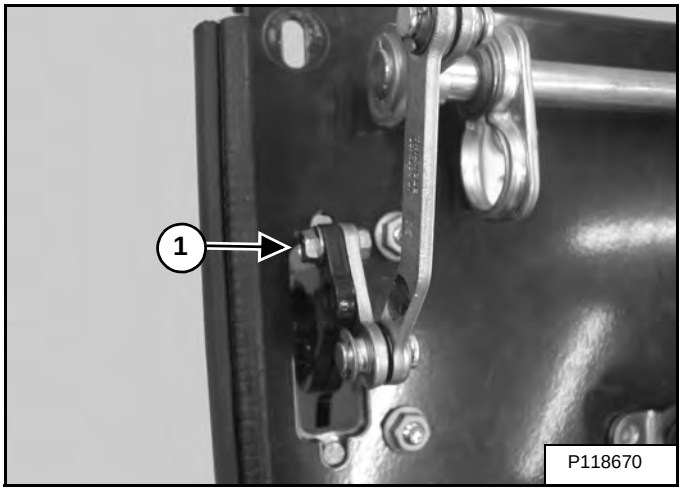
https://www.pdfmanual4trucks.com/

RIGHT PEDAL (BOOM SWING)

Removal And Installation

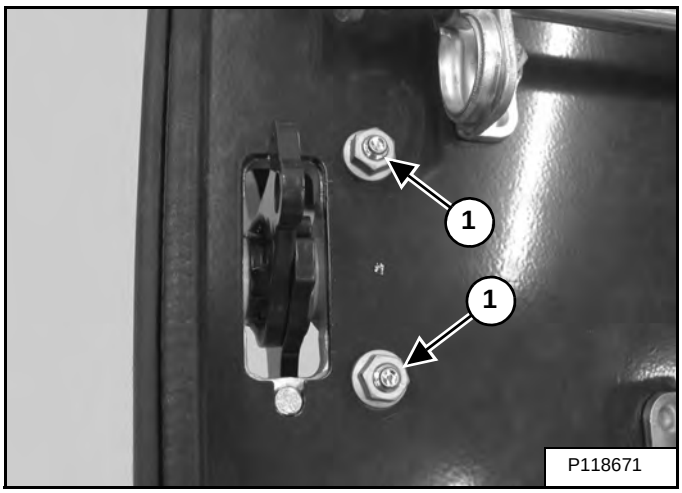
Remove the control linkage assembly. (See Removal And Installation on Page 40-130-1.)

Figure 40-100-1



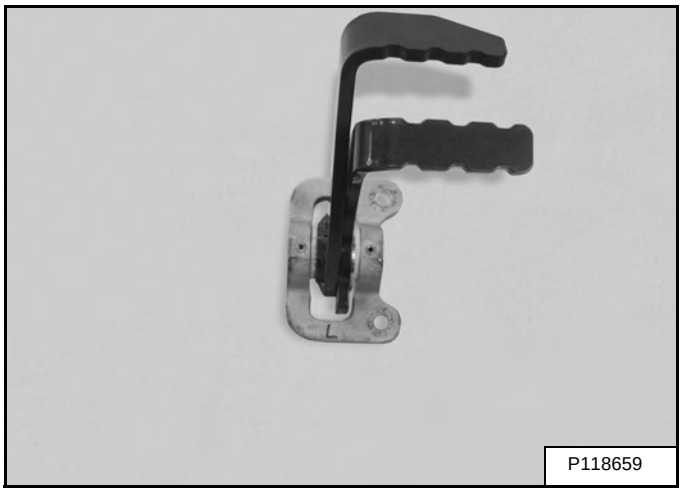
Remove the nut / bolt (Item 1) **[Figure 40-100-1]**.

Figure 40-100-2



Remove the nuts / bolts (Item 1) **[Figure 40-100-2]**.

Figure 40-100-3



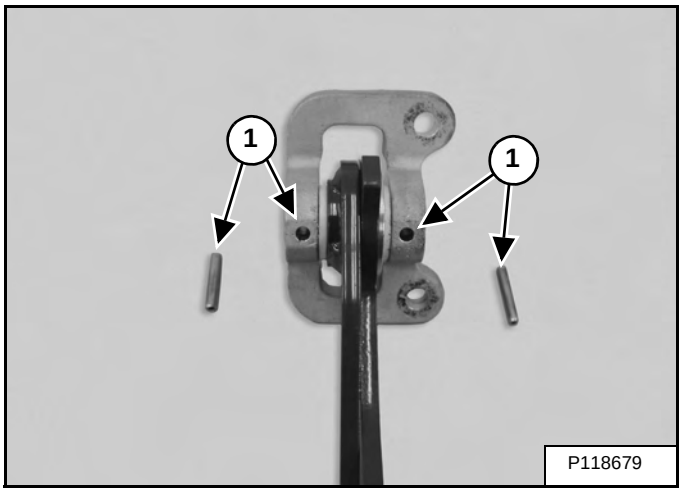
Remove the pedal assembly **[Figure 40-100-3]**.

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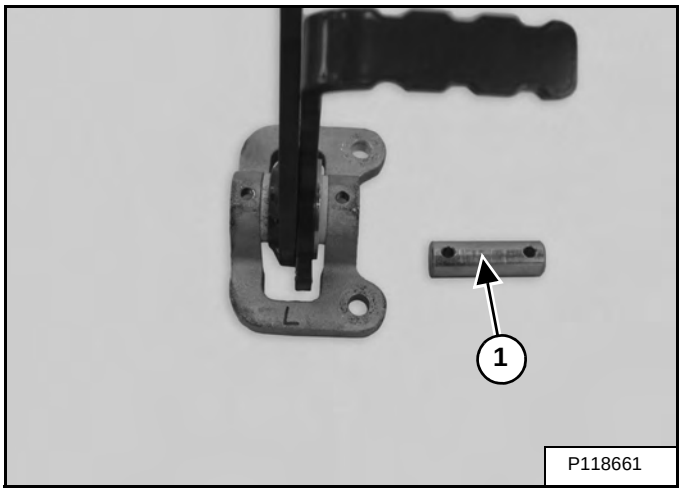
Disassembly And Assembly

Figure 40-100-4



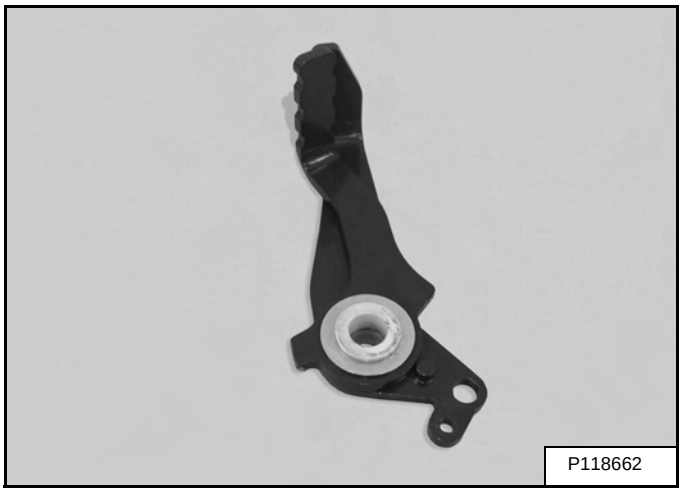
Remove the roll pins (Item 1) **[Figure 40-100-4]**.

Figure 40-100-5



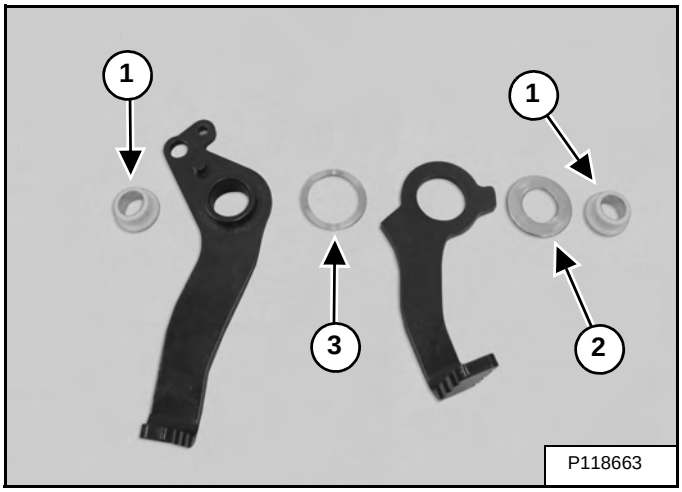
Remove the shaft (Item 1) **[Figure 40-100-5]**.

Figure 40-100-6



Remove the pedal from the mount bracket **[Figure 40-100-6]**.

Figure 40-100-7



Remove the bushings (Item 1), washer (Item 2) and spring washer (Item 3) **[Figure 40-100-7]**.

Inspect all parts and replace as needed.

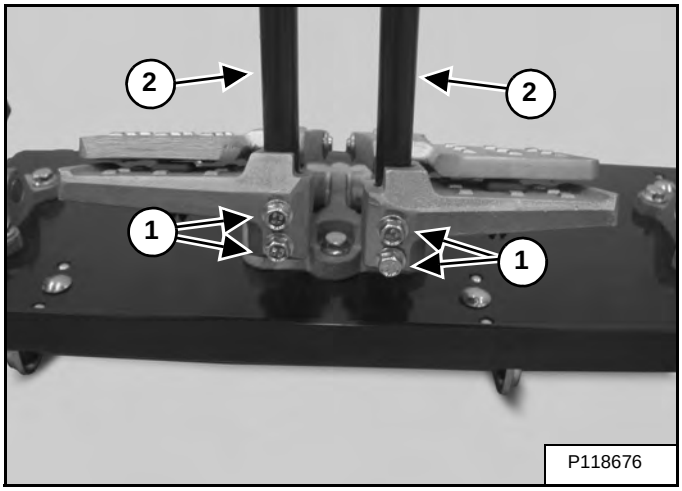
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Removal And Installation

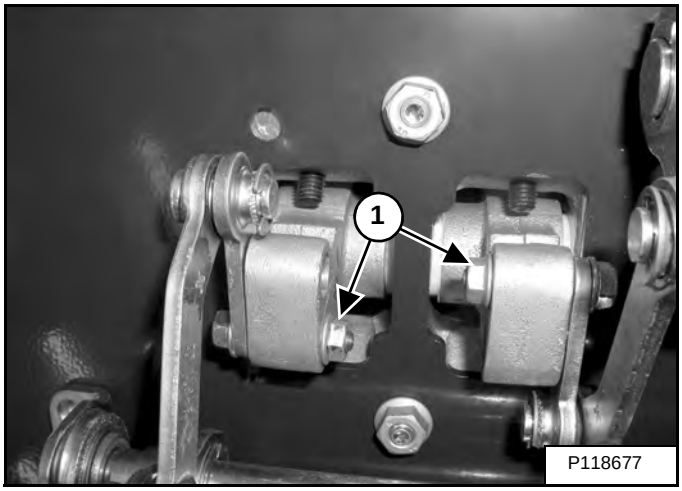
Remove the control linkage assembly. (See Removal And Installation on Page 40-130-1.)

Figure 40-110-1



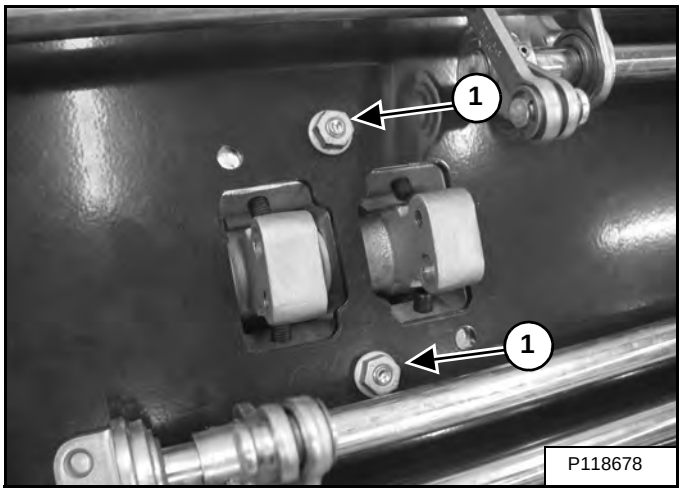
Remove the bolts (Item 1) and remove the control levers (Item 2) **[Figure 40-110-1]**.

Figure 40-110-2



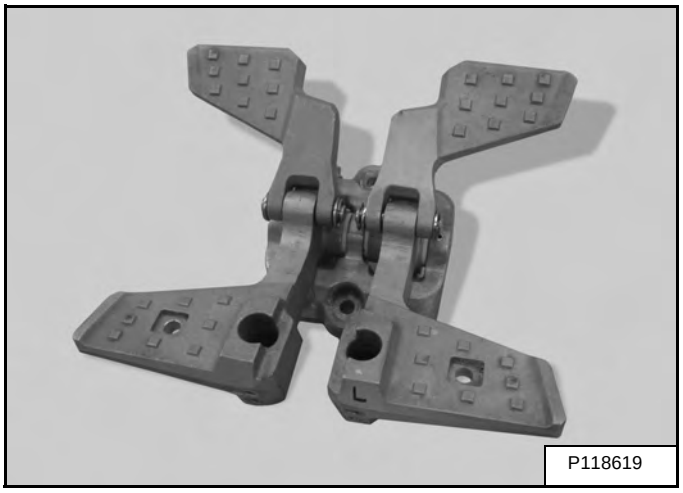
Remove the bolts (Item 1) **[Figure 40-110-2]**.

Figure 40-110-3



Remove the bolts (Item 1) **[Figure 40-110-3]**.

Figure 40-110-4



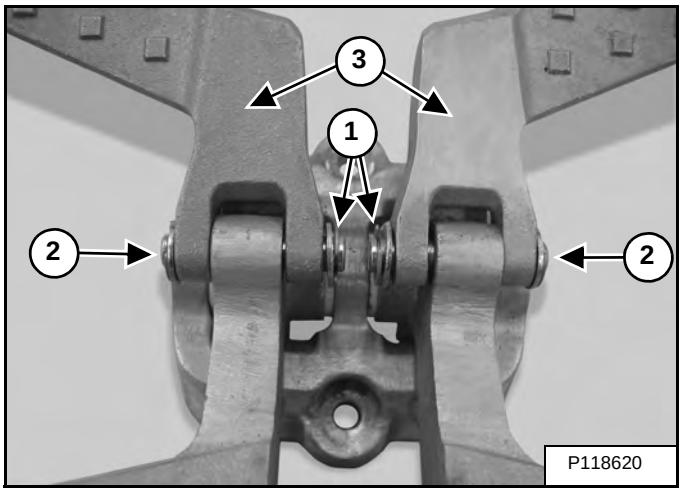
Remove the pedal assembly **[Figure 40-110-4]**.

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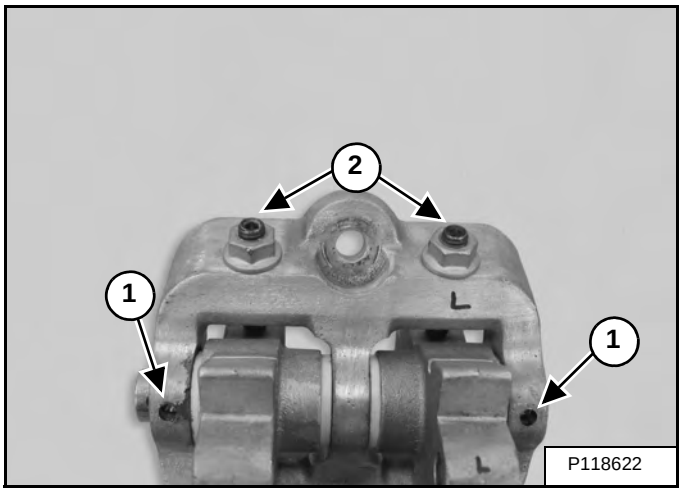
Disassembly And Assembly

Figure 40-110-5



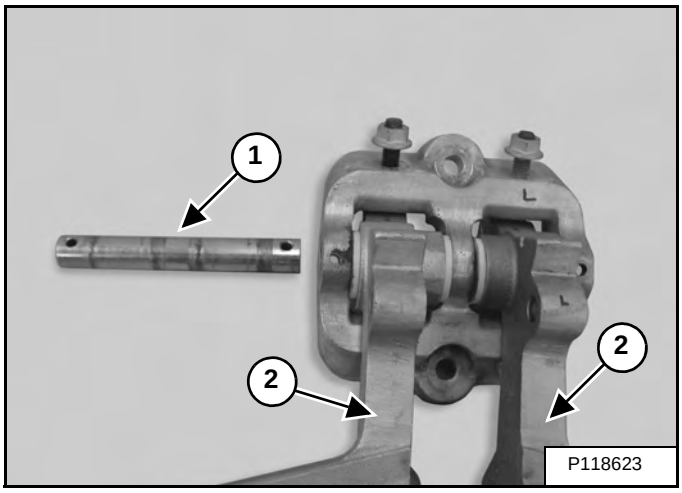
Remove the retaining clips / washers (Item 1), the pins (Item 2) and the upper pedals (Item 3) **[Figure 40-110-5]**.

Figure 40-110-6



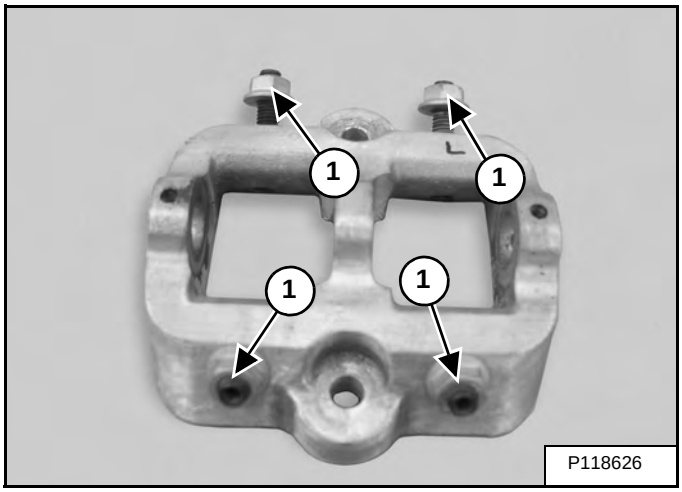
Remove the roll pins (Item 1) and loosen the pedal stops (Item 2) **[Figure 40-110-6]**.

Figure 40-110-7



Remove the pivot shaft (Item 1) and remove the pedals (Item 2) **[Figure 40-110-7]**.

Figure 40-110-8



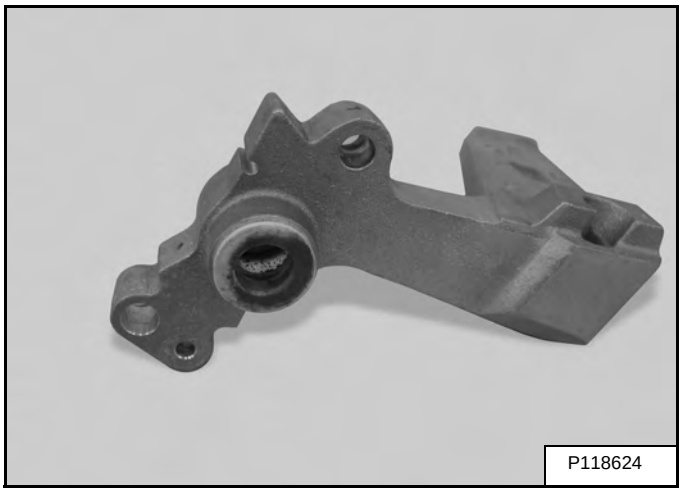
Remove the pedal stops (Item 1) **[Figure 40-110-8]**.

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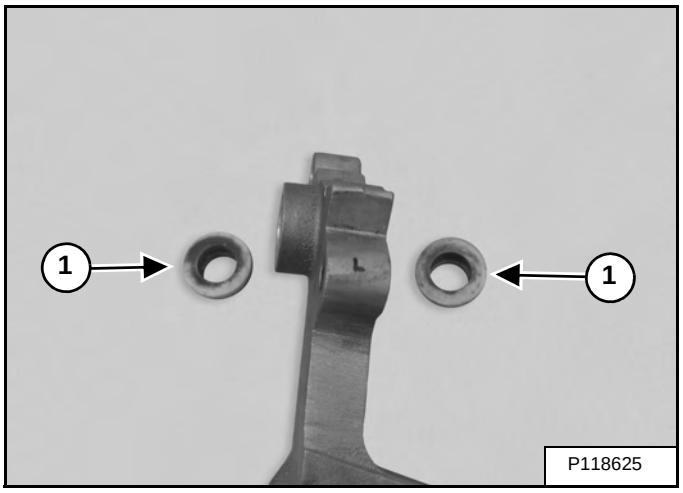
Disassembly And Assembly (Cont'd)

Figure 40-110-9



Remove the pedals **[Figure 40-110-9]**.

Figure 40-110-10



Remove the bushings (Item 1) **[Figure 40-110-10]** from the pedal.

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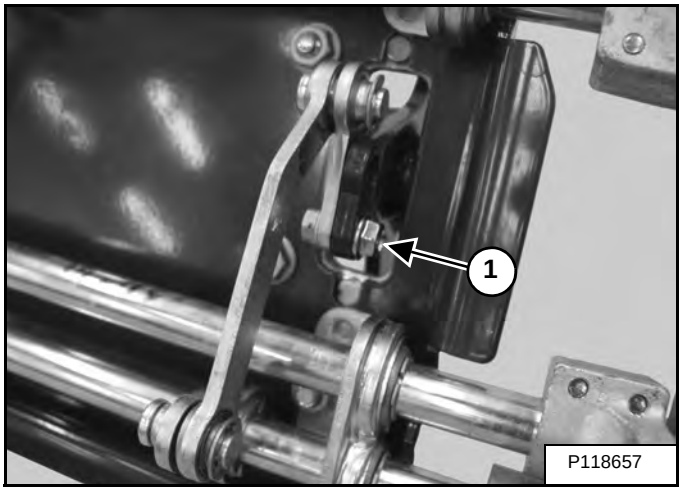
https://www.pdfmanual4trucks.com/

LEFT PEDAL (AUXILIARY)

Disassembly And Assembly

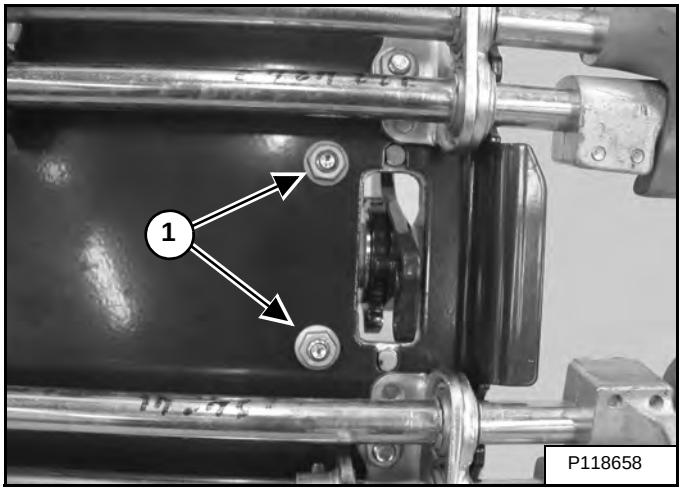
Remove the control linkage assembly. (See Removal And Installation on Page 40-130-1.)

Figure 40-120-1



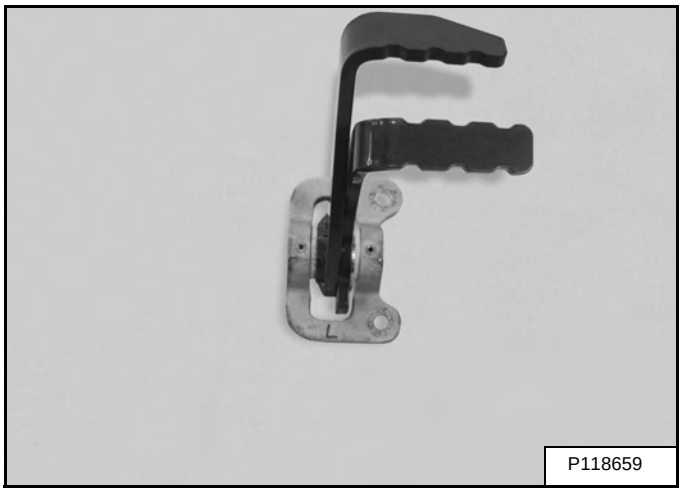
Remove the nut / bolt (Item 1) **[Figure 40-120-1]** connecting the linkage to the left pedal.

Figure 40-120-2



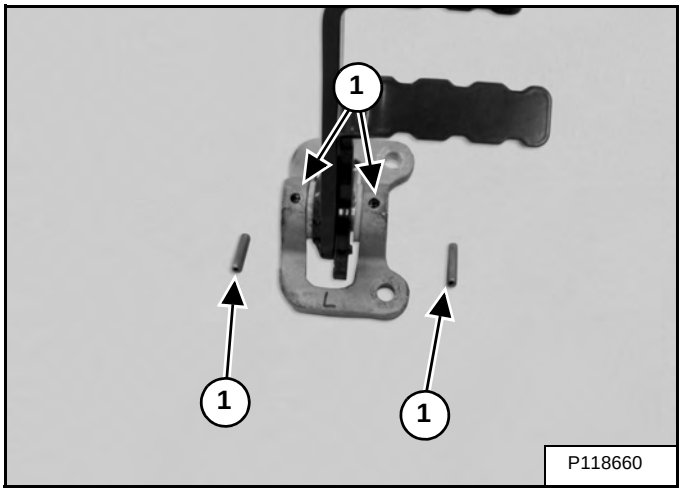
Remove the nuts / bolts (Item 1) **[Figure 40-120-2]** for the left pedal mounting bracket.

Figure 40-120-3



Remove the left pedal assembly **[Figure 40-120-3]**.

Figure 40-120-4



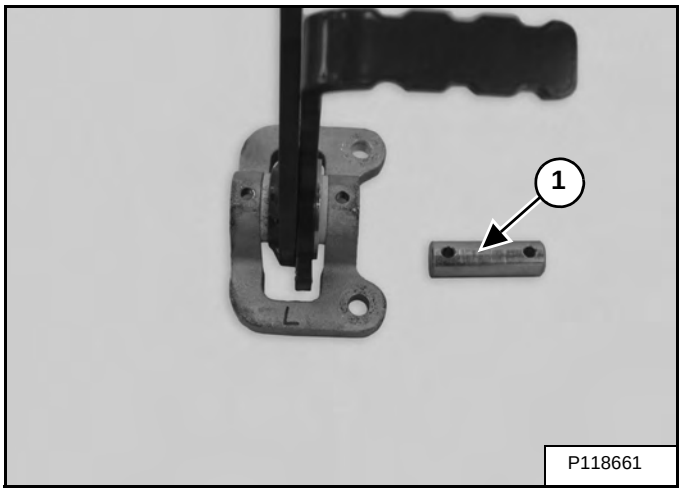
Remove the two roll pins (Item 1) **[Figure 40-120-4]**.

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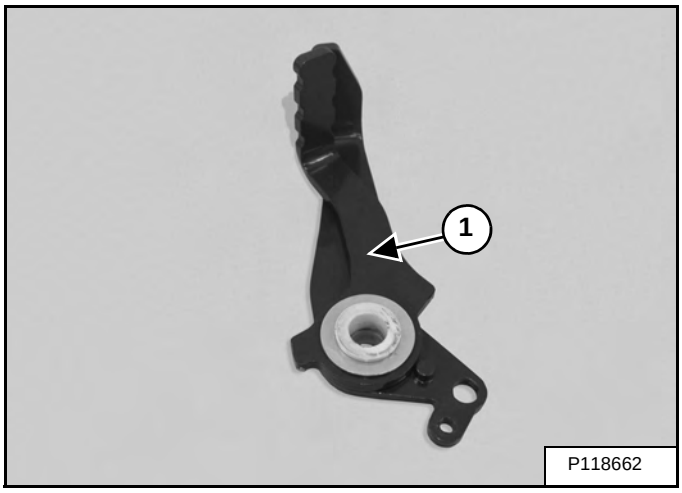
Disassembly And Assembly (Cont'd)

Figure 40-120-5



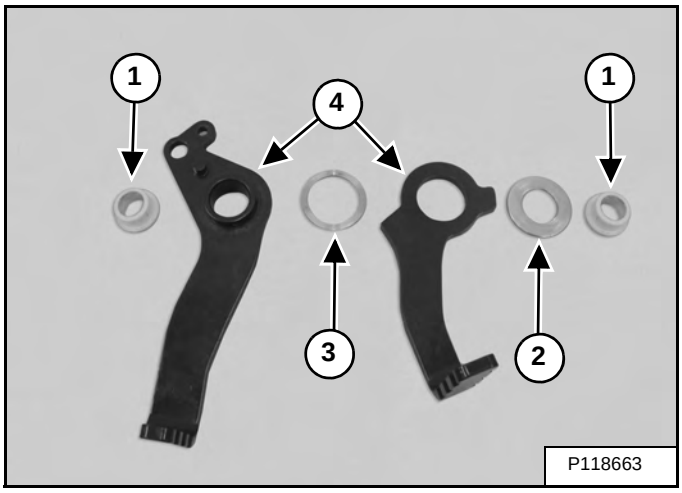
Remove the pedal pivot shaft (Item 1) **[Figure 40-120-5]**.

Figure 40-120-6



Remove the pedal (Item 1) **[Figure 40-120-6]** from the mounting bracket.

Figure 40-120-7



Remove the two bushings (Item 1), washer (Item 2), spring washer (Item 3) from the pedals (Item 4) **[Figure 40-120-7]**.

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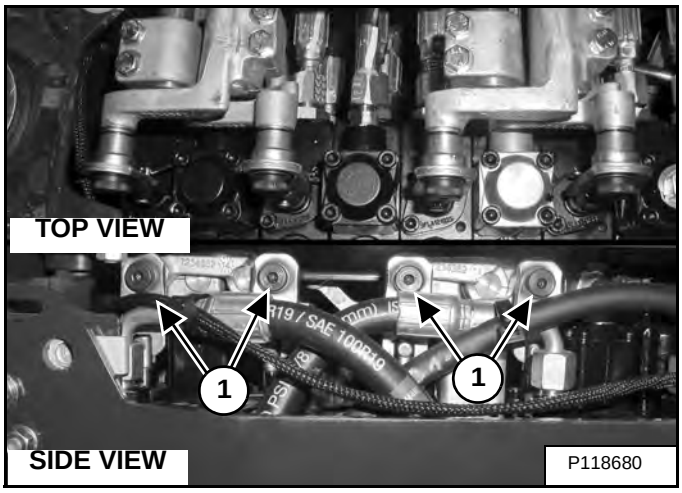
CONTROL LINKAGE ASSEMBLY

Removal And Installation

Remove the left upperstructure cover. (See Removal And Installation on Page 40-60-1.)

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

Figure 40-130-1



Remove the four linkage to spool bolts (Item 1) **[Figure 40-130-1]**.

Figure 40-130-2

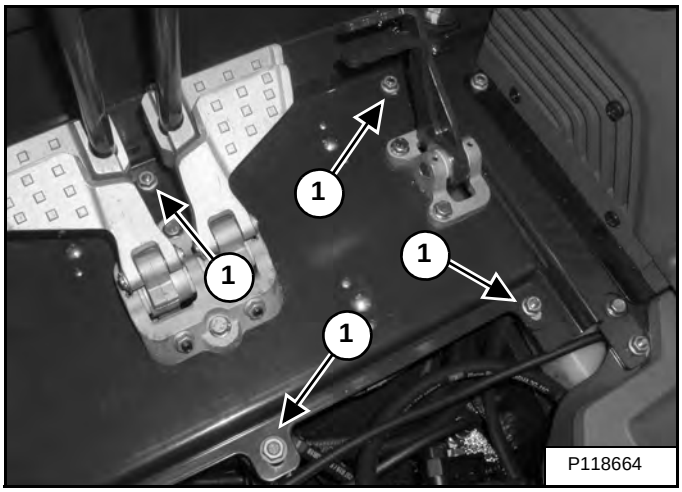
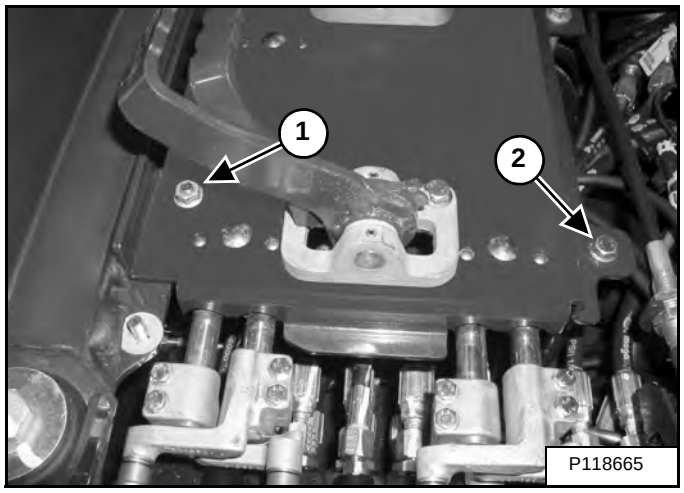
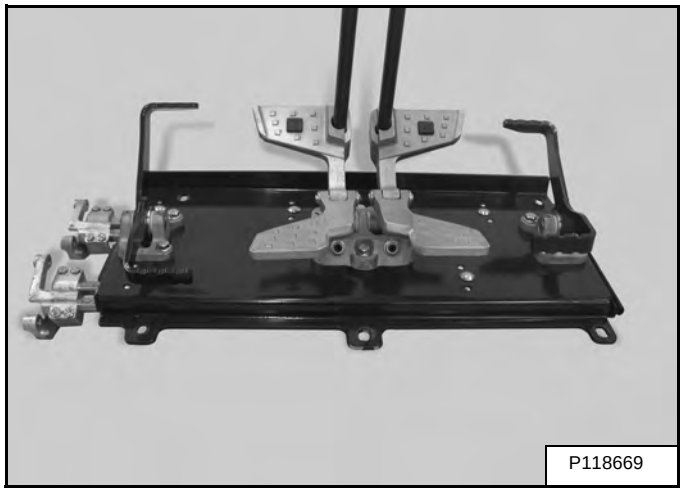


Figure 40-130-3



Remove the nuts (Item 1) and the bolt (Item 2) **[Figure 40-130-2]** and **[Figure 40-130-3]**.

Figure 40-130-4



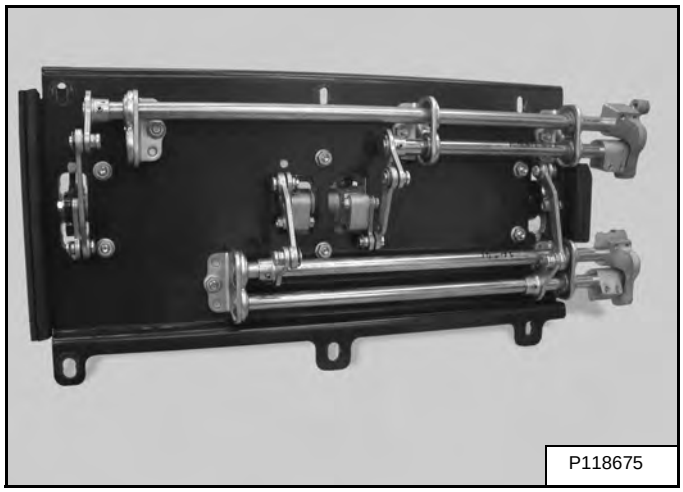
Remove the control linkage assembly **[Figure 40-130-4]**.

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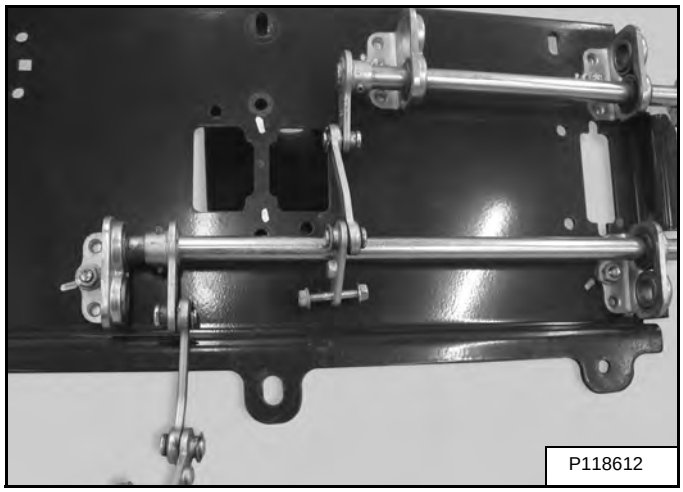
Disassembly And Assembly

Figure 40-130-5



The control linkage assembly will have four linkage shafts if equipped with the manual boom swing and auxiliary pedals **[Figure 40-130-5]**.

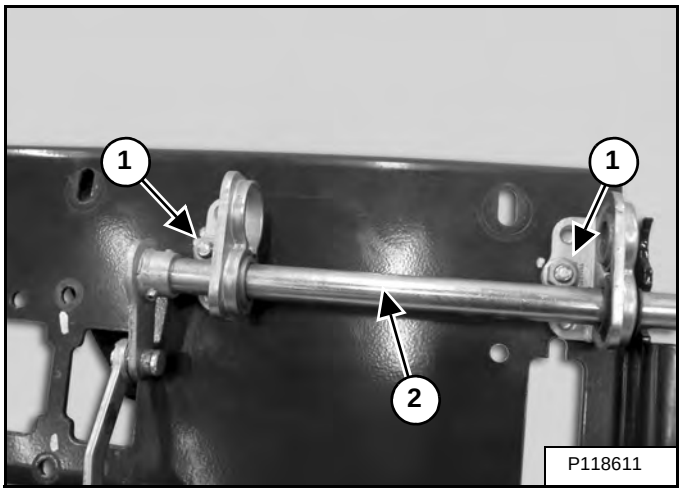
Figure 40-130-6



If equipped with the electric boom swing and auxiliary controls there are two linkage shafts **[Figure 40-130-6]**.

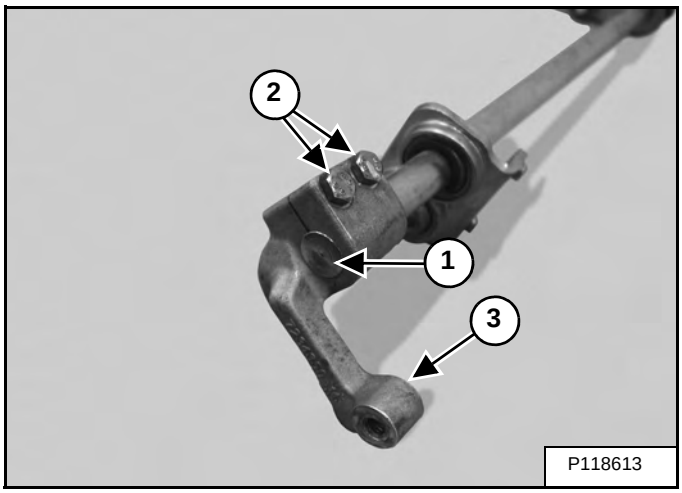
The following procedure will cover the disassembly and assembly of one shaft. All of the components are the same on all the shafts.

Figure 40-130-7



Remove the bolts (Item 1) from the mounting bracket to plate and remove the shaft assembly (Item 2) **[Figure 40-130-7]**.

Figure 40-130-8



Mark the shaft and arm (Item 1) **[Figure 40-130-8]** for reference in assembly.

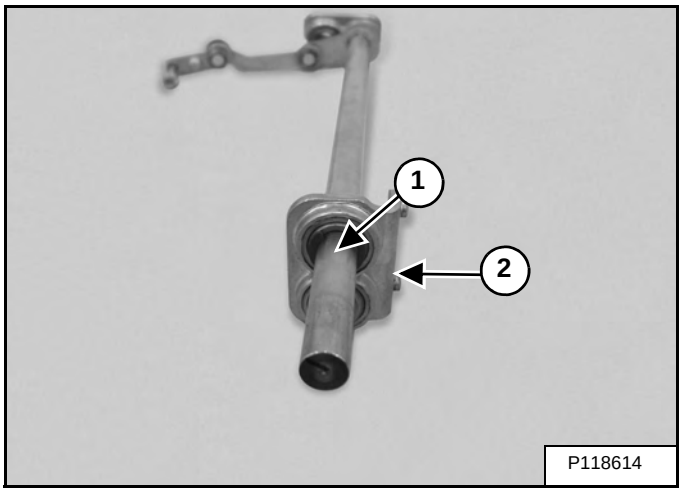
Loosen the bolts (Item 2) and remove the arm (Item 3) **[Figure 40-130-8]**.

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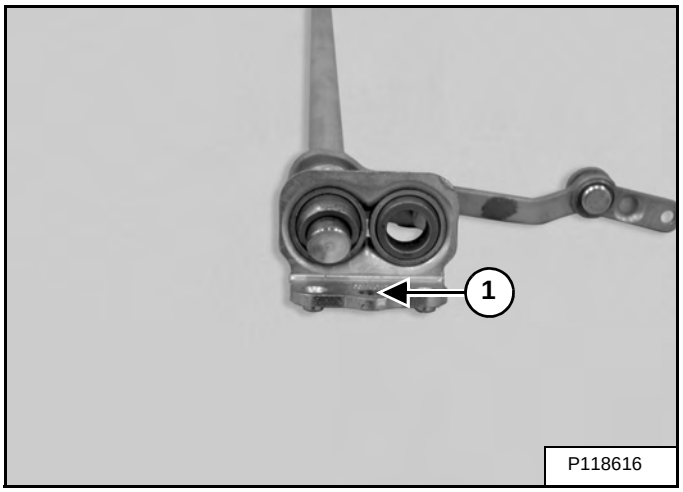
Disassembly And Assembly (Cont'd)

Figure 40-130-9



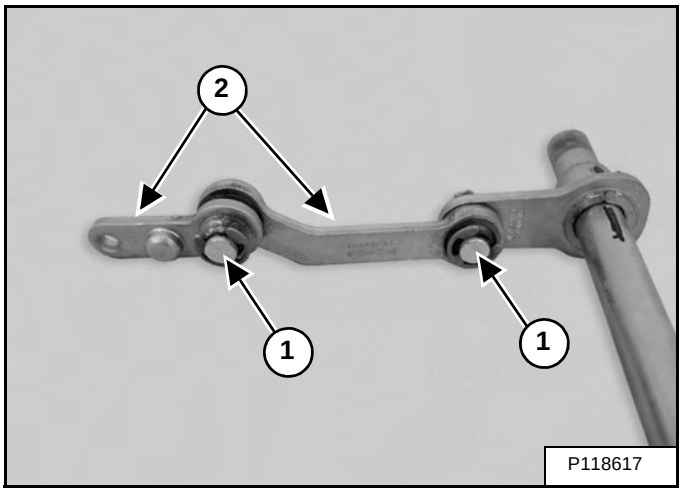
Remove the retaining clip (Item 1) on the shaft for the bearing mount bracket (Item 2) **[Figure 40-130-9]** and remove the bracket assembly.

Figure 40-130-10



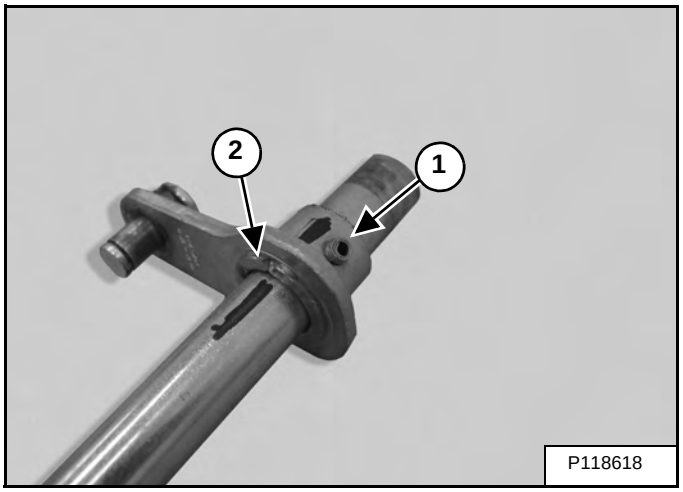
Remove the bracket assembly (Item 1) **[Figure 40-130-10]** from the other end of the shaft.

Figure 40-130-11



Remove the retaining clips (Item 1) from the pins and remove the linkage (Item 2) **[Figure 40-130-11]**.

Figure 40-130-12



Remove the roll pin (Item 1) and the arm (Item 2) **[Figure 40-130-12]**.

Inspect all parts and replace as needed.

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FLOOR MAT AND FLOOR PANELS

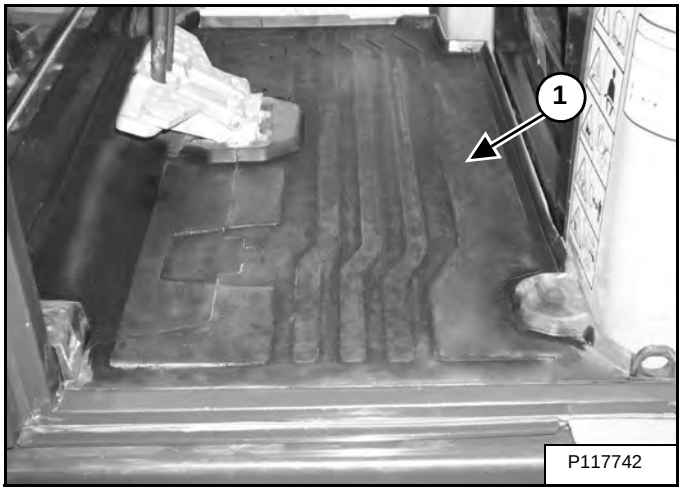
Description

The floor of the excavator (cab or canopy) is divided into three floor panels covered by a mat. The rear floor panel provides accessibility to the hydraulic components. The front panel consists of the travel levers and foot pedals and the side panel covers the control valve.

The rear and side floor panels are the only floor panels that needs to be removed when servicing the hydraulic components. The front floor panel only needs to be removed when the travel levers and pedals need servicing.

Removal And Installation

Figure 40-140-1



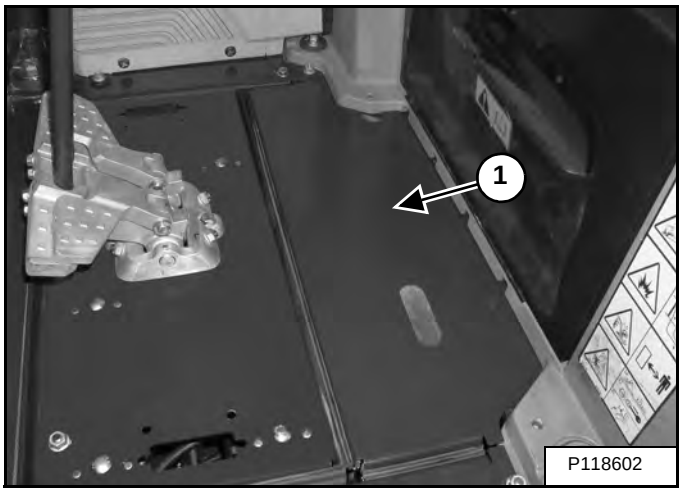
Remove the rear floor mat (Item 1) **[Figure 40-140-1]**.

Figure 40-140-2



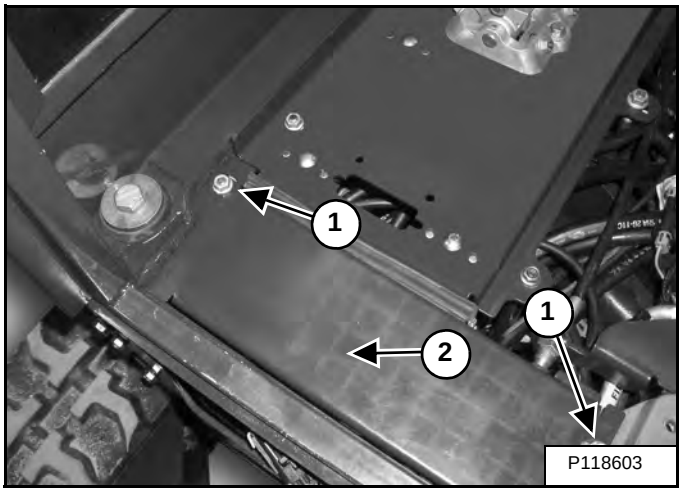
Remove the front floor mat (Item 1) **[Figure 40-140-2]**.

Figure 40-140-3



Remove the rear floor panel (Item 1) **[Figure 40-140-3]**.

Figure 40-140-4



Remove the two nuts (Item 1) and the side floor panel (Item 2) **[Figure 40-140-4]**.

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FUEL TANK

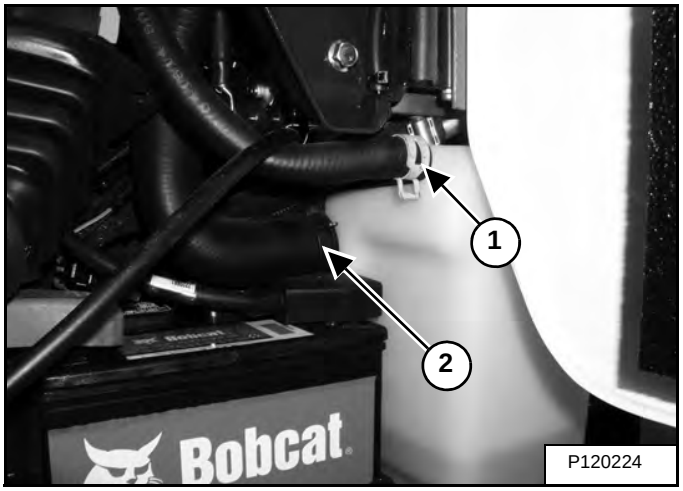
Removal And Installation

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

Open the right side cover.

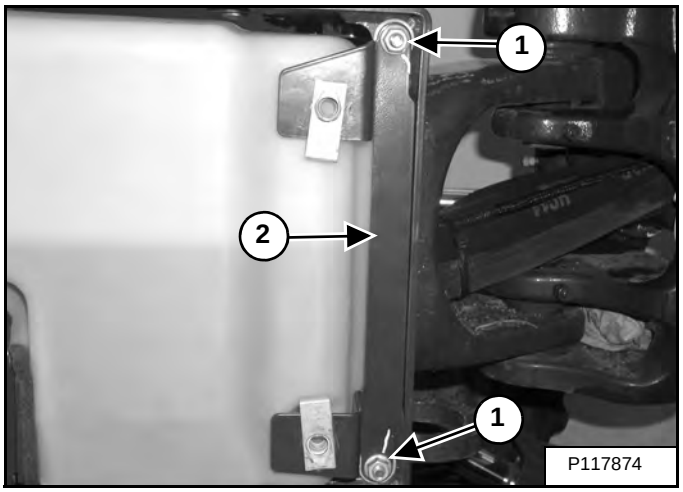
Drain the fuel tank. (See Draining The Fuel Tank on Page 10-110-4.)

Figure 40-150-1



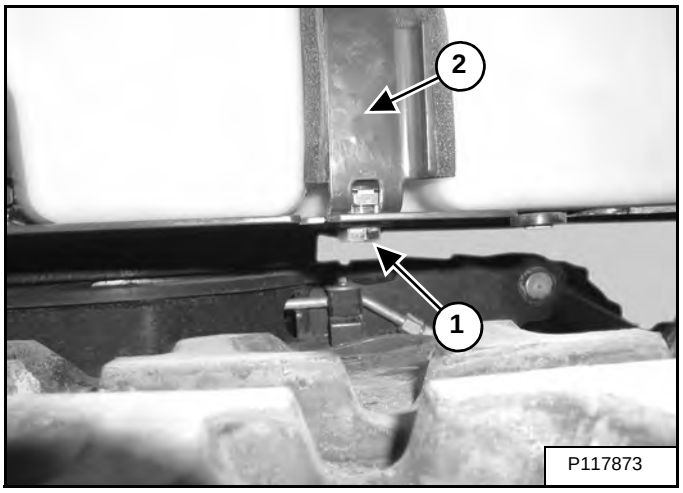
Remove the vent hose (Item 1) and the fill hose (Item 2) **[Figure 40-150-1]**.

Figure 40-150-2



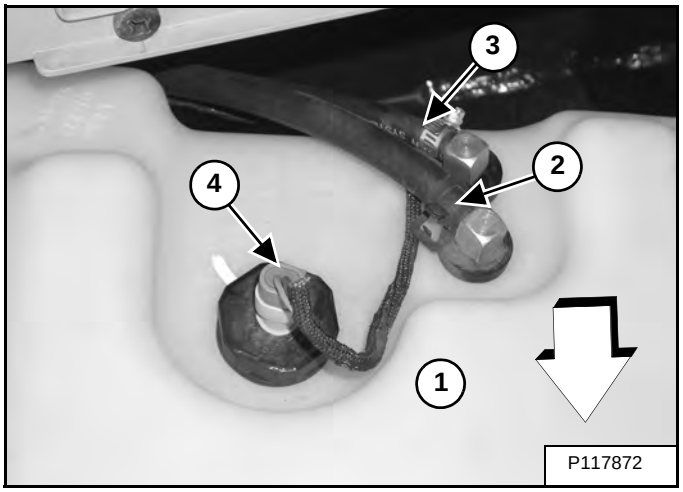
Remove the nuts (Item 1) and mounting bracket (Item 2) **[Figure 40-150-2]**.

Figure 40-150-3



Remove the bolt (Item 1) and bracket (Item 2) **[Figure 40-150-3]**.

Figure 40-150-4



Slide the fuel tank (Item 1) out the side opening enough to remove the fuel supply and return hoses (Item 2 and Item 3). Disconnect the fuel level sender harness (Item 4) **[Figure 40-150-4]**. Remove the fuel tank from the machine.

NOTE: Use caution to avoid damaging the sender when installing the tank.

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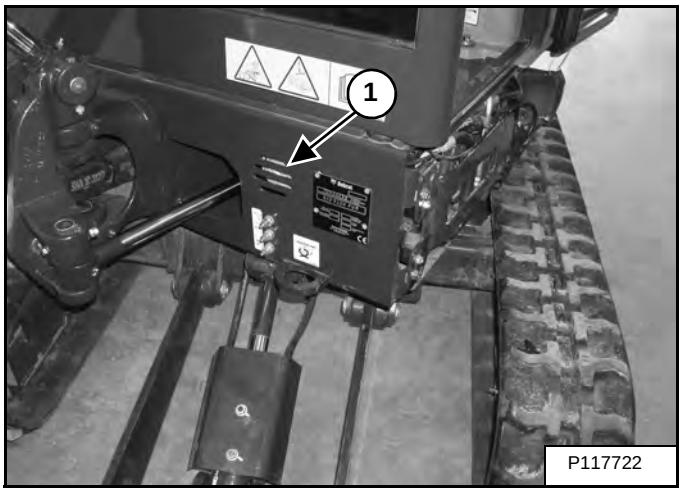
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HORN

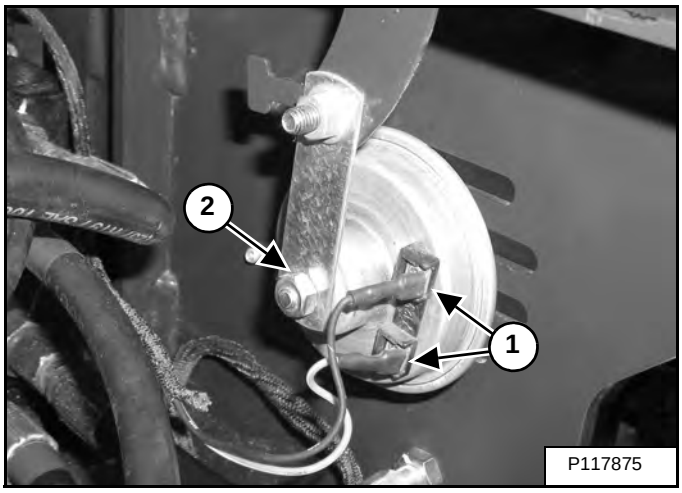
Removal And Installation

Figure 40-160-1



The horn is located behind the front panel (Item 1) **[Figure 40-160-1]**.

Figure 40-160-2



Remove the wires (Item 1) **[Figure 40-160-2]** from the horn.

Remove the nut (Item 2) **[Figure 40-160-2]**.

Remove the horn.

Travel control assembly removed for photo clarity.

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SWING FRAME

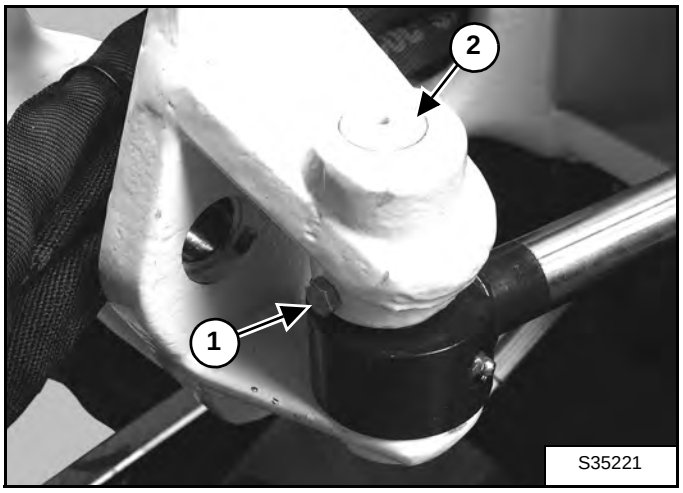
Description

The swing frame is the casting connected to the boom swing cylinder and the boom with top mounted boom cylinder. The swing casting provides the pivot point for the boom in the offset function and the up down motion of the boom. The swing frame is connected to the upperstructure by a top and bottom pivot pin.

Removal And Installation

Remove the boom. (See Removal And Installation on Page 40-180-1.)

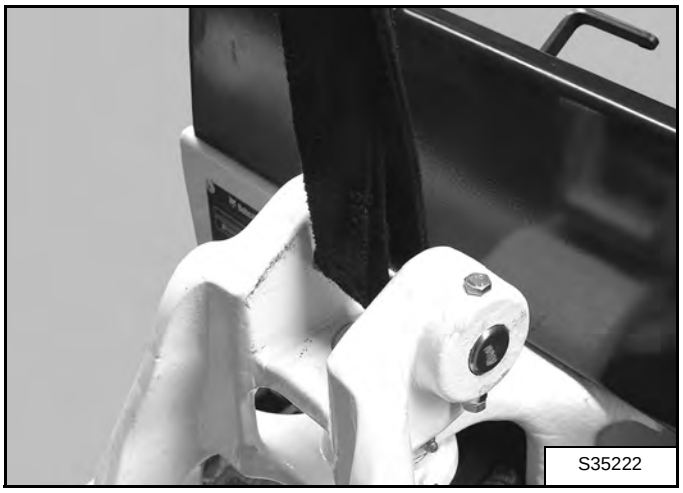
Figure 40-170-1



Remove the bolt and nuts (Item 1) **[Figure 40-170-1]** from the cylinder pivot pin.

Remove the pivot pin (Item 2) **[Figure 40-170-1]**.

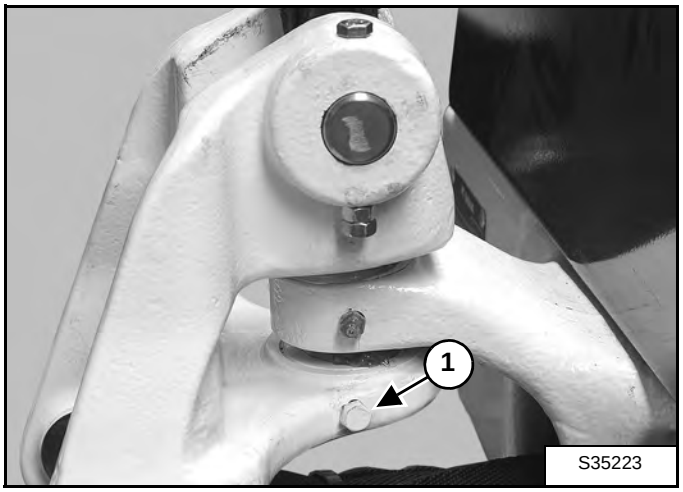
Figure 40-170-2



Install the pivot pin, bolt and nuts **[Figure 40-170-2]**.

Install a chain hoist on the swing frame **[Figure 40-170-2]**.

Figure 40-170-3



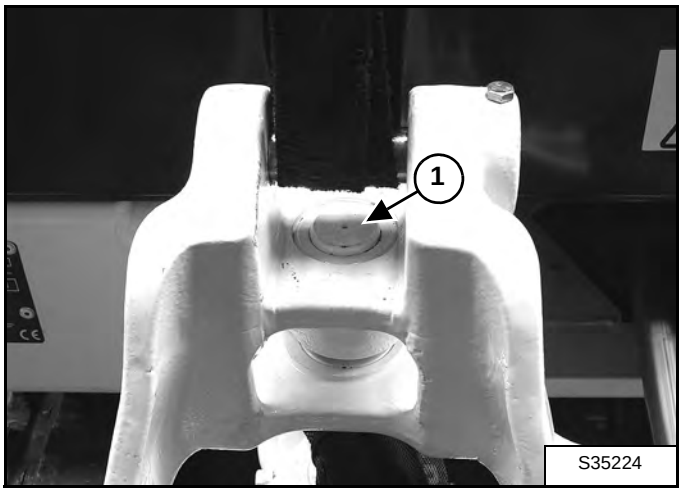
Remove the bolt and nuts (Item 1) **[Figure 40-170-3]** from the top pivot pin.

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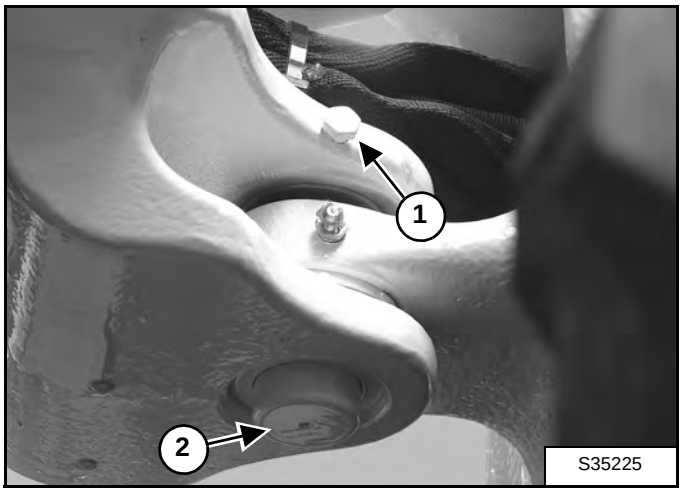
Removal And Installation (Cont'd)

Figure 40-170-4



Remove the top pivot pin (Item 1) **[Figure 40-170-4]** from the swing frame.

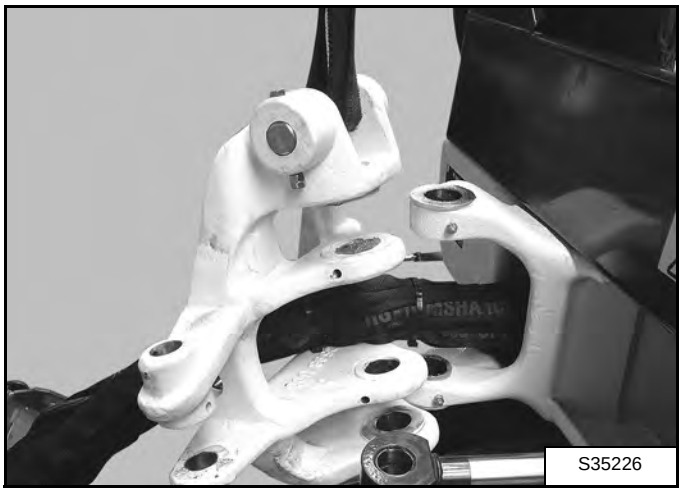
Figure 40-170-5



Remove the bolt and nuts (Item 1) **[Figure 40-170-5]** from the bottom pivot pin.

Remove the bottom pivot pin (Item 2) **[Figure 40-170-5]** from the swing frame.

Figure 40-170-6



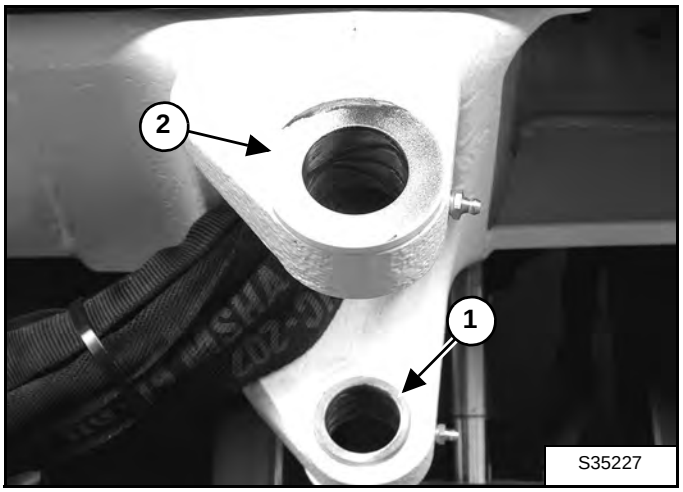
Remove the swing frame from the excavator **[Figure 40-170-6]**.

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Bushing Removal And Installation

Figure 40-170-7



Remove the bottom bushing (Item 1) **[Figure 40-170-7]** from the upperstructure by driving the bushing down through the casting.

Remove the top bushing (Item 2) **[Figure 40-170-7]** from the upperstructure by driving the bushing up through the casting.

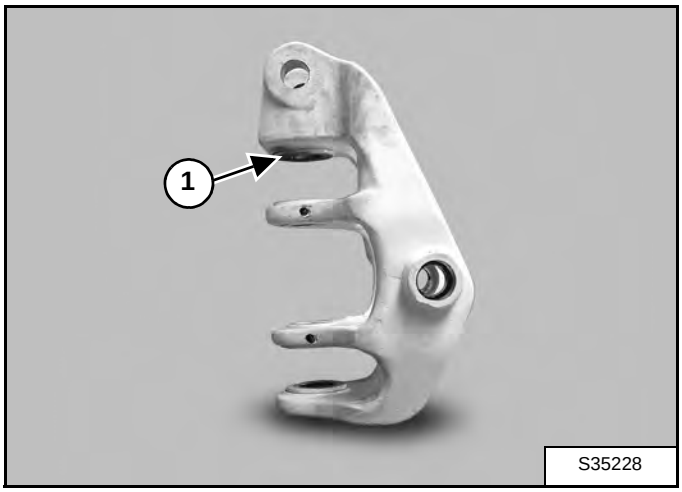
During installation, center the bushing on the casting hole.

NOTE: Make sure the bushing is centered in the casting hole and is started in the hole evenly and square.

Install the bushing so the flanged edge of bushing is seated in the casting. The flanged edge of the bushings must be installed from the top and bottom of the upperstructure casting.

Swing Frame Bushing Removal

Figure 40-170-8



Remove the top pivot bushing (Item 1) **[Figure 40-170-8]**. The bushing will need to be pressed down to be removed from the swing frame casting.

The following parts will be needed for removal and installation of the swing frame bushing:

Bolt -16 X 114 mm (0.625 x 4.5 in) long

Nut - 16 mm (0.625 in)

Washer - 16 mm I.D. x 59 mm O.D. x 6 mm thick or (0.625 in I.D. x 2.312 in O.D. x 0.25 in thick)

Washer - 16 mm I.D. x 89 mm).D. x 6 mm thick or (0.625 in I.D. x 3.5 in O.D. x 0.25 in thick)

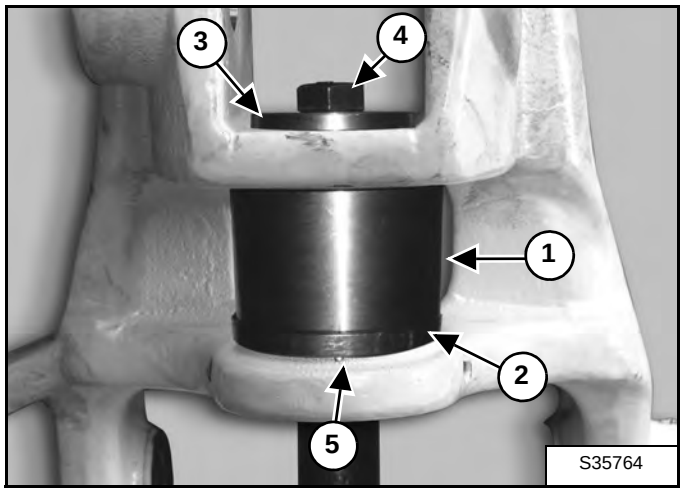
Spacer - 73 mm I.D. x 86 mm).D. x 38 mm thick or (2.875 in I.D. x 3.375 in O.D. x 1.5 in thick)

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Swing Frame Bushing Removal (Cont'd)

Figure 40-170-9



Install the spacer (Item 1) and washer (Item 2) **[Figure 40-170-9]** and over the flanged end of the bushing.

The spacer (Item 1) **[Figure 40-170-9]** must be centered over the bushing to avoid contact between the bushing and the spacer during removal.

Install the washer (Item 3) **[Figure 40-170-9]** and on the opposite end of the bushing. The washer must be centered on the bushing and must not contact the casting.

Install the bolt (Item 4) and the nut (Item 5) **[Figure 40-170-9]** and through the washers and spacer.

Tighten the bolt and nut to remove the bushing from the casting.

Swing Frame Bushing Installation

Apply a film of grease to the outer diameter of the bushing and the inner diameter of the casting.

Center the bushing on the casting hole.

NOTE: Make sure the bushing is centered in the casting hole and is started in the hole evenly and square.

Put the washer (Item 3) over the flanged end of the bushing. Put the washer (Item 2) **[Figure 40-170-9]** over the bushing hole casting, center the washer over the bushing hole.

Install the bolt (Item 4) through the washers and the bushing and install the nut (Item 5) **[Figure 40-170-9]**.

Tighten the bolt and nut until the bushing is seated in the casting.

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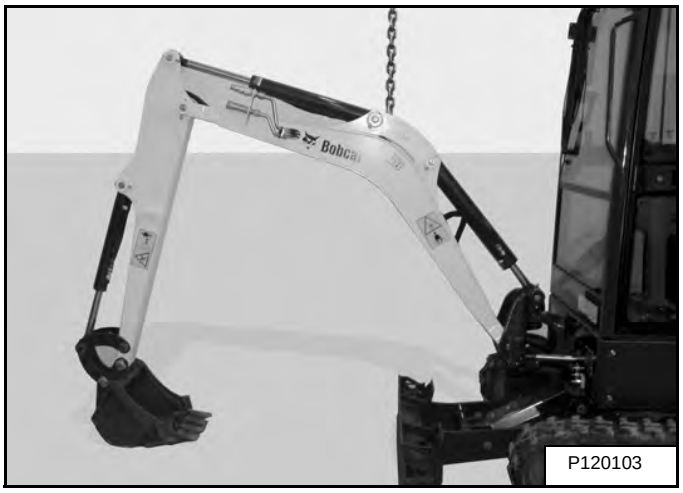
BOOM

Description

The boom is the section that is connected to the swing frame and the arm. The boom has the boom and arm cylinders mounted on the top of the boom.

Removal And Installation

Figure 40-180-1



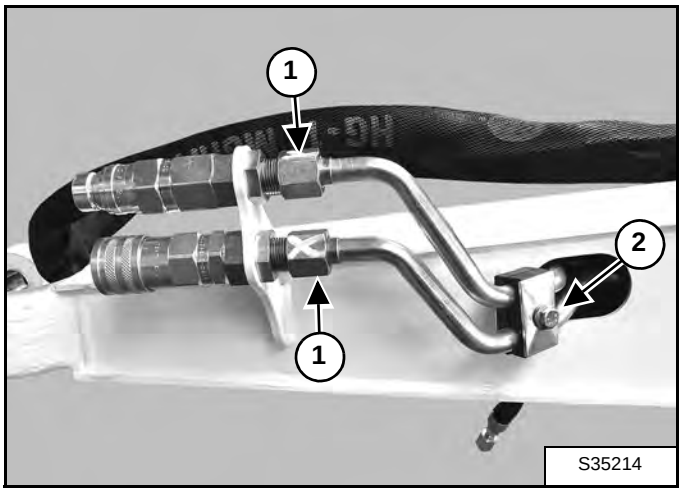
Install a chain hoist on the boom **[Figure 40-180-1]**.

Remove the arm. (See Removal And Installation on Page 40-190-1.)

Remove the arm cylinder. (See Removal And Installation on Page 20-21-3.)

Remove the boom cylinder. (See Removal And Installation on Page 20-20-3.)

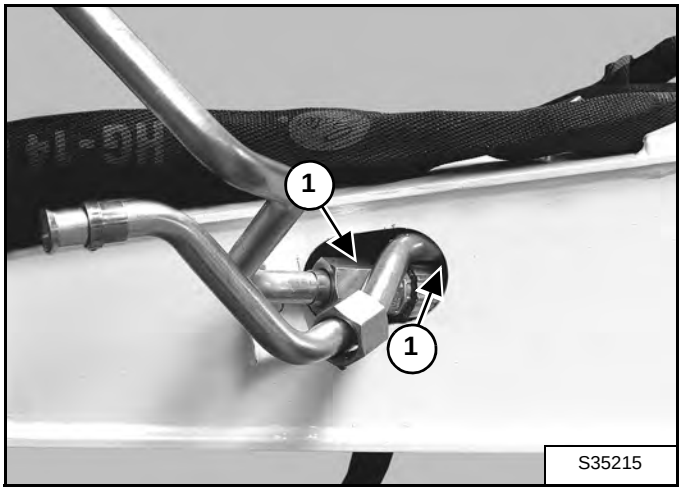
Figure 40-180-2



Disconnect the tubelines (Item 1) **[Figure 40-180-2]** from the hydraulic quick couplers.

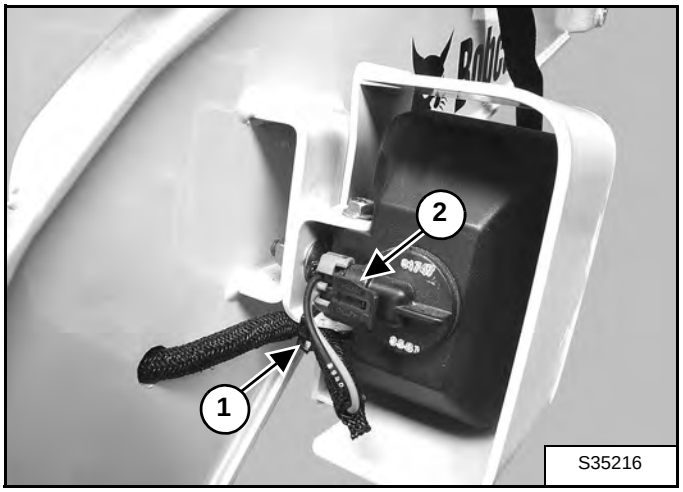
Remove the bolt and nut (Item 2) **[Figure 40-180-2]** from the bracket.

Figure 40-180-3



Pull the tubelines out of the boom and disconnect from the hydraulic hoses (Item 1) **[Figure 40-180-3]**.

Figure 40-180-4



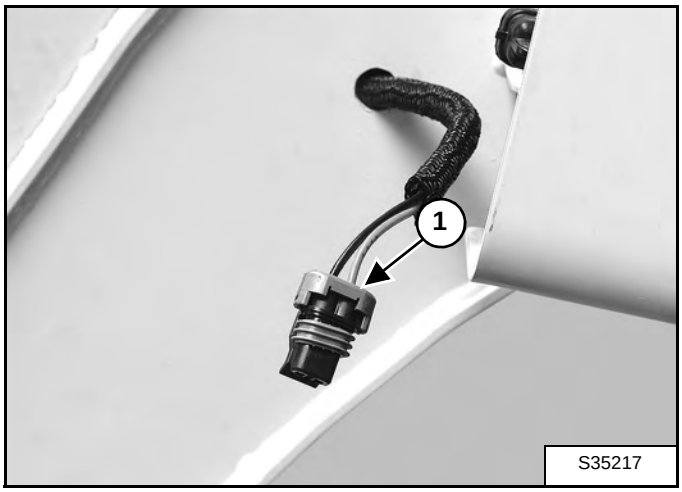
Remove the tie strap (Item 1) on the light wire harness. Disconnect the harness (Item 2) **[Figure 40-180-4]**.

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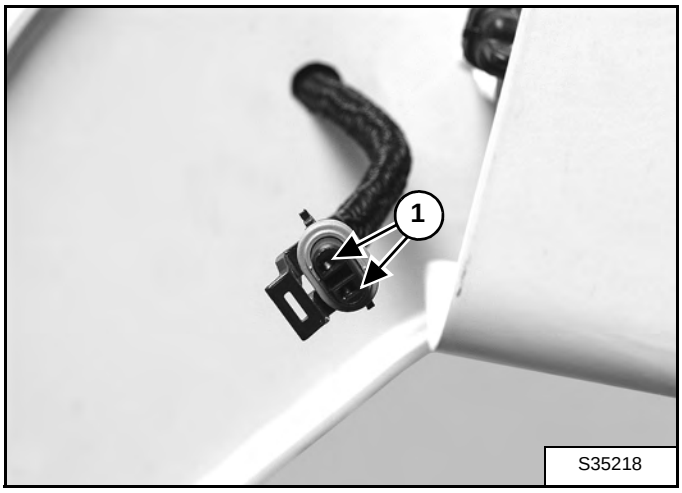
Removal And Installation (Cont'd)

Figure 40-180-5



Remove the lock (Item 1) **[Figure 40-180-5]** from the electrical connector.

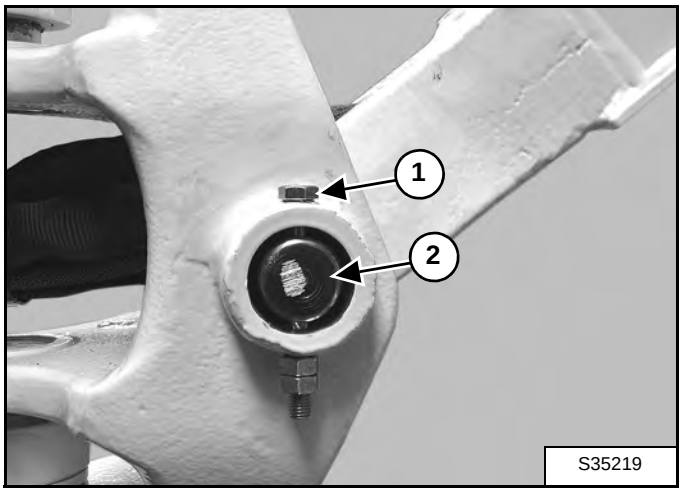
Figure 40-180-6



With a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 40-180-6]**.

Mark and remove the individual wires from the back of the electrical connector.

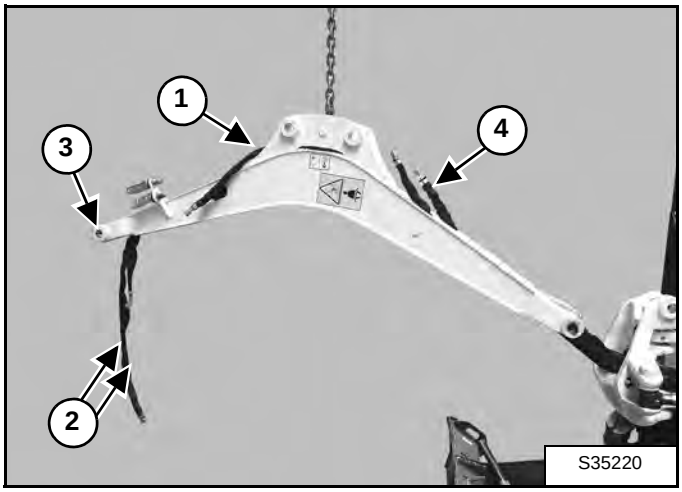
Figure 40-180-7



Remove the bolt and nuts (Item 1) **[Figure 40-180-7]** from the pivot pin.

Remove the pivot pin (Item 2) **[Figure 40-180-7]**.

Figure 40-180-8



Lift the boom from the swing frame **[Figure 40-180-8]**.

Installation: Feed the two arm cylinder hoses and the two auxiliary hoses (Item 1) through the inside of the boom and comes out at the base pivot of the arm cylinder. Continue feeding the two bucket cylinder hoses (Item 2) and the boom cylinder hoses (Item 4) through the end of the boom (Item 3) **[Figure 40-180-8]**.

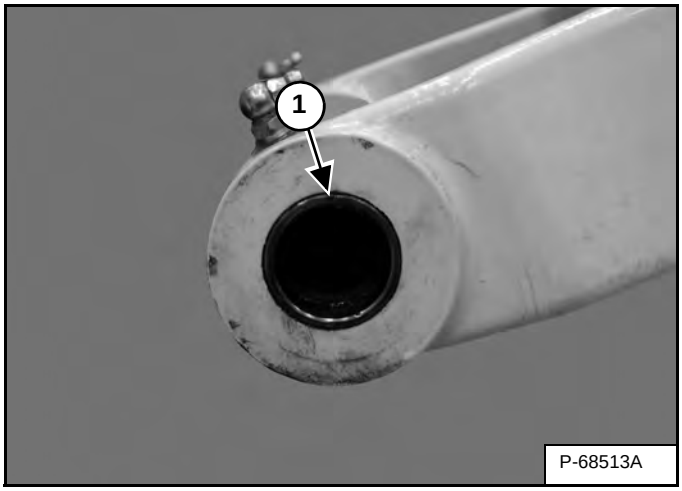
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Boom Bushing Removal And Installation

Remove the boom. (See Removal And Installation on Page 40-180-1.)

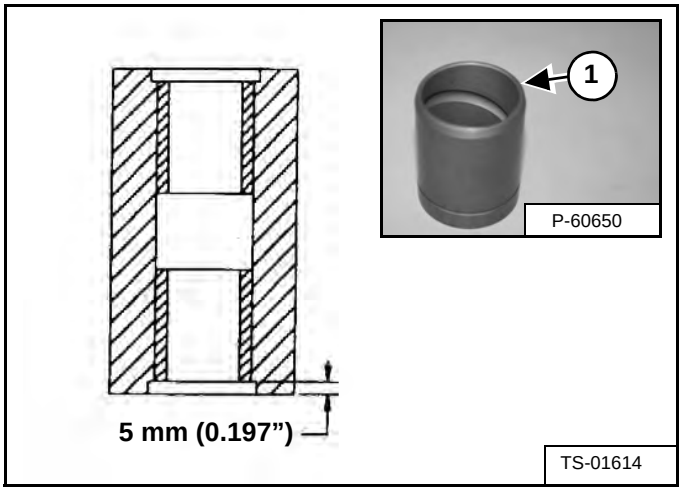
Figure 40-180-9



Remove the bushings (Item 1) **[Figure 40-180-9]** from both sides of the boom.

Install the new bushings in the boom.

Figure 40-180-10



Install the bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-180-10]**.

NOTE: Install the new bushings with the tapered end first (Item 1) [Figure 40-180-10].

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ARM

Description

The arm is the section that is connected to the end of the boom section and the bucket/bucket link. The excavator comes with a standard length but has an optional long arm.

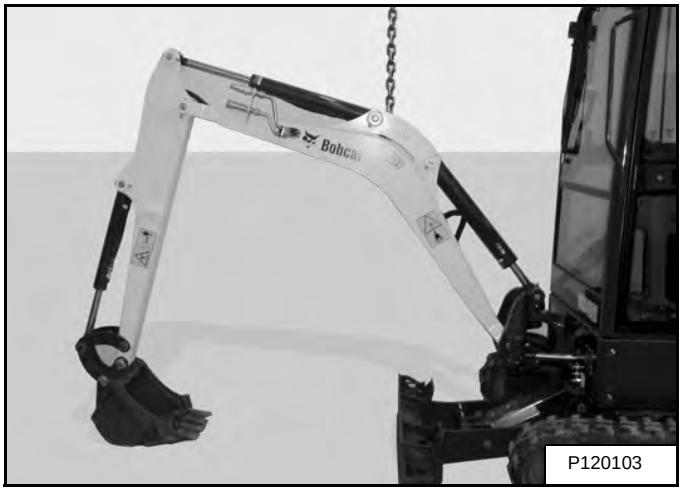
Removal And Installation

IMPORTANT

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

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Figure 40-190-1

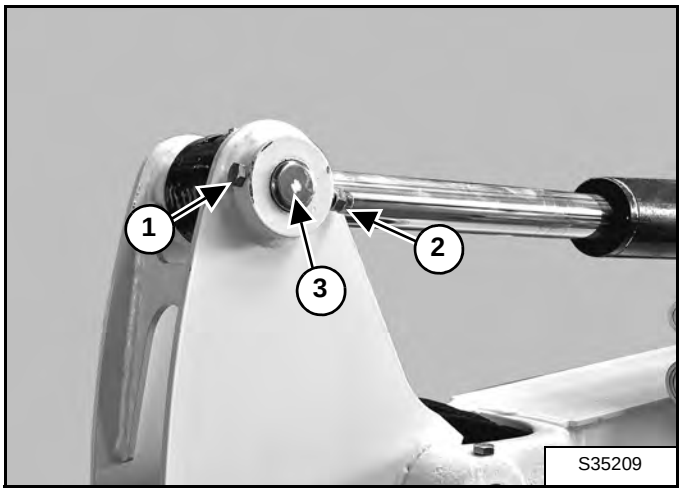


Support the boom with a chain hoist **[Figure 40-190-1]**.

Remove the bucket. (See Removal And Installation on Page 40-200-1.)

Remove the bucket cylinder. (See Removal And Installation on Page 20-23-3.)

Figure 40-190-2

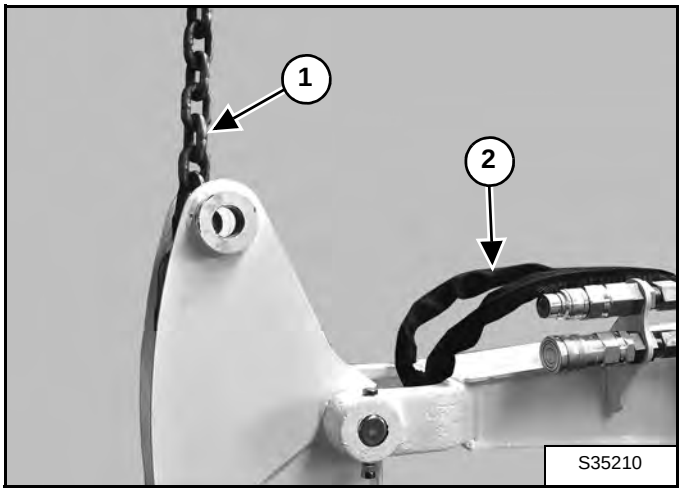


Remove the bolt (Item 1) and nuts (Item 2) **[Figure 40-190-2]** from the rod end pivot pin.

Remove the pivot pin (Item 3) **[Figure 40-190-2]**.

Remove the rod end of the cylinder from the arm.

Figure 40-190-3



Install a chain (Item 1) **[Figure 40-190-3]** to support the arm.

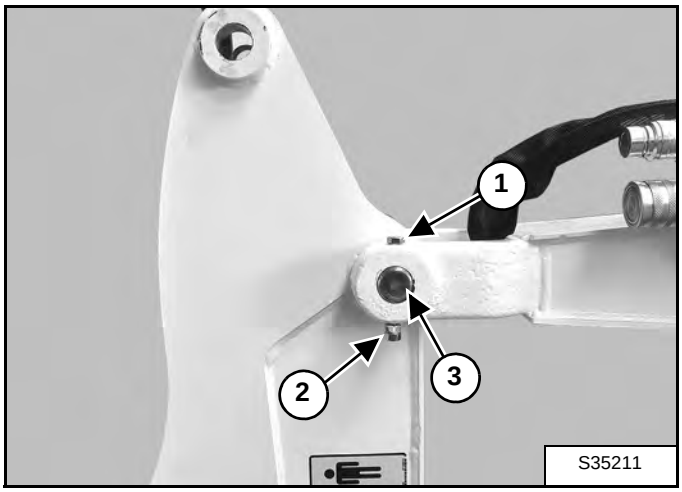
Move the bucket cylinder hoses (Item 2) **[Figure 40-190-3]** away from the arm.

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Removal And Installation (Cont'd)

Figure 40-190-4



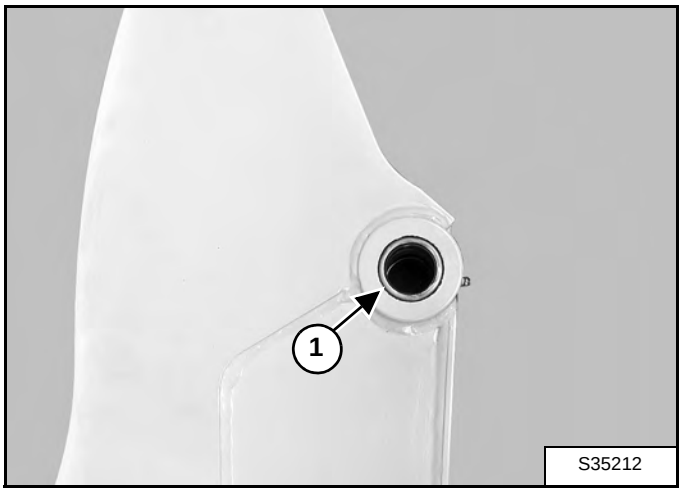
Remove the bolt (Item 1) and nuts (Item 2) **[Figure 40-190-4]** from the arm pivot pin.

Remove the pivot pin (Item 3) **[Figure 40-190-4]**.

Remove the arm.

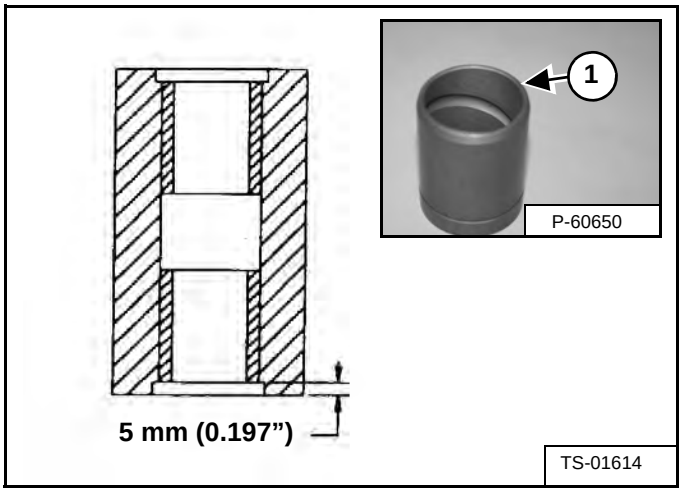
Arm To Boom Bushing Removal And Installation

Figure 40-190-5



Remove the dust seals and bushings (Item 1) **[Figure 40-190-5]** from both sides of the arm.

Figure 40-190-6



Install the new bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-190-6]**.

NOTE: Install the new bushings with the tapered end first (Item 1) [Figure 40-190-6].

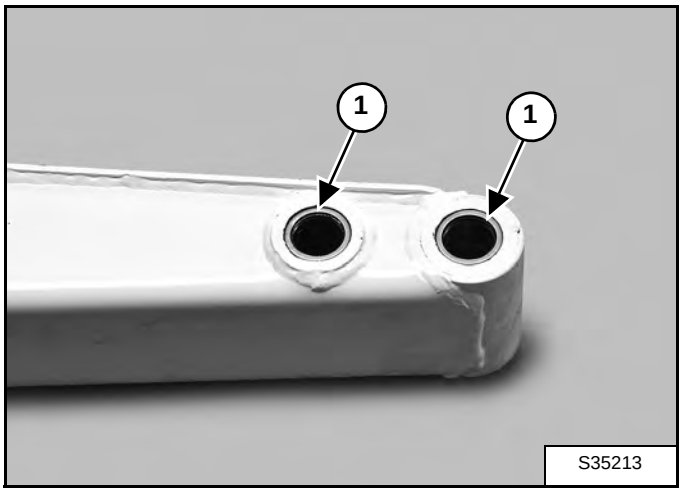
Install new dust seals with the lip facing out.

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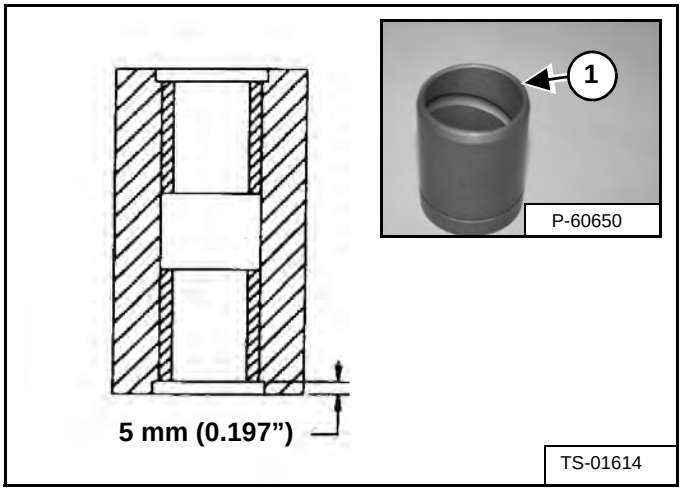
Arm To Bucket And Bucket Link Bushing Removal And Installation

Figure 40-190-7



Remove the dust seals and bushings (Item 1) **[Figure 40-190-7]** from both sides of the arm.

Figure 40-190-8



Install the bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-190-8]**.

NOTE: Install the new bushings with the tapered end first (Item 1) [Figure 40-190-8].

Install new dust seals with the lip facing out.

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BUCKET

Removal And Installation

WARNING

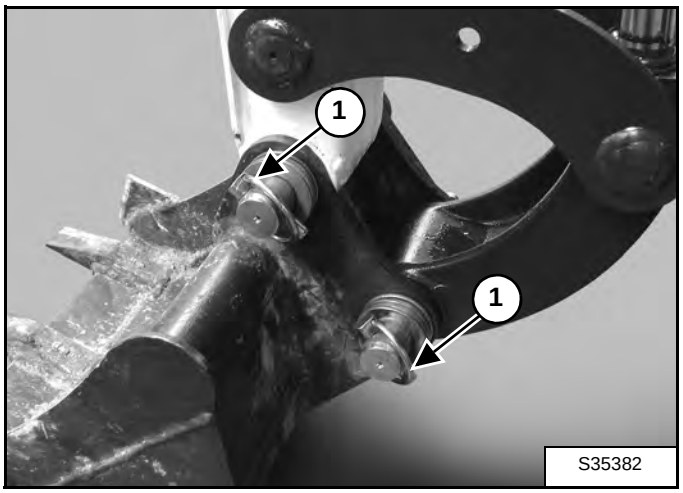
AVOID INJURY OR DEATH

Stop the machine on a firm flat surface. When removing or installing attachments (such as a bucket), always have a second person in the operator's seat, give clear signals and work carefully.

W-2140-0189

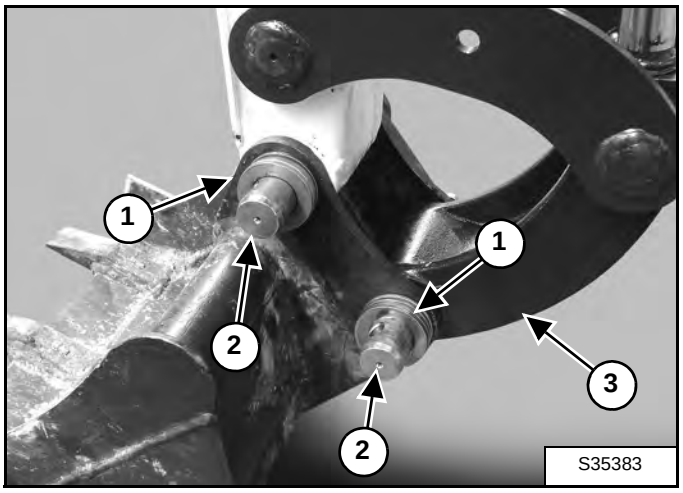
Park the excavator on a flat surface and put the bucket on the ground.

Figure 40-200-1



Remove the fasteners (Item 1) **[Figure 40-200-1]**.

Figure 40-200-2



Remove the washers (Item 1) and pivot pins (Item 2) **[Figure 40-200-2]**.

Keep the pins clean. Do not damage the dust seals in the arm when removing the bucket.

Install the arm into the bucket, align the hole, install the pivot pin (Item 2) and washer (Item 1) **[Figure 40-200-2]**.

Install the link (Item 3) into the bucket, align the hole, install the pivot pin and washer (Item 2) **[Figure 40-200-2]**.

Install the fasteners (Item 1) **[Figure 40-200-1]**. Add grease to the pivot.

WARNING

AVOID INJURY OR DEATH

Never use attachments or buckets which are not approved by Bobcat Company. Buckets and attachments for safe loads of specified densities are approved for each model. Unapproved attachments can cause injury or death.

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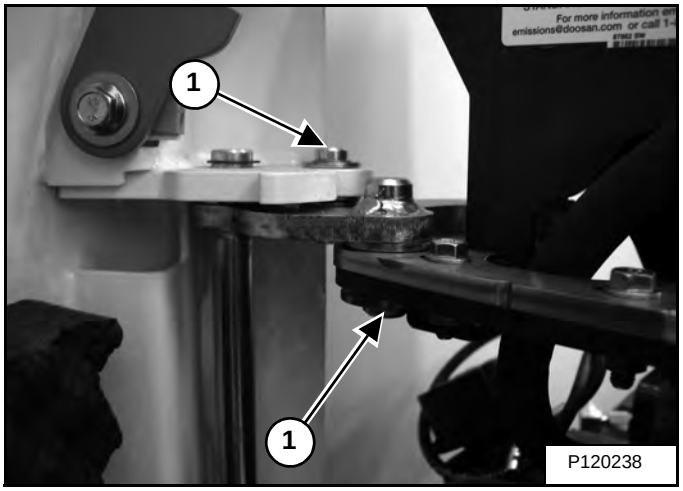
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TAILGATE

Removal And Installation

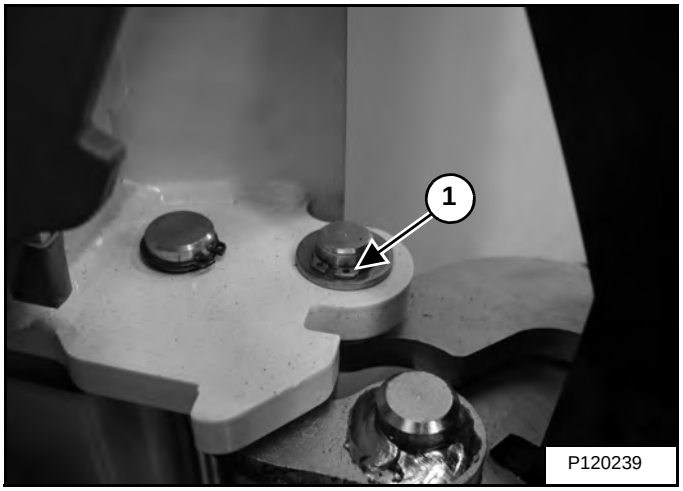
Open the tailgate.

Figure 40-210-1



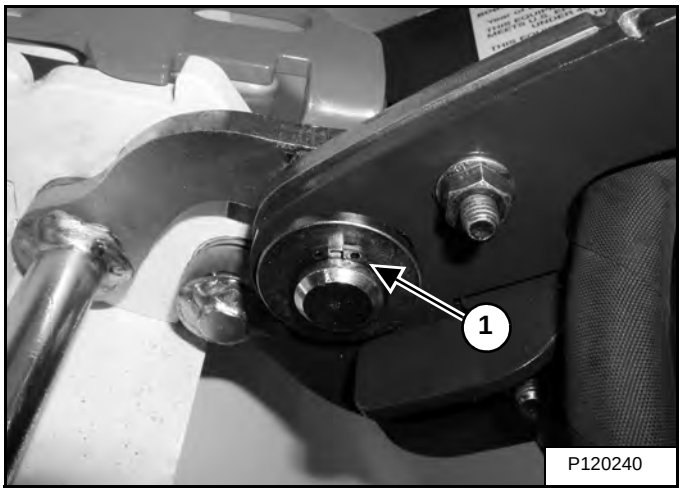
Locate the two pivot pins (Item 1) **[Figure 40-210-1]**.

Figure 40-210-2



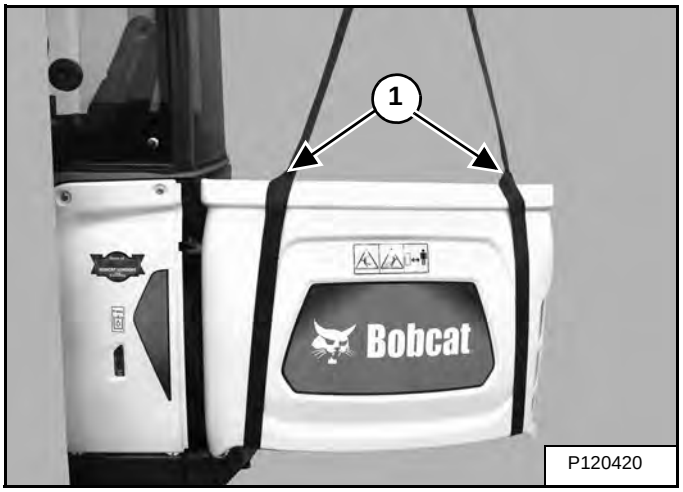
Remove the top retaining ring (Item 1) **[Figure 40-210-2]**.

Figure 40-210-3



Remove the lower retaining ring (Item 1) **[Figure 40-210-3]**.

Figure 40-210-4



Install lifting straps (Item 1) **[Figure 40-210-4]** on tailgate and attach to chain hoist.

Remove the tailgate from machine.

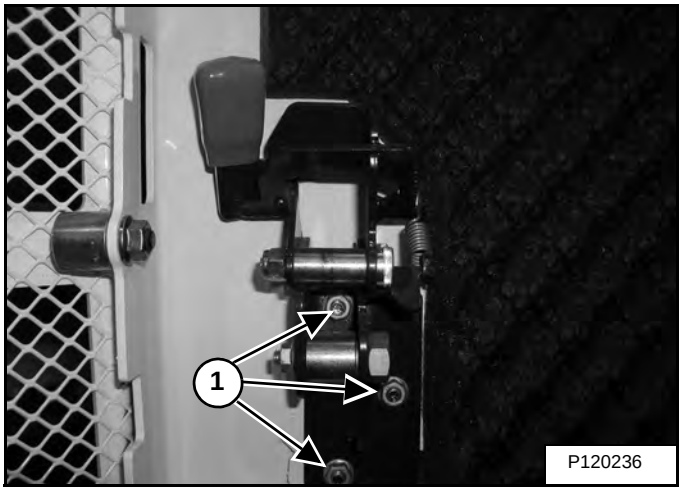
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Latch Removal And Installation

Open the tailgate.

Figure 40-210-5



Remove the three mounting nuts (Item 1) **[Figure 40-210-5]** and remove the latch assembly.

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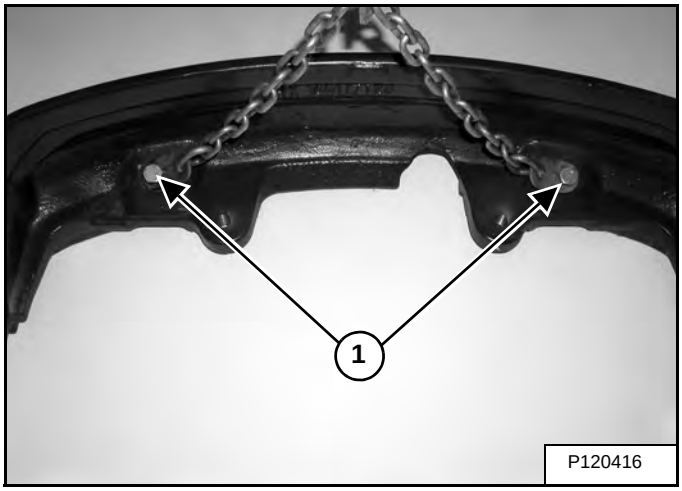
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COUNTERWEIGHT

Removal And Installation

Open the tailgate.

Figure 40-220-1

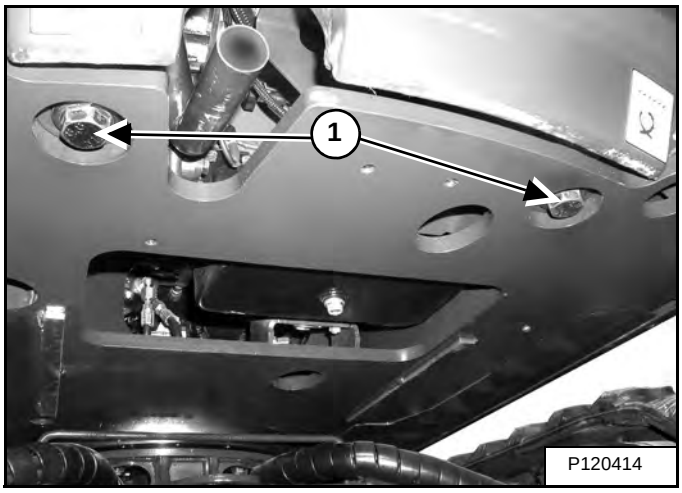


Install the lifting chain to the counterweight using the existing holes (Item 1) **[Figure 40-220-1]**.

Counterweight shown removed for photo clarity.

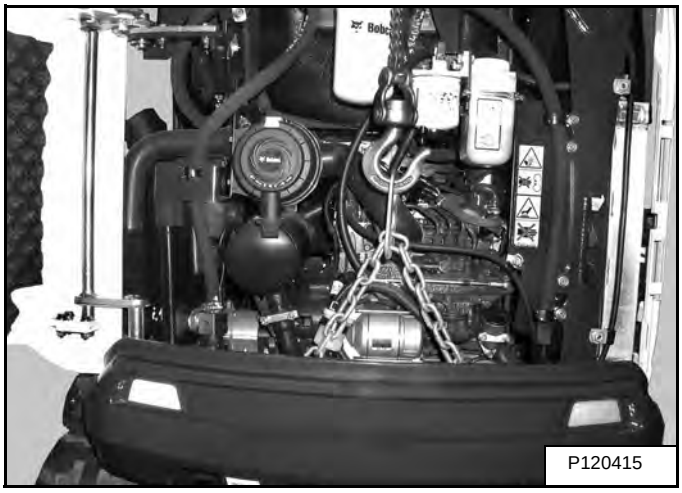
Hookup chain to chain hoist.

Figure 40-220-2



Remove the two bolts (Item 1) **[Figure 40-220-2]**.

Figure 40-220-3



Remove the counterweight from the machine. **[Figure 40-220-3]**.

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OPERATOR HOOD

Removal And Installation

Remove the ROPS canopy (See Removal And Installation on Page 40-20-1.) or the cab (See Removal And Installation on Page 40-30-1.)

Remove the seat and seat mount. (See Removal And Installation on Page 40-40-1.)

Remove the key switch. (See Removal And Installation on Page 50-110-1.)

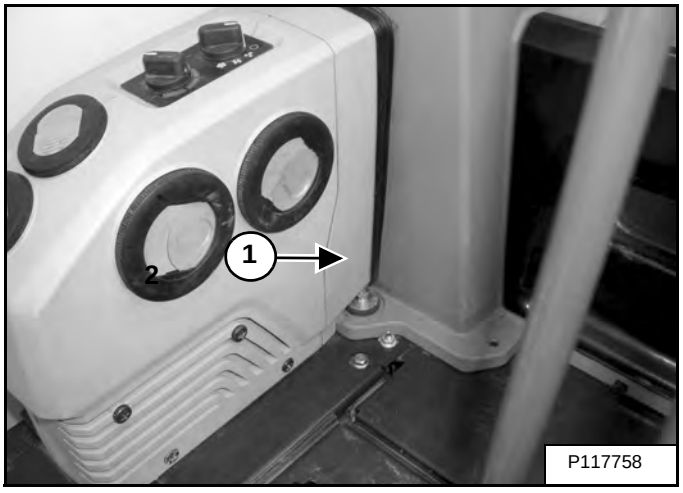
Remove the engine speed control. (See Removal And Installation on Page 40-80-1.)

Remove the left console frame. (See Console Removal And Installation on Page 40-50-4.)

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

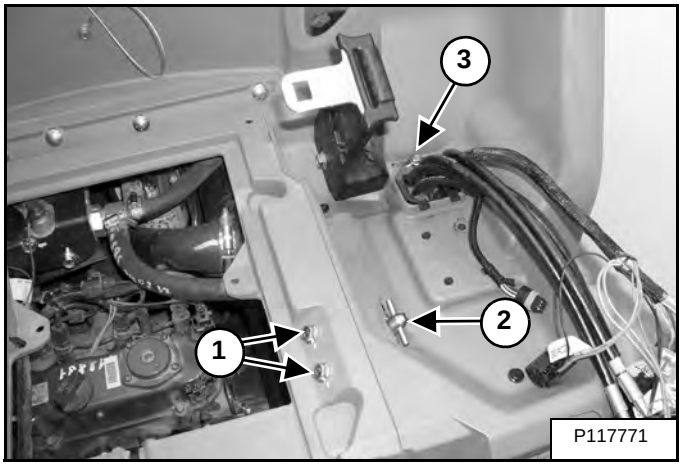
Remove the tool box. (See Removal And Installation on Page 40-260-1.)

Figure 40-230-1



Pull up on and remove the trim (Item 1) **[Figure 40-230-1]** from the heater.

Figure 40-230-2



Remove the bolts (Item 1) and lower the standard / ISO valve (Item 2) (if equipped) **[Figure 40-230-2]** into the engine compartment.

Remove the bolt and hose retainer (Item 3) **[Figure 40-230-2]**.

Figure 40-230-3



Remove the cover (Item 1) **[Figure 40-230-3]**.

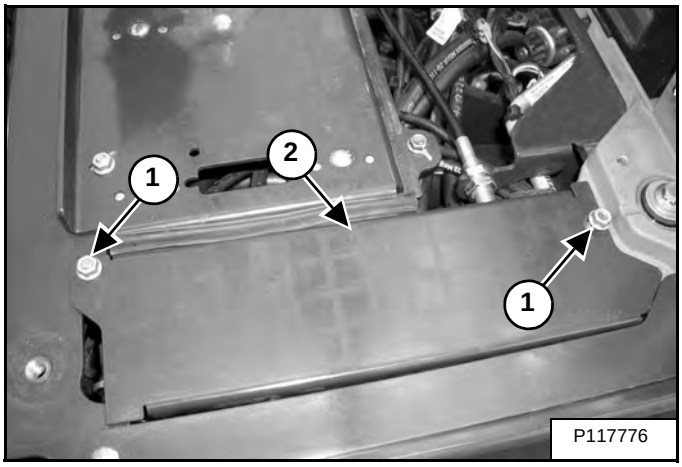
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OPERATOR BONNET (CONT'D)

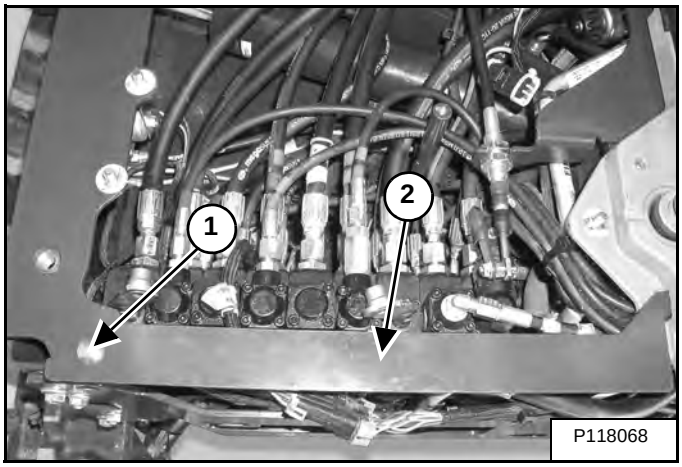
Removal And Installation (Cont'd)

Figure 40-230-4



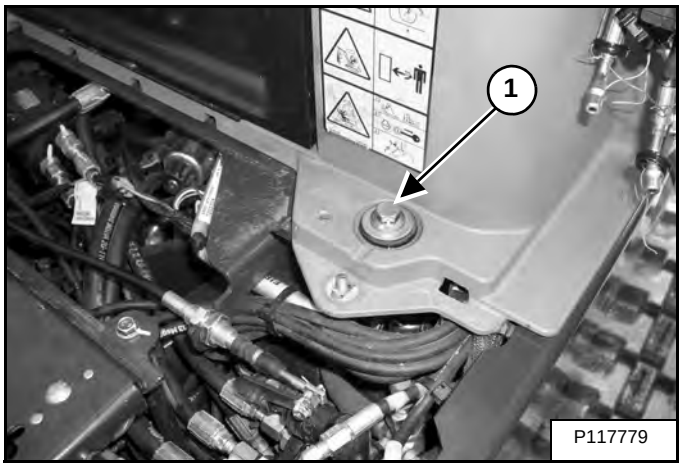
Remove the nuts (Item 1) and cover (Item 2) **[Figure 40-230-4]**.

Figure 40-230-5



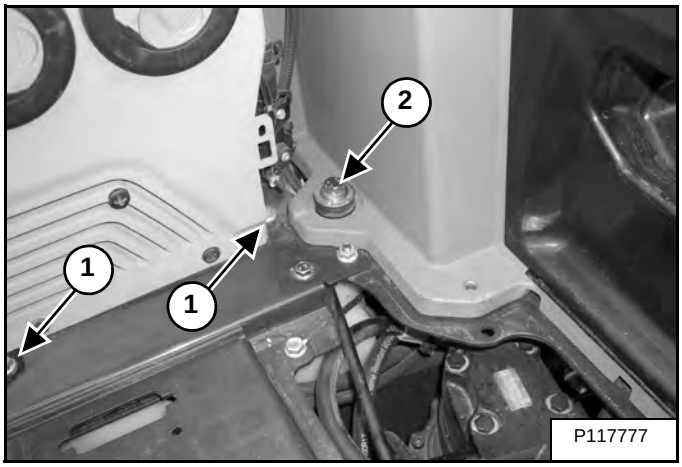
Remove the nut and bolt (Item 1) and the plate (Item 2) **[Figure 40-230-5]**.

Figure 40-230-6



Remove the bolt (Item 1) **[Figure 40-230-6]**.

Figure 40-230-7



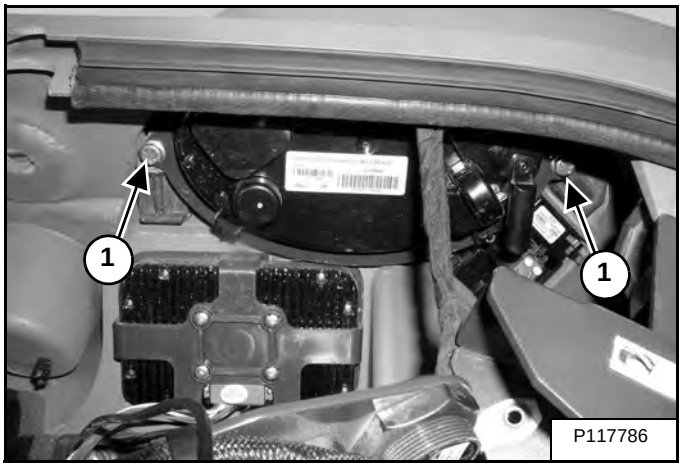
Remove the nuts (Item 1) and reposition the heater. Remove the bolt (Item 2) **[Figure 40-230-7]**.

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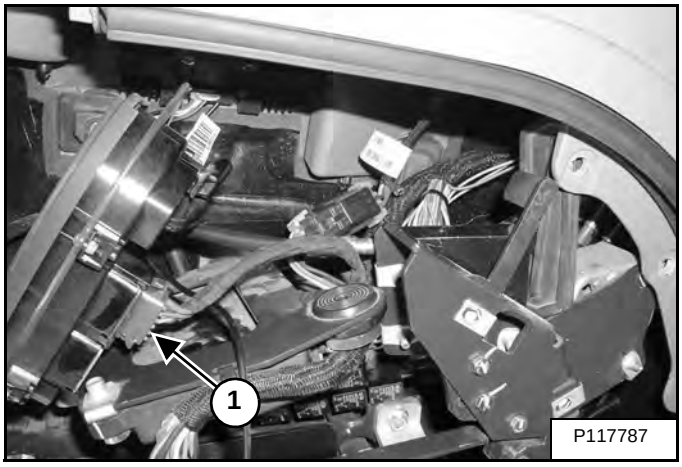
Removal And Installation (Cont'd)

Figure 40-230-8



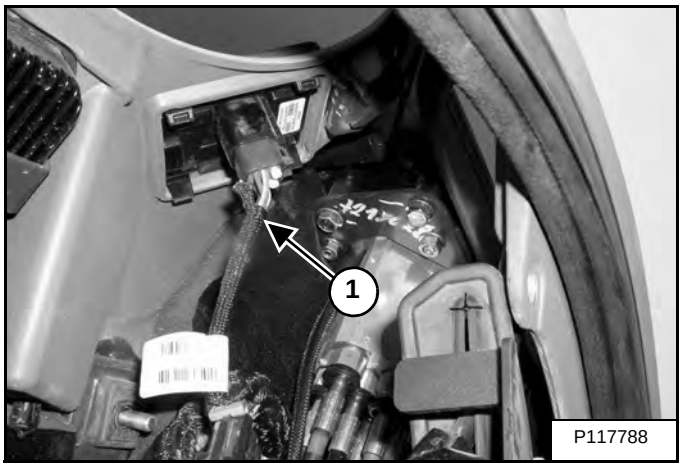
Remove the bolts (Item 1) **[Figure 40-230-8]** and lower the controller.

Figure 40-230-9



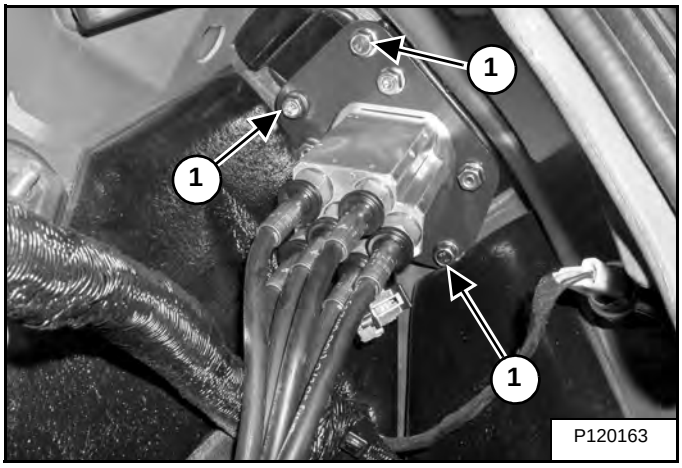
Disconnect the wire harness (Item 1) **[Figure 40-230-9]** and remove the controller.

Figure 40-230-10



Disconnect the wire harness (Item 1) **[Figure 40-230-10]** from the keyless start panel (if equipped).

Figure 40-230-11



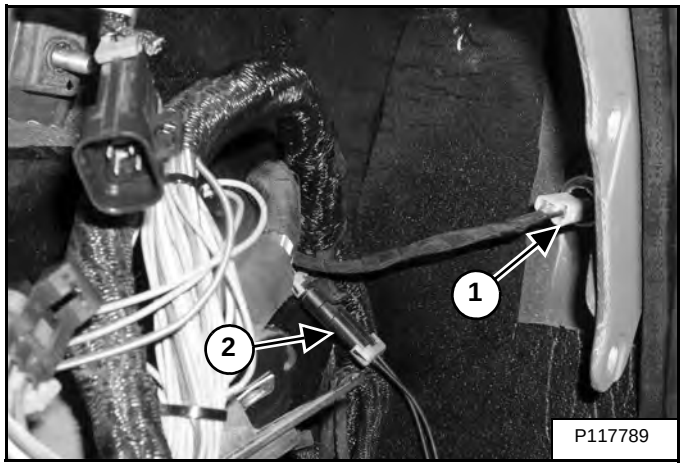
Remove the three bolts (Item 1) **[Figure 40-230-11]** from the joystick mount.

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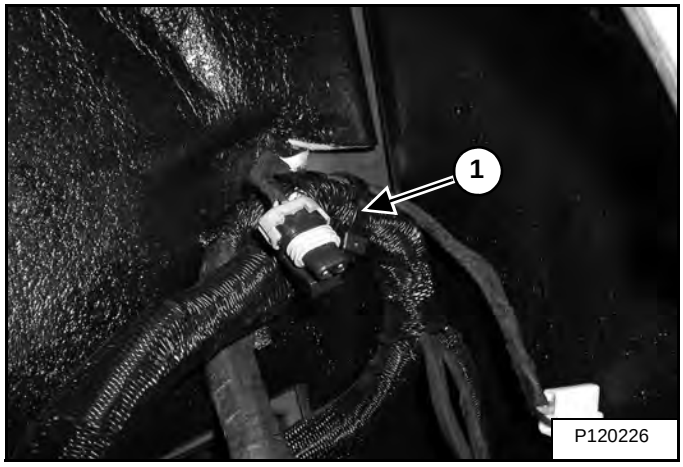
Removal And Installation (Cont'd)

Figure 40-230-12



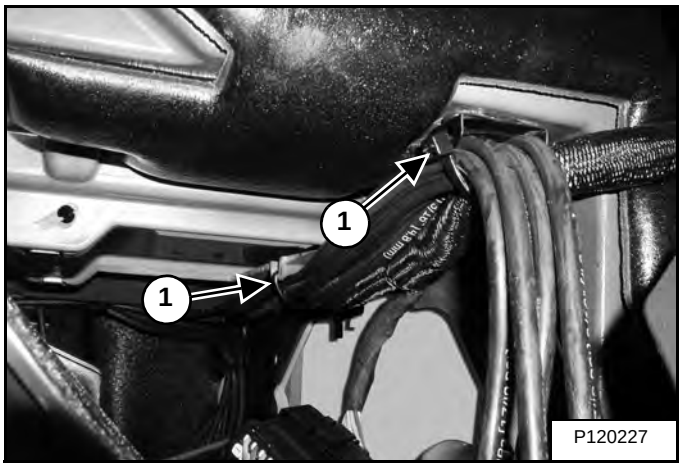
Disconnect the auxiliary power outlet wire harness (Item 1) and two speed wire harness (if equipped) (Item 2) **[Figure 40-230-12]**.

Figure 40-230-13



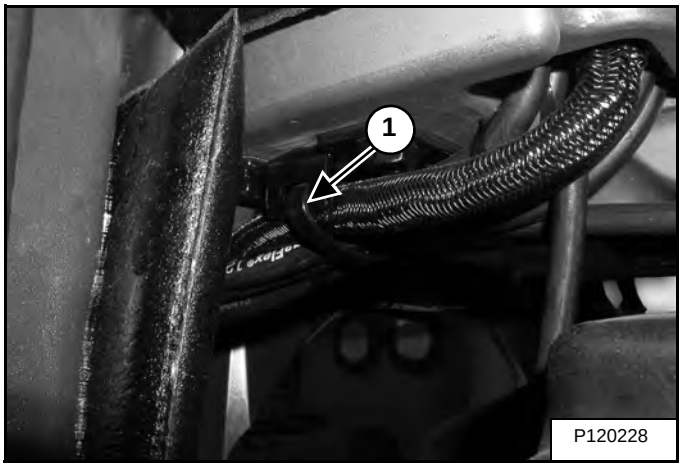
Cut and remove the cable tie (Item 1) **[Figure 40-230-13]**.

Figure 40-230-14



Cut and remove the cable ties (Item 1) **[Figure 40-230-14]**.

Figure 40-230-15



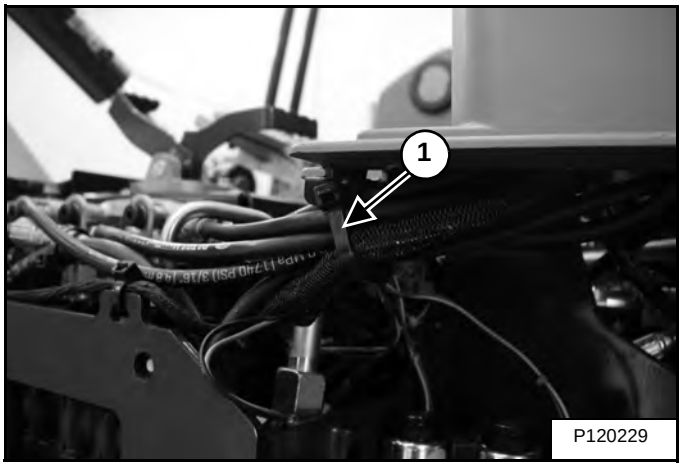
Cut and remove the cable tie (Item 1) **[Figure 40-230-15]**.

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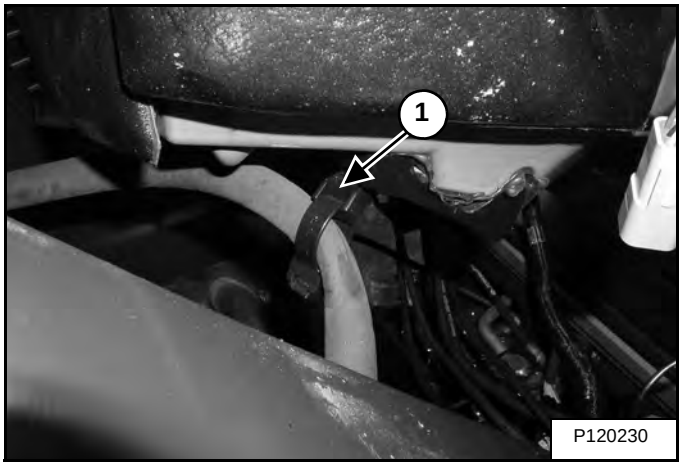
Removal And Installation (Cont'd)

Figure 40-230-16



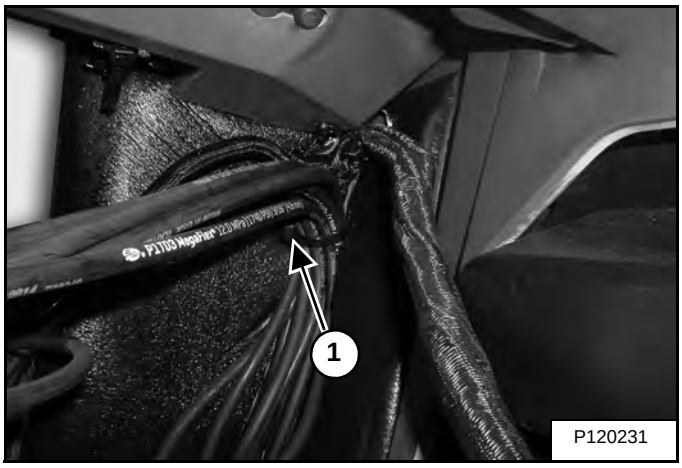
Cut and remove the cable tie (Item 1) **[Figure 40-230-16]**.

Figure 40-230-17



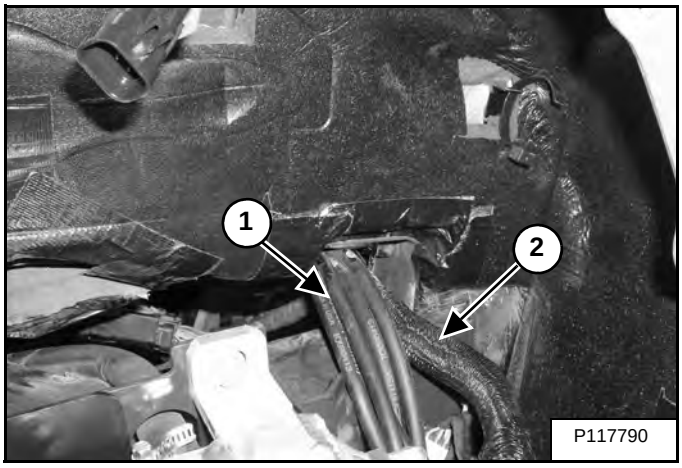
Cut and remove the cable tie (Item 1) **[Figure 40-230-17]**.

Figure 40-230-18



Cut and remove the cable tie (Item 1) **[Figure 40-230-18]**.

Figure 40-230-19



Remove the left joystick hoses (Item 1) and wire harness (Item 2) **[Figure 40-230-19]** from the bonnet.

Remove the bonnet from the machine.

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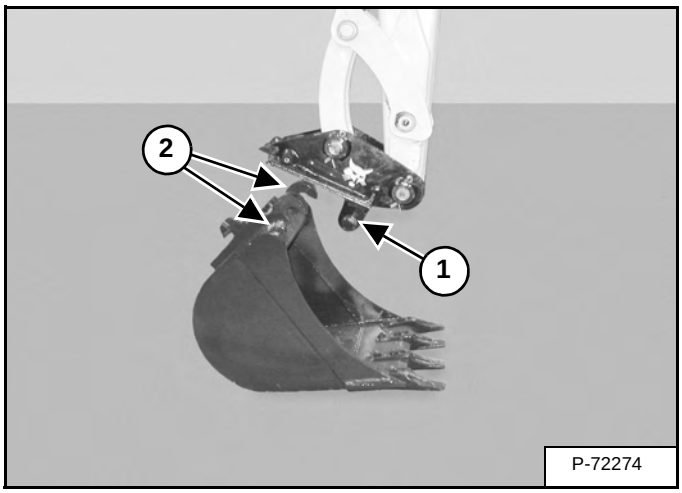
QUICK COUPLER (KLAC™ SYSTEM)

Troubleshooting

PROBLEM	CAUSE	CORRECTION
Coupler does not seat properly on the attachment mounting frame.	Mud, dirt, stones or debris are lodged between the coupler and the attachment mounting frame.	Remove mud, dirt, stones and debris from between the coupler and the attachment mounting frame.
	Worn locking mechanism.	Repair or replace worn pins and locking mechanisms.
	Attachment mounting frame damaged.	Repair or replace the attachment mounting frame.

Daily Inspection

Figure 40-240-1



Inspect the quick coupler for wear or damage. Inspect the quick locking shaft (Item 1) and the hooks (Item 2) **[Figure 40-240-1]** (on the attachment) for wear or damage.

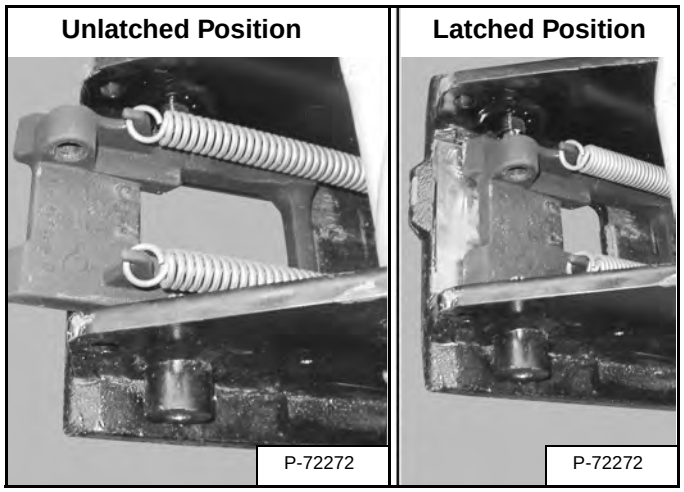
Repair or replace damaged parts.

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Removal And Installation

Figure 40-240-2



Remove the attachment.

The quick coupler must be in the latched position **[Figure 40-240-2]** for disassembly.

Inspect the quick coupler to make sure the latch is in the latched position.

If the latch is in the unlatched position, see **[Figure 40-240-3]** for additional information.

If the latch is in the latched position, proceed to **[Figure 40-240-3]**.

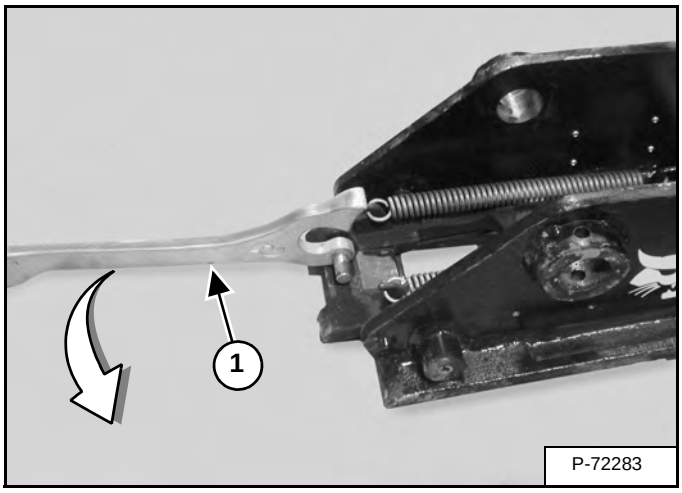
⚠ WARNING

AVOID INJURY

Keep fingers and hands out of pinch points when latching and unlatching the attachment quick coupler.

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Figure 40-240-3



Install the tool (Item 1) **[Figure 40-240-3]** in the quick coupler as shown. Push down on the tool until the latch snaps closed.

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Removal And Installation (Cont'd)

WARNING

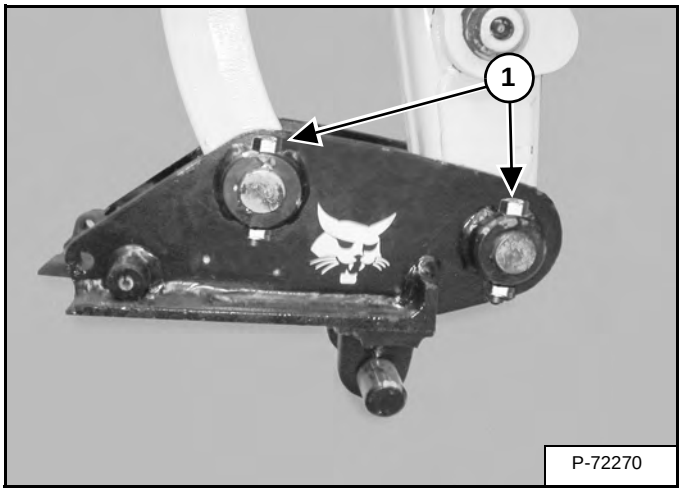
AVOID INJURY OR DEATH

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

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

W-2019-0907

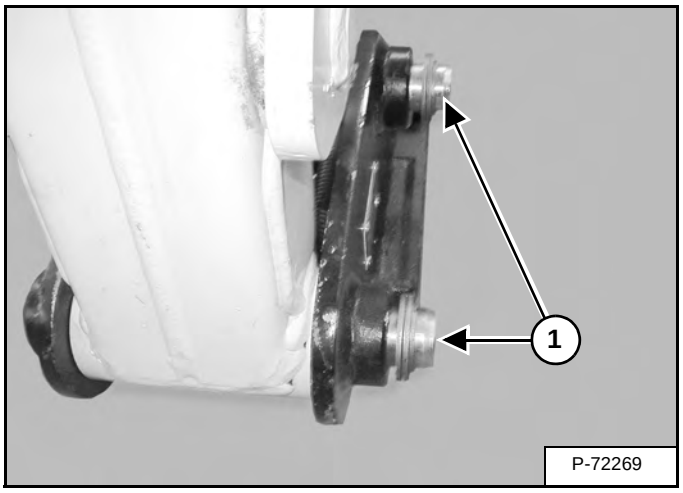
Figure 40-240-4



Remove the bolts (Item 1) **[Figure 40-240-4]** and nuts.

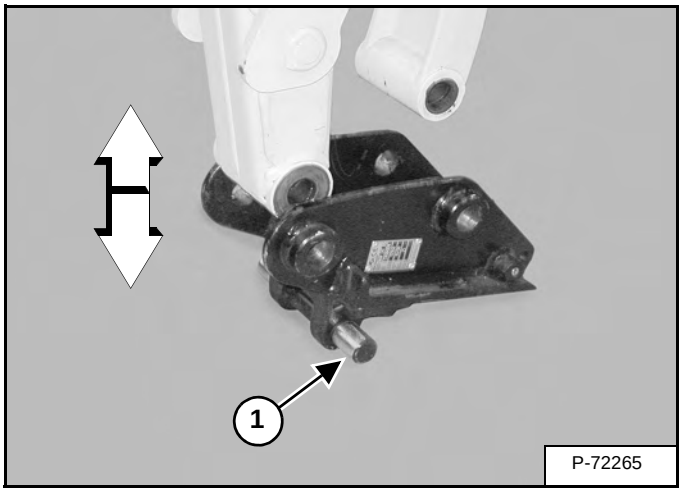
Installation: Align the holes of the connecting pins with the holes in the coupler. Install the two bolts (Item 1) **[Figure 40-240-4]** and nuts. Tighten the nuts securely against the couple.

Figure 40-240-5



Remove pins (Item 1) **[Figure 40-240-5]**.

Figure 40-240-6



Raise the arm and bucket link until the coupler is free **[Figure 40-240-6]**.

Installation: Align the arm and bucket link with the coupler **[Figure 40-240-6]**. Lower the arm and bucket link into the coupler.

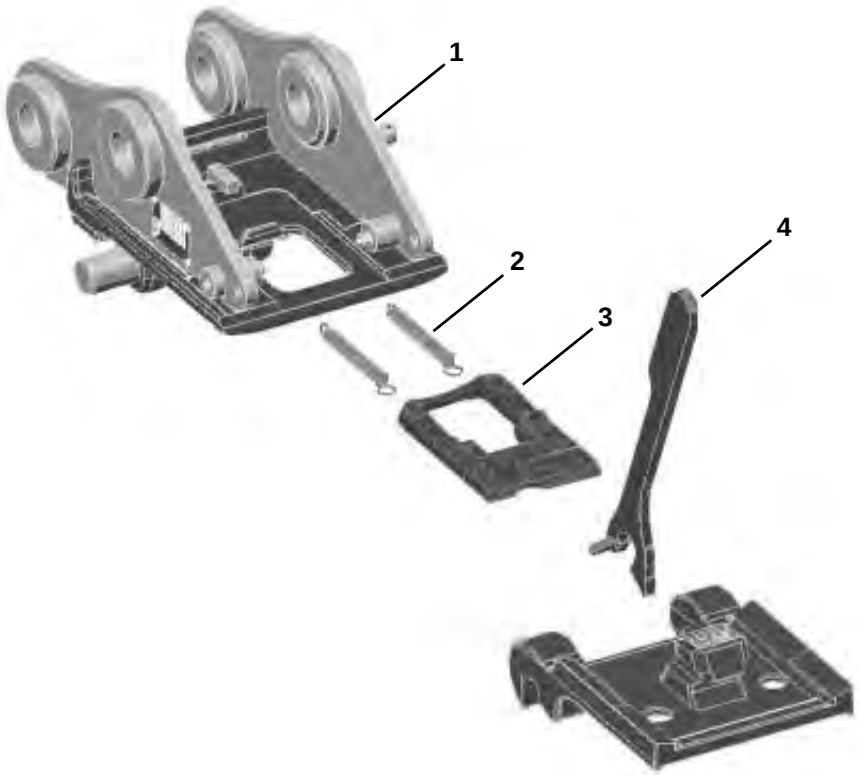
NOTE: Place the coupler on the ground with the mounting pin (Item 1) [Figure 40-240-6] facing towards the excavator.

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Parts Identification

1. Coupler Body
2. Spring
3. Locking Plate
4. Tool



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Disassembly

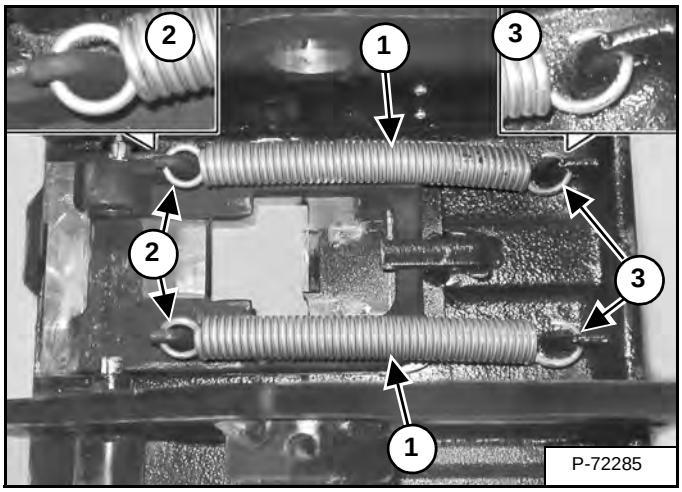
⚠ WARNING

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

- **Pressurized fluids and springs or other stored energy components.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

W-2505-0604

Figure 40-240-7



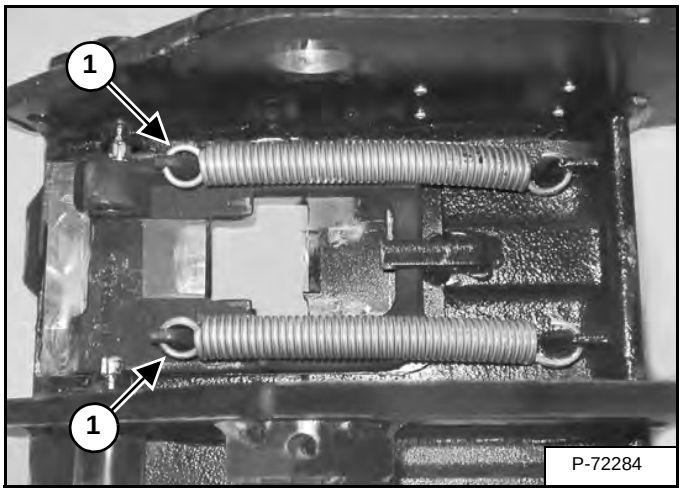
The two springs (Item 1) **[Figure 40-240-7]** have different style of end hooks.

The spring hook (Item 2) **[Figure 40-240-7]** are full circle hooks.

The spring hook (Item 3) **[Figure 40-240-7]** are partial circle hooks.

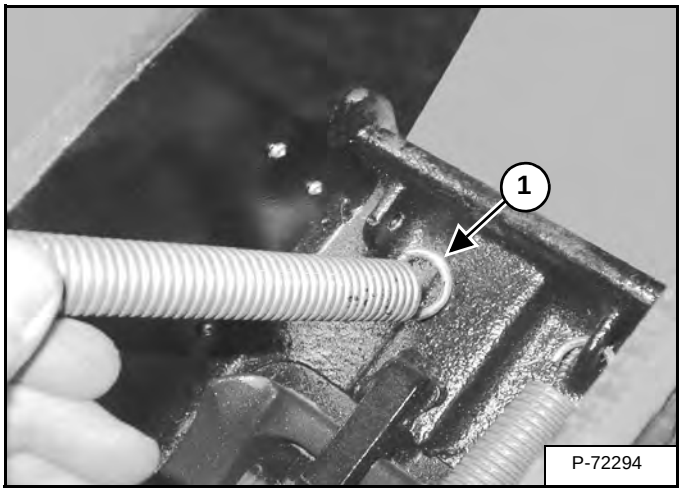
The spring ends must be positioned as shown when assembled.

Figure 40-240-8



Remove the spring end hook (Item 1) **[Figure 40-240-8]** from the quick coupler.

Figure 40-240-9



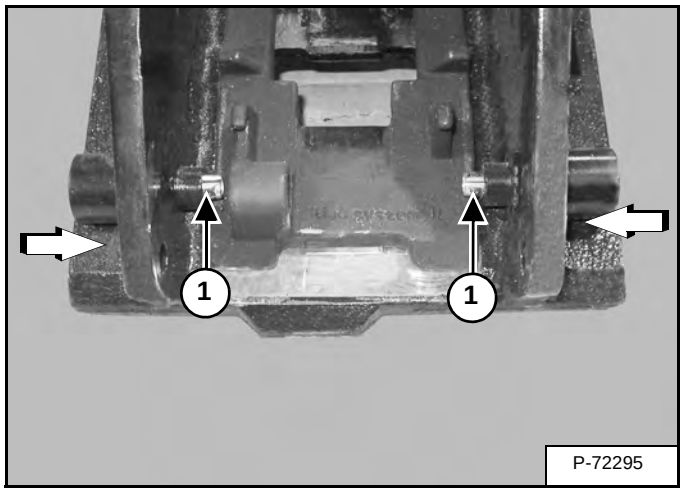
Remove the opposite end of the two springs (Item 1) **[Figure 40-240-9]**.

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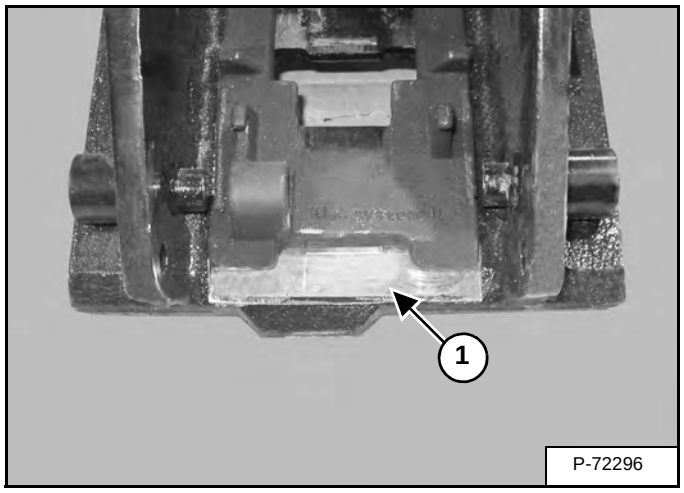
Disassembly (Cont'd)

Figure 40-240-10



Remove the two roll pins (Item 1) **[Figure 40-240-10]**. Drive the roll pins inwards to remove.

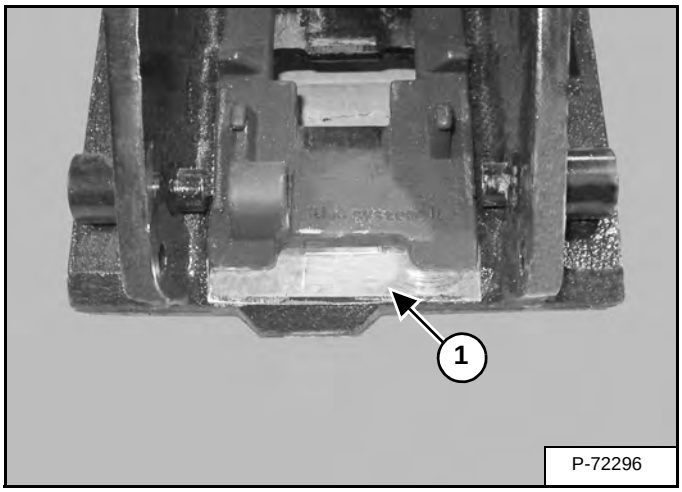
Figure 40-240-11



Remove the latch (Item 1) **[Figure 40-240-11]**.

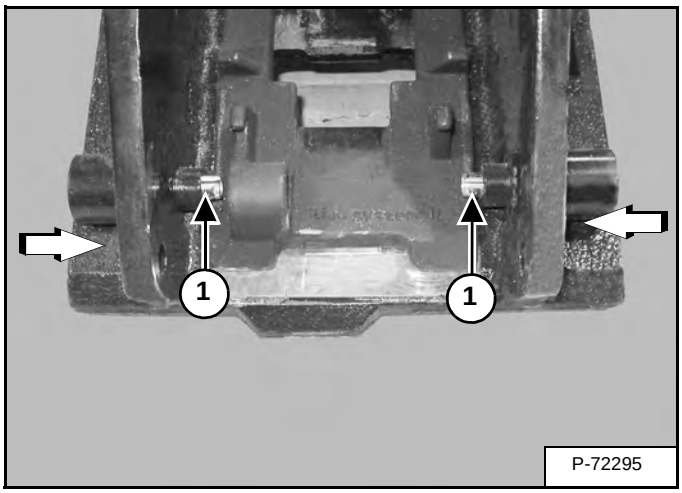
Assembly

Figure 40-240-12



Install the latch (Item 1) **[Figure 40-240-12]**.

Figure 40-240-13



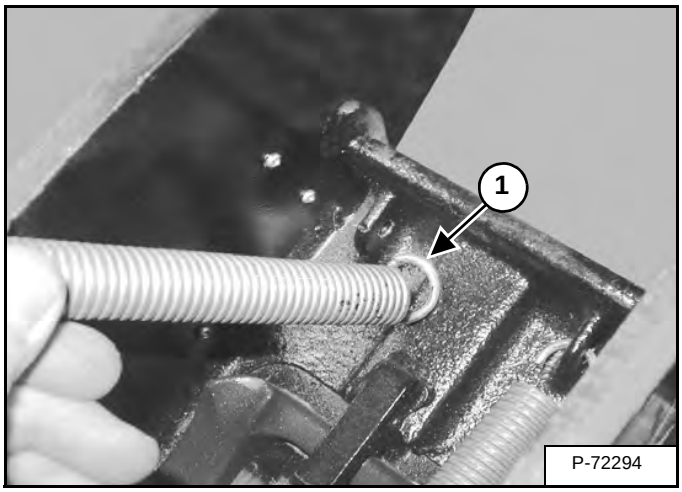
Install the two roll pins (Item 1) **[Figure 40-240-13]**. Drive the roll pins inwards until the roll pins are flush with the outside edge of the quick coupler.

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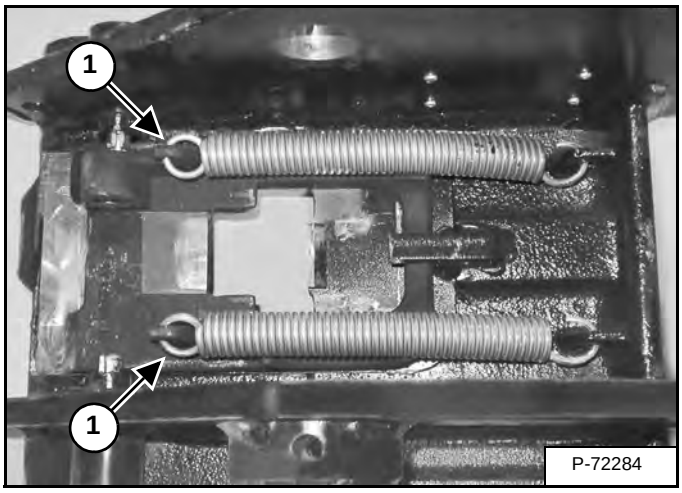
Assembly (Cont'd)

Figure 40-240-14



Install the partial circle hook end of the spring (Item 1) **[Figure 40-240-14]**.

Figure 40-240-15



Install the full circle end of the spring hook (Item 1) **[Figure 40-240-15]** on the quick coupler.

Do not lubricate the quick coupler. Lubrication will cause dirt to collect and interfere with proper movement of the quick coupler.

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QUICK COUPLER (LEHNHOFF® SYSTEM)

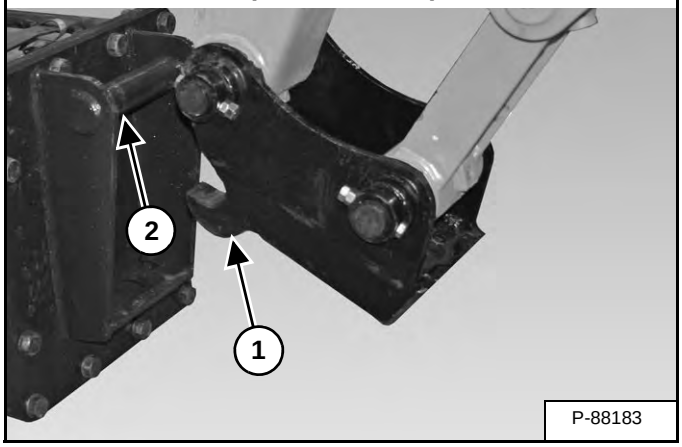
Troubleshooting

PROBLEM	CAUSE	CORRECTION
Coupler does not seat properly on the attachment mounting frame.	Mud, dirt, stones or debris are lodged between the coupler and the attachment mounting frame.	Remove mud, dirt, stones and debris from between the coupler and the attachment mounting frame.
	Worn locking mechanism.	Repair or replace worn pins and locking mechanisms.
	Attachment mounting frame damaged.	Repair or replace the attachment mounting frame.

Daily Inspection

Figure 40-241-1

(MS03 & MS08)



Inspect the quick coupler for wear or damage. Inspect the hooks (Item 1) and coupler locking shaft (Item 2) **[Figure 40-241-1]** (on the attachment) for wear or damage.

Repair or replace damaged parts.

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Removal (MS03 And MS08)

WARNING

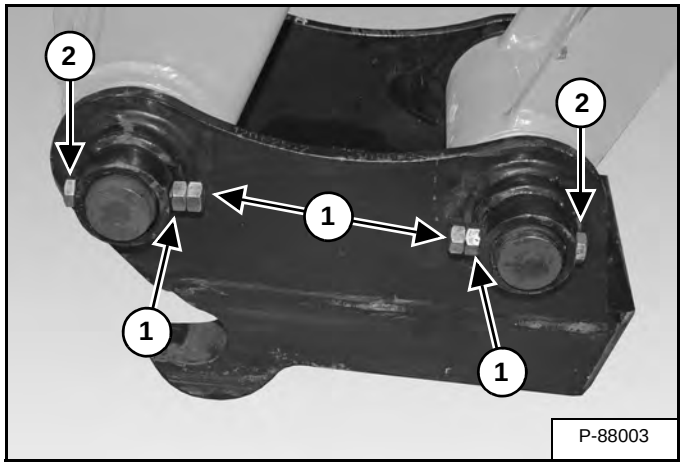
AVOID INJURY OR DEATH

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

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

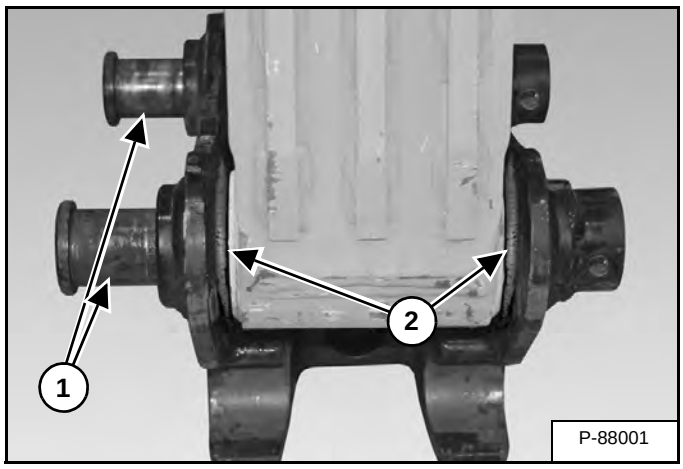
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Figure 40-241-2



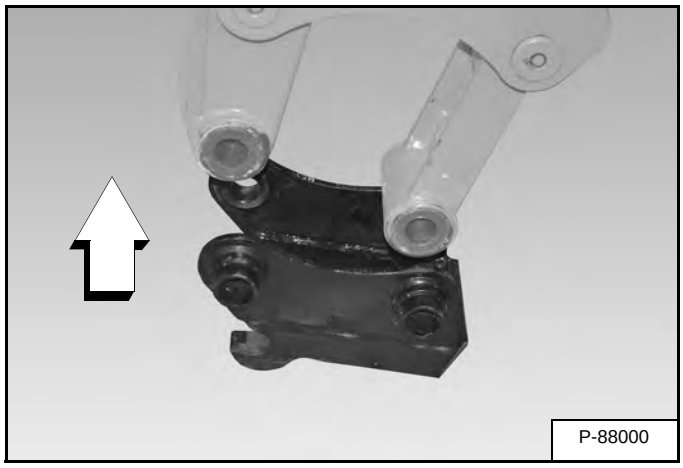
Remove the four nuts (Items 1). Remove the two bolts (Item 2) **[Figure 40-241-12]**.

Figure 40-241-3



Remove the two connecting pins (Item 1) and O-rings (Item 2) **[Figure 40-241-3]**.

Figure 40-241-4



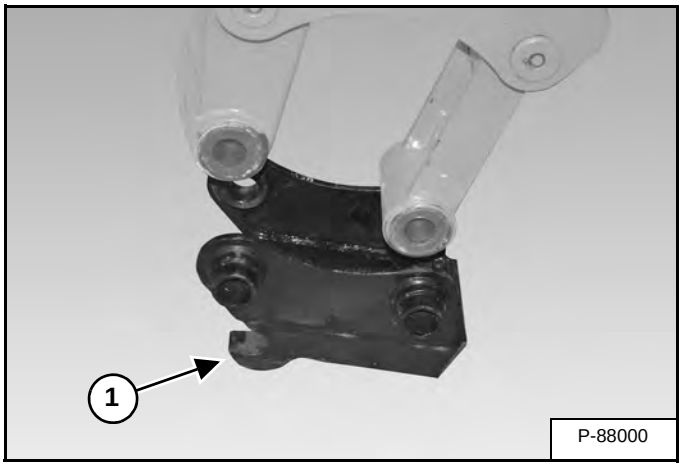
Raise the arm and bucket link until the quick coupler is free **[Figure 40-241-4]**.

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Installation (MS03 And MS08)

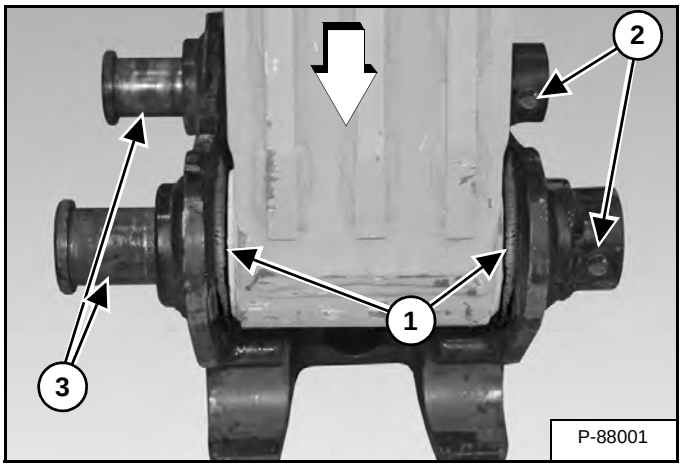
Figure 40-241-5



Place the coupler on the ground with the hooks (Item 1) **[Figure 40-241-5]** facing towards the excavator.

Align the arm and bucket link with the coupler **[Figure 40-241-5]**.

Figure 40-241-6



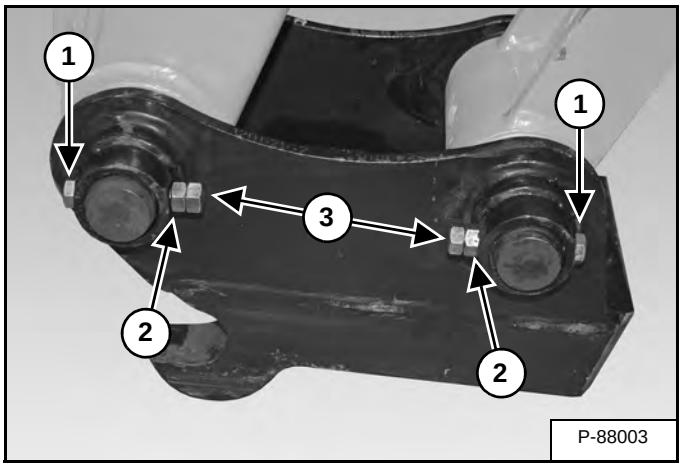
Install the O-rings (Item 1) **[Figure 40-241-6]** between the coupler pivot point and the arm and bucket link when lowering into position.

NOTE: The O-rings will prevent dirt and debris from entering the pivot points of the coupler.

Align the holes of the connecting pins with the holes (Item 2) **[Figure 40-241-6]** in the coupler.

Install the two pins (Item 3) **[Figure 40-241-6]** through the coupler, arm and bucket link.

Figure 40-241-7



Install the two bolts (Item 1) **[Figure 40-241-7]**.

Install nuts (Item 2) **[Figure 40-241-7]** just until contact is made with the coupler.

NOTE: Do Not tighten nuts (Item 2) [Figure 40-241-7] against the coupler. The retaining bolt must rotate freely.

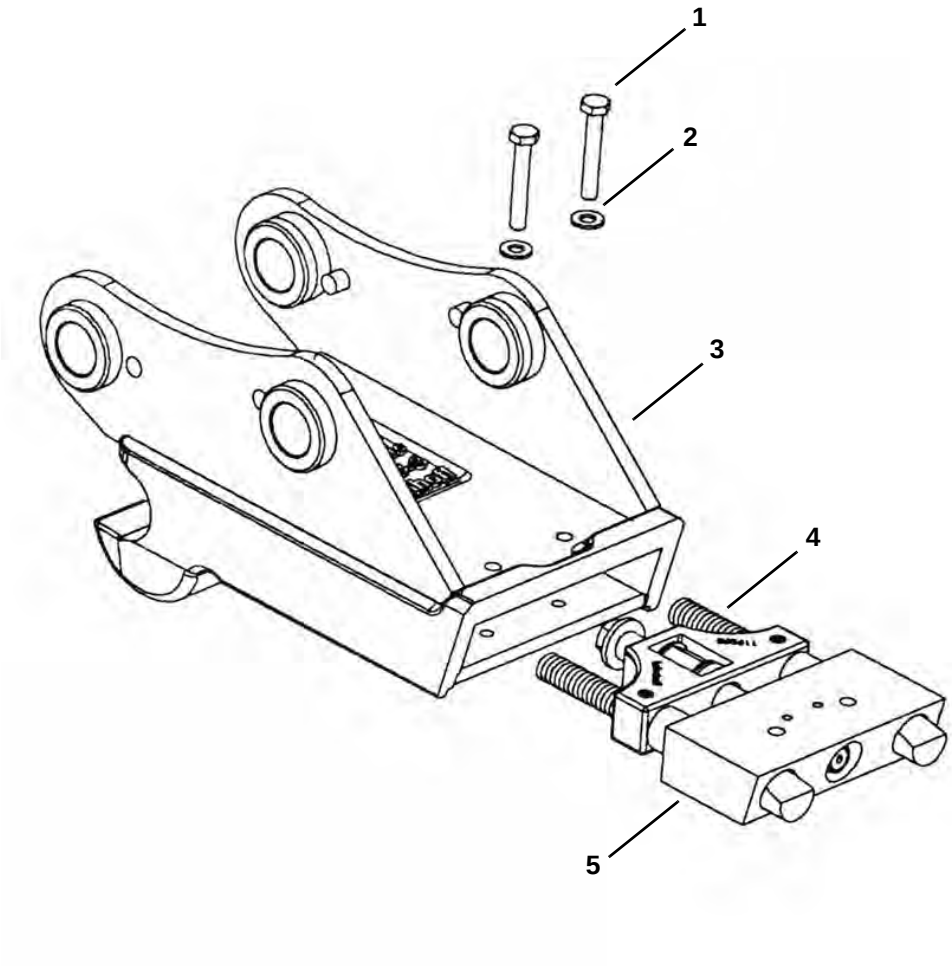
Install and tighten nuts (Item 3) securely against the two nuts (Item 2) **[Figure 40-241-7]**. The retaining bolts must rotate freely.

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Parts Identification (MS03)

1. Bolt
2. Lock Washer
3. Coupler Housing
4. Pressure Spring
5. Locking Mechanism



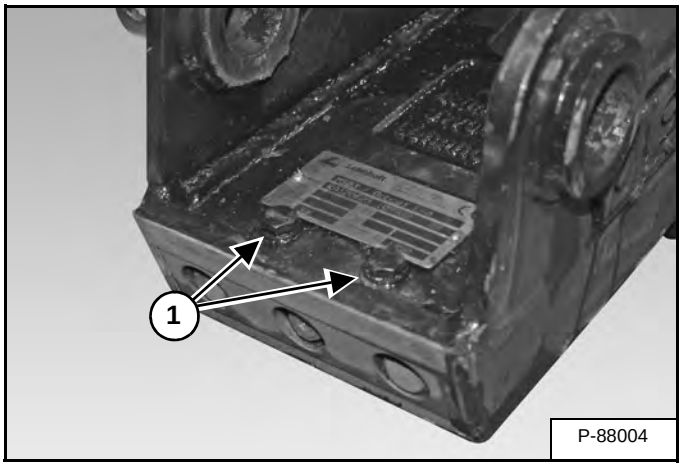
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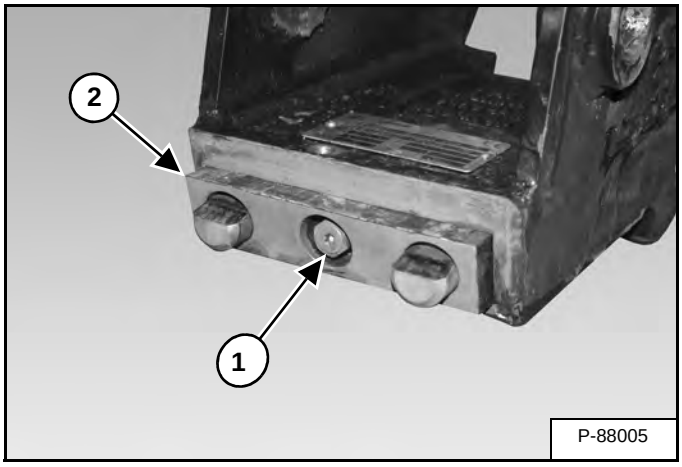
Disassembly And Assembly (MS03)

Figure 40-241-8



Remove the two bolts (Item 1) **[Figure 40-241-8]** and lock washers.

Figure 40-241-9



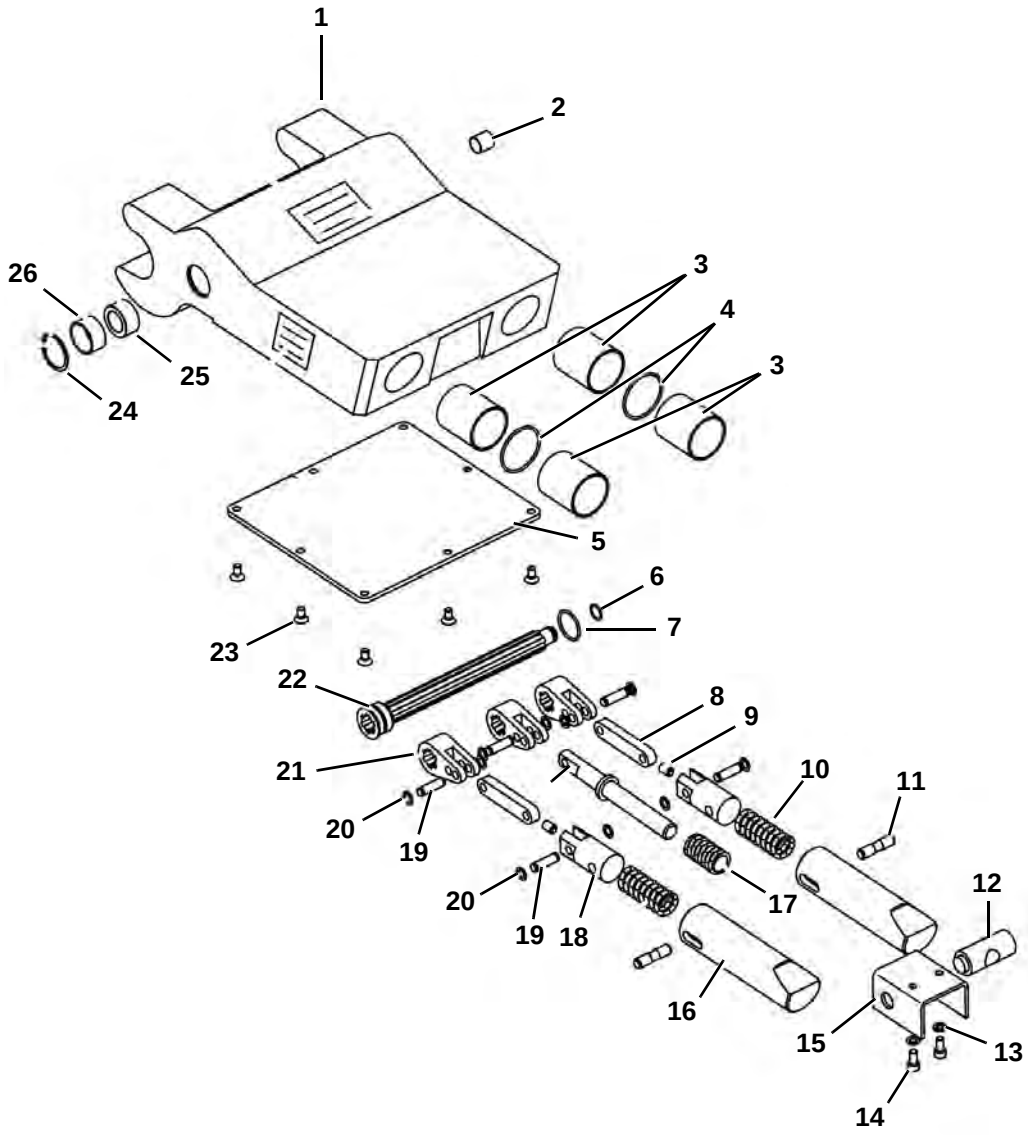
Turn the threaded spindle (Item 1) counterclockwise until the locking mechanism (Item 2) **[Figure 40-241-9]** is free from the housing.

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Parts Identification (MS08)

1. Housing
2. Bushing
3. Bushing
4. O-ring
5. Cover
6. O-ring
7. O-ring
8. Reversing Lever
9. Threaded Pin
10. Pressure Spring
11. Pin
12. Pivoting Journal
13. Spring Washer
14. Bolt
15. Bearing Block
16. Locking Pin
17. Pressure Spring
18. Thrust Journal
19. Pin
20. O-ring
21. Driving Fork
22. Control Shaft
23. Bolt
24. Snap Ring
25. Bushing
26. Bushing



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Disassembly (MS08)

⚠ WARNING

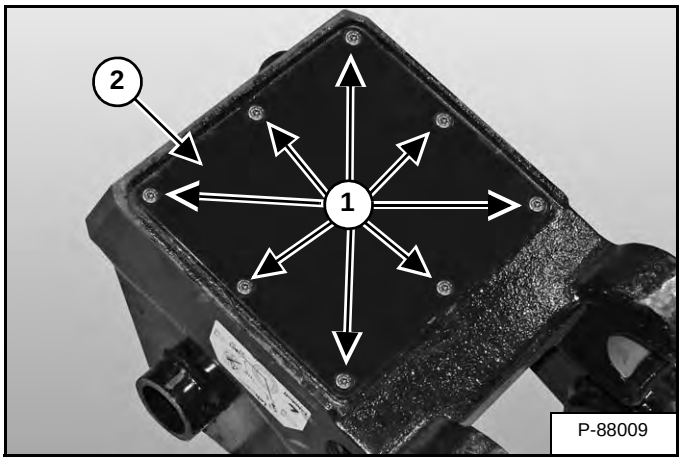
AVOID INJURY OR DEATH

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

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

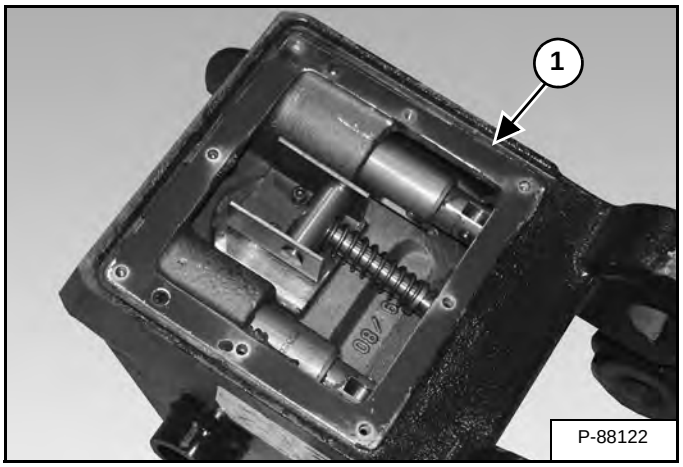
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Figure 40-241-10



Remove the eight bolts (Item 1) and cover (Item 2) **[Figure 40-241-10]**.

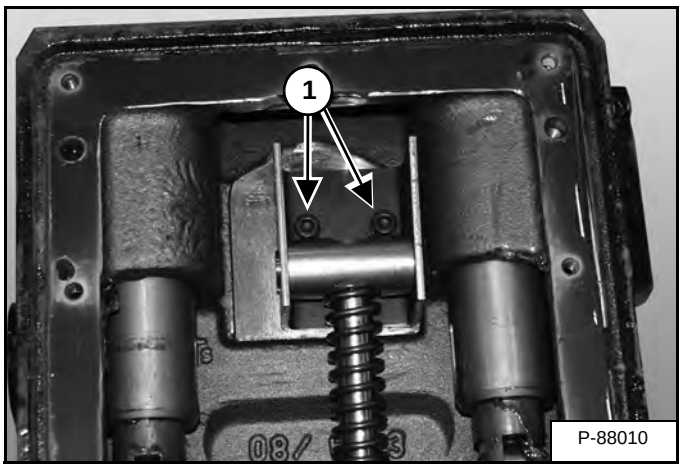
Figure 40-241-11



Remove all sealant (Item 1) **[Figure 40-241-11]** from the housing and cover.

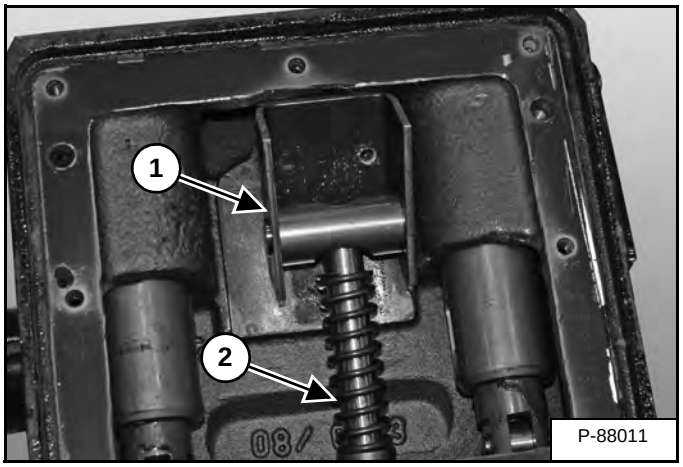
NOTE: Do not scratch the mounting surface while removing sealant.

Figure 40-241-12



Remove the two bolts (Item 1) **[Figure 40-241-12]**.

Figure 40-241-13



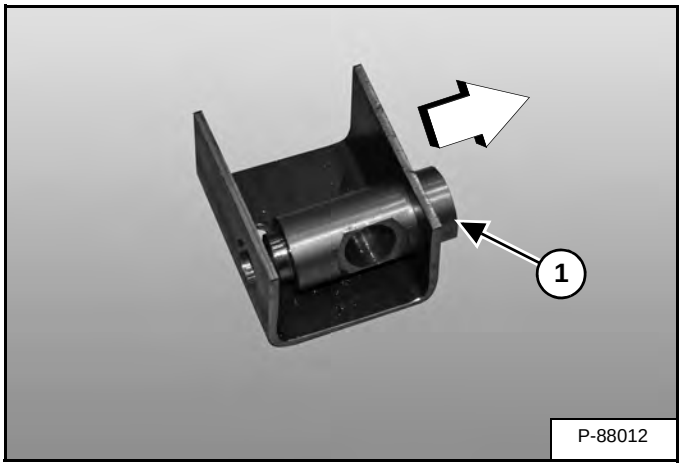
Tilt the bearing block and pivoting journal (Item 1) up and remove from the spring guide (Item 2) **[Figure 40-241-13]**.

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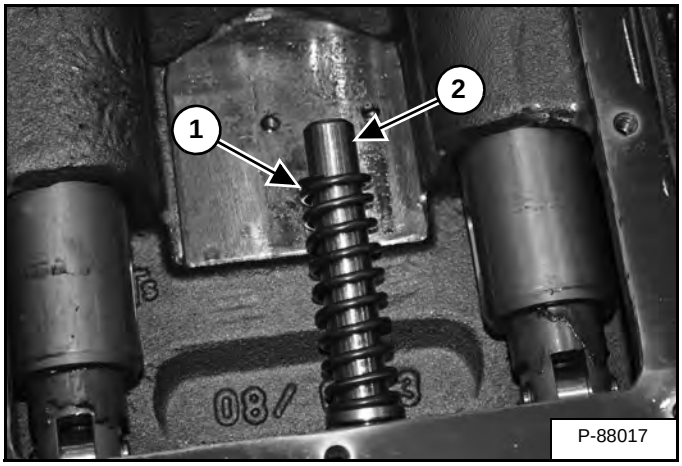
Disassembly (MS08) (Cont'd)

Figure 40-241-14



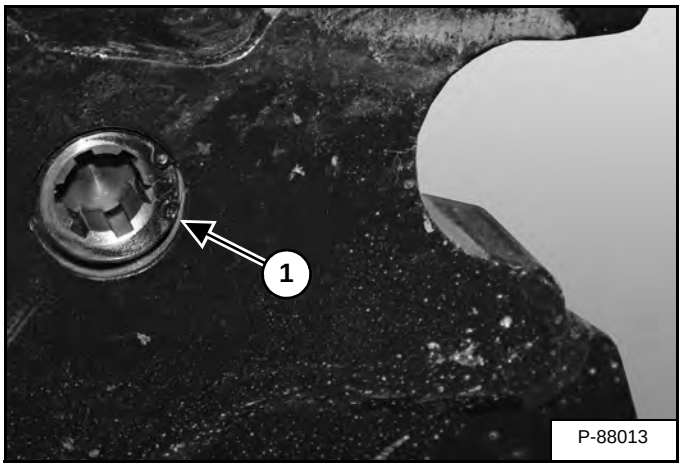
Remove the pivoting journal (Item 1) **[Figure 40-241-14]** from the bearing block.

Figure 40-241-15



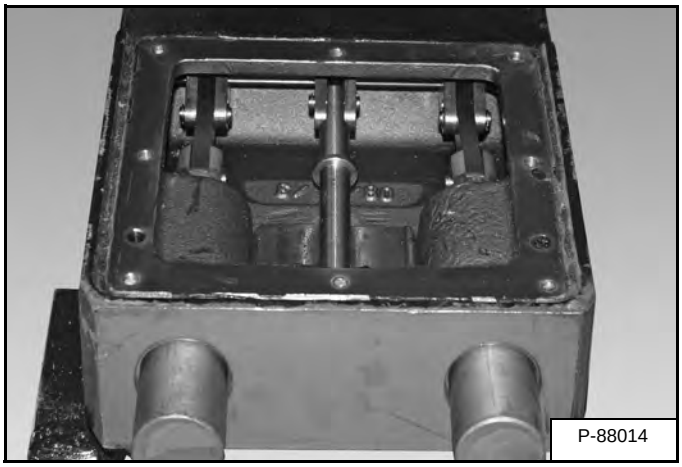
Remove the pressure spring (Item 1) from the spring guide (Item 2) **[Figure 40-241-15]**.

Figure 40-241-16



Remove the snap ring (Item 1) **[Figure 40-241-16]**.

Figure 40-241-17



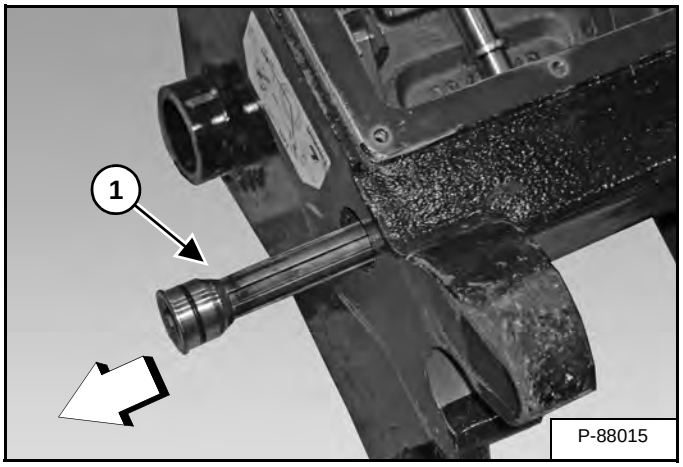
NOTE: Before removing the control shaft, note the position of each of the components so that when the coupler is reassembled all components are positioned correctly on the control shaft [Figure 40-241-17].

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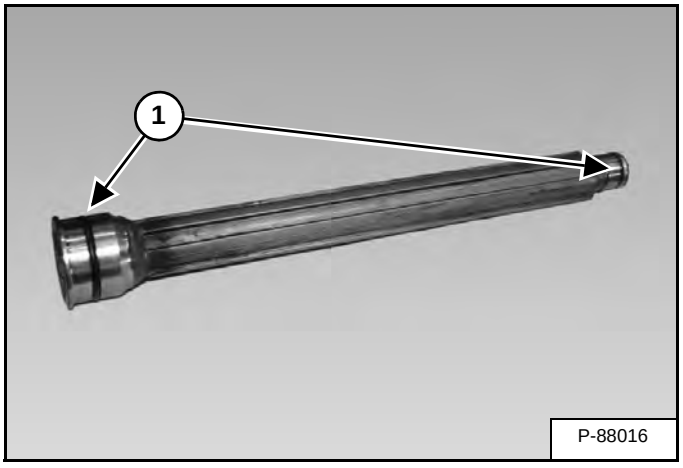
Disassembly (MS08) (Cont'd)

Figure 40-241-18



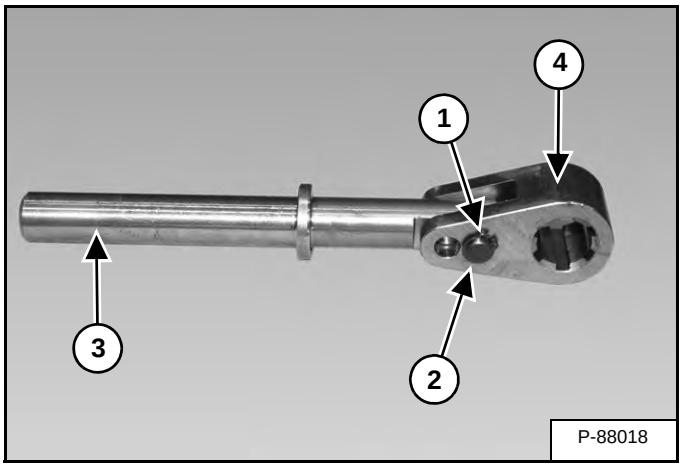
Remove the control shaft (Item 1) **[Figure 40-241-18]**.

Figure 40-241-19



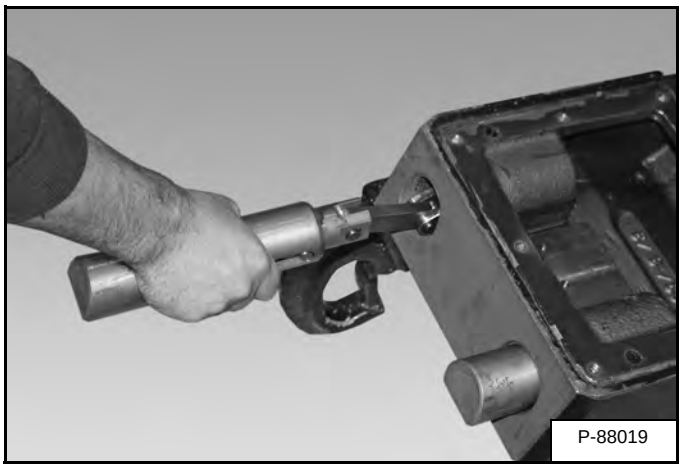
Remove O-rings (Item 1) **[Figure 40-241-19]**.

Figure 40-241-20



Remove the snap ring (Item 1) and pin (Item 2). Remove the spring guide (Item 3) from the driving fork (Item 4) **[Figure 40-241-20]**.

Figure 40-241-21



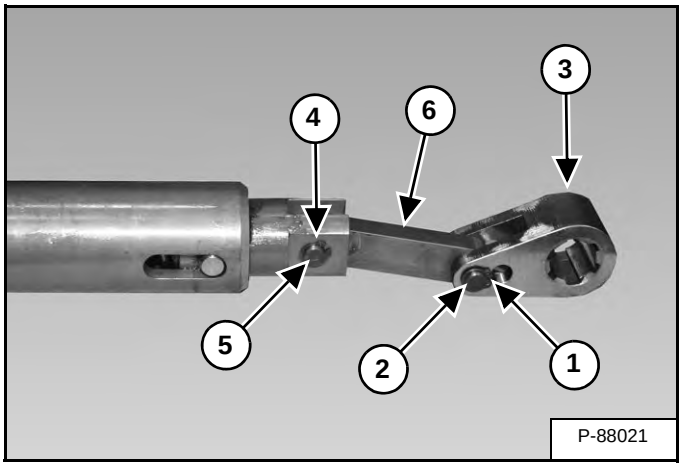
Remove the locking pin assemblies **[Figure 40-241-21]**.

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Disassembly (MS08) (Cont'd)

Figure 40-241-22

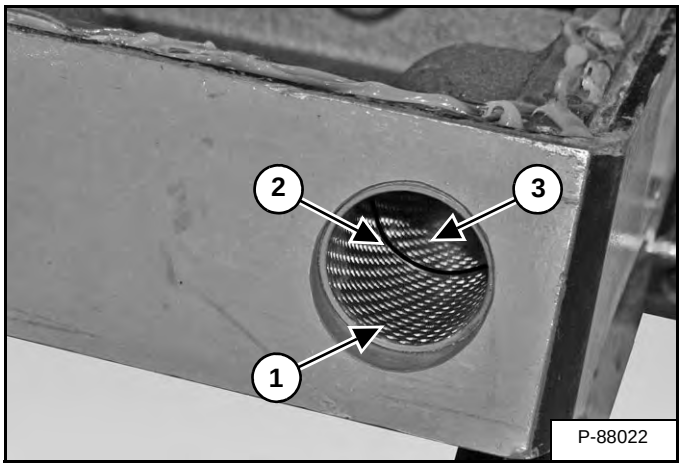


Remove the snap ring (Item 1) and pin (Item 2). Remove the driving fork (Item 3) **[Figure 40-241-22]**.

Remove the snap ring (Item 4) and pin (Item 5). Remove the reversing lever (Item 6) **[Figure 40-241-22]**.

Repeat the procedure for the other locking pin.

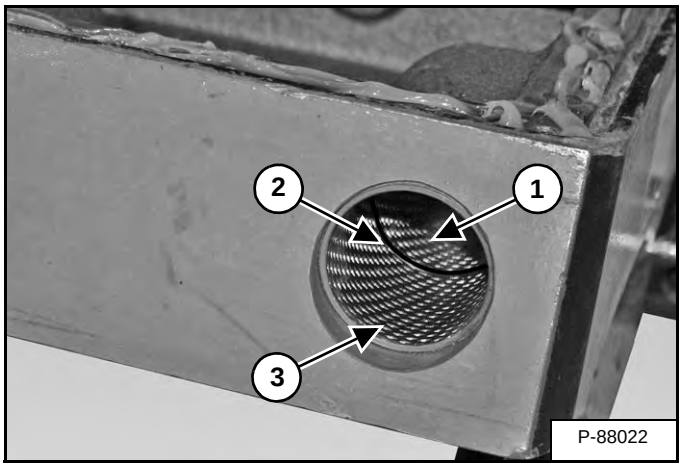
Figure 40-241-23



Remove the bushing (Item 1), O-ring (Item 2) and bushing (Item 3) **[Figure 40-241-23]** from both locking pin bores.

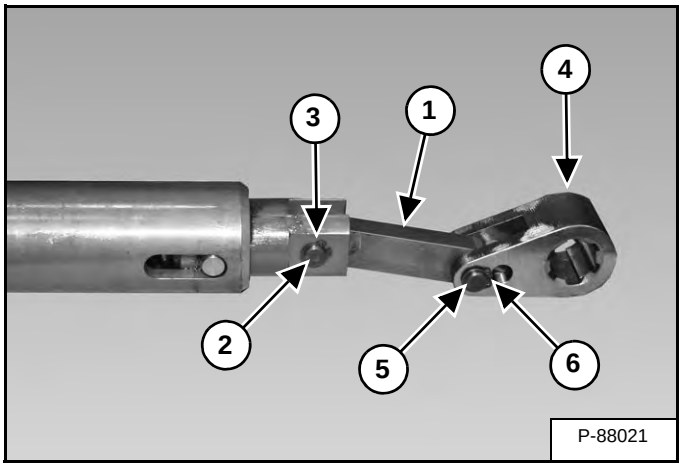
Assembly (MS08)

Figure 40-241-24



Install bushing (Item 1), O-ring (Item 2) and bushing (Item 3) **[Figure 40-241-24]** in both locking pin bores.

Figure 40-241-25



Install reversing lever (Item 1), pin (Item 2) and snap ring (Item 3) **[Figure 40-241-25]** on the locking pin.

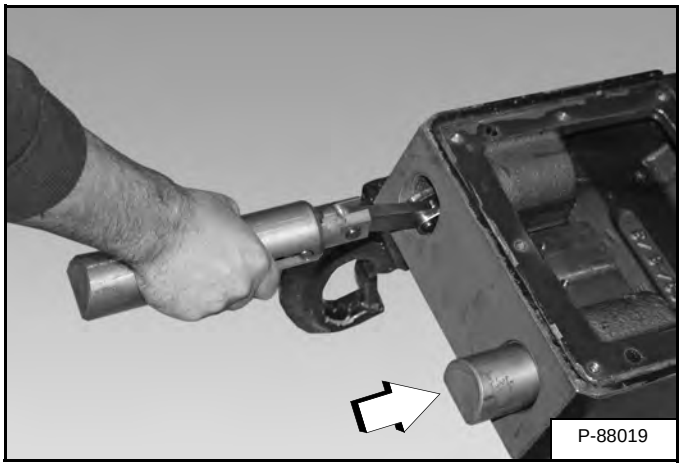
Install the driving fork (Item 4), pin (Item 5) and snap ring (Item 6) **[Figure 40-241-25]** on the reversing lever. Repeat the procedure for the other locking pin.

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Assembly (MS08) (Cont'd)

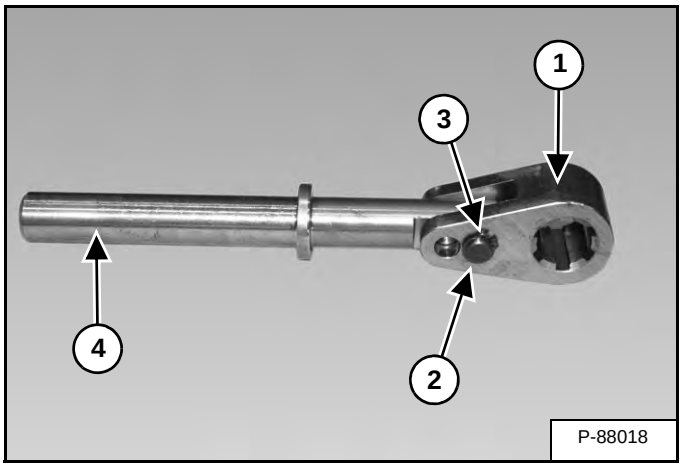
Figure 40-241-26



Install the locking pin assemblies **[Figure 40-241-26]**.

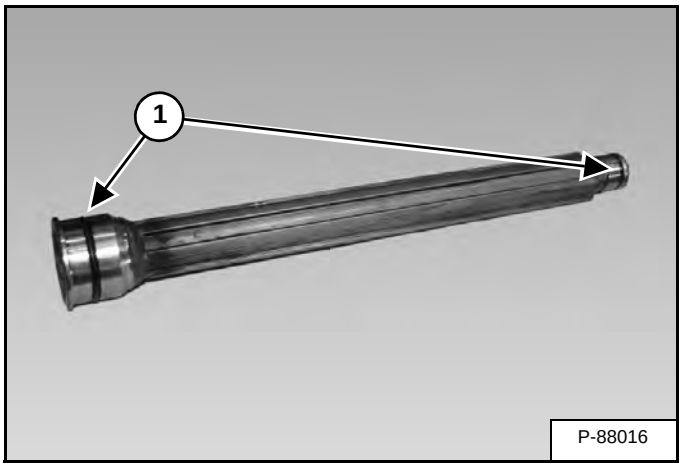
NOTE: Position the locking levers with the flat side down and away from the cover.

Figure 40-241-27



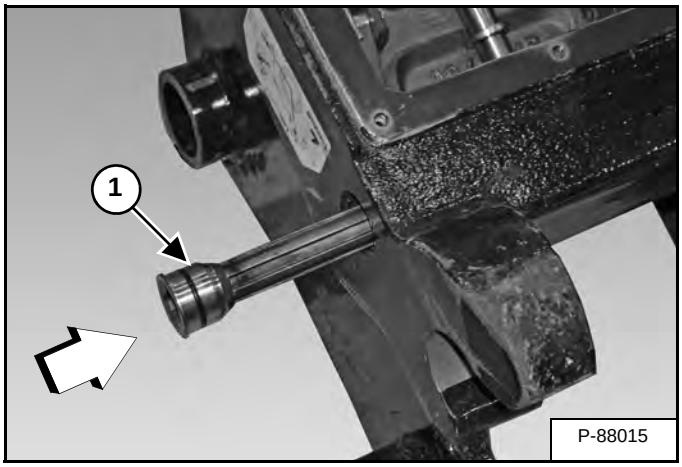
Install the driving fork (Item 1), pin (Item 2) and snap ring (Item 3) on the spring guide (Item 4) **[Figure 40-241-27]**.

Figure 40-241-28



Install the O-rings (Item 1) **[Figure 40-241-28]**.

Figure 40-241-29



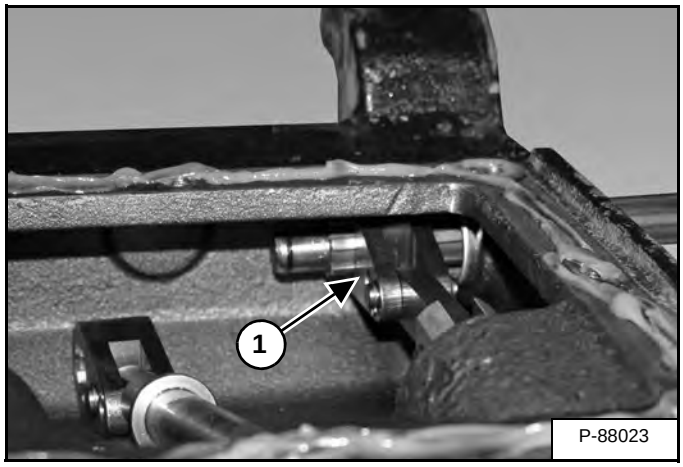
Install the control shaft (Item 1) **[Figure 40-241-29]**.

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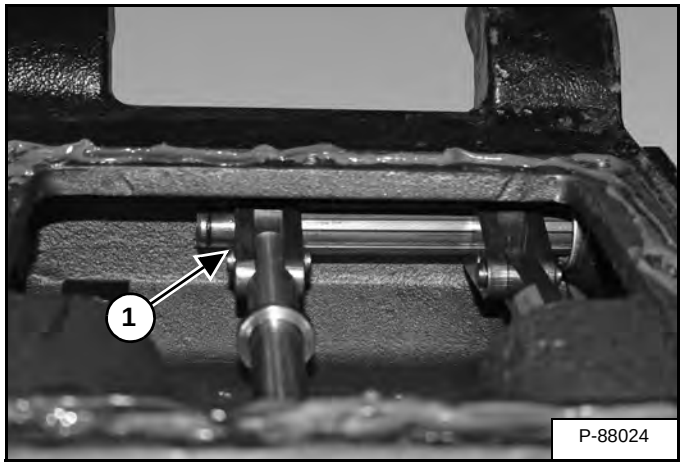
Assembly (MS08) (Cont'd)

Figure 40-241-30



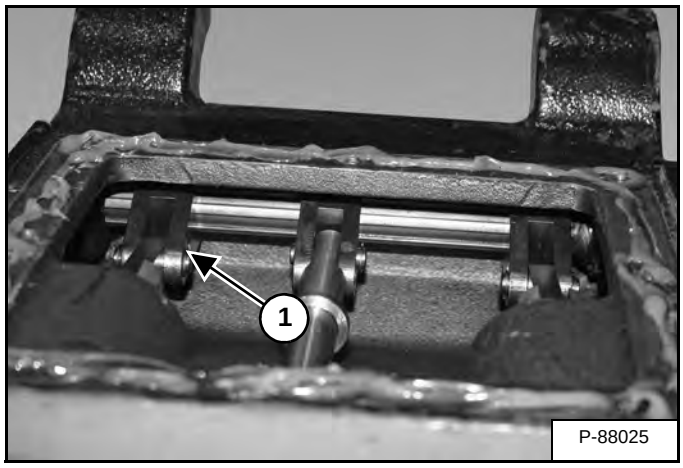
Install the control shaft through the first locking lever driving fork (Item 1) **[Figure 40-241-30]**.

Figure 40-241-31



Install the control shaft through the spring guide driving fork (Item 1) **[Figure 40-241-31]**.

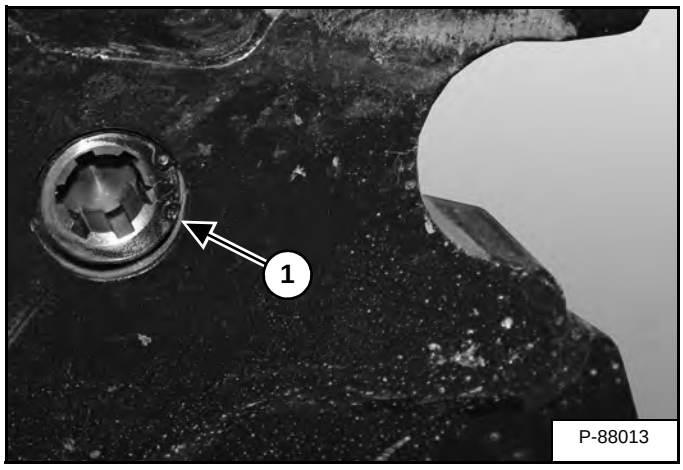
Figure 40-241-32



Install the control shaft through the second locking lever driving fork (Item 1) **[Figure 40-241-32]**.

NOTE: Check proper alignment of all three driving forks on the control shaft. If not aligned properly, repeat the procedure.

Figure 40-241-33



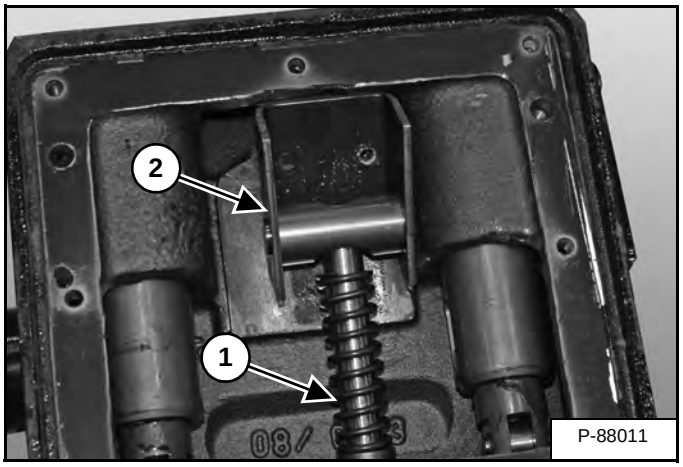
Install the snap ring (Item 1) **[Figure 40-241-33]**.

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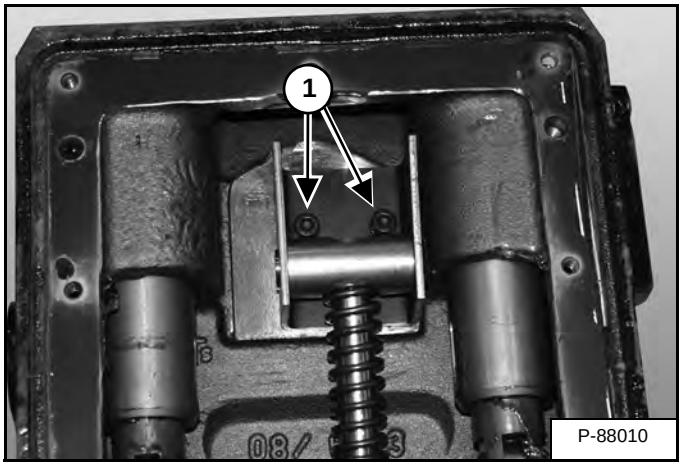
Assembly (MS08) (Cont'd)

Figure 40-241-34



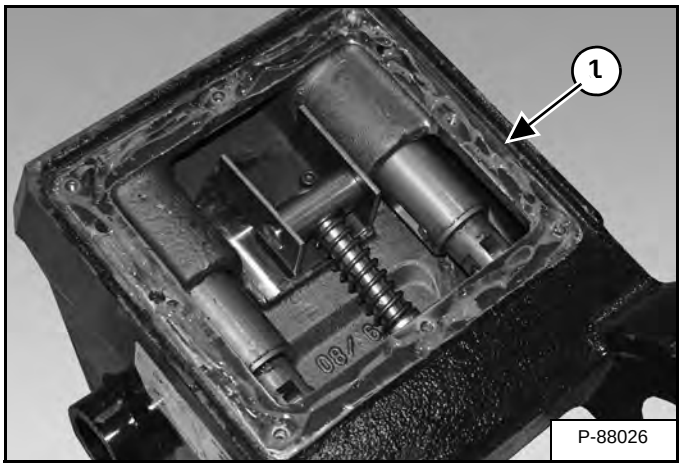
Install pressure spring (Item 1) on the spring guide. Tilt the bearing block and pivoting journal (Item 2) **[Figure 40-241-34]** down and install on the spring guide.

Figure 40-241-35



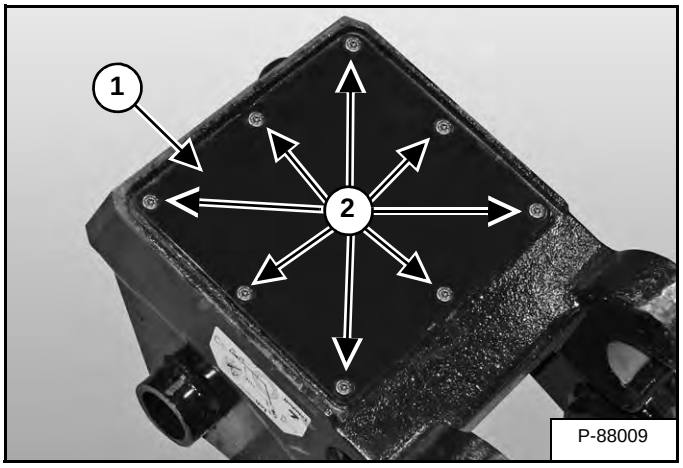
Install the two bolts (Item 1) **[Figure 40-241-35]**.

Figure 40-241-36



Apply a bead of sealant around the cover mounting surface (Item 1) **[Figure 40-241-36]**.

Figure 40-241-37



Install the cover (Item 1) **[Figure 40-241-37]**.

Apply Loctite® 242 on the eight bolts.

Install the eight bolts (Item 2) **[Figure 40-241-37]**.

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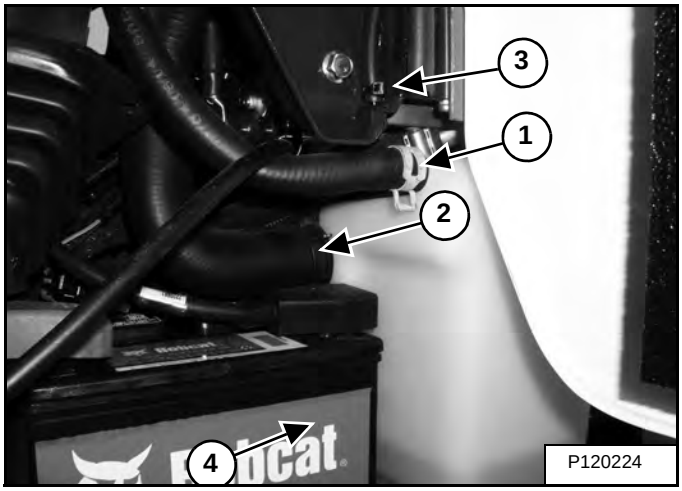
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RIGHT SIDE COVER

Removal And Installation

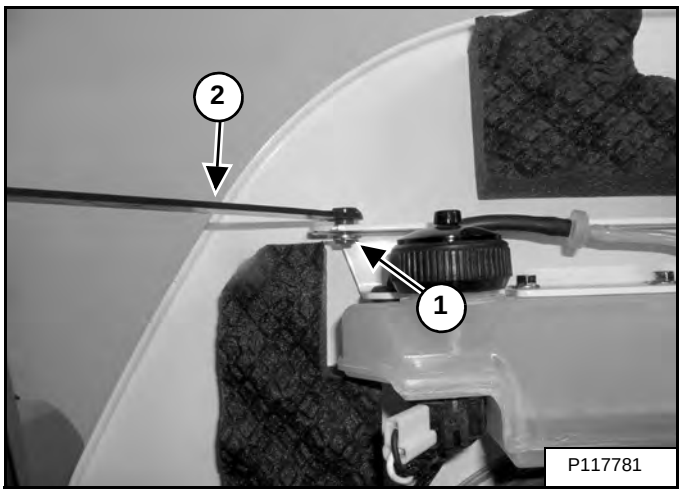
Open the right side cover.

Figure 40-250-1



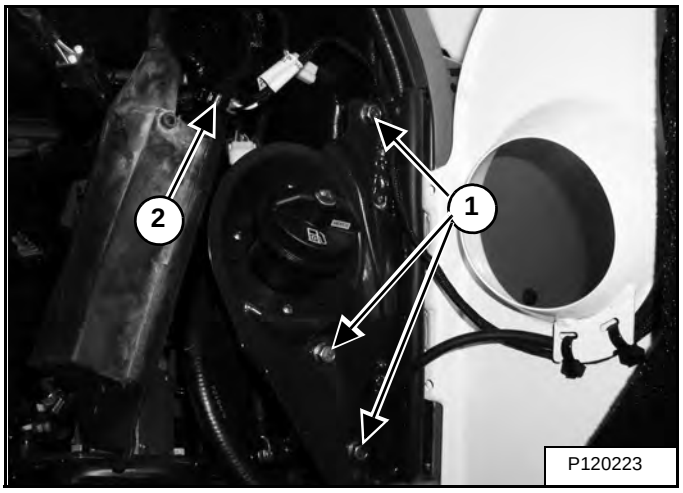
Remove the fuel tank vent hose (Item 1), fill hose (Item 2) and washer fluid hose (Item 3) **[Figure 40-250-1]**.

Figure 40-250-2



Remove the retaining clip (Item 1) and the door stop (Item 2) **[Figure 40-250-2]** from the cover.

Figure 40-250-3



Remove the cover hinge bolts (Item 1) and disconnect the window washer pump harness (Item 2) **[Figure 40-250-3]**.

Remove the cover assembly.

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TOOL BOX

Removal And Installation

Open the tool box access door.

Figure 40-260-1

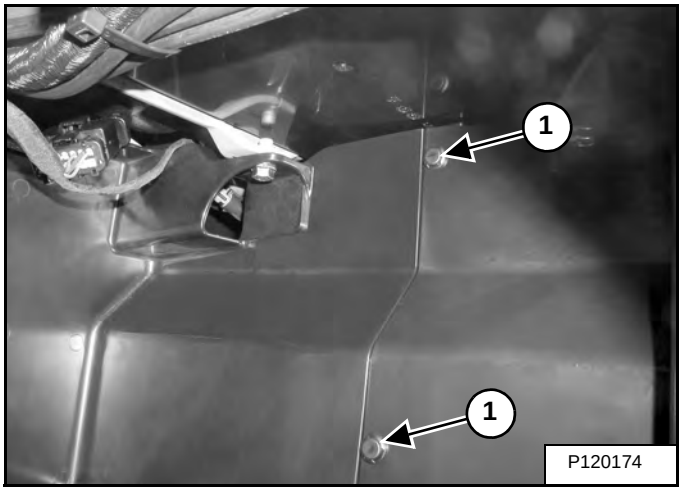
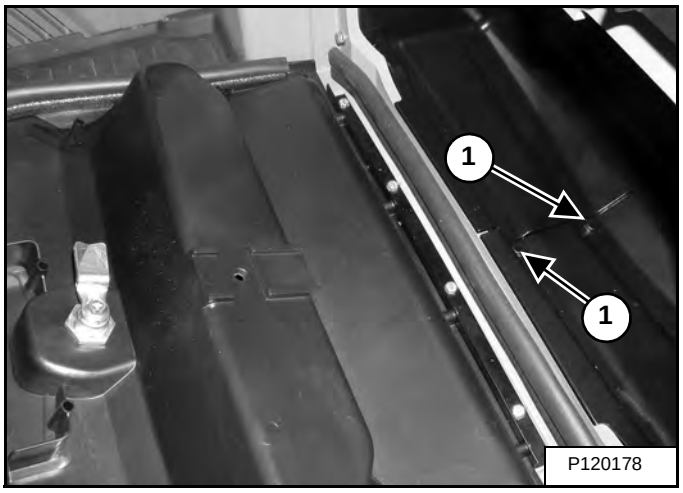
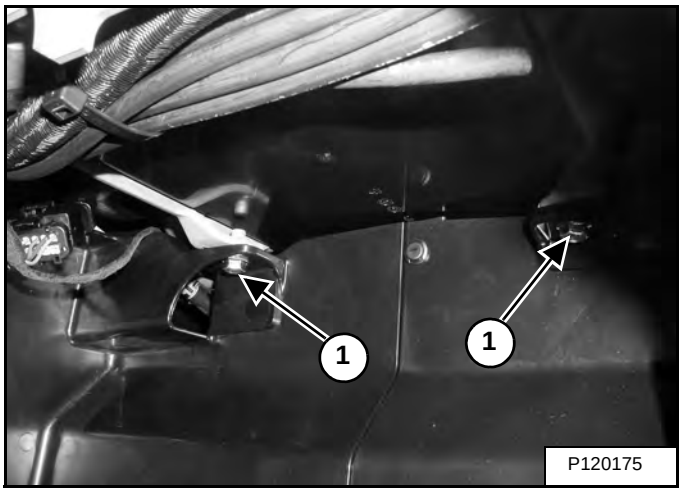


Figure 40-260-2



Remove the rivet fasteners (Item 1) **[Figure 40-260-1]** and **[Figure 40-260-2]**.

Figure 40-260-3



Remove the bolts (Item 1) **[Figure 40-260-3]**.

Figure 40-260-4

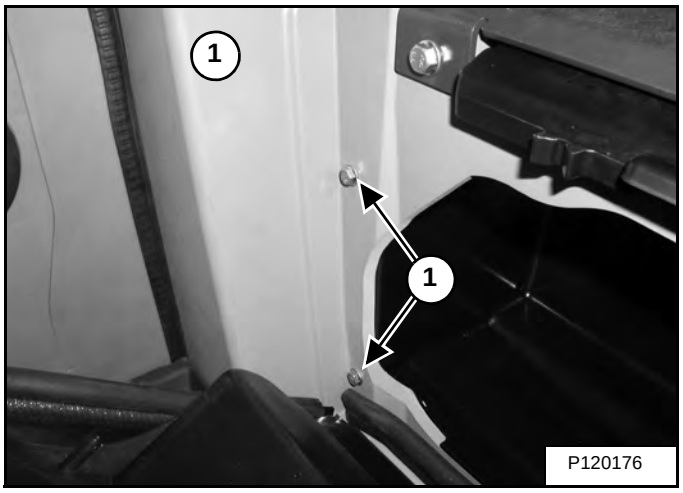
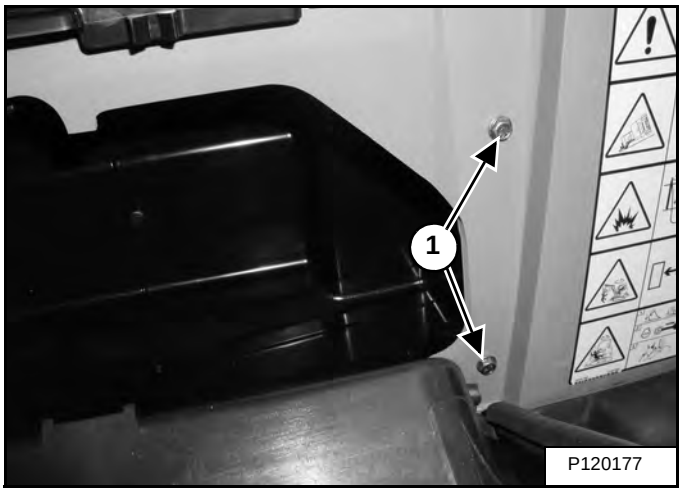


Figure 40-260-5



Remove the bolts (Item 1) **[Figure 40-260-4]** and **[Figure 40-260-5]**.

Remove the tool box panels.

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De

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HARNESSES PN# DX17Z, E17, E17z, E19, E20	
HARNESS BOOM LIGHT	7135895
HARNESS DIFF SWITCH ZTS / CTS	7198838 / 7228452
HARNESS VALVE SWITCH (IF EQUIPTED)	7217804
HARNESS MOTION ALARM (IF EQUIPTED)	7217809
HARNESS ENGINE	7217815
HARNESS JUMPER (IF EQUIPTED)	7232729
HARNESS WASHER BOTTLE (IF EQUIPTED)	7238179
HARNESS EH CONTROL (IF EQUIPTED)	7243646
HARNESS FRAME	7244548
HARNESS OWD (IF EQUIPTED)	7250792
HARNESS KEYED	7251398
HARNESS CAB KITS (IF EQUIPTED)	7266940
HARNESS REAR LIGHT (IF EQUIPTED)	7258225
HARNESS BEACON / STROBE (IF EQUIPTED)	7258226
HARNESS WORK LIGHT CANOPY (IF EQUPTED)	7258227
HARNESS LIGHT EXTENSION (IF EQUIPTED)	7258228
HARNESS CANOPY KITS (IF EQUIPTED)	7258229
HARNESS 2ND AUX (IF EQUIPPED)	7267960
HARNESS CAB (IF EQUIPTED) - FMS SUPPLIER	BC7229928
HARNESS WIPER (IF EQUIPTED) - FMS SUPLLIER	BC7230196

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E19 (S/N AWMM11001 - AWMM12393)

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J1 CONNECTOR ASSIGNMENTS (CONTROLLER PRIMARY)			
PIN	FUNCTION	PIN	FUNCTION
A-01	AUX ROD RETURN	B-01	LOAD SENSE PRESSURE SENSOR
A-02	OFFSET ROD RETURN	B-02	UNSWITCHED BATTERY P1
A-03	FUEL PULL RELAY	B-03	UNSWITCHED BATTERY P2
A-04	SWITCHED POWER OUT RELAY	B-04	FUEL SOL HOLD
A-05	LIGHTS RELAY	B-05	OFFSET ROD SOL
A-06	GLOW PLUG RELAY	B-06	2 SPEED SOL
A-07	STARTER RELAY	B-07	OFFSET BASE SOL
A-08	WARNING BUZZER	B-08	CAN_LO_1
A-09	PB VALVE RELAY	B-09	CAN_HI_1
A-10	OFFSET BASE RETURN	B-10	OFFSET POT INPUT
A-11	SPARE	B-11	CONSOLE POSITION SENSOR
A-12	AUX POT INPUT	B-12	FUEL LEVEL SENSOR
A-13	2 SPEED SWITCH INPUT	B-13	AUX ROD SOL
A-14	GLOW PLUG RELAY FDBK	B-14	CAN_HI_2
A-15	ENGINE SPEED SENSOR	B-15	GROUND P1
A-16	SPARE	B-16	GROUND P2
A-17	SPARE	B-17	SENSOR GROUND REFERENCE
A-18	AUX BASE RETURN	B-18	ENGINE COOLANT TEMP SENSOR
A-19	SPARE	B-19	AUX BASE SOL
A-20	OVERLOAD SENSOR	B-20	CAN_LO_2
A-21	SWITCHED POWER OUT RELAY FDBK	B-21	REMOTE KEY
A-22	STARTER RELAY FDBK	B-22	KEY RUN
A-23	SPARE	B-23	SENSOR SUPPLY 1 (8 VOLT)
A-24	CRANK INPUT	B-24	SENSOR SUPPLY 1 (5 VOLT)
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A-28	OVERLOAD WARNING DEVICE ENABLE		
A-29	AUX DETENT		
A-30	FUEL PULL RELAY FDBK		
A-31	PB VALVE REALY FDBK		
A-32	SPARE		
A-33	TRAVEL LEVER POS SWITCHES		
A-34	HYD OIL FILTER BYPASS SWITCH		

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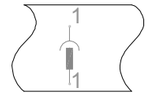
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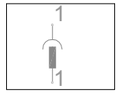
WIRE CATEGORIES FOR COLORS AND NUMBER RANGE			
GROUP DESCRIPTION	**GROUP NUMBER RANGE**	**WIRE COLOR**	**COLOR CODE**
BATT FEED, GENERAL	1000 THROUGH 1499	RED	RED
BATT FEED, FUSED	1000 THROUGH 1499	RED/WHITE	RED/WHT
BATT FEED, SWITCHED	1500 THROUGH 1999	ORANGE/WHITE	RNG/WHT
BATTERY GROUND	2000 THROUGH 2999	BLACK	BLK
CONTROLLER GROUND	2000 THROUGH 2999	BROWN	BRN
MONITORING	3000 THROUGH 3999	LIGHT BLUE	LBL
HYDRAULIC	4000 THROUGH 4999	LIGHT GREEN	LGN
CONTROLLER SUPLY (5V, 8V)	5000 THROUGH 5999	YELLOW	YEL
LIGHTS	6000 THROUGH 6999	PINK	PNK
OTHER FUNCTIONS	7000 THROUGH 7999	WHITE	WHT
ENGINE	8000 THROUGH 8999	TAN	TAN
COMMUNICATION CAN LO	90XX, 92XX, 94XX, 96XX, 98XX	PURPLE	PUR
COMMUNICATION CAN HI	91XX, 93XX, 95XX, 97XX, 99XX	PURPLE/WHITE	PUR/WHT

LEGEND

PARTIAL CONNECTOR



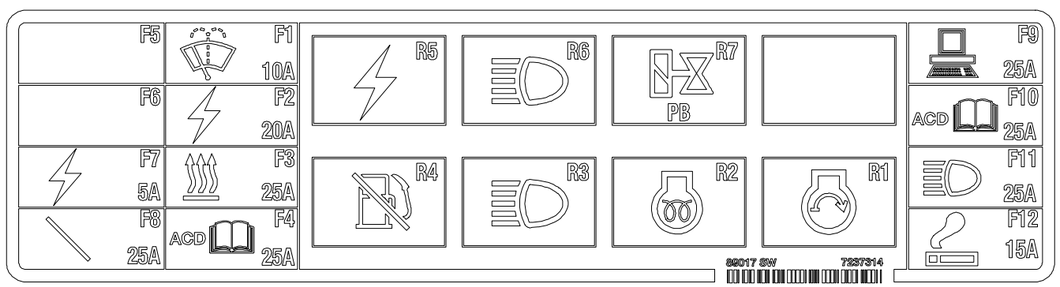
CONNECTOR



WIRE BREAK
(TWO WIRE BREAKS
JOIN ONE WIRE)

SHEET #

FUSE RELAY CENTER



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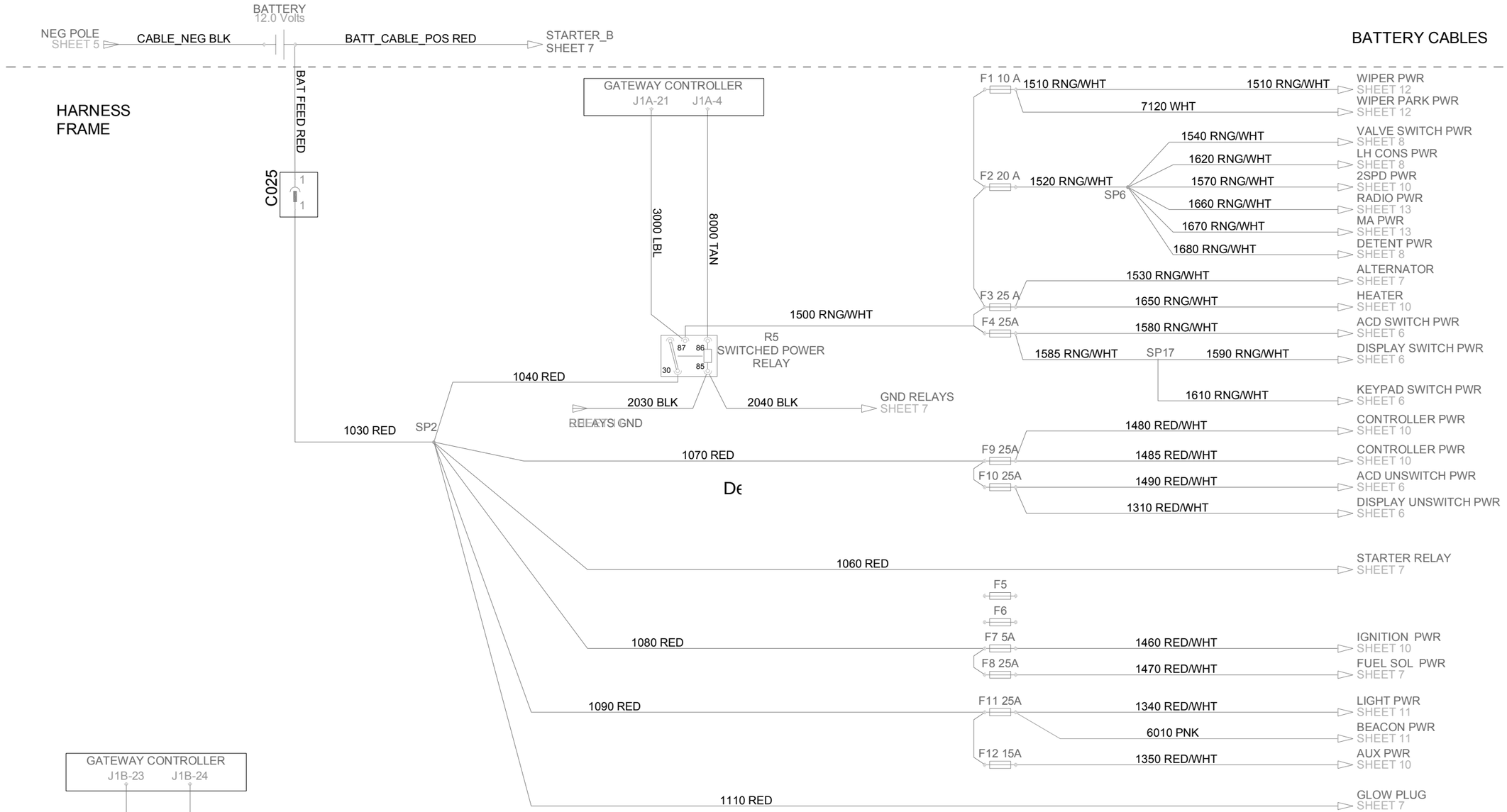
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POWER



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GROUND

HARNESS
FRAME

GATEWAY CONTROLLER
J1B-17

2510 BRN

SP10

SIG GND
SHEET 7 — 2500 BRN

SIG GND
SHEET 7

SIG GND
SHEET 8 — 4270 LGN

FUEL GND
SHEET 10 — 2570 BRN

SIG GND
SHEET 12 — 2580 BRN

SIG GND
SHEET 12 — 2630 BRN

SIG GND
SHEET 12 — 2640 BRN

SIG GND
SHEET 12 — 2650 BRN

HARNESS
CAB

CAB LIGHT GND
SHEET 11 — 2220 BLK

LIGHTS GND
SHEET 11 — 2240 BLK

WIPER GND
SHEET 12 — 2250 BLK

RADIO GND
SHEET 13

SP7

2340 BLK

C008
E E

2340 BLK

RELAYS GND
SHEET 7 — 2080 BLK

2SPD GND
SHEET 8 — 2540 BRN

RTR UC GND
SHEET 8 — 2120 BLK

PB SOLENOID GND
SHEET 8 — 2130 BLK

ACD GND
SHEET 6 — 2140 BLK

DISPLAY GND
SHEET 6 — 2150 BLK

KEYPAD GND
SHEET 6 — 2170 BLK

CONTROLLER GND
SHEET 10 — 2180 BLK

CONTROLLER GND
SHEET 10 — 2190 BLK

BUZZER GND
SHEET 10 — 2200 BLK

SP4

2090 BLK

AUX GND
SHEET 10 — 2210 BLK

WASHER GND
SHEET 12 — 2370 BLK

HORN GND
SHEET 12 — 2260 BLK

FILTER GND
SHEET 8 — 2350 BLK

HEATER GND
SHEET 10 — 2270 BLK

SP5

2100 BLK

T014

FRAME GND

BOOM LIGHT GND
SHEET 11 — 2940 BLK

MA GND
SHEET 13 — 2360 BLK

LIGHT GND
SHEET 11 — 2380 BLK

2310 BLK

2900 BLK

C110
6
6

BEACON
SWITCH

C109
6
6

LOAD MOMENT
SWITCH

BATTERY CABLES

BATTERY
DISCONNECT

16 BLK — CABLE_NEG BLK — NEG POLE
SHEET 4

16 BLK

FRAME GNG

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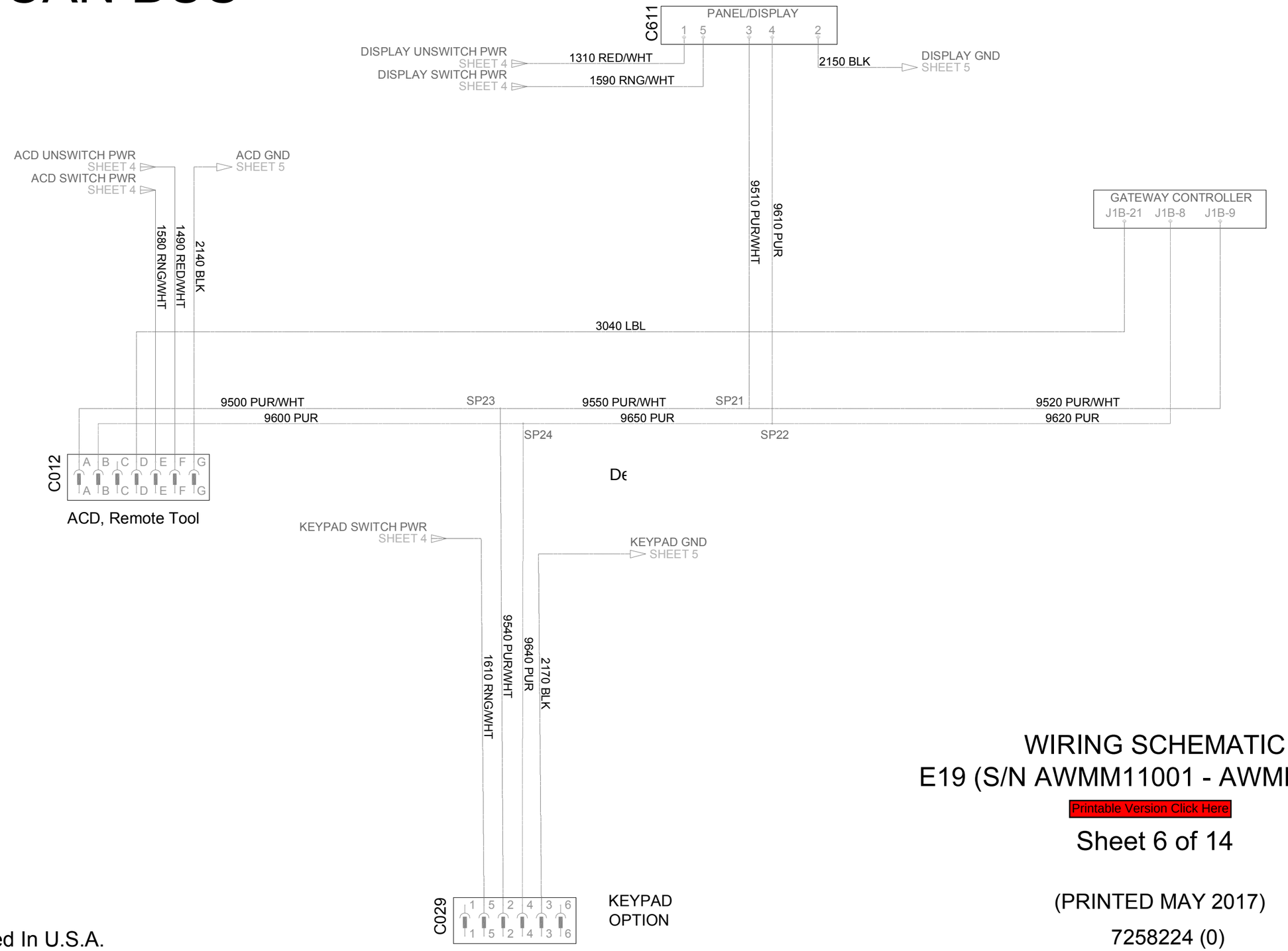
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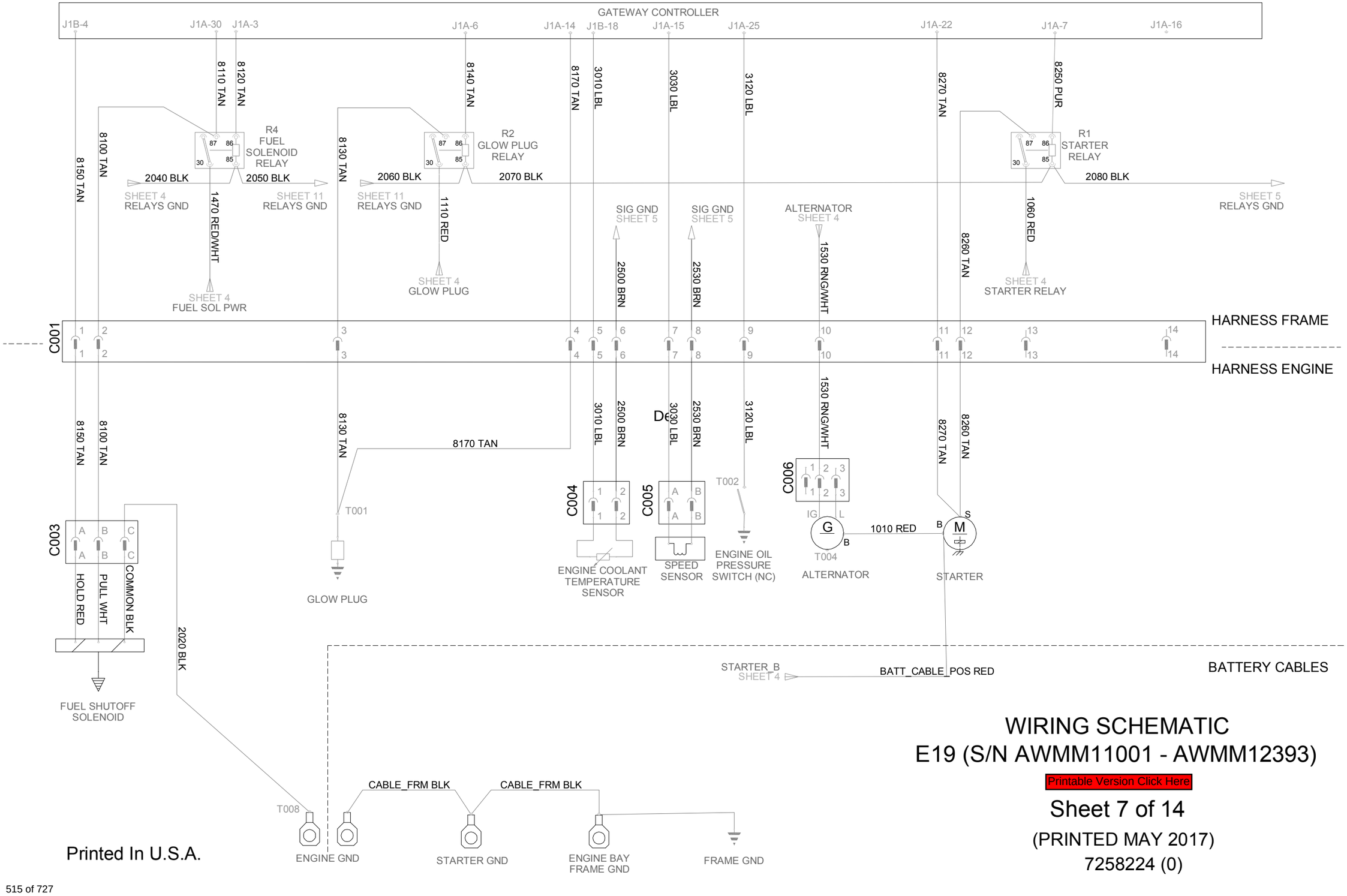
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ENGINE



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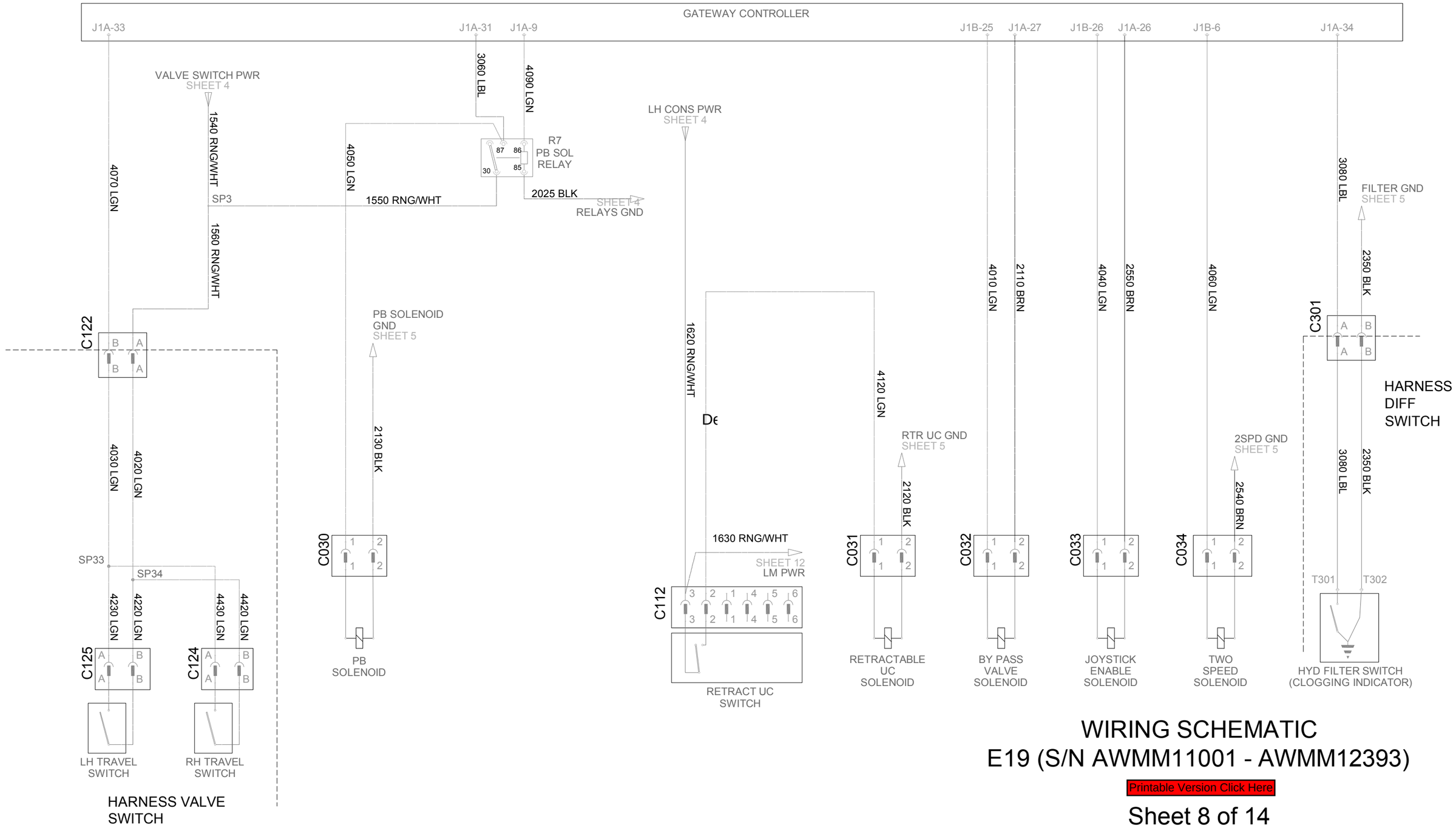
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HYDRAULICS



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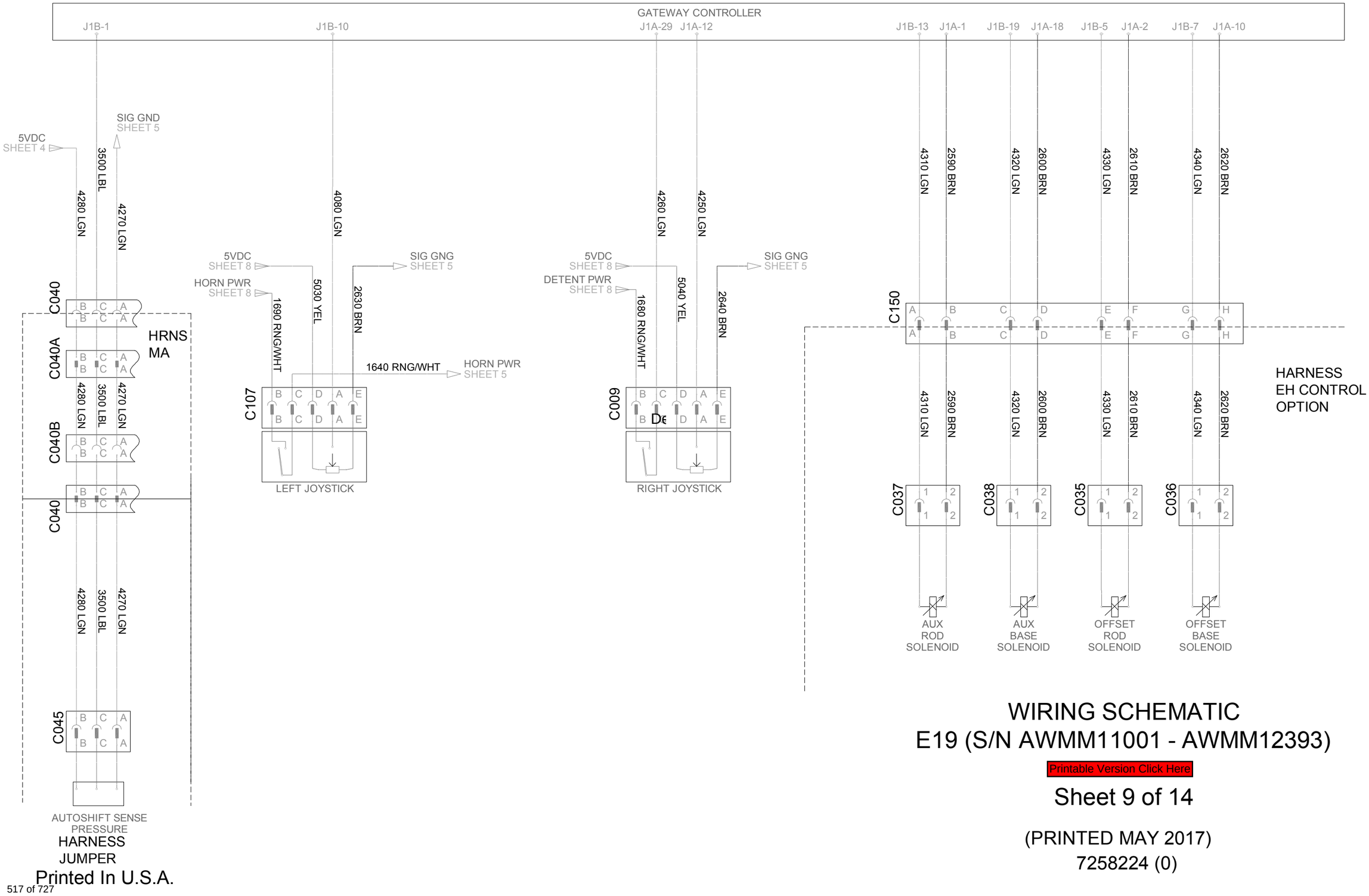
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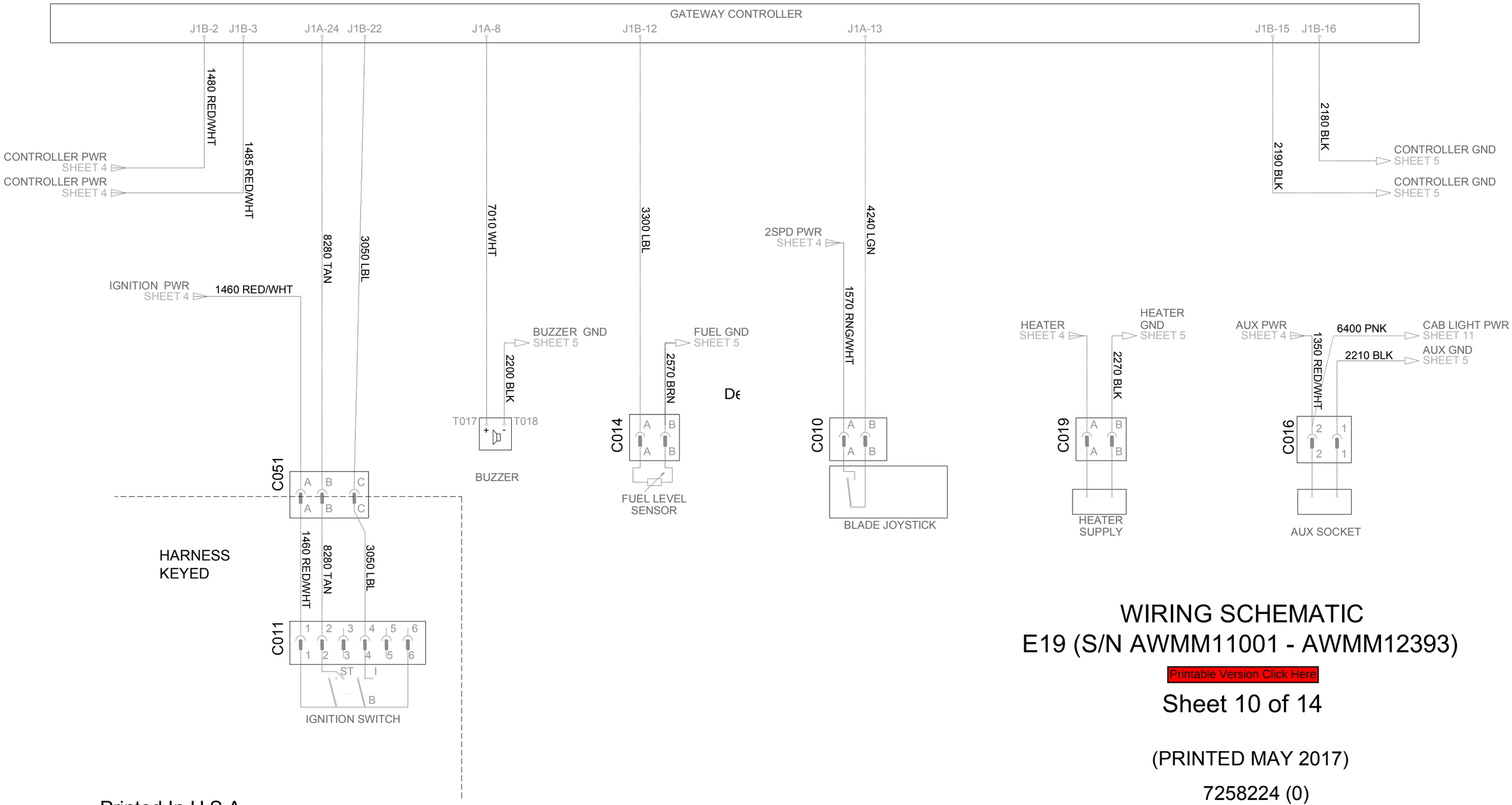
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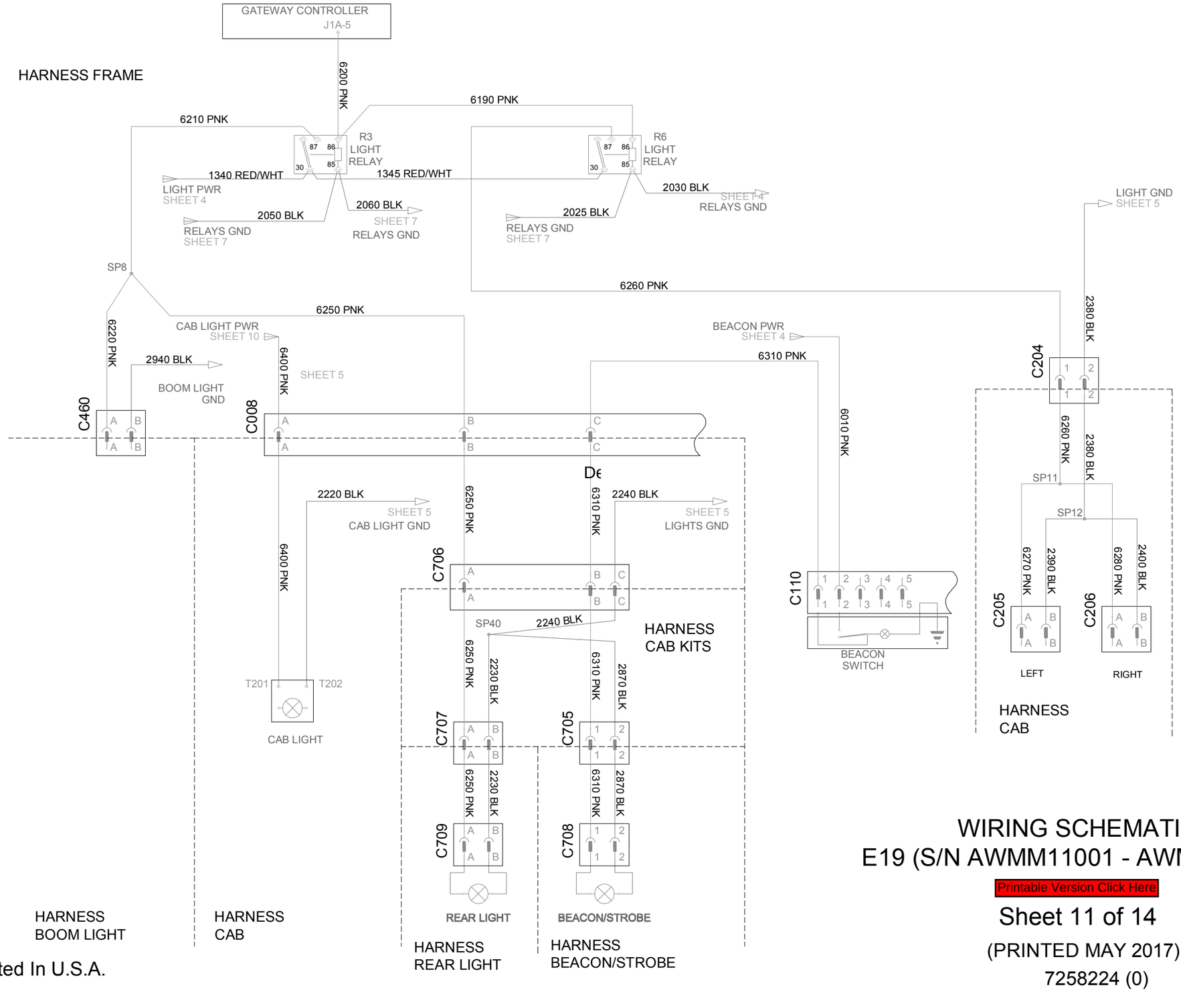
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LIGHTS / BEACON / STROBE - CABIN



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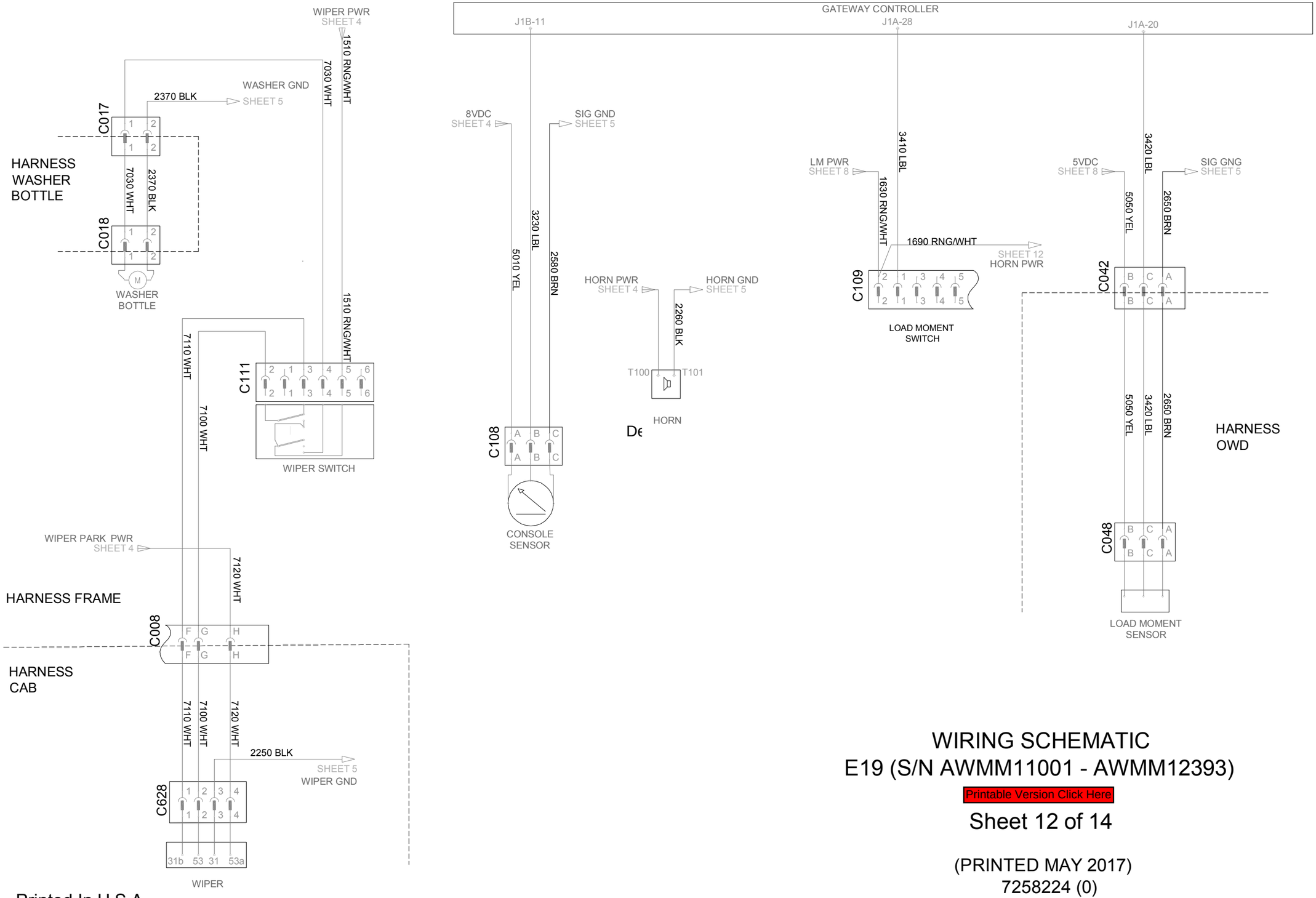
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WIPER / LH CONSOLE / HORN / OWD



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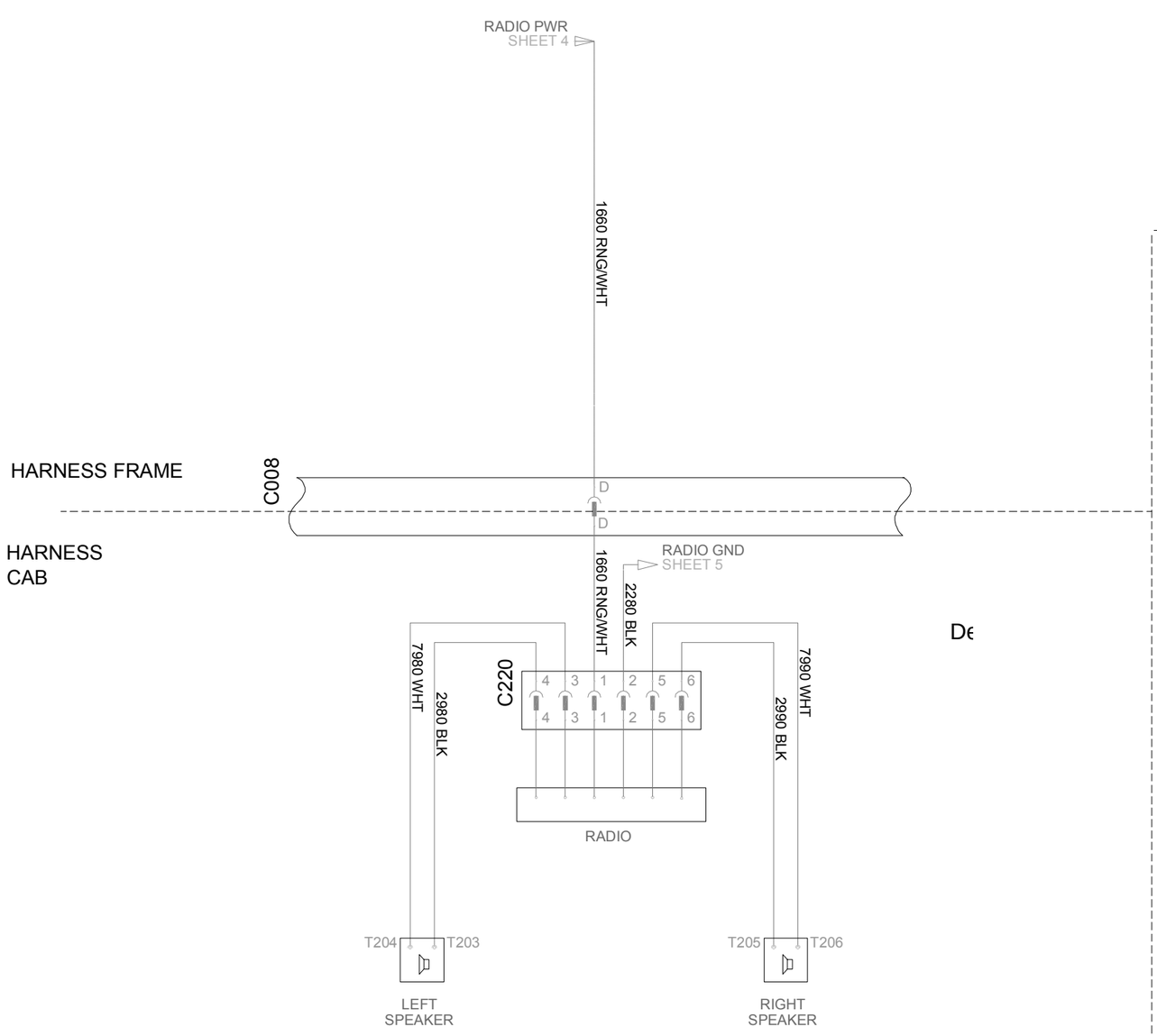
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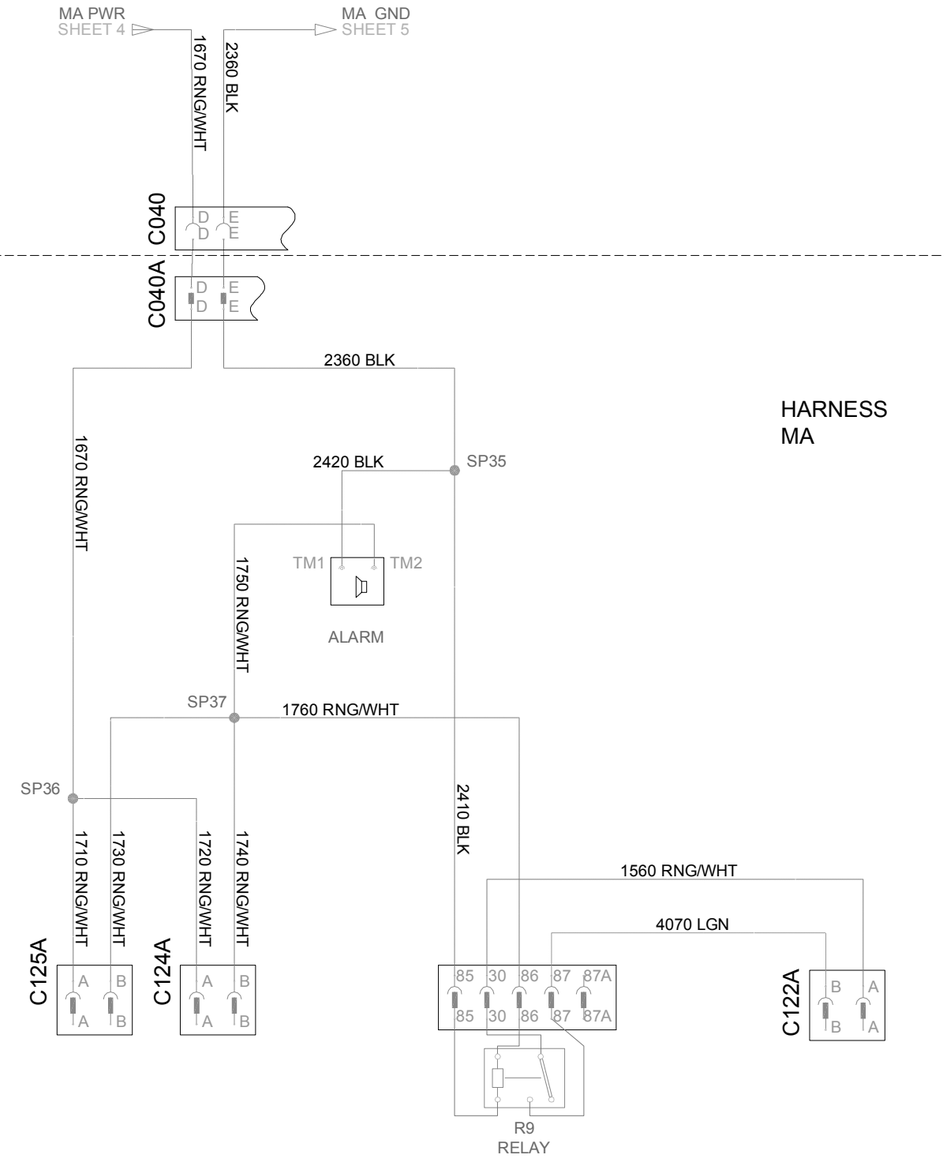
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RADIO / MA





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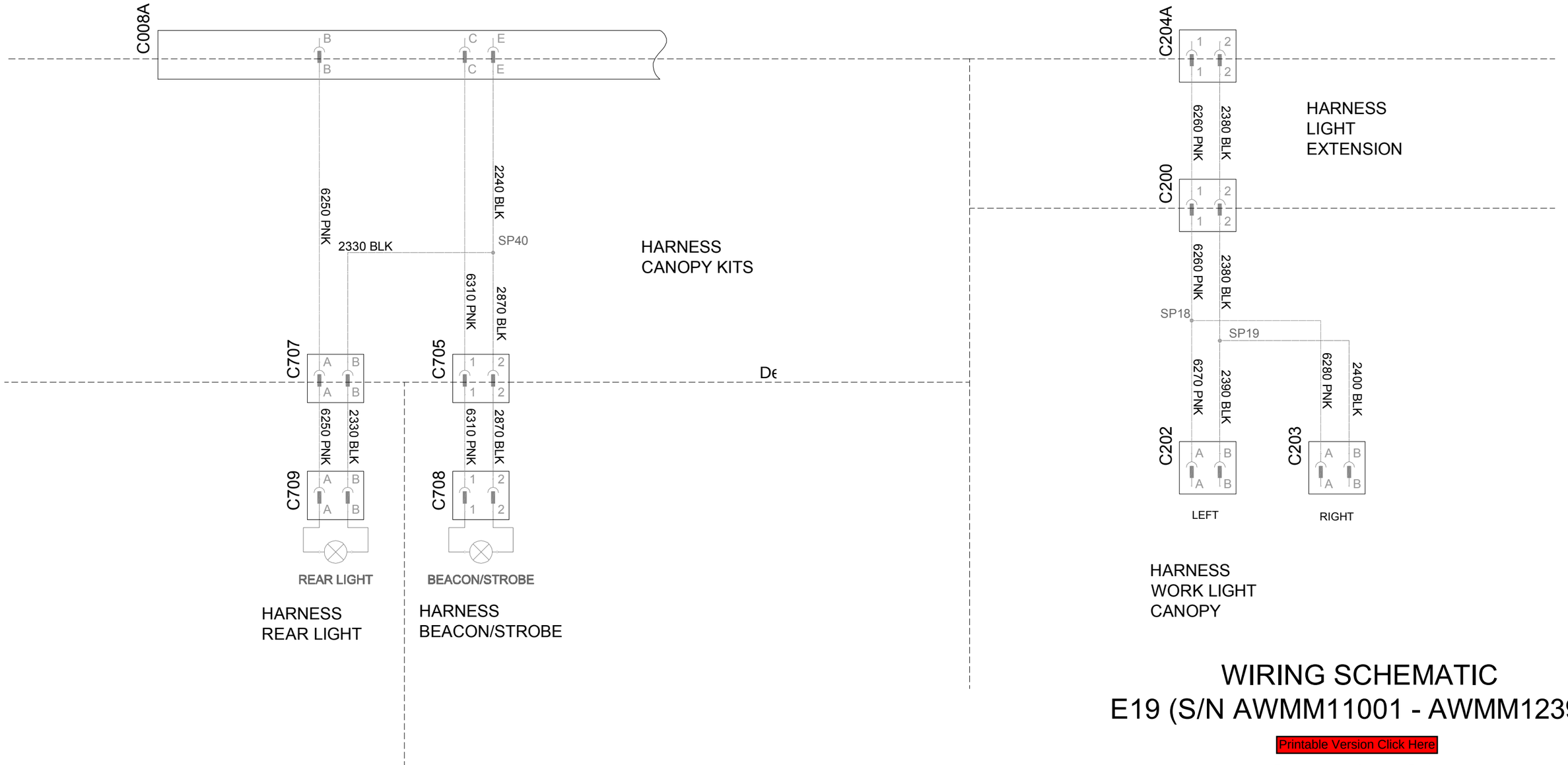
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LIGHTS / BEACON / STROBE - CANOPY



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2ND AUX	PAGE 15

De

HARNESSES PN# E17, E19, E20, D17, D19	
HARNESS BOOM LIGHT	7135895
HARNESS DIFF SWITCH ZTS / CTS	7198838 / 7228452
HARNESS VALVE SWITCH (IF EQUIPTED)	7217804
HARNESS MOTION ALARM (IF EQUIPTED)	7217809
HARNESS ENGINE	7217815
HARNESS JUMPER (IF EQUIPTED)	7232729
HARNESS WASHER BOTTLE (IF EQUIPTED)	7238179
HARNESS EH CONTROL (IF EQUIPTED)	7243646
HARNESS FRAME	7244548
HARNESS OWD (IF EQUIPTED)	7250792
HARNESS KEYED	7251398
HARNESS CAB KITS (IF EQUIPTED)	7266940
HARNESS REAR LIGHT (IF EQUIPTED)	7258225
HARNESS BEACON / STROBE (IF EQUIPTED)	7258226
HARNESS WORK LIGHT CANOPY (IF EQUPTED)	7258227
HARNESS LIGHT EXTENSION (IF EQUIPTED)	7258228
HARNESS CANOPY KITS (IF EQUIPTED)	7258229
HARNESS 2ND AUX (IF EQUIPTED)	7267960
HARNESS CAB (IF EQUIPTED) - FMS SUPPLIER	BC7229928
HARNESS WIPER (IF EQUIPTED) - FMS SUPLLIER	BC7230196

WIRING SCHEMATIC
E19 (S/N AWMM12394 AND ABOVE)
(S/N B3LA11001 AND ABOVE)
(S/N B3LB11001 AND ABOVE)

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J1 CONNECTOR ASSIGNMENTS (CONTROLLER PRIMARY)			
PIN	FUNCTION	PIN	FUNCTION
A-01	AUX ROD RETURN	B-01	LOAD SENSE PRESSURE SENSOR
A-02	OFFSET ROD RETURN	B-02	UNSWITCHED BATTERY P1
A-03	FUEL PULL RELAY	B-03	UNSWITCHED BATTERY P2
A-04	SWITCHED POWER OUT RELAY	B-04	FUEL SOL HOLD
A-05	LIGHTS RELAY	B-05	OFFSET ROD SOL
A-06	GLOW PLUG RELAY	B-06	2 SPEED SOL
A-07	STARTER RELAY	B-07	OFFSET BASE SOL
A-08	WARNING BUZZER	B-08	CAN_LO_1
A-09	PB VALVE RELAY	B-09	CAN_HI_1
A-10	OFFSET BASE RETURN	B-10	OFFSET POT INPUT
A-11	SPARE	B-11	CONSOLE POSITION SENSOR
A-12	AUX POT INPUT	B-12	FUEL LEVEL SENSOR
A-13	2 SPEED SWITCH INPUT	B-13	AUX ROD SOL
A-14	GLOW PLUG RELAY FDBK	B-14	CAN_HI_2
A-15	ENGINE SPEED SENSOR	B-15	GROUND P1
A-16	SPARE	B-16	GROUND P2
A-17	SPARE	B-17	SENSOR GROUND REFERENCE
A-18	AUX BASE RETURN	B-18	ENGINE COOLANT TEMP SENSOR
A-19	SPARE	B-19	AUX BASE SOL
A-20	OVERLOAD SENSOR	B-20	CAN_LO_2
A-21	SWITCHED POWER OUT RELAY FDBK	B-21	REMOTE KEY
A-22	STARTER RELAY FDBK	B-22	KEY RUN
A-23	SPARE	B-23	SENSOR SUPPLY 1 (8 VOLT)
A-24	CRANK INPUT	B-24	SENSOR SUPPLY 1 (5 VOLT)
A-25	ENGINE OIL PRESSURE SWITCH	B-25	BYPASS VALVE SOL
A-26	JOYSTICK LOCKOUT SOL RETURN	B-26	JOYSTICK LOCKOUT SOL
A-27	BYPASS VALVE SOL RETURN		
A-28	OVERLOAD WARNING DEVICE ENABLE		
A-29	AUX DETENT		
A-30	FUEL PULL RELAY FDBK		
A-31	PB VALVE REALY FDBK		
A-32	HYDRAULIC TEMP SENSOR		
A-33	TRAVEL LEVER POS SWITCHES		
A-34	HYD OIL FILTER BYPASS SWITCH		

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E19 (S/N AWMM12394 AND ABOVE)
(S/N B3LA11001 AND ABOVE)
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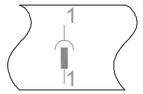
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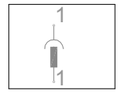
WIRE CATEGORIES FOR COLORS AND NUMBER RANGE			
GROUP DESCRIPTION	**GROUP NUMBER RANGE**	**WIRE COLOR**	**COLOR CODE**
BATT FEED, GENERAL	1000 THROUGH 1499	RED	RED
BATT FEED, FUSED	1000 THROUGH 1499	RED/WHITE	RED/WHT
BATT FEED, SWITCHED	1500 THROUGH 1999	ORANGE/WHITE	RNG/WHT
BATTERY GROUND	2000 THROUGH 2999	BLACK	BLK
CONTROLLER GROUND	2000 THROUGH 2999	BROWN	BRN
MONITORING	3000 THROUGH 3999	LIGHT BLUE	LBL
HYDRAULIC	4000 THROUGH 4999	LIGHT GREEN	LGN
CONTROLLER SUPLY (5V, 8V)	5000 THROUGH 5999	YELLOW	YEL
LIGHTS	6000 THROUGH 6999	PINK	PNK
OTHER FUNCTIONS	7000 THROUGH 7999	WHITE	WHT
ENGINE	8000 THROUGH 8999	TAN	TAN
COMMUNICATION CAN LO	90XX, 92XX, 94XX, 96XX, 98XX	PURPLE	PUR
COMMUNICATION CAN HI	91XX, 93XX, 95XX, 97XX, 99XX	PURPLE/WHITE	PUR/WHT

LEGEND

PARTIAL CONNECTOR



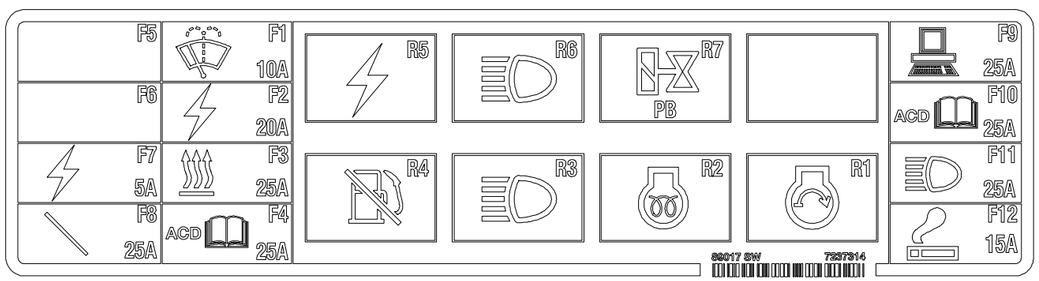
CONNECTOR



WIRE BREAK
(TWO WIRE BREAKS JOIN ONE WIRE)

SHEET #

FUSE RELAY CENTER



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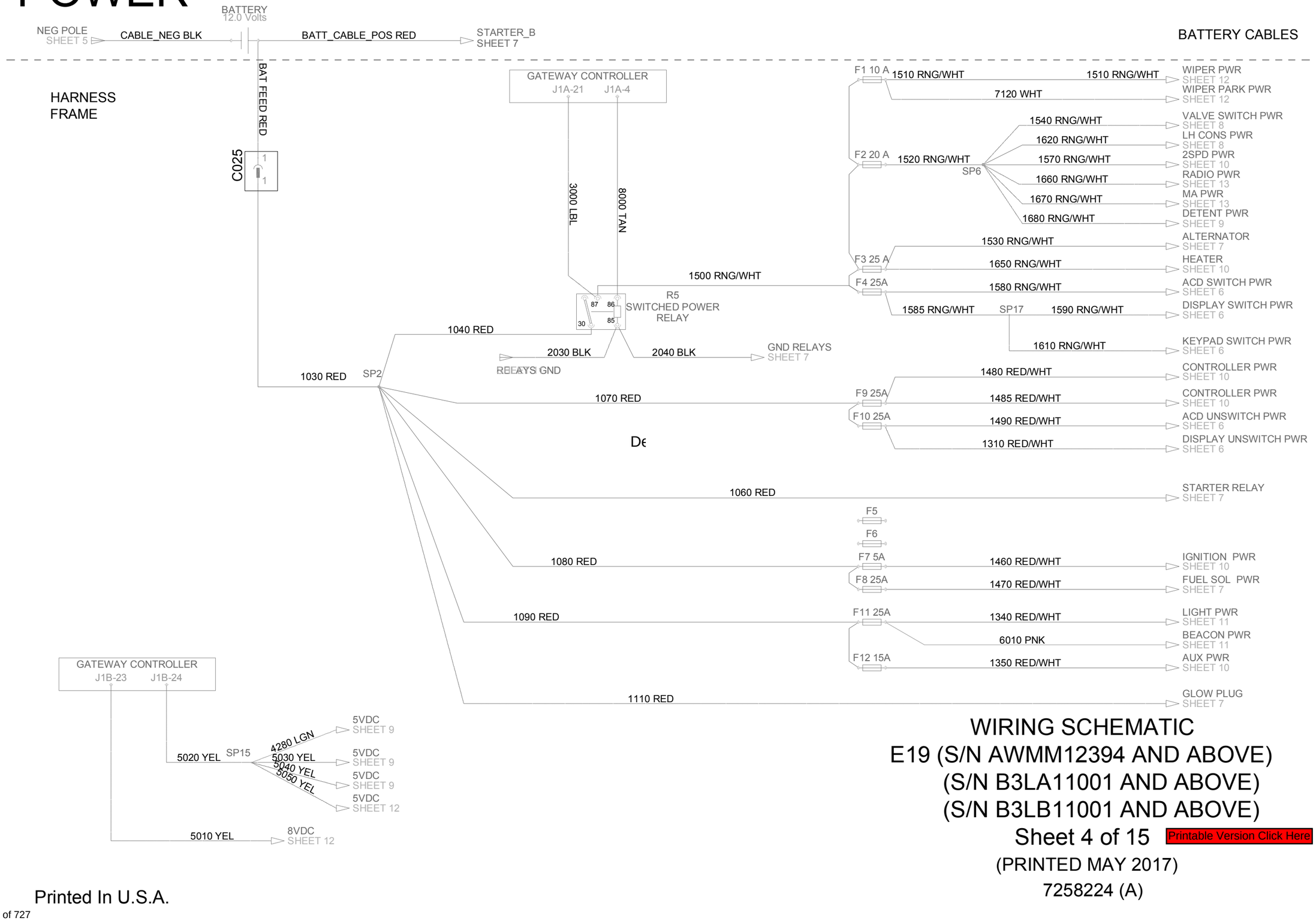
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POWER



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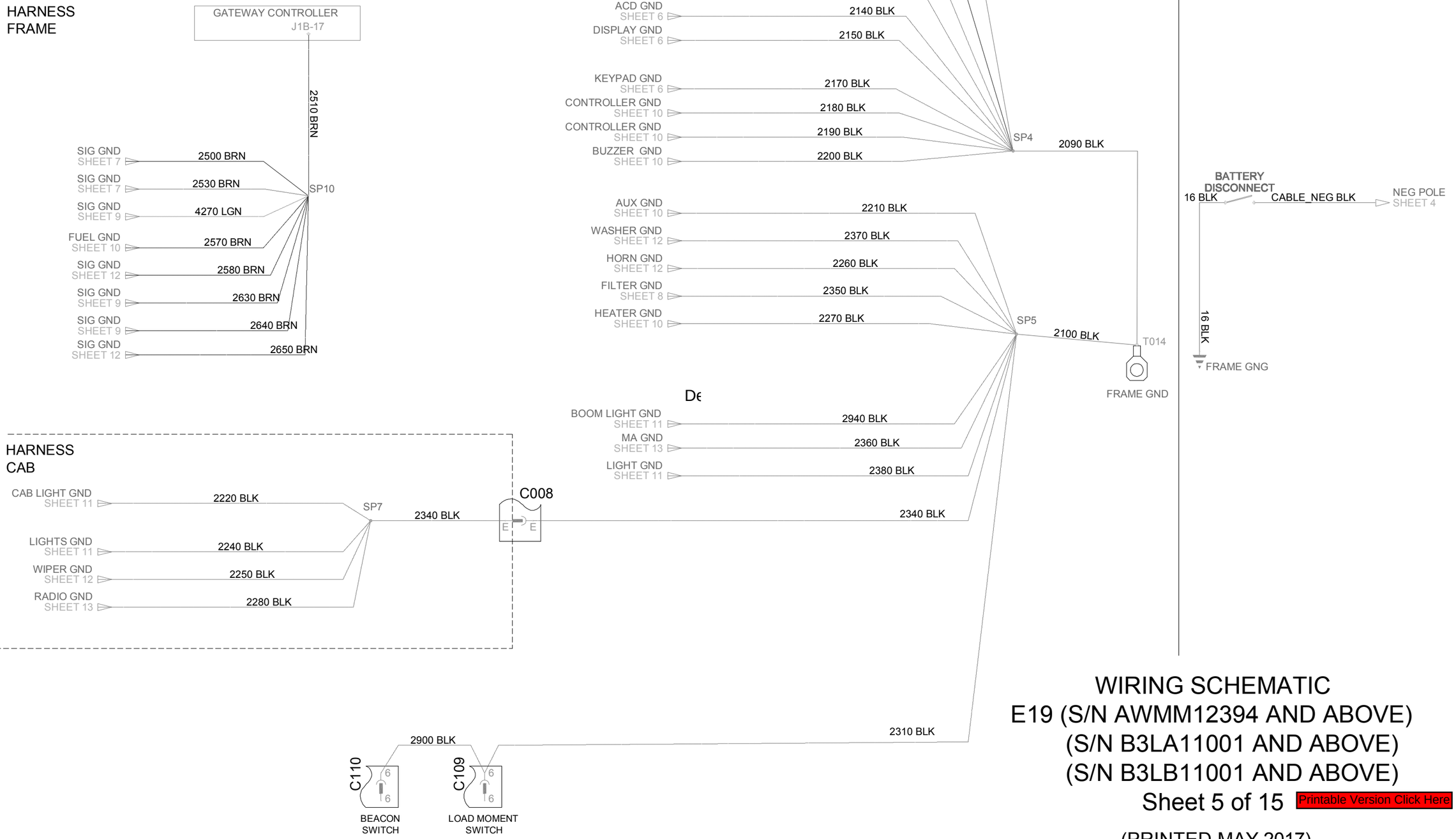
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GROUND



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(S/N B3LB11001 AND ABOVE)

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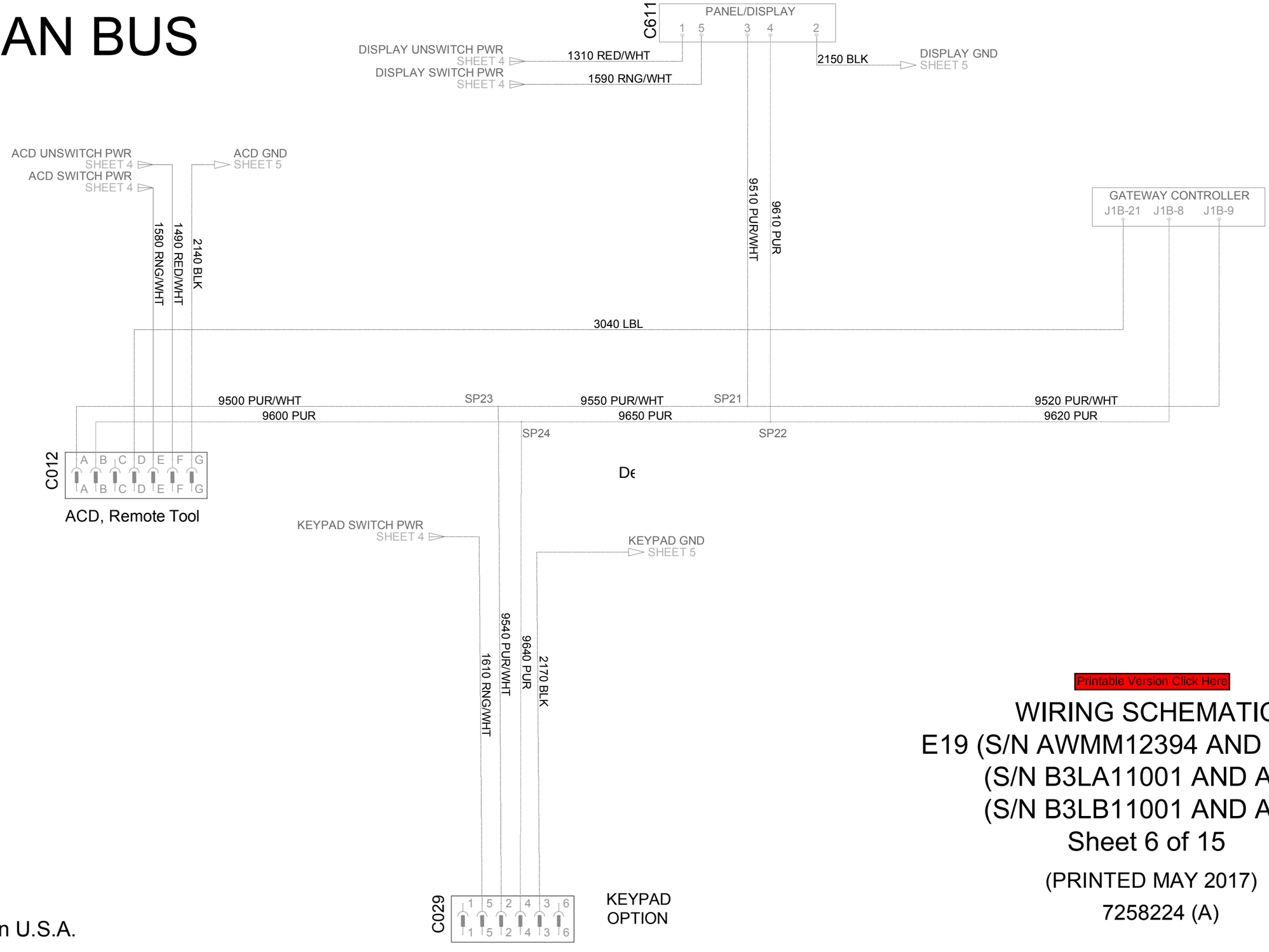
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CAN BUS



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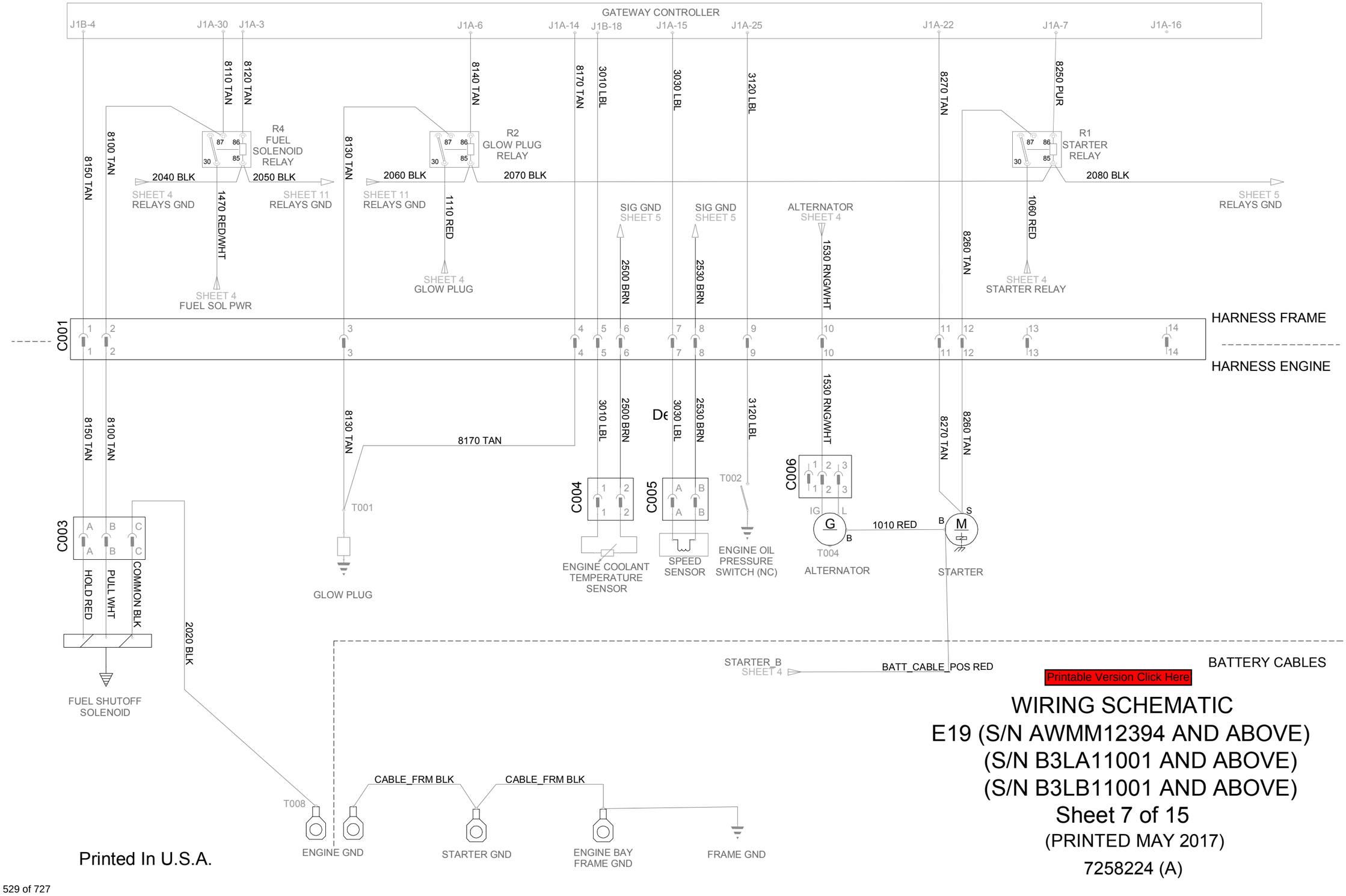
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ENGINE



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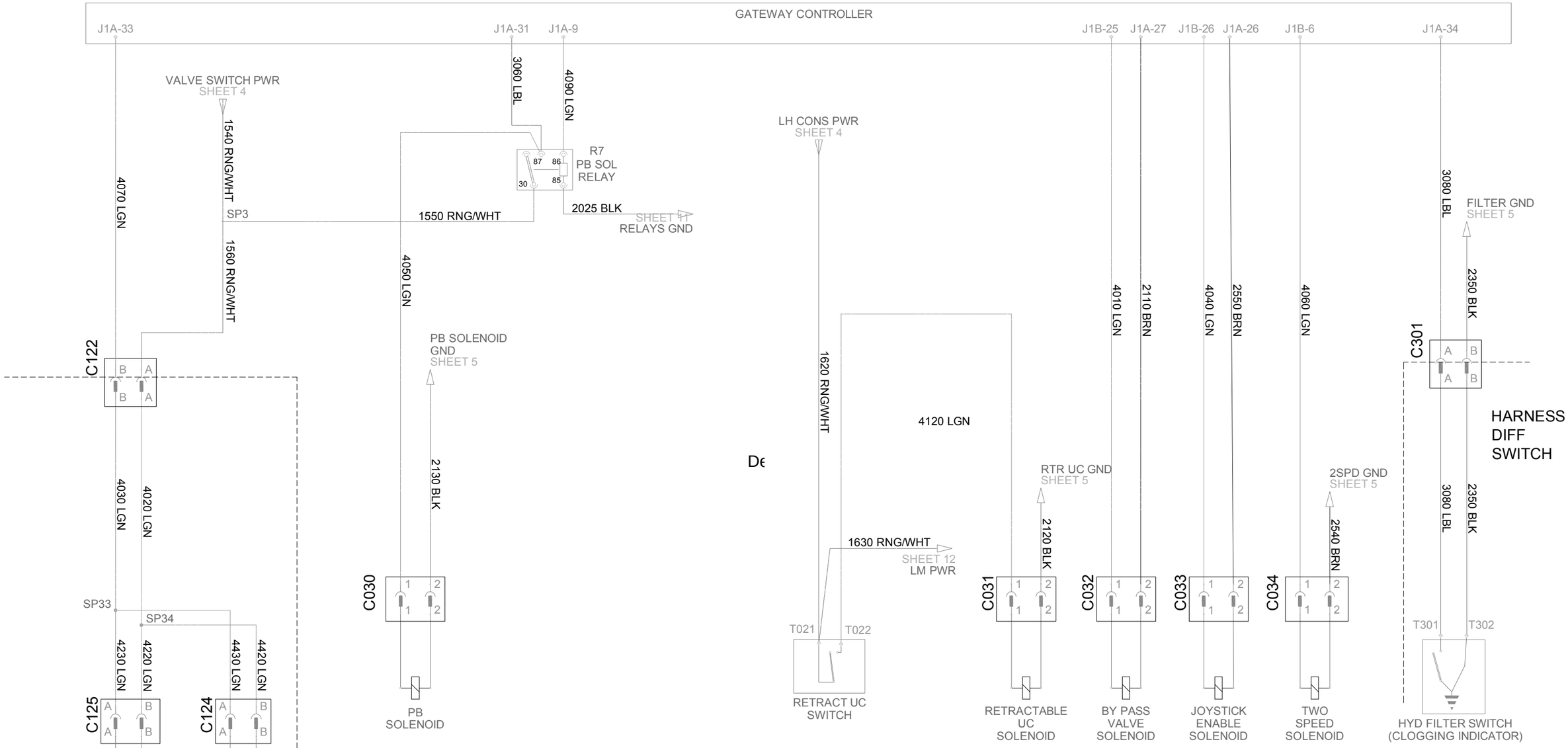
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HYDRAULICS



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(S/N B3LB11001 AND ABOVE)

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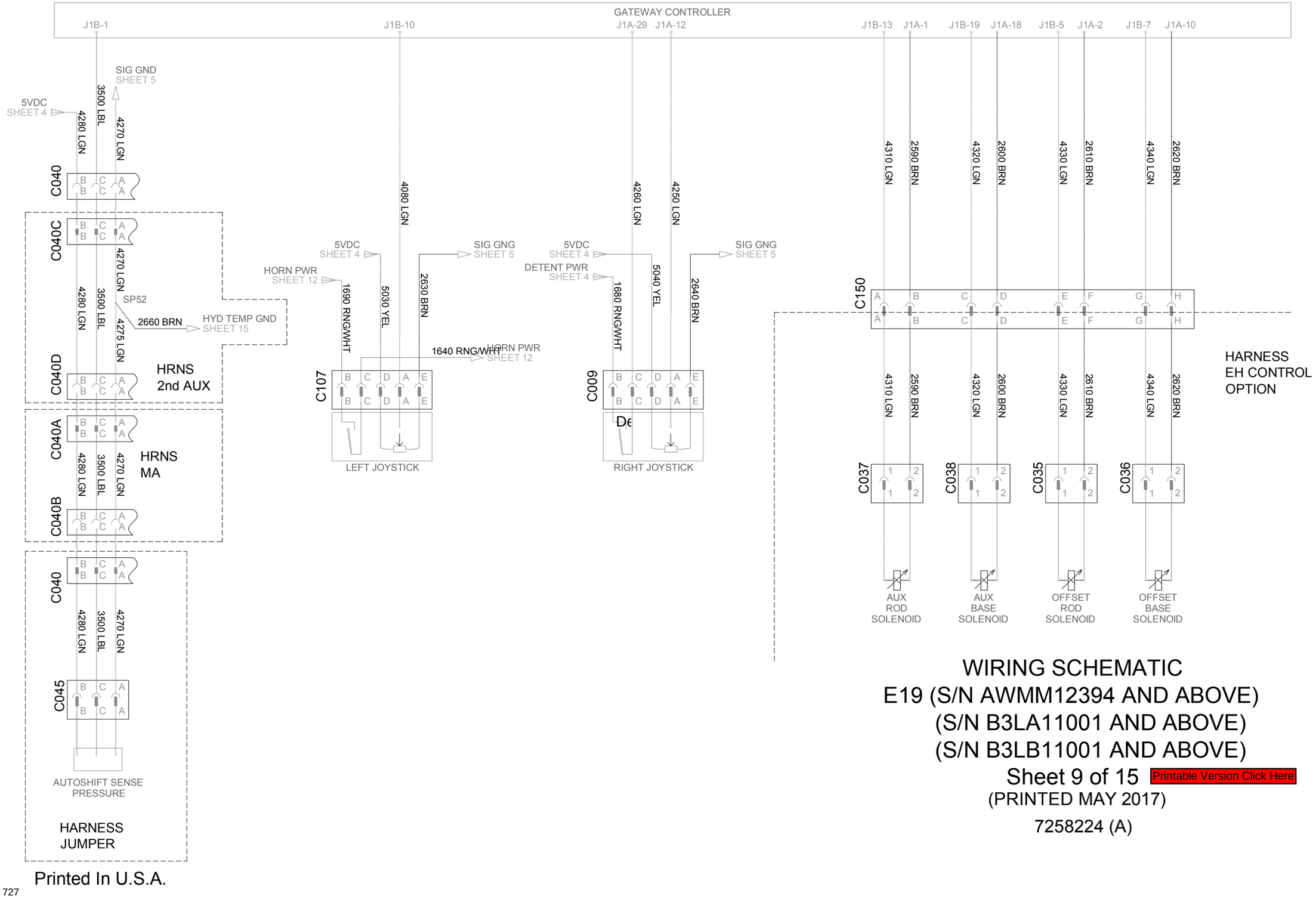
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HYDRAULICS



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(S/N B3LB11001 AND ABOVE)

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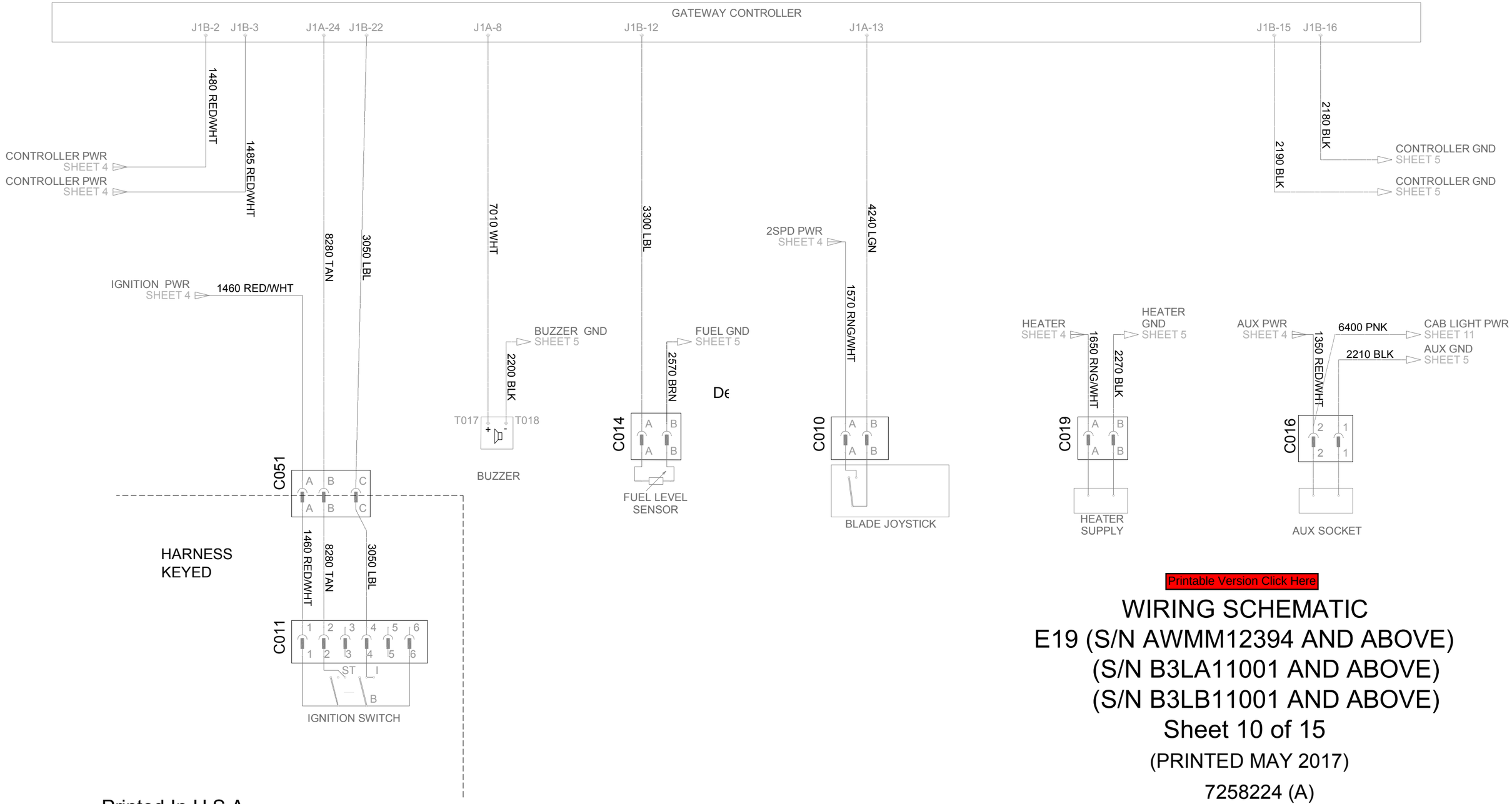
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FRAME



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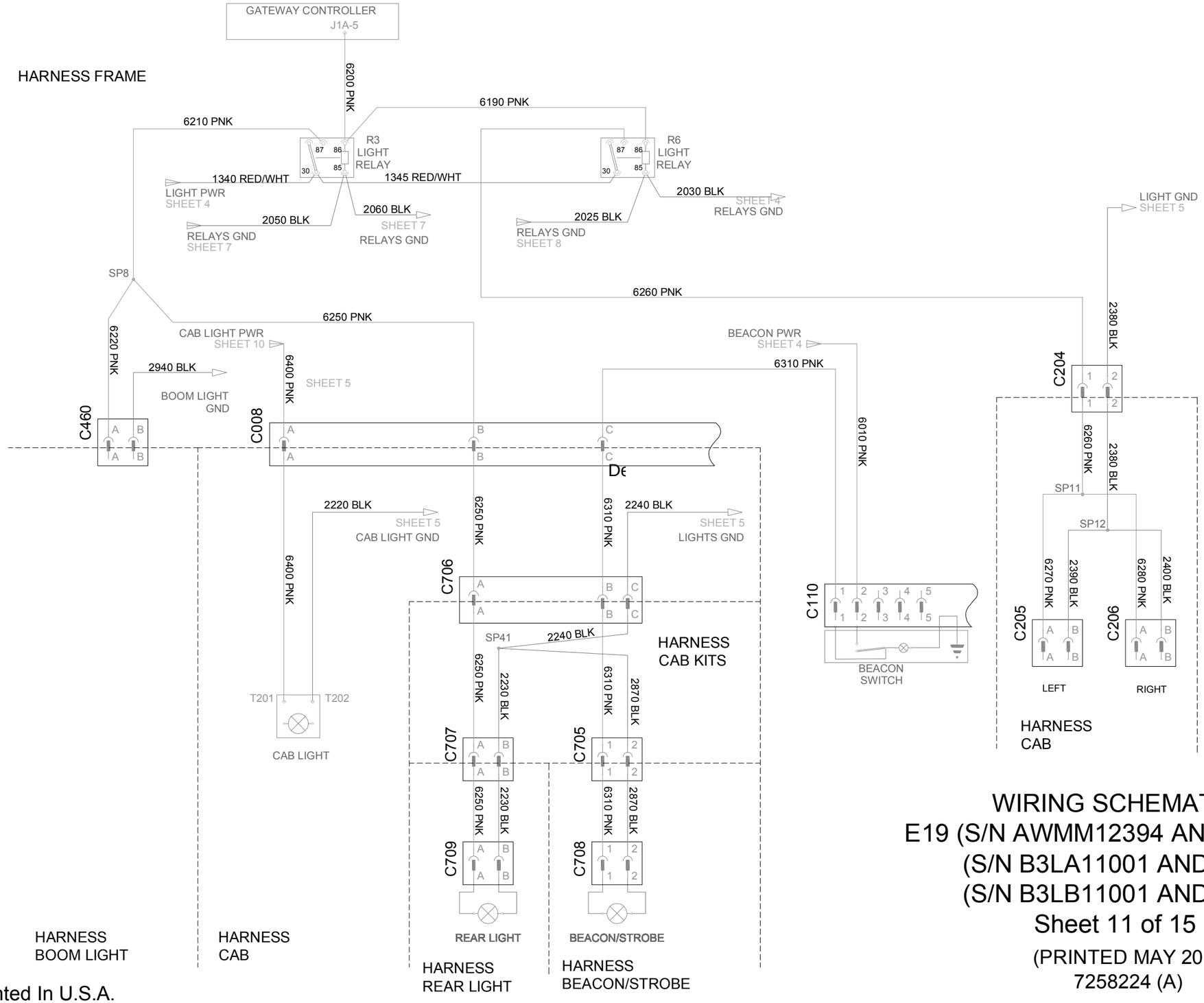
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LIGHTS / BEACON / STROBE - CABIN



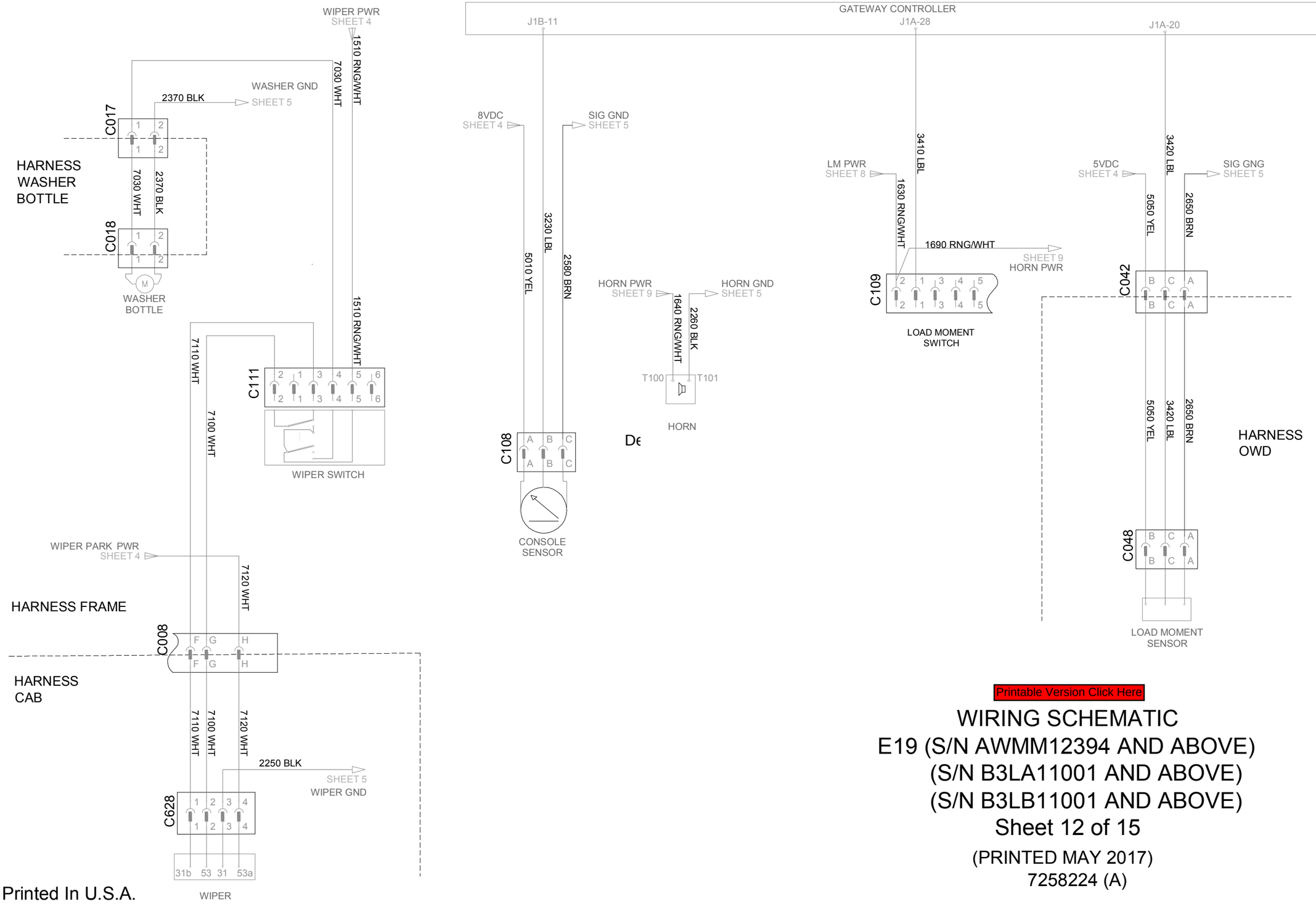
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WIPER / LH CONSOLE / HORN / OWD



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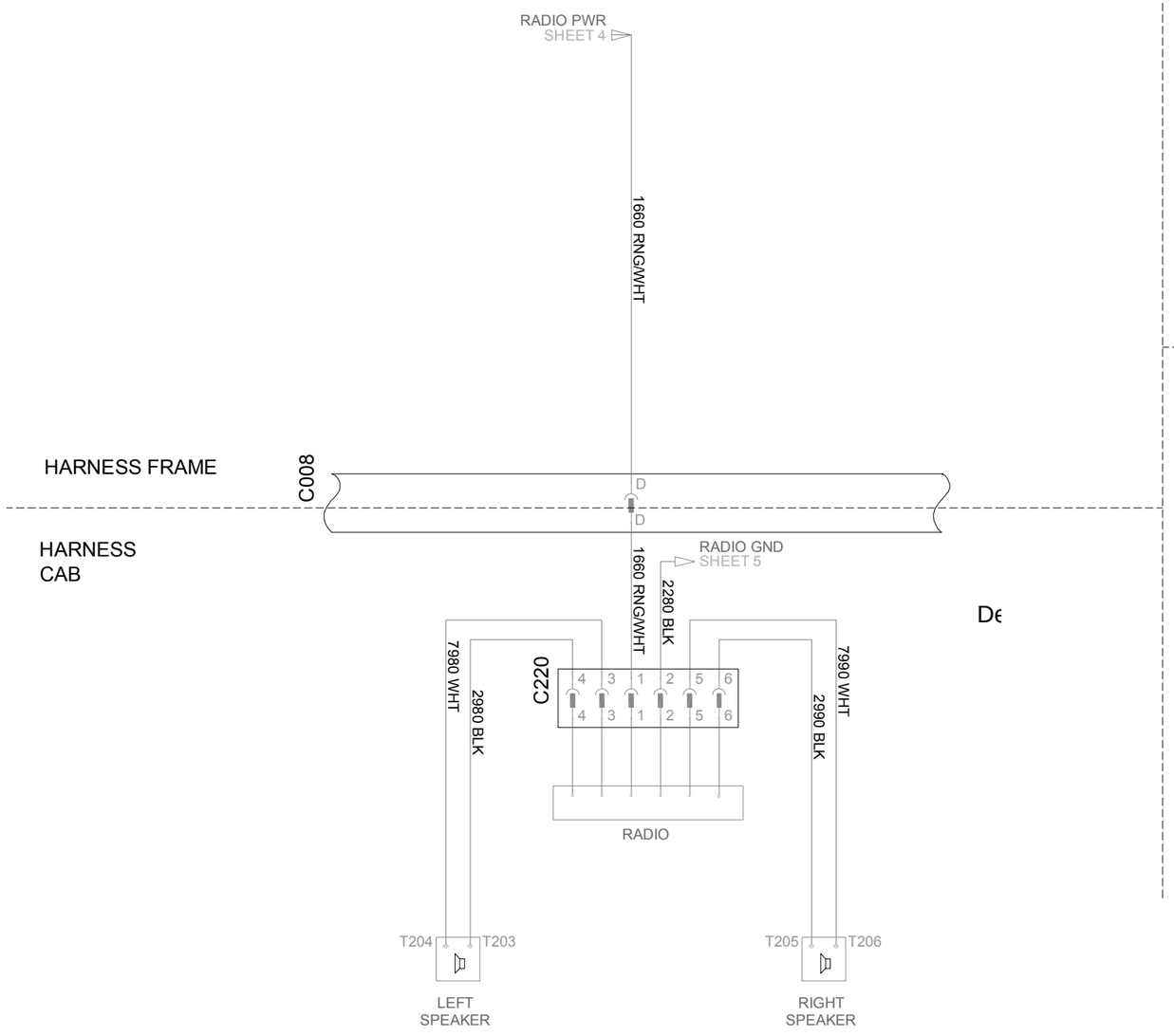
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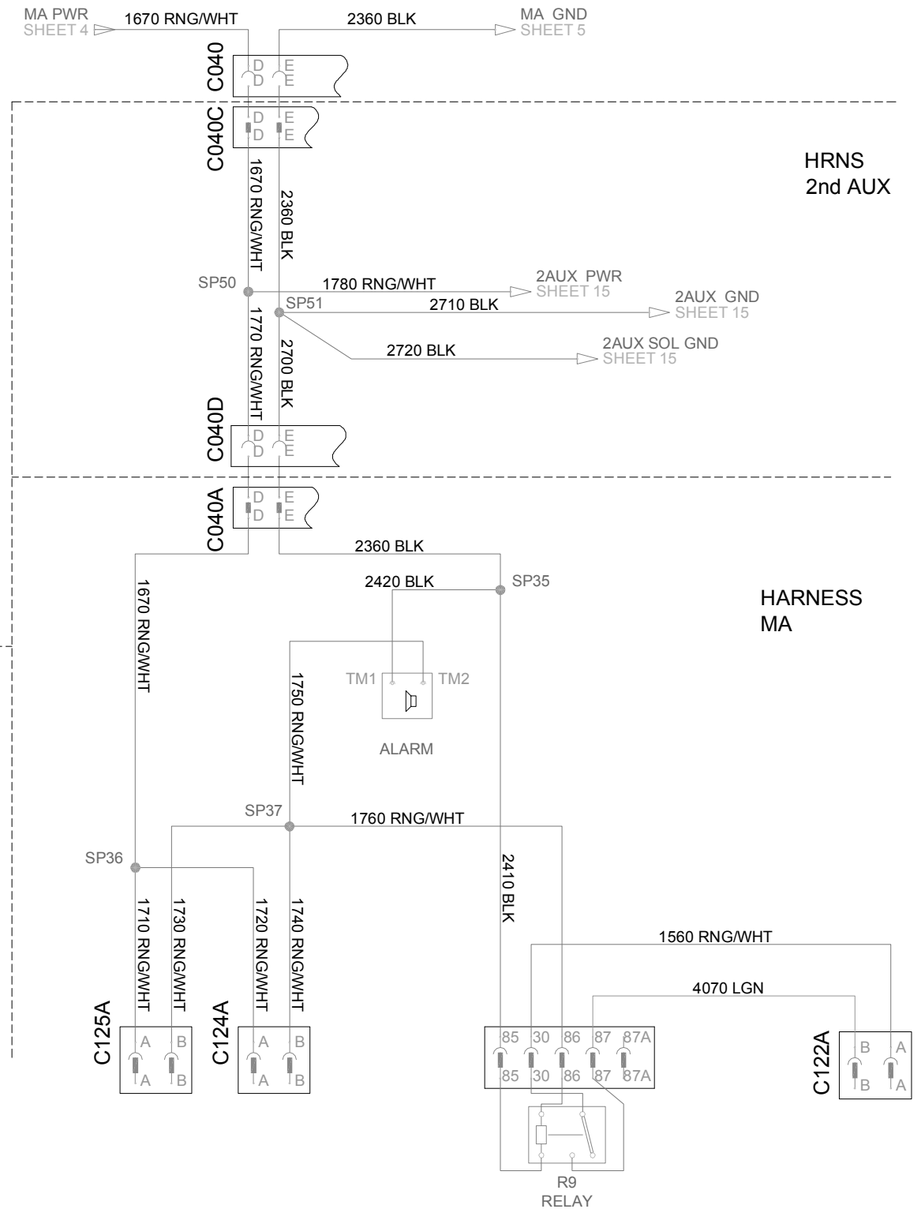
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RADIO / MA





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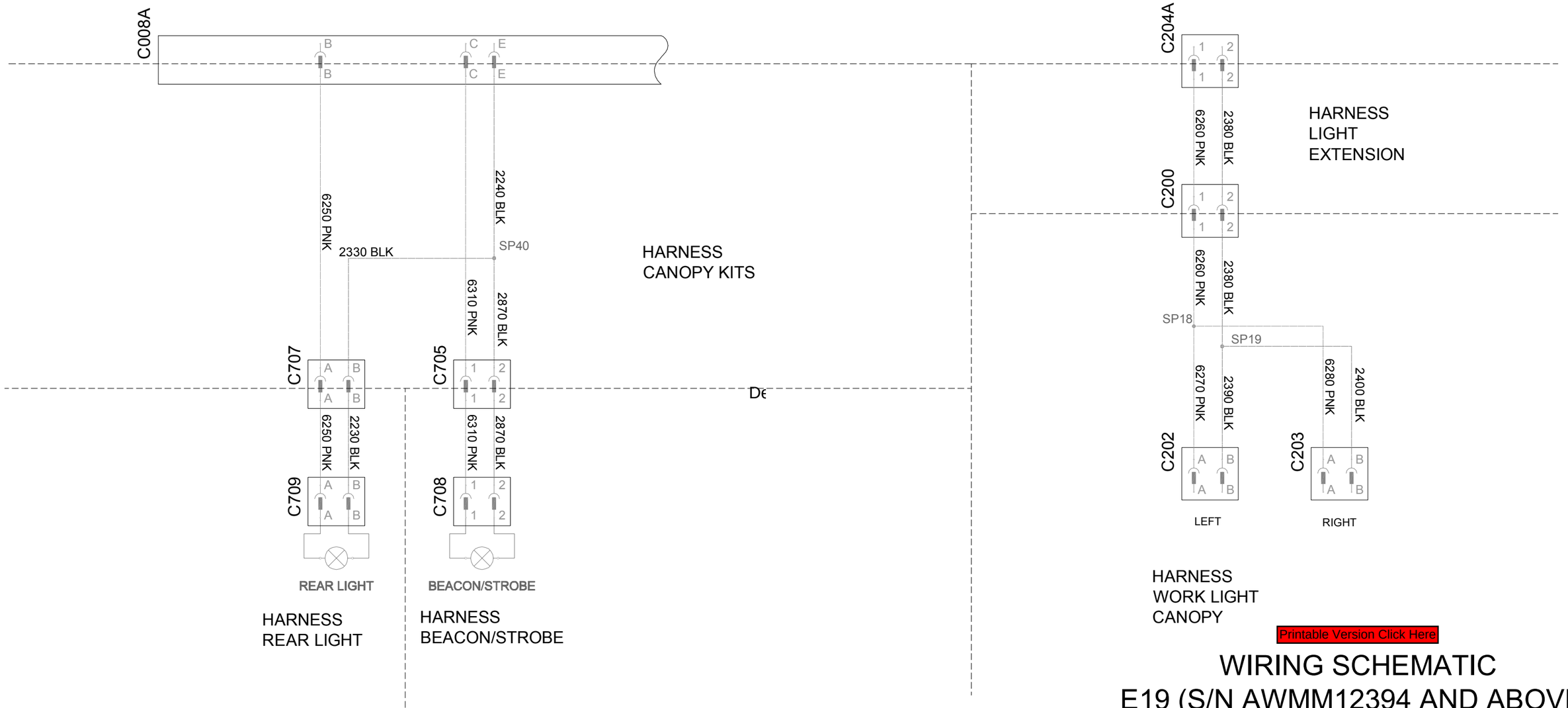
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LIGHTS / BEACON / STROBE - CANOPY



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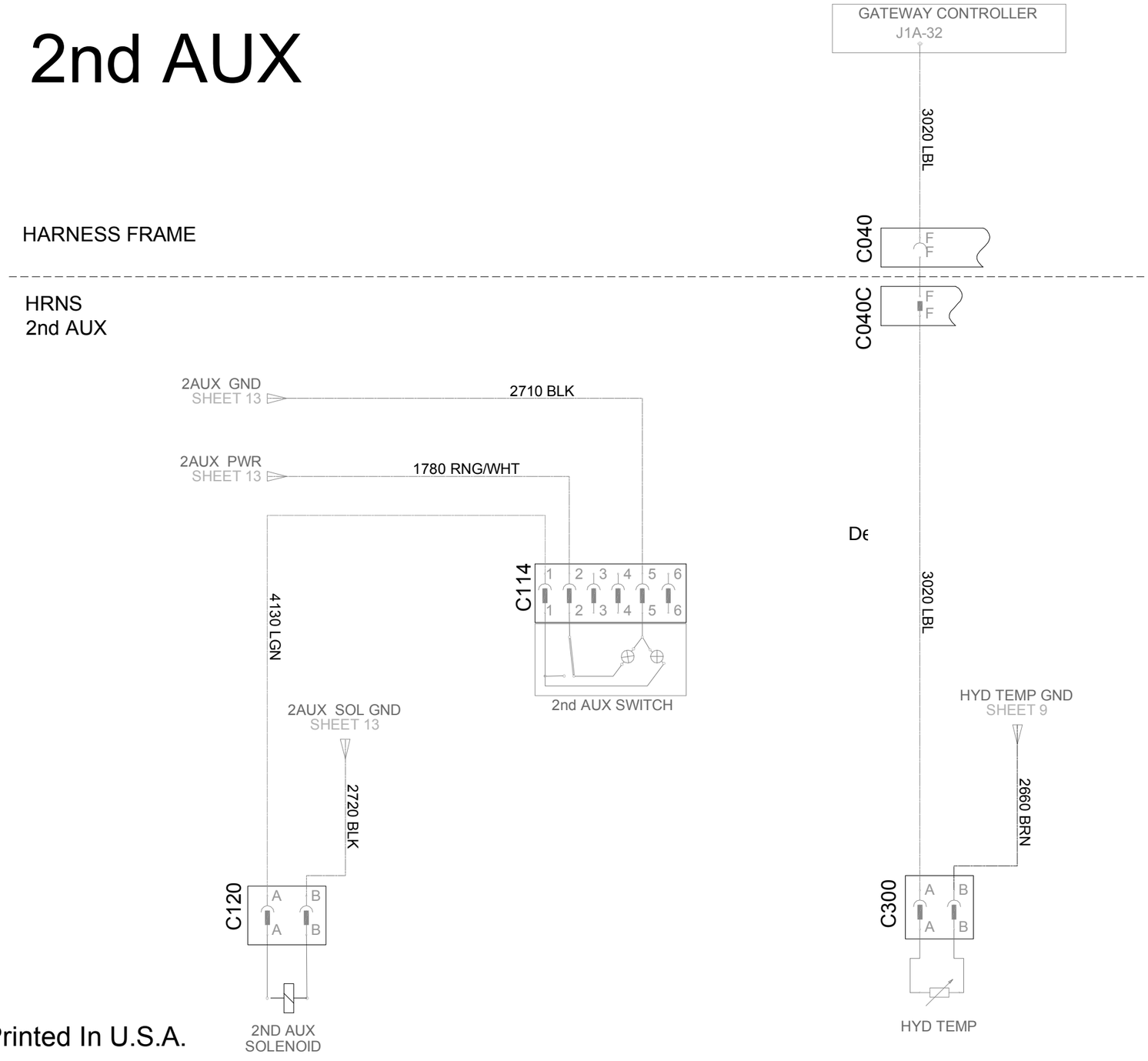
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2nd AUX



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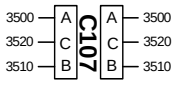
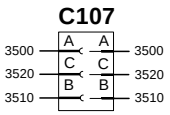
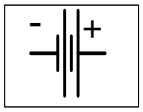
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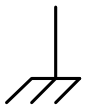
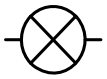
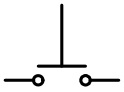
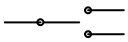
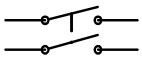
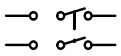
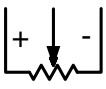
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ELECTRICAL SYSTEM INFORMATION

Glossary Of Electrical Symbols

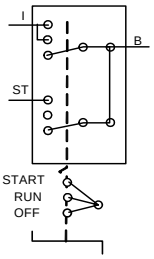
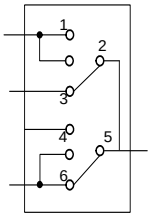
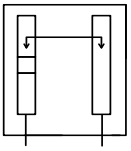
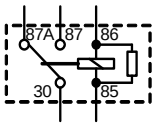
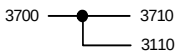
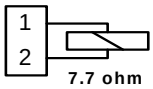
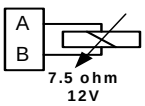
SYMBOL	DESCRIPTION
	CONNECTIONS
	CONNECTOR - Harness - Used for connecting 2 harnesses together or a harness to a component. The connector can vary from a single pin to any number of pins (Example: 3 pin connectors shown). The connector pins can be numbered alphabetical (shown) or numerical (1, 2, 3 etc.). The harness wires numbers are called out next to the connector (Example: 3500).
	The connector number is called out next to the connector (Example: C107). These connector numbers are used for schematic identification only and do not appear on the harness or connector.
	COMPONENTS
	BATTERY - Used for supplying and storing electrical power for the machine.
+	POSITIVE ELECTRICAL CIRCUIT - Indicates positive battery circuit.
-	NEGATIVE ELECTRICAL CIRCUIT - Indicates battery ground circuit.
	ALTERNATOR - Used to create the electrical current to supply voltage to the battery and components.
	STARTER - Uses battery current to start the machine engine.
	GROUND - Used to represent an external ground connection.

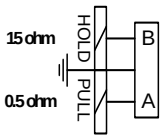
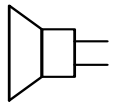
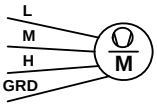
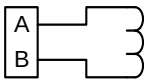
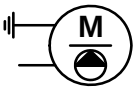
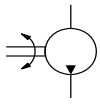
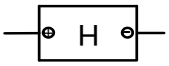
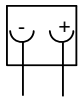
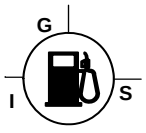
SYMBOL	DESCRIPTION
	COMPONENTS
	GROUND - Frame - Used to represent an component that is internally grounded.
	LIGHT -
	SWITCH - Single Pole - Single Throw (ON-OFF) Normally Open
	
	SWITCH - Single Pole - Single Throw (ON-OFF) Normally Closed.
	
	SWITCH - Single Pole - Double Throw (ON-OFF-ON) - This switch can be in any of three positions. (Some switches are spring activated to return them to a certain position when released.)
	SWITCH - Double Pole - Single Throw (ON-OFF) Open and Closed positions will be specified depending on switch application.)
	SWITCH - Double Pole - Double Throw (ON-OFF) Open and Closed positions will be specified depending on switch application.
	POTENTIOMETER - Variable resistance - Provides variable resistance.

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Glossary Of Electrical Symbols (Cont'd)

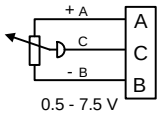
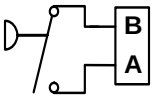
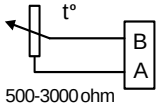
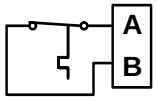
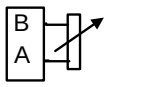
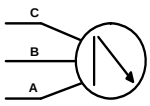
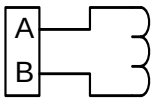
SYMBOL	DESCRIPTION
	COMPONENTS
	SWITCH - Ignition - Multi position switch to activate various start functions at different positions.
	SWITCH - Light - Multi position switch to activate various lights at different positions.
	ROTARY CONTROL - Provides variable voltage proportional to position.
	RELAY - Uses a low amp switch to control a high amp component.
	FUSE - Used to protect the wire harness from an overloaded circuit. (The fuse rating is listed next to the fuse.)
	SPLICE (•) - Used to show when multiple wires are connected together on the schematic.
	SOLENOID - ON / OFF - Electrically activated coil that controls movement magnetically. (The ohm rating of the solenoid coil is listed next to the component [if available]).
	SOLENOID - VARIABLE - Electrically activated coil that controls movement magnetically. (The ohm rating and voltage of the solenoid coil is listed next to the component [if available]).

SYMBOL	DESCRIPTION
	SOLENOID - Fuel and Traction Lock - Dual solenoids. (The ohm rating of the solenoid coils are listed next to the component [if available]). The pull solenoid is energized for a short time.
	HORN - Audible alarm. Sound is activated manually by a switch to warn personnel.
	BUZZER - Audible alarm. Sounds at a predetermined setting to warn the operator of a component condition.
	RESISTOR - Limits current flow.
	DIODE - Allows electrical current to flow in 1 direction only.
	MOTOR - HVAC - Multi speed motor.
	MOTOR - Wiper - Single or multi speed motor.
	MOTOR - Washer - Single speed.
	PUMP - FUEL
	HOURMETER - Records the time the engine is running.
	POWER PLUG - Supplies 12 volt power for customer supplied accessories.
	GAUGE - Instrument - Indicates certain engine or other component conditions. (The different types of gauge are marked with a icon that represents what function the gauge is monitoring. Example: the gauge shown is for fuel.)

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Glossary Of Electrical Symbols (Cont'd)

SYMBOL	DESCRIPTION
	SENDERS AND SENSORS
	PRESSURE SENDER - Provides a variable voltage proportional to pressure. (Sender voltage rating is listed to show volts at high and low setting.)
	PRESSURE SWITCH - Switch opens or closes at a predetermined pressure to active a function or to turn on a warning light. (Switch is shown in the open position.)
	TEMPERATURE SENDER - Provides a variable resistance (ohm) signal proportional to temperature. (Sender ohm rating is listed to show ohms at high and low setting.)
	TEMPERATURE SWITCH - The switch opens or closes at a predetermined temperature to active a function or to turn on a warning light. (Switch is shown in the closed position.)
	FUEL SENDER - Provides a variable resistance, based on the fuel level in the tank. (Sender ohm rating is listed to show ohms at full and empty setting.)
	HALL EFFECT SENSOR - Detects linear or rotary position and provides a proportional variable voltage.
	SPEED SENSOR - magnetic pickup - detects rpm.

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Troubleshooting

The following troubleshooting chart is provided for assistance in locating and correcting problems which are most common. Many of the recommended procedures must be done by authorized Bobcat Service personnel only.

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2003-0807

PROBLEM	CAUSE
Battery will not take charge.	1, 2, 3, 4, 5
Alternator will not charge.	1, 2, 5
Starter will not turn engine.	2, 3, 4, 6, 7, 8, 9

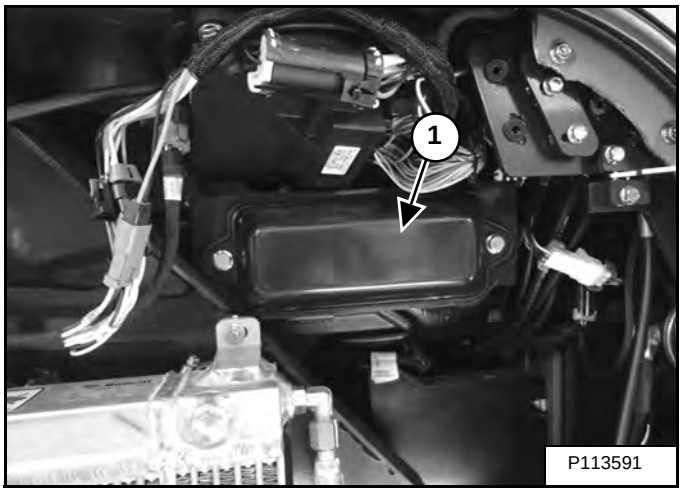
KEY TO CORRECT THE CAUSE
1. Engine accessory drive belt is loose or damaged.
2. Battery connections are dirty or loose.
3. Battery is damaged.
4. The ground connection is not making a good contact.
5. The alternator is damaged.
6. The engine is locked.
7. The starter is damaged.
8. The wiring or the solenoid is damaged.
9. Check the fuses.

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Description

Figure 50-10-1



The excavator has a 12 volt, negative ground electrical system. The electrical system is protected by fuses located under the right side cover of the excavator (Item 1) **[Figure 50-10-1]**. The fuses will protect the electrical system when there is an electrical overload. The reason for the overload must be found and corrected before starting the engine again.

The battery cables must be clean and tight. Check the electrolyte level in the battery. Add distilled water as needed. Remove acid or corrosion from the battery and cables with a sodium bicarbonate and water solution.

Put Battery Saver P/N 6664458 or grease on the battery terminals and cable ends to prevent corrosion.

⚠ WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

Fuse And Relay Location / Identification

A decal is inside the fuse cover to show location and amp ratings.

Remove the cover to check or replace the fuses and relays.

The location and sizes are shown in **[Figure 50-10-2]**.

Always replace fuses using the same type and capacity.

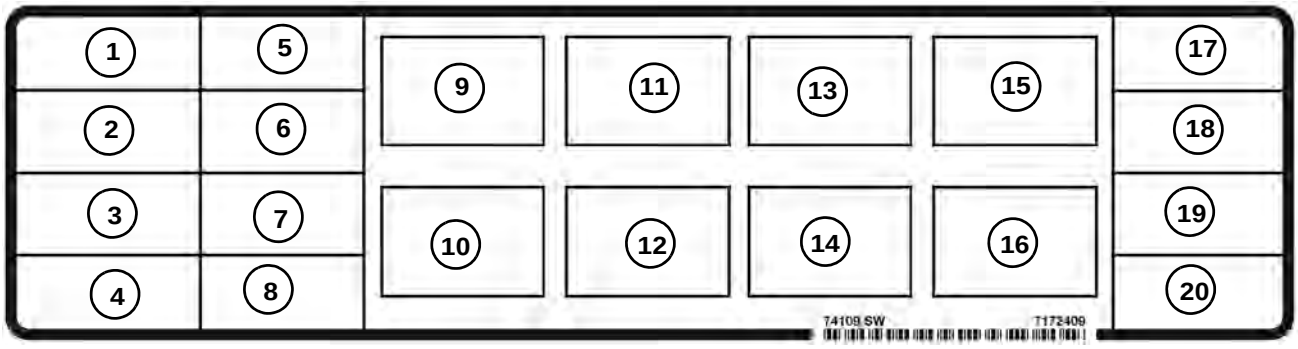
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ELECTRICAL SYSTEM INFORMATION (CONT'D)

Fuse And Relay Location / Identification (Cont'd)

Figure 50-10-2



The location and amperage ratings are shown in the table below and on the decal **[Figure 50-10-2]**. Relays are identified by the letter "R" in the AMP column.

REF	ICON	DESCRIPTION	AMP	REF	ICON	DESCRIPTION	AMP	REF	ICON	DESCRIPTION	AMP
1		NOT USED		**9**		Switched Power	R	**17**		Panel / Display Controller	25
2		NOT USED		**10**		Fuel Shutoff	R	**18**		ACD Unswitched Power	25
3		Start Key	5	**11**		Heater Fan	R	**19**		LIGHTS	25
4		Fuel Shutoff	25	**12**		Lights	R	**20**		Power Port	15
5		Wiper / Washer	10	**13**		Hydraulic By-Pass / Power Beyond	R				
6		Switched Power	20	**14**		Glow Plugs	R				
7		Alternator Excite / Heater	25	**15**		NOT USED	R				
8		ACD Switched Power	25	**16**		Starter	R				

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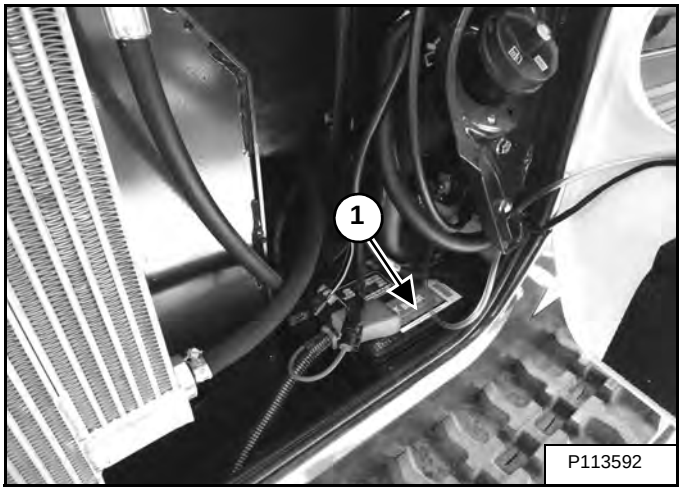
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BATTERY

Location

Open the right side cover.

Figure 50-20-1



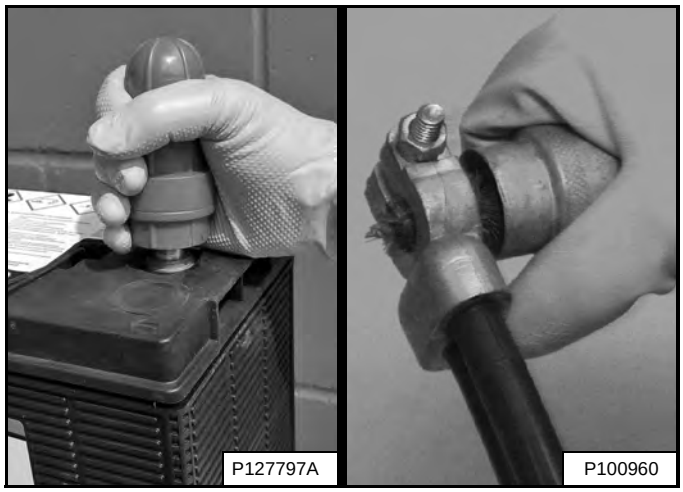
The battery (Item 1) **[Figure 50-20-1]** is located in the right side upperstructure below the oil cooler.

Servicing

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

The Bobcat brand battery supplied with your machine is sealed and does not require watering. Proper charging and storage are important to maximize the life of all batteries.

Figure 50-20-2



Simple steps for reliability and long battery life:

- Keep battery posts and terminals clean **[Figure 50-20-2]**.
- Keep terminals tight.
- Remove corrosion from battery and terminals with sodium bicarbonate (baking soda) and water solution.
- Put Bobcat Battery Saver or grease on the battery terminals and cable ends to prevent corrosion.
- Operate the machine for at least 15 minutes to recover from the battery drain caused by engine startup whenever practical.
- Maintain the battery charge level. This is a key factor for long battery life.
- Charge a severely discharged battery with a battery charger instead of relying on the machine charging system. (See Battery Charging on Page 50-20-3.)
- Check the battery state of charge every 30 days on machines that are not frequently used. (See Battery Testing on Page 50-20-2.)

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Servicing (Cont'd)

WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

Maintaining Battery Charge Level

All batteries will self-discharge over time. This machine has features that require battery power even when the machine is not being used. Use of a quality battery maintainer is highly recommended to ensure that your machine is ready to start when you need it and avoid costly battery replacement.

Battery Maintainers

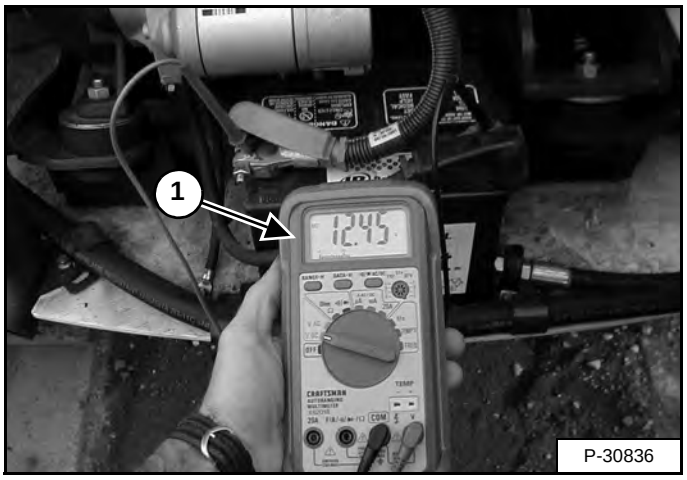
Use a good quality battery maintainer to keep the battery above 12.4 volts for machines that are not frequently used. Batteries below 12.4 volts must first be charged using a battery charger. Solar maintainers should have a minimum capacity of 10 watts to be effective.

Battery Service During Machine Storage

Remove the battery if storing the machine for an extended period of time. Fully charge the battery. Store the battery in a cool dry place above freezing and boost charge periodically. If battery removal is not desired, a good quality battery maintainer must be used to compensate for battery self-discharge and parasitic loads from machine controllers, accessories, and features such as connected machine intelligence.

Battery Testing

Figure 50-20-3



The simplest and most common check to determine battery state of charge is to use a digital multimeter or voltmeter (Item 1) **[Figure 50-20-3]**.

A battery found below 12.4 volts must be charged to 100% charge per the battery charger's recommendation. **Allow at least 60 minutes after operating the machine or charging the battery to get an accurate reading.**

If the reading is less than 12.4 volts after the battery has been charged for several hours, see your Bobcat dealer to have a more thorough battery test performed.

The freezing point of battery electrolyte is dependent on the battery state of charge. Keeping the battery voltage above 12.4 volts will help prevent batteries from freezing, even at extremely low temperatures.

If the battery freezes, the internal grid may be damaged and the case will be distorted or cracked. If this happens, dispose of the battery according to local regulations.

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Battery Charging

A battery charger designed for 12 volt charging systems is recommended. Follow the battery charger manufacturer's instructions to charge the battery to 12.6 volts (100% charge). Batteries should be charged at room temperature to avoid an undercharge or overcharge condition. Never attempt to charge a frozen battery.

The following table can be used to identify the approximate amount of time required to charge a discharged battery. Allow at least 60 minutes after operating the machine or charging the battery to get an accurate reading.

BATTERY VOLTAGE	STATE OF CHARGE	CHARGER MAXIMUM RATE		
		30 Amps	20 Amps	10 Amps
12.6 V	100%	READY TO USE		
12.4 V	75%	0.9 hr.	1.3 hr.	2.5 hr.
12.2 V	50%	1.9 hr.	2.7 hr.	5.1hr.
12.0 V	25%	2.9 hr.	4.3 hr.	7.8 hr.
11.8 V	0%	4.0 hr.	5.7 hr.	10.7 hr.

NOTE: Use a good quality automatic charger to avoid battery damage from overcharging.

⚠ WARNING

BATTERY GAS CAN EXPLODE AND CAUSE SERIOUS INJURY OR DEATH

Keep arcs, sparks, flames and lighted tobacco away from batteries. When *jumping* from booster battery make final connection (negative) at machine frame.

Do not jump start or charge a frozen or damaged battery. Warm battery to 16°C (60°F) before connecting to a charger. Unplug charger before connecting or disconnecting cables to battery. Never lean over battery while boosting, testing or charging.

W-2066-0910

Using a Booster Battery (Jump Starting)

IMPORTANT

If jump starting the excavator from a second machine:

When jump starting the excavator from a battery installed in a second machine, make sure the engine is NOT running while using the glow plugs. High voltage spikes from a running machine can burn out the glow plugs.

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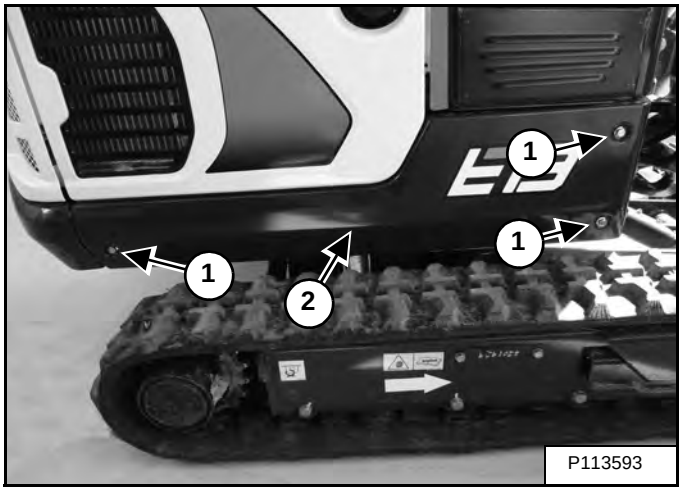
If it is necessary to use a booster battery to start the engine, BE CAREFUL! There must be one person in the operator's seat and one person to connect and disconnect the battery cables.

Be sure the key switch is OFF. The booster battery must be 12 volt.

Open the tailgate.

NOTE: To access the battery for jump starting, the battery hold-down will need to be removed and the battery moved outward to access the positive battery post.

Figure 50-20-4



Remove the three bolts (Item 1) and remove the right side lower cover (Item 2) **[Figure 50-20-4]**.

Open the right side cover.

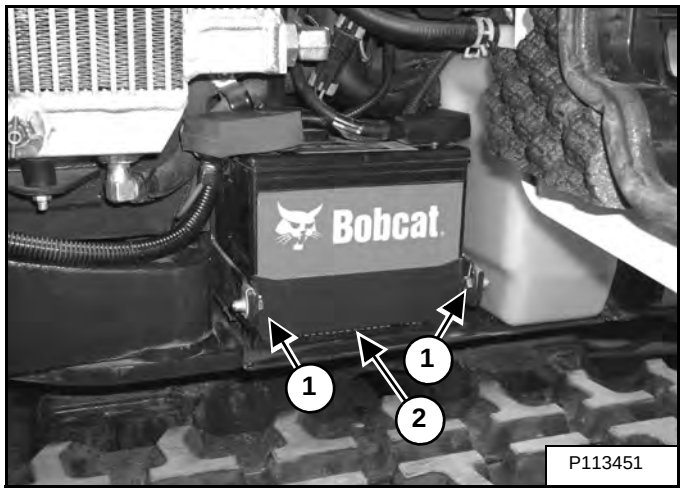
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BATTERY (CONT'D)

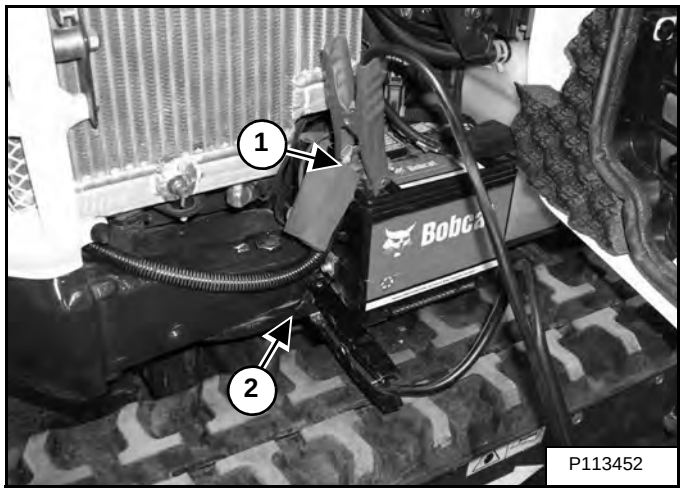
Using a Booster Battery (Jump Starting) (Cont'd)

Figure 50-20-5



Remove the two bolts (Item 1) and remove the battery hold-down plate (Item 2) **[Figure 50-20-5]**.

Figure 50-20-6



Connect one end of the first cable to the positive (+) terminal of the booster battery. Connect the other end of the same cable to the positive (+) terminal (Item 1) **[Figure 50-20-6]** of the excavator battery.

Connect one end of the second cable to the negative (-) terminal of the booster battery. Connect the other end of the same cable to a frame earth point (Item 2) **[Figure 50-20-6]**.

Start the engine. After the engine has started, remove the negative (-) cable first (Item 2) **[Figure 50-20-6]**.

Disconnect the cable from the positive (+) terminal (Item 1) **[Figure 50-20-6]**.

Replace the positive battery cable cover and push the battery in fully. Reinstall the battery hold-down plate (Item 2) and the two bolts (Item 1) **[Figure 50-20-5]**.

Reinstall the lower right side cover **[Figure 50-20-4]**.

IMPORTANT

Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the excavator. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

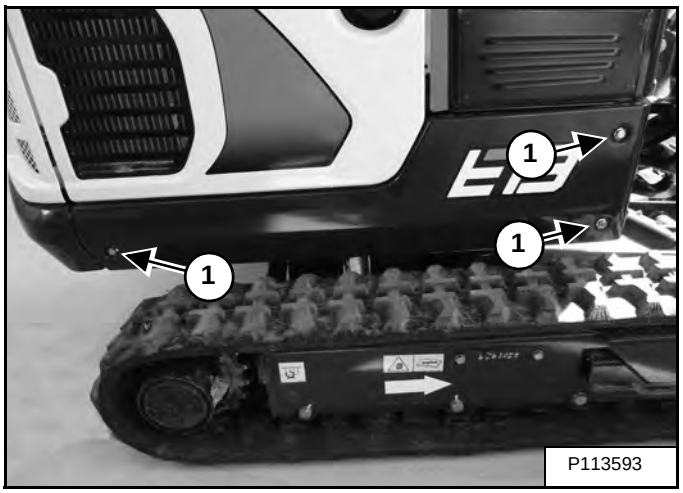
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Removing And Installing The Battery

Figure 50-20-7

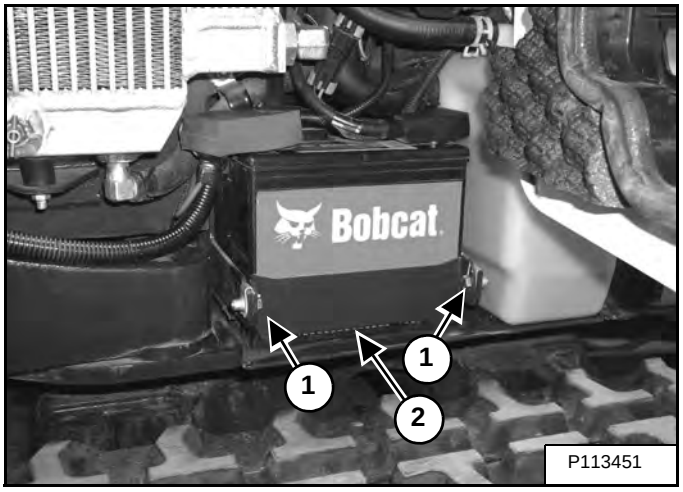


Remove the three bolts (Item 1) and remove the right side lower cover (Item 2) **[Figure 50-20-7]**.

Open the right side cover.

Turn the battery disconnect switch to the OFF position.

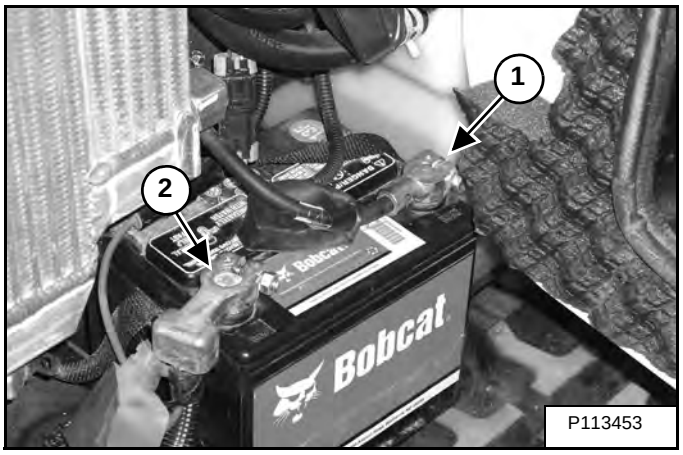
Figure 50-20-8



Remove the two bolts (Item 1) and remove the battery hold-down plate (Item 2) **[Figure 50-20-8]**.

Slide the battery to the right to access the battery cables.

Figure 50-20-9



Disconnect the negative (-) cable (Item 1) **[Figure 50-20-9]** first.

Disconnect the positive (+) cable (Item 2) **[Figure 50-20-9]**.

Remove the battery.

Always clean the terminals and the cable ends, even when installing a new battery.

Position the battery into the battery box.

Connect the battery cables. Connect the negative (-) cable (Item 1) **[Figure 50-20-9]** last to prevent sparks. Reinstall the battery post covers and slide the battery in fully.

Tighten the terminal clamp nuts to 7 N•m (5 ft-lb) torque.

Install the hold-down plate (Item 2) and the two bolts (Item 1) **[Figure 50-20-8]**. Reinstall the lower cover.

Turn the battery disconnect switch to the ON position.

⚠ WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

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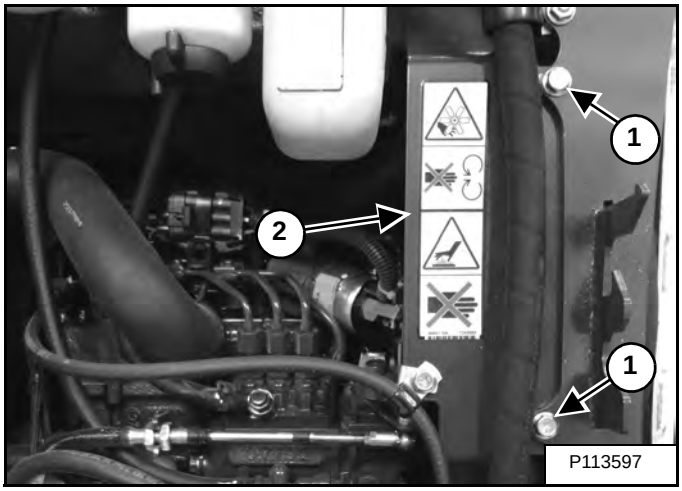
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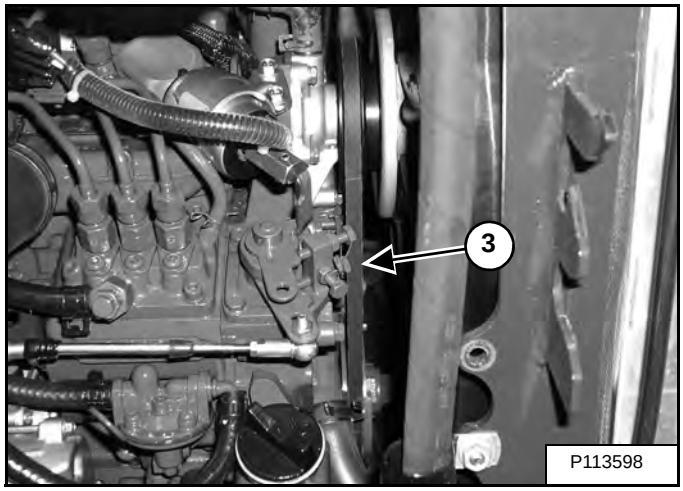
ALTERNATOR

Belt Adjustment

Stop the engine and open the tailgate.

Figure 50-30-1





Remove the two bolts (Item 1) and reposition the belt guard (Item 2) **[Figure 50-30-1]** out of the way.

Measure the belt (Item 3) **[Figure 50-30-1]** tension at the middle of the belt span.

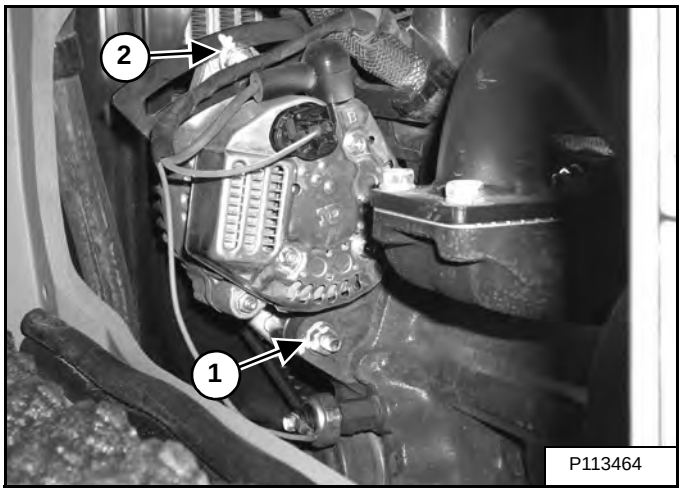
If a belt tension tool is available, move the alternator until the belt has (new belt = 272 - 292 N [61 - 65 lbf] or used belt = 233 - 252 N [53 - 57 lbf]) tension.

If a belt tension tool is not available, move the alternator until the belt has 8,0 mm (5/16 in) movement at the middle of the belt span with 66 N (15 lbf) of force.

Open the access door.

Remove the tool box. (See Removal And Installation on Page 40-260-1.)

Figure 50-30-2



NOTE: The seat is shown removed for photo clarity. The storage box below the seat can be removed to access the engine from below the seat.

NOTE: The alternator adjusting bolts can be accessed by removing the belt guard (Item 2) [Figure 50-30-1] and reaching around the engine.

If the belt tension is not correct, loosen the bolt and nut (Item 1) and the bolt (Item 2) **[Figure 50-30-2]** until the alternator can be moved toward the engine.

Adjust belt tension to correct specifications **[Figure 50-30-1]**.

Tighten the mounting and adjustment bolts. Recheck the belt tension to confirm it did not change while tightening the alternator bolts.

Reinstall the belt guard.

Close the tailgate.

Belt Replacement

Loosen the bolt and nut (Item 1) and the bolt (Item 2) **[Figure 50-30-2]** until the alternator can be moved toward the engine.

Remove the old belt and install a new belt.

Adjust belt tension to correct specifications **[Figure 50-30-1]**.

Tighten the mounting and adjustment bolts. Recheck the belt tension to confirm it did not change while tightening the alternator bolts.

Reinstall the belt guard (Item 2) **[Figure 50-30-1]**.

Close the tailgate.

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ALTERNATOR (CONT'D)

Charging System Inspection

⚠ WARNING

BATTERY GAS CAN EXPLODE AND CAUSE SERIOUS INJURY OR DEATH

Keep arcs, sparks, flames and lighted tobacco away from batteries. When *jumping* from booster battery make final connection (negative) at machine frame.

Do not jump start or charge a frozen or damaged battery. Warm battery to 16°C (60°F) before connecting to a charger. Unplug charger before connecting or disconnecting cables to battery. Never lean over battery while boosting, testing or charging.

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IMPORTANT

Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the excavator. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

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If the charging system malfunctions check the following:

Inspect the condition and tension of the alternator belt. (See Belt Adjustment on Page 50-30-1.) 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 electrolyte level in the battery. Add distilled water as needed. (Does not apply to maintenance free batteries.)

Verify the charge of the battery. Make sure battery is fully charged.

Disconnect the battery cables (negative first, then positive). Inspect the cable clamps and battery posts for corrosion. Remove acid or corrosion from the battery and cables with a sodium bicarbonate and water solution. Put grease on the cable ends and battery terminals to prevent corrosion. Reconnect the cable to the positive terminal.

⚠ WARNING

AVOID INJURY OR DEATH

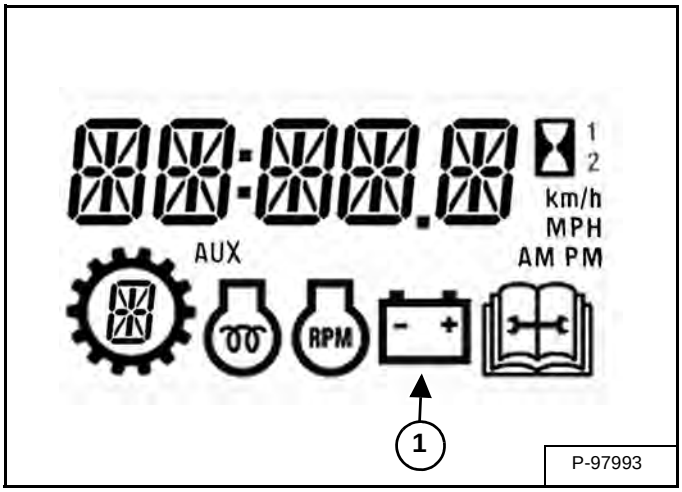
Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

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Figure 50-30-3



With the key in the run position and the engine off, the icon (Item 1) **[Figure 50-30-3]** must illuminate momentarily.

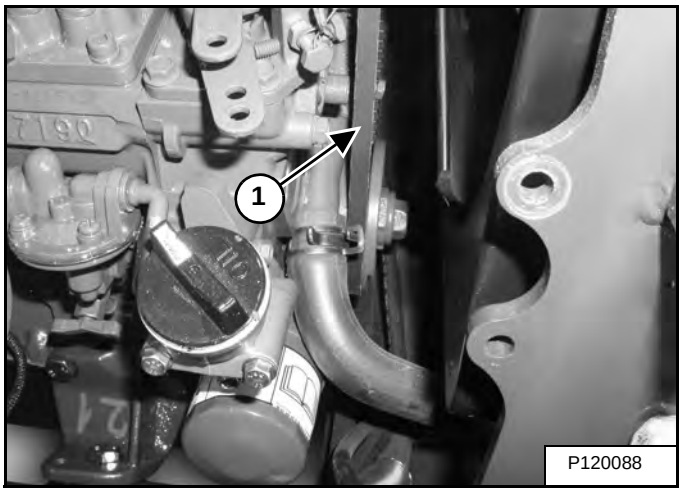
With the engine running, the icon will flash if system voltage is low or high.

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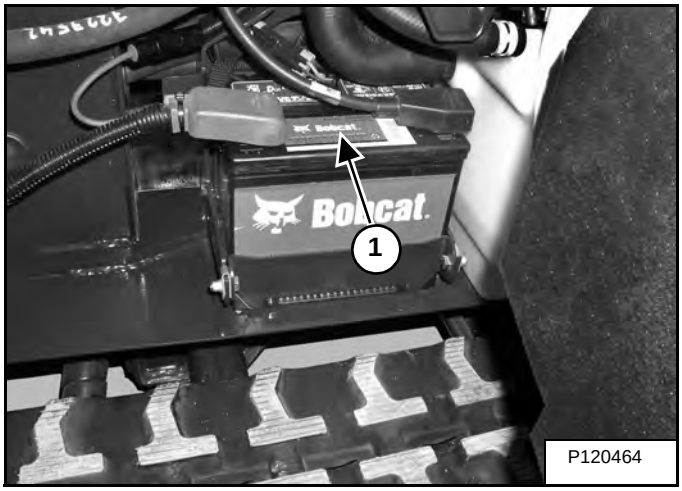
Charging System Inspection (Cont'd)

Figure 50-30-4



Start the engine. At low idle, the icon must be off. If the icon is flashing, inspect the alternator belt (Item 1) **[Figure 50-30-4]** for correct tension.

Figure 50-30-5



Increase engine speed to approximately 1500 rpm.

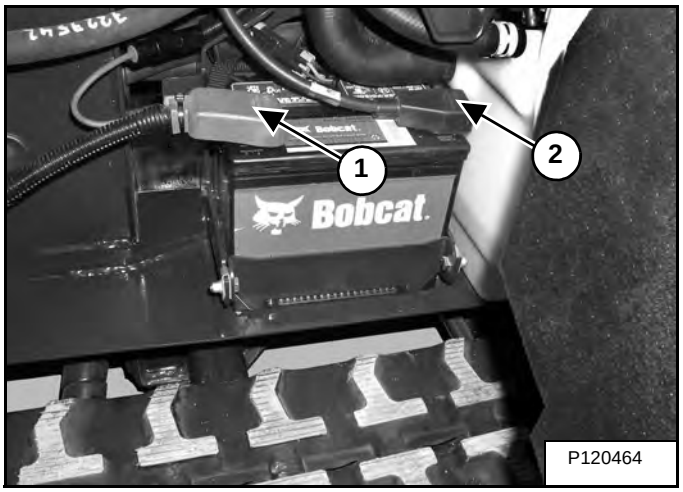
If the icon is illuminated, measure the voltage at the battery (Item 1) **[Figure 50-30-5]**.

Battery voltage should be between 13 and 15 volts.

If voltage is less than 13 volts or over 15.5 volts, replace the alternator.

Alternator Voltage Testing

Figure 50-30-6



Run the engine at rated speed. Check to make sure that all accessories are turned OFF. Connect the positive lead of the voltmeter to the positive terminal (Item 1) of the battery. Connect the negative lead of the volt meter to the negative terminal (Item 2) **[Figure 50-30-6]**. If the reading on the voltmeter is less than 13 volts or more than 15.5 volts, replace the alternator.

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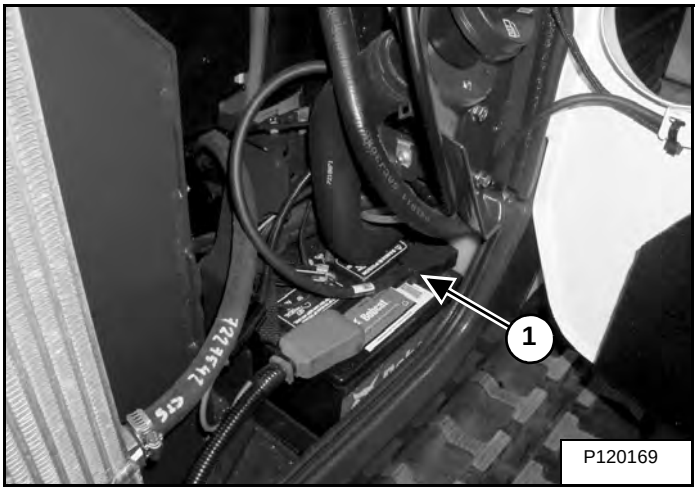
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ALTERNATOR (CONT'D)

Removal And Installation

Open the right side cover.

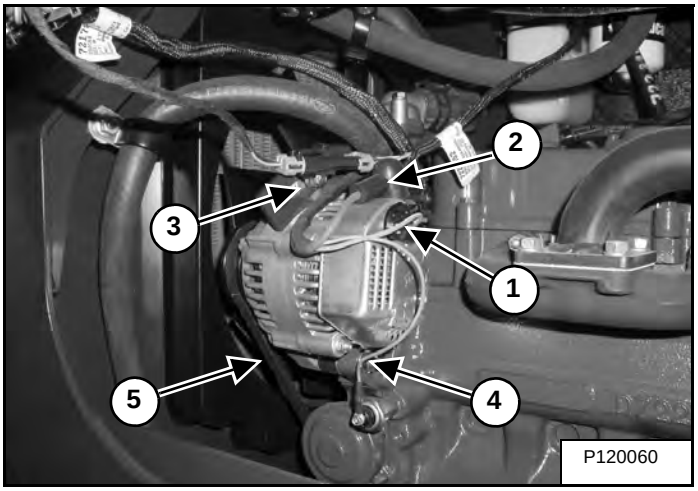
Figure 50-30-7



Disconnect the negative (-) cable (Item 1) **[Figure 50-30-7]** from the battery.

Remove the tool box. (See Removal And Installation on Page 40-260-1.)

Figure 50-30-8



Remove the wiring harness (Item 1) and output wire (Item 2) **[Figure 50-30-8]**.

Remove the top bolt (Item 3) and the lower bolt (Item 4) and remove the belt (Item 5) **[Figure 50-30-8]**.

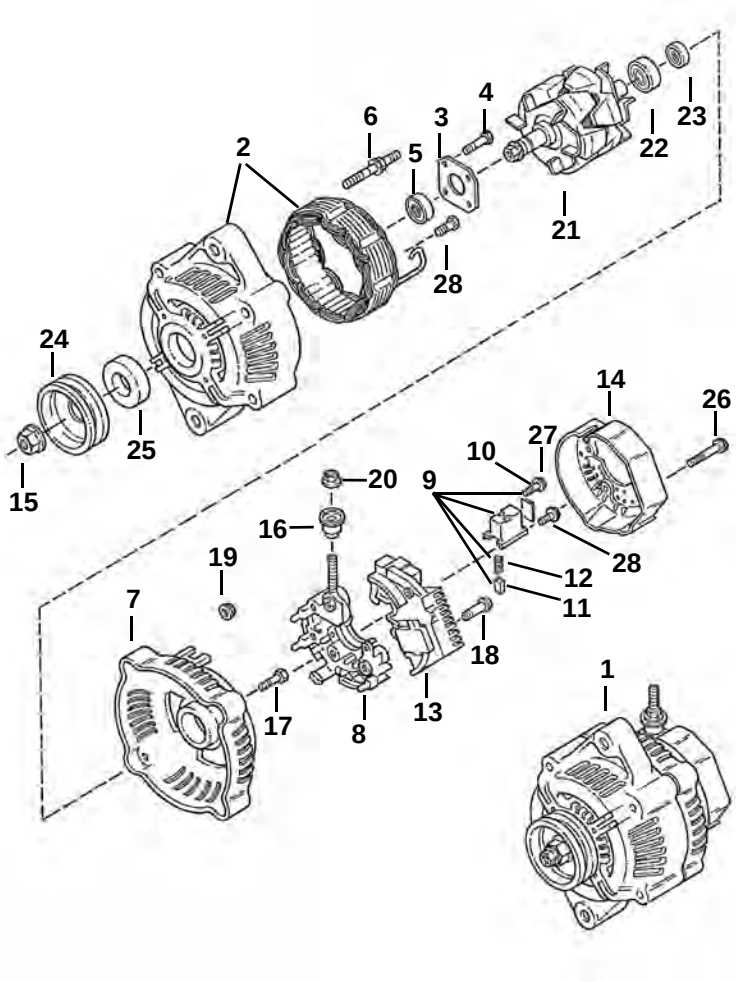
Remove the alternator from the machine.

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Parts Identification

1. Alternator
2. Frame Assy.
3. Plate
4. Screw
5. Bearing
6. Stud
7. Frame End
8. Holder
9. Holder
10. Seal
11. Brush
12. Spring
13. Regulator
14. Cover
15. Nut
16. Insulator
17. Bolt
18. Screw
19. Nut
20. Nut
21. Rotor Assy.
22. Bearing
23. Cover
24. Pulley
25. Spacer
26. Bolt
27. Screw
28. Screw



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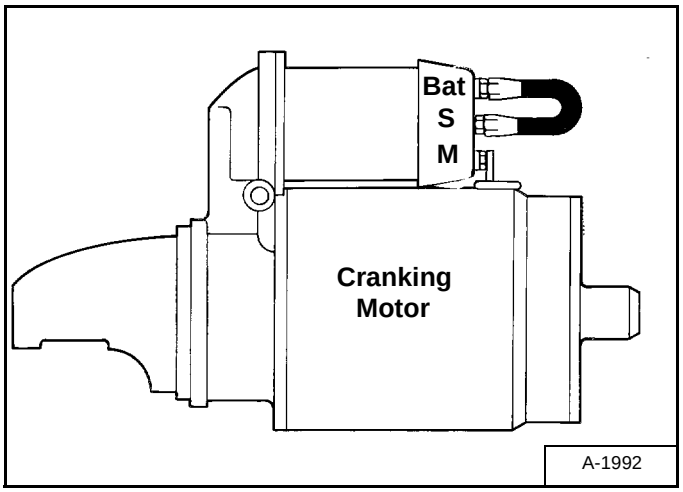


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Testing

Figure 50-40-1



The key switch must be in the OFF position.

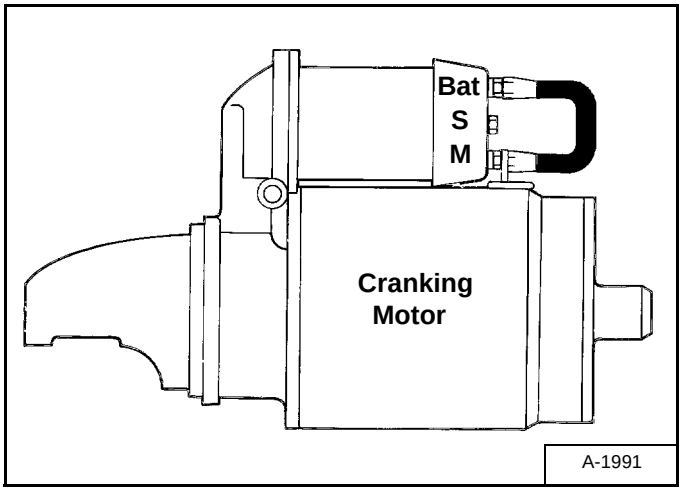
The battery must be at full charge.

The cable connections on the battery must be clean and tight.

Connect a jumper wire between S terminal and BAT terminal **[Figure 50-40-1]**.

If the starter turns but does not turn the engine, the starter drive has a defect.

Figure 50-40-2



Connect a jumper wire (of at least 4 gauge in size) between the M terminal and the BAT terminal **[Figure 50-40-2]**.

If the starter turns, the defect is in the solenoid.

If the starter does not turn, the starter is defective.

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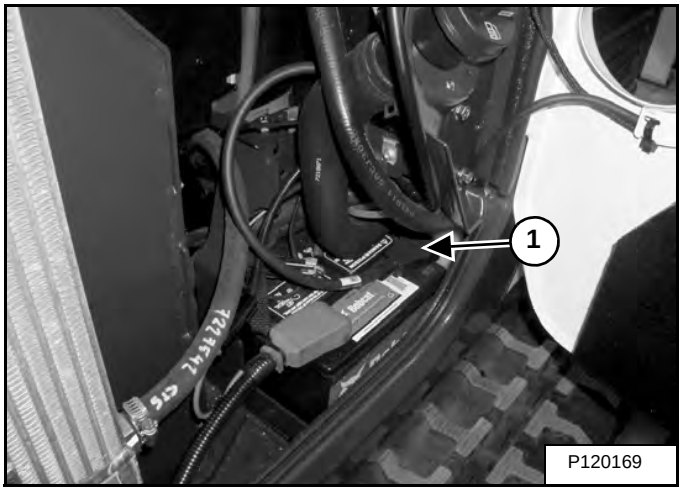
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STARTER (CONT'D)

Removal And Installation

Open the right side cover.

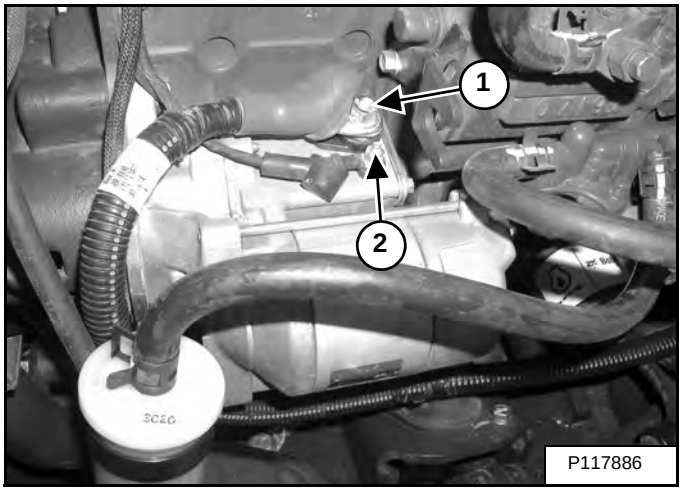
Figure 50-40-3



Disconnect the negative (-) cable (Item 1) **[Figure 50-40-3]** from the battery.

Open the tailgate.

Figure 50-40-4



Remove the positive cable (Item 1) and the solenoid wire (Item 2) **[Figure 50-40-4]** from the starter.

Figure 50-40-5

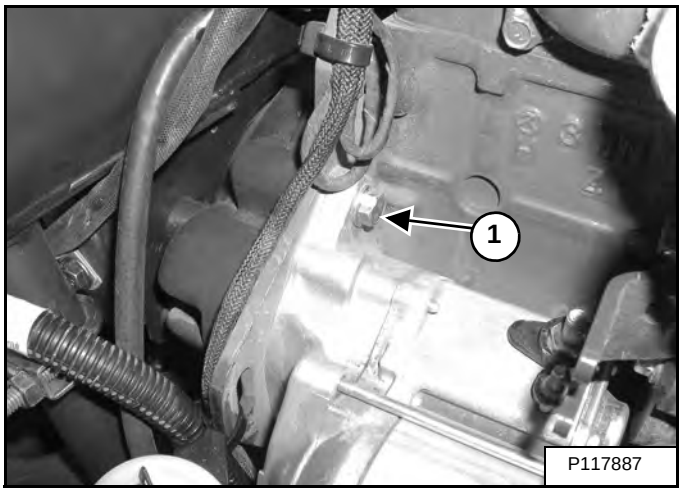
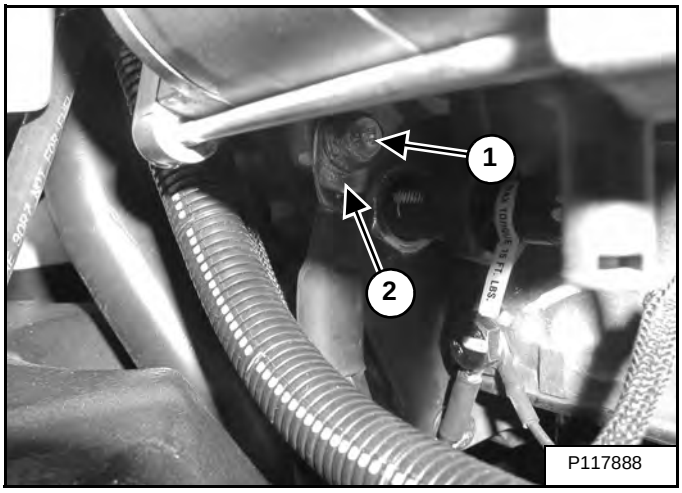


Figure 50-40-6



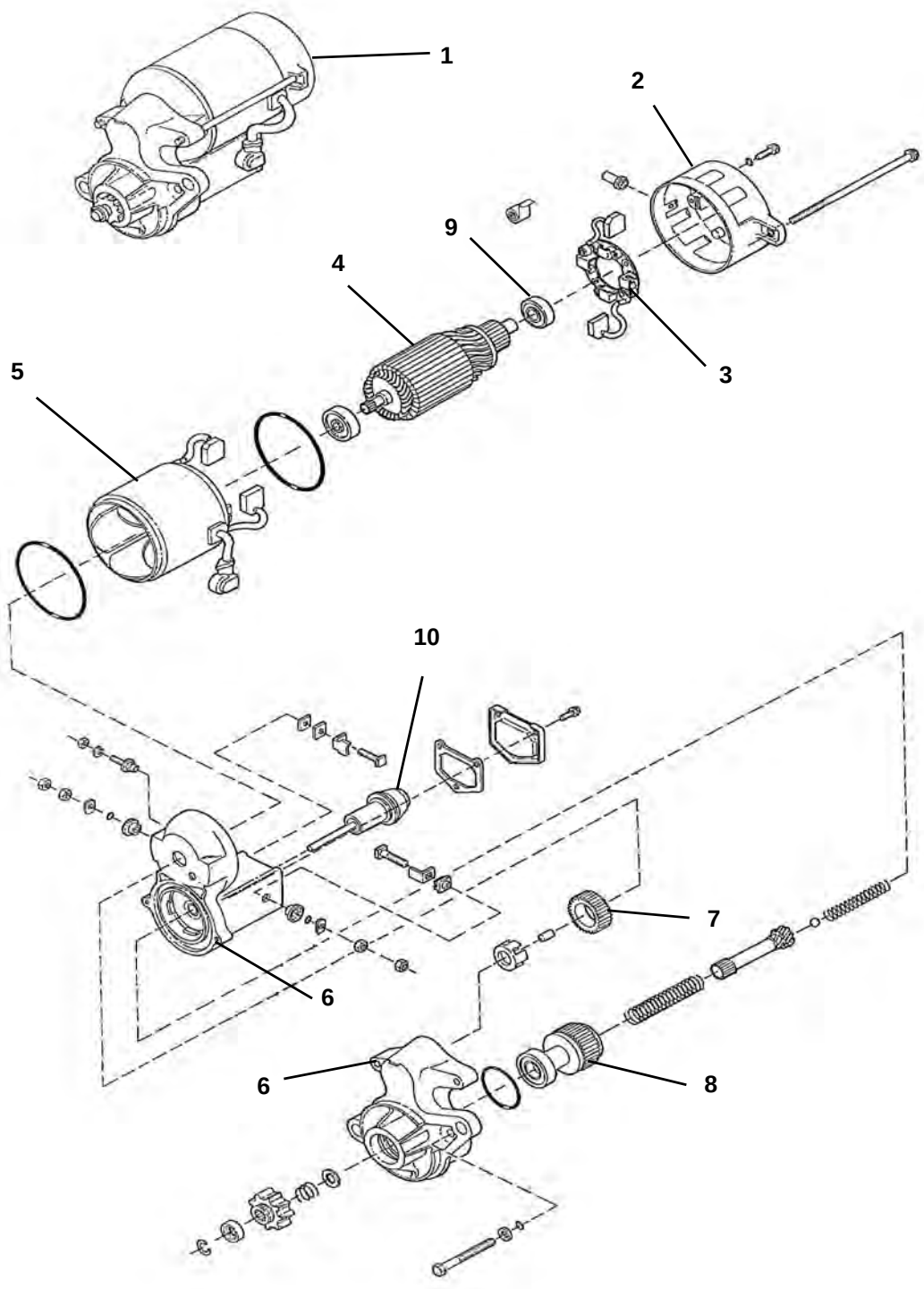
Remove the top bolt (Item 1) **[Figure 50-40-5]** and the bottom bolt (Item 1) **[Figure 50-40-6]**.

NOTE: The bottom bolt is also used to attach the frame to engine ground strap (Item 2) [Figure 50-40-6].

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Parts Identification



1. Starter
2. Frame
3. Brush
4. Armature
5. Frame
6. Housing
7. Pinion
8. Clutch
9. Bearing
10. Plunger

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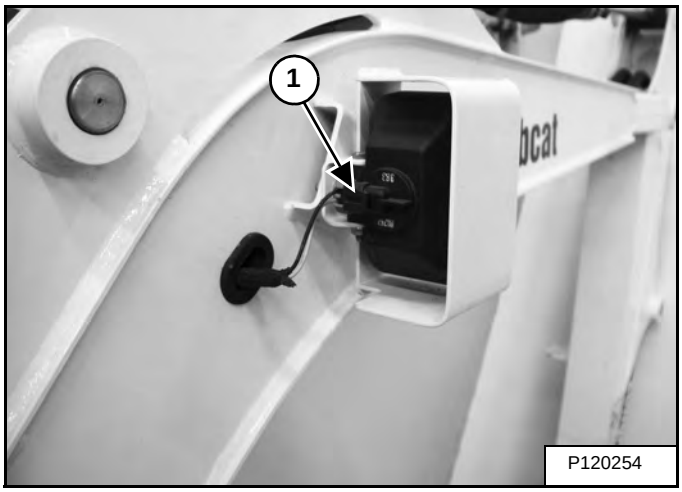
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LIGHTS

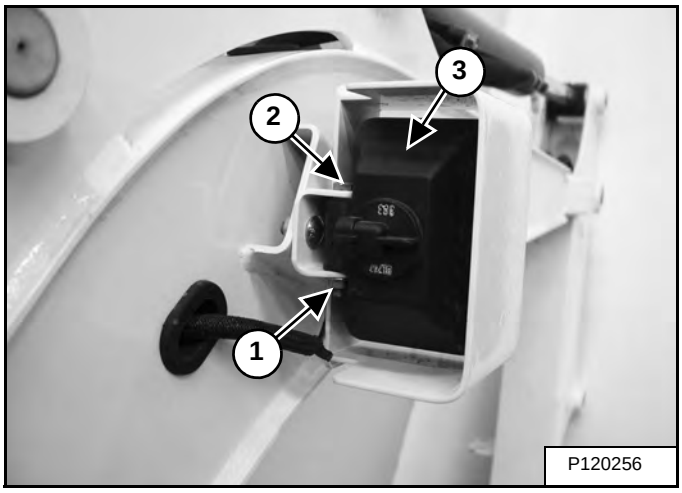
Boom Light Removal And Installation

Figure 50-50-1



Disconnect the wire harness (Item 1) **[Figure 50-50-1]**.

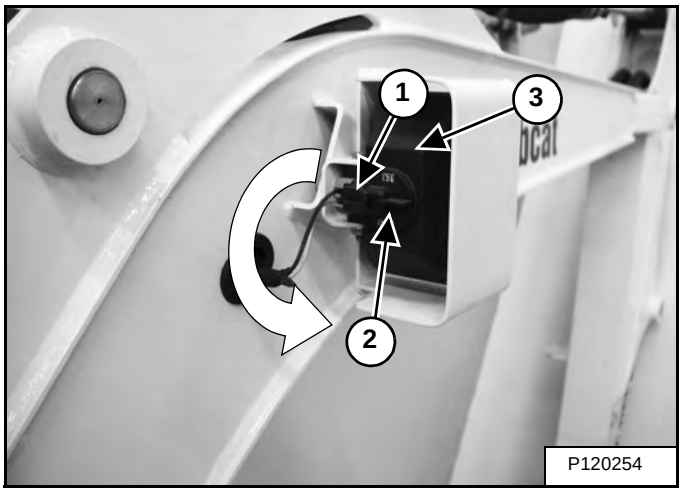
Figure 50-50-2



Remove the nut (Item 1) and bolt (Item 2). Remove the boom light (Item 3) **[Figure 50-50-2]** from the boom light guard.

Boom Light Bulb Replacement

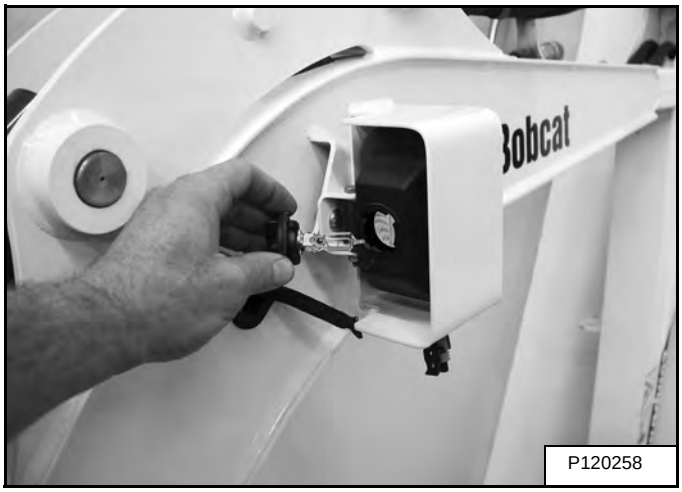
Figure 50-50-3



Disconnect the wire harness (Item 1) **[Figure 50-50-3]**.

Rotate light bulb assembly (Item 2) counterclockwise and pull straight out from the boom light (Item 3) **[Figure 50-50-3]**.

Figure 50-50-4



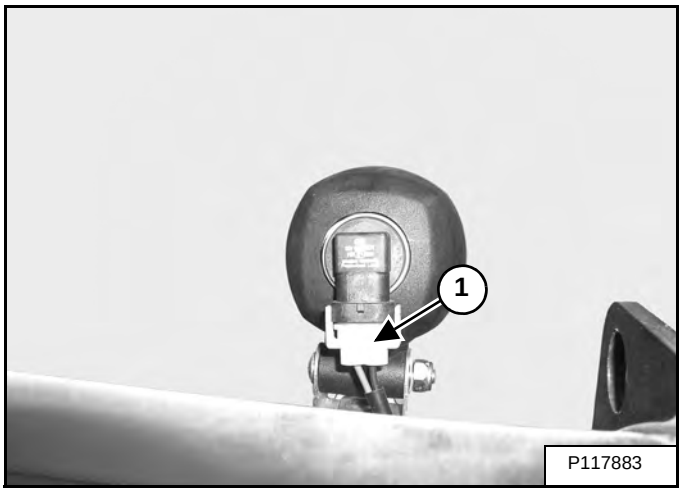
NOTE: Do not touch glass of halogen bulb with your fingers or allow bulb to come in contact with oils. If contaminated, the bulb should be cleaned with mild alcohol and a clean cloth [Figure 50-50-4].

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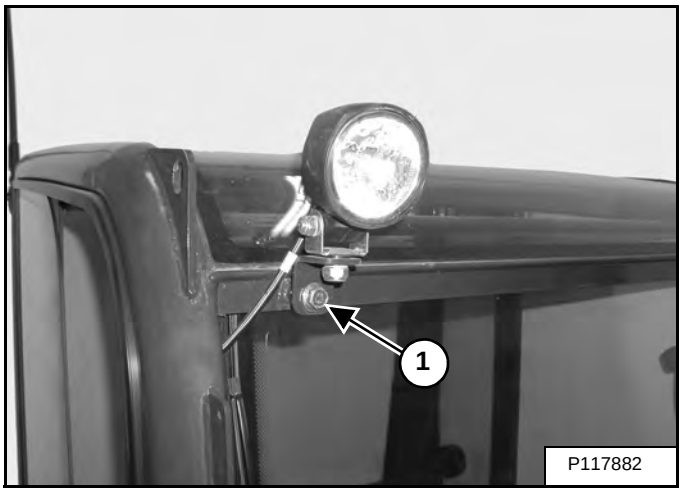
Cab Light Removal And Installation

Figure 50-50-5



Disconnect the wiring harness (Item 1) **[Figure 50-50-5]**.

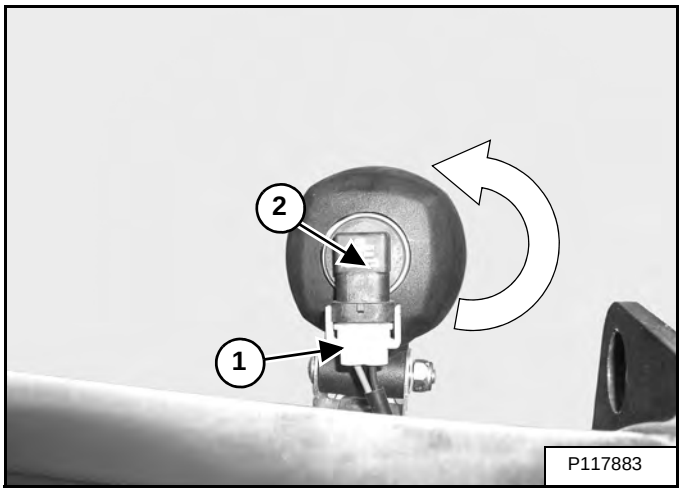
Figure 50-50-6



Remove the mounting bolt (Item 1) **[Figure 50-50-6]**.

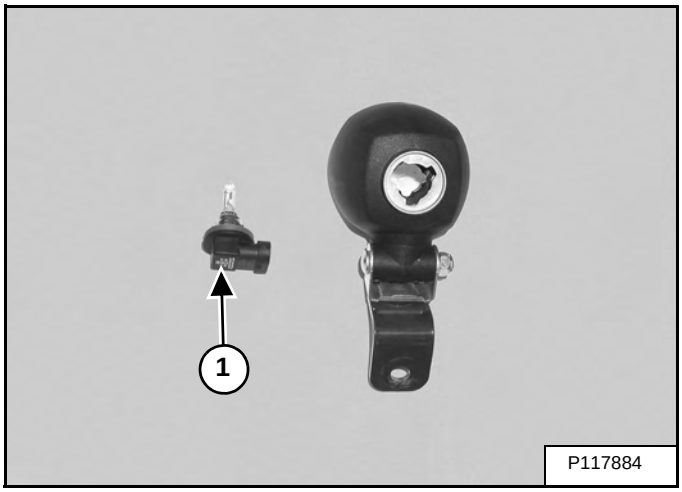
Cab Light Bulb Replacement

Figure 50-50-7



Disconnect the wire harness (Item 1). Rotate light bulb assembly (Item 2) **[Figure 50-50-7]** counterclockwise and pull straight out from the cab light.

Figure 50-50-8



Remove the light bulb assembly (Item 1) **[Figure 50-50-8]**.

NOTE: Don not touch glass of halogen bulb with your fingers or allow bulb to come in contact with oils. If contaminated, the bulb should be cleaned with mild alcohol and a clean cloth.

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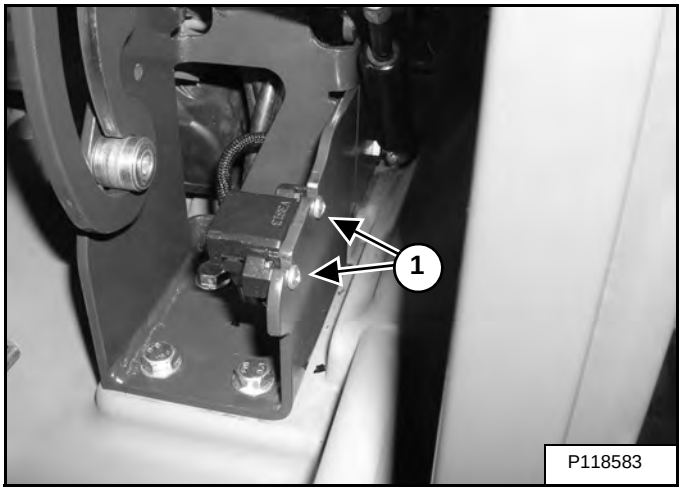
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MAGNETIC LOCKOUT SENSOR

Removal And Installation

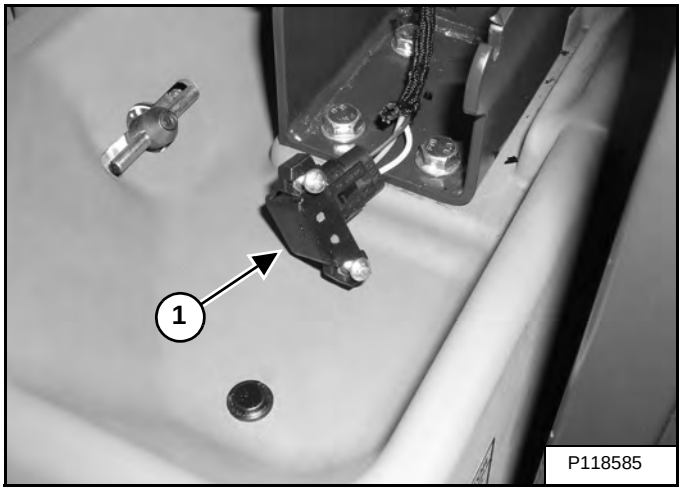
Lower the control console.

Figure 50-60-1



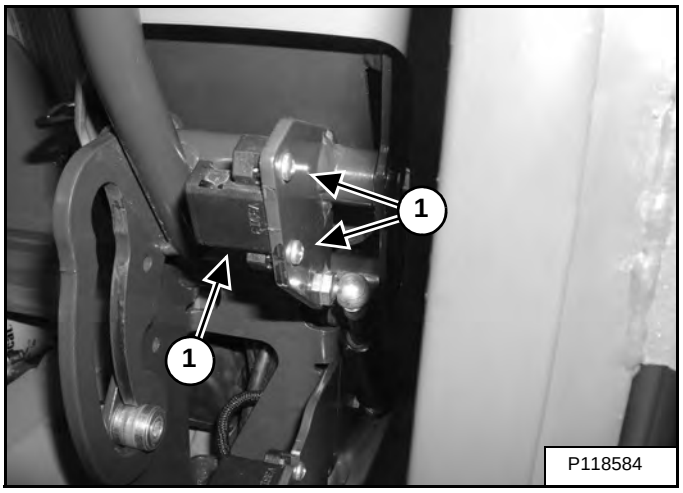
Loosen the screws (Item 1) **[Figure 50-60-1]**.

Figure 50-60-2



Remove the switch (Item 1) **[Figure 50-60-2]** from the wire harness.

Figure 50-60-3



Loosen the screws (Item 1) and remove the magnet (Item 2) **[Figure 50-60-3]**.

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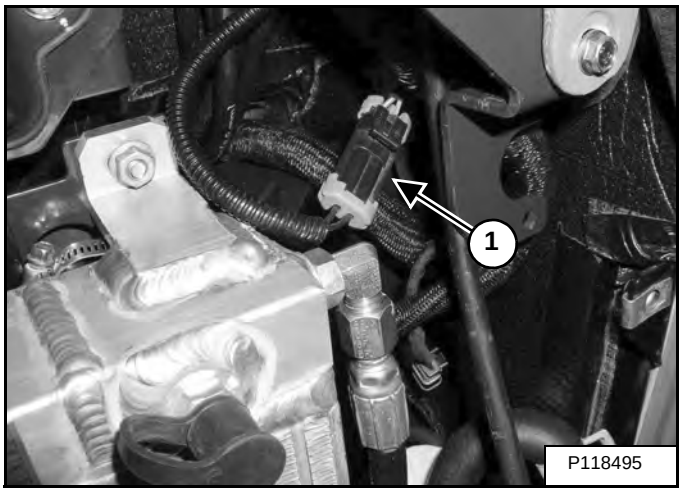
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TWO-SPEED SWITCH

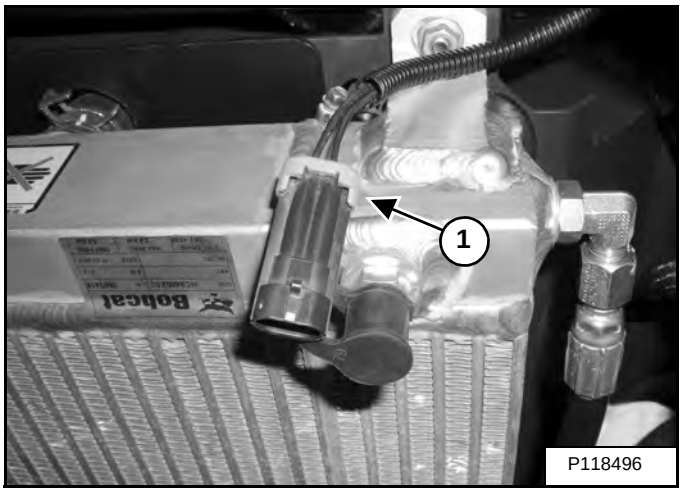
Removal And Installation

Figure 50-70-1



Open the right side cover and disconnect the wire harness (Item 1) **[Figure 50-70-1]**.

Figure 50-70-2



Remove the lock (Item 1) **[Figure 50-70-2]** from electrical connector.

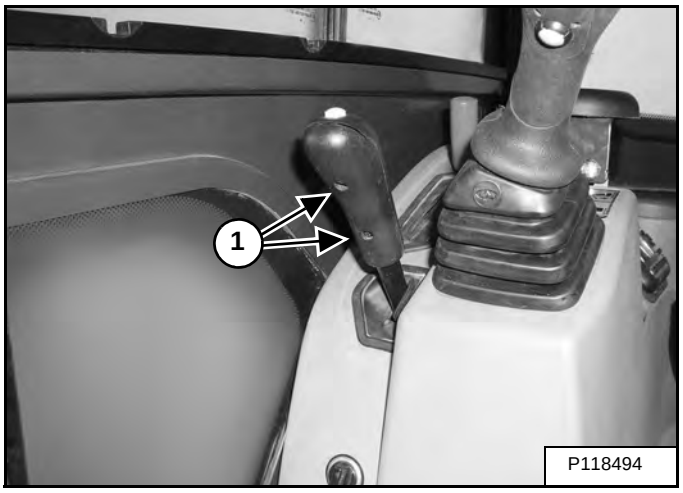
Using a small piece of wire, depress the wire terminal tabs.

Carefully remove the individual wires from the back of the electrical connector.

A	**Red**
B	**Green**

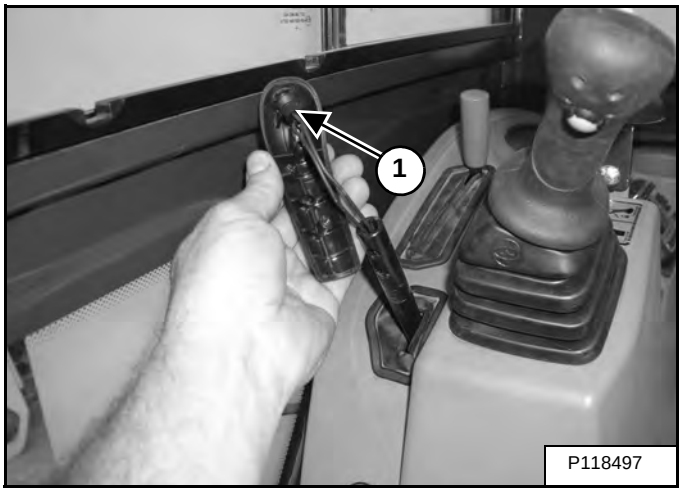
Installation: Check each wire to be certain it locks into place.

Figure 50-70-3



Remove the screws (Item 1) **[Figure 50-70-3]** from the blade handle.

Figure 50-70-4



Remove the two speed switch (Item 1) **[Figure 50-70-4]** and wire harness from the blade handle.

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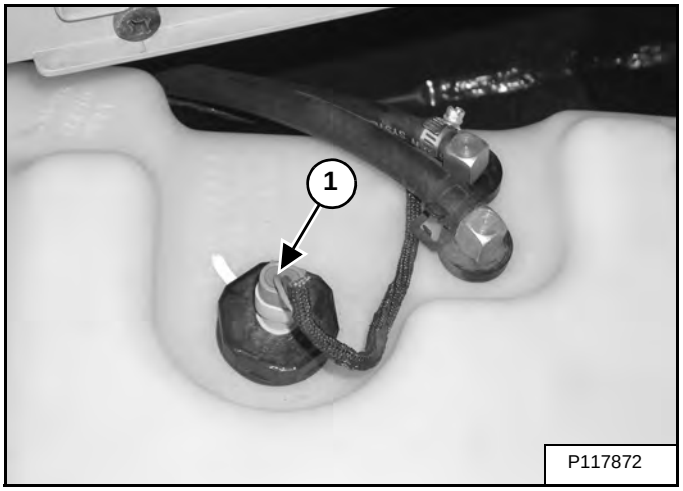
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FUEL LEVEL SENDER

Removal And Installation

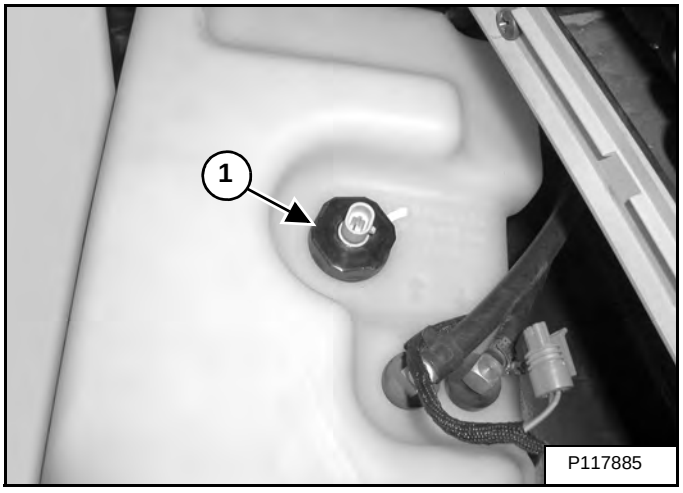
Remove the fuel tank. (See Removal And Installation on Page 40-150-1.)

Figure 50-80-1



Disconnect the wire harness (Item 1) **[Figure 50-80-1]** from the fuel level sender.

Figure 50-80-2

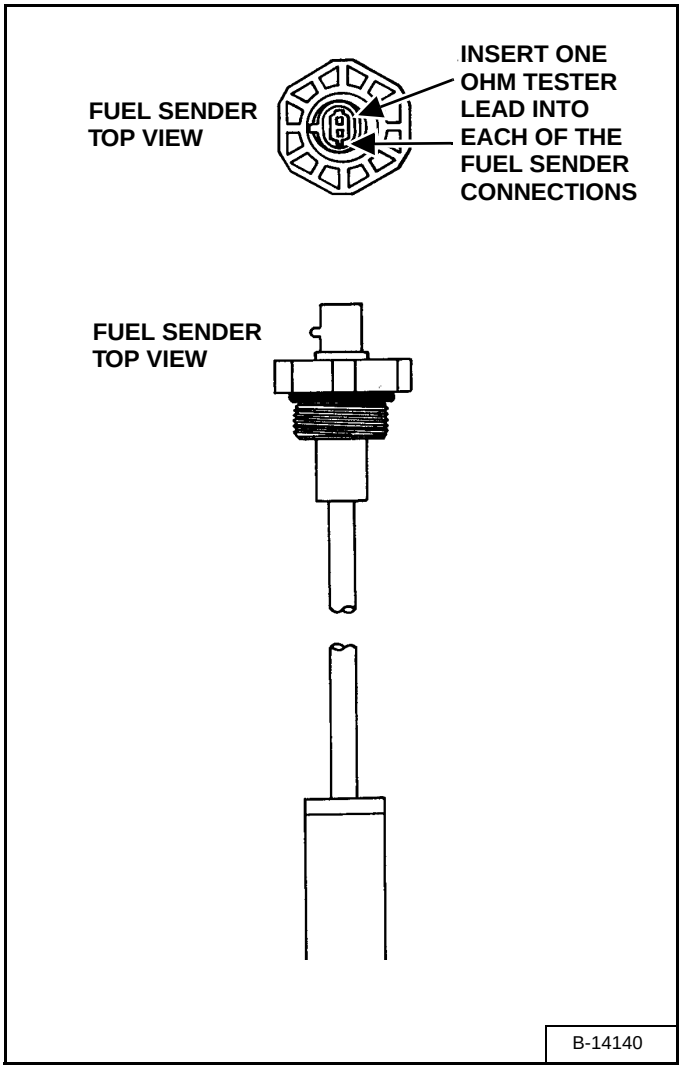


Remove the sender (Item 1) **[Figure 50-80-2]** from the fuel tank.

Testing

Use an ohmmeter to test the resistance of the fuel level sender.

Figure 50-80-3



Insert one of the ohm tester leads into each of the fuel sender electrical connectors in the end of the fuel sender **[Figure 50-80-3]**.

With the fuel sender in the position shown **[Figure 50-80-3]**, read the ohms in the empty position. Slide the float upwards and the ohm reading will decrease. See resistance chart below.

The approximate resistance should read as follows:

FULL: 15 - 35 ohm
HALF: 120 - 145 ohm
EMPTY: 230 - 250 ohm

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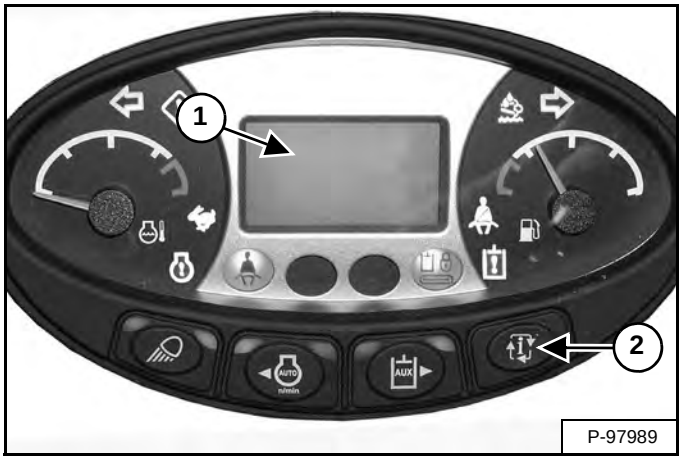
DIAGNOSTIC SERVICE CODES

Viewing Service Codes

The Service Codes will aid your dealer in diagnosing conditions that can damage your machine.

Standard Instrument Panel

Figure 50-90-1



Press the Information button (Item 2) to cycle the data display (Item 1) **[Figure 50-90-1]** until the service code screen is displayed. If more than one service code is present, the codes will scroll on the data display.

When no service code is present, **[NONE]** is displayed **[Figure 50-90-1]**.

NOTE: Corroded or loose earth can cause multiple service codes and / or abnormal symptoms. All instrument panel lights flashing, alarm sounding, headlights and taillights flashing, can indicate a bad earth. The same symptoms can apply if the voltage is low, such as loose or corroded battery cables. If you observe these symptoms, check earth and positive leads first.

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DIAGNOSTIC SERVICE CODES (CONT'D)

Number Codes List (S/N B3LA11001 & Above And B3LB11001 & Above)

CODE		CODE	
M0216	Hydraulic Filter Not Connected	M1705	Hydraulics Enable Solenoid Short to Battery
M0217	Hydraulic Filter Plugged	M1706	Hydraulics Enable Solenoid Short to Ground
		M1707	Hydraulics Enable Solenoid Open Circuit
		M1732	Hydraulics Enable Solenoid Overcurrent
M0309	Battery Voltage Low		
M0310	Battery Voltage High	M1802	Power Beyond Relay Error On
M0311	Battery Voltage Extremely High	M1803	Power Beyond Relay Error Off
M0314	Battery Voltage Extremely Low	M1807	Power Beyond Output Open Circuit
M0322	Battery Voltage Out of Range Low		
		M1902	Power Beyond Valve Relay Error On
M0610	Engine Speed High	M1903	Power Beyond Valve Relay Error Off
M0611	Engine Speed Extremely High		
M0613	Engine Speed No Signal	M2005	Two Speed Solenoid Short to Battery
M0615	Engine Speed Shutdown	M2006	Two Speed Solenoid Short to Ground
M0618	Engine Speed Out of Range	M2007	Two Speed Solenoid Open Circuit
M0810	Engine Coolant Temperature High	M2102	Glow Plug Output Error On
M0811	Engine Coolant Temperature Extremely High	M2103	Glow Plug Output Error Off
M0815	Engine Coolant Temperature Shutdown	M2107	Glow Plug Output Open Circuit
M0821	Engine Coolant Temperature Out of Range High		
M0822	Engine Coolant Temperature Out of Range Low	M2202	Starter Output Error On
		M2203	Starter Output Error Off
M0909	Fuel Level Low	M2207	Starter Output Open Circuit
M0921	Fuel Level Out of Range High	M2228	Starter Output Failure
M0922	Fuel Level Out of Range Low		
		M2302	Starter Relay Error On
M1121	Console Sensor Out of Range High	M2303	Starter Relay Error Off
M1122	Console Sensor Out of Range Low		
M1128	Console Sensor Failure	M2402	Fuel Pull Relay Error On
		M2403	Fuel Pull Relay Error Off
M1305	Fuel Hold Solenoid Short to Battery		
M1306	Fuel Hold Solenoid Short to Ground	M2521	Load Sense Sensor Out of Range High
M1307	Fuel Hold Solenoid Open Circuit	M2522	Load Sense Sensor Out of Range Low
		M2005	Two Speed Solenoid Short to Battery
M1405	Fuel Pull Solenoid Short to Battery		
M1406	Fuel Pull Solenoid Short to Ground	M2602	Glow Plug Relay Error On
M1407	Fuel Pull Solenoid Open Circuit	M2603	Glow Plug Relay Error Off
M1605	Hydraulics Bypass Solenoid Short to Battery	M3128	Interrupted Power Failure
M1606	Hydraulics Bypass Solenoid Short to Ground		
M1607	Hydraulics Bypass Solenoid Open Circuit		
M1632	Hydraulics Bypass Solenoid Overcurrent		

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Number Codes List (S/N B3LA11001 & Above And B3LB11001 & Above) (Cont'd)

CODE		CODE	
M4109	Alternator Low	M6204	Load Moment Sensor In Error
M4110	Alternator High	M6221	Load Moment Sensor Out of Range High
		M6222	Load Moment Sensor Out of Range Low
M4304	Keyless Start Panel No Communication		
		M6402	Switched Power Relay Error On
M4404	Secondary Controller No Communication		
M4621	5V Sensor Supply Out of Range High	M7002	Switched Power Output Error On
M4622	5V Sensor Supply Out of Range Low	M7003	Switched Power Output Error Off
		M7007	Switched Power Output Open Circuit
M4721	8V Sensor Supply Out of Range High	M7028	Switched Power Output Failure
M4722	8V Sensor Supply Out of Range Low		
M5002	Light Output Error On	M7423	Main Controller Not Programmed
M5003	Light Output Error Off	M7497	Main Controller Software Updated
M5205	Offset Base Solenoid Short to Battery	M7604	Standard Display Panel No Communication
M5206	Offset Base Solenoid Short to Ground		
M5207	Offset Base Solenoid Open Circuit	M7748	Key Switch Multiple
M5232	Offset Base Solenoid Overcurrent		
		M7839	Hourmeter Changed
M5305	Offset Rod Solenoid Error On		
M5306	Offset Rod Solenoid Short to Ground		
M5307	Offset Rod Solenoid Open Circuit		
M5332	Offset Rod Solenoid Overcurrent		
		R7404	No Communication To Main Controller
M5421	Offset Control Switch Out of Range High		
M5422	Offset Control Switch Out of Range Low		
M5424	Offset Control Switch Out of Neutral		
M5505	Auxiliary Base Solenoid Short to Battery		
M5506	Auxiliary Base Solenoid Short to Ground		
M5507	Auxiliary Base Solenoid Open Circuit		
M5532	Auxiliary Base Solenoid Overcurrent		
M5605	Auxiliary Rod Solenoid Short to Battery		
M5606	Auxiliary Rod Solenoid Short to Ground		
M5607	Auxiliary Rod Solenoid Open Circuit		
M5632	Auxiliary Rod Solenoid Overcurrent		
M5721	Auxiliary Control Switch Out of Range High		
M5722	Auxiliary Control Switch Out of Range Low		
M5724	Auxiliary Control Switch Out of Neutral		

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Number Codes List (S/N AWMM11001 & Above And B4PK11001 & Above)

CODE		CODE	
L0102	Lights Button Error On	M1305	Fuel Hold Solenoid Short to Battery
L0202	Auto Idle Button Error On	M1306	Fuel Hold Solenoid Short to Ground
L0302	Auxiliary Button Error On	M1307	Fuel Hold Solenoid Open Circuit
L0402	Information Button Error On		
L7404	Gateway Controller No Communication	M1402	Fuel Pull Solenoid Error On
L7672	Display Panel Programming Error	M1403	Fuel Pull Solenoid Error Off
		M1407	Fuel Pull Solenoid Open Circuit
M0216	Hydraulic Filter Not Connected		
M0217	Hydraulic Filter Plugged	M1605	Hydraulics Bypass Solenoid Short to Battery
		M1606	Hydraulics Bypass Solenoid Short to Ground
M0309	Battery Voltage Low	M1607	Hydraulics Bypass Solenoid Open Circuit
M0310	Battery Voltage High	M1632	Hydraulics Bypass Solenoid Overcurrent
M0311	Battery Voltage Extremely High		
M0314	Battery Voltage Extremely Low	M1705	Hydraulics Enable Solenoid Short to Battery
M0322	Battery Voltage Out of Range Low	M1706	Hydraulics Enable Solenoid Short to Ground
		M1707	Hydraulics Enable Solenoid Open Circuit
M0414	Engine Oil Pressure Extremely Low	M1732	Hydraulics Enable Solenoid Overcurrent
M0415	Engine Oil Pressure in Shutdown		
		M1802	PB Output Error On
M0610	Engine Speed High	M1803	PB Output Error Off
M0611	Engine Speed Extremely High	M1807	PB Output Open Circuit
M0613	Engine Speed No Signal		
M0615	Engine Speed Shutdown	M1902	Power Beyond Valve Relay Error On
M0618	Engine Speed Out of Range	M1903	PB Valve Relay Error Off
M0810	Engine Coolant Temperature High	M2005	Two Speed Solenoid Short to Battery
M0811	Engine Coolant Temperature Extremely High	M2006	Two Speed Solenoid Short to Ground
M0815	Engine Coolant Temperature Shutdown	M2007	Two Speed Solenoid Open Circuit
M0821	Engine Coolant Temperature Out of Range High		
M0822	Engine Coolant Temperature Out of Range Low	M2102	Glow Plug Output Error On
		M2103	Glow Plug Output Error Off
M0909	Fuel Level Low	M2107	Glow Plug Output Open Circuit
M0921	Fuel Level Out of Range High	M2128	Glow Plug Output Failure
M0922	Fuel Level Out of Range Low		
		M2202	Starter Output Error On
M1121	Console Sensor Out of Range High	M2203	Starter Output Error Off
M1122	Console Sensor Out of Range Low	M2207	Starter Output Open Circuit
M1128	Console Sensor Failure		

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Number Codes List (S/N AWMM11001 & Above And B4PK11001 & Above) (Cont'd)

CODE		CODE	
M2302	Starter Relay Error On	M5505	Auxiliary Base Solenoid Short to Battery
M2303	Starter Relay Error Off	M5506	Auxiliary Base Solenoid Short to Ground
		M5507	Auxiliary Base Solenoid Open Circuit
M2402	Fuel Pull Relay Error On	M5532	Auxiliary Base Solenoid Overcurrent
M2403	Fuel Pull Relay Error Off		
		M5605	Auxiliary Rod Solenoid Short to Battery
M2521	Load Sense Sensor Out of Range High	M5606	Auxiliary Rod Solenoid Short to Ground
M2522	Load Sense Sensor Out of Range Low	M5607	Auxiliary Rod Solenoid Open Circuit
		M5632	Auxiliary Rod Solenoid Overcurrent
M2602	Glow Plug Relay Error On		
M2603	Glow Plug Relay Error Off	M5721	Auxiliary Control Switch Out of Range High
		M5722	Auxiliary Control Switch Out of Range Low
M3128	Interrupted Power Failure	M5724	Auxiliary Control Switch Out of Neutral
M4109	Alternator Low	M6204	Load Moment Sensor In Error
M4110	Alternator High	M6221	Load Moment Sensor Out of Range High
		M6222	Load Moment Sensor Out of Range Low
M4304	Keyless Start Panel No Communication	M6204	Load Moment Sensor In Error
M4404	Secondary Controller No Communication	M6402	Switched Power Relay Error On
		M6403	Switched Power Relay Off
M4621	5V Sensor Supply Out of Range High	M6407	Switched Power Relay Open Circuit
M4622	5V Sensor Supply Out of Range Low		
		M7002	Switched Power Output Error On
M4721	8V Sensor Supply Out of Range High	M7003	Switched Power Output Error Off
M4722	8V Sensor Supply Out of Range Low	M7007	Switched Power Output Open Circuit
		M7028	Switched Power Output Failure
M5002	Light Output Error On		
M5003	Light Output Error Off	M7423	Main Controller Not Programmed
		M7497	Main Controller Software Updated
M5205	Offset Base Solenoid Short to Battery		
M5206	Offset Base Solenoid Short to Ground	M7604	Standard Display Panel No Communication
M5207	Offset Base Solenoid Open Circuit		
M5232	Offset Base Solenoid Overcurrent	M7748	Key Switch Multiple
M5305	Offset Rod Solenoid Error On	M7839	Hourmeter Changed
M5306	Offset Rod Solenoid Short to Ground		
M5307	Offset Rod Solenoid Open Circuit	R7404	No Communication To Main Controller
M5332	Offset Rod Solenoid Overcurrent		
M5421	Offset Control Switch Out of Range High		
M5422	Offset Control Switch Out of Range Low		
M5424	Offset Control Switch Out of Neutral		

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CONTROL PANEL SETUP

Password Setup (Keyless Start Panel)

Password Description

Master Password:

A permanent, randomly selected password set at the factory that cannot be changed. This password is used for service by the Bobcat dealer if the owner password is not known or to change the owner password.

Owner Password:

Allows for full use of the excavator. Must be used to change the owner password, or User 1 / User 2 password.

User 1 and User 2 Passwords:

By default, User 1 ad User 2 Passwords are not set.

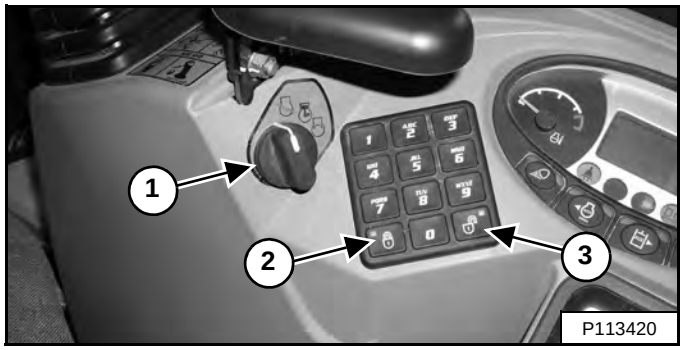
NOTE: The User 1 and User 2 Password cannot be used to change a password or to switch between the Locked / Unlocked models.

Changing The Owner, User 1 and User 2 Password

Turn the start switch (Item 1) **[Figure 50-100-1]** to the ON position to turn on the excavators electrical system.

Enter the five digit owner password using the number keys (1 through 0) if locked.

Figure 50-100-1



Press and hold the lock (Item 2) and unlock (Item 3) **[Figure 50-100-1]** keys for 2 seconds.

The lock key red light will flash and the instrument panel display screen will show **[CODE]**.

Enter a new five digit owner password using the number keys (1 through 0).

The display screen will show **[OWNER]** for two seconds. Press the unlock key (Item 3) **[Figure 50-100-1]** to navigate between **[OWNER]**, **[USER 1]**, and **[USER 2]**.

After two seconds, the display screen will show **[ENTER]**.

NOTE: The lock key (Item 2), red light and the unlock key (Item 3) [Figure 50-100-3], green light with flash during the procedure.

Enter a new five digit owner, user 1 or user 2 password using the number keys (1 through 0). An asterisk will show in the display screen for each key pass.

The display screen will show **[AGAIN]**.

Enter the new five digit owner password again.

The display screen will show **[ERROR]** if:

- The second five digit owner, user 1 or user 2 password is different from the first one entered.

or

- No number key was pressed for more than 20 seconds.

or

- “00000” was entered as owner, user 1 or user 2 password.

NOTE: “00000” is not an acceptable owner, user 1 or user 2 password.

The system returns to its previous state. Either the lock key (Item 2), red light or the unlock key (Item 3) **[Figure 50-100-3]**, green light will become solid.

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Password Lockout Feature

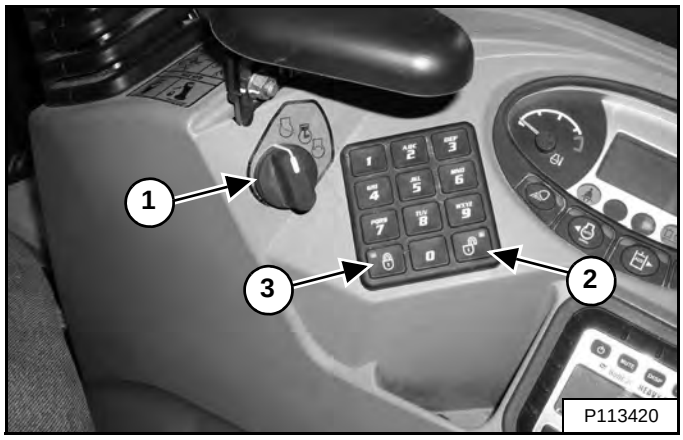
This feature allows the owner to unlock the password feature so that a password does not need to be used every time the engine is started.

NOTE: The password lockout feature does not function with the user 1 or user 2 password.

Turn the start switch (Item 1) **[Figure 50-100-2]** to the ON position to turn on the excavators electrical system.

Enter the five digit owner password using the number keys (1 through 0).

Figure 50-100-2



Press the unlock key (Item 2) **[Figure 50-100-3]**.

The left panel display screen will show **[CODE]**.

Enter the five digit owner password using the number keys (1 through 0). The unlock key green light will flash, then become solid.

The excavator can now be started without using a password.

NOTE: Use the following procedure to reset the machine lock so that the excavator requires a password to start the engine.

Turn the start switch to the ON position to turn on the excavators electrical system.

Press the lock key (Item 3) **[Figure 50-100-3]**.

The lock key red light will flash and the left panel display screen will show **[CODE]**.

Enter the five digit owner password using the number keys (1 through 0). The unlock key green light will flash, then the lock key red light will become solid.

You must now enter the password every time to start the excavator.

Password Setup (Deluxe Instrument Panel)

Password Setup is available on machines with a Deluxe Instrument Panel.

Password Description

All new machines with a Deluxe Instrument Panel arrive at Bobcat dealerships with the keypad in locked mode. Locked mode means that a password must be used to start the engine.

For security purposes, your dealer may change the password and set the keypad in the locked mode. Your dealer will provide you with the password.

Master Password:

A permanent, randomly selected password set at the factory that cannot be changed. This password is used for service by the Bobcat dealer if the owner password is not known or to change the owner password.

Owner Password:

Allows for full use of the excavator and to set up the Deluxe Instrument Panel. There is only one owner password. The owner password must be used to change the owner or user passwords. Owner should change the password as soon as possible for security of the excavator.

User Password:

Allows starting and operating the excavator; cannot change password or any of the other setup features.

For the procedures to change passwords: (See Changing The Owner Password on Page 50-100-3.) and (See Changing The User Passwords on Page 50-100-4.)

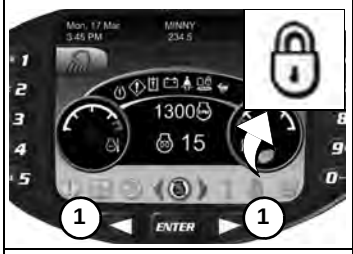
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CONTROL PANEL SETUP (CONT'D)

Password Setup (Deluxe Instrument Panel (Cont'd)

Changing The Owner Password

	Press a scroll button (Item 1) repeatedly until the Security screen icon (Inset) is highlighted.
	Select **[1. PASSWORDS / LOCKOUTS]**.
	Enter owner password and press **[ENTER]**.
	Select **[1. USER SETTINGS]**.
	Select **[1. OWNER]**.
	Select **[2. CHANGE PASSWORD]**.
	Enter new owner password and press **[ENTER]**. You will be prompted to reenter the new owner password.

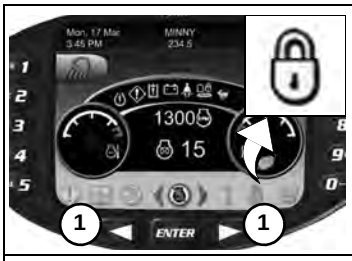
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CONTROL PANEL SETUP (CONT'D)

Password Setup (Deluxe Instrument Panel (Cont'd)

Changing The User Passwords

	Press a scroll button (Item 1) repeatedly until the Security screen icon (Inset) is highlighted.
	Select **[1. PASSWORDS / LOCKOUTS]**.
	Enter owner password and press **[ENTER]**.
	Select **[1. USER SETTINGS]**.
	Select user.
	Select **[2. CHANGE PASSWORD]**.
	Enter new user password and press **[ENTER]**.

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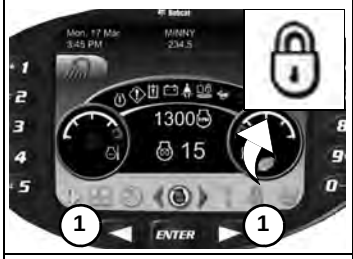
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CONTROL PANEL SETUP (CONT'D)

Password Setup (Deluxe Instrument Panel) (Cont'd)

Password Lockout Feature

This feature allows the owner to unlock the password feature so that a password does not need to be used every time the engine is started.

	Press a scroll button (Item 1) repeatedly until the Security screen icon (Inset) is highlighted.
	Select **[1. PASSWORDS / LOCKOUTS]**.
	Enter owner password and press **[ENTER]**.
	Select **[2. MACHINE LOCK]**.

NOTE: The procedure above can be followed to reset the machine lock so that the machine requires a password to start the engine.

NOTE: When the password is in UNLOCKED, no password is needed. The start switch is used to start the machine.

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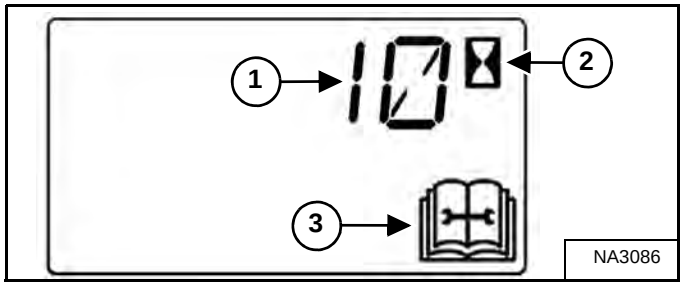
Maintenance Clock

Description

The Maintenance Clock alerts the operator when the next service interval is due. *EXAMPLE:* The maintenance clock can be set to a 500 hour interval as a reminder for the next 500 hour planned maintenance.

Standard Instrument Panel

Figure 50-100-3



During machine operation, a 2 beep alarm will sound when there are less than 10 hours until the next planned maintenance.

The remaining hours before maintenance is required (Item 1) will appear in the data display for 5 seconds while the service icon (Item 3) and the hourmeter icon (Item 2) **[Figure 50-100-4]** flash.

NOTE: The display will show negative numbers after counting down to zero.

The display will revert to the previous display and will appear for 5 seconds every time the machine is started until the maintenance clock is reset.

Reset

Figure 50-100-4



Press the Information button (Item 2) **[Figure 50-100-4]** until the display screen shows the maintenance clock.

Press and hold the Information button (Item 2) for 7 seconds until [RESET] (Item 1) **[Figure 50-100-4]** appears in the display screen.

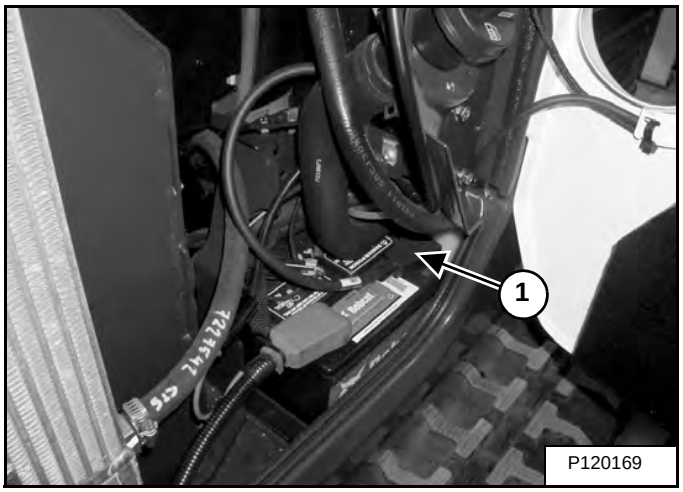
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KEY SWITCH

Removal And Installation

Figure 50-110-1



Disconnect the negative (-) cable (Item 1) **[Figure 50-110-1]** from the battery.

⚠ WARNING

AVOID INJURY OR DEATH

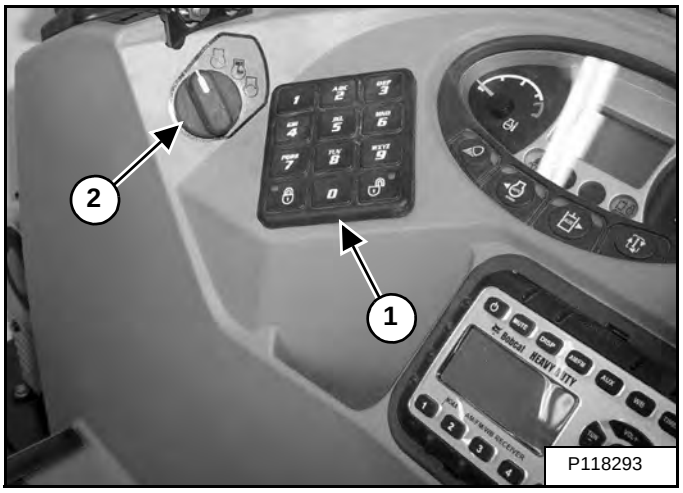
Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

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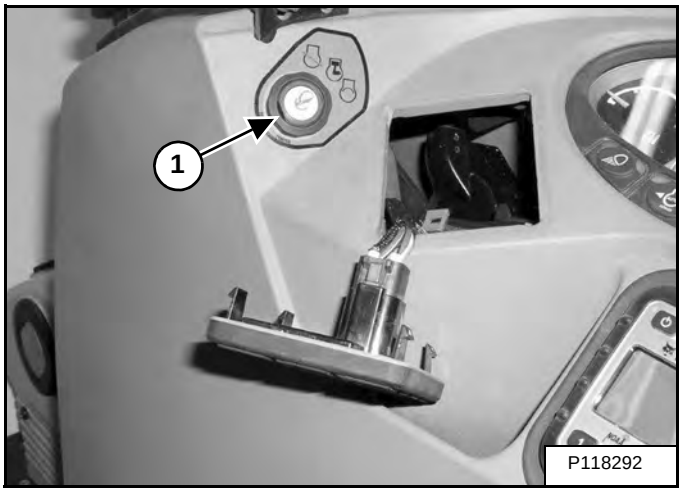
Figure 50-110-2



Shown is keyless, the keyed switch is the same procedure.

Remove the keypad (Item 1) (if equipped) and knob (Item 2) **[Figure 50-110-2]**.

Figure 50-110-3



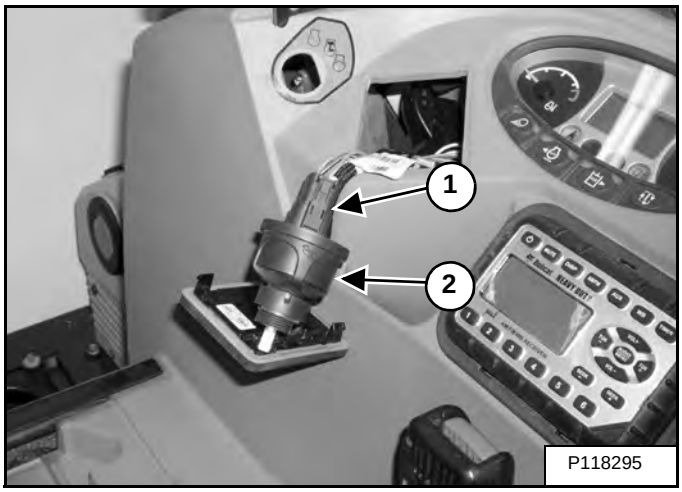
Remove the nut (Item 1) **[Figure 50-110-3]** from the switch and pull the switch out through the keypad opening.

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Removal And Installation (Cont'd)

Figure 50-110-4



Disconnect the wire harness (Item 1) from the switch (Item 2) **[Figure 50-110-4]**.

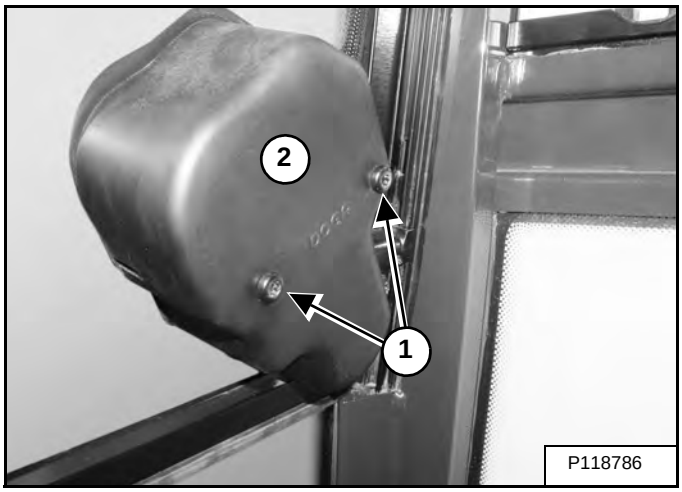
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WIPER MOTOR

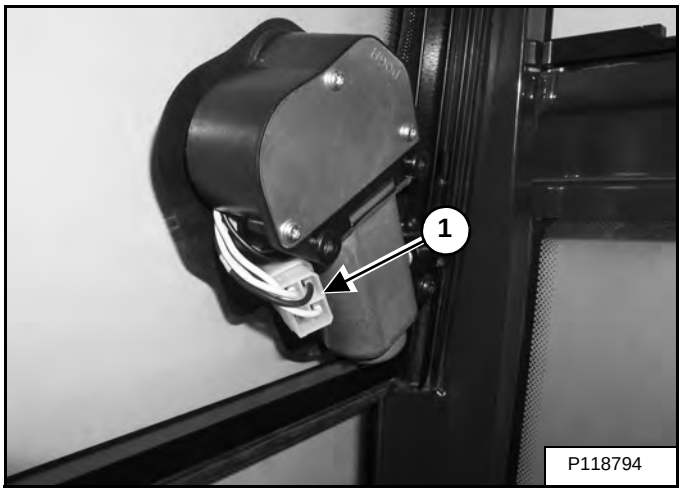
Removal And Installation

Figure 50-120-1



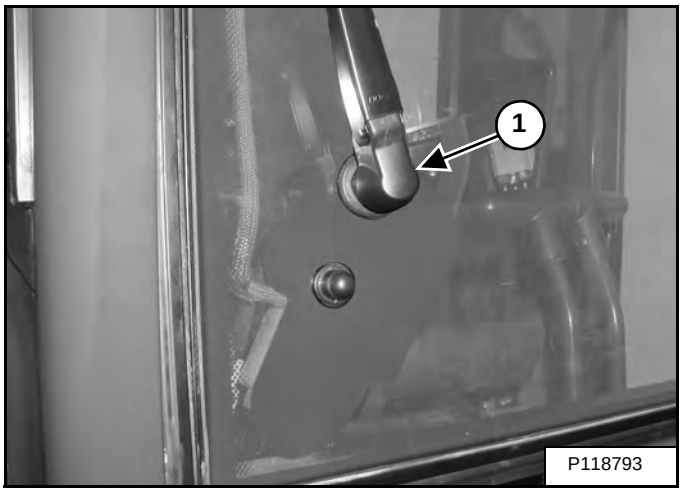
Remove the wiper motor cover screws (Item 1) and the cover (Item 2) **[Figure 50-120-1]**.

Figure 50-120-2



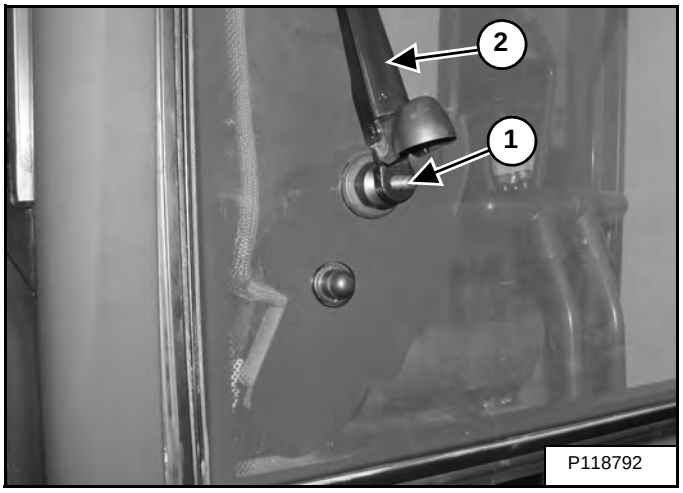
Disconnect the wire harness (Item 1) **[Figure 50-120-2]**.

Figure 50-120-3



Open the wiper arm cover (Item 1) **[Figure 50-120-3]**.

Figure 50-120-4



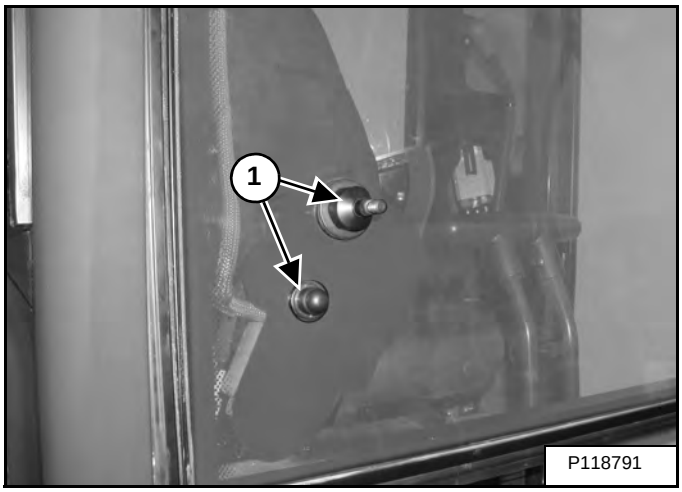
Remove the nut and washer (Item 1) and the wiper arm assembly (Item 2) **[Figure 50-120-4]**.

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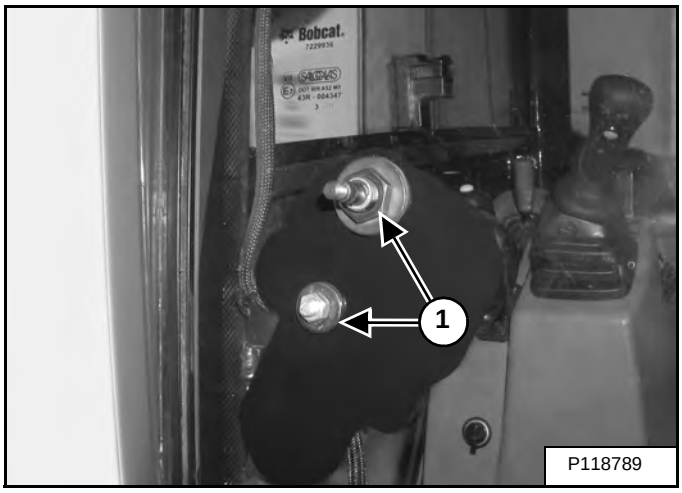
Removal And Installation (Cont'd)

Figure 50-120-5



Remove the cover on the wiper arm shaft and the mounting stud (Item 1) **[Figure 50-120-5]**.

Figure 50-120-6



Remove the nuts (Item 1) **[Figure 50-120-6]**.

Figure 50-120-7



Remove the wiper motor assembly **[Figure 50-120-7]**.

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MOTION ALARM SYSTEM

Description

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

Inspecting

Figure 50-130-1

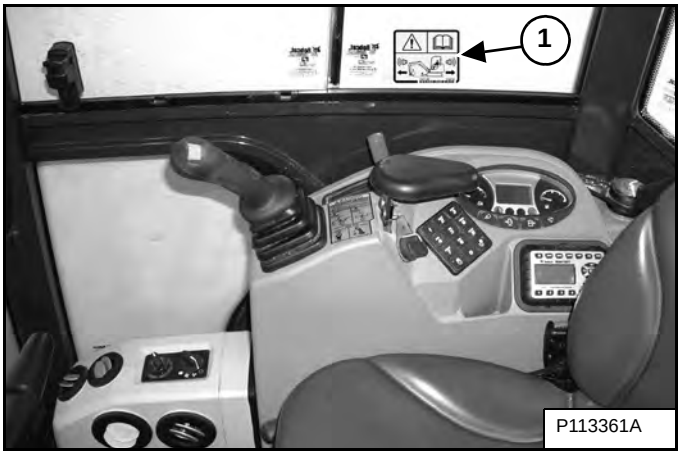
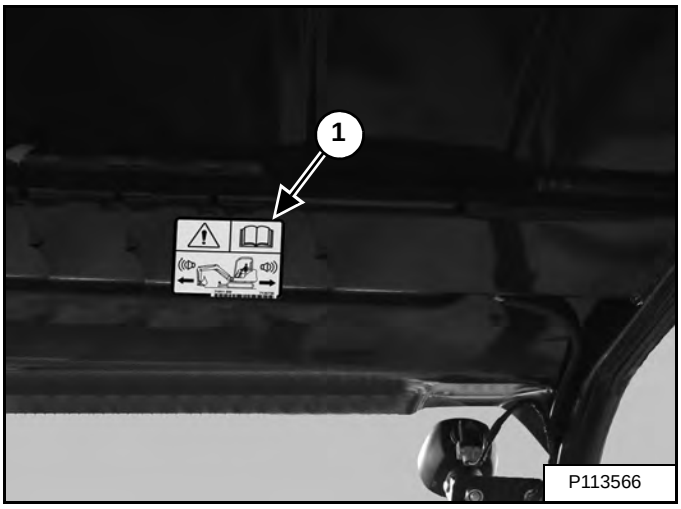


Figure 50-130-2



Inspect for damaged or missing motion alarm decal (Item 1) **[Figure 50-130-1]** (cab machine) or (Item 1) **[Figure 50-130-2]** (canopy machine). Replace if required.

NOTE: The excavator will need to be moved slightly in both the forward and reverse direction to test the motion alarm. Keep all bystanders away from machine during test.

⚠ WARNING

AVOID INJURY OR DEATH

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

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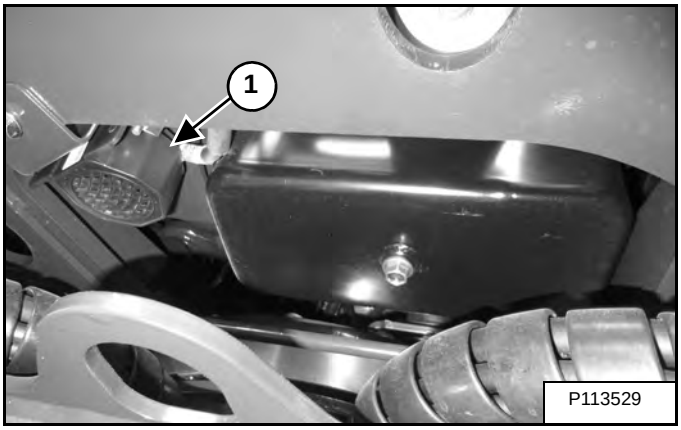
Inspecting (Cont'd)

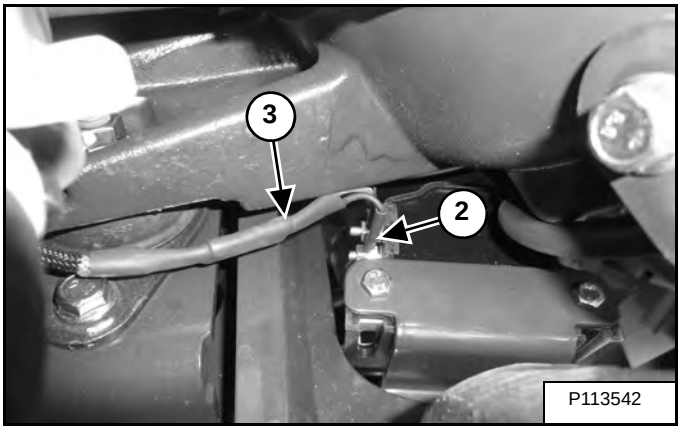
Sit in the operator's seat and fasten the seat belt. Start the engine.

Move the travel control levers (one lever at a time) in the forward direction. The motion alarm must sound. Move the travel control levers (one lever at a time) in the reverse direction. The motion alarm must sound.

Return both levers to neutral and turn excavator key to OFF position. Exit the excavator. (See STOPPING THE ENGINE AND LEAVING THE EXCAVATOR on Page 10-230-1.)

Figure 50-130-3





The motion alarm (Item 1) **[Figure 50-130-3]** is mounted to the bottom rear of the excavator. (Next to the engine oil pan.)

Inspect the motion alarm electrical connections (Item 2), wire harness (Item 3) **[Figure 50-130-3]** and motion alarm switch (Item 1) **[Figure 50-130-4]** for tightness and damage. Repair or replace any damaged components.

The motion alarm switch are non-adjustable, see the following information.

⚠ WARNING

This machine is equipped with a motion alarm.
ALARM MUST SOUND!
when operating forward or backward.

Failure to maintain a clear view in the direction of travel could result in serious injury or death.

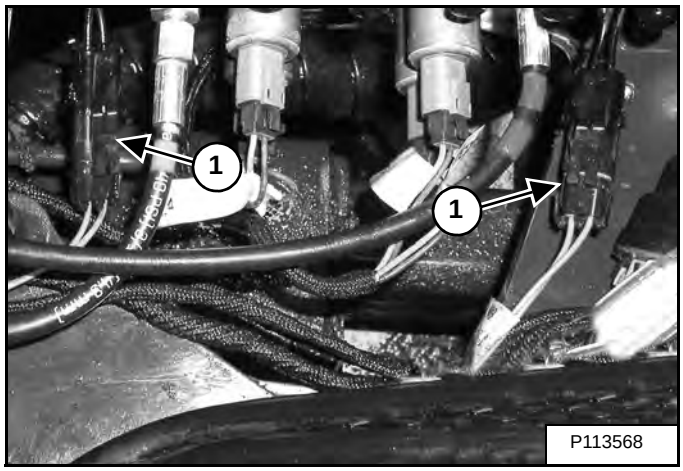
The operator is responsible for the safe operation of this machine.

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Adjusting Switch Position

The two motion alarm switches are located in the two travel control sections of the control valve that is located under the floorplate. Remove the floor mat and the floorplate. (See the Service Manual for the correct procedure.)

Figure 50-130-4



The two switches are non-adjustable.

Inspect the motion alarm electrical connections (Item 1) **[Figure 50-130-4]** and wire harness for damage. Repair or replace any damaged components.

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

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ENGINE INFORMATION

Description

The E19 Bobcat Excavator has a Kubota® direct injected D722-E2B or D722-E4B diesel engine with a displacement of 0,719 L (43.88 in^3).The engine is rated at 9,9 kWh (13.3 hp) and has a closed crankcase ventilation system.

The engine has three cylinders and the rotation is counter-clockwise (viewed from the flywheel side). Engine block heaters are also available from Bobcat Parts.

The engine serial number is stamped on the engine and is located near the injection pump. The model number is located on the valve cover. Use these numbers to obtain the correct service parts.

The engine is liquid cooled with a propylene glycol / water mixture. The cooling fan is belt driven. The speed of the fan is determined by the engine speed.

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Specifications

Fuel Injector Nozzles

Opening Pressure	13727 - 14713 kPa (137 - 147 bar) (1991 - 2134 psi)
Fuel Tightness Nozzle Seat	12748 kPa (127 bar) (1849 psi)

Fuel Injection Pump

Fuel Tightness of Pump Element	13727 kPa (137 bar) (1991 psi)
Fuel Tightness of Delivery Valve (factory spec)	10 Second Initial Pressure Drop From 13727 - 1 2748 kPa (137 - 127 bar) (1991 - 1849 psi)
Fuel Tightness of Delivery Valve Limit Permitted	5 Second Initial Pressure Drop From 14713 - 13727 kPa (137 - 127 bar) (2134 - 1991 psi)
Injection Timing @ 3600 rpm	19 - 21 degrees B.T.D.C.

Cylinder Head

Cylinder Head Distortion Limit	0,05 mm (0.002 in)
Thickness of Gasket Free	1,15 - 1,30 mm (0.0415 - 0.0512 in)
Thickness of Gasket Tightened	1,05 - 1,15 mm (0.0413 - 0.0453 in)
Top Clearance	0,50 - 0,70 mm (0.0197 - 0.0276 in)

Valves

Valve Seat Angle	45 degrees
Valve Seat Width	2,12 mm (0.084 in)
O.D. of Valve Stem	5,968 - 5,980 mm (0.2350 - 0.2354 in)
I.D. of Valve Guide	6,01 - 6,025 mm (0.2366 - 0.2372 in)
Clearance between Valve Stem and Guide	0,03 - 0,057 mm (0.0012 - 0.0022 in)
Limit Permitted	0,1 mm (0.004 in)
Depth of Valve	-0,10 - 0,10 mm (-0.004 - 0.004 in)
Limit Permitted	0,30 mm (0.0118 in)
Valve Clearance (Cold) (Intake and Exhaust)	0,145 - 0,185 mm (0.006 - 0.007 in)

Valve Springs

Free Length	31,3 - 31,8 mm (1.232 - 1.252 in)
Limit Permitted	28,4 mm (1.118 in)
Fitted Length	27 mm (1.063 in)
Load to Compress to Fitted Length	6,6 kg (14.6 lb)
Limited Permitted	5,6 kg (12.3 lb)
Limited Permitted for Spring Tilt	1,2 mm (0.047 in)

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Specifications (Cont'd)

Rocker Arms

O.D. of Rocker Arm Shaft	10,47 - 10,48 mm (0.4123 - 0.4128 in)
I.D. of Rocker Arm Bushing	10,5 - 10,52 mm (0.4134 - 0.4141 in)
Clearance between Rocker Arm Shaft and Bushing	0,016 - 0,045 mm (0.0006 - 0.0018 in)
Limit Permitted	0,15 mm (0.006 in)

Camshaft

O.D. of Camshaft Bearing Journal	32,93 - 32,95 mm (1.2966 - 1.2972)
I.D. of Camshaft Bearing	33,00 - 33,025 mm (1.2992 - 1.3002 in)
Clearance between Camshaft Bearing and Journal	0,05 - 0,91 mm (0.002 - 0.004 in)
Limit Permitted	0,15 mm (0.006 in)
Alignment of the Camshaft Limit Permitted	0,01 mm (0.0004 in)
Cam Lobe Height	26,88 mm (1.0583 in)
Limit Permitted	26,83 mm (1.0563 in)
Idle Gear to Cam Gear Backlash	0,041 - 0,123 mm (0.002 - 0.005 in)
Limit Permitted	0,15 mm (0.006 in)

Cylinders

I.D. of Cylinder Liner	67,000 - 67,019 mm (2.6378 - 2.6385 in)
Limit Permitted	67,169 mm (2.6445 in)
Rebore Size for Oversize Piston	67,250 - 67,269 mm (2.6476 - 2.6484 in)

Piston Rings

Ring Gap, Top and Oil	0,15 - 0,30 mm (0.0059 - 0.0118 in)
Ring Gap, 2nd	0,30 - 0,45 mm (0.0118 - 0.0177) in
Limit Permitted	1,20 mm (0.0472 in)
Side Clearance of Ring in Groove;	
Top Ring	Because of top ring design, measurement does not apply
2nd Ring	0,085 - 0,12 mm (0.0033 - 0.0045 in)
Oil Ring	0,02 - 0,06 mm (0.0016 - 0.0031 in)
Limit Permitted	0,15 mm (0.006 in)

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Specifications (Cont'd)

Pistons

I.D. of Piston Pin Bore	20,00 - 20,013 mm (0.7874 - 0.7879 in)
Limit Permitted	20,05 mm (0.7894 in)
O.D. of Piston Pin	20,002 - 20,011 mm (0.7875 - 0.7878 in)

Connecting Rods

I.D. of Connecting Rod Bushing (Small End, Fitted)	20,03 - 20,04 mm (0.7884 - 0.7890 in)
Clearance between Piston Pin and Bushing	0,014 - 0,038 mm (0.0006 - 0.0015 in)
Clearance between Piston Pin and Bushing Limit Permitted	0,10 mm (0.004 in)
Connecting Rod Alignment Limit Permitted	0,05 mm (0.002 in)

Crankshaft

Crankshaft Alignment Limit Permitted	0,02 mm (0.0008 in)
O.D. of Crankshaft Journal No. 1 (Water Pump Side)	39,93 - 39,95 mm (1.5722 - 1.5728 in)
I.D. of Crankshaft Bearing No. 1	39,98 - 40,04 mm (1.5715 - 1.5764 in)
Clearance between No. 1 Crankshaft Journal and Bearing	0,03 - 0,11 mm (0.0013 - 0.0042 in)
Limit Permitted	0,20 mm (0.008 in)
O.D. of Crankshaft Journal No. 2 (Flywheel Side)	43,93 - 43,95 mm (1.7297 - 1.7303 in)
I.D. of Crankshaft Bearing No. 2	43,98 - 44,03 mm (1.7317 - 1.7333 in)
Clearance between No. 2 Crankshaft Journal and Bearing	0,03 - 0,05 mm (0.0011 - 0.0020 in)
Limit Permitted	0,20 mm (0.008 in)
O.D. of Crankshaft Journal No. 3 (Intermediate)	39,93 - 39,95 mm (1.5722 - 1.5728 in)
I.D. of Crankshaft Bearing No. 3	39,98 - 40,03 mm (1.5742 - 1.5758 in)
Clearance between No. 3 Crankshaft Journal and Bearing	0,03 - 0,05 mm (0.0011 - 0.0020 in)
Limit Permitted	0,20 mm (0.008 in)
O.D. of Connecting Rod Journals	33,96 - 33,98 mm (1.3370 - 1.3376 in)
I.D. of Connecting Rod Bearings`	33,99 - 34,01 mm (1.3389 - 1.3390 in)
Clearance between Connecting Rod Journal and Bearing	0,02 - 0,051 mm (0.0008 - 0.0020 in)
Limit Permitted	0,15 mm (0.006 in)
Crankshaft End Play	0,15 - 0,31 mm (0.006 - 0.012 in)
Limit Permitted	0,50 mm (0.020 in)

Oil Pump

Oil Pressure At Rated rpm	193 - 441 kPa (2 - 4 bar) (28 - 64 psi)
Limit Permitted	145 kPa (1 bar) (21 psi)
Oil Pressure And Idle Speed	48 kPa (0,5 bar) (7 psi)
Clearance between Outer Rotor and Pump Body	0,07 - 0,15 mm (0.003 - 0.006 in)
End Clearance between Inner Rotor and Cover	0,08 - 0,14 mm (0.003 - 0.005 in)
Clearance between Inner Rotor and Outer Rotor	0,03 - 0,14 mm (0.0012 - 0.006 in)

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Specifications (Cont'd)

Thermostat

Opening Temperature	
Starting	70 - 73°C (157 - 163°F)
Full Open	85°C (185°F)

Engine Bolt Torque

	N•m	ft-lb
Camshaft Retainer Plate Bolts	18 - 21	14 - 15
* Connecting Rod Bolts	27 - 30	20 - 22
* Crankshaft Bolt	98 - 108	72 - 80
* Cylinder Head Bolts	38 - 42	28 - 31
* Flywheel Bolts	53,9 - 58,8	39.8 - 43.4
Fuel Camshaft Retainer Bolts	6,8 - 8,1	5 - 6
Fuel Injection Tubeline Fittings	25 - 34	18 - 25
Glow Plugs	8 - 15	6 - 11
* Idle Gear Shaft Bolt	10 - 11	7 - 8
Injection Nozzle	49 - 69	36 - 51
Injection Pump Mounting Nuts	24 - 27	18 - 20
* Main Bearing Bolts	27 - 30	20 - 22
* Main Bearing Case Bolts	13 - 16	9 - 12
Oil Switch	15 - 20	11 - 15
Rear Bearing Case Cover Bolts	10 - 11	7 - 8

* Lightly Oiled Threads

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Crankshaft Re-Grind Data

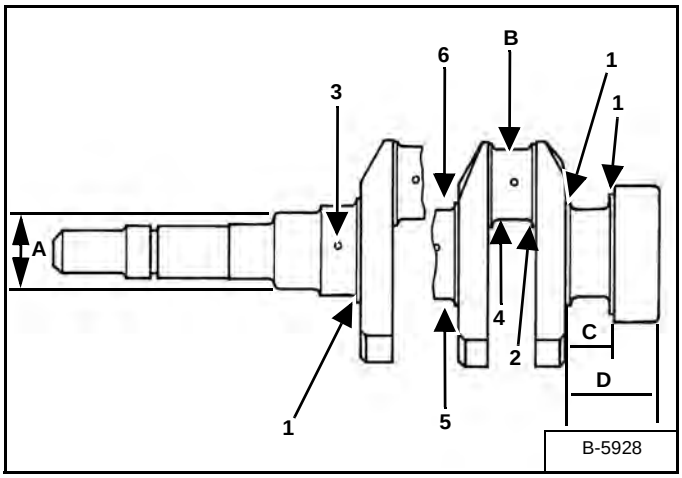
If the standard size bearing cannot be used due to excessive wear of the crank pin and crank journal use undersize or oversize bearings.

For undersize or oversize bearing use, follow the precautions noted below.

Grind the crankpin and journal with a wheel which has specified round corner and width without shoulder **[Figure 60-10-1]**.

1. 1,8 - 2,2 mm (0.071 - 0.087 in)
2. 2,3 - 2,7 mm (0.091 - 0.106 in)
3. Be sure to chamfer the oil hole circumference to 1,0 - 1,5 mm (0.04 - 0.06") radius with an oil stone.
4. The crankpin must be fine-finished to higher than (0,4-S).
5. The crank journal must be fine-finished to higher than (0,4-S).
6. The crank journal side surface must be fine-finished to higher than (1,6-S)

Figure 60-10-1

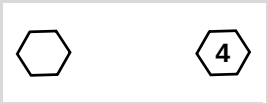


SIZE	CODE NO.	NAME OF BEARING	BEARING MARK	CRANKSHAFT PROCESSING DIM	
-0,2 mm (-0.008")	15861-23911	Crankshaft Bearing 1 0.008" minus (0,2 minus)	020 US	A	39,734 - 39,750 mm (1.5643 - 1.5650")
-0,2 mm (-0.008")	15694-23931	Crankshaft Bearing 2 0.008" minus (0,2 minus)	020 US		
-0,2 mm (-0.008")	15861-23861	Crankshaft Bearing 3 0.008 minus (0,2 minus)	020 US		43,734 - 43,750 mm (1.7218 - 1.7224 in)
-0,4 mm (-0.016")	15861-23921	Crankshaft Bearing 1 0.016" minus (0,4 minus)	040 US		39,534 - 39,550 mm (1.5565 - 1.5571")
-0,4 mm (-0.016")	15699-23941	Crankshaft Bearing 2 0.016" minus (0,4 minus)	040 US		
-0,4 mm (-0.0016")	15861-23871	Crankshaft Bearing 3 0.016 minus (0,4 minus)	040 US		43,534 - 43,550 mm (1.7139 - 1.7146")
-0,2 mm (-0.008")	15861-22971	Crank Pin Bearing 0.008" minus (0,2 minus)	020 US	B	33,759 - 33,775 mm (1.3291 - 1.3297")
-0,4 mm (-0.016")	15861-22981	Crank Pin Bearing 0.016" minus (0,4 minus)	040 US		33,559 - 33,575 mm 1.3212 - 1.3219"
+0.008" (-0,2 mm)	15261-23951	Thrust Bearing 1 0.008" plus (0,2 plus)	020 OS	C	46,1 - 46,3 mm (1.815 - 1.823")
	15261-23971	Thrust Bearing 2 0.008" plus (0,2 plus)			
+0.016" (+0,4 mm)	15261-23961	Thrust Bearing 1 0.016 plus (0,4 plus)	040 OS		46,3 - 46,5 mm (1.823 - 1.831")
	15261-23981	Thrust Bearing 2 0.016" (0,4 plus)			
0,2 mm (0.008")		Crankshaft over size Dimension		D	46,1 - 46,3 mm (1.815 - 1.823")
0,4 mm (0.016")					46,3 - 46,5 mm (1.823 - 1.831")

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Torque Values

GRADE		STANDARD SCREW AND BOLT			SPECIAL SCREW AND BOLT		
							
NOMINAL DIAMETER	**UNIT**	**N•m**	**KFG M**	**ft-lb**	**N•m**	**KFG M**	**ft-lb**
M6		7,9 - 9,3	0.80 - 0.95	5.8 - 6.9	9,8 - 11,3	1.00 - 1.15	7.23 - 8.32
M8		18 - 20	1.8 - 2.1	13.0 - 15	24 - 27	2.4 - 2.8	18 - 20
M10		40 - 45	4.0 - 4.6	29 - 33	49 - 55	5.0 - 5.7	37 - 41
M12		63 - 72	6.4 - 7.4	47 - 53	78 - 90	7.9 - 9.2	58 - 66

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Troubleshooting

The following troubleshooting chart is provided for assistance in locating and correcting problems which are most common. Many of the recommended procedures must be done by authorized Bobcat Service personnel only.

PROBLEM	CAUSE
Slow cranking speed	1, 2, 3, 4
Engine will not start	2, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 19, 27, 28, 29
Difficult to start	5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 25, 27, 28, 29
No power from engine	8, 9, 10, 11, 12, 13, 15, 16, 17, 21, 22, 24, 25, 26, 28, 29
Engine is mis-firing	8, 9, 11, 12, 13, 15, 16, 17, 21, 22, 24, 25, 26, 28
Too much fuel consumption	10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29
Black exhaust	10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29
Blue / white exhaust	4, 10, 15, 16, 17, 21, 23, 27, 29, 30, 50
Low oil pressure	4, 31, 32, 33, 34, 35, 37, 38, 39, 52
Engine knocking	13, 15, 16, 19, 22, 24, 25, 27, 29, 31, 40, 41, 53
Engine running rough	7, 8, 9, 10, 11, 12, 13, 17, 18, 22, 24, 25, 26, 29, 40, 53
Vibration	12, 13, 17, 21, 22, 25, 26, 29, 40, 42, 43
High oil pressure	4, 33, 36
Overheating	10, 12, 13, 15, 16, 20, 21, 40, 44, 45, 46, 47, 48, 51
Too much crankcase pressure	22, 27, 29, 30, 40, 49
Poor compression	10, 16, 21, 24, 25, 27, 28, 29, 30, 41, 53
Start and stop	9, 10, 11

KEY TO CORRECT THE CAUSE	
1. Battery capacity low	28. Worn valves and seat
2. Bad electrical connections	29. Broken or worn piston rings
3. Faulty starter motor	30. Worn valve stems or guides
4. Incorrect grade of oil	31. Worn or damaged bearings
5. Low cranking speed	32. Not enough oil in the oil pan
6. Fuel tank empty	33. Switch is defective
7. Faulty stop control operation	34. Oil pump worn
8. Plugged fuel line	35. Relief valve is stuck open
9. Plugged fuel filter	36. Relief valve is stuck closed
10. Restriction in the air cleaner	37. Broken relief valve spring
11. Air in the fuel system	38. Faulty suction pipe
12. Faulty fuel injection pump	39. Plugged oil filter
13. Faulty fuel injectors	40. Piston seizure
14. Broken injection pump drive	41. Incorrect piston height
15. Incorrect injection pump timing	42. Faulty engine mounting
16. Incorrect valve timing	43. Incorrect alignment of flywheel
17. Poor compression	44. Faulty thermostat
18. Plugged fuel tank vent	45. Restriction in water jacket
19. Incorrect grade of fuel	46. Loose alternator belt
20. Exhaust pipe restriction	47. Plugged radiator
21. Cylinder head gasket leaking	48. Plugged breather pipe
22. Over heating	49. Plugged breather pipe
23. Cold running	50. Damaged valve stem oil deflectors
24. Incorrect tappet adjustment	51. Coolant level too low
25. Sticking valves	52. Plugged oil pump pipe strainer
26. Incorrect high pressure fuel lines	53. Broken valve spring
27. Worn cylinder bores	

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Engine Removal And Installation

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

Drain the cooling system. (See Removing And Replacing Coolant on Page 10-100-3.)

Drain the hydraulic reservoir. (See Removal And Installation on Page 20-130-1.)

Remove air cleaner. (See Removal And Installation on Page 60-30-1.)

Remove the hydraulic filter mount. (See Removal And Installation on Page 20-120-1.)

Remove the hydraulic pump. (See Removal And Installation on Page 20-50-7.)

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

Remove the tool box. (See Removal And Installation on Page 40-260-1.)

IMPORTANT

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

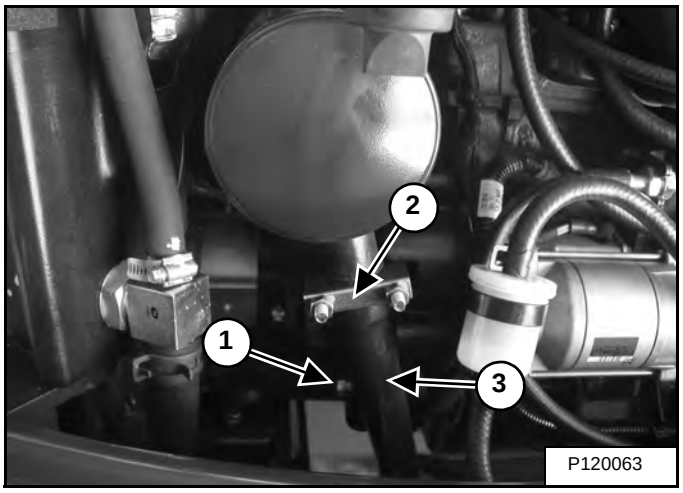
I-2003-0888

IMPORTANT

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

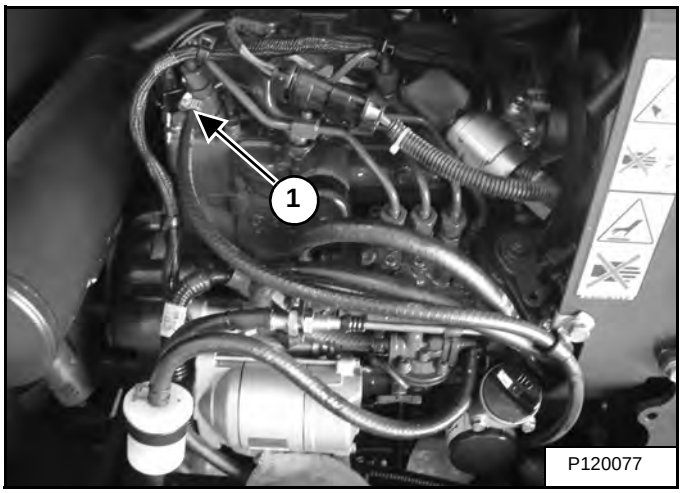
I-2067-0499

Figure 60-10-2



Remove the tailpipe mounting bolt (Item 1), loosen the exhaust pipe clamp (Item 2) and remove the tailpipe (Item 3) **[Figure 60-10-2]** from the machine.

Figure 60-10-3



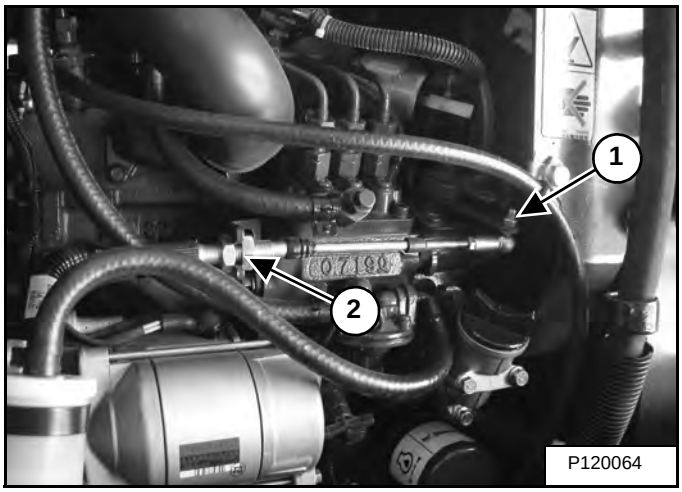
Remove the fuel line (Item 1) **[Figure 60-10-3]**.

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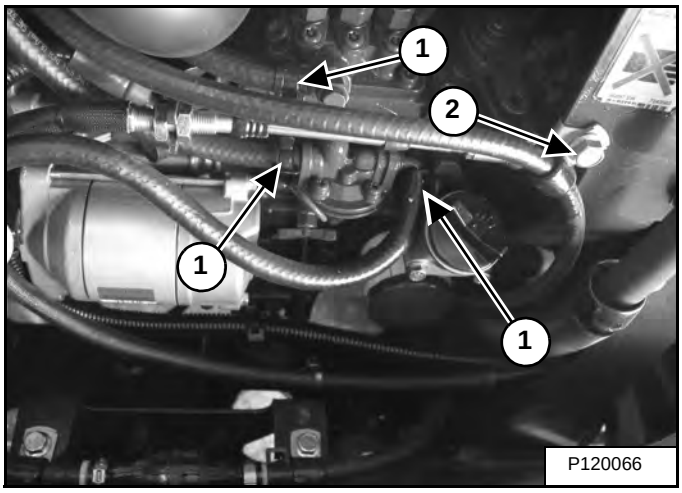
Removal And Installation (Cont'd)

Figure 60-10-4



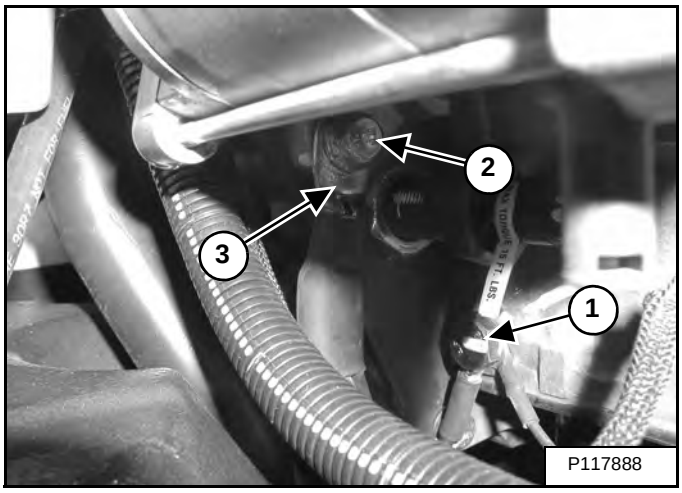
Remove the throttle cable (Item 1) and loosen the cable locknuts (Item 2) **[Figure 60-10-4]**.

Figure 60-10-5



Disconnect the fuel lines (Item 1) and the bolt / clamp (Item 2) **[Figure 60-10-5]**.

Figure 60-10-6



Remove the block ground cable bolt (Item 1) **[Figure 60-10-6]**.

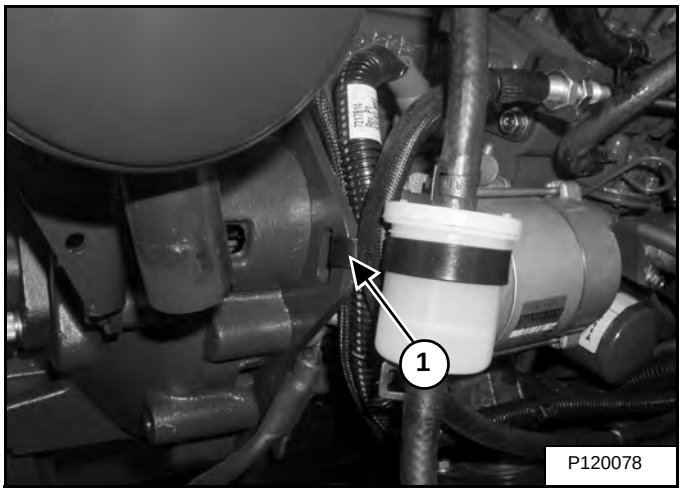
Remove the lower starter bolt (Item 2) to remove the ground cable (Item 3) **[Figure 60-10-6]**.

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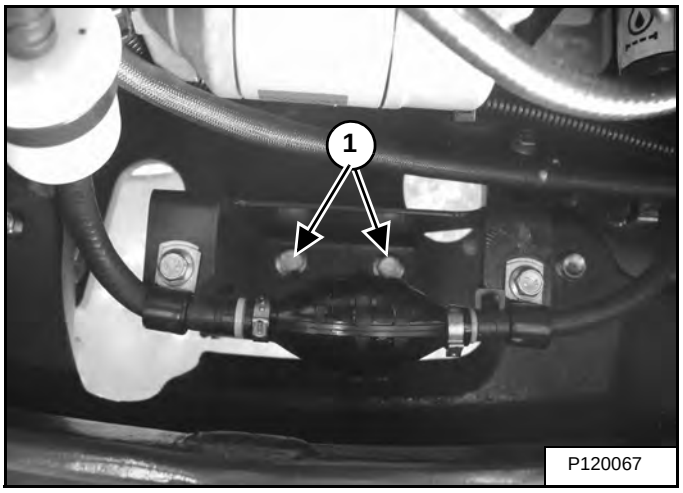
Removal And Installation (Cont'd)

Figure 60-10-7



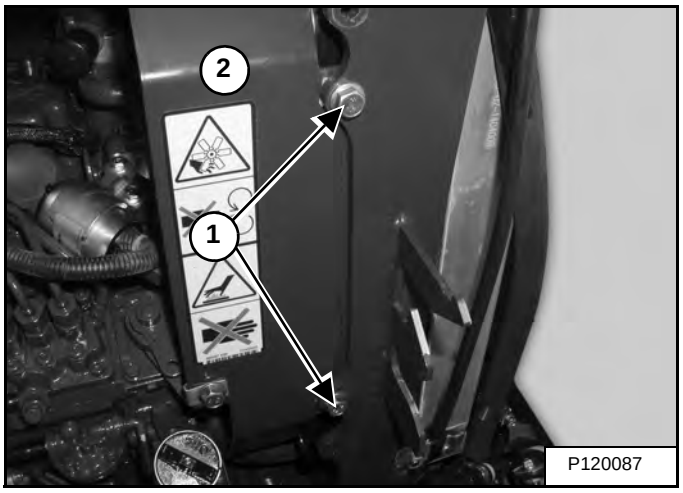
Remove the cable tie (Item 1) **[Figure 60-10-7]**.

Figure 60-10-8



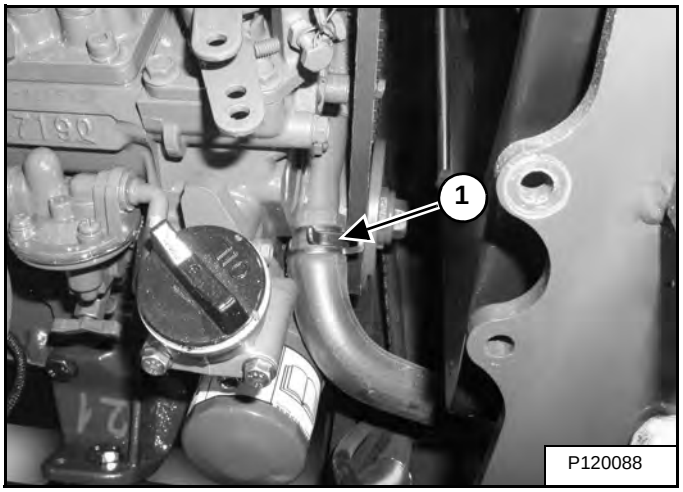
Remove the two bolts (Item 1) **[Figure 60-10-8]** and set the fuel primer pump bracket to the side.

Figure 60-10-9



Remove the bolts (Item 1) and the cover (Item 2) **[Figure 60-10-9]**.

Figure 60-10-10



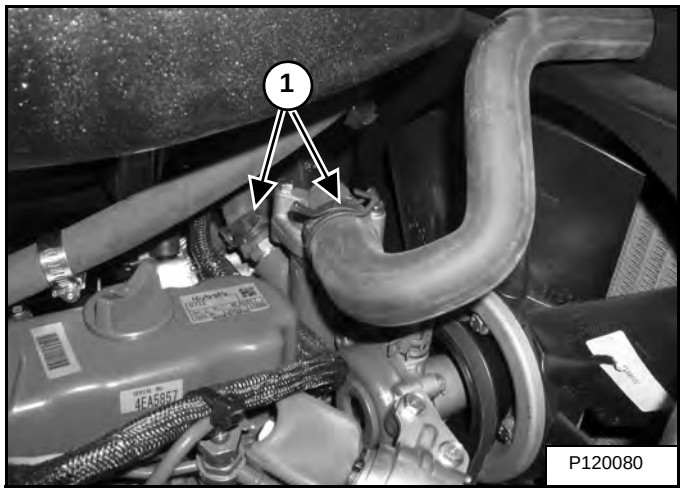
Remove the lower radiator hose (Item 1) **[Figure 60-10-10]**.

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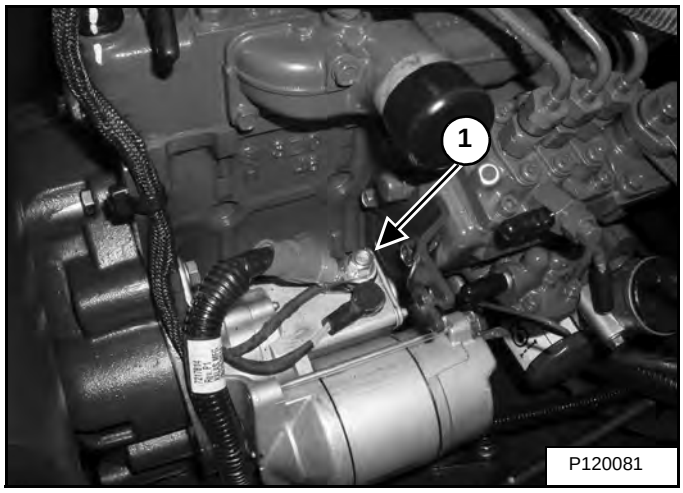
Removal And Installation (Cont'd)

Figure 60-10-11



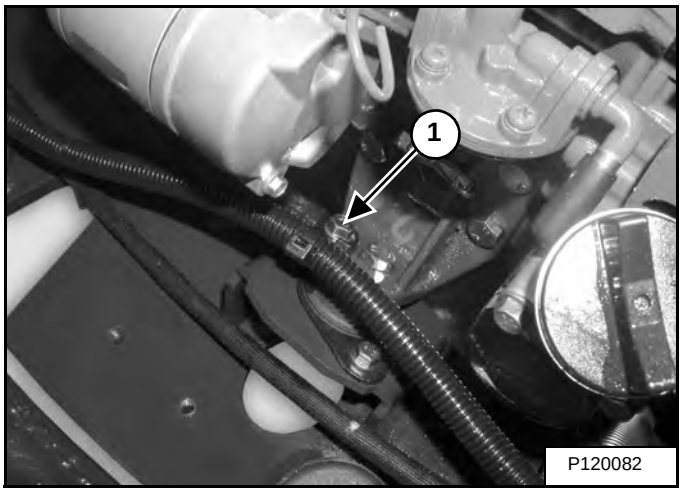
Remove the two hoses (Item 1) **[Figure 60-10-11]** from the top of the engine.

Figure 60-10-12



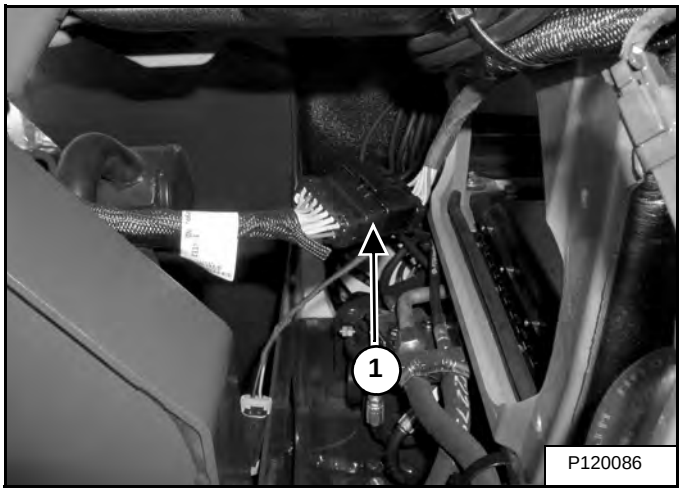
Remove the nut for the starter cable (Item 1) **[Figure 60-10-12]**.

Figure 60-10-13



Remove the bolt (Item 1) **[Figure 60-10-13]** and set the starter cable to the side.

Figure 60-10-14



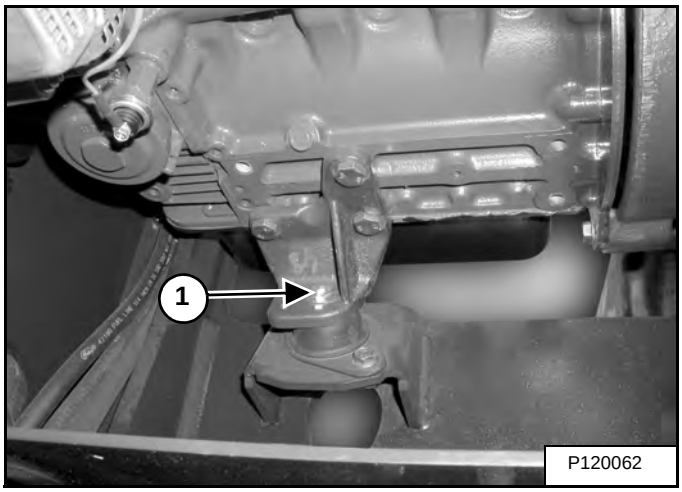
Disconnect the engine wire harness (Item 1) **[Figure 60-10-14]**.

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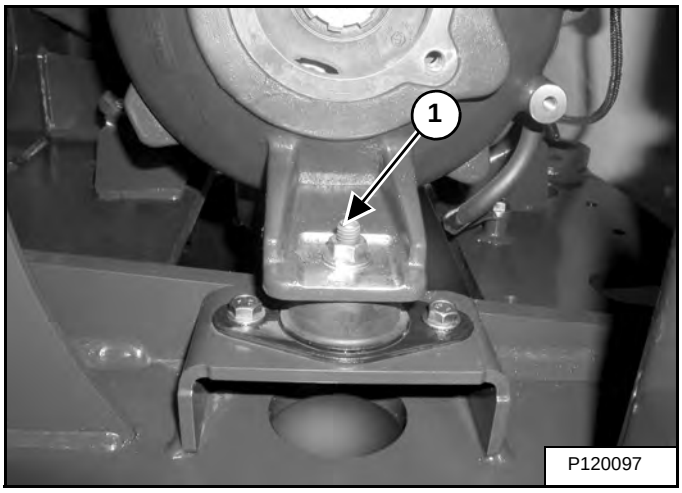
Removal And Installation (Cont'd)

Figure 60-10-15



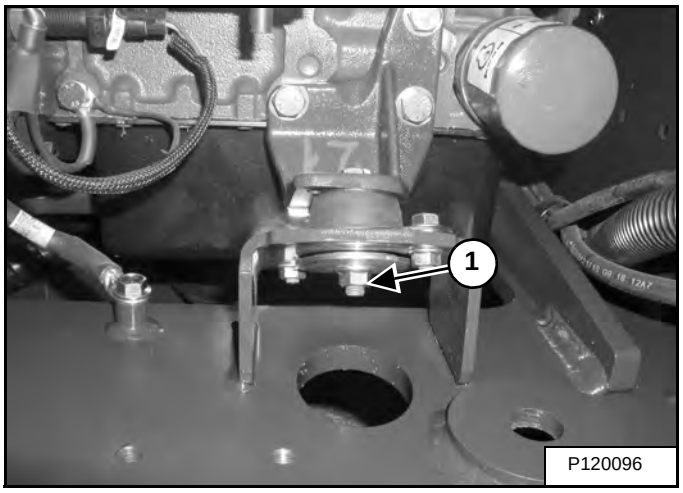
Remove the front engine mount (Item 1) **[Figure 60-10-15]**.

Figure 60-10-16



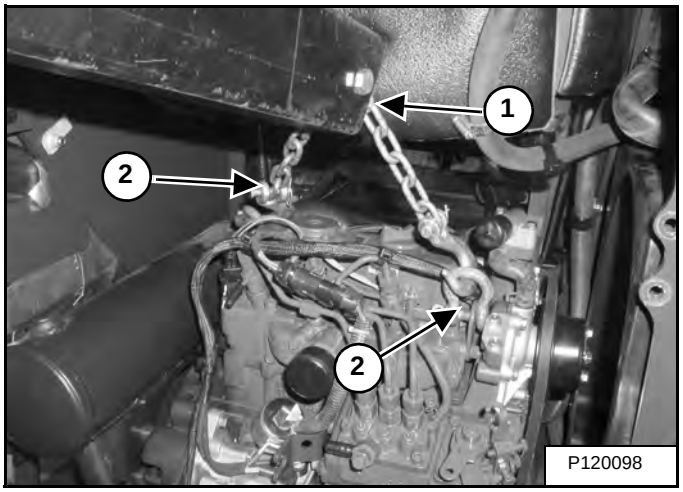
Remove the left side engine mount (Item 1) **[Figure 60-10-16]**.

Figure 60-10-17



Remove the rear engine mount (Item 1) **[Figure 60-10-17]**.

Figure 60-10-18



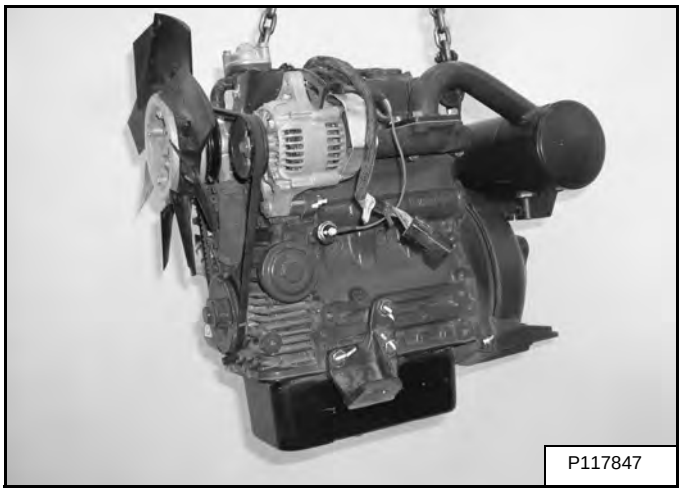
Install lifting device and chain (Item 1) to the lifting brackets (Item 2) **[Figure 60-10-18]**.

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Removal And Installation (Cont'd)

Figure 60-10-19



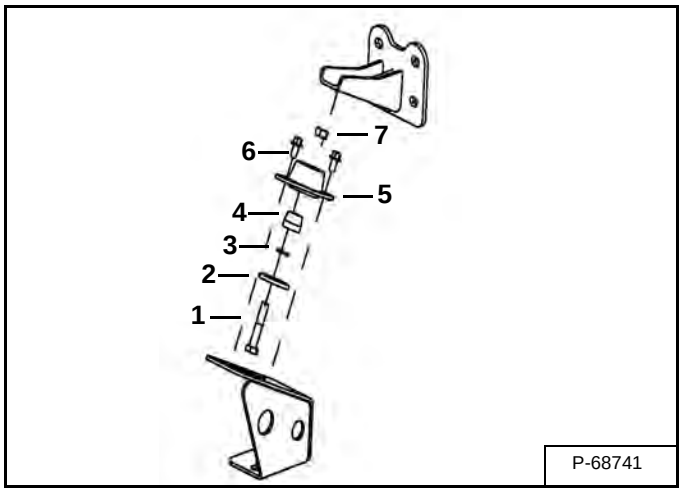
Remove the engine from the machine **[Figure 60-10-19]**.

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Engine Mount Replacement

Figure 60-10-20



Use the following procedure to install new front and rear engine mounts:

Remove the existing mount from the engine. Refer to engine removal and installation for engine mount locations.

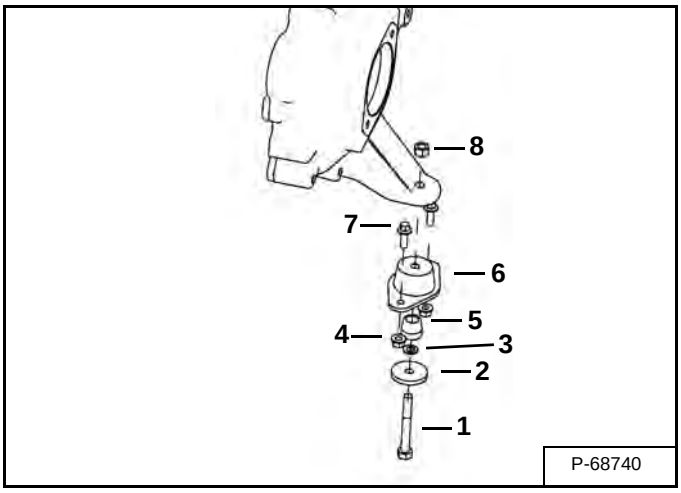
Replace the two front and rear engine mounts.

Use the parts shown to install the new engine mounts for the front and rear engine mounts **[Figure 60-10-20]**.

Item 1 - Mounting Bolt
Item 2 - Mount Washer
Item 3 - Flat Washer
Item 4 - Spacer
Item 5 - Mount
Item 6 - Screw
Item 7 - Nut

Tighten the mounting bolts to 43 - 47 N•m (32 - 35 ft-lb) torque.

Figure 60-10-21



Use the following procedure to install new side engine mounts:

Remove the existing side mount from the engine. Refer to engine removal and installation for engine mount locations.

Use the parts shown to install the new engine mount for the side engine mount **[Figure 60-10-21]**.

Item 1 - Mounting Bolt
Item 2 - Mount Washer
Item 3 - Flat Washer
Item 4 - Nut
Item 5 - Spacer
Item 6 - Mount
Item 7 - Screw
Item 8 - Nut

Tighten the mounting bolt to 43 - 47 N•m (32 - 35 ft-lb) torque.

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Engine Compression - Testing

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

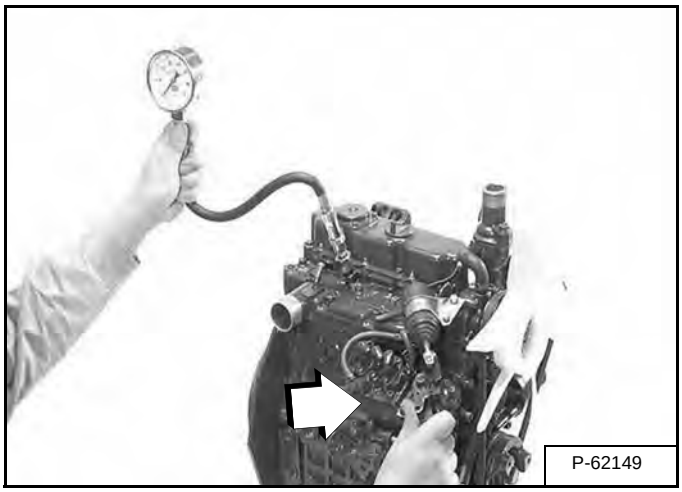
MEL10630 - Engine Compression Test Kit
Warm the engine.

Remove the glow plugs, muffler and air cleaner from the engine. (If testing through glow plug hole.)

Remove the air cleaner, muffler and all injector nozzles. (If testing through injector nozzle hole.)

Install the compression adapter in the cylinder head.

Figure 60-10-22



Connect the compression gauge to the adapter **[Figure 60-10-22]**.

Ensure the speed control lever is set at the low idle setting.

Hold fuel shut off lever to no fuel (see arrow) **[Figure 60-10-22]**. Shut off solenoid does not need to be removed.

Turn the engine with the starter at 200 - 300 rpm. Run the test for each cylinder more than twice for 5 to 10 seconds each time and take the average reading. Make sure you are using a fully charged battery.

The correct compression for the engine is 2840 - 3234 kPa (28 - 32 bar) (412 - 469 psi) with no more than 10% difference between the cylinders.

If the pressures are not within 10% of each other, apply a small amount of oil in the cylinders and retest.

If the pressures increase after applying oil, check cylinder walls and piston rings.

If the pressures do not increase after applying oil, check top clearance, valve clearance and cylinder head.

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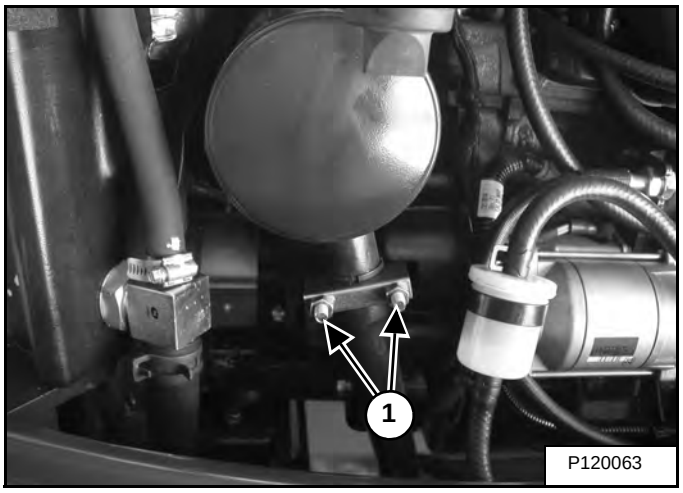
SPARK ARRESTER MUFFLER

Removal And Installation

Open the tailgate.

Remove the air cleaner. (See Removal And Installation on Page 60-30-1.)

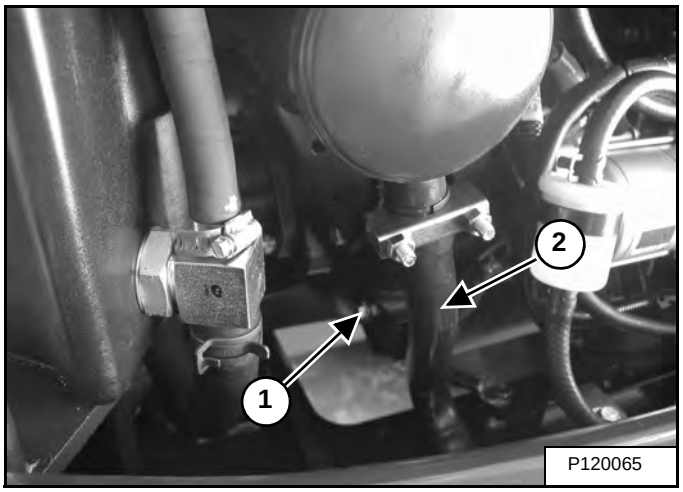
Figure 60-20-1



Loosen the exhaust extension clamp nuts (Item 1) **[Figure 60-20-1]**.

Installation: Tighten clamp to 8 - 10 N•m (5.90 - 7.37 ft-lb) torque.

Figure 60-20-2



Remove the bolt (Item 1) **[Figure 60-20-2]** from the exhaust extension mounting bracket.

Slide the exhaust extension (Item 2) **[Figure 60-20-2]** off the muffler and remove from the excavator.

WARNING

AVOID INJURY OR DEATH

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

W-2050-0807

WARNING

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

W-2011-1285

WARNING

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

W-2068-1285

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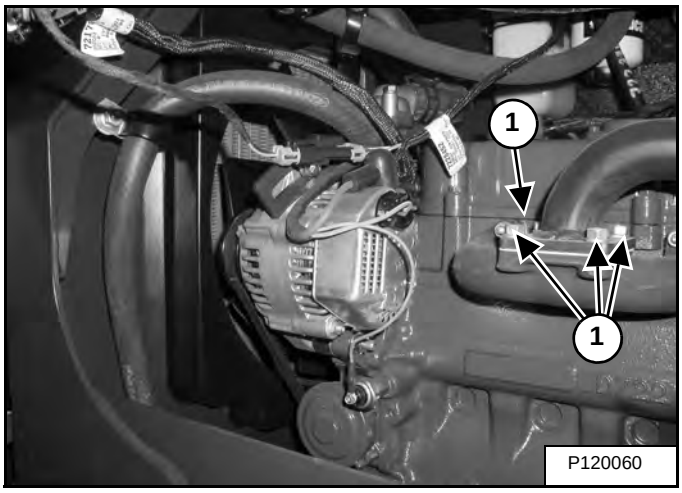
https://www.pdfmanual4trucks.com/

Removal And Installation (Cont'd)

Open the access door under the seat.

Remove the tool box. (See Removal And Installation on Page 40-260-1.)

Figure 60-20-3



Remove the four bolts (Item 1) **[Figure 60-20-3]** from the muffler mount flange.

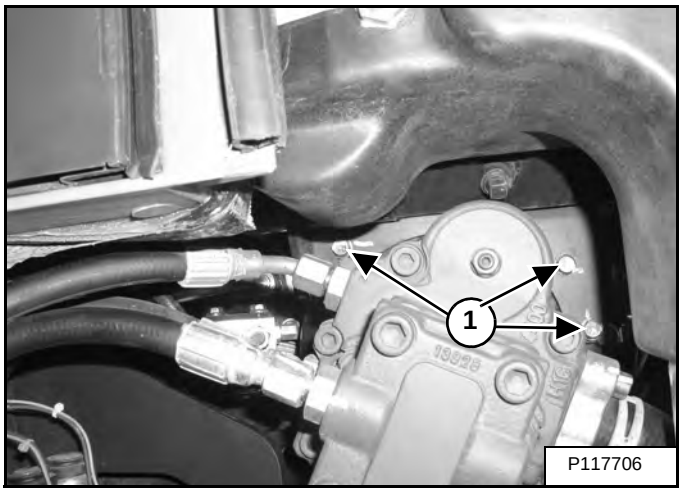
Installation: Torque sequence instructions for muffler hardware.

1: Torque four manifold bolts **[Figure 60-20-3]**.

2: Torque three mounting bolts **[Figure 60-20-4]**.

3: Torque exhaust extension bracket (Item 1) **[Figure 60-20-2]**.

Figure 60-20-4



Remove the three bolts (Item 1) **[Figure 60-20-4]**.

Remove the muffler.

NOTE: Plug the exhaust manifold hole after muffler removal so no contamination can get into the engine.

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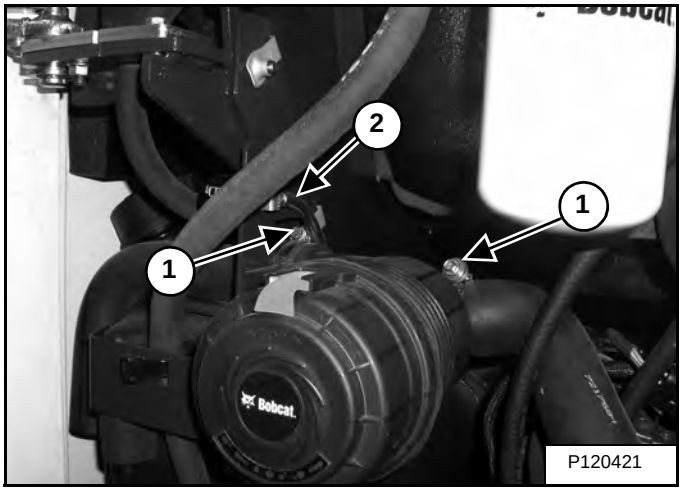
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AIR CLEANER

Removal And Installation

Open the tailgate.

Figure 60-30-1

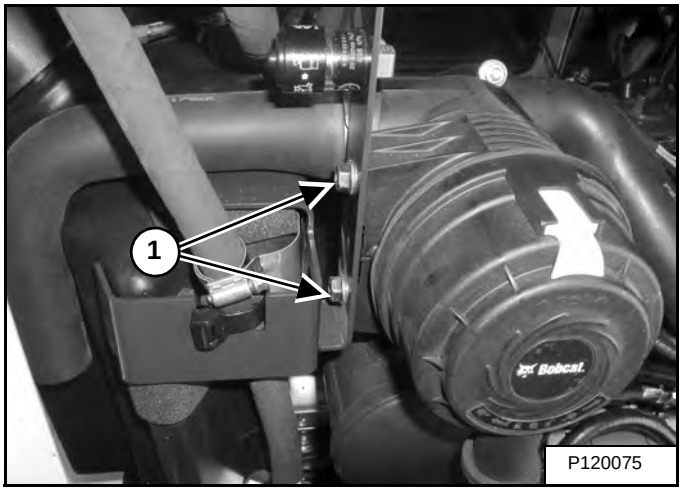


Loosen the hose clamps (Item 1) **[Figure 60-30-1]** and remove the air intake hoses.

Remove the condition indicator hose (Item 2) **[Figure 60-30-1]**.

NOTE: Plug the intake manifold hole to prevent any contamination from getting into the engine.

Figure 60-30-2



Remove the two mounting bolts (Item 1) **[Figure 60-30-2]** and remove the air cleaner assembly.

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Radiator / Oil Cooler Removal And Installation

WARNING

AVOID INJURY OR DEATH

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

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

W-2019-0907

IMPORTANT

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

I-2003-0888

IMPORTANT

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

I-2067-0499

IMPORTANT

Contain and dispose of any oil leakage in an environmentally safe manner.

I-2066-0395

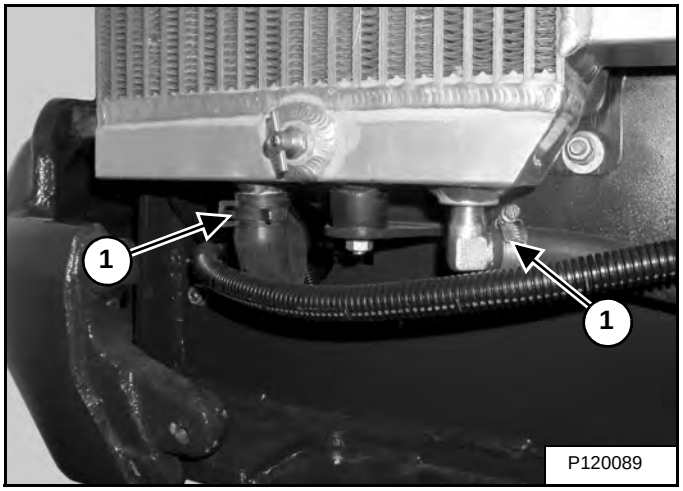
Remove the right upperstructure cover. (See Removal And Installation on Page 40-70-1.)

Drain the hydraulic fluid. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

Drain the engine coolant. (See Removing And Replacing Coolant on Page 10-100-3.)

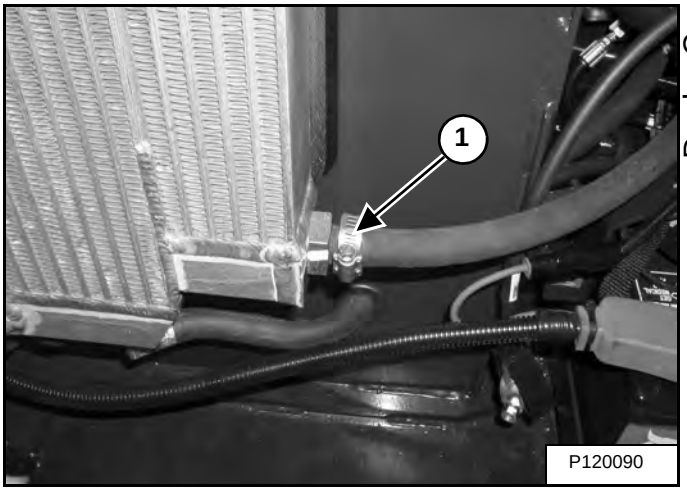
Open the right side cover.

Figure 60-40-1



Disconnect the hoses (Item 1) **[Figure 60-40-1]**.

Figure 60-40-2



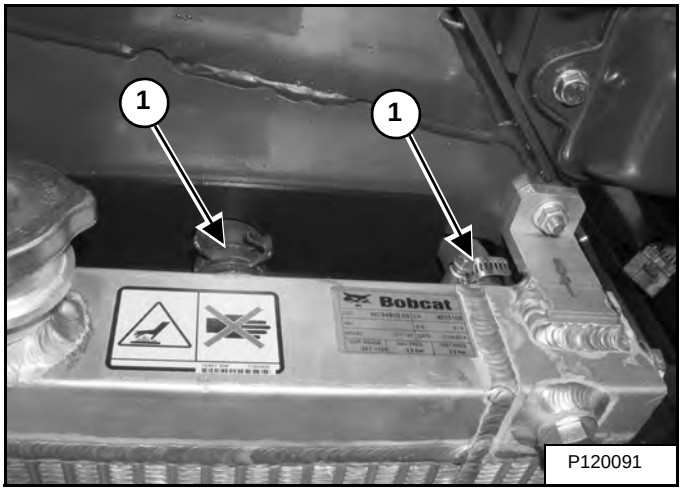
Disconnect the hose (Item 1) **[Figure 60-40-2]**.

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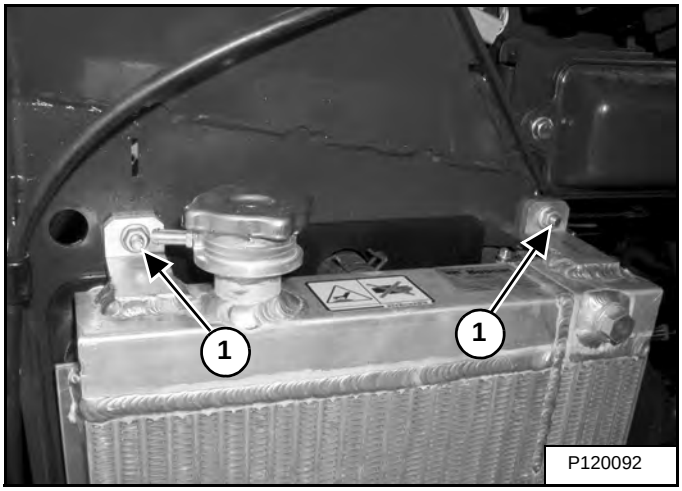
Radiator / Oil Cooler Removal And Installation (Cont'd)

Figure 60-40-3



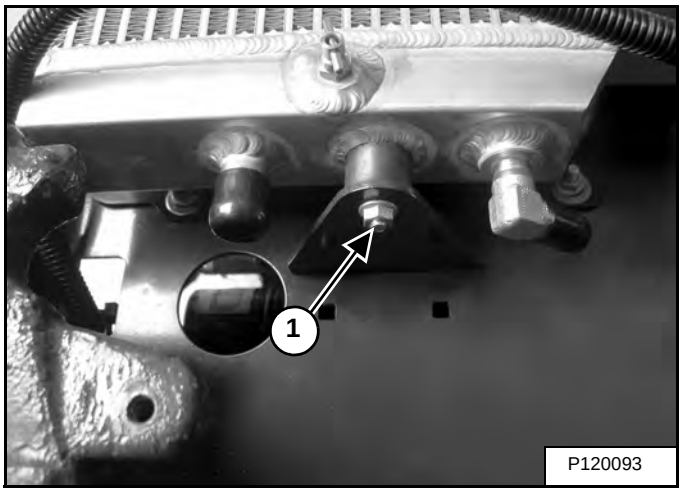
Loosen the clamps (Item 1) **[Figure 60-40-3]** and remove the hoses.

Figure 60-40-4



Remove the nuts (Item 1) **[Figure 60-40-4]** from the top of the radiator / oil cooler.

Figure 60-40-5



Remove the nut (Item 1) **[Figure 60-40-5]** and remove the radiator / oil cooler.

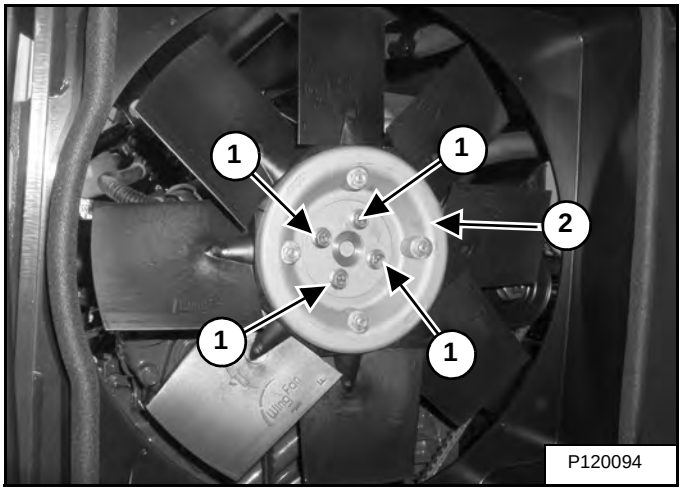
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Fan Removal

Remove the radiator / oil cooler. (See Radiator / Oil Cooler Removal And Installation on Page 60-40-1.)

Figure 60-40-6



Remove the four bolts (Item 1) and remove the fan (Item 2) **[Figure 60-40-6]**.

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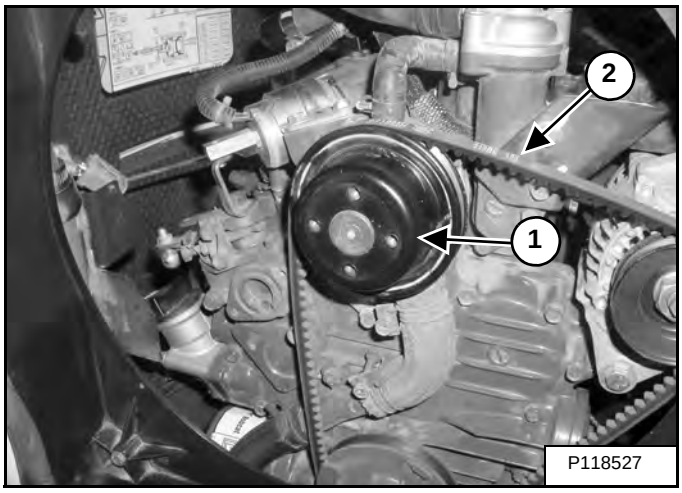
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Water Pump Removal And Installation

Remove the radiator / oil cooler. (See Radiator / Oil Cooler Removal And Installation on Page 60-40-1.)

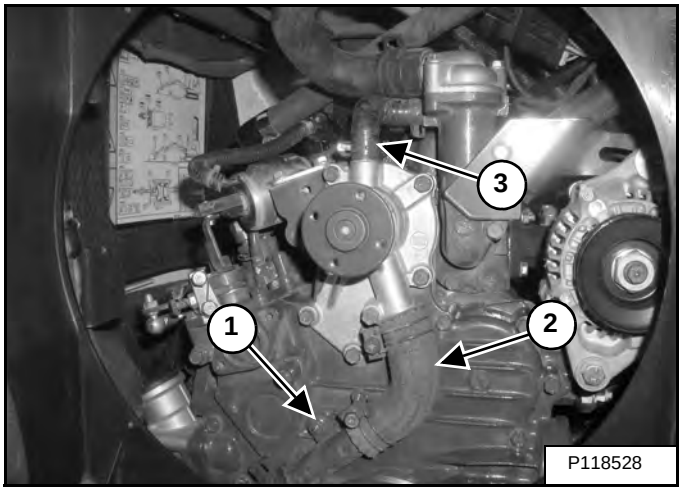
Remove the fan. (See Fan Removal on Page 60-40-3.)

Figure 60-40-7



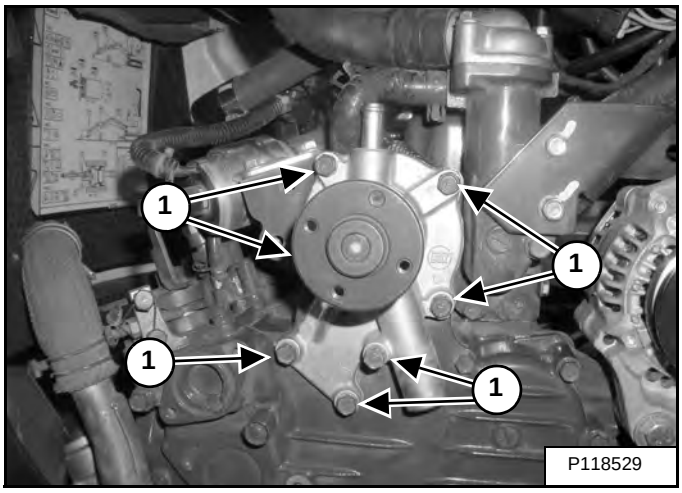
Remove the water pump pulley (Item 1) and the drive belt (Item 2) **[Figure 60-40-7]**.

Figure 60-40-8



Remove the nut (Item 1) holding the lower coolant line to the block, remove the lower hose (Item 2) and the upper hose (Item 3) **[Figure 60-40-8]**.

Figure 60-40-9



Remove the seven mounting bolts (Item 1) **[Figure 60-40-9]**.

Remove the water pump.

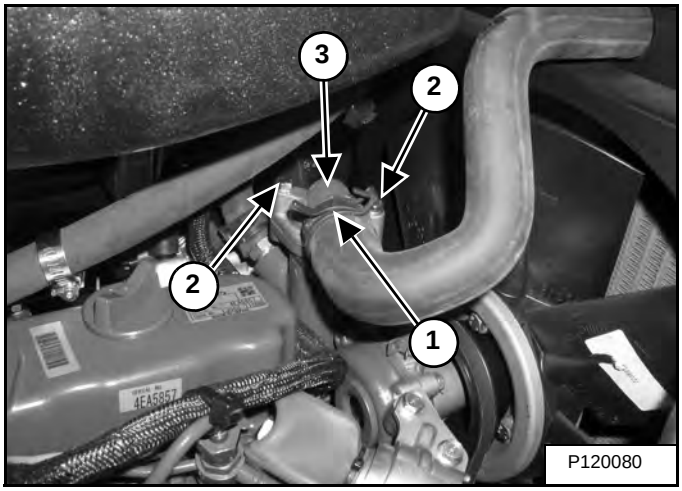
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Thermostat Removal And Installation

Drain the engine coolant. (See Removing And Replacing Coolant on Page 10-100-3.)

Figure 60-40-10



Remove the hose (Item 1) **[Figure 60-40-10]**.

Remove the bolts (Item 2), the housing (Item 3) **[Figure 60-40-10]** and the thermostat.

Installation: Make sure all gasket surfaces are clean. Replace the gasket before installing the thermostat housing. Install liquid gasket to thermostat housing.

Thermostat - Testing

Hang the thermostat in a suitable container filled with coolant.

Heat the coolant gradually. Use a thermometer to measure the temperature when it starts to open and when it's fully open.

If the thermostat does not operate correctly it must be replaced.

NOTE: See specifications on the thermostat. (See Specifications on Page 60-10-2.)

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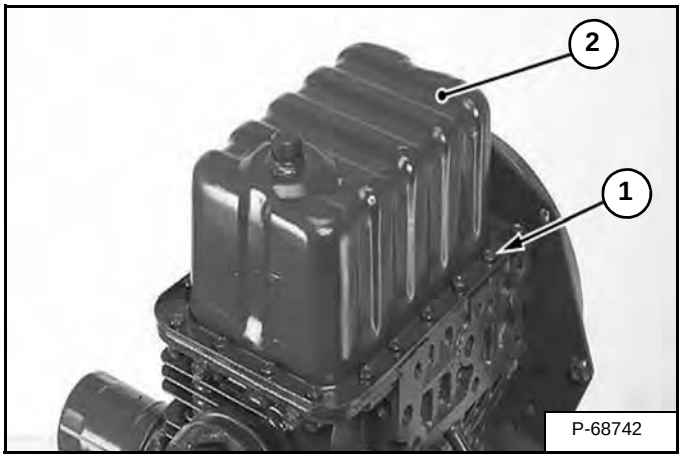
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Oil Pan Removal And Installation

Remove the engine from the excavator. (See Engine Removal And Installation on Page 60-10-9.)

Figure 60-50-1



Unscrew the oil pan mounting screws (Item 1) and remove the oil pan (Item 2) **[Figure 60-50-1]**.

Figure 60-50-2

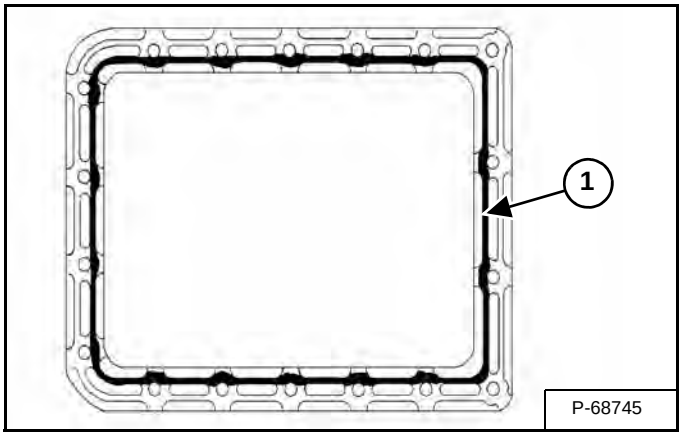
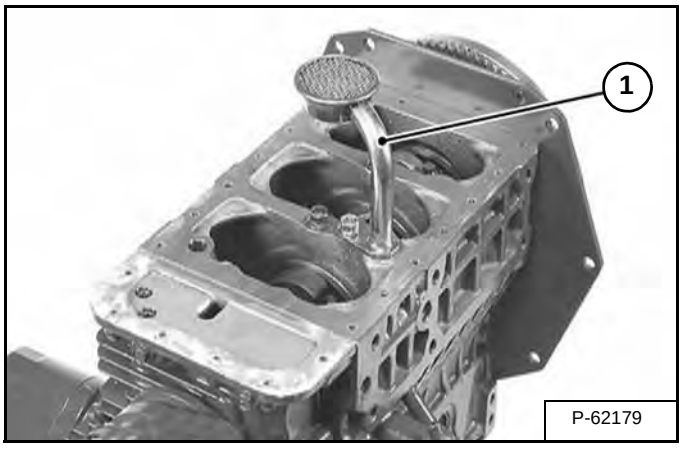
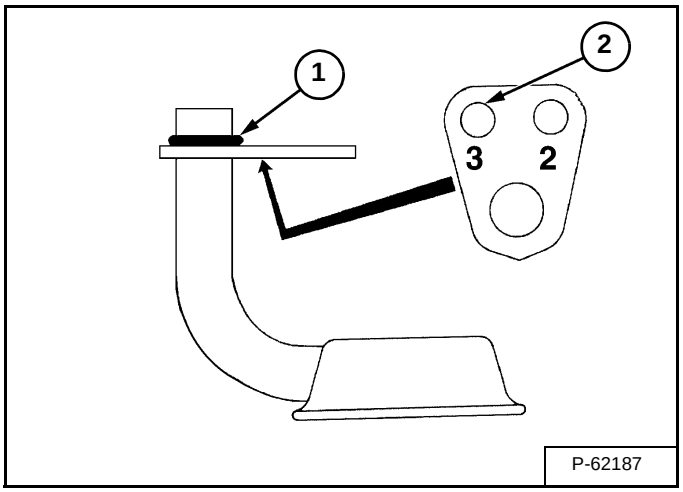


Figure 60-50-3



Remove the oil pump strainer (Item 1) **[Figure 60-50-3]**.

Figure 60-50-4



Installation: Replace the O-ring (Item 1) on strainer and use hole 3 (Item 2) **[Figure 60-50-4]** when installing strainer. Install the oil strainer, using care not to damage the O-ring.

Apply liquid gasket to the oil pan (Item 1) **[Figure 60-50-2]**.

Confirm that the liquid gasket coating surface is free of water, dust and oil in order to maintain sealing effect.

Carefully apply the adhesive evenly.

NOTE: When mounting the adhesive-applied parts, take care to fit them to the mating parts.

Assemble the adhesive-applied parts within 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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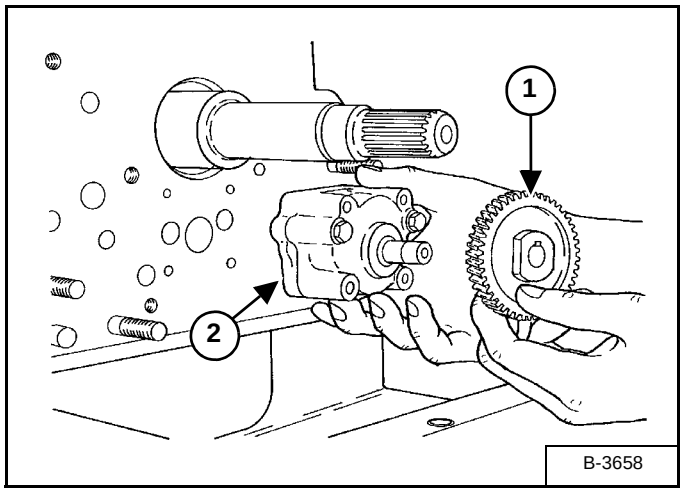
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Oil Pump Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-90-1.)

Remove the crankshaft gear.

Figure 60-50-5



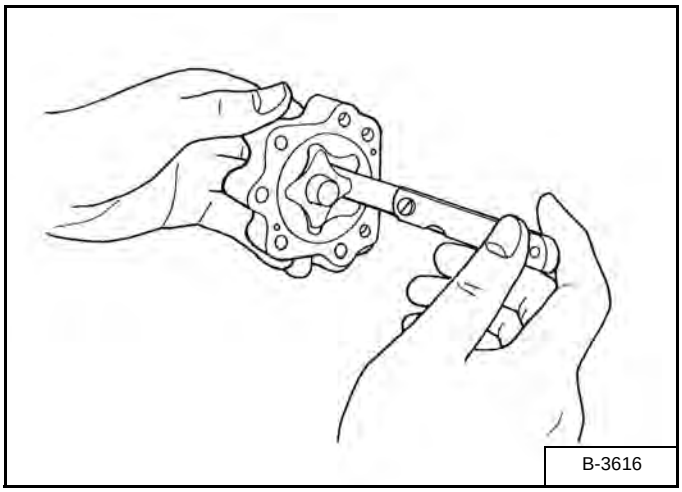
Remove the nut from the oil pump shaft. Use a puller to remove the oil pump gear (Item 1) **[Figure 60-50-5]**.

Remove the oil pump mounting bolts. Remove the oil pump (Item 2) **[Figure 60-50-5]**.

Installation: Tighten the oil pump mounting bolts to 6,9 - 8,1 N•m (60 - 72 in-lb) torque.

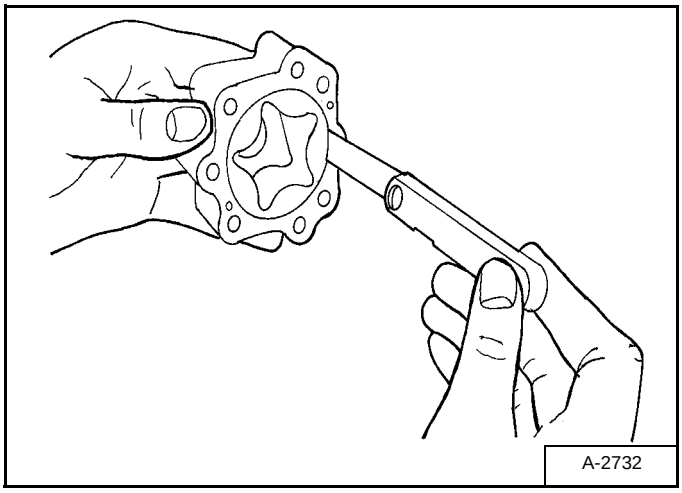
Oil Pump - Service

Figure 60-50-6



Measure the clearance between the lobes of the inner rotor and outer rotor with a feeler gauge **[Figure 60-50-6]**.

Figure 60-50-7



Measure the clearance between the outer rotor and pump body with a feeler gauge **[Figure 60-50-7]**.

If the clearance exceeds the factory limit, replace the oil pump rotor assembly.

Clearance Between Inner and Outer Rotor

0,03 - 0,14 mm (0.001 - 0.006 in)

Clearance Between Outer Rotor and Body

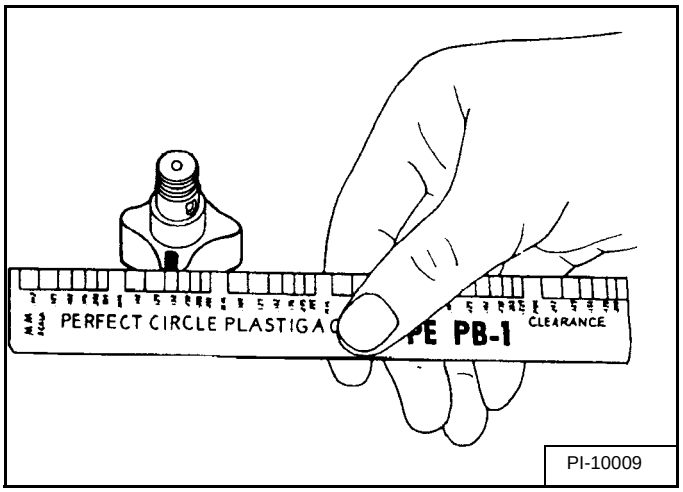
0,07 - 0,15 mm (0.003 - 0.006 in)

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Oil Pump - Service (Cont'd)

Figure 60-50-8



Put a piece of press gauge on the rotor face **[Figure 60-50-8]**.

Install the cover and tighten the bolts.

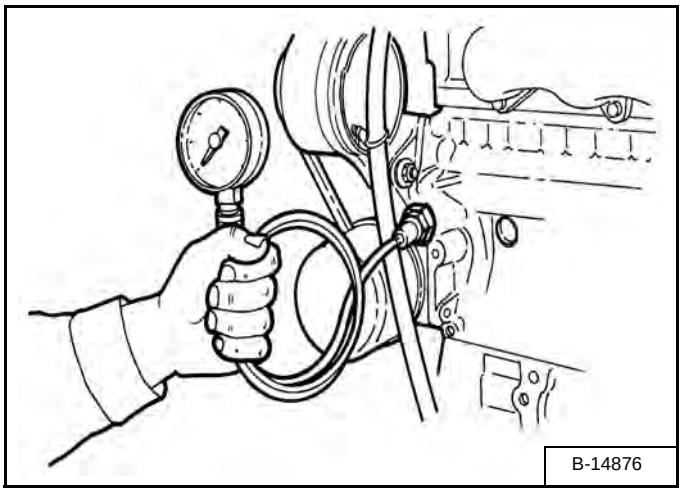
Remove the cover carefully. Measure the width of the press gauge **[Figure 60-50-8]**.

If the clearance exceeds the factory limit replace the oil pump rotor assembly.

End Clearance	0,08 - 0,14 mm (0.003 - 0.005 in)

Engine Oil Pressure - Testing

Figure 60-50-9



Remove the oil pressure sensor.

Install a pressure gauge **[Figure 60-50-9]**.

Start the engine and run until it is at operating temperature.

Measure oil pressure at both idling and rated speeds.

If the oil pressure is less than the allowable limit, check the following item:

- Engine Oil Insufficient
- Oil Pump Defective
- Oil Galley Plugged
- Oil Strainer Plugged
- Excessive Oil Clearance
- Foreign Matter in Relief Valve
- Oil Filer Cartridge plugged

At Idle Speed Allowable Limit	48 kPa (0,48 bar) (7 psi)
At Rated Speed	200 - 400 kPa (2 - 4 bar) (28 - 64 psi)
Allowable Limit	100 kPa (1 bar) (21 psi)

Installation: After testing engine oil pressure, tighten oil pressure sensor to 15 - 20 N•m (11 - 15 ft-lb).

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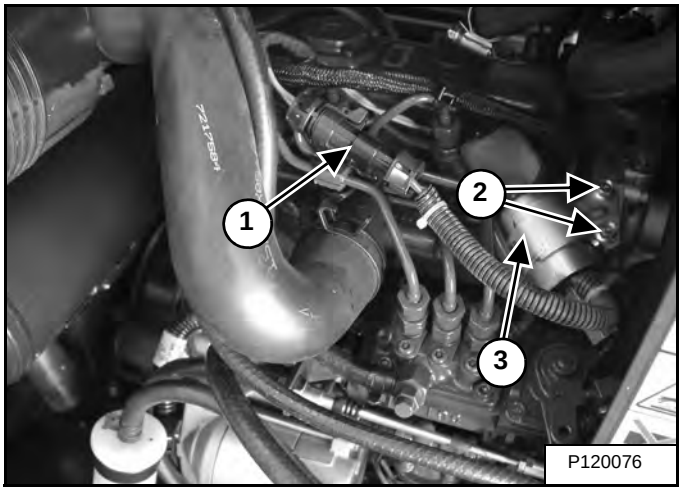
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Fuel Shutoff Solenoid Removal And Installation

Open the tailgate.

Figure 60-60-1



Disconnect the wire harness from the solenoid (Item 1) **[Figure 60-60-1]**.

Remove the solenoid mounting bolts (Item 2) **[Figure 60-60-1]**.

Remove the solenoid (Item 3) **[Figure 60-60-1]**.

Hydraulic filter mount and fuel filter mount removed for photo clarity.

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Fuel Injection Pump - Testing

NOTE: Never try to disassemble the injection pump assembly. For repairs, you should contact a Kubota-authorized pump service shop.

Remove the air cleaner. (See Removal And Installation on Page 60-30-1.)

Remove the hydraulic filter mount. (See Removal And Installation on Page 20-120-1.)

Remove the fuel shutoff solenoid. (See Fuel Shutoff Solenoid Removal And Installation on Page 60-60-1.)

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

MEL1237 - Adapter Fuel Line
MEL1173-1 - Pressure Gauge

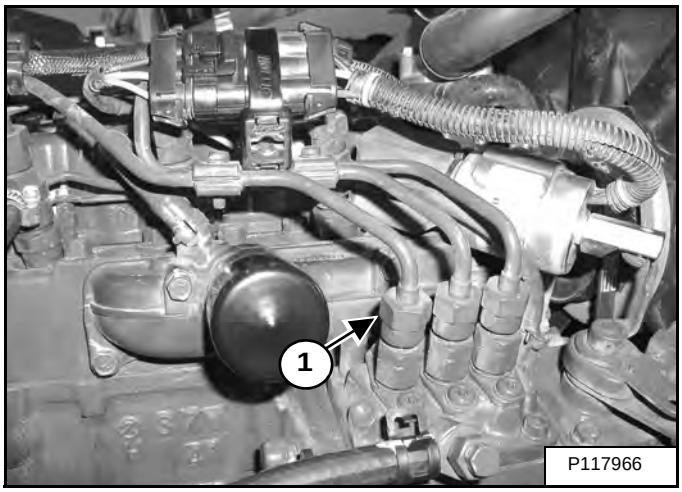
⚠ WARNING

AVOID INJURY OR DEATH

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

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Figure 60-60-2



To test the initial discharge pressure, remove a high pressure tubeline (Item 1) **[Figure 60-60-2]** from the fuel injection pump.

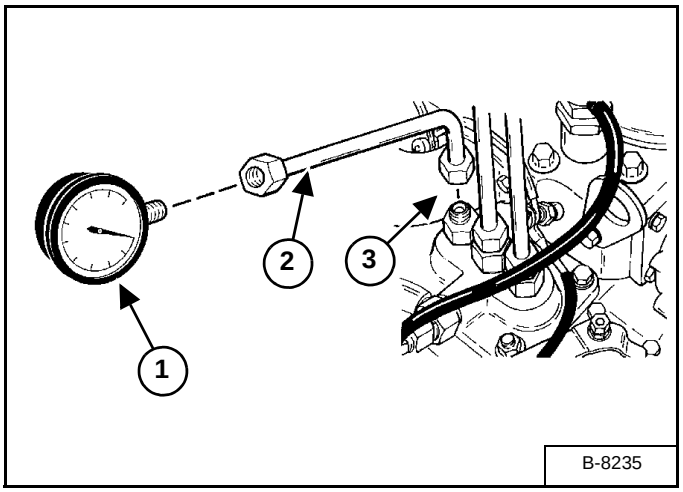
Loosen the other end of the tubeline at the injector, so that the tubeline can be turned away from the fitting.

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Fuel Injection Pump - Testing (Cont'd)

Figure 60-60-3



Connect a pressure gauge (Item 1) to the long leg of the test tubeline (Item 2) **[Figure 60-60-3]** and tighten.

Connect the short leg of the tubeline to the fitting at the fuel injection pump (Item 3) **[Figure 60-60-3]**.

Set the speed control lever to the maximum engine speed position to allow full fuel delivery.

Fuel Tightness of Pump Element

With the starter, rotate the engine to increase the pressure to 13727 kPa (137 bar) (1991 psi).

If the pressure cannot be reached, replace the pump with a new one or send to a Kubota-authorized pump service shop.

Fuel Tightness of Delivery Valve

Manually turn the flywheel to raise the pressure to approx. 13727 kPa (137 bar) (1991 psi). Now turn the flywheel back about 1/2 turn (to keep the plunger free), and clock the time taken for the pressure to drop from 13727 - 12748 kPa (137 - 127 bar) (1991 - 1849 psi).

The pressure should hold at 13727 kPa (137 bar) (1991 psi), for at least 5 seconds or more.

If the time is less than the allowable limit, replace the pump with a new one, or send to a Kubota - authorized pump service shop.

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Fuel Injection Pump Removal And Installation

IMPORTANT

Do not attempt to maintain or adjust unless you are trained and have the correct equipment.

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IMPORTANT

Never steam clean or put cold water on an injection pump while the engine is running or while it is hot. If you do it will cause serious damage to the injection pump.

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IMPORTANT

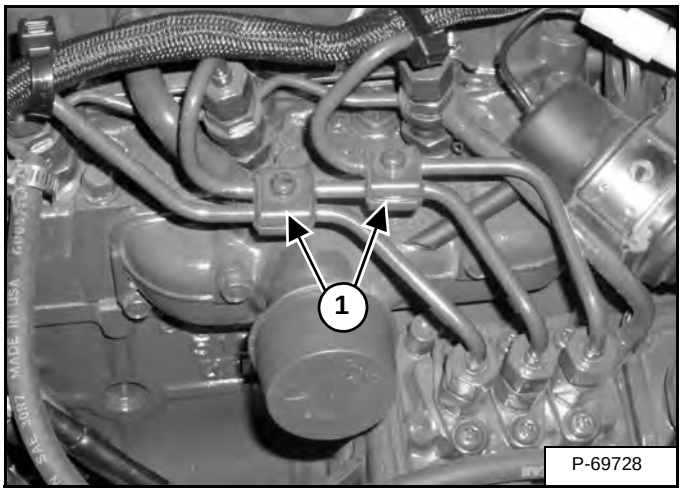
Do not bend the high pressure fuel injection tubes when removing or installing them.

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Remove the air cleaner. (See Removal And Installation on Page 60-30-1.)

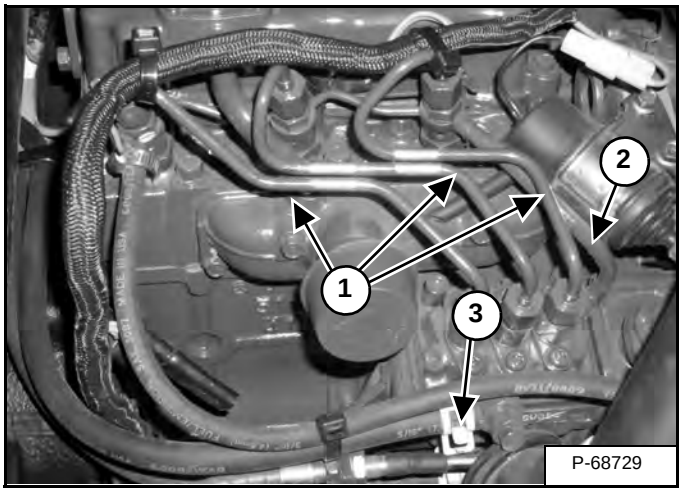
Remove the hydraulic filter mount. (See Removal And Installation on Page 20-120-1.)

Figure 60-60-4



Remove the fuel line clamps (Item 1) **[Figure 60-60-4]**.

Figure 60-60-5



Disconnect the high pressure lines (Item 1) **[Figure 60-60-5]** from the fuel injector and fuel injection pump.

Installation: Tighten the pipe retaining nuts to 25 - 34 N•m (18 - 25 ft-lb) torque.

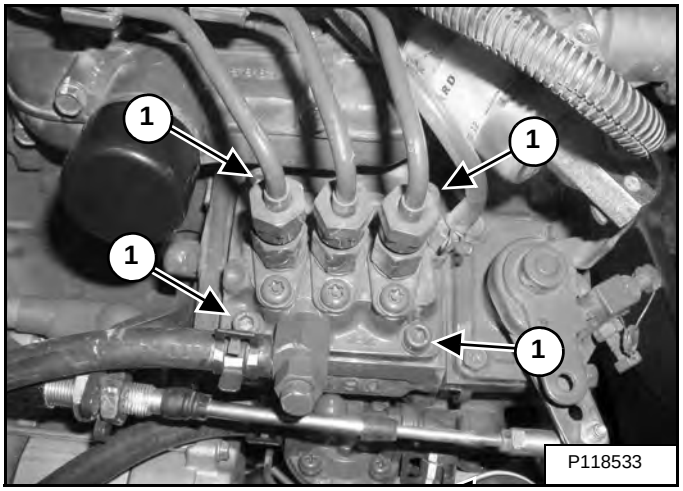
Disconnect the fuel return hose (Item 2) and the fuel inlet hose (Item 3) **[Figure 60-60-5]**.

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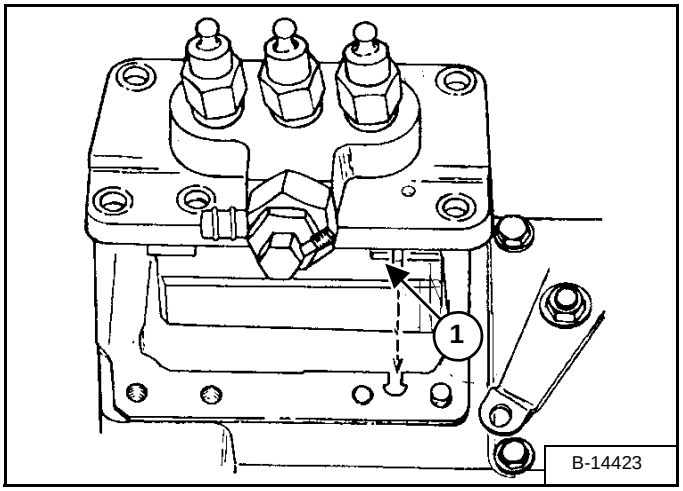
Fuel Injection Pump Removal And Installation (Cont'd)

Figure 60-60-6



Remove the four injection pump mounting bolts (Item 1) **[Figure 60-60-6]**.

Figure 60-60-7



Align the pin (Item 1) **[Figure 60-60-7]** in the control rack with the slot in the engine block.

Remove the injection pump.

Installation: When the injection pump is installed, make sure the pin (Item 1) **[Figure 60-60-7]** on the control rack is correctly installed on the fork lever. If the slot is not installed correctly, the engine will run over maximum speed and serious damage can result.

NOTE: Make sure the same number shims are installed under the injection pump. The shims are used for engine timing.

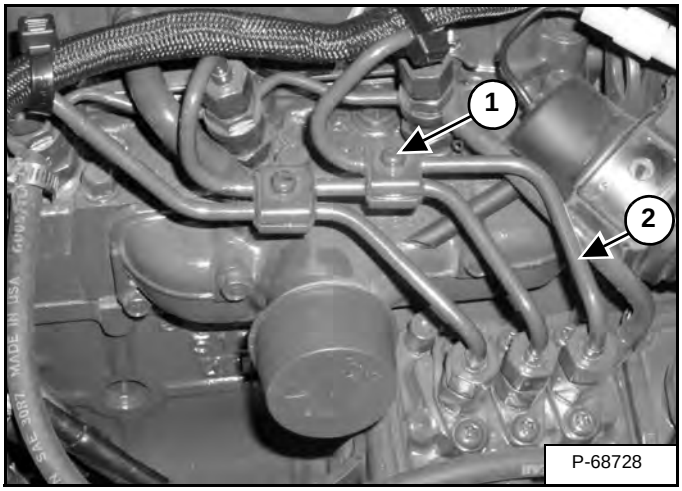
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Fuel Injection Pump - Timing

Timing the injection pump is done by changing the number of shims between the injection pump and the injection pump mounting surface.

Figure 60-60-8



Remove the fuel line clamp (Item 1) **[Figure 60-60-8]**.

Remove the number one cylinder high pressure line (Item 2) **[Figure 60-60-8]** from the injection pump.

IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

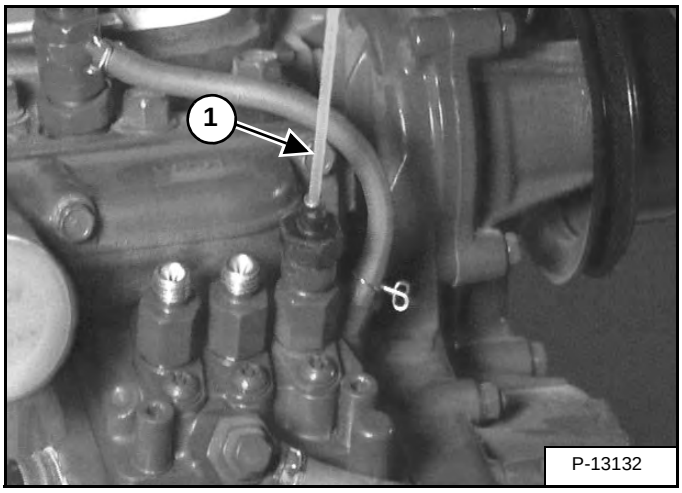
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IMPORTANT

Do not attempt to maintain or adjust unless you are trained and have the correct equipment.

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Figure 60-60-9



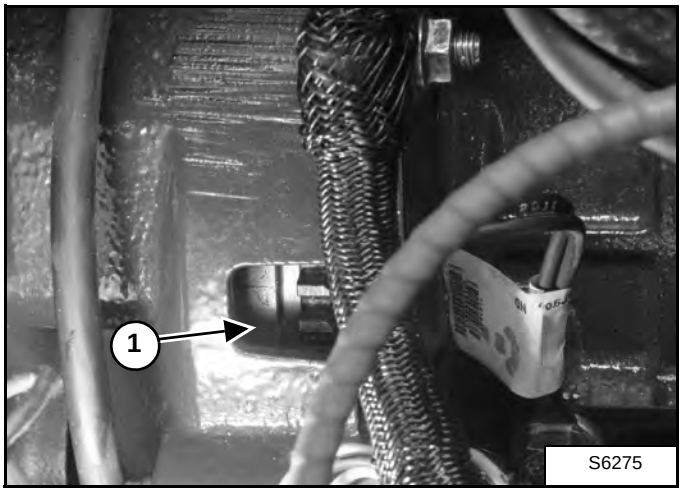
Install a short plastic tube (Item 1) **[Figure 60-60-9]** in the number one cylinder port of the injection pump. The tube should fit tight in the port and point upward.

NOTE: The fuel must be in the tube before attempting timing.

Move the fuel lever on the injection pump to full fuel position (or full throttle).

Turn the flywheel counterclockwise (facing the flywheel) slowly until the start of fuel rise in the plastic tube (Item 1) **[Figure 60-60-9]**.

Figure 60-60-10



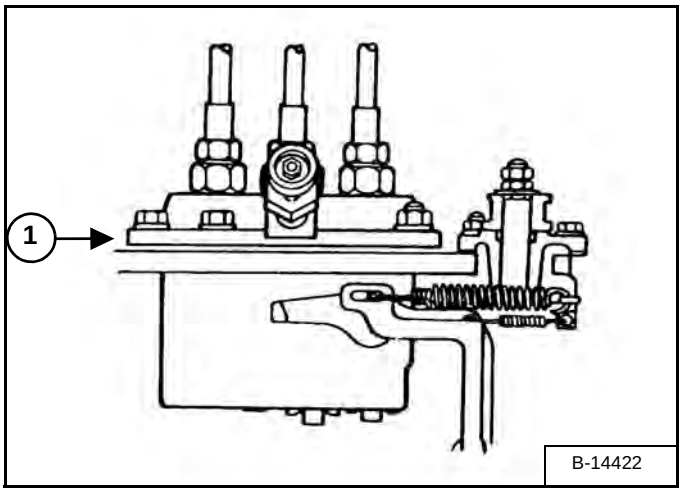
At this point look at the timing mark (located on the flywheel) for proper alignment (Item 1) **[Figure 60-60-10]**. When the timing mark is aligned as shown the timing is correct for the injection pump, which is 19 - 21° B.T.D.C.

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Fuel Injection Pump - Timing (Cont'd)

Figure 60-60-11



The correct engine timing for all Kubota® D722-E2B engines is 19 - 21° B.T.D.C. Add or subtract shims (Item 1) **[Figure 60-60-11]** to time the engine to 19 - 21° B.T.D.C. The engine is correctly timed when the 19 - 21° B.T.D.C. mark on the flywheel is aligned with the notch in the timing hole.

NOTE: Adding or reducing the shim thickness by 0,05 mm retards or advances the injection timing by approximately 0.5°.

Some problems caused by faulty injector nozzles:

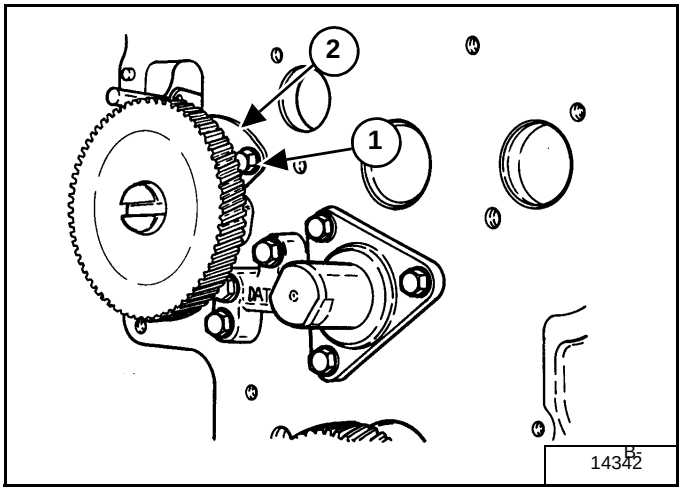
- The engine is hard to start or will not start.
- Rough engine operation at idle.
- The engine will not have full power.
- The engine exhaust smoke is black, white or blue.

Fuel Camshaft Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-90-1.)

Remove the idler gear. (See Cylinder Head Removal And Installation on Page 60-70-3.)

Figure 60-60-12



Remove the bolt (Item 1) from the retainer plate (Item 2) **[Figure 60-60-12]**.

Installation: Tighten the bolt to 6,8 - 8,1 N•m (60 - 72 in-lb) torque.

Remove the fuel camshaft retainer plate (Item 2) **[Figure 60-60-12]**.

Remove the fuel camshaft and fork lever assembly at the same time.

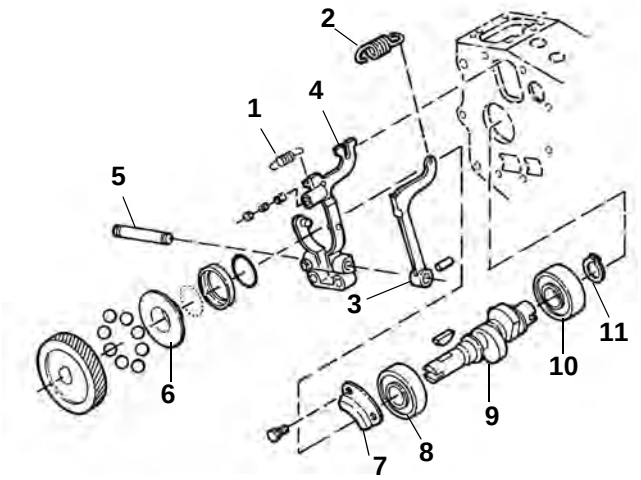
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Fuel Camshaft Governor

The governor serves to keep the engine speed constant by automatically adjusting the amount of fuel supplied to the engine according to changes in the load.

Figure 60-60-13



1. Start Spring
2. Governor Spring
3. Fork Lever
4. Fork Lever
5. Fork Lever shaft
6. Governor Sleeve
7. Retaining Plate
8. Bearing
9. Fuel Camshaft
10. Bearing
11. Snap Ring

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Disassemble and assemble the governor and fuel camshaft as shown **[Figure 60-60-13]**.

Inspect all the parts for wear or damage and replace as needed.

Fuel Injector Removal And Installation

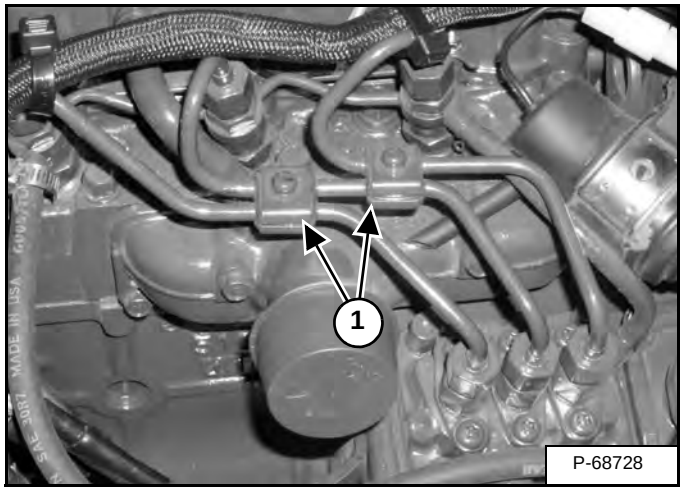
IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

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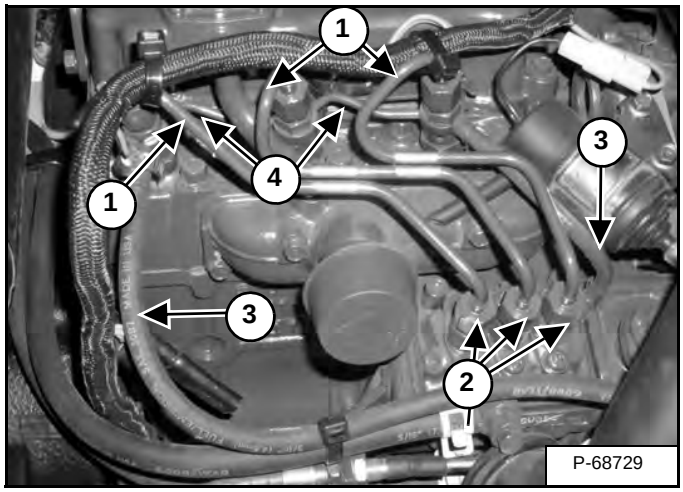
Remove the air cleaner assembly. (See Removal And Installation on Page 60-30-1.)

Figure 60-60-14



Remove the high pressure fuel line clamps (Item 1) **[Figure 60-60-14]**.

Figure 60-60-15



Disconnect the high pressure fuel lines from the fuel injectors (Item 1) **[Figure 60-60-15]**.

Disconnect the fuel lines (Item 2) **[Figure 60-60-15]** from the injection pump.

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Fuel Injector Removal And Installation (Cont'd)

Remove the high pressure fuel lines.

Disconnect the return fuel hoses (Item 3) **[Figure 60-60-15]**.

Remove the retainer nut from the top of the fuel injectors.

Remove the fuel return pipe (Item 4) **[Figure 60-60-15]**.

Loosen the injector nozzle.

Installation: Tighten the injector nozzle to 49 - 69 N•m (36 - 51 ft-lb) torque.

Remove the injector nozzle from the cylinder head.

NOTE: Be sure to replace the copper washer and nozzle cap anytime new or reconditioned fuel injectors are installed.

⚠ WARNING

AVOID INJURY OR DEATH

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

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Fuel Injector Nozzle Pressure - Testing

IMPORTANT

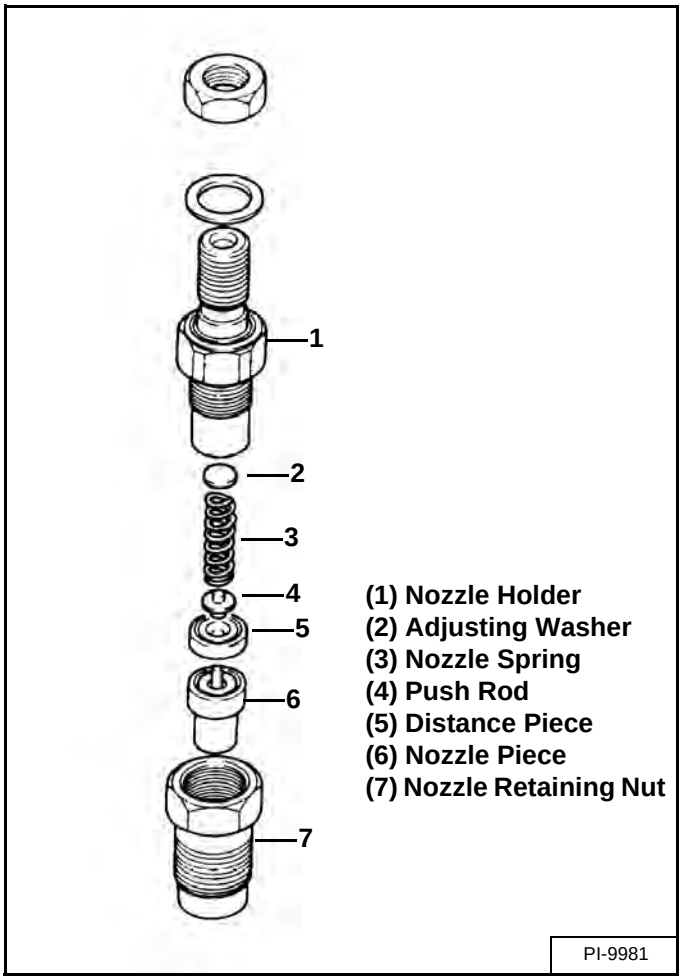
Do not disassemble or test the fuel injector nozzles unless you have the correct service and testing tools.

I-2027-0284

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

4200 - Injector Nozzle Tester
4201 - Injector Nozzle Tester Adapter Set

Figure 60-60-16



The nozzle release pressure can be adjusted by adding or removing washer(s) (Item 2) from the top of the nozzle spring (Item 3) **[Figure 60-60-16]**.

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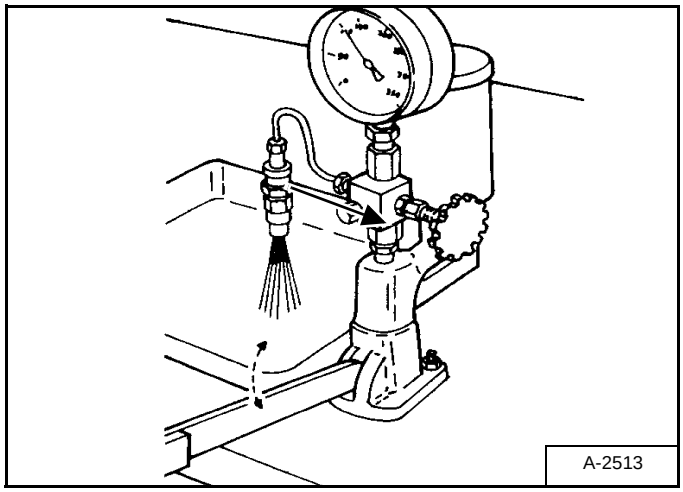
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Fuel Injector Nozzle Pressure - Testing (Cont'd)

Each spacer will change the release pressure by about 234 kPa (2,3 bar) (34 psi).

Fuel Injection Pressure.	13727 - 14713 kPa (137 - 147 bar) (1991 - 2134 psi)

Figure 60-60-17



Assemble the injector nozzle. Connect the nozzle to the tester with the nozzle down **[Figure 60-60-17]**.

Operate the hand lever at a slow rate and record the opening pressure. If the pressure is not correct, disassemble the nozzle and add or remove the spacer (Item 2) **[Figure 60-60-16]** as needed.

NOTE: When assembling the injector nozzle, tighten the retainer nut (Item 1) [Figure 60-60-16] to 25,3 - 28,9 N•m (23.5 - 28.9 ft-lb) torque. Any higher torque will cause slow action of the valve.

When the injector nozzle is assembled, tighten the nozzle body to 49 - 69 N•m (36 - 51 ft-lb) torque.

Check for inside leakage. Operate the hand lever until the pressure is 12748 kPa (127 bar) (1849 psi). Keep the nozzle under this pressure for 10 seconds, check to see if fuel leaks from the nozzle. If fuel leaks, replace the nozzle.

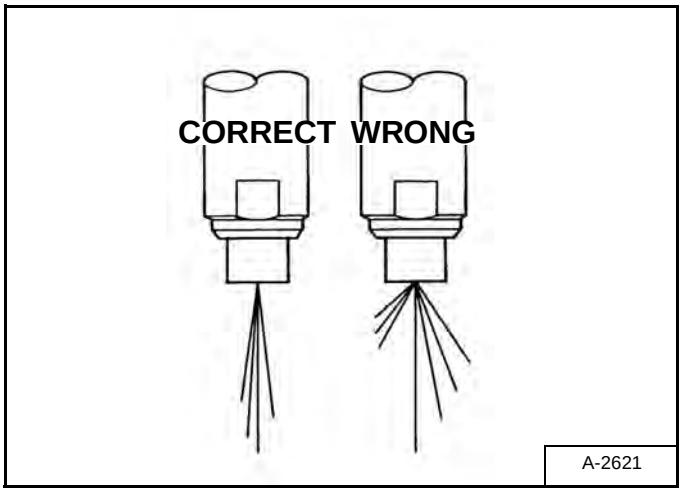
⚠ WARNING

AVOID INJURY OR DEATH

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

W-2072-0807

Figure 60-60-18



Check that the spray pattern is correct **[Figure 60-60-18]**:

1. Fuel does not come out the side of the nozzle.
2. Drops of fuel are not present at the nozzle.
3. The injector has an even flow coming from the nozzle.

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Glow Plug Removal And Installation

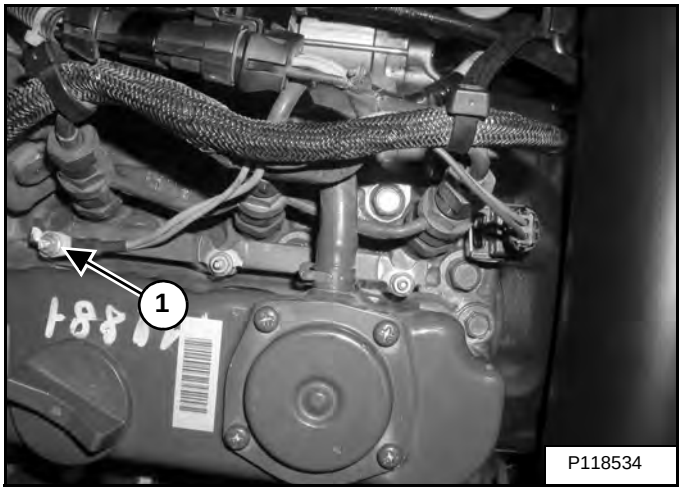
IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

I-2029-0289

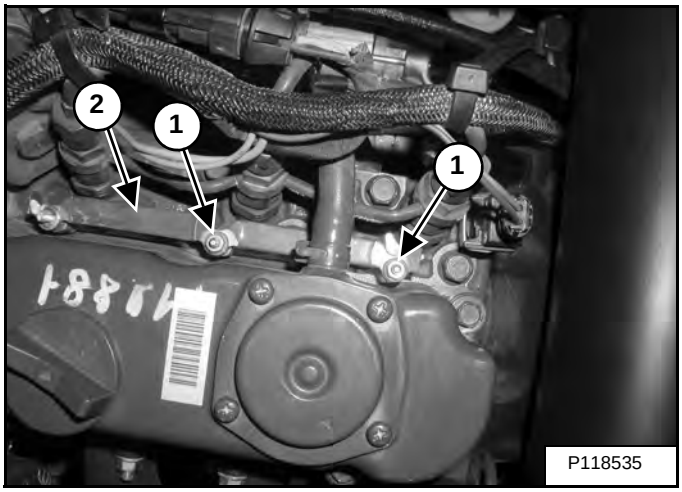
Remove the tool box. (See Removal And Installation on Page 40-260-1.)

Figure 60-70-1



Remove the glow plug lead (Item 1) **[Figure 60-70-1]**.

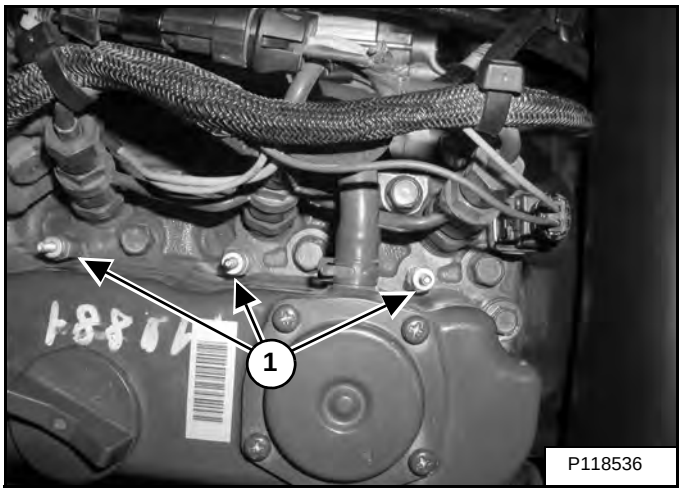
Figure 60-70-2



Remove the nuts (Item 1) **[Figure 60-70-2]**.

Remove the glow plug connector (Item 2) **[Figure 60-70-2]**.

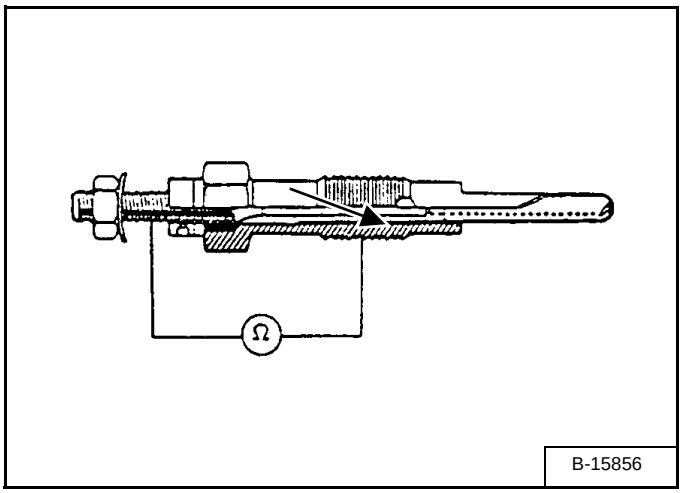
Figure 60-70-3



Remove the glow plugs (Item 1) **[Figure 60-70-3]** from the cylinder head.

Installation: Tighten the glow plugs to 8 - 15 N•m (6 - 11 ft-lb) torque.

Figure 60-70-4



Connect an ohmmeter to the terminal end of the glow plug, touch the other lead from the ohmmeter to the heating end of the glow plug **[Figure 60-70-4]**.

The reading will be approximately 0.9 ohm. If the resistance is 0 ohm, the glow plug has a short circuit. If the resistance is infinite, the coil of the glow plug is broken.

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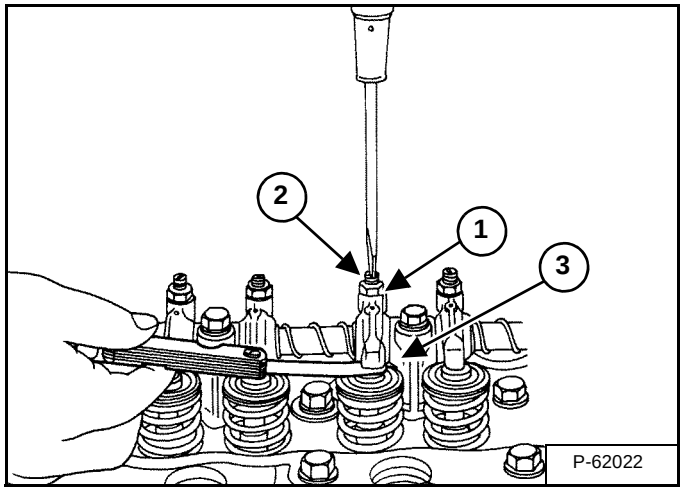
Valve Clearance Adjustment

NOTE: The valve clearance must be checked and adjusted when the engine is cold.

Remove the cylinder head cover and the glow plugs.

Adjust the valve clearance as follows:

Figure 60-70-5



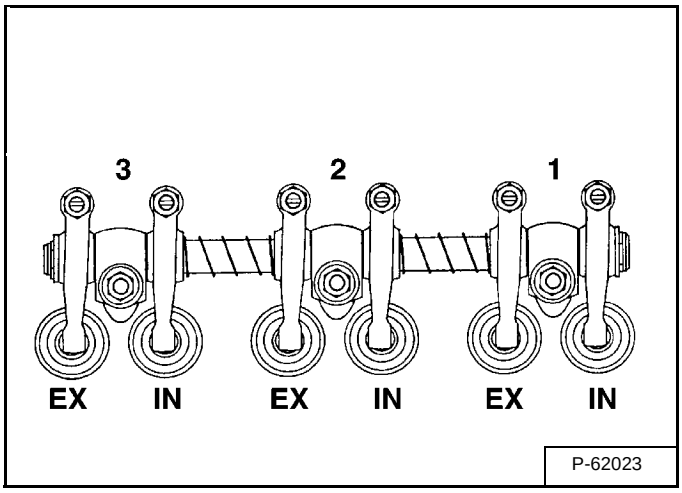
Loosen the locknut (Item 1) **[Figure 60-70-5]**.

Turn the adjustment screw (Item 2) **[Figure 60-70-5]** until the correct clearance is obtained.

NOTE: The clearance is measured between the rocker arm and valve stem tip (Item 3) [Figure 60-70-5].

If adjustments are necessary, tighten locknut before moving on to the next rocker arm.

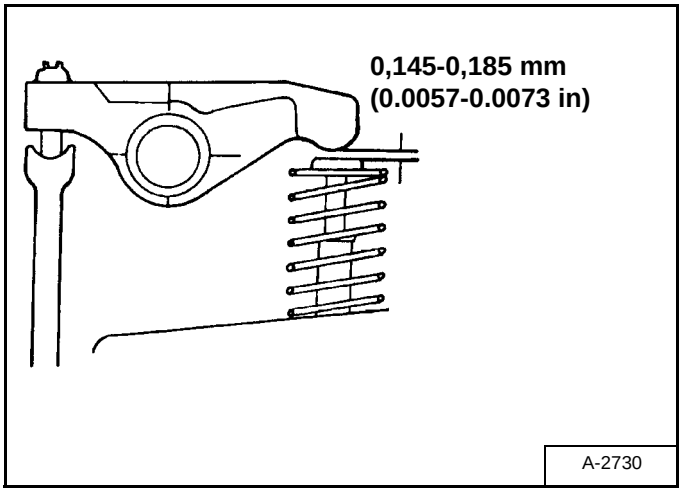
Figure 60-70-6



With No. 1 piston at TDC (compression) both the intake and exhaust valves are up. Set both No. 1 valves, No. 2 exhaust valve and No. 3 intake valve. **[Figure 60-70-6]**.

Rotate the flywheel 360°, No. 1 (overlap position). Set No. 2 intake valve and No. 3 exhaust valve. **[Figure 60-70-6]**.

Figure 60-70-7



Make sure the piston is at TDC when adjusting the clearance at the valves. The correct clearance is 0,145 - 0,185 mm (0.0057 - 0.0073 inch) cold clearance **[Figure 60-70-7]**.

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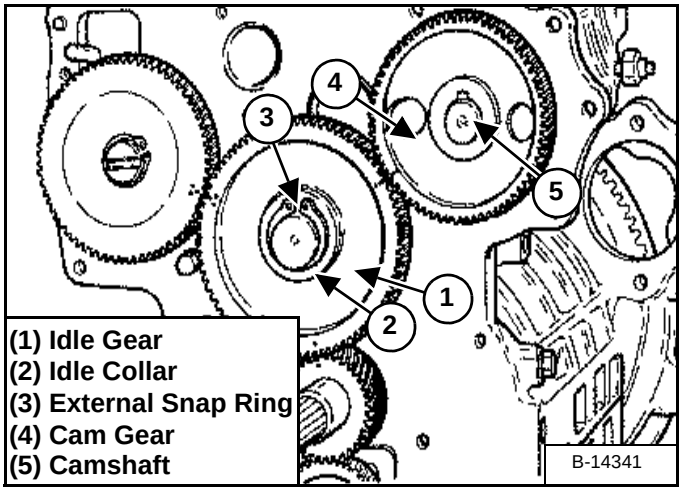
Valve Timing - Checking

Stop the engine and open the rear door.

Remove the engine. (See Engine Removal And Installation on Page 60-10-9.)

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-90-1.)

Figure 60-70-8

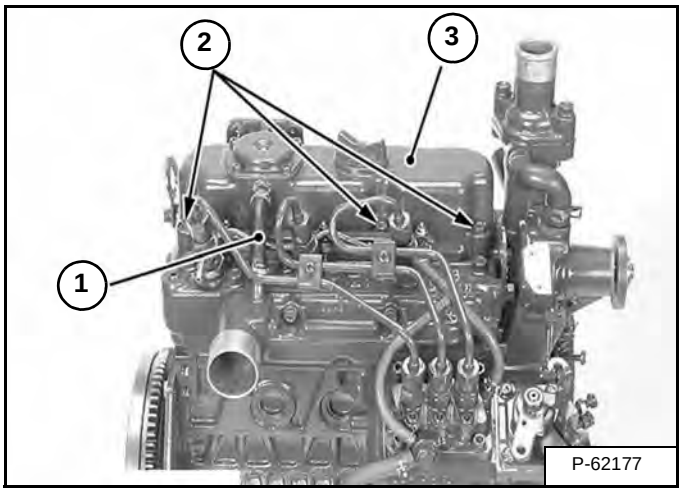


(1) Idle Gear
(2) Idle Collar
(3) External Snap Ring
(4) Cam Gear
(5) Camshaft

Make sure the timing marks are in correct alignment **[Figure 60-70-8]**.

Cylinder Head Removal And Installation

Figure 60-70-9



Remove the breather hose (Item 1) **[Figure 60-70-9]**.

Remove the bolts (Item 2) from the valve cover and remove the valve cover and gasket (Item 3) **[Figure 60-70-9]**.

Installation: Tighten the bolts to 7 - 11 N•m (5 - 8 ft-lb) torque. Gradually tighten center bolts before the end bolts to avoid cracking valve cover.

Remove the fuel injector nozzles. (See Fuel Injector Removal And Installation on Page 60-60-8.)

Remove the glow plugs. (See Glow Plug Removal And Installation on Page 60-70-1.)

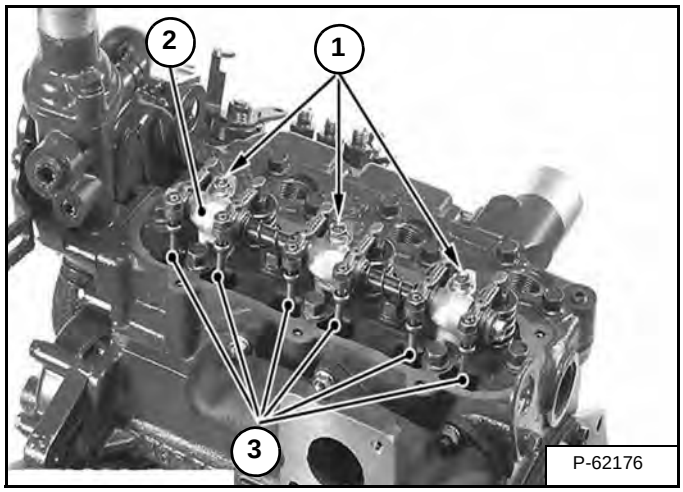
Remove the alternator. (See Removal And Installation on Page 50-30-4.)

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Cylinder Head Removal And Installation (Cont'd)

Figure 60-70-10



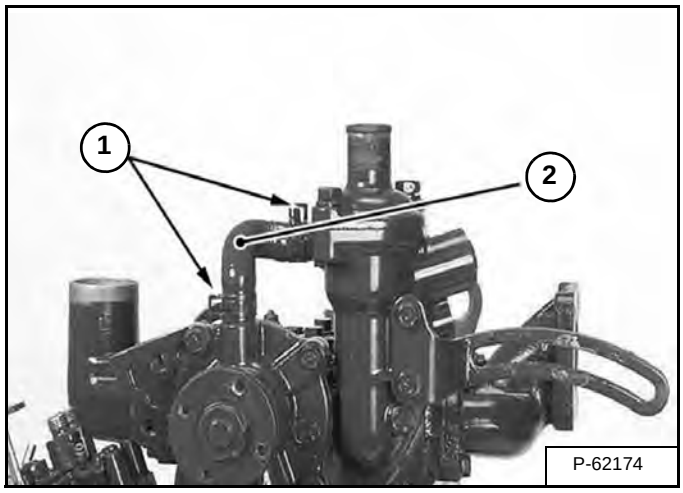
Remove the rocker arm bracket screws (Item 1) and shaft assembly (Item 2) **[Figure 60-70-10]**.

Installation: Tighten the nuts to 9,8 - 11,3 N•m (7 - 8 in-lb) torque.

Remove the push rods (Item 3) **[Figure 60-70-10]**.

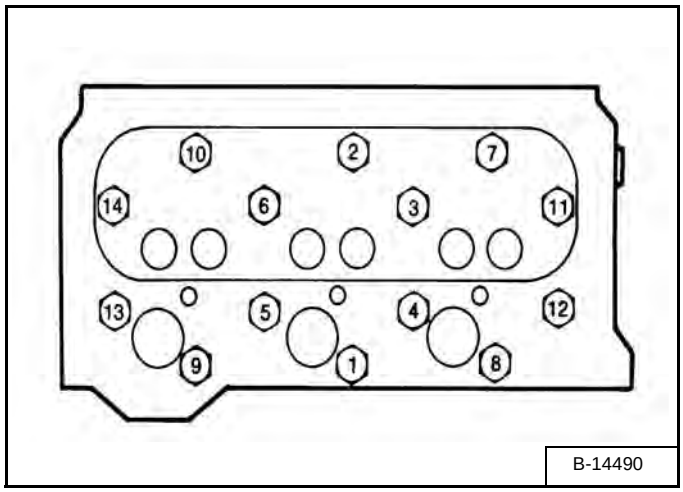
Remove the intake and exhaust manifolds.

Figure 60-70-11



Remove the water return hose **[Figure 60-70-11]**.

Figure 60-70-12



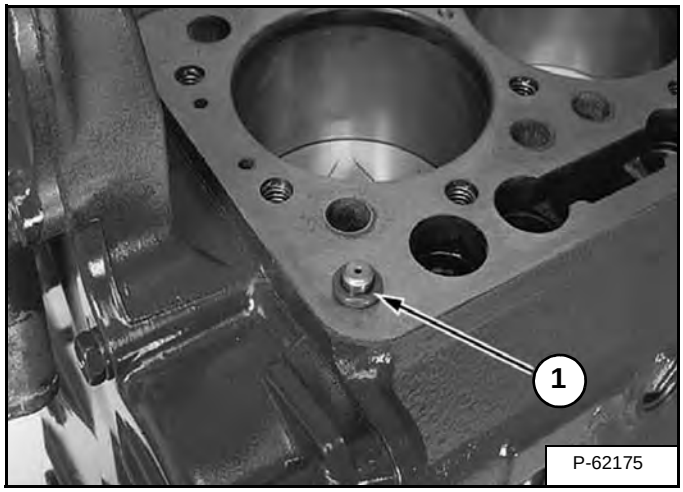
Remove the cylinder head bolts in order of #14 to #1 **[Figure 60-70-12]**.

Installation: Put oil on the bolt threads. Tighten the bolts in the correct sequence of #1 to #14 38 - 42 N•m (28 - 31 ft-lb) torque.

NOTE: Re-tighten the cylinder head bolts in the correct sequence after the engine has been run for 30 minutes.

Remove the cylinder head from the engine block.

Figure 60-70-13



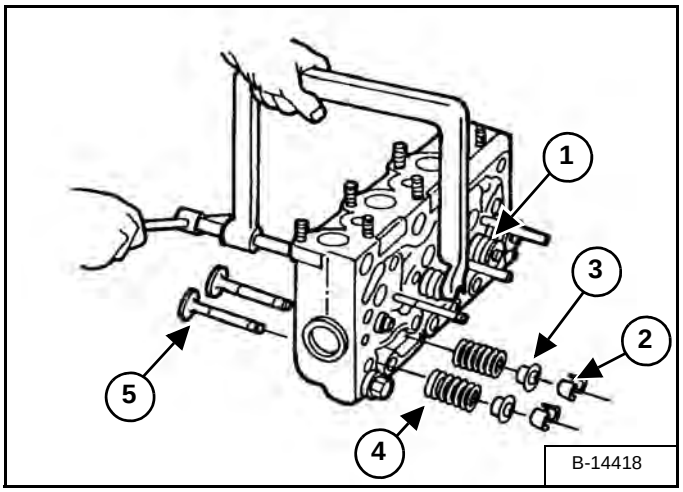
Installation: Always use a new head gasket and new O-ring. Make sure the O-ring (Item 1) **[Figure 60-70-13]** is seated over the dowel.

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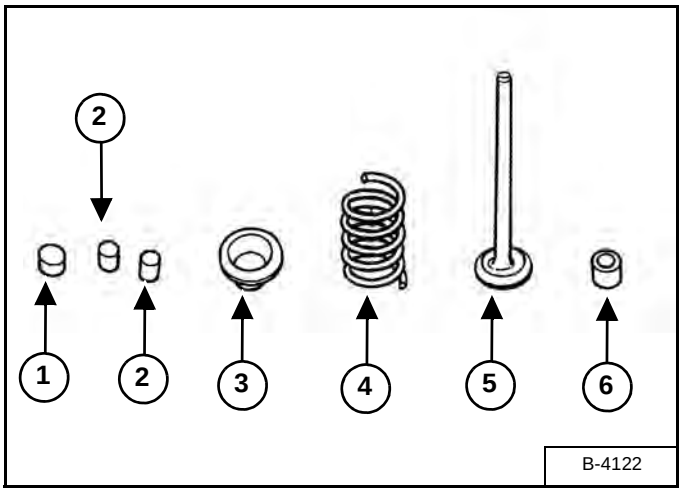
Cylinder Head Disassembly And Assembly

Figure 60-70-14



Use a valve spring compressor to compress the valve spring **[Figure 60-70-14]**.

Figure 60-70-15



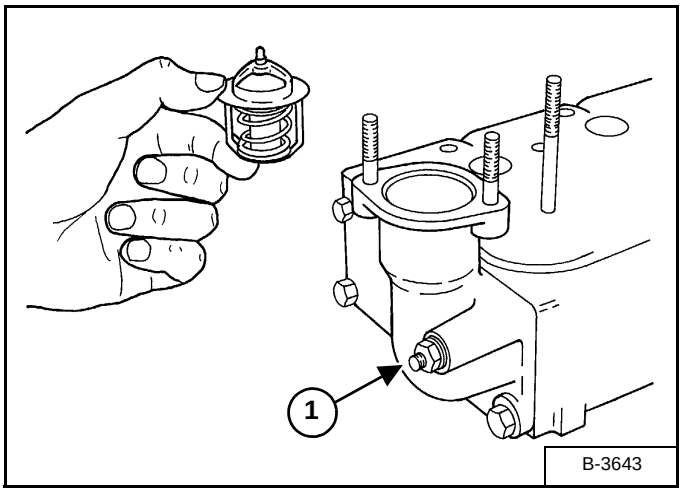
Remove the valve cap (Item 1) **[Figure 60-70-15]** and valve spring collet (Item 2) **[Figure 60-70-14]** and **[Figure 60-70-15]**.

Remove the valve spring retainer (Item 3) **[Figure 60-70-14]** and **[Figure 60-70-15]** and the spring (Item 4) **[Figure 60-70-14]** and **[Figure 60-70-15]**.

Remove the valve (Item 5) **[Figure 60-70-14]** and **[Figure 60-70-15]**.

Remove the seal (Item 6) **[Figure 60-70-15]**.

Figure 60-70-16



Remove the thermostat cover and thermostat from the cylinder head. Remove the thermostat housing (Item 1) **[Figure 60-70-16]**.

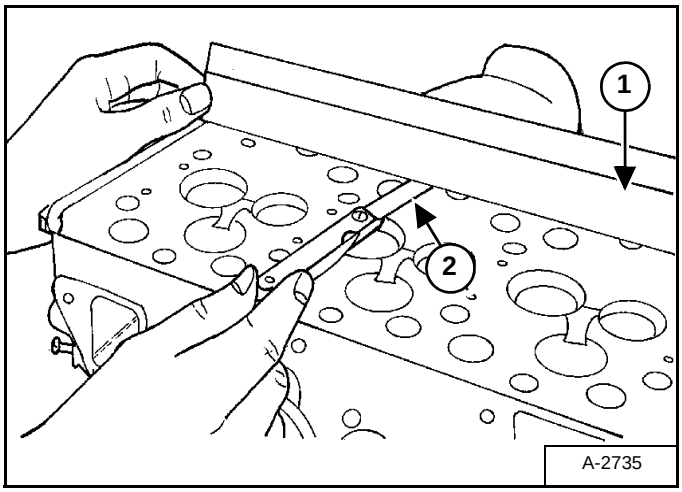
Installation: Apply Liquid-Type Gasket (Three Bond 1215 or equivalent) to both sides of the new thermostat cover gasket and new thermostat housing gasket.

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Cylinder Head - Servicing

Figure 60-70-17



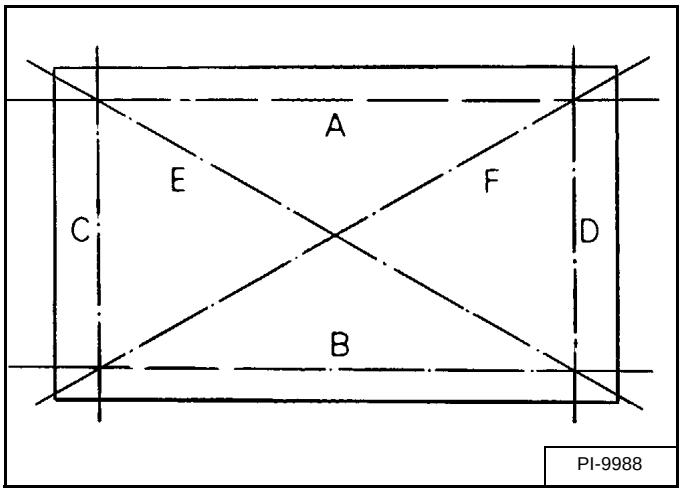
Clean the surface of the cylinder head.

Put a straight edge (Item 1) **[Figure 60-70-17]** on the cylinder head.

NOTE: Do not put the straight edge across combustion chambers.

Put a feeler gauge (Item 2) **[Figure 60-70-17]** between the straight edge and the surface of the cylinder head.

Figure 60-70-18



Put the straight edge on the cylinder head's four sides and two diagonal as shown in figure **[Figure 60-70-18]**.

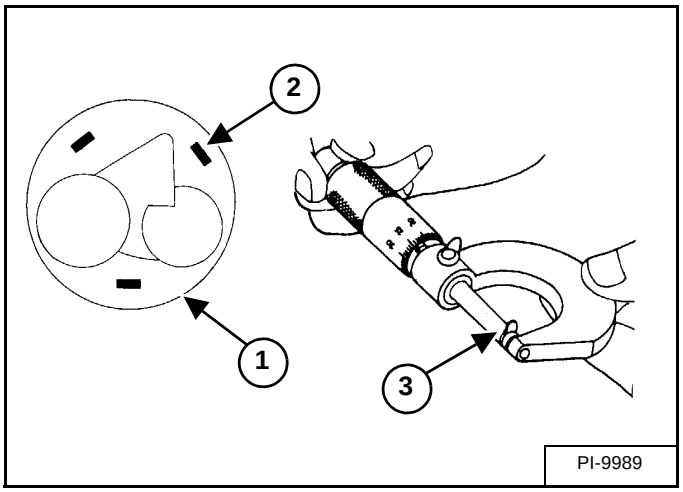
The maximum distortion of the head surface ± 0,05 mm (± 0.002 in). If the measurement is more than the specification, remove the combustion chambers, then grind the cylinder head. Grind the same amount of material from the bottom of the combustion chambers as was removed from the head.

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Cylinder Head Top Clearance

Figure 60-70-19



Install the cylinder head gasket. Put the piston (Item 1) **[Figure 60-70-19]** being checked at T.D.C.

Put 3 pieces of 1,5 mm (0.06 in) diameter solder (Item 2) **[Figure 60-70-19]** on the top piston. Use grease to hold them in position.

NOTE: Put the solder in position so they do not touch the valves.

Turn the piston to bottom dead center.

Install the cylinder head and tighten to the correct torque in the correct sequence. (See Cylinder Head Removal And Installation on Page 60-70-3.)

Turn the crankshaft until the piston exceeds T.D.C. Remove the cylinder head.

Remove the solder wire (Item 3) **[Figure 60-70-19]** and measure it.

If the measurement exceeds the specifications, check the oil clearance of the crank pin journal or the piston pin

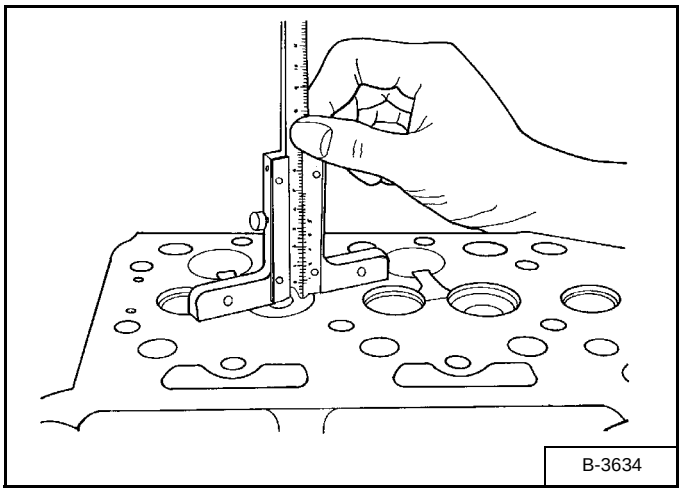
Top clearance 0,50 - 0,70 mm (0.0197 - 0.0276 in)

Valve Guide - Servicing

Remove the valve and spring from the cylinder head. (See Cylinder Head Removal And Installation on Page 60-70-3.)

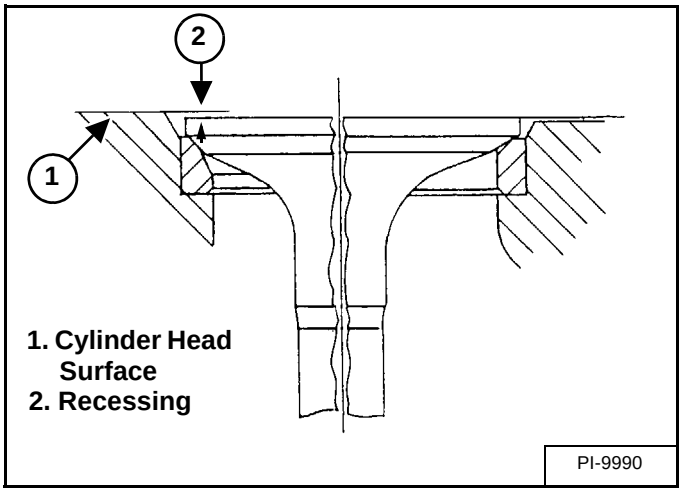
Clean the valve seat and combustion chamber.

Figure 60-70-20



Install the valve into the guide. Measure the valve recessing with a depth gauge **[Figure 60-70-20]**.

Figure 60-70-21



If the measurement exceeds the allowable limit, replace the valve or cylinder head **[Figure 60-70-21]**.

Recessing	0,10 mm (0.004 in)
Allowable Limit (Recessing)	0,30 mm (0.012 in)

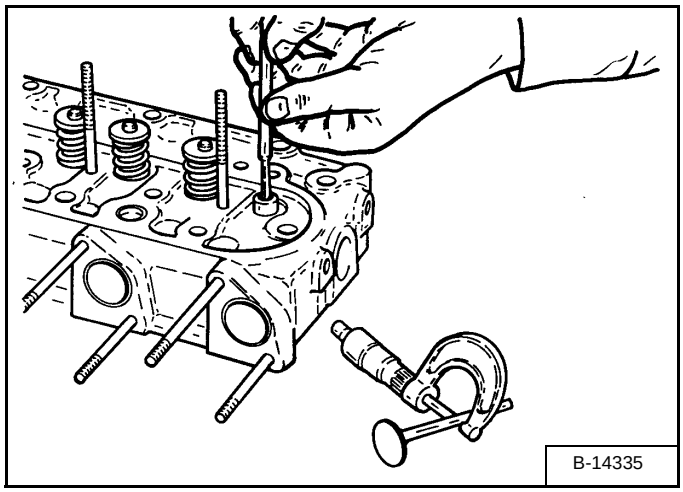
Remove the carbon from the valve guide.

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Valve Guide - Servicing (Cont'd)

Figure 60-70-22



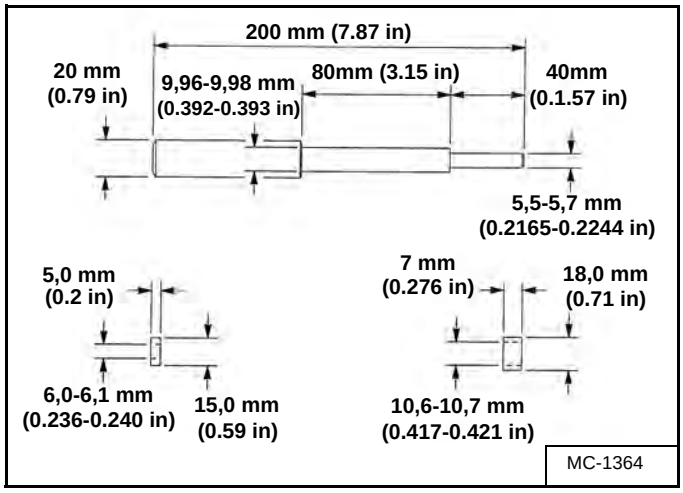
Measure the valve stem O.D. **[Figure 60-70-22]**.

Measure the valve guide I.D. **[Figure 60-70-22]**.

Calculate the clearance. If the clearance exceeds the allowable limit, replace the valve and / or valve guide.

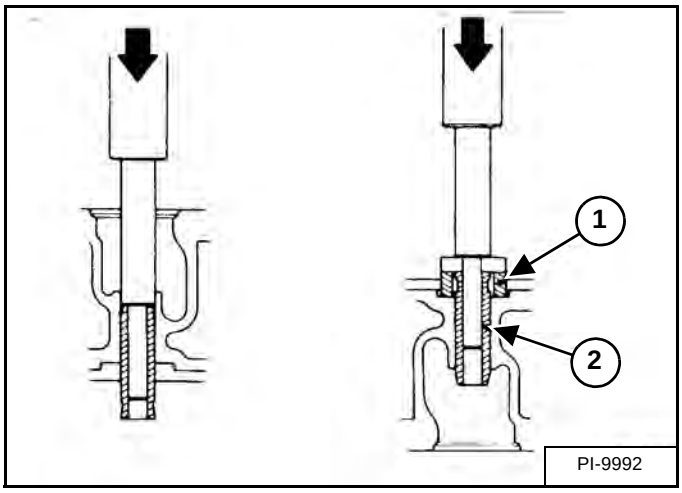
Valve Guide I.D	6,01-6,025 mm (0.2366-0.2372 in)
Valve Stem O.D	5,968-5,980 mm (0.2350-0.2354 in)
Clearance Between Valve Stem and Guide	0,03-0,057 mm (0.0012-0.0022 in)
Allowable Limit	0,10 mm (0.0039 in)

Figure 60-70-23



To remove and replace the valve guide, make the driver tools as shown in figure **[Figure 60-70-23]**.

Figure 60-70-24



Press the used valve guide out of the cylinder head using the special driver tool **[Figure 60-70-24]**. (See previous page for tool dimensions.)

Put oil on the outside diameter of the new valve guide. Press the new valve guide into the cylinder head from the top side. Use the special driver tools (Item 1 and 2) **[Figure 60-70-24]**, press the new guide until the tools contact the cylinder head.

Ream the valve guide to the correct specifications.

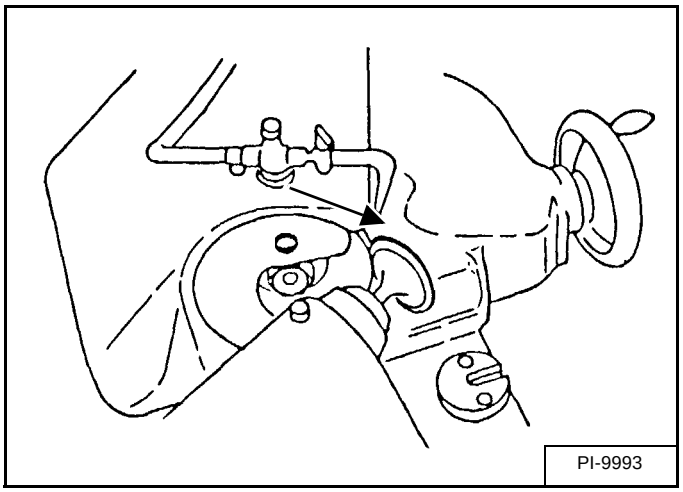
NOTE: Valve guide I.D. (Intake and Exhaust) factory spec. is 6,01 - 6,025 mm (0.2366 - 0.2372 in)

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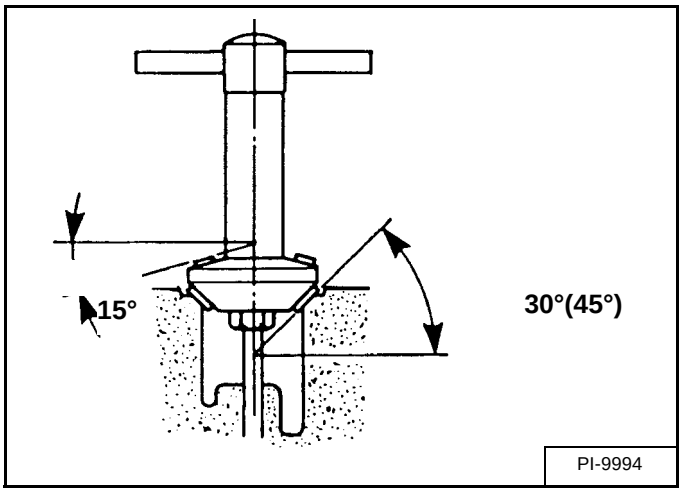
Valve And Valve Seat Reconditioning

Figure 60-70-25



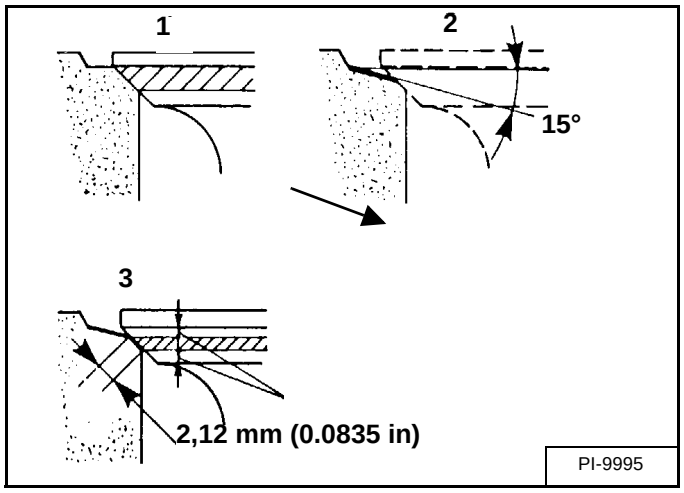
Grind the valve face to the correct angle using a valve refacer **[Figure 60-70-25]** and **[Figure 60-70-27]**.

Figure 60-70-26



Grind the valve surface in the cylinder head to the correct angle **[Figure 60-70-26]**.

Figure 60-70-27



Check the seat surface and valve face (Item 1) **[Figure 60-70-27]**.

If the seat surface is too wide, use a 15 degree cutter (Item 2) to get the correct width (Item 3) **[Figure 60-70-27]**.

Valve Seat Width

Intake	2,12 mm (0.0835 in)
Exhaust	2,12 mm (0.0835 in)

Valve Seat And Face Angle

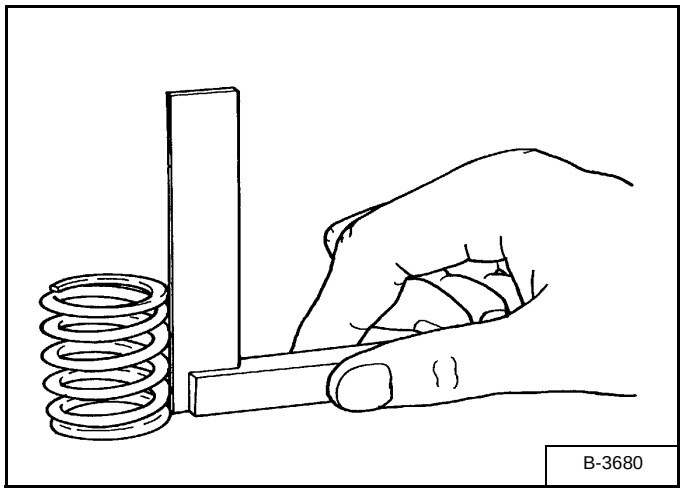
Intake	45°
Exhaust	45°

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Valve Spring

Figure 60-70-28



Measure the length of the valve spring. If the measurement is less than the allowable limit, replace the spring **[Figure 60-70-28]**.

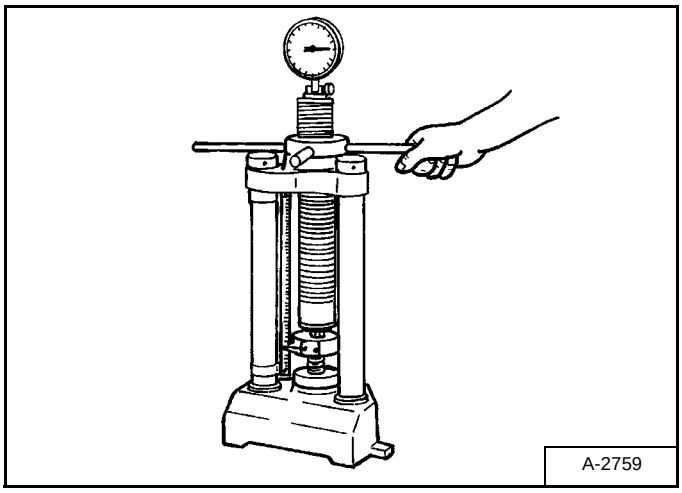
Free Length	31,3 - 31,8 mm (1.232 - 1.252 in)
Allowable Limit	28,4 mm (1.118 in)

Put the spring on a flat surface, place a square on the side of the spring **[Figure 60-70-28]**.

Rotate the spring and measure the maximum tilt. If the measurement is in excess of the allowable limit, replace the spring.

Tilt	1,2 mm (0.047 in)

Figure 60-70-29



Put the spring on a tester and compress to specified length **[Figure 60-70-29]**.

Read the compressed load on the gauge. If the measurement exceeds allowable limit, replace the spring.

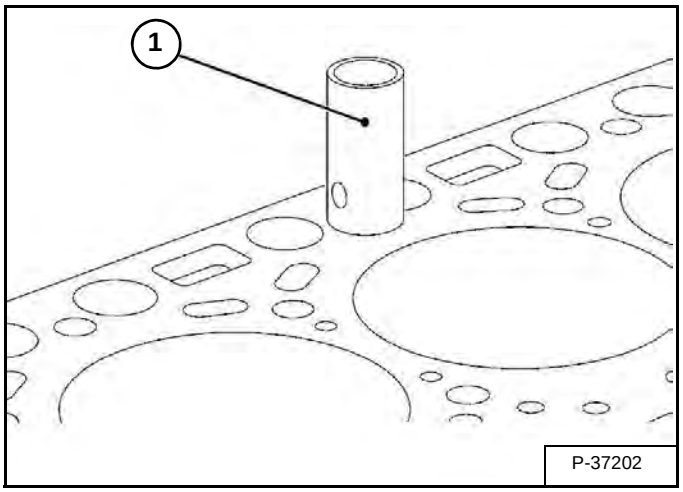
Setting Length	27 mm (1.063 in)
Setting Load	64,7 N (14.6 lb)
Allowable Limit (setting load)	54,9 N (12.3 lb)

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Valve Tappets

Figure 60-70-30



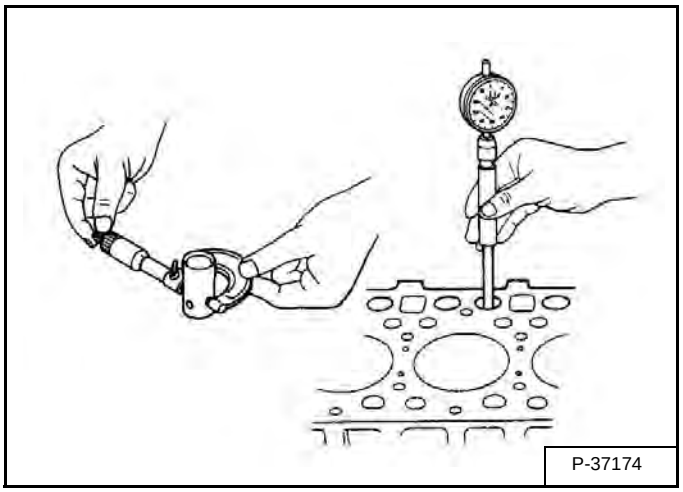
Remove the tappets (Item 1) **[Figure 60-70-30]** from the crankcase.

When reassembling replace the head gasket with a new one.

Before installing the tappets (Item 1) **[Figure 60-70-30]**, apply engine oil thinly around them.

NOTE: Mark the cylinder number to the tappets to prevent interchanging.

Figure 60-70-31



Measure the tappet O.D. with an outside micrometer **[Figure 60-70-31]**.

Measure the I.D. of the tappet guide bore with a cylinder bore gauge, and calculate the oil clearance **[Figure 60-70-31]**.

If the oil clearance exceeds the allowable limit or the tappet is damaged, replace the tappet.

Oil clearance between tappet and guide	Factory spec.	0,016 - 0,052 mm (0.00063 - 0.00205 in)
	Allowable limit	0,10 mm (0.0039 in)

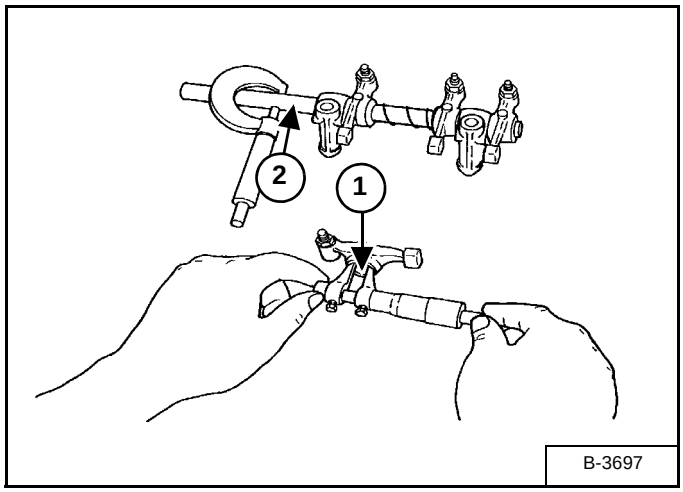
Tappet O.D.	Factory spec.	17,966 - 17,984 mm (0.70732 - 0.70803 in)
Tappet guide I.D.	Factory spec.	18,000 - 18,018 mm (0.70866 - 0.70937 in)

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Rocker Arm And Shaft - Servicing

Figure 60-70-32



Measure the rocker arm I.D. (Item 1) **[Figure 60-70-32]** with an inside micrometer.

Measure the rocker shaft O.D. (Item 2) **[Figure 60-70-32]** with an outside micrometer.

If the clearance exceeds the allowable limit, replace the rocker arm and measure the clearance again.

If the clearance still exceeds the allowable limit after the rocker arm is replaced, replace the rocker arm shaft.

Oil Clearance Between Rocker Arm and Shaft	
	0,016 - 0,045 mm (0.0006 - 0.0018 in)
Allowable Limit	0,15 mm (0.0059 in)
Rocker Arm Shaft	10,47 - 10,48 mm (0.4123 - 0.4128 in)
Rocker Arm I.D.	10,5 - 10,52 mm (0.4134 - 0.4141 in)

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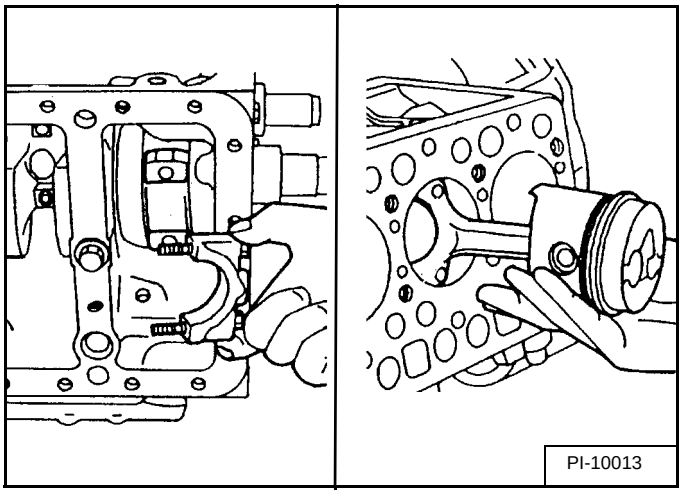
https://www.pdfmanual4trucks.com/

Piston And Connecting Rod Removal And Installation

Remove the cylinder head. (See Cylinder Head Removal And Installation on Page 60-70-3.)

Remove the top edge from the cylinder bore with a ridge reamer.

Figure 60-80-1

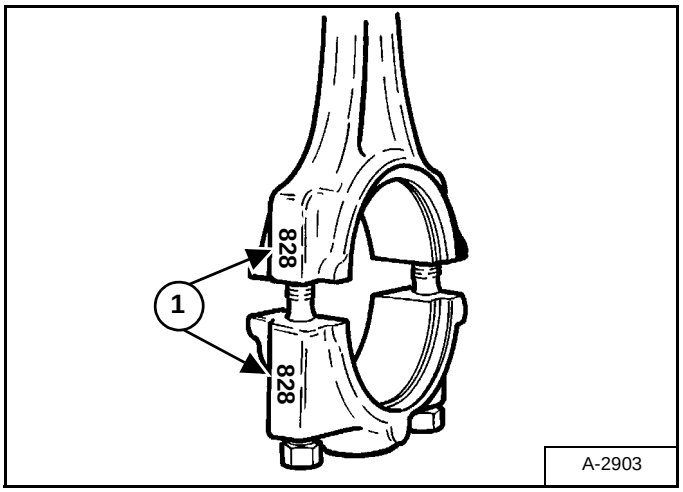


Remove the rod cap and bearing **[Figure 60-80-1]**.

Use a hammer handle and push the piston connecting rod assembly out of the cylinder bore **[Figure 60-80-1]**.

NOTE: Make sure the pistons are marked so they will be returned to the same cylinder bore.

Figure 60-80-2



Installation: Make sure the marks (Item 1) on the connecting rod and bearing are aligned when installing the bearing cap **[Figure 60-80-2]**.

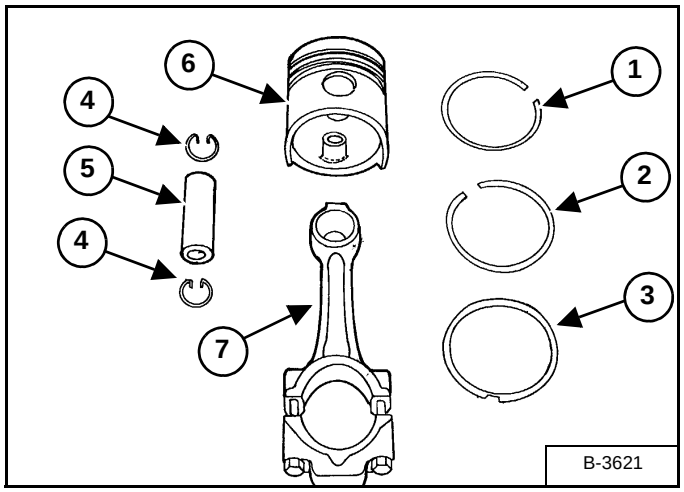
Repeat the procedure to remove the other piston / connecting rod assemblies from the engine block.

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Piston And Connecting Rod Disassembly And Assembly

Figure 60-80-3



Remove the first compression ring (Item 1) **[Figure 60-80-3]**.

Remove the second compression ring (Item 2) **[Figure 60-80-3]**.

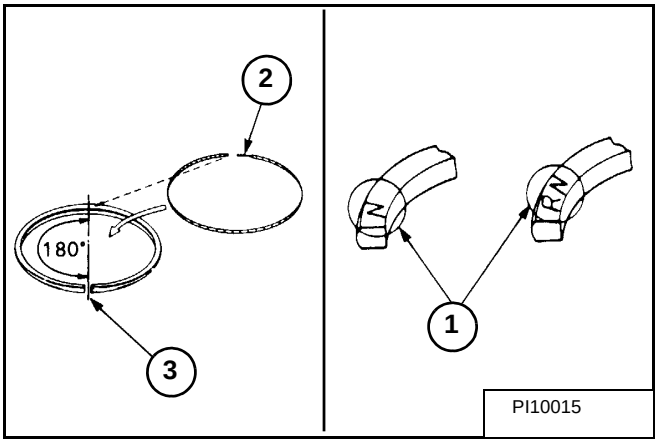
Remove the oil ring (Item 3) **[Figure 60-80-3]**.

Remove the snap ring (Item 4) and piston pin (Item 5) **[Figure 60-80-3]**.

Separate the piston (Item 6) from the connecting rod (Item 7) **[Figure 60-80-3]**.

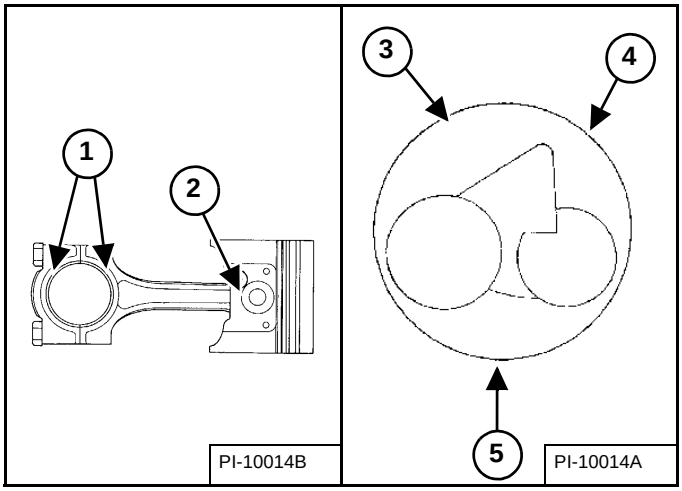
NOTE: Make sure the piston and rod assembly is marked so as not to change the piston rod assembly with another piston or connecting rod.

Figure 60-80-4



Installation: When installing new rings, assemble the ring so the mark (Item 1) near the gap faces the top of the piston. When installing the oil ring, place the expander joint (Item 2) on the opposite side of the oil ring gap (Item 3) **[Figure 60-80-4]**.

Figure 60-80-5



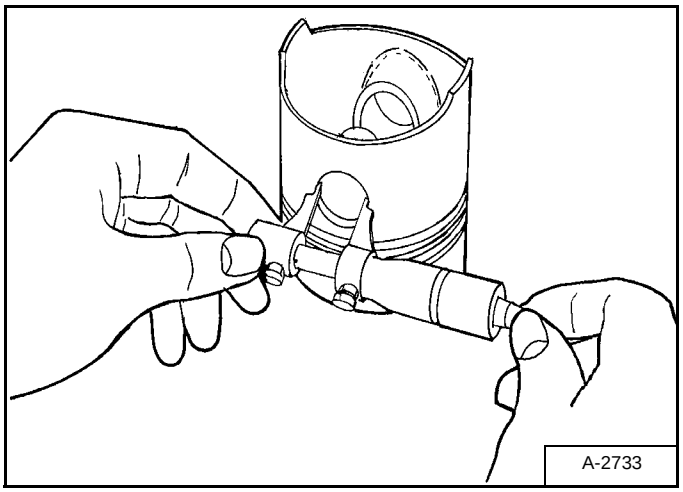
Installation: When reassembling, align the marks (Item 1) on the connecting rod and piston (Item 2). Heat the piston in oil to 80°C (176°F) for 10 to 15 minutes and tap the piston pin into position. Place the piston rings so that there are gaps every 120° (Items 3, 4 and 5) **[Figure 60-80-5]** with no gap facing the piston pin in the cylinder.

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Piston And Connecting Rod - Servicing

Figure 60-80-6

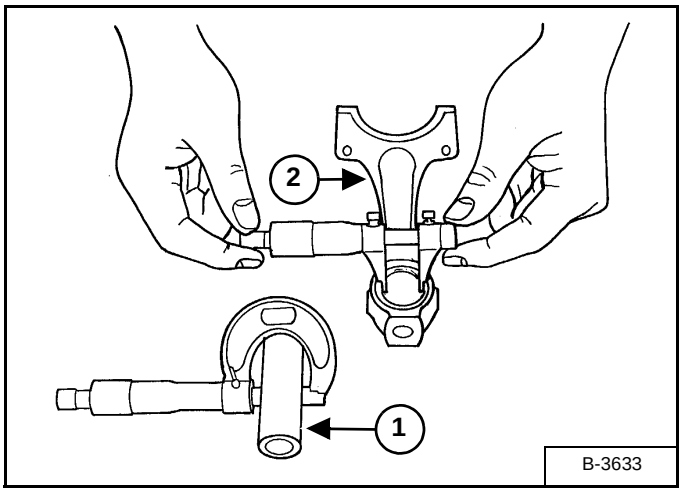


Measure the I.D. of the piston pin bore in both horizontal and vertical direction **[Figure 60-80-6]**.

If the measurement exceeds the allowable limit, replace the piston.

Piston Pin Bore I.D.	20,00 - 20,013 mm (0.7874 - 0.7879 in)
Allowable Limit	20,05 mm (0.789 in)

Figure 60-80-7



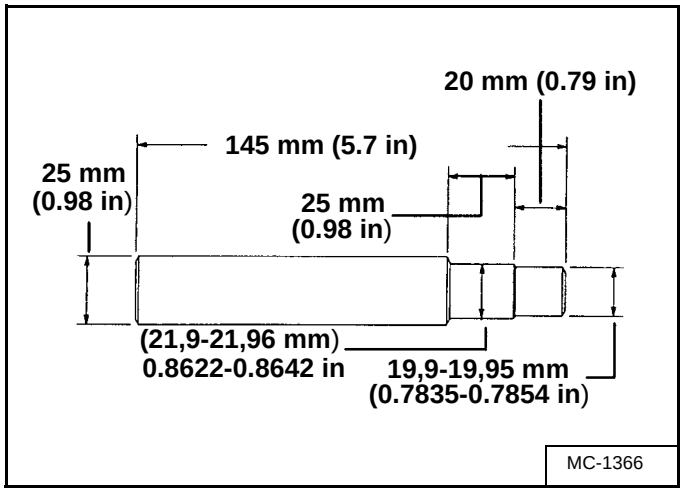
Measure the O.D. of the piston pin (Item 1) **[Figure 60-80-7]**.

Measure the I.D. of the connecting rod small end (Item 2) **[Figure 60-80-7]**.

Calculate the oil clearance. If the clearance exceeds the allowable limit, replace the bushing. If it still exceeds the specifications, replace the piston pin.

Piston Pin O.D.	20,002-20,011 mm (0.7875-0.7878 in)
Bushing I.D.	20,025-20,04 mm (0.7884-0.7890 in)
Oil Clearance between Piston Pin and Bushing	0,014-0,038 mm (0.0006-0.0015 in)
Allowable Limit	0,10 mm (0.004 in)

Figure 60-80-8



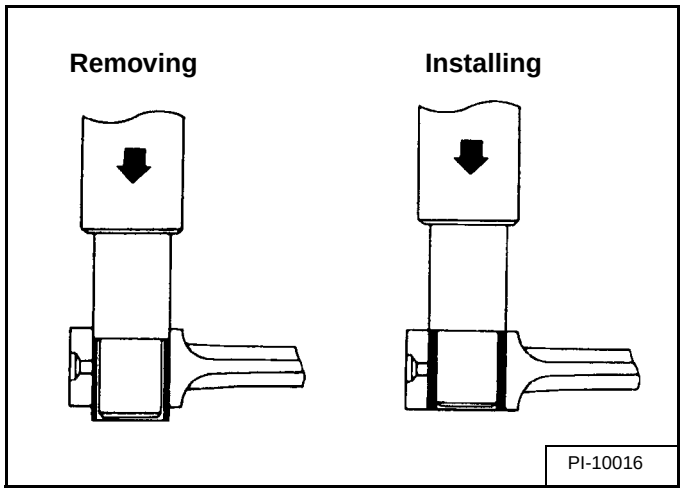
To replace the connecting rod small end bushing, make a driver tool as shown in figure **[Figure 60-80-8]**.

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Piston And Connecting Rod - Servicing (Cont'd)

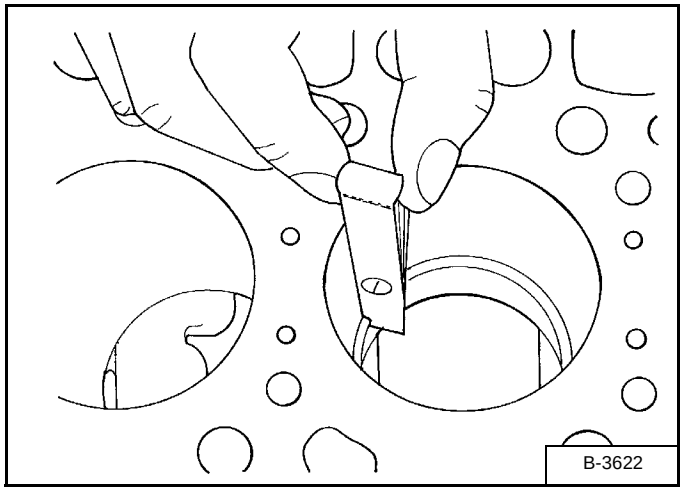
Figure 60-80-9



Use a press and special driver tool to remove the small end bushing **[Figure 60-80-9]**.

Installation: Clean the small end bushing and bore. Put oil on the bushing and press into the connecting rod until it is flush **[Figure 60-80-9]**.

Figure 60-80-10

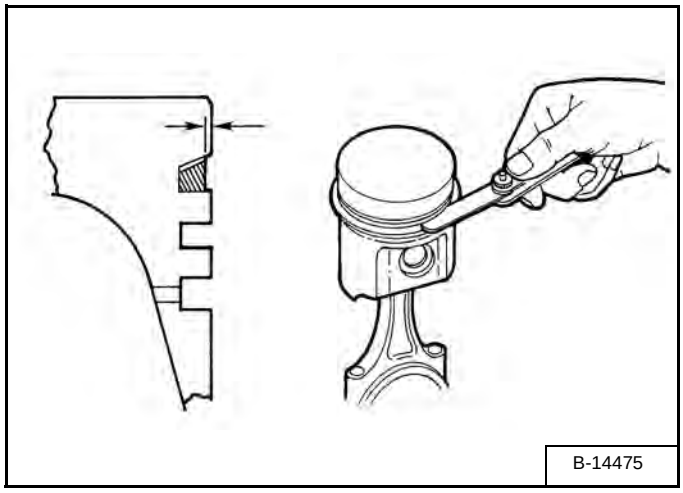


Install a new piston ring into the lower part of the cylinder bore. Measure the ring gap with a feeler gauge **[Figure 60-80-10]**.

If the gap exceeds the allowable limit, replace the piston ring.

Top Compression Ring and Oil Ring
0,15 - 0,30 mm (0.006 - 0.012 in)
Second Compression Ring
0,30 - 0,45 mm (0.012 - 0.018 in)
Allowable Limit 1,2 mm (0.047 in)

Figure 60-80-11



Remove the carbon from the ring grooves. Measure the clearance between the ring and groove with a feeler gauge **[Figure 60-80-11]**.

Second ring 0,09 - 0,12 mm (0.0033 - 0.0045 in)
Oil ring 0,04 - 0,08 mm (0.0016 - 0.0031 in)
Allowable limit second ring
0,15 mm (0.0059 in)
Allowable limit oil ring
0,15 mm (0.0059 in)

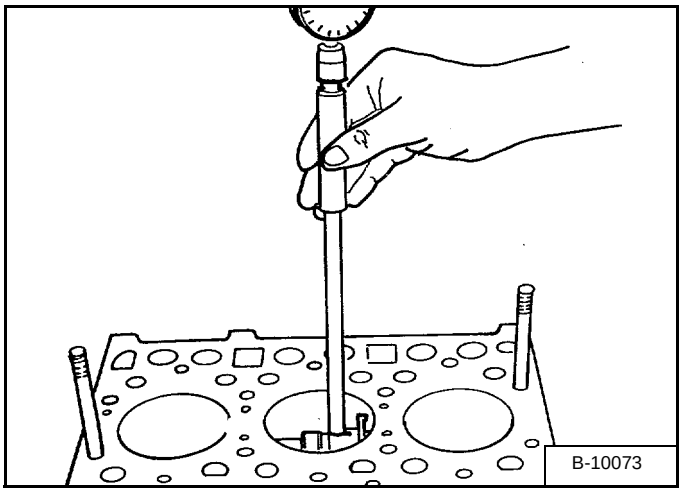
If the clearance exceeds the allowable limit, replace the piston.

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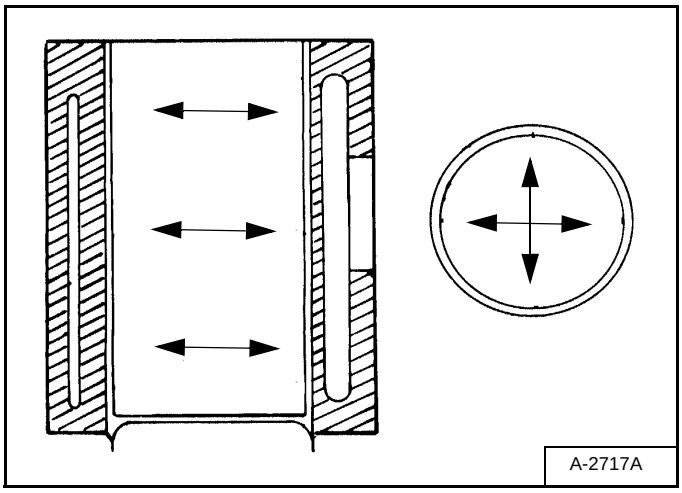
Cylinder Bore - Measuring

Figure 60-80-12



Measure the inside diameter of the cylinder bore **[Figure 60-80-12]**.

Figure 60-80-13



To find the maximum wear measure the inside diameter in different locations **[Figure 60-80-13]**.

When the cylinder bore is not within specifications, bore and hone the cylinder for an oversize piston.

Cylinder Bore I.D. 67,0 - 67,02 mm (2.638 - 2.639 in)

Allowable Limit 67,17 mm (2.644 in)

NOTE: Make sure you use the correct oversize pistons and rings.

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Connecting Rod Alignment

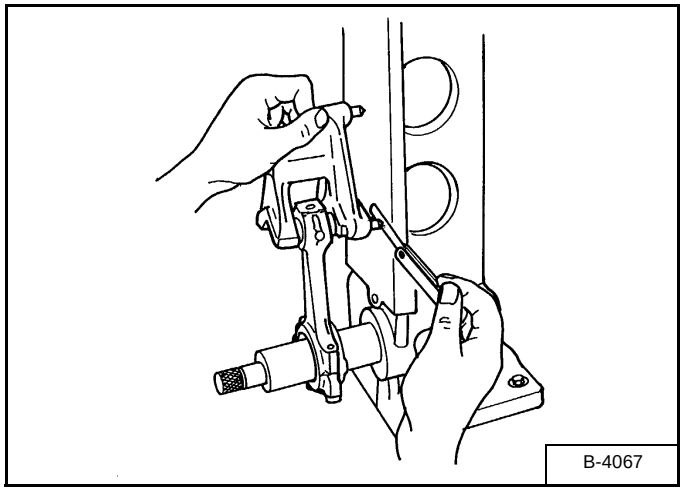
NOTE: The small end bushing is the basis of this check, check the bushing for wear before doing this check.

Install the piston pin into the connecting rod.

Install the connecting rod on an alignment tool.

Put the gauge over the piston pin and move it against the face plate.

Figure 60-80-14



If the gauge does not fit squarely against the face place, measure the space between the gauge and face plate **[Figure 60-80-14]**.

If the measurement exceeds the allowable limit, replace the connecting rod.

Rod Alignment Allowable Limit

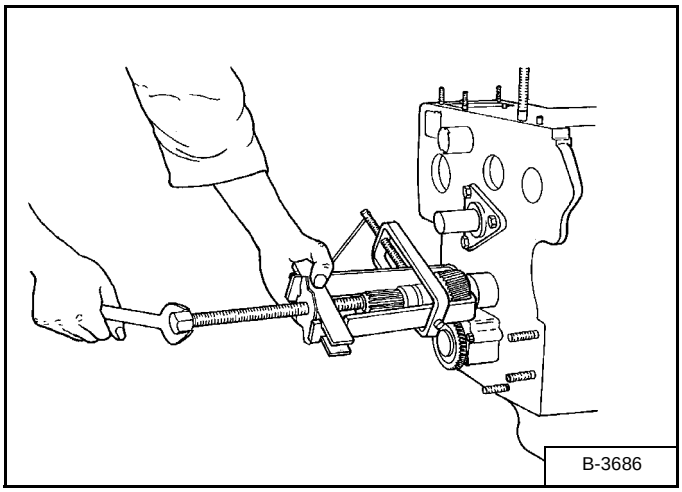
0,05 mm (0.002 in)

Crankshaft Gear Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-90-1.)

Remove the idler gear. (See Idler Gear And Camshaft Removal And Installation on Page 60-90-3.)

Figure 60-80-15



Remove the crankshaft gear with a puller **[Figure 60-80-15]**.

Remove the crankshaft key.

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Crankshaft And Bearings Removal And Installation

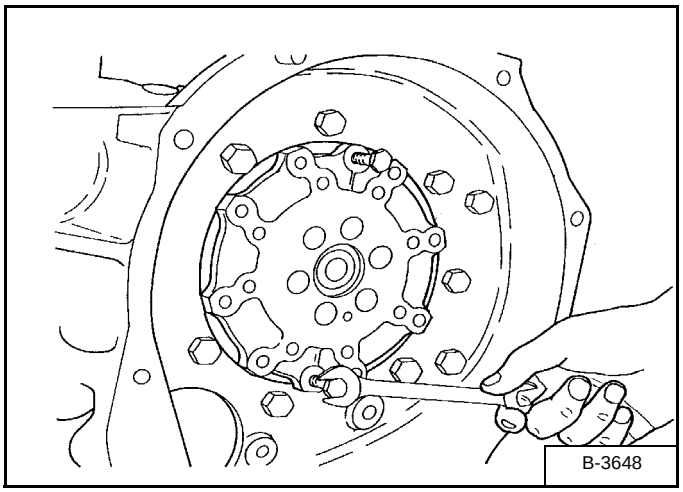
Remove the piston and connecting rod assemblies. (See Piston And Connecting Rod Removal And Installation on Page 60-80-1.)

Remove the engine flywheel. (See Cylinder Head Removal And Installation on Page 60-70-3.)

Remove the bolts which fasten the bearing case cover to the block.

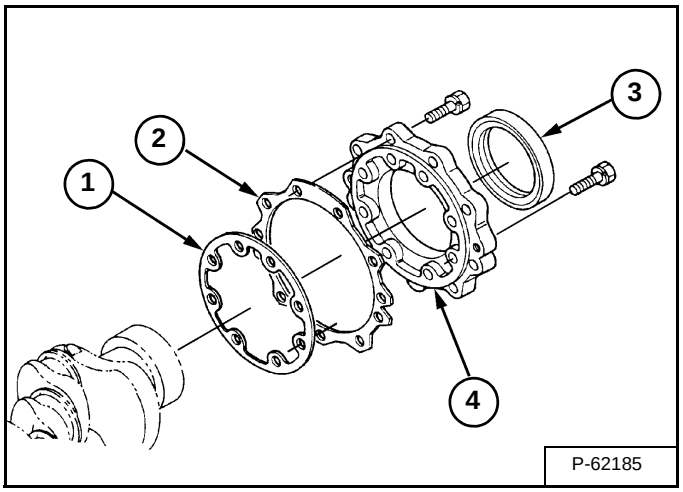
Installation: Tighten the bearing case cover bolts to 10 - 11 N•m (7 - 8 ft-lb) torque. Tighten bolts with even force on the diagonal line.

Figure 60-80-16



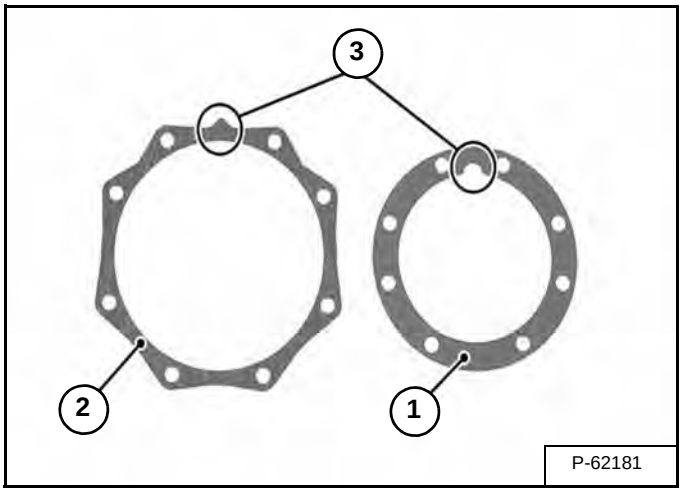
Install two bolts into the bearing case cover and pull the cover out **[Figure 60-80-16]**.

Figure 60-80-17



Installation: When installing the cover (Item 4), make sure the casting mark (Item 3) **[Figure 60-80-17]** is in the up position. Lightly oil inside lip of oil seal (Item 3) **[Figure 60-80-17]**.

Figure 60-80-18



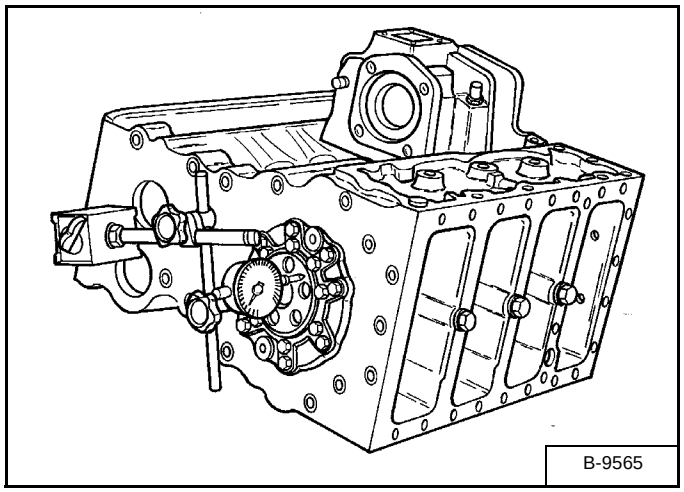
Installation: When installing the bearing case gasket (Item 1) **[Figure 60-80-17]** and **[Figure 60-80-18]**, and the bearing case cover gasket (Item 2) **[Figure 60-80-17]** and **[Figure 60-80-18]** make sure the mark (Item 3) **[Figure 60-80-18]** is in the up position.

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Crankshaft And Bearings Removal And Installation (Cont'd)

Figure 60-80-19

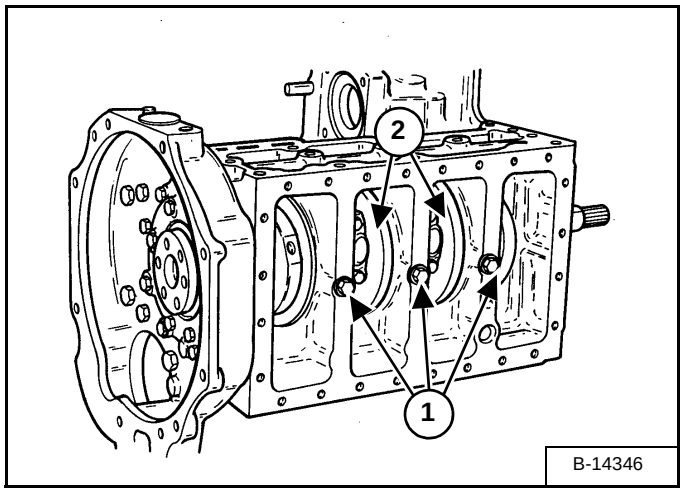


Before removing the crankshaft / main bearings, measure the end play. Install a dial indicator. Measure the end play by moving the crankshaft back and forth **[Figure 60-80-19]**.

If the measurement exceeds the allowable limit, replace the thrust washers.

End Play	0,15 - 0,31 mm (0.006 - 0.012 in)
Allowable Limit	0,5 mm (0.020 in)

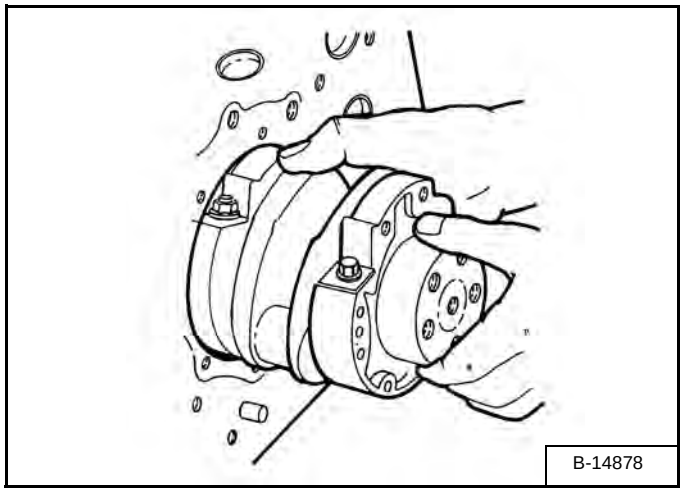
Figure 60-80-20



Remove the main bearing case bolt (Item 1) **[Figure 60-80-20]**.

Installation: Align the bearing case hole (Item 2) **[Figure 60-80-20]** with the hole in the block. Put oil on the bolt threads and tighten to 27 - 30 N•m (20 - 22 ft-lb) torque.

Figure 60-80-21



Remove the crankshaft / main bearing assembly from the engine block **[Figure 60-80-21]**.

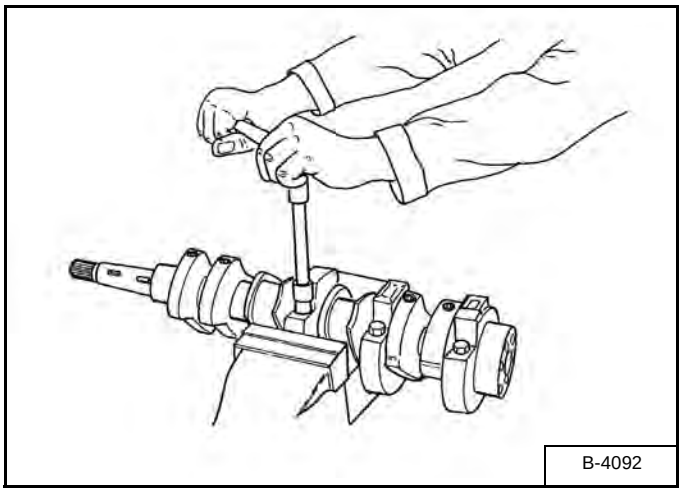
Mark the bearing case halves for correct installation.

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Crankshaft And Bearings Removal And Installation (Cont'd)

Figure 60-80-22

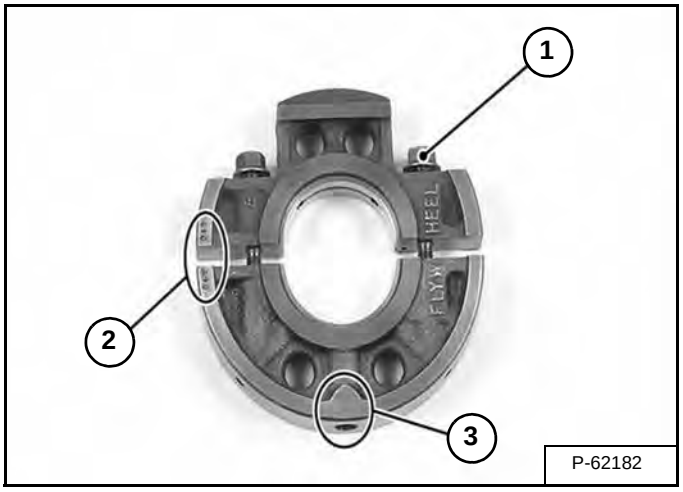


Remove the two bearing case bolts **[Figure 60-80-22]**.

Remove the bearing case and bearing.

Installation: Tighten the bearing case bolts (Item 1) **[Figure 60-80-23]** to 13 - 16 N•m (9 - 12 ft-lb) torque.

Figure 60-80-23

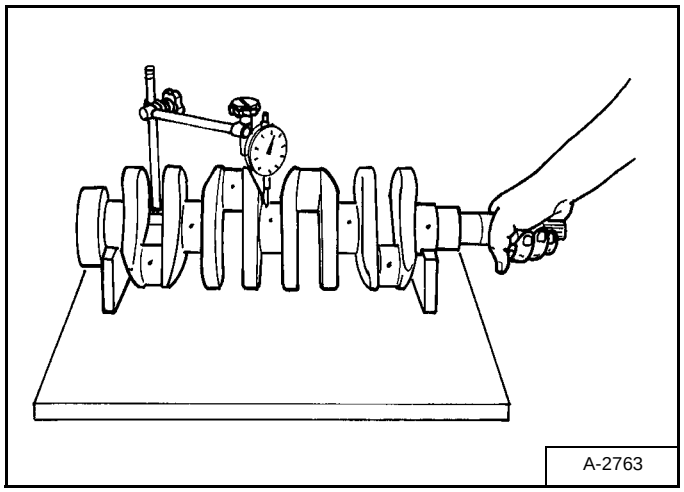


Installation: When installing the main bearing case assemblies, face the mark FLYWHEEL to the flywheel side of the engine block **[Figure 60-80-23]**. Be sure the thrust washer with its oil grooves face outward.

Identification marks on the main bearing case assemblies are the alignment number (Item 2) and the marking "1" or "2" (Item 3) **[Figure 60-80-23]** can be found on the main bearing case assemblies to ensure proper assembly.

Crankshaft And Bearings - Servicing

Figure 60-80-24



Put the crankshaft on V-blocks. Install a dial indicator on the center journal **[Figure 60-80-24]**.

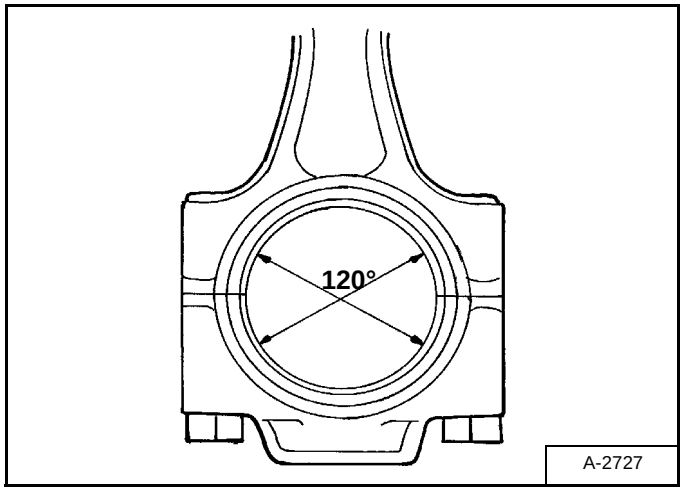
Turn the crankshaft at a slow rate.

If the misalignment exceeds the allowable limit, replace the crankshaft.

Alignment	0,02 mm (0.0008 in)

Tighten the connecting rod cap bolts 27 - 30 N•m (20 - 22 ft-lb) torque.

Figure 60-80-25



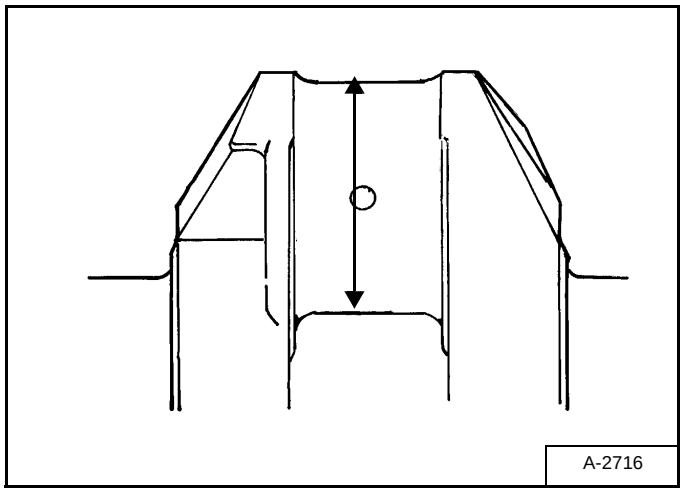
Measure the crankpin bearing I.D. **[Figure 60-80-25]**.

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Crankshaft And Bearings - Servicing (Cont'd)

Figure 60-80-26



Measure the crankpin O.D. **[Figure 60-80-26]**.

Calculate the oil clearance.

Crankpin Bearing I.D.	
	33,99 - 34,01 mm (1.3389 - 1.3390 in)
Crankpin O.D.	33,96 - 33,98 mm (1.3370 - 1.3376 in)
Oil Clearance	0,020 - 0,051 mm (0.0008 - 0.0020 in)
Allowable limit	0,15 mm (0.0059 in)

Figure 60-80-27

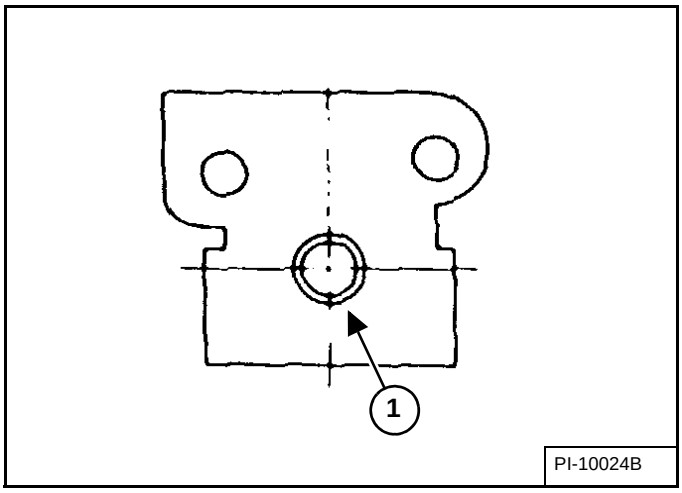
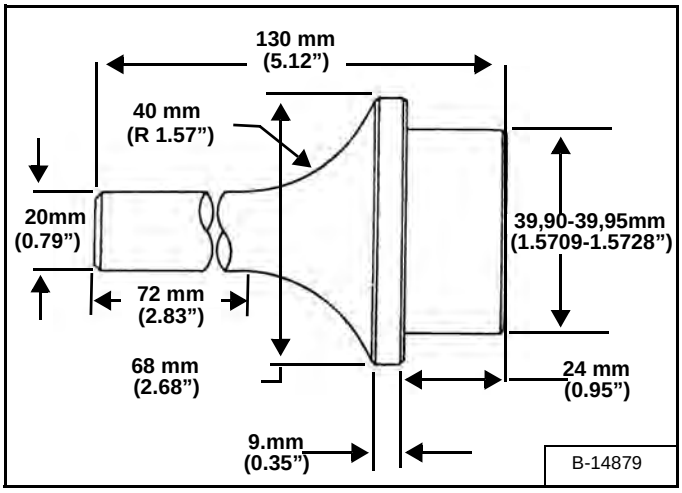


Figure 60-80-28



Remove the bearing (Item 1) **[Figure 60-80-27]** from the front of the engine block with the removal tool shown in **[Figure 60-80-28]**.

Installation: Clean the new bearing and bore and apply oil to them. Install the new bearing with the installation driver tool **[Figure 60-80-27]**.

Clean the crankshaft journal and bearing. Put a strip of press gauge on the center journal.

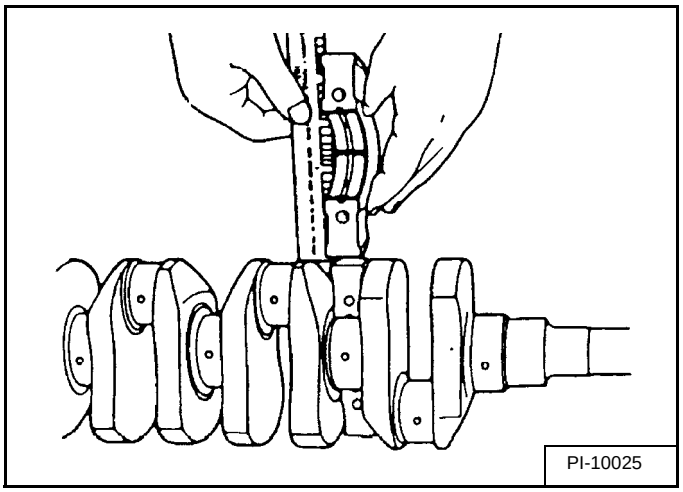
Install the main bearing case halves and tighten the bolts to 12,7 - 15,7 N•m (9 - 12 ft-lb) torque. Remove the bearing case halves.

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Crankshaft And Bearings - Servicing (Cont'd)

Figure 60-80-29



Measure the flattened press gauge **[Figure 60-80-29]**.

If the clearance exceeds the allowable limit, replace the crankshaft bearing.

Crankshaft Journal O.D. (Flywheel side)	
	43,93 - 43,95 mm (1.7297 - 1.7303 in)
Bearing I.D.	43,98 - 44,03 mm (1.7317 - 1.7333 in)
Crankshaft Journal O.D. (Middle)	
	39,93 - 39,95 mm (1.5722 - 1.5728 in)
Bearing I.D.	39,98 - 40,03 mm (1.5742 - 1.5758 in)
Crankshaft journal O.D. (Front)	
	39,93 - 39,95 mm (1.5722 - 1.5728 in)
Bearing I.D.	39,98 - 40,04 mm (1.5714 - 1.5764 in)
Oil Clearance	0,034 - 0,106 mm (0.0013 - 0.0042 in)
Allowable Limit	0,2 mm (0.008 in)

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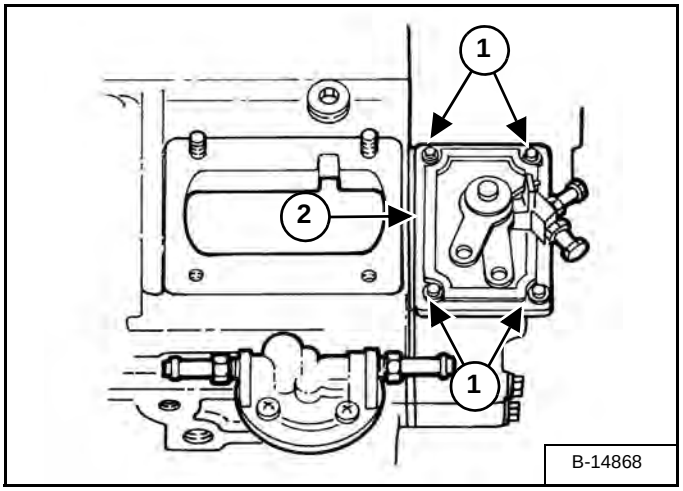
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Timing Gearcase Cover Removal And Installation

Remove the fuel injection pump. (See Fuel Injection Pump Removal And Installation on Page 60-60-4.)

Figure 60-90-1

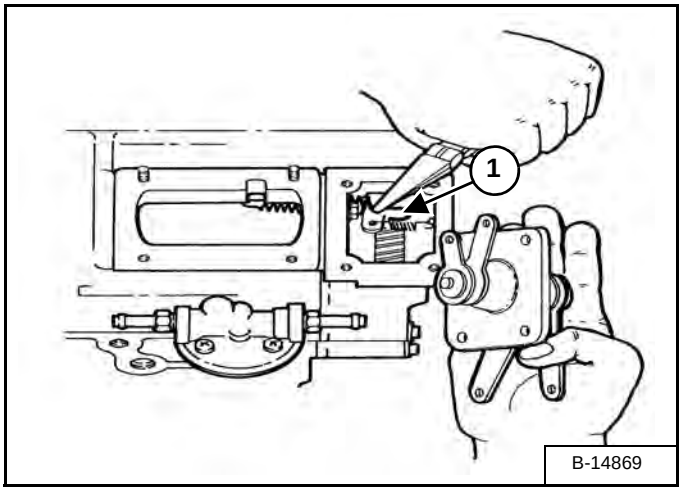


Remove the cylinder head, rocker arms and push rods. (See Cylinder Head Removal And Installation on Page 60-70-3.)

Remove the screws (Item 1) from the speed control plate (Item 2) **[Figure 60-90-1]**.

NOTE: Take care not to damage the spring.

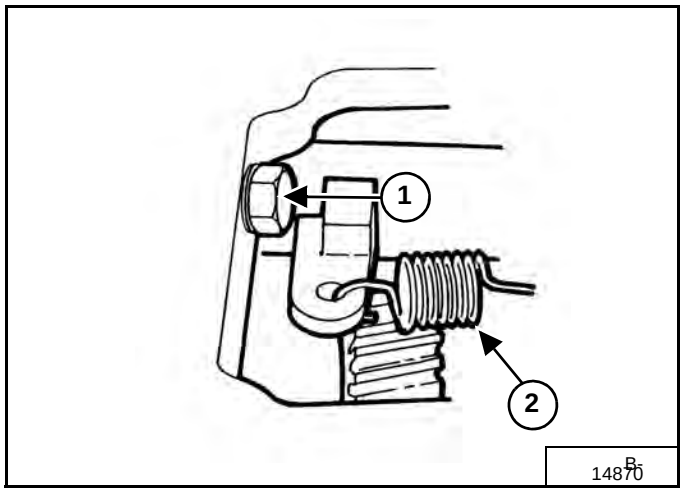
Figure 60-90-2



Separate the speed control plate from the engine and remove the spring (Item 1) **[Figure 60-90-2]**.

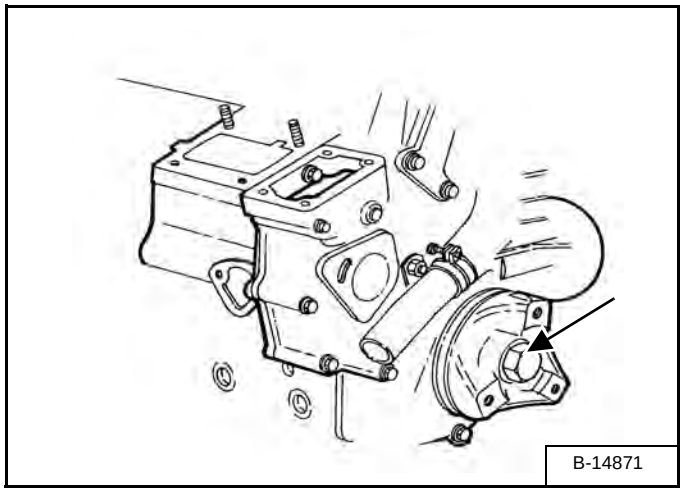
Remove the speed control plate.

Figure 60-90-3



Remove the bolt (Item 1) and disconnect the shaft spring (Item 2) **[Figure 60-90-3]**.

Figure 60-90-4



Remove the crankshaft pulley bolt.

Installation: Tighten the bolt 98 - 108 N•m (72 - 80 ft-lb) torque.

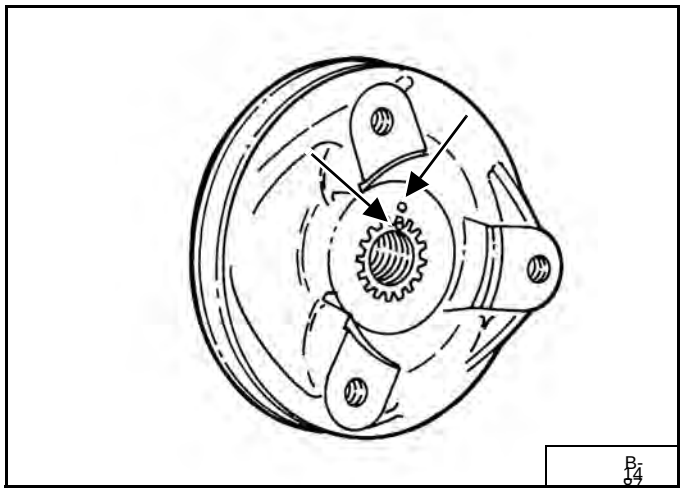
Use a puller and remove the crankshaft pulley **[Figure 60-90-4]**.

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Timing Gearcase Cover Removal And Installation (Cont'd)

Figure 60-90-5

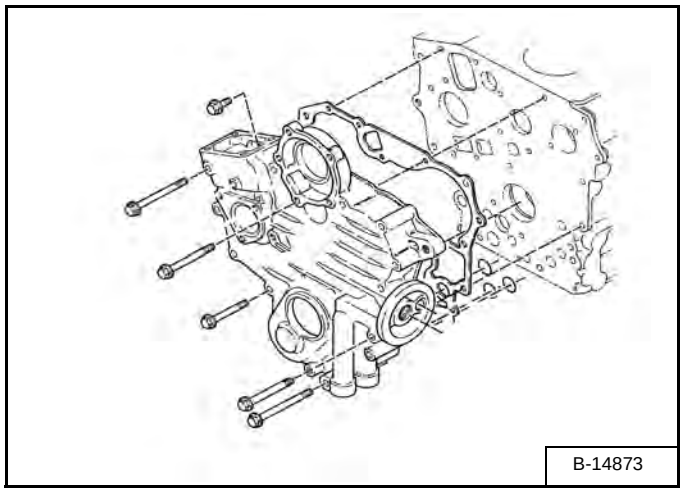


When installing the crank shaft pulley, make sure the alignment marks are aligned **[Figure 60-90-5]**.

Remove the timing gearcase cover bolts.

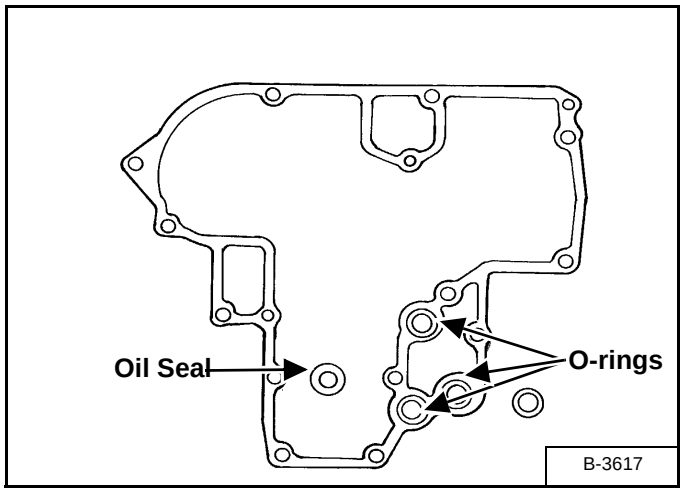
Installation: Tighten the bolts to 10 - 11 N•m (7 - 8 ft-lb) torque.

Figure 60-90-6



Remove the timing gearcase **[Figure 60-90-6]**.

Figure 60-90-7



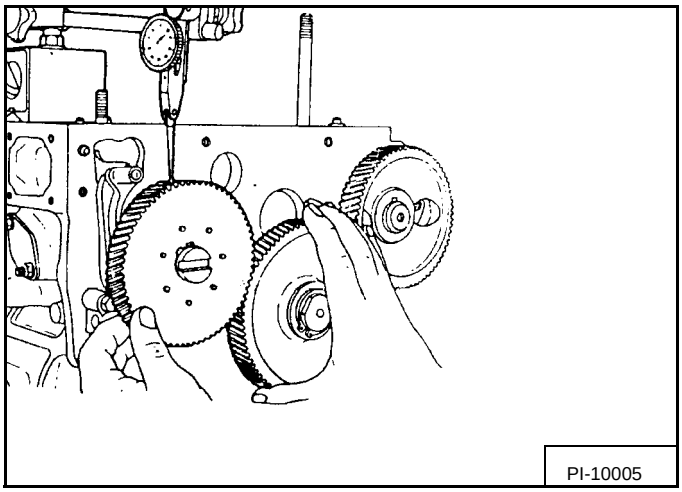
Installation: Install three new O-rings and the oil seal into the timing gearcase cover **[Figure 60-90-7]**.

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Timing Gears Measuring Backlash

Figure 60-90-8



When the gears are installed, measure the backlash of the gears.

Install a dial indicator with its tip on a gear tooth **[Figure 60-90-8]**.

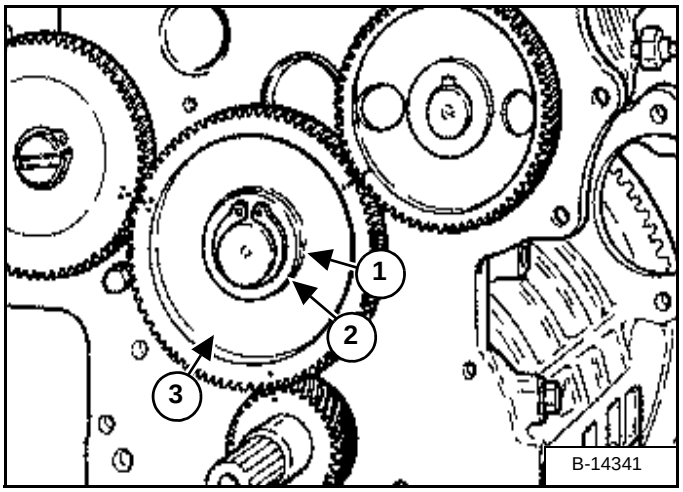
Hold one gear while turning the other gear **[Figure 60-90-8]**.

If the backlash exceeds the allowable limit, measure the oil clearance of the shaft and gear. If the oil clearance is correct, replace the gears.

Crank Gear and Idler Gear.
0,043 - 0,124 mm (0.002 - 0.005 in)
Allowable Limit 0,15 mm (0.006 in)
Cam Gear and Idler Gear
0,047 - 0,12 mm (0.002 - 0.005 in)
Allowable Limit 0,15 mm (0.006 in)
Injection Pump Gear and Idler Gear
0,046 - 0,124 mm (0.006 in)
Allowable Limit 0,15 mm (0.006 in)
Oil Pump Gear and Crankshaft Cover
0,041 - 0,123 mm (0.002 - 0.005 in)
Allowable Limit 0,15 mm (0.006 in)

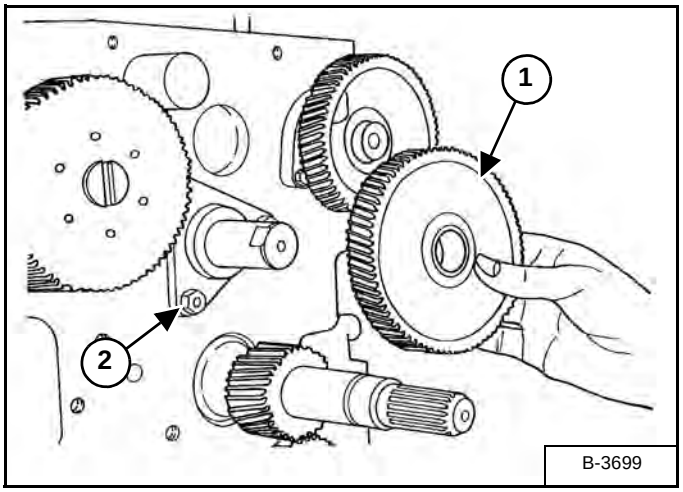
Idler Gear And Camshaft Removal And Installation

Figure 60-90-9



Remove the snap ring (Item 1) and collar (Item 2) from the idler gear shaft (Item 3) **[Figure 60-90-9]**.

Figure 60-90-10



Remove the idler gear (Item 1) **[Figure 60-90-10]**.

Remove idler gear mounting screws (Item 2) **[Figure 60-90-10]**.

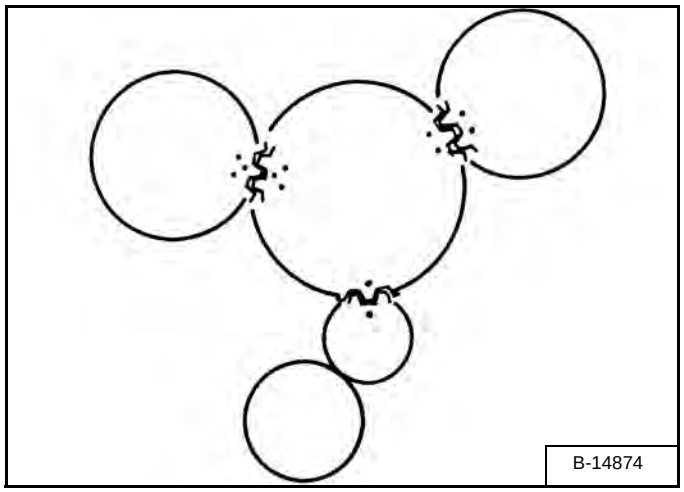
Installation: Tighten screws to 10 - 11 N•m (7 - 8 ft-lb) torque.

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Idler Gear And Camshaft Removal And Installation (Cont'd)

Figure 60-90-11

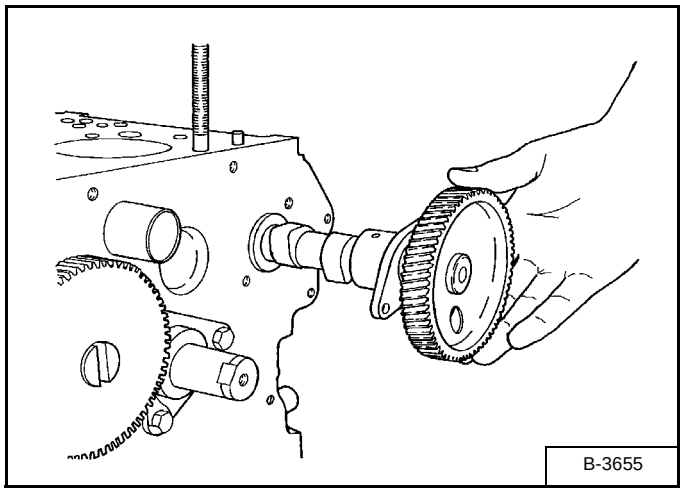


Installation: Make sure the timing marks are in correct alignment when installing the timing gears **[Figure 60-90-11]**.

Align the holes on the camshaft gear with the camshaft retainer plate bolts.

Remove the bolts.

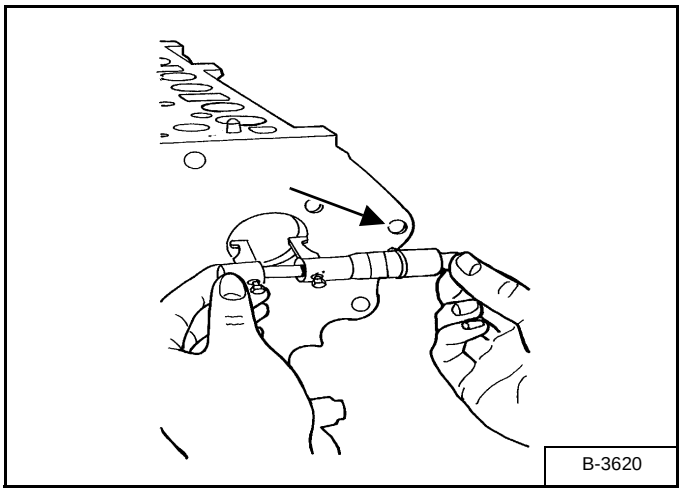
Figure 60-90-12



Remove the camshaft from the engine block **[Figure 60-90-12]**.

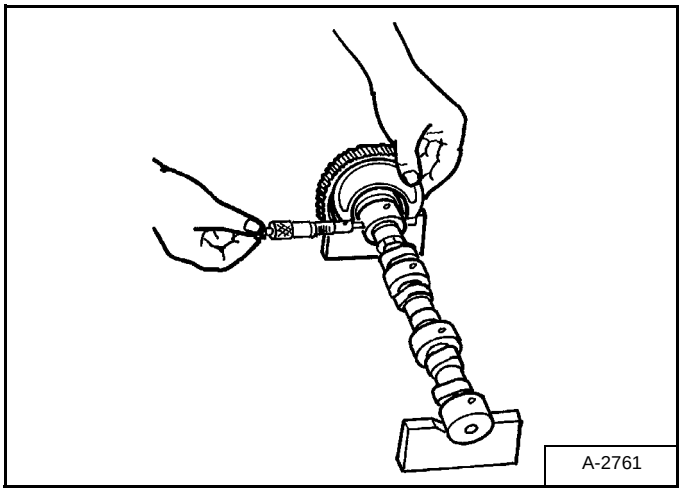
Installation: Tighten the camshaft retainer bolts to 18 - 21 N•m (14 - 15 ft-lb) torque.

Figure 60-90-13



Measure the camshaft bearing in the engine block **[Figure 60-90-13]**.

Figure 60-90-14



Measure the camshaft journal **[Figure 60-90-14]**.

Calculate the oil clearance. If the clearance exceeds the allowable limit, replace the camshaft.

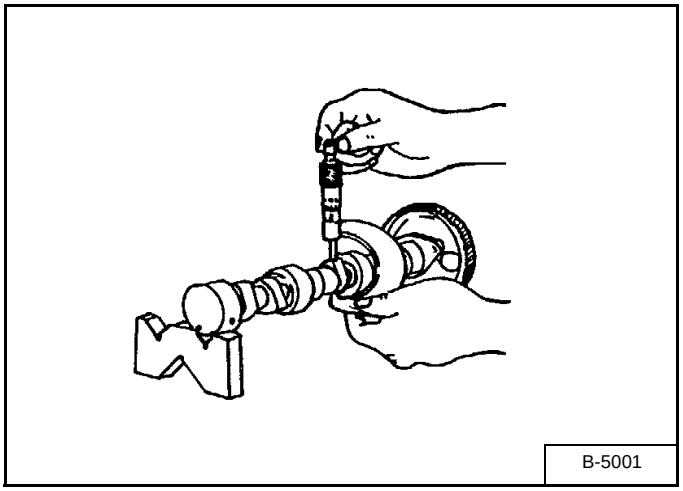
Bearing I.D.	33,00 - 33,03 mm (1.299 - 1.300 in)
Journal O.D.	32,93 - 32,95 mm (1.2966 - 1.2972 in)
Clearance of Camshaft Journal	0,05 - 0,09 mm (0.002 - 0.004 in)
Allowable Limit	0,15 mm (0.006 in)

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Idler Gear And Camshaft Removal And Installation (Cont'd)

Figure 60-90-15

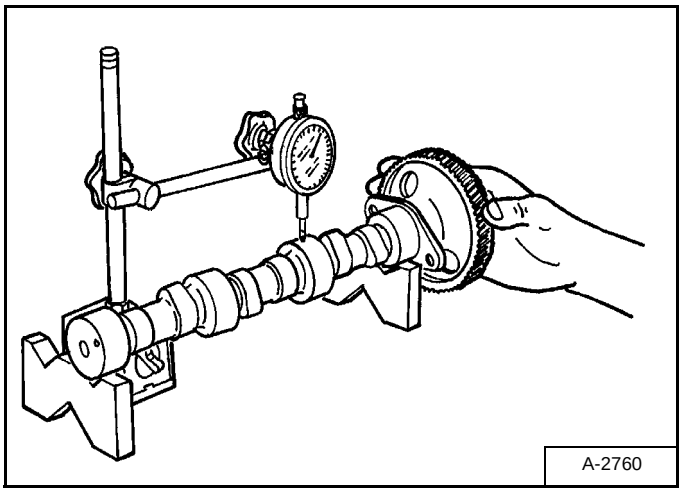


Measure the cam lobes at their highest point **[Figure 60-90-15]**.

If the measurement is less than the allowable limit, replace the camshaft.

Cam Lob Height	26,88 mm (1.058 in)
Allowable Limit	26,83 mm (1.056 in)

Figure 60-90-16



Put the camshaft in V-blocks. Install a dial indicator **[Figure 60-90-16]**.

Turn the camshaft at a slow rate. If the misalignment exceeds the allowable limit, replace the camshaft.

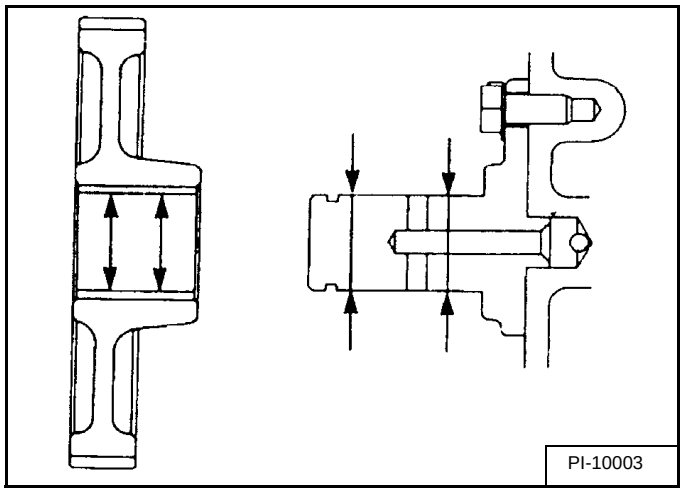
Camshaft Alignment Allowable Limit	0,01 mm (0.0004 in)

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Idler Gear and Shaft - Servicing

Figure 60-90-17



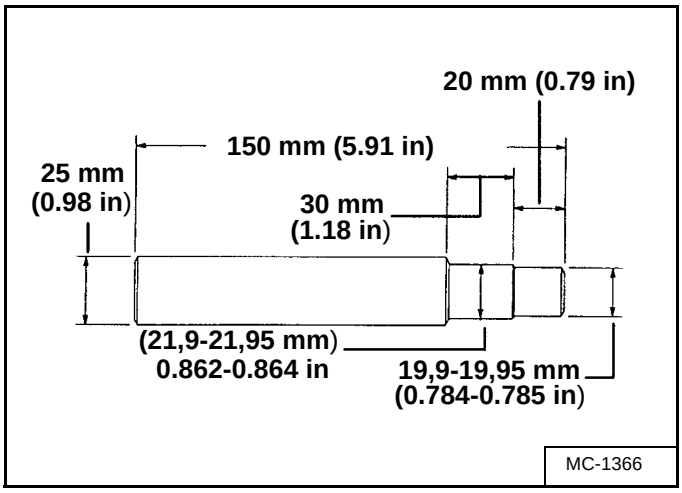
Measure the O.D. of the idler gear shaft **[Figure 60-90-17]**.

Measure the I.D. of the idler gear bushing **[Figure 60-90-17]**.

If the clearance exceeds the allowable limit, replace the bushing.

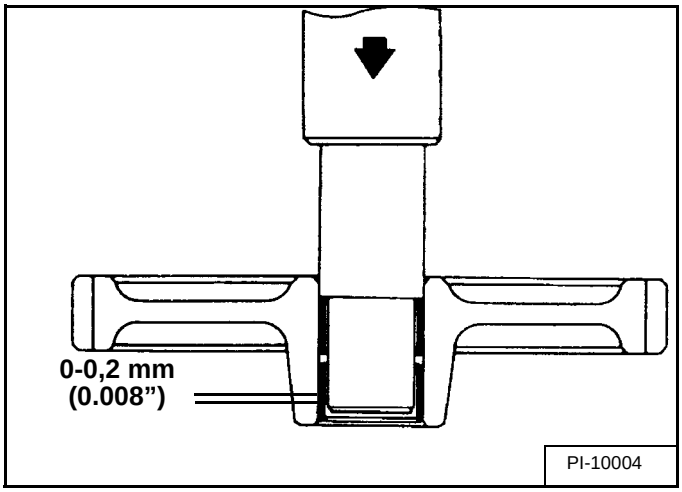
Idler Gear Shaft O.D.	19,97 - 19,98 mm (0.786 - 0.787 in)
Idler Gear Shaft I.D.	20,00 - 20,05 mm (0.787 - 0.789 in)
Oil Clearance between Idler Shaft and Gear Bushing	
	0,020 - 0,084 mm (0.0008 - 0.0033 in)
Allowable Limit	0,10 mm (0.004 in)

Figure 60-90-18



To replace the idler gear bushing, make a driver tool as shown in figure **[Figure 60-90-18]**.

Figure 60-90-19



Use a press and special driver tool, to remove the old bushing and install the new bushing **[Figure 60-90-19]**.

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FLYWHEEL AND HOUSING

Flywheel Housing Removal And Installation

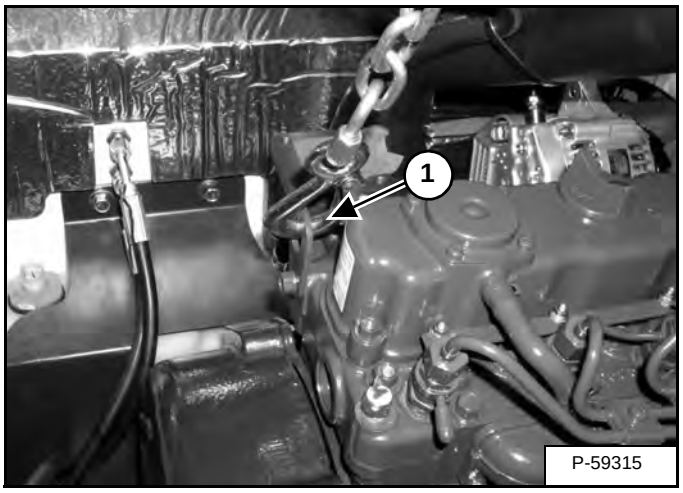
Drain the hydraulic reservoir. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

Remove the hydraulic pump. (See Removal And Installation on Page 20-50-7.)

Remove the spark arrester muffler. (See Removal And Installation on Page 60-20-1.)

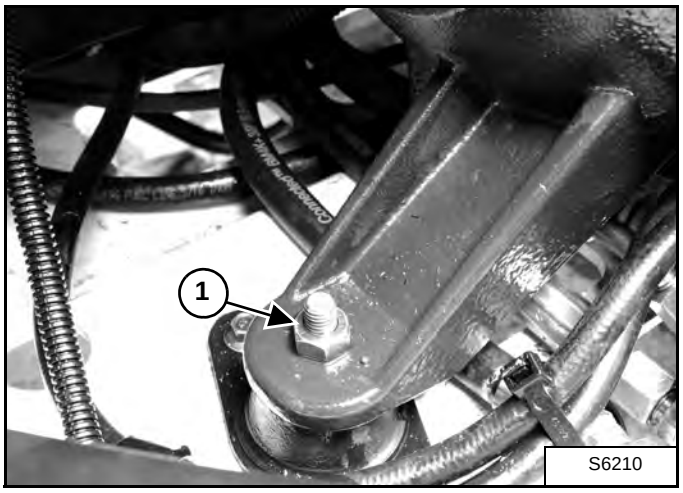
Remove the starter. (See Removal And Installation on Page 50-40-2.)

Figure 60-100-1



Install a chain hoist to the engine lifting eye to support the engine (Item 1) **[Figure 60-100-1]**.

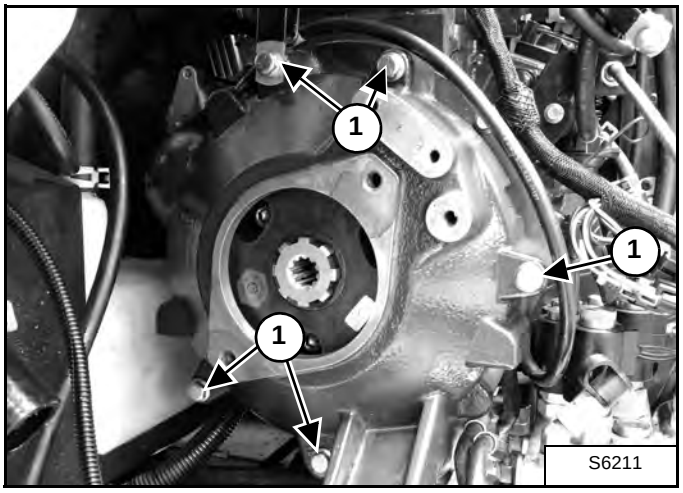
Figure 60-100-2



Remove the mount bolt and nut (Item 1) **[Figure 60-100-2]** from the engine mount.

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

Figure 60-100-3



Remove the five flywheel housing bolts (Item 1) **[Figure 60-100-3]**.

Installation: Tighten the bolts to 24 - 26 N•m (18 - 19 ft-lb) torque.

Remove the flywheel housing.

NOTE: Check that the alignment dowel pins are installed in the flywheel housing for assembly.

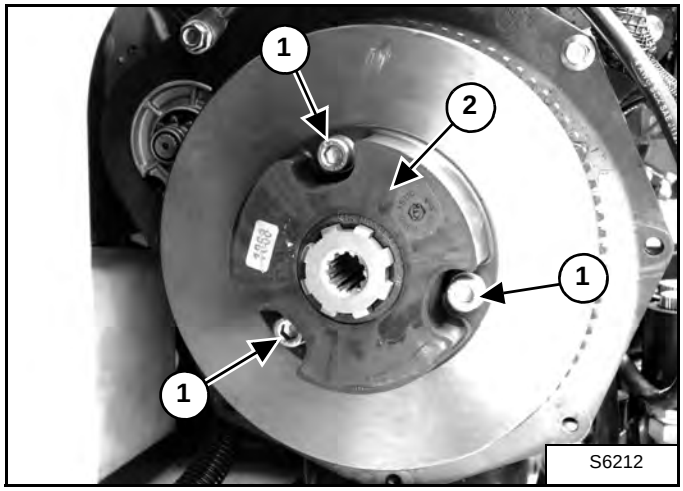
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Hydraulic Pump Coupler Removal And Installation

Remove the flywheel housing. (See Flywheel Housing Removal And Installation on Page 60-100-1.)

Figure 60-100-4



Remove the three bolts (Item 1) **[Figure 60-100-4]** from the hydraulic pump coupler.

Installation: Apply Loctite® 242 (Blue) to bolts and tighten the bolts to 71 - 79 N•m (52.5 - 58.5 ft-lb) torque. Also lubricate the bolt heads prior to installation.

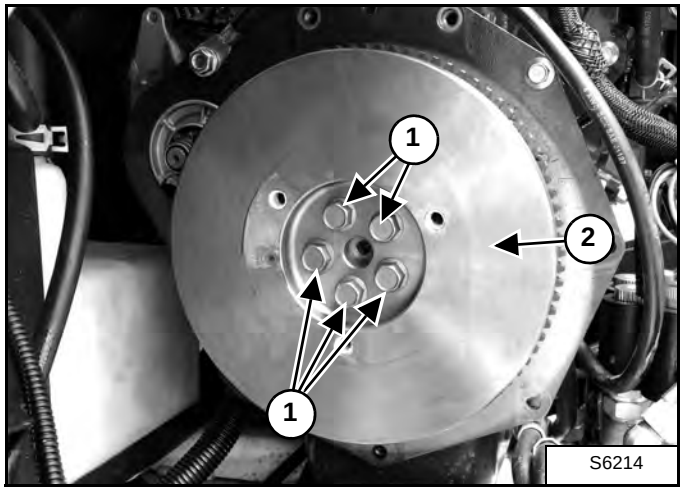
NOTE: Apply anti-seize compound on spline teeth prior to pump installation.

Remove the hydraulic pump coupler (Item 2) **[Figure 60-100-4]**.

Flywheel Removal

Remove the hydraulic pump coupler. (See Hydraulic Pump Coupler Removal And Installation on Page 60-100-2.)

Figure 60-100-5



Remove the five bolts (Item 1) **[Figure 60-100-5]** from the flywheel.

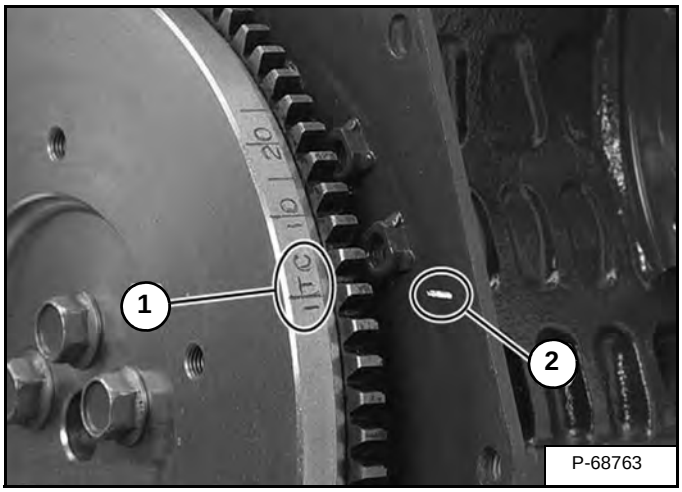
Remove the flywheel (Item 2) **[Figure 60-100-5]**.

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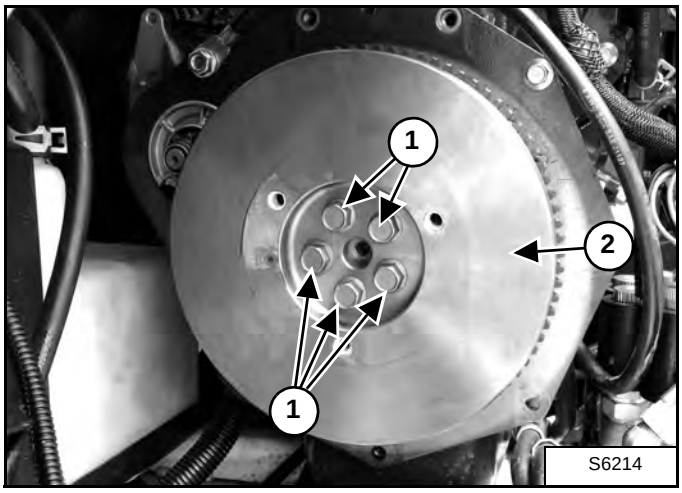
Flywheel Installation

Figure 60-100-6



Mark the flywheel (Item 1) and the plate (Item 2) **[Figure 60-100-6]** before the flywheel is removed.

Figure 60-100-7



Apply engine oil to the five bolt threads and underside of bolt heads before installation.

Install the five bolts (Item 1) **[Figure 60-100-7]** on the flywheel.

Tighten the bolts to 53,9 - 58,8 N•m (39.8 - 43.4 ft-lb) torque.

Rear End Plate Removal And Installation

Remove the flywheel housing. (See Flywheel Housing Removal And Installation on Page 60-100-1.)

Remove the hydraulic pump coupler. (See Hydraulic Pump Coupler Removal And Installation on Page 60-100-2.)

Remove the flywheel. (See Flywheel Removal on Page 60-100-2.)

Figure 60-100-8

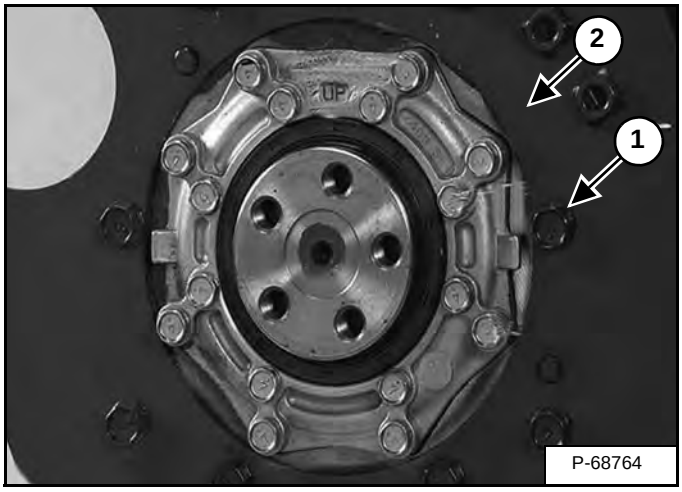
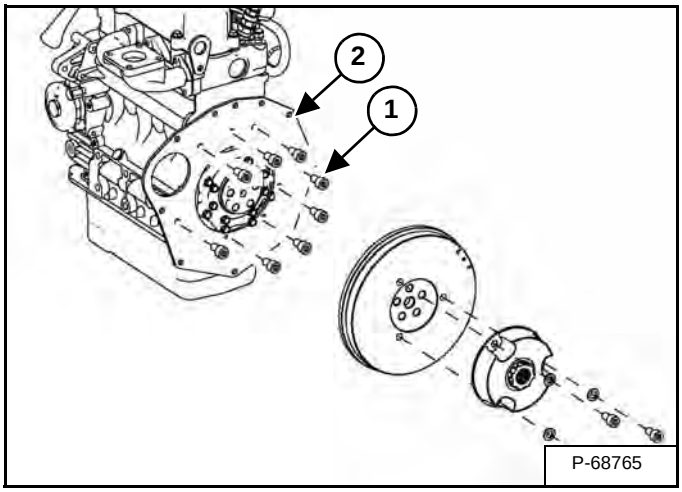


Figure 60-100-9



Remove the bolts (Item 1) from the rear end plate (Item 2) **[Figure 60-100-8]** and **[Figure 60-100-9]**. Remove end plate from the side of the engine.

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HEATING AND VENTILATION

HEATER SYSTEM 70-10-1
Description 70-10-1
Components 70-10-1

REGULAR MAINTENANCE 70-20-1
Filter Element Removal And Installation 70-20-1
Heater Coil 70-20-1

HEATER UNIT 70-30-1
Removal And Installation 70-30-1

HEATER COIL 70-40-1
Removal And Installation 70-40-1

HEATER FAN 70-50-1
Removal And Installation 70-50-1

HEATER VALVE 70-60-1
Removal And Installation 70-60-1

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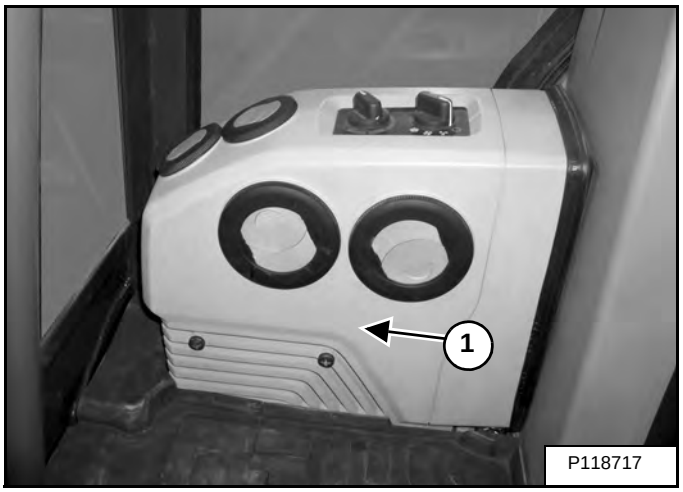
HEATER SYSTEM

Description

The heater system includes the heater unit which is located on the floor on the right side of excavator cab. The heater unit includes the heater coil, fan motor, blower cage, a temperature switch, fan switch, filter and louvers.

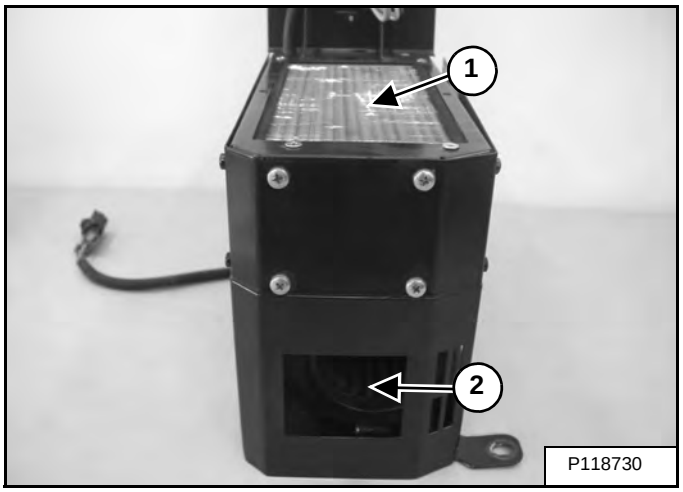
Components

Figure 70-10-1



Heater Unit: The heater unit (Item 1) **[Figure 70-10-1]** is located on the floor on the ride side of the excavator cab. The unit delivers the warm air for heat into the cab.

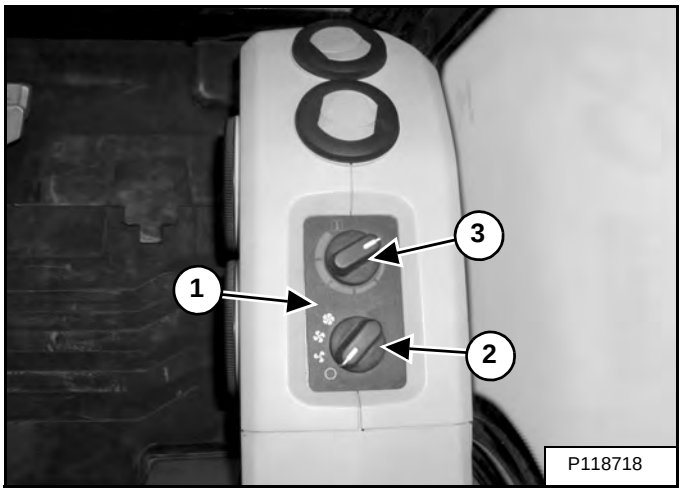
Figure 70-10-2



Heater Coil: The heater coil (Item 1) **[Figure 70-10-2]** supplies the warm air into the cab by passing air through the coil.

Heater Fan: The fan (Item 2) **[Figure 70-10-2]** is used to push air through the heater coil and into the cab.

Figure 70-10-3

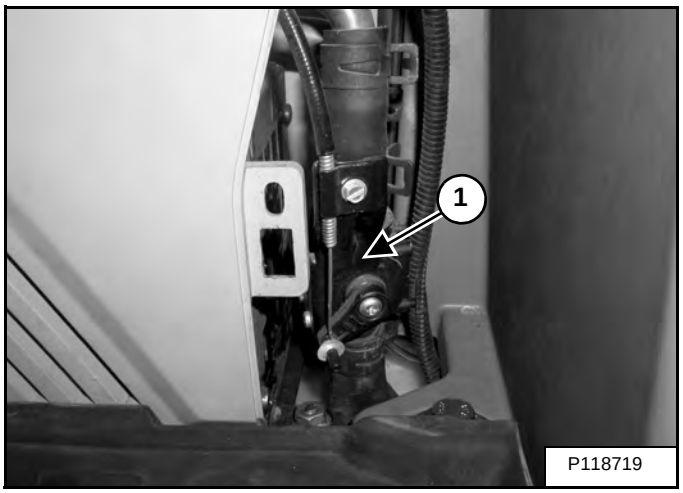


Control Panel: The panel (Item 1) **[Figure 70-10-3]** has two separate components:

Fan Switch: This is a four position rotary switch (Item 2) **[Figure 70-10-3]**.

Temperature Switch: The temperature switch (Item 3) **[Figure 70-10-3]** controls the Heat Valve from fully Off to fully On.

Figure 70-10-4



Heater Valve: The heater valve (Item 1) **[Figure 70-10-4]** manually controls the amount of engine coolant that flows to the heater coil.

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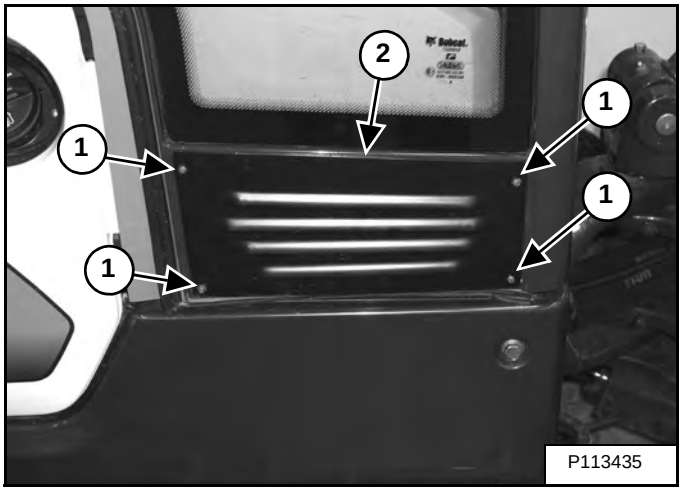
Filter Element Removal And Installation

The fresh air filter must be cleaned regularly. (See AIR CLEANER SERVICE on Page 10-80-1.)

The fresh air filter is located on the right front corner of the cab.

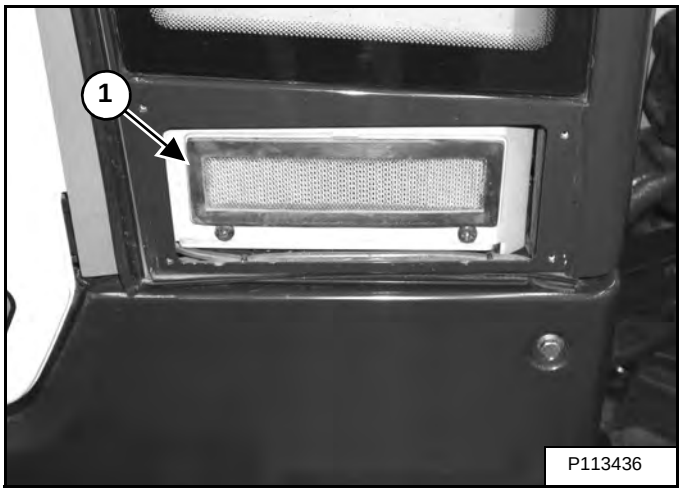
Fresh Air Filter

Figure 70-20-1



Remove the four screws (Item 1) and remove the cover (Item 2) **[Figure 70-20-1]**.

Figure 70-20-2



Pull the filter (Item 1) **[Figure 70-20-2]** out of the housing.

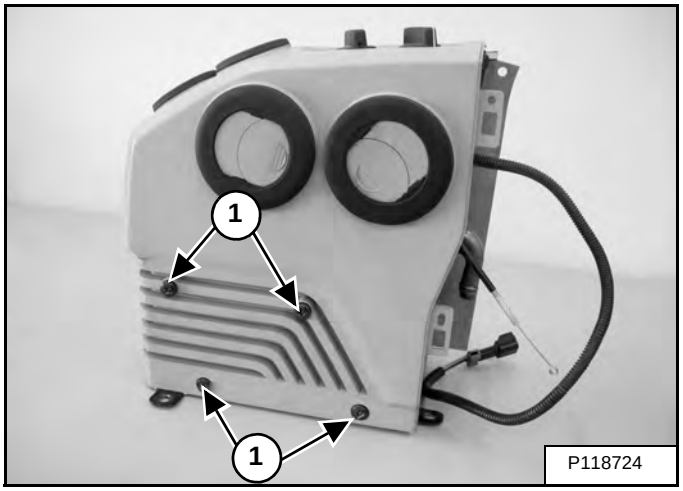
Use low air pressure to clean the filter. Replace the filter when very dirty.

Reinstall the cover (Item 2) and the four screws (Item 1) **[Figure 70-20-1]**.

Heater Coil

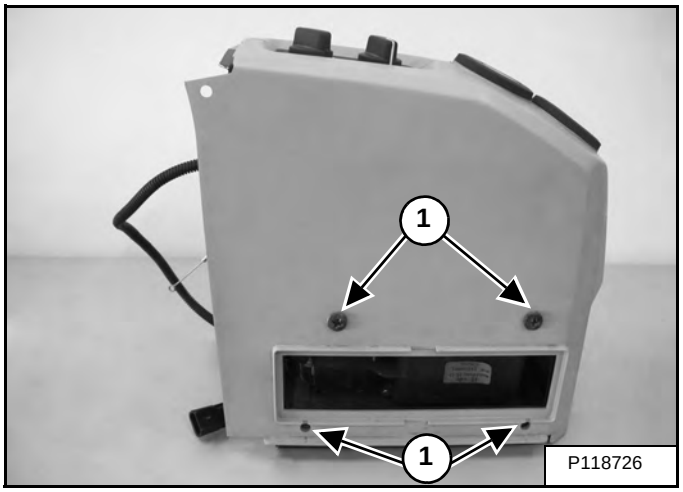
Remove the heater unit. (See Removal And Installation on Page 70-30-1.)

Figure 70-20-3



Remove the four bolts (Item 1) **[Figure 70-20-3]**.

Figure 70-20-4



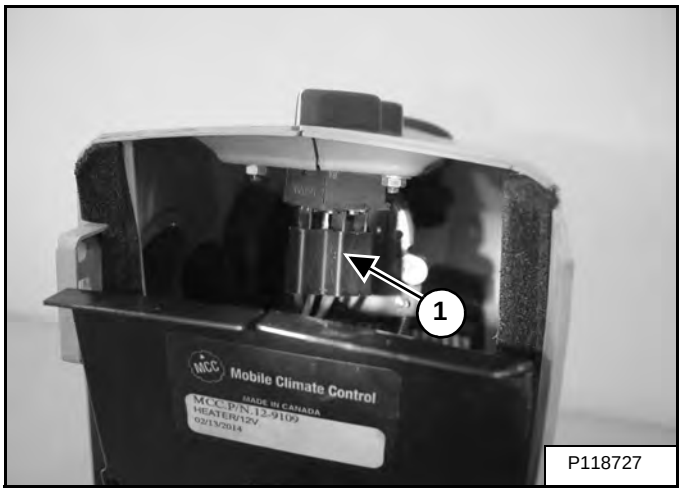
Remove the four bolts (Item 1) **[Figure 70-20-4]**.

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Heater Coil (Cont'd)

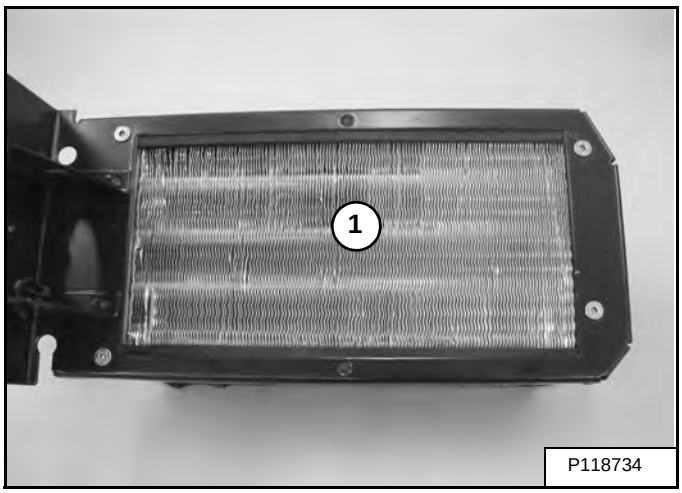
Figure 70-20-5



Raise the cover to disconnect the fan motor switch harness (Item 1) **[Figure 70-20-5]**.

Remove the cover.

Figure 70-20-6



The heater coil (Item 1) **[Figure 70-20-6]** can now be cleaned with low pressure water or air.

NOTE: High pressure may damage the fins of the heater coil.

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HEATER UNIT

Removal And Installation

Drain the engine coolant. (See Removing And Replacing Coolant on Page 10-100-3.)

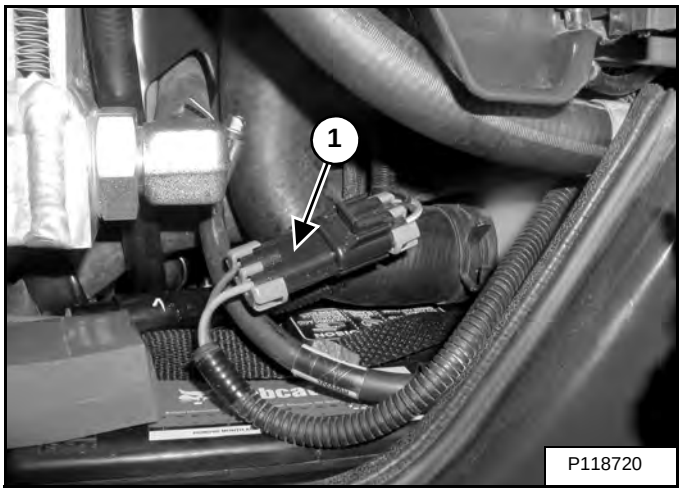
Remove the floor mats. (See Removal And Installation on Page 40-140-1.)

Figure 70-30-1



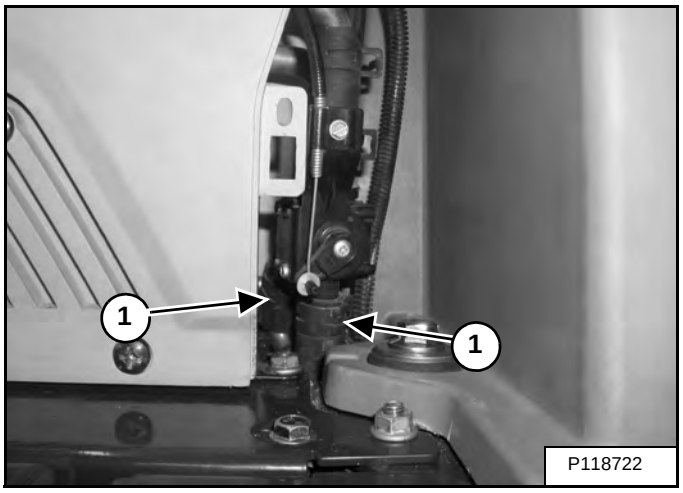
Remove the rear cover of heater unit (Item 1) **[Figure 70-30-1]**.

Figure 70-30-2



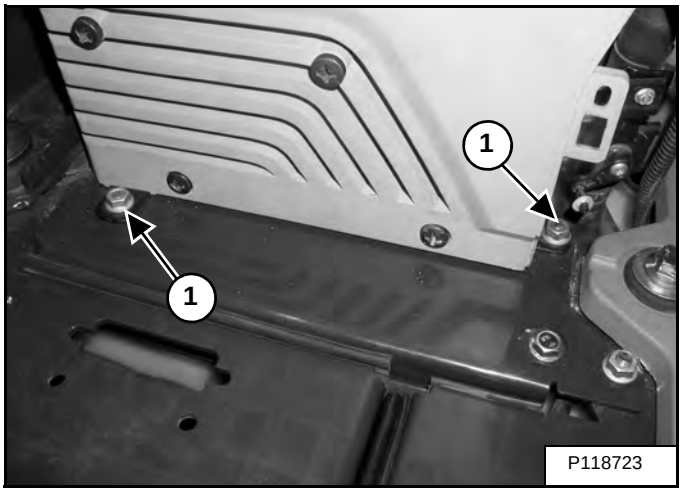
Disconnect the fan switch harness (Item 1) **[Figure 70-30-2]**.

Figure 70-30-3



Remove the two clamps (Item 1) **[Figure 70-30-3]** for the heater hoses.

Figure 70-30-4



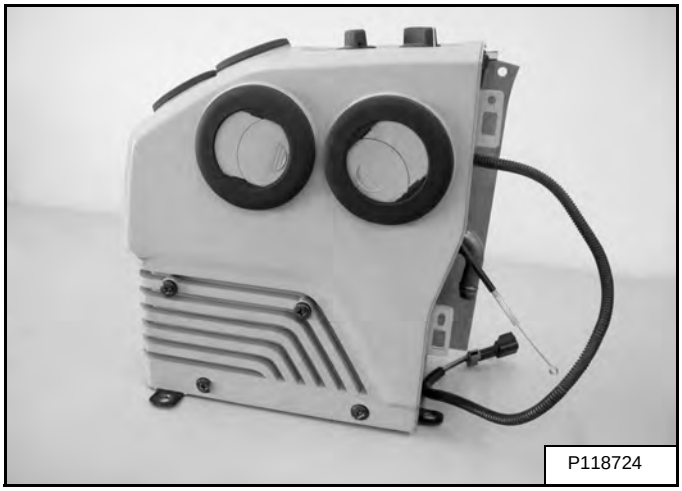
Remove the two mounting nuts (Item 1) **[Figure 70-30-4]**.

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Removal And Installation (Cont'd)

Figure 70-30-5



Remove the heater unit assembly **[Figure 70-30-5]**.

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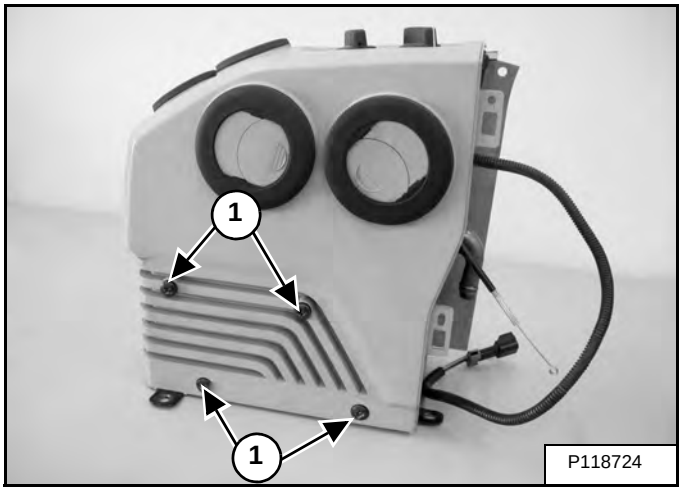
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HEATER COIL

Removal And Installation

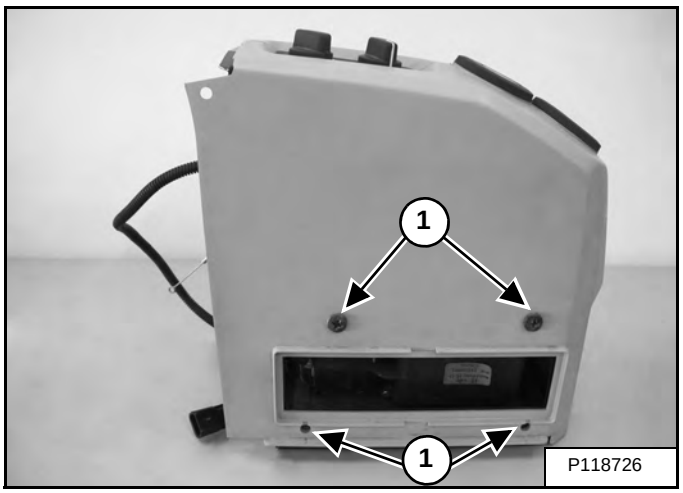
Remove the heater unit. (See Removal And Installation on Page 70-30-1.)

Figure 70-40-1



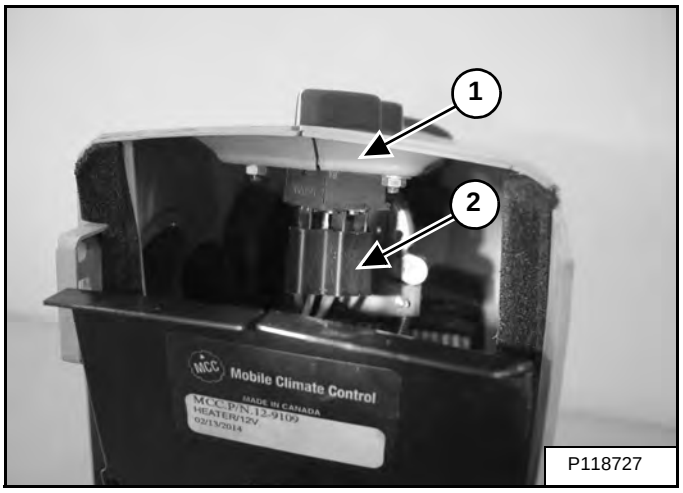
Remove the four bolts (Item 1) **[Figure 70-40-1]**.

Figure 70-40-2



Remove the four bolts (Item 1) **[Figure 70-40-2]**.

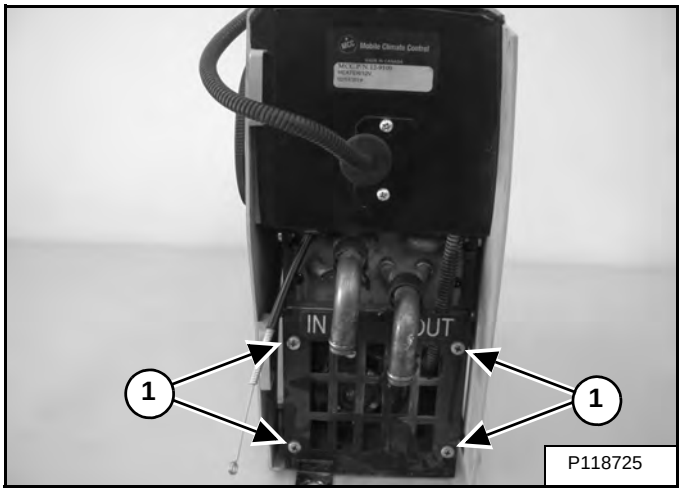
Figure 70-40-3



Raise the cover (Item 1) to disconnect the fan switch harness (Item 2) **[Figure 70-40-3]**.

Remove the cover assembly.

Figure 70-40-4



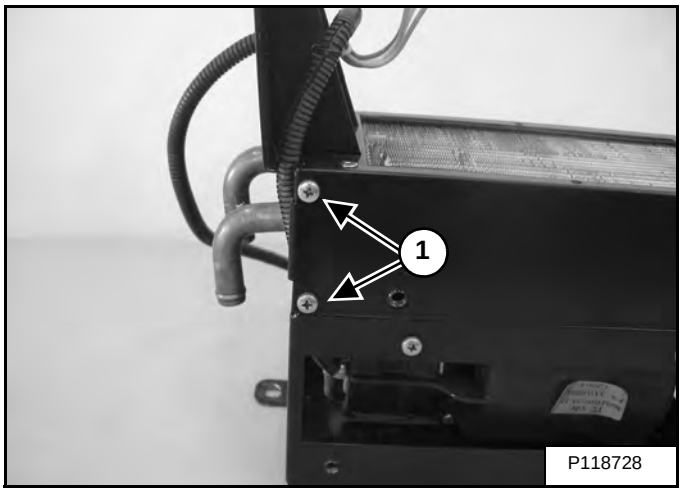
Remove the screws (Item 1) **[Figure 70-40-4]**.

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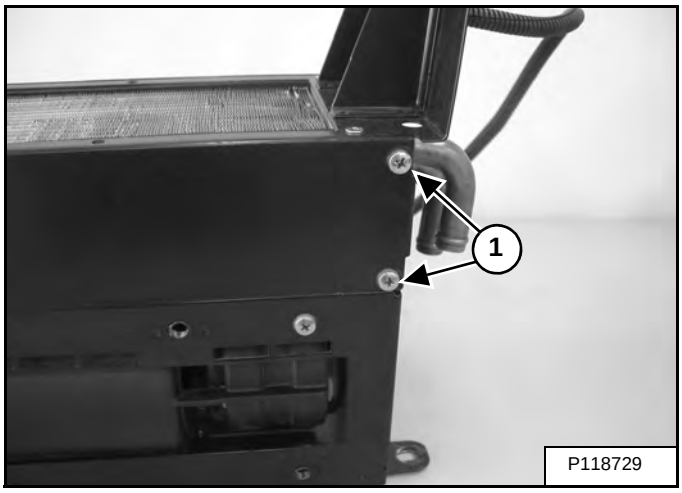
Removal And Installation (Cont'd)

Figure 70-40-5



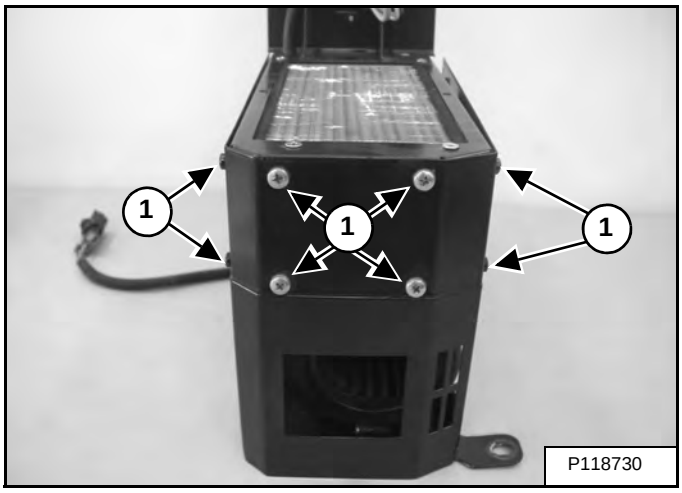
Remove the screws (Item 1) **[Figure 70-40-5]**.

Figure 70-40-6



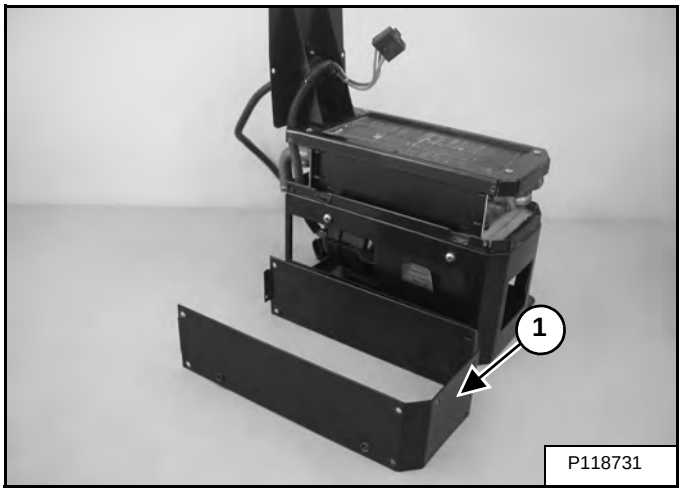
Remove the screws (Item 1) **[Figure 70-40-6]**.

Figure 70-40-7



Remove the screws (Item 1) **[Figure 70-40-7]**.

Figure 70-40-8



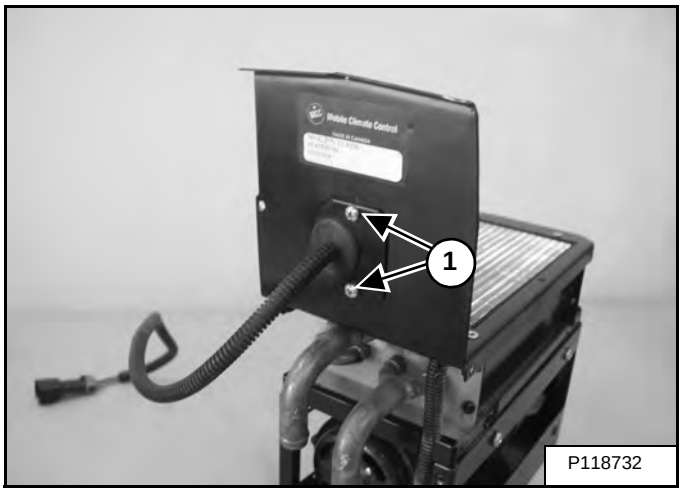
Remove the cover (Item 1) **[Figure 70-40-8]**.

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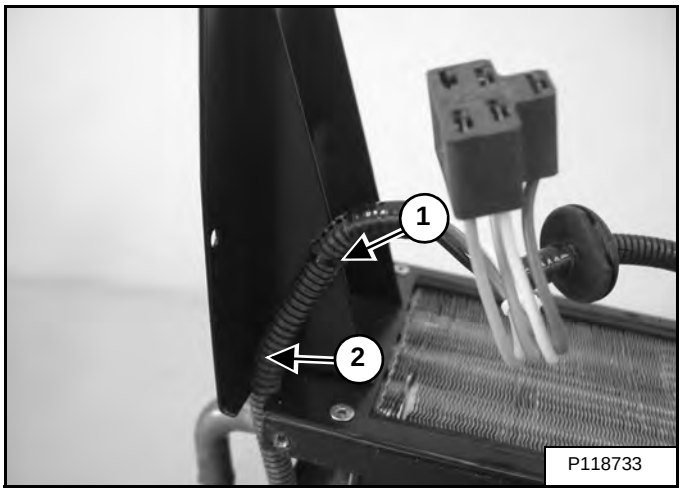
Removal And Installation (Cont'd)

Figure 70-40-9



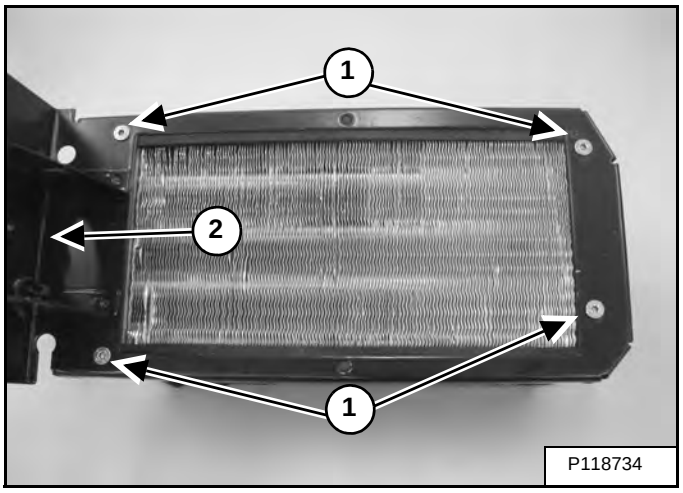
Remove the screws (Item 1) **[Figure 70-40-9]**.

Figure 70-40-10



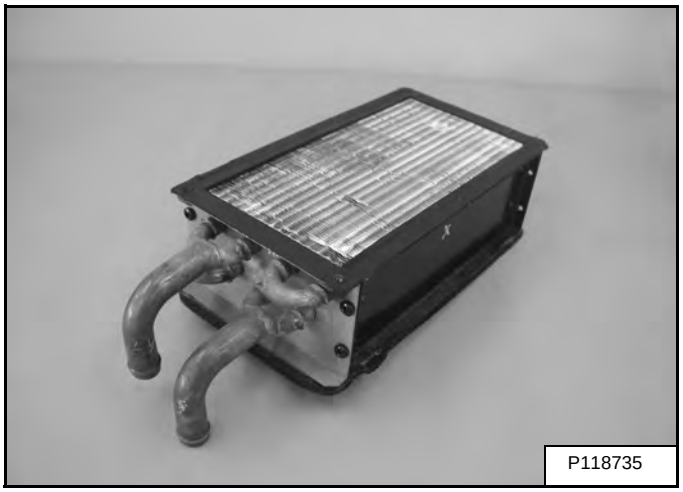
Cut and remove the cable tie (Item 1) and remove the harness (Item 2) **[Figure 70-40-10]** from the heater coil assembly.

Figure 70-40-11



Remove the screws (Item 1) and remove the heater coil mount (Item 2) **[Figure 70-40-11]**.

Figure 70-40-12



If the heater coil needs replacement it must be replaced as a complete unit **[Figure 70-40-12]**.

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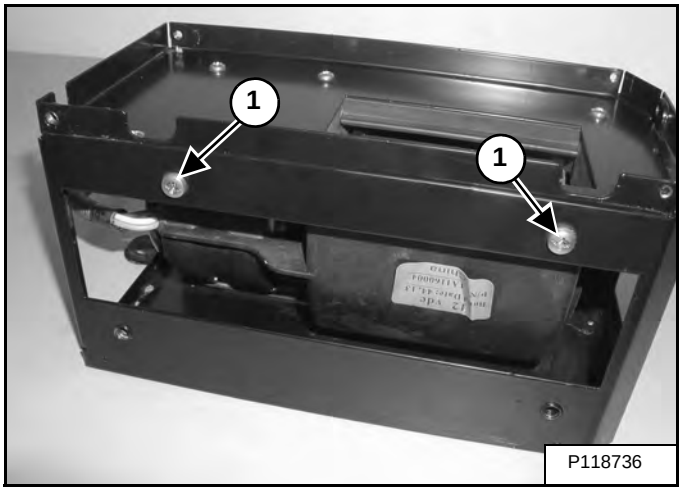
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HEATER FAN

Removal And Installation

Remove the heater coil. (See Removal And Installation on Page 70-40-1.)

Figure 70-50-1



Remove the screws (Item 1) **[Figure 70-50-1]** and **[Figure 70-50-2]**.

Figure 70-50-2

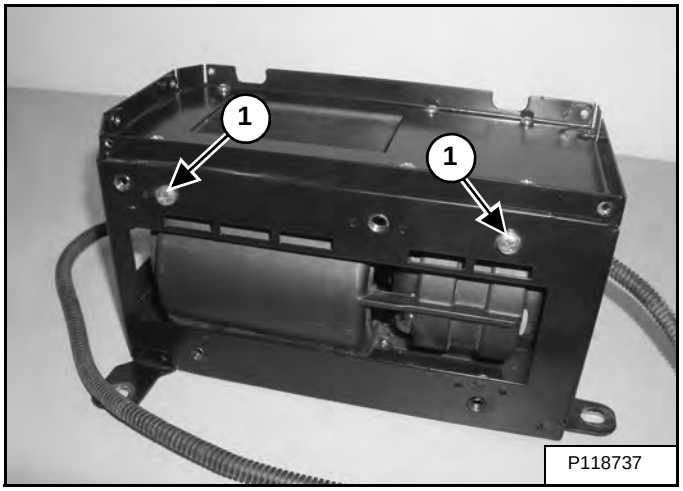
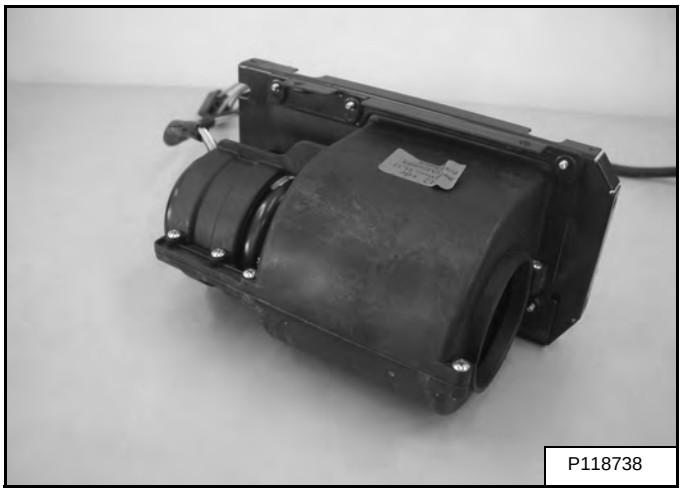
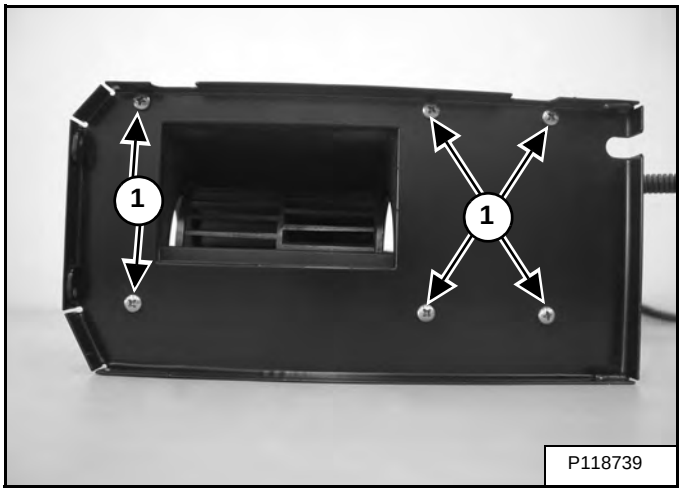


Figure 70-50-3



Remove the heater fan assembly **[Figure 70-50-3]**.

Figure 70-50-4



Remove the screws (Item 1) **[Figure 70-50-4]** from the mounting bracket.

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Removal And Installation (Cont'd)

Figure 70-50-5



Remove the heater fan assembly **[Figure 70-50-5]**.

The heater fan assembly is not repairable. Order the complete assembly.

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HEATER VALVE

Removal And Installation

Remove the heater unit. (See Removal And Installation on Page 70-30-1.)

Figure 70-60-1

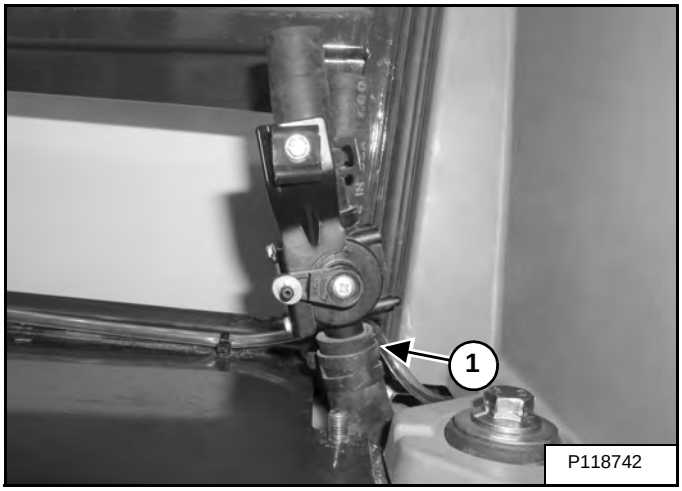


Figure 70-60-2



Remove the lower hose clamp (Item 1) **[Figure 70-60-1]** and remove the heater valve **[Figure 70-60-2]**.

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EXCAVATOR SPECIFICATIONS SPEC-10-1
Machine Dimensions SPEC-10-1
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Machine Dimensions (Long Arm) SPEC-10-3
Rated Lift Capacity - With Standard Arm And Canopy (No Demolition Kit) SPEC-10-4
Rated Lift Capacity - With Standard Arm And Canopy (With Demolition Kit) SPEC-10-5
Rated Lift Capacity - With Standard Arm, Optional Counterweight And Canopy (No Demolition Kit) SPEC-10-6
Rated Lift Capacity - With Standard Arm, Optional Counterweight And Canopy (With Demolition Kit) SPEC-10-7
Rated Lift Capacity - With Standard Arm And Cab (No Demolition Kit) SPEC-10-8
Rated Lift Capacity - With Standard Arm And Cab (With Demolition Kit) SPEC-10-9
Rated Lift Capacity - With Standard Arm, Optional Counterweight And Cab (No Demolition Kit) SPEC-10-10
Rated Lift Capacity - With Standard Arm, Optional Counterweight And Cab (With Demolition Kit) SPEC-10-11
Rated Lift Capacity - With Long Arm And Canopy (No Demolition Kit) SPEC-10-12
Rated Lift Capacity - With Long Arm And Canopy (With Demolition Kit) SPEC-10-13
Rated Lift Capacity - With Long Arm, Optional Counterweight And Canopy (No Demolition Kit) SPEC-10-14
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TECHNICAL SERVICE GUIDE SPECIFICATIONS SPEC-20-1
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Torque For General Metric Bolts SPEC-30-2

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Straight Thread O-ring Fitting SPEC-40-2
Tubelines And Hoses SPEC-40-2
Flare Fitting SPEC-40-3
Port Seal Fitting SPEC-40-4

HYDRAULIC FLUID SPECIFICATIONS SPEC-50-1
Specifications SPEC-50-1

CONVERSIONS SPEC-60-1
Decimal And Millimeter Equivalent Chart SPEC-60-1
U.S. To Metric Conversion Chart SPEC-60-1

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Electrical Tools SPEC-70-7
HVAC Tools SPEC-70-7

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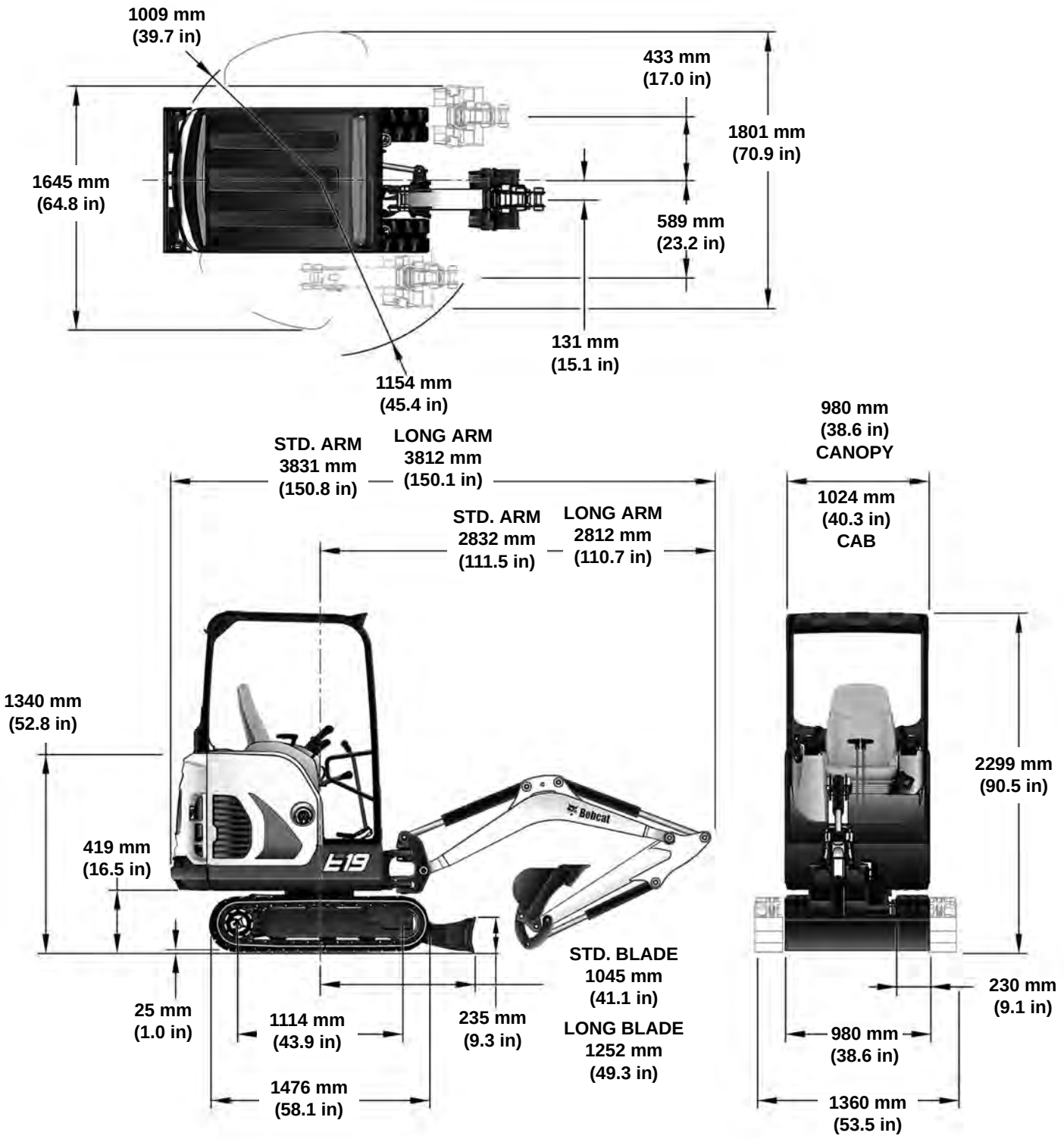
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EXCAVATOR SPECIFICATIONS

Machine Dimensions

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



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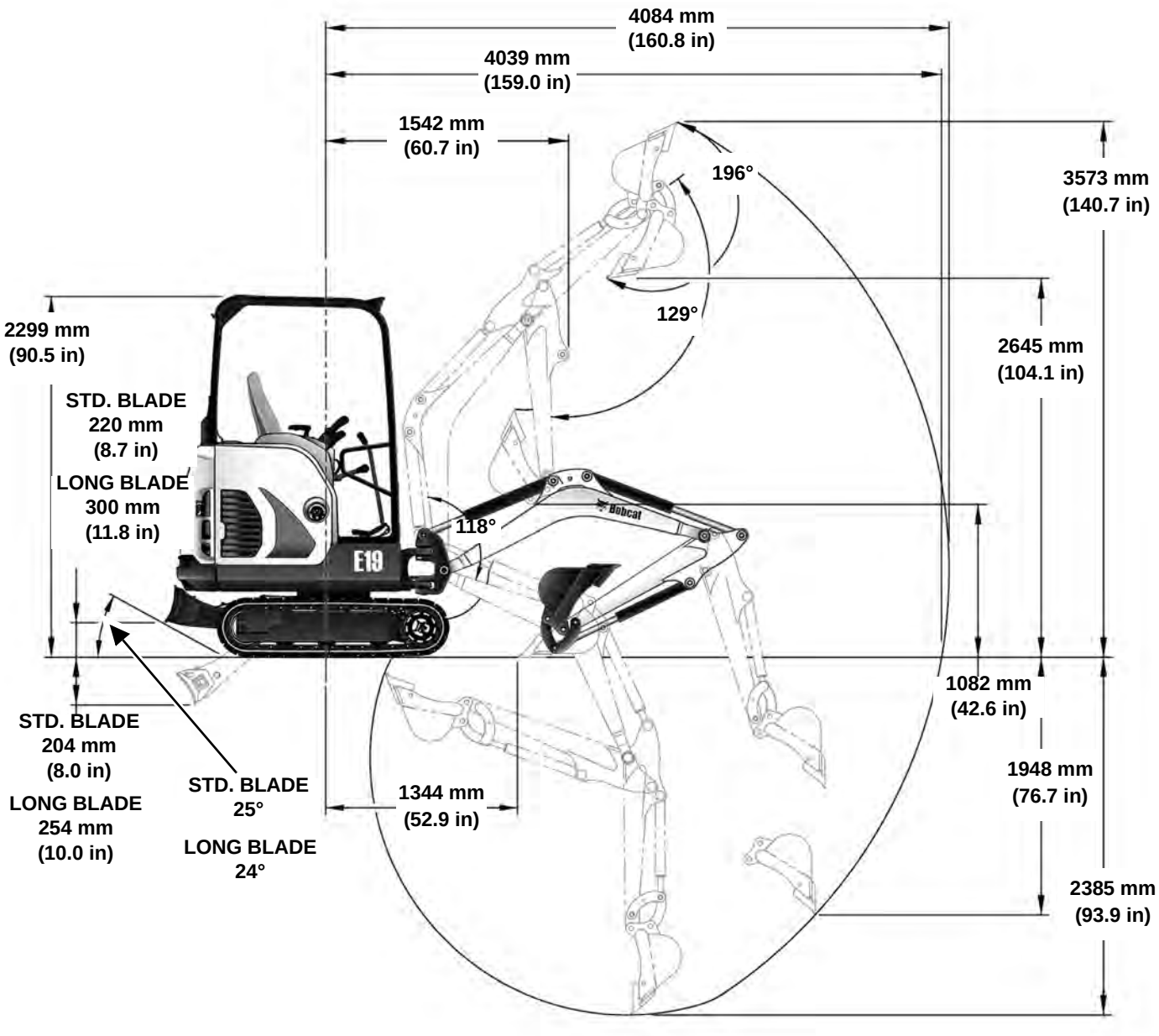
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EXCAVATOR SPECIFICATIONS (CONT'D)

Machine Dimensions (Standard Arm)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



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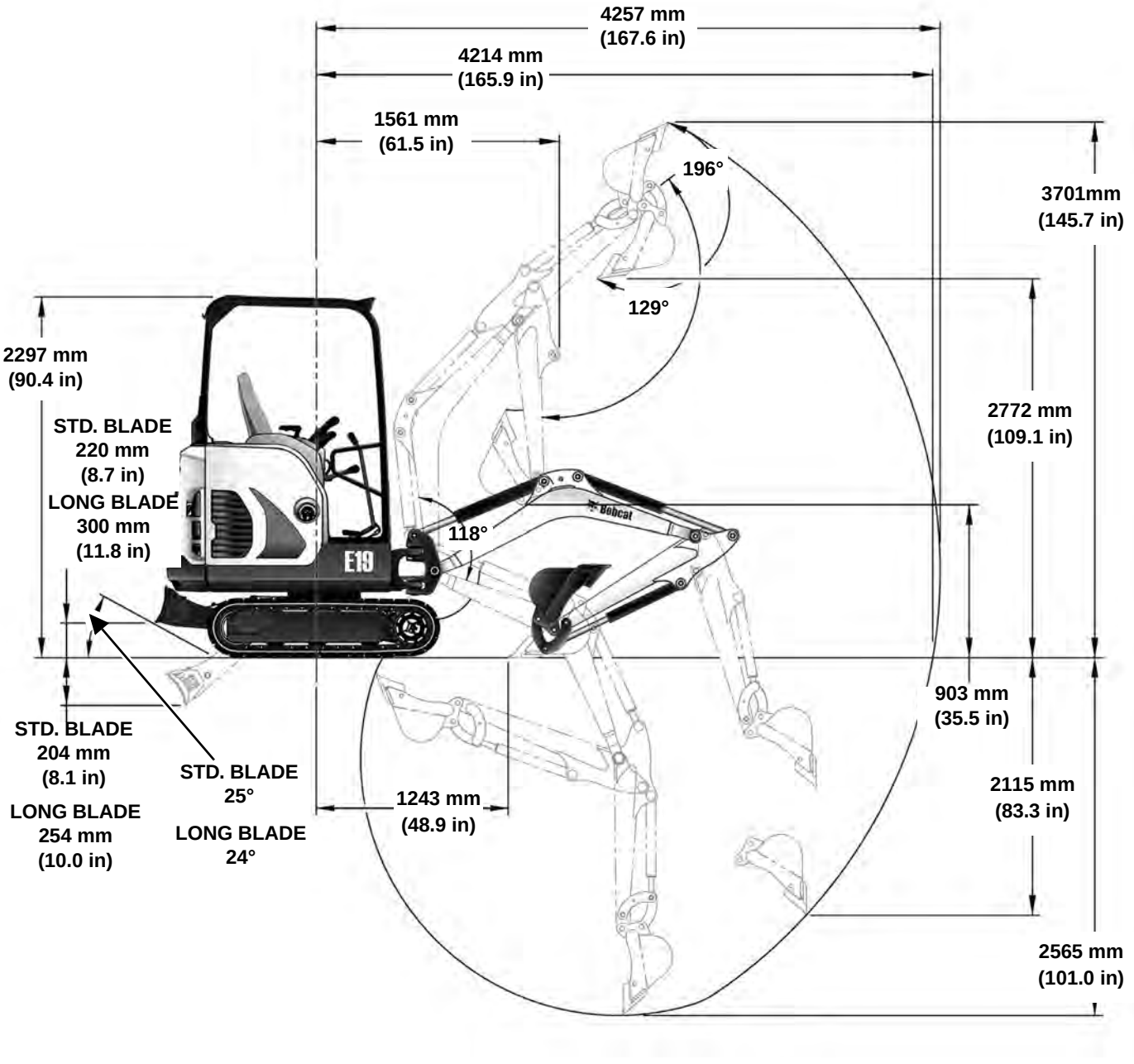
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EXCAVATOR SPECIFICATIONS (CONT'D)

Machine Dimensions (Long Arm)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



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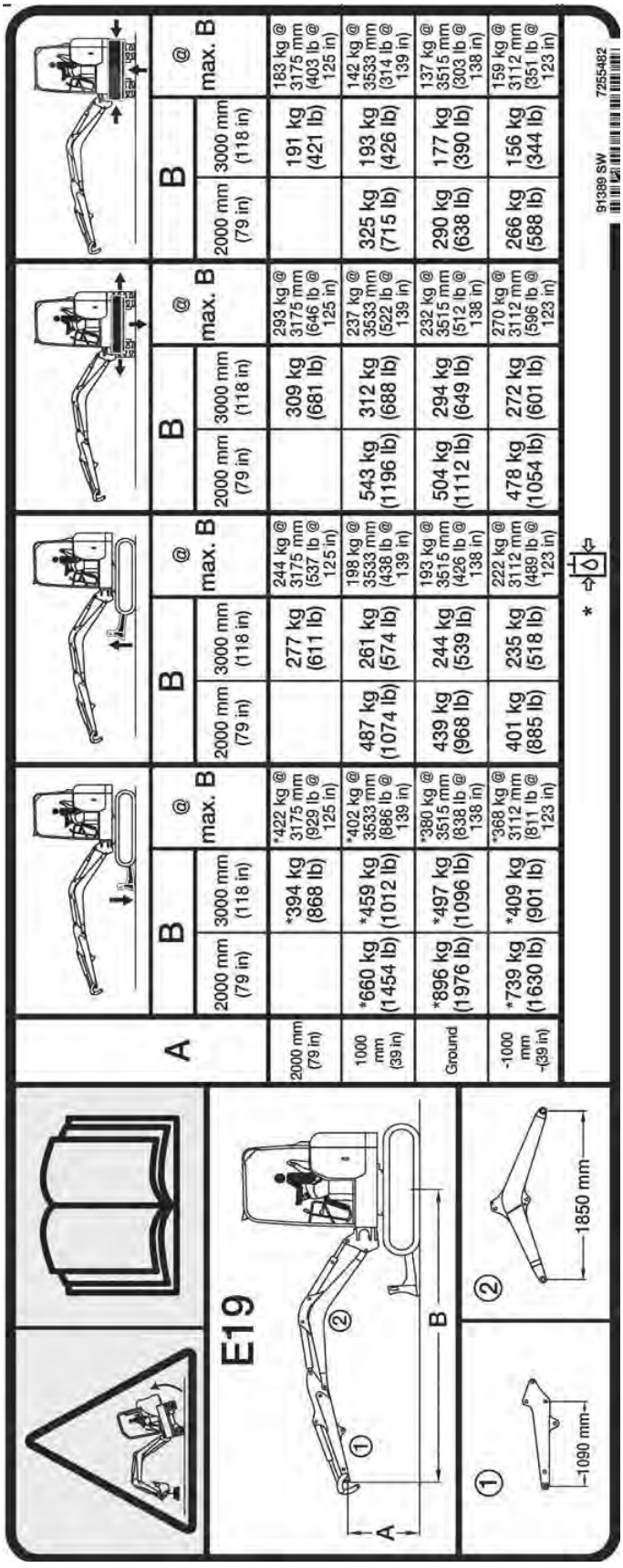
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EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Standard Arm And Canopy (No Demolition Kit)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



A	B @ max. B		B @ max. B		B @ max. B		B @ max. B	
	2000 mm (79 in)	3000 mm (118 in)	2000 mm (79 in)	3000 mm (118 in)	2000 mm (79 in)	3000 mm (118 in)	2000 mm (79 in)	3000 mm (118 in)
2000 mm (79 in)		*394 kg (868 lb) *422 kg @ 3175 mm (929 lb @ 125 in)		277 kg (611 lb) 244 kg @ 3175 mm (537 lb @ 125 in)		309 kg (681 lb) 293 kg @ 3175 mm (646 lb @ 125 in)		191 kg (421 lb) 183 kg @ 3175 mm (403 lb @ 125 in)
1000 mm (39 in)	*660 kg (1454 lb)	*459 kg (1012 lb) *402 kg @ 3533 mm (886 lb @ 139 in)	487 kg (1074 lb)	261 kg (574 lb) 198 kg @ 3533 mm (438 lb @ 139 in)	543 kg (1196 lb)	312 kg (688 lb) 237 kg @ 3533 mm (522 lb @ 139 in)	325 kg (715 lb)	193 kg (426 lb) 142 kg @ 3533 mm (314 lb @ 139 in)
Ground	*896 kg (1976 lb)	*497 kg (1096 lb) *380 kg @ 3515 mm (838 lb @ 138 in)	439 kg (968 lb)	244 kg (539 lb) 193 kg @ 3515 mm (426 lb @ 138 in)	504 kg (1112 lb)	294 kg (649 lb) 232 kg @ 3515 mm (512 lb @ 138 in)	290 kg (638 lb)	177 kg (390 lb) 137 kg @ 3515 mm (303 lb @ 138 in)
-1000 mm -(39 in)	*739 kg (1630 lb)	*409 kg (901 lb) *368 kg @ 3112 mm (811 lb @ 123 in)	401 kg (885 lb)	235 kg (518 lb) 222 kg @ 3112 mm (489 lb @ 123 in)	478 kg (1054 lb)	272 kg (601 lb) 270 kg @ 3112 mm (596 lb @ 123 in)	266 kg (588 lb)	156 kg (344 lb) 159 kg @ 3112 mm (351 lb @ 123 in)

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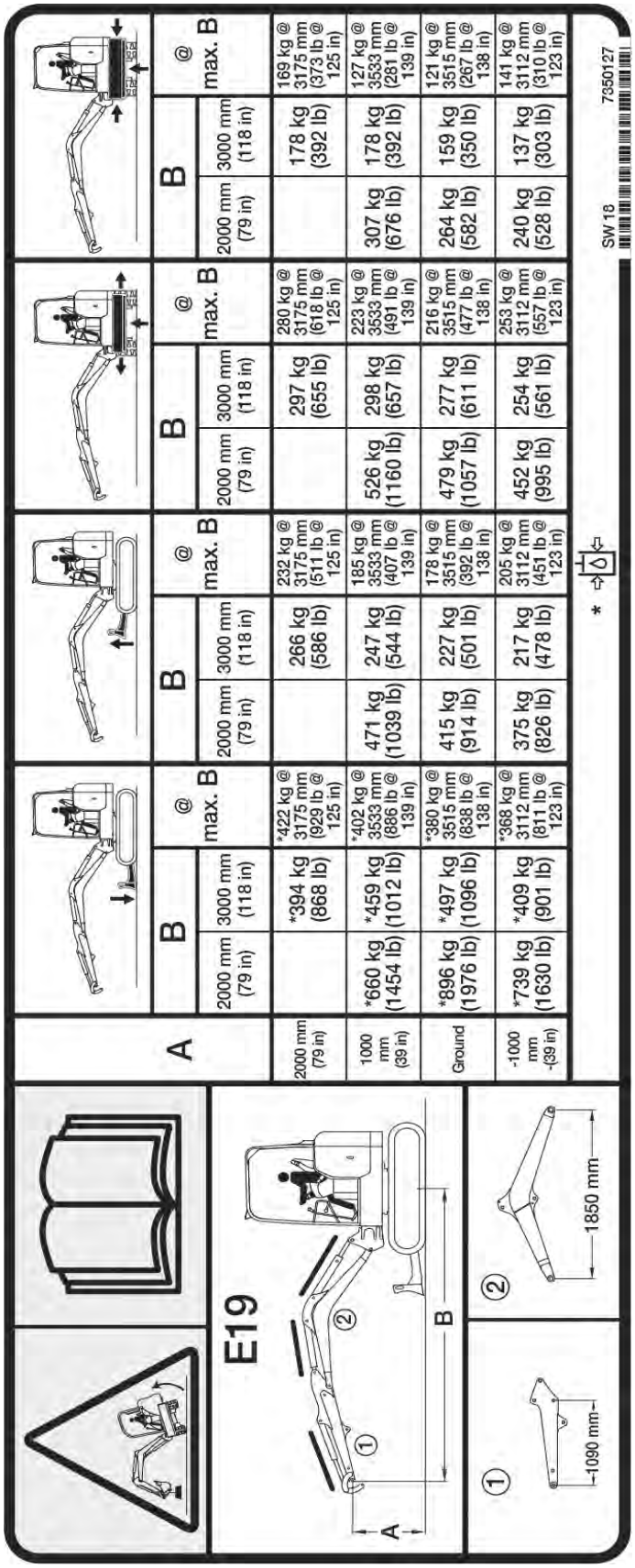
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EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Standard Arm And Canopy (With Demolition Kit)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



A	B @ max. B											
	2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)	
2000 mm (79 in)		*394 kg (868 lb)	*422 kg @ 3175 mm (929 lb @ 125 in)		266 kg (586 lb)	232 kg @ 3175 mm (511 lb @ 125 in)		297 kg (655 lb)	280 kg @ 3175 mm (618 lb @ 125 in)		178 kg (392 lb)	169 kg @ 3175 mm (373 lb @ 125 in)
1000 mm (39 in)	*660 kg (1454 lb)	*459 kg (1012 lb)	*402 kg @ 3533 mm (886 lb @ 139 in)	471 kg (1039 lb)	247 kg (544 lb)	185 kg @ 3533 mm (407 lb @ 139 in)	526 kg (1160 lb)	298 kg (657 lb)	223 kg @ 3533 mm (491 lb @ 139 in)	307 kg (676 lb)	178 kg (392 lb)	127 kg @ 3533 mm (281 lb @ 139 in)
Ground	*896 kg (1976 lb)	*497 kg (1096 lb)	*380 kg @ 3515 mm (838 lb @ 138 in)	415 kg (914 lb)	227 kg (501 lb)	178 kg @ 3515 mm (392 lb @ 138 in)	479 kg (1057 lb)	277 kg (611 lb)	216 kg @ 3515 mm (477 lb @ 138 in)	264 kg (582 lb)	159 kg (350 lb)	121 kg @ 3515 mm (267 lb @ 138 in)
-1000 mm -(39 in)	*739 kg (1630 lb)	*409 kg (901 lb)	*368 kg @ 3112 mm (811 lb @ 123 in)	375 kg (826 lb)	217 kg (478 lb)	205 kg @ 3112 mm (451 lb @ 123 in)	452 kg (995 lb)	254 kg (561 lb)	253 kg @ 3112 mm (557 lb @ 123 in)	240 kg (528 lb)	137 kg (303 lb)	141 kg @ 3112 mm (310 lb @ 123 in)

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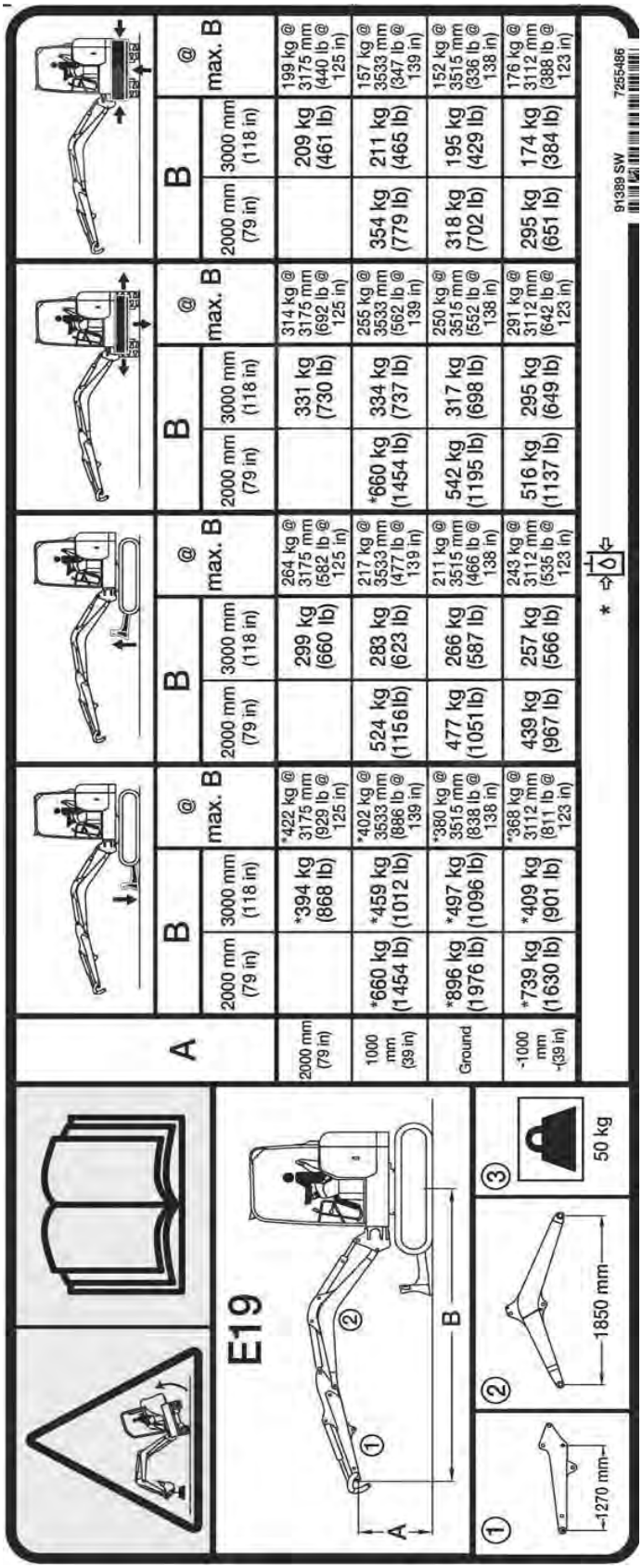
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EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Standard Arm, Optional Counterweight And Canopy (No Demolition Kit)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



A	B		@ max. B	B		@ max. B	B		@ max. B	B		@ max. B
	2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)	
2000 mm (79 in)		*394 kg (868 lb)	*422 kg @ 3175 mm (929 lb @ 125 in)		299 kg (660 lb)	264 kg @ 3175 mm (582 lb @ 125 in)		331 kg (730 lb)	314 kg @ 3175 mm (692 lb @ 125 in)		209 kg (461 lb)	199 kg @ 3175 mm (440 lb @ 125 in)
1000 mm (39 in)	*660 kg (1454 lb)	*459 kg (1012 lb)	*402 kg @ 3533 mm (886 lb @ 139 in)	524 kg (1156 lb)	283 kg (623 lb)	217 kg @ 3533 mm (477 lb @ 139 in)	*660 kg (1454 lb)	334 kg (737 lb)	255 kg @ 3533 mm (562 lb @ 139 in)	354 kg (779 lb)	211 kg (465 lb)	157 kg @ 3533 mm (347 lb @ 139 in)
Ground	*896 kg (1976 lb)	*497 kg (1096 lb)	*380 kg @ 3515 mm (838 lb @ 138 in)	477 kg (1051 lb)	266 kg (587 lb)	211 kg @ 3515 mm (466 lb @ 138 in)	542 kg (1195 lb)	317 kg (698 lb)	250 kg @ 3515 mm (552 lb @ 138 in)	318 kg (702 lb)	195 kg (429 lb)	152 kg @ 3515 mm (336 lb @ 138 in)
-1000 mm -(39 in)	*739 kg (1630 lb)	*409 kg (901 lb)	*368 kg @ 3112 mm (811 lb @ 123 in)	439 kg (967 lb)	257 kg (566 lb)	243 kg @ 3112 mm (535 lb @ 123 in)	516 kg (1137 lb)	295 kg (649 lb)	291 kg @ 3112 mm (642 lb @ 123 in)	295 kg (651 lb)	174 kg (384 lb)	176 kg @ 3112 mm (388 lb @ 123 in)

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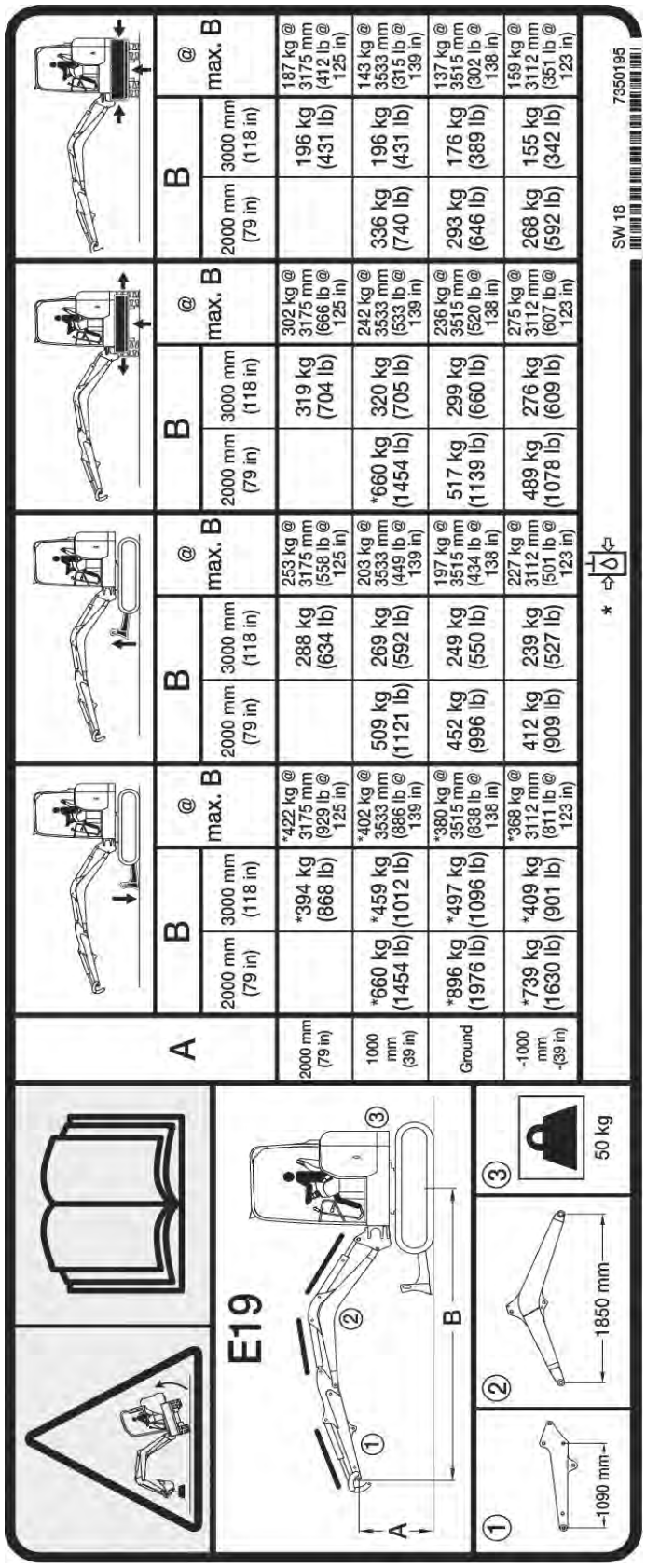
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EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Standard Arm, Optional Counterweight And Canopy (With Demolition Kit)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



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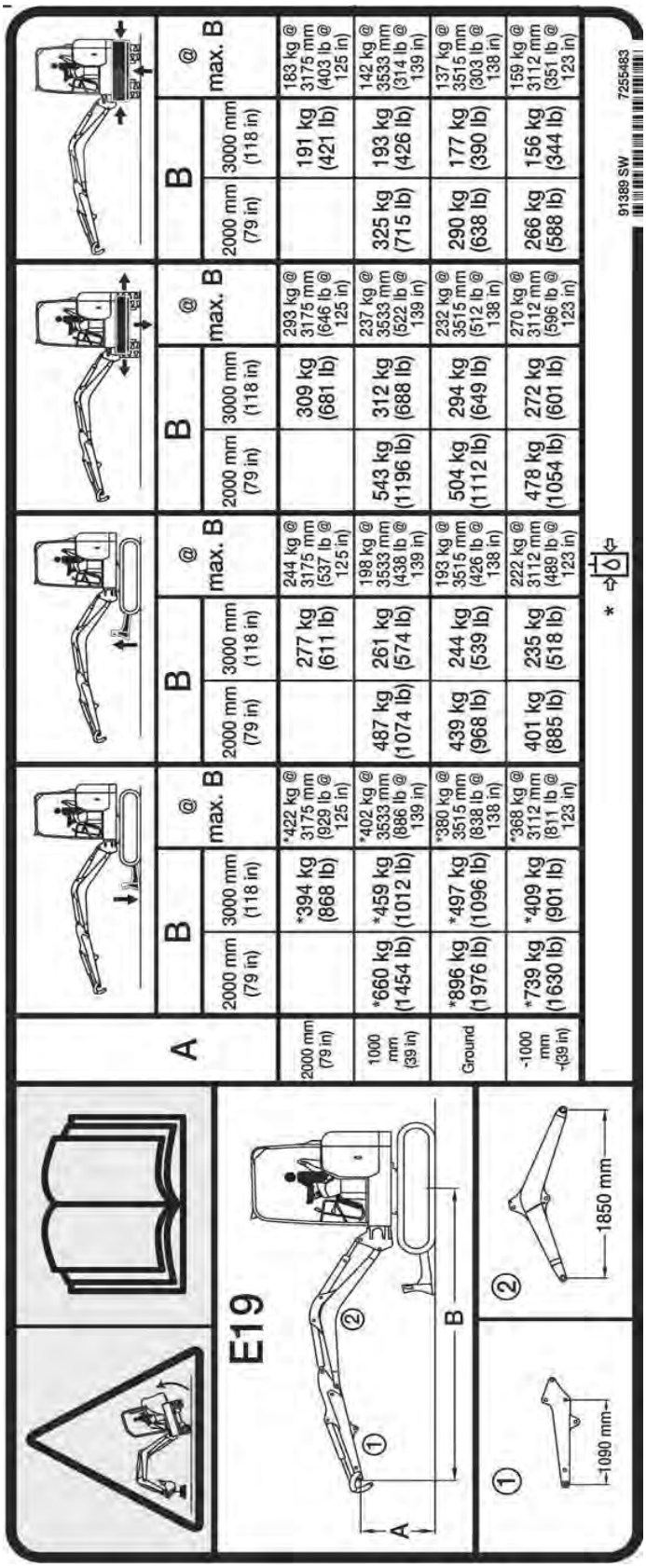
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EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Standard Arm And Cab (No Demolition Kit)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



A	B @ max.	B	B @ max.	B	B @ max.	B
	2000 mm (79 in)	3000 mm (118 in)	2000 mm (79 in)	3000 mm (118 in)	2000 mm (79 in)	3000 mm (118 in)
2000 mm (79 in)		*394 kg (868 lb)	*422 kg @ 3175 mm (929 lb @ 125 in)	277 kg (611 lb)	244 kg @ 3175 mm (537 lb @ 125 in)	309 kg (681 lb)	293 kg @ 3175 mm (646 lb @ 125 in)	191 kg (421 lb)	183 kg @ 3175 mm (403 lb @ 125 in)
1000 mm (39 in)	*660 kg (1454 lb)	*459 kg (1012 lb)	*402 kg @ 3533 mm (886 lb @ 139 in)	487 kg (1074 lb)	261 kg (574 lb)	198 kg @ 3533 mm (438 lb @ 139 in)	543 kg (1196 lb)	312 kg (688 lb)	237 kg @ 3533 mm (522 lb @ 139 in)	325 kg (715 lb)	193 kg (426 lb)	142 kg @ 3533 mm (314 lb @ 139 in)
Ground	*896 kg (1976 lb)	*497 kg (1096 lb)	*380 kg @ 3515 mm (838 lb @ 138 in)	439 kg (968 lb)	244 kg (539 lb)	193 kg @ 3515 mm (426 lb @ 138 in)	504 kg (1112 lb)	294 kg (649 lb)	232 kg @ 3515 mm (512 lb @ 138 in)	290 kg (638 lb)	177 kg (390 lb)	137 kg @ 3515 mm (303 lb @ 138 in)
-1000 mm -(39 in)	*739 kg (1630 lb)	*409 kg (901 lb)	*368 kg @ 3112 mm (811 lb @ 123 in)	401 kg (885 lb)	235 kg (518 lb)	222 kg @ 3112 mm (489 lb @ 123 in)	478 kg (1054 lb)	272 kg (601 lb)	270 kg @ 3112 mm (596 lb @ 123 in)	266 kg (588 lb)	156 kg (344 lb)	159 kg @ 3112 mm (351 lb @ 123 in)

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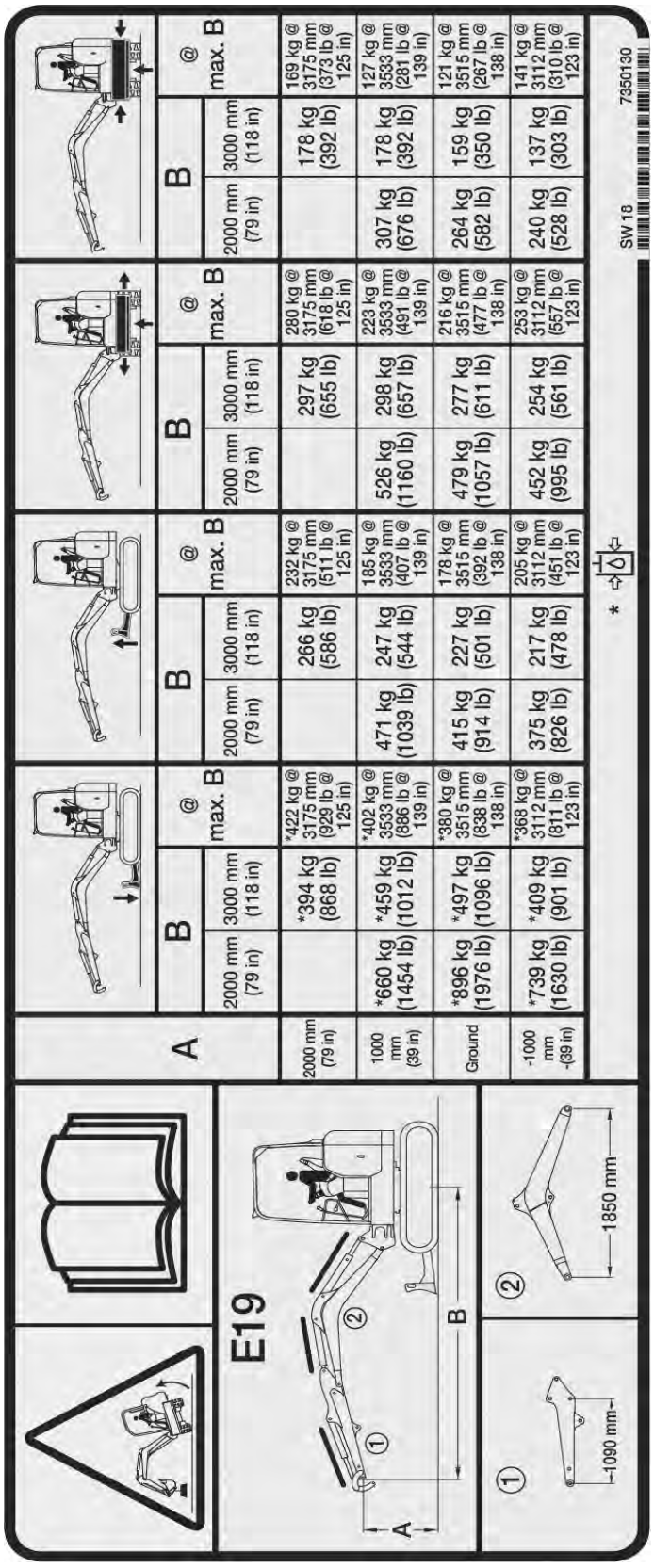
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EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Standard Arm And Cab (With Demolition Kit)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



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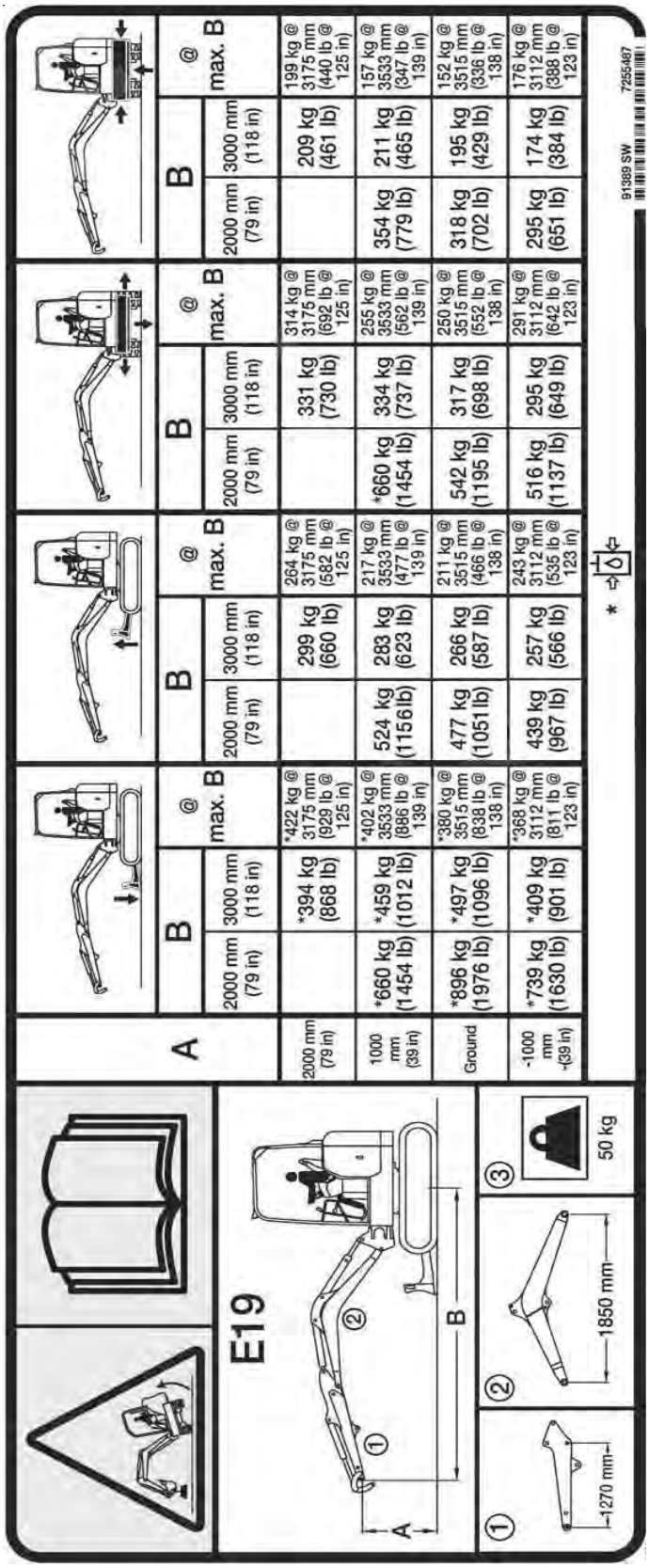
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EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Standard Arm, Optional Counterweight And Cab (No Demolition Kit)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



A	B		@ max. B	B		@ max. B	B		@ max. B	B		@ max. B
	2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)	
2000 mm (79 in)		*394 kg (868 lb)	*422 kg @ 3175 mm (929 lb @ 125 in)		299 kg (660 lb)	264 kg @ 3175 mm (582 lb @ 125 in)		331 kg (730 lb)	314 kg @ 3175 mm (692 lb @ 125 in)		209 kg (461 lb)	199 kg @ 3175 mm (440 lb @ 125 in)
1000 mm (39 in)	*660 kg (1454 lb)	*459 kg (1012 lb)	*402 kg @ 3533 mm (886 lb @ 139 in)	524 kg (1156 lb)	283 kg (623 lb)	217 kg @ 3533 mm (477 lb @ 139 in)	*660 kg (1454 lb)	334 kg (737 lb)	255 kg @ 3533 mm (562 lb @ 139 in)	354 kg (779 lb)	211 kg (465 lb)	157 kg @ 3533 mm (347 lb @ 139 in)
Ground	*896 kg (1976 lb)	*497 kg (1096 lb)	*380 kg @ 3515 mm (838 lb @ 138 in)	477 kg (1051 lb)	266 kg (587 lb)	211 kg @ 3515 mm (466 lb @ 138 in)	542 kg (1195 lb)	317 kg (698 lb)	250 kg @ 3515 mm (552 lb @ 138 in)	318 kg (702 lb)	195 kg (429 lb)	152 kg @ 3515 mm (336 lb @ 138 in)
-1000 mm (-39 in)	*739 kg (1630 lb)	*409 kg (901 lb)	*368 kg @ 3112 mm (811 lb @ 123 in)	439 kg (967 lb)	257 kg (566 lb)	243 kg @ 3112 mm (535 lb @ 123 in)	516 kg (1137 lb)	295 kg (649 lb)	291 kg @ 3112 mm (642 lb @ 123 in)	295 kg (651 lb)	174 kg (384 lb)	176 kg @ 3112 mm (388 lb @ 123 in)

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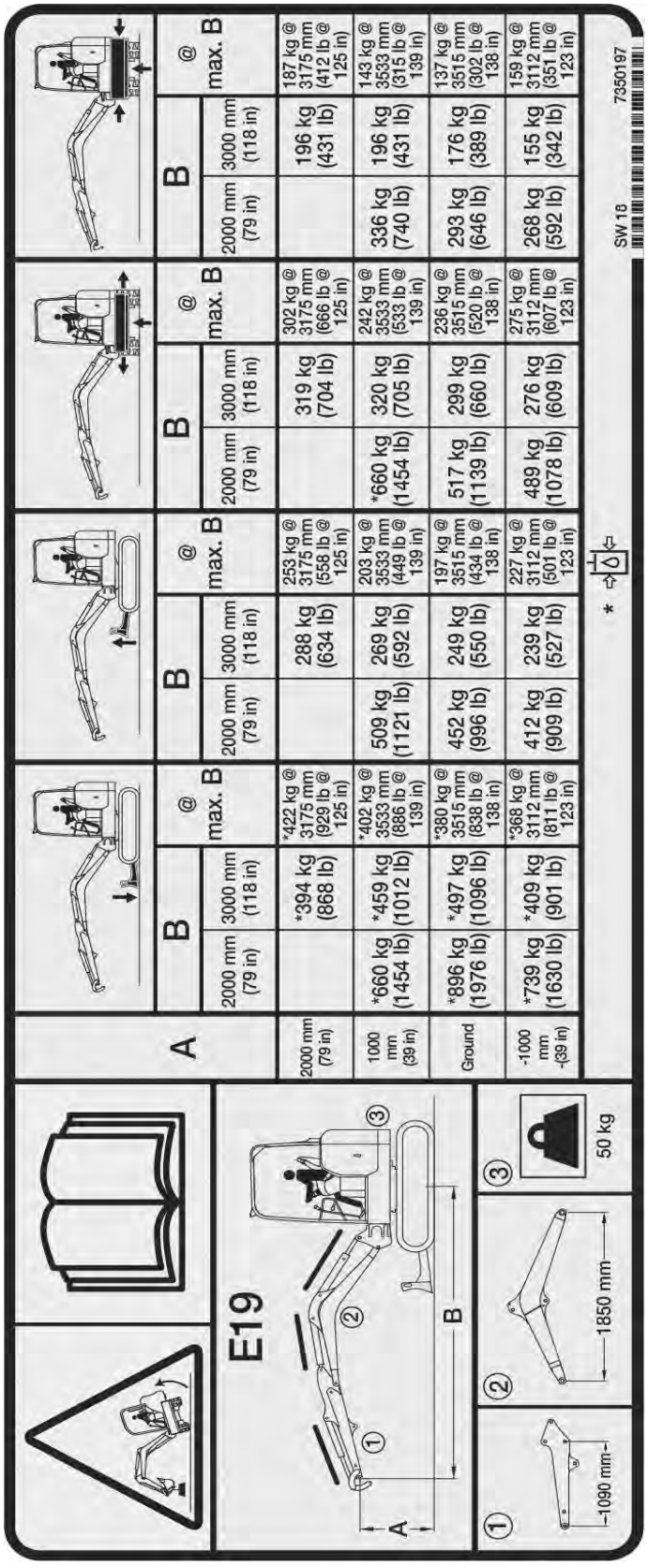
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EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Standard Arm, Optional Counterweight And Cab (With Demolition Kit)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



A	B		@ max. B		B		@ max. B		B		@ max. B	
	2000 mm (79 in)	3000 mm (118 in)			2000 mm (79 in)	3000 mm (118 in)			2000 mm (79 in)	3000 mm (118 in)		
2000 mm (79 in)		*394 kg (868 lb)	*422 kg @ 3175 mm (929 lb @ 125 in)			288 kg (634 lb)	253 kg @ 3175 mm (558 lb @ 125 in)			196 kg (431 lb)	187 kg @ 3175 mm (412 lb @ 125 in)	
1000 mm (39 in)	*660 kg (1454 lb)	*459 kg (1012 lb)	*402 kg @ 3533 mm (886 lb @ 139 in)		509 kg (1121 lb)	269 kg (592 lb)	203 kg @ 3533 mm (449 lb @ 139 in)		*660 kg (1454 lb)	320 kg (705 lb)	242 kg @ 3533 mm (533 lb @ 139 in)		336 kg (740 lb)	196 kg (431 lb)	143 kg @ 3533 mm (315 lb @ 139 in)	
Ground	*896 kg (1976 lb)	*497 kg (1096 lb)	*380 kg @ 3515 mm (838 lb @ 138 in)		452 kg (996 lb)	249 kg (550 lb)	197 kg @ 3515 mm (434 lb @ 138 in)		517 kg (1139 lb)	299 kg (660 lb)	236 kg @ 3515 mm (520 lb @ 138 in)		293 kg (646 lb)	176 kg (389 lb)	137 kg @ 3515 mm (302 lb @ 138 in)	
-1000 mm (-39 in)	*739 kg (1630 lb)	*409 kg (901 lb)	*368 kg @ 3112 mm (811 lb @ 123 in)		412 kg (909 lb)	239 kg (527 lb)	227 kg @ 3112 mm (501 lb @ 123 in)		489 kg (1078 lb)	276 kg (609 lb)	275 kg @ 3112 mm (607 lb @ 123 in)		268 kg (592 lb)	155 kg (342 lb)	159 kg @ 3112 mm (351 lb @ 123 in)	

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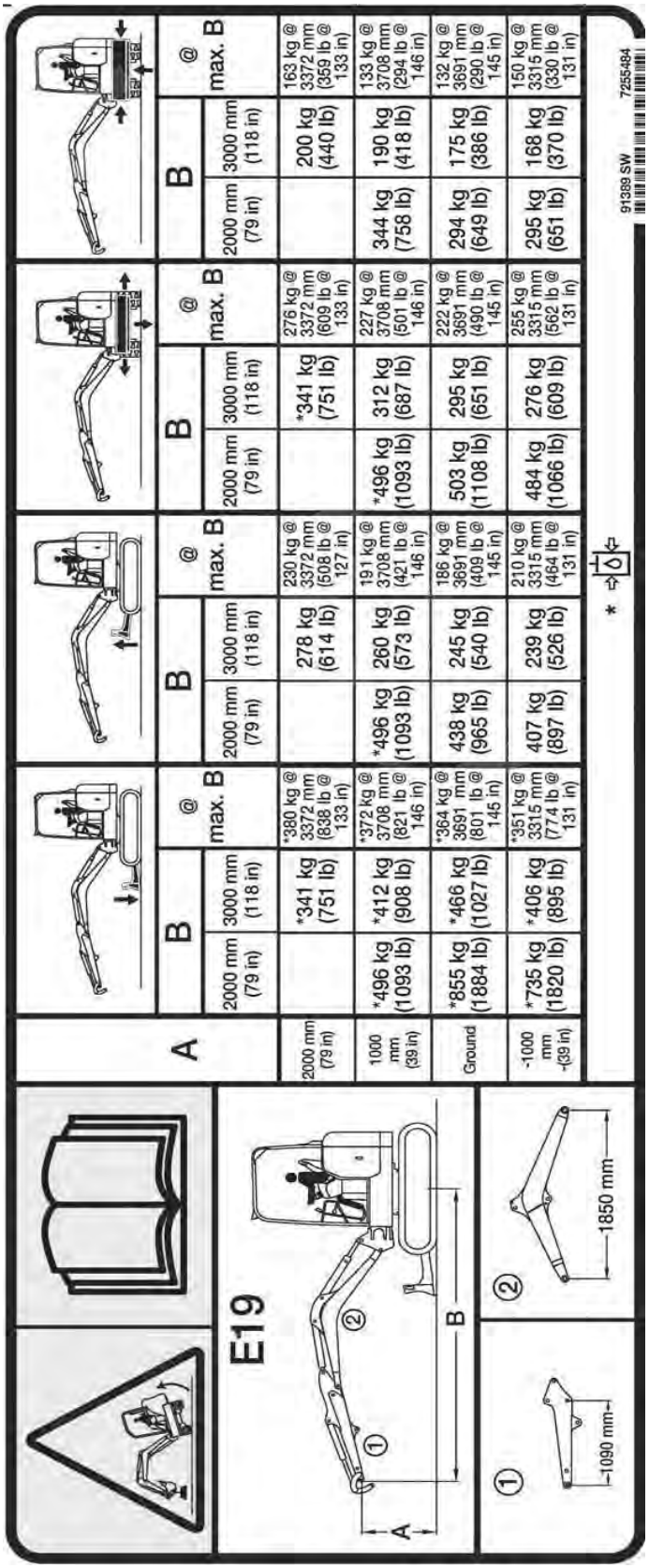
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EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Long Arm And Canopy (No Demolition Kit)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



A	B @ 2000 mm (79 in)	B @ 3000 mm (118 in)	max. B
2000 mm (79 in)		*341 kg (751 lb)	*380 kg @ 3372 mm (838 lb @ 133 in)
1000 mm (39 in)	*496 kg (1093 lb)	*412 kg (908 lb)	*372 kg @ 3708 mm (821 lb @ 146 in)
Ground	*855 kg (1884 lb)	*466 kg (1027 lb)	*364 kg @ 3691 mm (801 lb @ 145 in)
-1000 mm -(39 in)	*735 kg (1820 lb)	*406 kg (895 lb)	*351 kg @ 3315 mm (774 lb @ 131 in)

A	B @ 2000 mm (79 in)	B @ 3000 mm (118 in)	max. B
2000 mm (79 in)		278 kg (614 lb)	230 kg @ 3372 mm (508 lb @ 127 in)
1000 mm (39 in)	*496 kg (1093 lb)	260 kg (573 lb)	191 kg @ 3708 mm (421 lb @ 146 in)
Ground	438 kg (965 lb)	245 kg (540 lb)	186 kg @ 3691 mm (409 lb @ 145 in)
-1000 mm -(39 in)	407 kg (897 lb)	239 kg (526 lb)	210 kg @ 3315 mm (464 lb @ 131 in)

A	B @ 2000 mm (79 in)	B @ 3000 mm (118 in)	max. B
2000 mm (79 in)		*341 kg (751 lb)	276 kg @ 3372 mm (609 lb @ 133 in)
1000 mm (39 in)	*496 kg (1093 lb)	312 kg (687 lb)	227 kg @ 3708 mm (501 lb @ 146 in)
Ground	503 kg (1108 lb)	295 kg (651 lb)	222 kg @ 3691 mm (490 lb @ 145 in)
-1000 mm -(39 in)	484 kg (1066 lb)	276 kg (609 lb)	255 kg @ 3315 mm (562 lb @ 131 in)

A	B @ 2000 mm (79 in)	B @ 3000 mm (118 in)	max. B
2000 mm (79 in)		200 kg (440 lb)	163 kg @ 3372 mm (359 lb @ 133 in)
1000 mm (39 in)	344 kg (758 lb)	190 kg (418 lb)	133 kg @ 3708 mm (294 lb @ 146 in)
Ground	294 kg (649 lb)	175 kg (386 lb)	132 kg @ 3691 mm (290 lb @ 145 in)
-1000 mm -(39 in)	295 kg (651 lb)	168 kg (370 lb)	150 kg @ 3315 mm (330 lb @ 131 in)

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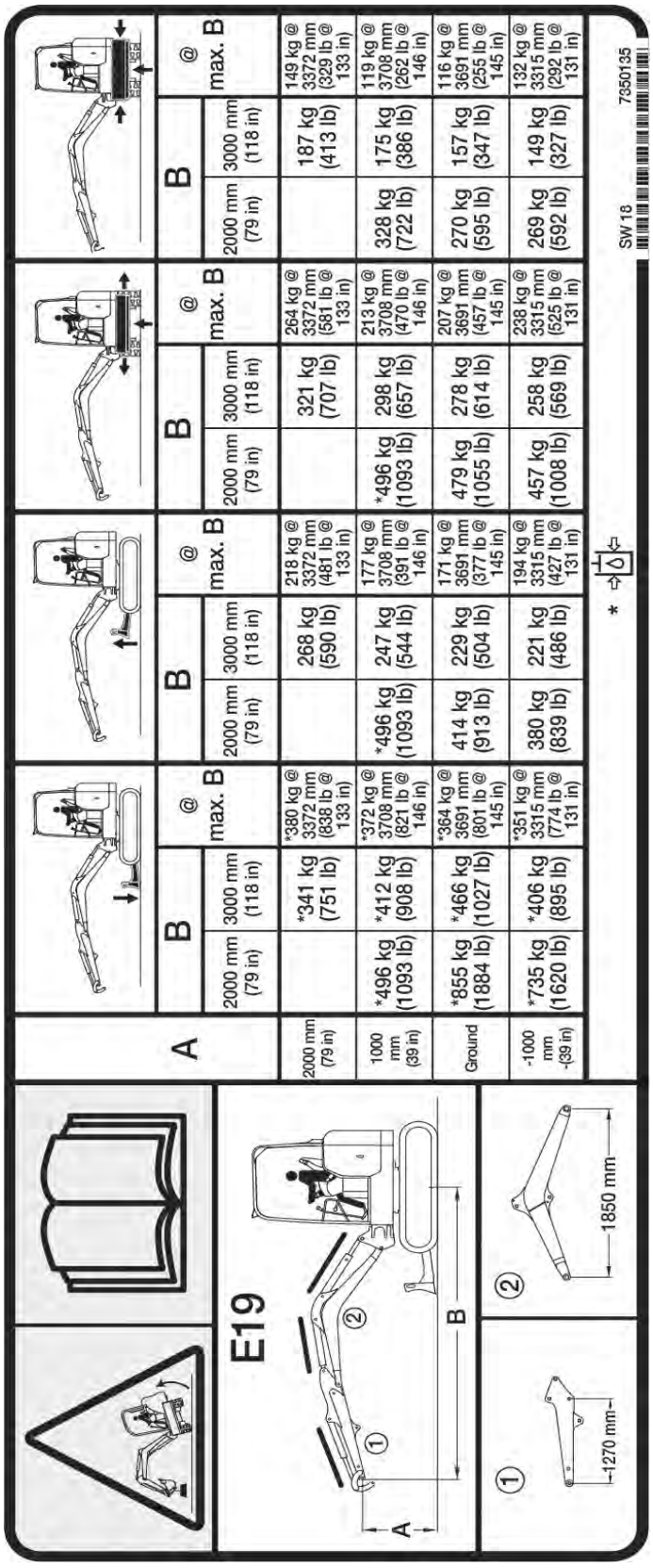
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EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Long Arm And Canopy (With Demolition Kit)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



A	B @ max.	B @ max.	B @ max.	B @ max.	B @ max.
2000 mm (79 in)	*341 kg (751 lb) @ 3372 mm (838 lb @ 133 in)	268 kg (590 lb) @ 3372 mm (481 lb @ 133 in)	321 kg (707 lb) @ 3372 mm (581 lb @ 133 in)	187 kg (413 lb) @ 3372 mm (329 lb @ 133 in)	
1000 mm (39 in)	*412 kg (908 lb) @ 3708 mm (821 lb @ 146 in)	247 kg (544 lb) @ 3708 mm (391 lb @ 146 in)	298 kg (657 lb) @ 3708 mm (470 lb @ 146 in)	175 kg (386 lb) @ 3708 mm (262 lb @ 146 in)	
Ground	*466 kg (1027 lb) @ 3691 mm (801 lb @ 145 in)	229 kg (504 lb) @ 3691 mm (377 lb @ 145 in)	278 kg (614 lb) @ 3691 mm (457 lb @ 145 in)	157 kg (347 lb) @ 3691 mm (255 lb @ 145 in)	
-1000 mm -(39 in)	*406 kg (895 lb) @ 3315 mm (774 lb @ 131 in)	221 kg (486 lb) @ 3315 mm (427 lb @ 131 in)	258 kg (569 lb) @ 3315 mm (525 lb @ 131 in)	149 kg (327 lb) @ 3315 mm (292 lb @ 131 in)	

A	B @ max.	B @ max.	B @ max.	B @ max.	B @ max.
2000 mm (79 in)	*496 kg (1093 lb) @ 3372 mm (838 lb @ 133 in)	*496 kg (1093 lb) @ 3372 mm (481 lb @ 133 in)	*496 kg (1093 lb) @ 3372 mm (581 lb @ 133 in)	328 kg (722 lb) @ 3372 mm (329 lb @ 133 in)	
1000 mm (39 in)	*372 kg (821 lb) @ 3708 mm (821 lb @ 146 in)	414 kg (913 lb) @ 3708 mm (391 lb @ 146 in)	479 kg (1055 lb) @ 3708 mm (470 lb @ 146 in)	270 kg (595 lb) @ 3708 mm (262 lb @ 146 in)	
Ground	*364 kg (801 lb) @ 3691 mm (801 lb @ 145 in)	380 kg (839 lb) @ 3691 mm (377 lb @ 145 in)	457 kg (1008 lb) @ 3691 mm (457 lb @ 145 in)	269 kg (592 lb) @ 3691 mm (255 lb @ 145 in)	
-1000 mm -(39 in)	*351 kg (774 lb) @ 3315 mm (774 lb @ 131 in)	194 kg (427 lb) @ 3315 mm (427 lb @ 131 in)	238 kg (525 lb) @ 3315 mm (525 lb @ 131 in)	132 kg (292 lb) @ 3315 mm (292 lb @ 131 in)	

* 2000 mm (79 in)

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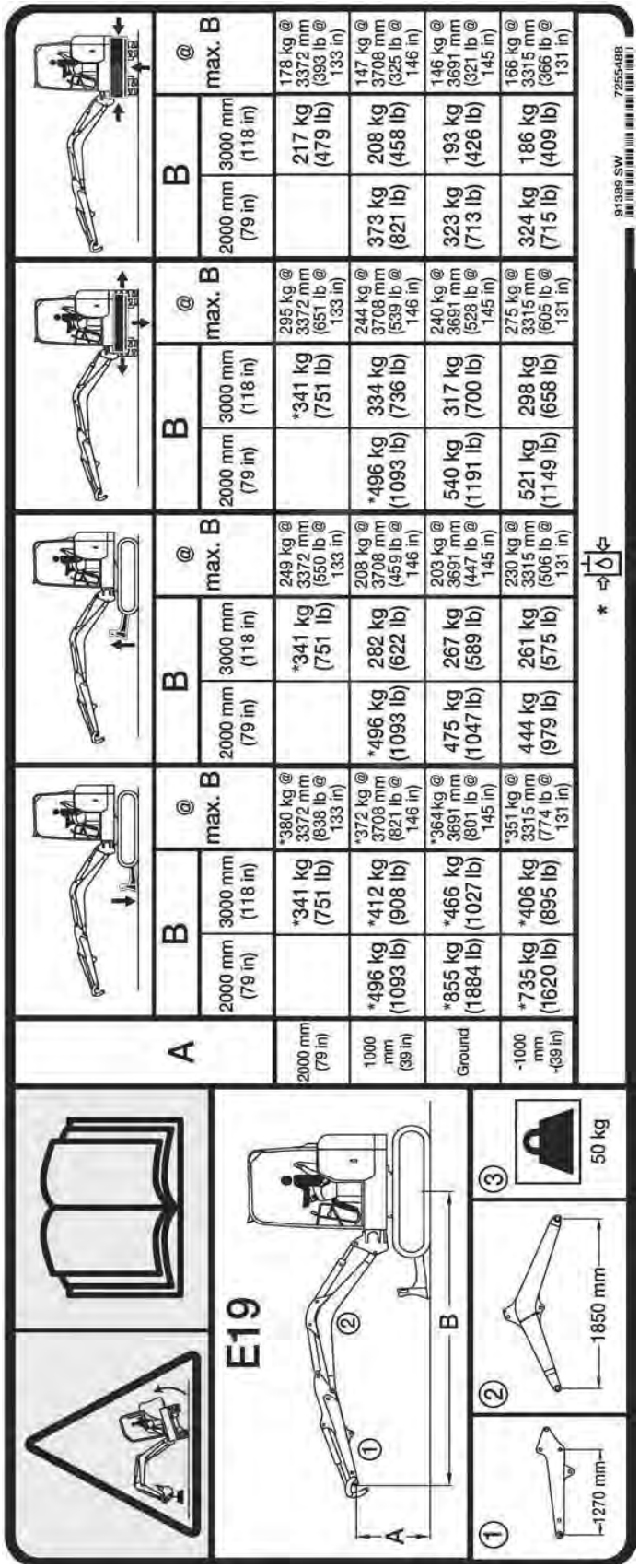
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EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Long Arm, Optional Counterweight And Canopy (No Demolition Kit)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



A	B @ max. B						B @ max. B						B @ max. B						B @ max. B					
	2000 mm (79 in)	3000 mm (118 in)					2000 mm (79 in)	3000 mm (118 in)					2000 mm (79 in)	3000 mm (118 in)					2000 mm (79 in)	3000 mm (118 in)				
2000 mm (79 in)		*341 kg (751 lb)	*380 kg @ 3372 mm (838 lb @ 133 in)					*341 kg (751 lb)	249 kg @ 3372 mm (550 lb @ 133 in)					*341 kg (751 lb)	295 kg @ 3372 mm (651 lb @ 133 in)				217 kg (479 lb)	178 kg @ 3372 mm (393 lb @ 133 in)				
1000 mm (39 in)	*496 kg (1093 lb)	*412 kg (908 lb)	*372 kg @ 3708 mm (821 lb @ 146 in)				*496 kg (1093 lb)	282 kg (622 lb)	208 kg @ 3708 mm (459 lb @ 146 in)				*496 kg (1093 lb)	334 kg (736 lb)	244 kg @ 3708 mm (539 lb @ 146 in)				208 kg (458 lb)	147 kg @ 3708 mm (325 lb @ 146 in)				
Ground	*855 kg (1884 lb)	*466 kg (1027 lb)	*364 kg @ 3691 mm (801 lb @ 145 in)				475 kg (1047 lb)	267 kg (589 lb)	203 kg @ 3691 mm (447 lb @ 145 in)				540 kg (1191 lb)	317 kg (700 lb)	240 kg @ 3691 mm (528 lb @ 145 in)				193 kg (426 lb)	146 kg @ 3691 mm (321 lb @ 145 in)				
-1000 mm (-39 in)	*735 kg (1620 lb)	*406 kg (895 lb)	*351 kg @ 3315 mm (774 lb @ 131 in)				444 kg (979 lb)	261 kg (575 lb)	230 kg @ 3315 mm (506 lb @ 131 in)				521 kg (1149 lb)	298 kg (658 lb)	275 kg @ 3315 mm (605 lb @ 131 in)				186 kg (409 lb)	166 kg @ 3315 mm (366 lb @ 131 in)				

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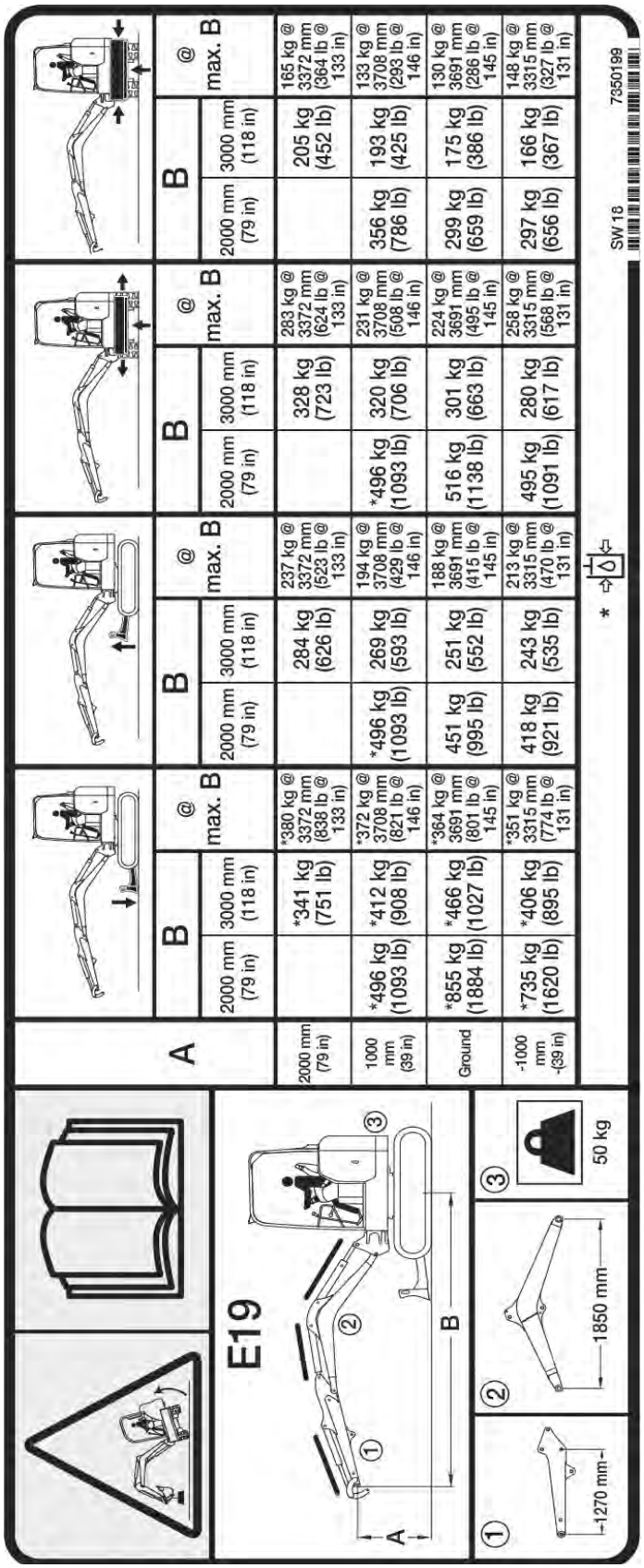
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EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Long Arm, Optional Counterweight And Canopy (With Demolition Kit)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



A	B		@ max. B	B		@ max. B	B		@ max. B	B		@ max. B
	2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)	
2000 mm (79 in)		*341 kg (751 lb)	*380 kg @ 3372 mm (838 lb @ 133 in)		284 kg (626 lb)	237 kg @ 3372 mm (523 lb @ 133 in)		328 kg (723 lb)	283 kg @ 3372 mm (624 lb @ 133 in)		205 kg (452 lb)	165 kg @ 3372 mm (364 lb @ 133 in)
1000 mm (39 in)	*496 kg (1093 lb)	*412 kg (908 lb)	*372 kg @ 3708 mm (821 lb @ 146 in)	*496 kg (1093 lb)	269 kg (593 lb)	194 kg @ 3708 mm (429 lb @ 146 in)	*496 kg (1093 lb)	320 kg (706 lb)	231 kg @ 3708 mm (508 lb @ 146 in)	356 kg (786 lb)	193 kg (425 lb)	133 kg @ 3708 mm (293 lb @ 146 in)
Ground	*855 kg (1884 lb)	*466 kg (1027 lb)	*364 kg @ 3691 mm (801 lb @ 145 in)	451 kg (995 lb)	251 kg (552 lb)	188 kg @ 3691 mm (415 lb @ 145 in)	516 kg (1138 lb)	301 kg (663 lb)	224 kg @ 3691 mm (495 lb @ 145 in)	299 kg (659 lb)	175 kg (386 lb)	130 kg @ 3691 mm (286 lb @ 145 in)
-1000 mm (-39 in)	*735 kg (1620 lb)	*406 kg (895 lb)	*351 kg @ 3315 mm (774 lb @ 131 in)	418 kg (921 lb)	243 kg (535 lb)	213 kg @ 3315 mm (470 lb @ 131 in)	495 kg (1091 lb)	280 kg (617 lb)	258 kg @ 3315 mm (568 lb @ 131 in)	297 kg (656 lb)	166 kg (367 lb)	148 kg @ 3315 mm (327 lb @ 131 in)

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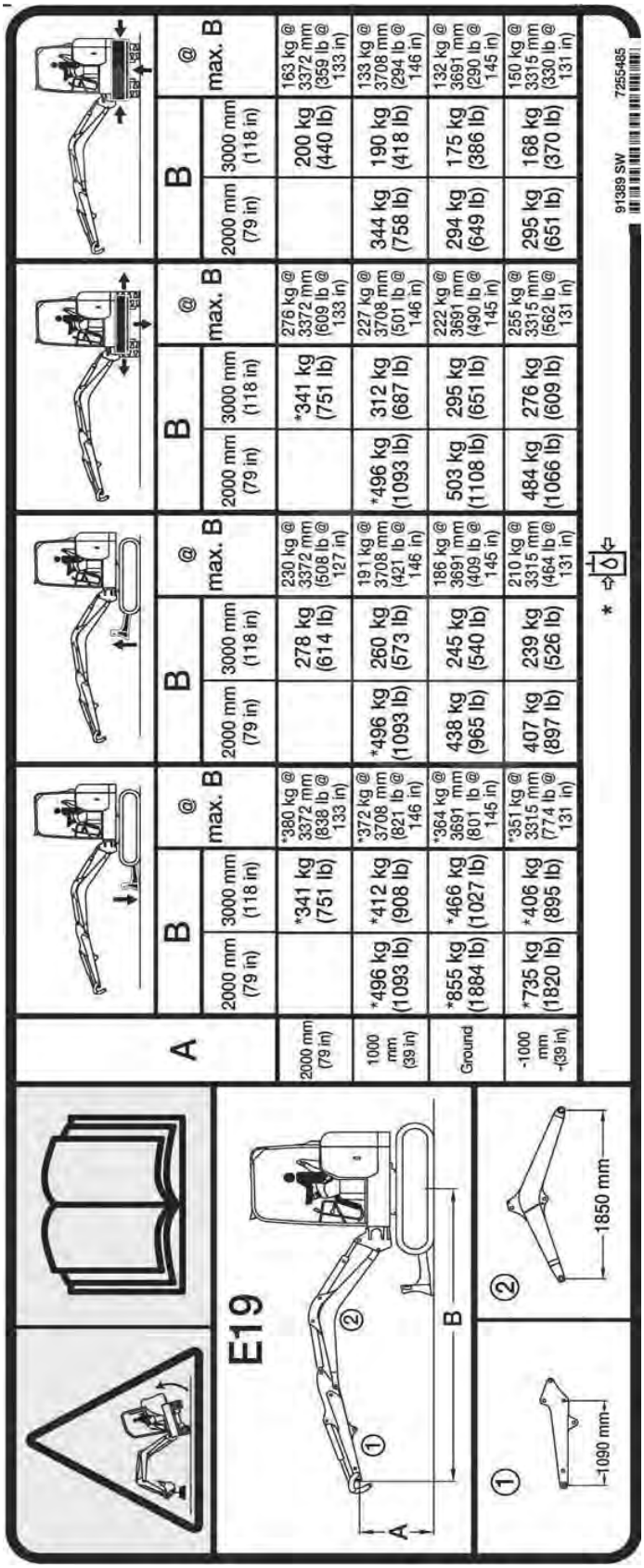
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EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Long Arm And Cab (No Demolition Kit)

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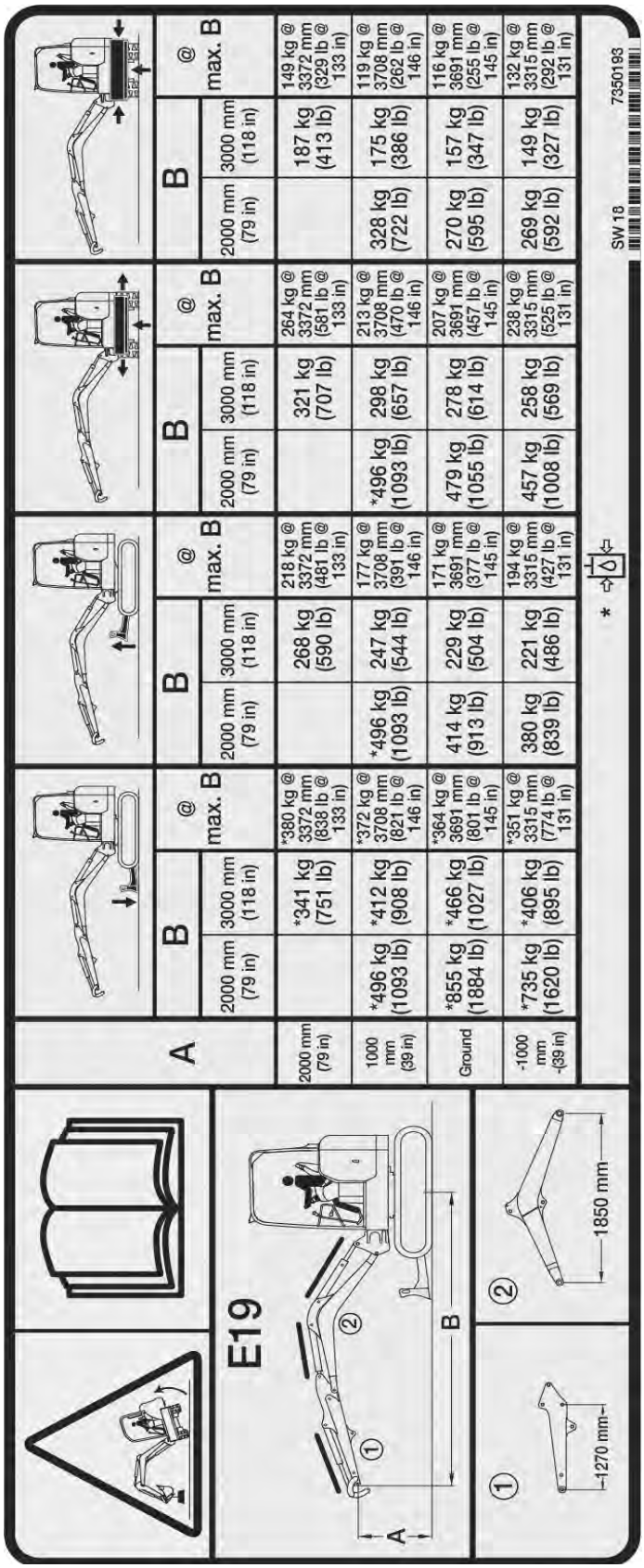
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EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Long Arm And Cab (With Demolition Kit)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



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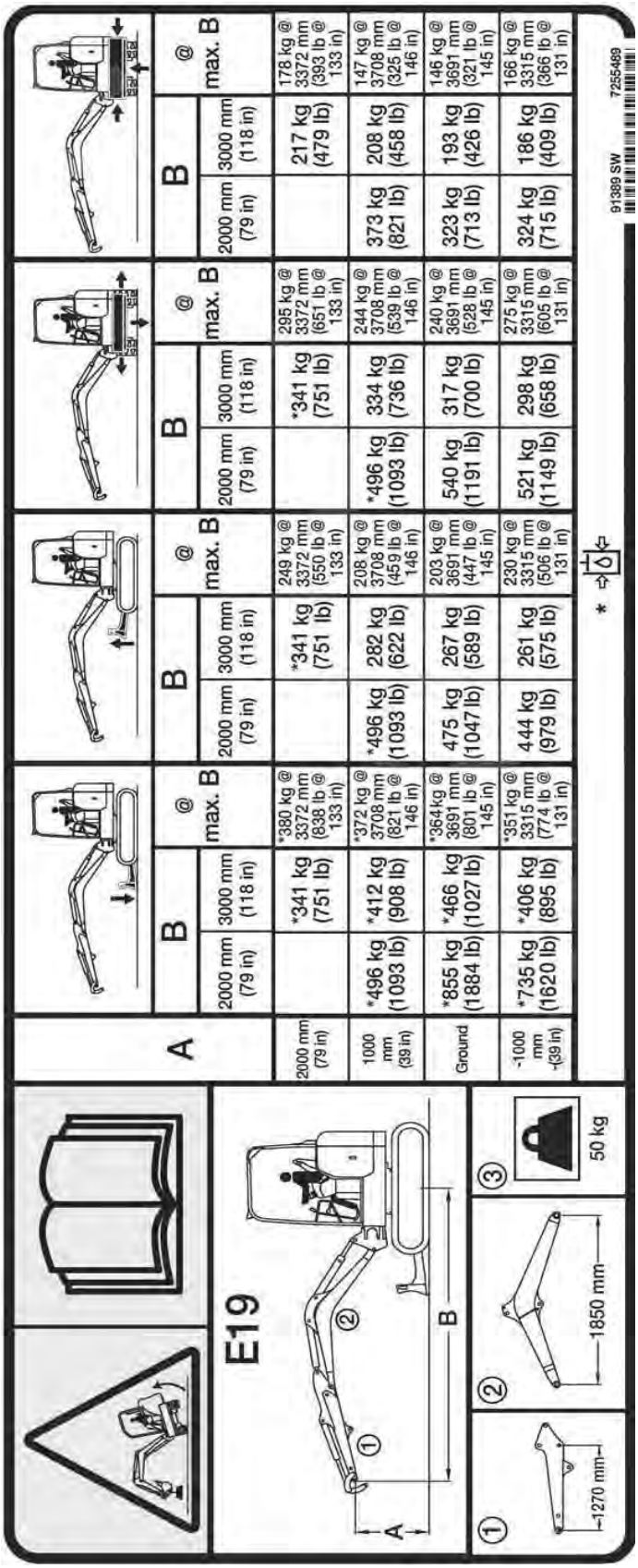
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EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Long Arm, Optional Counterweight And Cab (No Demolition Kit)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



A	B		@ max. B	B		@ max. B	B		@ max. B	B		@ max. B
	2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)	
2000 mm (79 in)		*341 kg (751 lb)	*380 kg @ 3372 mm (838 lb @ 133 in)		*341 kg (751 lb)	249 kg @ 3372 mm (550 lb @ 133 in)		*341 kg (751 lb)	295 kg @ 3372 mm (651 lb @ 133 in)		217 kg (479 lb)	178 kg @ 3372 mm (393 lb @ 133 in)
1000 mm (39 in)	*496 kg (1093 lb)	*412 kg (908 lb)	*372 kg @ 3708 mm (821 lb @ 146 in)	*496 kg (1093 lb)	282 kg (622 lb)	208 kg @ 3708 mm (459 lb @ 146 in)	*496 kg (1093 lb)	334 kg (736 lb)	244 kg @ 3708 mm (539 lb @ 146 in)	373 kg (821 lb)	208 kg (458 lb)	147 kg @ 3708 mm (325 lb @ 146 in)
Ground	*855 kg (1884 lb)	*466 kg (1027 lb)	*364kg @ 3691 mm (801 lb @ 145 in)	475 kg (1047 lb)	267 kg (589 lb)	203 kg @ 3691 mm (447 lb @ 145 in)	540 kg (1191 lb)	317 kg (700 lb)	240 kg @ 3691 mm (528 lb @ 145 in)	323 kg (713 lb)	193 kg (426 lb)	146 kg @ 3691 mm (321 lb @ 145 in)
-1000 mm -(39 in)	*735 kg (1620 lb)	*406 kg (895 lb)	*351 kg @ 3315 mm (774 lb @ 131 in)	444 kg (979 lb)	261 kg (575 lb)	230 kg @ 3315 mm (506 lb @ 131 in)	521 kg (1149 lb)	298 kg (658 lb)	275 kg @ 3315 mm (605 lb @ 131 in)	324 kg (715 lb)	186 kg (409 lb)	166 kg @ 3315 mm (366 lb @ 131 in)

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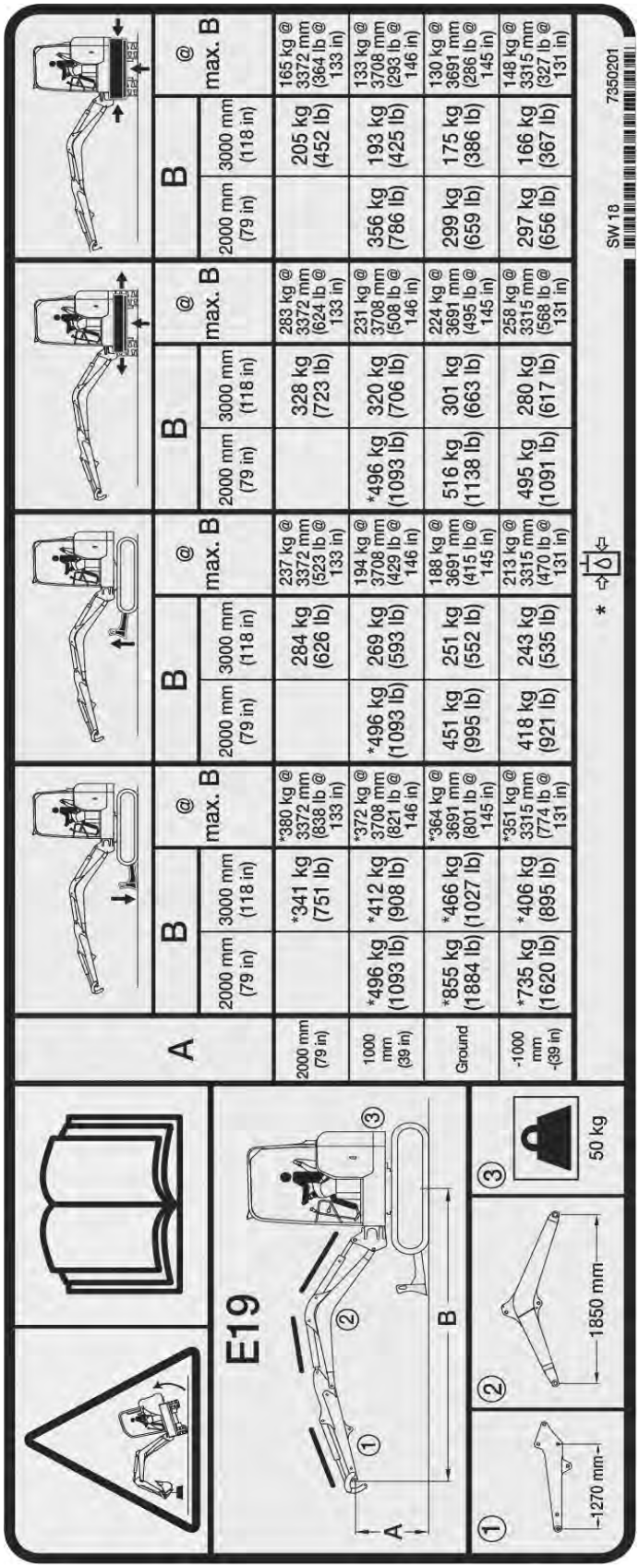
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EXCAVATOR SPECIFICATIONS (CONT'D)

Rated Lift Capacity - With Long Arm, Optional Counterweight And Cab (With Demolition Kit)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



A	B		@ max. B	B		@ max. B	B		@ max. B	B		@ max. B
	2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)		2000 mm (79 in)	3000 mm (118 in)	
2000 mm (79 in)		*341 kg (751 lb)	*380 kg @ 3372 mm (838 lb @ 133 in)		284 kg (626 lb)	237 kg @ 3372 mm (523 lb @ 133 in)		328 kg (723 lb)	283 kg @ 3372 mm (624 lb @ 133 in)		205 kg (452 lb)	165 kg @ 3372 mm (364 lb @ 133 in)
1000 mm (39 in)	*496 kg (1093 lb)	*412 kg (908 lb)	*372 kg @ 3708 mm (821 lb @ 146 in)	*496 kg (1093 lb)	269 kg (593 lb)	194 kg @ 3708 mm (429 lb @ 146 in)	*496 kg (1093 lb)	320 kg (706 lb)	231 kg @ 3708 mm (508 lb @ 146 in)	356 kg (786 lb)	193 kg (425 lb)	133 kg @ 3708 mm (293 lb @ 146 in)
Ground	*855 kg (1884 lb)	*466 kg (1027 lb)	*364 kg @ 3691 mm (801 lb @ 145 in)	451 kg (995 lb)	251 kg (552 lb)	188 kg @ 3691 mm (415 lb @ 145 in)	516 kg (1138 lb)	301 kg (663 lb)	224 kg @ 3691 mm (495 lb @ 145 in)	299 kg (659 lb)	175 kg (386 lb)	130 kg @ 3691 mm (286 lb @ 145 in)
-1000 mm -(39 in)	*735 kg (1620 lb)	*406 kg (895 lb)	*351 kg @ 3315 mm (774 lb @ 131 in)	418 kg (921 lb)	243 kg (535 lb)	213 kg @ 3315 mm (470 lb @ 131 in)	495 kg (1091 lb)	280 kg (617 lb)	258 kg @ 3315 mm (568 lb @ 131 in)	297 kg (656 lb)	166 kg (367 lb)	148 kg @ 3315 mm (327 lb @ 131 in)

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Performance

Operating weight (canopy w/ rubber tracks, counterweight, basic seat and standard bucket)	1781 kg (3926 lb)
If equipped with the following, add:	Cab w/ Heater, add 96 kg (211 lb); Long Arm, add 6 kg (13 lb) Long Blade, add 9 kg (20 lb) Additional Counterweight, add 50 kg (110 lb) Standard Seat, add 8 kg (18 lb) Suspension Seat, add 14 kg (30 lb)
Maximum Approved Attachment Weight	225 kg (496 lb)
Travel Speed (Low / High)	2,5 km/h / 4,0 km/h (1.5 mph / 2.5 mph)
Digging Force (per ISO 6015)	
With Standard Arm	Arm - 10371 N (2331 lb) Bucket - 20835 N (4684 lb)
With Long Arm	Arm - 9279 N (2086 lb) Bucket - 20835 N (4684 lb)

Controls

Steering	Two hand levers (optional foot pedals)
Hydraulics	Two hand operated levers (joysticks) control boom, bucket, arm and upperstructure slew
Blade	Hand lever
Two Speed	Switch on blade lever
Boom Swing	Electric switch in left joystick or R.H. foot pedal
Auxiliary Hydraulics	Electric switch in right joystick or L.H. foot pedal
Auxiliary Pressure Release	Electric switch in right joystick or L.H. foot pedal
Engine	Engine speed control lever, key type start switch
Starting Aid	Glow Plugs - activated by key switch
Brakes Travel Service and Parking Slew Service Holding	 Hydraulic lock in motor circuit Hydraulic lock on motor Spring applied - hydraulic release

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Engine

Make / Model	Kubota D722-E2B-BCZ-7 Tier II
Fuel / Cooling	Diesel NO.2-D / Liquid
Horsepower (SAE Net) @ 2500 rpm	9,9 kW (13,3 hp)
Torque @ 2000 rpm (SAE)	42,3 N•m (31.9 ft-lb)
Number Of Cylinders	3
Displacement	0,719 L (43.9 in^3)
Bore / Stroke	67 x 68 mm (2.64 x 2.68 in)
Lubrication	Forced Lubrication / Cartridge type
Crankcase Ventilation	Closed breathing
Air Cleaner	Dual dry replacement paper elements
Ignition	Diesel-Compression
Low Idle Speed	1200 ± 50 rpm
High Idle Speed	2650 ± 20 rpm
Engine Coolant	Propylene Glycol / water mixture (53% PG / 47% water)

Hydraulic System

Pump Type	Engine driven, dual outlet, variable displacement, load sensing, torque limited, piston pump with gear pump
Pump Capacity Piston Pump Gear Pump	 2 x 15 L/min (2 x 4.0 U.S. gpm) 11,3 L/min (3.0 U.S. gpm)
Auxiliary Flow Standard Flow	 30,0 L/min (7.9 U.S. gpm)
Hydraulic Filter	Full flow replaceable, 3 micron synthetic media element
Control Valve	9 spool, parallel series type, open center.
System Relief Pressure Blade Slew Relief Pressure Boom Swing, Boom Arm, Bucket, and Travel Joystick Control Pressure	 20600 kPa (206 bar) (2987 psi) 13700 kPa (137 bar) (1987 psi) 23100 kPa (231 bar) (3350 psi) 3100 kPa (31 bar) (450 psi)
Auxiliary Relief	18000 kPa (180 bar) (2610 psi)
Arm Port Relief Base And Rod End	25000 kPa (250 bar) (3625 psi)
Boom Port Relief Base End, Boom Port Relief Rod End	21000 kPa (210 bar) (3046 psi) 25000 kPa (250 bar) (3625 psi)
Bucket Port Relief Base And Rod End	25000 kPa (250 bar) (3625 psi)
Blade Port Relief Base End and Track Expansion Port Relief Base End	29000 kPa (290 bar) (4206 psi)
Main Hydraulic Filter Bypass	340 kPa (3,4 bar) (50 psi)

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Hydraulic Cylinders

Cylinder	Bore	Rod	Stroke
Boom (cushion up)	69,9 mm (2.75 in)	41,3 mm (1.63 in)	445,0 mm (17.5 in)
Arm (cushion retract / extend)	60,3 mm (2.375 in)	38,1 mm (1.50 in)	424,9 mm (16.75 in)
Bucket	57,2 mm (2.25 in)	38,1 mm (1.50 in)	385,0 mm (15.16 in)
Boom Swing	60,3 mm (2.375 in)	31,8 mm (1.25 in)	411,2 mm (16.19 in)
Blade	63,5 mm (2.5 in)	34,9 mm (1.375 in)	107,9 mm (4.25 in)
Track Expansion	44,5mm (1.75 in)	25,4 mm (1.00 in)	385,0 mm (15.16 in)

Hydraulic Cycle Times

Bucket Curl	2,00 seconds
Bucket Dump	1,20 seconds
Arm Retract	2,40 seconds
Arm Extend	2,00 seconds
Boom Raise	4,40 seconds
Boom Lower	3,80 seconds
Boom Swing Left (80°)	2,90 seconds
Boom Swing Right (60°)	3,60 seconds
Blade Raise	2,60 seconds
Blade Lower	2,60 seconds
Track Expand	4,10 seconds
Track Retract	3,50 seconds

Electrical

Starting Aid	Glow Plugs
Alternator	12 volt, 40 Amp open frame w/ internal regulator
Battery	12 volt - 500 CCA @ -18°C (0°F)
Starter	12 volt; gear reduction 1,4 kW (1.4 hp)
Instrumentation	Fuel gauge, audible alarm, visual warning for engine functions and hourmeter
Lights Work Lights Boom Light (If Equipped)	 65 watt (2) 35 watt

Drive System

Final Drive	Each track is driven by hydrostatic axial piston motor
Drive Reduction	30,36:1 two stage planetary
Grade ability	30°
Brakes	Hydraulic lock on motor
Maximum Draw bar Pull	19380 N (4357 lbf)

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Slew System

Slew Drive	Orbital motor, direct drive
Slew Circle	Single row shear type ball bearings with internal gear
Gear Reduction	21.5:1
Brake	Spring applied, pressure released
Slew Speed	8,4 rpm

Undercarriage

Crawler Track Design With Expandable Undercarriage	Sealed track rollers with boxed section track roller frame, grease type track adjuster with shock absorbing recoil spring
Width of crawler - Retracted Width of crawler - Expanded	980 mm (38.6 in) 1360 mm (53.5 in)

Capacities

Fuel Tank	19,0 L (5.0 U.S. gal)
Hydraulic Reservoir Only (Centre of Sight Glass)	Tank Cap. 14,3 L (3.78 U.S. gal)
Hydraulic System (with Reservoir)	19,0 L (5.0 U.S. gal)
Cooling System	3,3 L (0.87 U.S. gal)
Engine Oil and Filter	3,3 L (3.5 qt)
Final Drive (each)	0,4 L (0.11 qt)

Tracks

Type	Rubber
Width	230 mm (9.0 in)
Number Of Shoes	Single Assembly
Number of Track Rollers (per side)	3

Ground Pressure

Rubber Tracks	32,4 kPa (0,324 bar) (4.70 psi)

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Environmental

DECLARED SINGLE-NUMBER NOISE EMISSION VALUES In accordance with ISO 4871	
Noise level per Directive 2000/14/EC - L_{wA}	93 dB
Operator noise level per Directive 2006/42/EC — L_{pA}	77 dB

DECLARED VIBRATION EMISSION VALUES In accordance with EN 12096	
Whole-body vibration per ISO 2631-1	0,09 m/s^2 (0.30 ft/s^2)
Hand-arm vibration per ISO 5349-1	0,33 m/s^2 (1.08 ft/s^2)

Temperature Range

Operation and storage	-17° - +43°C (-1.3° - +109.4°F)

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TECHNICAL SERVICE GUIDE SPECIFICATIONS

Engine

Engine Oil Pressure at Low Idle	49 kPa (49 bar) (7.1 psi)
Engine Oil Pressure at High Idle	197 - 441 kPa (1,97 - 4,41 bar) (28.5 - 64 psi)
Location of Number 1 Cylinder	Closest to water pump
Crankshaft Rotation (Facing Crankshaft Pulley)	Clockwise
Valve Clearance (Cold) Intake	145 - 185 mm (.005 - 007 in)
Valve Clearance (Cold) Exhaust	145 - 185 mm (.005 - 007 in)

NOTE: For additional engine specifications, (See Specifications on Page 60-10-2.)

Engine Torques

Fuel Injection Tubeline Nuts	29,4 N•m (21.7 ft-lb)
Glow Plugs	8 - 14 N•m (5.8 - 10 ft-lb)
Injection Pump Mounting Nuts	22 N•m (16 ft-lb)
Valve Cover Bolts	9 - 11 N•m (7.3 - 8.4 ft-lb)
Head Bolts	38 - 42 N•m (28 - 31 ft-lb)

NOTE: For additional engine torques, (See Torque Values on Page 60-10-7.)

Cooling System

Coolant Type and Mix	47% Water and 53% Propylene Glycol
Radiator Cap Pressure	89 kPa (0,9 bar) (13 psi)
Thermostat	Fully Open at 85°C (185°F)

NOTE: For additional cooling system information, (See ENGINE COOLING SYSTEM on Page 60-40-1.)

Excavator Torques

Drive Motor To Frame Bolt	40 - 50 N•m (29 - 37 ft-lb)
Sprocket To Drive Motor	65 - 75 N•m (48 - 55 ft-lb)
Swing Bearing To Frame Bolt	105 - 115 N•m (78 - 85 ft-lb)
Swing Bearing To Upperstructure Bolt	105 - 115 N•m (78 - 85 ft-lb)
Swing Motor Mounting Bolts	115 N•m (85 ft-lb)
Swivel Joint Mounting Bolts	105 - 115 N•m (78 - 85 ft-lb)

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TORQUE SPECIFICATIONS FOR BOLTS

Torque For General SAE Bolts

The following table shows standard torque specifications for bolts with zinc phosphate coating. Bolts purchased from Bobcat that have zinc phosphate coating are specified by the letter “H” following the part number.

	THREAD SIZE	SAE GRADE 5	SAE GRADE 8
N•m (in-lb)	0.250	9 - 10 (80 - 90)	13 - 14 (110 - 120)
	0.3125	21 - 23 (180 - 200)	24 - 27 (215 - 240)
N•m (ft-lb)	0.375	34 - 38 (25 - 28)	48 - 54 (35 - 40)
	0.4375	54 - 61 (40 - 45)	82 - 88 (60 - 65)
	0.500	88 - 95 (65 - 70)	125 - 135 (90 - 100)
	0.5625	125 - 135 (90 - 100)	170 - 190 (125 - 140)
	0.625	170 - 190 (125 - 140)	240 - 190 (175 - 190)
	0.750	300 - 330 (220 - 245)	410 - 450 (300 - 330)
	0.875	450 - 490 (330 - 360)	645 - 710 (475 - 525)
	1.000	645 - 710 (475 - 525)	985 - 1085 (725 - 800)
	1.125	880 - 975 (650 - 720)	1425 - 1600 (1050 - 1175)
	1.250	1200 - 1360 (900 - 1000)	2000 - 2200 (1475 - 1625)
	1.375	1630 - 1830 (1200 - 1350)	2720 - 2980 (2000 - 2200)
	1.500	2040 - 2240 (1500 - 1650)	3530 - 3870 (2600 - 2850)
	1.625	2720 - 2980 (2000 - 2800)	4680 - 5150 (3450 - 3800)
	1.750	3390 - 3730 (2500 - 2750)	5830 - 6500 (4300 - 4800)
	1.875	4270 - 4750 (3150 - 3500)	7450 - 8300 (5500 - 6100)
	2.000	5150 - 5700 (3800 - 4200)	8800 - 9800 (6500 - 7200)

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TORQUE SPECIFICATIONS FOR BOLTS (CONT'D)

Torque For General Metric Bolts

Thread Size (Dia.)	Material		
	8.8	10.9	12.9
M4	2,5 - 3,5 N•m (2.0 - 2.5 ft-lb)	3,8 - 4,2 N•m (2.8 - 3.1 ft-lb)	4,7 - 5,3 N•m (3.5 - 3.9 ft-lb)
M5	5,5 - 6,5 N•m (4.0 - 5.0 ft-lb)	8,4 - 7,6 N•m (5.6 - 6.2 ft-lb)	8,5 - 9,5 N•m (6.2 - 7.0 ft-lb)
M6	9,5 - 10,5 N•m (7.0 - 7.5 ft-lb)	12,2 - 13,7 N•m (9.1 - 10.1 ft-lb)	14,2 - 15,8 N•m (10.4 - 11.6 ft-lb)
M7	15 - 17 N•m (11.0 - 12.5 ft-lb)	20 - 22 N•m (16.2 - 14.7 ft-lb)	23,7 - 26,3 N•m (17.5 - 19.5 ft-lb)
M8	24 - 26 N•m (18 - 19 ft-lb)	29,4 - 32,6 N•m (21.7 - 24.0 ft-lb)	35 - 39 N•m (25.5 - 28.5 ft-lb)
M10	43 - 47 N•m (32 - 35 ft-lb)	57 - 63 N•m (42.0 - 46.5 ft-lb)	71 - 79 N•m (52.5 - 58.5 ft-lb)
M12	75 - 85 N•m (55 - 60 ft-lb)	105 - 115 N•m (78 - 85 ft-lb)	91 - 110 N•m (91 - 110 ft-lb)
M14	125 - 140 N•m (100 - 90 ft-lb)	118 - 133 N•m (118 - 133 ft-lb)	140 - 155 N•m (140 - 155 ft-lb)
M16	190 - 210 N•m (140 - 155 ft-lb)	255 - 285 N•m (188 - 210 ft-lb)	300 - 330 N•m (225 - 245 ft-lb)
M18	260 - 290 N•m (190 - 215 ft-lb)	345 - 385 N•m (255 - 285 ft-lb)	420 - 460 N•m (210 - 340 ft-lb)
M20	370 - 410 N•m (275 - 300 ft-lb)	490 - 550 N•m (360 - 405 ft-lb)	590 - 650 N•m (440 - 490 ft-lb)
M22	500 - 550 N•m (370 - 400 ft-lb)	740 - 760 N•m (554 - 560 ft-lb)	800 - 880 N•m (590 - 650 ft-lb)
M24	640 - 700 N•m (470 - 520 ft-lb)	850 - 950 N•m (625 - 700 ft-lb)	1000 - 1120 N•m (730 - 830 ft-lb)
M27	930 - 1030 N•m (680 - 760 ft-lb)	1230 - 1370 N•m (900 - 1000 ft-lb)	1470 - 1630 N•m (1100 - 1200 ft-lb)
M30	1260 - 1400 N•m (930 - 1030 ft-lb)	1700 - 1900 N•m (1250 - 1400 ft-lb)	2000 - 2200 N•m (1500 - 1600 ft-lb)
M33	1720 - 1900 N•m (1270 - 1400 ft-lb)	2300 - 2500 N•m (2300 - 2500 ft-lb)	2700 - 3100 N•m (2000 - 2300 ft-lb)
M36	200 - 2450 N•m (1620 - 1800 ft-lb)	2900 - 3200 N•m (2200 - 2400 ft-lb)	3500 - 3900 N•m (2600 - 2900 ft-lb)

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HYDRAULIC CONNECTION SPECIFICATIONS

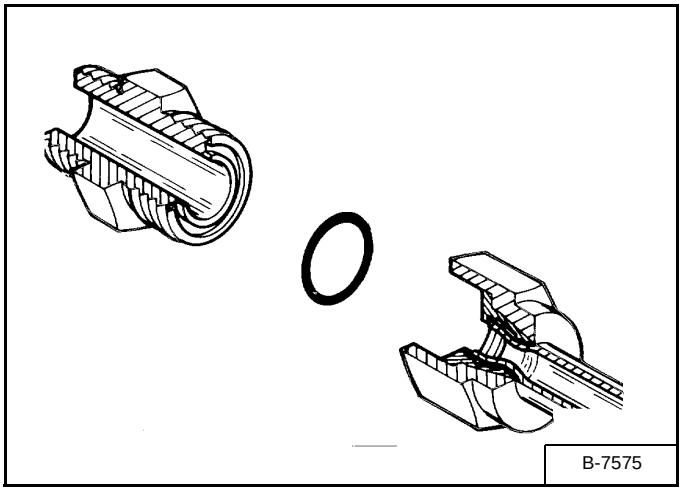
O-ring Face Seal Connection

IMPORTANT

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

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Figure SPEC-40-1



When the fitting is tightened, you can feel when the fitting is tight to eliminate leakage caused by under or over torqued fittings. Use Vaseline petroleum jelly to hold the O-ring in position until the fittings are assembled **[Figure SPEC-40-1]**.

Figure SPEC-40-2

O-ring Face Seal Tightening Torque		
Tubeline Outside Diameter	**Thread Size**	**TORQUE N•m (ft-lb)**
1/4”	9/16” - 18	18 (13)
3/8”	11/16” - 16	30 (22)
1/2”	13/16” - 16	54 (40)
5/8”	1” - 14	81 (60)
3/4”	1-3/16” - 12	114 (84)
7/8”	1-3/16” - 12	133 (98)
1”	1-7/16” - 12	160 (118)
1-1/4”	1-11/16” - 12	209 (154)
1-1/2”	2” - 12	221 (163)

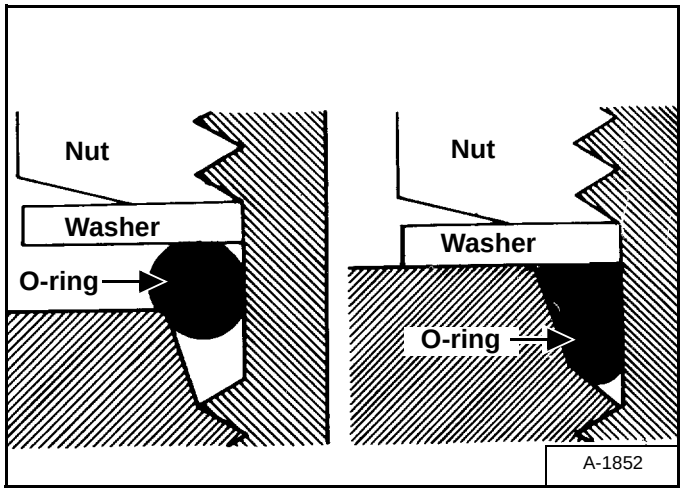
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HYDRAULIC CONNECTION SPECIFICATIONS (CONT'D)

Straight Thread O-ring Fitting

Figure SPEC-40-3



Lubricate the O-ring before installing the fitting. Loosen the locknut and install the fitting. Tighten the locknut until the washer is tight against the surface **[Figure SPEC-40-3]**.

Tubelines And Hoses

Replace any tubelines that are bent or flattened. They will restrict flow, which will slow hydraulic action and cause heat.

Replace hoses which show signs of wear, damage or weather cracked rubber.

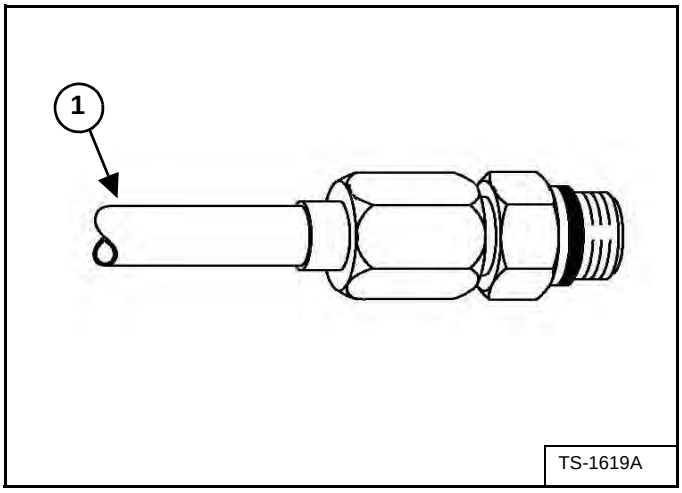
Always use two wrenches when loosening and tightening hose or tubeline fittings.

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Flare Fitting

Figure SPEC-40-4



Use the following procedure to tighten the flare fitting:

Tighten the nut until it makes contact with the seat. Make a mark across the flats of both the male and female parts of the connection (Item 1) **[Figure SPEC-40-4]**.

Use the chart **[Figure SPEC-40-5]** to find the correct tightness needed. If the fitting leaks after tightening, disconnect it and inspect the seat area for damage.

Figure SPEC-40-5

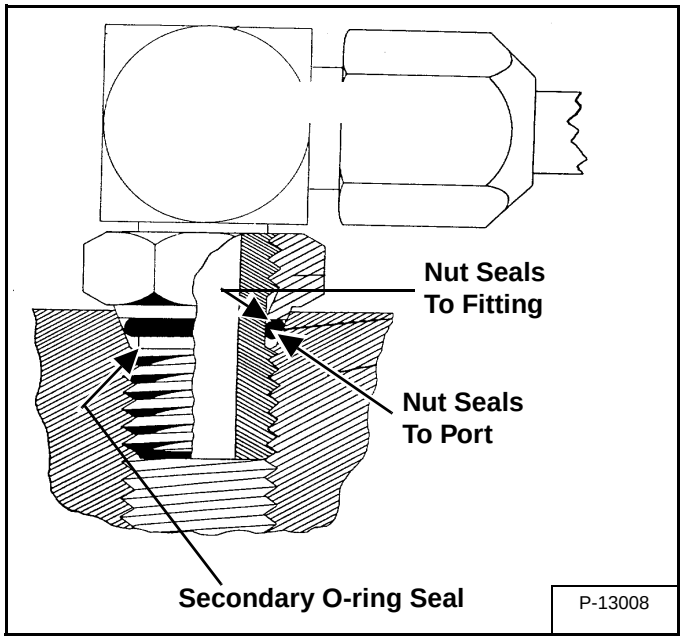
Flare Fitting Tightening Torque		
Tubeline Outside Diameter	**Thread Size**	**TORQUE N•m (ft-lb)**
1/4”	7/16” - 20	18 (13)
5/16”	1/2” - 20	23 (17)
3/8”	9/16” - 18	30 (22)
1/2”	3/4” - 16	54 (40)
5/8”	7/8” - 14	81 (60)
3/4”	1-1/16” - 12	114 (84)
7/8”	1-3/16” - 12	133 (98)
1”	1-5/16” - 12	160 (118)
1-1/4”	1-5/8” - 12	209 (154)
1-1/2”	1-7/8” - 12	221 (163)
2”	2-1/2” - 12	342 (252)

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Port Seal Fitting

Figure SPEC-40-6



The nut is the primary seal, the O-ring is the secondary seal and helps absorb vibration and pressure pulses at the connection **[Figure SPEC-40-6]**.

The hex portion of the nut does not contact the surface of the component when the nut is tight.

Figure SPEC-40-7

Port Seal and O-ring Boss Tightening Torque	
Thread Size	**TORQUE ft-lb (N•m)**
7/16” - 20	18 (13)
9/16” - 18	30 (22)
3/4” - 16	54 (40)
7/8” - 14	81 (60)
1-1/16” - 12	114 (84)
1-3/16” - 12	133 (98)
1-5/16” - 12	160 (118)
1-7/16” - 12	209 (154)
1-5/8” - 12	221 (163)

Use the following procedure to tighten the port seal fitting:

Port seal and nut, washer and O-ring (O-ring Boss) fittings use the same tightening torque valve chart.

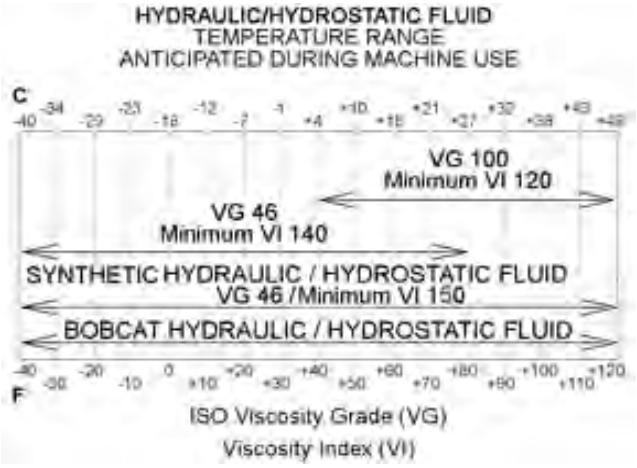
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HYDRAULIC FLUID SPECIFICATIONS

Specifications

Use Bobcat hydraulic fluid (P/N 6903117 - 2, 2 1/2 U.S. gal), (P/N 6903118 - 5 U.S. gal), (P/N 6903119 - 55 U.S. gal).



DO NOT use automatic transmission fluids in the excavator or permanent damage to the hydraulic system will result.

⚠ WARNING

AVOID INJURY OR DEATH

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

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When temperatures below -18°C (0°F) are common, the excavator must be kept in a warm building. Extra warm-up time must be used each time the excavator is started during cold temperature conditions. Cold fluid will not flow easily and it makes action of the hydraulic function slower. Loss of fluid flow to the hydraulic system can cause damage in less than 60 seconds.

⚠ WARNING

During cold weather (0°C [32°F] and below), do not operate machine until the engine has run for at least 5 minutes at less than half throttle. This warm-up period is necessary for foot pedal operation and safe stopping. Do not operate controls during warm-up period.

When temperatures are below -30°C (-20°F), the hydrostatic oil must be heated or kept warm. The hydrostatic system will not get enough oil at low temperatures. Park the machine in an area where the temperature will be above -18°C (0°F) if possible.

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CONVERSIONS

Decimal And Millimeter Equivalent Chart

FRACTIONS	DECIMALS	MM
1/64	0.015625	0.397
1/32	0.03125	0.794
3/64	0.046875	1.191
1/16	0.0625	1.588
5/64	0.078125	1.984
3/32	0.09375	2.381
7/64	0.109375	2.778
1/8	0.1250	3.175
9/64	0.140625	3.572
5/32	0.15625	3.969
11/64	0.171875	4.366
3/16	0.1876	4.762
13/64	0.203125	5.159
7/32	0.21875	5.556
15/64	0.234375	5.953
1/4	0.2500	6.350
17/64	0.265625	6.747
9/32	0.28125	7.144
19/64	0.296875	7.541
5/16	0.3125	7.938
21/64	0.328125	8.334
11/32	0.34375	8.731
23/64	0.359375	9.128
3/8	0.3750	9.525
25/64	0.390625	9.922
13/32	0.40625	10.319
27/64	0.421875	10.716
7/16	0.4375	11.112
29/64	0.453125	11.509
15/32	0.46875	11.906
31/64	0.484375	12.303
1/2	0.5000	12.700

1 mm = 0.03937”

FRACTIONS	DECIMALS	MM
33/64	0.515625	13.097
17/32	0.53125	13.494
35/64	0.546875	13.891
9/16	0.5625	14.288
37/64	0.578125	14.684
19/32	0.59375	15.081
39/64	0.609375	15.478
5/8	0.6250	15.875
41/64	0.640625	16.272
21/32	0.65625	16.669
43/64	0.671875	17.066
11/16	0.6875	17.462
45/64	0.703125	17.859
23/32	0.71875	18.256
47/64	0.734375	18.653
3/4	0.7500	19.050
49/64	0.765625	19.447
25/32	0.78125	19.844
51/64	0.796875	20.241
13/16	0.8125	20.638
53/64	0.828125	21.034
27/32	0.84375	21.431
55/64	0.859375	21.828
7/8	0.8750	22.225
57/64	0.890625	22.622
29/32	0.90625	23.019
59/64	0.921875	23.416
15/16	0.9375	23.812
61/64	0.953125	24.209
31/32	0.96875	24.606
63/64	0.984375	25.003
1	1.000	25.400

0.001 = 0.0254 mm

U.S. To Metric Conversion Chart

	TO CONVERT	INTO	MULTIPLY BY
LINEAR MEASUREMENT	Miles	Kilometers	1.609
	Yards	Meters	0.9144
	Feet	Meters	0.3048
	Feet	Centimeters	30.48
	Inches	Meters	0.0254
	Inches	Centimeters	2.54
	Inches	Millimeters	25.4
AREA	Square Miles	Square Kilometers	2.59
	Square Feet	Square Meters	0.0929
	Square Inches	Square Centimeters	6.452
	Acre	Hectare	0.4047
VOLUME	Cubic Yards	Cubic Meters	0.7646
	Cubic Feet	Cubic Meters	0.02832
	Cubic Inches	Cubic Centimeters	16.39
WEIGHT	Tons (Short)	Metric Tons	0.9078
	Pounds	Kilograms	0.4536
	Ounces (Avdp.)	Grams	28.3495
PRESSURE	Pounds/Sq. In.	Kilopascal	6.895
WORK	Foot–Pounds	Newton–Meter	1.356
LIQUID VOLUME	Quarts	Liters	0.9463
	Gallons	Liters	3.785
LIQUID FLOW	Gallons/Minute	Liters/Minute	3.785
TEMPERATURE	Fahrenheit	Celsius	1.Subtract 32° 2. Multiply by 5/9

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SERVICE TOOLS REQUIRED

The following is a list of service tools required for servicing excavators.

Remote Start Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1563	Remote Start Tool	E20 - E55	This tool has been replaced by the new remote start tool 7217666, see below. MEL1563 includes: MEL1565 and MEL1566.	
MEL1565	Service Tool Harness		Used with MEL1563 to connect remote start tool to machine	
MEL1566	Service Tool Harness Communicator		Used with MEL1563 to connect remote start tool to Service PC	
7217666 (Was 7003031) (Was 6689779)	Remote Start Tool Kit		This tool replaced the original remote start tool kit MEL1563, 7003031 and 6689779. Kit 7217666 includes: 7022042, 6689747, 6689746 and 6689745.	
7022042 (Was 7003030) (Was 6689778)	Remote Start Tool		This tool replaces remote start tool 6689778 and 7003030.	
6689747	Remote Start Tool Harness		Used with 7022042 to connect remote start tool to machine.	
6689746	Remote Start Tool Harness		Used with 7022042 to connect Service PC to remote start tool.	
6689745	BOSS Service Tool Harness			

See BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

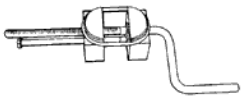
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SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1744	Hydraulic Tester (Flow Meter)	E08 - E85	Hydraulic tester MEL1744, MEL10003 or TWX-RFIK200-S-6 can be used for hydraulic testing.	
MEL10003	Hydraulic Tester (Flow Meter)		MEL10003 and TWX-RFIK22-S-6 are no longer available, order MEL1744.	
TWX-RFIK200-S-6	Hydraulic Tester (Flow Meter)			
MEL1074	O-Ring Seal Hook			
MEL1075	Adjustable Gland Nut Wrench		Includes MEL1075-1 and MEL1075-2	
MEL1075-1	Standard Pins		These are replaceable pins that insert into MEL1075-1 for disassembling various cylinders	No Image Available
MEL1075-2	Offset Pins		These are replaceable pins that insert into MEL1075-1 for disassembling various cylinders	No Image Available
MEL1396-1	Universal Seal Expander		MEL1396 includes: MEL1396-1 and MEL1396-2	
MEL1396-2	Piston Ring Compressor			
MEL1418	Cylinder Hone = 2.00 in			
OEM6275	Cylinder Hone = 2.75 - 3.00 in			
OEM6270	Cylinder Hone = 3.00 - 3.50 in			
OEM6271	Cylinder Hone = 3.50 - 4.00 in			

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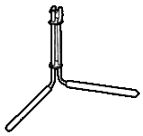
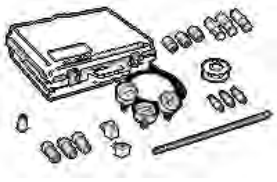
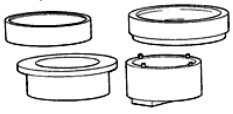
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SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools (Cont'd)

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1033	Rod Seal Installation Tool	E08 - E85		
MEL1355	Hydraulic Test Kit		This test kit includes various gauges, adapters, couplers and hoses that are used when testing hydraulic functions. MEL1355 Includes: MEL1355-1 thru MEL1355-12	
MEL1355-2	1000 psi gauge			
MEL1355-3	5000 psi gauge			
MEL1355-12	Coupler			
MEL1412	Seal Installation Tool	E32, E35	Used for installing Travel Motor Seal	
MEL1413	Seal Installation Tool	E26	Used for installing Travel Motor Seal	
MEL1553	Travel Motor Tool Kit	E42 - E55	MEL1553 Includes: MEL1553-1 thru MEL1553-4	
MEL1553-1	Motor Seal Installation Tool		Included with MEL1553	
MEL1553-2	Motor Seal Installation Tool		Included with MEL1553	
MEL1553-3	Motor Seal Installation Tool		Included with MEL1553	
MEL1553-4	Motor Seal Installation Tool		Included with MEL1553	
6675936 (MEL1560)	Bleed Tool	E08 - E55	Machines with two track tension fittings.	

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SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools (Cont'd)

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
7277225	Bleed Tool	E08 - E85	Machines with one track tension fitting.	
MEL1713	Hydraulic Fitting Kit	E60, E63, E80, E85	This test kit includes various adapters and couplers that are used when testing hydraulic functions. MEL1713 Includes: MEL1713-1 thru MEL1713-12	
MEL1727	Spanner Wrench	E60, E63	Used for removing and installing bearing nut used in the Travel Motor	
MEL1728	Seal Installation Tool	E60, E63	Used for installing Travel Motor Seal	
7323185	Spanner Wrench	E32, E32i, E35 & E35i	Used for removing and installing bearing nut used in the Travel Motor	
7335495	Hydraulic Fitting Kit	E85	This test kit includes various adapters and couplers that are used when testing hydraulic functions. 7335495 Includes: 7335499 thru 7335505	

See BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

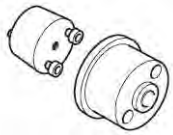
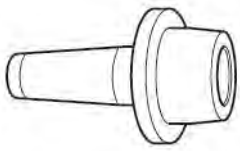
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SERVICE TOOLS REQUIRED (CONT'D)

Engine Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
7009358	Bobcat Diagnostic Interface Box	E63, E85	Interface for using Yanmar SA-D SmartAssist-Direct diagnostic service software.	No Image Available
7031222	Bobcat Engine Analyzer Diagnostic Tool Kit	T4 Bobcat Engine Applications	Includes: Diagnostic Service Tool (7031223), Vehicle Cable 6 pin (7031398), Vehicle Cable 14 pin (7031356), USB Cable (7031357)	
7031370	Rear Main Seal Installer	1.8L & 2.4L Bobcat Engine Models	Used for installing rear main seal	
7031369	Front Seal Installer	T4 Bobcat Engine Applications	Used for installing front seal	
7031371	Valve Spring Compressor	T4 Bobcat Engine Applications	Used for compressing valve springs	
MEL10630	Engine Compression Test Kit	E08 - E55	Includes: MEL1352, MEL1433, MEL1489, MEL1546, MEL1551, MEL1594, MEL1594, MEL10630-1 - MEL10630-11 and MEL10630-14	
MEL1352	Compression Adapter	E26, E42 - E55	Used in glow plug port for testing compression - Included with MEL10630	
MEL1631	Compression Adapter	E32, E35	Used in glow plug port for testing compression, NOT included with MEL10630	
MEL1743	Compression Adapter	E63, E85	Used in glow plug port for testing compression, NOT included with MEL10630	

See BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

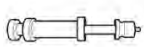
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SERVICE TOOLS REQUIRED (CONT'D)

Engine Tools (Cont'd)

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1237	Fuel Line Adapter	E25 - E55	Adapter used to test delivery valve at the injection pump (Used with pressure gauge MEL1173-1)	
MEL1173-1	Pressure Gauge 10000 psi			
4200	Injector Nozzle Tester			
7268212	Valve Lash Adjusting Wrench	All Bobcat Engine Models		
7255632	Valve Stem Seal Tool			
7313843	Glow Plug Compression Tool	1.8L & 2.4L Bobcat Engine Models	Used in glow plug port for testing compression.	
7299831	Injector Compression Tool	All Bobcat Engine Models	Used in injector port for testing compression.	
7332314	Turbo and Oil Sensor Block Adapter Kit		7332314 includes: 7332313 - Oil Sensor Block Adapter and 7332298 - Turbo Oil Adapter.	

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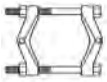
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SERVICE TOOLS REQUIRED (CONT'D)

Electrical Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
7313846 Was 7292829	Injector Signal Tester	Excavators equipped with Bobcat engines	Used to test injector signal on Bobcat 1.8L and 2.4L engines.	
MEL1712	Push Button Starter Switch	E17 - E55		

HVAC Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1581	HVAC Recover, Recycling, Recharging Machine	E25 - E85	MEL1581 is no longer available, order MEL1735 or MEL1736	
MEL1735	Deluxe HVAC Recover, Recycling, Recharging Machine			
MEL1736	Standard HVAC Recover, Recycling, Recharging Machine			
MEL1592	HVAC Refrigerant Identification Tool			
MEL1595	AC Compressor Pulley Puller			

See BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

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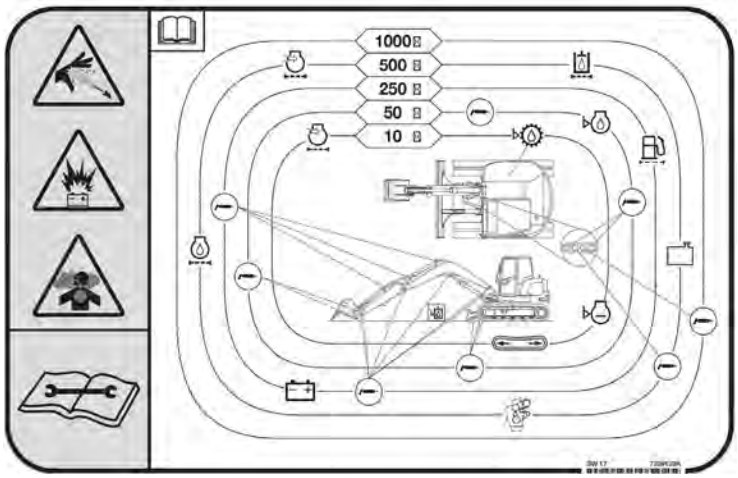
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SERVICE SCHEDULE SYMBOLS



Check Engine Oil	**Check Gear Box and / or Travel Motor Fluid**
Change Engine Oil and Filter	**Change Gear Box and / or Travel Motor Fluid**
Check Engine Coolant	**Check Track Tension, Adjust As Needed**
Change Engine Coolant	**Check Belt Tension, Adjust Or Replace As Needed**
Check Engine Air Filter, Change As Necessary	**Lubricate Grease Fittings**
Drain Contaminants From Fuel Filter	**Seat Belt**
Drain Contaminants From Fuel Tank	**Cab / Canopy**
Change Fuel Filter	**Spark Arrestor Muffler**
Check Hydraulic Fluid	
Change Hydraulic Fluid and Filter(s)	

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