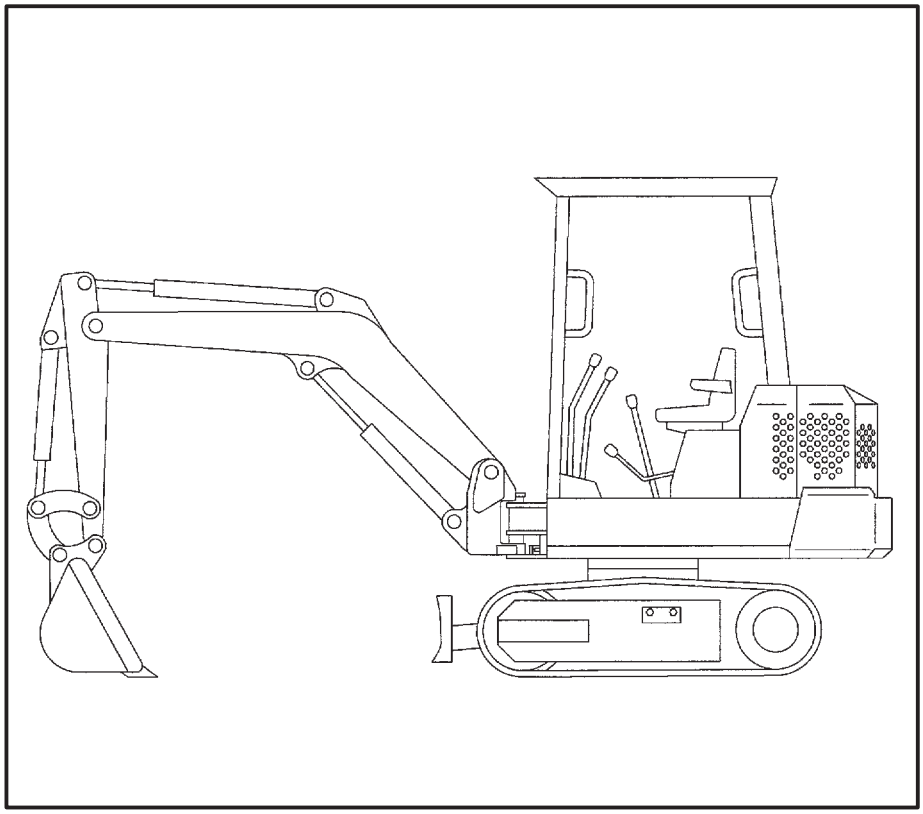
X 225

Excavator

Service Manual

(S/N 508311001–508311999)



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INGERSOLL-RAND

6720347 (6-12)

Printed in U.S.A.

bobcat

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MAINTENANCE SAFETY

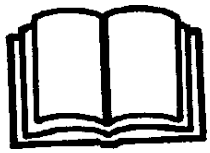
WARNING

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

W-2003-0903

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

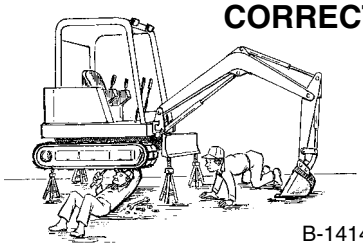
CORRECT



B-10731a

Never service the Bobcat Hydraulic Excavator without instructions.

CORRECT

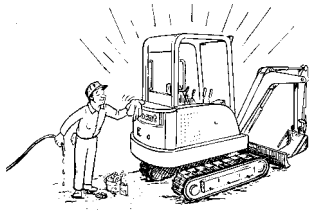


B-14148

Use the correct procedure to lif t and support the excavator.

Always lift the blade fully before installing jackstands.

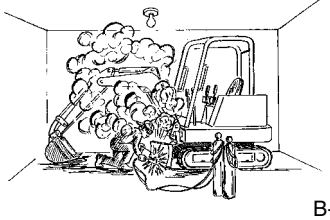
CORRECT



B-14142

Cleaning and maintenance are required daily.

WRONG

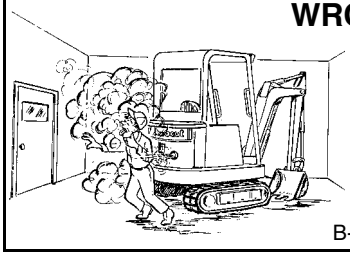


B-14147

Have good ventilation when welding or grinding painted parts.

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

WRONG

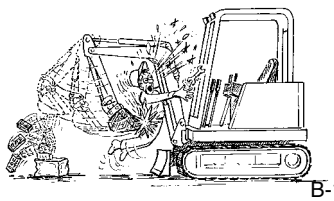


B-14141

Vent exhaust to o utside when engine must be run for service.

Exhaust system must be tightly sealed. Ex haust Fumes can kill without warning.

WRONG

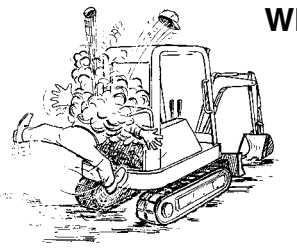


B-14145

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-14146

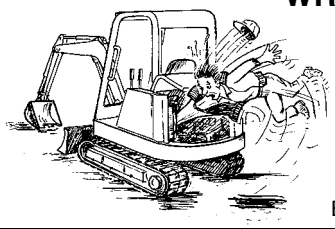
Stop, cool and clean engine of flammable materials before checking fluids.

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 e ngine running, while smoking or when near open flame.

WRONG



B-14143

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

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

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

WRONG



B-6589

Lead-acid batteries produce flammable and explosive gases.

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

Batteries contain acid which burns eyes or skin on contact. Wear protective clothing. If acid contacts body, flush well with water. For eye contact flush well and get immediate medical attention.

Maintenance procedures which are given in the Operation & Maintenance Manual can be perform ed 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.

MSW20-0805

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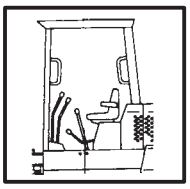
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FOREWORD

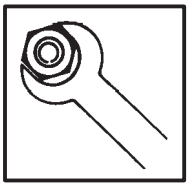
This manual is for the Bobcat hydraulic excavator mechanic. It provides necessary servicing and adjustment procedures for the hydraulic excavator and its component parts and systems. Refer to the Operation & Maintenance Manual for operating instructions, starting procedure, daily checks, etc.

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

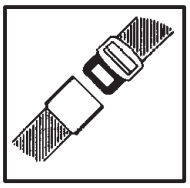
1. Check that the operatorcanopy is in good condition and is not modified.



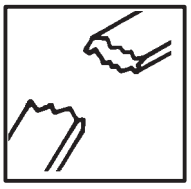
2. Check that the operating canopy mounting hardware is tightened and is Melroe approved.



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



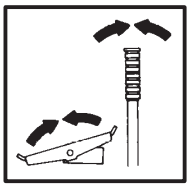
4. Inspect for loose or broken parts or connections.



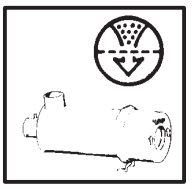
5. Machine signs must belegible and in the correct location.



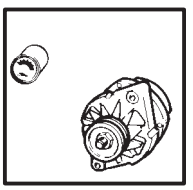
6. Steering levers, control levers and foot pedals must return to neutral. Control lock mustlock controls securely.



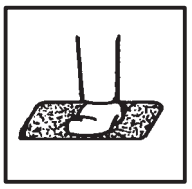
7. Inspect the air cleaner for damage or leaks. Check the condition of the element.



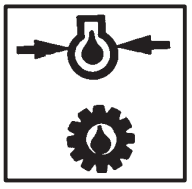
8. Check the electrical charging system.



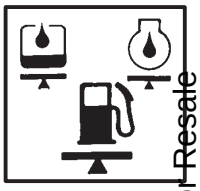
9. Safety treads must be in good condition.



10. Check for the correct function of the the indicator lamps.



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



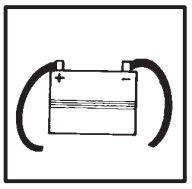
12. Inspect for fuel, oil orhydraulic leaks..



13. Lubricate the hydraulic excavator.



14. Check the condition of the battery and cables.



15. Check for any field modifications not completed.



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



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SAFETY INSTRUCTIONS

WARNING

Instructions are necessary before operating or servicing machine. Read Operation & Maintenance Manual, 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. Failure to follow instructions can cause injury or death.

W–2003–0797

The following publications provide information on the safe use and maintenance of the excavator 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 excavator gives operating information as well as routine maintenance and service procedures. It is a part of the excavator and must stay with the machine when it is sold. Replacement Operation & Maintenance Manuals can be ordered from your Bobcat Excavator dealer.
- The excavator has machine signs (decals) which instruct on the safe operation and care. The signs and their locations are shown in the Operation & Maintenance Manual. Replacement signs are available from your Bobcat Excavator dealer.
- The CIMA Safety Manual delivered with the excavator gives information for safe operating and standard signals.
- The Service Manual and Parts Manual are available from Bobcat Excavator dealers for use by mechanics to do shop-type service and repair work.

WARNING

Warnings on the machine and in the manuals are for your safety. Failure to obey warnings can cause injury or death.

W–2044–1285

IMPORTANT

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

I–2019–0284

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Safety Alert Symbol: This Safety Symbol is used for important safety messages. When you see this symbol follow the safety message to avoid personal injury or death.

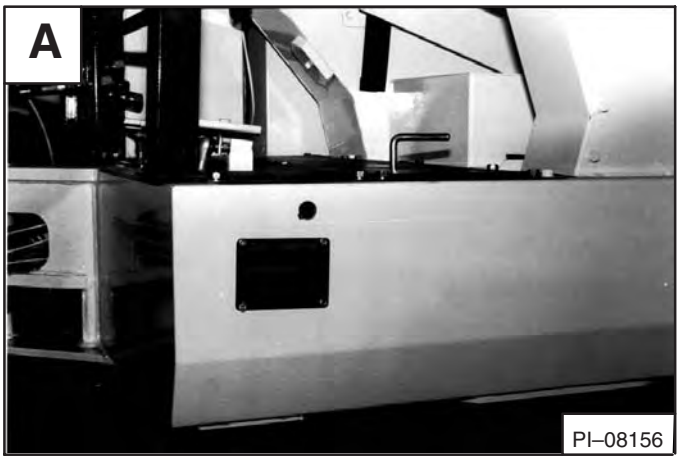
- Wear tight fitting clothing. Always wear safety glasses when maintaining or servicing the excavator. Safety glasses, hearing protection or excavator special application kits are required for some work. See your dealer for Melroe Safety equipment.
- Know where fire extinguishers and first aid kits are located and how to use them.
- Do not use the Bobcat excavator where exhaust, arcs, sparks or hot components can contact flammable material, explosive dust or gases.
- The engine compartment and engine cooling system must be inspected every day and cleaned if necessary to prevent a fire hazard and overheating.
- Check all electrical wiring and connections for damage. Keep the battery terminals clean and tight. Repair or replace any damaged part.
- Check fuel and hydraulic tubes, hoses and fittings for damage and leakage. Never use open flame or bare skin to check for leaks. Tighten or replace any parts that show leakage. Always clean fluid spills. Do not use gasoline or diesel fuel for cleaning parts. Use commercial nonflammable solvents.
- Follow any environmental safety regulations when disposing of used fluids such as engine oil, grease or anti–freeze.
- Do not use ether or starting fluids on an engine that has glow plugs. These starting aids can cause an explosion and injure you or bystanders.
- Always clean the excavator and disconnect the battery before doing any welding. Cover rubber hoses, battery and all other flammable parts. Keep a fire extinguisher near the excavator when welding. Have good ventilation when grinding or welding painted parts. Wear a dust mask when grinding painted parts. Toxic dust or gas can be produced.
- Stop the engine and let it cool before adding fuel. No smoking!
- Use the procedure in the Operation & Maintenance or Service Manuals for connecting the battery.

SERIAL NUMBER LOCATIONS

Always use the serial number of the machine 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.

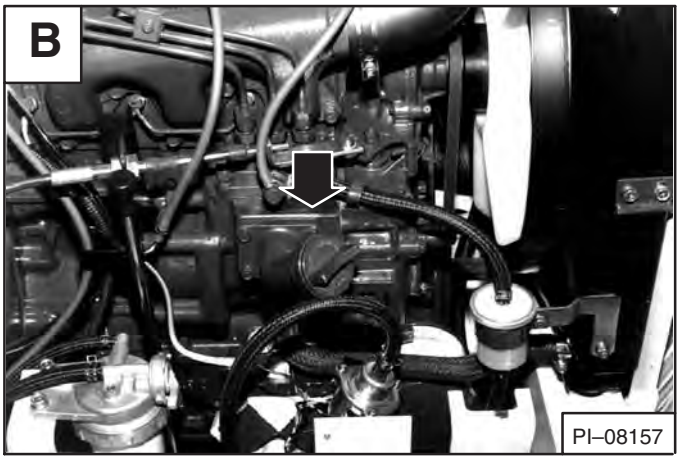
HYDRAULIC EXCAVATOR SERIAL NUMBER

The excavator serial number is on the machine frame, at the left side near the front corner **[A]**.



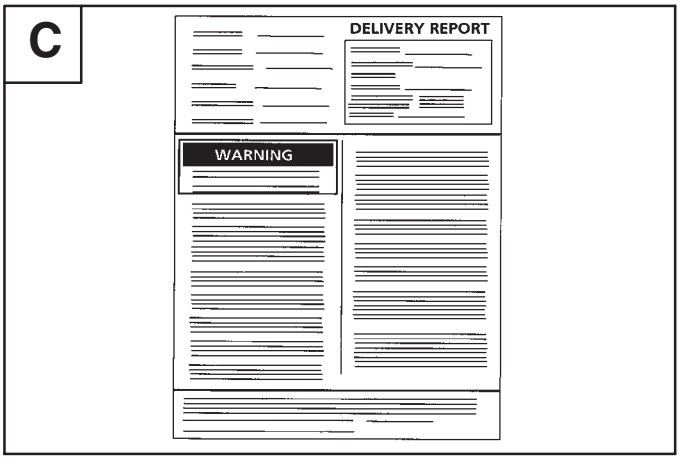
ENGINE SERIAL NUMBER

The engine serial number is located on the engine block, near the fuel injection pump **[B]**.



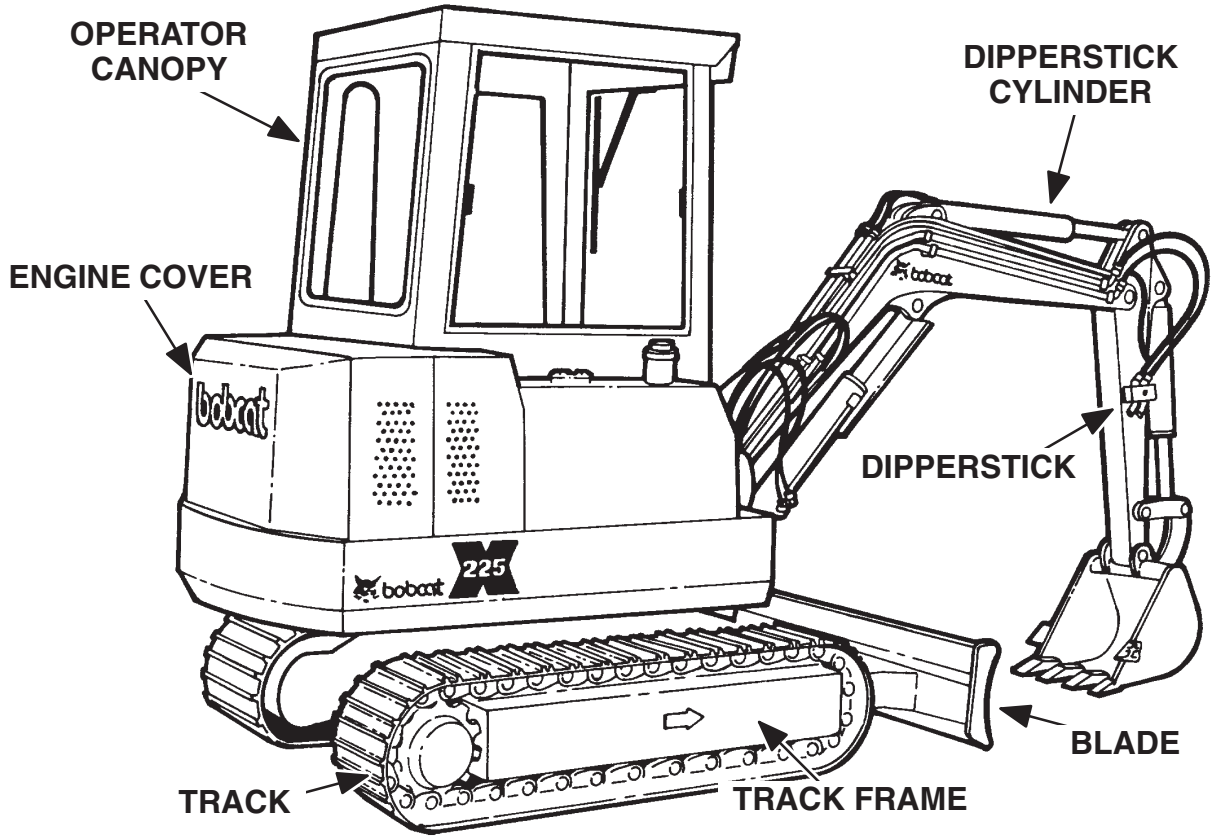
DELIVERY REPORT

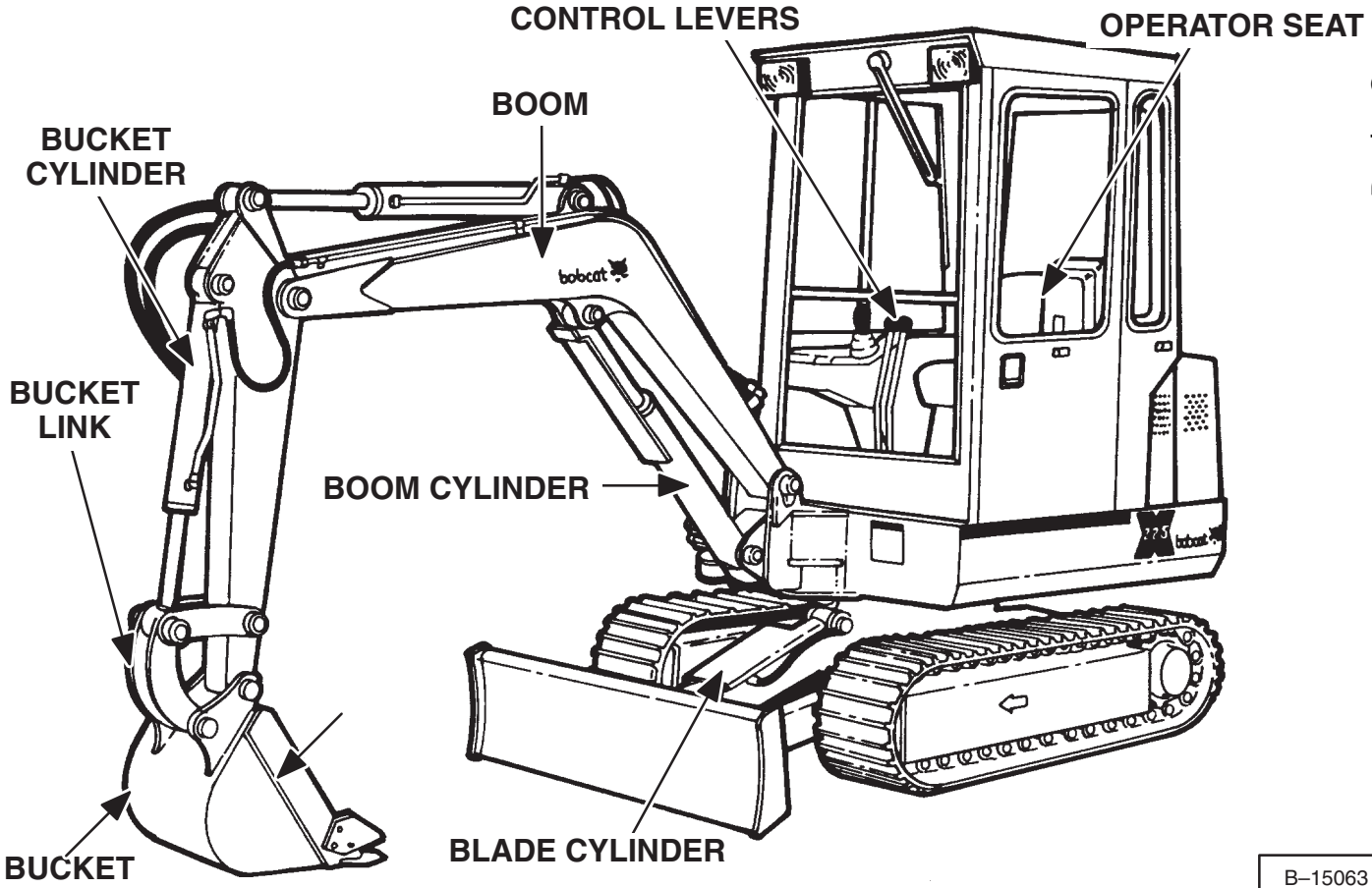
The Delivery Report must be explained to the owner/operator by the dealer. The dealer is to fill out the form and the owner/operator sign the formto indicate his understanding **[C]**.



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HYDRAULIC EXCAVATOR IDENTIFICATION





B–15063
B–15062

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Page Number

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Procedure 1–10

SERVICE SCHEDULE
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USING A BOOSTER BATTERY (JUMP STARTING)
Procedure 1–9

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SERVICE SCHEDULE

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 Hydraulic Excavator.

⚠ WARNING

Instructions are necessary before operating or servicing machine. Read Operation & Maintenance Manual, 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. Failure to follow instructions can cause injury or death.

W–2003–0797

SERVICE SCHEDULE		HOURS					
ITEM	**SERVICE REQUIRED**	**8–10**	**50**	**100**	**250**	**500**	**1000**
Engine Air Cleaner	Check & empty dust cap as required.	■					
Engine Oil	Check the oil level & add oil as needed.	■					
Engine Coolant System	Check radiator coolant level.	■					
Indicator Lights	Check for correct operation.	■					
Operator Canopy	Check the fastening bolts, nuts & condition of canopy.	■					
Seat Belt & Control Locks	Check the condition & that fasteners are tight.	■					
Safety Signs (Decals)	Check for damaged signs (decals) and safety treads	■					
Safety Treads	replace as needed.	■					
Tracks	Check and adjust tension.	■					
Hydraulic Reservoir	Check fluid level.	■					
All Machinery Pivot Pts.	Lubricate 20 grease fittings.	■					
Fuel Tank	Drain water & sediment from fuel tank.		■				
Swing Circle	Lubricate two grease fittings.		■				
Swing Pinion	Lubricate one grease fitting.		■				
Alternator Belt	Check & adjust tension.			■			
Engine Oil & Filter	Replace oil & filter element.			■			
Final Drive Case	Check fluid level & add oil as needed.				■		
Hydraulic Filter	Replace filter element.				■		
Fuel Filters	Replace filter elements.				■		
Battery	Check & clean cable ends & check electrolyte level.				■		
Air Cleaner	Replace the filter element.				■		
Cooling System	Clean the radiator fins.					■	
Alternator & Starter	Check the condition.					■	
Engine Valve Clearance	Check & adjust valve clearance.					■	
Cooling System	Drain, flush & add new coolant to the cooling system.						■
Hydraulic Tank	Change the fluid, clean fill neck strainer & suction strainer.						■
Final Drive Case	Change the oil.						■

After the first 250 hours of machine operation do the following:
- **Change oil in final drive case.**
- **Check and adjust engine valve clearance.**

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ENGINE COVER

Procedure

WARNING

AVOID INJURY

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

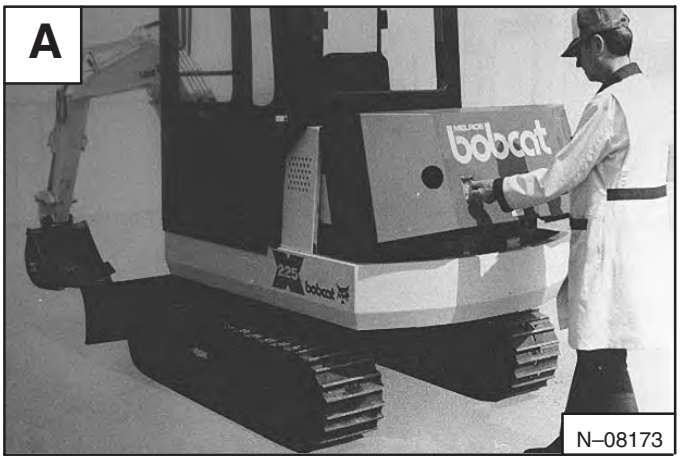
W–2012–0290

WARNING

Keep the engine cover closed when operating the machine.

W–2141–0189

Open the engine cover to service the engine. Pull on the latches and lift the engine cover until it is fully raised **[A]**.



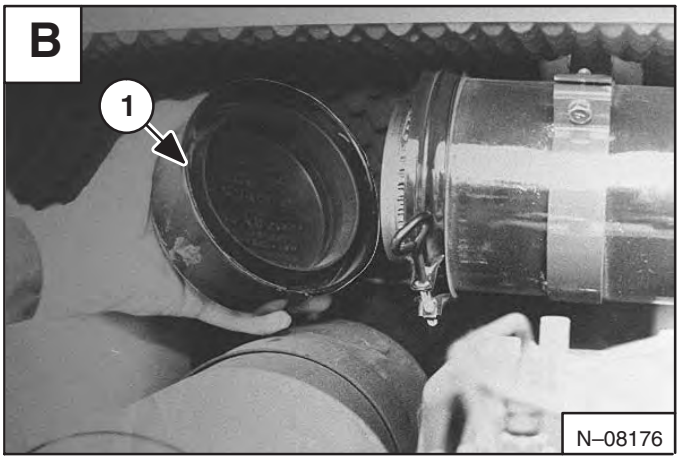
AIR CLEANER SERVICE

Replacing The Filter Element

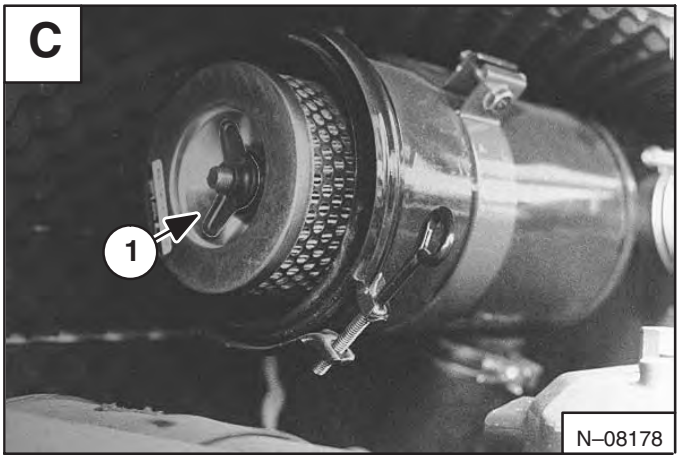
See the *SERVICE SCHEDULE* Page 1–1 for the correct service interval.

Service the air cleaner as follows:

Remove the dust cup (Item 1) **[B]**.



Remove the wing nut (Item 1) **[C]**.



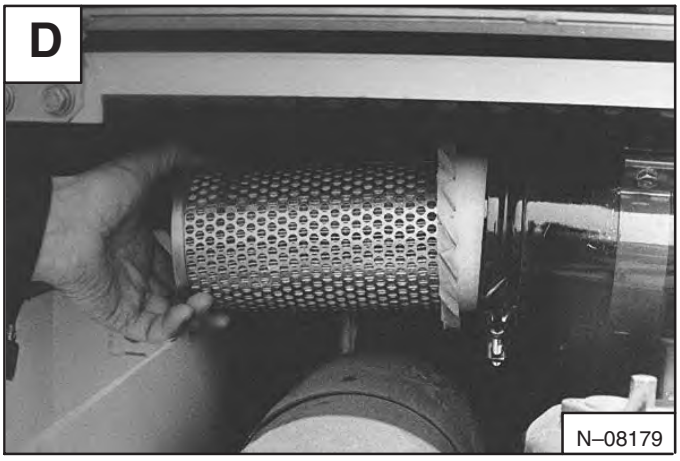
Remove the filter element **[D]**.

Check the air cleaner housing for damage.

Install a new air filter element. Install and tighten the wing nut.

Install the dust cup so the arrow points up.

Check that the air cleaner hose clamps are tight.



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FUEL SYSTEM

Fuel Specifications

Use Number 2 diesel fuel in the engine. During very cold temperatures, Number 1 fuel can be used.

Fuel System Service

The fuel level in the tank is indicated by the fuel gauge or by the sight tube (Item 1) **[A]** on the side of the fuel tank.

⚠ WARNING

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

W–2063–0887

Use the key to un–lock the fuel fill cap **[B]**.

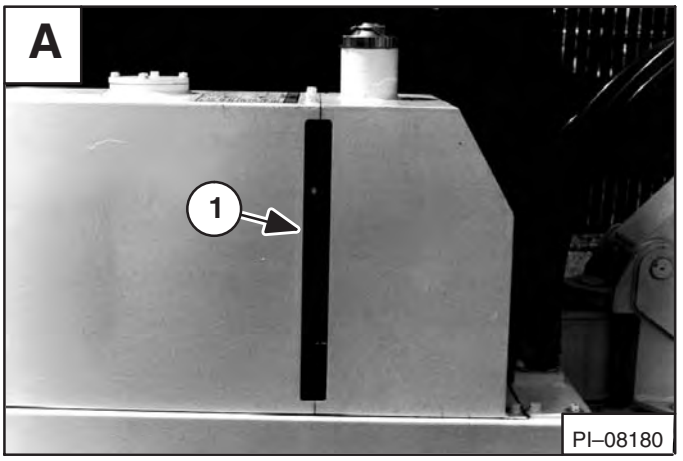
Turn the fill cap to remove it from the fuel tank **[C]**.

NOTE: The fuel fill strainer can be removed for cleaning. Make sure it is installed before adding fuel to the tank.

Use a clean, approved safety container to add fuel to the tank.

Add fuel only in an area that has a free movement of air and no open flames or sparks. NO SMOKING!

After the tank is full, install and tighten the fuel fill cap.







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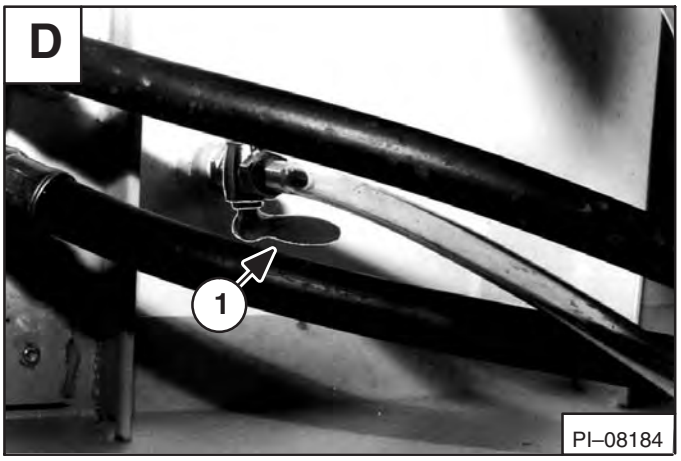
FUEL SYSTEM (Cont'd)

To remove the water and sediment from the fuel tank, open the drain (Item 1) **[A]** on the bottom of the tank.

⚠ WARNING

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 which can result in injury or death.

W–2103–1285



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ENGINE LUBRICATION SYSTEM

Checking The Engine Oil

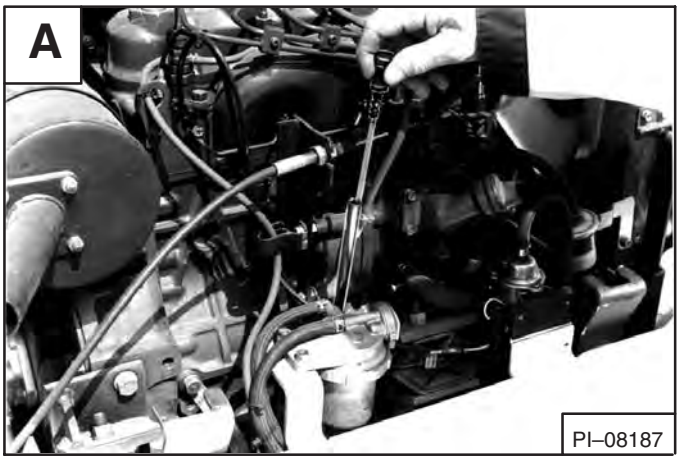
Check the engine oil every day.

Stop the engine. Open the engine cover.

Remove the dipstick **[A]**.

Keep the oil level between the marks on the dipstick.

Use a good quality motor oil that meets API Service Classification of CC or CD (See *FUEL, COOLANT AND LUBRICANTS Chart*, Page 8–1).

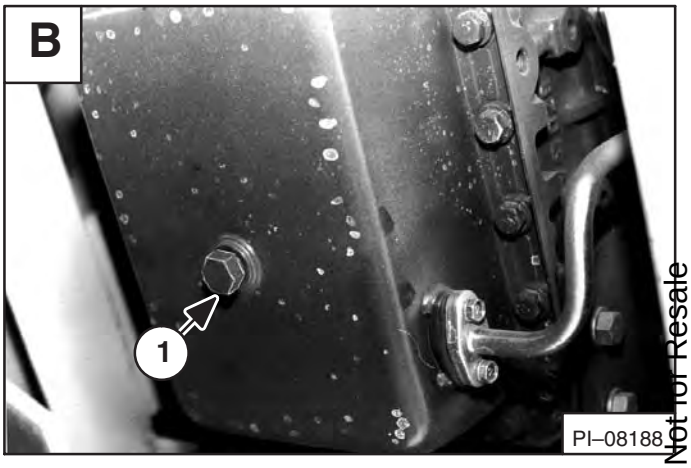


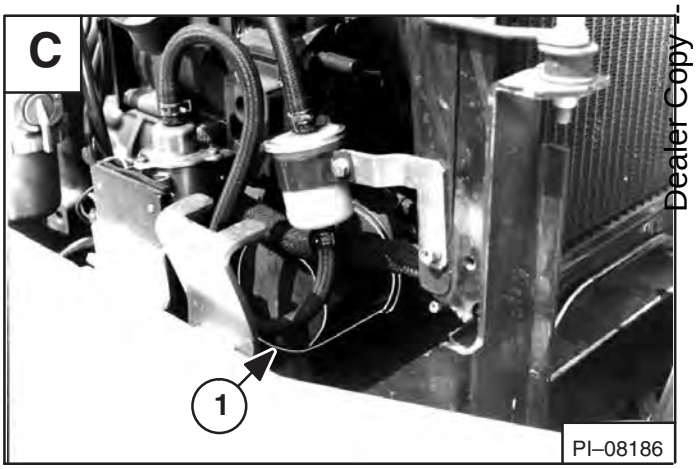
Engine Oil And Filter Replacement

See the *SERVICE SCHEDULE* Page 1–1 for the correct service interval.

Use the following procedure to change the oil and filter:

1. Run the engine until it is at operating temperature.
2. Turn the upper works so there is clearance for the engine oil drain plug. Stop the engine.
3. Remove the drain plug (Item 1) **[B]**. Drain the oil into a container.
4. Remove the oil filter (Item 1) **[C]**, using a filter wrench.
5. Clean the filter housing surface. Put clean oil on the filter gasket. Install the new filter and hand tighten only.





6. Remove the oil fill cap **[D]**. Put 6.34 quarts (6,0 L) of oil into the engine (See *FUEL, COOLANT AND LUBRICANTS Chart* Page 8–1).
7. Start the engine and let it run for several minutes. Stop the engine. Check the oil filter for leaks.
8. Check the oil level and add oil as needed to bring it to the *top* mark on the dipstick.



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COOLING SYSTEM

Coolant Level

When the engine is cool, the coolant level in the recovery tank (Item 1) **[A]** must be half full.

If the coolant level is low, add pre–mixed coolant (50% water and 50% ethylene glycol) to the recovery tank.

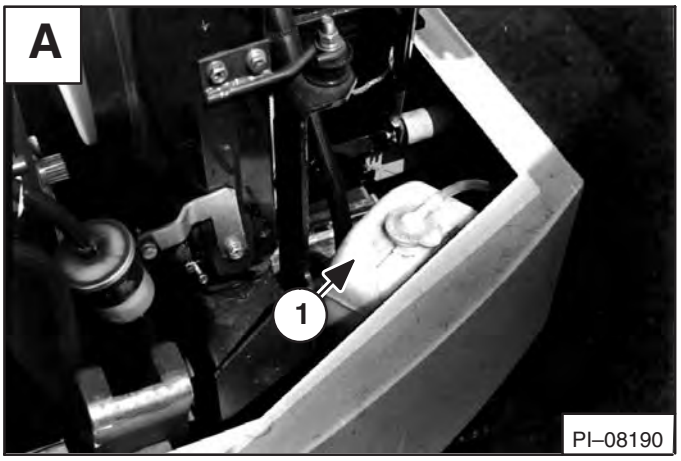
Coolant Replacement

⚠ WARNING

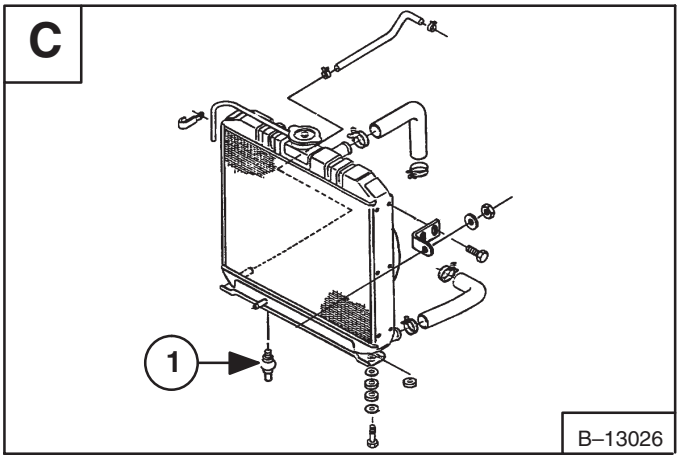
Do not remove radiator cap when the engine is hot. You can be seriously burned.

W–2070–1285

1. Turn the upper works so there is access to the engine and radiator from underneath. Stop the engine.
2. Loosen and remove the radiator cap **[B]**.
3. Open the radiator drain valve (Item 1) **[C]**.
4. Drain all the coolant from the system.
5. When all the coolant is removed, close the drain valve.
6. Pre–mix 50% water and 50% ethylene glycol in a separate container. Fill the radiator with pre–mixed coolant until it is full. Add coolant to the recovery tank until it is half full.
7. Run the engine at idle speed for about five to ten minutes to remove the air from the cooling system (leave the radiator cap off during this operation).
8. Stop the engine. Check the coolant level and add as needed to bring it up to the radiator filler neck. Install the radiator cap and tighten.







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HYDRAULIC SYSTEM

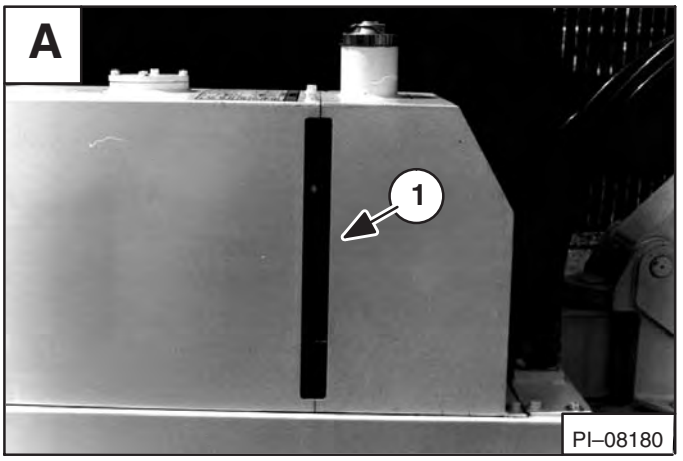
Checking And Adding Fluid

To check and add hydraulic fluid to the reservoir, use the following procedure:

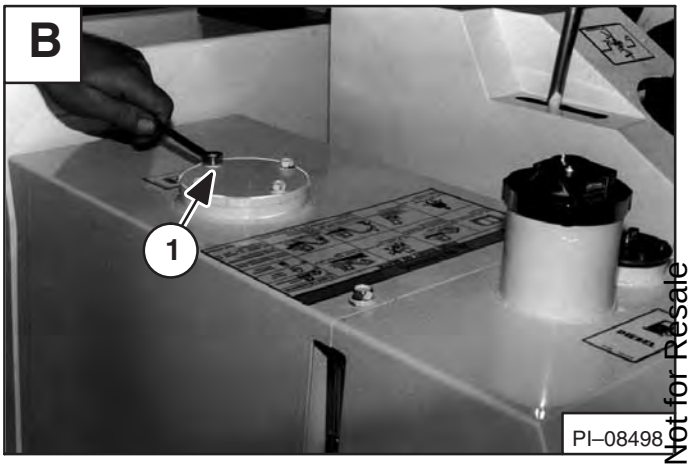
Put the machine on a flat level surface.

Retract the dipperstick and bucket cylinders, put the bucket on the ground and raise the blade. Stop the engine.

Check the hydraulic fluid level, it must be visible and between the marks in the sight gauge (Item 1) **[A]**.



If fluid level is not correct, remove the four bolts (Item 1) **[B]** from the reservoir cover.

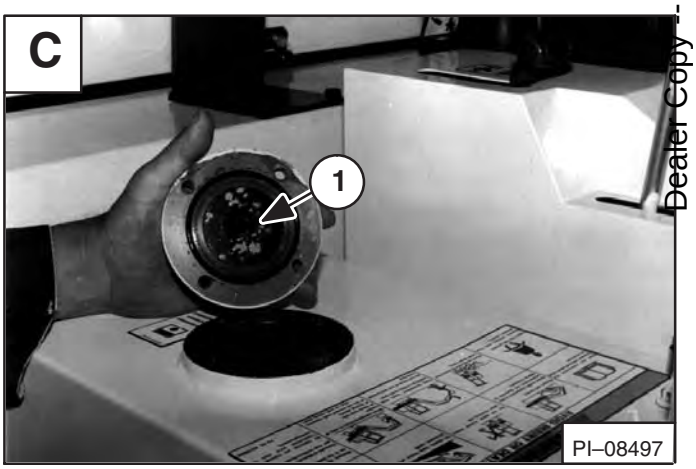


Remove the reservoir cover **[C]**.

Add the correct fluid to the reservior until it is at the top mark in the sight gauge **[A]**. (See *FUEL, COOLANT AND LUBRICANTS Chart*, Page 8–8.)

Install the reservoir cover, make sure the O–ring is in the correct position.

Install the four bolts and tighten.



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Replacement Of The Hydraulic Filters

See the *SERVICE SCHEDULE* Page 1–1 for the correct service interval.

Open the engine cover. Use a filter wrench and remove the filter elements (Item 1) **[A] [B]**.

Clean the housing where the filter gasket makes contact.

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

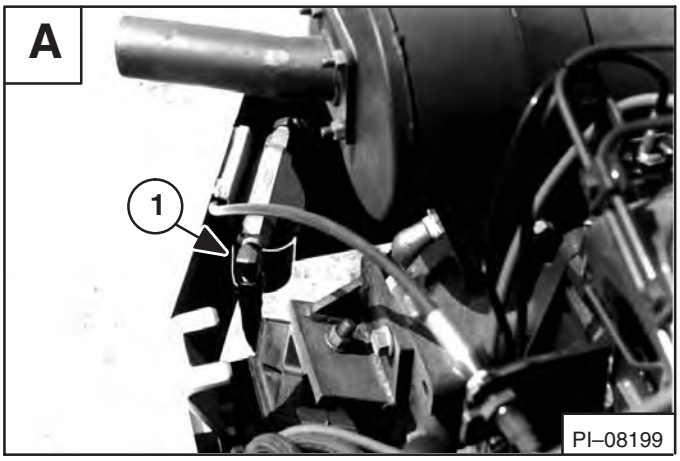
Start the engine. Run the machine through the hydraulic functions. Stop the engine. Check the fluid level at the reservoir and add as needed. Check the filter area for leaks.

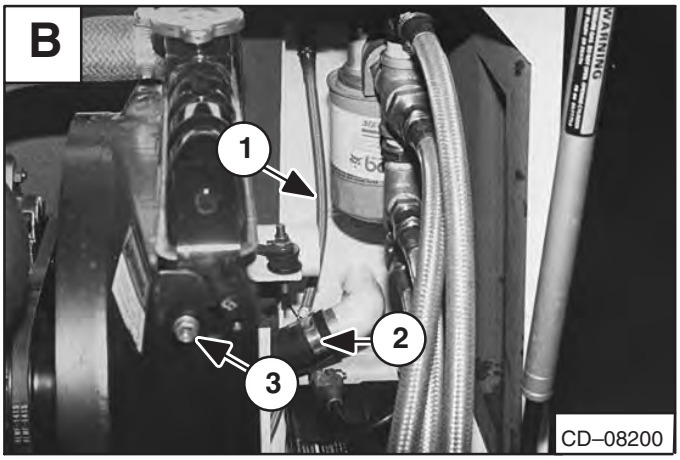
Hydraulic Reservoir

See the *SERVICE SCHEDULE* Page 1–1 for the correct service interval.

Move the upper works so there is clearance for the reservoir between the track frame.

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





⚠ WARNING

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 which can result in injury or death.

W–2103–1285

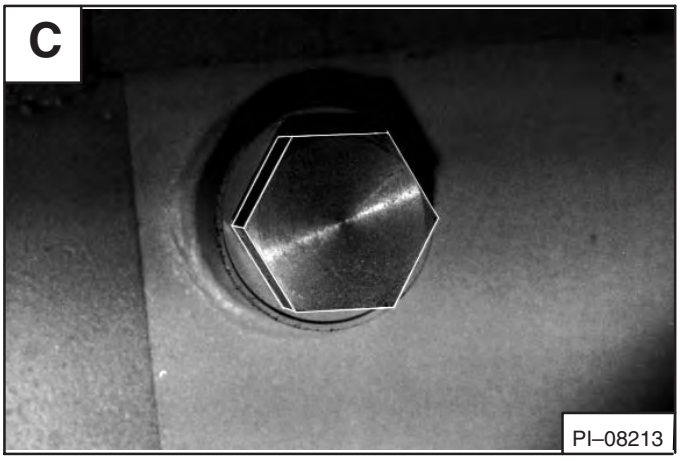
Remove the hydraulic filters. Remove the drain plug from the bottom of the reservoir **[C]**.

Remove the hose clamp (Item 2)**[B]** and disconnect the hose. Remove the bolts (Item 3) **[B]**. Remove the flange/mesh screen assembly from the reservoir.

Clean all the parts with clean solvent and air dry them. Replace the parts and tighten the bolts, hose clamp and drain plug.

Add approximately 10.0 gals. (37,9 L.) of fluid to the reservoir. (See *FUEL, COOLANT AND LUBRICANTS Chart*, Page 8–8.)

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



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USING A BOOSTER BATTERY (JUMP STARTING)

Procedure

If it becomes necessary to use a booster battery to start the engine, BE CAREFUL! Make sure the control lock pin is engaged.

The key switch must be in the OFF position.

The booster battery must be 12 volt.

Open the engine cover.

Connect the 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 (Item1) **[A]** of the machine battery.

Connect the end of the second cable to the negative (–) terminal of the booster battery. Connect the other end of the same cable to the machine frame (Item 2) **[A]**.

NOTE: Also see *Cold Starting Procedure*, in Operation & Maintenance Manual.

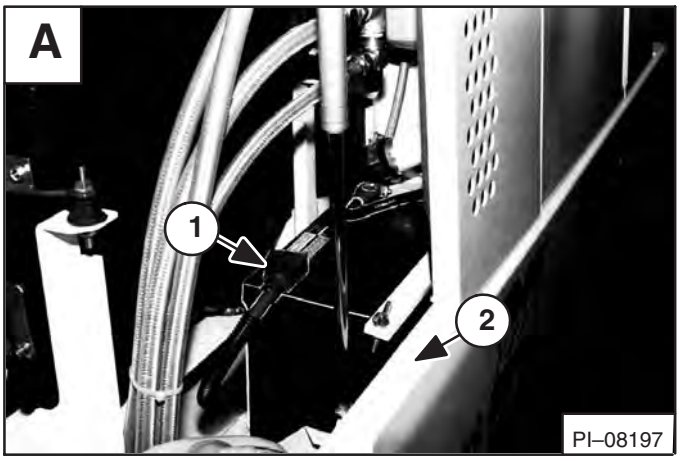
Start the engine. After the engine is running, remove the cable (Item 2) **[A]** connected to the frame first. Disconnect the cable from the machine battery (Item 1) **[A]**.

IMPORTANT

Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the loader (Remove both cables from the battery).**
- **Extra battery cables (booster cables) are connected wrong.**

I–2023–1285



⚠ WARNING

Keep arcs, sparks, flames and lighted tobacco away from batteries. When *jumping* from booster battery make final connection (negative) at engine frame.

Do not jump start or charge a frozen or damaged battery. Warm battery to 60 °F. (16°C.) before connecting to a charger. Unplug charger before connecting or disconnecting cables to battery. Never lean over battery while boosting, testing or charging.

Battery gas can explode and cause serious injury.

W–2066–1296

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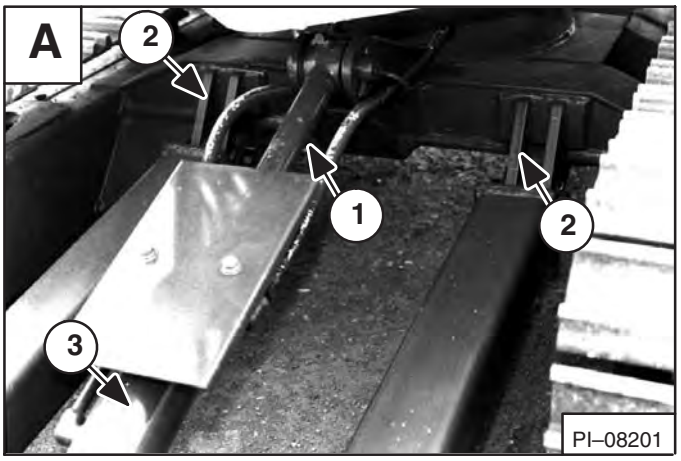
LUBRICATION OF THE HYDRAULIC EXCAVATOR

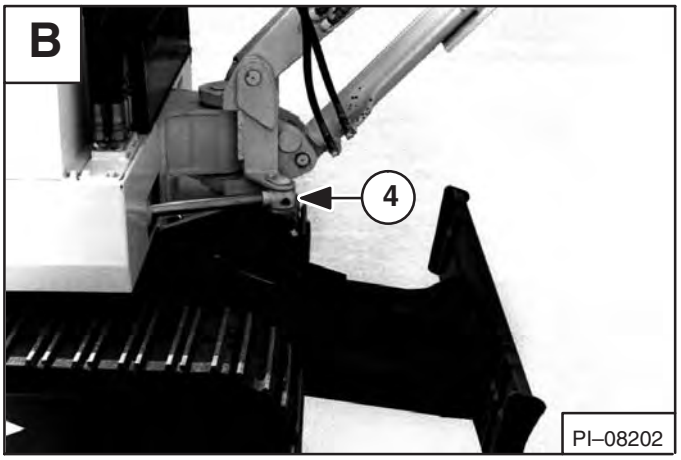
Procedure

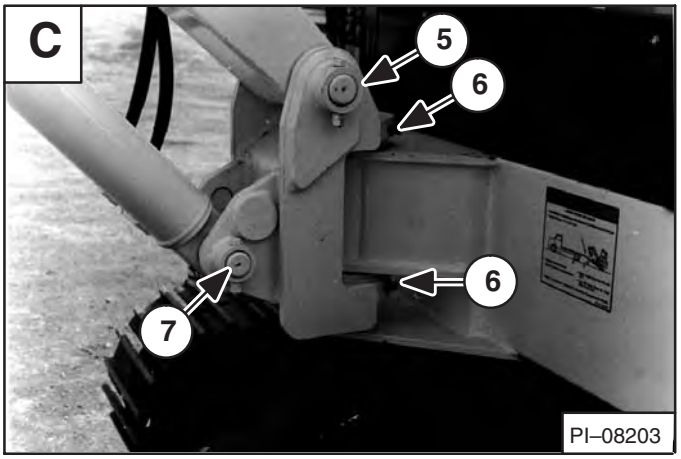
Lubricate the Hydraulic Excavator as specified in the *SERVICE SCHEDULE* Page 1–1 for the best performance of the machine.

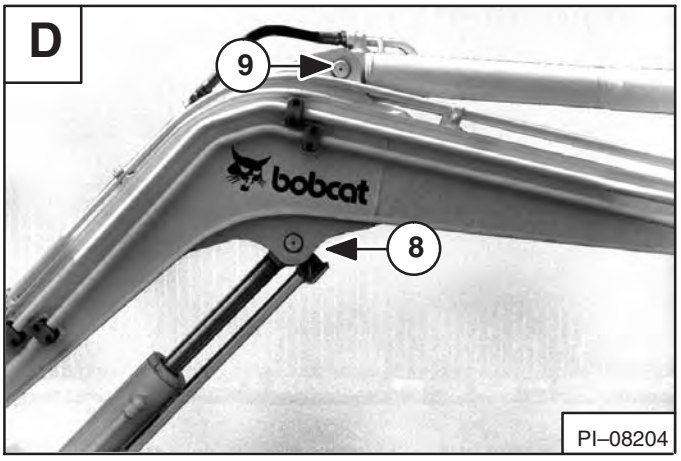
Always use a good quality lithium based multi–purpose grease when lubrication the machine. Apply the lubricant until extra grease shows.

Ref.	Description (# of Fittings)
1.	Blade Cylinder Rod End (1) **[A]**.
2.	Blade Pivots (2) **[A]**.
3.	Blade Cylinder Base End (1) **[A]**.
4.	Boom Swing Cylinder Rod End (1) **[B]**.
5.	Boom Base Pivot Pin (1) **[C]**.
6.	Boom Swing Bracket Pivot (2) **[C]**.
7.	Boom Cylinder Base End (1) **[C]**.
8	Boom Cylinder Rod End **[D]**.
9	Dipperstick Cylinder Base End (1) **[D]**.







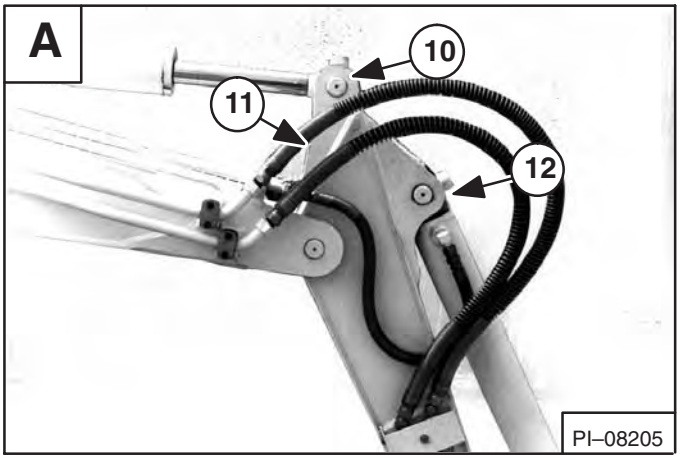


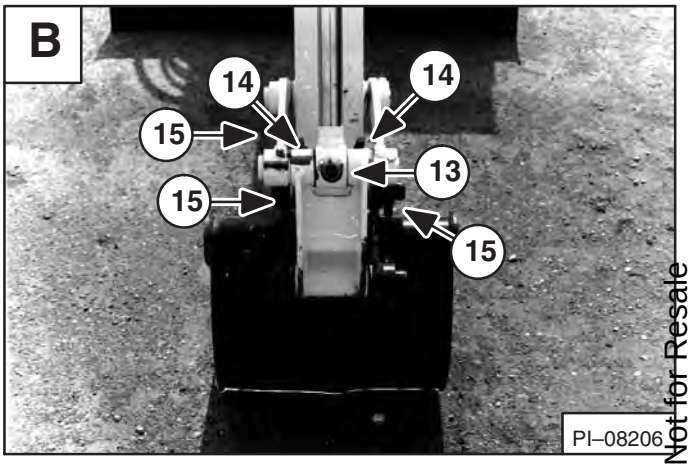
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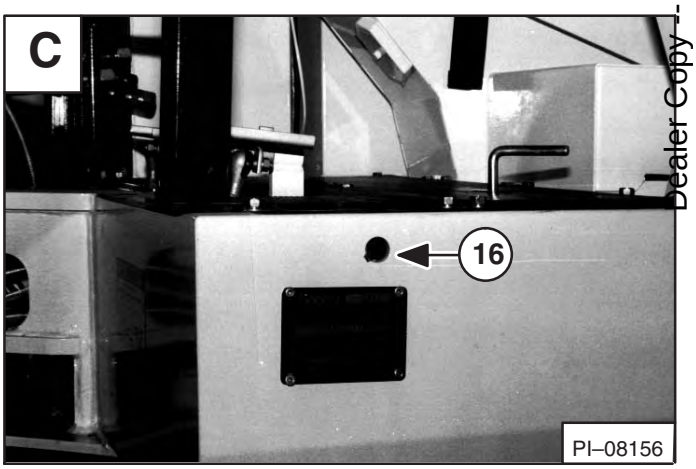
LUBRICATION OF THE HYDRAULIC EXCA VATOR (Cont'd)

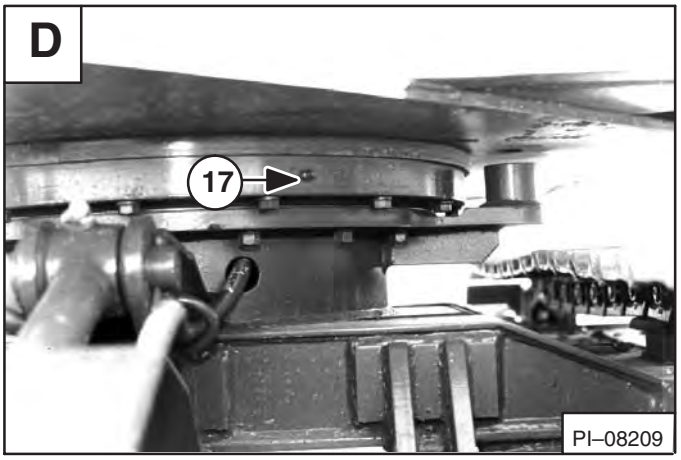
Procedure (Cont'd)

Ref.	Description (# of Fittings)
10.	Dipperstick Cylinder Rod End (1) **[A]**.
11.	Dipperstick Base Pivot Pin (1) **[A]**.
12.	Bucket Cylinder Base End (1) **[A]**.
13.	Bucket Cylinder Rod End (1) **[B]**.
14.	Bucket Link Pivots (12 **[B]**.
15.	Bucket Pivots (4) **[B]**.
16.	Swing Circle Pinion (1) **[C]**.
17.	Swing Circle Ball Bearings (2) **[D]**





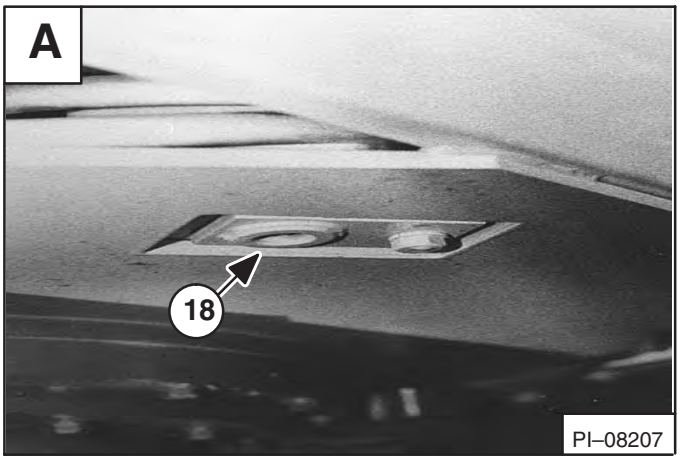




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Procedure (Cont'd)

Ref.	Description (# of Fittings)
18.	Boom Swing Cylinder Base End (1) **[A]**.



FINAL DRIVE CASE

Checking Oil Level

Put the machine on a flat level surface.

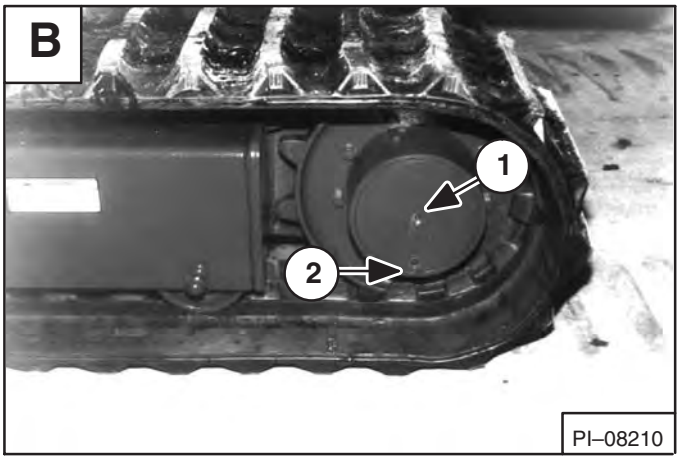
Position the plugs as shown.

Remove the plug (Item 1) **[B]**.

Add oil through the hole if the oil level is below the hole (See *FUEL, COOLANT AND LUBRICANT Chart*, Page 8–8).

Install and tighten the plug.

Repeat the procedure for the other side.



Draining Final Drive Case

See the *SERVICE SCHEDULE* Page 1–1 for the correct service interval.

Put the machine on a flat level surface with the plugs position as shown in figure **[B]**.

Remove the bottom plug (Item 2) **[B]** and the top plug (Item 1) **[B]**.

After the oil is removed, install and tighten the bottom plug.

Add .32 quarts (0,3 L) of oil to the top plug hole. Install the plug.

Repeat the procedure for the other side.

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Page Number

BLADE CYLINDER
Removal And Installation 2–18

BOOM CYLINDER
Removal And Installation 2–15

BOOM SWING CYLINDER
Removal And Installation 2–19

BUCKET CYLINDER
Removal And Installation 2–17

CONTROL VALVE
Disassembly And Assembly 2–12a

DIPPERSTICK CYLINDER
Removal And Installation 2–16

HYDRAULIC CONTROL VALVE
Removal And Installation 2–11

HYDRAULIC CYLINDER
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HYDRAULIC FILTER
Removal And Installation 2–42

HYDRAULIC PUMP
Assembly 2–7
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Removal And Installation 2–4

HYDRAULIC RESERVOIR
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HYDRAULIC SERVICE INFORMATION
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Checking The Control Valve Relief Valves 2–1
Checking The Locking Lever Relief Valve 2–3
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SOLENOID VALVE
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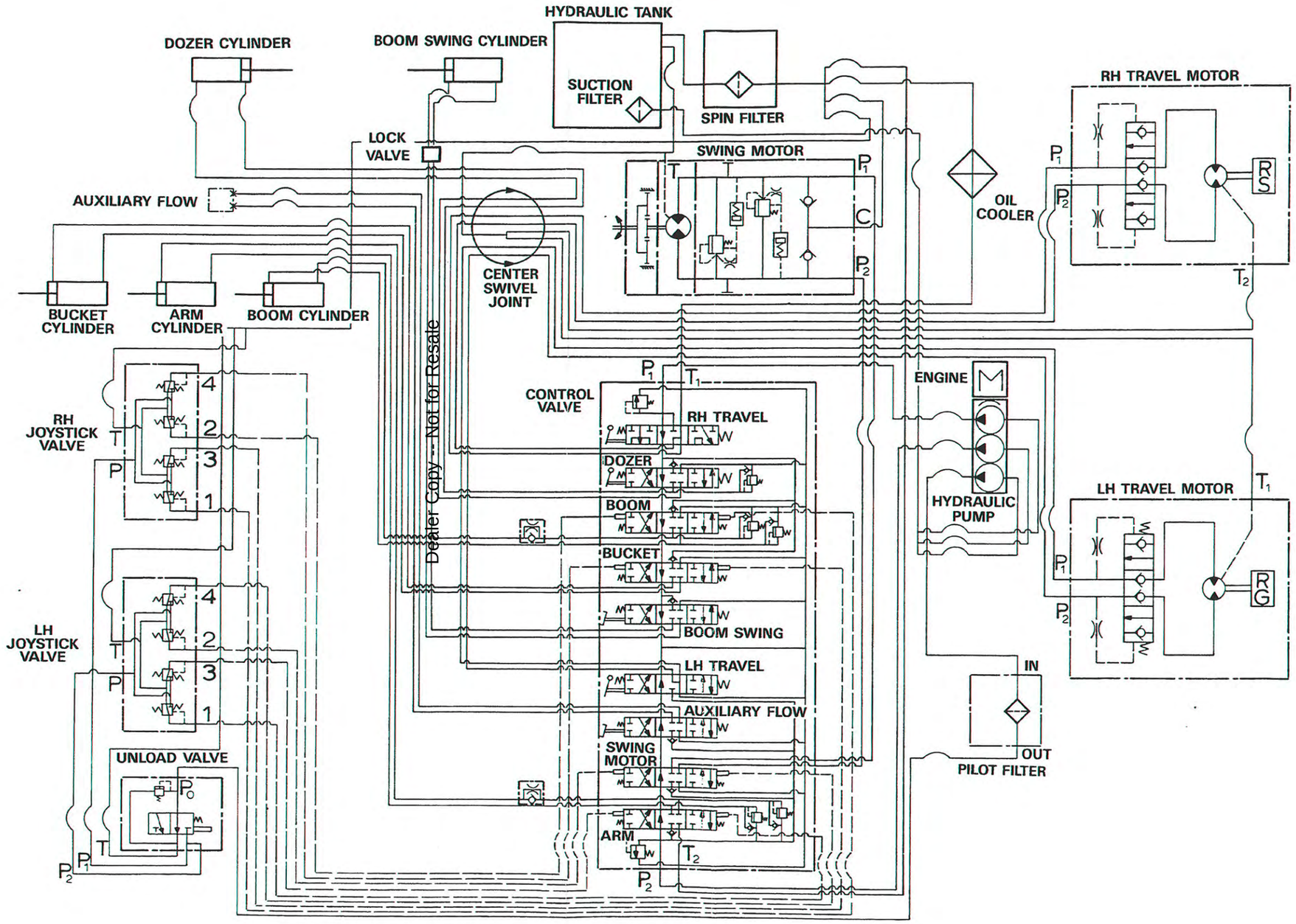
SWING CYLINDER LOCK VALVE
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Disassembly 2–31
Parts Identification 2–30

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HYDRAULIC SCHEMATIC (225 EXCAVATOR)
(S/N 11999 & Below) Without High Flow



6720323 (7-91)

D-2000

HYDRAULIC FLOW CHART

For Model

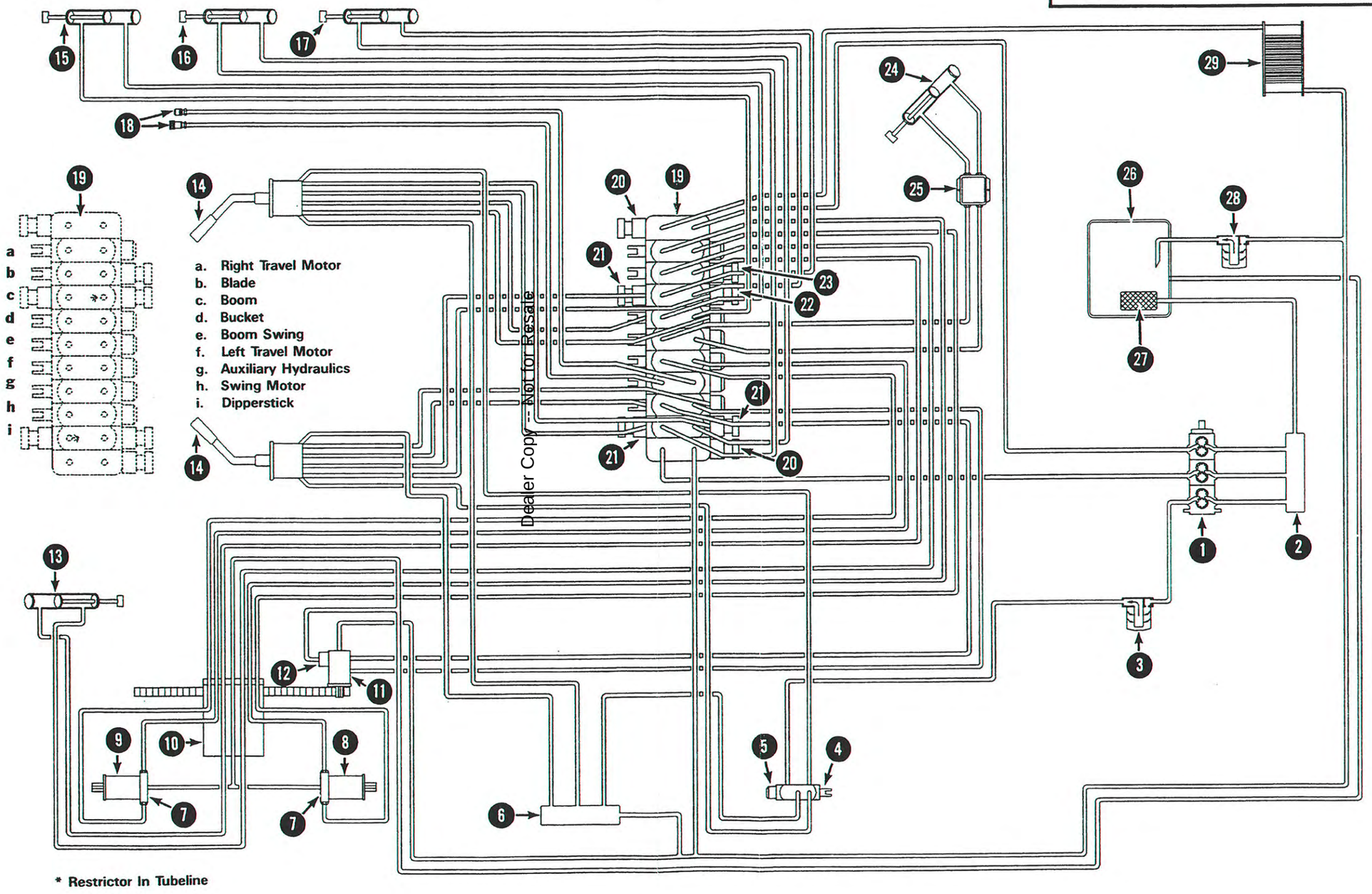
225 EXCAVATOR (STANDARD)

Chart #6720322 (Printed July 1991)

(Without Hi-Flow)

NOTE

Chart shows oil flow in Forward Drive Position and with Hydraulic Cylinders Partially Extended. For Hydraulic/ Hydrostatic System Operation, refer to Sheet 2 of this publication.



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HYDRAULIC SYSTEM OPERATION

To Be Used With

HYDRAULIC FLOW CHART

For Model

225 EXCAVATOR (STANDARD)

Chart # 6720322 (Printed July 1991)

(Without Hi-Flow)

CHART LEGEND

1. **HYDRAULIC PUMP** Triple Section - Gear Pump: 2 x 7.0 GPM (26,5 L/min.) = 4.6 GPM (17,5 L/min.)
2. **SUPPLY MANIFOLD**
3. **HYDRAULIC FILTER ELEMENT**
4. **LOCKING LEVER VALVE**
5. **LOCKING LEVER RELIEF VALVE** 300 PSI (2068 kPa)
6. **RETURN BLOCK**
7. **BRAKE VALVE**
8. **RIGHT SIDE TRAVEL MOTOR**
9. **LEFT SIDE TRAVEL MOTOR**
10. **SWIVEL JOINT**
11. **SWING MOTOR**
12. **BRAKE VALVE**
13. **BLADE CYLINDER**
14. **JOYSTICK CONTROLS**
15. **BUCKET CYLINDER**
16. **DIPPERSTICK CYLINDER**
17. **BOOM CYLINDER**
18. **FRONT AUXILIARY HYDRAULICS**
19. **HYDRAULIC CONTROL VALVE** 9 Sections
20. **MAIN RELIEF VALVES (2)** . . 2275 PSI (15686 kPa) + or — 50 PSI
21. **PORT RELIEF VALVES** . . . . . 2980 PSI (20544 kPa)
22. **BOOM CYLINDER RELIEF VALVE (Rod End)** . . . . 3480 PSI (23991 kPa)
23. **BLADE RELIEF VALVE** . . . . . 1140 PSI (7860 kPa)
24. **BOOM SWING CYLINDER**
25. **BOOM SWING CYLINDER LOCK VALVE**
26. **HYDRAULIC RESERVOIR** . . . 11.6 Gals. (44 L) (Tank Capacity)
27. **SUCTION SCREEN**
28. **HYDRAULIC FILTER ELEMENT** 10 Micron
29. **HYDRAULIC OIL COOLER**

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Printed in U.S.A.

HYDRAULIC FLOW CHART

For Model

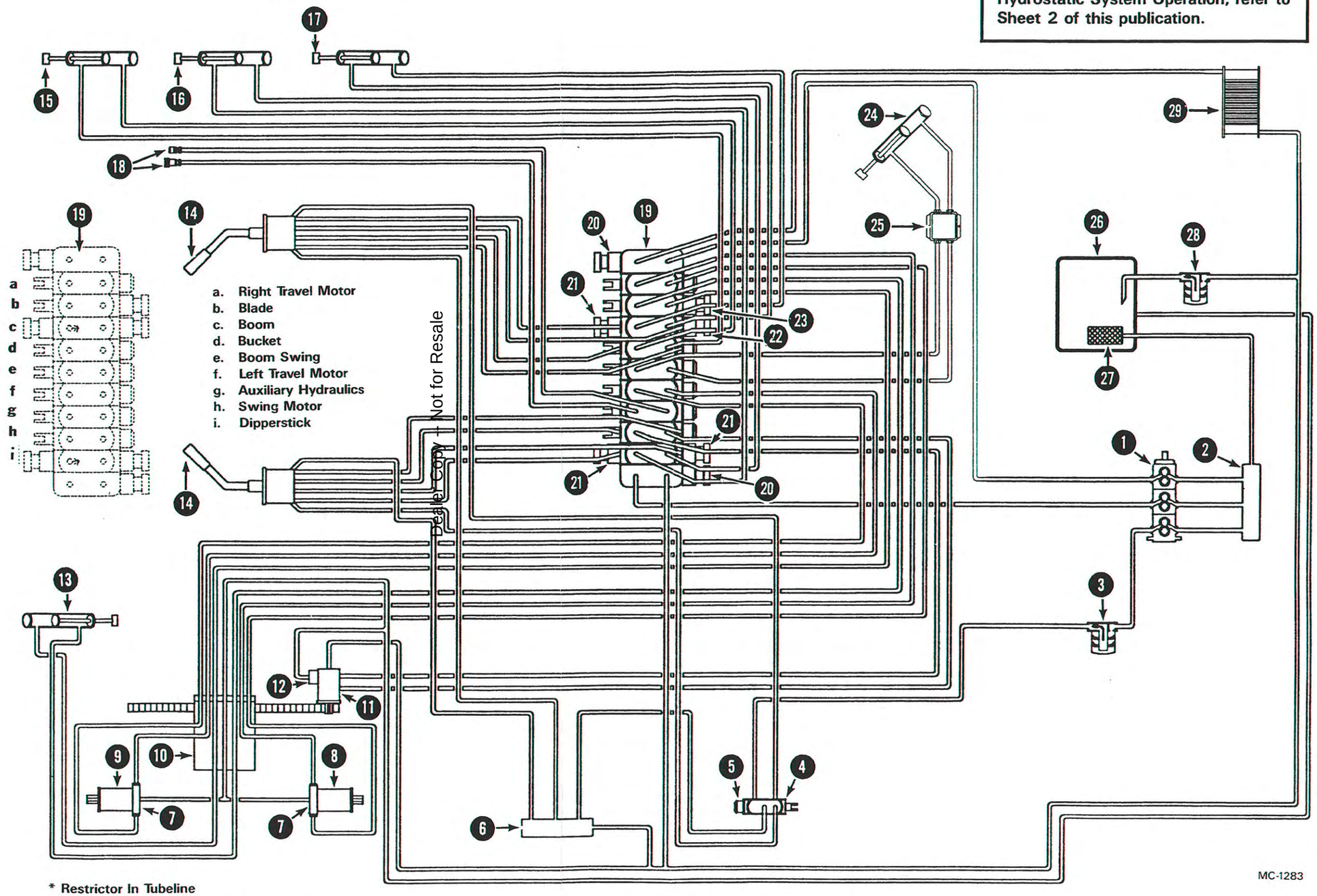
225 EXCAVATOR (I.S.O.)

Chart #6720523 (Printed July 1991)

(Without Hi-Flow)

NOTE

Chart shows oil flow in Forward Drive Position and with Hydraulic Cylinders Partially Extended. For Hydraulic/ Hydrostatic System Operation, refer to Sheet 2 of this publication.



6720523 (7-91)

(Sheet 1 of 2)

Printed in U.S.A.

HYDRAULIC SYSTEM OPERATION

To Be Used With

HYDRAULIC FLOW CHART

For Model

225 EXCAVATOR (I.S.O.)

Chart # 6720523 (Printed July 1991)

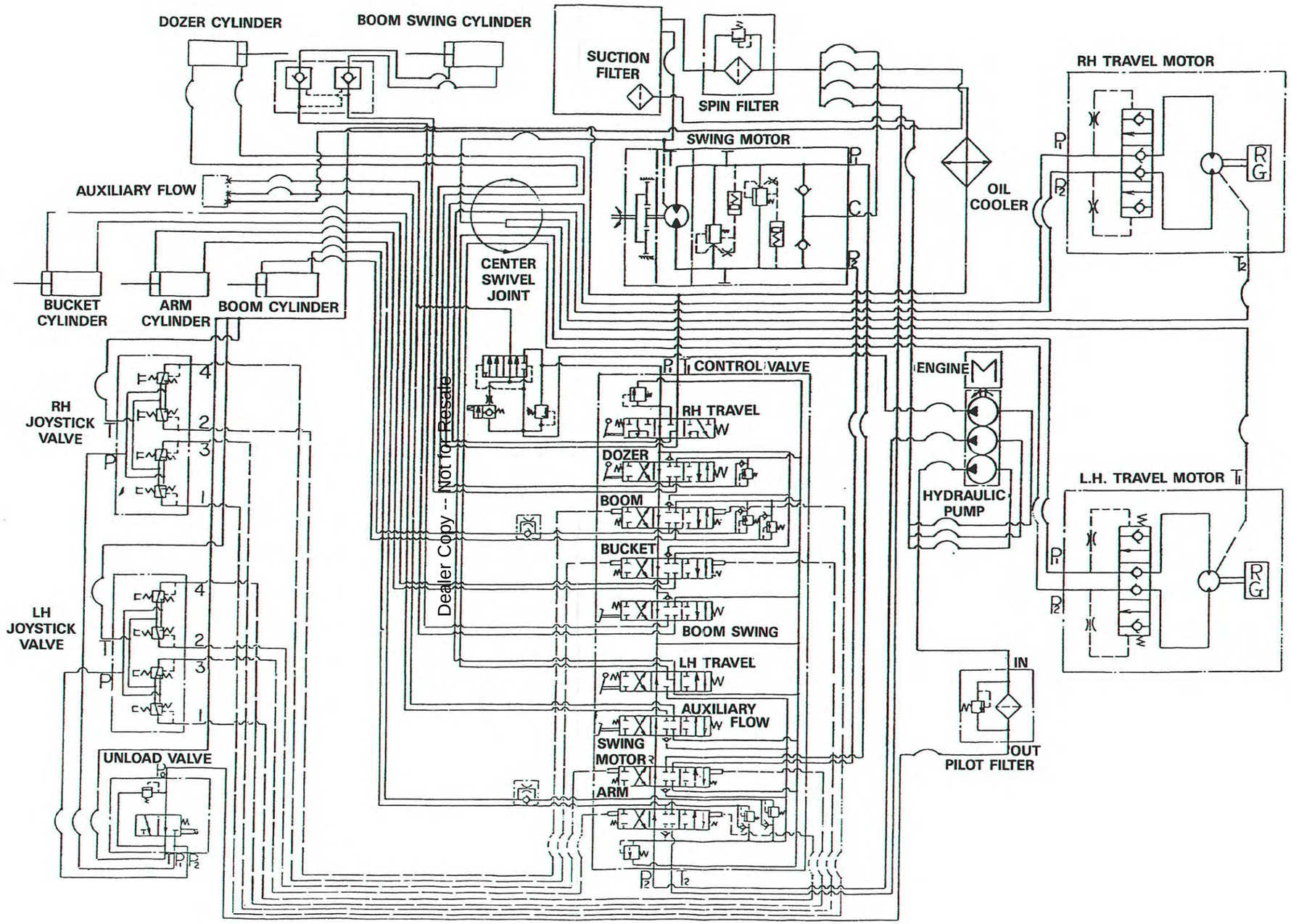
(Without Hi-Flow)

CHART LEGEND

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3. **HYDRAULIC FILTER ELEMENT**
4. **LOCKING LEVER VALVE**
5. **LOCKING LEVER RELIEF VALVE** 300 PSI (2068 kPa)
6. **RETURN BLOCK**
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8. **RIGHT SIDE TRAVEL MOTOR**
9. **LEFT SIDE TRAVEL MOTOR**
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11. **SWING MOTOR**
12. **BRAKE VALVE**
13. **BLADE CYLINDER**
14. **JOYSTICK CONTROLS**
15. **BUCKET CYLINDER**
16. **DIPPERSTICK CYLINDER**
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18. **FRONT AUXILIARY HYDRAULICS**
19. **HYDRAULIC CONTROL VALVE** 9 Sections
20. **MAIN RELIEF VALVES (2)** . . 2275 PSI (15686 kPa) + or — 50 PSI
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25. **BOOM SWING CYLINDER LOCK VALVE**
26. **HYDRAULIC RESERVOIR** . . . 11.6 Gals. (44 L) (Tank Capacity)
27. **SUCTION SCREEN**
28. **HYDRAULIC FILTER ELEMENT** 10 Micron
29. **HYDRAULIC OIL COOLER**

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HYDRAULIC SCHEMATIC (225 EXCAVATOR)
(S/N 11999 & Below) With High Flow



D-2146

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

Description

There are three main relief valves (Item 1) **[A]** and five port relief valves (Item 2) **[A]** in the hydraulic system.

Checking The Control Valve Relief Valves

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

OEM1238 – Hydraulic Tester
OEM1239 – Hydraulic Tester
6657708 – Test Fitting
6657709 – Hose Adapter

Stop the engine and raise the engine cover.

Disconnect the outlet hose from the hydraulic pump (Item 1) **[B]** and connect that hose to the outlet of the tester.

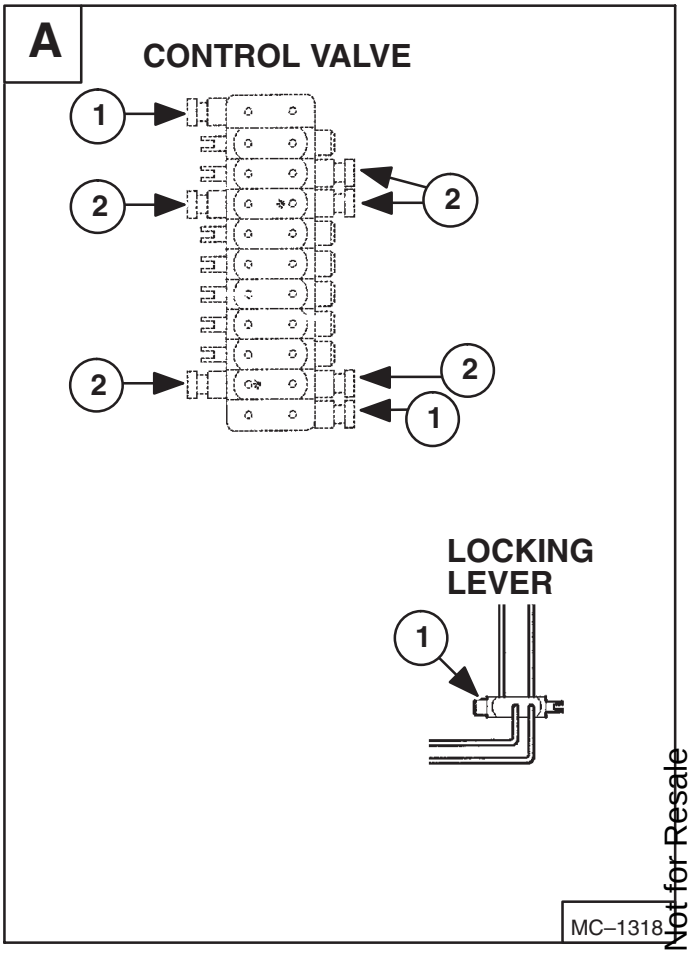
NOTE: Use hose adapter 6657709 when checking pumps (Item 1 or Item 2) [B]. Install the adapter between outlet hose of tester and outlet hose of the pump.

Remove the outlet fitting from the pump being tested and install the test fitting shown below **[B]**.

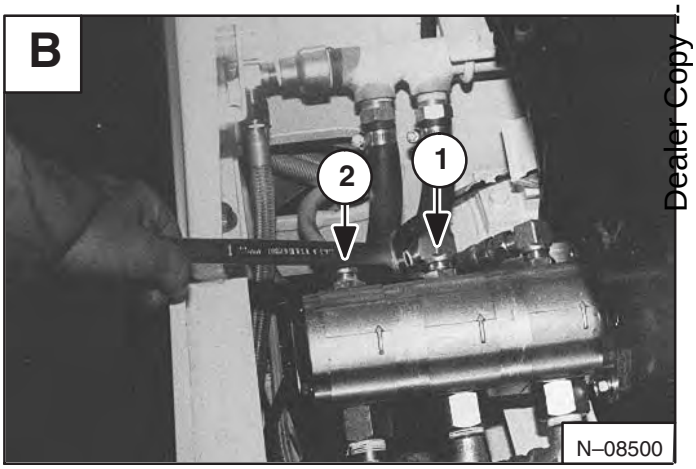
Ref.	Part No.	Description
1.	6657708	Hydraulic Pump for Control Valve
2.	6657708	Hydraulic Pump for Locking Lever

Connect the inlet of the tester to the test fitting in the pump **[B]**.

A



B



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HYDRAULIC SERVICE INFORMATION (Cont'd)

Checking The Control Valve Relief Valves (Cont'd)

NOTE: Open the flow control knob (Item 1) [A] fully to prevent pump damage.

NOTE: Refer to the hydraulic flow chart valve section.

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. W arm the hydraulic fluid to 140° F (60° C) by turning restrictor valve until the gauge reads about 1000 PSI (6895 kPa). Do not exceed system pressure.

Stroke a cylinder to it's limit, in the section being tested, to open the relief valve.

The relief valve pressure should open at 2550 PSI (17580 kPa) ± 75 PSI. The flow should be 4.6 GPM (17.5 L/min.) on a new pump.

Release the pressure on the cylinder being tested.

Close the flow control knob (Item 1) **[A]** slowly, to 100 PSI below relief valve setting, and record the free flow.

NOTE: The high pressure flow must be at least 80% of free flow.

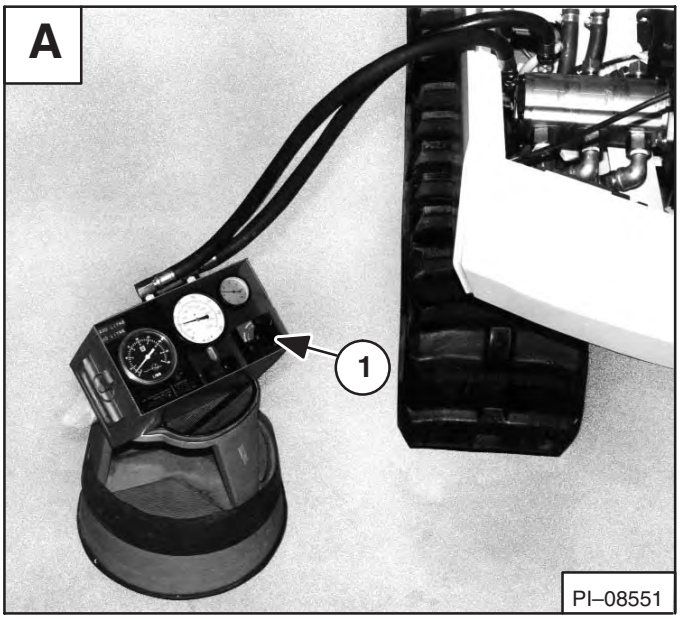
$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \times 100$$

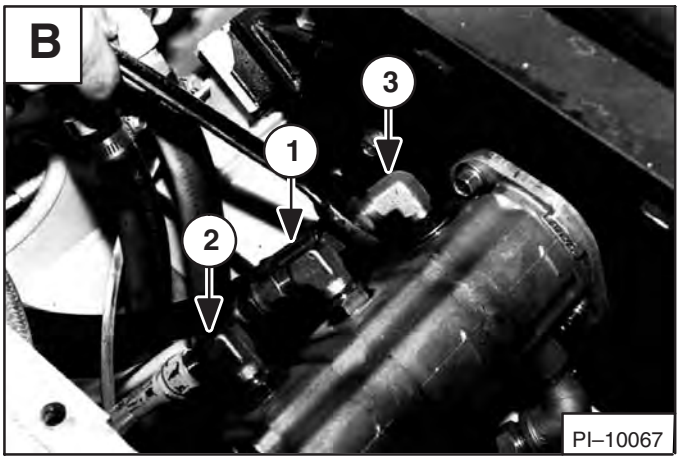
If high pressure is less than 80% of freeflow, remove the hydraulic pump for repair or replacement.

Connect the tester to the inside hydraulic pump (Item 3) **[B]**. Use the same hose routing as shown on page 2–1.

No adapter is needed for this pump outlet hose.

Repeat the testing procedure and use same readings as shown.





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Checking The Locking Lever Relief Valve

Use OEM1238 or OEM1239 HYDRAULIC TESTER and hose adapter 6657709 to do the following procedure:

Stop the engine.

Raise the engine cover.

Disconnect the outlet hose from the hydraulic pump (Item 1) **[A]** and connect that hose to the inlet of the tester.

Install hose adapter between pump outlet hose and tester output hose.

NOTE: This hose is the inlet to the filter . (See Page 2–1 for correct hose fitting.)

Connect the inlet of the tester to the outlet of the pump **[A]**.

NOTE: Be sure the left control lever panel is lowered and locked in the operating position.

NOTE: Be sure the flow control knob (Item 2) [A] is fully open to prevent damage to the pump.

Start the engine and run to 2500 RPM.

With Locking Lever Up (By–Passing Relief Valve)

The relief working pressure should be 430 PSI (2964 kPa). The flow should be 9.4 GPM (35.75 L/min.) on a new pump.

Close the flow control knob (Item 2**[A]** slowly, to 100 PSI below relief valve setting, and record the free flow.

NOTE: The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \times 100$$

If high pressure is less than 80% of freeflow, remove the hydraulic pump for repair or replacement.

With Locking Lever Down (Going Over Relief) Stroke the Bucket (Curl)

The pressure should read 700 PSi (4826 kPa) @ full RPM. the flow should be 9.4 GPM (35.75 L/min.) on a new pump.

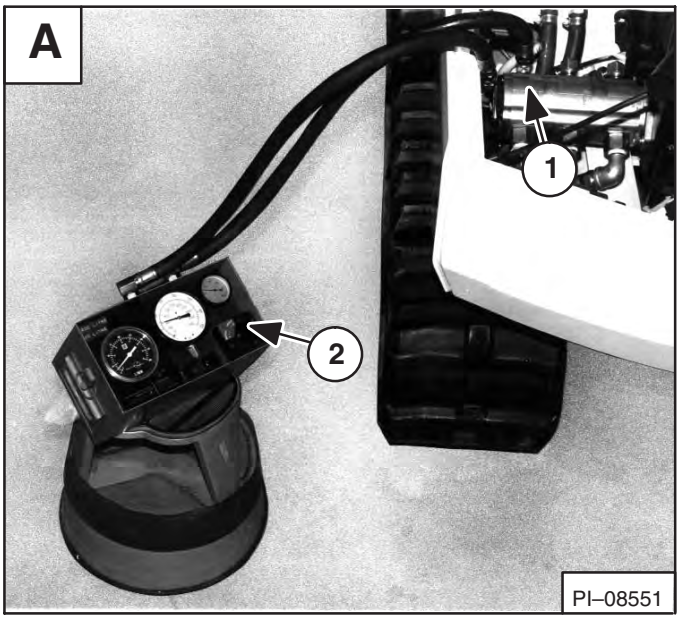
Checking The Auxiliary Relief Valve

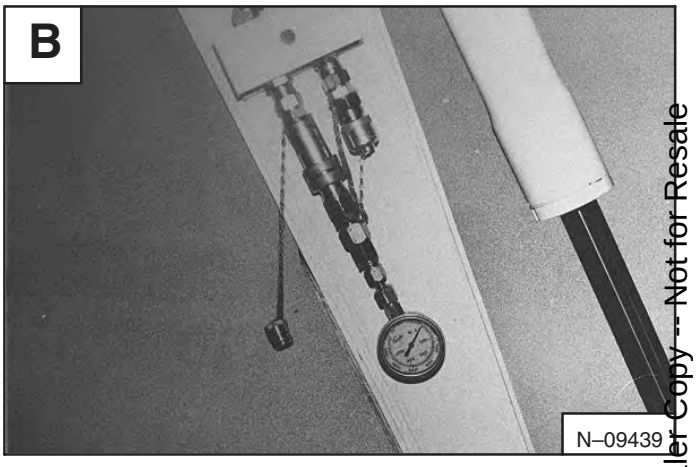
Connect the gauge to the female quick coupler **[B]**.

Start the engine and run at high RPM.

The pressure should be 2200 PSI (15167 kPa).

Replace the relief valve if the pressure is not correct.





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HYDRAULIC PUMP

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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NOTE: Mark the hoses and tubelines for correct installation.

Disconnect the three inlet hoses (Item 1) **[A]** from the hydraulic pump.

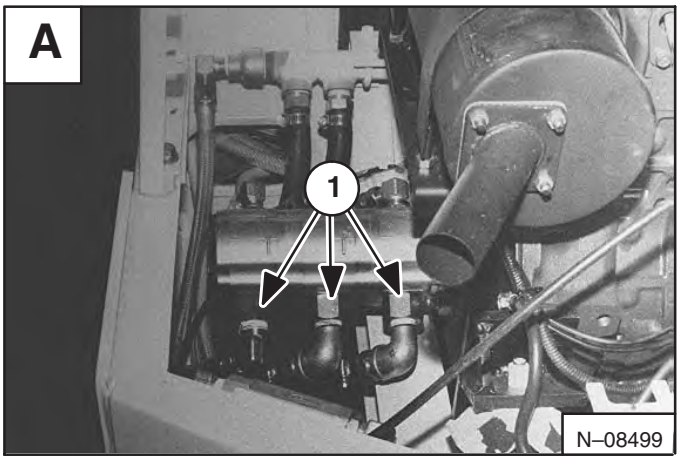
Drain the hydraulic fluid into a container.

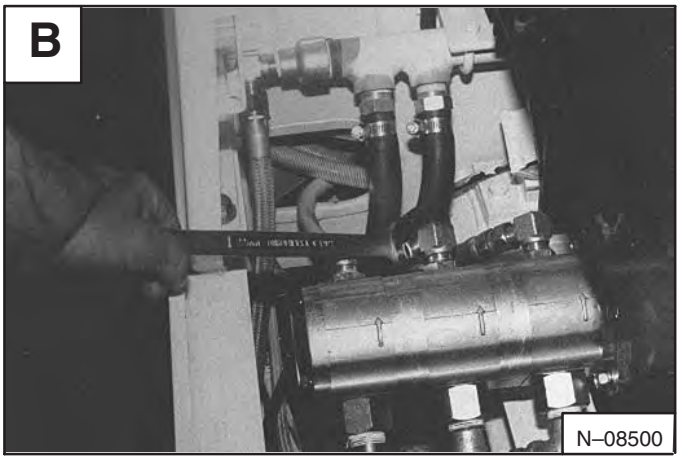
Disconnect the three pressure hoses **[B]**.

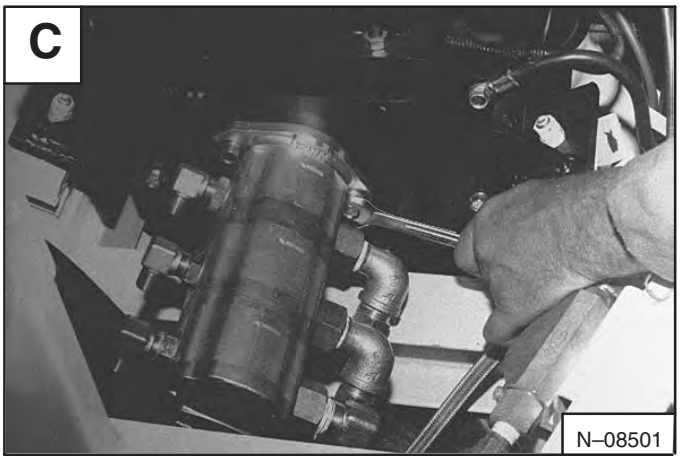
Loosen the pump mounting bolts **[C]**.

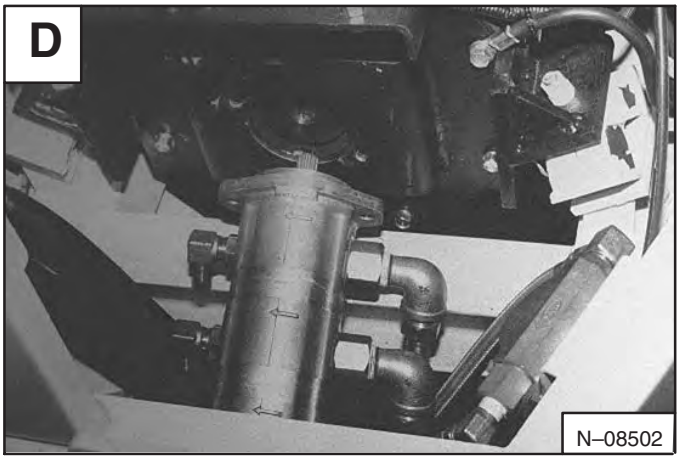
Remove the bolts.

Remove the hydraulic pump adapter from the pump plate **[D]**.









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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 pumps.

NOTE: During disassembly, place all parts on a clean paper.

Clamp the mounting flange of the pumps in a vise as shown **[A]**.

Mark the housing for assembly purposes.

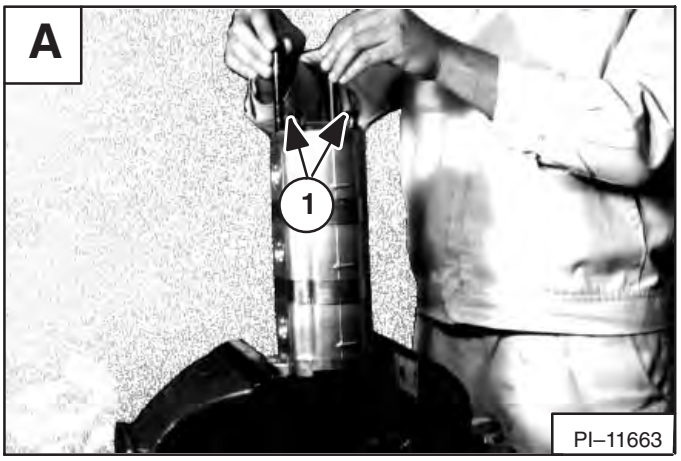
Remove the bolts (Item 1) **[A]**.

Remove the cover **[B]**.

Remove the seal **[C]**.

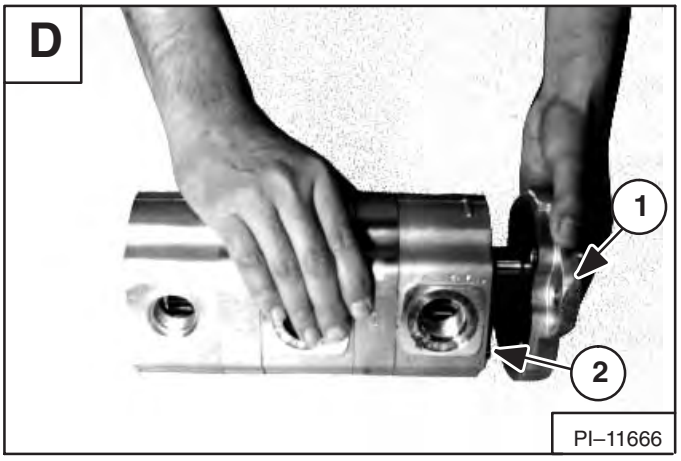
Remove the pumps from the vise.

Remove the mounting flange (Item 1) **[D]** and seal (Item 2) **[D]**.









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HYDRAULIC PUMP (Cont'd)

Disassembly (Cont'd)

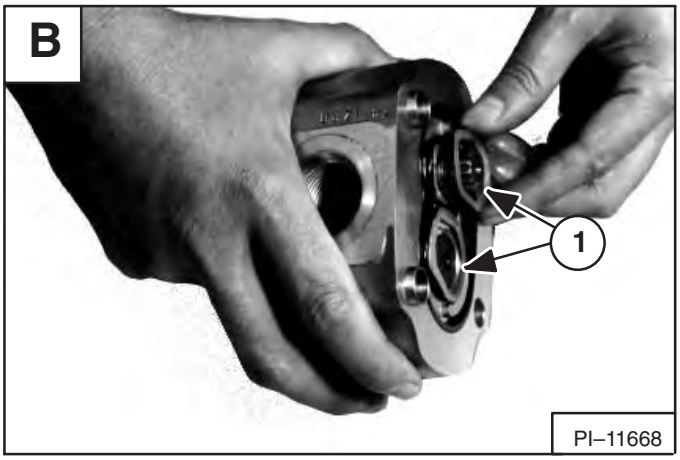
Separate the three parts **[A]**.

NOTE: Use a rubber hammer to help separate the pumps if needed.

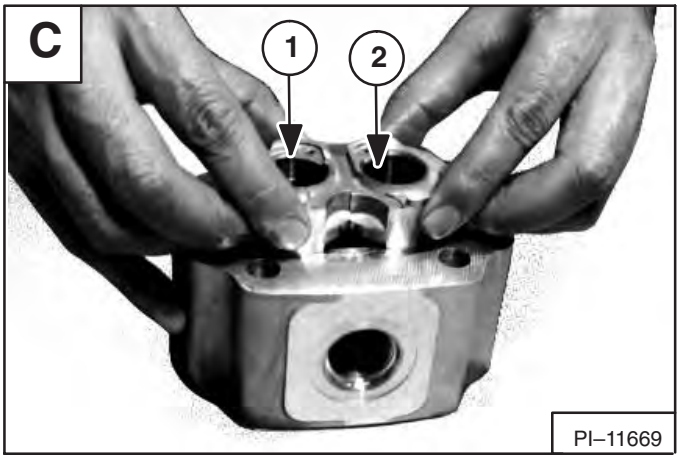


Remove the center plate from the rear pump **[B]**.

Remove the seal (Item 1) **[B]**.



Remove the bushings (Items 1 & 2) **[C]**.

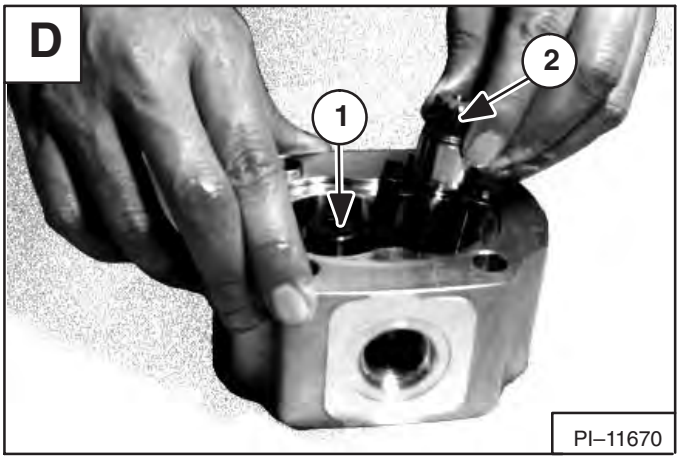


Remove the gears (Items 1 & 2) **[D]**.

NOTE: Use the gears to push out stuck bushings.

Remove the center plate from center pump and disassemble same as the rear pump.

Remove the seal from the front pump. Disassemble in the same procedure.

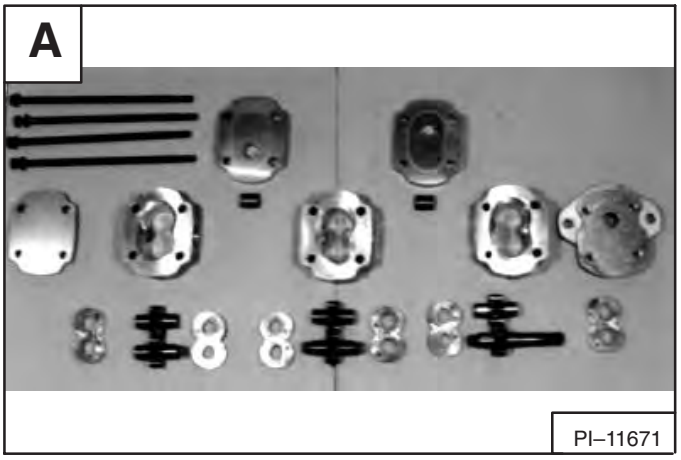


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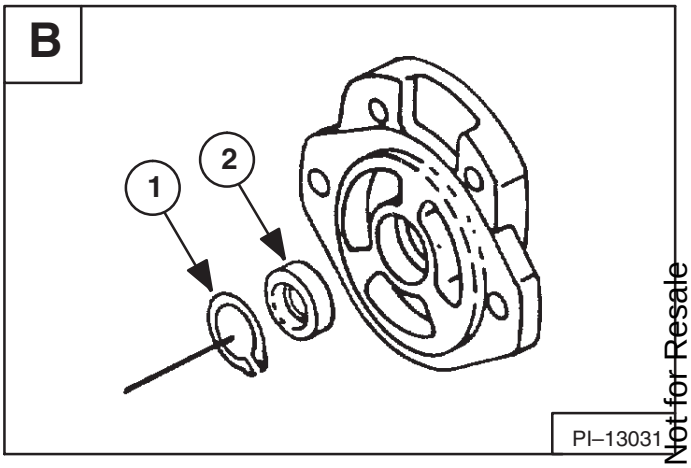
HYDRAULIC PUMP (Cont'd)

Disassembly (Cont'd)

Lay parts on paper as shown for assembly **[A]**.



Remove the snap ring (Item 1**[B]** and oil seal (Item 2**[B]** from inside the mounting flange.



Assembly

Clean all parts thoroughly.

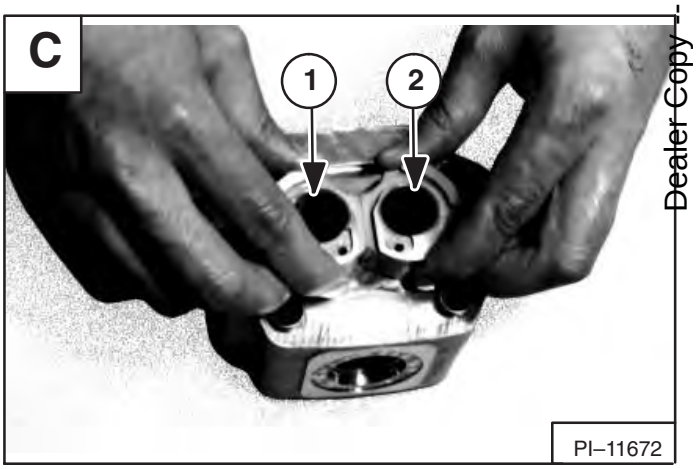
Put clean grease on all seals.

Apply a clean oil film on inside of all pumps.

Place center pump on a table.

Install the bushings (Items 1 & 2) **[C]** at the same time in the body until they are flat with the top surface.

NOTE: DO NOT FORCE the bushings.



Turn the body over. Do not allow the bushings to drop out of the body **[D]**.

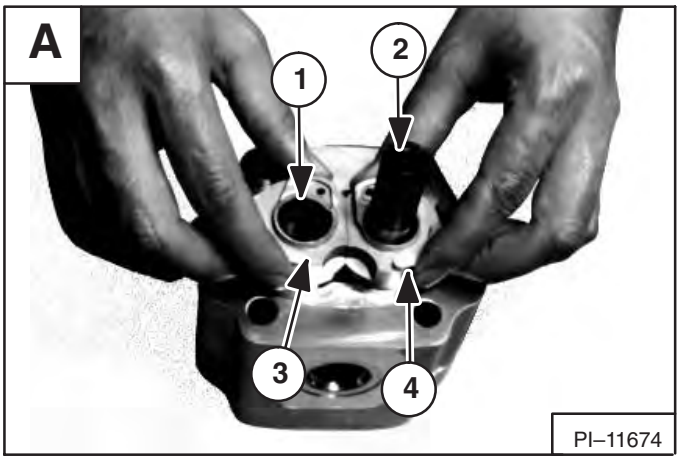


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HYDRAULIC PUMP (Cont'd)

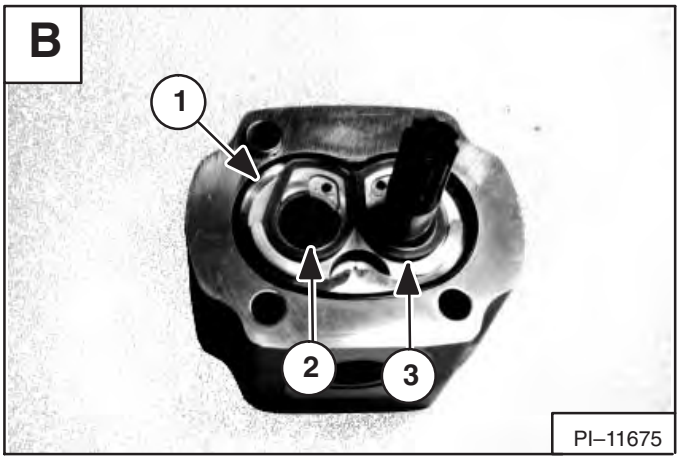
Assembly (Cont'd)

Install the gears (Items 1 & 2) **[A]** and bushings (Items 3 & 4) **[A]**.



Install the bushing seal body (Item 1)**[B]** and the packing ring (Items 2 & 3) **[B]**.

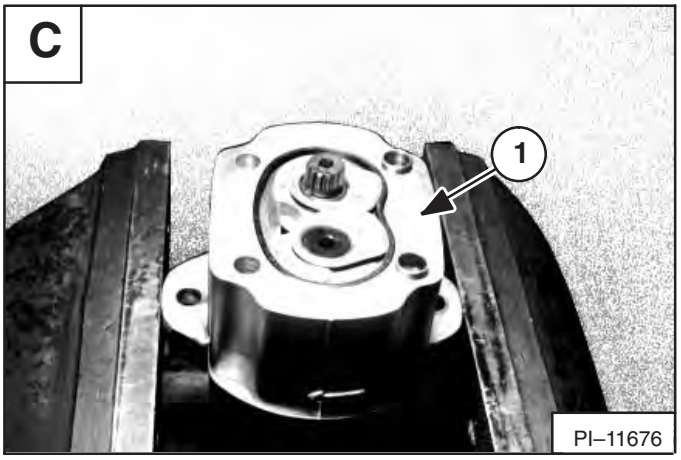
NOTE: DO NOT OVERLAP the center part of the packing rings (Items 2 & 3) [B].



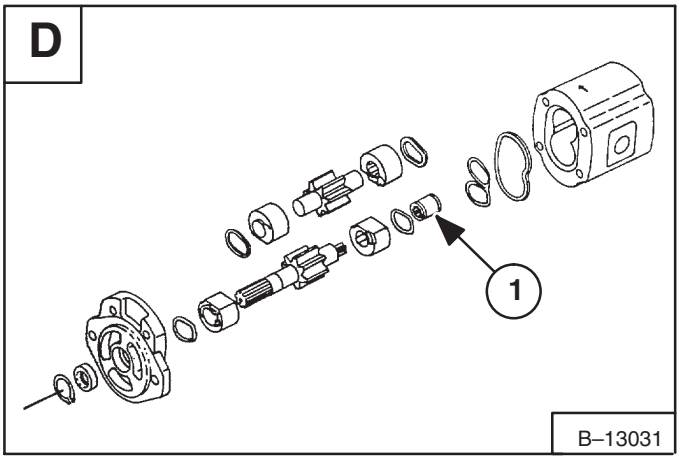
Install the rear pump (Item 1)**[C]** on the mounting flange.

Install the mounting flange in a vise **[C]**.

Assemble the center and rear pumps in the same procedure as the rear pump.



Install the splined coupler (Item 1)**[D]** on the splined gear of the rear pump.



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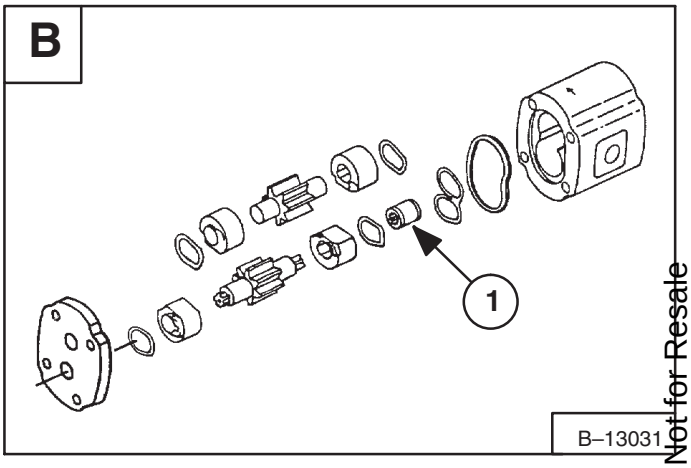
HYDRAULIC PUMP (Cont'd)

Assembly (Cont'd)

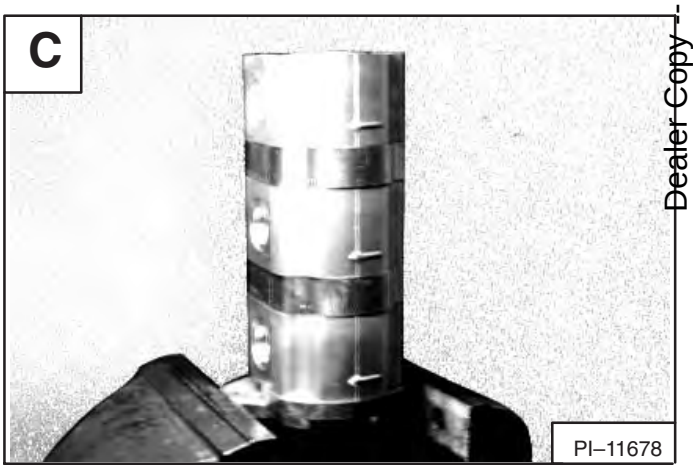
Install the center pump on the rear pump using the coupler for alignment **[A]**.



Install the splined coupler (Item 2)**[B]** on the splined gear of the center pump.



Install the front pump on the center pump using the coupler for alignment **[C]**.

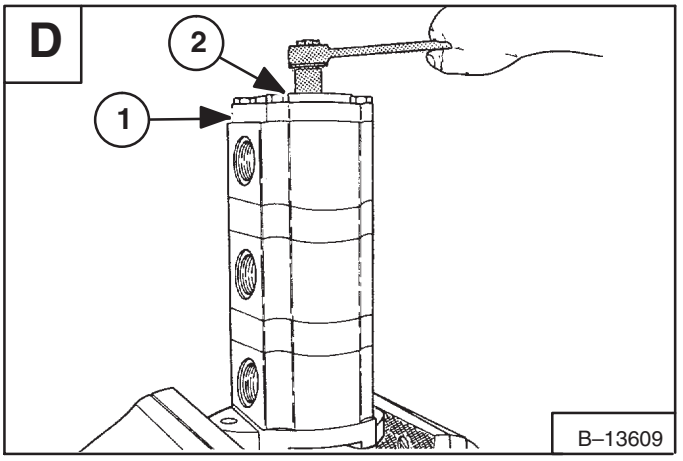


Check the alignment marks made earlieron the housing.

Install the cover (Item 1) **[D]** and the washers and bolts (Item 2) **[D]**.

Tighten the bolts to 34 ft.–lbs. (46 Nm) torque.

Rotate to see if the shaft rotates freely **[D]**.

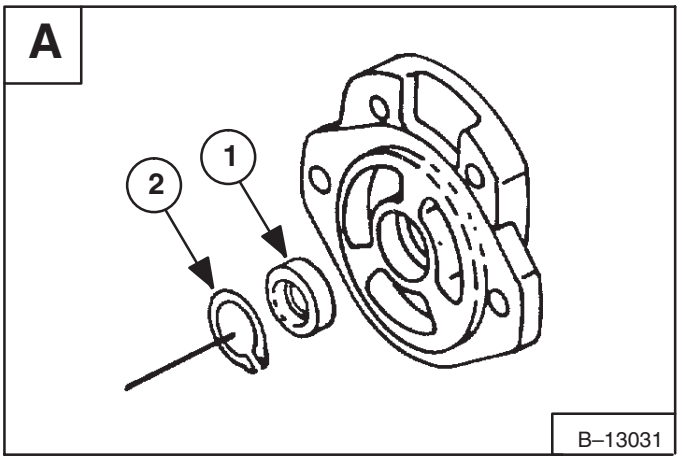


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HYDRAULIC PUMP (Cont'd)

Assembly (Cont'd)

Install the oil seal (Item 1) **[A]** and snap ring (Item 2) **[A]** in the mounting flange.



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HYDRAULIC CONTROL VALVE

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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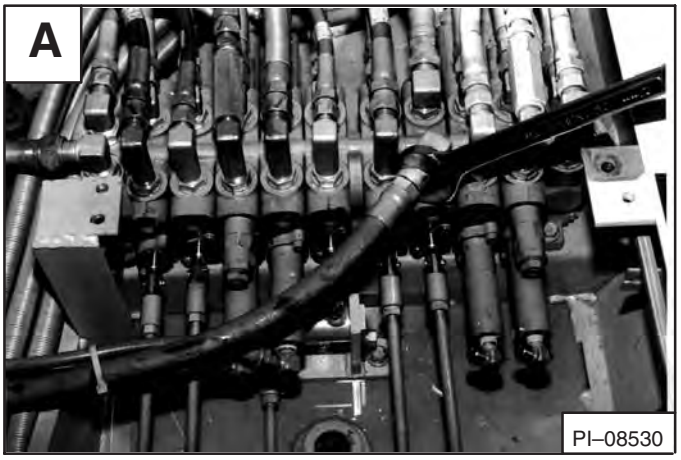
NOTE: Mark all the hoses for correct installation.

Disconnect the two auxiliary hoses **[A]**.

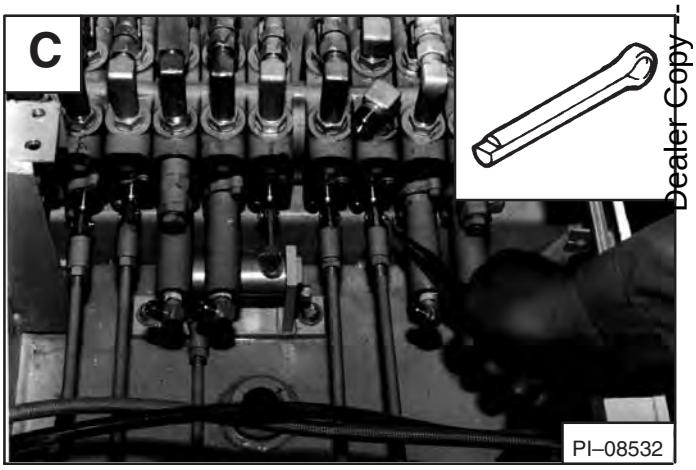
Disconnect the hand control lever hoses from the front and rear of the control valve **[B]**.

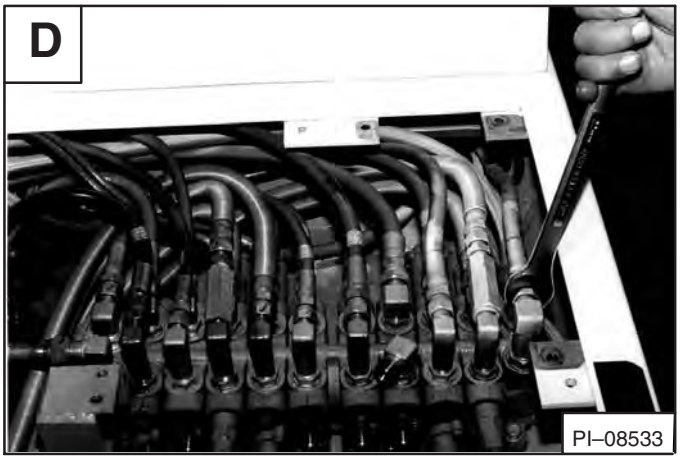
Disconnect the control linkage pins from the control valve spools **[C]**.

Disconnect the hoses from the control valve **[D]**.







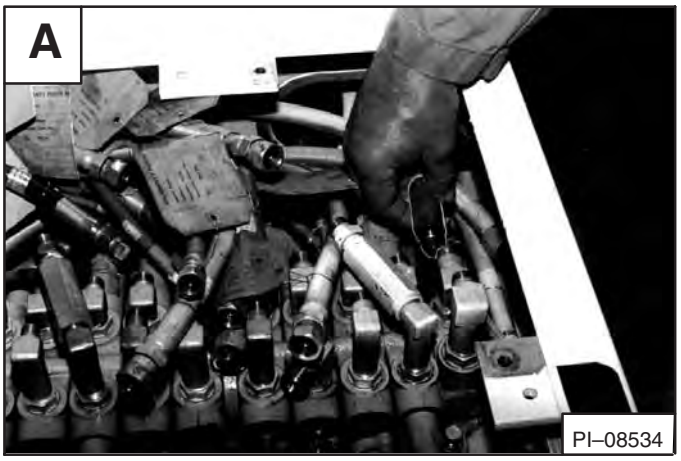


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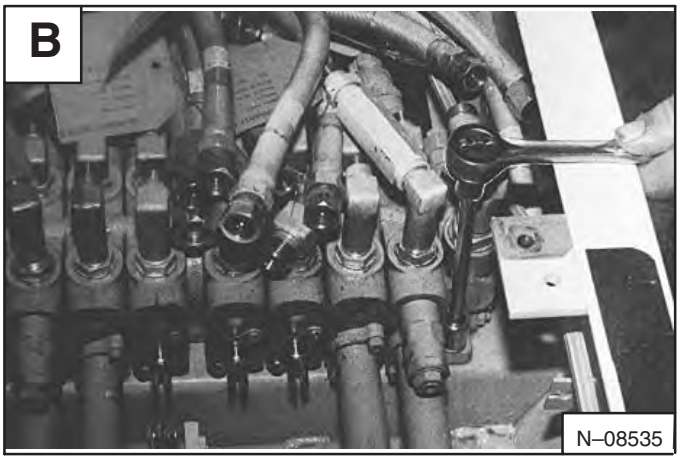
HYDRAULIC CONTROL VALVE (Cont'd)

Removal And Installation (Cont'd)

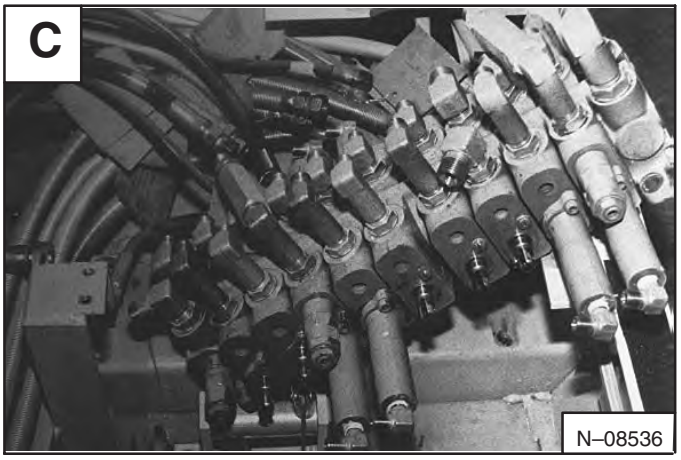
The main relief valve must be removed to remove the mounting bolts from the control valve **[A]**.



Remove the control valve mounting bolts **[B]**.



Remove the control valve **[C]**.



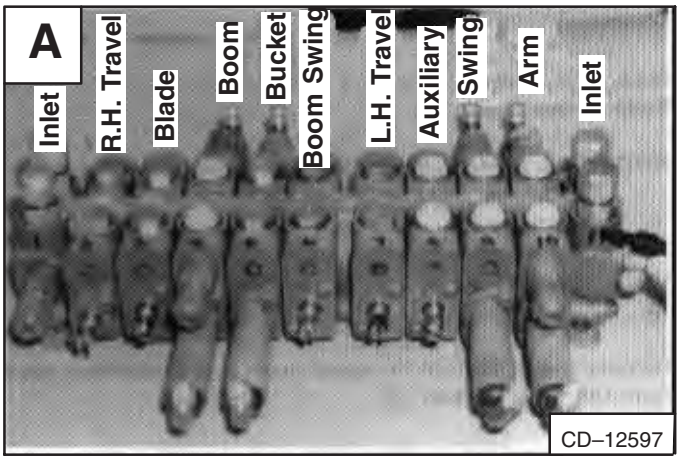
Dealer Copy -- Not for Resale

CONTROL VALVE

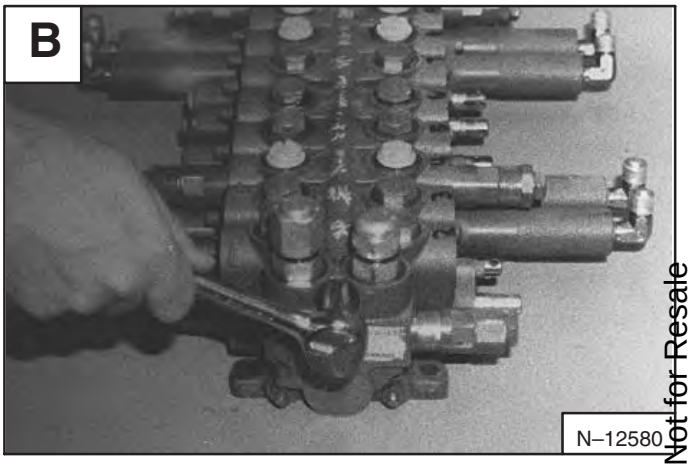
Disassembly And Assembly

Mark each section of the control valve for ease of reassembly **[A]**.

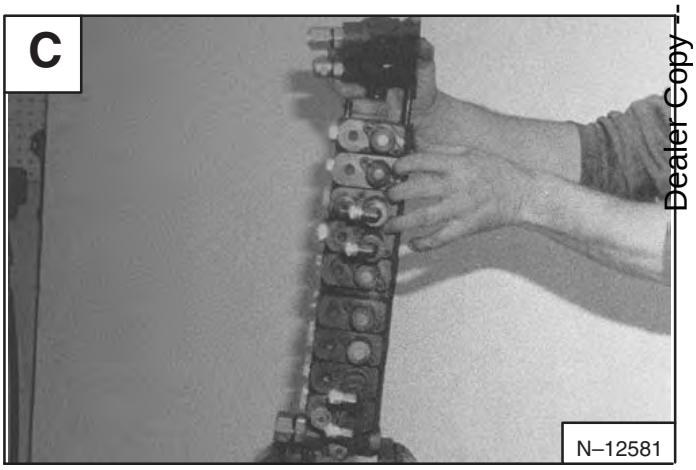
NOTE: Always use new O–rings during assembly of the control valve.



Loosen and remove the nuts from one end of the control valve through bolts **[B]**.



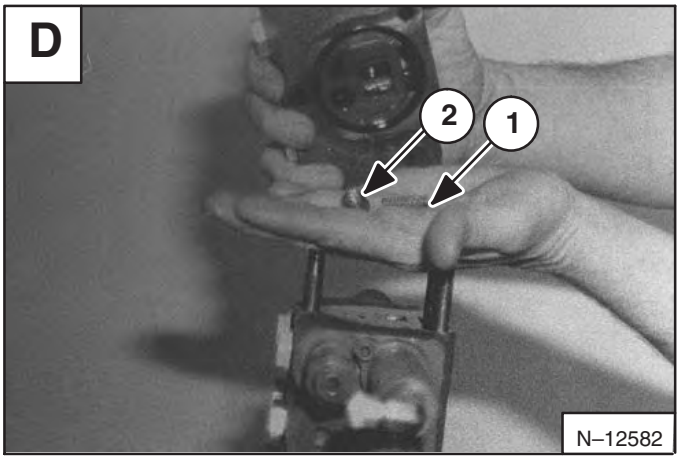
Position the valve assembly on it's end and remove the inlet section of the control valve **[C]**.



Remove each of the additional valve sections by lifting them off of the valve through bolts **[D]**

Do not scratch the side faces of the valve sections.

NOTE: With the exception of the two travel sections, each section of the control valve has a spring (Item 1) [D] and load check plug (Item 2) [D] in the side face of the sections. Keep the load check plug and spring with the sections in which they were originally installed.



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CONTROL VALVE (Cont'd)

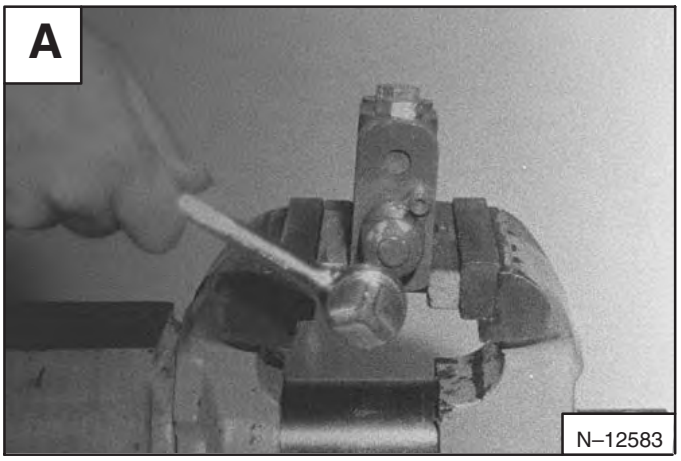
Disassembly And Assembly (Cont'd)

Blade, Boom Swing, Bucket, L.H. T ravel, Auxiliary and House Swing Valve Sections

NOTE: The photo may not show the valve section exactly as it appears, but the procedure is correct for these sections.

Use a vise with protective jaws and clamp the valve section **[A]**.

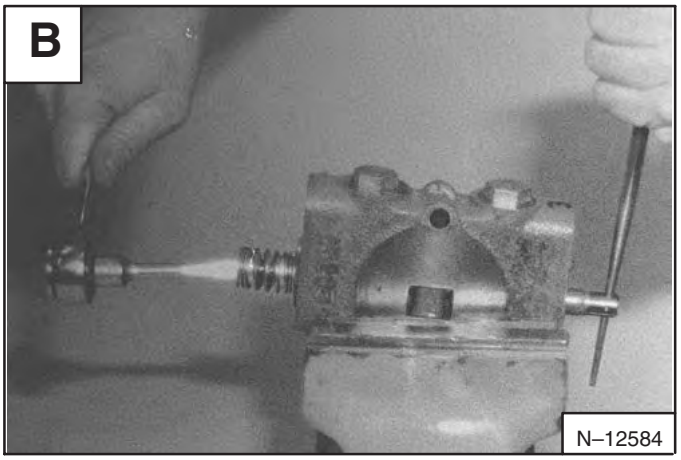
Remove the bolts from the spool cover and remove the cover from the valve section **[A]**.



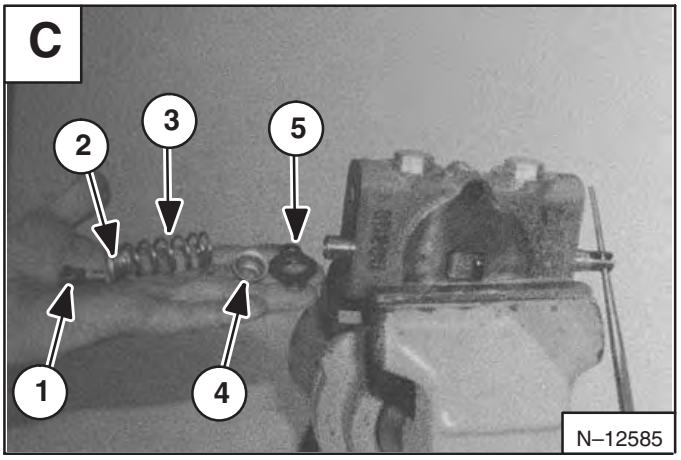
Install a rod through the clevis end of the spool. Remove the bolt from the end of the spool **[B]**.

DO NOT grip the spool with any type of tool.

NOTE: The spool spring is under pressure, use care when removing the bolt from the spool end.

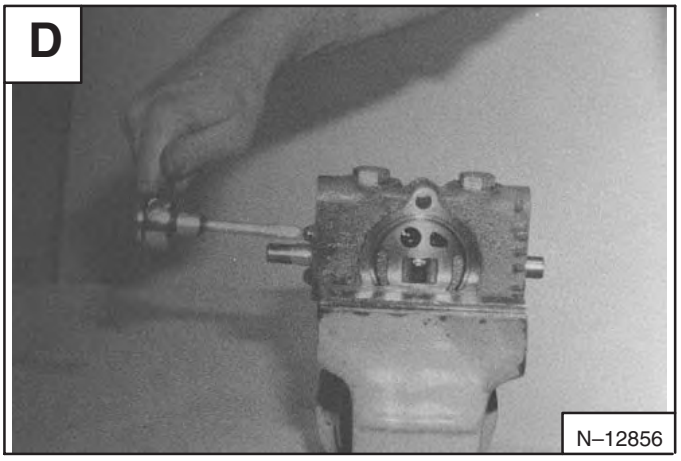


Remove the bolt (Item 1)**[C]**, spring retainer (Item 2)**[C]**, spring (Item 3) **[C]**, spring retainer (Item 4) **[C]** and the cover plate (Item 5) **[C]**.



Remove the screws and cover plate from the clevis end of the valve section **[D]**.

NOTE: The spool and valve housing are not serviceable, they are a matched set. It is not necessary to remove the spool from the housing to service the spool wipers and O–rings. If the spool isremoved, use extreme care not to scratch the spool surface and do not intermix the spools and housings.

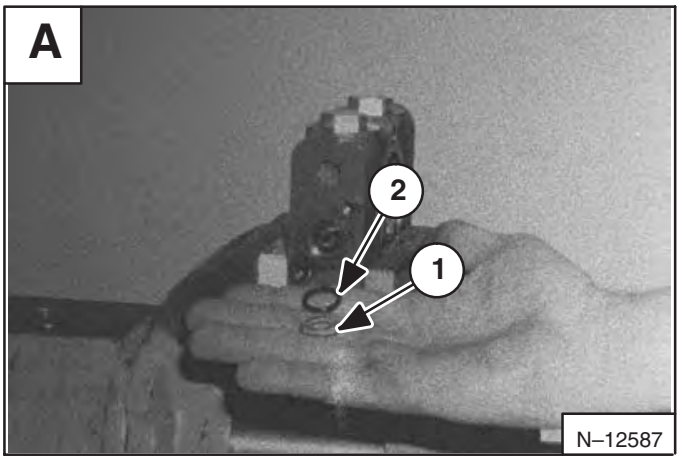


Dealer Copy -- Not for Resale

CONTROL VALVE (Cont'd)

Disassembly And Assembly (Cont'd)

Push the spool into the valve housing far enough to remove the wiper (Item 1) **[A]** and O–ring (Item 2) **[A]** from the clevis end of the housing.

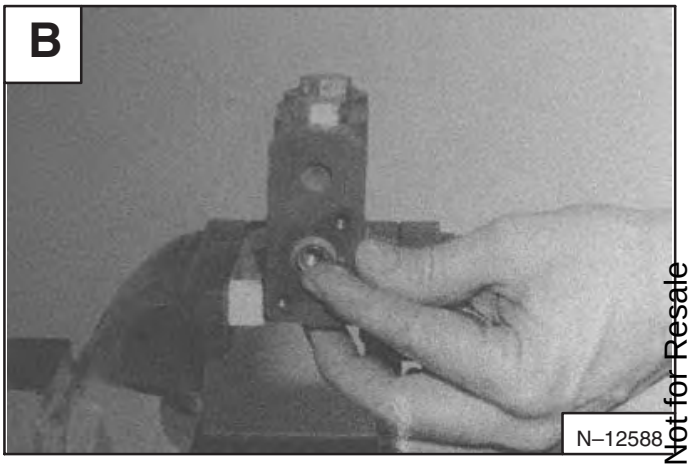


Check the O–ring groove in the housing for contaminates and clean as necessary.

Apply oil to the O–ring and wiper.

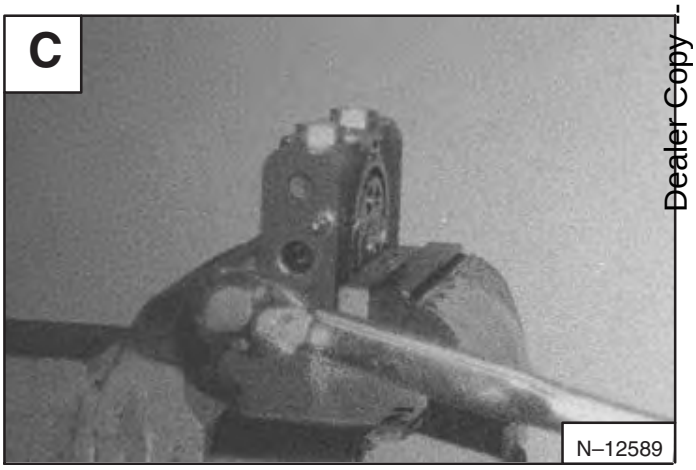
Install the O–ring and wiper into the housing **[B]**.

NOTE: The flange side of the wiper faces outwards from the housing.

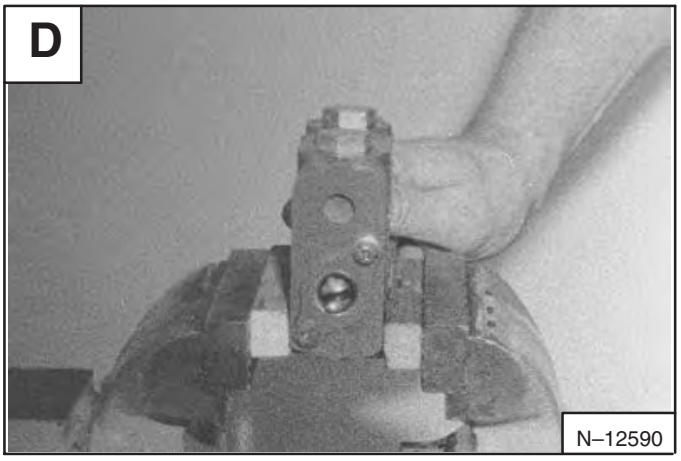


Install the cover plate onto the clevis end of the housing **[C]**.

Tighten the screws to 24 in.–lbs. (2,75 Nm) torque.



Slowly rotate the spool and push it into thevalve until the clevis end of the spool has past through the O–ring and wiper **[D]**.

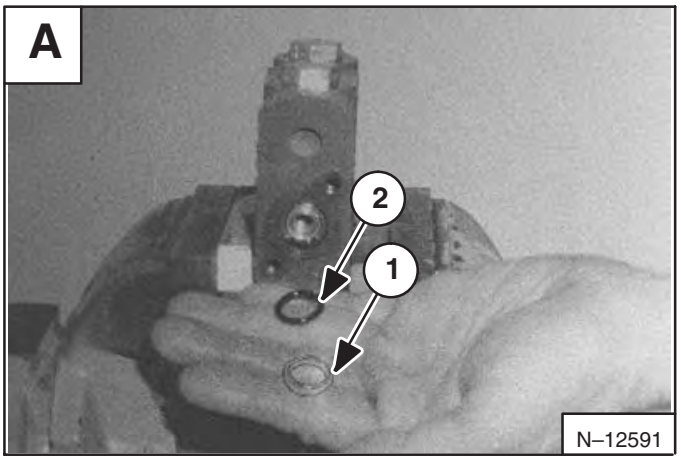


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CONTROL VALVE (Cont'd)

Disassembly And Assembly (Cont'd)

Pull the spool out of the valve far enough to remove the rear wiper (Item 1) **[A]** and O–ring (Item 2) **[A]** from the housing.

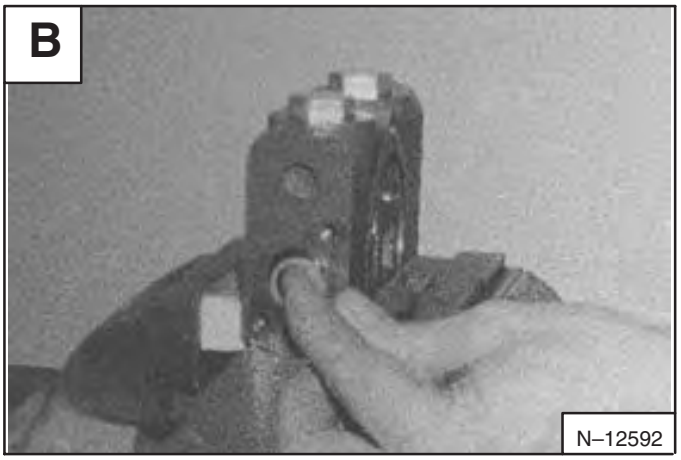


Check the O–ring groove in the housing for contamination and clean as necessary.

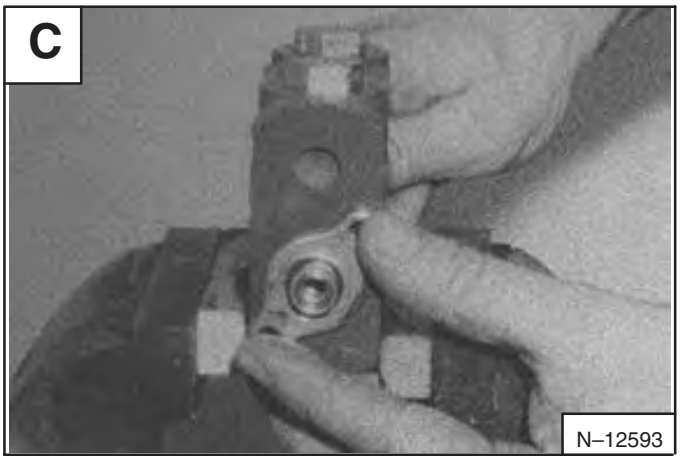
Apply oil to the O–ring and wiper.

Install the O–ring and wiper into the housing **[B]**.

NOTE: The flange side of the wiper faces outwards from the housing.

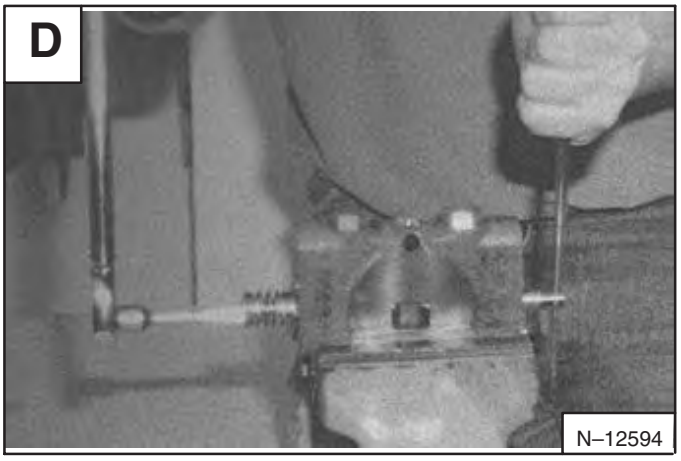


Install the cover plate onto the rear housing. Hold the cover plate in position and slowly rotate the spool and push it through the O–ring, wiper and the cover plate **[C]**.



Leave the cover plate positioned over the wiper and install the spring retainer, spring, spring retainer and the bolt **[D]**.

Install a rod through the clevis end of the spool and tighten the bolt to 55 in.–lbs. (6,27 Nm) torque.

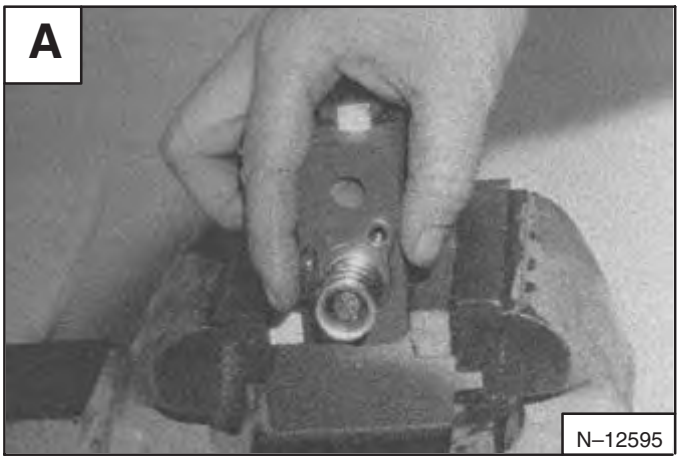


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CONTROL VALVE (Cont'd)

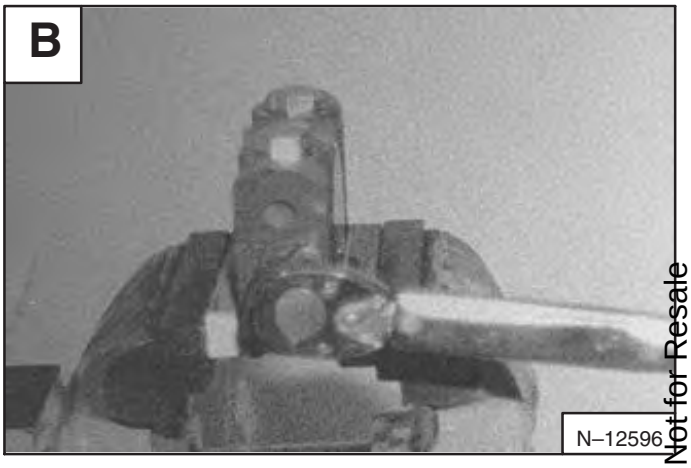
Disassembly And Assembly (Cont'd)

Apply grease to the outer diameter of the spring **[A]**.



Install the cover and the bolts **[B]**.

Tighten the bolts to 152 in.–lbs. (17,25 Nm) torque.



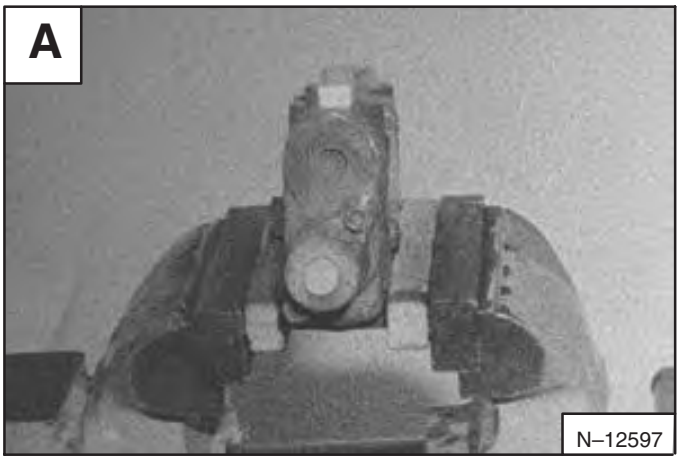
Dealer Copy -- Not for Resale

CONTROL VALVE (Cont'd)

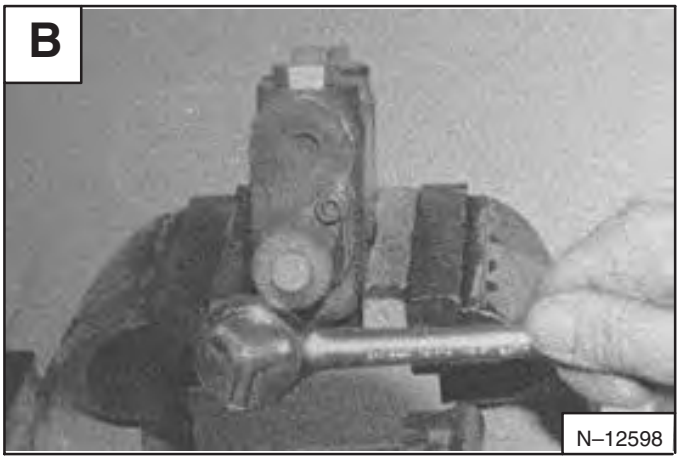
Disassembly And Assembly (Cont'd)

R.H. Travel Valve Section

Use a vise with protective jaws and clamp the valve section **[A]**.



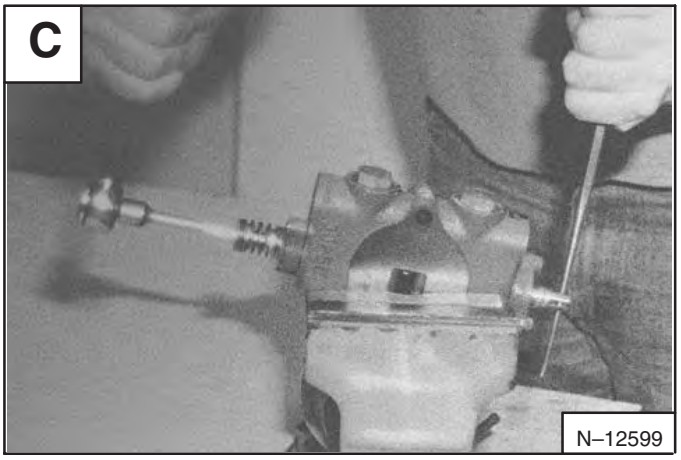
Remove the bolts from the spool cover and remove the cover from the valve section **[B]**.



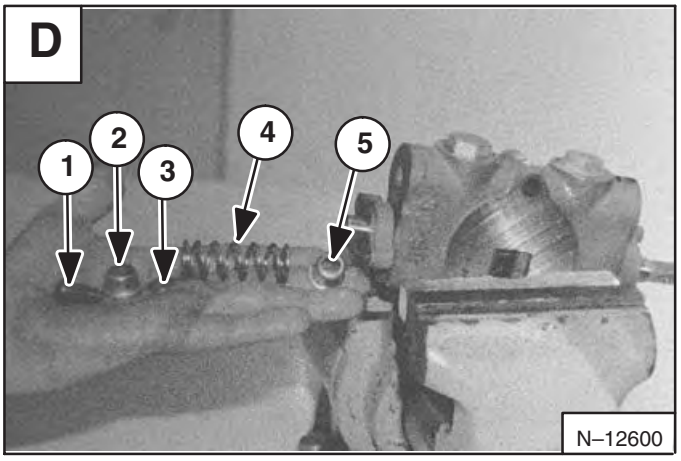
Install a rod through the clevis end of the spool. Remove the bolt from the end of the spool **[C]**.

Do not grip the spool with any type of tool.

NOTE: The spool spring is under pressure, use care when removing the bolt from the spool end.



Remove the bolt with O–ring (Item 1) **[D]**, spring retainer (Item 2) **[D]**, washer (Item 3) **[D]**, spring (Item 4) **[D]** and spring retainer (Item 5) **[D]**.

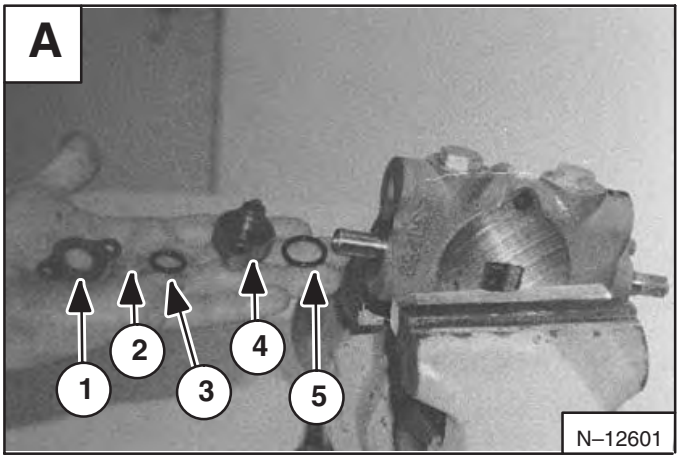


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CONTROL VALVE (Cont'd)

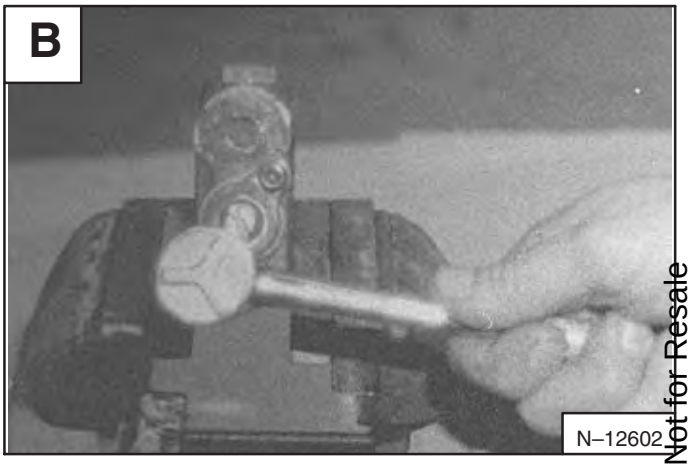
Disassembly And Assembly (Cont'd)

Remove the cover plate (Item 1) **[A]**, wiper (Item 2) **[A]**, O–ring (Item 3) **[A]**, spacer (Item 4) **[A]**, and O–ring (Item 5) **[A]**.

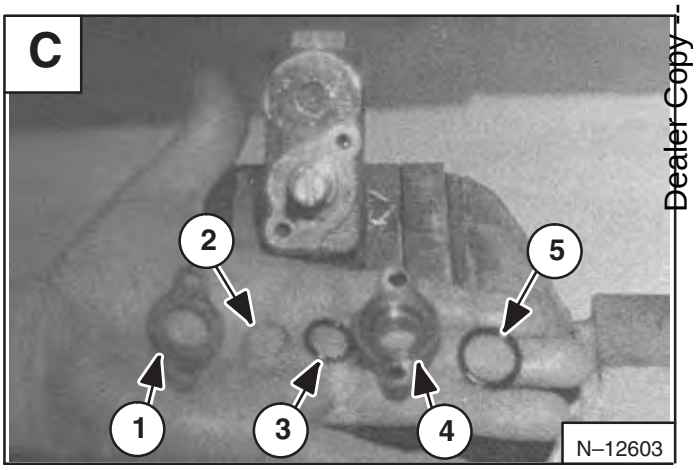


Remove the screws from the cover plate from the clevis end of the valve section **[B]**.

NOTE: The spool and the valve housing are not serviceable, they are a matched set. It is not necessary to remove the spool from the valve housing. If the spool is removed from the valve section, use extreme care not to scratch the spool surface and do not intermix spools and housings.



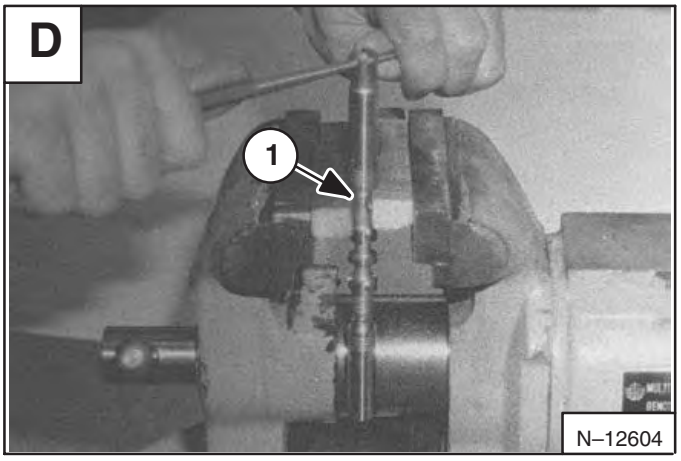
Remove the cover plate (Item 1) **[C]**, wiper (Item 2) **[C]**, O–ring (Item 3) **[C]** spacer (Item 4) **[C]** and O–ring (Item 5) **[C]**.



The clevis end of this spool is replaceable. Unless the clevis end has been damaged, or the O–ring on the threaded end of the clevis is leaking, do not remove it.

If it must be removed, carefully remove the spool from the valve section.

Install a hardened dowel pin (Item 1) **[D]** through the hole in the spool and clamp the spool in a vise with protective jaws. Install a rod through the clevis end and turn the clevis off the spool.



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CONTROL VALVE (Cont'd)

Disassembly And Assembly (Cont'd)

If the clevis end has been removed, replace the O–ring **[A]**.

To install the O–ring onto the clevis, wrap the threaded end of the clevis with three or four wraps of household wax paper. Oil the O–ring and slide it over the wax paper and into the O–ring groove.

Install the clevis end into the spool.

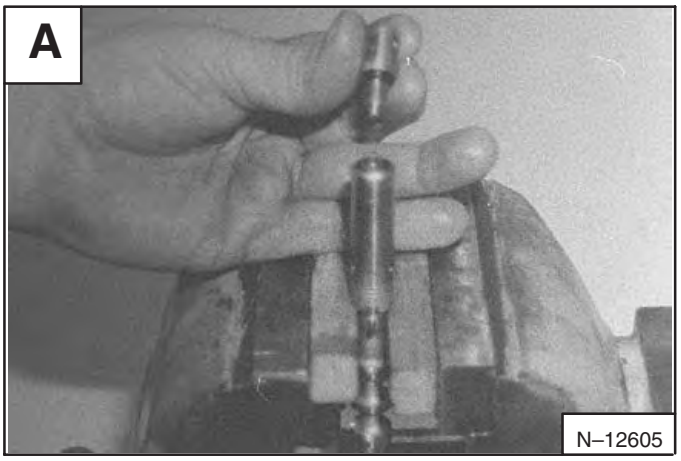
Tighten the clevis to 55 in.–lbs. (6,25 Nm) torque.

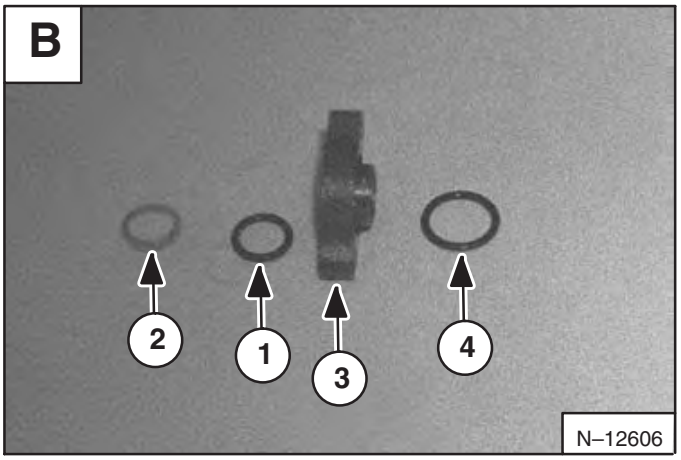
Reinstall the spool into the valve section.

Check the O–ring groove in the spacer for contaminates and clean as necessary . Apply oil to the wiper and O–rings.

Install the O–ring (Item 1) **[B]** and wiper (Item 2) **[B]** into the spacer (Item 3) **[B]**. Install the O–ring (Item 4) **[B]** to the spacers flange.

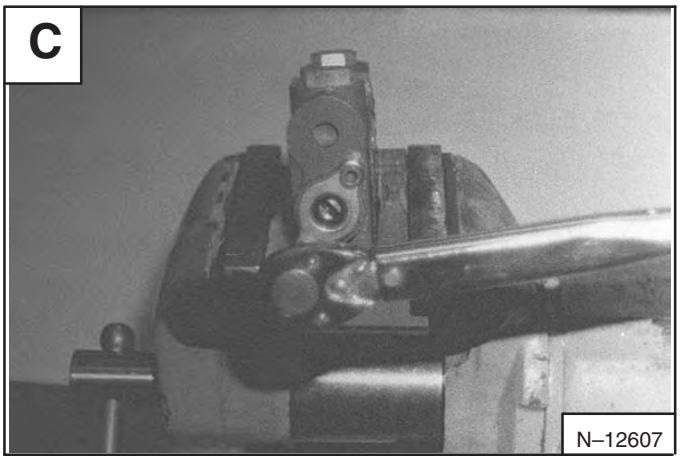
NOTE: The flanged side of the wiper faces outwards from the spacer.



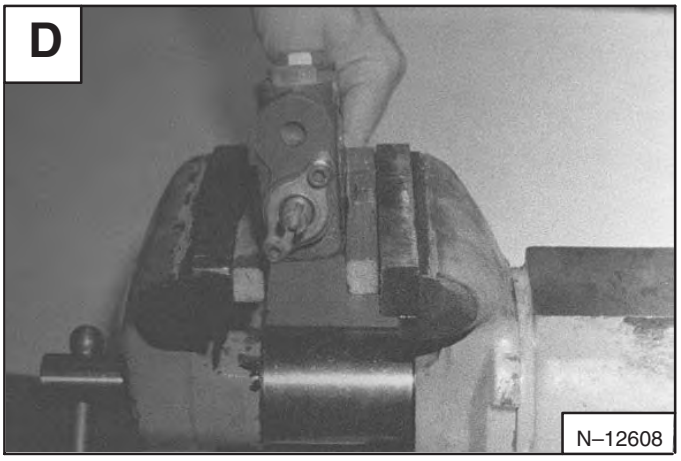


Install the spacer and the cover plate onto the clevis end of the valve section **[C]**.

Tighten the bolts to 76 in.–lbs. (8,6 Nm) torque.



Slowly rotate the spool and push it into thevalve until the clevis end of the spool has past through the O–ring and wiper **[D]**.



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CONTROL VALVE (Cont'd)

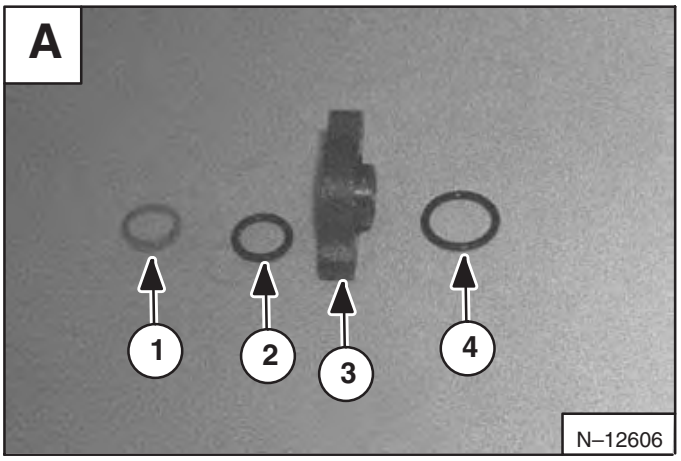
Disassembly And Assembly (Cont'd)

Check the O–ring groove in the spacer for contaminates and clean as necessary.

Apply oil to the wiper and O–rings.

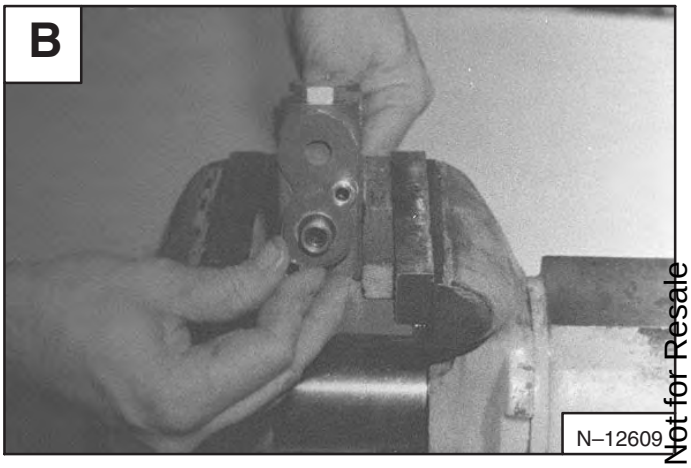
Install the O–ring (Item 1) **[A]** and wiper (Item 2) **[A]** into the spacer (Item 3) **[A]**. Install the O–ring (Item 4) **[A]** to the spacers flange.

NOTE: The flanged side of the wiper faces outwards from the spacer.



Install the spacer and cover plate onto the rear end of the valve section and hold these in place **[B]**.

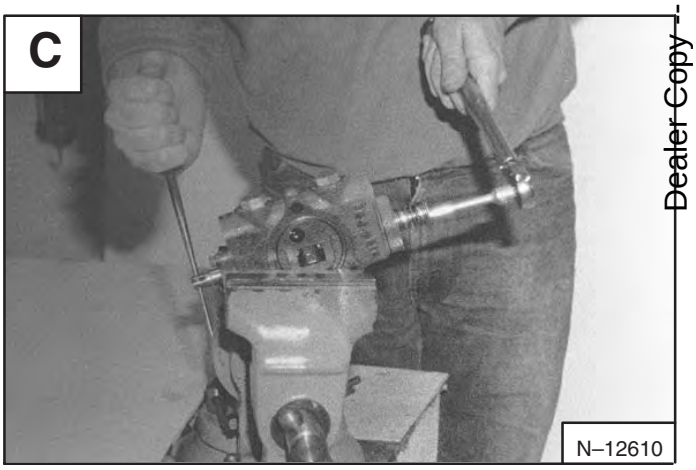
Slowly rotate the spool and push it through the O–ring and wiper in the spacer.



Install the new O–ring onto the spring retaining bolt by wrapping the threads with three or four wraps of household wax paper. Oil the O–ring and slide it overthe wax paper and into the O–ring groove.

Install the spring retainer, spring washer, spring retainer onto the end of the spool **[C]**.

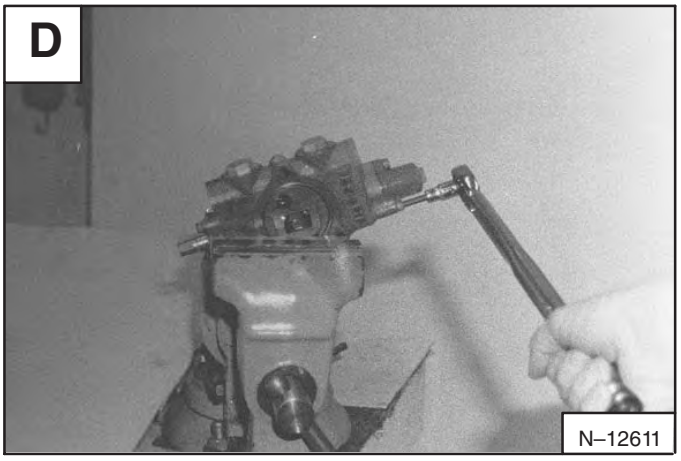
Tighten the bolt to 55 in.–lbs. (6,25 Nm) torque.



Apply grease to the outer diameter of the spring.

Install the end cover **[D]**.

Tighten the bolts to 76 in.–lbs. (8,63 Nm) torque.



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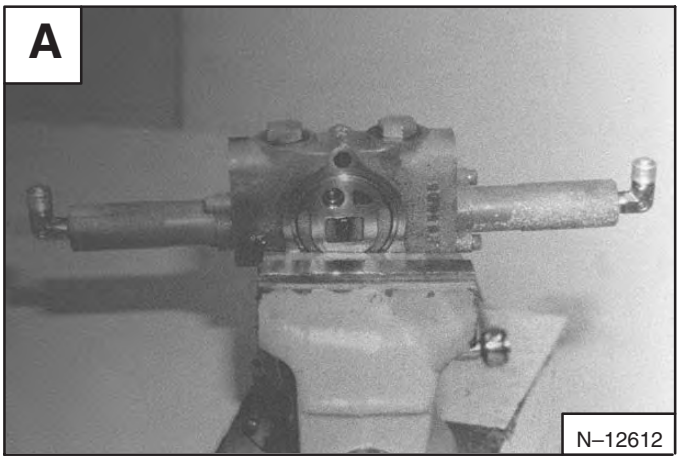
CONTROL VALVE (Cont'd)

Disassembly And Assembly (Cont'd)

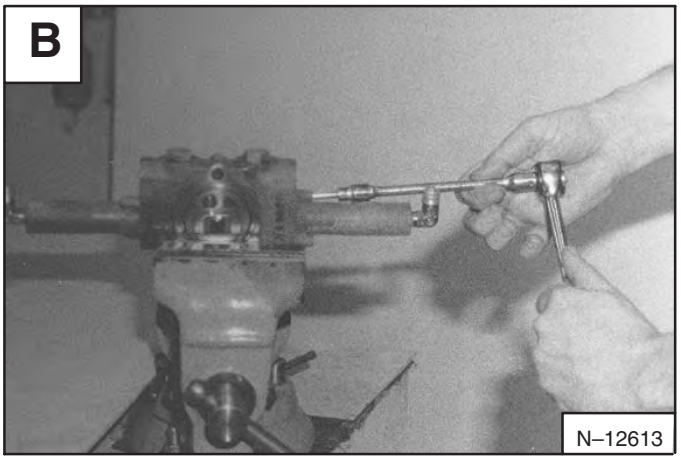
Hydraulically Activated Valve Sections

NOTE: The photos may not show the valve exactly as they appear, but the procedure is correct for these sections.

Use a vise with protective jaws and clamp the valve section **[A]**.

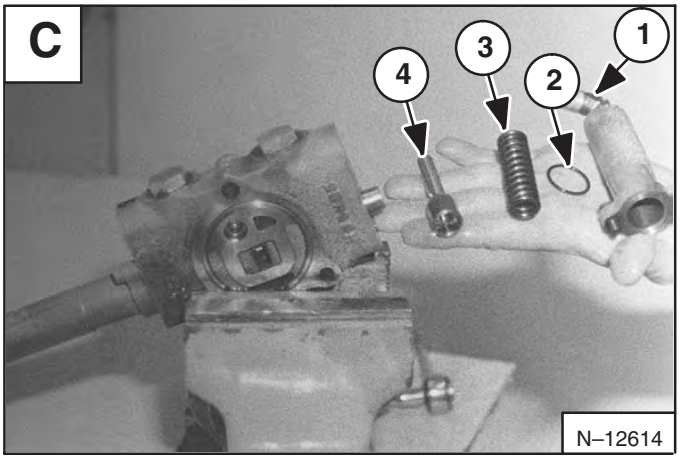


Remove the bolts from the cover **[B]**.



Remove the cover (Item 1) **[C]**, O–ring (Item 2) **[C]**, spring (Item 3) **[C]** and the spring retainer (Item 4) **[C]**.

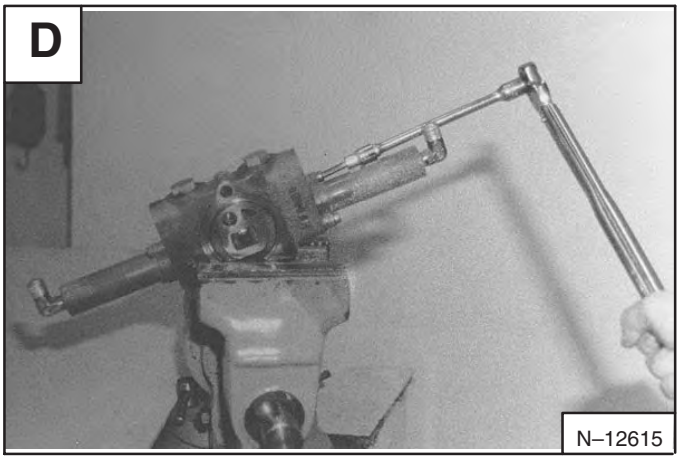
NOTE: There are no O–rings or wipers used with these spools and housings. The spool and housing are not serviceable separately, they are a matched set. It is not necessary to remove the spool from the housing. If the spool is removed, use extreme care not to scratch the spool surface and the spool must be reinstalled in the same housing and in the same orientation.



Install the spring retainer and the spring. Apply grease to the outer diameter of the spring. Install a new O–ring and attach the cover to the housing **[D]**.

Torque the bolts to 76 in.–lbs. (8,63 Nm) torque.

NOTE: Both ends of the valve section use identical parts. Repeat steps [B], [C] and [D] for the opposite end of the valve.



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CONTROL VALVE (Cont'd)

Disassembly And Assembly (Cont'd)

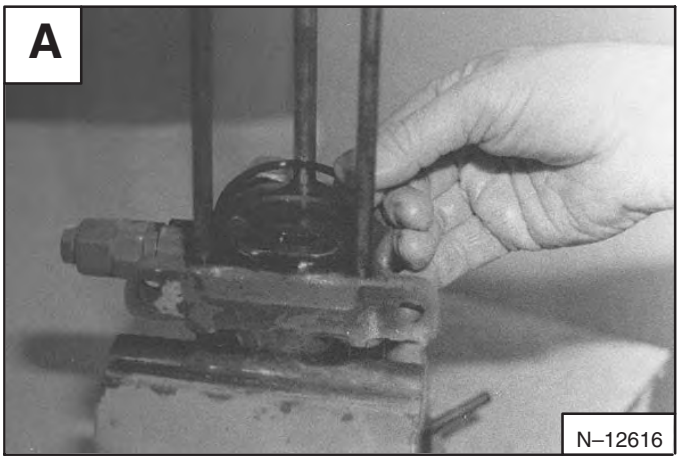
Install the three through bolts into the inlet section of the control valve.

Position the inlet section on its end.

Install a new O–ring into the inlet section O–ring groove **[A]**.

Oil the O–ring.

Check each valve section for location marks. Make sure that the valve section are installed in the correct order.

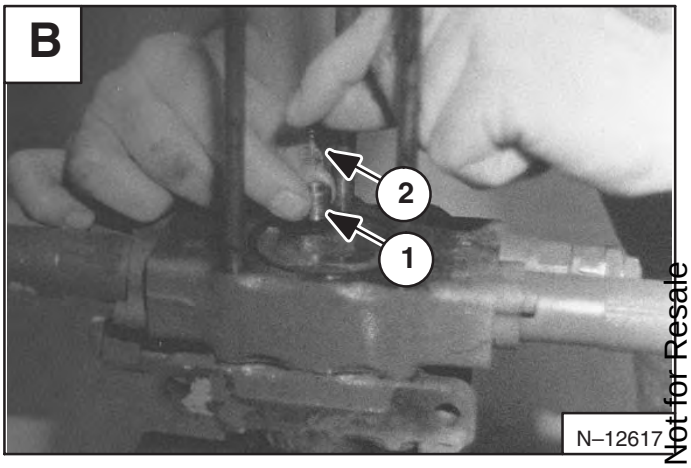


Install the next section over the three through bolts and position it flat against the previous valve section.

If the valve section had a load check plug (Item 1) **[B]** and spring (Item 2) **[B]**, oil the load check plug and install it in the side face of the valve and set the spring into the load check plug cavity.

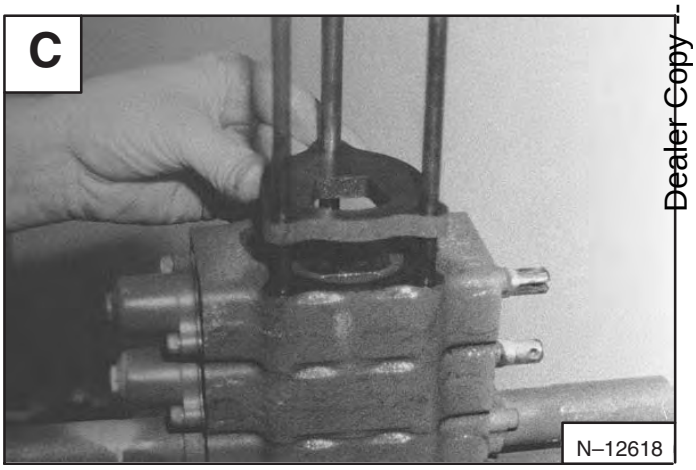
Install the O–ring into the valvesection groove and oil the O–ring.

Continue the installation of each of the valve sections in their correct locations.



Install the valve plate between sections marked six and seven **[C]**.

Continue the installation of the sections until all valve sections are installed

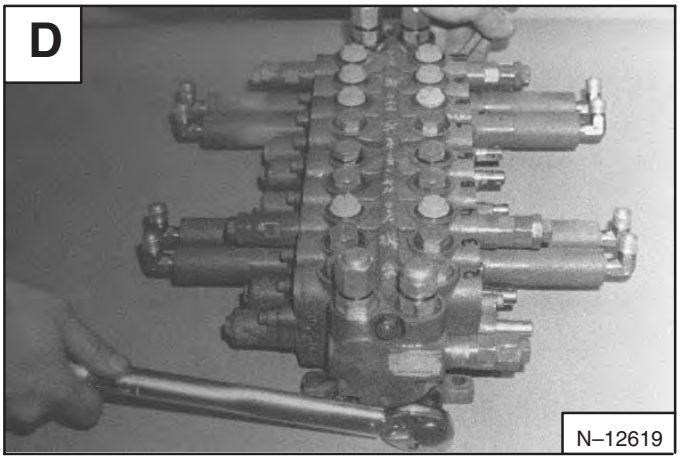


Install the nuts onto the through bolts **[D]**.

Tighten the 10 mm nuts to 34 ft.–lbs. (46 Nm) torque.

Tighten the 8 mm nut to 14 ft.–lbs. (19 Nm) torque.

NOTE: Tighten the nuts evenly to avoid the spools binding in the housings. Check the operation of spools, they must move freely in and out. If any binding is felt, loosen the nuts and retorque.



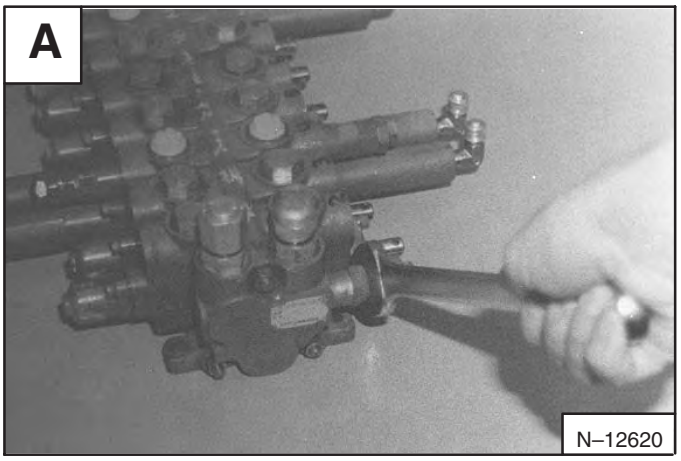
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CONTROL VALVE (Cont'd)

Disassembly And Assembly (Cont'd)

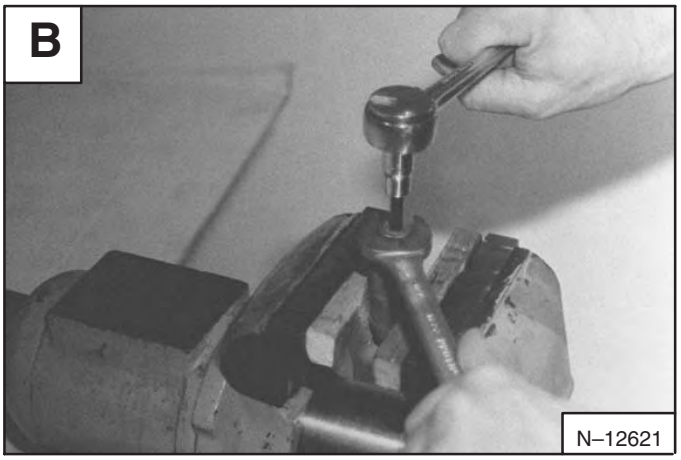
Main Relief Valves

Remove the main relief valve from the inlet section **[A]**.

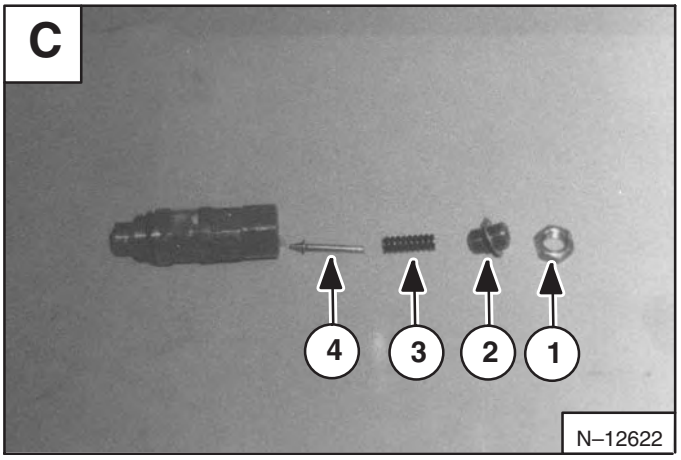


Use a vise with protective jaws and hold the relief valve.

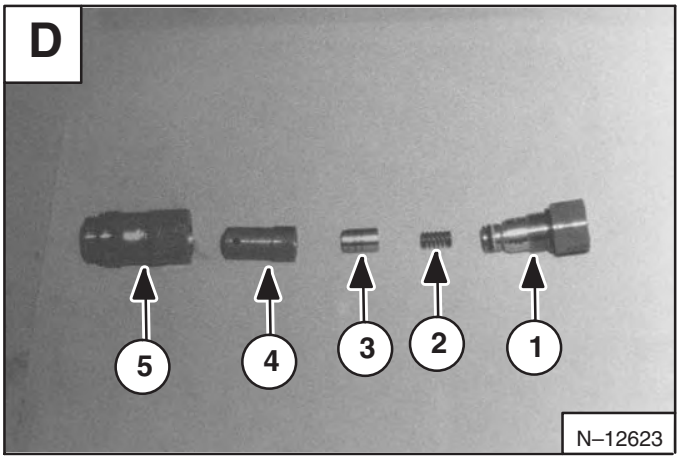
Loosen the adjusting set screws jam nut from the end of the relief valve **[B]**.



Remove the jam nut (Item 1) **[C]**, the adjusting set screw with O–ring (Item 2) **[C]**, spring (Item 3) **[C]** and the poppet (Item 4) **[C]** from the relief valve housing.



Remove the relief plug (Item 1) **[D]**, spring (Item 2) **[D]**, poppet (Item 3) **[D]** and the sleeve (Item 4) **[D]** from the relief valve housing (Item 5) **[D]**.



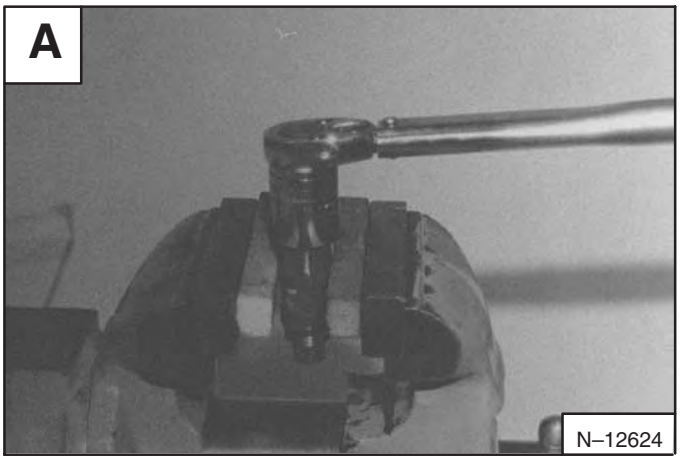
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CONTROL VALVE (Cont'd)

Disassembly And Assembly (Cont'd)

Clean and inspect all parts of the main relief valve. If any of the relief valve components are scratched or damaged, a new relief valve will need to be ordered, as internal components are not serviced separately.

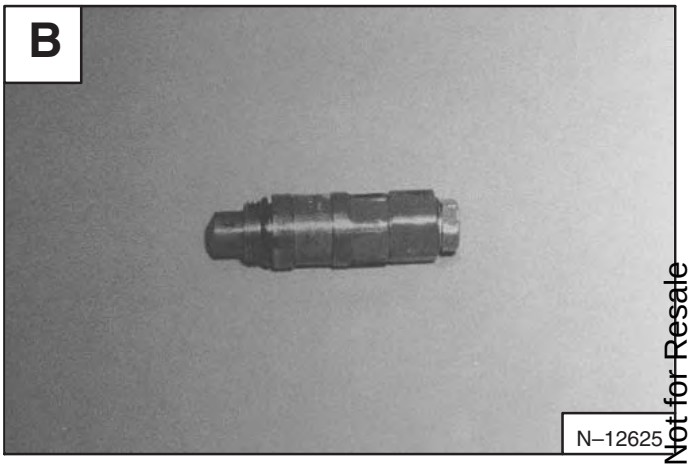
Oil all moving parts and reassemble the sleeve, poppet, spring and the relief plug to 33 ft.–lbs. (45 Nm) torque.



Install a new O–ring onto the adjusting set screw . Wrap the threads of the set screw with three or four wraps of wax paper, oil the O–ring and slide the O–ring over the threads and into the O–ring groove.

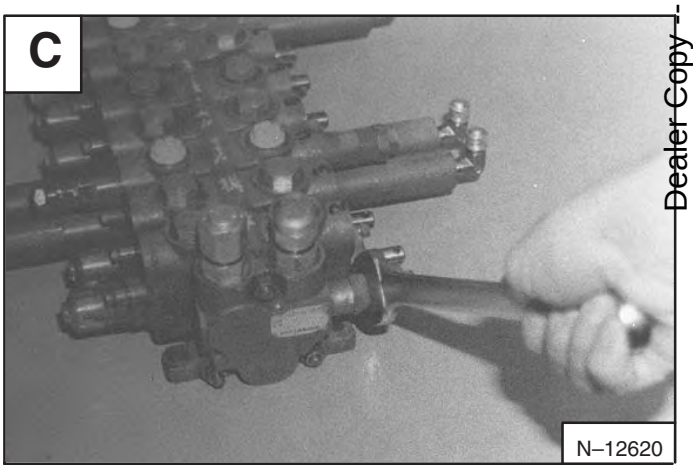
Install the poppet, spring, adjusting set screw and the jam nut into the relief valve **[B]**. Leave the jam nut loose until relief valves have been set to specified pressure settings.

See *MAIN RELIEF VALVE* adjustment procedure on Page 2–12p.



Install the main relief valve into the inlet section of the control valve **[C]**.

Tighten the relief valve to 54 ft.–lbs. (73 Nm) torque.



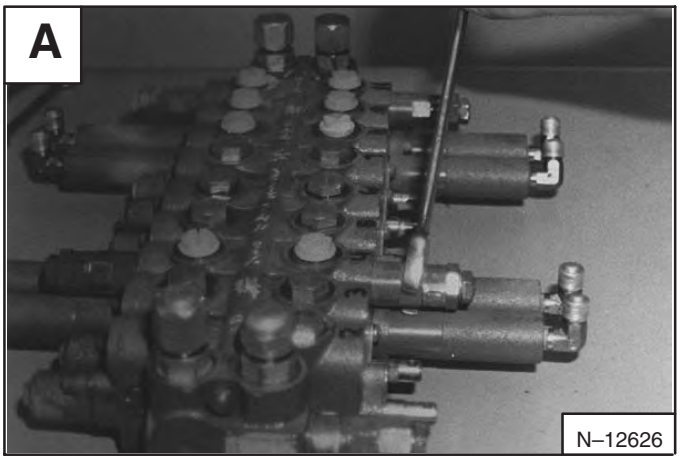
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CONTROL VALVE (Cont'd)

Disassembly And Assembly (Cont'd)

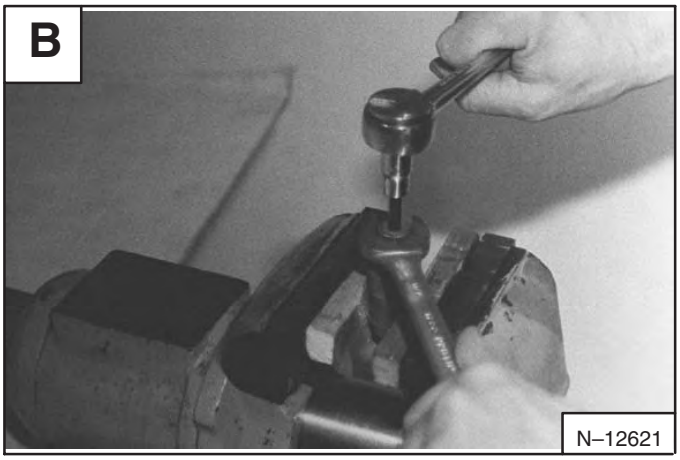
Work Port Relief Valves

Remove the relief valve from the valve section **[A]**.

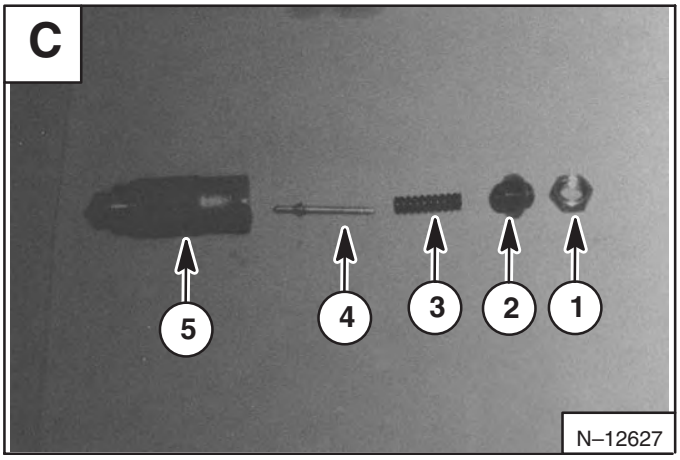


Use a vise with protective jaws and hold the relief valve.

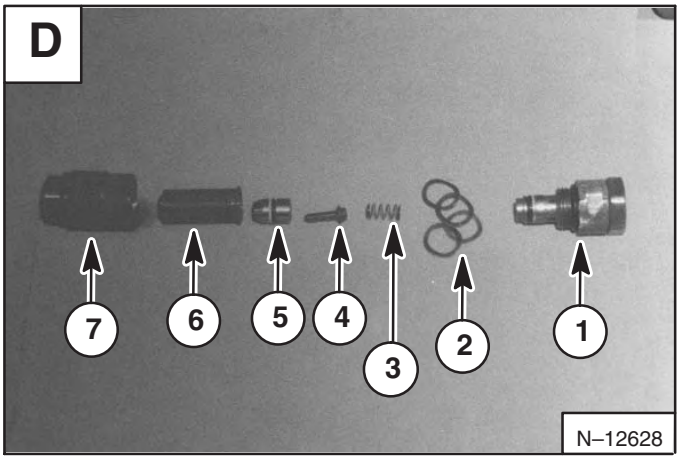
Loosen the adjusting set screws jam nut from the end of the relief valve **[B]**.



Remove the jam nut (Item 1) **[C]**, the adjusting set screw with O–ring (Item 2) **[C]**, spring (Item 3) **[C]** and poppet (Item 4) **[C]** from the relief valve housing.



Remove the relief plug (Item 1) **[D]**, spring washers (Item 2) **[D]**, spring (Item 3) **[D]**, piston (Item 4) **[D]**, poppet (Item 5) **[D]**, sleeve (Item 6) **[D]** and the relief valve housing (Item 7) **[D]**.



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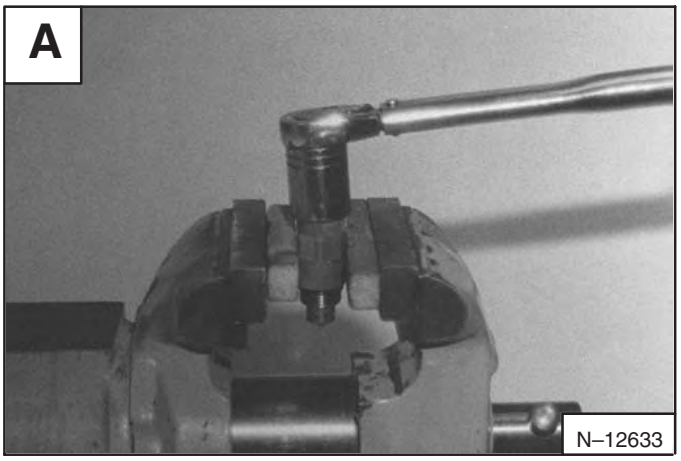
CONTROL VALVE (Cont'd)

Disassembly And Assembly (Cont'd)

Clean and inspect all parts of the work port relief valve. If any of the relief valves components are scratched or damaged, a new relief valve assembly will need to be ordered as the internal components are not sold separately.

Oil all moving parts and reassemble the sleeve, poppet, piston spring, spring washers and relief plug into the relief valve housing **[A]**.

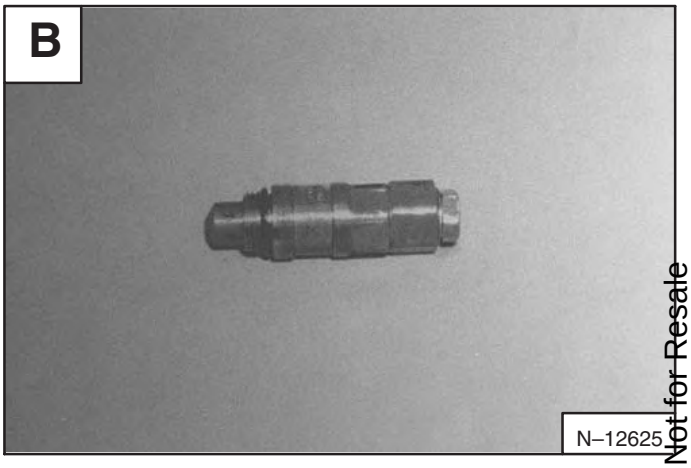
Tighten the relief plug to 33 ft.–lbs. (45 Nm) torque.



Install a new O–ring onto the adjusting set screw . Wrap the threads of the set screw with three or four wraps of wax paper, oil the O–ring and slide the O–ring over the threads and into the O–ring groove.

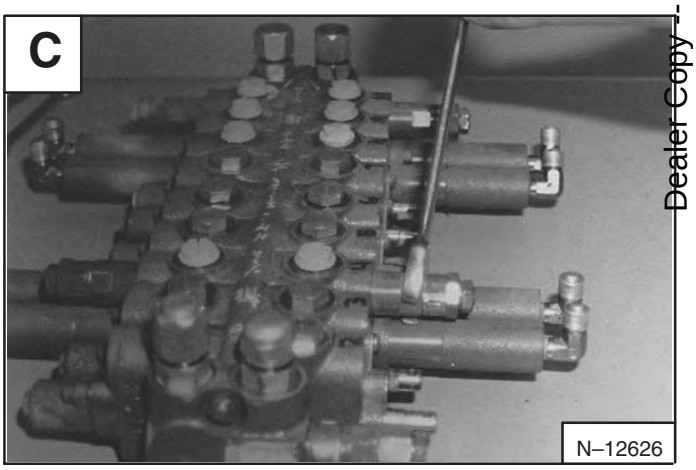
Install the poppet, spring, set screw and jam nut into the relief valve **[B]**. Leave the jam nut loose until relief valves have been set to specified pressure settings.

See *MAIN RELIEF VALVE* adjustment procedure on Page 2–12p and 2–12q.



Install the work port relief valve into the inlet section of the control valve **[C]**.

Tighten the relief valve to 54 ft.–lbs. (73 Nm) torque.



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CONTROL VALVE (Cont'd)

Relief Valve Pressure Setting Adjustment

Main Relief Set At . . . . . .2275 PSI (15686 kPa)
Blade Relief Set At . . . . . .1140 PSI (7860 kPa)
Arm Relief Set At:
(Rod End) Front . . . . . .2980 PSI (20544 kPa)
(Base End) Rear . . . . . .2980 PSI (20544 kPa)
Boom Reliefs Set At:
(Base End) Front . . . . . .2980 PSI (20544 kPa)
(Rod End) Rear . . . . . .3480 PSI (23991 kPa)

Main Relief Valve

To adjust the main relief valves, the hydraulic circuit back pressure must be known.

Install OEM1238 or OEM1239 hydraulic tester and hose adapter 6657709 into the pump pressure circuit that is next to the engine **[A]**. (Pump outlet to tester inlet/tester outlet to hose going to the valve.) Open the flow control knob on the tester to full open.

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. 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. W arm the hydraulic fluid to 140° F (60° C).

Take a gauge reading of the hydraulic circuit back pressure and record this information. Back pressure is the pressure noted on the gauge with the flow restrictor fully open and all spools in neutral.

Turn the excavator engine off.

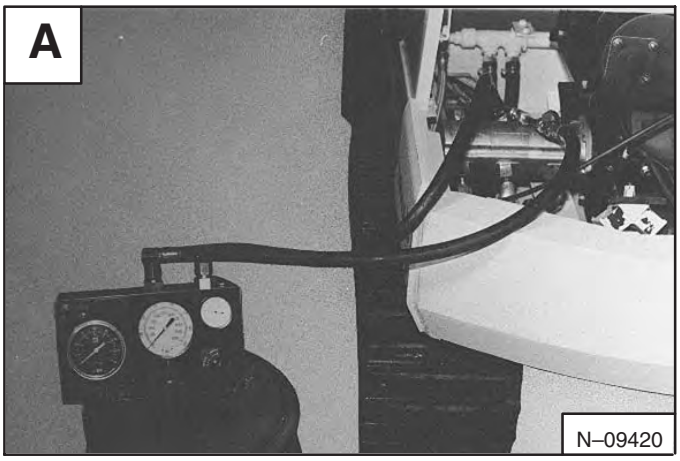
Repeat this test procedure on the center hydraulic pump circuit.

The recorded circuit back pressure will needto be added to the relief valve pressure setting that is listed in the above chart. This will assure accurate relief valve settings;

EXAMPLE: The circuit next to the engine has 150 PSI (1034 Nm) back pressure, add 150 PSI (1034 Nm) to 2550 PSI (17580 Nm) and set that relief valve to 2700 PSI (18614 Nm). The circuit in the center of the pump has 225 PSI (1551 Nm) back pressure, add225 PSI (1551 Nm) to 2550 PSI (17580 Nm) and set that relief valve to 2775 PSI (19130 Nm).

NOTE: This is only applicable to the main relief valves. Work port relief valves are to be set per the above chart.

NOTE: When testing the main relief valves, the appropriate cylinder for the relief valve being tested, will have to be extended or retracted fully to activate the relief valves. Make sure that there is adequate clearance for excavator movement and that no unauthorized personnel are in the work area. If adequate room is not available, the hydraulic work hoses can be removed from the control valve section being tested andthe control valve ports plugged.



⚠ WARNING

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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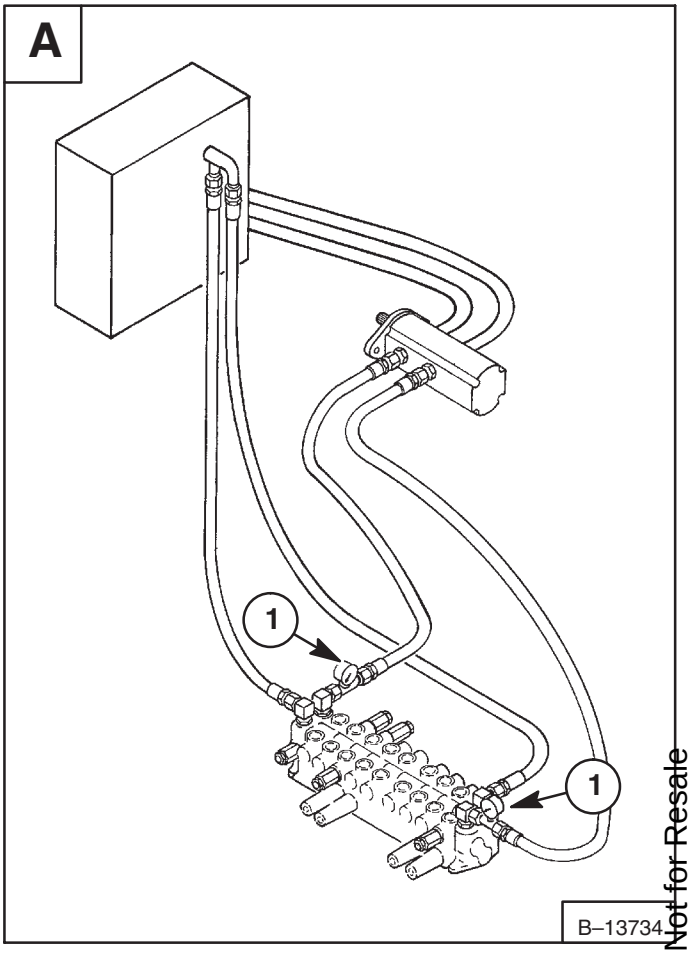
CONTROL VALVE (Cont'd)

Relief Valve Pressure Setting Adjustment (Cont'd)

Main Relief Valve (Cont'd)

Install a pressure gauge (Item 1) **[A]** (minimum of 5000 PSI) into the pressure line at the inlet section of both sides of the control valve.

Run the hydraulic pump at maximum rated RPM (high idle on engine).

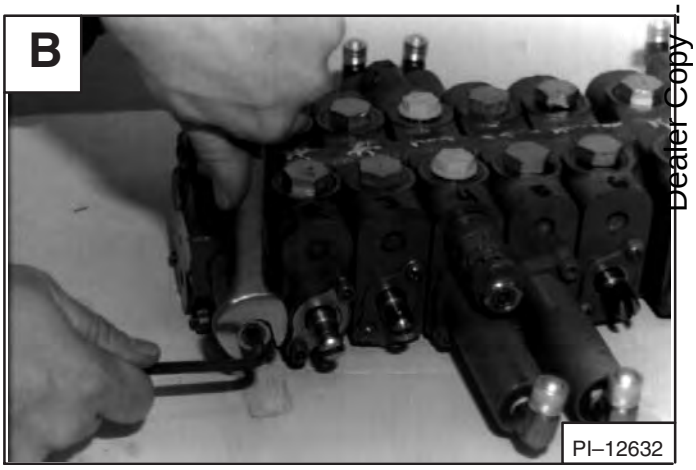


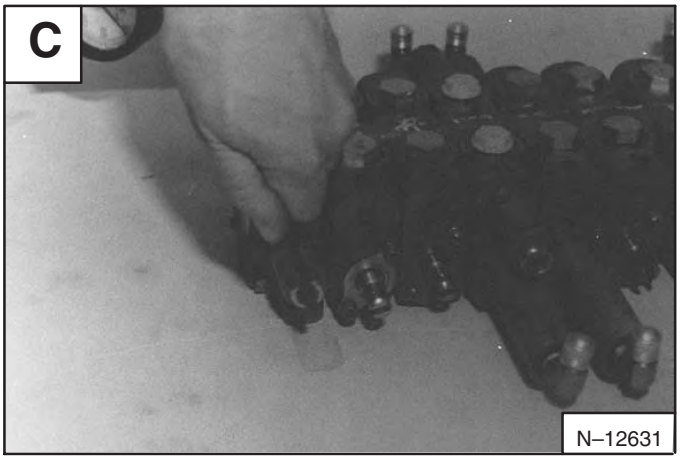
Loosen the jam nut on the relief valve adjusting set screw.

Stroke a spool and check the pressure gauge PSI reading.

Turn the set screw clockwise to increase the pressure, counterclockwise to decrease the pressure **[B]**. When the correct pressure setting is obtained, tighten the jam nut while holding the adjusting screw from turning **[C]**.

Recheck the gauge reading after tightening the jam nut to assure that the correct setting has been maintained.





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CONTROL VALVE (Cont')

Relief Valve Pressure Setting Adjustment (Cont'd)

Work Port Relief Valves

⚠ WARNING

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–2019–1285

Work port relief valves will need to be tested and set with a different test method.

Use a portable hydraulic hand pump with clean fluid that is compatible with the Melroe hydraulic fluid or use SAE 10W–30 motor oil.

Lower the arm and boom to the ground. Turn off the engine. Move the control levers back and forth to relieve any hydraulic pressure. Loosen the hydraulic tank cap or cover.

Disconnect the hose from the control valve section in which the work port relief valve to be tested is located.

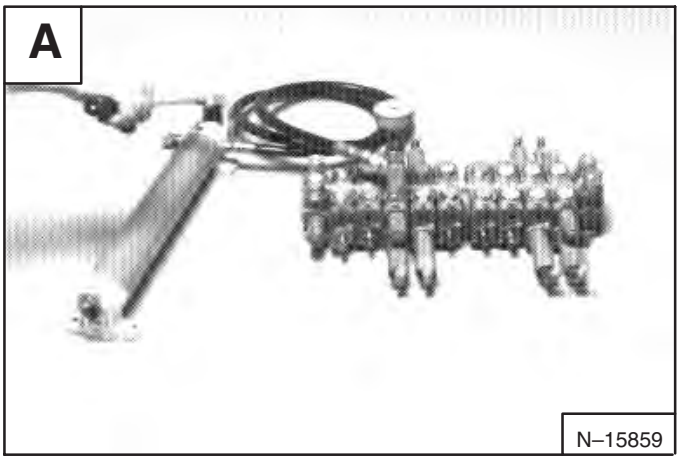
Install a pressure gauge (minimum of 5000 PSI) into the section being tested. Attach the hydraulic hand pump hose onto the pressure gauge **[A]**.

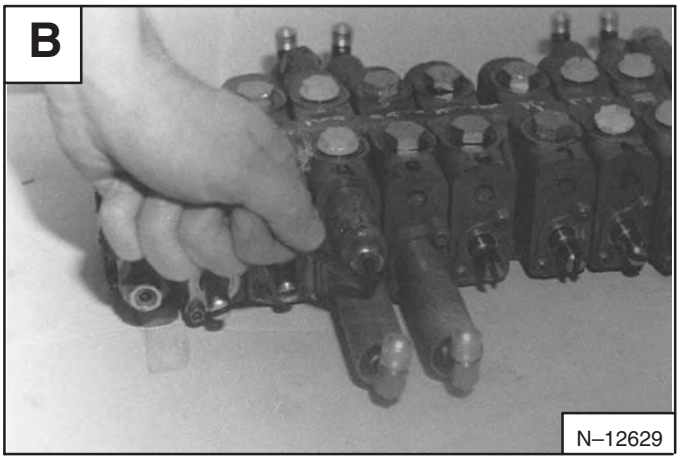
Pressurize the section with the hydraulic hand pump until the relief valve opens. Record the gauge reading at which the relief valve opens. If the relief valve needs to be reset, loosen the jam nut on the relief valve adjusting set screw. Turn the set screw clockwise to increase the pressure, counterclockwise to decrease the pressure **[B]**.

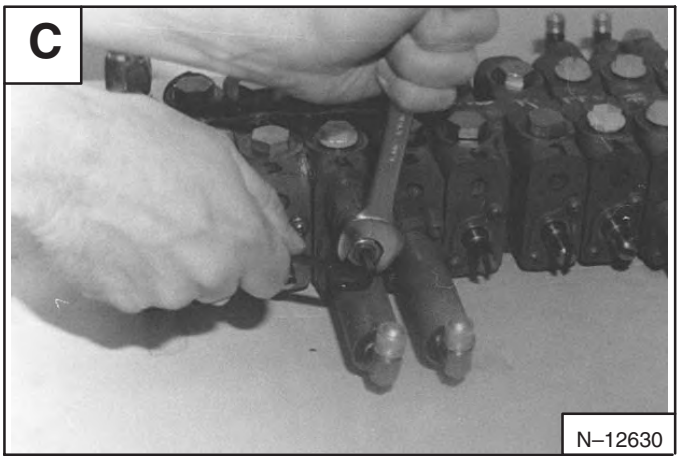
When the correct pressure setting is obtained, tighten the jam nut while holding the adjustment set screw from turning **[C]**.

Recheck the gauge reading after tightening the jam nut to assure that the correct setting has been maintained.

To check and reset the additional port relief valves, the hydraulic hand pump can either be relocated to the different valve sections or the port relief valves can be installed into the section that the hydraulic hand pump has been installed. Test each relief valve and then reinstall the relief valve into the correct valve section.







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HYDRAULIC RESERVOIR

Removal And Installation

IMPORTANT

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

I–2003–0888

Remove the fuel tank. (See Page 5–1.)

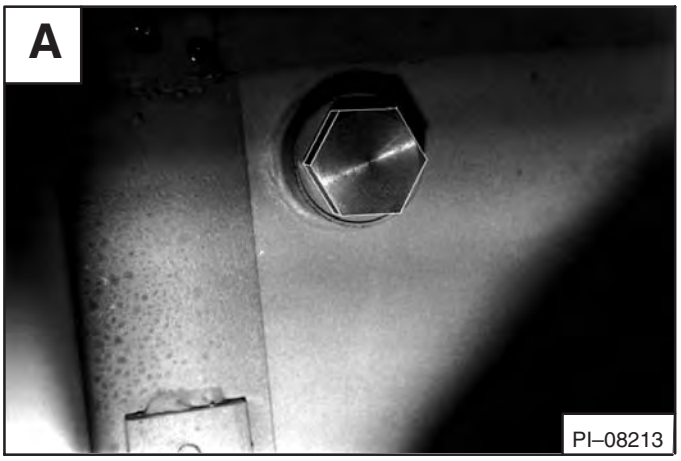
Remove the drain plug from the bottom of the reservoir **[A]**. Drain the fluid into a container.

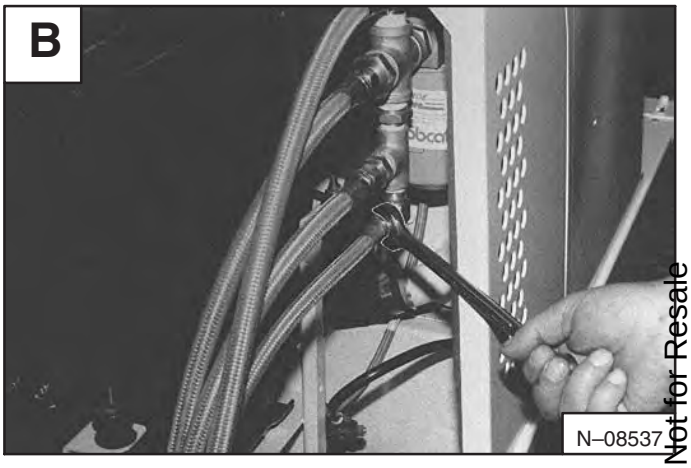
Mark all the hoses for correct installation.

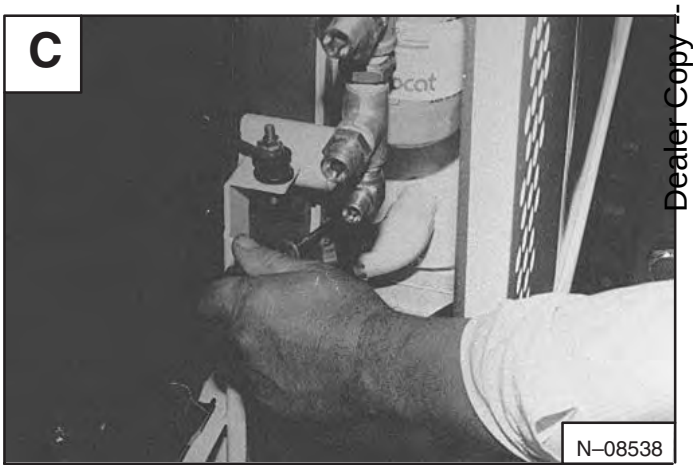
Disconnect the reservoir return lines **[B]**.

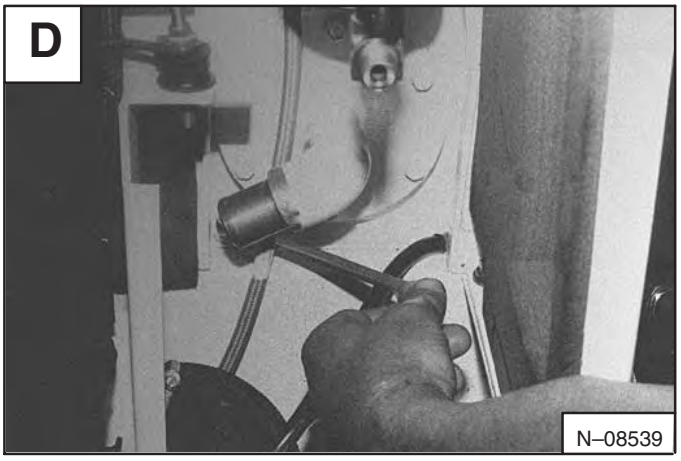
Remove the supply hose clamp anddisconnect the hose **[C]**.

Remove the bolts from the reservoir base **[D]**.







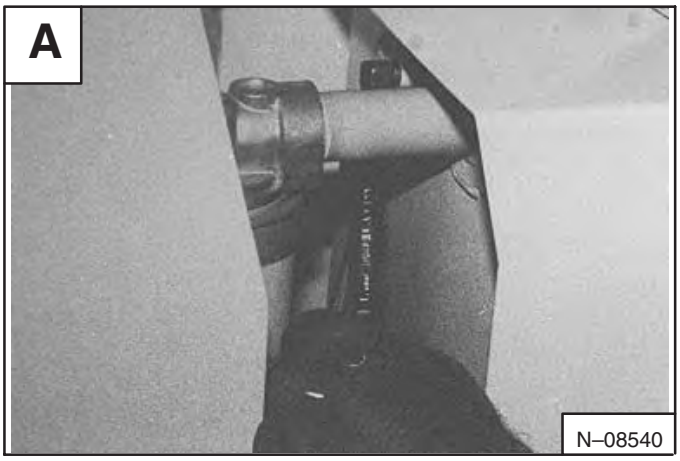


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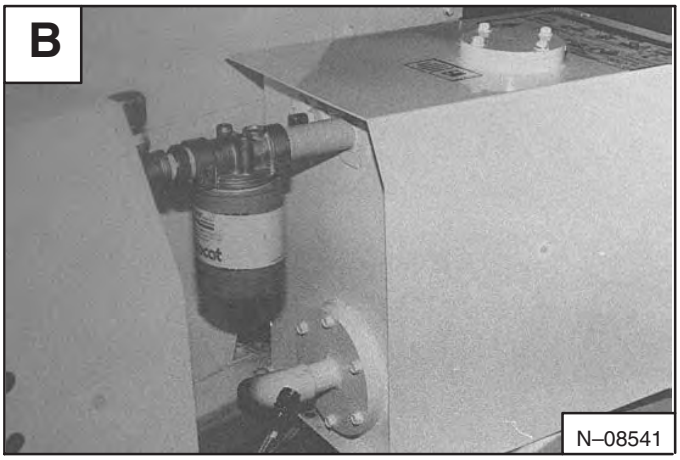
HYDRAULIC RESERVOIR (Cont'd)

Removal And Installation (Cont'd)

Slide the reservoir forward and remove the swing motor return hose from the reservoir **[A]**.



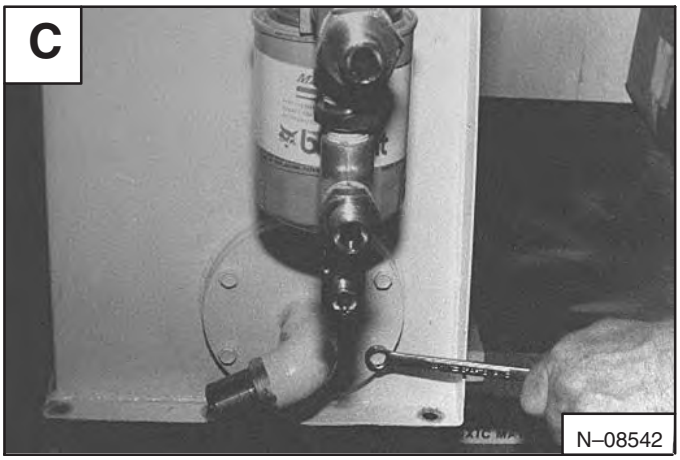
Remove the hydraulic reservoir from the machine **[B]**.



Suction Filter

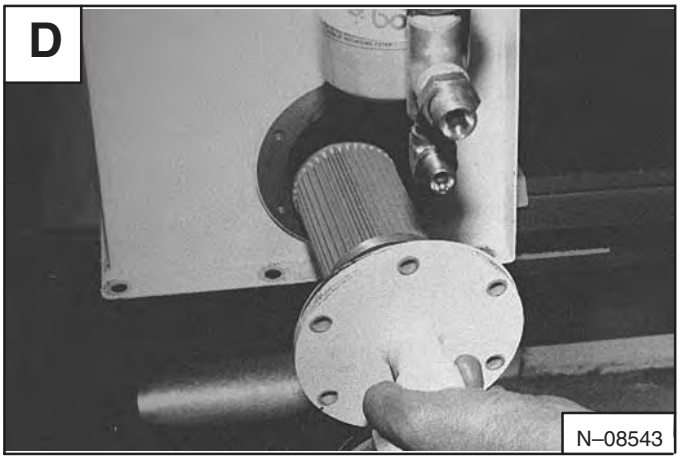
To remove and install the mesh filter use the following procedure:

Remove the bolts from the mounting flange **[C]**.



Remove the mesh screen and mounting flange assembly from the reservoir **[D]**.

Use clean solvent to clean the suction filter . Use air pressure to dry the mesh screen.



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BOOM CYLINDER

Removal And Installation

Put the bucket on the floor. Stop the engine.

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

Disconnect the two hoses from the boom cylinder.

Remove the retainer bolt and nut from the boom cylinder base end pin **[A]**.

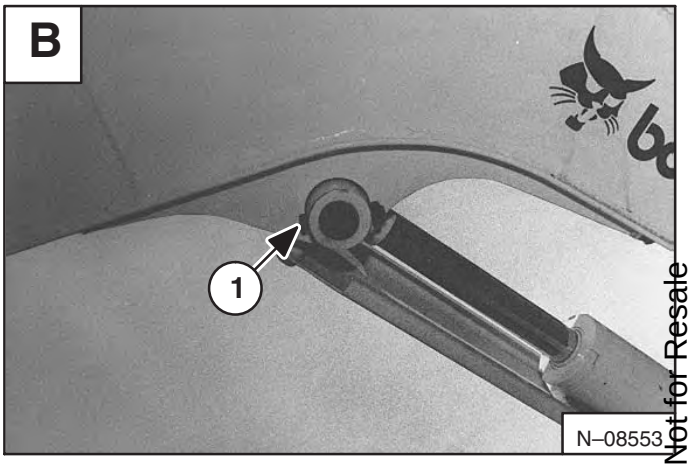
Remove the cylinder base end pin.

Lower the base end of the boom cylinder to the floor.

Remove the bolt (Item 1)**[B]** and nut from the cylinder rod end pin.

Remove the cylinder rod end pin. Remove the boom cylinder from the boom.





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DIPPERSTICK CYLINDER

Removal And Installation

Put the bucket on the floor. Stop the engine.

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

Disconnect the two hoses from the dipperstick cylinder **[A]**.

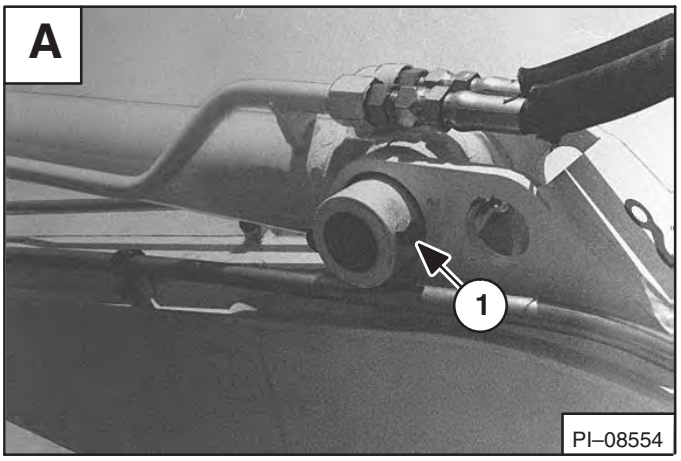
Remove the retainer bolt (Item 1) **[A]** and nut from the cylinder base end pin.

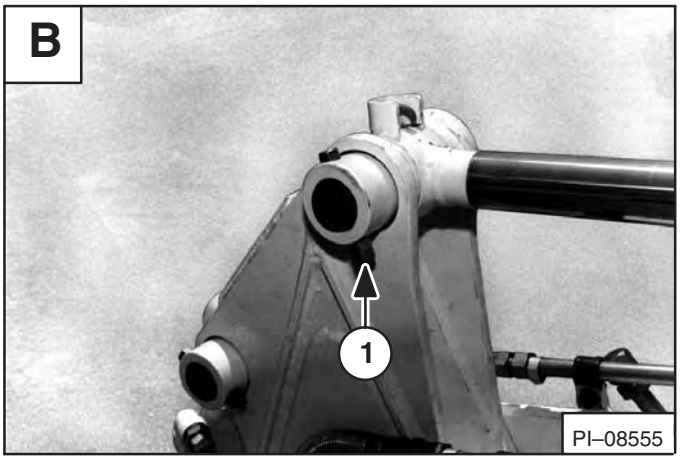
Remove the cylinder base end pin.

Remove the retainer bolt (Item 1) **[B]** and nut from the cylinder rod end pin.

Remove the cylinder rod end pin.

Remove the cylinder from the dipperstick.





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BUCKET CYLINDER

Removal And Installation

Put the bucket on the floor. Stop the engine.

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

Disconnect the two hoses (Item 1) **[A]** from the bucket cylinder.

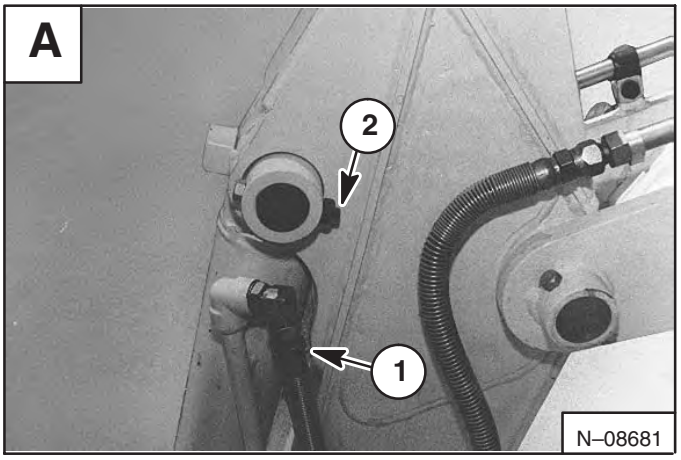
Remove the retainer bolt (Item 2) **[A]** and nut from the cylinder base end pin.

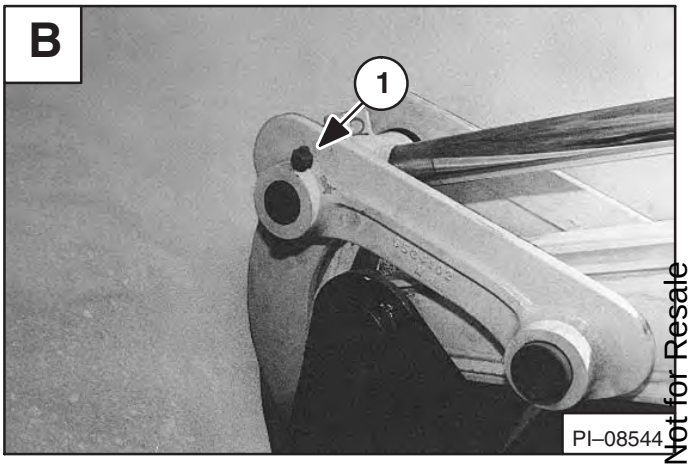
Remove the cylinder base end pin.

Remove the retainer bolt (Item 1) **[B]** and nut from the cylinder rod end pin.

Remove the cylinder rod end pin.

Remove the bucket cylinder.





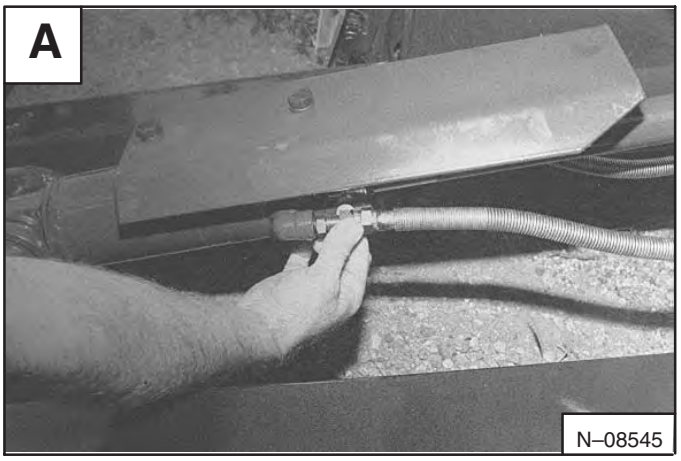
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BLADE CYLINDER

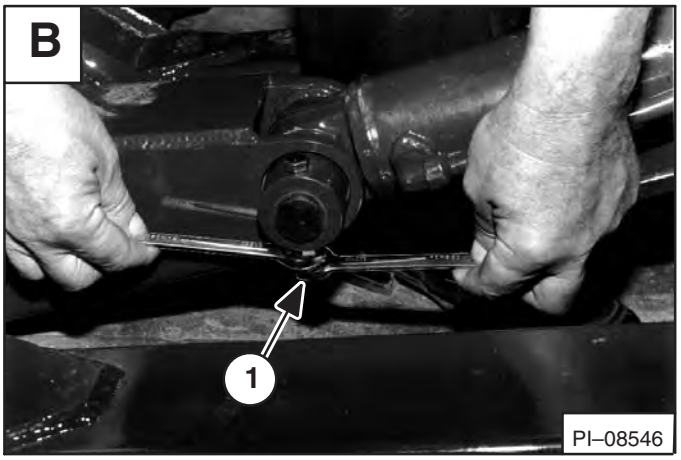
Removal And Installation

Put the blade on the floor . Stop the engine. Move the blade control lever to release the hydraulic pressure.

Disconnect the two hoses **[A]**.

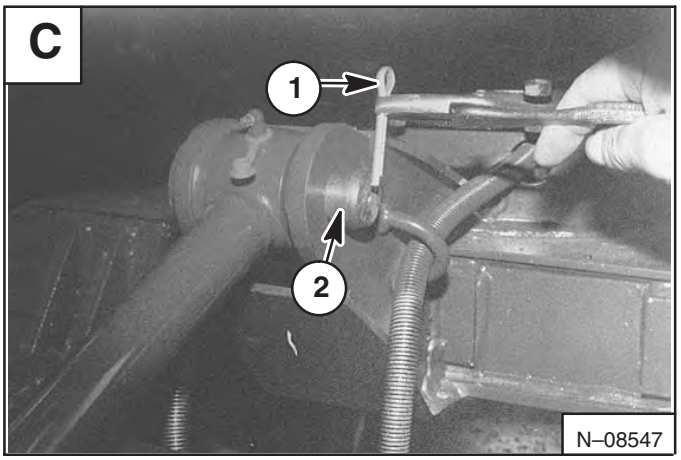


Remove the retainer bolt (Item 1) **[B]**, nut and base end pin from the blade cylinder.



Remove the cotter pin (Item 1) **[C]** from the cylinder rod end pin.

Remove the cylinder rod end pin (Item 2) **[C]**. Remove the blade cylinder.



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BOOM SWING CYLINDER

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

Disconnect the hoses (Item 1) **[A]** from the cylinder.

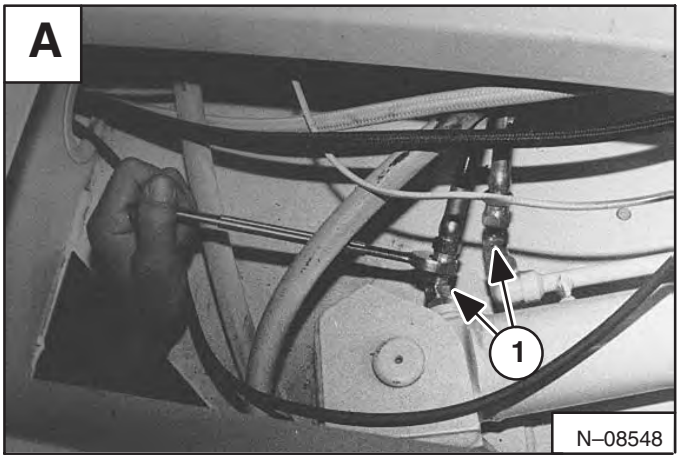
Remove the retainer bolt from the cylinder base end pin.

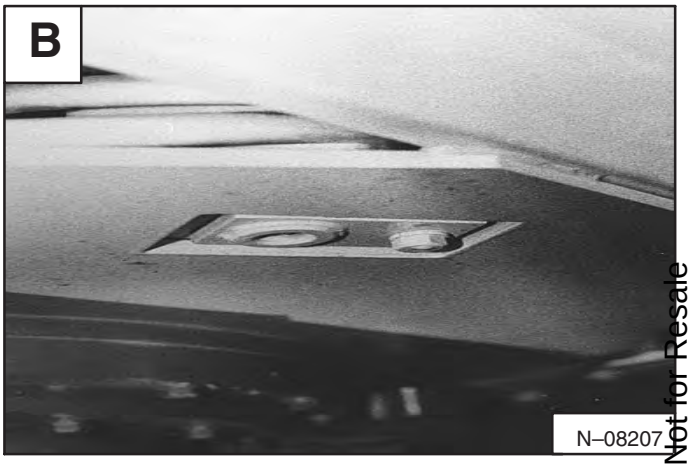
Remove the cylinder base end pin **[B]**.

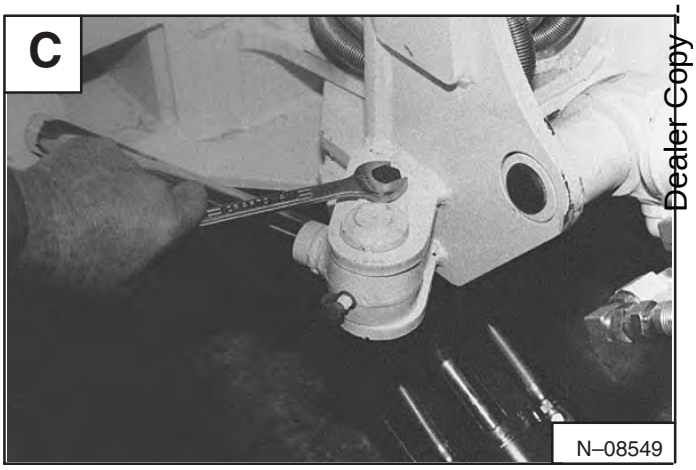
Remove the retainer bolt from the cylinder rod end pin **[C]**.

Remove the cylinder rod end pin.

Remove the boom swing cylinder.







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HYDRAULIC CYLINDER

Disassembly

The following tools will be needed:

Adjustable Gland Nut Wrench MEL1075
Seal Stretcher MEL1396
Rod Seal Installation Tool MEL1033

The following hones are available. Order the appropriate size hone from OTC Service Tools.

2.0 inch Diameter Hone MEL1418
2.750 inch – 3.0 inch Diameter Hone OEM6275
3.0 inch – 3.500 inch Diameter Hone OEM6270
3.500 inch – 4.0 inch Diameter Hone OEM6271

NOTE: The photos may not show the cylinder exactly as it appears, but the procedure is the same for all cylinders.

Put the base end of the hydraulic cylinder in a drain pan. Move the rod in and out to remove the fluid from the cylinder. Move the rod slowly so the fluid will go directly into the drain pan.

Put the base end of the cylinder in a vise.

Straighten the lock ring (Item 1) **[A]** in two places.

Use the adjustable gland nut wrench to loosen the head (Item 2) **[A]**.

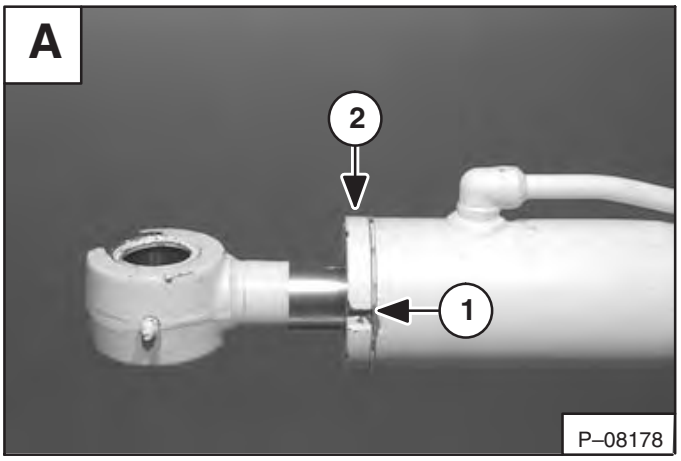
Remove the rod assembly from the cylinder case **[B]**.

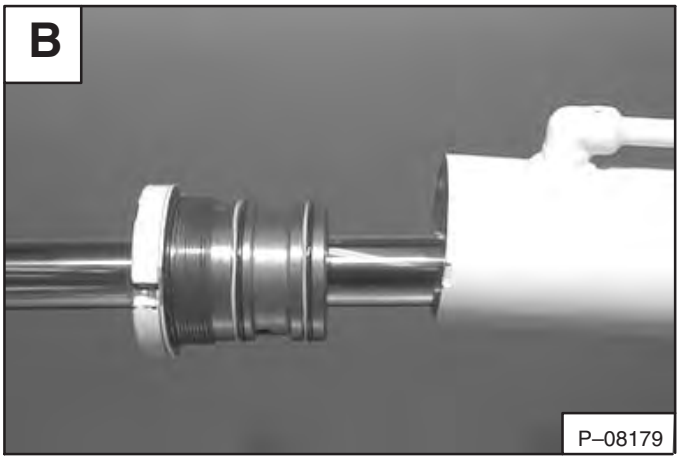
Remove the cylinder case from the vise.

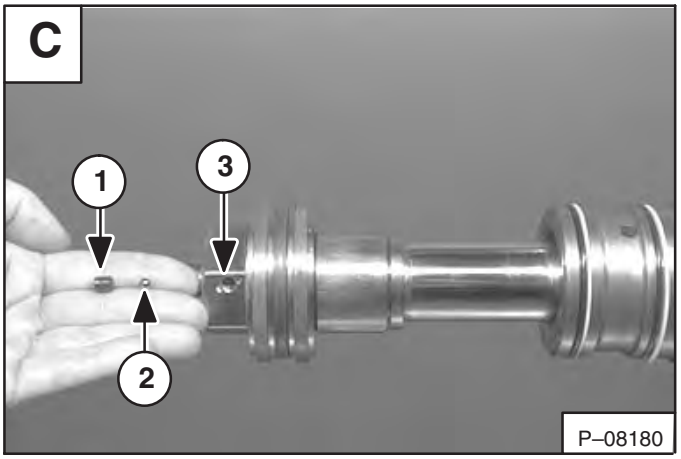
Put the rod end in the vise.

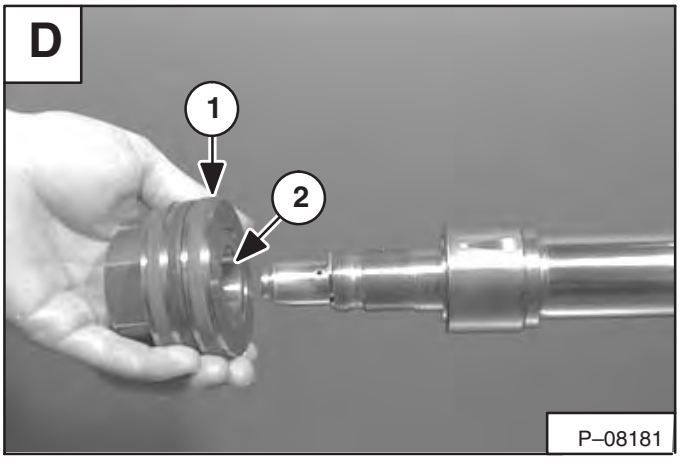
Remove the set screw (Item 1) **[C]** and steel ball (Item 2) **[C]** from the piston (Item 3) **[C]**.

Remove the piston (Item 1) **[D]** and shim (Item 2) **[D]** from the rod.









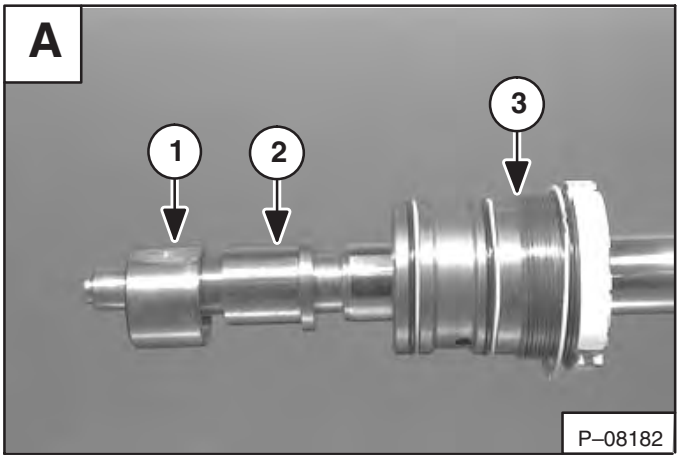
Dealer Copy -- Not for Resale

HYDRAULIC CYLINDER (Cont'd)

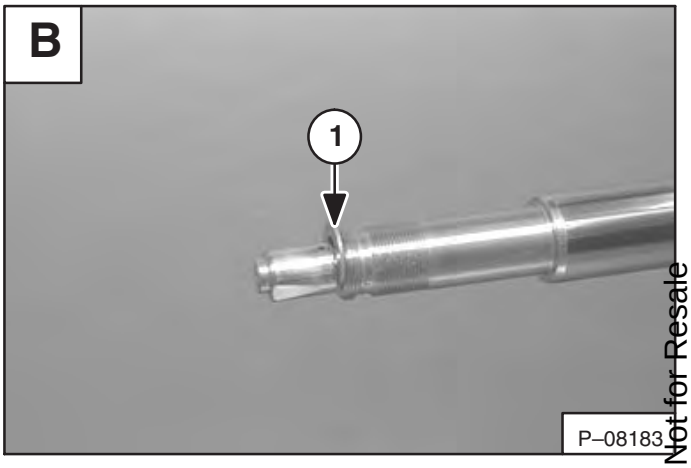
Disassembly (Cont'd)

Slide the bushing (Item 1) **[A]**, shim (Item 2) **[A]**, and head (Item 3) **[A]** off the rod.

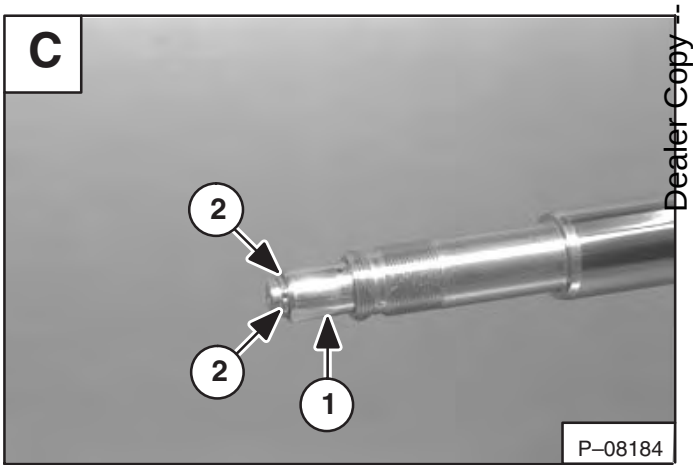
NOTE: Only the boom and blade cylinders have this type of shim (Item 2) [A].



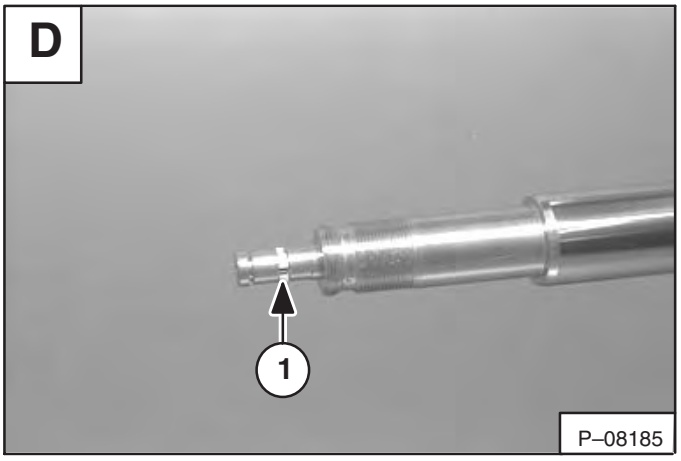
Remove the C–clip (Item 1) **[B]** from the rod.



Slide the bushing (Item 1) **[C]** back and remove the two bushing stops (Item 2) **[C]**. Slide the bushing (Item 1)**[C]** off the rod.



Remove the cushion seal (Item 1) **[D]** from the rod.



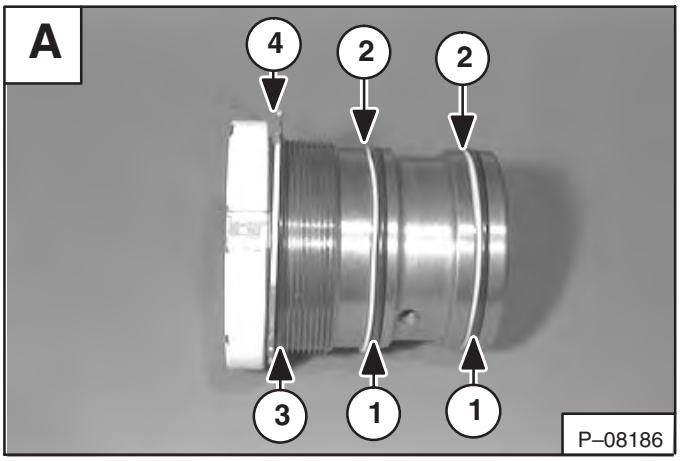
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HYDRAULIC CYLINDER (Cont'd)

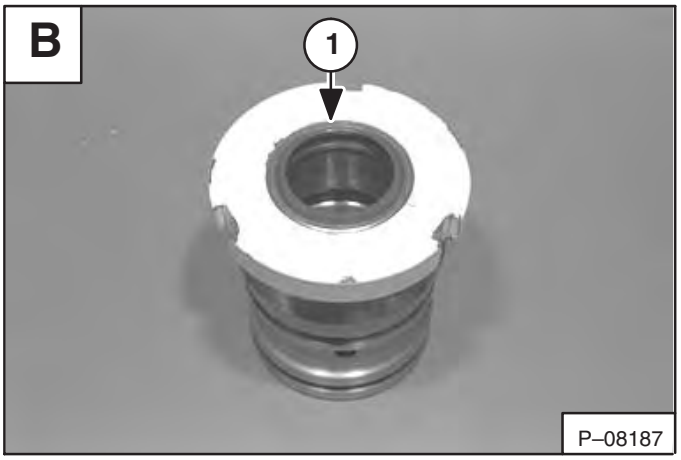
Disassembly (Cont'd)

Remove the O–rings (Item 1)**[A]** and back–up rings (Item 2) **[A]** from the head.

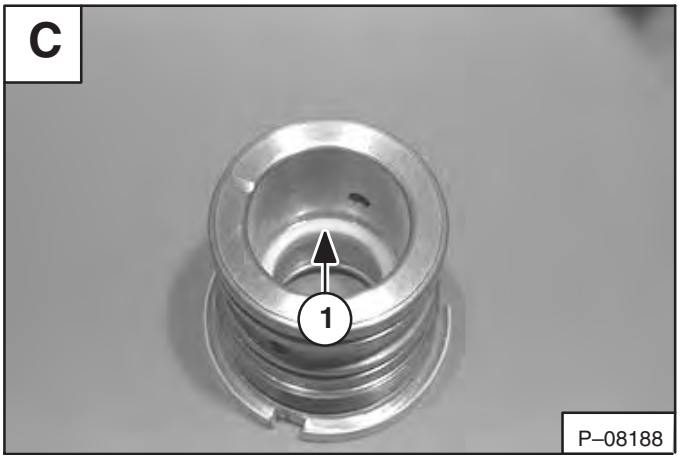
Remove the O–ring (Item 3)**[A]** and lock ring (Item 4)**[A]** from the head.



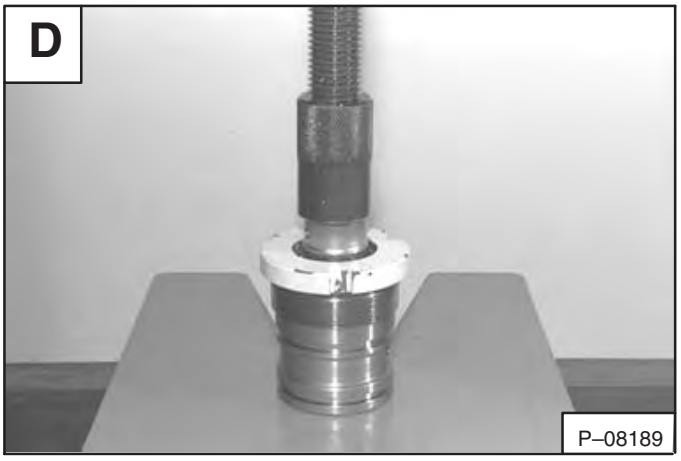
Remove the wiper seal (Item 1) **[B]** from the head. The seal will be destroyed when it is removed.



Cut and remove the U–ring (Item 1) **[C]** from inside the head.



Press the bushing out the bottom of the head **[D]**.



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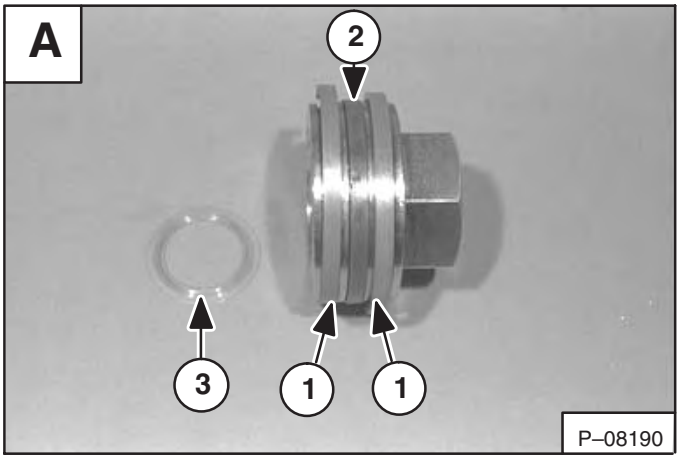
HYDRAULIC CYLINDER (Cont'd)

Disassembly (Cont'd)

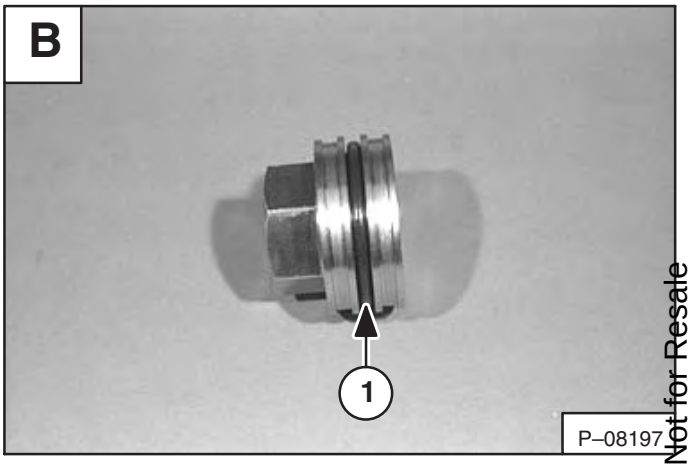
Remove the two slide rings (Item 1) **[A]** from the piston.

Cut and remove the Teflon seal (Item 2) **[A]**.

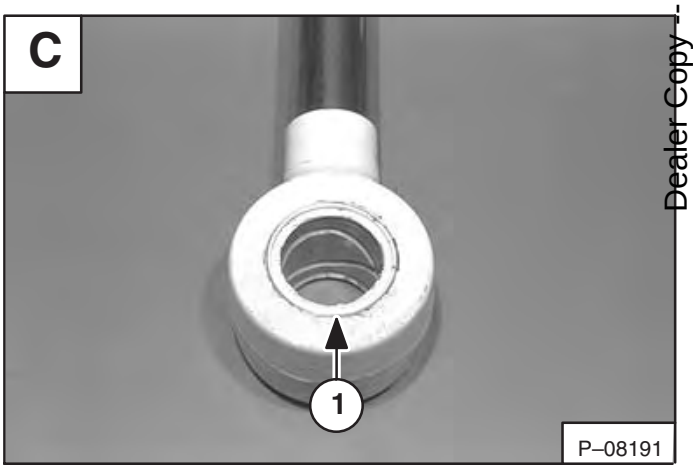
Remove the shim (Item 3) **[A]** from the piston.



Remove the O–ring (Item 1) **[B]** from the piston.

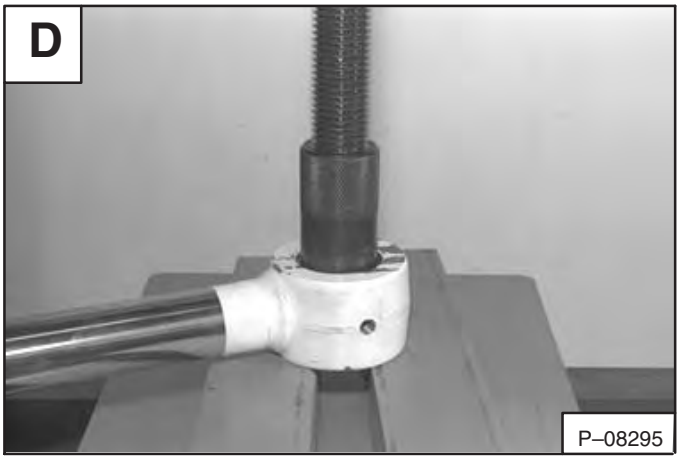


Remove the seal (Item 1) **[C]** from both sides of the rod end.



Press the bushing out of the rod end **[D]**.

Repeat the above procedure **[C]** & **[D]** to remove the seals and bushing from the cylinder base end.



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HYDRAULIC CYLINDER (Cont'd)

Disassembly (Cont'd)

Inspect the inside of the cylinder case for nicks and scratches. If the cylinder case has minor scuf fing, the cylinder case can be honed **[A]**. Use a flexible hone and lubricate with oil during the honing process.

Thoroughly wash the inside of the cylinder case after honing process.

The following hones can be ordered from OTC Service Tools:

2.0 inch Diameter Hone MEL1418
2.750 inch –3.0 inch Diameter Hone OEM6275
3.0 inch –3.500 inch Diameter Hone OEM6270
3.500 inch –4.0 inch Diameter Hone OEM6271

Assembly

Wash the cylinder parts in solvent and dry with compressed air.

While servicing the cylinder do not damage the parts. Inspect for nicks, scratches or otherwise damaged or bent parts before assembling the cylinder. Replace parts that appear damaged in any way. The cylinder may not function correctly if there is damage to any of the parts.

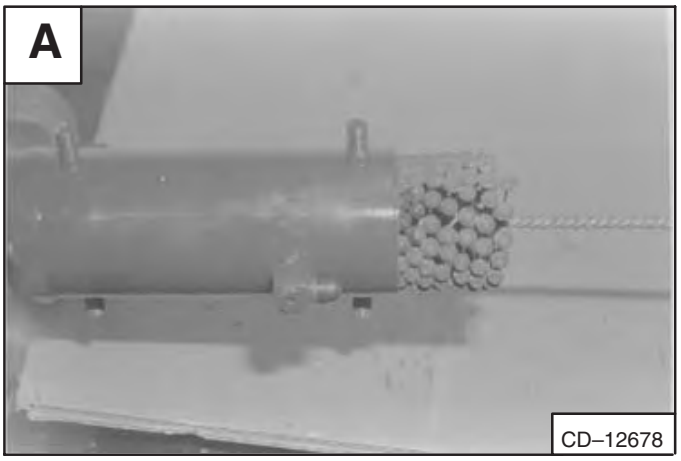
Destroy all the O–rings and seals and replace them with NEW O–rings and seals.

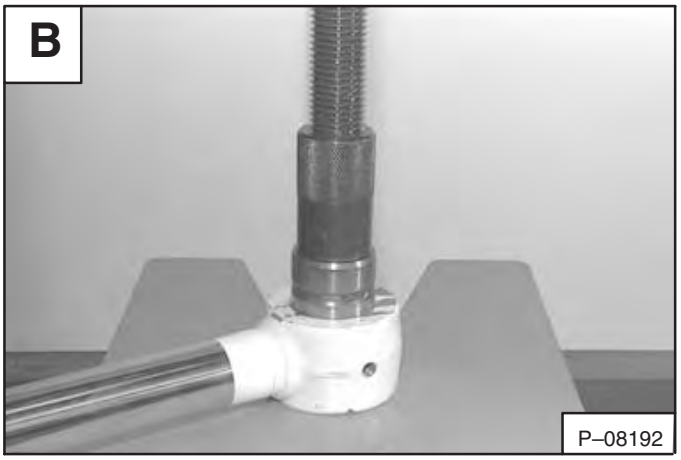
Press the bushing in the rod end until it is centered in the rod end **[B]**.

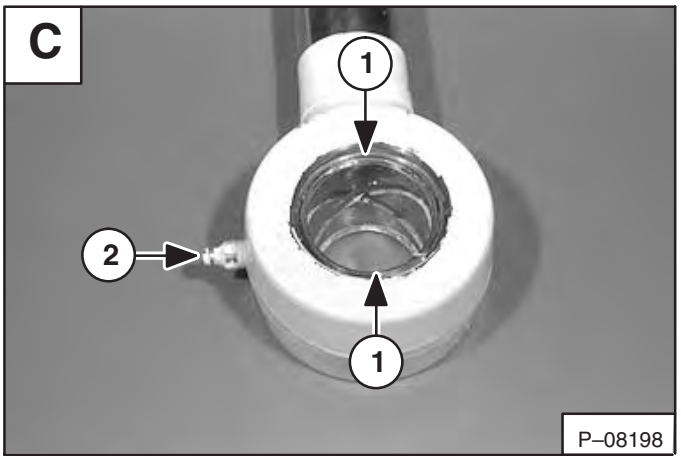
NOTE: When installing the bushing, the grease holes (Item 1) [C] should be 90 ° from the grease fitting (Item 2) [B].

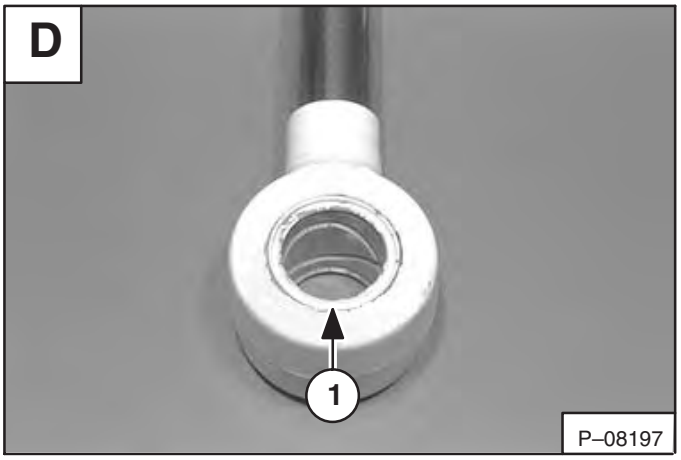
Install the seal (Item 1) **[D]** on both sides of the rod end.

Repeat the above procedure **[B]** through **[D]** to install the bushing and seals on the cylinder base end.







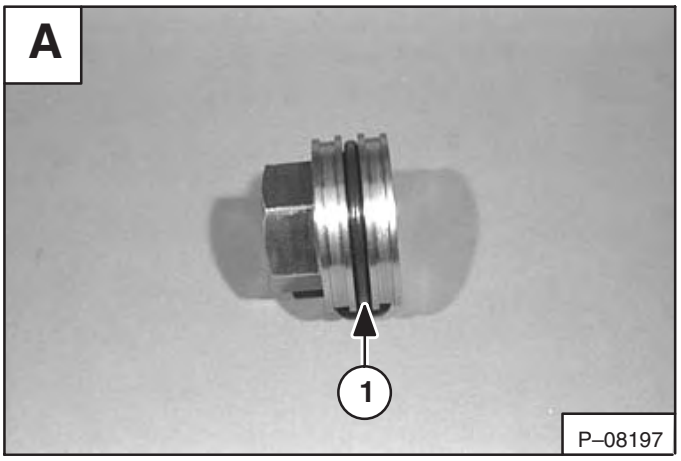


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HYDRAULIC CYLINDER (Cont'd)

Assembly (Cont'd)

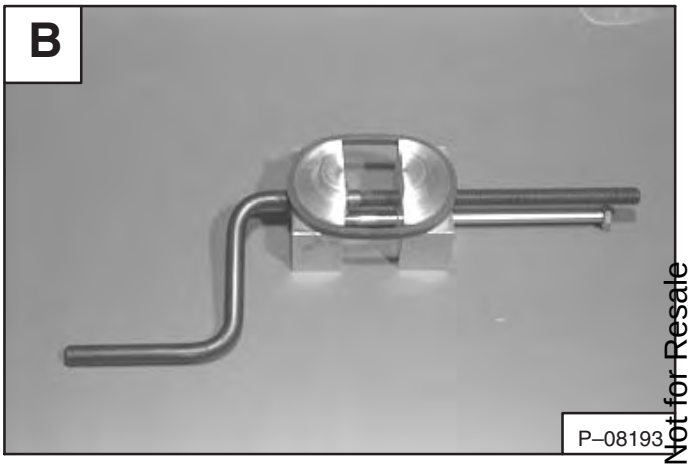
Apply oil and install the O–ring (Item1) **[A]** on the piston.



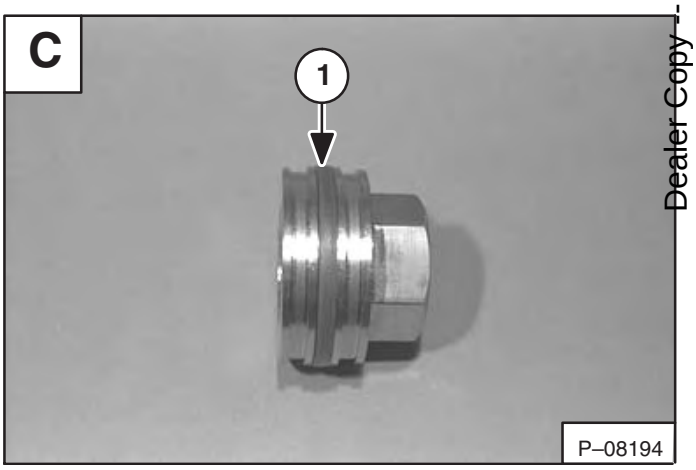
Install the Teflon seal on the tool (MEL1396) and stretch it until it fits the piston **[B]**.

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

NOTE: Do not over stretch the seal.



Install the seal (Item 1) **[C]** on the piston.



Use a ring compressor to compress the seal to the correct size **[D]**.

Leave the piston in the ring compressor for three minutes.

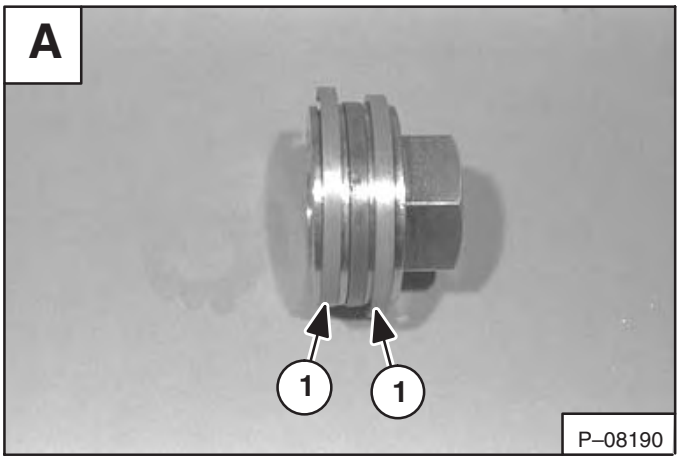


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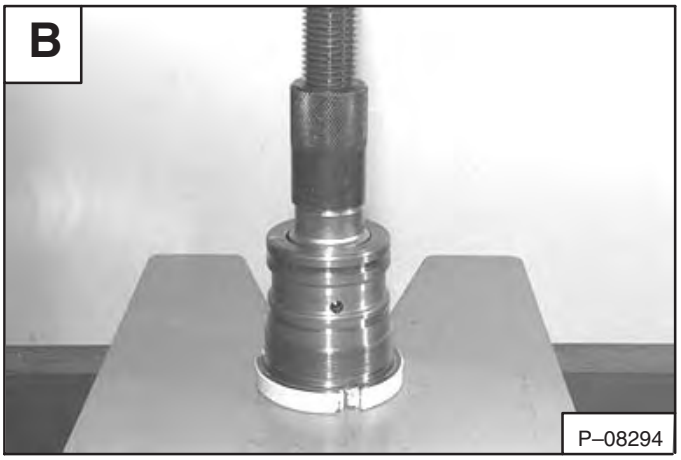
HYDRAULIC CYLINDER (Cont'd)

Assembly (Cont'd)

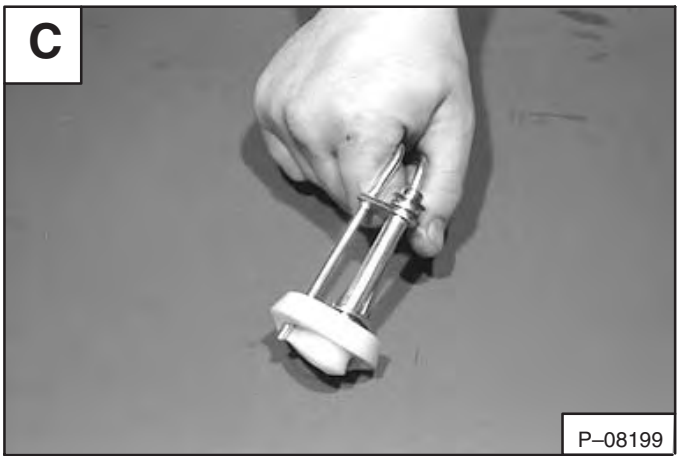
Install the two slide rings (Item 1) **[A]** on the piston.



Press the bushing in the head **[B]**.

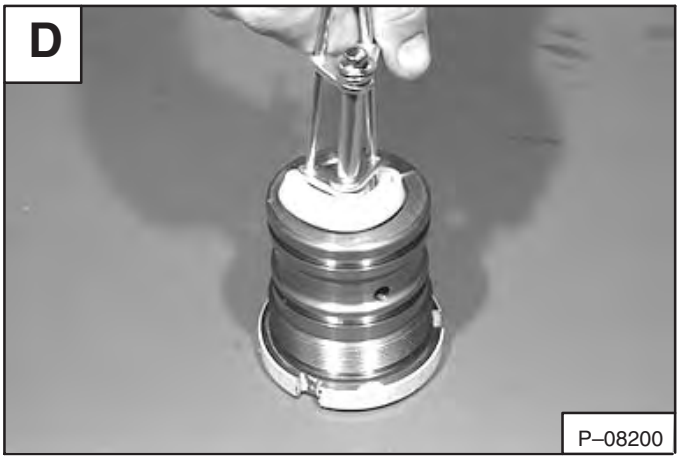


Install the U–ring on the rod seal tool (MEL1033) **[C]**.



Install the U–ring in the head **[D]**.

NOTE: The open side of the U–ring will face the bottom of the head.

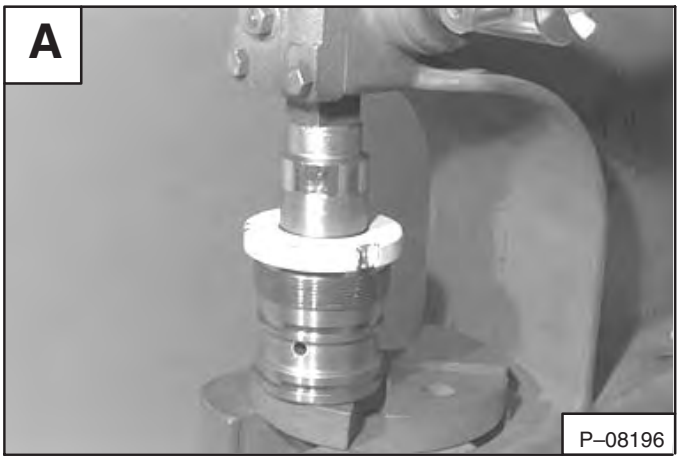


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HYDRAULIC CYLINDER (Cont'd)

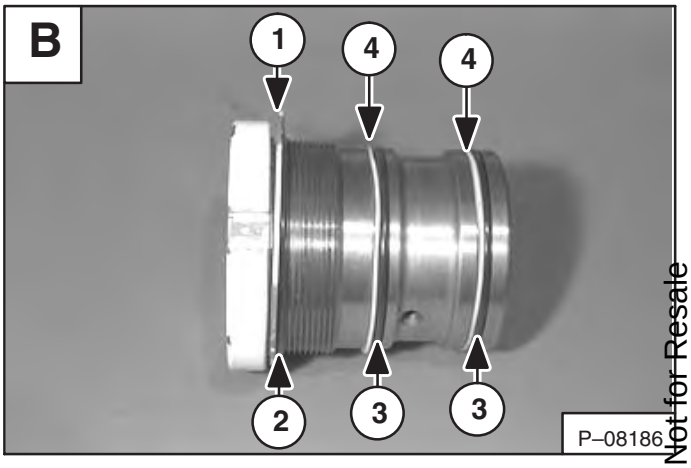
Assembly (Cont'd)

Install the wiper seal in the head **[A]**.

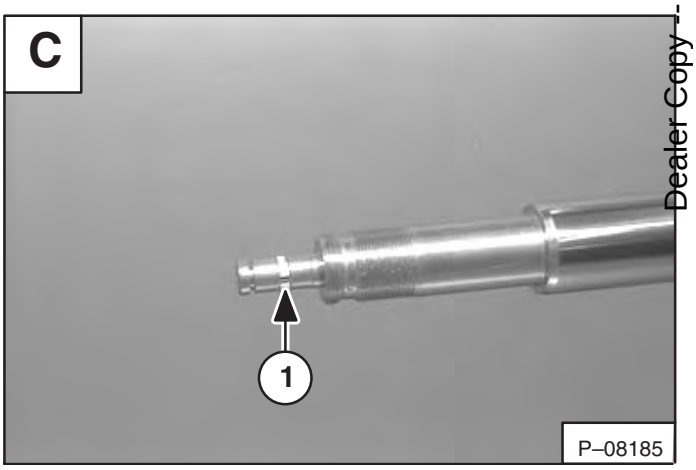


Install the lock ring (Item 1) **[B]** and O–ring (Item 2) **[B]** on the head.

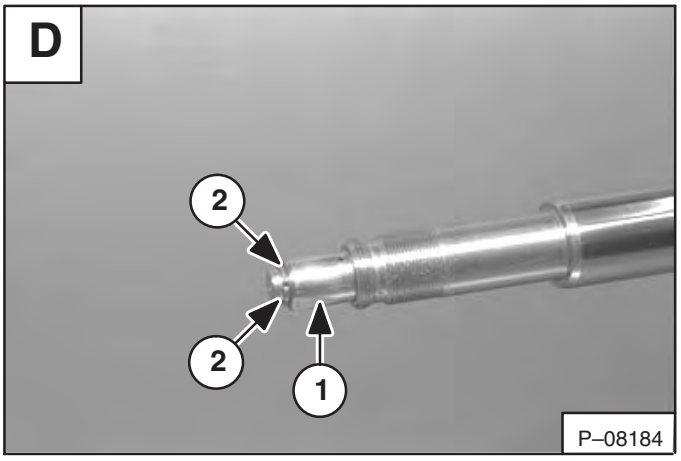
Install the O–rings (Item 3) **[B]** and back–up rings (Item 4) **[B]** on the head.



Install the cushion seal (Item 1) **[C]** on the rod.



Install the bushing (Item 1)**[D]** and the two bushing stops (Item 2) **[D]**.

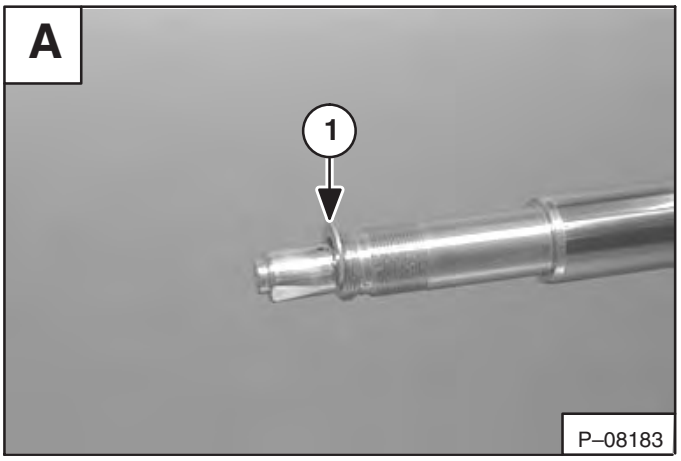


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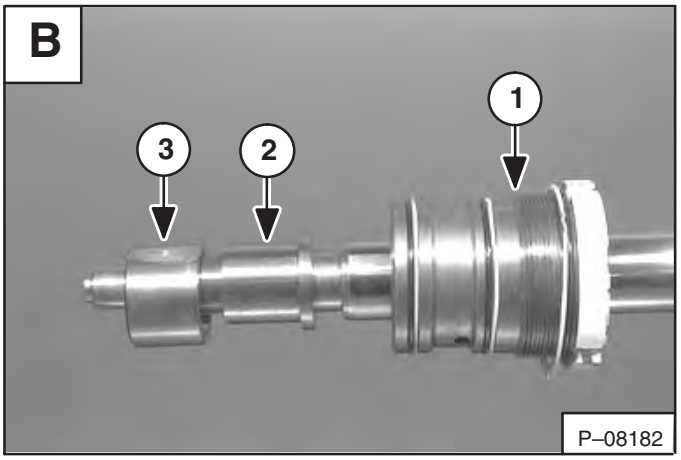
HYDRAULIC CYLINDER (Cont'd)

Assembly (Cont'd)

Slide the bushing against the bushing stops and install the C–clip (Item 1) **[A]** on the rod.

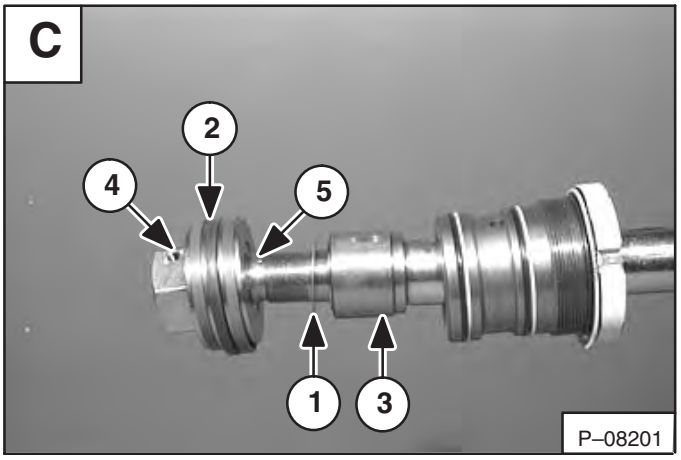


Slide the head (Item 1) **[B]**, shim (Item 2) **[B]**, and bushing (Item 3) **[B]** on the rod.



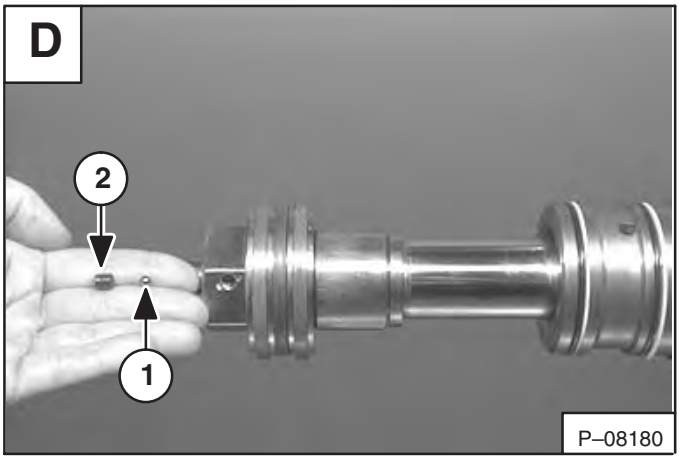
Install the shim (Item 1) **[C]** and piston (Item 2) **[C]** on the rod.

NOTE: Tighten the piston (Item 2) [C] on the rod until it touches the bushing (Item 3) [C]. Further tighten the piston (Item 2) [C] until the hole in the piston (Item 4) [C] lines up with the machined depression (Item 5) [C] in the rod.



Apply thread lock (LOCTITE #242) to the set screw (Item 2) **[D]**.

Install the steel ball (Item 1) **[D]** and set screw (Item 2) **[D]** in the piston.



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HYDRAULIC CYLINDER (Cont'd)

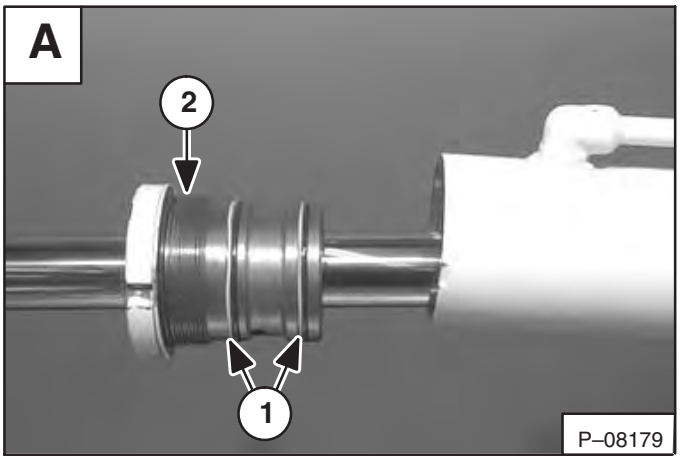
Assembly (Cont'd)

Put the base end of the cylinder in a vise.

Apply oil to the Teflon seal and slide rings.

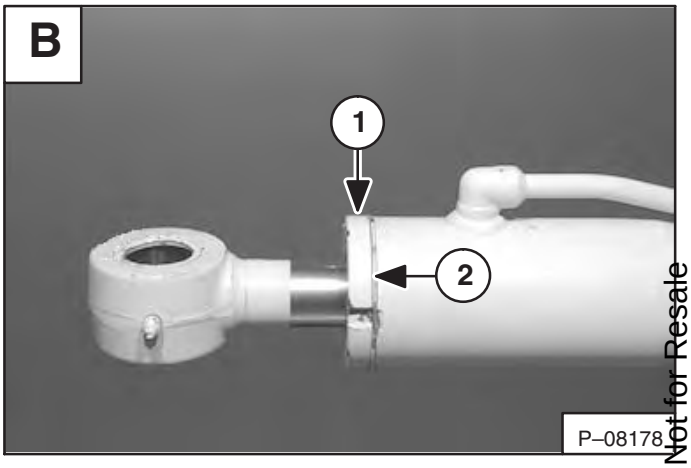
Install the rod assembly in the cylinder case **[A]**.

Apply oil to the O–rings (Item 1)**[A]** and threads (Item 2) **[A]** of the head.



Tighten the head (Item 1) **[B]** until it is flush with the end of the cylinder case. Tap the lock ring (Item 2) **[B]** in the grooves of the cylinder and head.

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

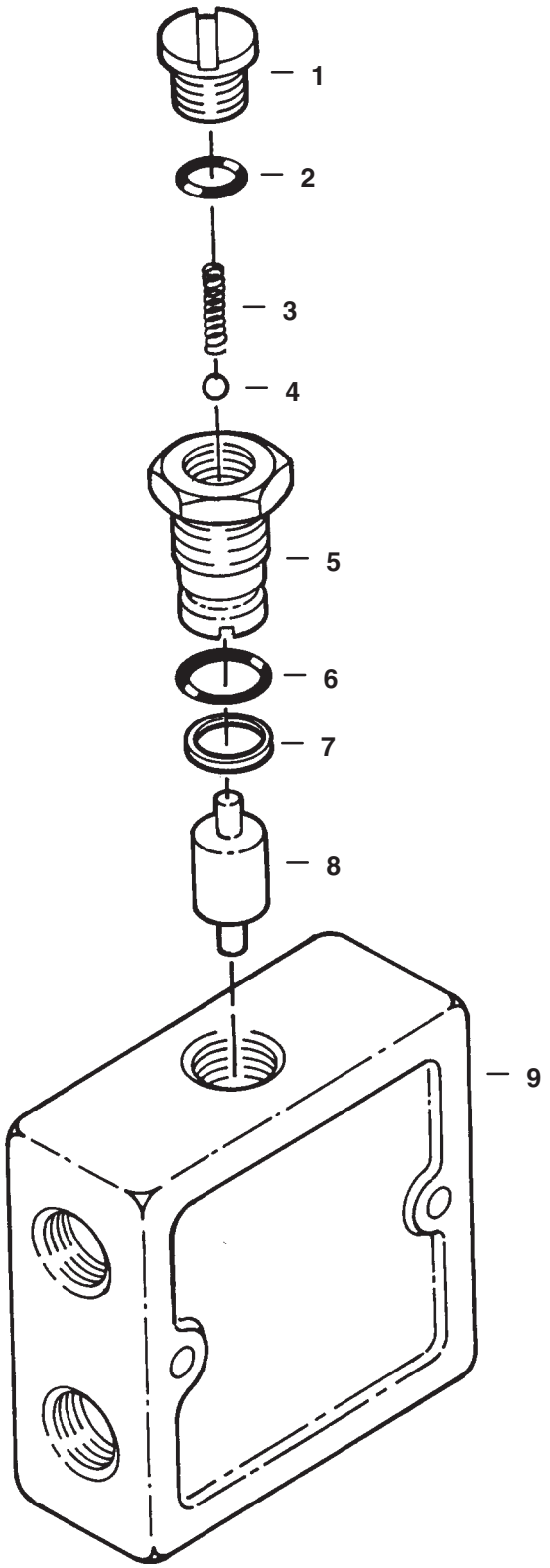


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SWING CYLINDER LOCK VALVE

Parts Identification

1. Plug
2. O–ring
3. Spring
4. Ball
5. Check Valve Body
6. O–ring
7. Back–up Ring
8. Spool
9. Valve Body



C–03458

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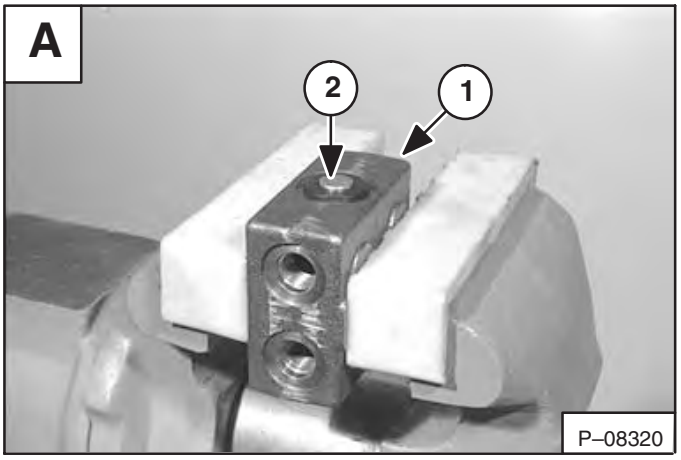
SWING CYLINDER LOCK VALVE (Cont'd)

Disassembly

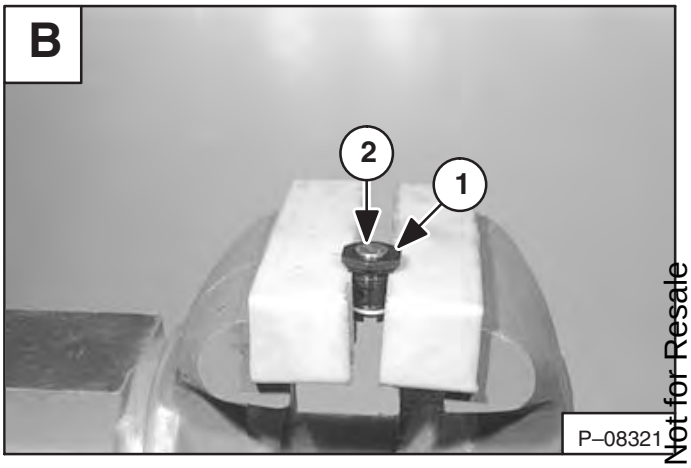
Before disassembly:

Clean the outside of the valve.
Disassemble the valve in a clean area.

Clamp the valve (Item 1) **[A]** in the vise, with padded jaws, and remove the check valve (Item 2) **[A]** (both sides).

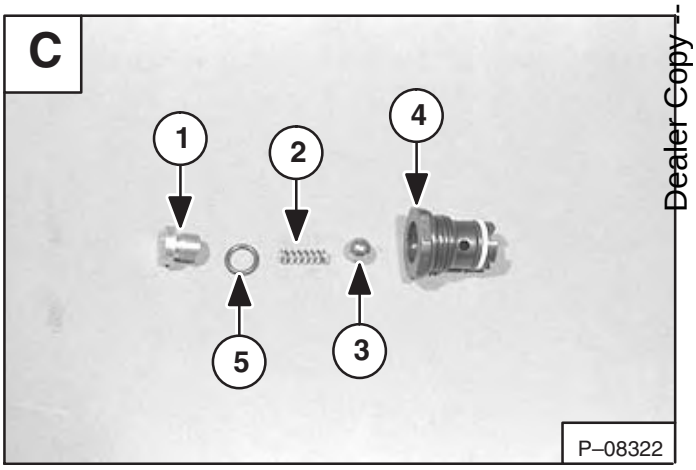


Clamp the check valve (Item 1) **[B]** in the vise, with padded jaws, and loosen the cap (Item 2) **[B]** (on both valves).

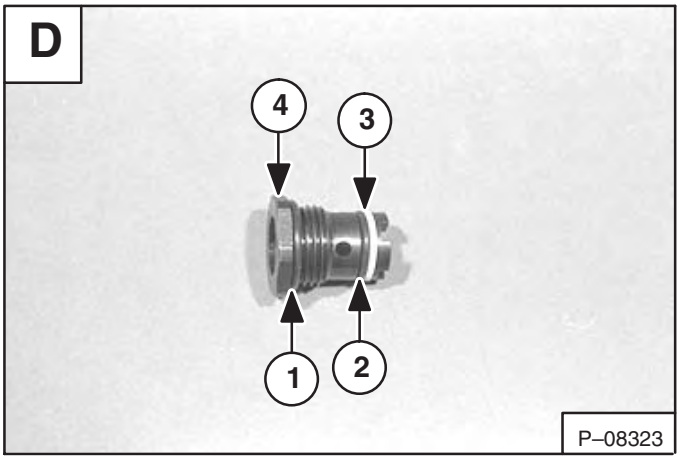


Remove the cap (Item 1) **[C]** the spring (Item 2) **[C]** and the check ball (Item 3) **[C]** from the check valve (Item 4) **[C]**.

Remove the O–ring (Item 5) **[C]** from the cap (Item 1) **[C]** (on both valves).



Remove the large O–ring (Item 1) **[D]**, the small O–ring (Item 2) **[D]** and the back–up ring (Item 3) **[D]** from the check valve (Item 4) **[D]** (on both valves).



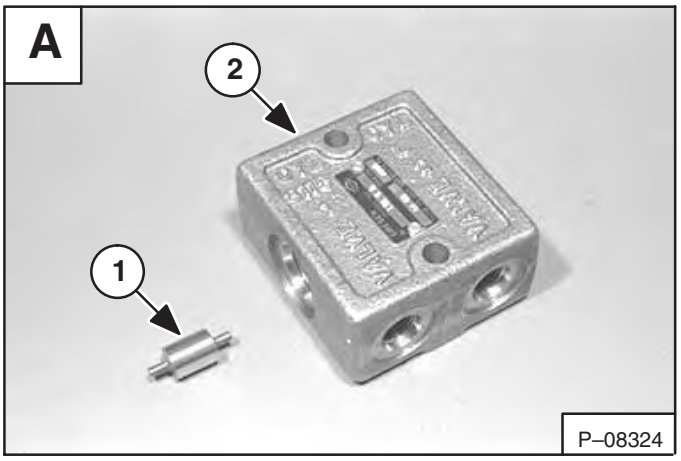
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SWING CYLINDER LOCK VALVE (Cont'd)

Disassembly (Cont'd)

Remove the spool (Item 1) **[A]** from the valve body (Item 2) **[A]**.

NOTE: Be careful not to scratch or damage the spool.



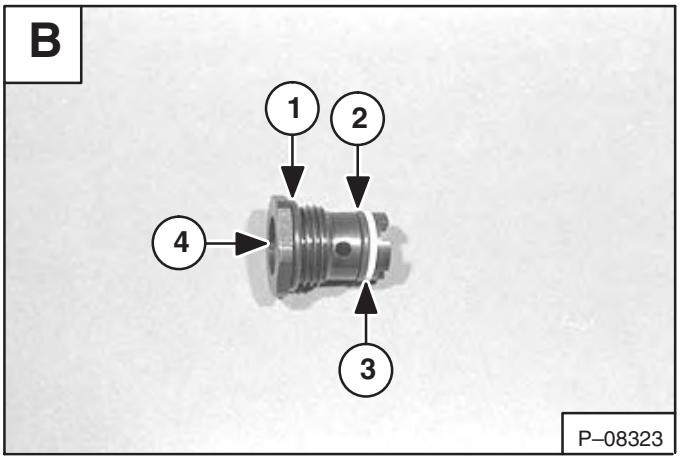
Assembly

Before assembly:

Clean all parts with solvent and dry with compressed air
Put oil on all O–rings.

Apply oil and install the spool (Item 1) **[A]** in the valvebody (Item 2) **[A]**.

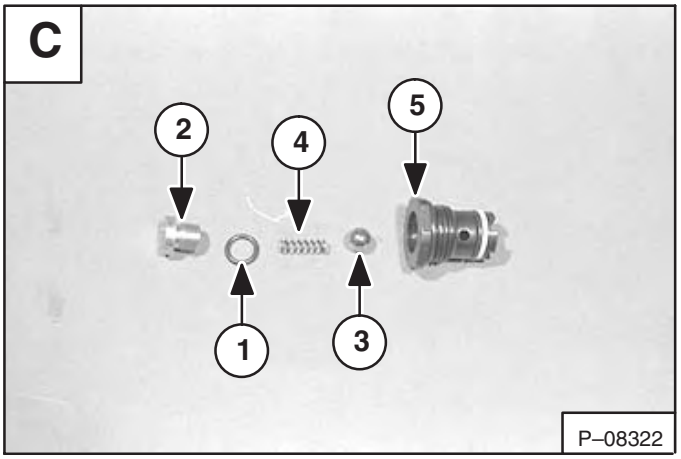
Install the large O–ring (Item 1) **[B]** the small O–ring (Item 2) **[B]** and the back–up ring (Item 3) **[B]** on the check valve (Item 4) **[B]**.



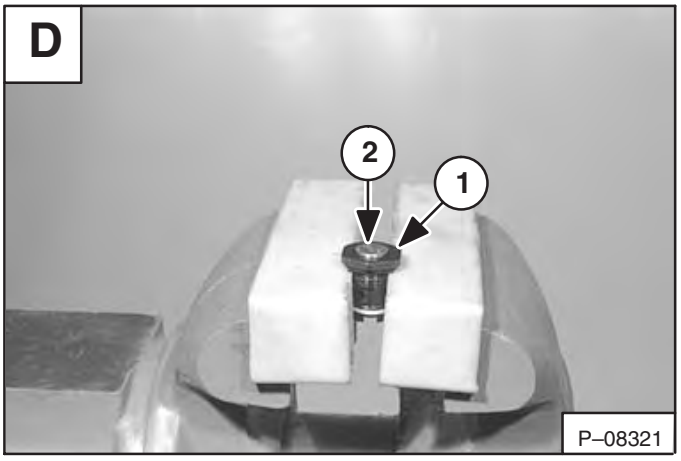
Install the O–ring (Item 1) **[C]** on the cap (Item 2) **[C]**.

Install the check ball (Item 3) **[C]** the spring (Item 4) **[C]**.

Install the cap (Item 2) **[C]** in the check valve (Item 5) **[C]** and tighten by hand.



Clamp the check valve (Item 1) **[D]** in a vise with padded jaws, and tighten the cap (Item 2) **[D]**.

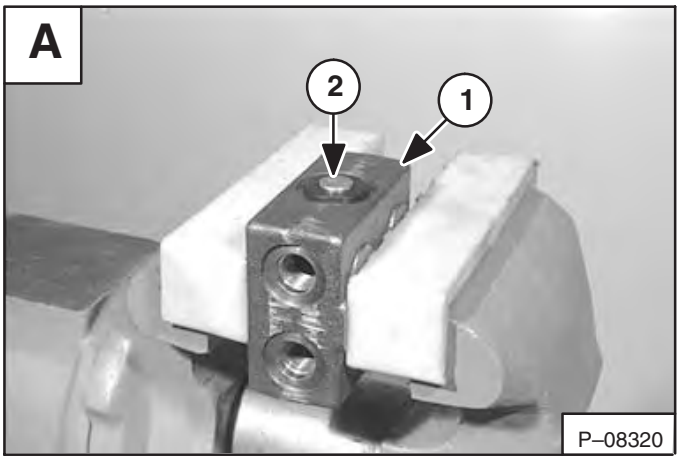


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SWING CYLINDER LOCK VALVE (Cont'd)

Assembly (Cont'd)

Clamp the valve (Item 1) **[A]** in a vise with padded jaws and tighten the check valve (Item 2) **[A]** (both sides).

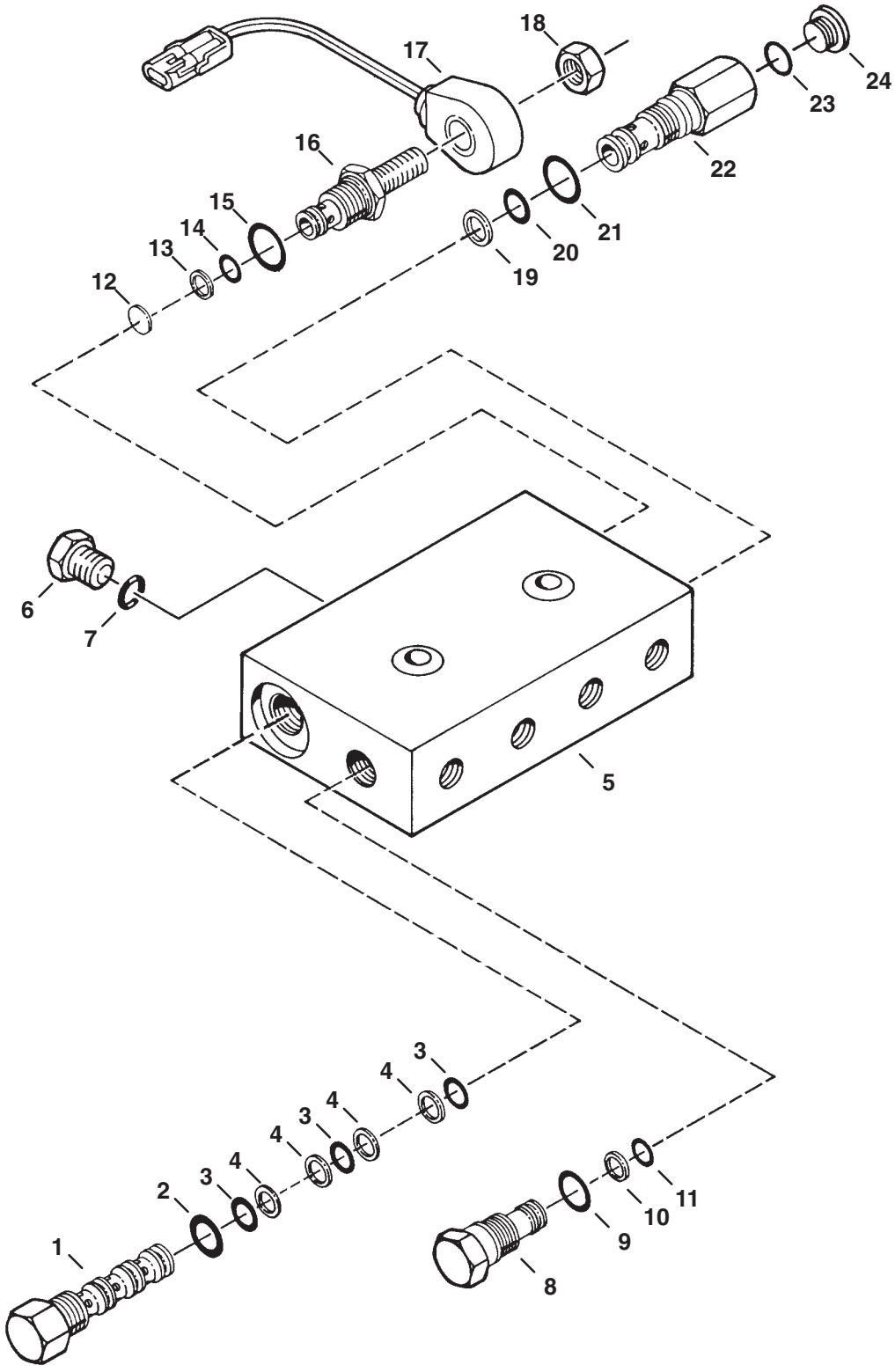


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SOLENOID VALVE

Parts Identification

1. Compensator
2. O–ring
3. O–ring
4. Back–up Ring
5. Valve Body
6. Plug
7. O–ring
8. Check Valve
9. O–ring
10. Back–up Ring
11. O–ring
12. Restrictor Plate 0.130”
13. Back–up Ring
14. O–ring
15. O–ring
16. Valve Stem
17. Coil
18. Nut
19. Back–up Ring
20. O–ring
21. O–ring
22. Relief Valve
23. O–ring
24. Plug



B–14927

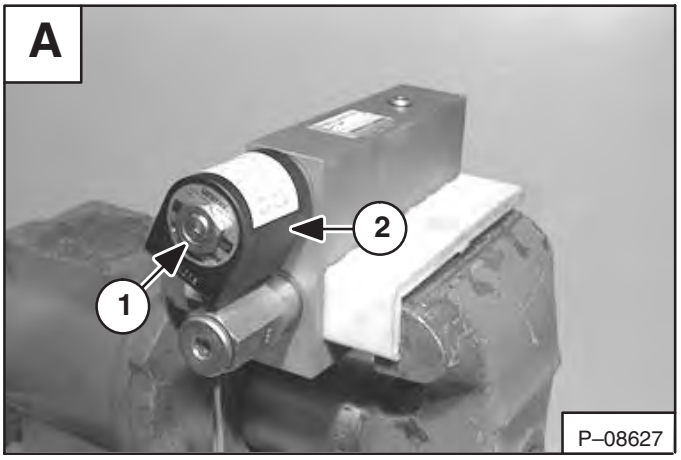
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SOLENOID VALVE (Cont'd)

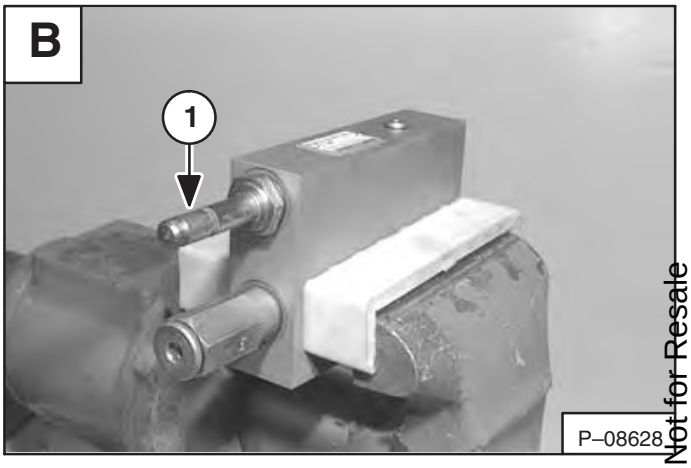
Disassembly

Clamp the valve in a vise that has padded jaws.

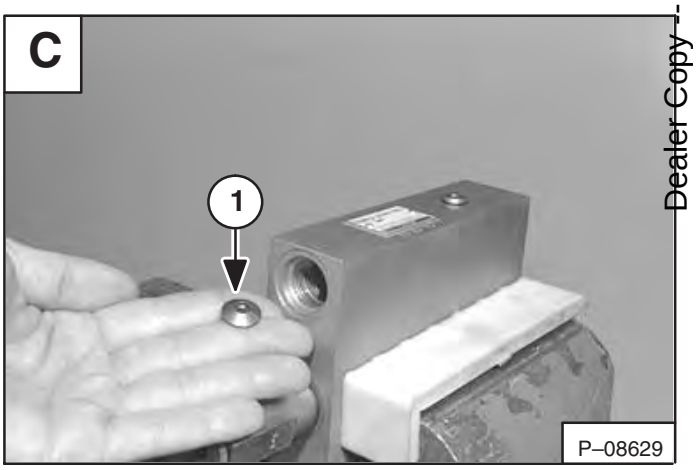
Remove the nut (Item 1) **[A]** and coil (Item 2) **[A]** from the valve stem.



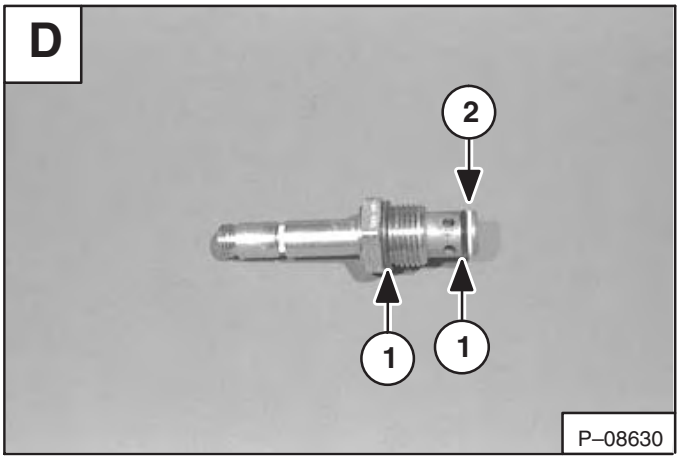
Remove the valve stem (Item 1) **[B]** from the valve body.



Remove the restrictor plate (Item 1) **[C]** from the valve body.



Remove the O–rings (Item 1) **[D]** and back–up ring (Item 2) **[D]** from the valve stem.

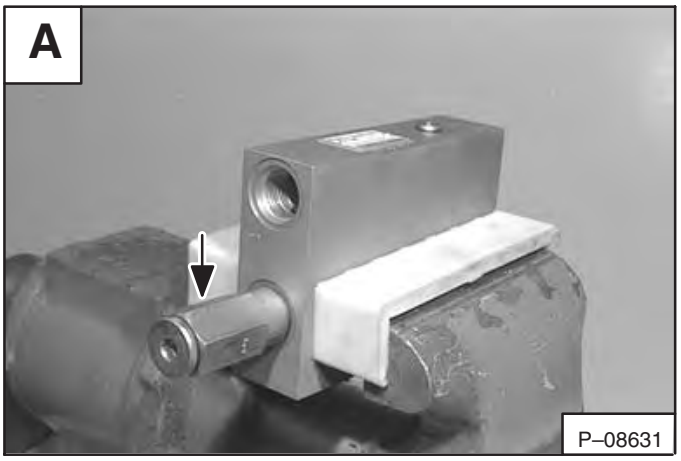


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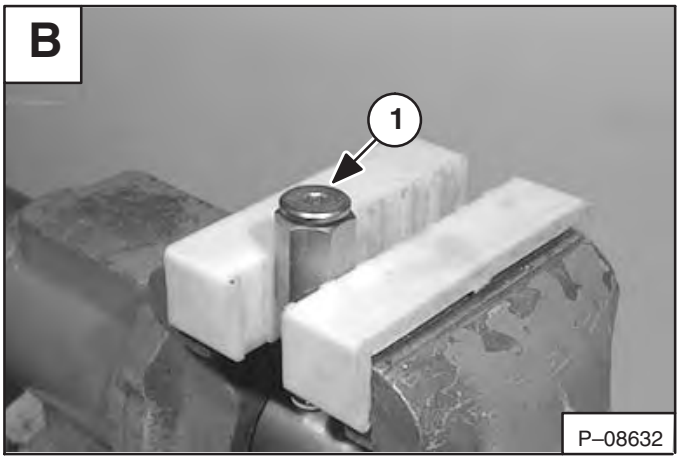
SOLENOID VALVE (Cont'd)

Disassembly (Cont'd)

Remove the relief valve (Item 1) **[A]** from the valve body.

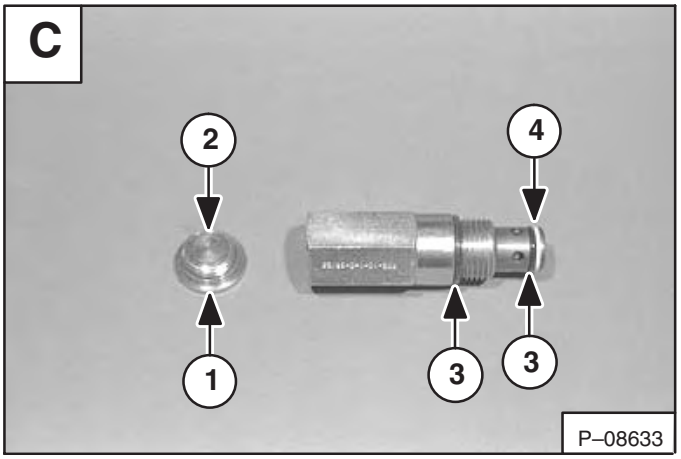


Remove the plug (Item 1) **[B]** from the end of the relief valve.

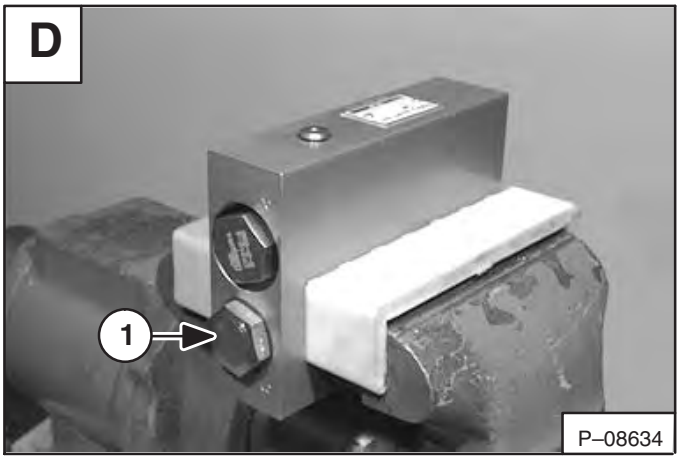


Remove the O–ring (Item 1) **[C]** from the plug (Item 2 **[C]**.

Remove the O–ring (Item 3) **[C]** and back–up rings (Item 4) **[C]** from the relief valve.



Remove the check valve (Item 1) **[D]** from the valve body

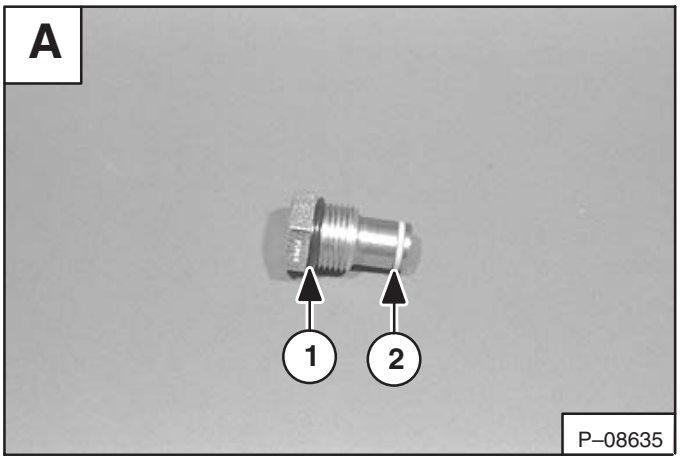


Dealer Copy -- Not for Resale

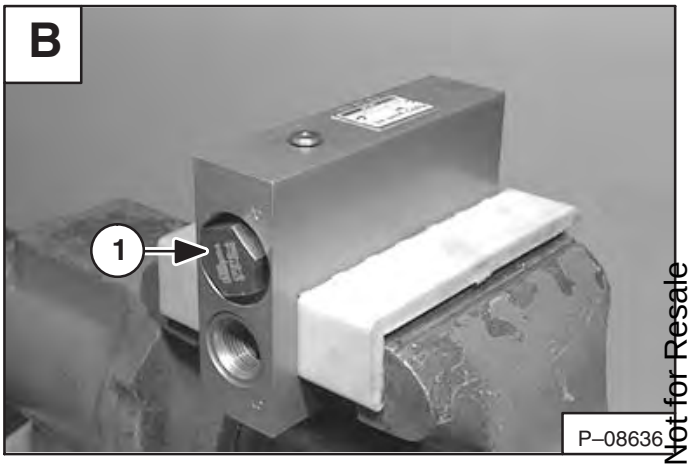
SOLENOID VALVE (Cont'd)

Disassembly (Cont'd)

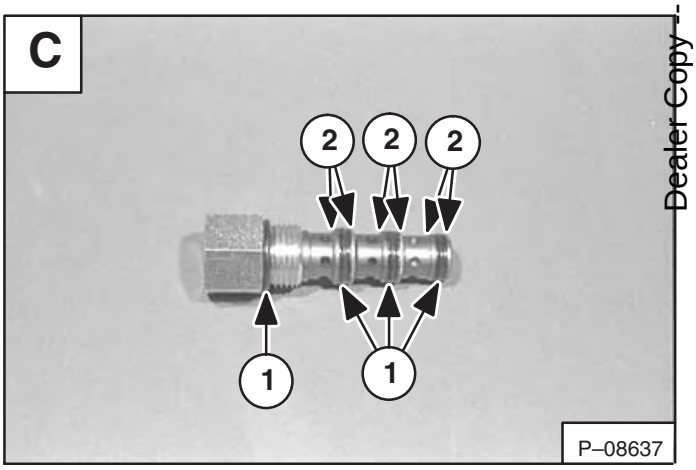
Remove the O–ring (Item 1) **[A]** and the seal (Item 2)**[A]** from the check valve.



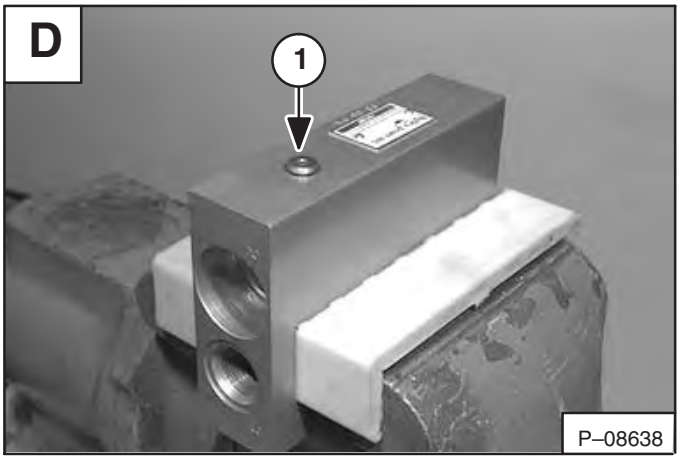
Remove the compensator valve (Item 1) **[B]** from the valve body.



Remove the O–rings (Item 1)**[C]** and back–up rings (Item 2) **[C]** from the compensator valve.



Remove the plug (Item 1) **[D]** from the valve body.

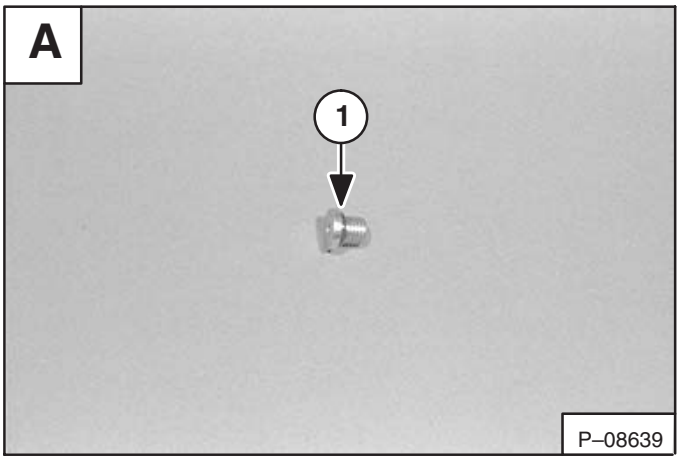


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SOLENOID VALVE (Cont'd)

Disassembly (Cont'd)

Remove the O–ring (Item 1) **[A]** from the plug.

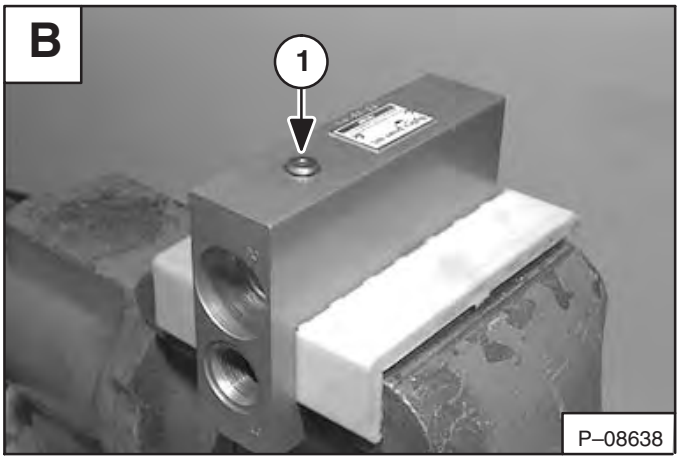


Assembly

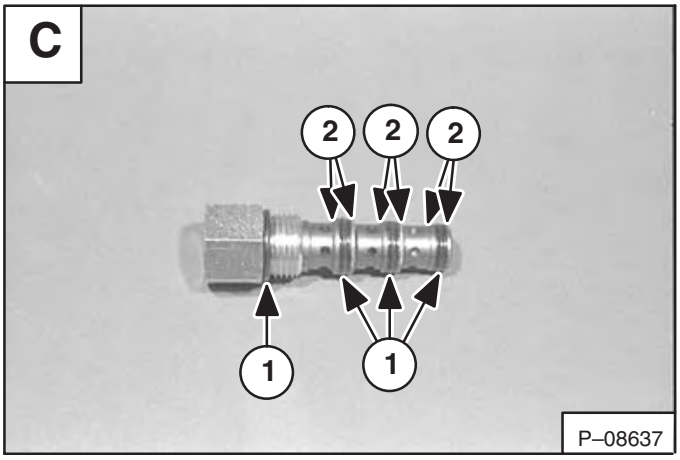
Clean all parts in solvent and dry with compressed air . The valves are not serviceable. If the valves do not operate correctly after cleaning, the relief valves must be replaced. Order new valves from Melroe Parts.

Apply oil and install a new O–ring (Item 1) **[A]** on the plug.

Install the plug (Item 1) **[B]** in the valve body.

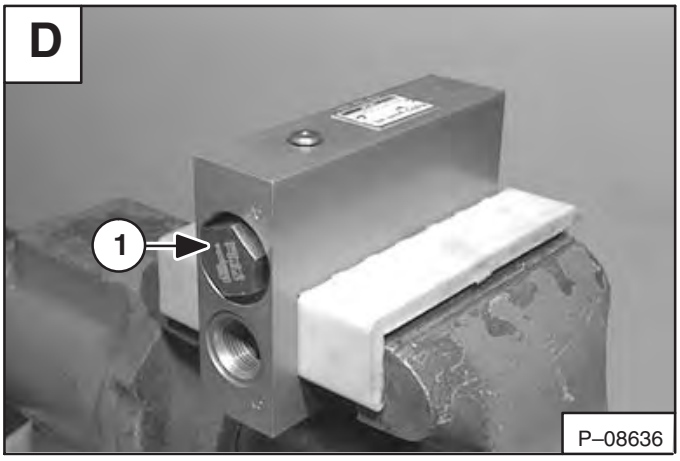


Apply oil and install new O–rings (Item 1) **[C]** and back–up rings (Item 2) **[C]** on the compensator valve.



Dip the compensator valve in clean hydraulic fluid.

Install the compensator valve (Item 1) **[D]** in the valve body.

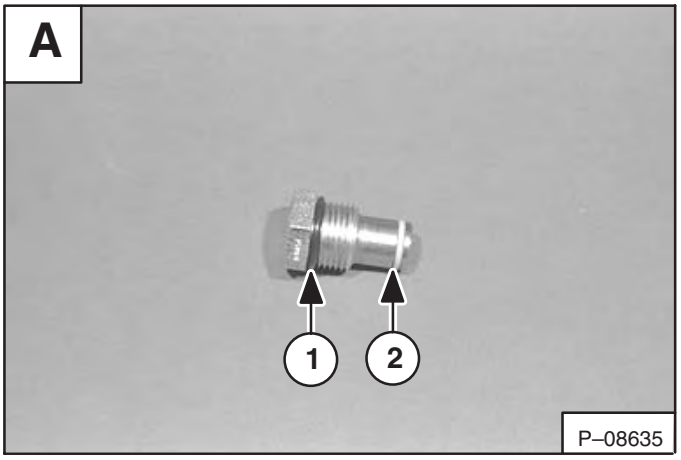


Dealer Copy -- Not for Resale

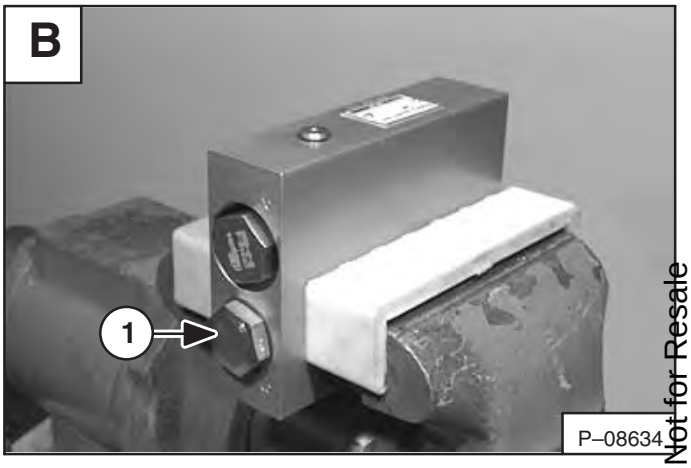
SOLENOID VALVE (Cont'd)

Assembly (Cont'd)

Apply oil and install new O–ring (Item 1) **[A]** and seal (Item 2) **[A]** on the check valve.

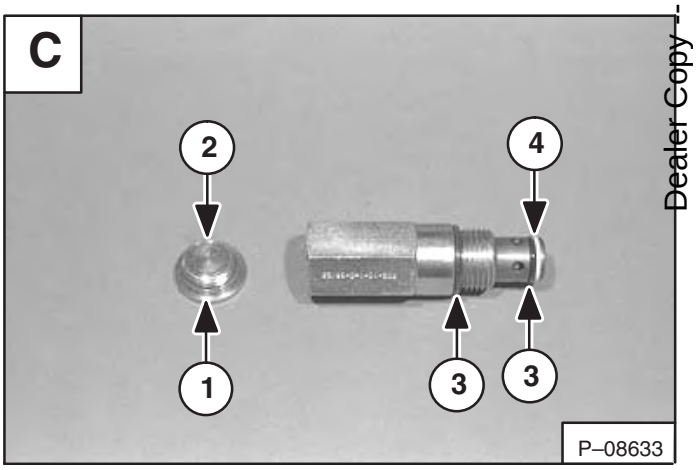


Install the check valve (Item 1) **[B]** in the valve body.

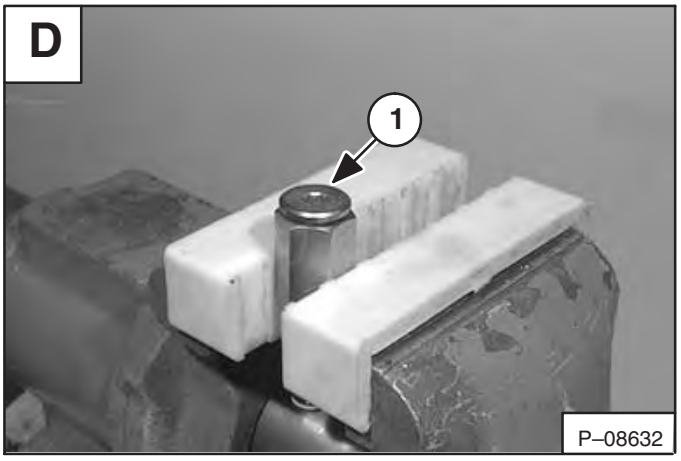


Apply oil and install a new O–ring (Item 1) **[C]** on the plug (Item 2) **[C]**.

Apply oil and install new O–rings (Item 3) **[C]** and back–up ring (Item 4) **[C]** on the relief valve.



Install the plug (Item 1) **[D]** in the end of the relief valve.

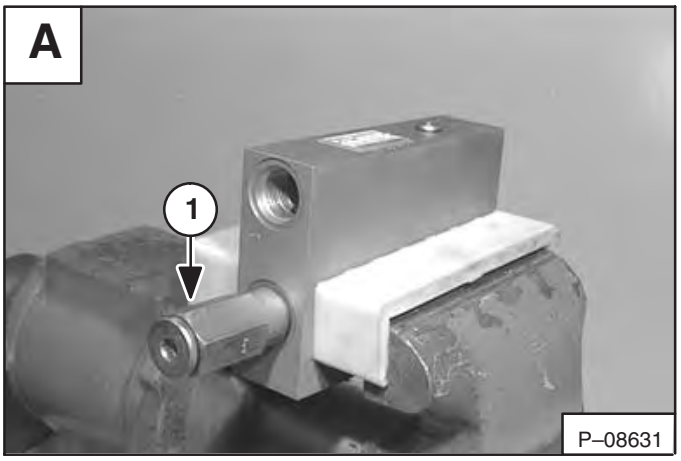


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SOLENOID VALVE (Cont'd)

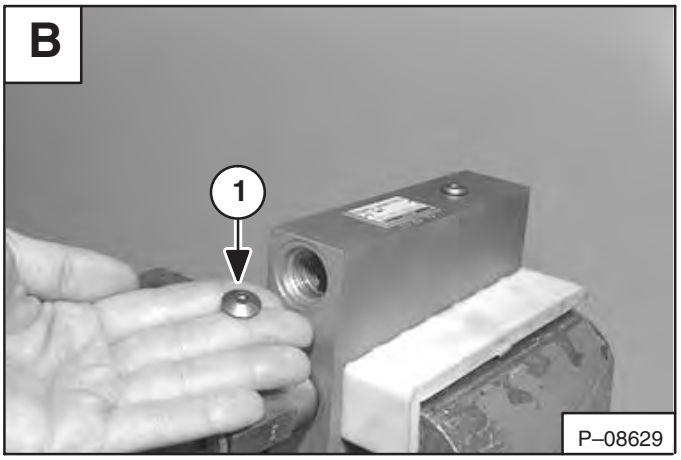
Assembly (Cont'd)

Dip the relief valve (Item 1) **[A]** in clean hydraulic fluid and install in the valve body.

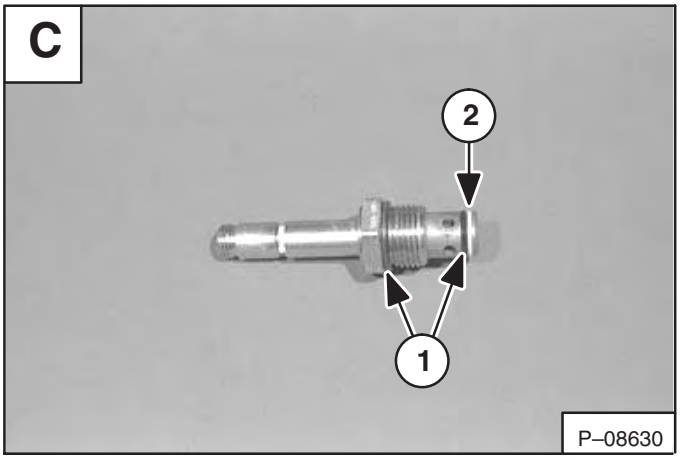


Make sure the restrictor plate (Item 1) **[B]** orifice is open.

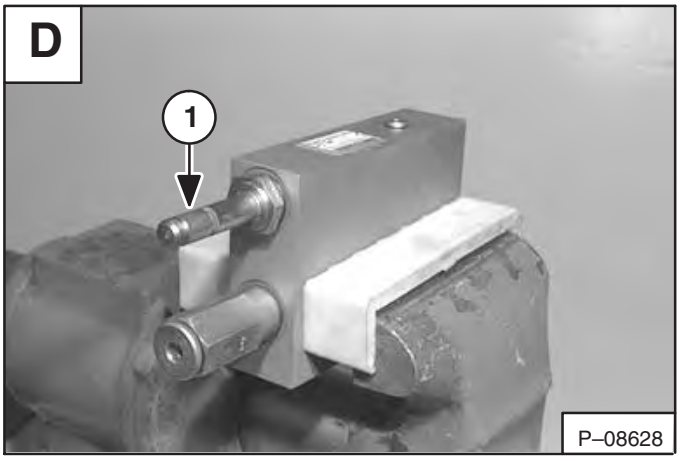
Install the restrictor plate (Item 1) **[B]** in the valve body.



Apply oil and install new O–rings (Item 1) **[C]** and back–up ring (Item 2) **[C]** on the valve stem.



Dip the valve stem (Item 1) **[D]** in clean hydraulic fluid and install in the valve body.



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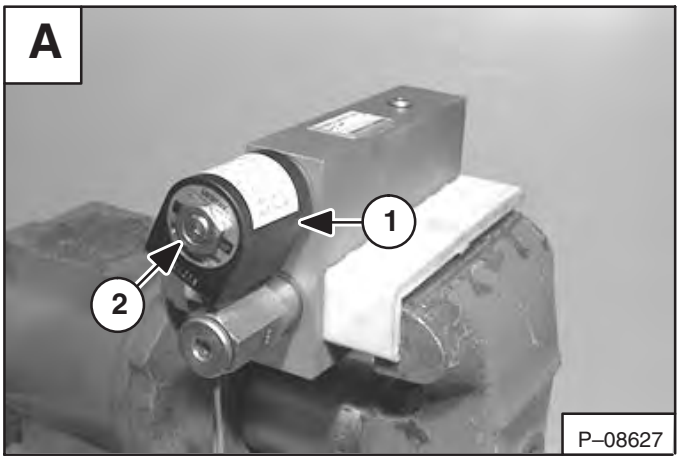
SOLENOID VALVE (Cont'd)

Assembly (Cont'd)

Install the coil (Item 1) **[A]** and nut (Item 2) **[A]** on the valve stem.

Tighten to 4–6 ft.–lbs. (5–8 Nm) torque.

NOTE: If the coil is over torqued it may cause valve failure.



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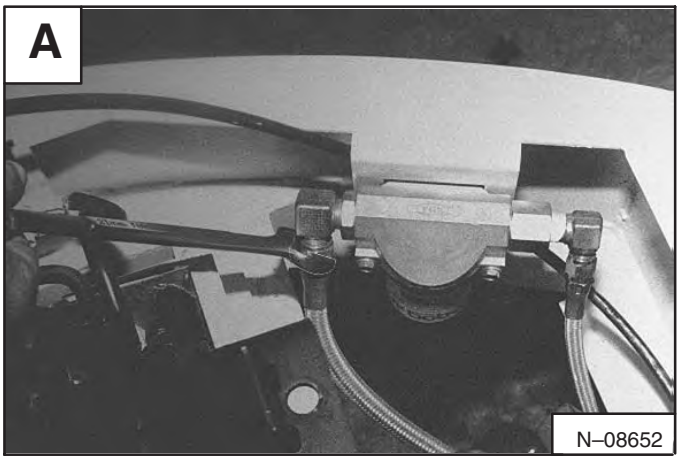
HYDRAULIC FILTER

Removal And Installation

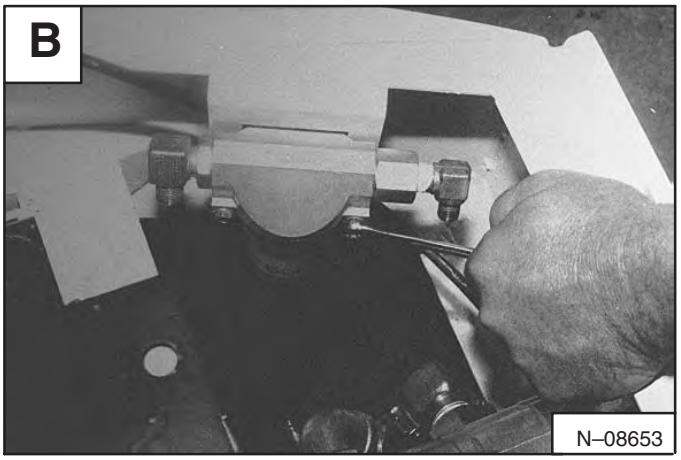
Raise the engine cover.

Remove the inlet and outlet hoses from the filter **[A]**.

Drain the fluid into a container.



Remove the mounting bolts from the filter **[B]**.



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JOYSTICK CONTROL CHANGE

To change from I.S.O. to STANDARD joystick controls do the following procedure:

Remove the seat and swing motor cover. (See Page 5–1.)

Remove the rear floor panel. (See Page 5–1.)

Remove the left control panel base. (See Page 3–1.)

Exchange the boom control hose (Item 1) **[A]** with the dipperstick control hose (Item 2) **[A]**.

Exchange the dipperstick control hose (Item 3) **[A]** with the boom control hose (Item 4) **[A]**.

After exchange of hoses the routing from the joystick to the control valve will be as shown **[B]**.

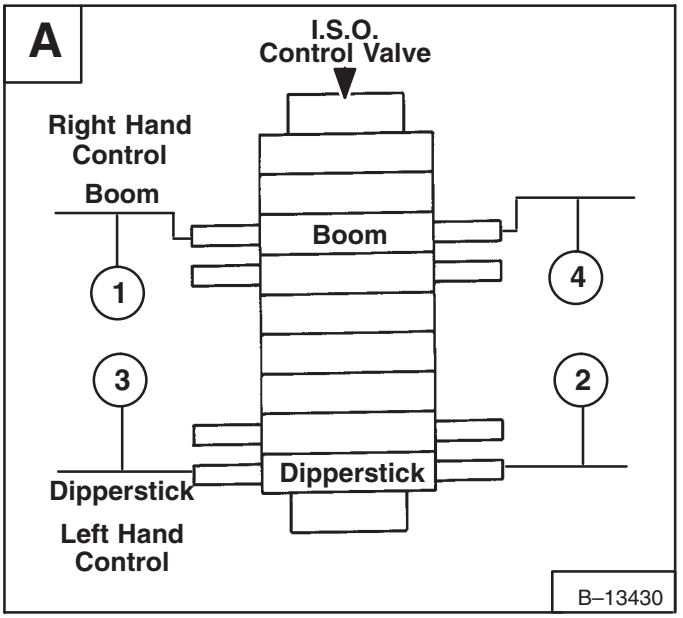
The right joystick now will control dipperstick raise and lower as well as bucket curl **[B]**.

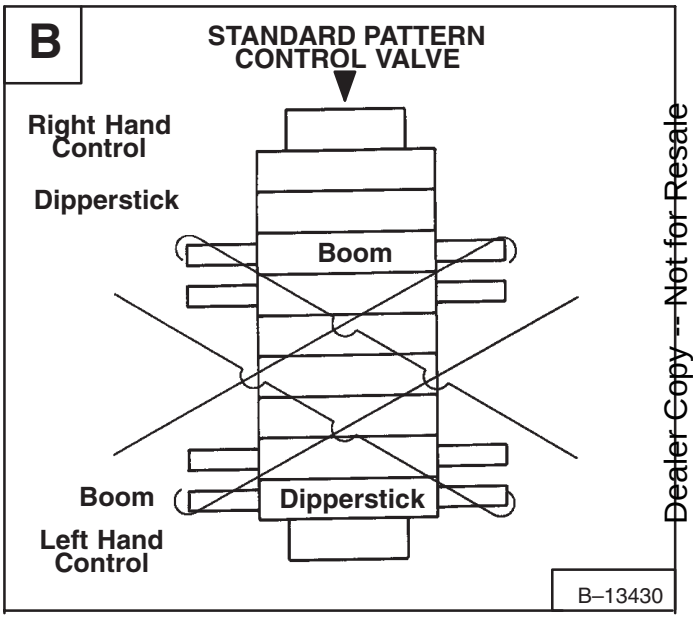
The left joystick now will control upper works swing and boom raise and lower **[B]**.

NOTE: The piping from the control valve to the effected cylinders DOES NOT change.

NOTE: Remove the decal for I.S.O. controls and install decals (P/N 6658049 R.H. & 6658050 L.H.) for U.S. control.

To change from STANDARD to I.S.O. joystick controls reverse the hose routing to **[A]**.





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Page Number

BLADE CONTROL LEVER
Removal And Installation 3–7

CONTROL LOCKING ARM
Removal And Installation 3–8

CONTROL PANEL BASE
Removal And Installation 3–12

DRIVE MOTOR
Disassembly 3–17
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FINAL DRIVE
Removal And Installation 3–15

FINAL DRIVE CASE
Check Oil Level 3–40
Draining Final Drive Case 3–40

FOOT PEDAL AND STEERING LEVER LINKAGE
Removal And Installation 3–13

HYDRAULIC CONTROL LEVERS
Boom/Bucket Control Lever 3–3
Disassembly And Assembly 3–3
Swing/Dipperstick Control Lever 3–1

LOCKING LEVER CABLE
Removal And Installation 3–11

LOCKING LEVER VALVE
Removal And Installation 3–10

PANEL LIFT CYLINDER
Removal And Installation 3–9

STEERING LEVERS
Removal And Installation 3–14

THROTTLE LEVER
Removal And Installation 3–7

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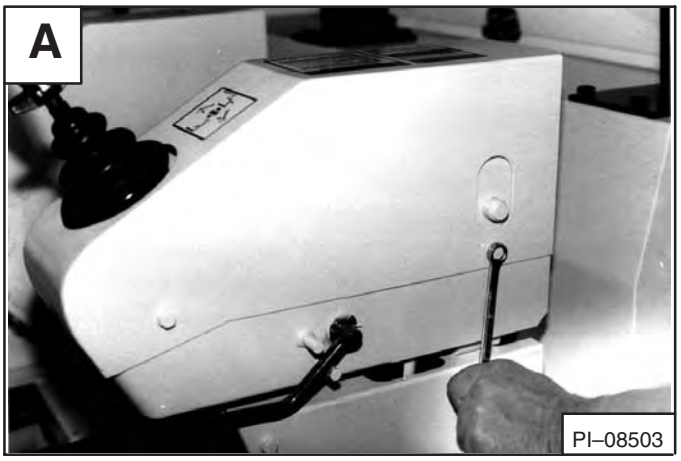
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HYDRAULIC CONTROL LEVERS

Swing/Dipperstick Control Lever

Use the following procedure to remove and install the swing/dipperstick control lever:

Remove the control panel mounting bolts **[A]**.

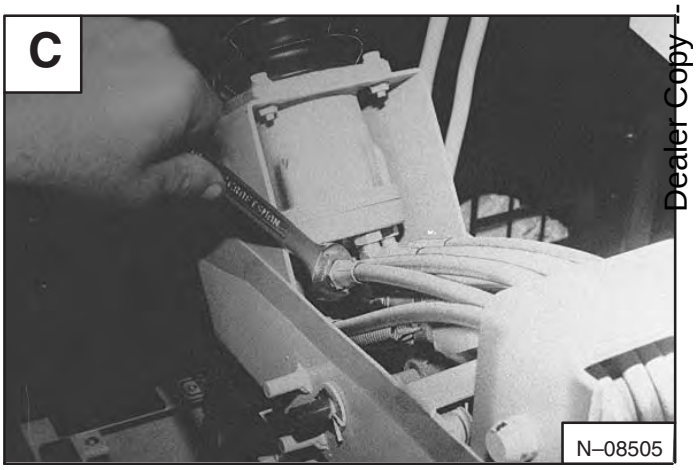


Remove the control panel **[B]**.

NOTE: Mark the hose locations for correct installation.



Remove the hoses from the control **[C]**.



Remove the mounting bolts from the control lever flange **[D]**.

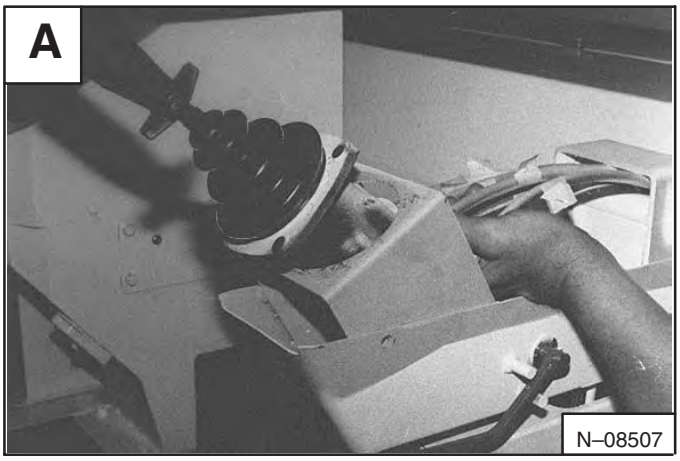


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HYDRAULIC CONTROL LEVERS (Cont'd)

Swing/Dipperstick Control Lever (Cont'd)

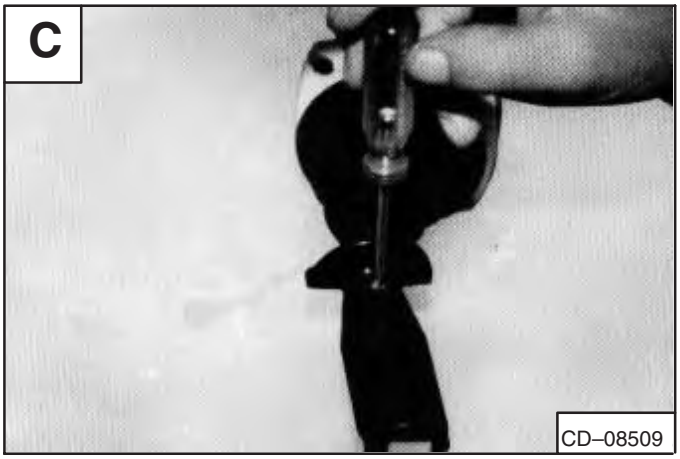
Remove the control from the mount **[A]**.



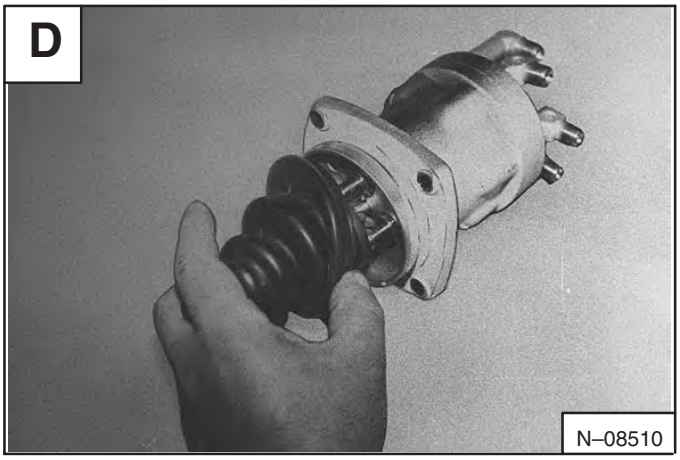
Remove the cap from the control lever **[B]**.



Remove the screws from the handle **[C]**.



Remove the rubber boot from the control lever **[D]**.

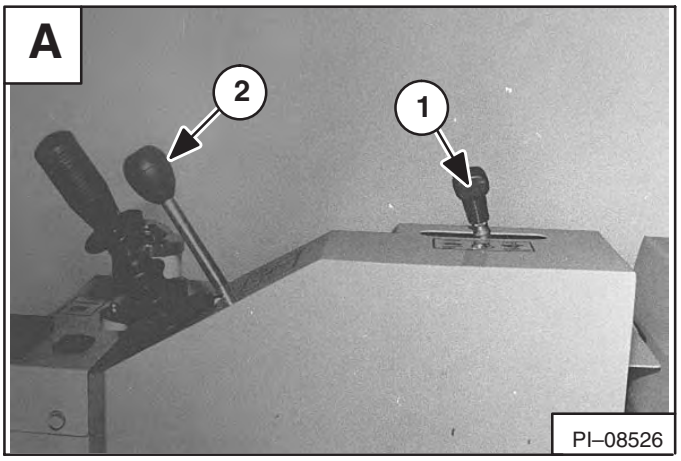


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HYDRAULIC CONTROL LEVERS (Cont'd)

Boom/Bucket Control Lever

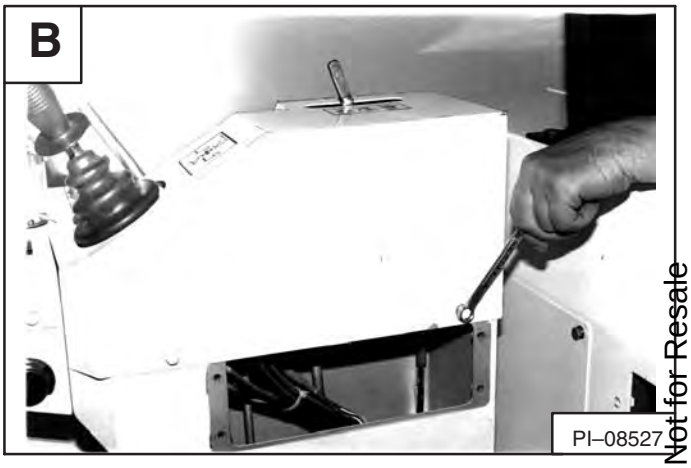
Remove the knobs from the throttle lever (Item 1**[A]** and the blade control lever (Item 2) **[A]**.



Remove the mounting bolts from the control panel **[B]**.

Remove the panel.

NOTE: Use the same procedure shown on Page 3–3 to remove the right control lever from the panel.



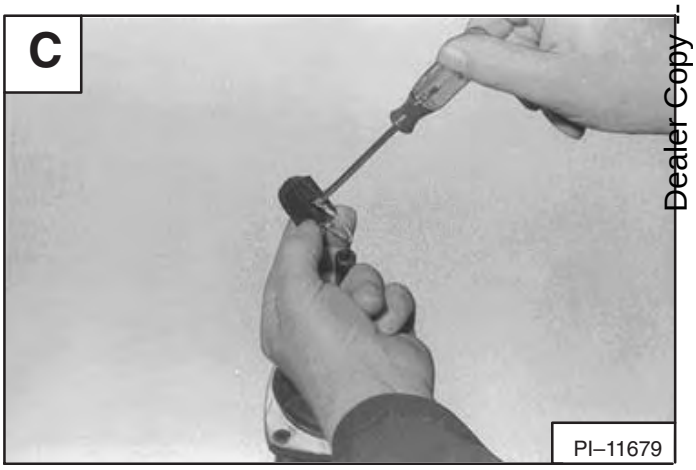
Disassembly And Assembly

NOTE: The right control lever is equipped with a horn button. the valve body disassemblyand assembly procedure is the same.

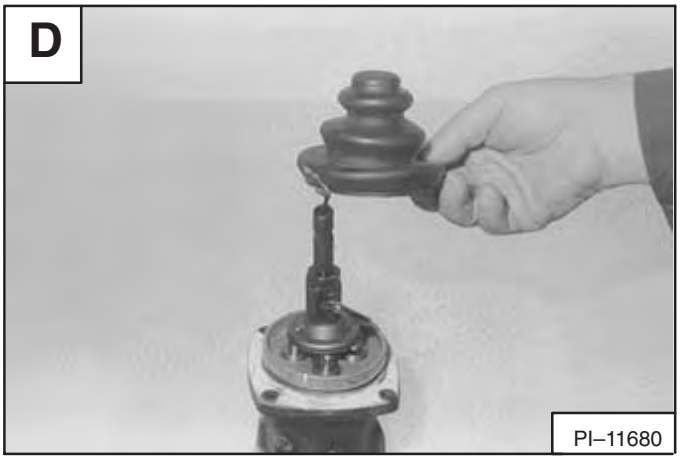
Remove the handle from the control lever(Refer to Page 3–2.)

Remove the screws from the horn wires **[C]**.

NOTE: Mark the wires for correct installation.



Remove the rubber boot from the control lever **[D]**.



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HYDRAULIC CONTROL LEVERS (Cont'd)

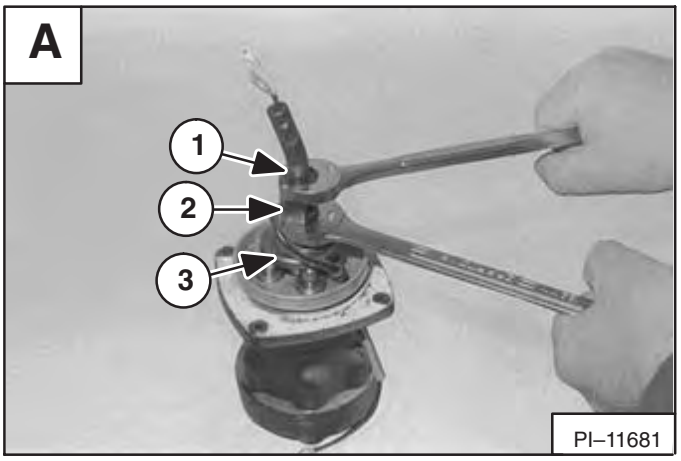
Disassembly And Assembly (Cont'd)

Remove the joystick lever and the lock nut (Item 1) **[A]**.

Remove the adjustment nut (Item 2) **[A]** and the horn wires.

Remove the push rod disc (Item 3) **[A]**.

Installation: Apply grease to the disc contact surface. Tighten the disc until it touches the push rods equally then tighten the adjustment nut to 43 in.–lbs. (5 Nm) torque.



Remove the joint **[B]**.

Installation: Tighten the joint to 30 in.–lbs. (3,4 Nm) torque.

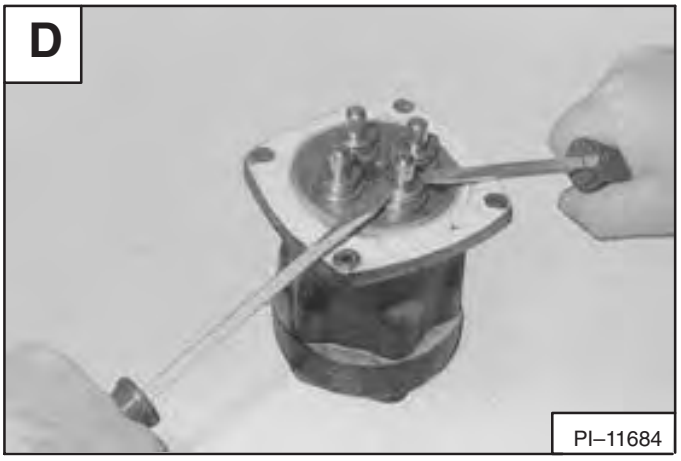


Remove the plate **[C]**.

Installation: Align the hole in the plate with the valve body hole.



Use screwdrivers to remove the plugs **[D]**.



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HYDRAULIC CONTROL LEVERS (Cont'd)

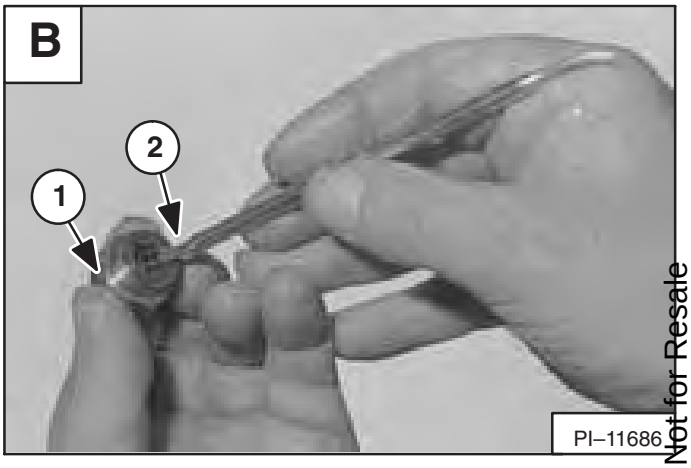
Disassembly And Assembly (Cont'd)

Remove the push rod from the plug **[A]**.

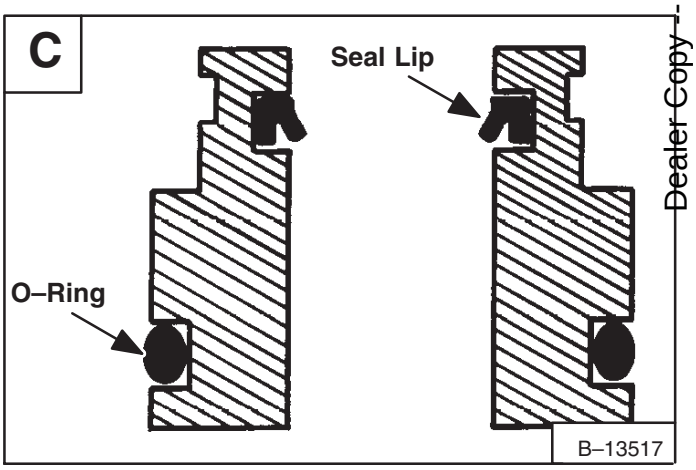
Check the push rod crown for wear.



Remove the O–ring (Item 1) **[B]** and seal (Item 2) **[B]** from the plug.

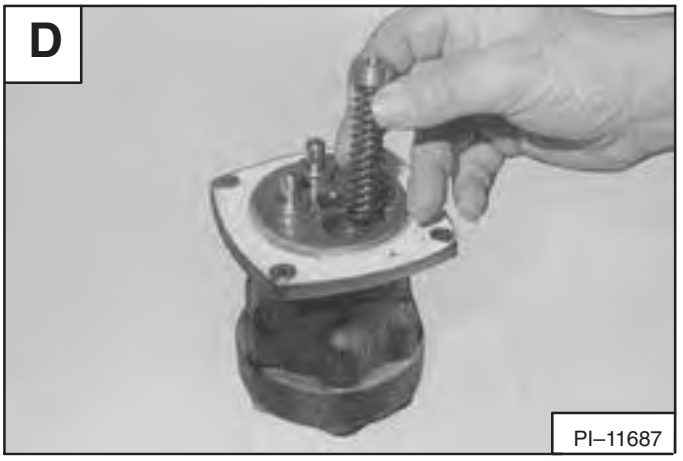


Installation: Be sure the seal lip is toward the valve body **[C]**.



Remove the spool assembly from the valve body **[D]**.

NOTE: Install the spool assemblies in the same location from where they are removed.

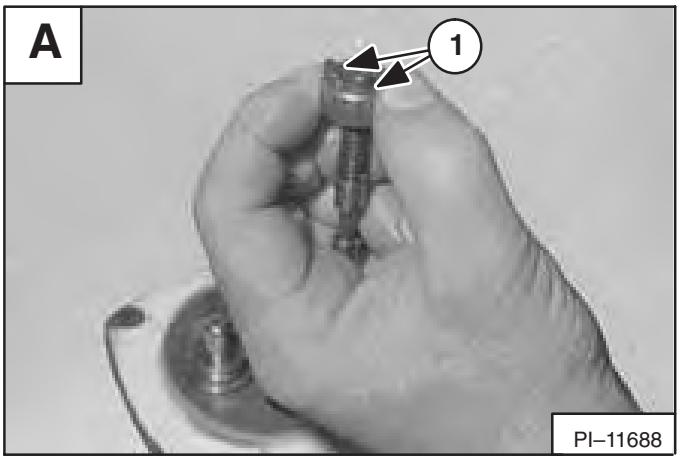


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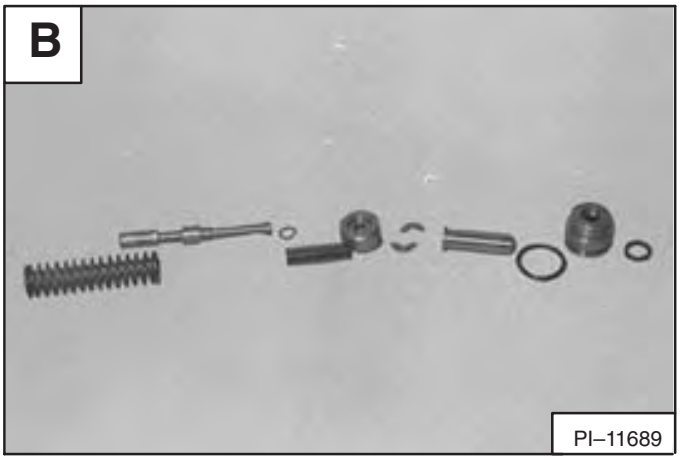
HYDRAULIC CONTROL LEVERS (Cont'd)

Disassembly And Assembly (Cont'd)

Push the spring seat down to remove the washers (Item 1) **[A]**.

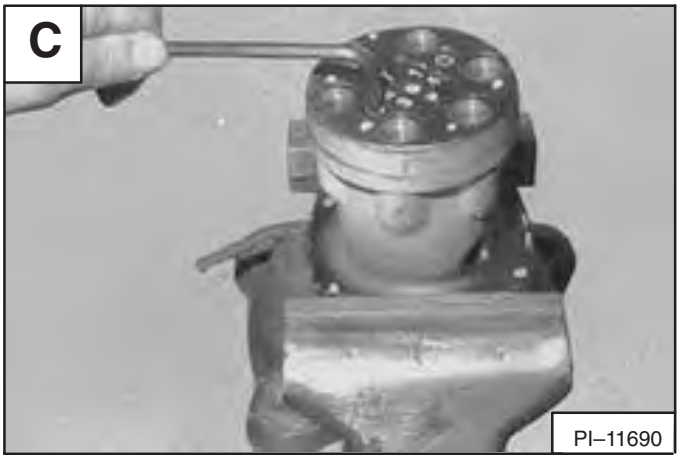


Remove spring seat, spring and washers from the spool **[B]**.



Remove the two bolts from the port plate **[C]**.

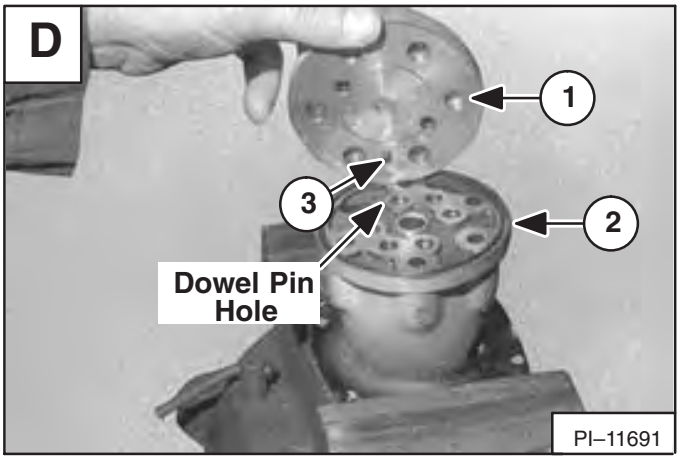
Installation: Tighten the bolts to 26 in.–lbs. (3 Nm) torque.



Remove the port plate (Item 1) **[D]**, and O–ring (Item 2) **[D]** from the valve body.

Use a new O–ring during assembly.

Installation: Align the dowel pin (Item 3) **[D]** with the dowel pin hole in the valve body.

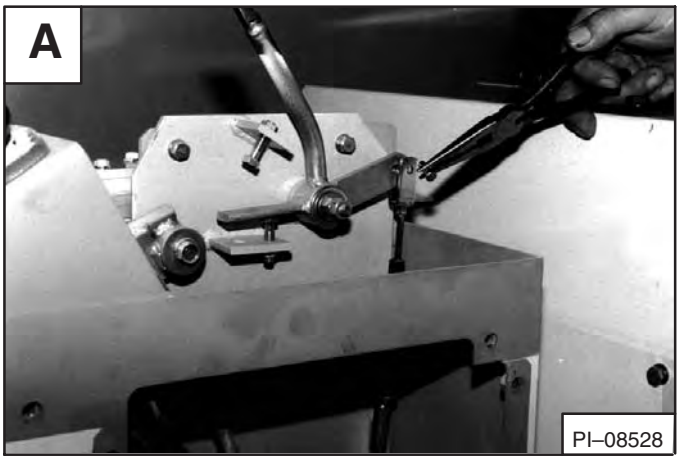


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THROTTLE LEVER

Removal And Installation

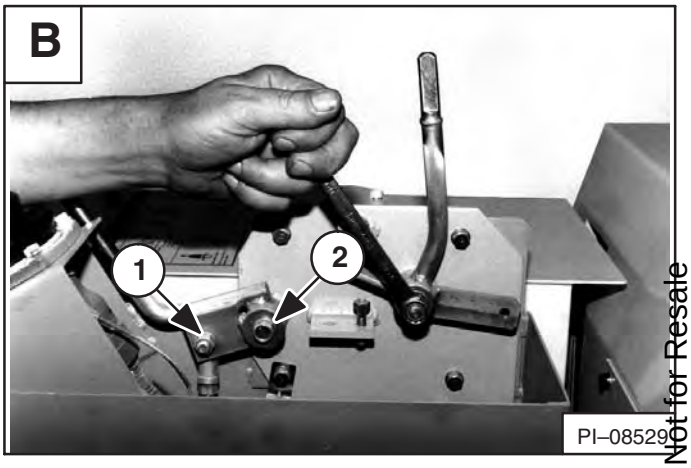
Remove the cotter pin and clevis pin from the throttle cable **[A]**.



Remove the mounting nut from the throttle lever (Item 1) **[B]**.

Remove the throttle lever.

(See Page 7–1) to remove the throttle cable.



BLADE CONTROL LEVER

Removal And Installation

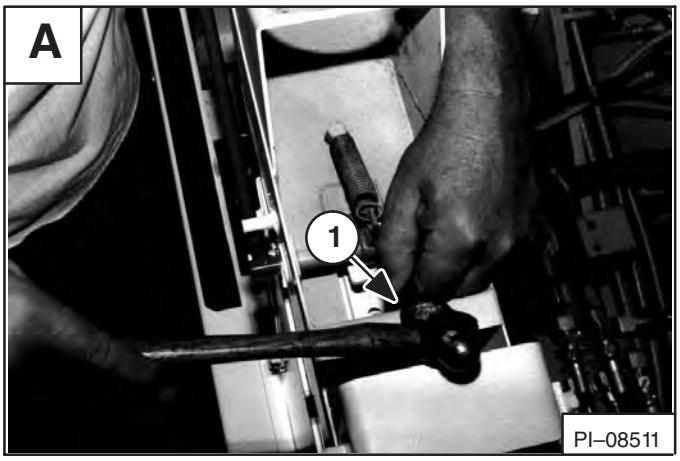
Remove the control linkage nut (Item 2)**[B]** and the lever mounting bolt to remove the lever.

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CONTROL LOCKING ARM

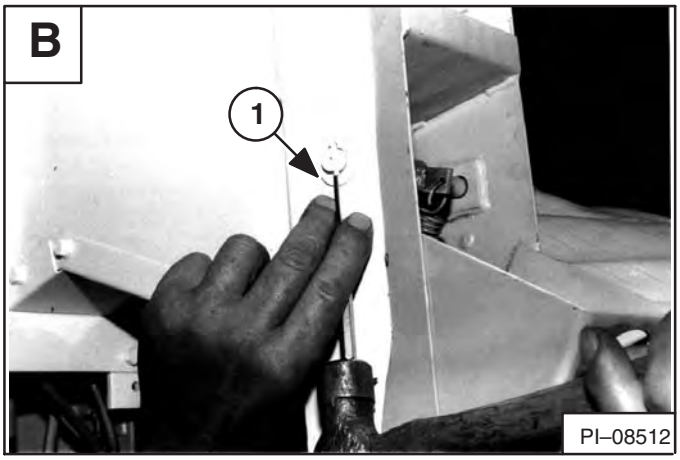
Removal And Installation

Use a hammer and punch to tap the inner roll pin (Item 1) **[A]** from the lever lock.



Remove the outer roll pin (Item 1)**[B]** from the lever lock.

Slide the lever lock from the bushings.

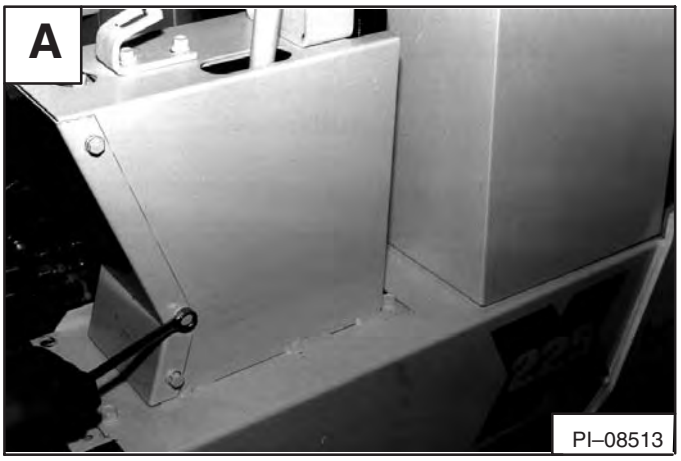


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PANEL LIFT CYLINDER

Removal And Installation

Remove the front cover mounting bolts **[A]**.



Remove the cover **[B]**.



Remove the hair pin and washers from both ends of the gas cylinder **[C]**.



Remove the gas cylinder **[D]**.

⚠ WARNING

Cylinder contains high pressure gas. Do not open. Opening cylinder can release rod and cause injury or death.

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LOCKING LEVER VALVE

Removal And Installation

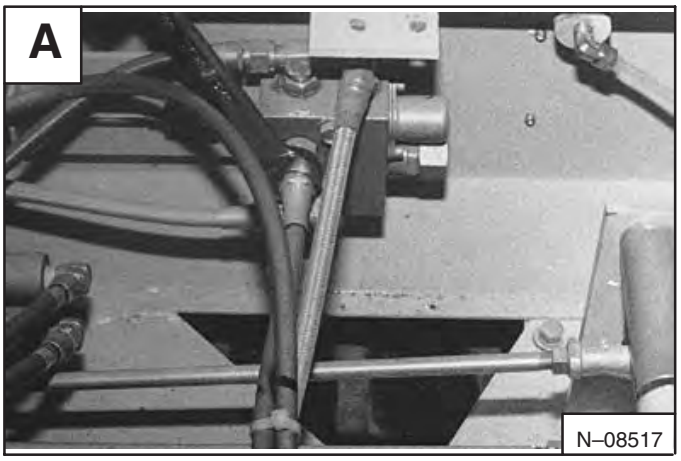
Remove the floor panel. (See Page 5–2.)

Remove the seat. (See Page 5–4.)

Remove the swing motor cover. (See Page 5–4.)

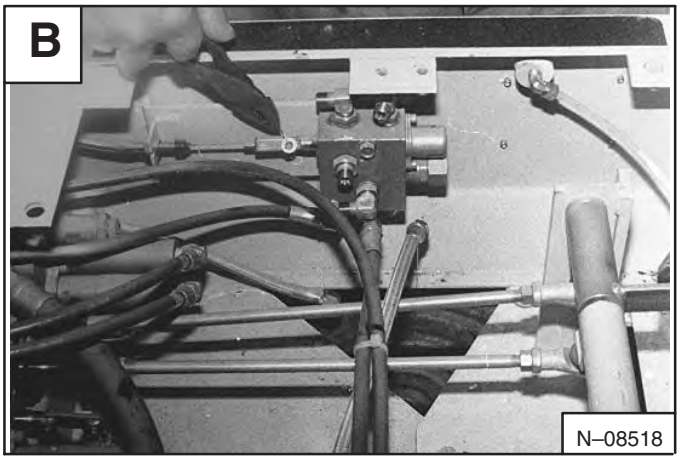
Mark the hoses for correct installation.

Remove the hoses from the valve body **[A]**.

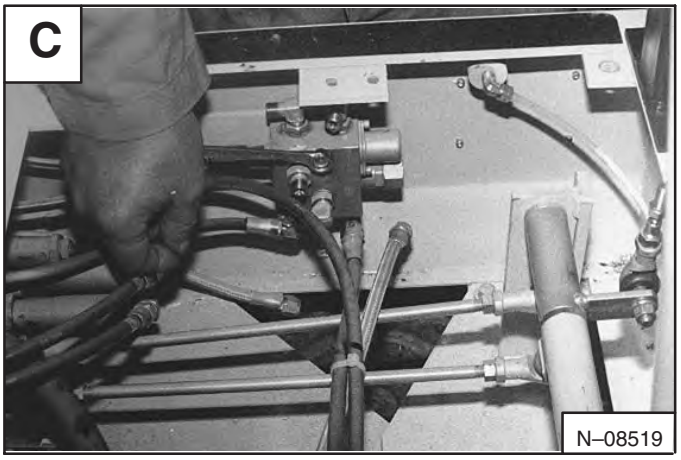


Remove the cotter pin and washer from the control cable clevis **[B]**.

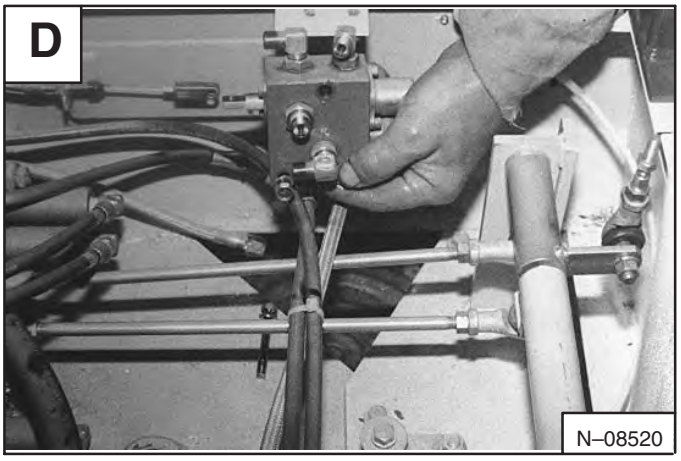
Remove the clevis pin.



Remove the mounting bolts **[C]**.



Remove the locking lever valve **[D]**.

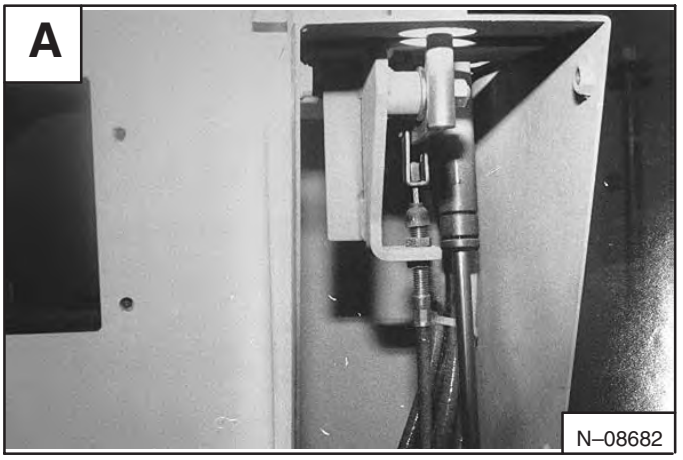


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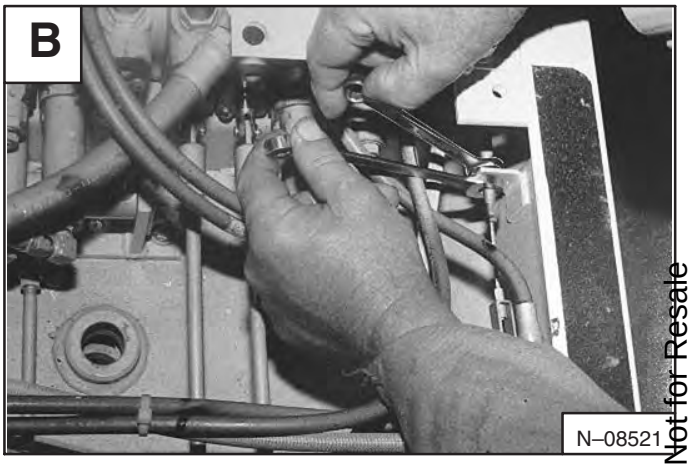
LOCKING LEVER CABLE

Removal And Installation

Remove the cotter pin and clevis pin from the control lever pivot **[A]**.



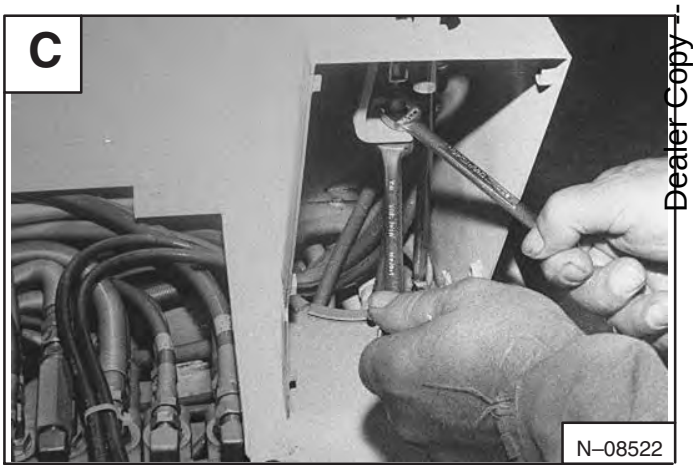
Loosen the control cable jam nuts from the lower bracket **[B]**.



Loosen the control cable jam nuts from the upper bracket **[C]**.

Remove the cotter pin and clevis pin from the control lever pivot.

Remove the cable.



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CONTROL PANEL BASE

Removal And Installation

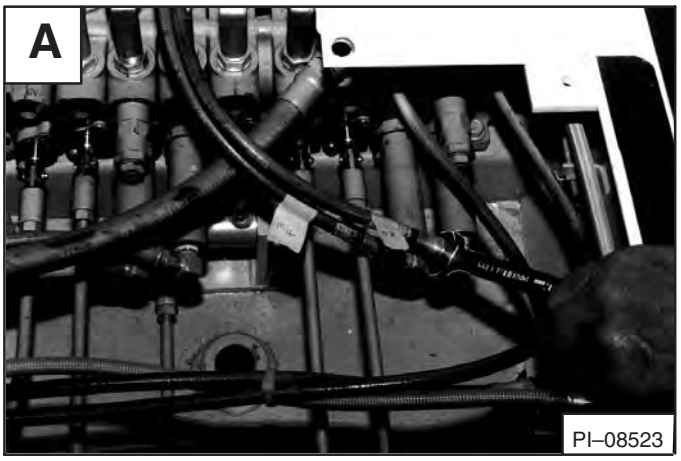
Remove the floor panel. (See Page 5–2.)

Remove the seat. (See Page 5–4.)

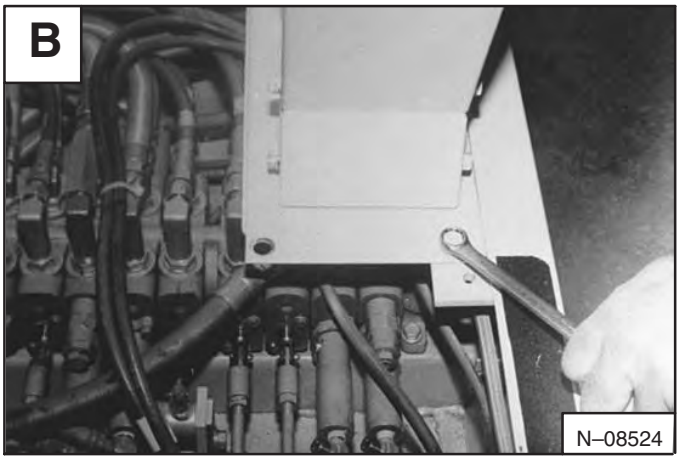
Remove the swing motor cover. (See Page 5–4.)

NOTE: Mark the hoses for correct installation.

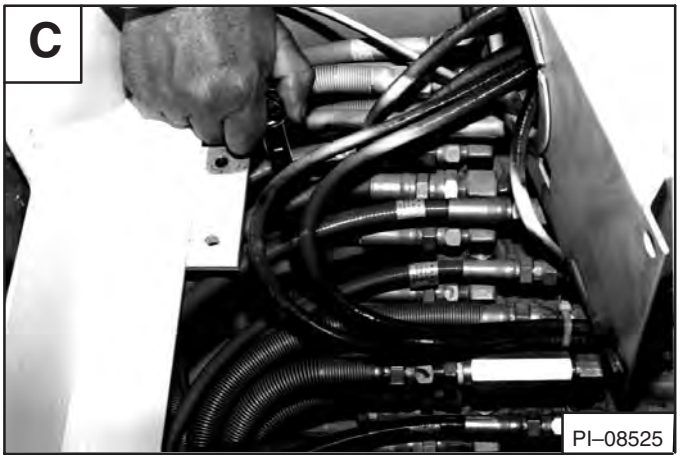
Remove the control lever hoses from the front of the control valve **[A]**.



Remove the mounting bolts from the base plate **[B]**.



Move the control panel base to remove the hoses from the rear of the control valve **[C]**.



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FOOT PEDAL AND STEERING LEVER LINKAGE

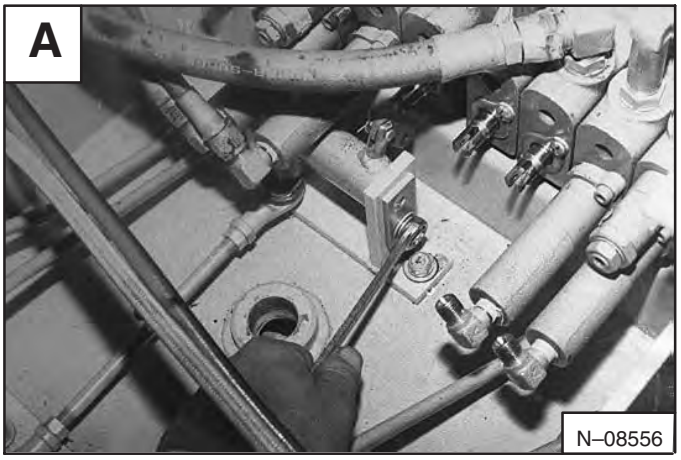
Removal And Installation

Remove the floor panels. (See Page 5–2.)

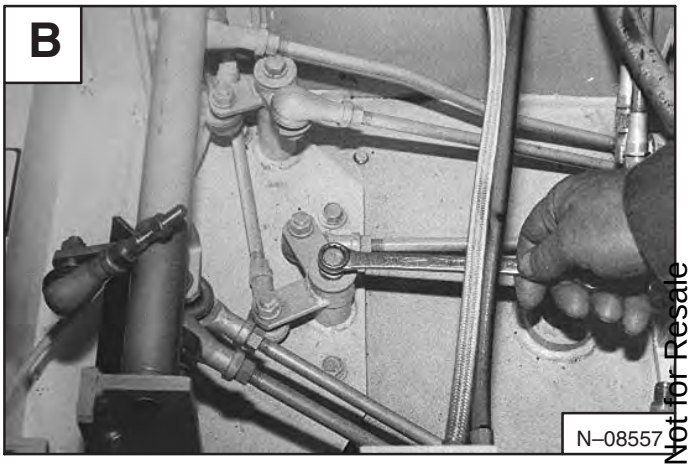
Mark the linkage for correct installation.

Disconnect the linkage rods from the spools.

Remove the bolt holding the boom swing pivot pin **[A]**.

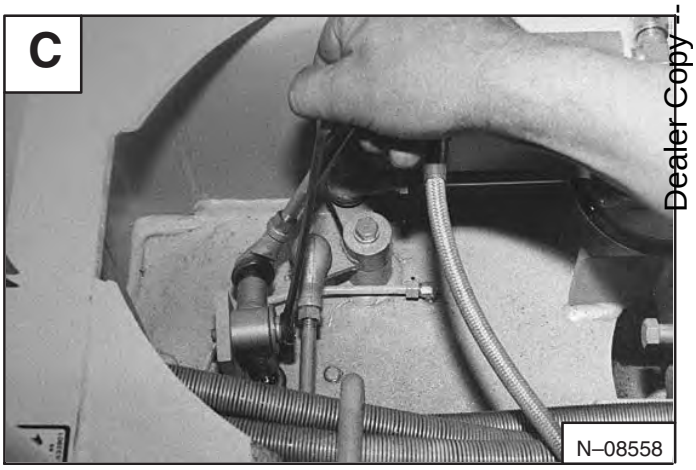


Remove the boom swing center pivot bolt **[B]**.

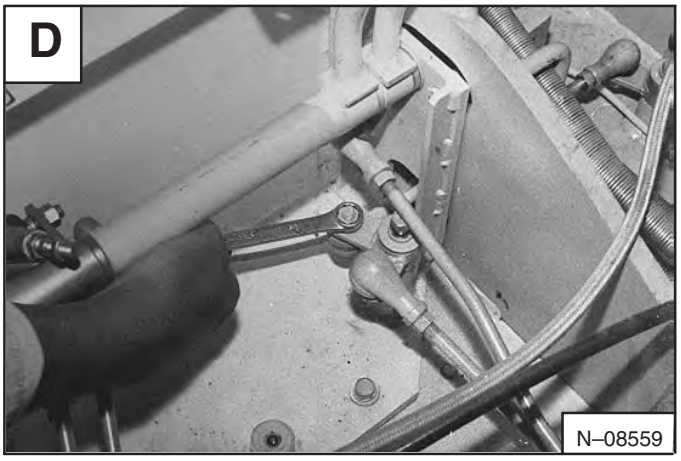


Remove the pivot bolt below the foot pedal **[C]**.

Remove the boom swing linkage assembly.



Remove the bolts from the blade linkage pivots **[D]**.



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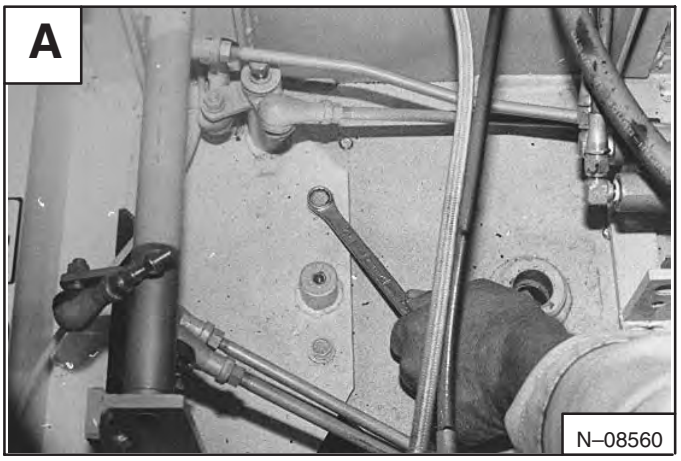
STEERING LEVERS

Removal And Installation

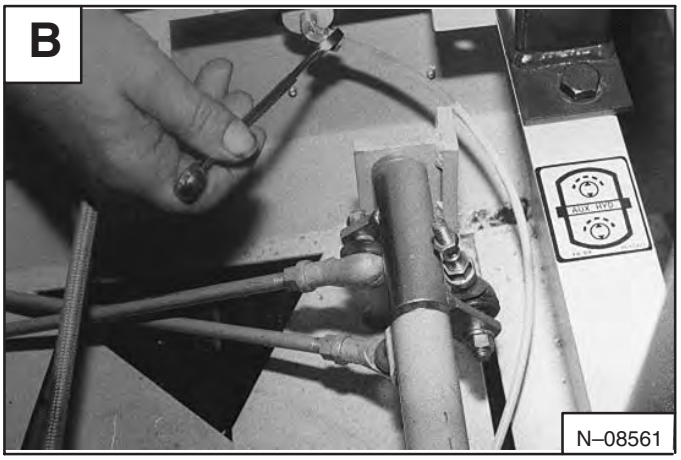
Remove the floor panels. (See Page 5–2.)

Remove the control linkage. (See Page 3–10.)

Remove the mounting bolts **[A]**.

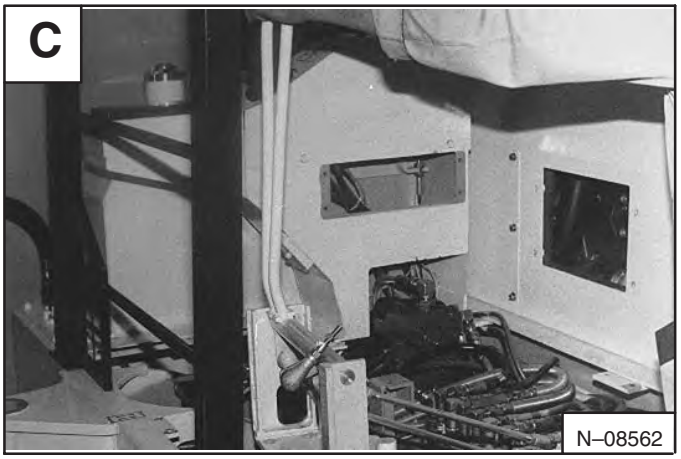


Remove the grease tubeline for the swing circle pinion gear **[B]**.



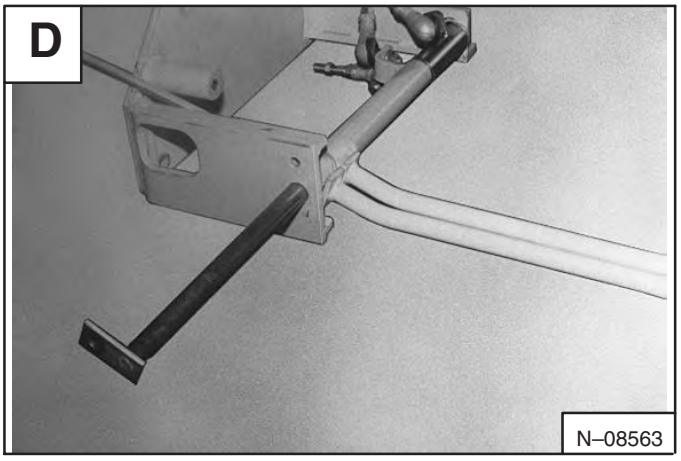
Lift the steering levers from the machine **[C]**.

Remove the bolt holding the steering levers pivot pin.



Remove the pivot pin **[D]**.

***Installation*:** Install spacers or shims in the original locations and grease the pivot shaft.



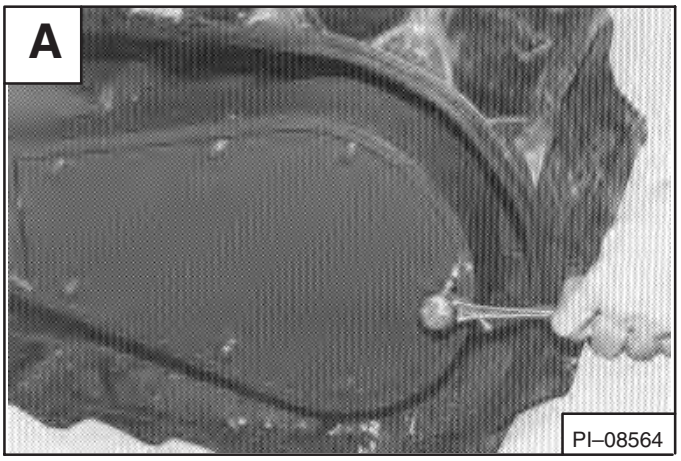
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FINAL DRIVE

Removal And Installation

Remove the bolts from the track frame cover **[A]**.

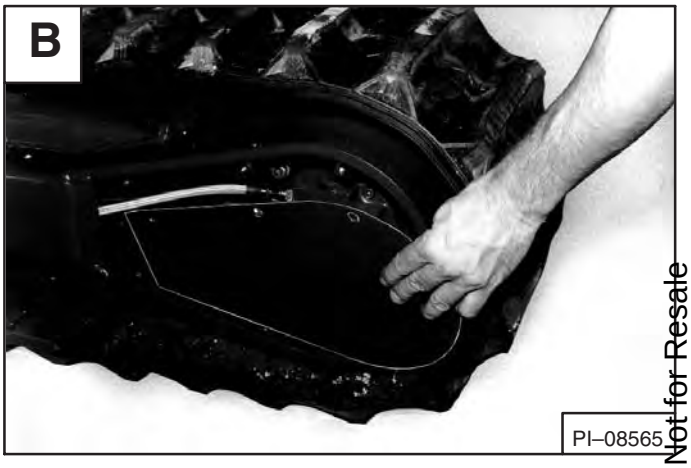
Installation: Tighten the bolts to 48 ft.–lbs. (65 Nm) torque.



Remove the cover **[B]**.

Lift and block the side of the track frame where the final drive will be removed.

Release the track tension and remove the track. (See Page 5–11.)



IMPORTANT

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

I–2003–0888

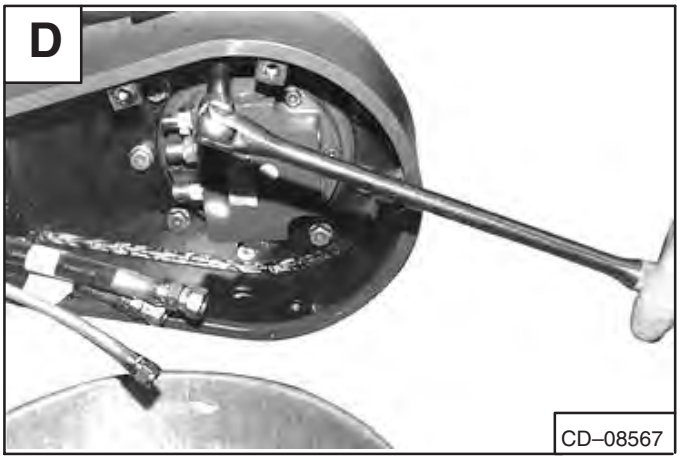
Mark the hoses for correct installation.

Disconnect the hoses from the drive motor **[C]**.



Loosen and remove the final drive mounting bolts **[D]**.

Installation: Put LOCTITE on the bolts and tighten to 80 ft.–lbs. (108 Nm) torque.



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FINAL DRIVE (Cont'd)

Removal And Installation (Cont'd)

Remove the motor , sprocket and reduction gear assembly from the track frame **[A]**.



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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.

I–2003–0888

The following tools will be needed for disassembly and/or reassembly purposes:

Floating Seal installation tool (MEL1412, available from OTC Service Tools) (See Page 3–29) and bearing nut tool (See Page 3–26) (made locally).

Disassembly

Remove the drain plugs from the end cover of the drive motor **[A]**.

Drain the oil into a container.

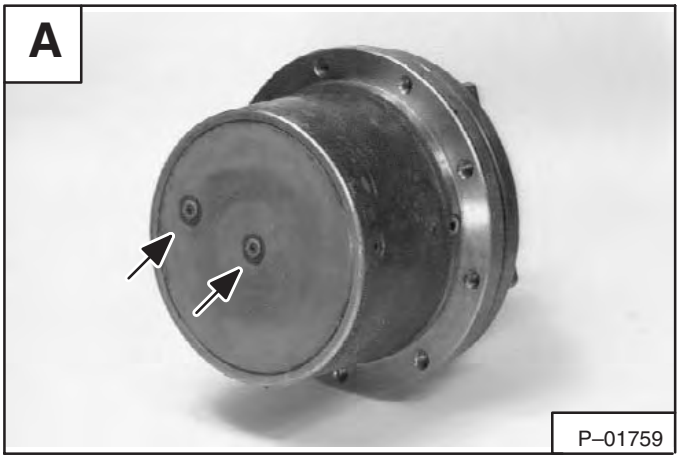
Remove the two spool caps from the valve end cover **[B]**.

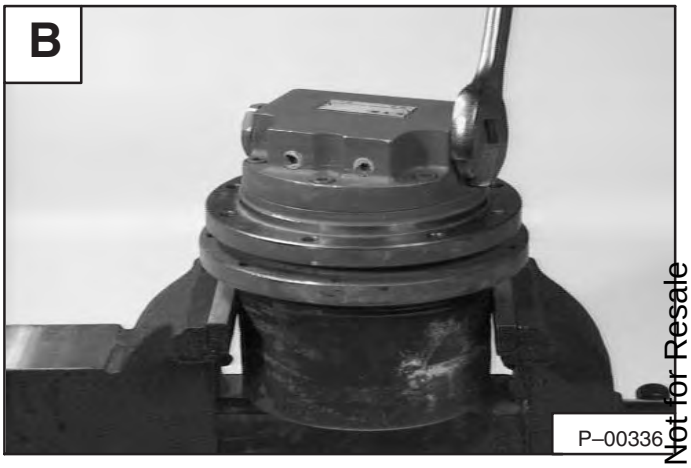
Remove the spring (Item 1) **[C]** and washer (Item 2) **[C]** from each end of the housing and remove the spool (Item 3) **[C]**.

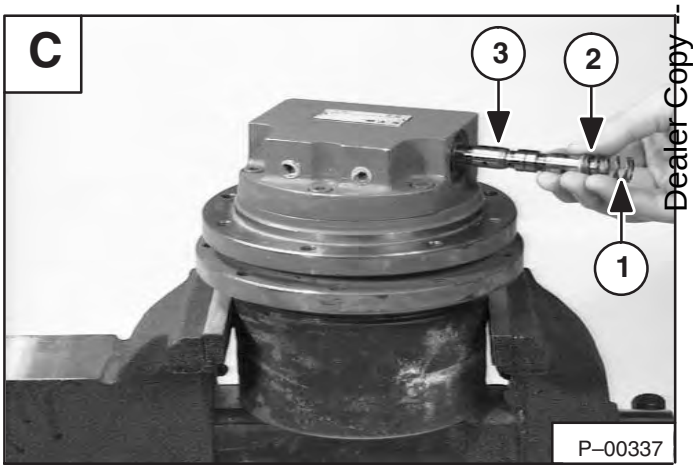
To disassemble the spool, insert a hardened pin (Item 1) **[D]** thru the hole in the spool gland and use a vise with protective jaws to hold the spool.

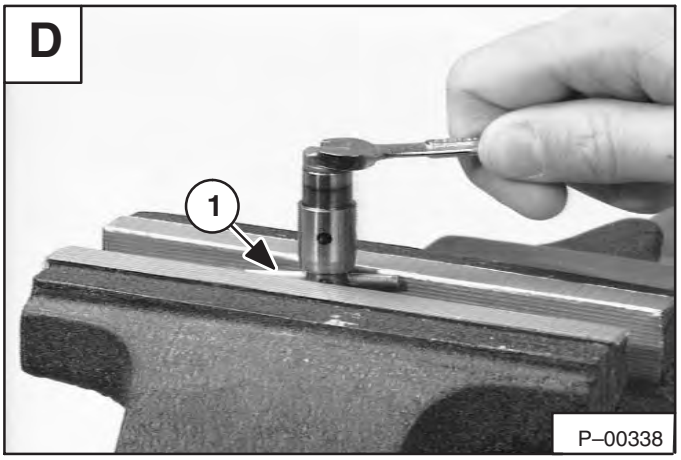
Remove the two end plugs from the ends of the spool.

NOTE: DO NOT use any type of clamp tool on the spool. The spool must be replaced if it has scratches or any other damage to the machined surfaces.









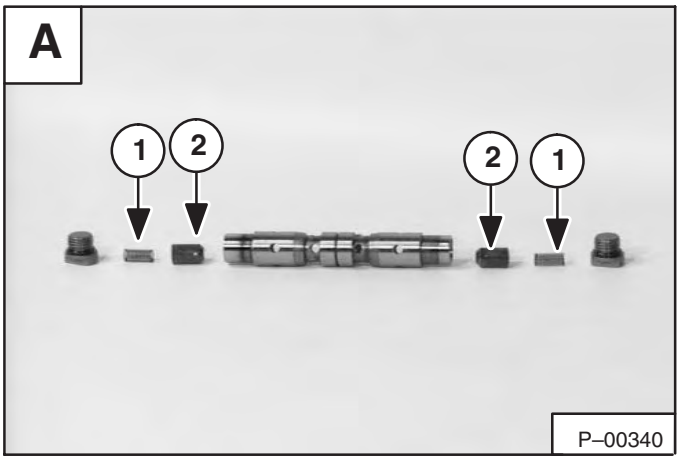
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DRIVE MOTOR (Cont'd)

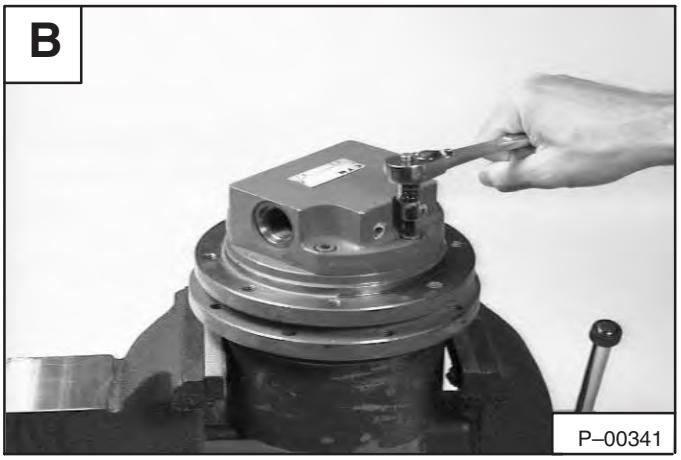
Disassembly (Cont'd)

Remove the spring (Item 1) **[A]** and the poppet (Item 2) **[A]** from the ends of the spool.

Use solvent and clean and dry all spool components.

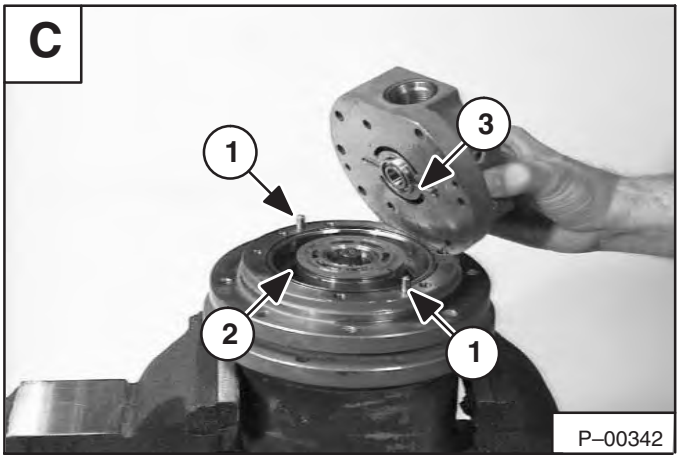


Remove the six bolts holding the valve end plate onto the housing **[B]**.



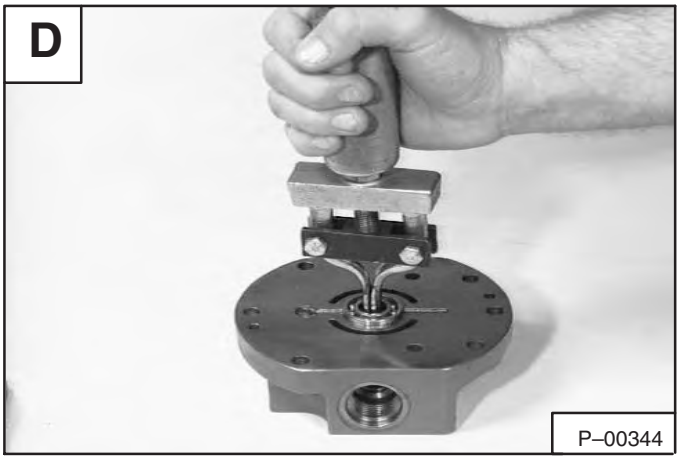
Lift off the valve end plate and remove the two dowel pins (Item 1) **[C]** and the O–ring (Item 2) **[C]**.

NOTE: The dowel pin (Item 3) [C] is staked into the valve plate end cover, do not remove unless damaged.



Remove the bearing from the valve end plate **[D]**.

Use a slide hammer bearing puller.



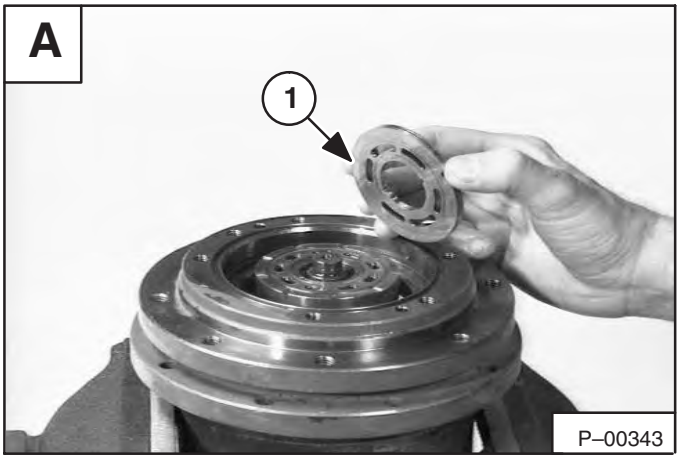
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DRIVE MOTOR (Cont'd)

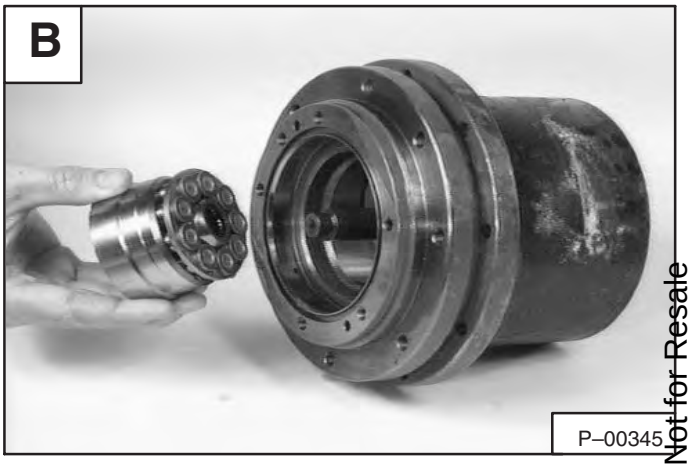
Disassembly (Cont'd)

Remove the valve plate **[A]**.

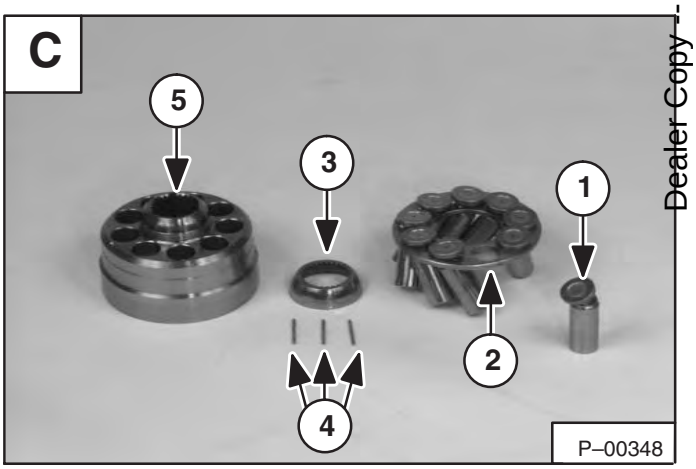
NOTE: The bronze side (Item 1) [A] of the valve plate goes towards the rotating group.



Remove the rotating group from the motor housing **[B]**.



Disassemble the pistons (Item 1) **[C]** retainer plate (Item 2) **[C]**, conical spacer (Item 3) **[C]** and the three (3) pins (Item 4) **[C]** from the piston housing (Item 5) **[C]**.

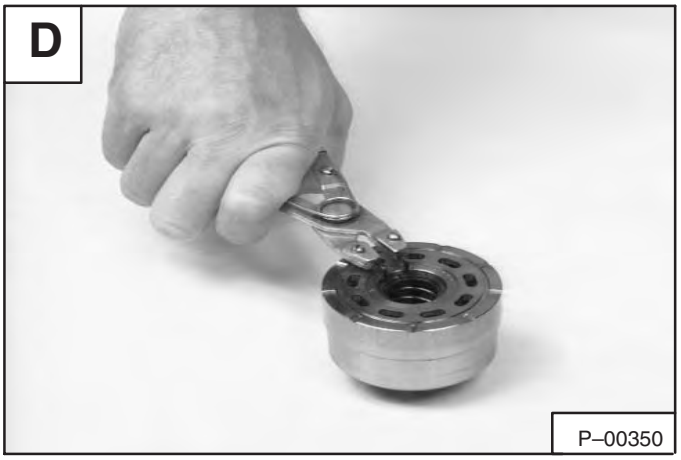


NOTE: The spring inside the piston housing is under pressure, use care when removing the snap ring from the piston housing.

Install a bolt and flat washer thru the center of the piston housing. The outer diameter of the washer should be smaller than the snap ring but large enough to make good contact with the spring spacer top face **[D]**.

Install a nut on the bolt and tighten until the spring is compressed **[D]**.

Remove the snap ring and loosen the nut to remove the spring **[D]**.

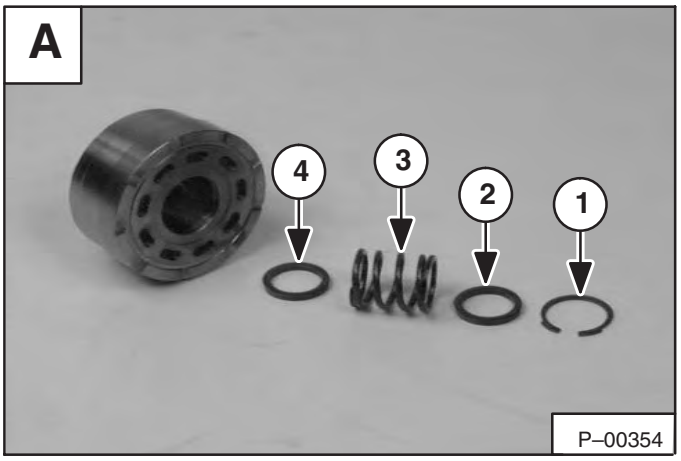


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DRIVE MOTOR (Cont'd)

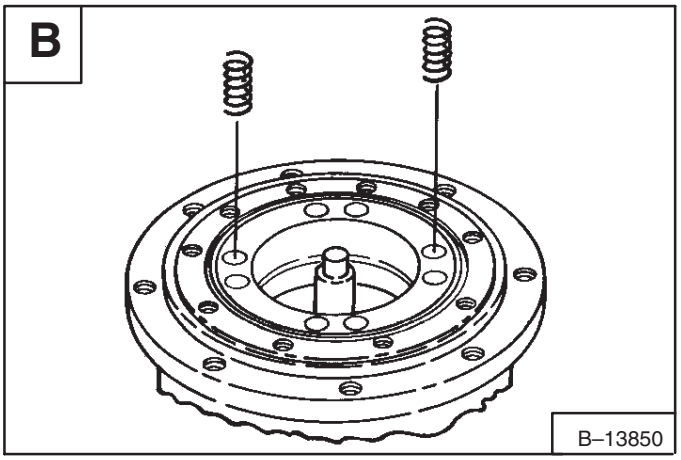
Disassembly (Cont'd)

Disassemble the snap ring (Item 1 **[A]**, collar (Item 2) **[A]**, spring (Item 3) **[A]** and the collar (Item 4) **[A]** from the piston housing.

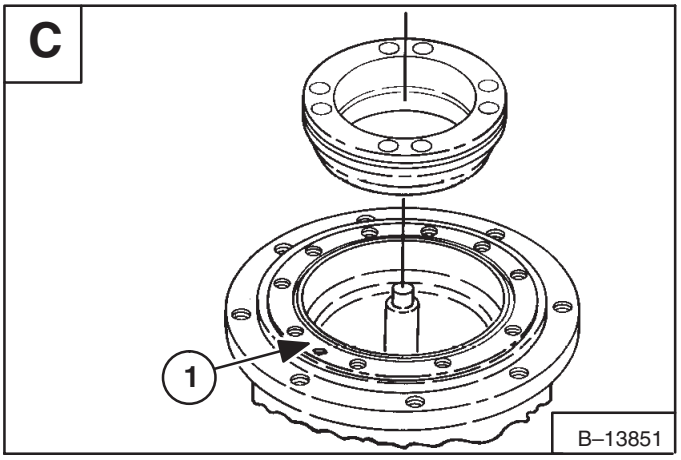


The following four steps (Page 3–20 **[B]** through Page 3–21 **[A]** are for drive motors with brakes; for drive motors without brakes, skip to step **[B]** on page 3–21.

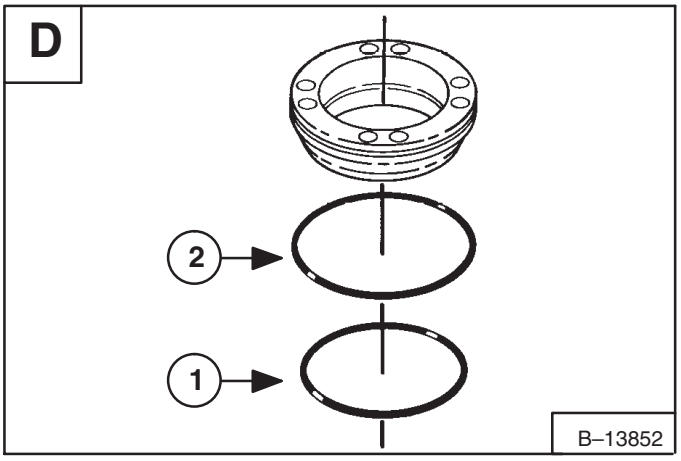
Remove the eight springs from the brake piston **[B]**.



Remove the brake piston from the drive motor hub by blowing compressed air into the park brake release port (Item 1) **[C]**.



Remove the two O–rings (Item 1 & 2) **[D]** from the brake piston.

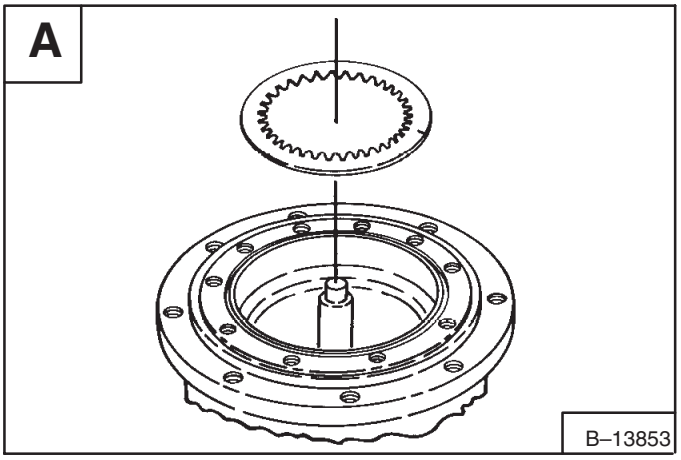


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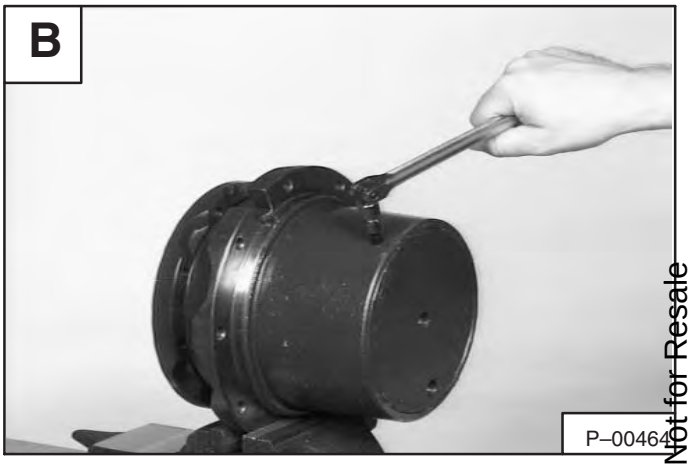
DRIVE MOTOR

Disassembly (Cont'd)

Remove the brake disc from the drive motor hub **[A]**.



Clamp the housing flange into a vise and remove the plug from the side of the housing **[B]**.



If the drive motor lube oil has not already been drained, do so now.

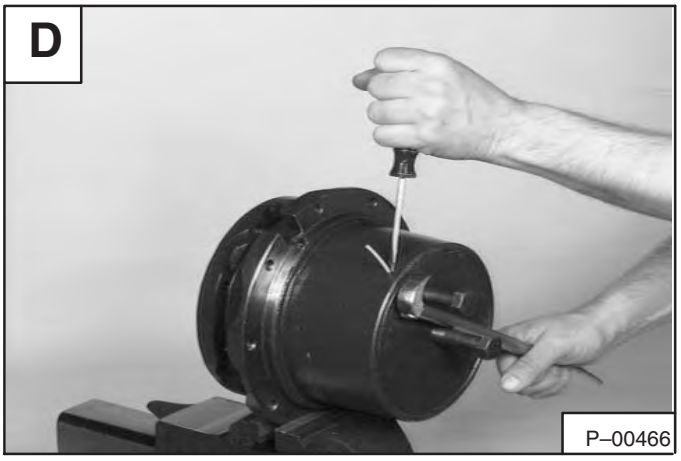
Remove the two plugs from the cover of the drive motor housing **[C]**. Drain the fluid into a container. Dispose of this fluid properly.



Install two bolts (PT 3/8 mm threads) into the plug holes in the cover **[D]**.

Install a flat blade screw driver tip into the hole in the side of the housing and use a bar to turn the end cover **[D]**.

Turn the end cover until the lock wire starts to come out of the housing hole **[D]**.

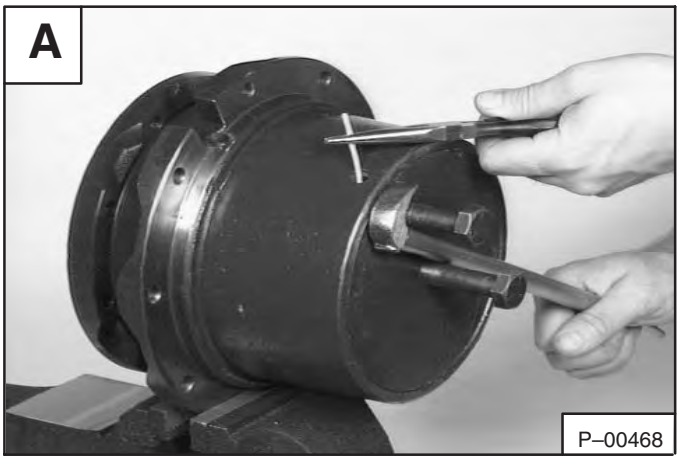


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DRIVE MOTOR (Cont'd)

Disassembly (Cont'd)

Use a plier to pull out on the lock wire while turning the end cover until the wire is completely removed from the housing **[A]**.

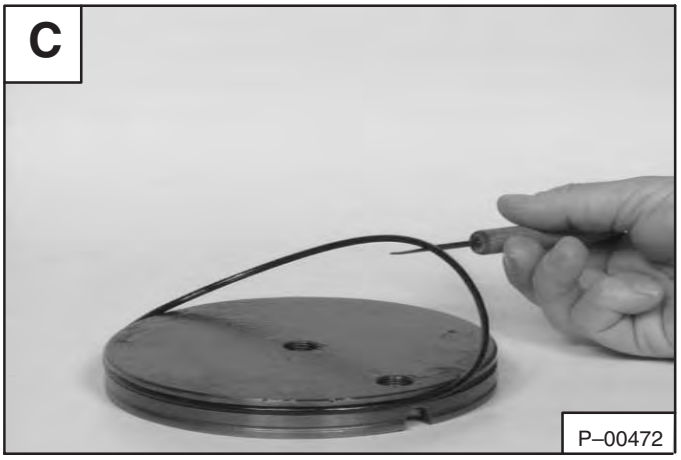


Remove the drive motor from the vise and set onto a flat surface.

Remove the end cover from the drive motor housing**[B]**.



Remove the O–ring from the edge of the cover **[C]**.



Remove the thrust plate from the planetary assembly**[D]**.

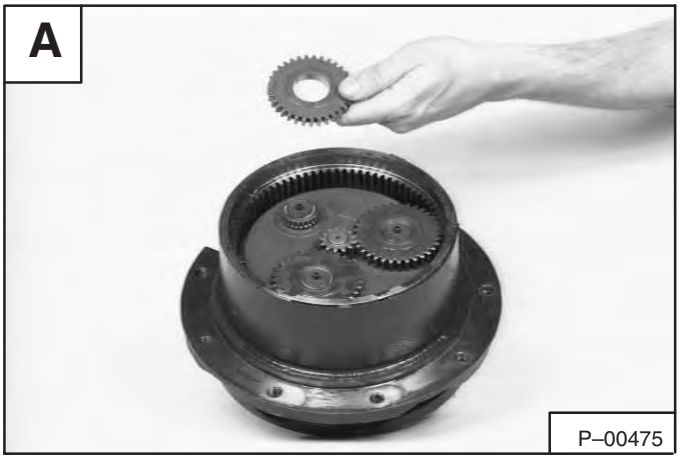


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DRIVE MOTOR (Cont'd)

Disassembly (Cont'd)

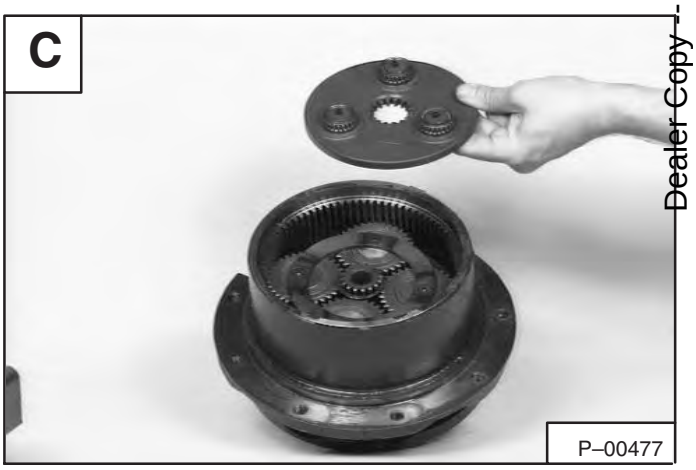
Remove the three planetary gears from the planetary holder **[A]**.



Remove the drive gear shaft from the housing **[B]**.

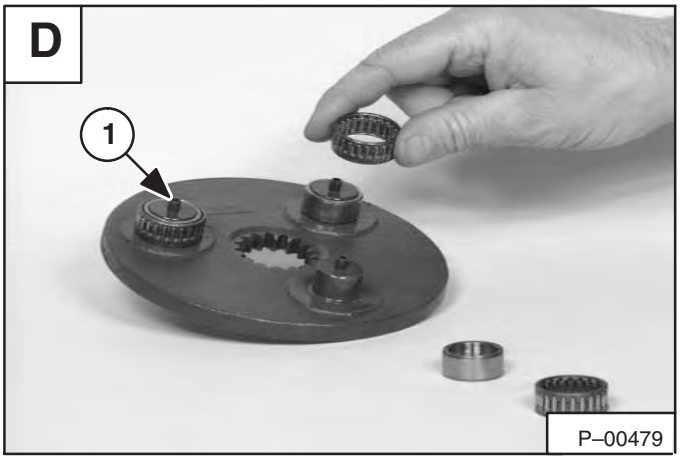


Remove the planetary holder from the housing **[C]**.



Remove the three needle bearings and bearing races from the holder **[D]**.

NOTE: The spring pins (Item 1) [D] do notneed to be removed or replaced unless damaged.



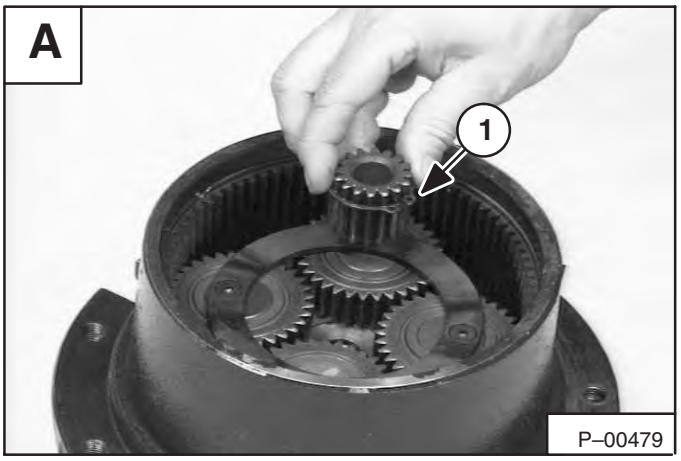
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DRIVE MOTOR (Cont'd)

Disassembly (Cont'd)

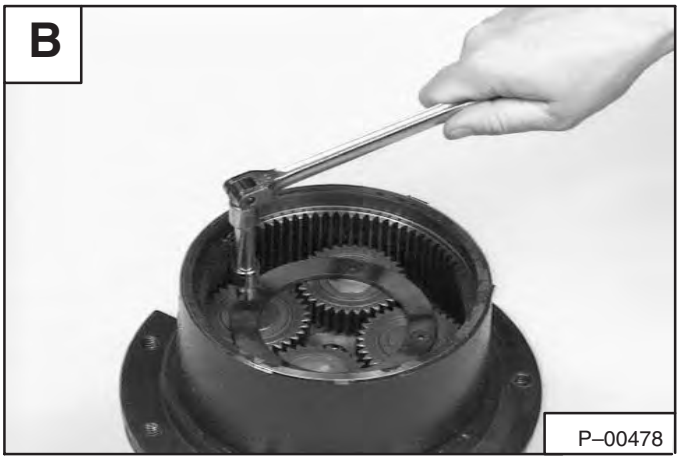
Remove the drive gear from the center of the planetary gears **[A]**.

NOTE: The snap ring (Item 1) [A] does not need to be removed from the gear unless it is damaged.

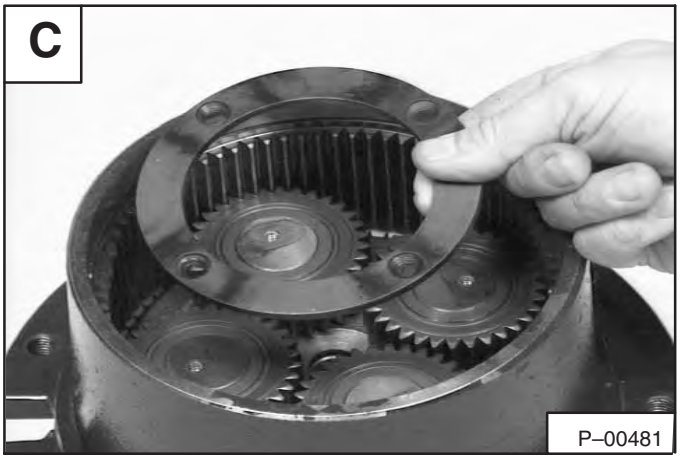


Remove the four screws holding the retaining ring to the inner planetary **[B]**.

NOTE: These screws have thread lock applied and are difficult to remove. Apply heat to the heads of the screws to soften the adhesive.



Remove the retaining ring **[C]**.



Remove the four gears, needle bearings, bearing races and the thrust washers **[D]**.



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DRIVE MOTOR (Cont'd)

Disassembly (Cont'd)

Remove the plug from the notched area in the travel motor flange **[A]**.



Remove the 131 or 132 steel balls that retain the drive motor housing to the drive motor hub **[B]** & **[C]**.

The balls must be removed thru the plug hole. Use solvent and flush oil off of the steel balls and the mating surfaces of the bearing and housing.

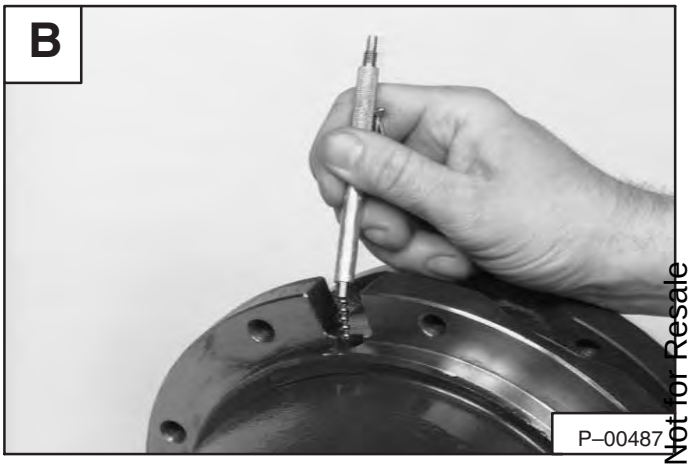
Use a magnet and remove the exposed steel balls from the plug hole. Use short burst of compressed air to force the first few steel balls to the plug hole and remove these with the magnet. Continue this process until no more balls will appear at the plug hole.

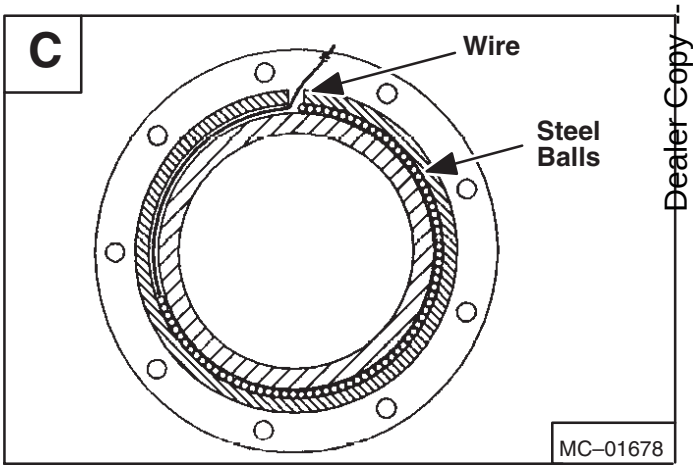
NOTE: Use care with the following process not to allow the wire to become lodged or to break off inside the motor.

Use a length of 16 gauge mechanics wire and bend a tight, close loop at one end of the wire. Insert the wire into the plug hole and carefully feed the wire around the diameter of the bearing and force the steel balls to the hole.

Remove the exposed balls with a magnet and continue this process until all 132 balls are removed and the end of the wire is visible thru the hole. Carefully remove the wire, DO NOT break the wire of inside the housing when removing the wire **[C]**.

NOTE: If balls seem to be lodged in the housing, it may be necessary to use a press or a three jaw puller to center the ball bearing groove into the center of the plug hole.





Use a three jaw puller and remove the travel motor housing **[D]**.

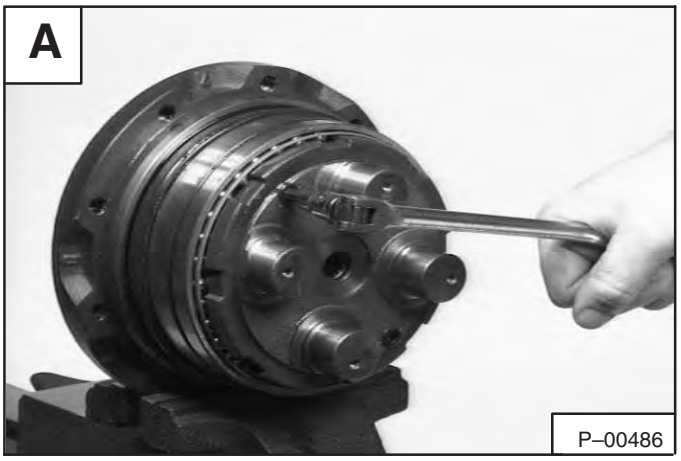


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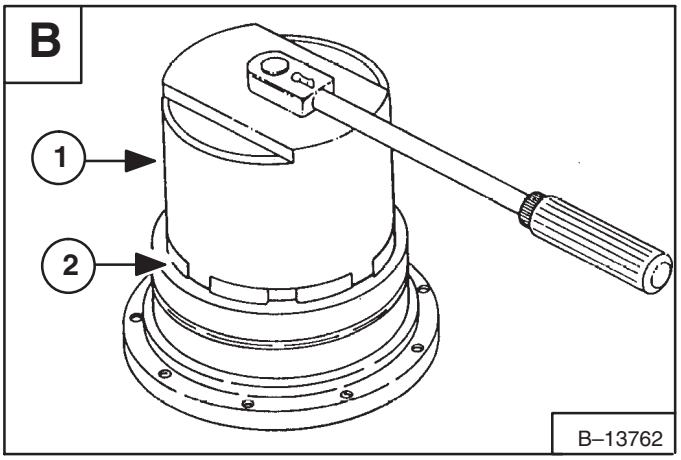
DRIVE MOTOR (Cont'd)

Disassembly (Cont'd)

Remove the two setscrews that retain the bearing nut from turning **[A]**.

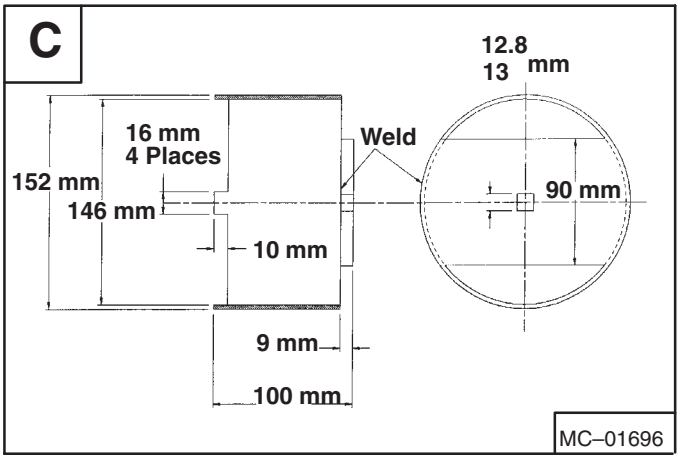


Use the bearing nut socket (Item 1) **[B]**, and remove the bearing nut (Item 2) **[B]** from the drive motor hub.



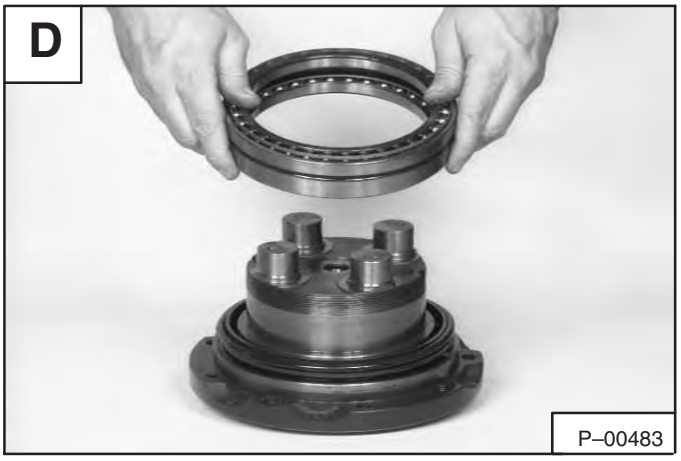
Bearing nut socket dimensions **[C]**.

This tool can be made at a local machine shop.



Carefully remove the double race bearing from the hub **[D]**.

NOTE: The inner and outer races of this bearing are not permanently retained to each other. If not lifted off as an assembly , the races will separate and the steel balls will come loose.

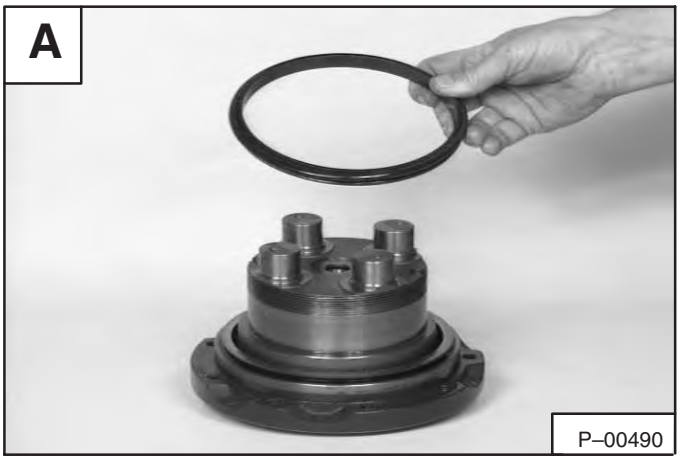


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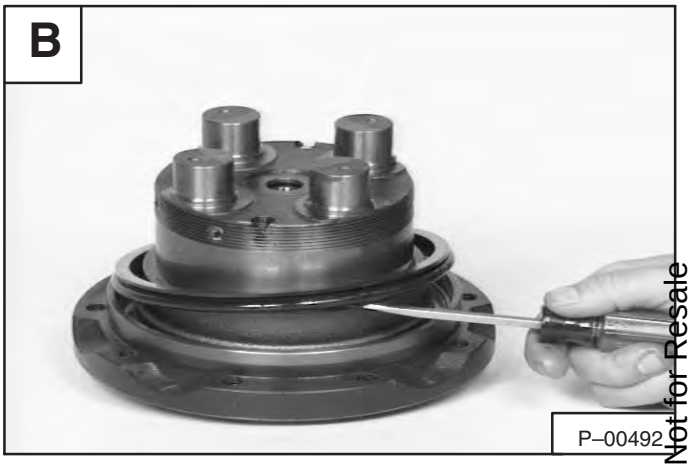
DRIVE MOTOR (Cont'd)

Disassembly (Cont'd)

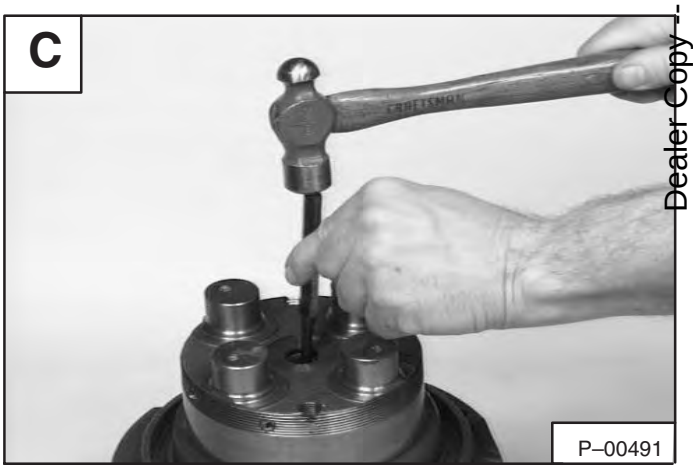
Remove the top half of the floating seal from the hub**[A]**.



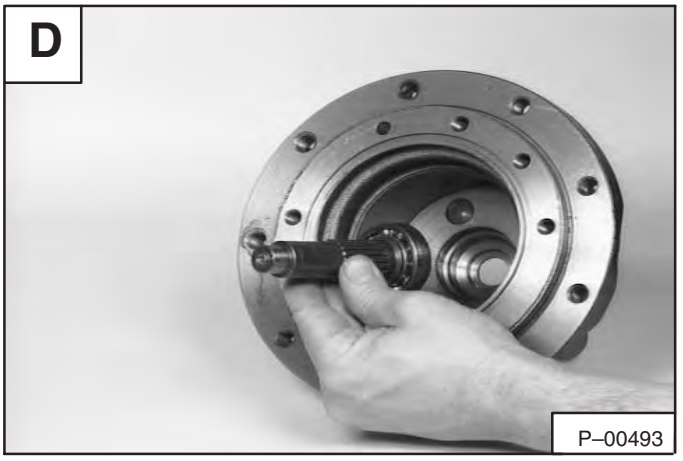
Pry the lower half of the floating seal from the hub **[B]**.



Use a punch and tap the rotating group drive shaft and bearing out of the hub **[C]**.



Remove the drive shaft and bearing from the hub **[D]**.



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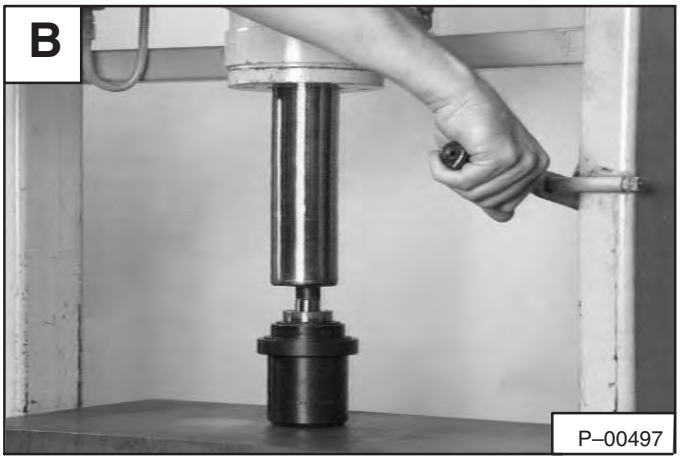
DRIVE MOTOR (Cont'd)

Disassembly (Cont'd)

Remove the seal from the hub **[A]**.



Use a press and press the drive shaft out of the bearing **[B]**.



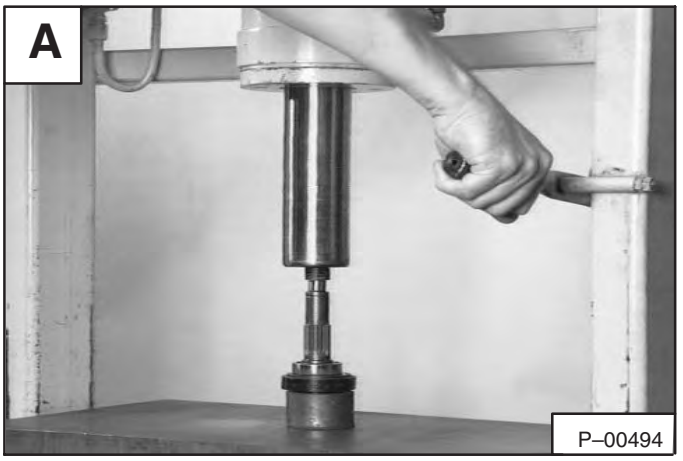
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DRIVE MOTOR (Cont'd)

Assembly

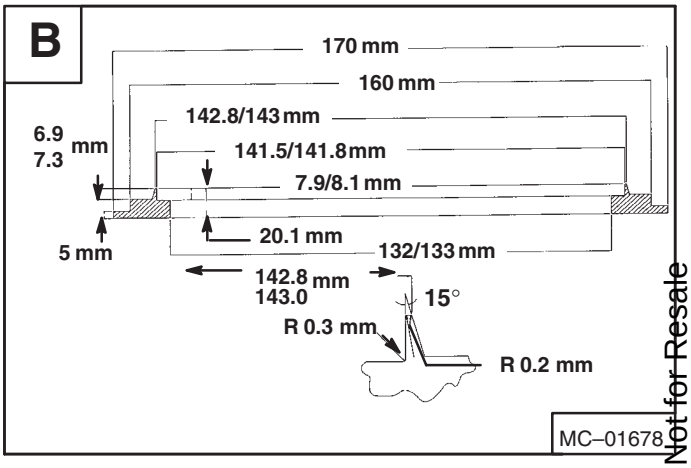
Install a new bearing onto the rotating group drive shaft **[A]**.

NOTE: Use a press tube that contacts the inner bearing race.



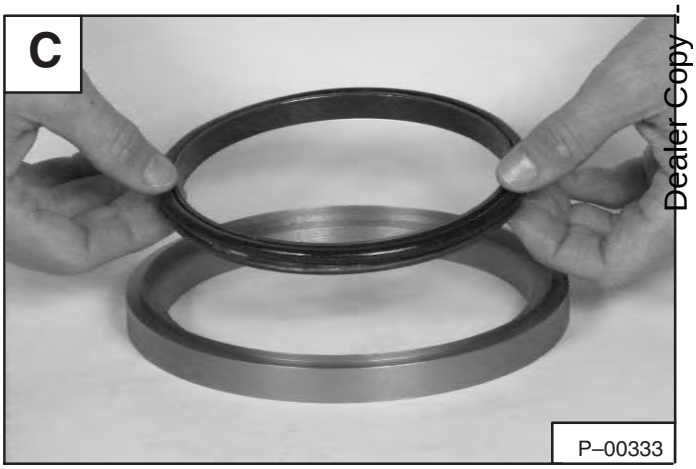
Floating seal installation tool **[B]**.

This tool (MEL1412) is available through OTC Service Tools.



Apply grease to the floating seal O–ring and to the floating seal surface of the drive motor hub.

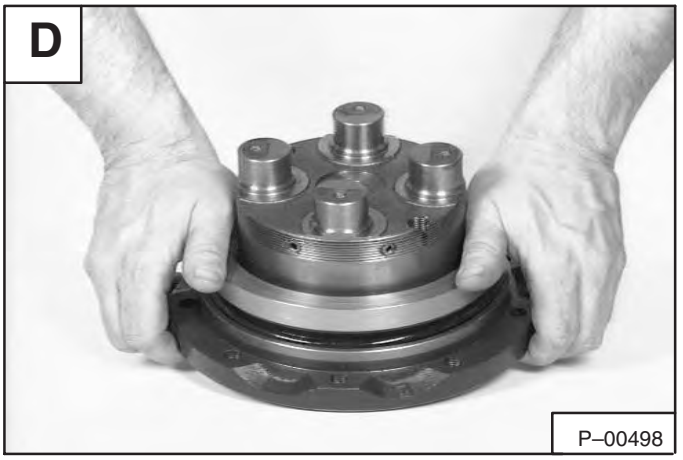
Install the floating seal into the installation tool **[C]**.



Turn the seal and installation tool over and set it inplace in the hub **[D]**.

Using both hands, evenly press down on the installation tool to insert the floating seal into the hub **[D]**.

The tool presses against the O–ring and the floatingseal housing and guides it into the hub.



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DRIVE MOTOR (Cont'd)

Assembly (Cont'd)

Apply grease to the O–ring of the other halfbf the floating seal.

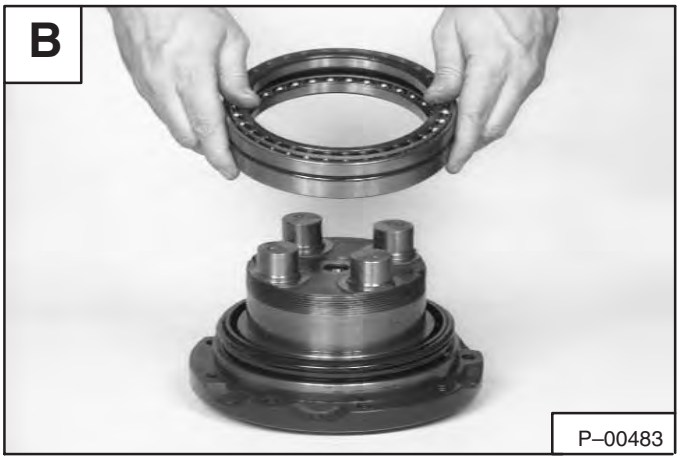
Install the top half of the floating seal onto the previously installed floating seal half **[A]**.

NOTE: The O–ring of this half of the floating seal faces upwards.



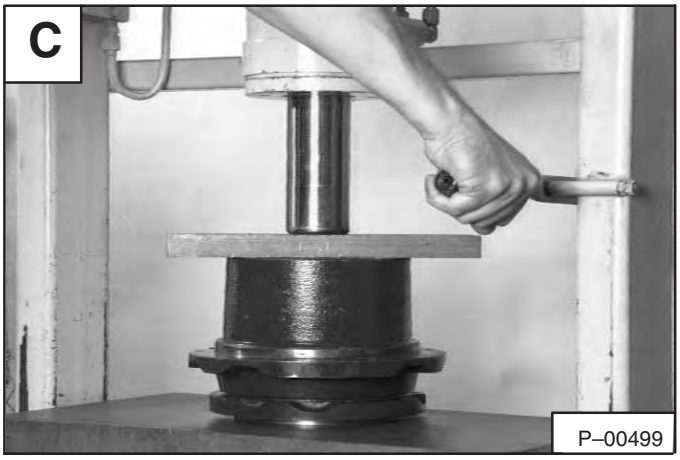
Carefully install a new double roller bearing onto the hub **[B]**.

Install the bearing nut onto the bearing, tighten the nut so that the bearing is seated against the hub but not tight. The bearing nut will be tighten more in a later step.



Press the drive motor housing onto the hub **[C]**.

NOTE: Be sure the housing is positioned over the bearing and the top half floating seal.



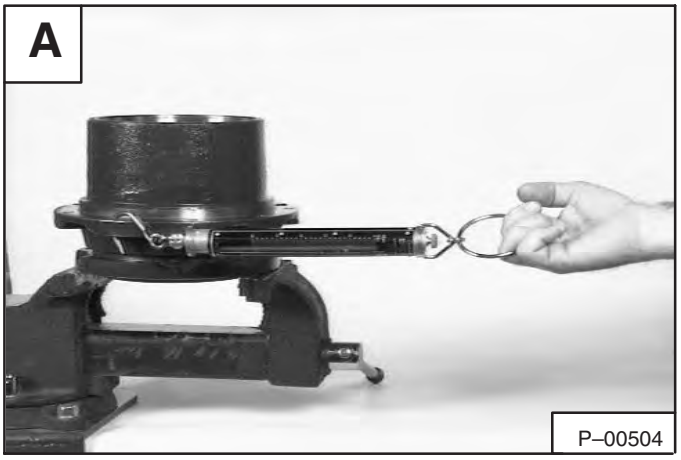
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DRIVE MOTOR (Cont'd)

Assembly (Cont'd)

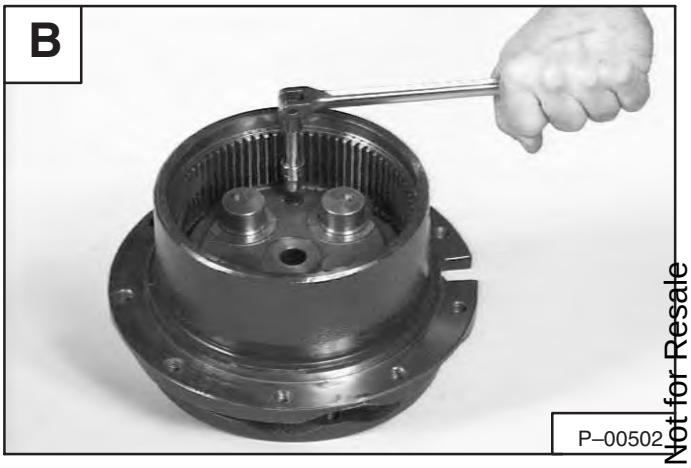
Use a spring scale to check the housing start up load **[A]**.

Use the bearing nut socket to tighten the bearing nut until there is 13–18 ft.–lbs. (1.7–2.5 kgf) force need for housing start up load.

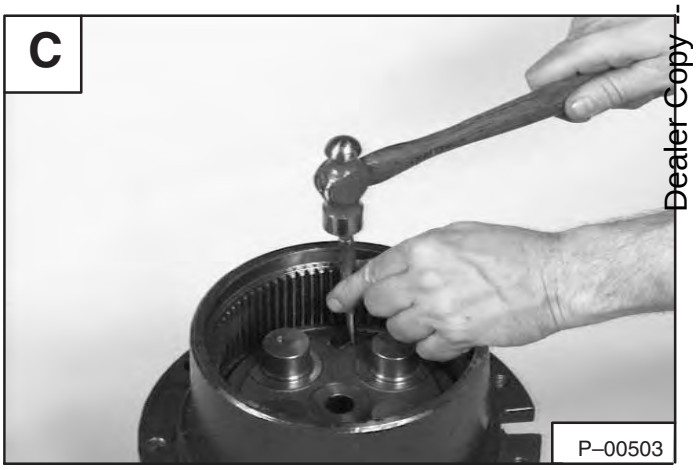


After the correct start up load has been established, install the two set screws to retain the bearing nut **[B]**.

Tighten the set screws to 21–29 ft.–lbs. (29–39 Nm) torque.

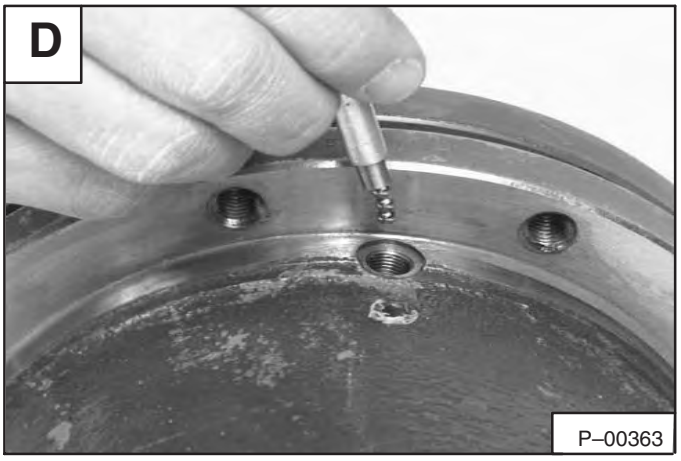


Use a center punch and stake the hub to the set screw so that the set screws will not work loose **[C]**.



Turn the motor on its side and install the 132 steel balls into the housing hole **[D]**.

NOTE: If the steel balls will not easily flow into the bearing groove, it may be necessary to usea press or a three jaw puller to center the ball bearing groove into the center of the plug hole.



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DRIVE MOTOR (Cont'd)

Assembly (Cont'd)

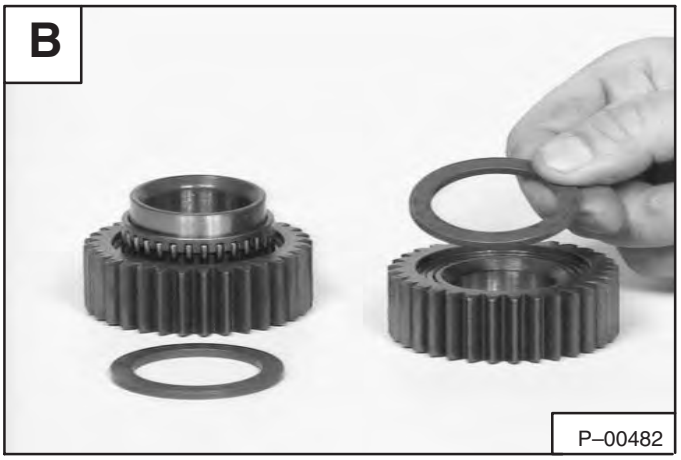
Install the plug into the housing **[A]**.

Tighten the plug to 5–6 ft.–lbs. (6–8 Nm) torque.



Apply a light coating of petroleum jelly to the needle bearing and install the bearings into the gears **[B]**.

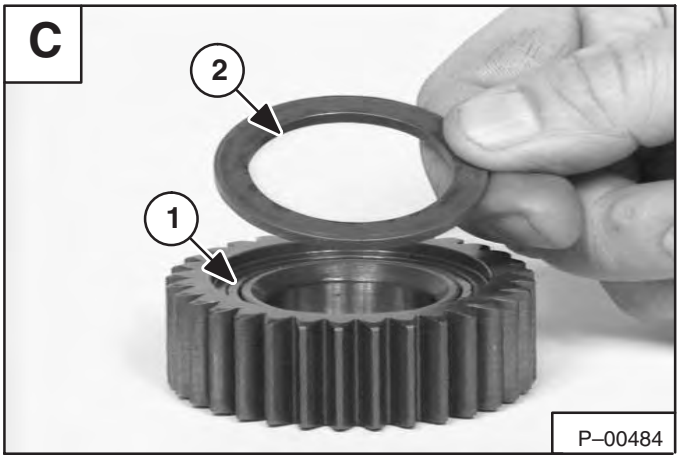
Install the bearing race into the needle bearings **[B]**.



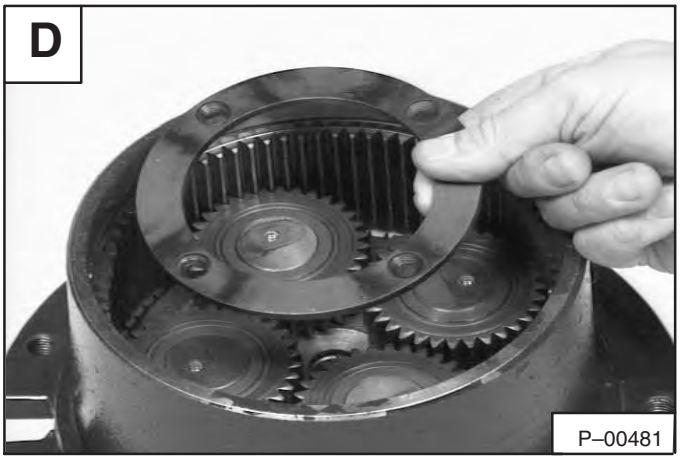
Apply a light coating of petroleum jelly to the thrust washer and install the thrust washer into the notched groove (Item 1) **[C]** in the side of the gear and the beveled edge (Item 2) **[C]** of the thrust washer will face upwards as viewed in **[C]**.

Turn the gear assemblies over and install them onto the pinion stub shafts on the hub. The beveled edge of the thrust washer must match up to the beveled edge of the stub shaft at the hub face and the thrust washers must remain seated in the notched groove of the gear.

If installed properly, the top face of the gear will be slightly lower than the top face of the stub shaft.



Install retaining ring onto the top of the stub shafts **[D]**.



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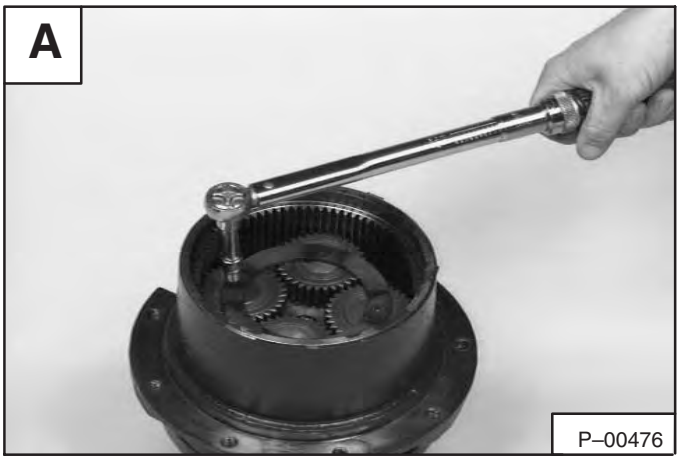
DRIVE MOTOR (Cont'd)

Assembly (Cont'd)

Clean the screw threads of any dried on thread locking compound and inspect the screws. Replace screws if any damage is found.

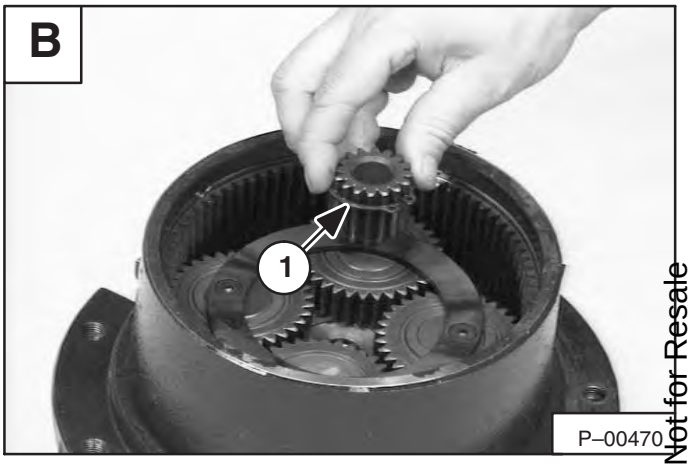
Apply LOCTITE 262 to the threads of the screws. Install the four screws thru the retainer ring **[A]**.

Tighten the screws to 3–6 ft.–lbs. (4–8 Nm) torque.

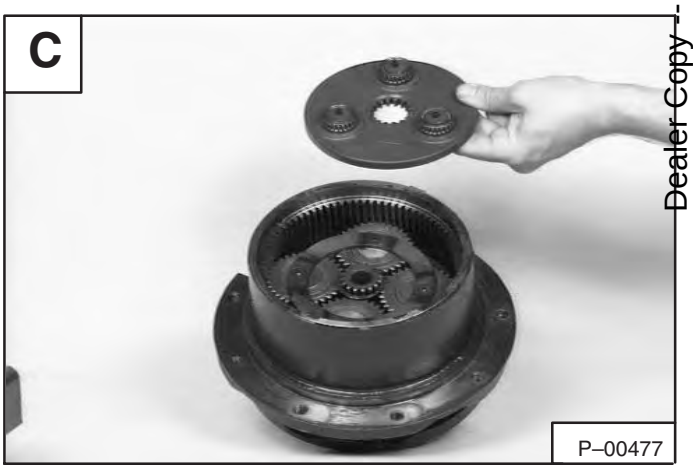


Install the snap ring (Item 1) **[B]** onto the drive gear (if previously removed) and install the drive gear into the center of the planetary gears.

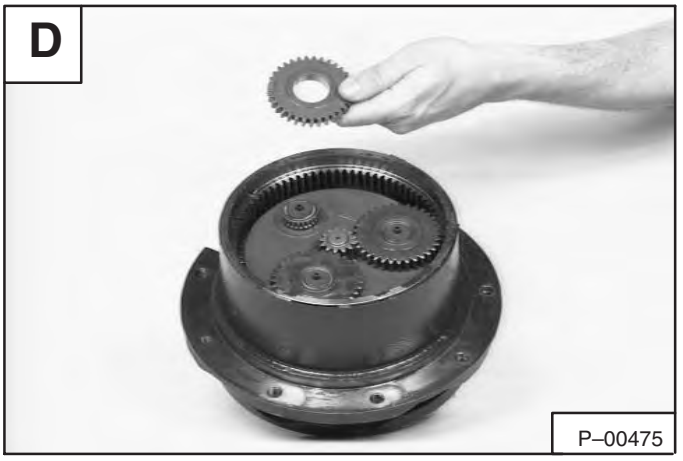
NOTE: The gear must be installed with the narrow section of the gear upwards (when viewed using the snap ring as the dividing line).



Install new spring pins into the stub shafts (if the spring pins were removed) and install the planetary holder onto the drive gear **[C]**.



Install the bearing race onto the stub shafts. Apply a light coating of petroleum jelly to the needle bearings and install over the bearing races. Install the planetary gears over needle bearings **[D]**.



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DRIVE MOTOR (Cont'd)

Assembly (Cont'd)

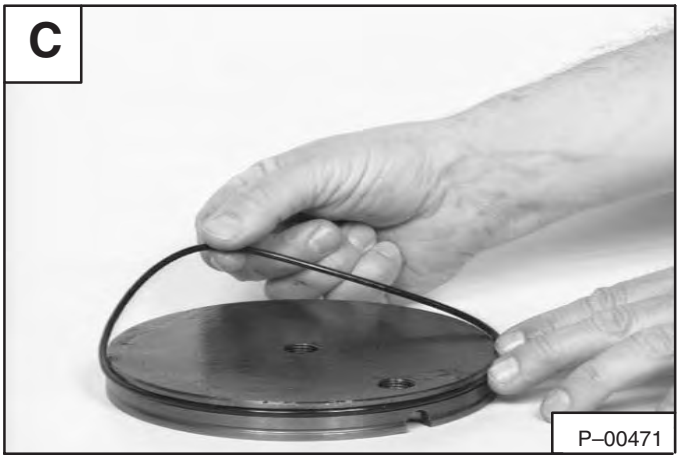
Install the drive shaft into the planetary gears **[A]**.



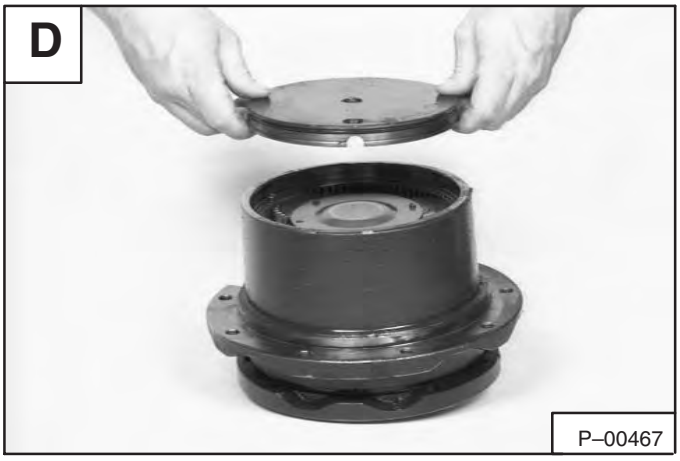
Position the four holes in the thrust plate over the spring pins in the stub shafts **[B]**.



Apply petroleum jelly and install a new O–ring onto the end cover **[C]**.



Install the end cover onto the housing **[D]**.



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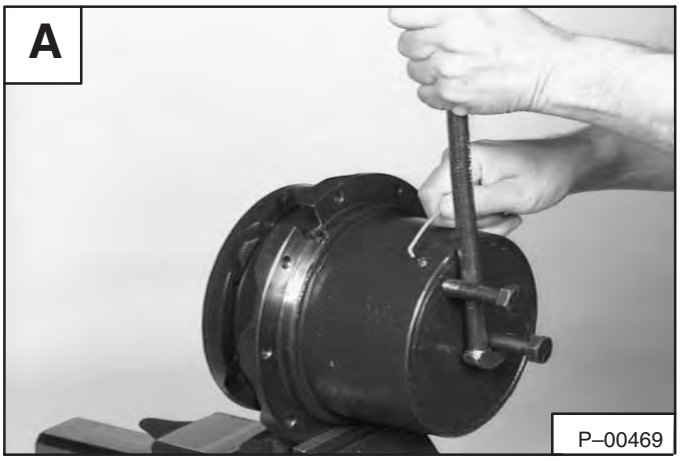
DRIVE MOTOR (Cont'd)

Assembly (Cont'd)

Clamp the drive motor in a vise and install two bolts (3/8 PT mm thread) into the end cover **[A]**.

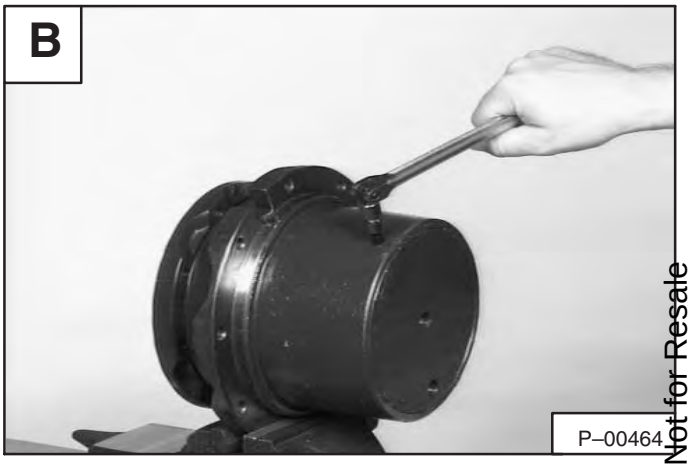
Bend a 1/4 inch hook in the end of the lock wire. Insert the hook end of the lock wire into the hole in the side of the motor and into the slot on the edge of the end cover.

Turn the end cover with a bar and insert the lock wire into the hole as it wraps around the end cover **[A]**.



Install the plug into the lock wire hole **[B]**.

Tighten the plug to 6–8 ft.–lbs. (8–10 Nm) torque.



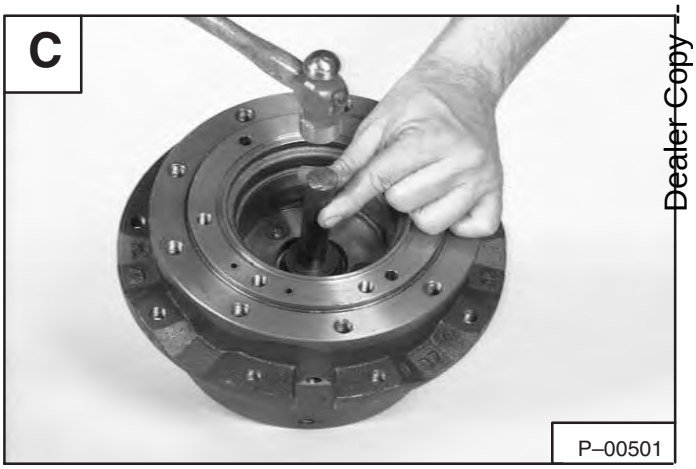
Remove the drive motor from the vise.

Set the motor on the end cover on a flat surface.

Apply a light coating of petroleum jelly to the outer diameter of the seal and install the seal into the drive motor **[C]**.

NOTE: The lip side of the seal faces upward as viewed [C].

Apply a light coating of petroleum jelly to the seal lips.



Apply a light coating of petroleum jelly to the end of the rotating group drive shaft and press the shaft and bearing into the hub **[D]**.

NOTE: Be sure the end of the shaft is positioned thru the center of the seal before pressing the shaft in place.



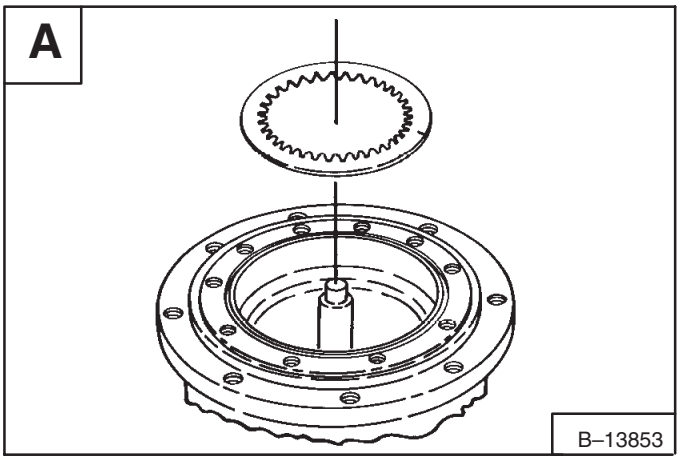
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DRIVE MOTOR (Cont'd)

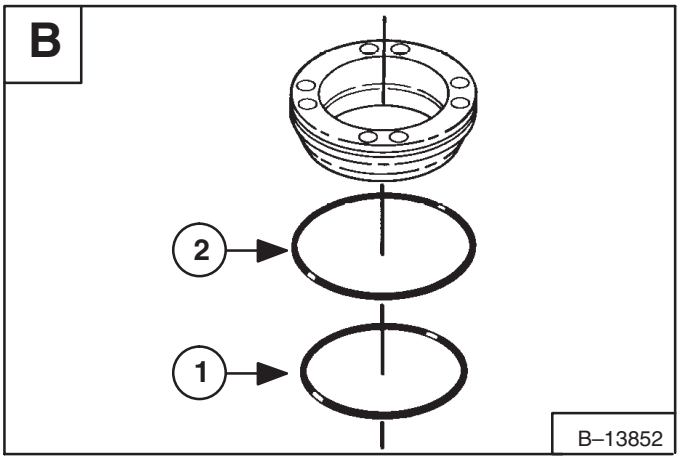
Assembly (Cont'd)

The following four steps are for drive motors with brakes (Page 3–38 **[A]** thru 3–38 **[D]**; for drive motors without brakes, skip to step **[A]** on Page 3–39.

Install the brake disc plate into the drive motor hub **[A]**.

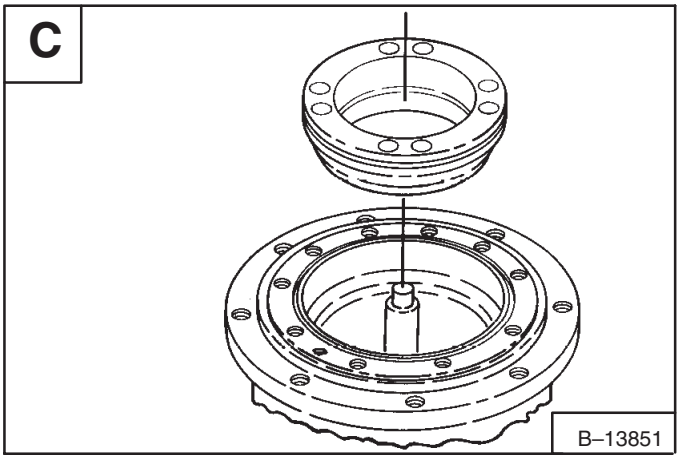


Install new O–rings (Item 1 & 2**[B]** onto the brake piston.



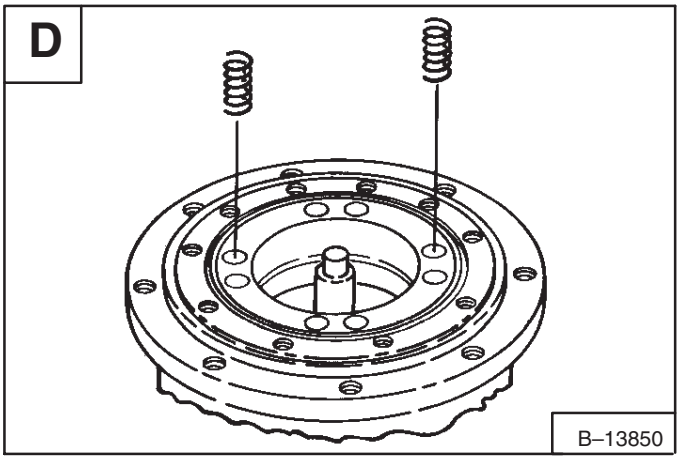
Apply oil to the inner and outer diameter of the brake piston and to the O–rings.

Install the brake piston into the drive motor hub **[C]**.



Install the eight springs into the brake piston **[D]**.

The following steps apply to travel motorswith or without brakes.



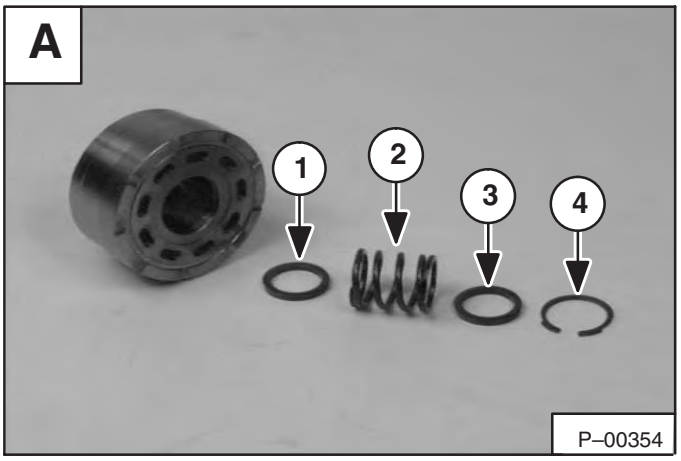
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DRIVE MOTOR (Cont'd)

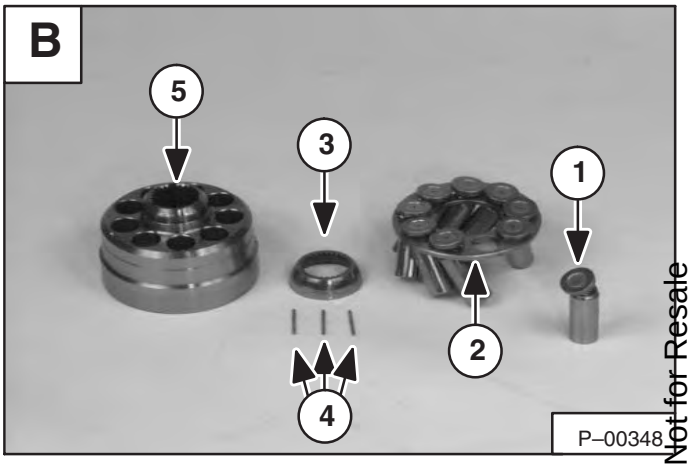
Assembly (Cont'd)

Install the collar (Item 1) **[A]**, spring (Item 2) **[A]**, collar (Item 3) **[A]** and snap ring (Item 4) **[A]** into the piston housing.

Install a bolt and flat washer thru the spacers and the spring. Insert these parts thru the piston housing and install a nut. The outer diameter of the washer should be smaller than the inner diameter of the snap ring but large enough to make good contact with the spring spacer top face. Tighten the nut to compress the spring and install the snap ring. Loosen the nut and remove the bolt and washer.



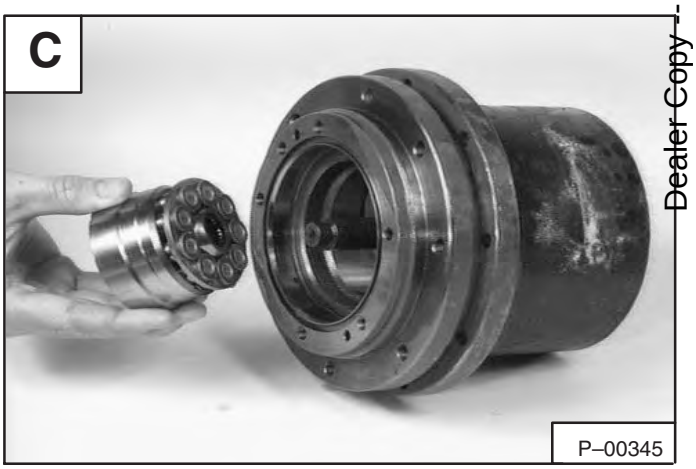
Assembly the rotating group by applying petroleum jelly to the three (3) pins (Item 4) **[B]**. Insert the pins (Item 4) **[B]** into the notches in the splined inner diameter of the piston housing (Item 5) **[B]**. Set the conical spacer (Item 3) **[B]** over the pins (Item 4) **[B]** and on top of the piston housing (Item 5) **[B]**. Insert the pistons (Item 1) **[B]** into the retainer plate (Item 2) **[B]**. Apply clean hydraulic fluid to the outer diameter of the piston (Item 1) **[B]** and insert the pistons into the piston housing (Item 5) **[B]**.



Turn the drive motor on its side and apply oil to the face of the swash plate. Install the rotating group into the drive motor hub and onto the piston driveshaft **[C]**.

On drive motors with brakes:

Make sure that the splined diameter of the piston housing meshes with the splined inner diameter of the brake disc.



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DRIVE MOTOR (Cont'd)

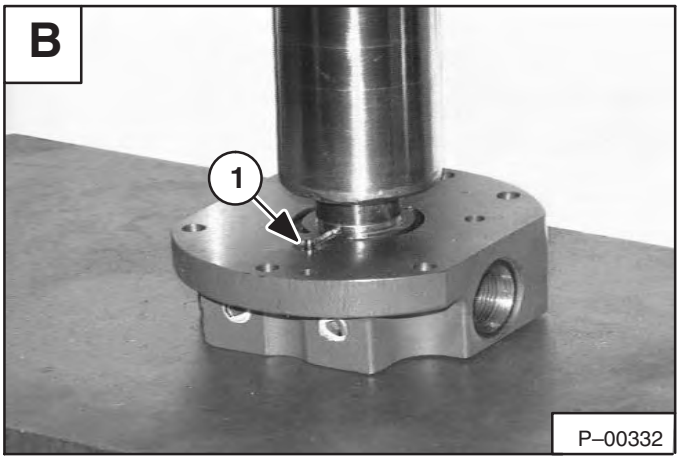
Assembly (Cont'd)

Install a new O–ring into the groove in the motor face **[A]**.



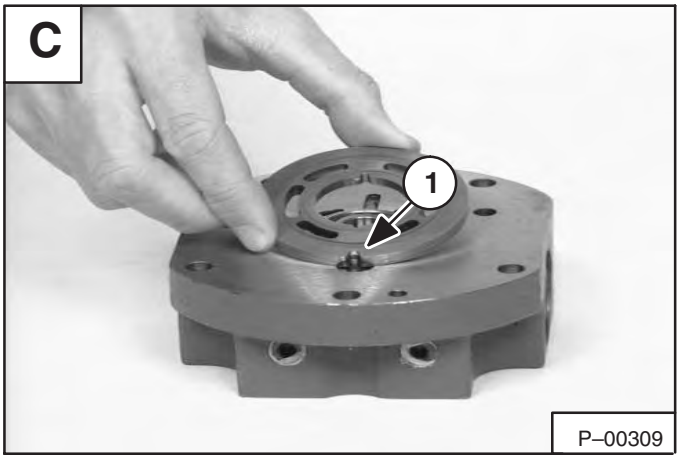
Press the bearing into the valve end plate **[B]**.

If a new valve end plate is being used, or if the locating dowel pin was removed from the valve end plate, press the dowel pin (Item 1) **[B]** into the valve end plate.



Apply a film of petroleum jelly to the steel face of the valve plate. Install the valve plate (bronze side faces upwards) onto valve end plate.

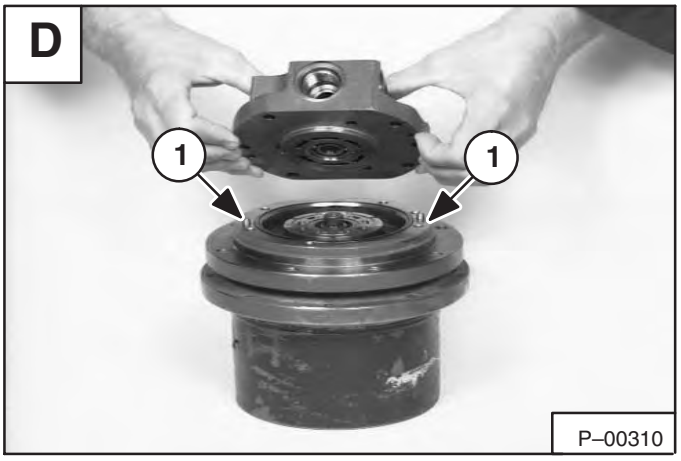
The notch in the valve plate must align with the dowel pin (Item 1) **[C]** in the valve end plate.



On drive motors with brakes:

Install the small O–ring onto the brake actuating port gland.

Insert the two dowel pins (Item 1) **[D]** into the drive motor hub and install the valve end plate onto the drive motor.



On drive motors with brakes:

Make sure that the eight brake piston springs are inserted into the holes in the valve end plate and the brake piston.

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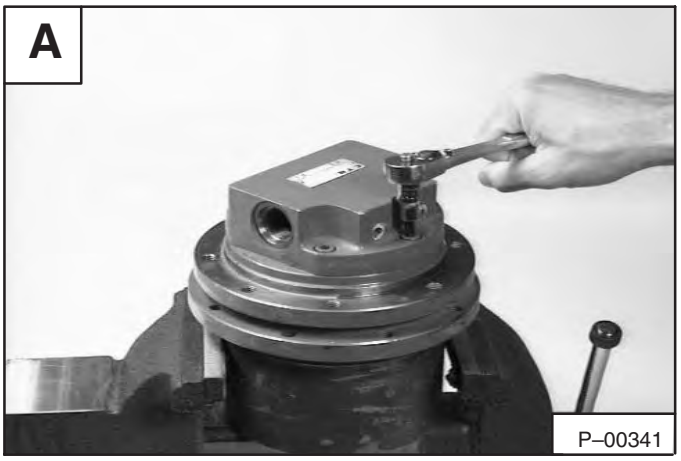
DRIVE MOTOR (Cont'd)

Assembly (Cont'd)

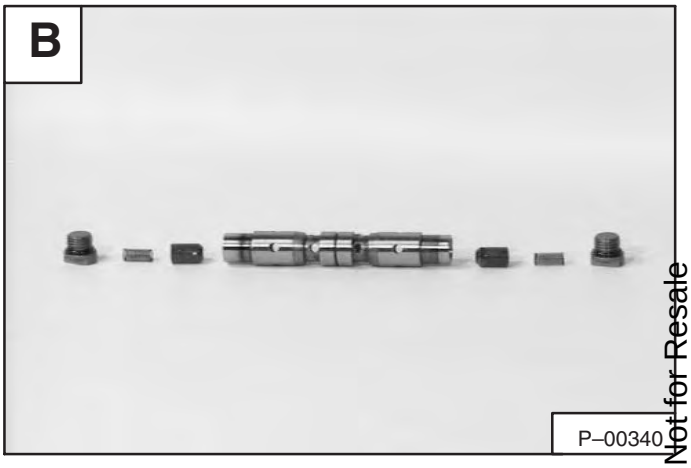
Install the six bolts into the valve end plate **[A]**. Insert a pin thru the holes in the hub and the housing to keep the hub from rotating and tighten the six bolts.

Tighten the bolts to 21–26 ft.–lbs. (29–35 Nm) torque.

Remove the pin that was installed to keep the hub and housing from rotating.



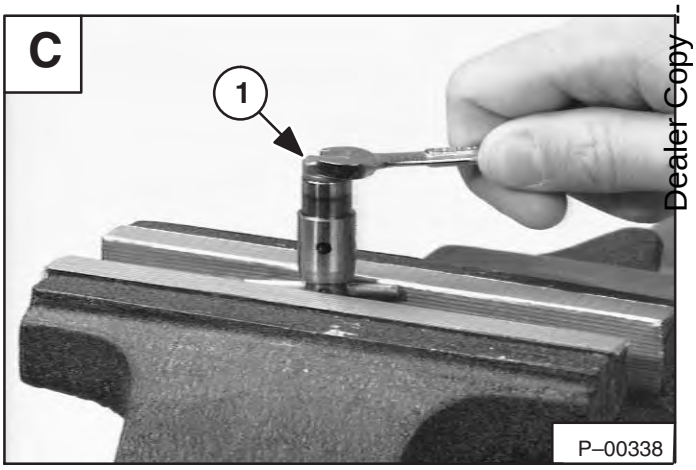
Apply oil to the outer diameter of the poppets and install the poppets (tapered end in first) into the spool **[B]**. Insert the spring into the cavity of the poppets. Install a new O–ring onto the end plugs and install the plugs **[B]**.



Insert a hardened dowel pin (Item 1) **[C]** thru the hole in the spool gland and use a vise with protective jaws to hold the spool from turning. tighten the end plugs.

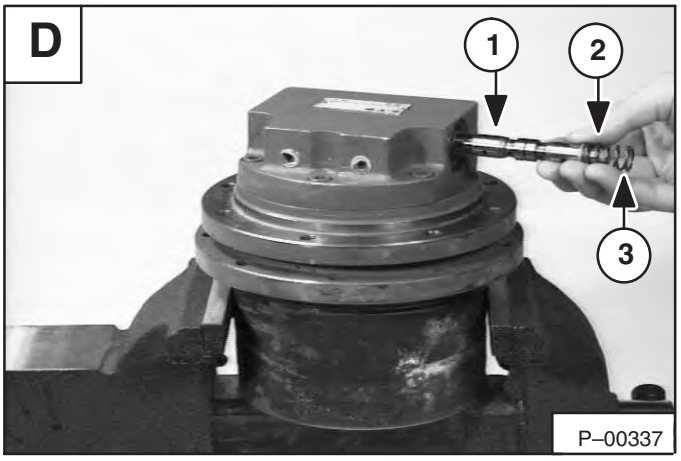
Tighten the plugs to 18–21 ft.–lbs. (24–29 Nm) torque.

NOTE: DO NOT use any type of clamp tool on the spool. The spool must be replaced if it has scratches or any other damage to the machined surface.



Apply oil to the spool (Item 1) **[D]** and install the spool into the valve end plate.

Install the washer (Item 2) **[D]** over the end of the spool and the spring (Item 3) **[D]**.



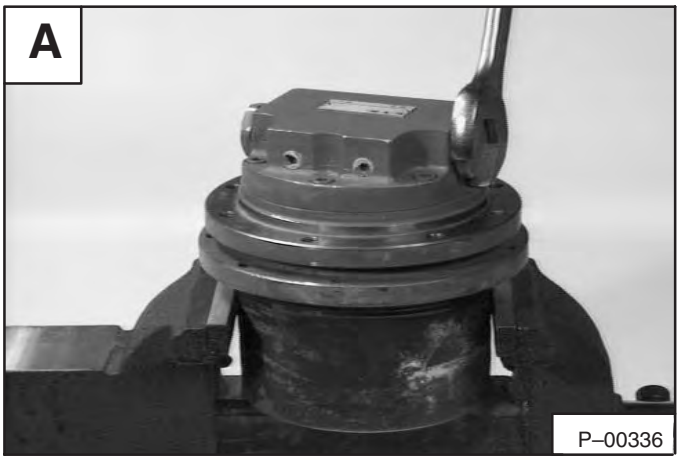
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DRIVE MOTOR (Cont'd)

Assembly (Cont'd)

Install a new O–ring onto the end plugs. Apply oil to the O–rings and install the plugs.

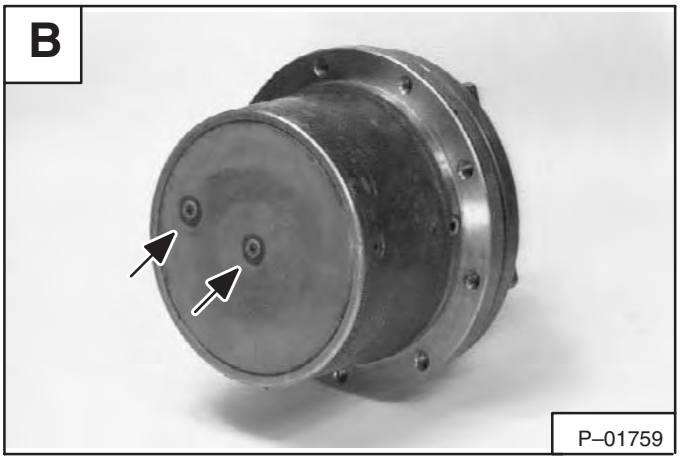
Tighten the plugs to 86–101 ft.–lbs. (117–137 Nm) torque **[A]**.



NOTE: Before the drive motor can be put into service, SAE 90W gear lubricant will need to be added to the drive motor. See information below for oil installation and checking procedure.

Install the two end plugs into the end cover **[B]**.

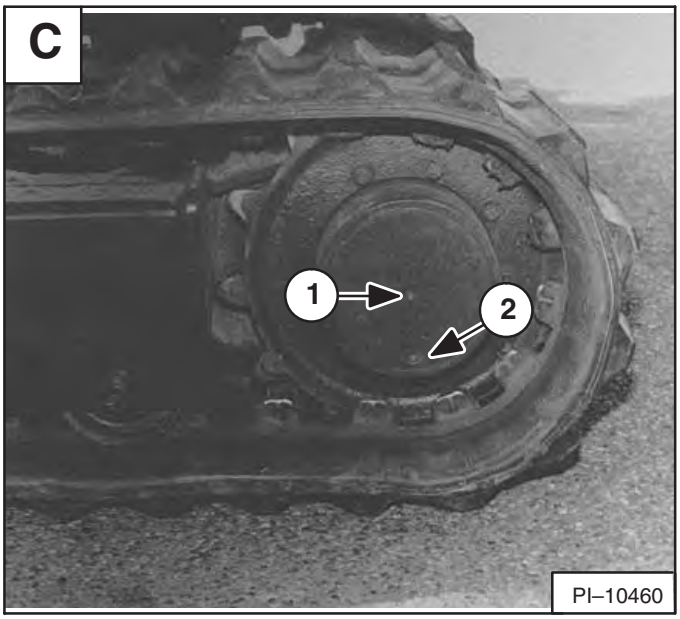
Tighten the two outer plugs (M8) to 21–29 ft.–lbs. (29–39 Nm) torque.



FINAL DRIVE CASE

Check Oil Level

1. Put the machine on a flat level surface with the plugs positioned as shown in figure **[C]**.
2. Remove the top plug (Item 1) **[C]**.
3. Add oil through the hole if the oil level is below the hole. (See *FUEL, COOLANT AND LUBRICANTS Chart*, Page 8–8.)
4. Install and tighten the plug.
5. Repeat the procedure for the other side.



Draining Final Drive Case

See the *SERVICE SCHEDULE* Page 1–1 for correct service interval.

1. Put the machine on a flat level surface with the plugs position as shown in figure **[C]**.
2. Remove the bottom plug (Item 2) **[C]** and the top plug (Item 1) **[C]**.
3. After all the oil is removed, install and tighten the bottom plug.
4. Add 0.550 quarts (0,5 L) of oil to the top plug hole. Install the plug.
5. Repeat the procedure for other side.

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Page Number

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Removal And Installation 4–34

SWING CIRCLE GEAR
Removal And Installation 4–33

SWING MOTOR
Removal And Installation 4–1

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Disassembly 4–3
Parts Identification 4–2
Piston Housing
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UPPER WORKS
Removal And Installation 4–32

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SWING MOTOR

Removal And Installation

Remove the seat and swing motor cover (See Page 5–1.)

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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Mark the hoses for correct installation.

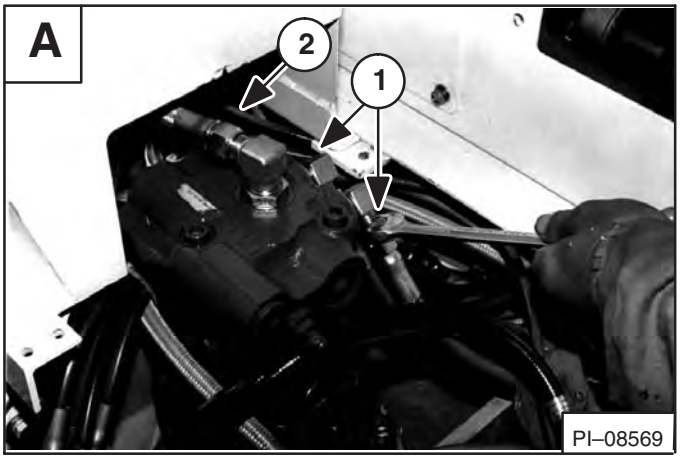
NOTE: Use caps and plugs on all hydraulic hoses and fittings.

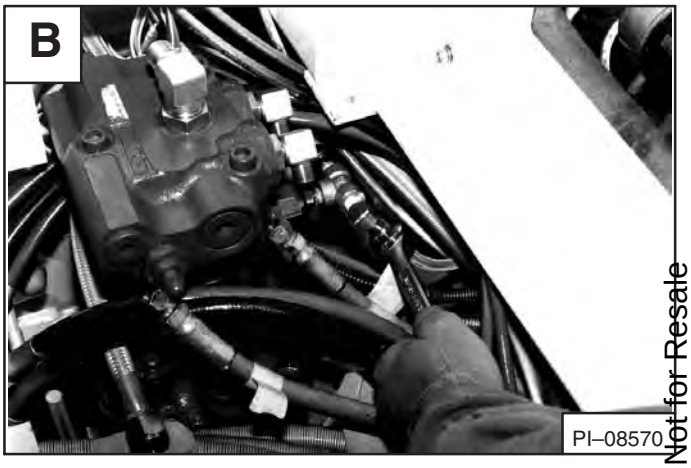
Remove the pressure hoses (Item 1) **[A]** and the drain hose (Item 2) **[A]** from the swing motor.

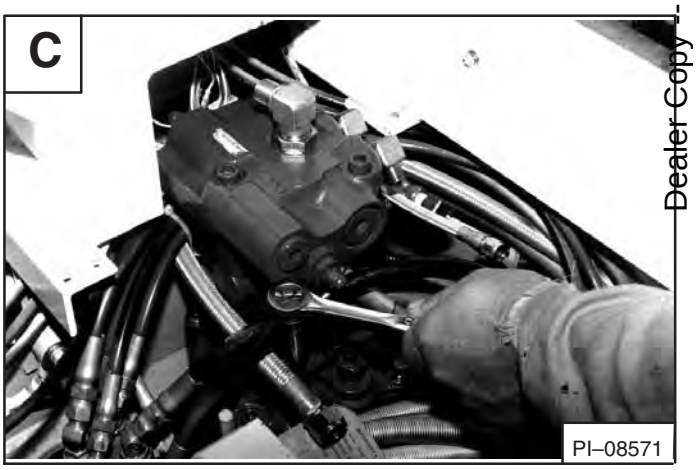
Remove the center swivel joint drain hose **[B]**.

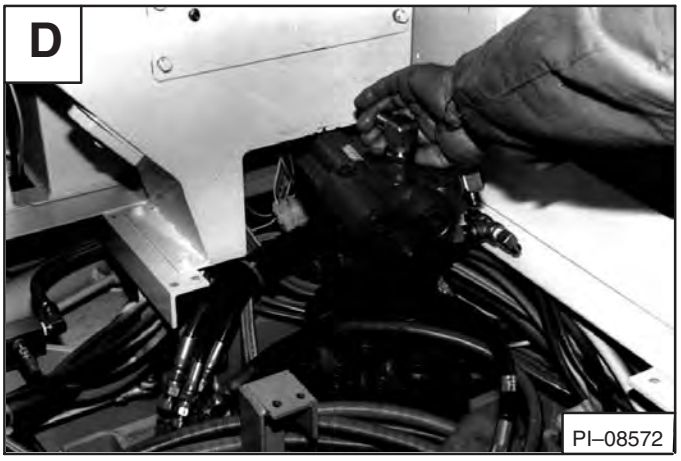
Remove the mounting bolts from the swing motor **[C]**.

Remove the swing motor **[D]**.









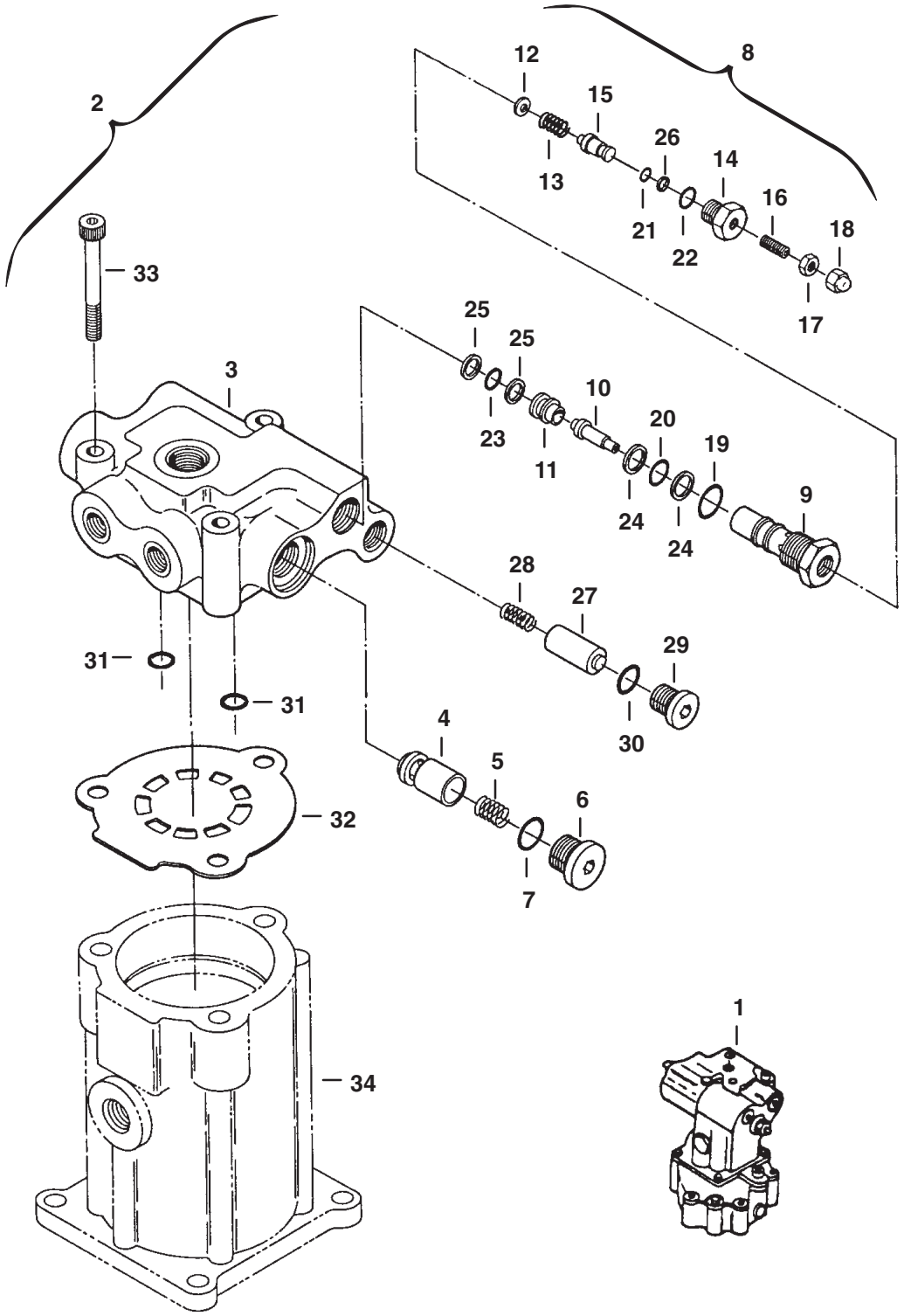
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SWING MOTOR ASSEMBLY

Brake Valve

Parts Identification

1. Swing Motor
2. Valve
3. Housing
4. Check Valve
5. Spring
6. Plug
7. O–ring
8. Relief Valve
9. Housing
10. Poppet
11. Poppet Seat
12. Spring Seat
13. Spring
14. Plug
15. Guide
16. Set Screw
17. Nut
18. Cap
19. O–ring
20. O–ring
21. O–ring
22. O–ring
23. O–ring
24. Back–up Ring
25. Back–up Ring
26. Back–up Ring
27. Piston
28. Spring
29. Plug
30. O–ring
31. O–ring
32. Gasket
33. Bolt
34. Housing
35. Seal Kit
36. Seal Kit



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SWING MOTOR ASSEMBLY (Cont'd)

Brake Valve (Cont'd)

Disassembly

Prior to disassembly:

Clean the outside of the unit.

Drain oil from unit.

Select a clean environment.

Handle with care.

Remove the fitting (Item 1) **[A]** from the brake valve assembly.

Remove the brake valve assembly (Item 2) **[A]** from the swing motor by removing the three bolts (Item 3) **[A]**.

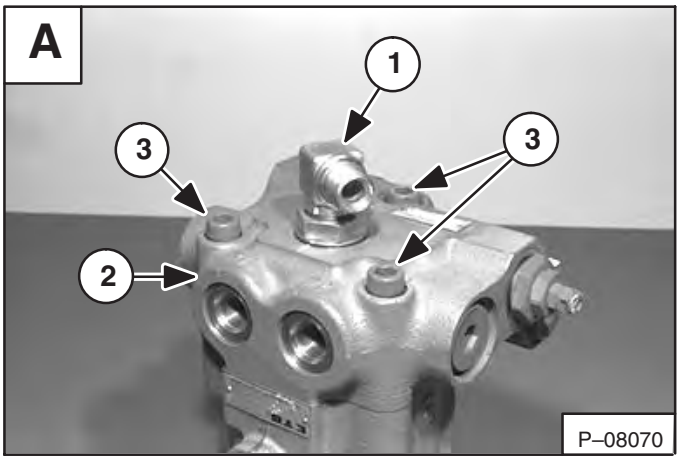
Remove the O–rings (Item 1) **[B]** from the valve assembly.

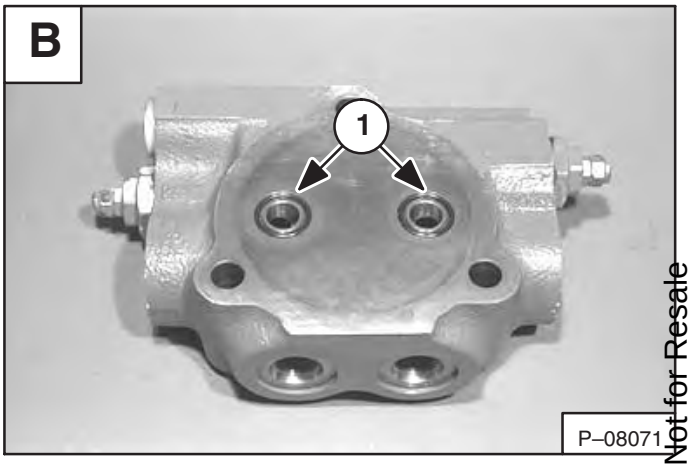
Clamp the valve assembly in a vise with padded jaws and remove the plug (Item 1)**[C]** from both sides of the valve.

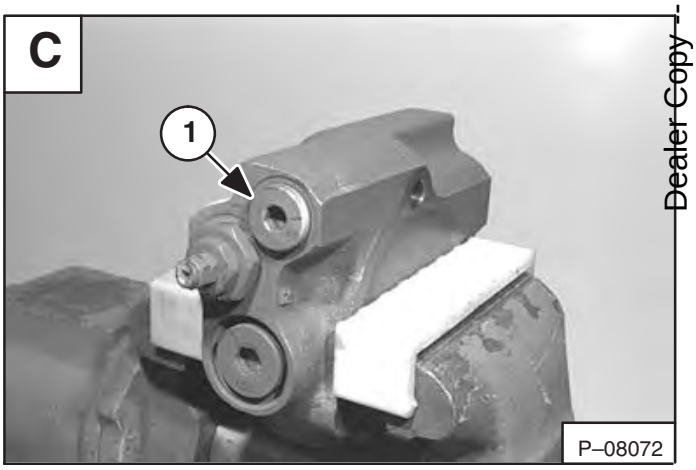
Do not use any type of tool to grip the finished surface of the piston or the piston will be damaged.

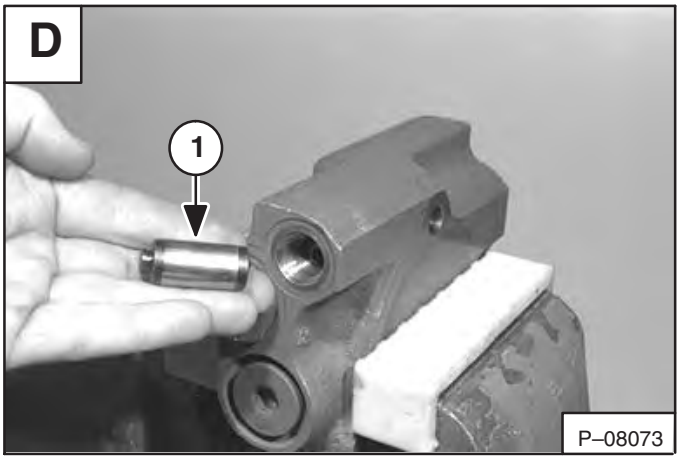
Remove the piston (Item 1) **[D]** from both sides of the valve.

NOTE: Do not mix up the parts that are removed from the valve.









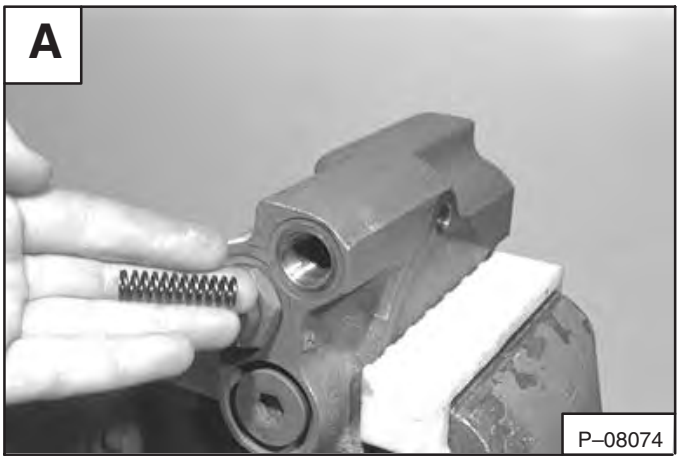
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SWING MOTOR ASSEMBLY (Cont'd)

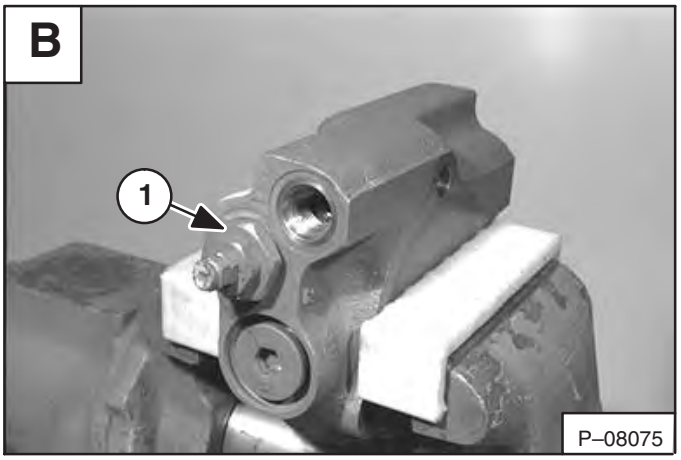
Brake Valve (Cont'd)

Disassembly (Cont'd)

Remove the spring from both sides of the valve **[A]**.

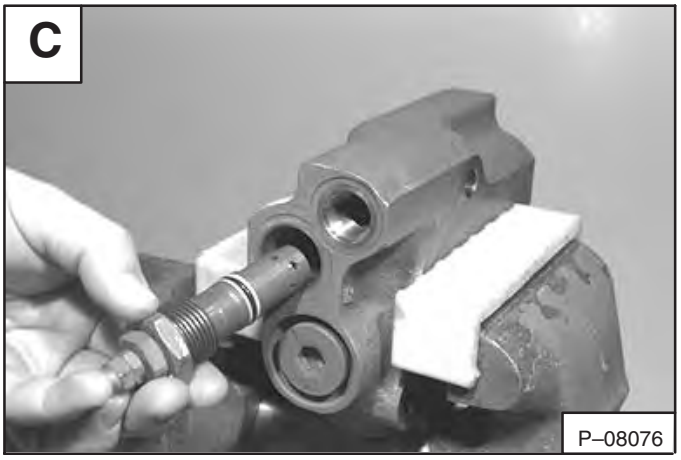


Loosen the relief valve cartridge (Item 1) **[B]** from both sides of the valve.

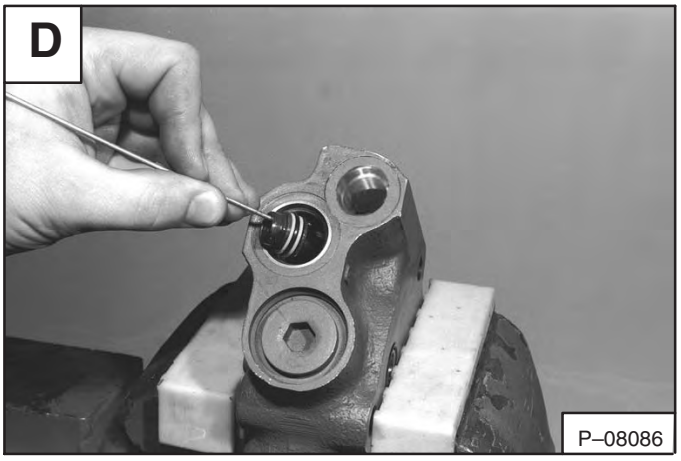


Remove the relief valve cartridge **[C]**.

NOTE: If the relief valve is disassembled, the relief pressure setting must be reset. See Page 4–12 for the valve repair.



Remove the poppet seat from the valve unit using a piece of the wire **[D]**.



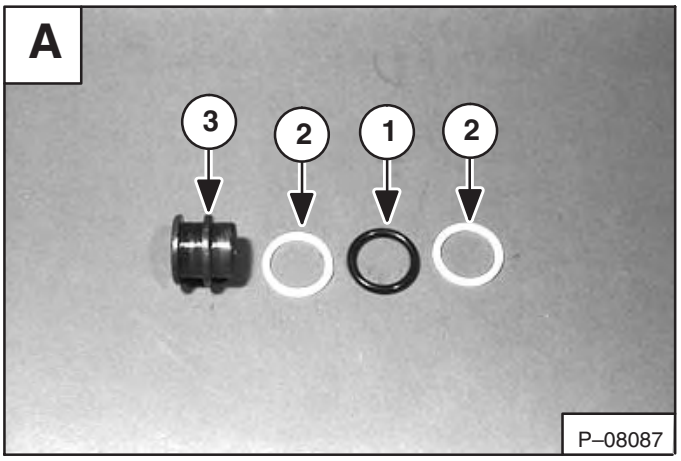
Dealer Copy -- Not for Resale

SWING MOTOR ASSEMBLY (Cont'd)

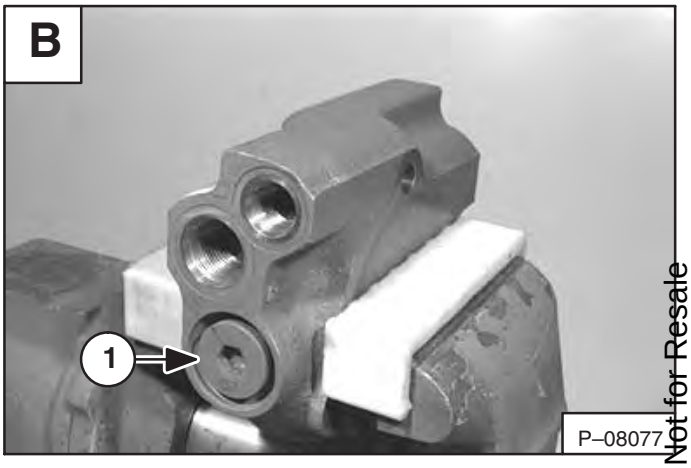
Brake Valve (Cont'd)

Disassembly (Cont'd)

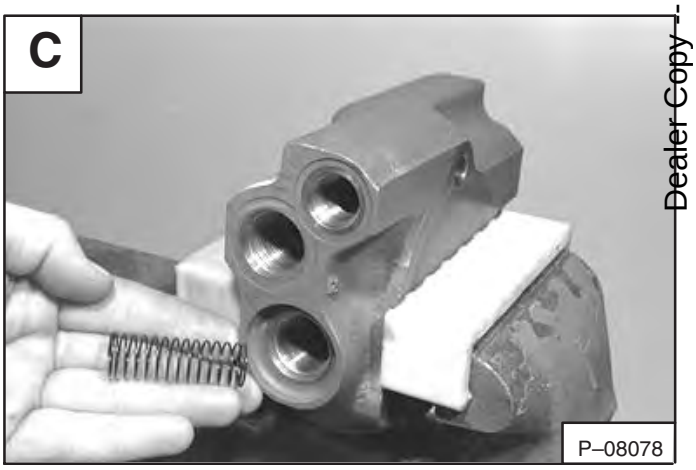
Remove the O–ring (Item 1) **[A]** and the back–up washers (Item 2) **[A]** from the poppet seat (Item 3) **[C]**.



Remove the plug (Item 1) **[B]** from both sides of the valve.

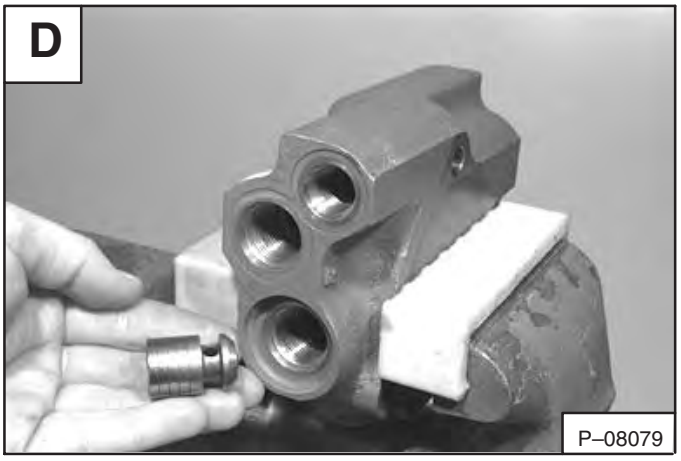


Remove the spring from both sides of the valve **[C]**.



Do not use any type of tool to grip the finished surface of the piston or the piston will be damaged.

Remove the check valve piston from both sides of the valve body **[D]**.



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SWING MOTOR ASSEMBLY (Cont'd)

Brake Valve (Cont'd)

Assembly

Prior to assembly:

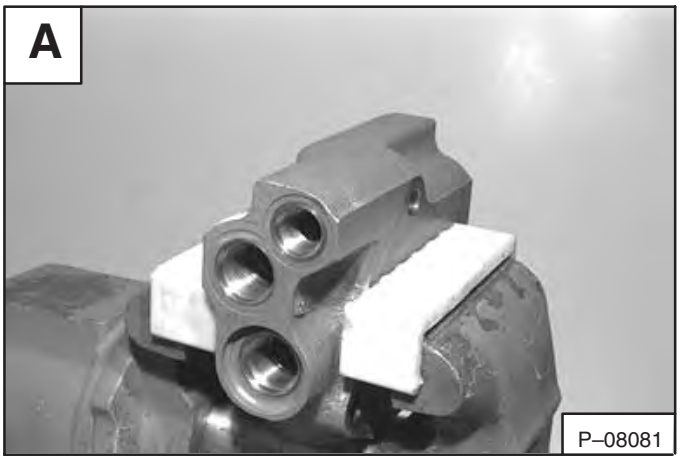
Clean all the parts with solvent and dry with compressed air.

Handle all parts with care.

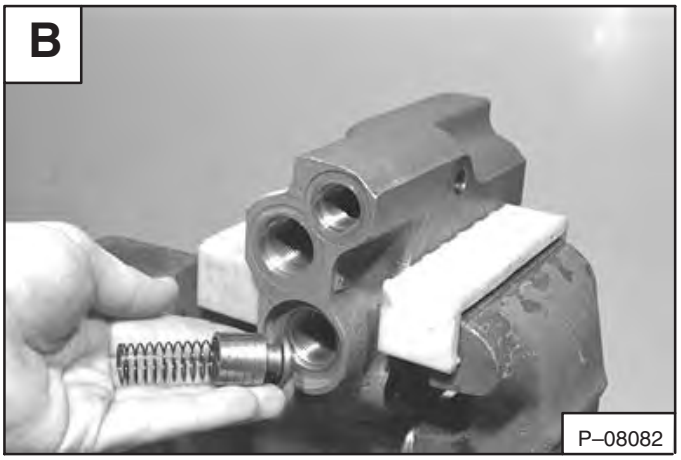
Replace all the O–rings.

Put oil on the O–rings.

Clamp the valve assembly into a vise with padded jaws **[A]**.

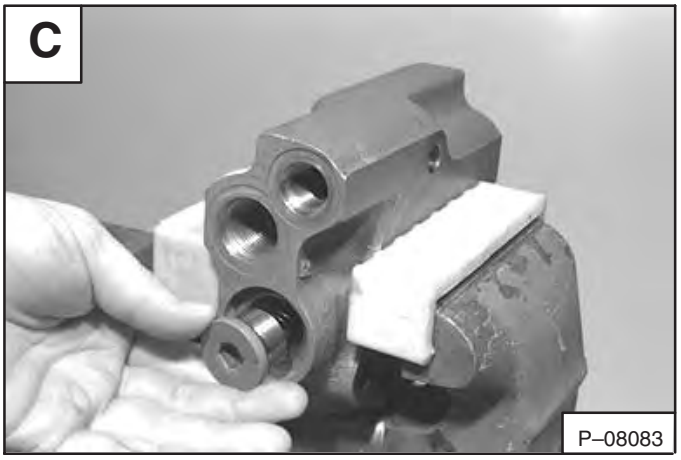


Install a check valve piston and spring in both sides of the valve **[B]**.

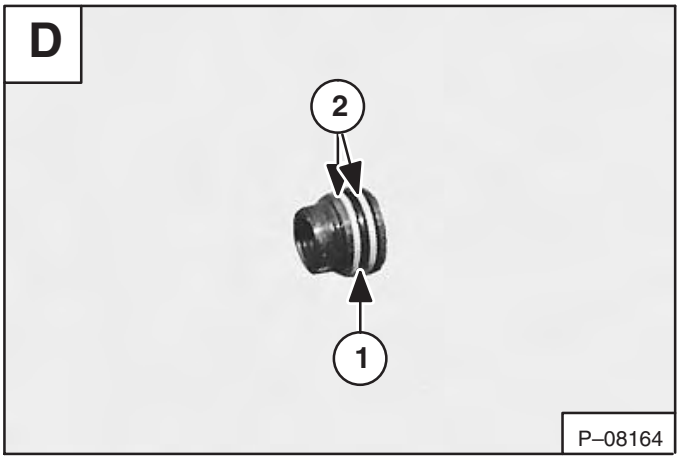


Install the O–ring on the plug and install the plug in both sides of the valve **[C]**.

Tighten the plug to 109–123 ft.–lbs. (147–167 Nm) torque.



Install the new O–ring (Item 1) **[D]** and back–up washers (Item 2) **[D]** on the poppet seat **[D]**.



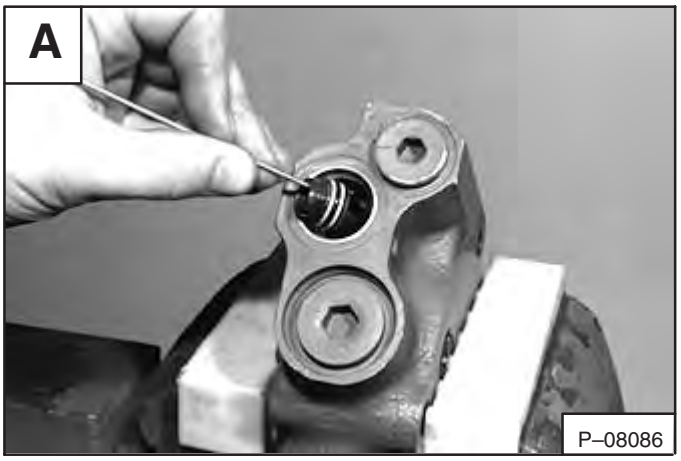
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SWING MOTOR ASSEMBLY (Cont'd)

Brake Valve (Cont'd)

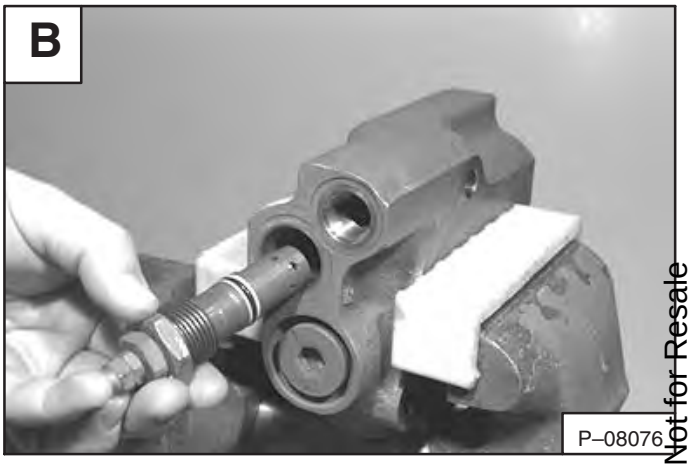
Assembly (Cont'd)

Install the poppet seat assembly into the valve using a piece of wire **[A]**.



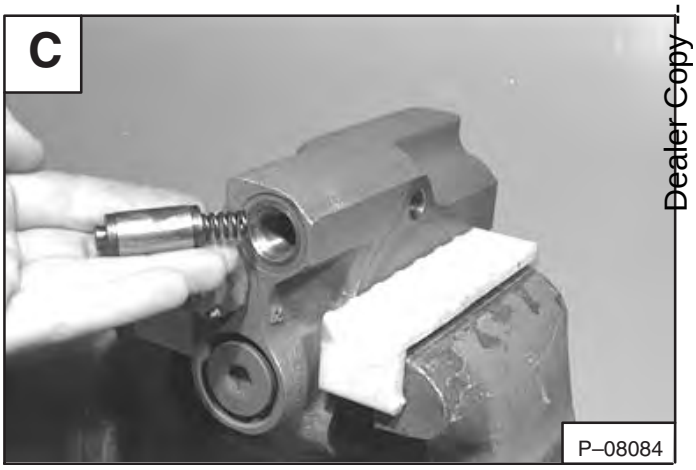
Install the relief valve assembly in both sidesof the valve **[B]**.

Tighten the relief valves to 58–65 ft. lbs. (78–88 Nm) torque.



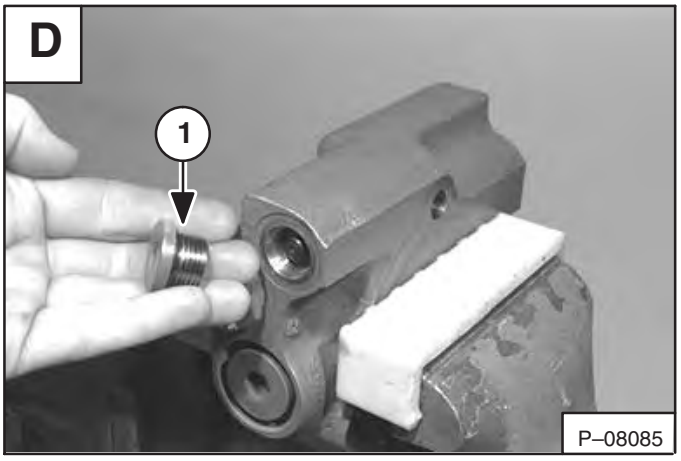
Install the spring into the piston. Apply oil to the piston and install in both sides of the valve **[C]**.

NOTE: Do not use force when installing the piston in to the valve. Check for smooth movement of the piston.



Install the O–ring (Item 1) **[D]** on the plug and install in both sides of the valve **[D]**.

Tighten the plugs to 58–65 ft. lbs. (78–88 Nm) torque.



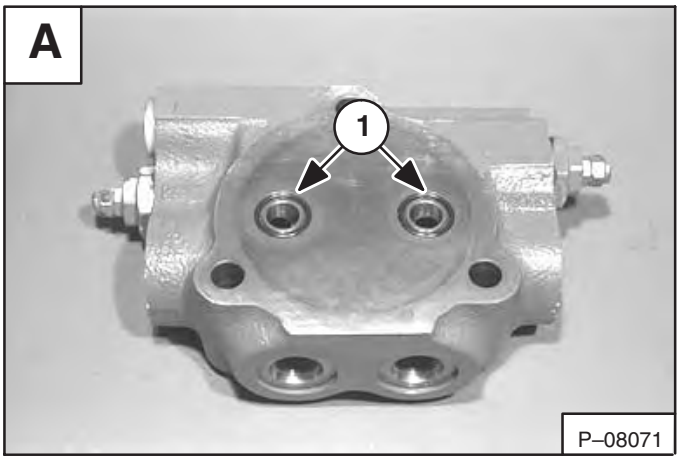
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SWING MOTOR ASSEMBLY (Cont'd)

Brake Valve (Cont'd)

Assembly (Cont'd)

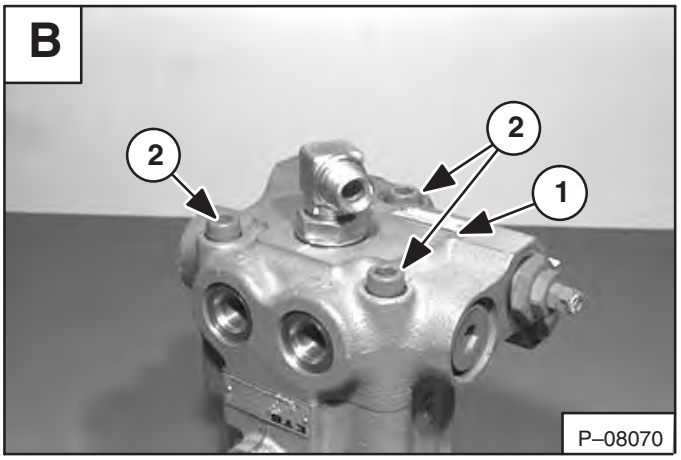
Install the two O–rings (Item 1) **[A]**.



Install the brake valve assembly (Item 1) **[B]** on the swing motor.

Install the three bolts (Item 2) **[B]**.

Tighten the bolts to 42 ft.–lbs. (57 Nm) torque.



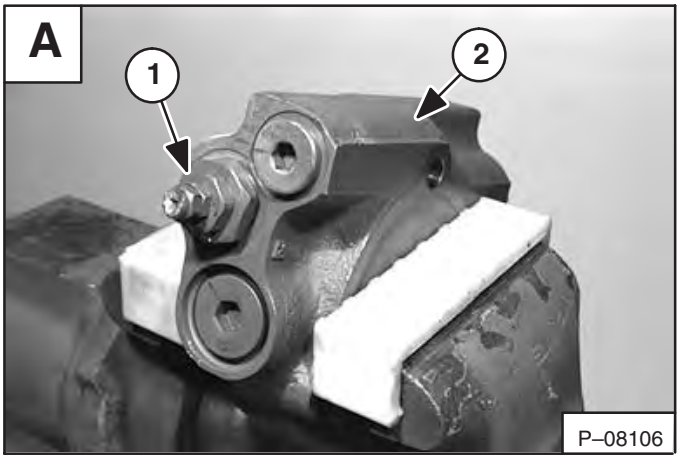
Dealer Copy -- Not for Resale

SWING MOTOR ASSEMBLY (Cont'd)

Relief Valve

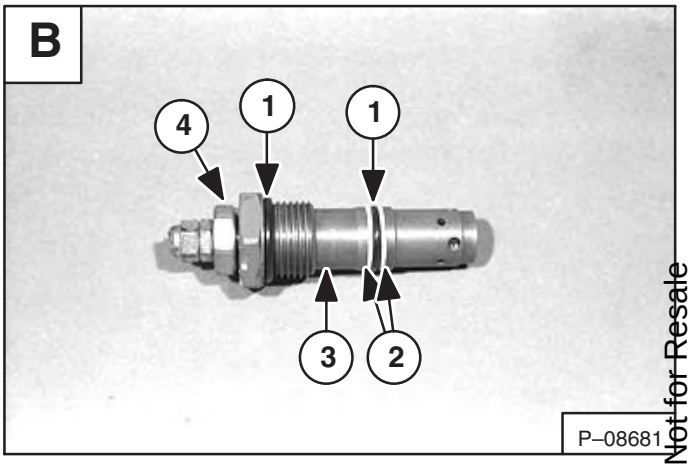
Disassembly

Remove the relief valve cartridge (Item 1) **[A]** from the valve assembly (Item 2) **[A]**.

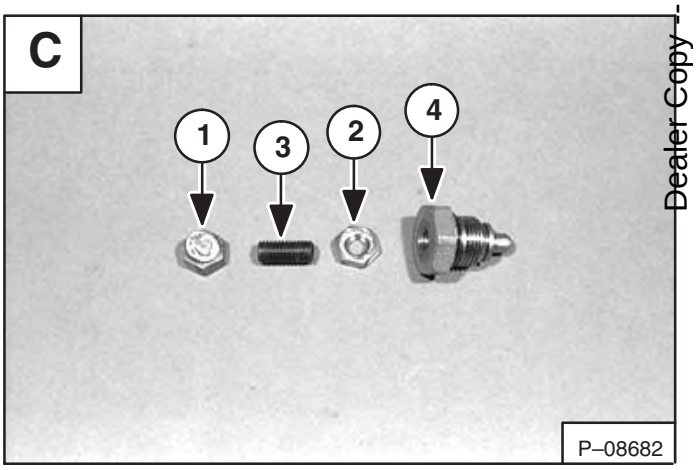


Remove the O–rings (Item 1) **[B]** and the two back–up washers (Item 2) **[B]** from the housing (Item 3) **[B]**.

Remove the adjusting bolt assembly (Item 4**[B]** from the housing (Item 3) **[B]**.

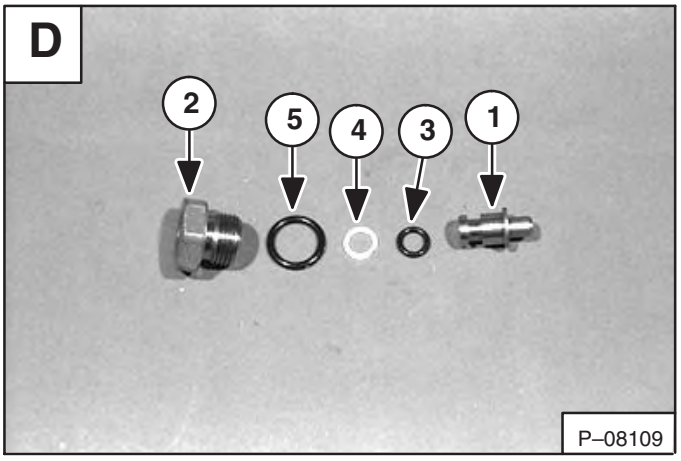


Remove the cap (Item 1)**[C]**, the jam nut (Item 2)**[C]** and the set screw (Item 3) **[C]** from the plug (Item 4) **[C]**.



Remove the guide assembly (Item 1) **[D]** from the plug (Item 2) **[D]**.

Remove the O–ring (Item 3) **[D]**, the back–up washer (Item 4) **[D]** and the O–ring (Item 5) **[D]** from plug (Item 2) **[D]**.



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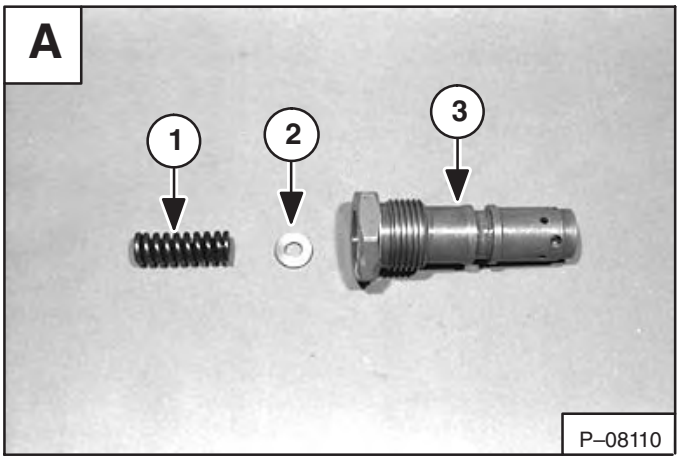
SWING MOTOR ASSEMBLY (Cont'd)

Relief Valve (Cont'd)

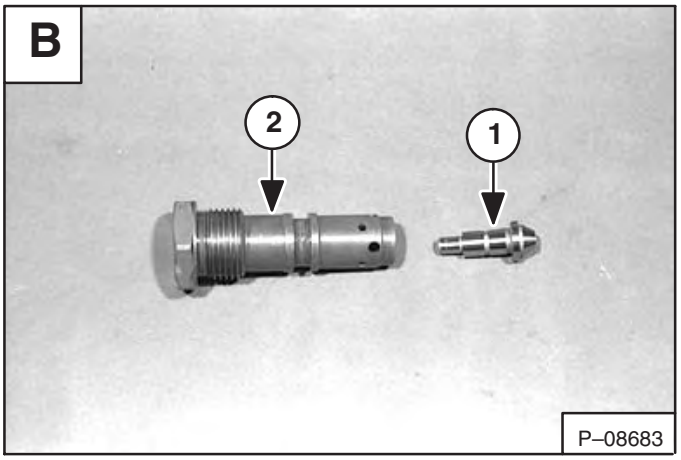
Disassembly (Cont'd)

Remove the spring (Item 1) **[A]** and the spring seat (Item 2) **[A]** from the housing (Item 3) **[A]**.

NOTE: The inside diameter of the spring seat is beveled on one side only , and should be positioned with the spring resting on the non–beveled side.



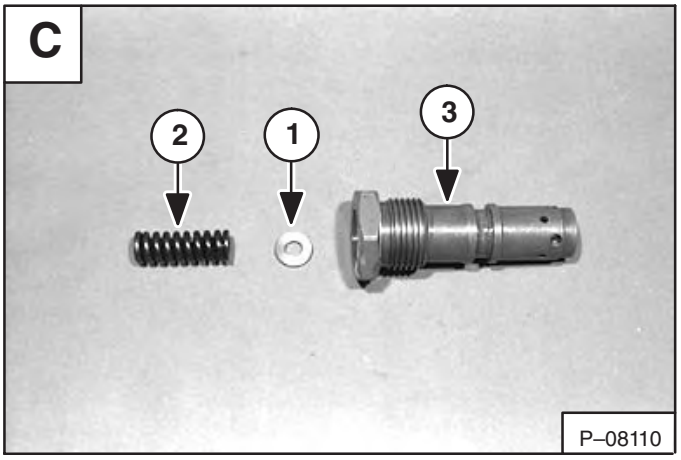
Remove the poppet (Item 1) **[B]** from the housing (Item 2) **[B]**.



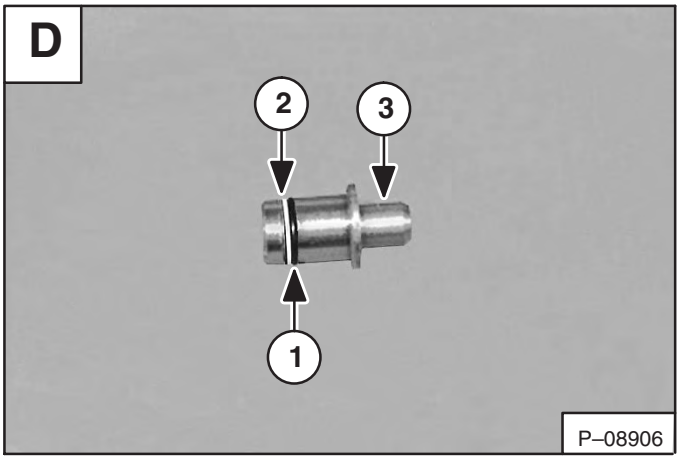
Assembly

Install the spring seat (Item 1)**[C]** and spring (Item 2)**[C]** in the housing (Item 3) **[C]**.

NOTE: The inside diameter of the spring seat (Item 1) [C] is beveled on one side onlyand should be positioned with the spring resting on the non–beveled side.



Install the O–ring (Item 1) **[D]** and back–up washer (Item 2) **[D]** on the guide assembly (Item 3) **[D]**.



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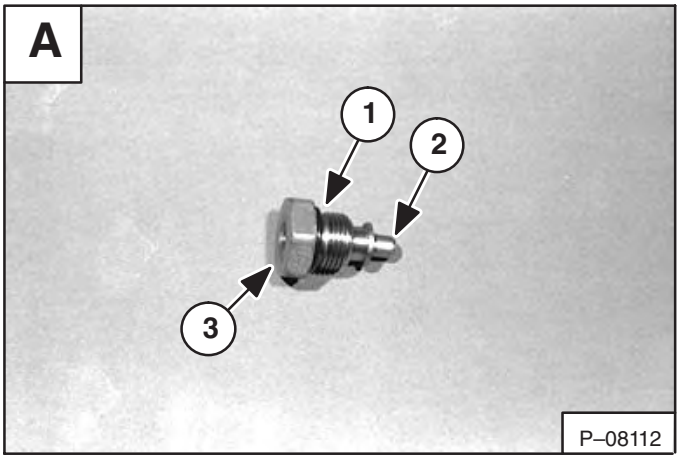
SWING MOTOR ASSEMBLY (Cont'd)

Relief Valve (Cont'd)

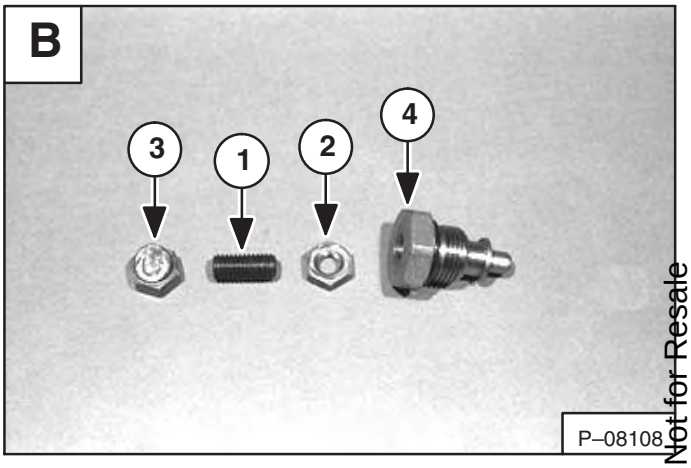
Assembly (Cont'd)

Install the O–ring (Item 1) **[A]**.

Install the guide assembly (Item 2) **[A]** in the plug (Item 3) **[A]**.



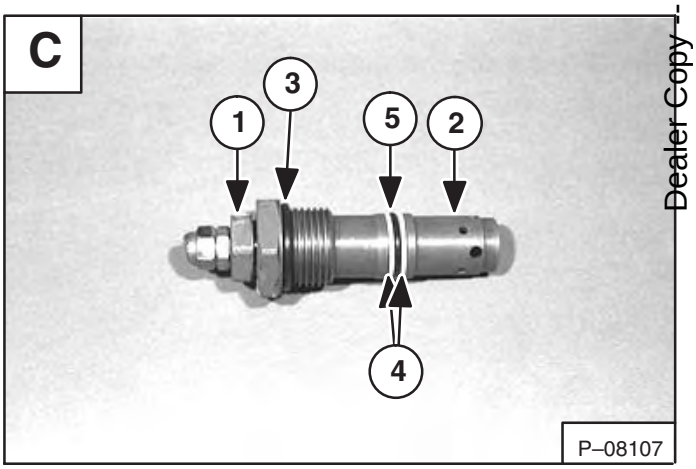
Install the set screw (Item 1) **[B]** the jam nut (Item 2) **[B]** and the cap (Item 3) **[B]** in the plug (Item 4) **[B]**.



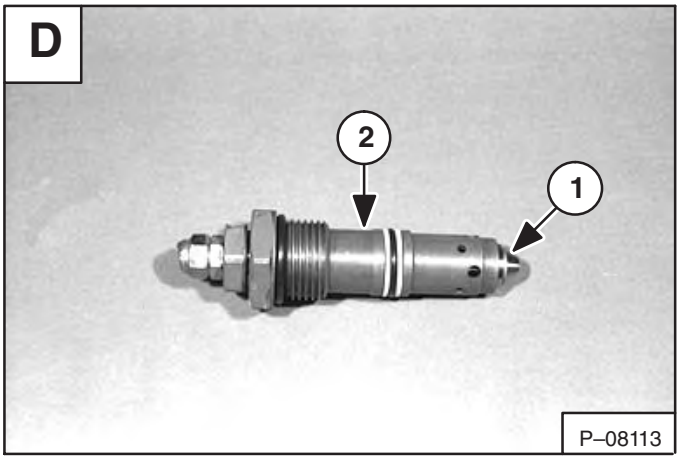
Install the guide assembly and plug (Item 1) **[C]** in the housing (Item 2) **[C]**.

Install the large O–ring (Item 3) **[C]**.

Install the two back–up washers (Item 4) **[C]** and the small O–ring (Item 5) **[C]**.



Install the poppet (Item 1) **[D]** in the housing (Item 2) **[D]**.



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SWING MOTOR ASSEMBLY (Cont'd)

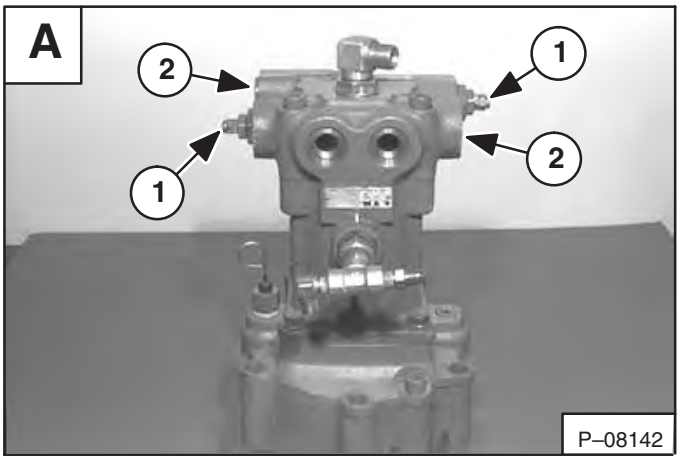
Relief Valve (Cont'd)

Adjustment for Model 225

The brake valve used on the swing motor has two relief valves (Item 1) **[A]** and two check valves (Item 2) **[A]** mounted on either side of the valve body.

Check valves are used to dampen the swing stop, preventing damage to the swing motor. The relief valves also prevent the upperstructure from independent movement, or creeping, until the swing circuit is engaged.

The relief valves, control valve, and swing motor are shown removed from the excavator for photo clarity **[A]**.



Disconnect the outlet hose (Item 1) **[B]** from the middle pump sections.

Install a tee between the middle pump section, outlet, and the outlet hose.

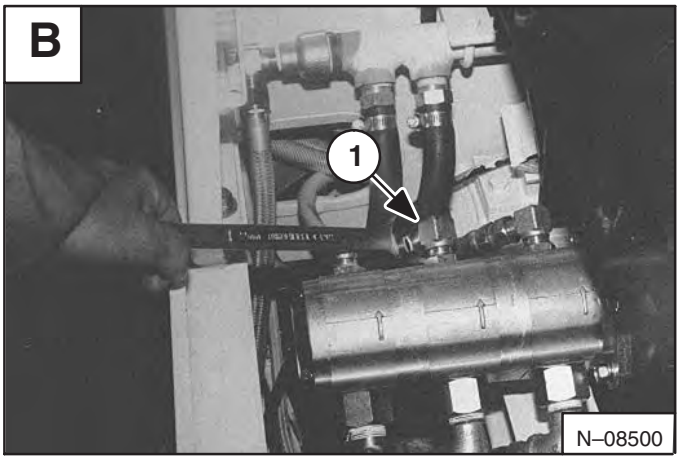
Install a 5,000 PSI gauge on the tee fitting.

Warm the excavator up to operating temperature.

With the swing lock engaged, activate the swing circuit in one direction.

Record the pressure.

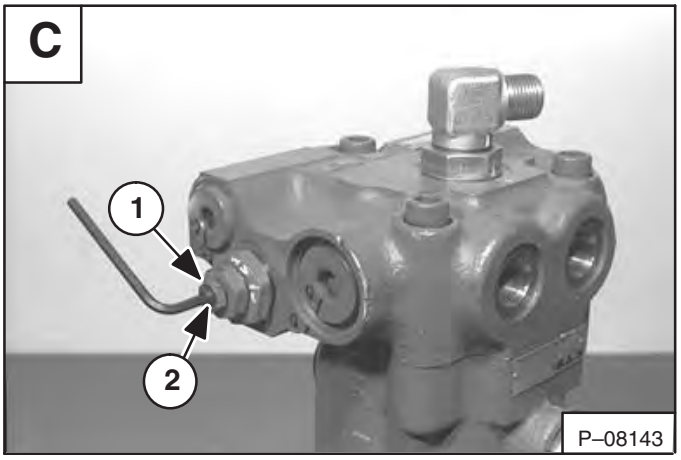
Activate the swing circuit in the opposite direction. Record the pressure.



If adjustment is needed, remove the cap and loosen the lock nut (Item 1) **[C]**.

Turn the adjustment screw (Item 2) **[C]** until the correct pressure is recorded on the gauge.

NOTE: The swing motor is out of the excavator for photo clarity.



The correct pressure for the relief valves is: 1,650 PSI (11375 kPa)

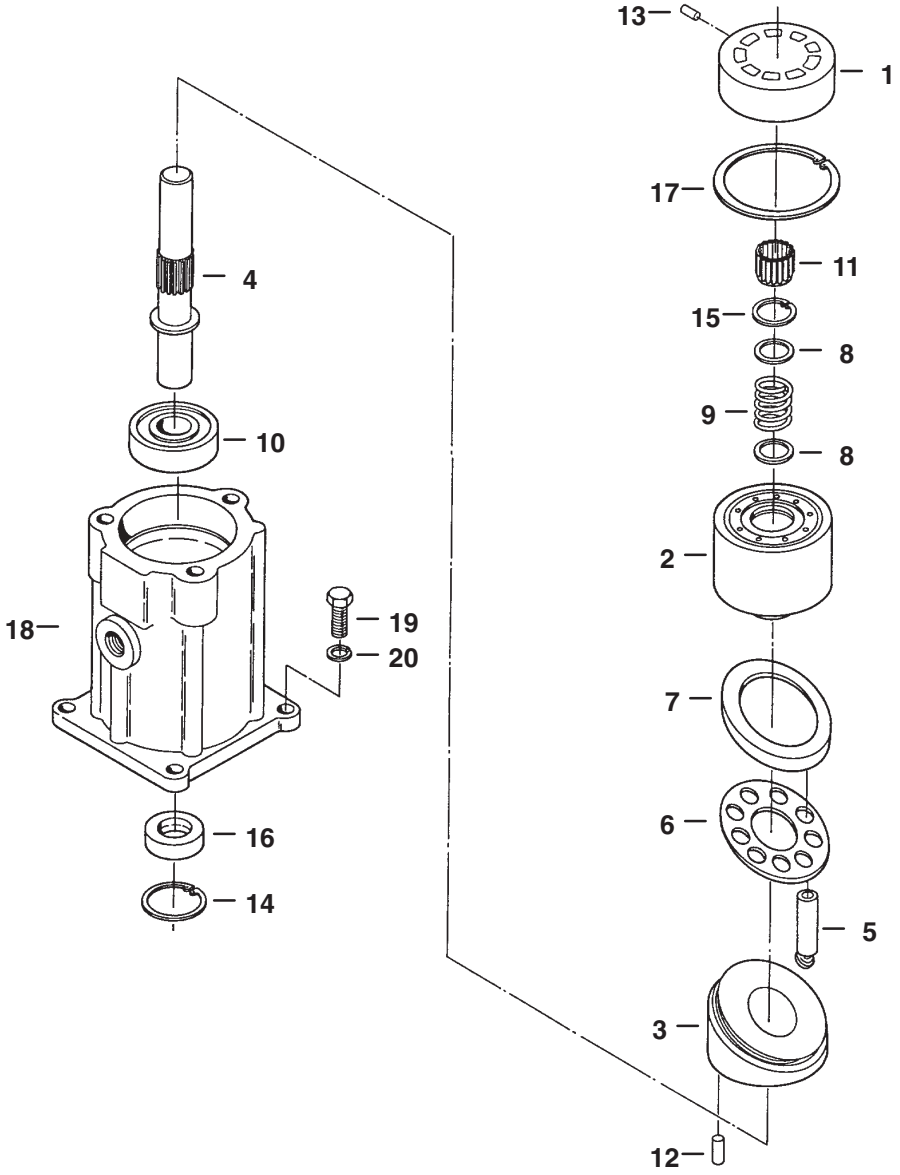
The front relief valve controls the clockwise direction of rotation while the rear relief valve controls the counterclockwise direction of rotation.

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Piston Housing

Parts Identification

1. Block
2. Block
3. Plate
4. Shaft
5. Piston
6. Retainer
7. Holder
8. Washer
9. Spring
10. Bearing
11. Bearing
12. Pin
13. Pin
14. Snap Ring
15. Snap Ring
16. Seal
17. Snap Ring
18. Case
19. Bolt
20. Washer



D–01954

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SWING MOTOR ASSEMBLY (Cont'd)

Piston Housing (Cont'd)

Disassembly

Prior to disassembly:

Clean the outside of the motor.

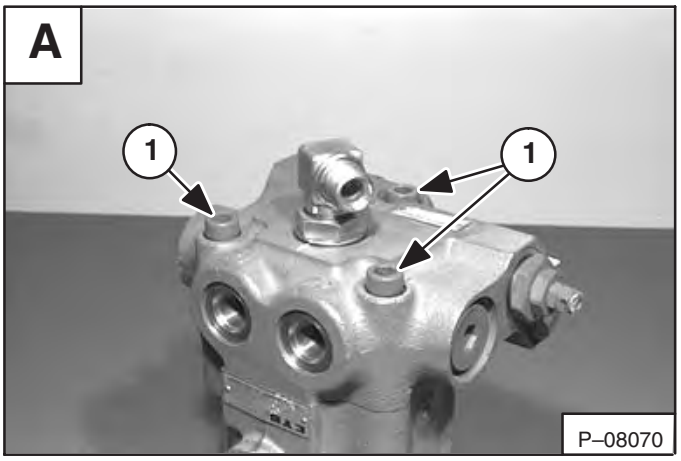
Drain the oil from the motor casing and port piping.

Select a clean environment.

Handle with care

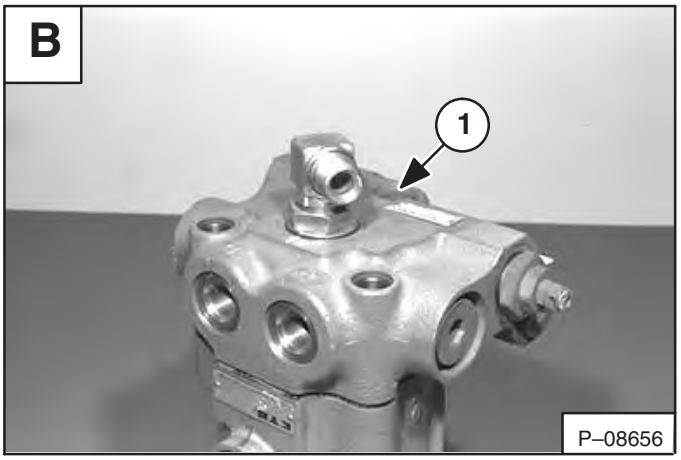
Clamp the swing motor in a vise with padded jaws **[A]**.

Remove the three bolts (Item 1) **[A]** from the valve assembly.

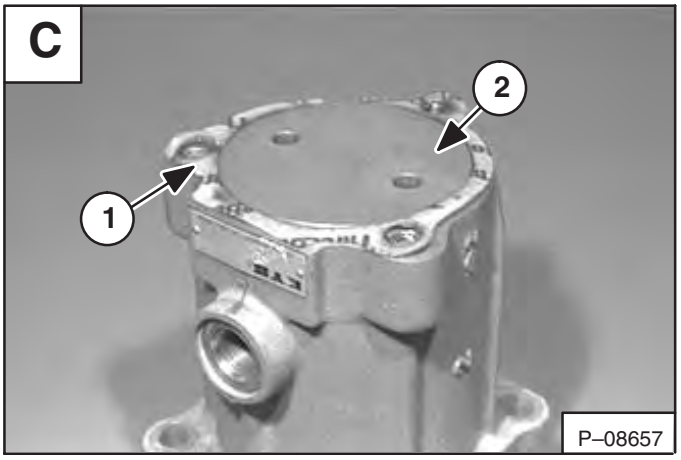


Remove the valve assembly (Item 1) **[B]** from the case.

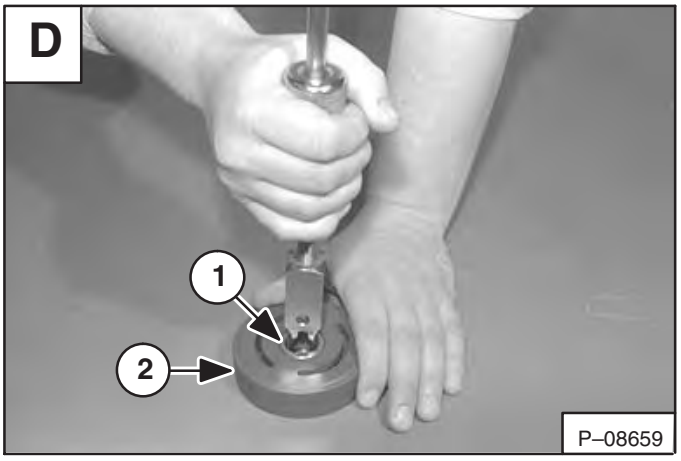
(See Page for valve assembly rebuild procedure.)



Remove the gasket (Item 1)**[C]** and the block (Item 2)**[C]** from the case.



Remove the bearing (Item 1) **[D]** from the block (Item 2) **[D]**.



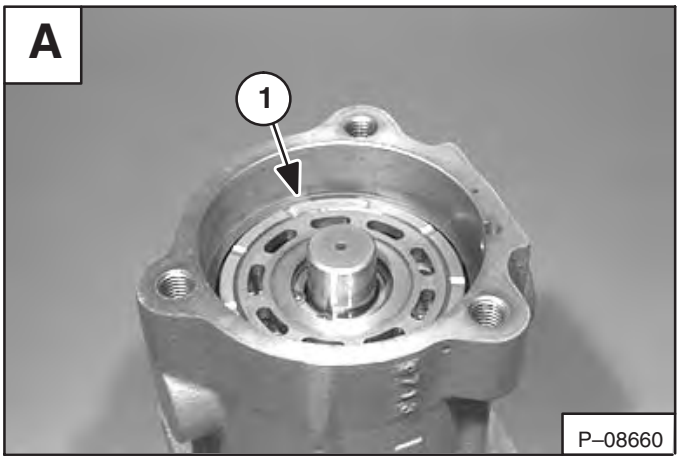
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SWING MOTOR ASSEMBLY (Cont'd)

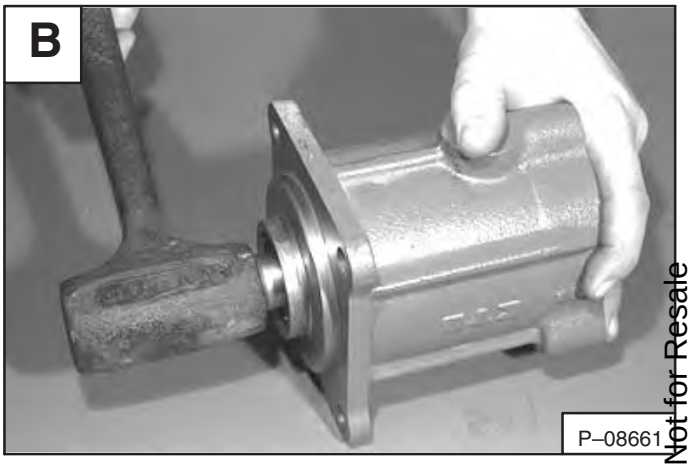
Piston Housing (Cont'd)

Disassembly (Cont'd)

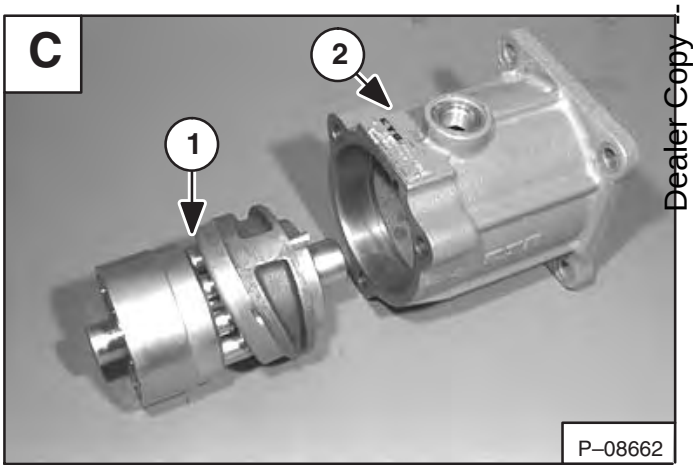
Remove the snap ring (Item 1) **[A]** from the case.



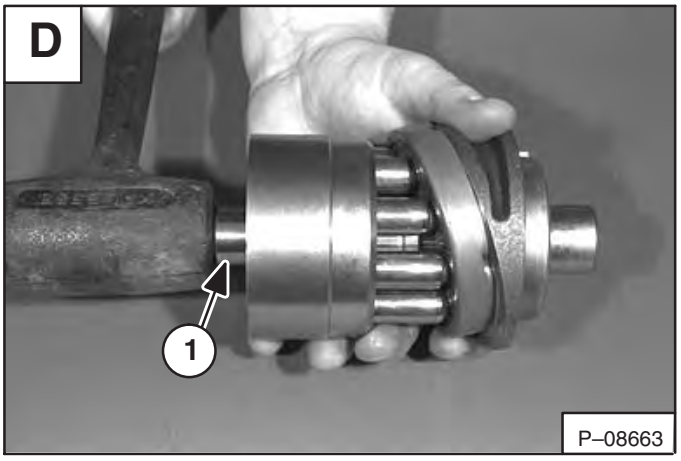
Tap the end of the shaft to remove the cylinder block and inclining plate assembly from the case **[B]**.



Remove the cylinder block/inclining plate assembly (Item 1) **[C]** from the case (Item 2) **[C]**.



Tap the shaft (Item 1) **[D]** (cylinder block side) to remove the shaft from the block assembly.



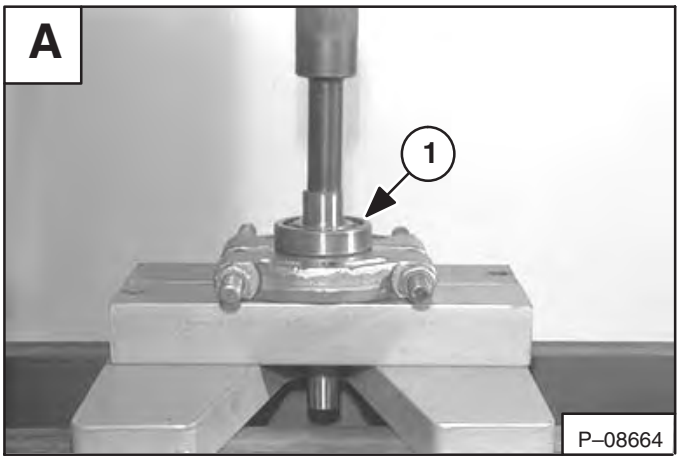
Dealer Copy -- Not for Resale

SWING MOTOR ASSEMBLY (Cont'd)

Piston Housing (Cont'd)

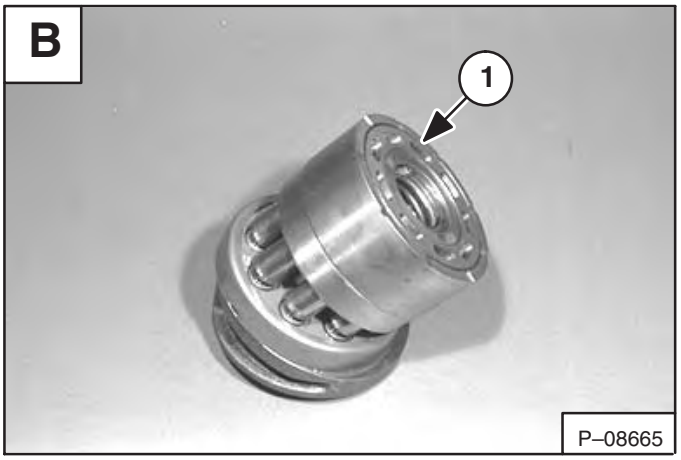
Disassembly (Cont'd)

Remove the bearing (Item 1) **[A]** from the shaft.



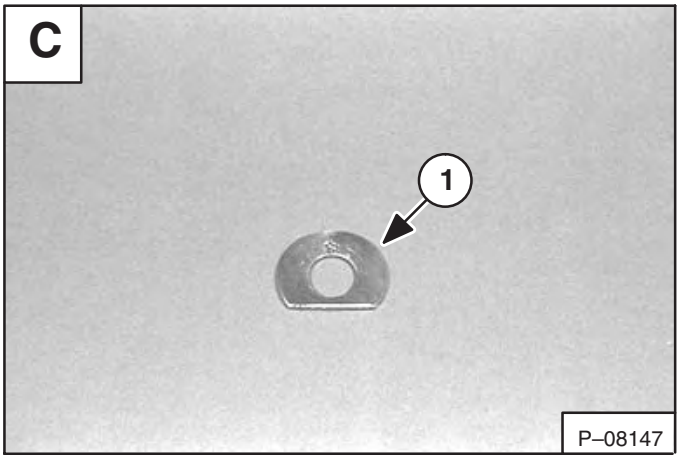
Remove the cylinder block (Item 1) **[B]** from the inclining plate.

NOTE: Inclining plate, piston, piston retainer plate and holder is one unit. They cannot be disassembled.

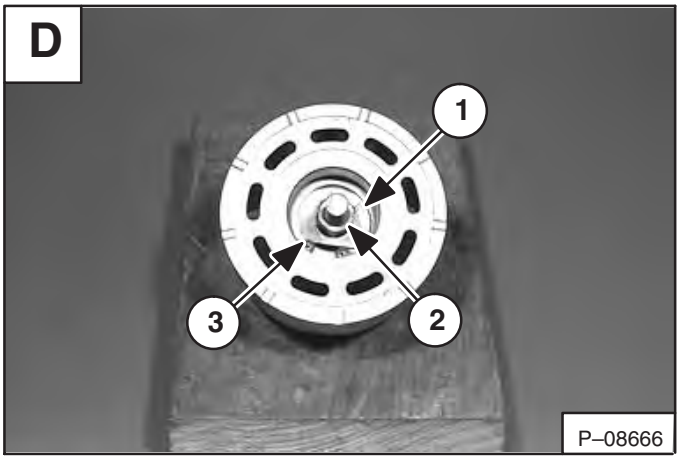


NOTE: To remove the spring from inside the cylinder block the following parts will be needed: one 3/8 X 4.0 inch bolt, two flat washers and one 3/8 inch nut will be needed. One of the washers will need to be trimmed to allow the spring to be compressed [C].

The washers must fit over the spring but it must also fit inside the snap ring.



Install the non–modified washer on the bolt and insert the bolt and washer through the spring in the cylinder block. Install the modified washer (Item 1) **[D]** and nut (Item 2) **[D]**. Tighten the nut until the spring is compressed enough to remove the snap ring (Item 3) **[D]**.



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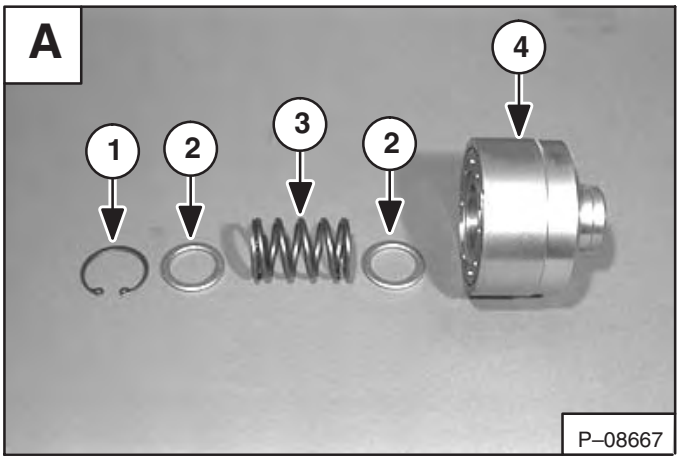
SWING MOTOR ASSEMBLY (Cont'd)

Piston Housing (Cont'd)

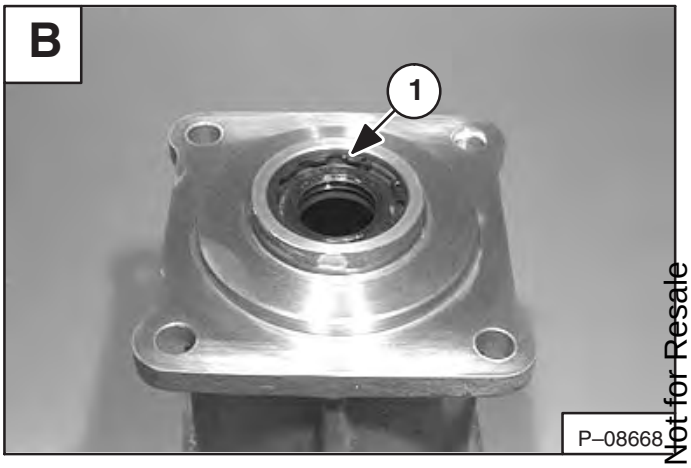
Disassembly (Cont'd)

Remove the bolt used to compress the spring.

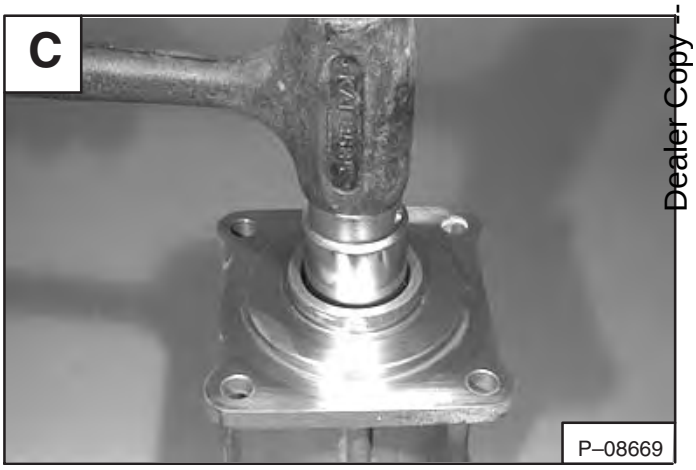
Remove the snap ring (Item 1) **[A]**, the washers (Item 2) **[A]**, the spring (Item 3) **[A]** from the cylinder block (Item 4) **[A]**.



Remove the snap ring (Item 1) **[B]** from the case.



Remove the oil seal **[C]**.

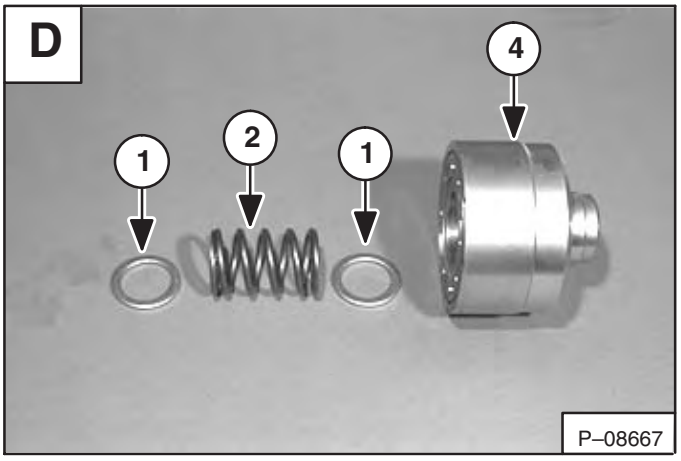


Assembly

Prior to assembly:

Clean all parts with solvent and dry.

Install the washers (Item 1) **[D]**, spring (Item 2) **[D]** and washer (Item 3) **[D]** in the cylinder block (Item 4) **[D]**.



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SWING MOTOR ASSEMBLY (Cont'd)

Piston Housing (Cont'd)

Assembly (Cont'd)

NOTE: To compress the spring the following parts will be needed: one 3/8 x 4.0 inch bolt, two flat washers and one 3/8 inch nut. One of the washers will need to be trimmed to allow installation of the snap ring [A].

Install the non–modified washer on the bolt and insert the bolt and washer through the spring in the cylinder block. Install the modified washer (Item 1) **[A]** and nut (See Page 4–16 **[D]**). Tighten the nut until the spring is compressed enough to install the snap ring (Item 2) **[A]**.

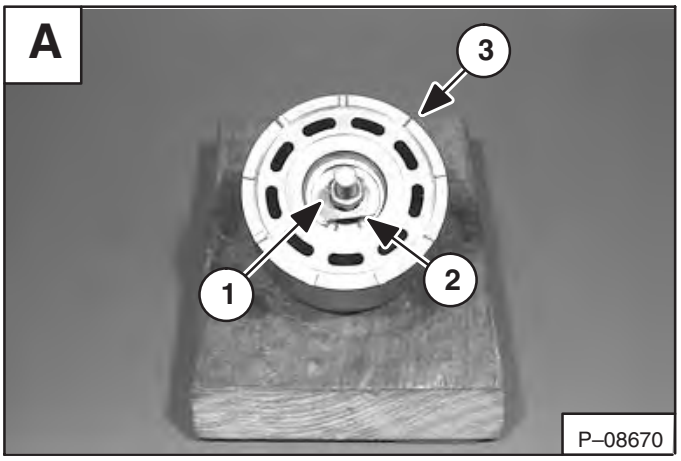
Install the snap ring (Item 2) **[A]** in the cylinder block (Item 3) **[A]**.

Remove the nut, washers and bolt from the cylinder block that was used to compress the spring.

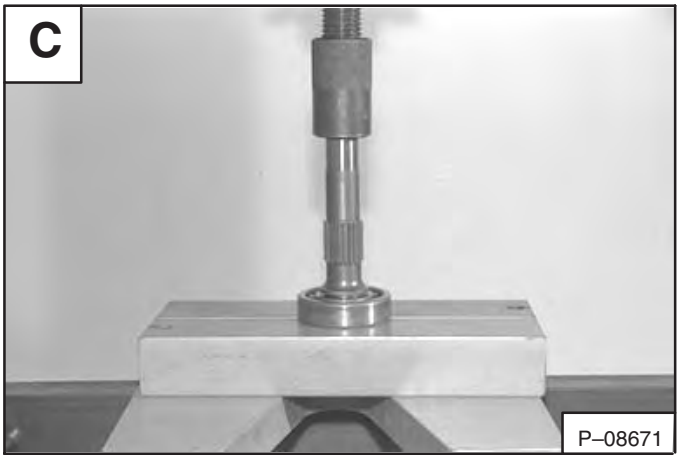
Insert the pistons in the cylinder block **[B]**.

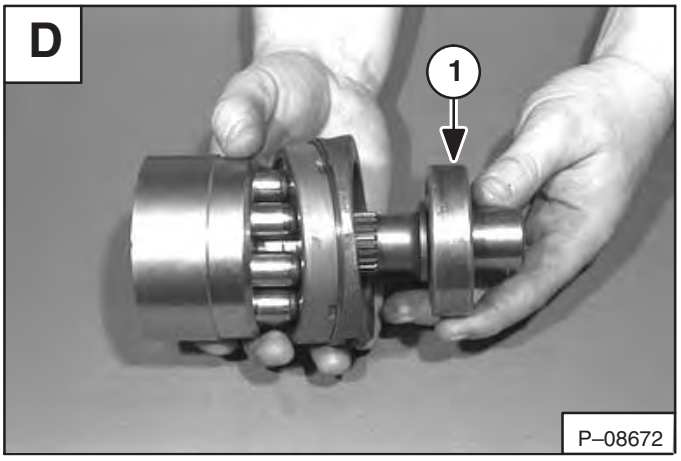
Press the bearing on the shaft **[C]**.

Install the shaft and bearing (Item 1) **[D]** in the cylinder block assembly, making sure that the splineson the shaft and housing are aligned.









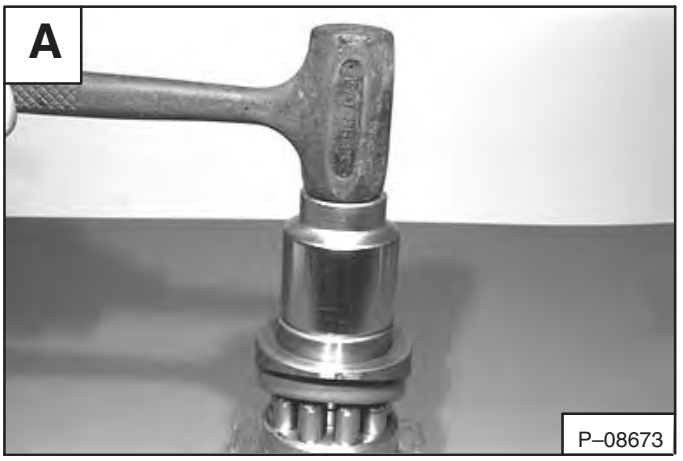
Dealer Copy -- Not for Resale

SWING MOTOR ASSEMBLY (Cont'd)

Piston Housing (Cont'd)

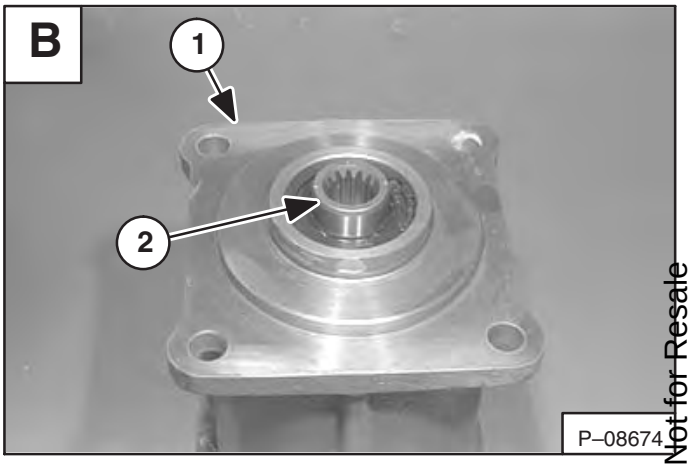
Assembly (Cont'd)

Tap the bearing in the cylinder block (press on the outer edge of the bearing only) **[A]**.

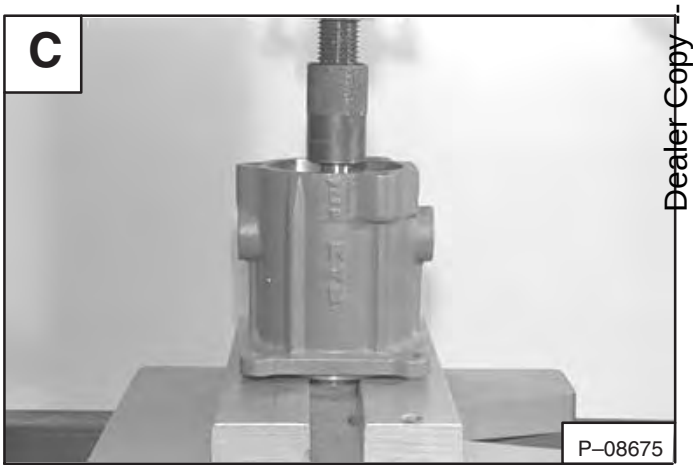


Install the case (Item 1) **[B]** over the shaft and cylinder block assembly (Item 2) **[B]**.

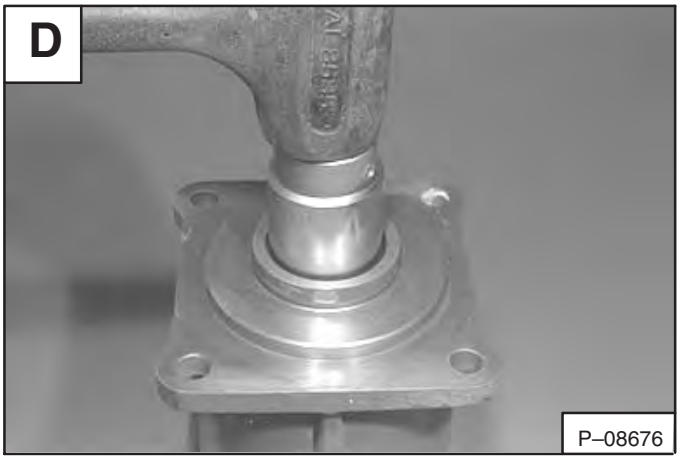
NOTE: Make sure that the alignment pin is in proper alignment with the alignment hole.



Press the case on the shaft bearing **[C]**.



Install the oil seal over the shaft and tap in place **[D]**.



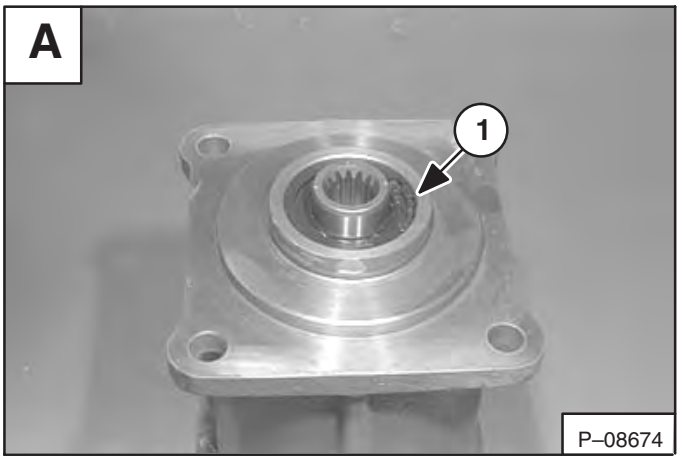
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SWING MOTOR ASSEMBLY (Cont'd)

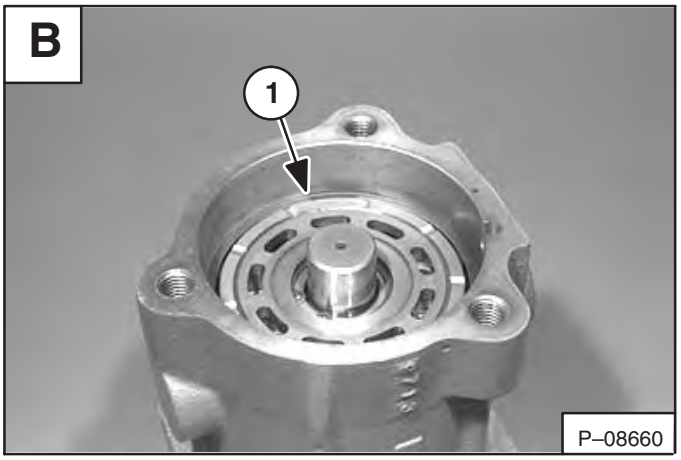
Piston Housing (Cont'd)

Assembly (Cont'd)

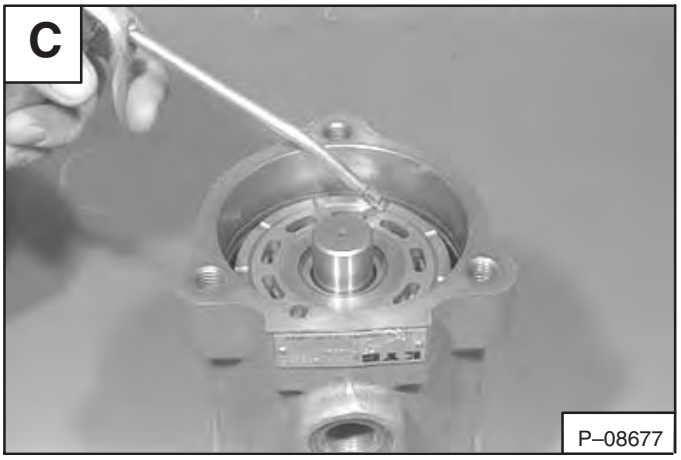
Install the snap ring (Item 1) **[A]** in the groove to hold the seal in place.



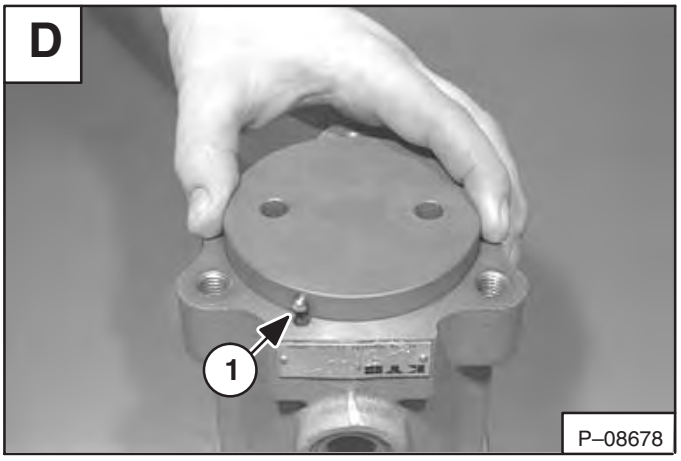
Install the snap ring (Item 1) **[B]**.



Put oil on the surface of the cylinder block **[C]**.



Align the pin (Item 1) **[D]** on the port block with the groove on the case and insert the port block.



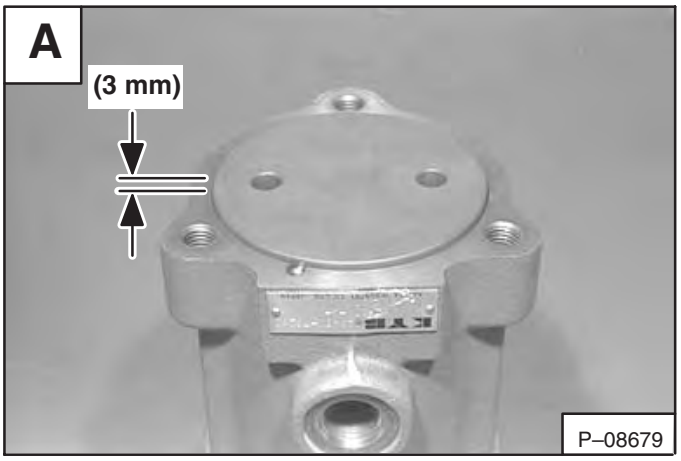
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SWING MOTOR ASSEMBLY (Cont'd)

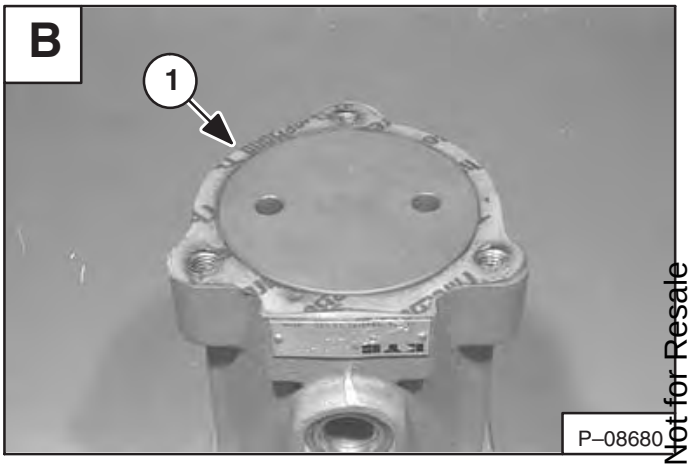
Piston Housing (Cont'd)

Assembly (Cont'd)

The port block surface is 3mm higher than the case surface until the brake valve is installed **[A]**.

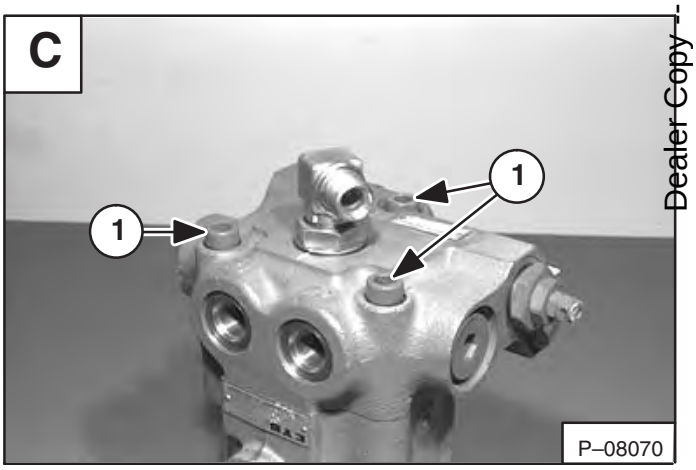


Install the new gasket (Item 1) **[B]** on the surface of the case.



Install the valve unit assembly on the case with the three bolts (Item 1) **[C]**.

Tighten the bolts to 68 ft.–lbs. (92 Nm) torque.

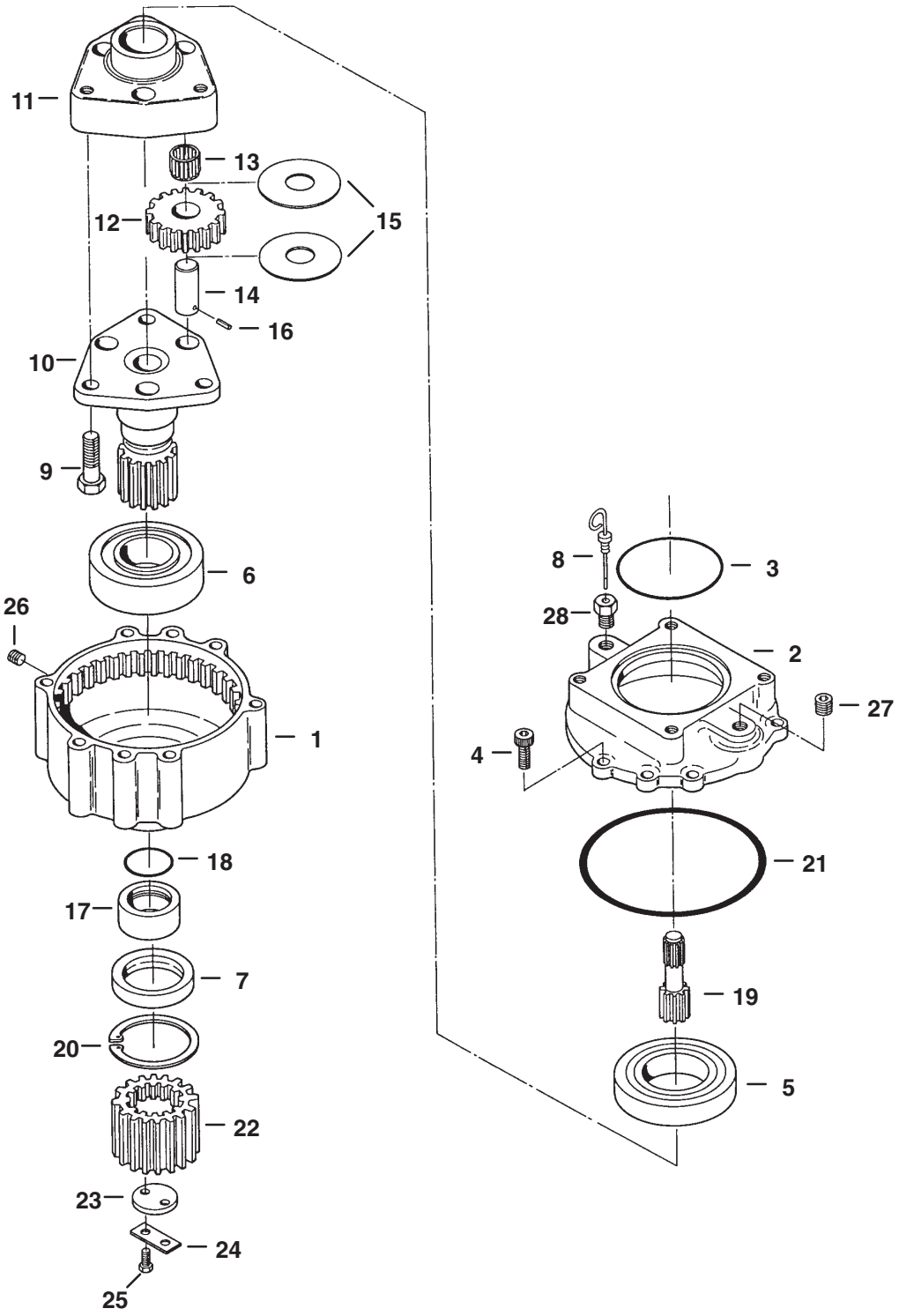


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Reduction Gear

Parts Identification

1. Housing
2. Housing
3. O–ring
4. Bolt
5. Bearing
6. Bearing
7. Seal
8. Dipstick
9. Bolt
10. Shaft
11. Cage
12. Gear
13. Bearing
14. Shaft
15. Washer
16. Pin
17. Spacer
18. O–ring
19. Gear
20. Snap Ring
21. O–ring
22. Gear
23. Plate
24. Locking Plate
25. Bolt
26. Plug
27. Plug
28. Adapter



D–1954

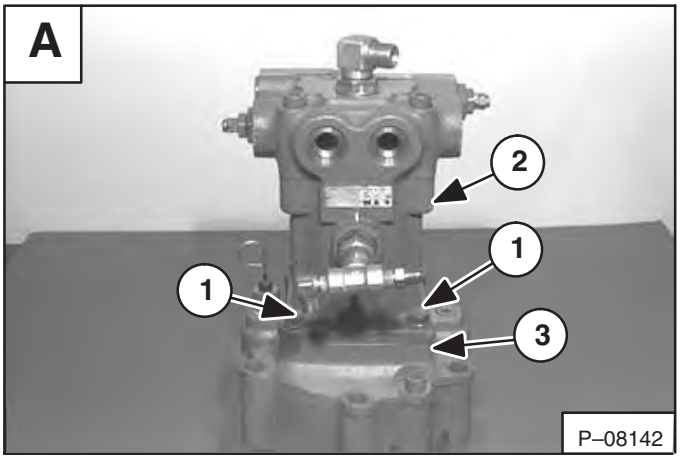
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SWING MOTOR ASSEMBLY (Cont'd)

Reduction Gear (Cont'd)

Disassembly

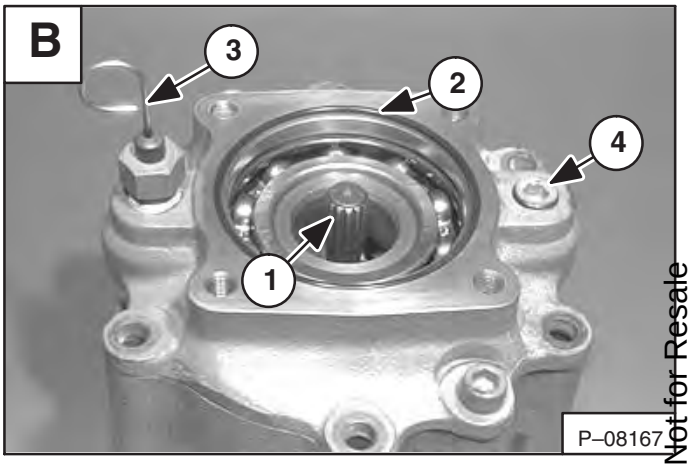
Remove the four bolts (Item 1)**[A]** and remove the swing motor assembly (Item 2) **[A]** from the housing (Item 3) **[A]**.



Drain the oil from the unit.

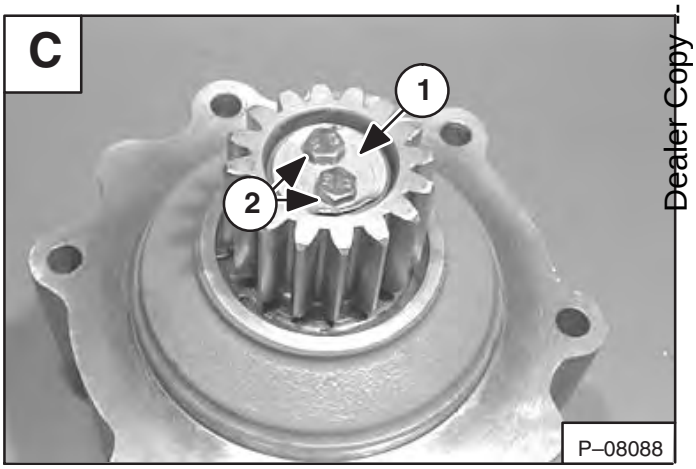
Remove the gear (Item 1)**[B]**, the O–ring (Item 2)**[B]**, the dipstick (Item 3) **[B]** and plug (Item 4) **[B]** from the assembly.

NOTE: Mark the position of the dipstick and the plug and remove.

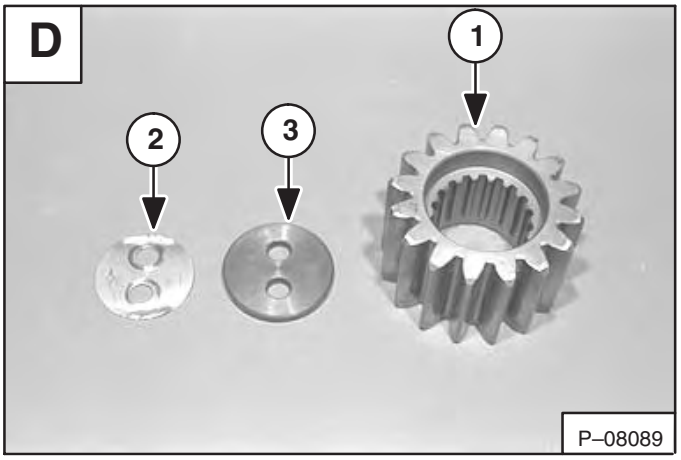


Flatten the two edges of the locking plate (Item 1) **[C]**.

Remove the bolts (Item 2) **[C]**.



Remove the drive gear (Item 1) **[D]**, the locking plate (Item 2) **[D]** and the plate (Item 3) **[D]** from the shaft.



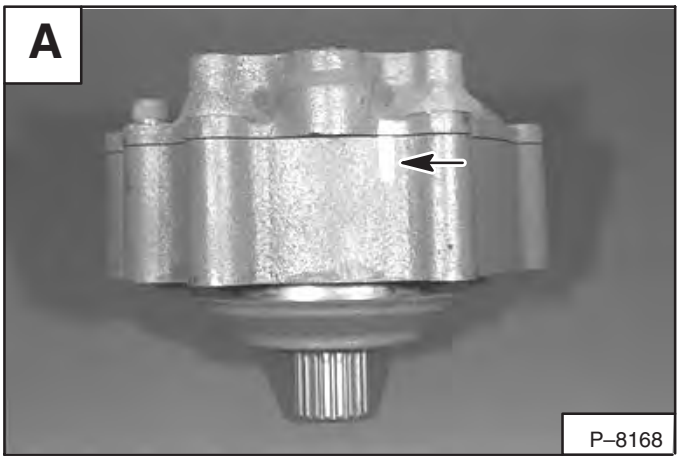
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SWING MOTOR ASSEMBLY (Cont'd)

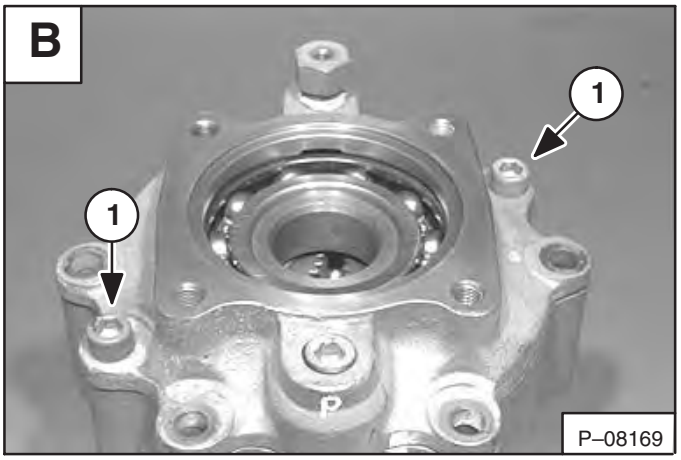
Reduction Gear (Cont'd)

Disassembly (Cont'd)

Mark the upper and lower housing for ease of assembly **[A]**.

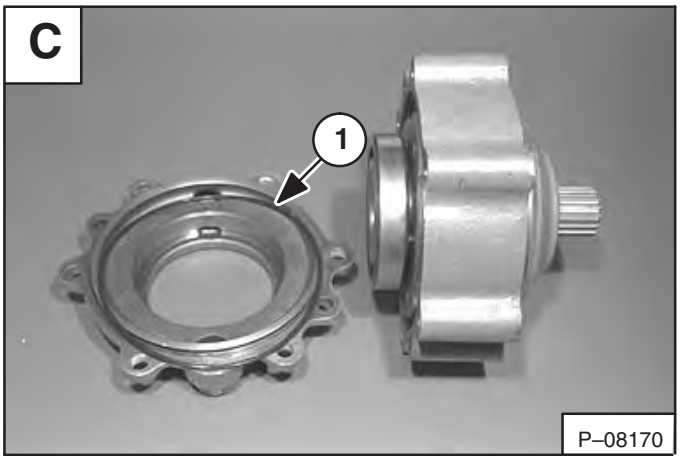


Remove the two bolts (Item 1) **[B]** from the upper case.

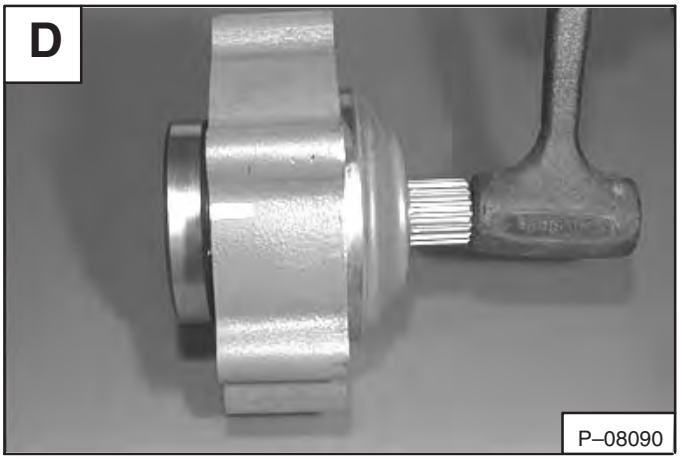


Remove the upper housing from the lower housing **[C]**.

Remove the O–ring (Item 1) **[C]** from the upper housing.



Remove the shaft assembly from the lower housing by laying the housing on its side and tap with a mallet on the shaft assembly **[D]**.



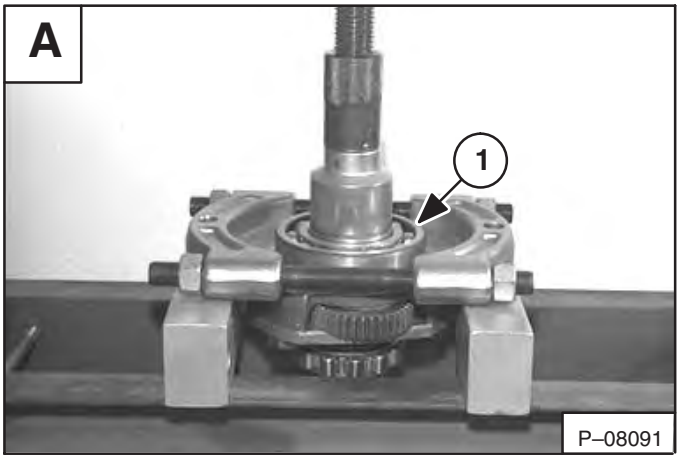
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SWING MOTOR ASSEMBLY (Cont'd)

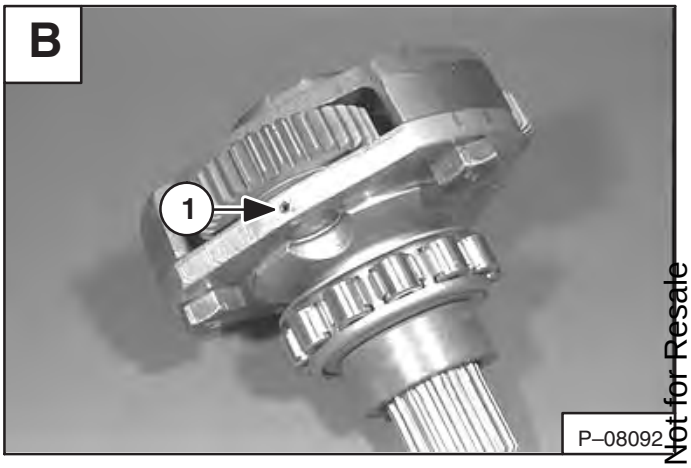
Reduction Gear (Cont'd)

Disassembly (Cont'd)

Remove the bearing (Item 1) **[A]** from the shaft assembly

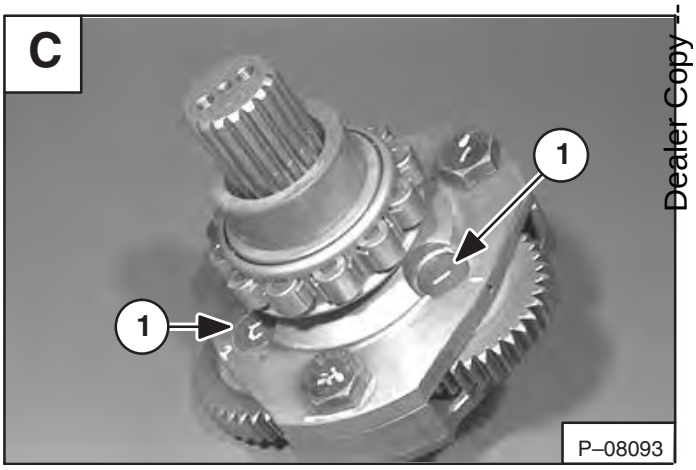


Tap the pins (Item 1) **[B]** in the shaft assembly taking care not to push the pin to deep.

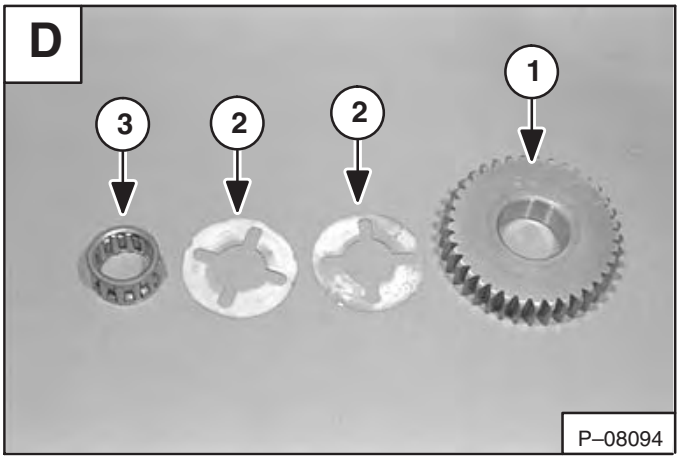


Remove the three pins (Item 1) **[C]** by taping them out from the bearing side.

NOTE: Mark the pins and housing for ease of assembly.



Remove the gear (Item 1) **[D]**, the two washers (Item 2) **[D]** and the bearing (Item 3) **[D]** as one unit from the assembly.



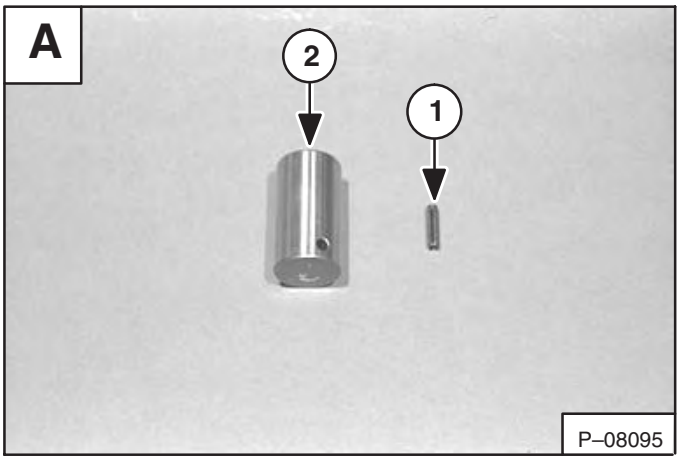
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SWING MOTOR ASSEMBLY (Cont'd)

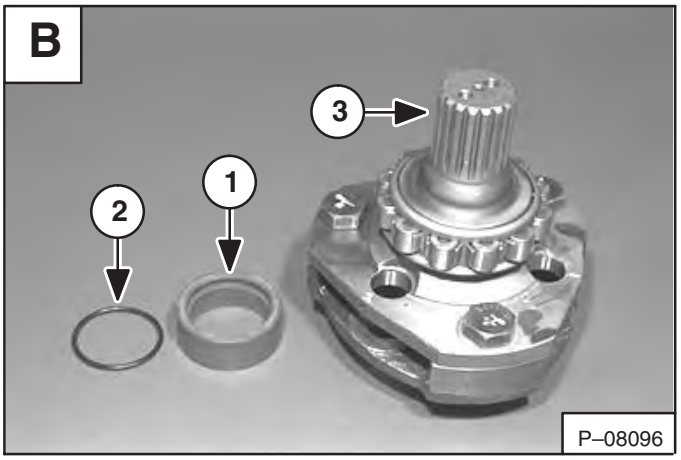
Reduction Gear (Cont'd)

Disassembly (Cont'd)

Remove the pins (Item 1) **[A]** from the shaft (Item 2) **[A]**.

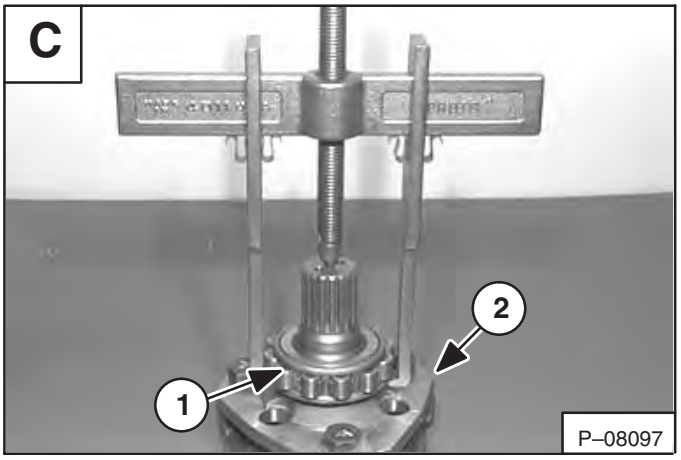


Remove the spacer (Item 1) **[B]** and O–ring (Item 2) **[B]** from the shaft assembly (Item 3) **[B]**.

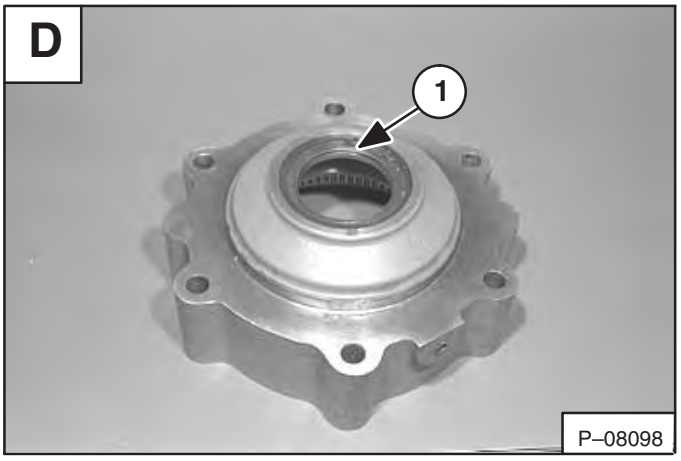


Remove the bearing (Item 1)**[C]** from the shaft assembly

NOTE: The sun gear housing (Item 2) [C] is a machined assembly and should not be disassembled.



Remove the snap ring (Item 1) **[D]** from the upper housing.



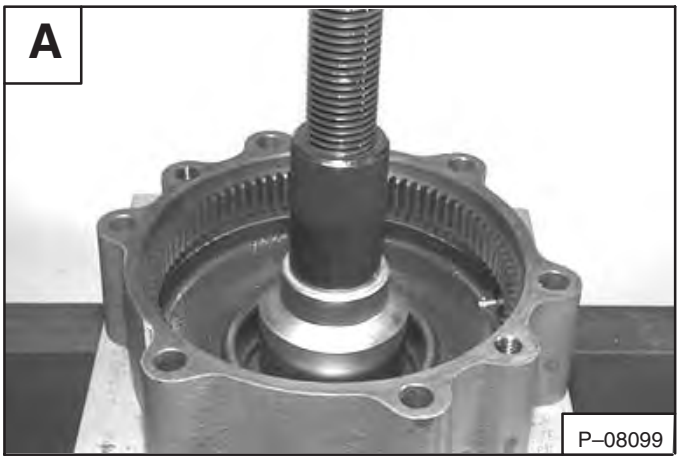
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SWING MOTOR ASSEMBLY (Cont'd)

Reduction Gear (Cont'd)

Disassembly (Cont'd)

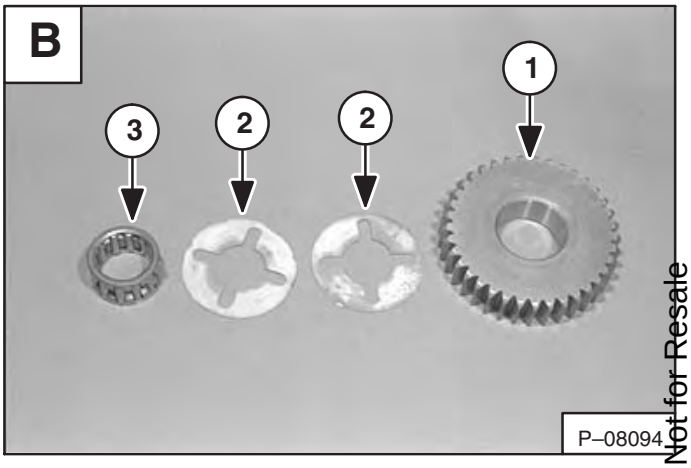
Remove the seal from the upper housing **[A]**. Push only on the seal not the flange.



Assembly

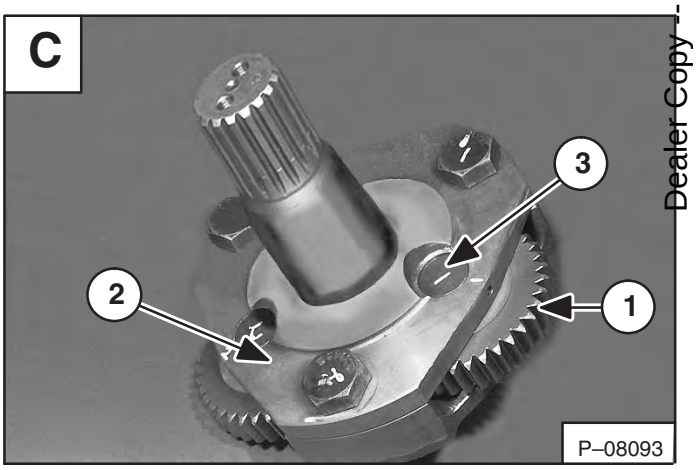
Clean all parts in solvent and dry will compressed air . Inspect all of the parts and replace any that are damaged. If any of the planetary gears are damaged, replace all the planetary and sun gears. One damaged gear can cause microscopic fatigue cracks in the mating gear and cause premature failure after servicing. Apply oil to all O–rings and light grease to the ball and roller bearings during installation.

Assemble the gear (Item 1) **[B]** the two washers (Item 2) **[B]** and the bearing (Item 3) **[B]** as one unit. One washer (Item 2) **[B]** on each side of the gear (Item 1) **[B]**.

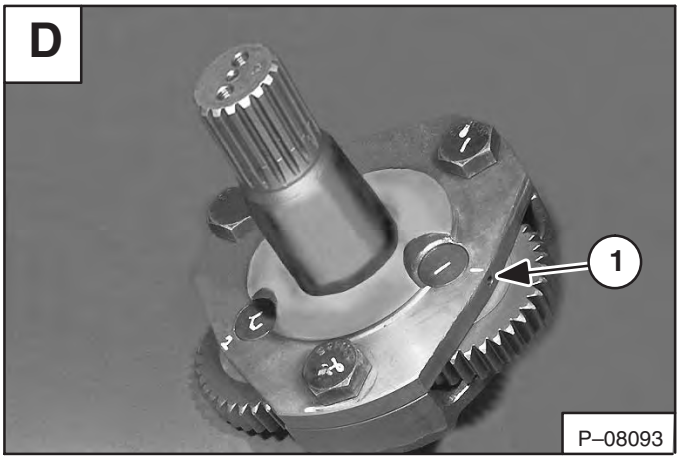


Install the gear assembly (Item 1) **[C]** in the shaft assembly (Item 2) **[C]**.

Install the three pins (Item 3) **[C]**.



Install the roll pins (Item 1) **[D]** in the shaft assembly.



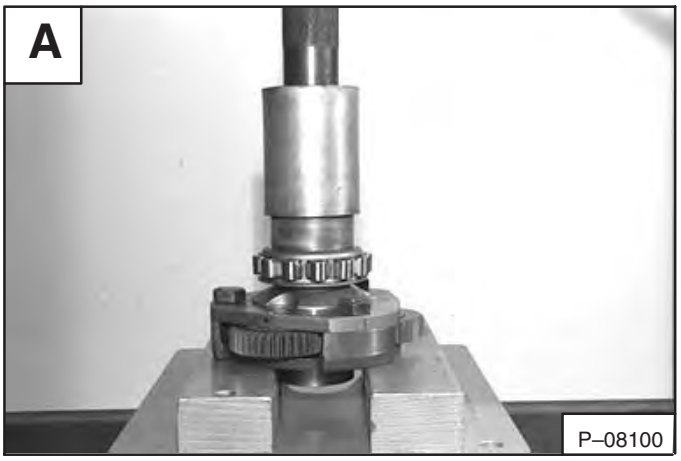
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SWING MOTOR ASSEMBLY (Cont'd)

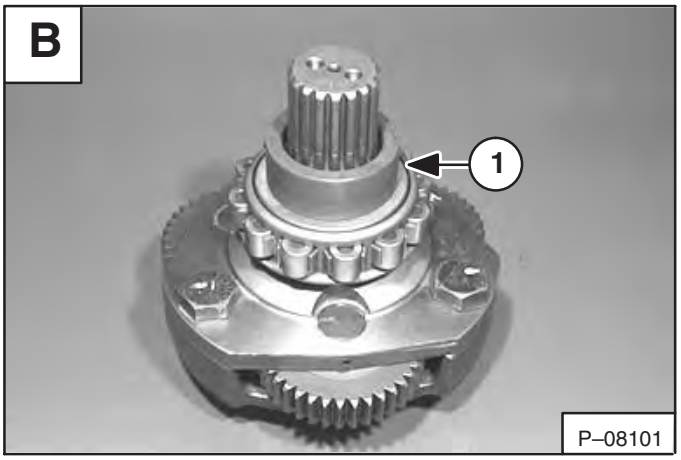
Reduction Gear (Cont'd)

Assembly (Cont'd)

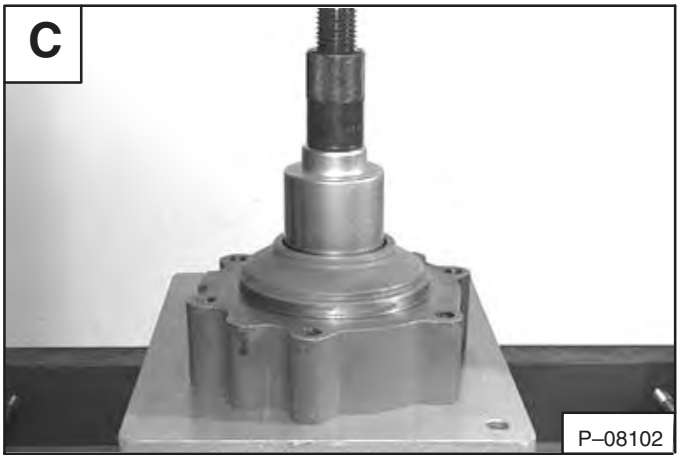
Install the bearing on the shaft assembly **[A]**.



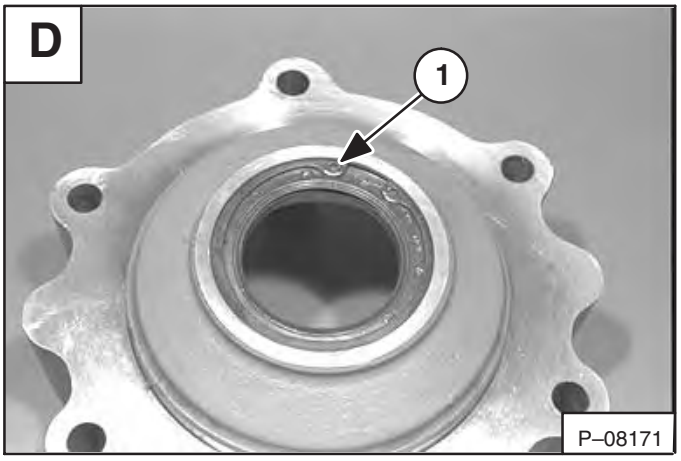
Install a new O–ring in the spacer and install the spacer (Item 1) **[B]** on the shaft assembly.



Install the new oil seal in the lower housing until the snap ring groove is seen **[C]**.



Install the snap ring (Item 1) **[D]** in the lower housing.



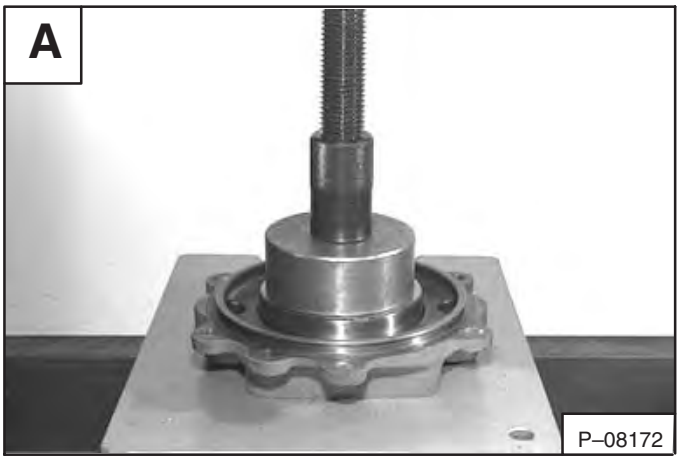
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SWING MOTOR ASSEMBLY (Cont'd)

Reduction Gear (Cont'd)

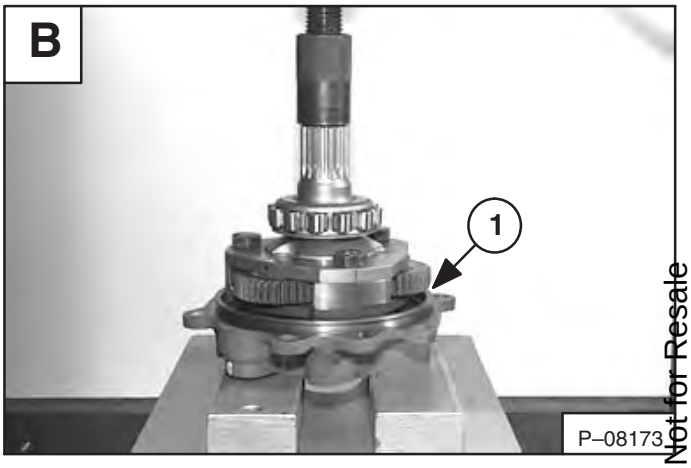
Assembly (Cont'd)

Press the outer race of the bearing in the upper housing.



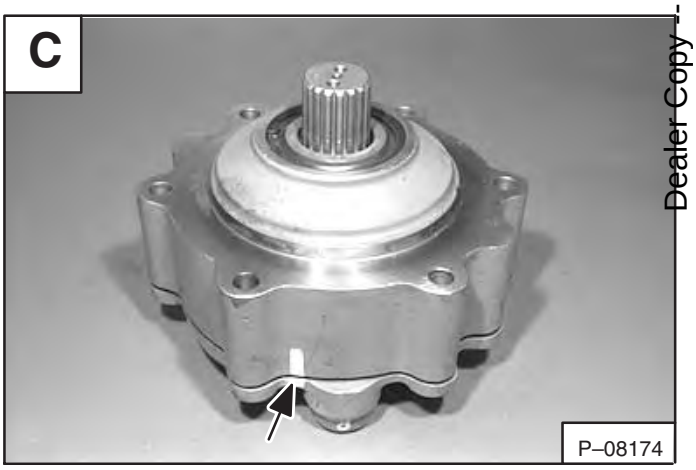
Press the shaft assembly in the upper case **[B]**.

Install a new O–ring (Item 1) **[B]** on the upper case.



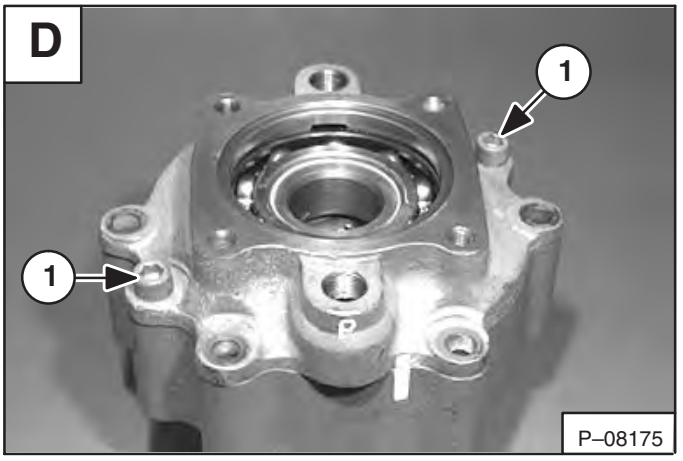
Install the lower housing on the shaft assembly by aligning the planetary gears **[C]**.

NOTE: Make sure to align the marks made earlier.



Install the two bolts (Item 1) **[D]** in the housing.

Tighten the bolts to 68 ft.–lbs. (92 Nm) torque.



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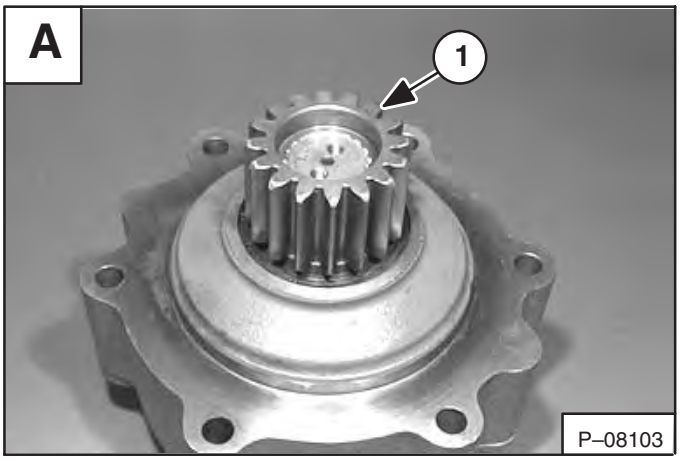
SWING MOTOR ASSEMBLY (Cont'd)

Reduction Gear (Cont'd)

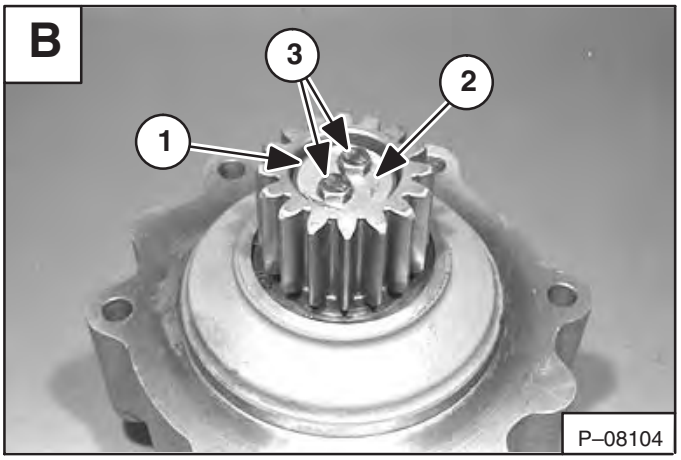
Assembly (Cont'd)

Install the drive gear (Item 1) **[A]** onto the shaft.

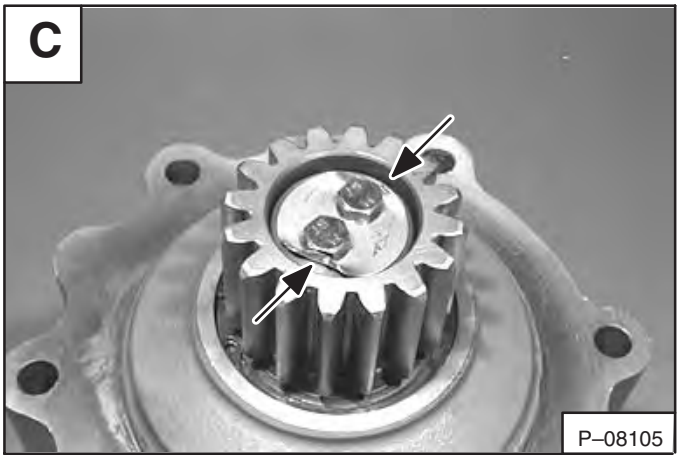
NOTE: The drive gear only goes on one way–deepest groove to the top.



Install the plate (Item 1) **[B]**, the locking washer (Item 2) **[B]** and two bolts (Item 3) **[B]**. Tighten the bolts to 21.0 ft.–lbs. (28.5 Nm) torque.



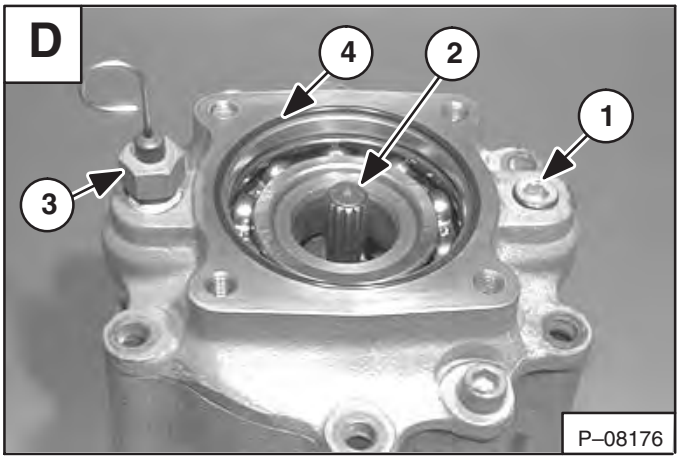
Bend the locking washer to keep the bolts from moving **[C]**.



Install the plug (Item 1) **[D]** in the assembly.

Install the shaft (Item 2) **[D]** in the assembly.

Install the dipstick plug (Item 3) **[D]** and O–ring (Item 4) **[D]** in the assembly.



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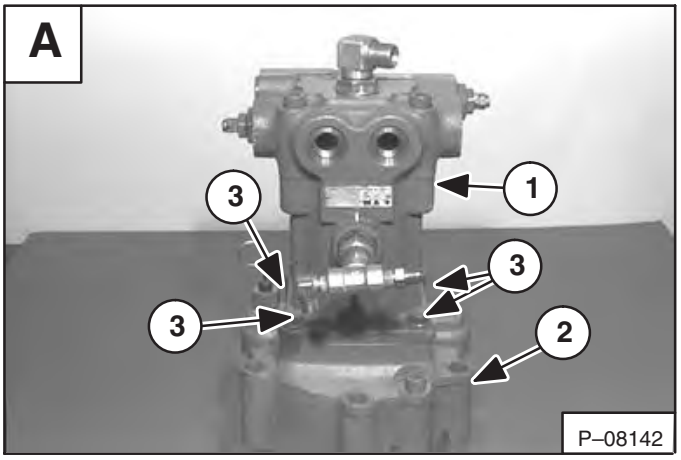
SWING MOTOR ASSEMBLY (Cont'd)

Reduction Gear (Cont'd)

Assembly (Cont'd)

Set the swing motor assembly (Item 1) **[A]** on the reduction gear case (Item 2) **[A]** and install the four bolts (Item 3) **[A]**.

Tighten the bolts to 42.0 ft.–lbs. (57 Nm) torque.



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UPPER WORKS

Removal And Installation

Remove the operator canopy.

Remove the seat and swing motor cover.(See Page5–1.)

Remove the engine. (See Page 7–1.)

Remove the floor panel. (See Page 5–1.)

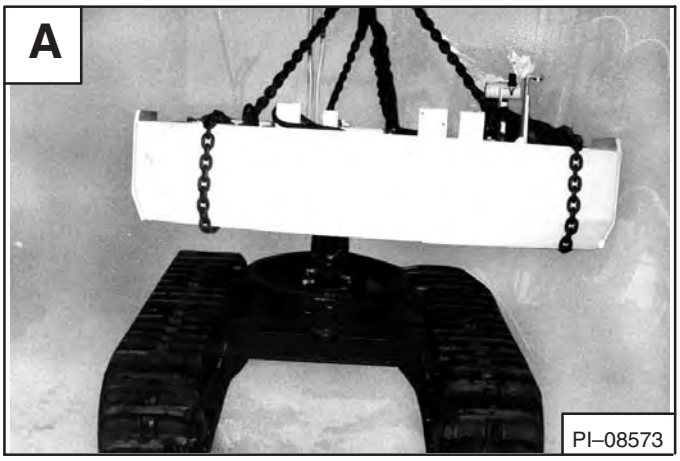
Remove the boom/dipperstick assembly . (See Page 5–1.)

Remove the swing motor. (See Page 4–1.)

Loosen and remove all the bolts around the swing circle gear.

Installation: Tighten the bolts to 80 ft–lbs. (108 Nm) torque.

Connect a chain hoist to the upper works frame and lift it off the swing circle gear **[A]**.



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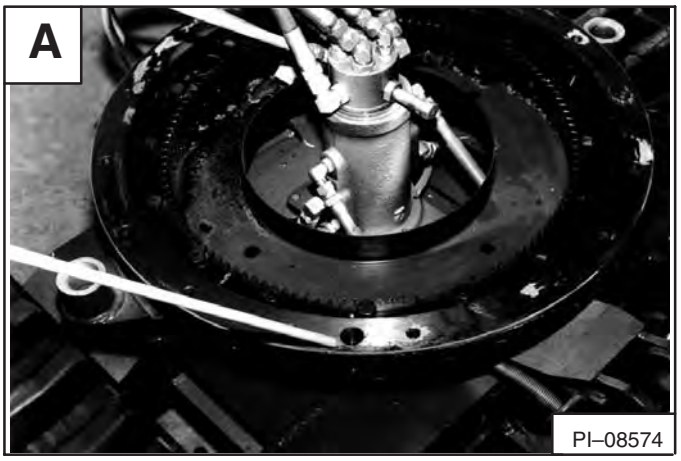
SWING CIRCLE GEAR

Removal And Installation

Remove the upper works from the swing circle gear (See Page 4–32.)

There is an *S* stamped on the swing gear, make sure this mark is located to either side of the centerline of the machine.

Remove the slip ring **[A]**.



Remove the bolts from the swing circle gear **[B]**.

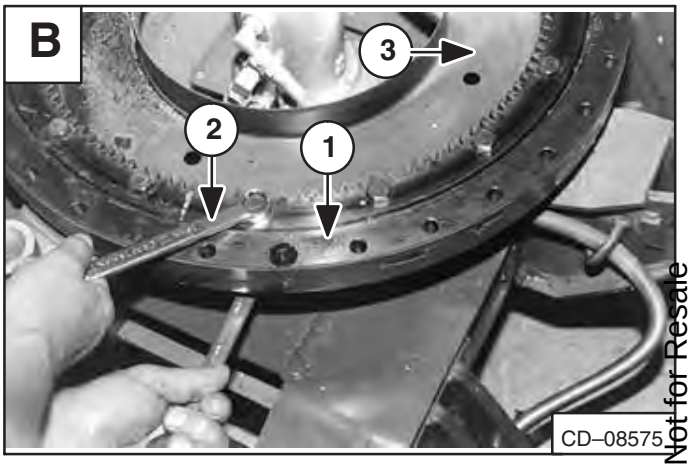
Installation: Add LOCTITE and tighten the bolts to 40 ft–lbs. (54 Nm) torque.

Mark the outer ring of the assembly (Item 1) **[B]** with the circle gear soft zone (Item 2) **[B]**.

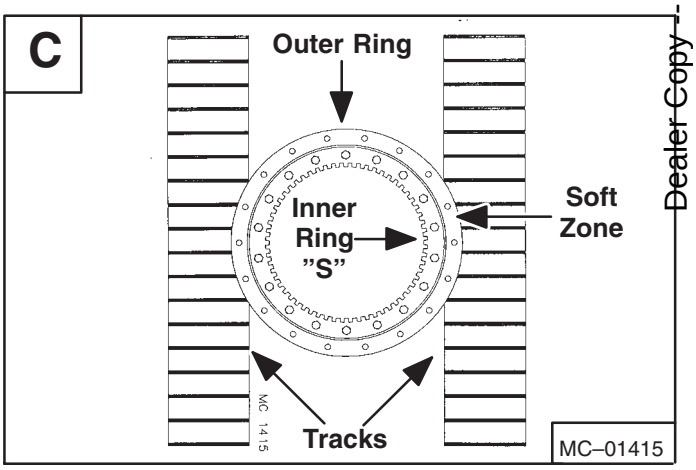
Use a chain hoist to remove the swing circle gear assembly.

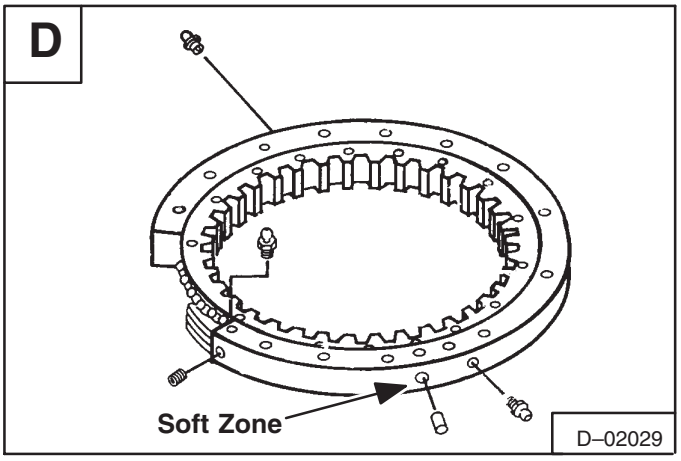
Always replace the seals when installing the swing circle gear.

Remove the shield (Item 3) **[B]** from the track frame.



Position the outer ring soft zone to either side of the center line of the machine when installing the swing frame on the track frame **[C]** & **[D]**.





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CENTER SWIVEL JOINT

Removal And Installation

Raise the back of the machine.

Use jackstands under the machine frame.

IMPORTANT

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

I–2003–0888

Remove the bolts from the plate below the swivel joint.

Remove the plate.

Mark all the hoses for correct installation.

Disconnect the hoses from the swivel joint (Item 2) **[A]**.

Remove the four mounting bolts (Item 1) **[A]**.

Remove the center swivel joint from the track frame.

Disassembly And Assembly

Remove the bolt (Item 1) **[B]**.

Remove the head cover bolt.

Remove the rotor (Item 2) **[B]** from the housing.

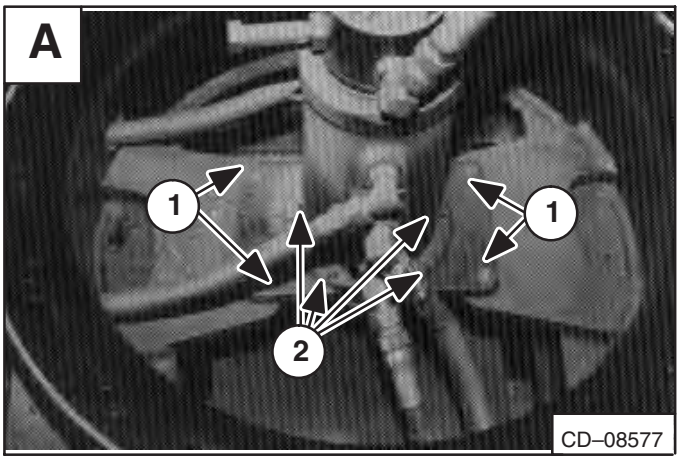
NOTE: Tap the rotor lightly with a rubber hammer if needed for removal.

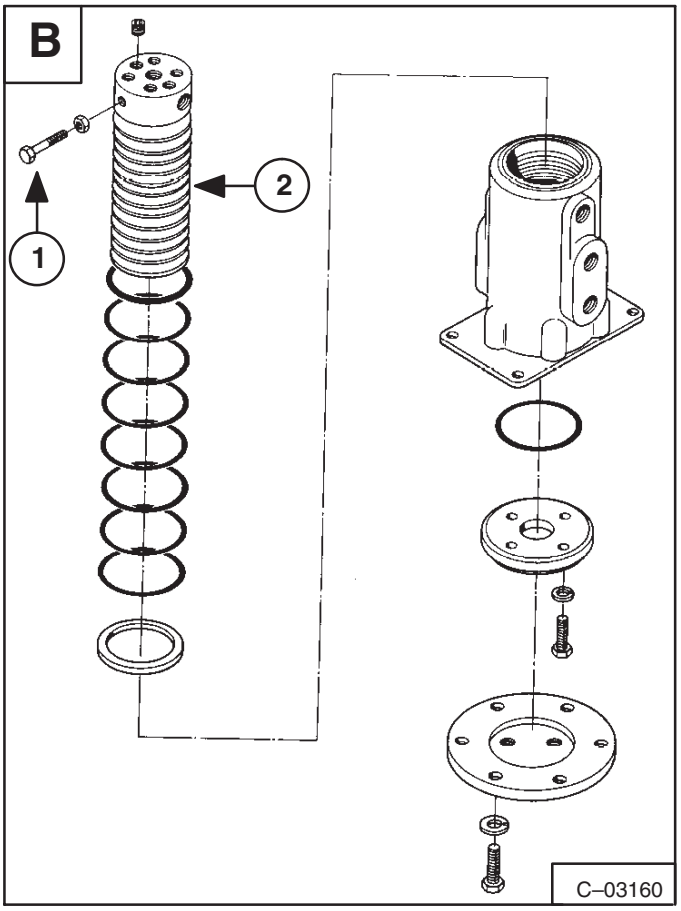
Check the condition of the O–rings.

Check the rotor and housing for scratches or wear marks.

Use grease or hydraulic oil on the O–rings during assembly.

Assemble the swivel joint in reverse order.





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Page Number

BLADE
Removal And Installation 5–10

BOOM
Removal And Installation 5–7

BOOM SWING BRACKET
Removal And Installation 5–9

BUCKET
Removal And Installation 5–6

DIPPERSTICK
Removal And Installation 5–7

ENGINE COVER
Removal And Installation 5–1

FLOOR PANELS
Removal And Installation 5–2

FUEL TANK
Removal And Installation 5–5

ROPS WINDOWS
Front Window Removal 5–15
Side Window Removal 5–16

RUBBER TRACK IDLER
Assembly 5–13k
Disassembly 5–13i
Parts Identification 5–13h

RUBBER TRACK ROLLER
Assembly 5–14k
Disassembly 5–14i
Parts Identification 5–14h

SEAT AND MOUNTING FRAME
Removal And Installation 5–4

SWING MOTOR COVER
Removal And Installation 5–4

TOOL BOX
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TRACK TENSION
Removal And Installation 5–12
Adjustment 5–11

TRACK FRAME
Disassembly And Assembly 5–13

Continued On Next Page

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Page Number

TRACK IDLER
Assembly 5–13d
Disassembly 5–13b
Parts Identification 5–13a

TRACK ROLLER
Assembly 5–14d
Disassembly 5–14b
Parts Identification 5–14a

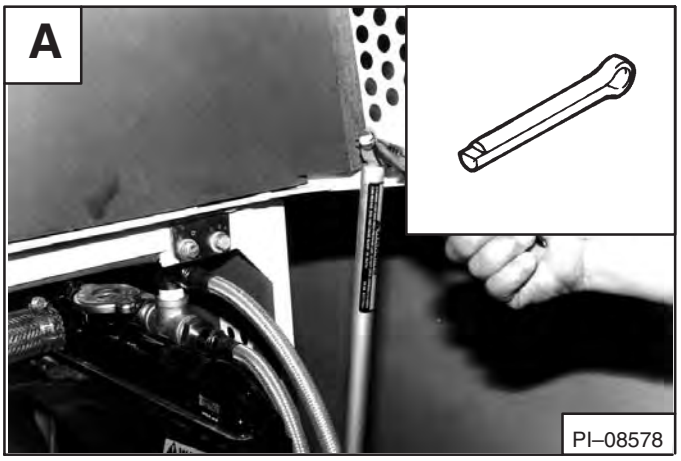
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ENGINE COVER

Removal And Installation

Open the engine cover.

Remove the retainer clip from the rod end pin of the gas cylinder **[A]**.



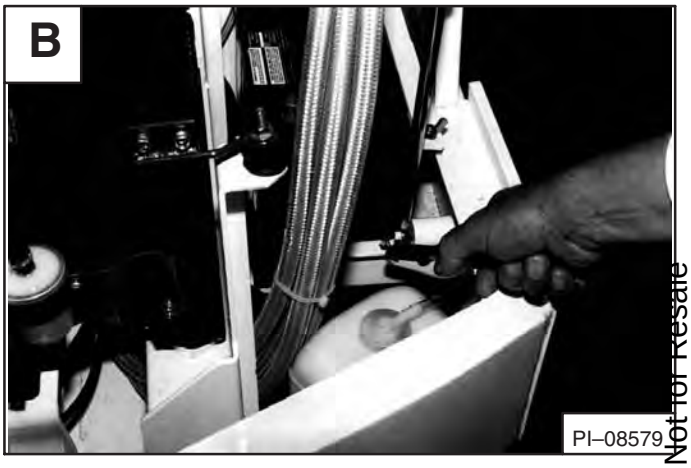
Remove the retainer clip from the base end pin of the gas cylinder **[B]**.

Hold the engine cover and remove the gas cylinder. Close the engine cover.

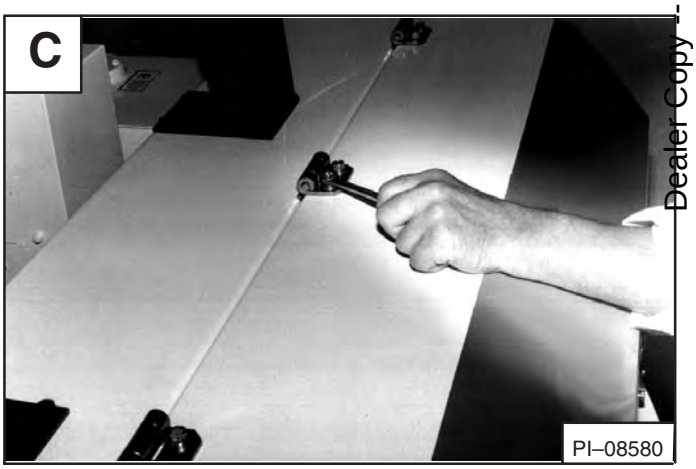
⚠ WARNING

Cylinder contains high pressure gas. Do not open. Opening cylinder can release rod and cause injury or death.

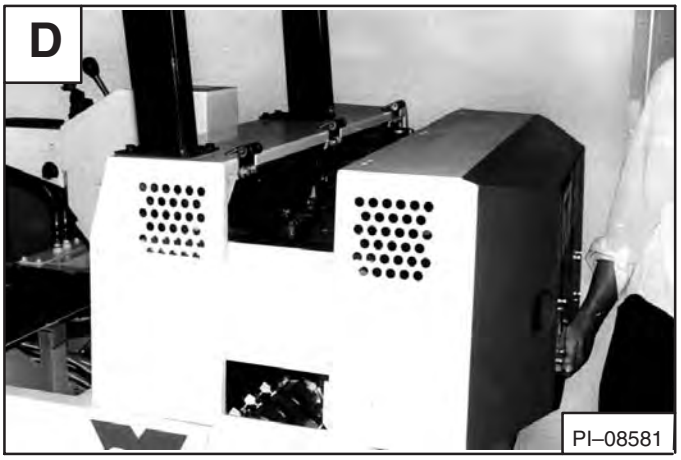
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Remove the bolts from the hinge **[C]**.



Remove the engine cover from the machine **[D]**.

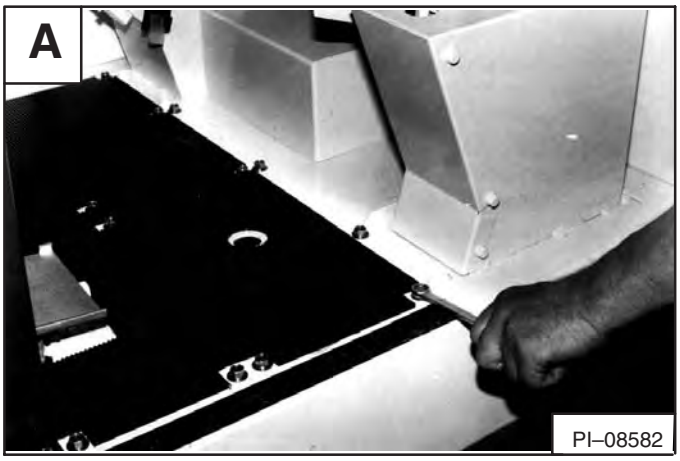


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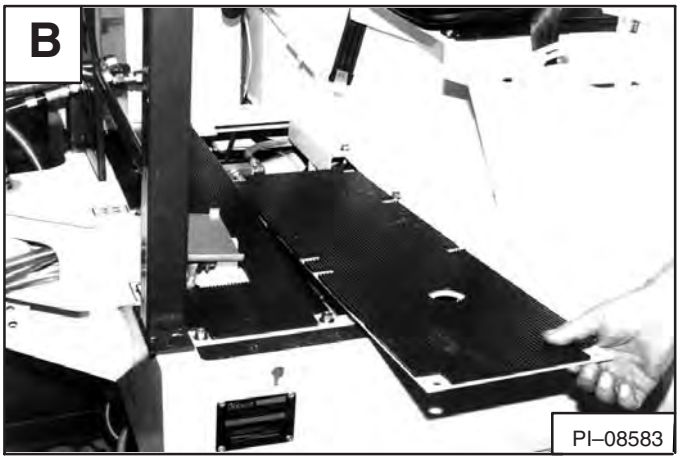
FLOOR PANELS

Removal And Installation

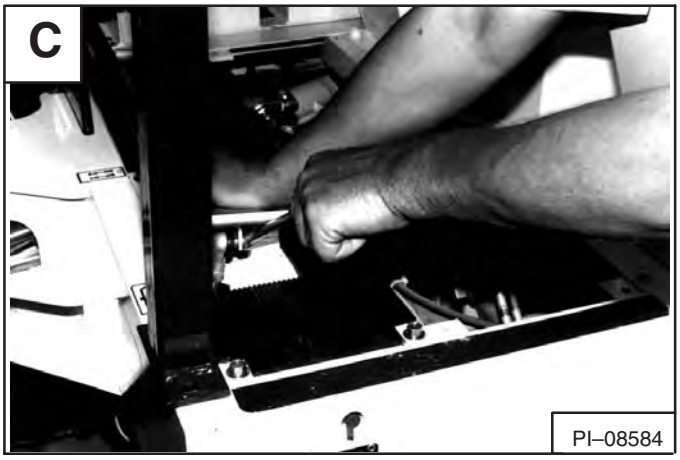
Remove the bolts from the rear floor panel **[A]**.



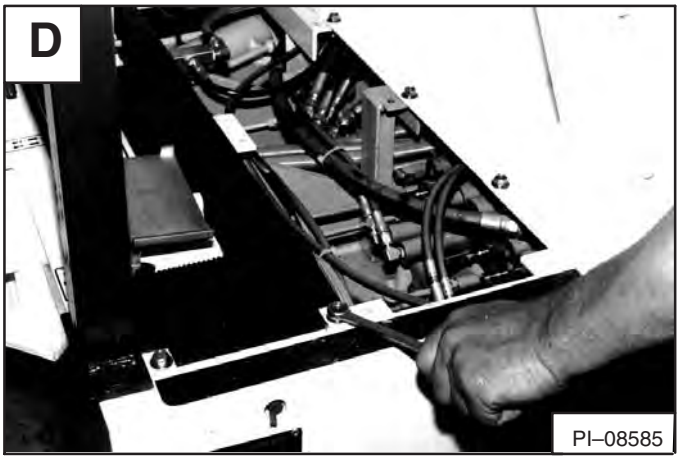
Remove the floor panel **[B]**.



Remove the nut from the foot pedal linkage (both pedals) **[C]**.



Remove the bolts from the front floor panel **[D]**.

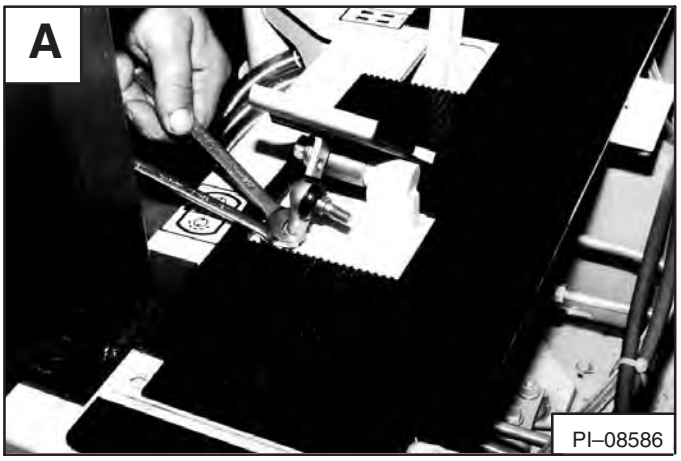


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FLOOR PANELS (Cont'd)

Removal And Installation (Cont'd)

Remove the jam nut from the cable ends (both pedals) **[A]**.



Remove the knobs from the steering levers **[B]**.



Remove the front floor panel **[C]**.

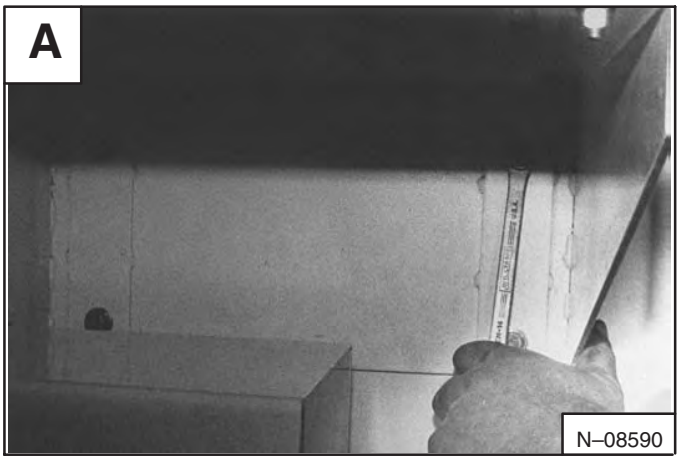


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SEAT AND MOUNTING FRAME

Removal And Installation

Remove the four mounting bolts **[A]**.



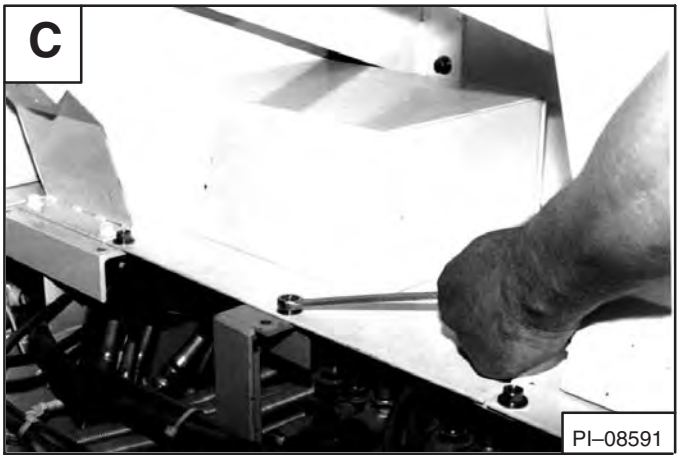
Remove the seat and the mounting frame **[B]**.



SWING MOTOR COVER

Removal And Installation

Remove the bolts from the swing motor cover **[C]**.



Remove the swing motor cover **[D]**.



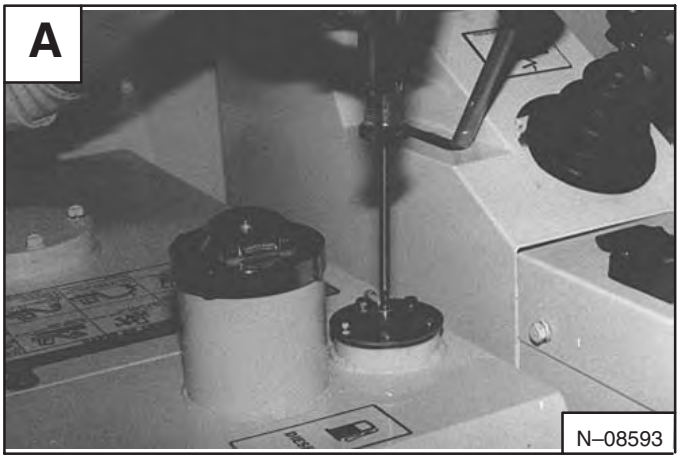
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FUEL TANK

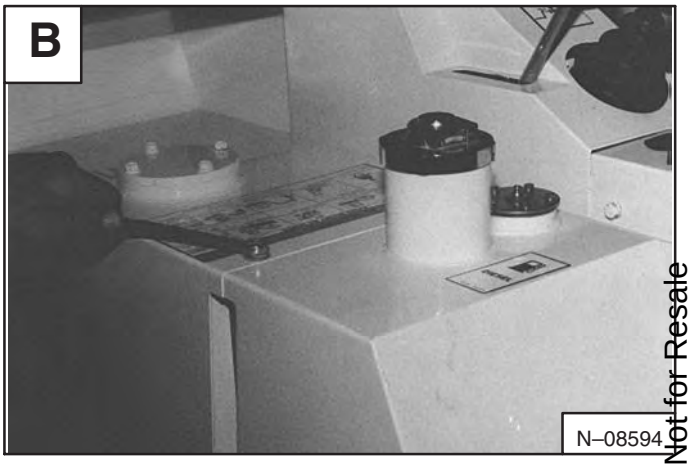
Removal And Installation

Drain the fuel from the tank into a container.

Disconnect the fuel switch wire **[A]**.



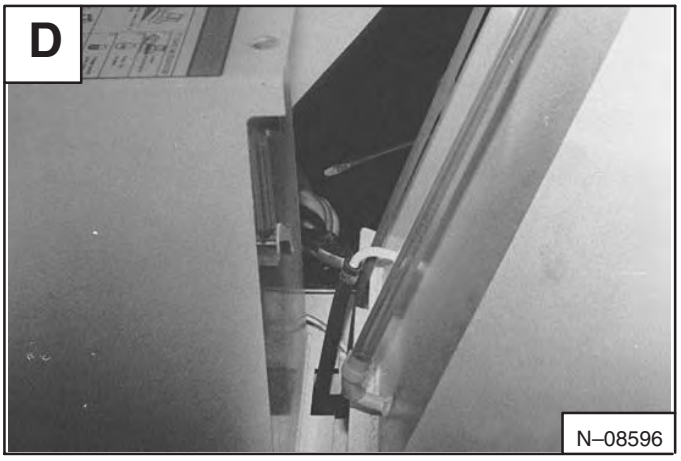
Remove the fuel tank mounting bolts **[B]** & **[C]**.





Lift and move the fuel tank forward. Disconnect the fuel hoses **[D]**.

Remove the fuel tank from the machine.



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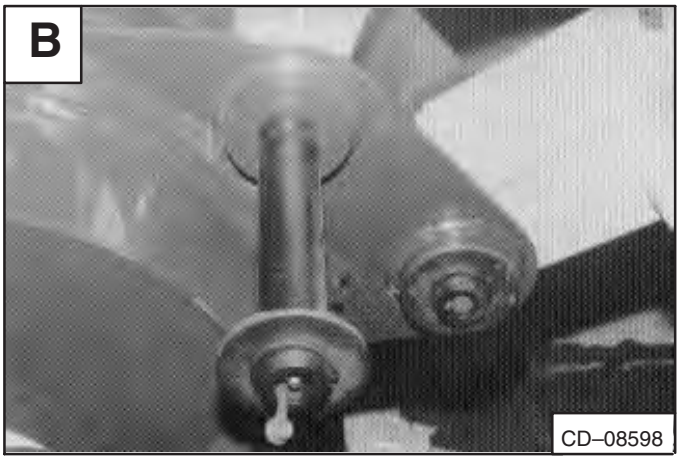
BUCKET

Removal And Installation

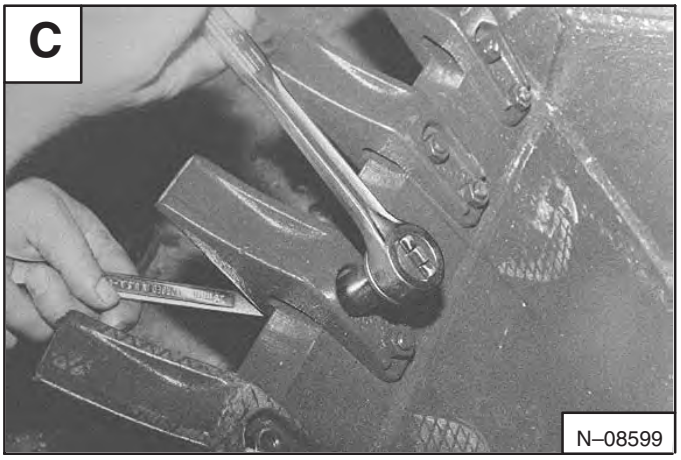
Remove the retainer clips from the bucket pins **[A]**.



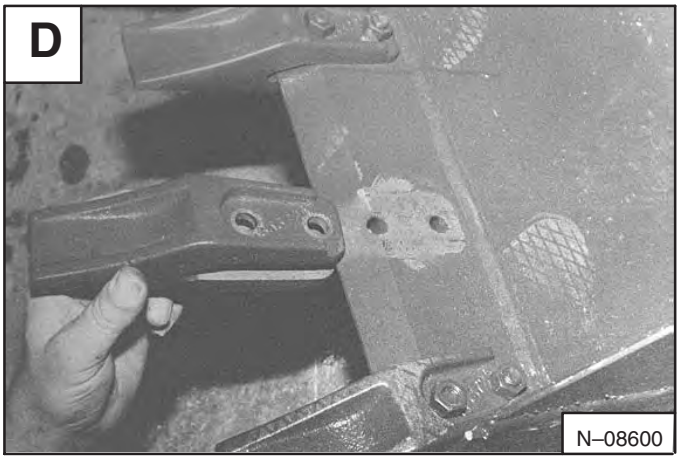
Remove the bucket pins **[B]**.



Remove the nuts and bolts from the bucket teeth **[C]**.



Remove the bucket teeth **[D]**.



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DIPPERSTICK

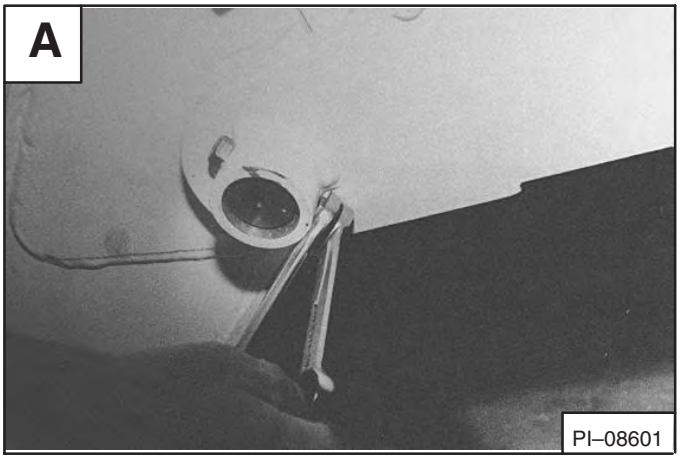
Removal And Installation

Support the dipperstick with a chain hoist.

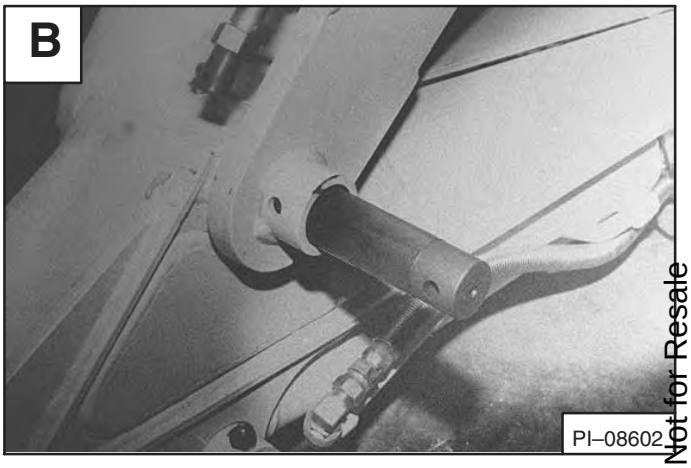
Disconnect the bucket hoses. (See Page 2–10.)

Remove the rod end of the dipperstick cylinder from the dipperstick. (See Page 2–9.)

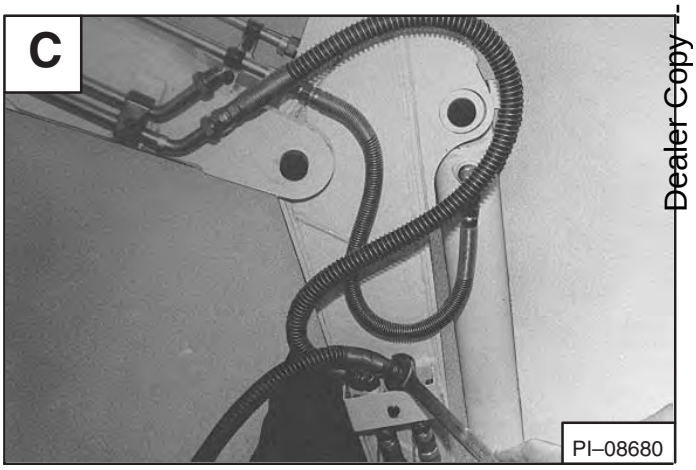
Remove the bolt from the dipperstick pivot pin **[A]**.



Remove the dipperstick pivot pin **[B]**.



Remove the auxiliary hoses from the dipperstick **[C]**.

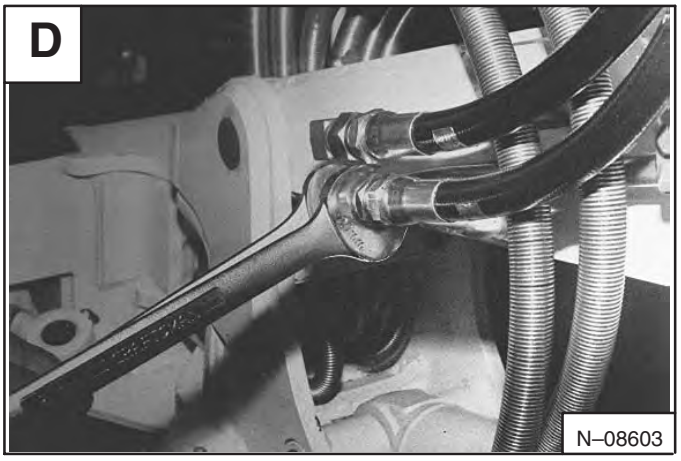


BOOM

Removal And Installation

Support the boom with a chain hoist.

Remove the auxiliary hoses from the boom **[D]**.



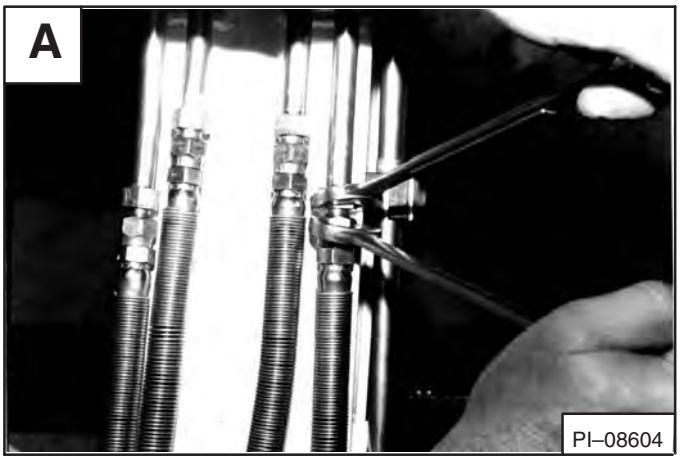
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BOOM (Cont'd)

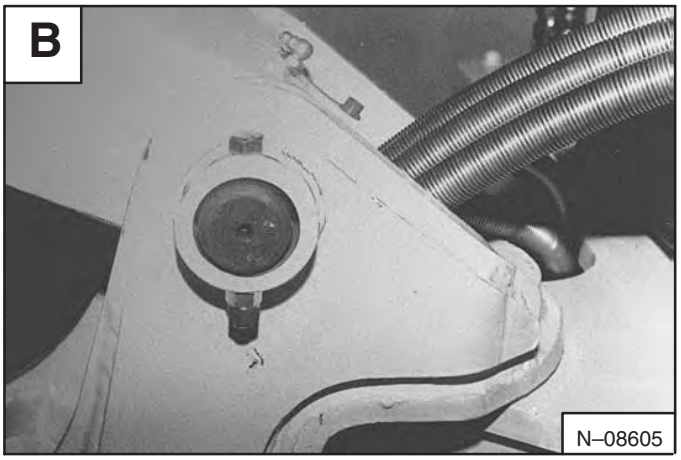
Removal And Installation (Cont'd)

Remove all the cylinder hoses from the tubelines on the boom **[A]**.

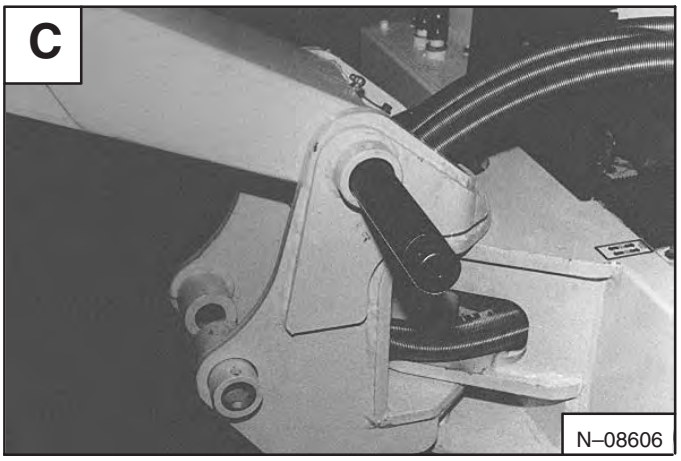
Remove the boom cylinder base end from the boom swing bracket. (See Page 2–9.)



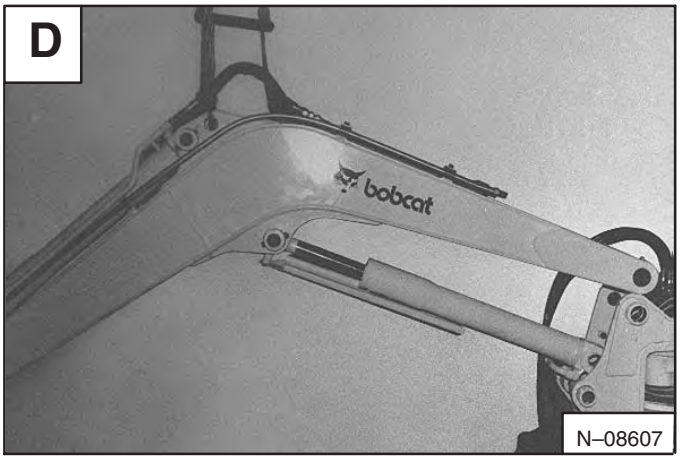
Remove the bolt from the boom pivot pin **[B]**.



Remove the boom pivot pin **[C]**.



Remove the boom **[D]**.



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BOOM SWING BRACKET

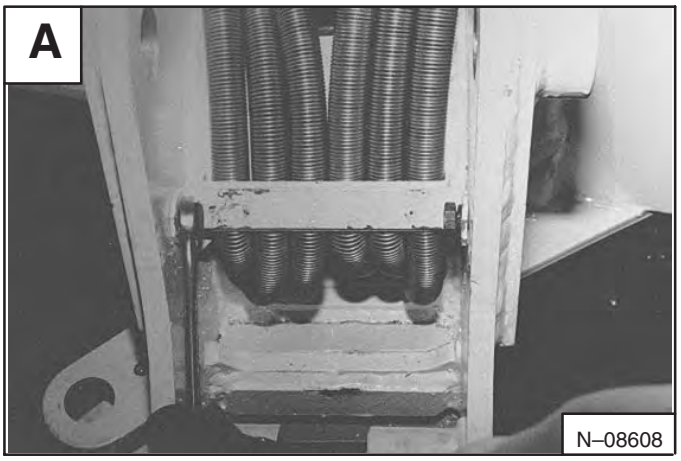
Removal And Installation

Remove the boom and dipperstick. (See Page 5–7.)

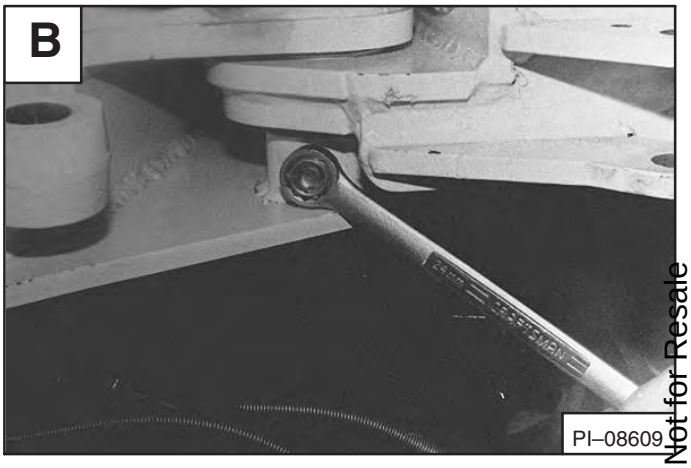
Remove the boom swing cylinder pin. (See Page 2–12.)

Remove the hose retaining bracket **[A]**.

Pull the hoses out of the boom swing bracket.



Remove the retainer bolt and nut from the boom swing bracket pivot pin **[B]**.



Remove the boom swing bracket pivot pin **[C]**.

Remove the boom swing bracket.



Dealer Copy -- Not for Resale

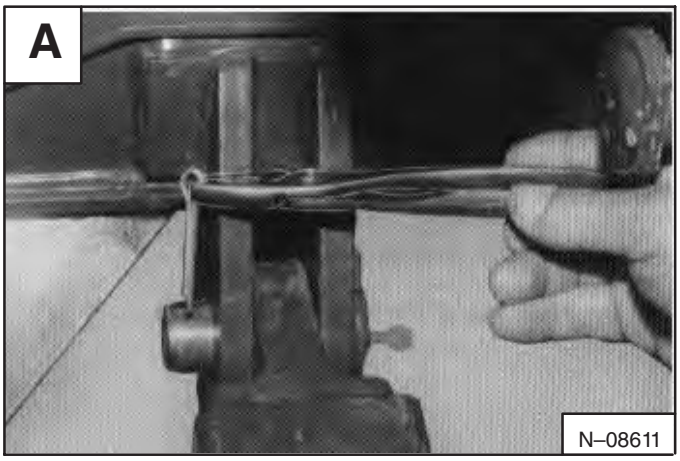
BLADE

Removal And Installation

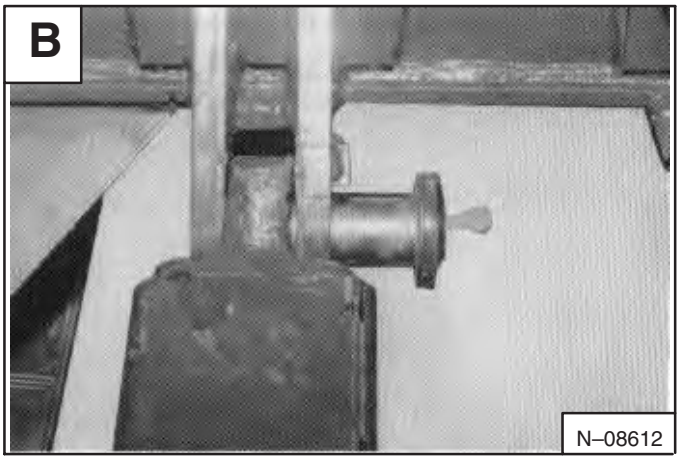
Lower the blade to the ground.

Remove the blade cylinder hoses. (See Page 2–11.)
Remove the cylinder. (See Page 2–11.)

Remove the cotter pins from the blade arm pivot pins (both sides) **[A]**.



Remove the blade arm pivot pins **[B]**.



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TRACK

NOTE: The wear of the pins and bushings on the undercarriage vary with the work conditions and different types of soil conditions. It is necessary to inspect track tension to maintain the correct tension. See *SERVICE SCHEDULE* Page 1–1 for the correct service interval.

Track Tension Adjustment

Raise the machine using the boom and arm as shown in **[A]**.

Raise the blade and install jackstands under the blade and the swing frame **[B]**.

Stop the engine.

⚠ WARNING

AVOID INJURY

Keep fingers and hands out of pinch points when checking the track tension.

W–2142–0189

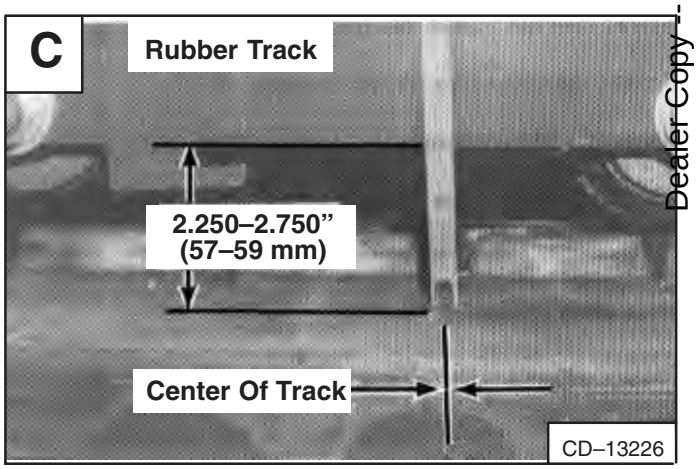
Measure the track sag at the center of the track, between the lower edge of the track frame and the top surface of the track **[C]** & **[D]**.

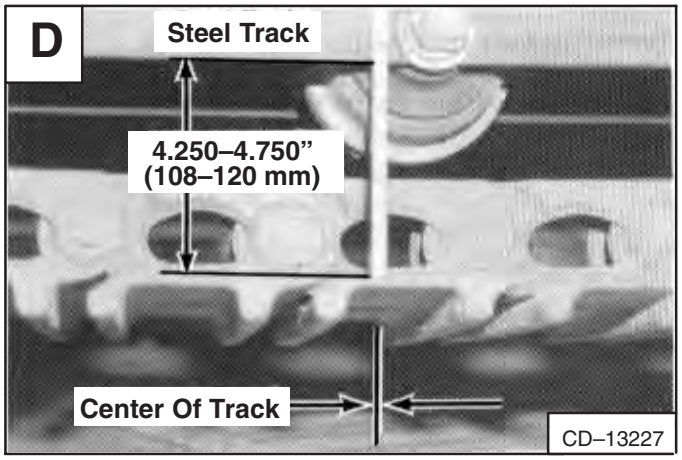
Repeat the procedure for the other side.

Rubber Track . . . 2.250–2.750 inches (57–59 mm) **[C]**.
Steel Track . . . 4.250–4.750 inches (108–120 mm) **[D]**.







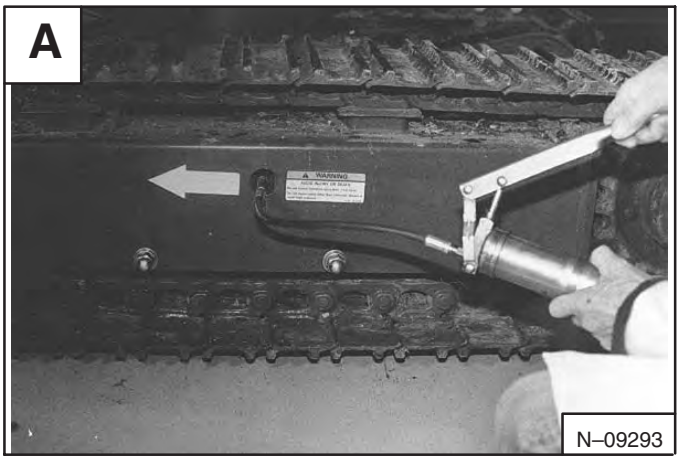


Dealer Copy -- Not for Resale

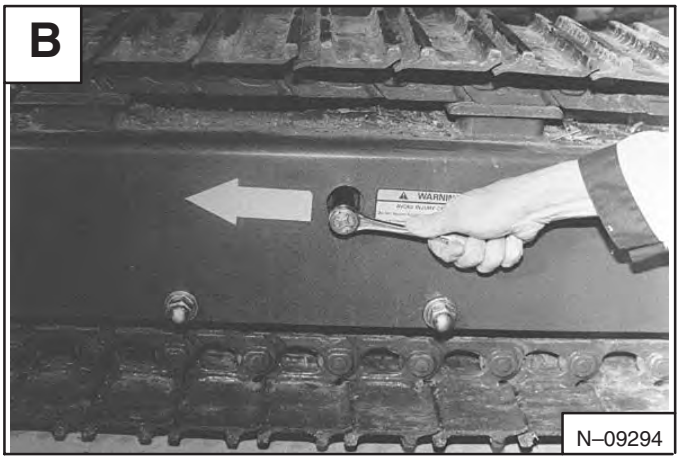
TRACK (Cont'd)

Track Tension Adjustment (Cont'd)

Add grease to the fitting until the track tension is correct **[A]**.



Loosen the fitting (Item 2) **[B]**. one to 1–1/2 turns to release the tension from the track **[B]** & **[C]**.



NOTE: Do not loosen the grease fitting (Item 1) [C].

Repeat the procedure for the opposite side.

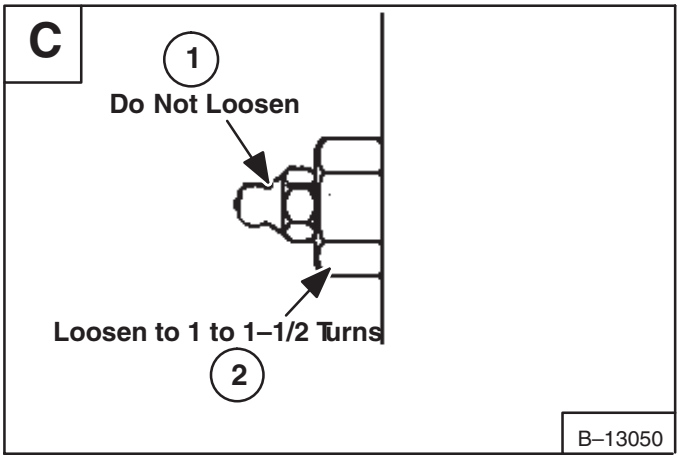
Removal And Installation

Lift and block the side of the machine where the track will be removed. (See Page 5–11 **[A]** & **[B]**.)

Loosen the large hex nut (Item 2) **[C]** from the recoil spring cylinder, 1–1/2 turns maximum.

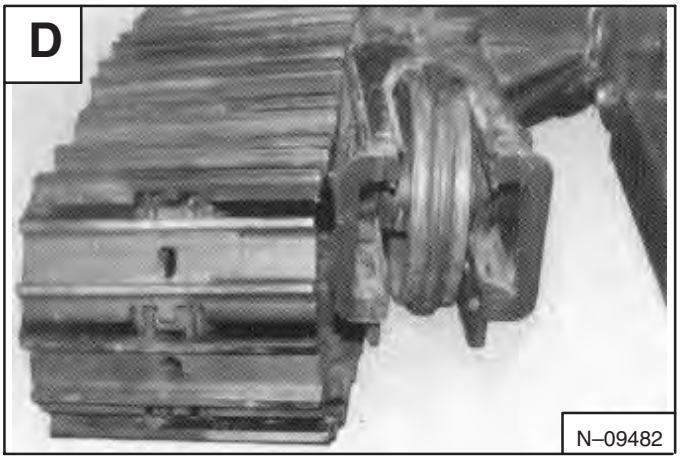
NOTE: Do not loosen the grease fitting (Item 1) [C] .

NOTE: A chain hoist can be used to pull up on the track so all the tension is released from the recoil spring cylinder for easier removal of the track.



Remove the track from the front track idler **[D]**.

Remove the track from the frame and rear drive sprocket.



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TRACK FRAME

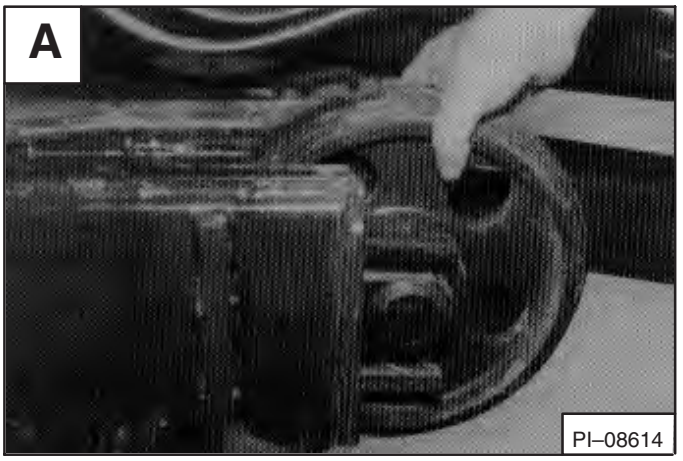
Disassembly And Assembly

Use the following procedure to remove the different parts from the track frame:

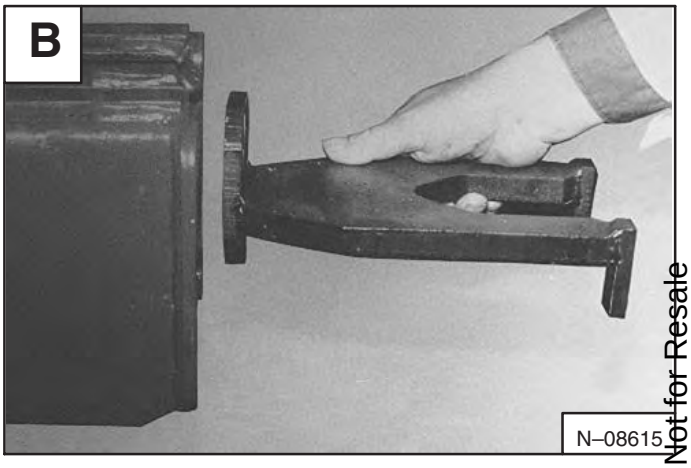
Remove the track. (See Page 5–11.)

Slide the front track idler out of the track frame to remove it **[A]**.

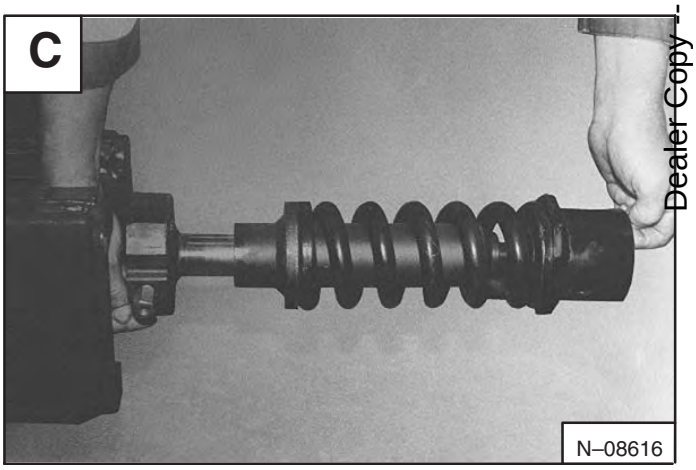
See Page 5–13a or 5–13h for *Disassembly And Assembly* procedure.



Remove the sliding plate **[B]**.



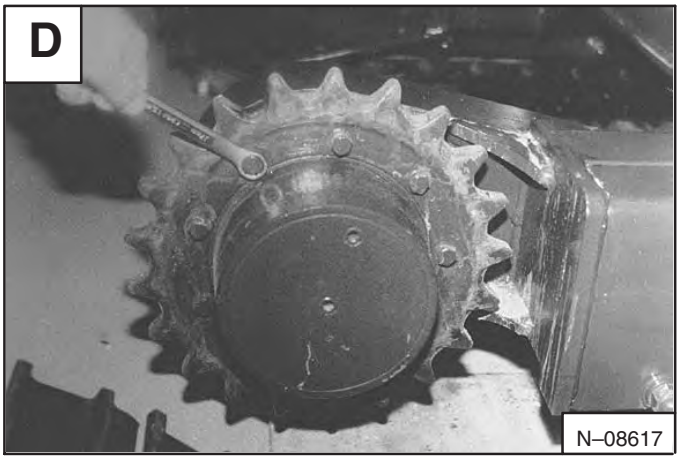
Slide the recoil spring cylinder forward and remove it from the track frame **[C]**.



Remove the drive gear bolts **[D]**.

Installation: Put LOCTITE on the bolts and tighten to 80 ft.–lbs. (108 Nm) torque.

Remove the drive gear from the drive motor and planetary gear assembly.

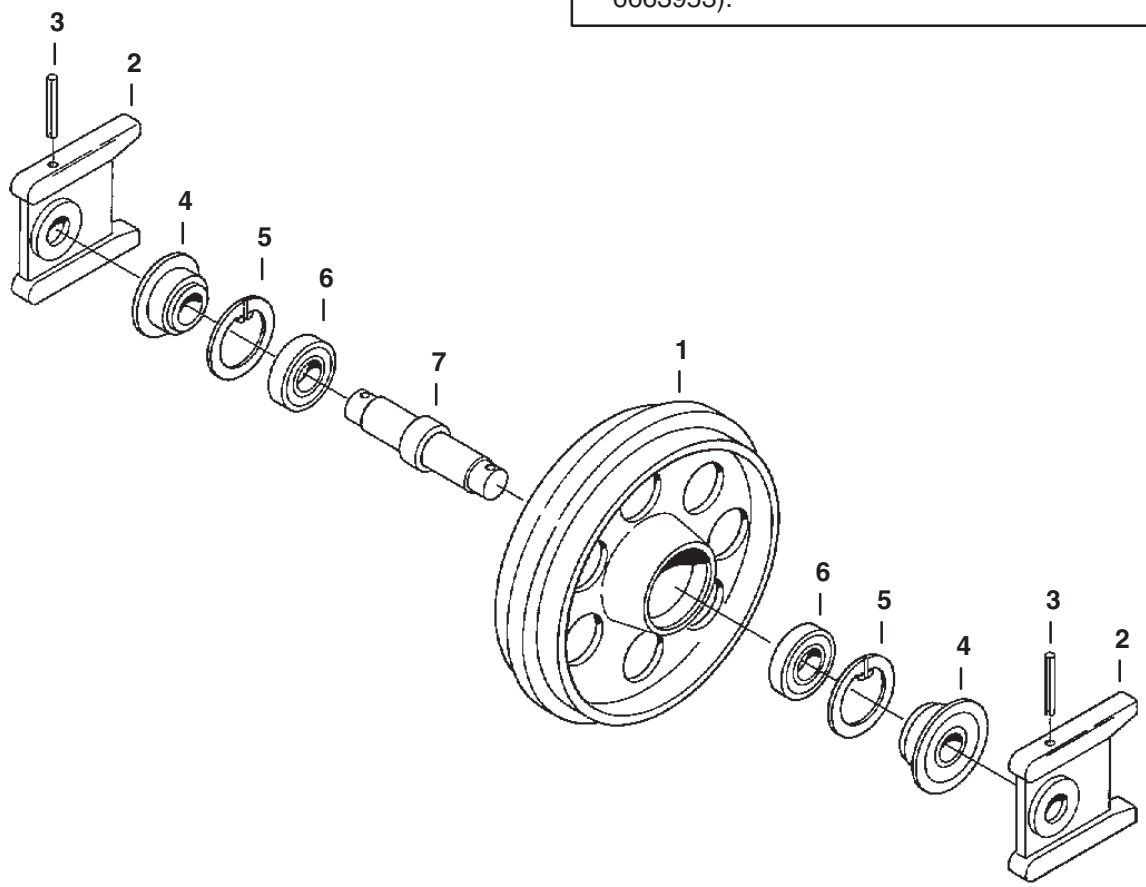


Dealer Copy -- Not for Resale

TRACK IDLER

Parts Identification

NOTE: For use on all steel tracks and on interchangeable rubber track (6663906). (See BTI E–030 for detailed information.) See Page 5–13h for track idler used with rubber tracks (6662301 & 6663953).



D–01960

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TRACK IDLER

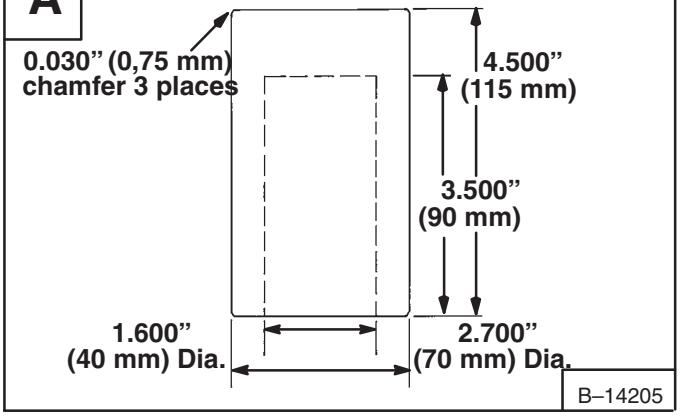
Ref.	Description
1.	Idler
2.	Block
3.	Pin
4.	Seal
5.	Snap Ring
6.	Bearing
7.	Shaft

TRACK IDLER (Cont'd)

The following tools must be fabricated for this procedure:

1. Driver Tool – See **[A]**.
2. Support Fixture – Tube, 3.0 inches ID x 0.250 inch wall x 6.0 inches long.

A



B–14205

Disassembly

Remove the roll pin and block from each end of the shaft **[B]**.

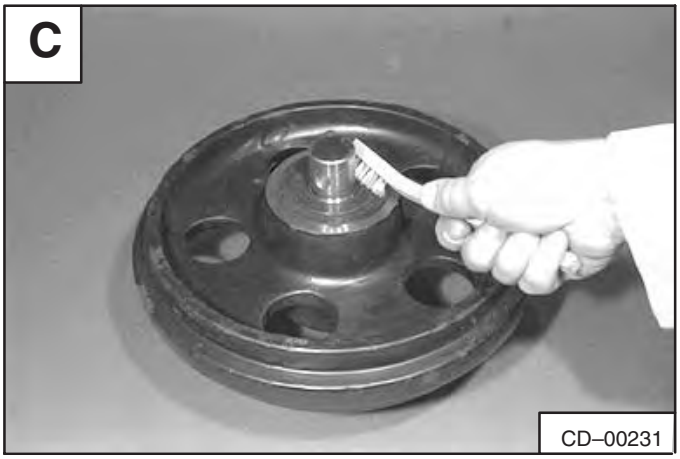
B



CD–00230

Use a wire brush to remove any corrosion or paint from both ends of the exposed shaft that could affect seal removal or damage the new seal during installation **[C]**.

C

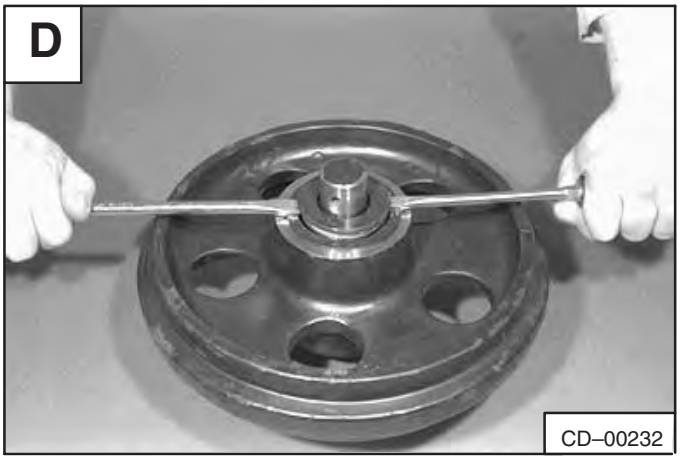


CD–00231

Apply penetrating oil to both ends of the exposed shaft to ease removal of the inner part of the seal.

Remove the inner part of the seal using two screwdrivers **[D]**.

D



CD–00232

Dealer Copy -- Not for Resale

TRACK IDLER (Cont'd)

Disassembly (Cont'd)

Remove the outer part of the seal from the idler using two screwdrivers **[A]**.

Pour the oil out of the idler . Discard the oil in an appropriate manner.

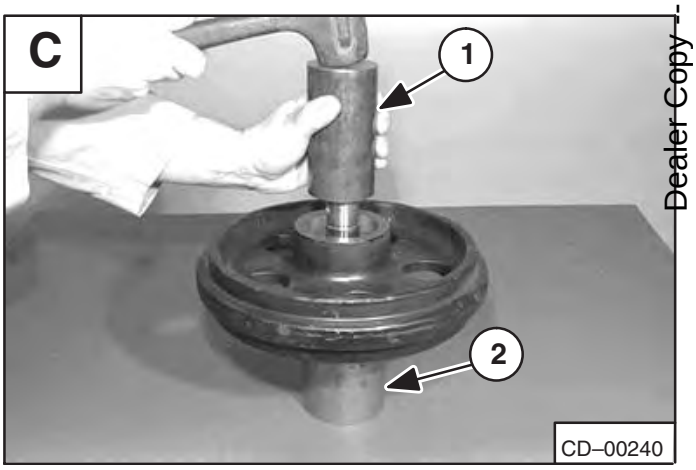
Turn the idler assembly over and remove the other seal.



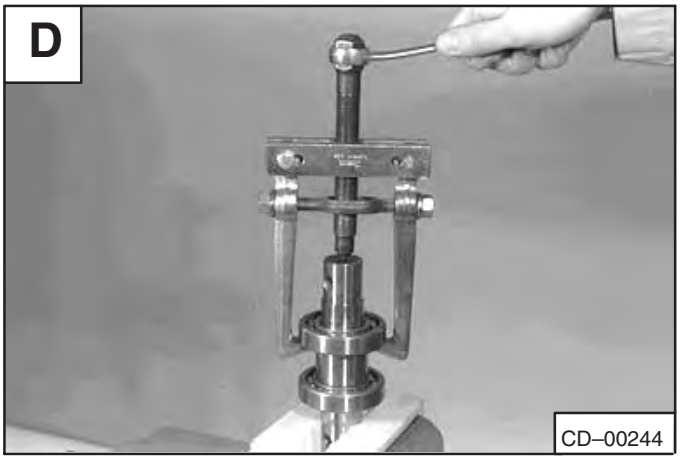
Remove the snap ring from each side of the idler **[B]**.



Using the fabricated driver tool (Item 1) **[C]** and support fixture (Item 2) **[C]**, press or drive the shaft and bearing assembly out of the idler.



Inspect the bearings for rust or for rough spots. The bearings must turn freely. If any damage is found, replace the bearings. If replacement of the bearings is necessary, use a two or three jaw puller, remove the two bearings from the shaft **[D]**.



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TRACK IDLER (Cont'd)

Assembly

Remove all paint and corrosion from the seal surface on both sides of the idler **[A]**.

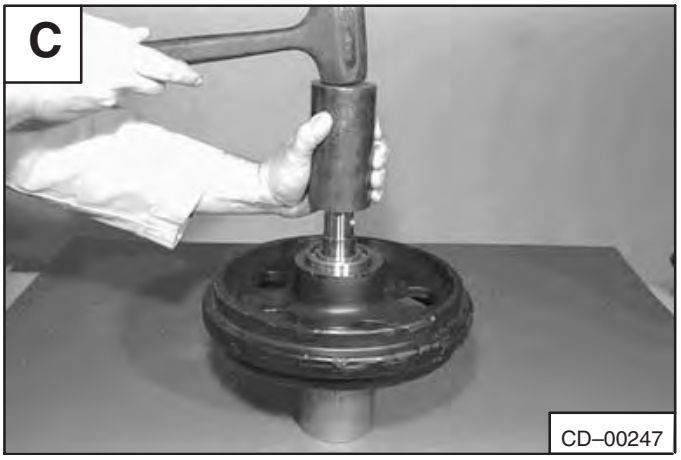
Be sure all parts are clean before assembly.



Using the driver tool, install a new bearing, with the numbered side upward, onto the shaft **[B]**. Press only on the inner diameter of the bearing.



Using the driver tool, install the shaft and bearing assembly into the idler **[C]**.



Install the snap ring **[D]**.



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TRACK IDLER (Cont'd)

Assembly (Cont'd)

Turn the idler assembly over.

Using the driver tool, install the other bearing, with the numbered side upward, into the idler **[A]**.



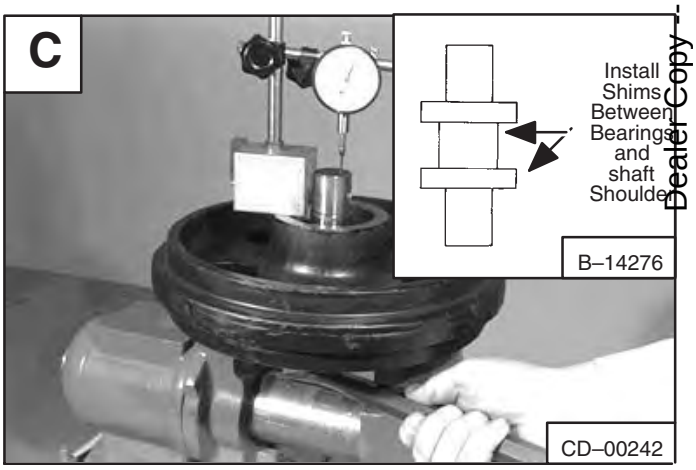
Install the snap ring **[B]**.



Using a dial indicator, check the endplay of the shaft **[C]**.

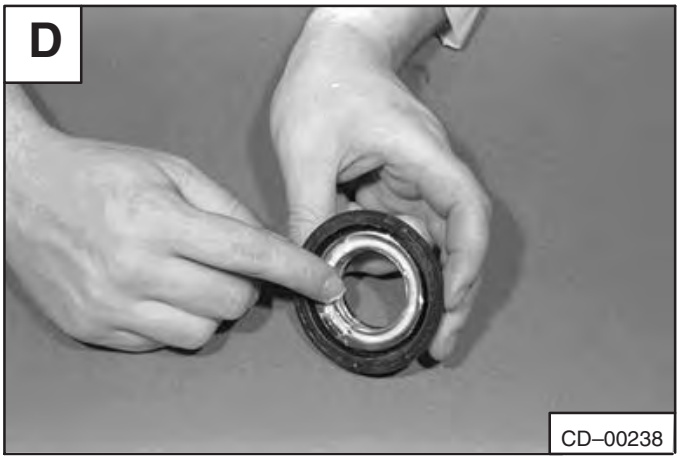
If the endplay is greater than 0.030 inch (0,76 mm) then the bearing must be shimmed.

Cut a shim from the necessary thickness shim stock an install the shim between the bearing and the shoulder on the shaft.



Separate the inner and outer halves of the seal.

Apply grease to the grooves on the outer part of a new seal **[D]**.

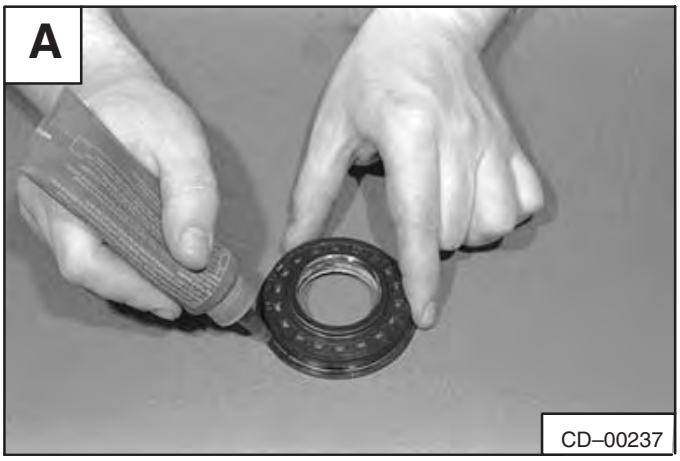


Dealer Copy -- Not for Resale

TRACK IDLER (Cont'd)

Assembly (Cont'd)

Apply a small bead of high temperature silicone sealant around the flange surface of the seal **[A]**.



Using the driver tool, install the outer part of the new seal into the idler **[B]**.

NOTE: The inner and outer parts of the seal must be installed separately so the air will escape from under the seal.



Using the driver tool, install the inner part ofthe new seal over the shaft **[C]**.

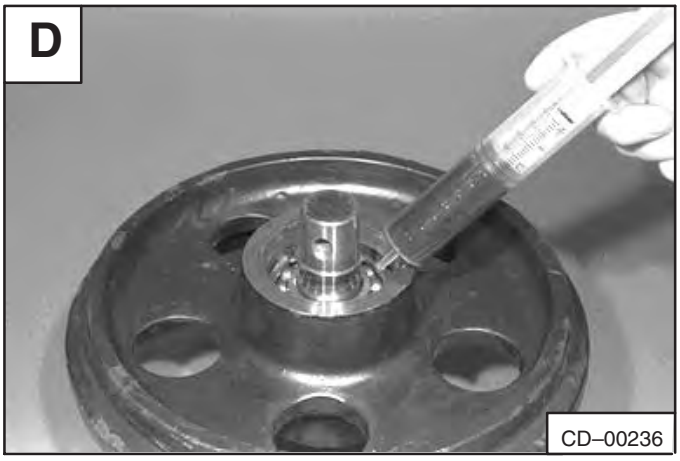
NOTE: The inner part of the seal must be pressed down level with the outer part of the seal to seal properly.



Turn the idler assembly over. Using a syringe add 80 cc of SAE 10W/30 oil to the assembly **[D]**.

Repeat Page 5–13e **[D]** thru Page 5–13f **[C]** to install the remaining seal.

Check for leaks.



Dealer Copy -- Not for Resale

TRACK IDLER (Cont'd)

Assembly (Cont'd)

Install the roll pin and block on each end of the shaft**[A]**.

The two blocks must point the same direction.

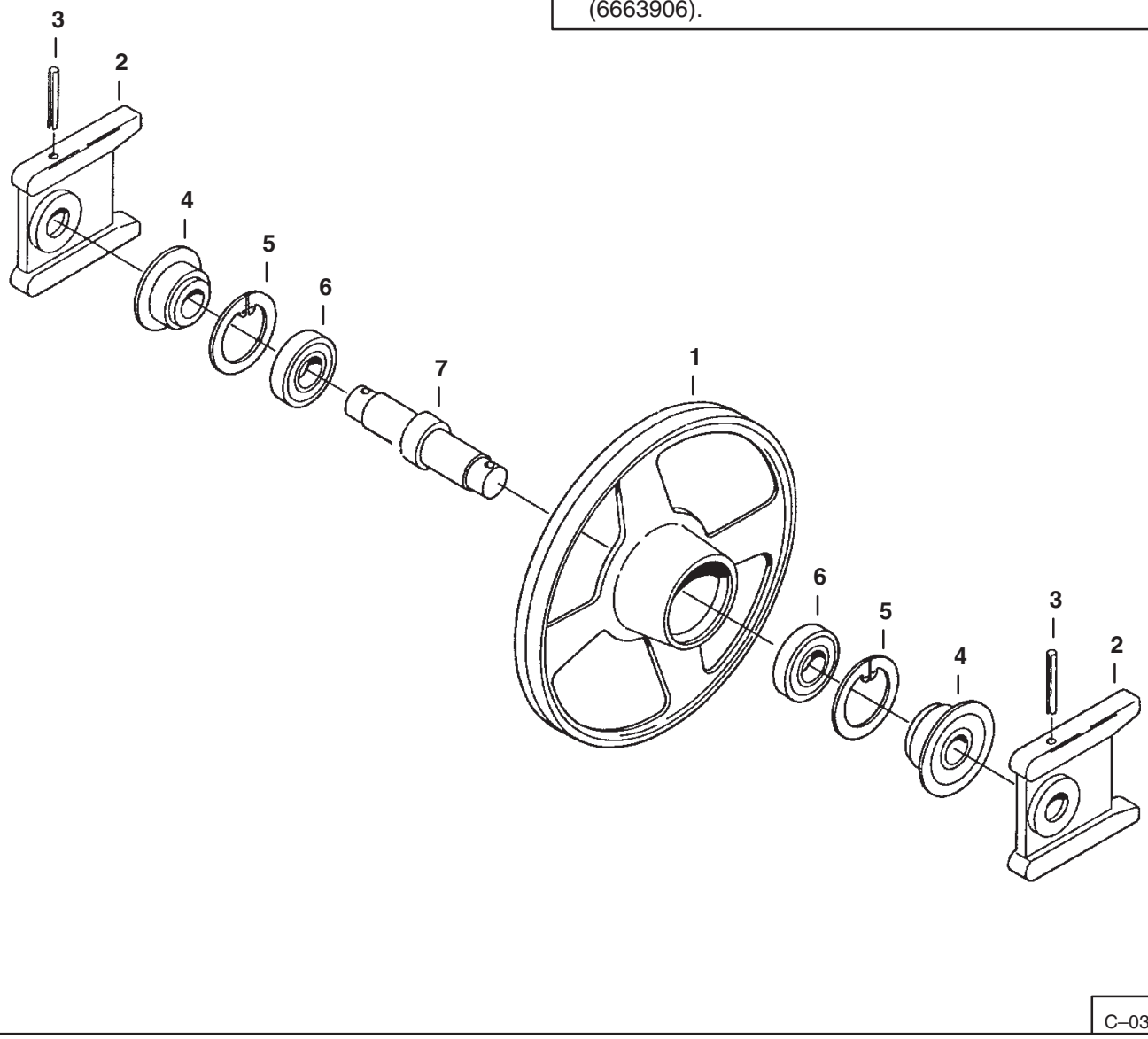


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RUBBER TRACK IDLER

Parts Identification

NOTE: For use on all rubber tracks (6662301 and 6663953) only. (See BTI E–030 for detailed information.) See Page 5–13a for track idler used with steel tracks and interchangeable rubber track (6663906).



TRACK IDLER

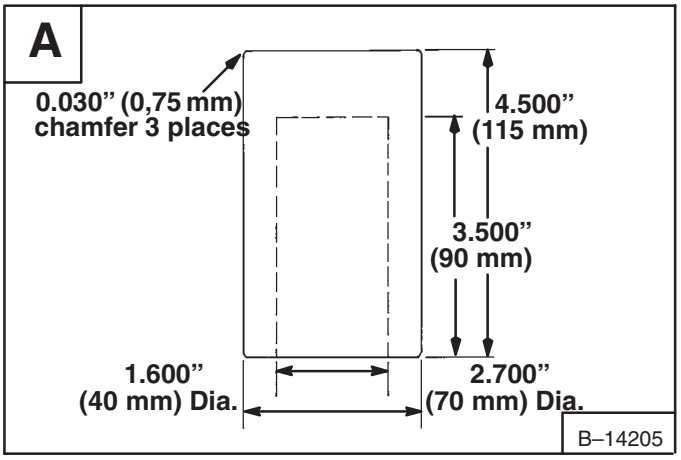
Ref.	Description
1.	Idler
2.	Block
3.	Pin
4.	Seal
5.	Snap Ring
6.	Bearing
7.	Shaft

Dealer Copy -- Not for Resale

RUBBER TRACK IDLER (Cont'd)

The following tools must be fabricated for this procedure:

1. Driver Tool – See **[A]**.
2. Support Fixture – tubing, 3.0 inches ID x 0.250 inch wall x 6.0 inches long.



Disassembly

Remove the roll pin and block from each end of the shaft **[B]**.



Use a wire brush to remove any corrosion or paint from both ends of the exposed shaft that could affect seal removal or damage the new seal during installation **[C]**.



Apply penetrating oil to both ends of the exposed shaft to ease removal of the inner part of the seal.

Remove the inner part of the seal using two screwdrivers **[D]**.



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RUBBER TRACK IDLER (Cont'd)

Disassembly (Cont'd)

Remove the outer part of the seal from the idler using two screwdrivers **[A]**.

Pour the oil out of the idler . Discard the oil in an appropriate manner.

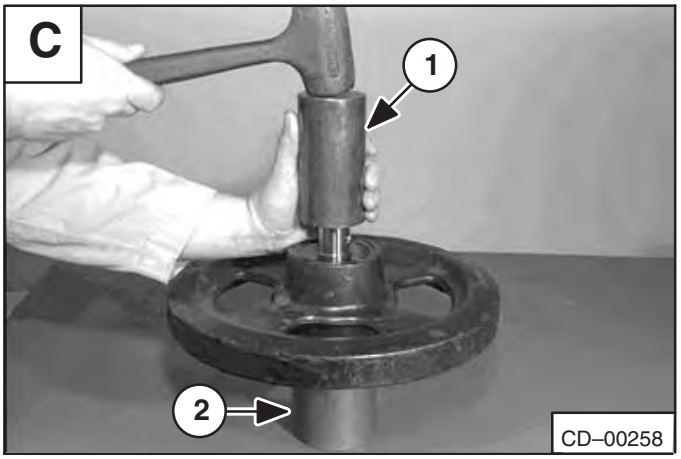
Turn the idler assembly over and remove the other seal.



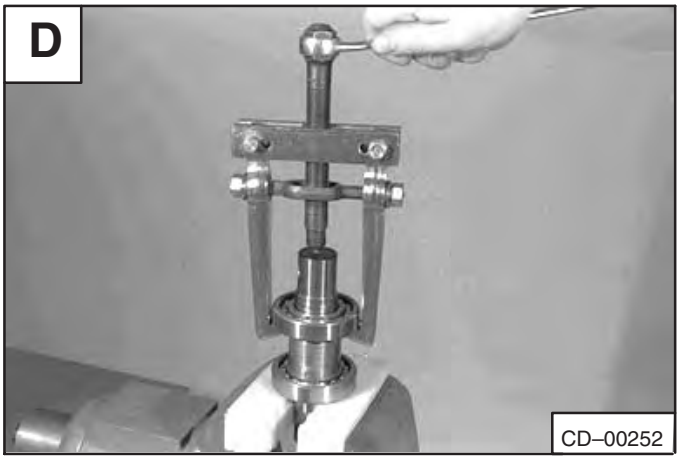
Remove the snap ring from each side of the idler **[B]**.



Using the fabricated driver tool (Item 1) **[C]** and support fixture (Item 2) **[C]**, press or drive the shaft and bearing assembly out of the idler.



Inspect the bearings for rust or for rough spots. The bearings must turn freely. If any damage is found, replace the bearings. If replacement of the bearings is necessary, use a two or three jaw puller, remove the two bearings from the shaft **[D]**.



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RUBBER TRACK IDLER (Cont'd)

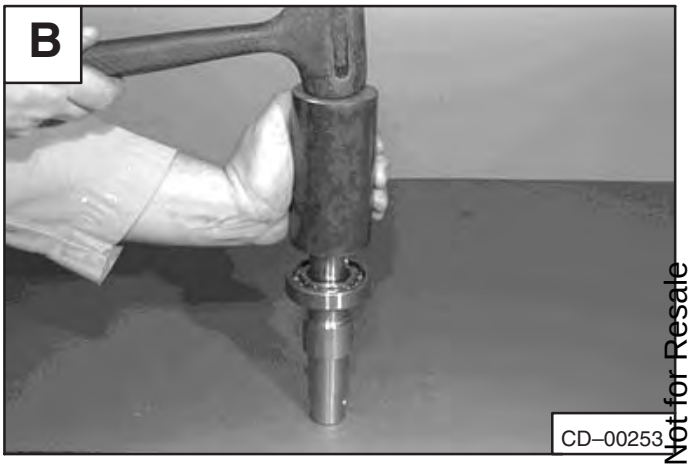
Assembly

Remove all paint and corrosion from the seal surface on both sides of the idler **[A]**.

Be sure all parts are clean before assembly.



Using the driver tool, install a new bearings, with the numbered side upward, onto the shaft **[B]**. Press only on the inner diameter of the bearing.



Using the driver tool, install the shaft and bearing assembly into the idler **[C]**.



Install the snap ring **[D]**.



Dealer Copy -- Not for Resale

RUBBER TRACK IDLER (Cont'd)

Assembly (Cont'd)

Turn the idler assembly over.

Using the driver tool, install the other bearing, with the numbered side upward, into the idler **[A]**.



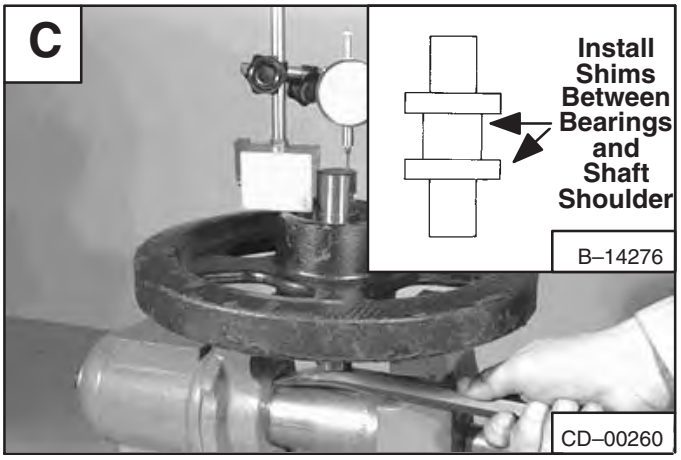
Install the snap ring **[B]**.



Using a dial indicator, check the endplay of the shaft **[C]**.

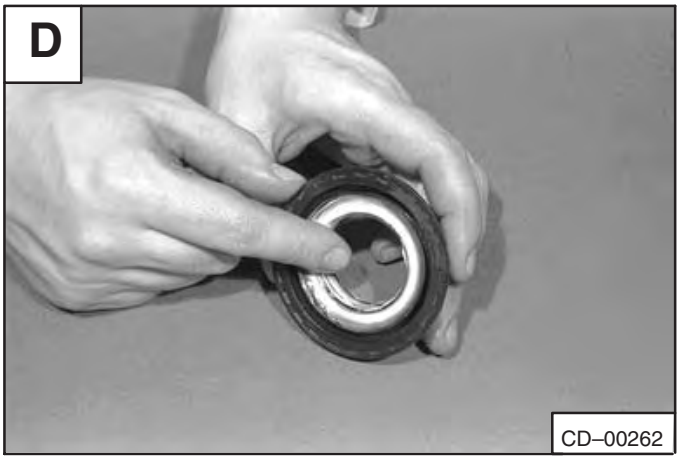
If the endplay is greater than 0.030 inch (0,76 mm) then the bearing must be shimmed.

Cut a shim from the necessary thickness shim stock and install the shim between the bearing and the shoulder on the shaft.



Separate the inner and outer halves of the seals.

Apply grease to the grooves on the outer part of a new seal **[D]**.

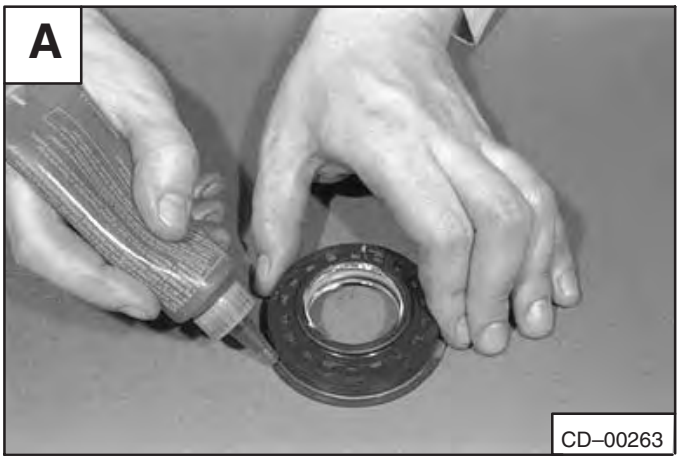


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RUBBER TRACK IDLER (Cont'd)

Assembly (Cont'd)

Apply a small bead of high temperature silicone sealant around the flange surface of the seal **[A]**.



Using the driver tool, install the outer part of the new seal into the idler **[B]**.

NOTE: The inner and outer parts of the seal must be installed separately so the air will escape from under the seal.



Using the driver tool, install the inner part ofthe new seal over the shaft **[C]**.

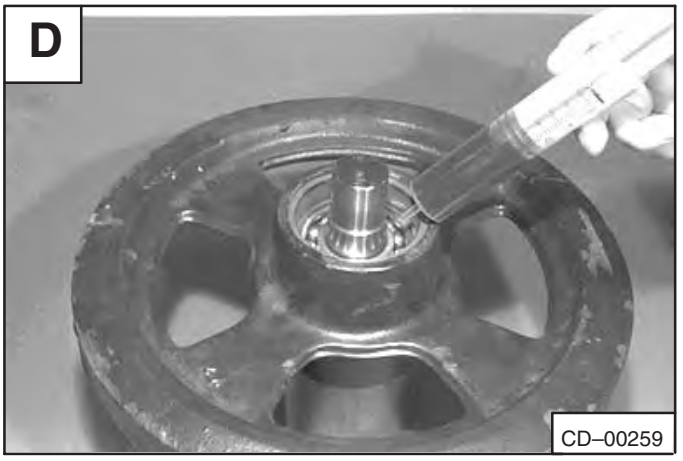
NOTE: The inner part of the seal must be pressed down level with the outer part of the seal to seal properly.



Turn the idler assembly over. Using a syringe add 50 cc of SAE 10W/30 oil to the assembly **[D]**.

Repeat Page 5–13l **[D]** thru Page 5–13m **[C]** to install the remaining seal.

Check for leaks.



Dealer Copy -- Not for Resale

RUBBER TRACK IDLER (Cont'd)

Assembly (Cont'd)

Install the roll pin and block on each end of the shaft**[A]**.

The two blocks must point the same direction.

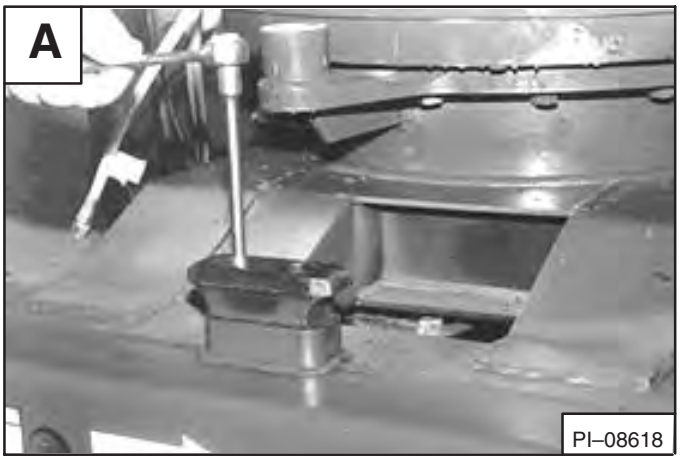


Dealer Copy -- Not for Resale

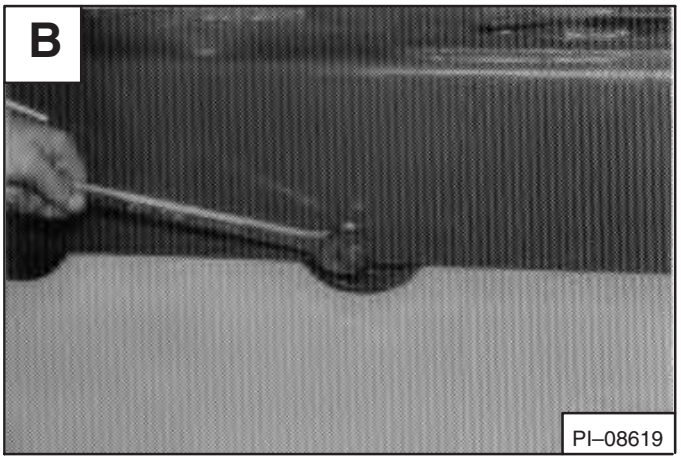
TRACK FRAME (Cont'd)

Disassembly And Assembly (Cont'd)

Remove the guide block bolts **[A]**.

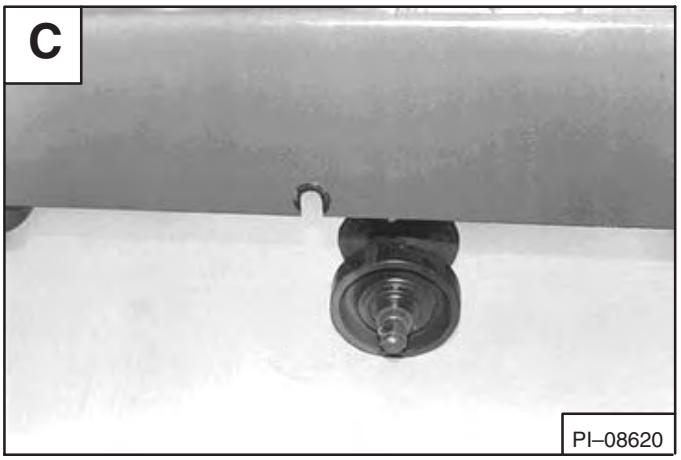


Loosen the nuts at the track roller on both sides of the track frame **[B]**.



Remove the track roller **[C]**.

See Page 5–14a or 5–14h for disassembly and assembly procedure.



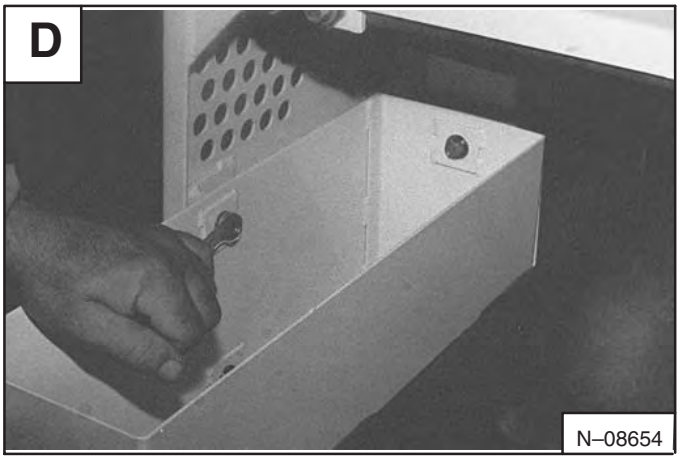
TOOL BOX

Removal And Installation

Raise the engine cover.

Remove the mounting bolts from the tool box **[D]**.

Remove the tool box.

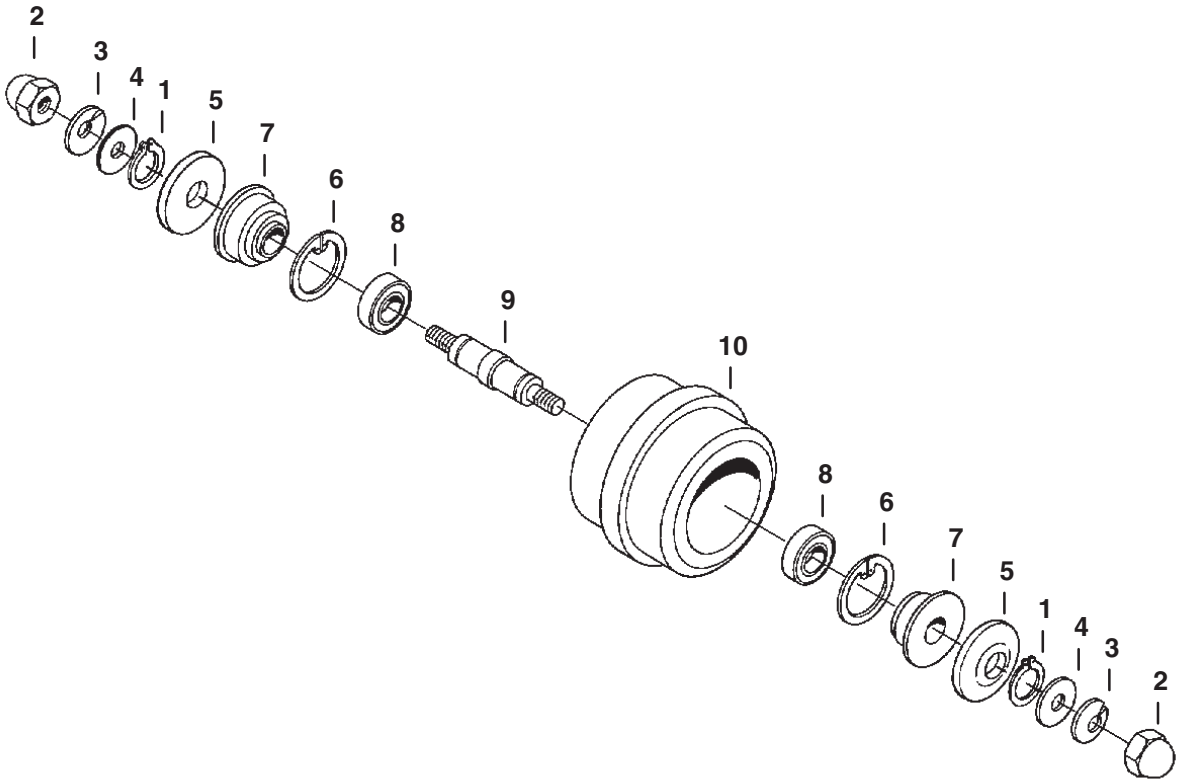


Dealer Copy -- Not for Resale

TRACK ROLLER

Parts Identification

NOTE; For use on all steel tracks and on interchangeable rubber track (6663906). (See BTI E–030 for detailed information.) See Page 5–14h for track roller used with rubber tracks (6662301 & 6663953).



D–01958

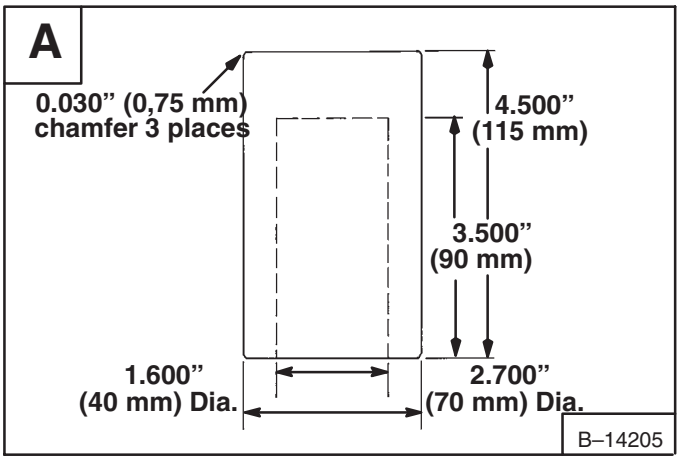
Ref.	Description	Ref.	Description
1.	Spacer	6.	Snap Ring
2.	Nut	7.	Seal
3.	Washer	8.	Bearing
4.	Washer	9.	Shaft
5.	Snap Ring	10.	Roller

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TRACK ROLLER (Cont'd)

The following tools must be fabricated for this procedure:

1. Driver Tool – See **[A]**.
2. Support Fixture – Tubing, 3.0 inch ID x 0.250 inch wall x 6 inches long.



Disassembly

Remove the snap ring and spacer from each end of the shaft **[B]**.



Use a wire brush to remove any corrosion or paint from both ends of the exposed shaft that could affect seal removal or damage the new seal during installation **[C]**.



Apply penetrating oil to both ends of the exposed shaft to ease removal of the inner part of the seal.

Remove the inner part of the seal using two screwdrivers **[D]**.



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TRACK ROLLER (Cont'd)

Disassembly (Cont'd)

Remove the outer part of the seal from the roller using two screwdrivers **[A]**.

Pour the oil out of the roller. Discard the oil in an appropriate manner.

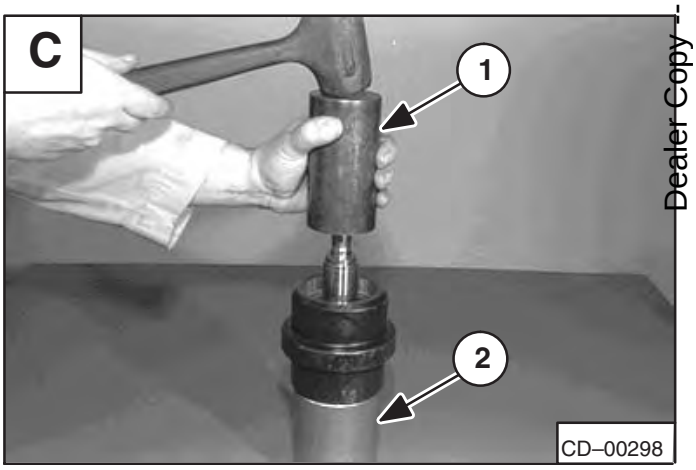
Turn the roller assembly over and removethe other seal.



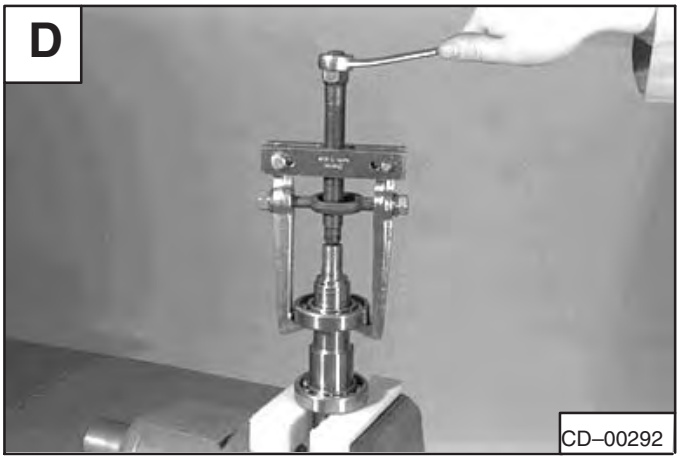
Remove the snap ring from each side of the roller **[B]**.



Using the fabricated driver tool (Item 1) **[C]** and support fixture (Item 2) **[C]**, press or drive the shaft and bearing assembly out of the roller.



Inspect the bearings for rust or for rough spots. The bearings must turn freely. If any damage is found, replace the bearing. If replacement of the bearings is necessary, use a two or three jaw puller, remove the two bearings from the shaft **[D]**.



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TRACK ROLLER (Cont'd)

Assembly

Remove all paint and corrosion from the seal surface on both sides of the roller **[A]**.

Be sure all parts are clean before assembly.



Using the driver tool, install a new bearing, with the numbered side upward, onto the shaft **[B]**. Press only on the inner diameter of the bearing.



Using the driver tool, install the shaft and bearing assembly into the roller **[C]**.



Install the snap ring **[D]**.



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TRACK ROLLER (Cont'd)

Assembly (Cont'd)

Turn the roller assembly over.

Using the driver tool, install the other bearing, with the numbered side upward, into the roller **[A]**.



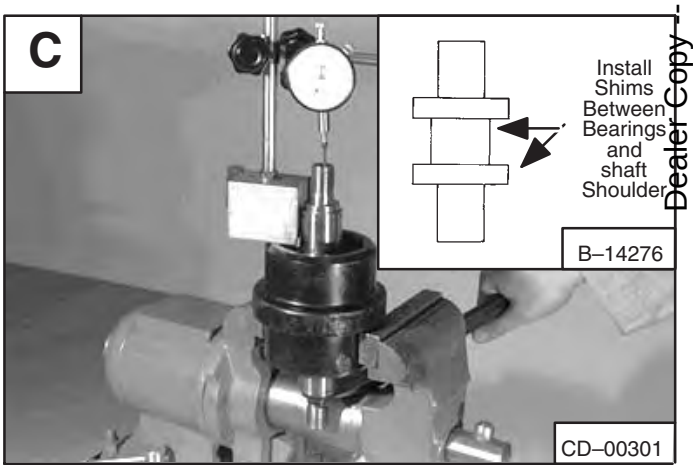
Install the snap ring **[B]**.



Using a dial indicator, check the endplay of the shaft **[C]**.

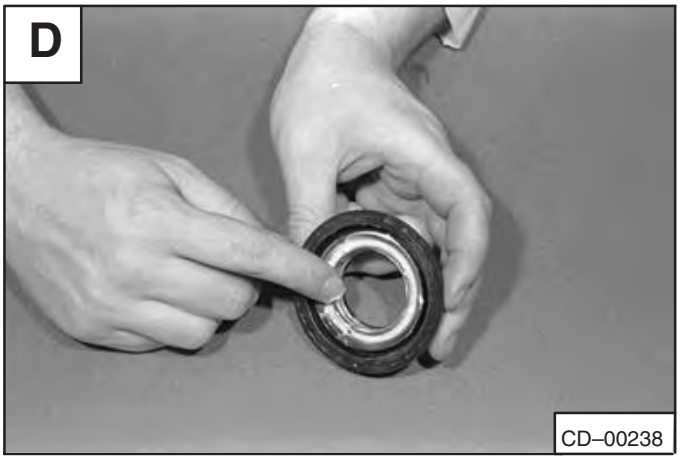
If the endplay is greater than 0.030 inch (0,76 mm) then the bearing must be shimmed.

Cut a shim from the necessary thickness shim stock and install the shim between the bearing and the shoulder on the shaft.



Separate the inner and outer halfs of the seal.

Apply grease to the grooves on the outer part of a new seal **[D]**.

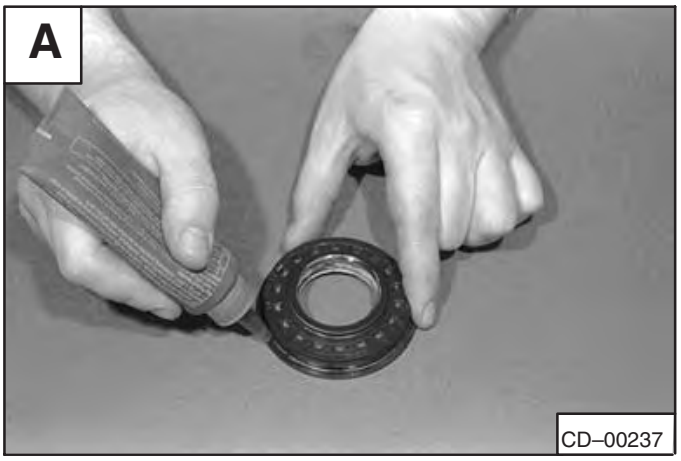


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TRACK ROLLER (Cont'd)

Assembly (Cont'd)

Apply a small bead of high temperature silicone sealant around the flange surface of the seal **[A]**.



Using the driver tool, install the outer part of the new seal into the roller **[B]**.

NOTE: The inner and outer parts of the seal must be installed separately so the air will escape from under the seal.



Using the driver tool, install the inner part ofthe new seal over the shaft **[C]**.

NOTE: The inner part of the seal must be pressed down level with the outer part of the seal to seal properly.



Turn the roller assembly over Using a syringe add 100 cc of SAE 10W/30 oil to the assembly **[D]**.

Repeat Page 5–14e **[D]** thru Page 5–14f **[C]** to install the remaining seal.

Check for leaks.



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TRACK ROLLER (Cont'd)

Assembly (Cont'd)

Install the spacer and the snap ring on each end of the shaft **[A]**.

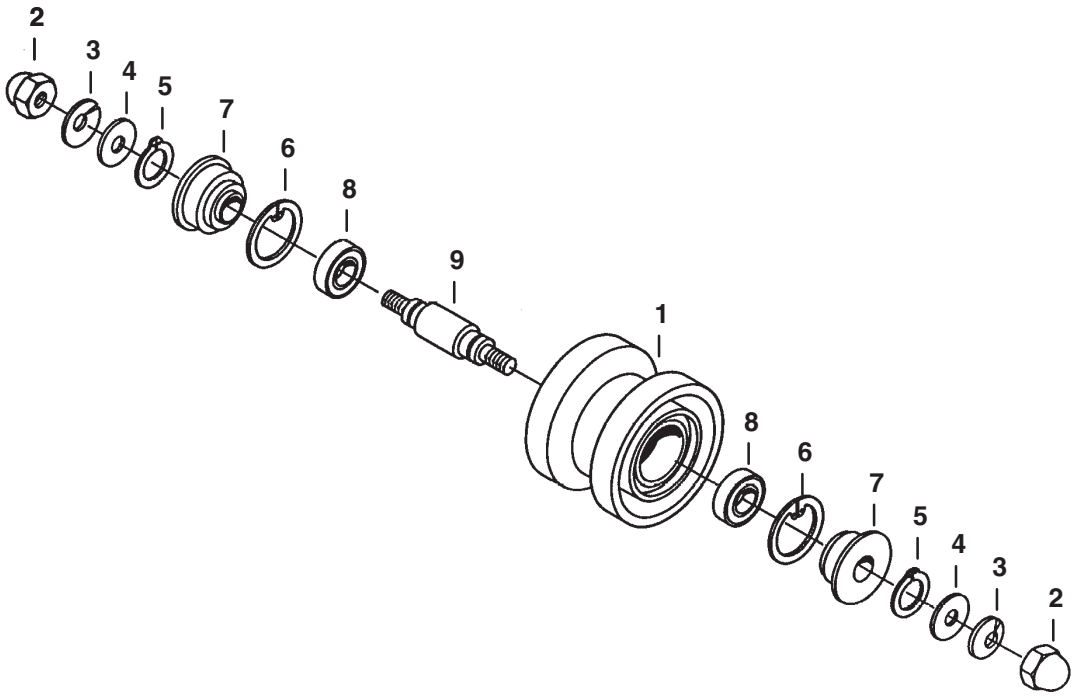


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RUBBER TRACK ROLLER

Parts Identification

NOTE; For use on all rubber tracks (6662301 and 6663953) only. (See BTI E–030 for detailed information.) See Page 5–14a for track roller used with steel tracks and interchangeable rubber track (6663906.)



D–01960

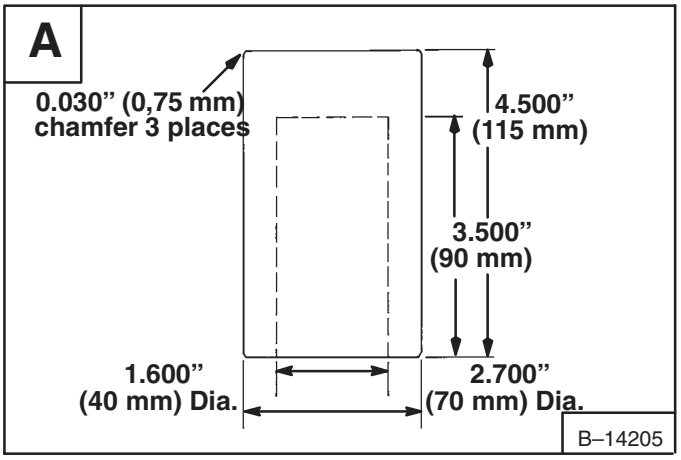
Ref.	Description
1.	Roller
2.	Nut
3.	Washer
4.	Washer
5.	Snap Ring
6.	Snap Ring
7.	Seal
8.	Bearing
9.	Shaft

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RUBBER TRACK ROLLER (Cont'd)

The following tools must be fabricated for this procedure:

1. Driver Tool – See **[A]**.
2. Support Fixture – Tubing, 3.0 inches ID x 0.250 inch wall x 6.0 inches long.



Disassembly

Remove the snap ring from each end of the shaft **[B]**.

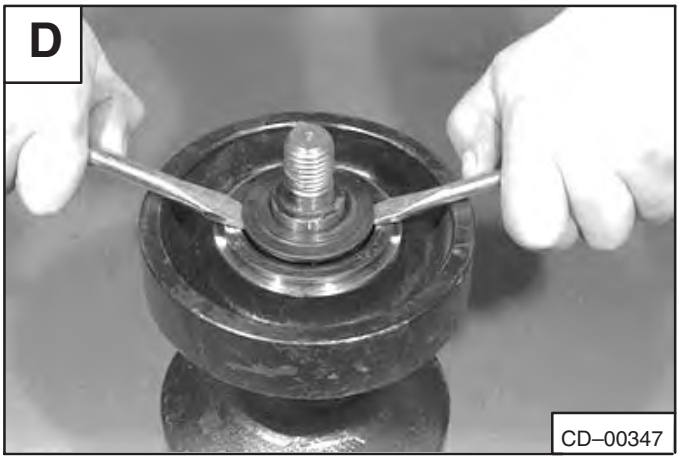


Use a wire brush to remove any corrosion or paint from both ends of the exposed shaft that could affect seal removal or damage the new seal during installation **[C]**.



Apply penetrating oil to both ends of the exposed shaft to ease removal of the inner part of the seal.

Remove the inner part of the seal using two screwdrivers **[D]**.



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RUBBER TRACK ROLLER (Cont'd)

Disassembly (Cont'd)

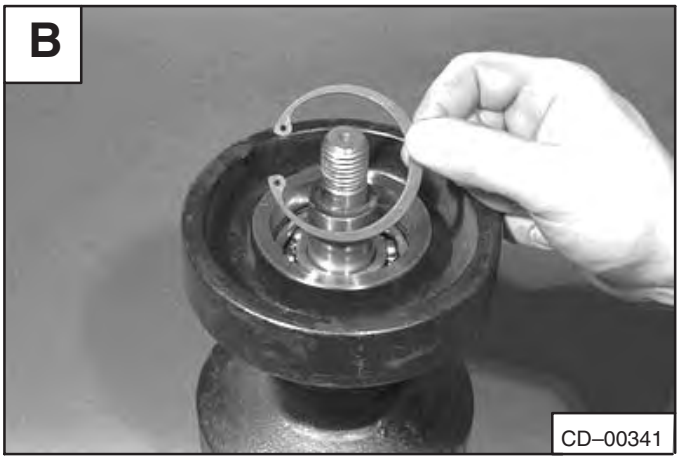
Remove the outer part of the seal from the roller using two screwdrivers **[A]**.

Pour the oil out of the roller. Discard the oil in an appropriate manner.

Turn the roller assembly over and removethe other seal.



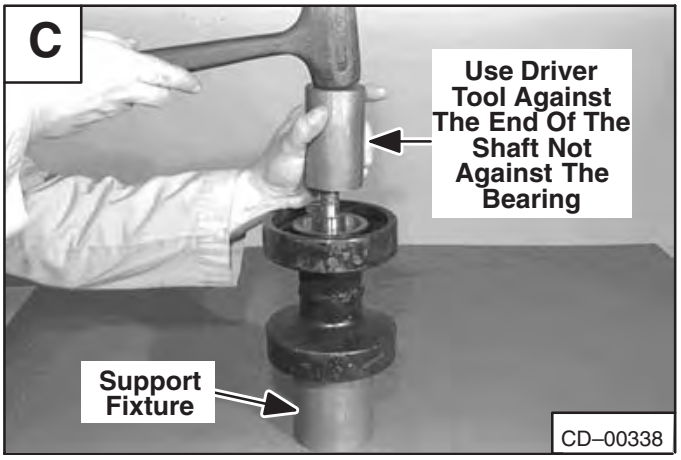
Remove the snap ring from each side of the roller **[B]**.



Put the support fixture below the roller.

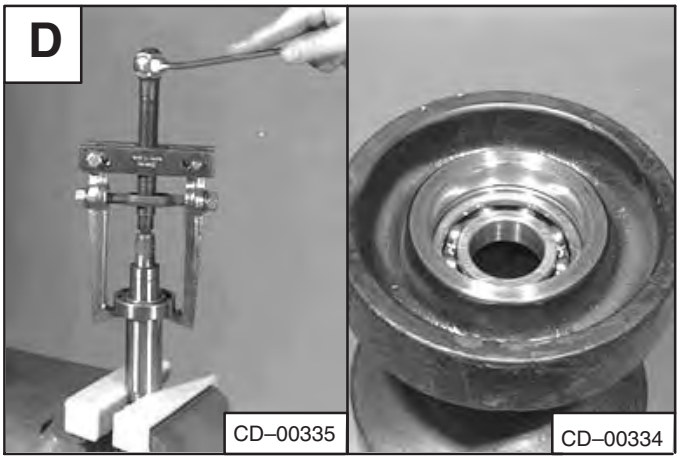
Using the fabricated driver tool and support fixture, with the solid end facing the shaft, push the shaft and lower bearing out of the roller **[C]**.

The upper bearing will stay in the housing.



Using a two or three jaw puller, remove the two bearings from the shaft and the bearing from the roller **[D]**.

Inspect the bearings for rust or for rough spots. the bearings must turn freely. If any damage is found, replace the bearings.



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RUBBER TRACK ROLLER (Cont'd)

Assembly

Remove all paint and corrosion from the seal surface on both sides of the roller **[A]**.

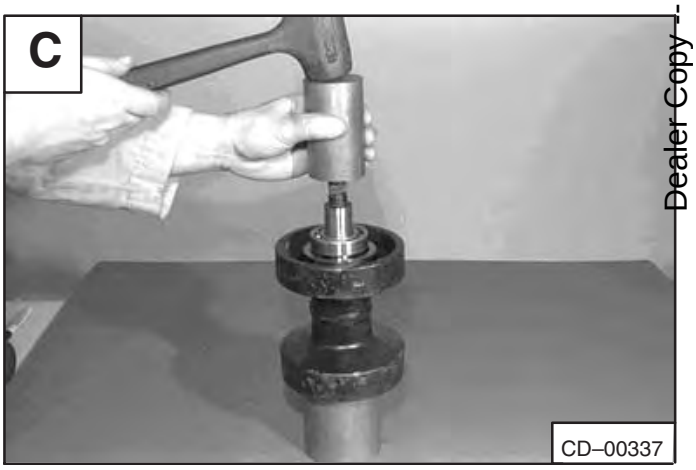
Be sure all parts are clean before assembly.



Using the driver tool, install a new bearings, with the numbered side upward, onto the shaft **[B]**. Press only on the inner diameter of the bearing.



Using the driver tool, install the shaft and bearing assembly into the roller **[C]**.



Install the snap ring **[D]**.



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RUBBER TRACK ROLLER (cont'd

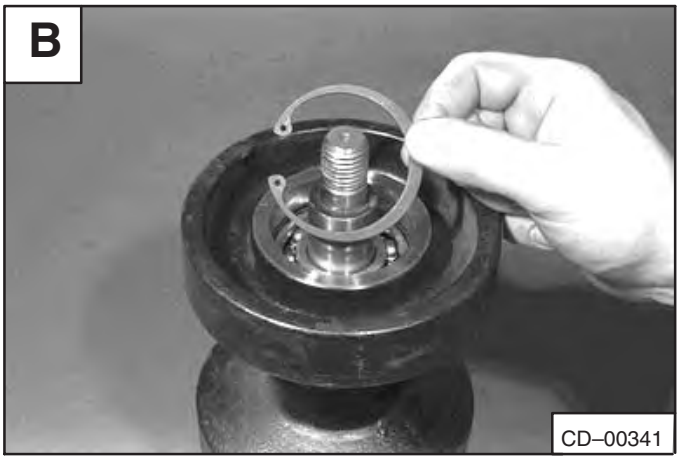
Assembly (Cont'd)

Turn the roller assembly over.

Using the driver tool, install the other bearing, with the numbered side upward, into the roller **[A]**.



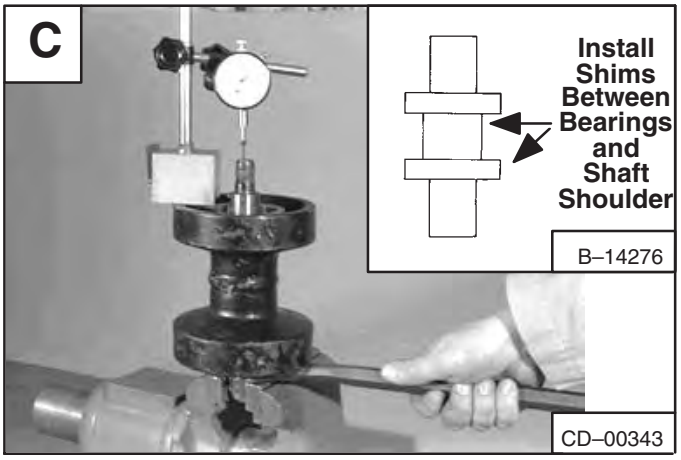
Install the snap ring **[B]**.



Using a dial indicator, check the endplay of the shaft **[C]**.

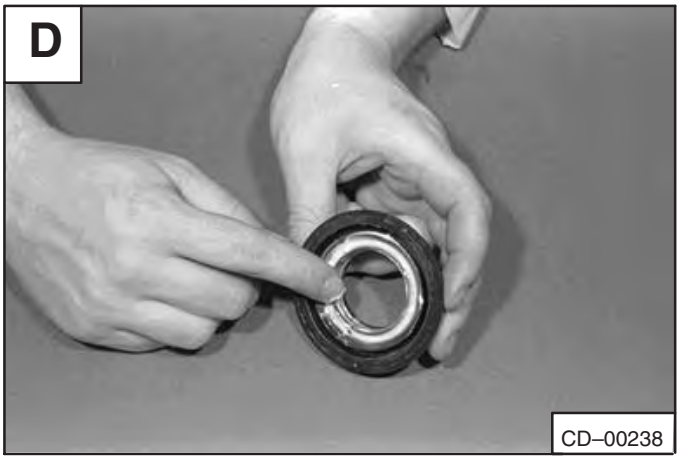
If the endplay is greater than 0.030 inch (0,76 mm) then the bearing must be shimmed.

Cut a shim from the necessary thickness shim stock and install the shim between the bearing and the shoulder on the shaft.



Separate the inner and outer halves of the seals.

Apply grease to the grooves on the outer part of a new seal **[D]**.

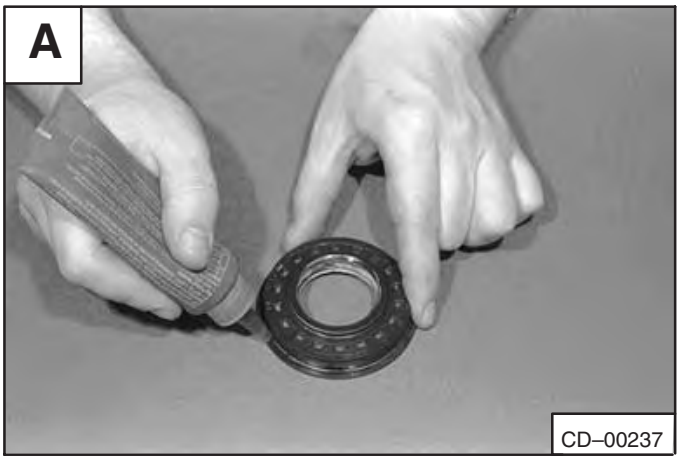


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RUBBER TRACK ROLLER (Cont'd)

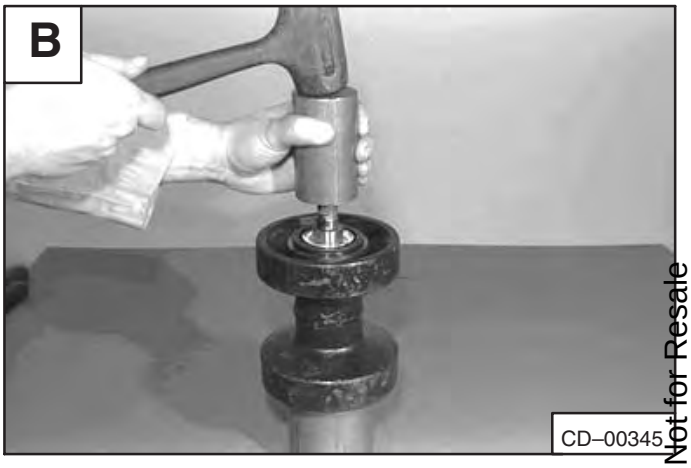
Assembly (Cont'd)

Apply a small bead of high temperature silicone sealant around the flange surface of the seal **[A]**.



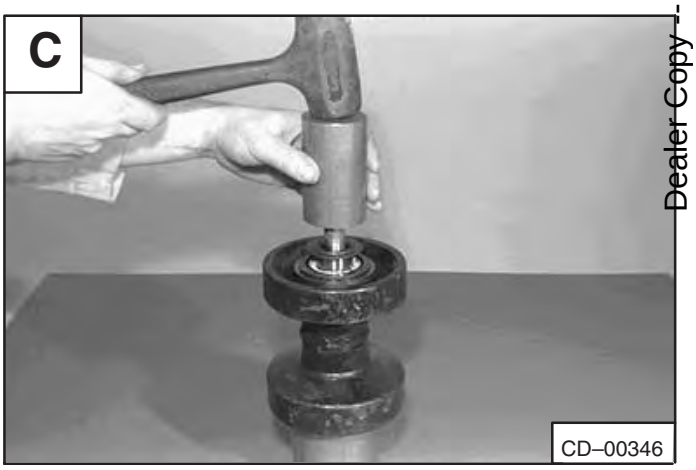
Using the driver tool, install the outer part of the new seal into the roller **[B]**.

NOTE: The inner and outer parts of the seal must be installed separately so the air will escape from under the seal.



Using the driver tool, install the inner part ofthe new seal over the shaft **[C]**.

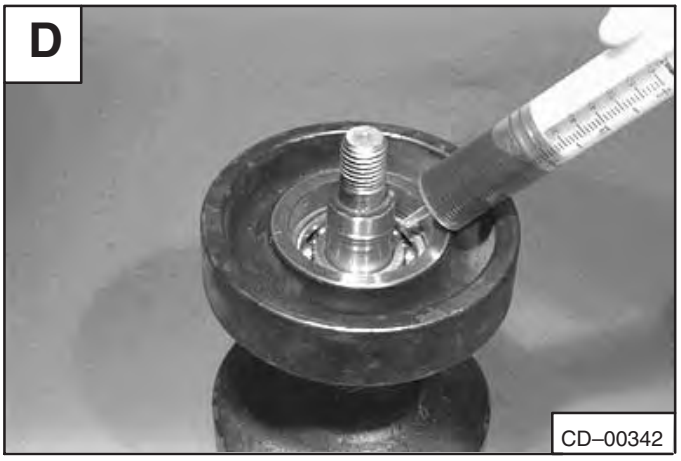
NOTE: The inner part of the seal must be pressed down level with the outer part of the seal to seal properly.



Turn the roller assembly over. Using a syringe add 70 cc of SAE 10W/30 oil to the assembly **[D]**.

Repeat Page 5–14l **[D]** thru Page 5–14m **[C]** to install the remaining seal.

Check for leaks.



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RUBBER TRACK ROLLER (Cont'd)

Assembly (Cont'd)

Install the snap ring on each end of the shaft **[A]**.



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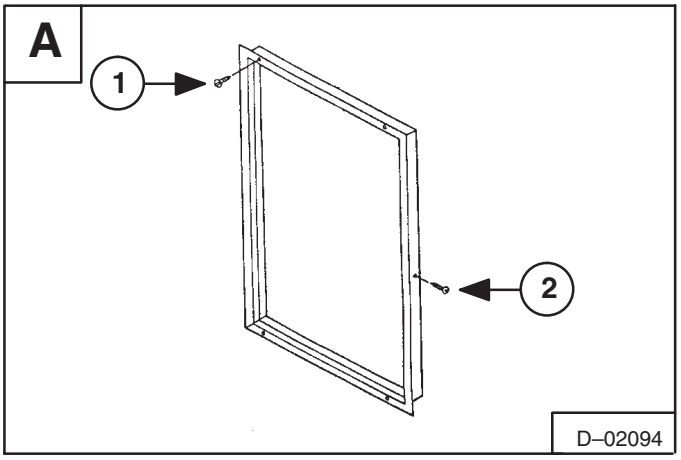
ROPS WINDOWS

Front Window Removal

Remove the four screws (Item 1) **[A]** from the window frame.

NOTE: Cabs with S/N M8960B–1 & Above use a single bead of urethane around the window perimeter only.

NOTE: Cabs with S/N M8960A–50 & Below only, use an extra bead of urethane under the window flange.



All Cabs: Use a utility knife to cut the urethane from the window perimeter **[B]**.

Remove the window from the ROPS frame.

Cab S/N M8960A–50 & Above Only: From the inside of the cab, force a corner of the window out slightly , use wedges to hold window in position.

Cut the urethane bead from the window flange until the window is free from the ROPS frame.

Remove the two screws (Item 2) **[A]** that hold the center post in the window frame. Remove the center post.

Spread the frame and remove the glass or clean the channel of all broken glass particles, if necessary.

Installation: Install the glazing vinyl on threesides of the stationary glass. Hold the vinyl in place with tape during installation.

Apply water diluted liquid soap on channels during window installation.

Install the glass in one side of the channel, spread the frame and use a putty knife to control glazing vinyl while guiding window into position.

Push glass into bottom position.

Install the glazing vinyl and center post on top of stationary window.

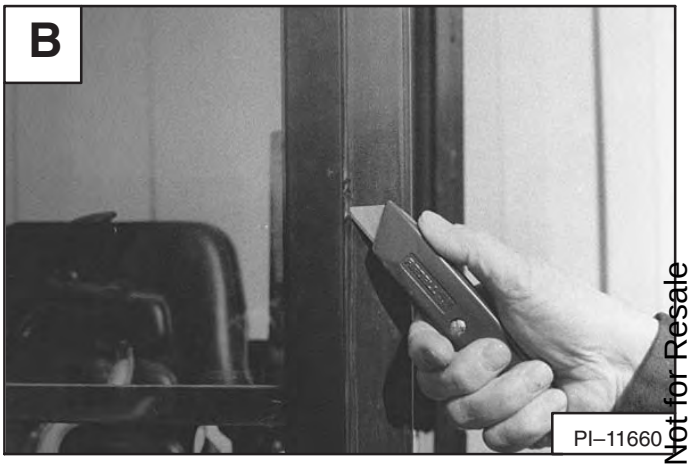
Install the screws in the center post to hold frame. DO NOT TIGHTEN.

Install the sliding glass in one side of the frame, spread the frame and use a putty knife to control glazing vinyl and guide the window in position.

Tighten the screws into the center post.

Use a utility knife to cut the tape from the window.

Install the window in the opening, install the four screws and apply a bead of urethane on the perimeter of the window **[C]**.





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ROPS WINDOWS (Cont'd)

Side Window Removal

NOTE: The removal procedure for the side window is the same as the front window . (See Page 5–14.)

Installation:

Remove the glass or clean the channel of all broken glass particles, if necessary.

Install the locks on glass.

Install the sliding glass in one side of the frame, spread the frame and use a putty knife to control glazing vinyl and guide the window in position.

Install the window in the opening, install the four screws and apply a bead of urethane on the perimeter of the window **[A]**.



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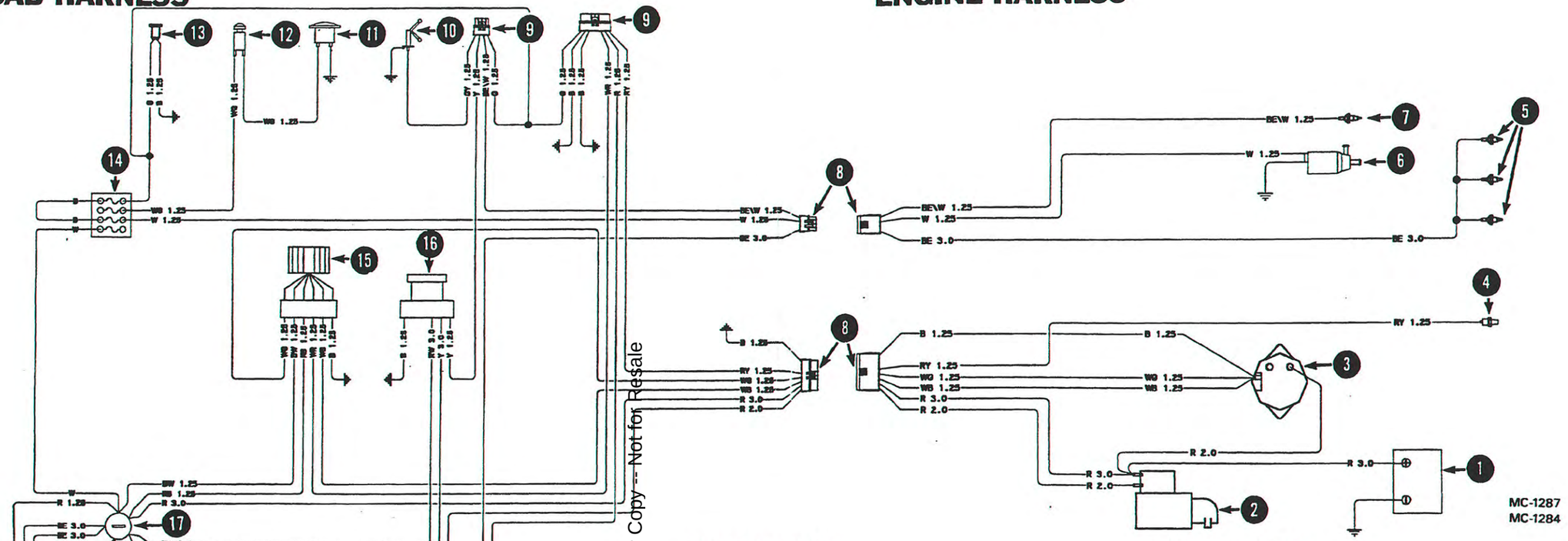
WIRING DIAGRAM (#6720330)

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(Printed November 1989)

CAB HARNESS

ENGINE HARNESS



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WIRE LEGEND

NO.'s	COLOR	GAUGE
B	Black	
W	White	
R	Red	
G	Green	
Y	Yellow	
W/R	White/Red	
R/Y	Red/Yellow	
BE/W	Blue/White	
BE	Blue	
B/W	Black/White	
R/B	Red/Black	
R/W	White/Red	
W/G	White/Green	
GY	Gray	
W/B	White/Black	

PARTS LEGEND

1. Battery
2. Starter
3. Alternator
4. Engine Oil Pressure Switch
5. Glow Plugs
6. Fuel Pump
7. Temperature
8. Harness Connectors
9. Instrument Panel Connector
10. Fuel Switch
11. Horn
12. Horn Button
13. Hourmeter
14. Fuses
15. Regulator
16. Glow Plug Timer
17. Ignition Switch

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TROUBLESHOOTING

Chart

The following troubleshooting chart is provided for assistance in locating and correcting problems which are most common. Many of the recommended procedures must be done by authorized Bobcat Service personnel only.

⚠ WARNING

Instructions are necessary before operating or servicing machine. Read Operation & Maintenance Manual, 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. Failure to follow instructions can cause injury or death.

W–2003–0797

PROBLEM	CAUSE
Battery will not take a charge.	1, 2, 3, 4, 5
Alternator will not charge.	1, 2, 5
Starter will not turn the engine.	2, 3, 4, 6, 7, 8, 9

KEY TO CORRECT THE CAUSE

1. Alternator belt is loose or damaged.
2. Battery connections are dirty or loose.
3. Battery is damaged.
4. The 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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ELECTRICAL SYSTEM

Description

The excavator has a 12 volt, negative ground electrical system. There are two main circuits.

1. The charging circuit has an alternator, regulator and a battery.
2. The starting circuit has a starter motor, solenoid and ignition switch for starting the engine.

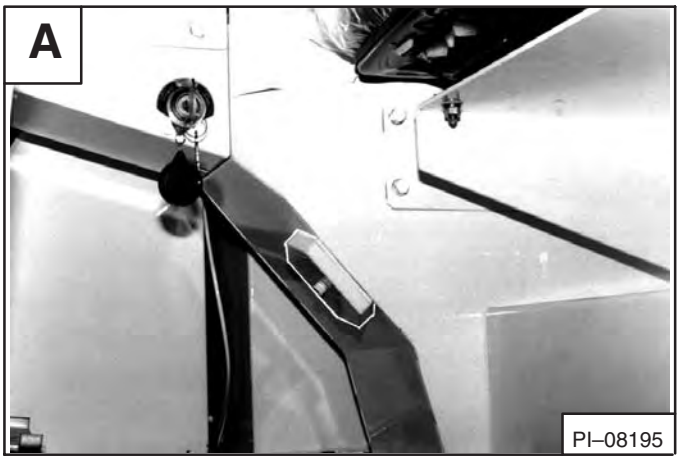
The electrical system is protected by fuses, installed in the instrument panel. Fuses protect the electrical system from an overload. The reason for the overload must be found before starting the engine.

Fuses

The fuses protect the electrical system from damage. To replace the fuse(s), loosen the screw and remove the cover **[A]**.

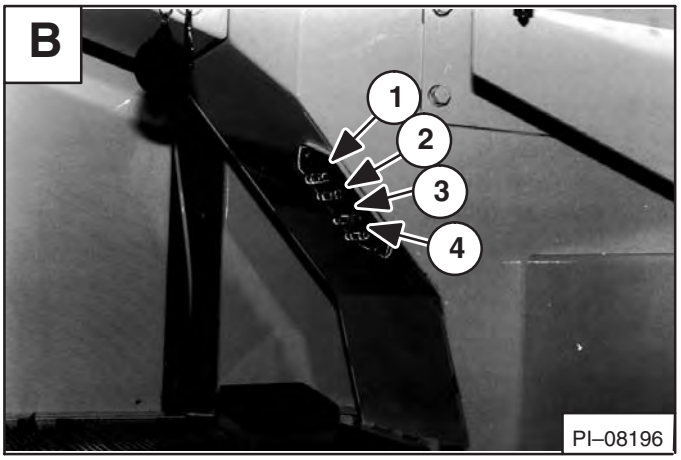
Replace the fuse(s) with the same type and capacity.

NOTE: Before replacing any fuse(s), make sure the key switch is in the OFF position.



Fuse Arrangement [B]

Ref.	Fuse Capacity
1.	10 Amp
2.	10 Amp
3.	10 Amp
4.	10 Amp



Electrical System Service

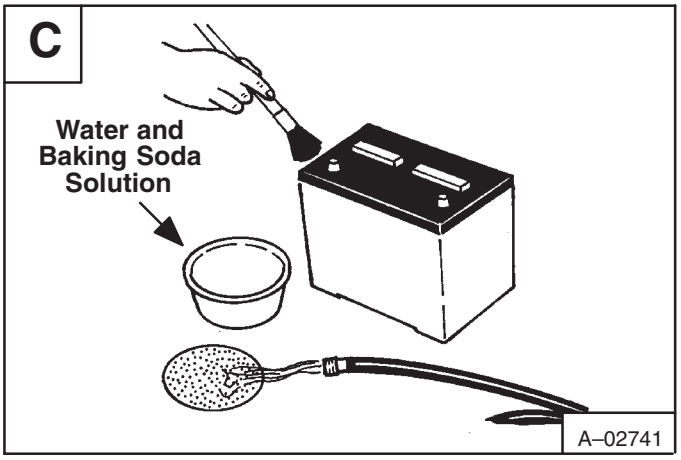
Use the following procedure to service the electrical system:

The battery cables must be clean and tight. Remove any acid or corrosion from the battery and cables using a sodium bicarbonate and water solution **[C]**. Cover the battery terminals and cable ends with battery saver grease.

Check the electrolyte in the battery. Add distilled water as needed.

Check the alternator belt for wear and correct tension.

Check that all wire connections are secure.



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BATTERY

Checking The Battery

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

MEL10004A–Battery Tester

To make a safe and complete check of the battery, see the Melroe Battery Manual (P/N 6566047). The battery manual has all the information needed for checking and servicing the battery.

Removal And Installation

Raise the engine cover **[A]**.

⚠ WARNING

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–2065–1296

Disconnect the negative (–) cable first **[B]**.

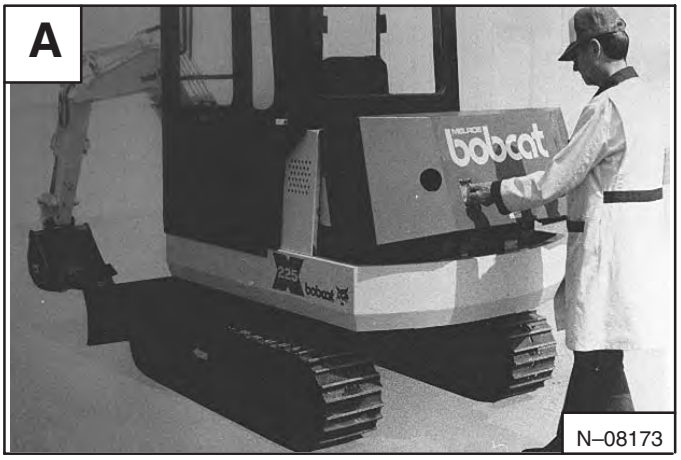
Disconnect the positive (+) cable.

Remove the battery holddown clamp **[C]**.

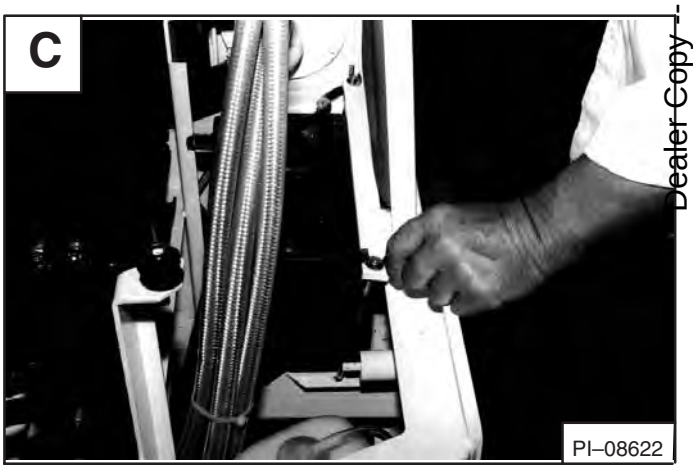
Remove the battery from the machine **[D]**.

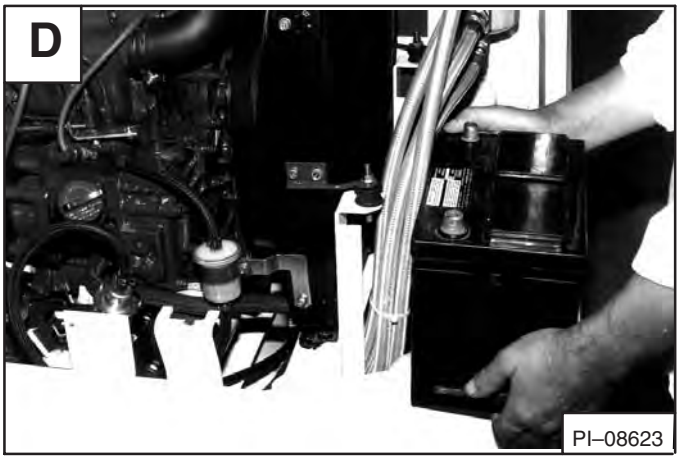
Always clean the terminals and cable ends, even when installing a new battery.

Reverse the procedure for battery installation.









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ALTERNATOR

Belt Adjustment

Stop the engine. Open the engine cover.

The belt should deflect about 0.500 inch (13 mm) when pressed between the water pump pulley and crankshaft pulley with approximately 13 lbs. (58 N) force **[A]**.

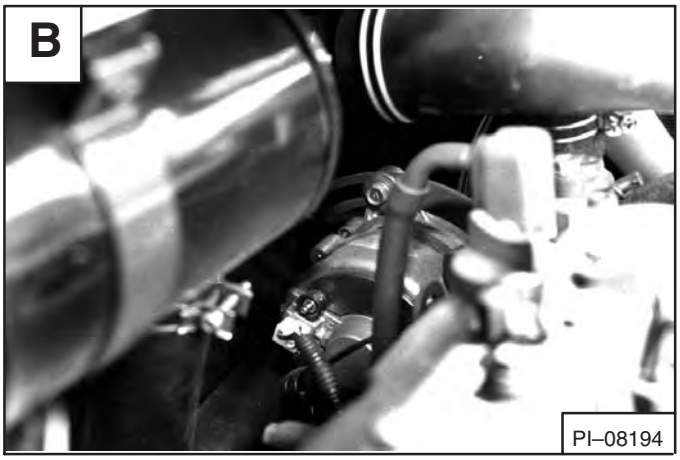
If the tension is not correct, loosen the alternator mounting bolt.



Loosen the adjustment bolt **[B]**.

Move the alternator until the belt tension is correct. Tighten the adjustment bolt and mounting bolt.

Replace the belt if it has stretched or there are cracks in the belt. Check the pulley grooves, make sure the belt is not in contact with the bottom of the grooves in the pulleys.



Removal And Installation

Disconnect the negative (–) cable from the battery.

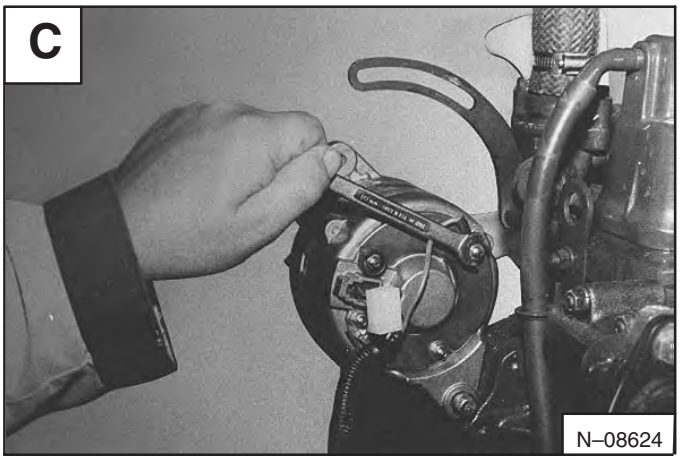
Disconnect the alternator wires **[C]**.

Remove the adjustment bolt **[B]**.

Remove the alternator belt.

Remove the mounting bolt.

Remove the alternator from the bracket.



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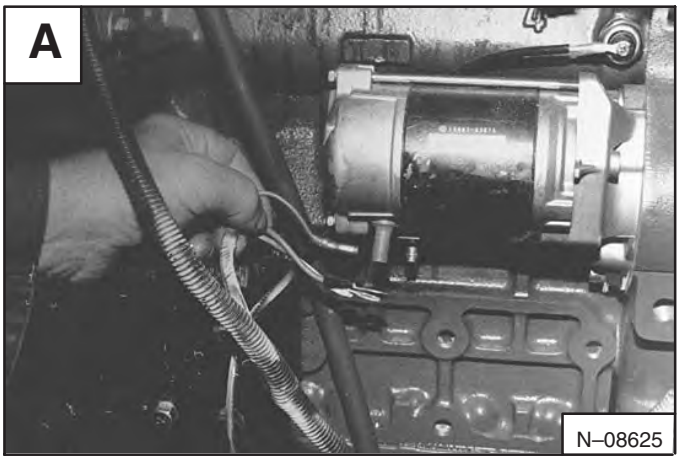
STARTER

Removal And Installation

Remove the operator seat and seat mount to gain access to the starter.

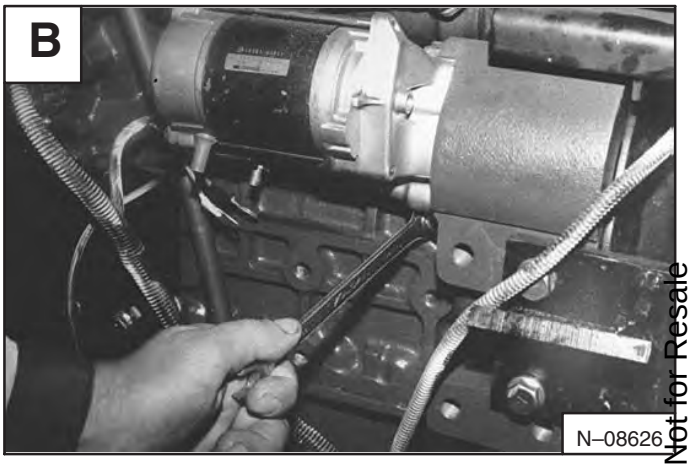
Disconnect the negative (–) cable from the battery.

Disconnect the wires from the starter **[A]**.



Remove the mounting bolts from the starter **[B]**.

Remove the starter from the bell housing.



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STARTER (Cont'd)

Disassembly And Assembly

Disassemble the starter as shown in figure **[A]**.

Cleaning And Inspection

> **⚠ WARNING**
>
> **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–2019–1285**

Use a brush and air pressure to clean the drive, field coils, armature and starter housing.

NOTE: Do not use solvent to clean the drive assembly. The solvent will remove the lubricant and the drive will slip.

Check the following items:

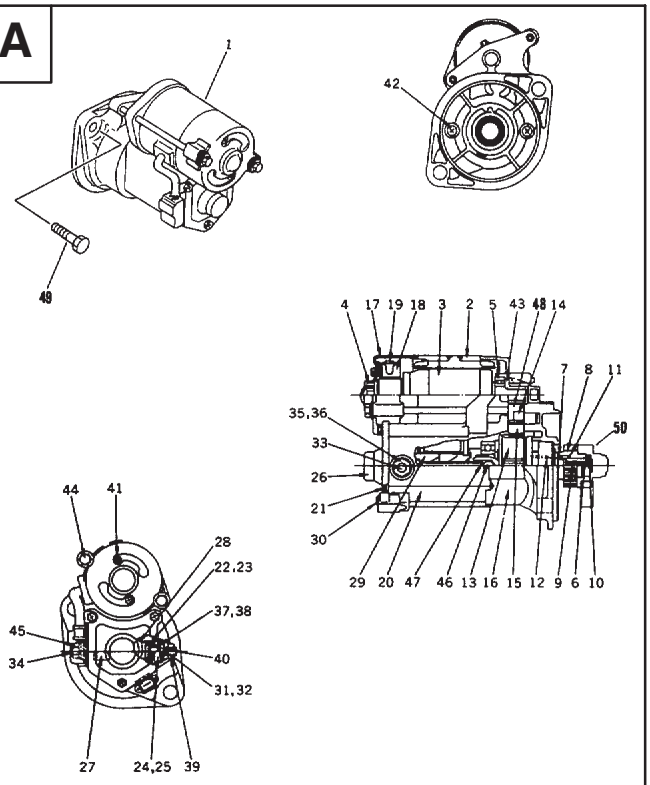
Armature
- Broken or burned insulation
- Loose connections at commutator
- Open or grounded circuits
- Worn shaft or bearings
- Rough commutator

Field Coils
- Broken or burned insulation
- Electrical continuity
- Brush connections

Drive Gear
- Worn Teeth
- Tooth engagement (drive gear must engage ring gear by 1/2 the depth of the ring gear tooth).

Brush Holders
- Broken springs
- Broken insulation
- Spring tension

A



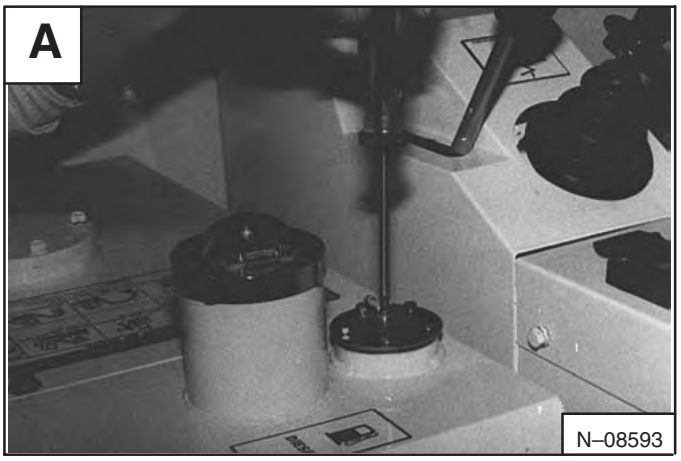
1.	Starter	26.	Cover
2.	Yoke Assy.	27.	Plate
3.	Armature	28.	Plate
4.	Bearing	29.	Plunger
5.	Bearing	30.	Bolt
6.	Nut	31.	Washer
7.	Retainer	32.	Washer
8.	Pinion	33.	Bolt
9.	Shaft	34.	Bolt
10.	Snap Ring	35.	Nut
11.	Spring	36.	Nut
12.	Spring	37.	O–ring
13.	Clutch	38.	O–ring
14.	Roller	39.	Nut
15.	Pinion	40.	Washer
16.	Housing	41.	Screw
17.	Frame	42.	Screw
18.	Holder Assy.	43.	Washer
19.	Spring	44.	Bolt
20.	Solenoid	45.	Nut
21.	Gasket	46.	Ball
22.	Bushing	47.	Spring
23.	Bushing	48.	Retainer
24.	Bushing	49.	Bolt
25.	Bushing	50.	Clutch Assy.

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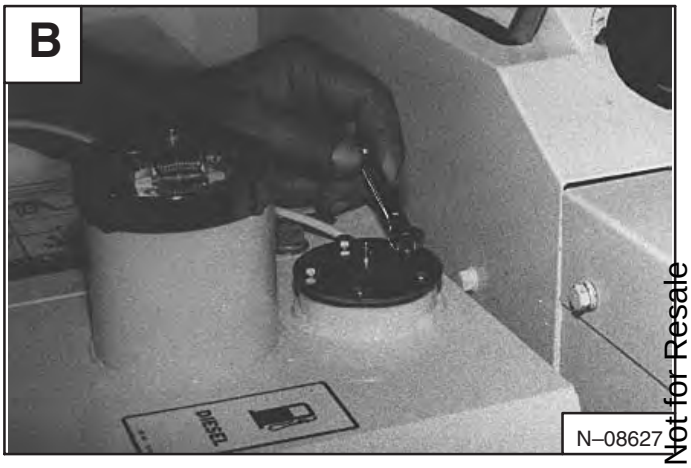
FUEL LEVEL SENDER

Removal And Installation

Remove the wire from the fuel sender screw **[A]**.



Remove the sender mounting bolts **[B]**.

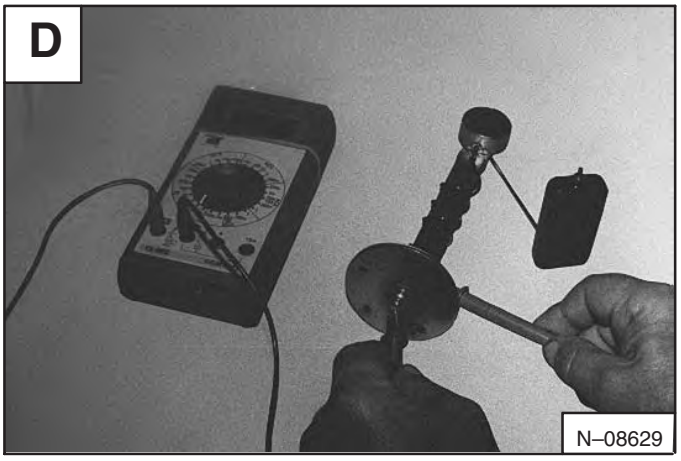


Remove the sender from the tank **[C]**.



Checking

Use a ohmmeter to check the resistance of the fuel sender **[D]**.



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DISPLAY MODULE

Removal And Installation

Use the following procedure to remove or install the display module:

Disconnect the negative (–) cable from the battery.

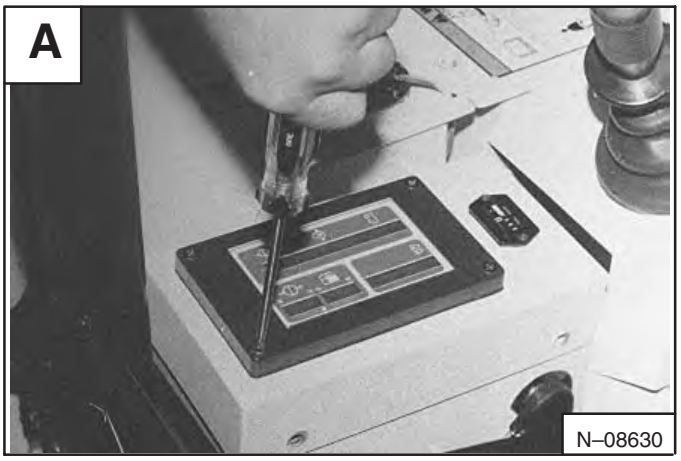
Remove the screws from the cover **[A]**.

Lift the cover.

Remove the defective part and install the new part.

See Pages 6–9 thru 6–17 for display module testing and trouble shooting with the display module installed in the excavator.

If the display module has been removed from the excavator and has been brought into the service shop for diagnosis. (See Pages 6–18 thru 6–22 for test procedures.)



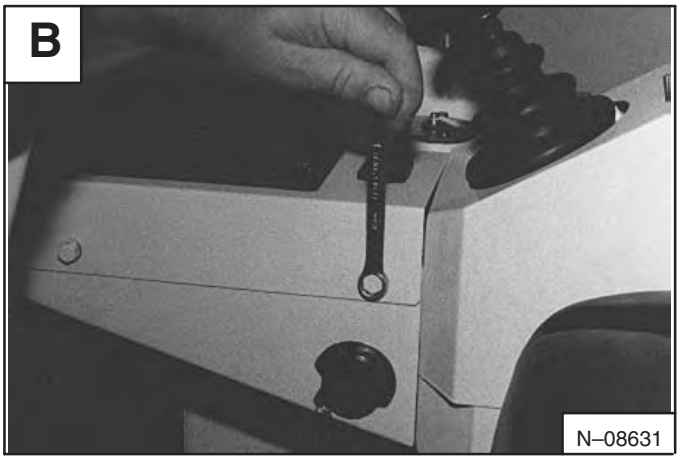
INSTRUMENT PANEL

Removal And Installation

Disconnect the negative (–) cable from the battery.

Remove the bolts on both sides of the instrument panel housing **[B]**.

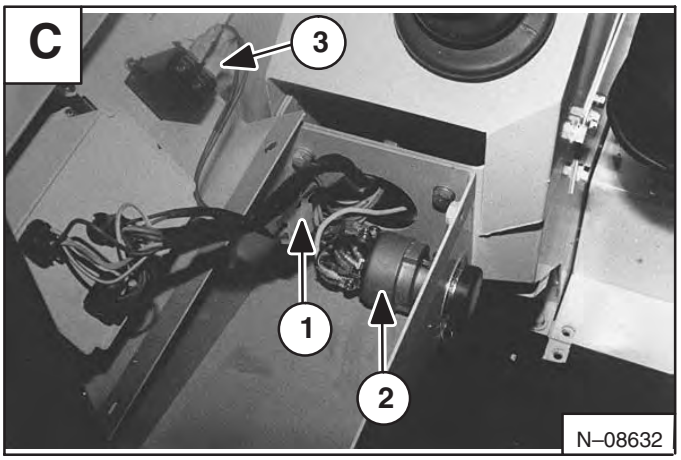
Lift the cover.



Remove the wiring harness connectors (Item 1) **[C]**.

Mark the wires on the ignition switch (Item 2) **[C]** for correct installation.

Mark the wires on the hourmeter (Item 3) **[C]** for the correct installation.



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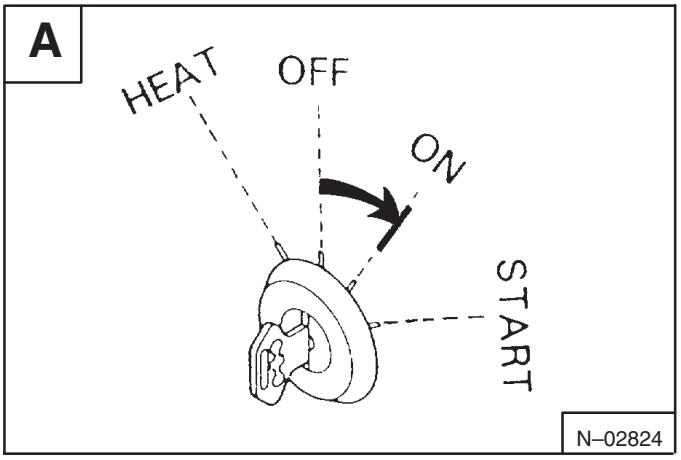
DISPLAY MODULE (Cont'd)

Testing And Troubleshooting

Initial test (with Display Module installed in the Excavator.)

NOTE: If the display module has been removed from the excavator. (See the gauge test information on Pages 6–18 thru 6–22.)

Turn the ignition key to the ON position (do not start the engine) **[A]**. The following display module conditions will exist.



Engine temperature bar graph will illuminate at the current engine temperature. If the engine temperature is below the minimum normal operating temperature warning light will blink on and off **[B]**.

Fuel level bar graph will illuminate at the full *F* setting. At ten second intervals, the fuel level bar graph will drop one bar at a time until the actual fuel level in the tank is reached. If the fuel level is in the empty *E* range on the bar graph the low fuel warning light will blink on and off **[B]**.

Engine oil pressure warning light will blink on and off continuously **[B]**.

Voltage charging light will blink on and off continuously **[B]**.

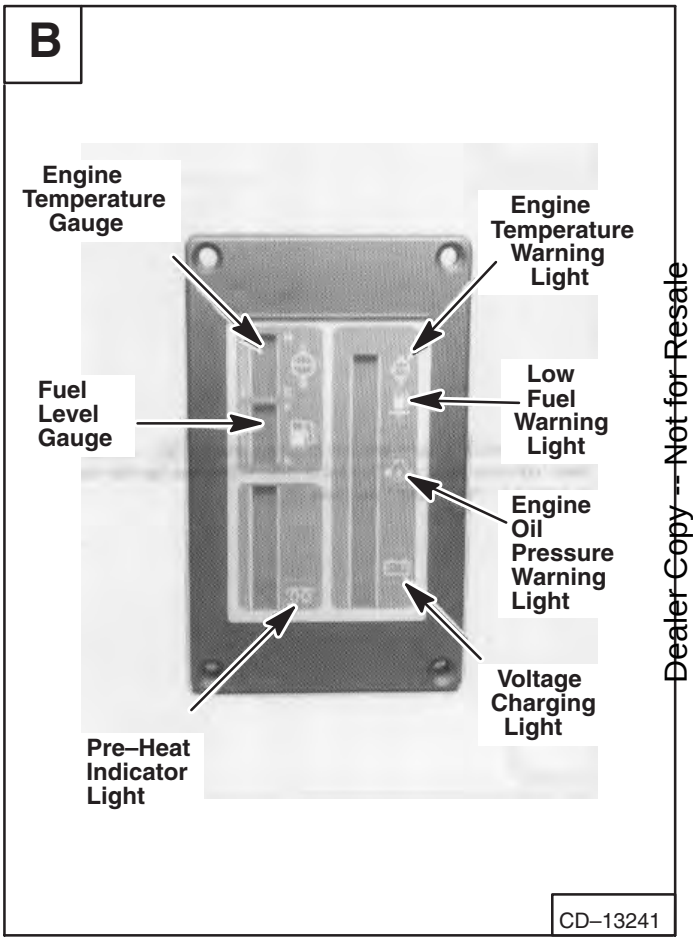
Pre heat indicator light will not be illuminated. The pre–heat indicator light will illuminate only when the ignition key is turned to the *heat* position **[A]**.

Start the excavator **[A]**.

With the excavator started, the display module will perform an internal module check. This will last for three seconds and the following display module conditions will exist.

Engine temperature bar graph will illuminate at the current engine temperature. The engine temperature warning light will blink on and off for three seconds. After the three second check, if the engine temperature is below the minimum normal operating temperature (122°F–50°C), the engine warning light will continue to blink on and off until the engine reaches the normal operating temperature and the second bar graph illuminates.

If the engine temperature at start up is above the minimum operating temperature, the warning light will not blink on and off.



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DISPLAY MODULE (Cont'd)

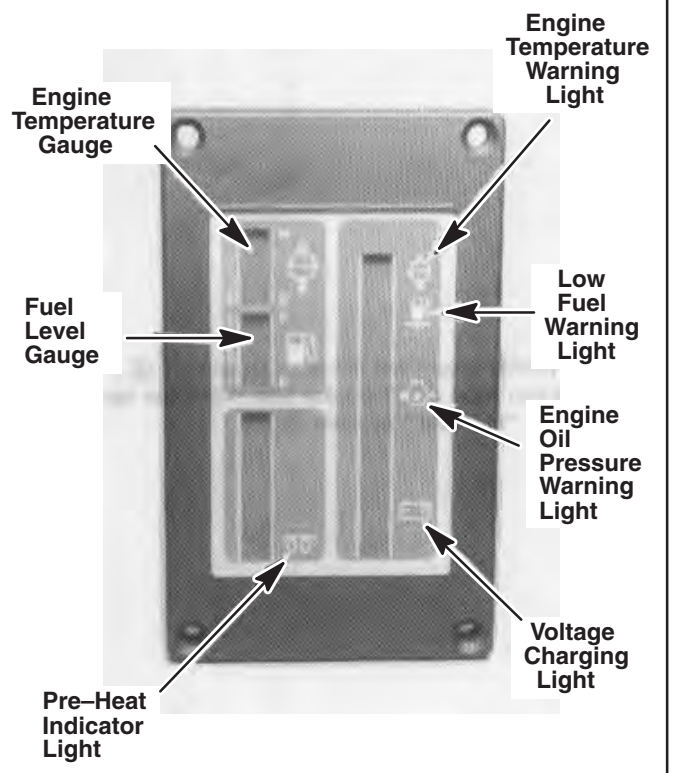
Testing And Trouble Shooting (Cont'd)

Fuel level bar graph will illuminate at the full*F* setting. At ten second intervals, the fuel level bar graph will drop one bar at a time until the actual fuel level in the tank is reached. The low fuel warning light does not blink on and off during the three second check. Only if the fuel level bar graph drops to the empty *E* level will the low fuelwarning light blink on and off **[A]**.

Engine oil pressure warning light will blink on and off for three seconds, then the warning light will turn off. If the warning light continues to blink after the three second check, STOP the engine.

Voltage charging light will blink on and of f for three seconds, then the charging light will turn off **[A]**.

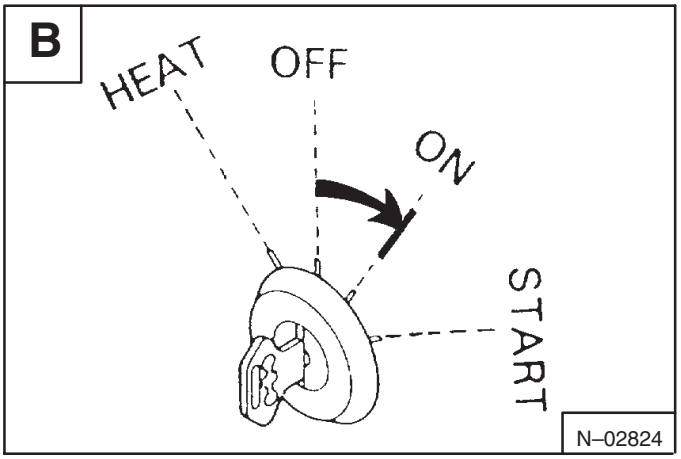
A



CD–13241

Pre–heat indicator light will not blink on and off **[A]**. The pre–heat indicator light will illuminate only when the ignition key is turned to the *heat* position **[B]**.

B



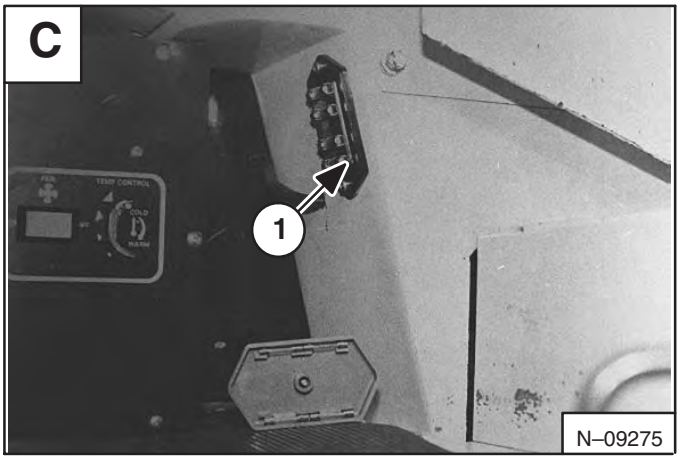
N–02824

If the display module does not illuminate at all, check the fuse (Item 1) **[C].** If the fuse is blown, check the wire harness for damage, then, replace the fuse (10 amp).

If the fuse is in good working condition, check the voltage at the fuse block, (10–14 volts). If no voltage is recorded, check the wire harness for damage and repair or replace the harness **[C]**.

If the voltage is correct, see the following pages for additional display module testing information.

C



N–09275

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DISPLAY MODULE (Cont'd)

Engine Temperature Circuit T est (display module installed)

The engine temperature gauge bar graph (Item 1) **[A]** & **[B]** will illuminate per the engine temperature shown.

After engine start–up, the engine temperature warning light (Item 2) **[A]** will blink on and of f until the engine reaches the operating temperature of approximately 122°F (50°C). The temperature warning light will then turn off. If the engine operating temperature rises to an overheat temperature of 212 °F (110°C) or above, the engine temperature warning light (Item 2)**[A]** will blink on and off until either the operating temperature drops below 212°F (110°C) or the engine is shut off.

Testing The Display Panel

The following tools will be needed:

A potentiometer with a range of 0–100 ohms and and ohm meter.

Connect the ohm meter (Item 1) **[C]** to the potentiometer (Item 2) **[C]** and set the potentiometer to 22 ohms.

Disconnect the engine harness at the water temperature sender **[D]**.

Connect the potentiometer to the engine harness water temperature sender wire and ground the opposite potentiometer terminal to the excavator frame.

Turn the ignition key to the ON position, but do not start the excavator.

The water temperature warning light will blink for approximately two seconds and then the second temperature bar graph light will illuminate and the warning light will turn off.

NOTE: The display module has a two second delay built into the water temperature circuit to eliminate erratic lighting of the gauge bar graph as the engine temperature changes.

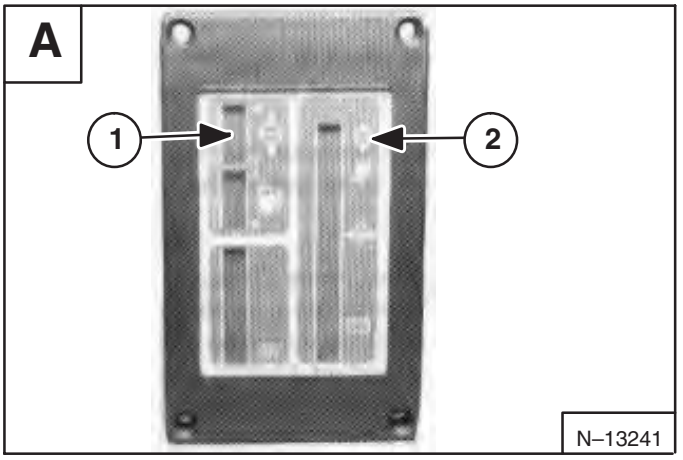
After approximately ten seconds, the fifth bar graph light should be illuminated. If further checks are desired, adjust the potentiometer settings per the chart **[B]** and check for the corresponding bar graph light changes.

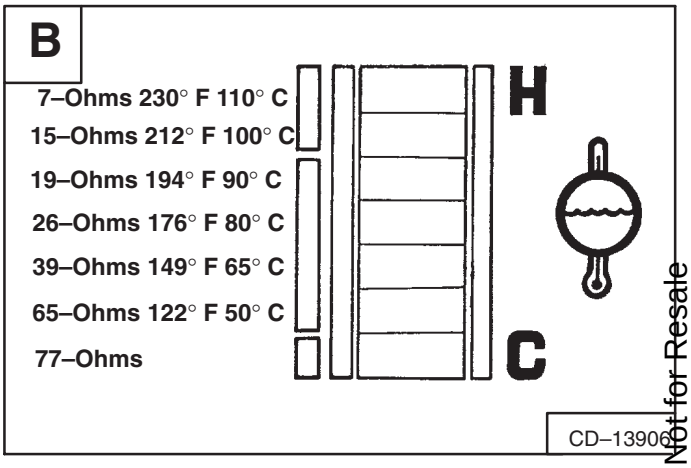
If the display module test shows the dash is working correctly, the water temperature sending unit may be defective.

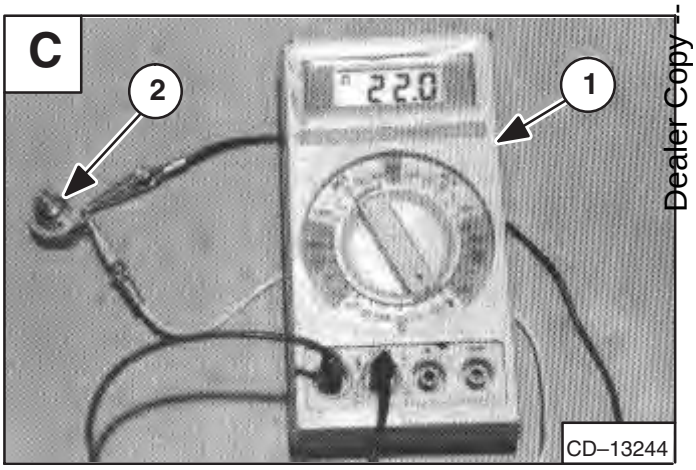
To test the sending unit, use an ohm meter . Disconnect the wire from the sending unit **[D]**. Connect one end of the ohm meter leads to the sending units wire connection terminal and ground the other lead to the base of the sending unit. With the engine temperature (and the sending unit) at ambient temperature (engine cool to the touch), the ohm meter should read approximately 180 ohms.

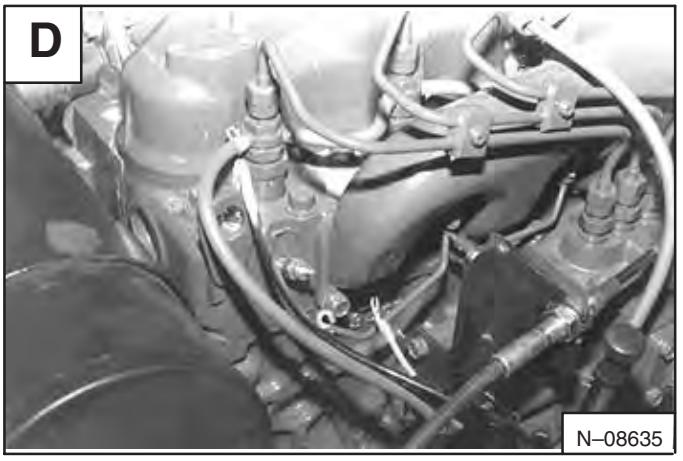
Start the engine.

As the engine temperature rises, the ohm meter reading should continually decrease. If the ohm meter reading did not show the correct (approximately 180 ohms) initial test or as the engine temperature increase the meter reading does not decrease, or if the ohm meter shows an open circuit, replace the sending unit.









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DISPLAY MODULE (Cont'd)

Testing The Display Panel (Cont'd)

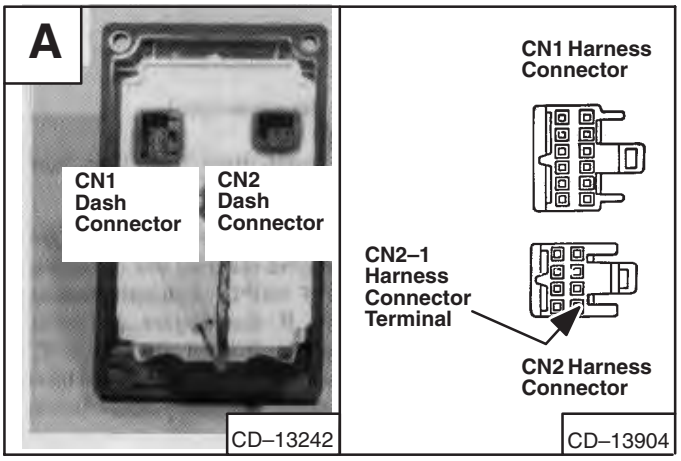
If the display module test does not illuminate the engine temperature bar graph lights per the ohm test, check the engine harness wire that attaches to the temperature sending unit and to the CN2–1 pin **[A]** in the display module harness to make sure this wire is not broken or shorted out.

NOTE: If the engine harness wire is shorted out, the engine temperature bar graph will show the overheat level setting continuously and the warning light will blink on and off. If the wire is broken, the bar graph will show the cold *C* level setting continuously and the warning light will blink on and off.

To check the wire, use the ohm meter and connect the ohm meter leads to each end of the harness wire. If the wire is in good working condition, the ohm meter will show approximately 0.4 ohms.

If the wire is found defective, repair or replace the harness.

If the wire is in good working order and the sending unit is in good working order, but the display module bar graph will not illuminate per the previous tests, replace the display module.



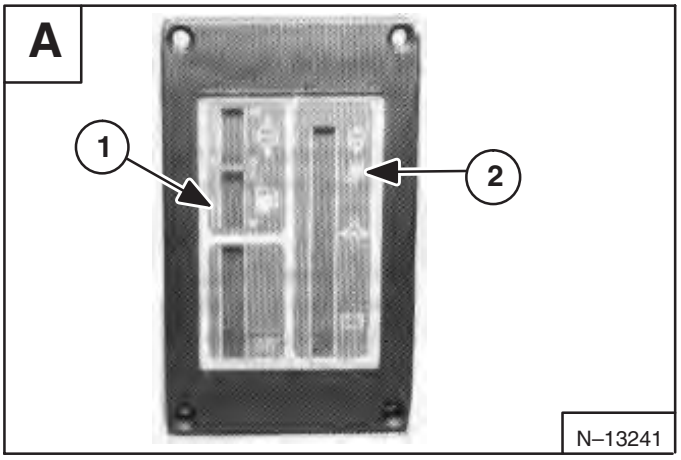
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DISPLAY MODULE (Cont'd)

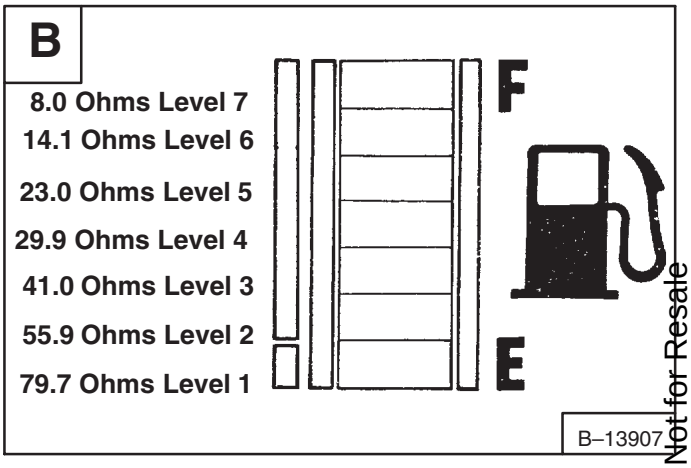
Fuel Level Circuit Test (display module installed)

The fuel level gauge bar graph (Item 1) **[A]** & **[B]** will illuminate per the fuel level shown. When the fuel level drops to the *E* level on the bar graph, the low fuel warning light (Item 2) **[A]** & **[B]** will blink on and off.

A



B



Testing The Display Panel

The following tools will be needed:

A potentiometer with a range of 0–100 ohms and an ohm meter. Connect the ohm meter (Item 1) **[C]** to the potentiometer (Item 2) **[C]** and set the potentiometer to 41 ohms.

Disconnect the engine harness at the fuellevel sender in the fuel tank **[D]**.

Connect the potentiometer to the fuel level sender wire and ground the opposite potentiometer terminal to the excavator frame.

Turn the ignition key to the ON position, but do not start the engine.

The fuel level bar graph will be illuminated at all seven levels **[B]**. After approximately ten seconds, the seventh bar graph light will turn off.

NOTE: The display module has a ten second delay built into the fuel level circuit to eliminate erratic lighting of the bar graphs as fuel sloshes in the fuel tank.

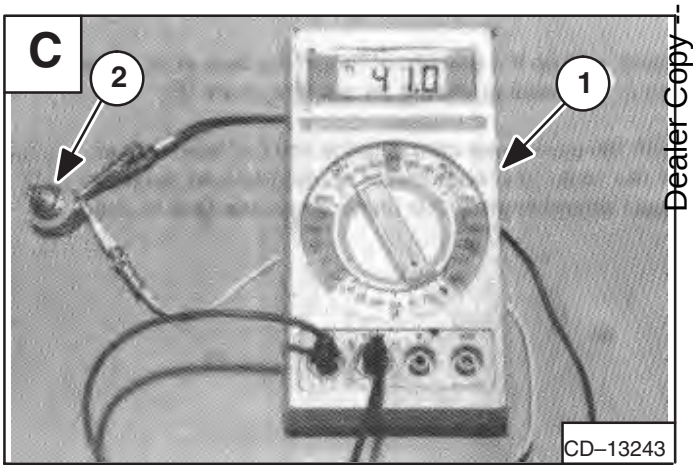
After approximately forty seconds, the bar graph will be illuminated through the third level **[B]**.

To do additional tests, adjust the potentiometer per the chart **[B]**.

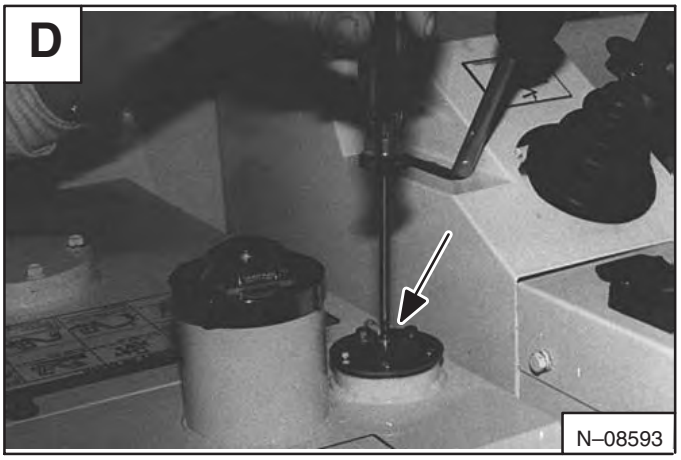
Adjust the potentiometer so the bar graph drops to level one, empty *E,* the low fuel warning light will blink on and off.

If the display module test shows that the fuel level bar graph is working properly, then the fuel level sender may be defective, test the sender (see information on next page).

C



D



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DISPLAY MODULE (Cont'd)

Testing The Display Panel (Cont'd)

If the display module test does not illuminate the fuel level bar graph lights, check the wire harness that attaches to the fuel level sender and to the CN2–3 terminal **[A]** on the display harness, to make sure that this wire is not broken or shorted.

NOTE: If the fuel level sender wire is shorted, the fuel level bar graph should show a full F level setting at all times. If the wire is broken, the fuel level bar graph will show an empty E level setting at all times and the low fuel light will blink on and off.

To check the wire, use the ohm meter. Connect one ohm meter lead to each end of the fuel wire. The ohm meter should read approximately 0.4 ohms.

If the wire is found defective, repair or replace the harness. If the wire is in good condition, check the fuel sender.

Fuel Level Sender

To check the fuel level sender (in the tank test), connect the ohm meter to the sender at the wire connection screw and ground the other lead to the fuel level sender mounting flange **[B]**.

NOTE: Ignition key must be in the off position when doing this check.

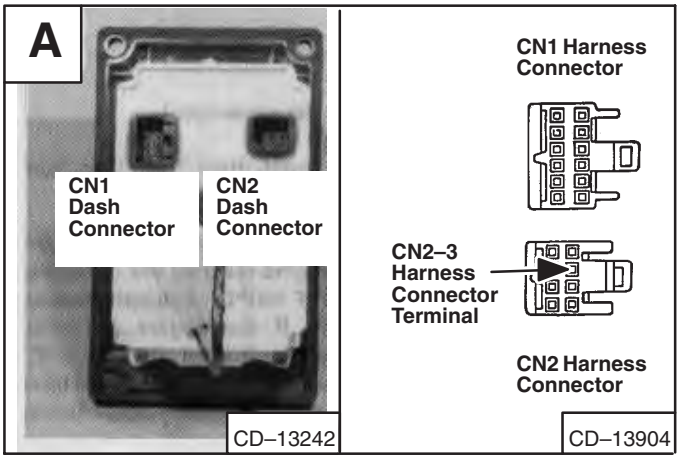
Depending on the amount of fuel in the tank at the time of test, the meter reading should be per the chart **[C]**.

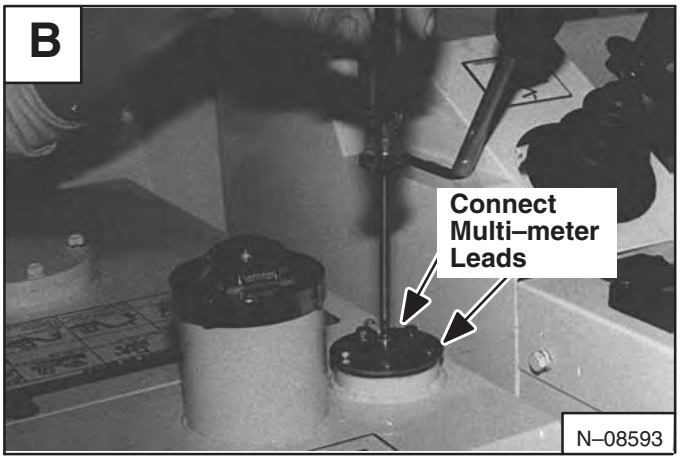
With the ohm meter connected to the fuel level sender, add fuel to the tank. The ohm meter reading should decrease until it reads approximately 2.0 ohms when the tank is full.

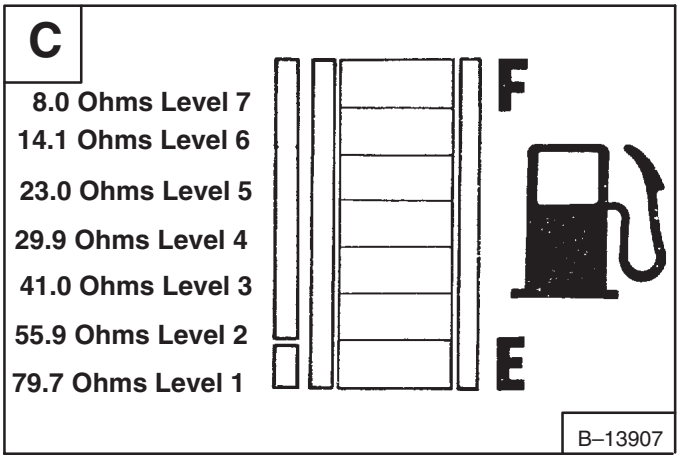
To check the fuel level sender (out of the tank test), connect the ohm meter to the sender at the wire connection screw and ground the other lead to the fuel level sender mounting flange **[D]**.

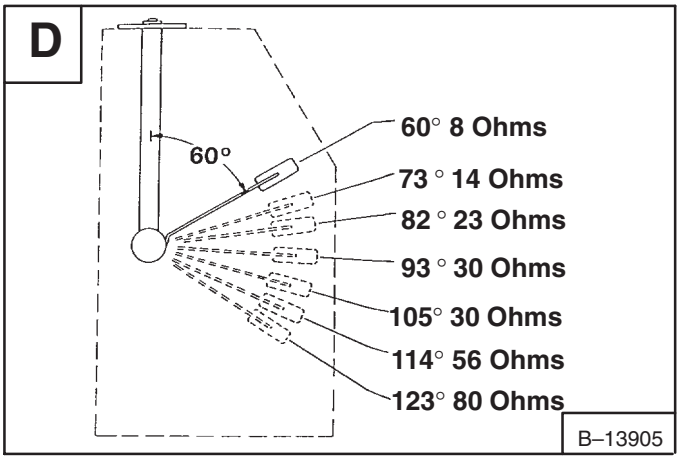
Hold the mounting flange horizontally and move the fuel level arm to the angles shown in the chart **[D]** and read the corresponding ohms per the arm angle.

If the wire is in good working order, the sending unit is in good working order, but the display module bar graph will not illuminate, replace the display module.









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DISPLAY MODULE (Cont'd)

Engine Oil Pressure Circuit Test (display module installed)

The low oil pressure warning light (Item 1) **[A]** will start to blink when the engine oil pressure drops below 7 PSI (50 kPa).

STOP engine immediately.

Testing The Display Panel

Turn the ignition switch to the ON position but do not start the engine.

The engine oil pressure warning light should continuously blink on and off. Disconnect the engine harness at the oil pressure sending unit on the engine **[B]**.

Wait four seconds and if the warning light goes off, the sending unit is defective.

Replace the sending unit.

NOTE: Grounding the sending unit wire to the engine will cause the light to blink on and off in four seconds.

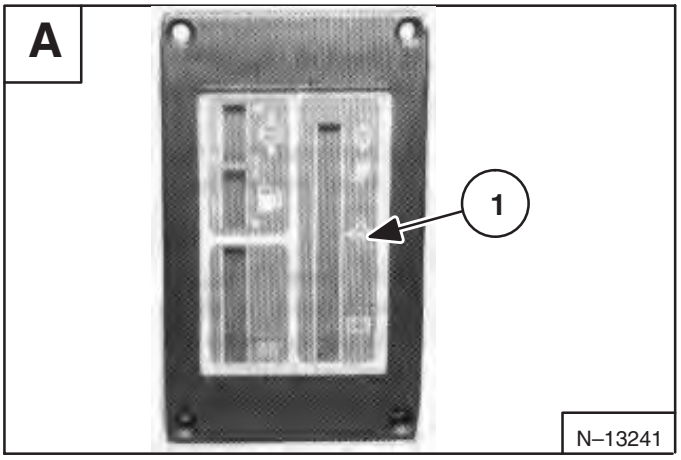
If the light continues to blink on and off with the wire disconnected from the sending unit, check the wire harness. Disconnect the harness wire at the oil pressure sending unit. Use an ohm meter and connect one of the leads to this wire and connect the other lead to the display module harness, terminal CN1–9 **[C]**. The ohm meter should read approximately 0.4 Ohms.

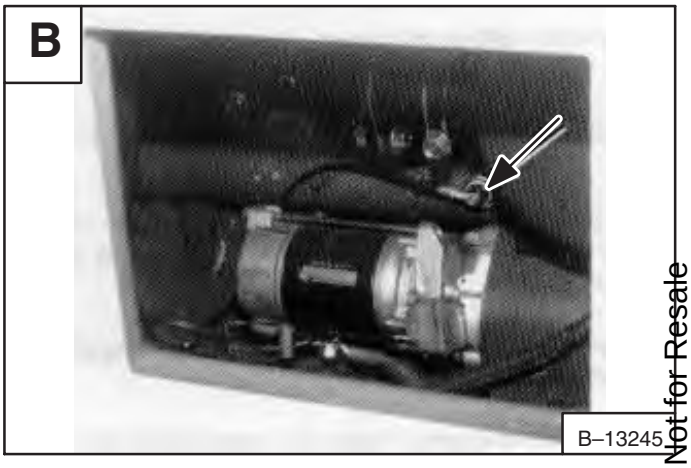
If the wire is defective, repair or replace the harness.

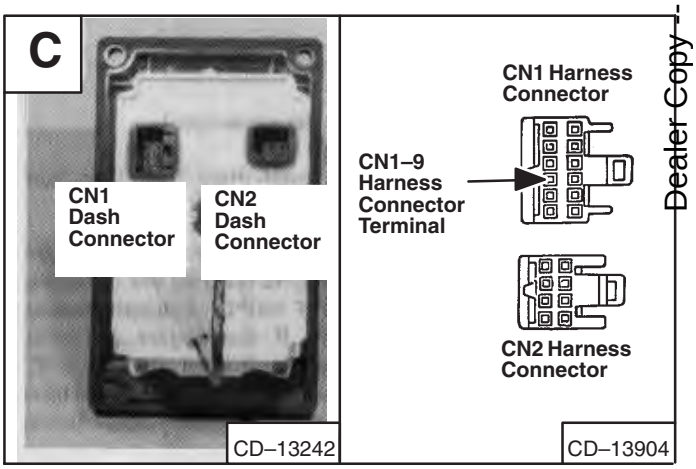
NOTE: If this wire has a bare spot and is grounded to the excavator frame or to the engine, the oil pressure warning light will continually blink on and off. If the wire is broken, the low oil pressure light will not blink, repair or replace the wire harness.

If the harness is in good working order but the display module does not work properly, remove the sending unit from the engine and install a mechanical oil pressure gauge to the engine. Start the engine, the oil pressure should be 42–64 PSI (294–441 kPa).

If the oil pressure is correct, the display module is defective, replace the display module.





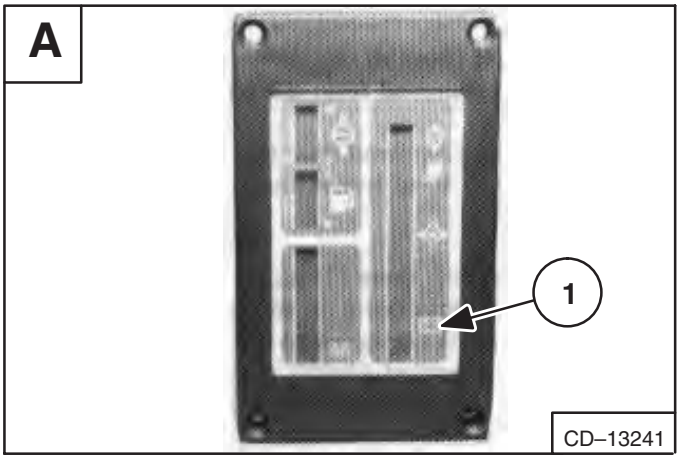


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DISPLAY MODULE (Cont'd)

Battery Charge Circuit Test (display module installed)

If the battery light (Item 1 **[A]**) continually blinks on and off with the engine running, this indicates a low voltage condition (less than 9 volts).



Install a DC voltmeter between the alternator battery B terminal and the engine ground **[B]**.

Start the engine.

The voltage at engine idle should be approximately 14 volts. Stop the engine. If the voltage is incorrect, repair or replace the alternator.

If the alternator voltage is correct, check the engine harness to display harness.

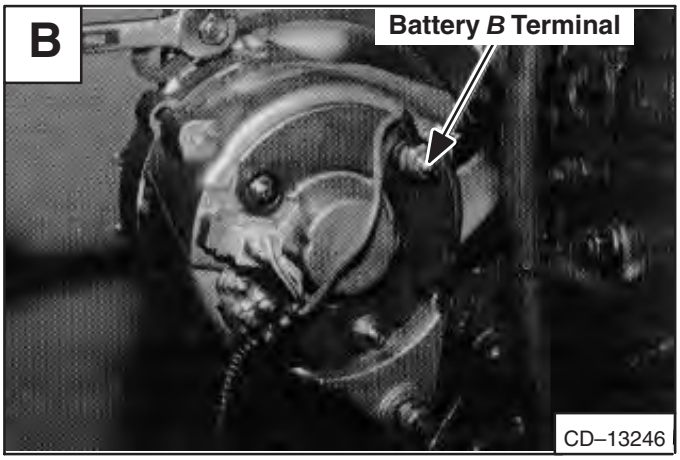
Disconnect the CN1 connector from the back of the display module.

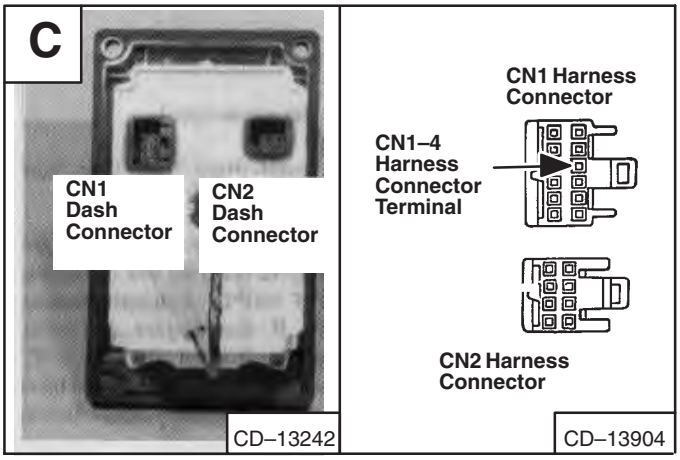
Connect a DC voltmeter to the display module harness connector pin CN1–4 **[C]**. Connect the other lead to ground. Start the excavator.

The voltage should be approximately 14 volts at engine idle. Stop the engine.

If no voltage is measured, check the wire harness for broken or damaged wires. Repair or replace the harness.

If voltage at the display module harness (connector pin CN1–4) is correct, the display module is defective. Replace the display module.



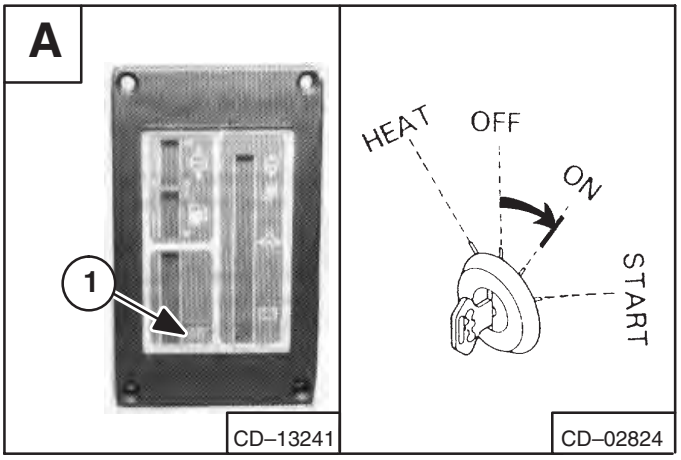


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DISPLAY MODULE (Cont'd)

Glow Plug Circuit Test (display module installed)

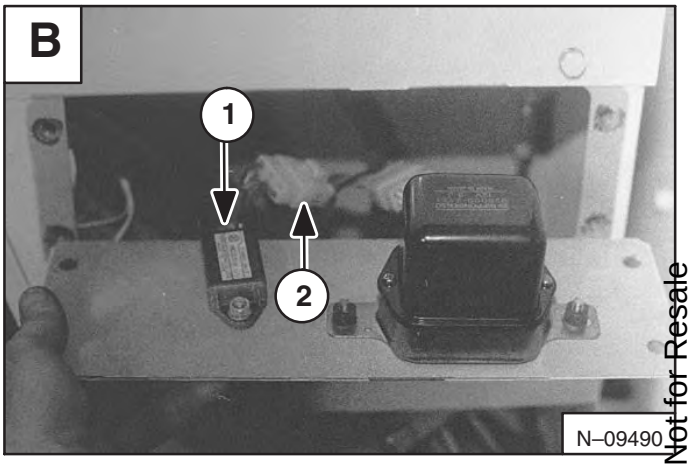
The glow plug light (Item 1) **[A]** will illuminate when the glow plugs are activated by turning the ignition key to the *heat* position.



The glow plug light is activated by a glow plug timer (Item 1) **[B]**.

When the ignition key is held in the *heat* position the timer will turn the glow plug light off after fifteen (15) seconds **[B]**. This indicates that the engine is ready to start.

NOTE: The ignition timer only turns off the display light. If the ignition key is held in the heat position after the display light turns off, the glow plugs will still be heating.

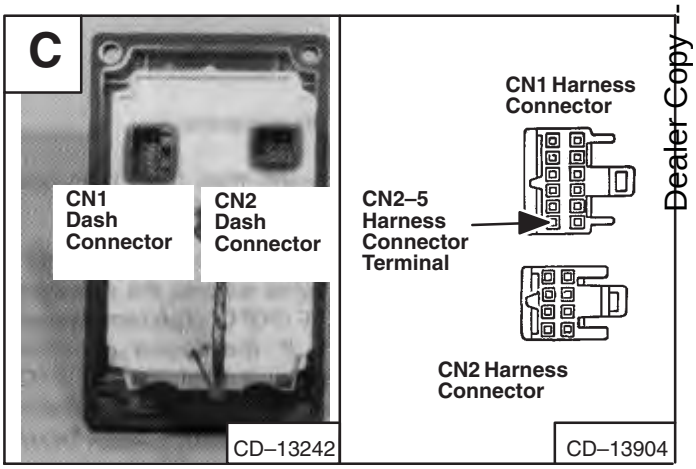


If the glow plug light (Item 1) **[A]** does not illuminate when the ignition key is turned to the *heat* position, check the voltage at the glow plugs. Connect a DC volt–meter leads to a glow plug wire and to ground **[C]**. Turn the key to the heat position, the voltage at the glow plug should be approximately 10.6 volts.

If no voltage is recorded at the glow plugs, check the engine harness for broken or damaged wires. Check the ignition switch harness connections. Repair or replace the engine harness.

If voltage is correct, the glow plug timer (Item 1) **[B]** may be defective.

Disconnect the CN1 and CN2 connectors from the back of the display module. Connect a DC voltmeter to the display harness terminal CN2–5 **[C]**. Connect the other lead to ground. Turn the ignition key to *heat*, the voltage should be 10–14 volts. If no voltage is recorded, disconnect the timer module harness (Item 2) **[B]** from the engine harness. Use a jumper wire and connect the two (2) yellow wire terminals together. Turn the ignition key to *heat* and check for voltage at the CN2–5 terminal **[C]**. If voltage is now recorded, the glow plug timer is defective, replace the glow plug timer. With the jumper wire still in place, connect the dash harness (CN1) to the dash module. Turn the key to *heat* position and check to see that the glow plug light is on. If glow plug light is not on, the display module is defective, replace the display module.



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DISPLAY MODULE (Cont'd)

Engine Temperature Circuit Test (display module removed)

The following tools will be needed:

A potentiometer with a range of 0–100 ohms and an ohm meter.

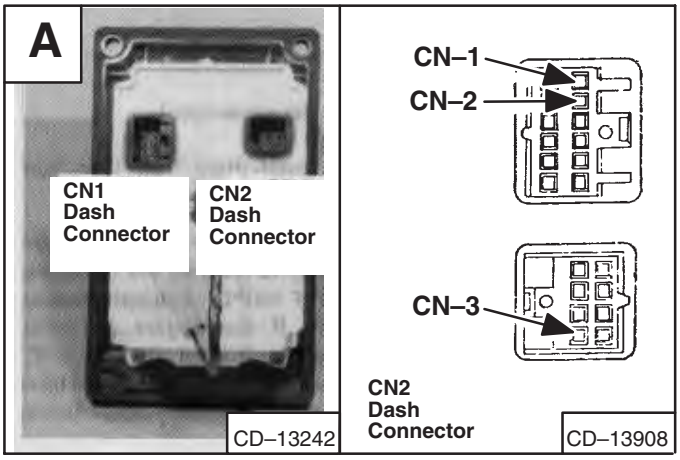
With the display module removed from the excavator, the only test that can be made is to see if the engine temperature bar graph and warning light will illuminate.

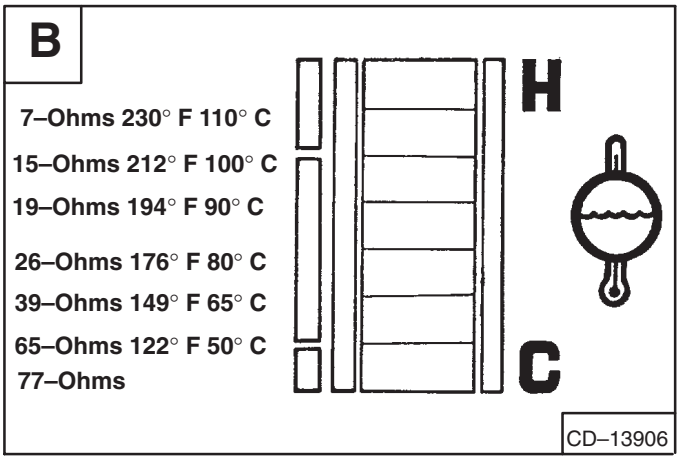
To test the display module, three test leads will need to be connected to the connector pins on the back of the module **[A]**. These leads must be protected so that the test wires will only contact the pins specified. Expose approximately 3/8 inch (10 mm) of the end of the test lead. Wrap the exposed end of the wire with electrical tape so only a small opening is exposed at the end of the lead. Connect one (1) of the test leads to the CN1–1 connector pin **[A]**. Connect this lead to a 12 volt battery positive (+) terminal. Connect a test lead to the CN1–2 connector pin **[A]**. Connect this lead to the battery negative (–) terminal. The display should now be illuminated. Connect the third test lead to the CN2–1 connector pin **[A]**. Connect the opposite end of this lead to the potentiometer (preset to 22 ohms, see instructions below) and ground the other potentiometer terminal to the negative (–) battery terminal.

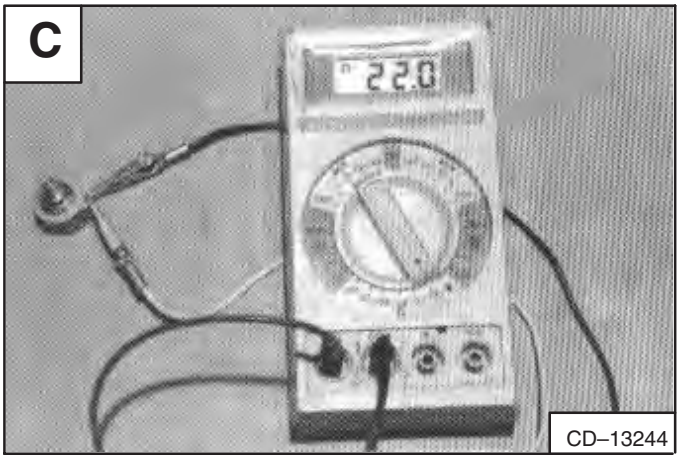
The engine temperature bar graph should illuminate the fifth bar in approximately ten (10) seconds. Change the potentiometer setting per chart **[B]** to further test the bar graph. When the bar graph is tested, and the first (cold *C*) bar is illuminated or the six or seven (Hot *H*) bars are illuminated, then the engine temperature warning light will blink on and off.

To set the potentiometer, connect the ohm meter to the potentiometer and turn the potentiometer until a reading of 22 ohms is recorded **[C]**. Disconnect the multi–meter.

If the display module will not illuminate, replace the display module.







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DISPLAY MODULE (Cont'd)

Fuel Level Circuit Test (display module removed)

The following tools will be needed:

A potentiometer with a range of 0–100 ohms and an ohm meter.

With the display module removed from the excavator, the only test that can be made is to see if the fuel level bar graph and the warning light will illuminate.

To test the display module, three test leads will need to be connected to the connector pins on the back of the module **[A]**. These leads must be protected so that the test wires will only contact the pins specified. Expose approximately 3/8 inch (10 mm) of the end of the test lead. Wrap the exposed end of the wire with electrical tape so only a small opening is exposed at the end of the lead. Connect one (1) of the test leads to the CN1–1 connector pin **[A]**. Connect the opposite end of this lead to a 12 volt battery positive (+) terminal. Connect a test lead to the CN1–2 connector pin **[A]**. Connect the opposite end of this lead to the battery negative (–) terminal. The dash should now be illuminated.

Connect the third test lead to the CN2–3 connector pin **[A]**. Connect the opposite end of this lead to the potentiometer (preset to 41 ohms, see instructions below), and ground the other potentiometer terminal to the negative (–) battery terminal.

The fuel level bar graph should be illuminated in the level *E* area **[B]** and the low fuel warning light should be blinking on and off.

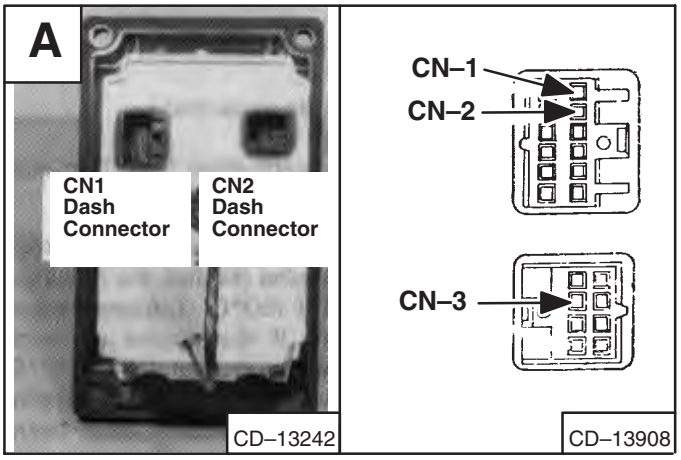
After approximately ten seconds the second bar graph (level 2) should illuminate and the low fuel warning light will turn off.

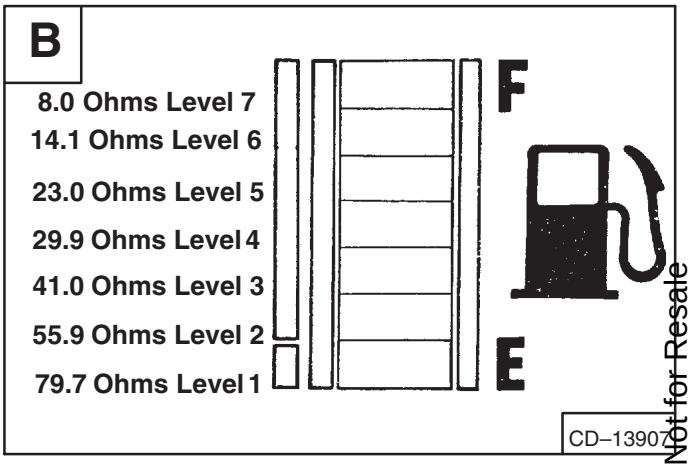
NOTE: The display module fuel circuit has a ten second delay built in to eliminate erratic lighting of the bar graphs as the fuel sloshes in the tank, After approximately thirty seconds the bar graph will be illuminated through the third level [B].

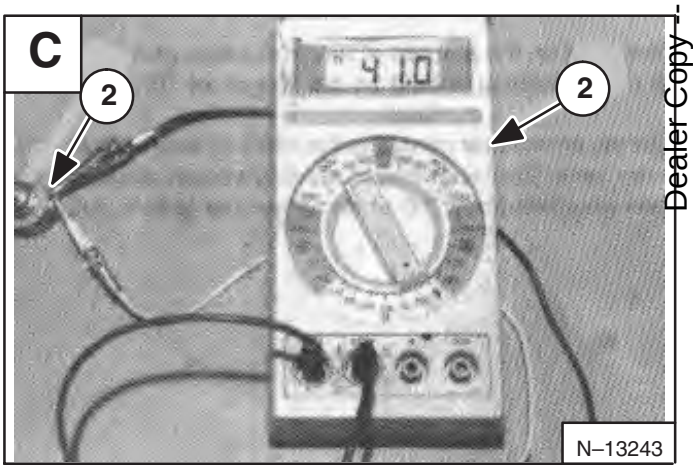
Change the potentiometer setting per chart **[B]** to further test the bar graph. When the bar graph is tested so only the level one bar is illuminated, the low fuel warning light will blink on and off.

To set the potentiometer, connect the ohm meter (Item 1) **[C]** to the potentiometer and turn the potentiometer (Item 2) **[C]** until a reading of 41 ohms is recorded. Disconnect the ohm meter.

If the display module will not illuminate, replace the display module.







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DISPLAY MODULE (Cont'd)

Engine Oil Pressure Circuit T est (display module removed)

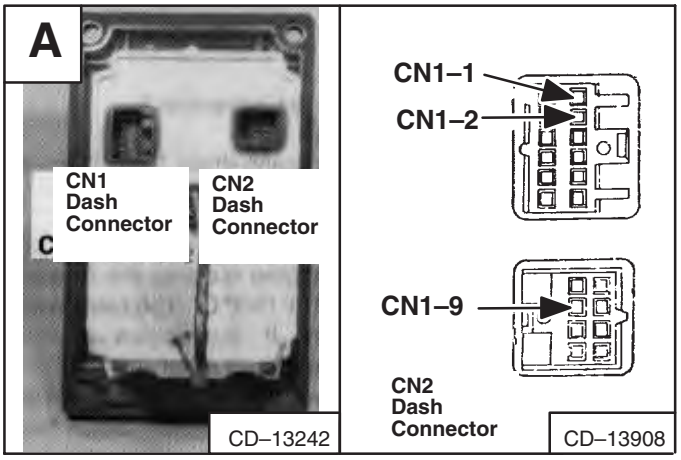
With the display module removed from the excavator, the only test that can be made is to see if the low oil pressure warning light will illuminate.

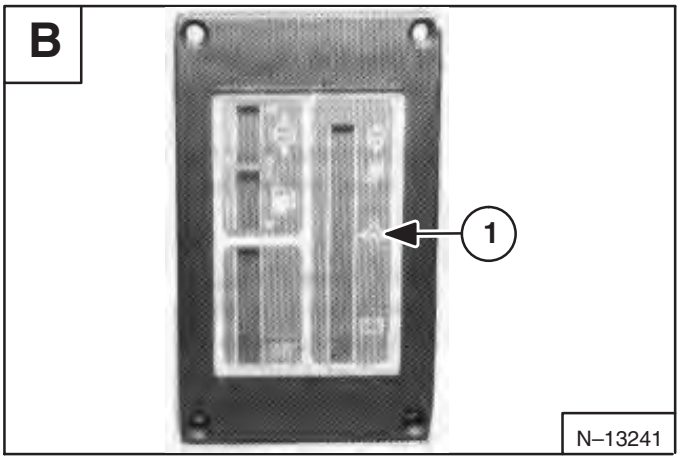
To test the display module, three test leads will need to be connected to the connector pins on the back of the module **[A]**. These leads must be protected so that the test wires will only contact the pins specified. Expose approximately 3/8 inch (10 mm) of the end of the test lead. Wrap the exposed end of the wire with electrical tape so only a small opening is exposed at the end of the lead. Connect one of the test leads to the CN1–1 connector pin **[A]**. Connect the opposite end of this lead to a 12 volt battery positive (+) terminal. Connect a test lead to the CN1–2 connector pin **[A]**. Connect the opposite end of this lead to the battery negative (–) terminal. The display should now be illuminated.

Connect the third test lead to the CN1–9 connector pin **[A]**. Ground the other end of this test lead to the battery negative (–) terminal. In approximately four seconds the low pressure warning light (Item 1) **[B]** will start to blink on and off.

Remove the third test lead from the negative (–) battery terminal and the low oil pressure warning light (Item 1) **[B]** will turn off.

If the display light will not illuminate, replace the display module.





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DISPLAY MODULE (Cont'd)

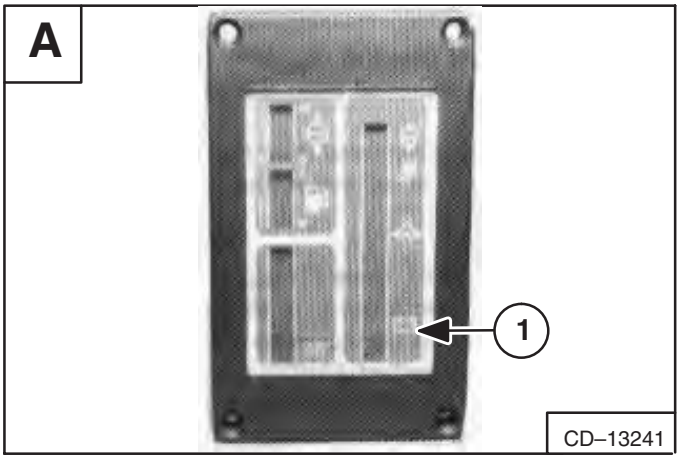
Battery Charge Circuit Test (display module removed)

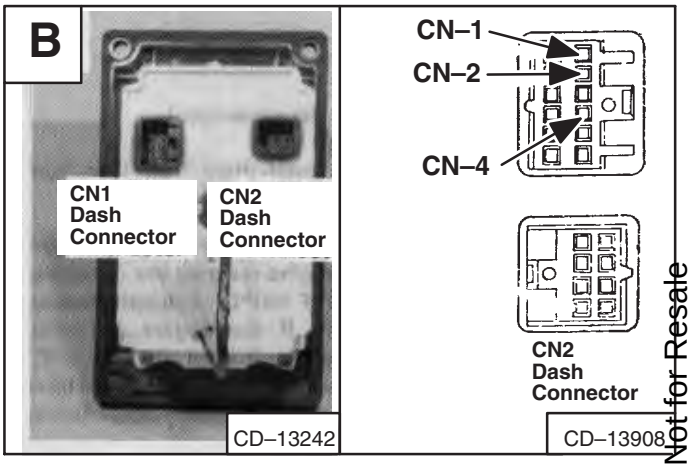
With the display module removed from the excavator, the only test that can be made is to see if the charge light (Item 1) **[A]** will illuminate.

To test the display module, three test leads will need to be connected to the connector pins on the back of the module **[B]**. These leads must be protected so that the test wires will only contact the pins specified. Expose approximately 3/8 inch (10 mm) of the end of the test lead. Wrap the exposed end of the wire with electrical tape so only a small opening is exposed at the end of the lead. Connect one (1) of the test leads to the CN1–1 connector pin **[B]**. Connect the opposite end of this lead to a 12 volt battery positive (+) terminal. Connect a test lead to the CN1–2 connector pin **[B]**. Connect the opposite end of this lead to the battery negative (–) terminal. The display should now be illuminated.

Connect the third test lead to the CN1–4 connector pin **[B]**. Connect the other end of the lead to the positive (+) battery terminal. The battery charge light (Item 1) **[A]** should stop blinking in approximately four seconds.

If the display module does not illuminate per above information, replace the display module.





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DISPLAY MODULE (Cont'd)

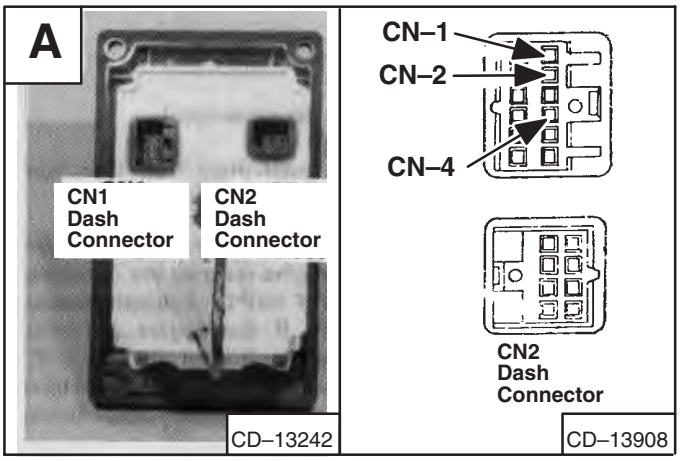
Glow Plug Circuit Test (display module removed)

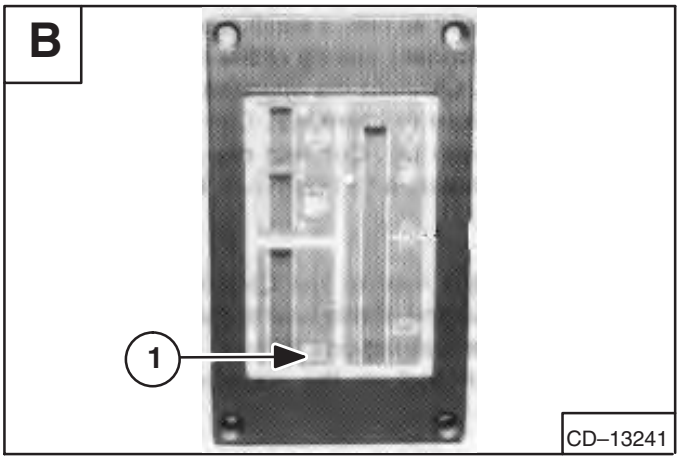
With the display module removed from the excavator, the only test that can be made is to see if the glow plug light will illuminate.

To test the display module, three test leads will need to be connected to the connector pins on the back of the module **[A]**. These leads must be protected so that the test wires will only contact the pins specified. Expose approximately 3/8 inch (10 mm) of the end of the test lead. Wrap the exposed end of the wire with electrical tape so only a small opening is exposed at the end of the lead. Connect one of the test leads to the CN1–1 connector pin **[A]**. Connect the opposite end of this lead to a 12 volt battery positive (+) terminal. Connect a test lead to the CN1–2 connector pin **[A]**. Connect the opposite end of this lead to the battery negative (–) terminal. The display should now be illuminated.

Connect the third test lead to the CN2–5 connector pin **[A]**. Connect the opposite end of the lead to the battery positive (+) terminal. The glow plug light (Item 2) **[B]** should be illuminated. Remove this wire from the battery positive (+) terminal and the light will turn off.

If the glow plug light does not illuminate, the display module is defective. Replace the display module.



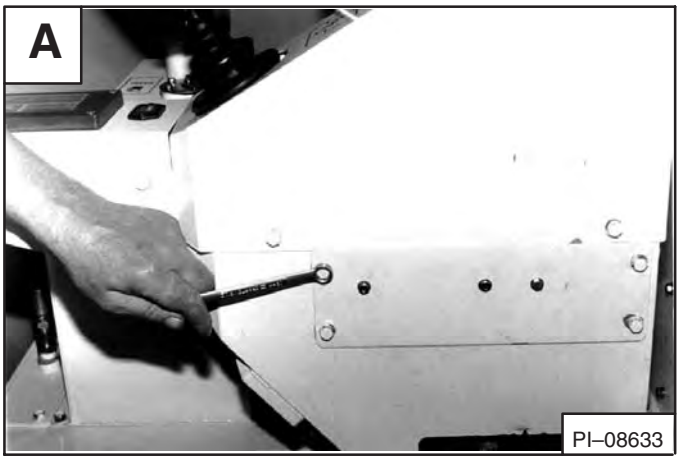


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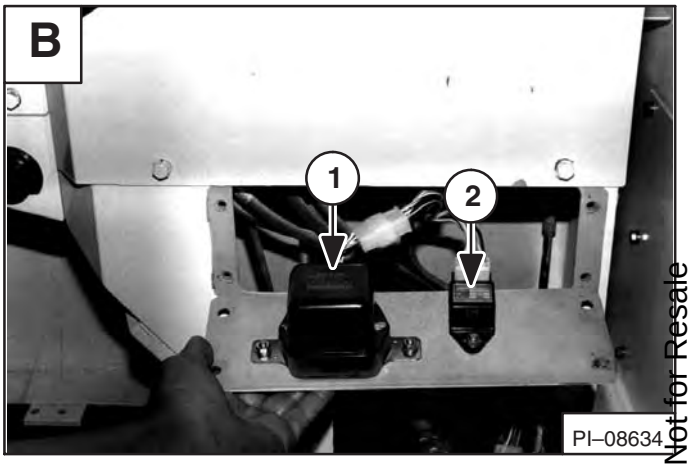
VOLTAGE REGULATOR/GLOW PLUG TIMER

Removal And Installation

Remove the mounting bolts from the panel **[A]**.



Remove the voltage regulator (Item 1) **[B]** and the glow plug timer (Item 2) **[B]**.

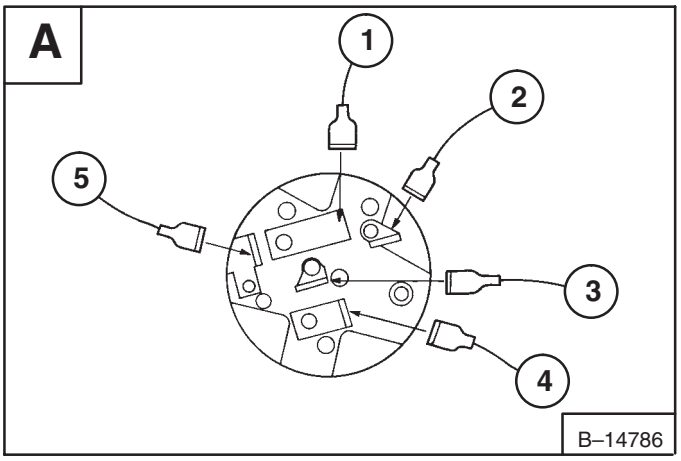


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WIPER MOTOR AND SWITCH

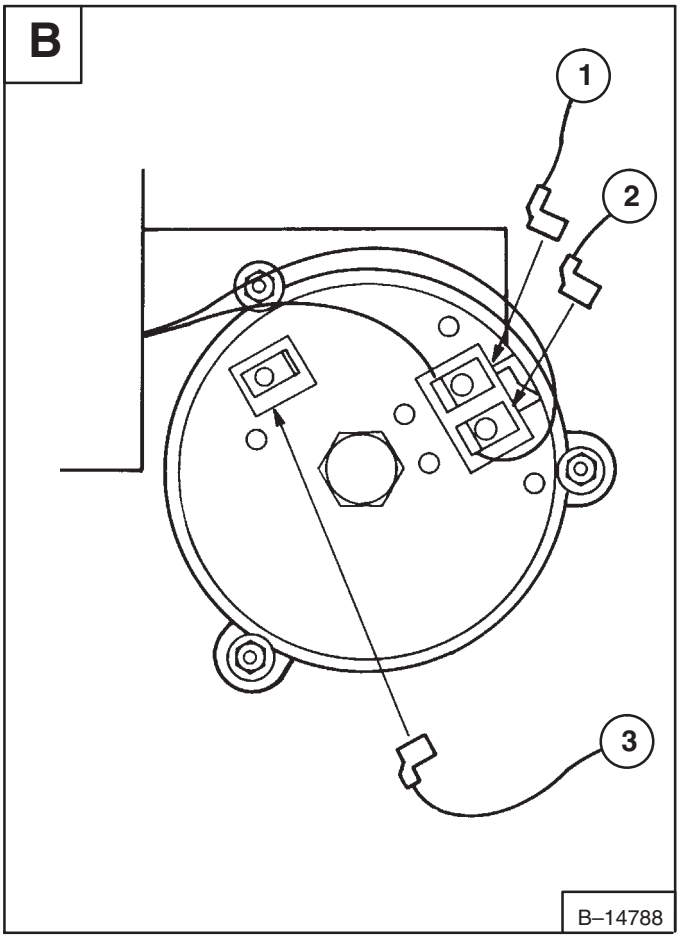
The wiper switch wiring connections are as shown in **[A]**:

1.) Red Wire . . . . . Wiper High Speed
2.) Yellow Wire . . . . . Wiper Park Position
3.) Red/White Wire . . . Power from the Fuse Panel
4.) Green Wire . . . . . Wiper Low Speed
5.) Purple Wire . . . . . Washer (if equipped)



On Excavators with the old wiper motor (P/N 6654163) the wiring connections are as shown in **[B]**:

1.) Green Wire . . . . . Wiper Low Speed
2.) Red Wire . . . . . Wiper High Speed
3.) Yellow Wire . . . . . Wiper Park Position

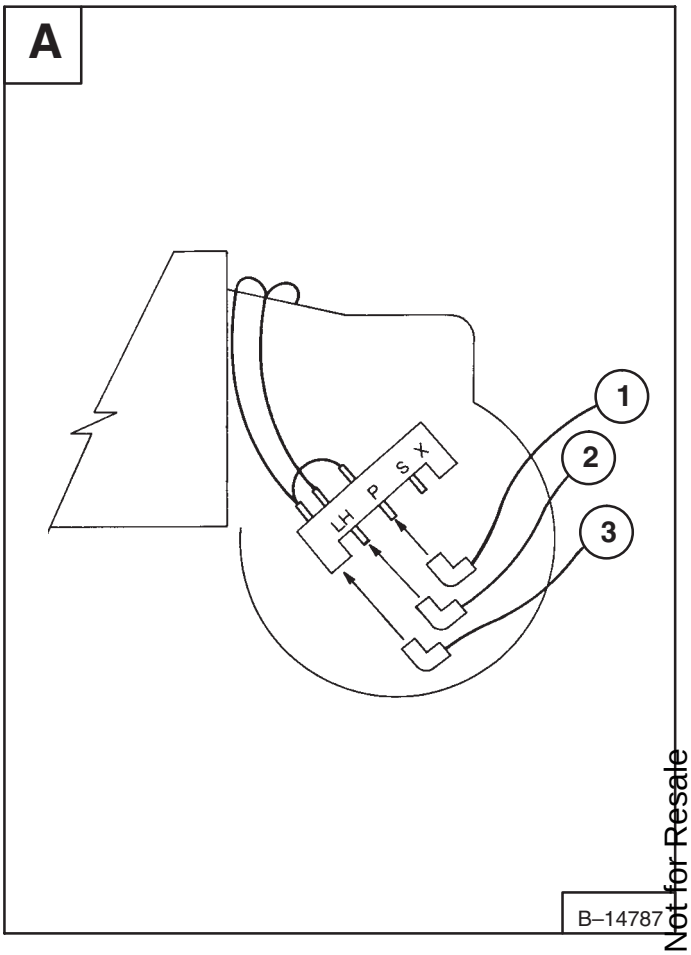


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WIPER MOTOR AND SWITCH (Cont'd)

On Excavators with the new wiper motor (P/N 6664094) the wiring connections are as shown in **[A]**:

1.) Yellow Wire . . . . . Wiper Park Position
2.) Red Wire . . . . . Wiper High Speed
3.) Green Wire . . . . . Wiper Low Speed



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TROUBLESHOOTING

Chart

The following troubleshooting chart is provided for assistance in locating and correcting problems which are most common. Many of the recommended procedures must be done by authorized Bobcat Service personnel only.

PROBLEM	CAUSE
Slow cranking speed.	1, 2, 3, 4
Engine will not start.	2, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 19, 27, 28, 29
Difficult to start.	5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 25, 27, 28, 29
No power from engine.	8, 9, 10, 11, 12, 13, 15, 16, 17,18, 20, 21, 22, 23, 27, 28, 29
Engine is mis–firing.	8, 9, 11, 12, 13, 15, 16, 17, 21, 22, 24, 25, 26, 28
Too much fuel consumption.	10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29
Black exhaust.	10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29
Blue/white exhaust.	4, 10, 15, 16, 17, 21, 23, 27, 29, 30, 50
Low oil pressure.	4, 31, 32, 33, 34, 35, 37, 38, 39, 52
Engine knocking.	13, 15, 16, 19, 22, 24, 25, 27, 29, 31, 40, 41, 53
Engine running rough.	7, 8, 9, 10, 11, 12, 13, 17, 18, 22, 24, 25, 26, 29, 40, 53
Vibration.	12, 13, 17, 21, 22, 25, 26, 29, 40, 42, 43
High oil pressure.	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.
2. Bad electrical connections.
3. Faulty starter motor.
4. Incorrect grade of oil.
5. Low cranking speed.
6. Fuel tank empty.
7. Faulty stop control operation.
8. Plugged fuel line.
9. Plugged fuel filter.
10. Restriction in the air cleaner.
11. Air in the fuel system.
12. Faulty fuel injection pump.
13. Faulty fuel injectors.
14. Broken injection pump drive.
15. Incorrect injection pump timing.
16. Incorrect valve timing.
17. Poor compression.
18. Plugged fuel tank vent.
19. Incorrect grade of fuel.
20. Exhaust pipe restriction.
21. Cylinder head gasket leaking.
22. Overheating.
23. Cold running.
24. Incorrect tappet adjustment.
25. Sticking valves.
26. Incorrect high pressure fuel lines.
27. Worn cylinder bores.
28. Worn valves and seat.
29. Broken or worn piston rings.
30. Worn valve stems or guides.
31. Worn or damaged bearings.
32. Not enough oil in the oil pan.
33. Switch is defective.
34. Oil pump worn.
35. Relief valve is stuck open.
36. Relief valve is stuck closed.
37. Broken relief valve spring.
38. Faulty suction pipe.
39. Plugged oil filter.
40. Piston seizure.
41. Incorrect piston height.
42. Faulty engine mounting.
43. Incorrect alignment of flywheel.
44. Faulty thermostat.
45. Restriction in water jacket.
46. Loose alternator belt.
47. Plugged radiator.
48. Faulty water pump.
49. Plugged breather pipe.
50. Damaged valve stem oil deflectors.
51. Coolant level too low.
52. Plugged oil pump pipe strainer.
53. Broken valve spring.

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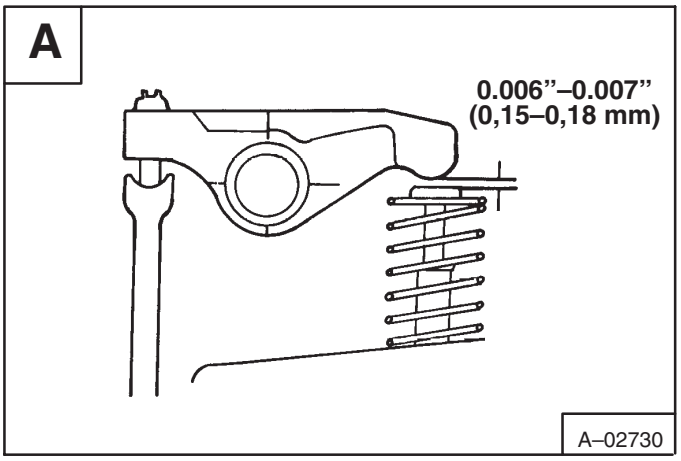
VALVE CLEARANCE

Adjustment

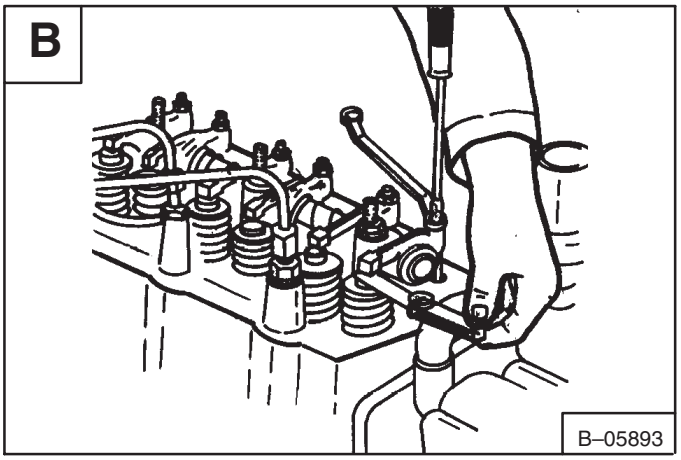
Adjust the valve clearance with the engine stopped and cold.

The correct valve clearance is 0.006–0.007 inch (0,15–0,18 mm) **[A]**.

Make sure the piston is at T .D.C. when making the adjustment for the valves of the particular cylinder.



Put the correct size feeler gauge between the rocker arm and valve stem. Turn the adjustment bolt until the clearance is correct **[B]**.



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ENGINE COMPRESSION

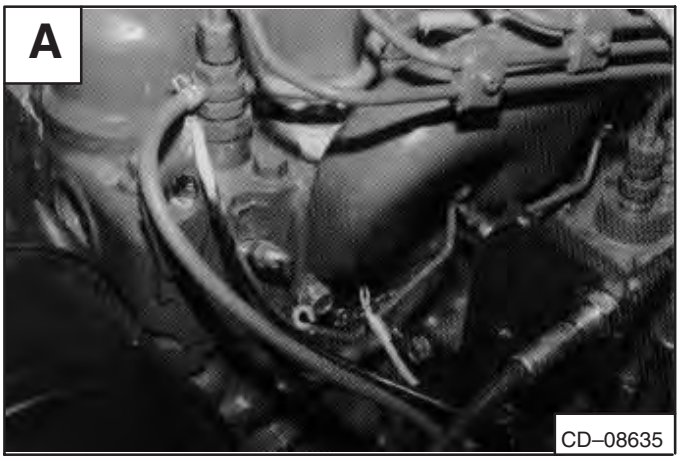
Checking

Use MEL1063 – Engine Compression Kit to do the following procedure.

The engine must be a operating temperature.

The compression must be at least 75% of 337–448 PSI (2324–3089 kPa) with no more than 50 PSI (345 kPa) difference between the cylinders.

Remove the nut and the glow plug wire **[A]**.



Remove the glow plug **[B]**.

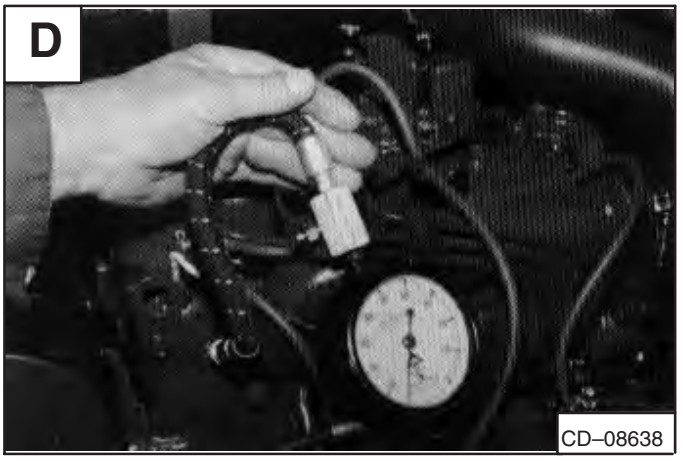


Install the compression adapter in the glow plug hole **[C]**.



Connect the compression gauge to the tester **[D]**.

Turn the engine with the starter and check the gauge pressure.



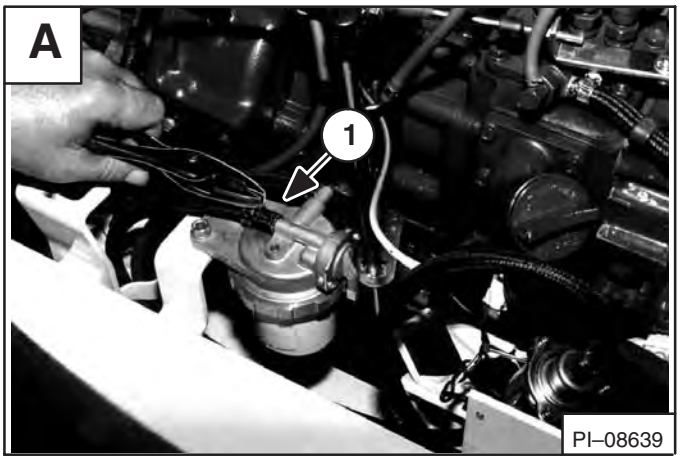
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FUEL FILTER

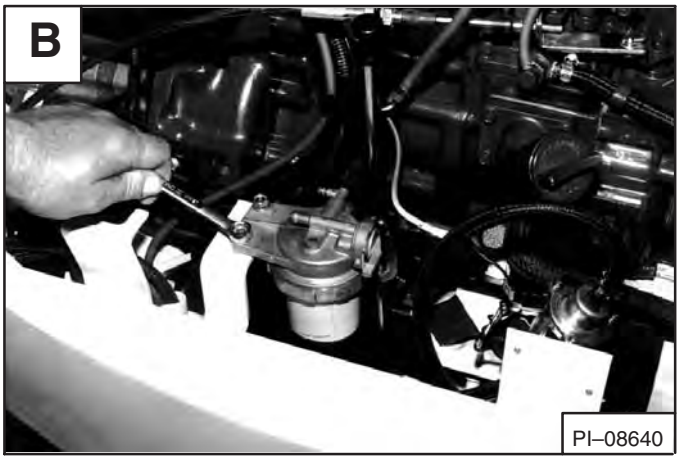
Final Filter

See the *SERVICE SCHEDULE* Page 1–1 for the correct service interval to service the fuel filters.

Close the valve (Item 1) **[A]** when removing the fuel lines from the filter.



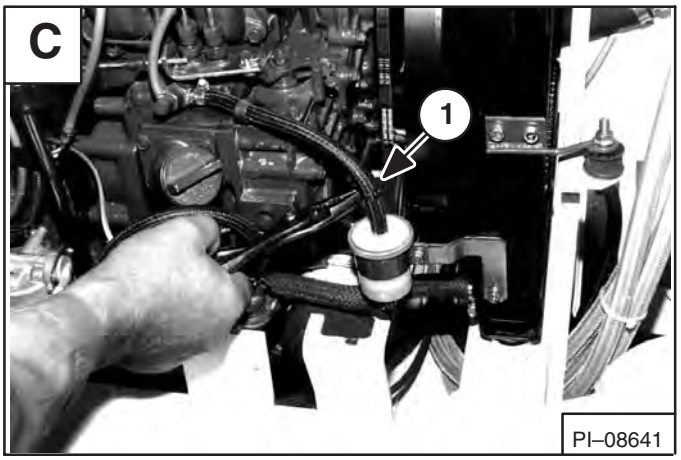
Remove the mounting bolts from the filter **[B]**.



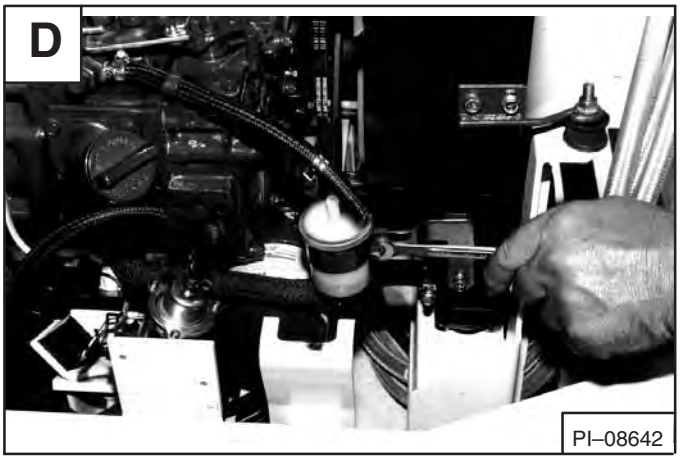
In–Line Filter

Remove the hose clamp (Item 1) **[C]** from the in–line fuel filter.

Remove the fuel hose.



Remove the nut from the filter clamp and remove the filter **[D]**.



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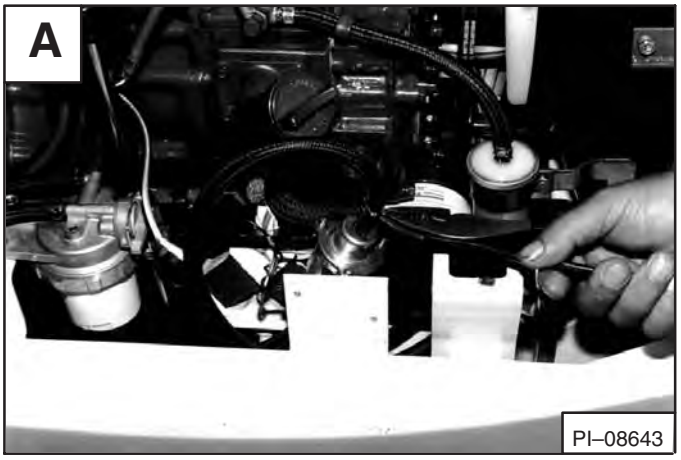
ELECTRIC FUEL PUMP

No air removal from the fuel system is not necessary when filters are changed or the machine runs out of fuel.

The electric fuel pump will self bleed the system by turning the ignition key to the *ON* position.

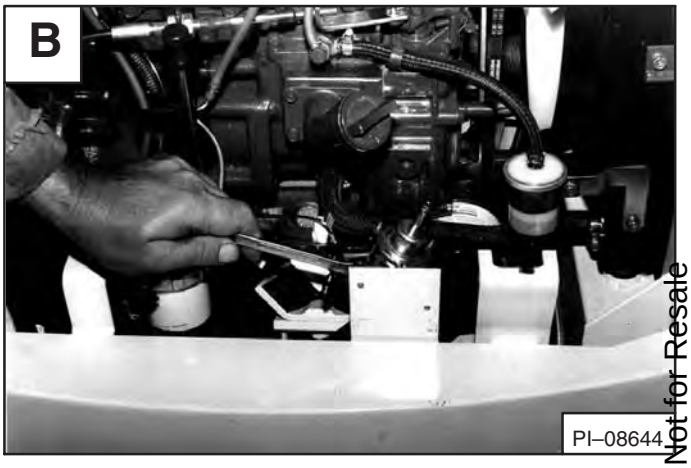
Removal And Installation

Remove the hose clamp from the fuel pump **[A]**.



Remove the mounting bolts from the fuel pump bracket **[B]**.

Remove the electric fuel pump.



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FUEL INJECTION PUMP

Checking The Injection Pump

The injection pump contains parts which have a very close tolerance and its operation has a direct effect on the performance of the engine.

IMPORTANT

Do not attempt to maintain or adjust unless you are trained and have the correct equipment.

I–2028–0289

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

MEL1237 – Adapter Fuel Line
MEL1173–1 – Pressure Gauge

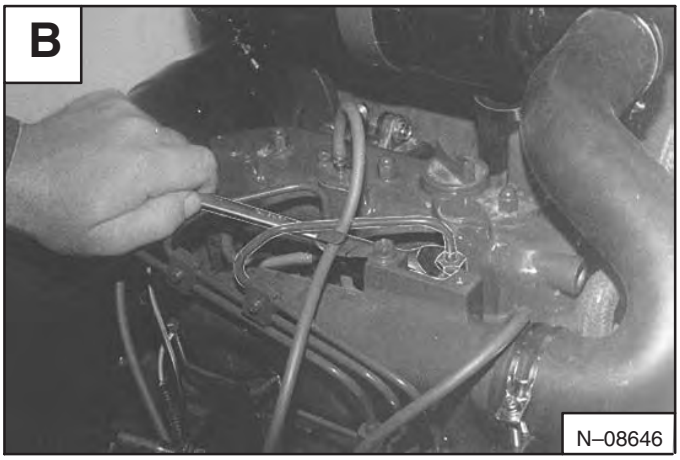
To check the discharge pressure at the fuel injection pump, use the following procedure:

Disconnect the high pressure fuel line at the pump **[A]**.

Disconnect the other end of the same high pressure line **[B]**.

Disconnect the clamp from the fuel line **[C]**.





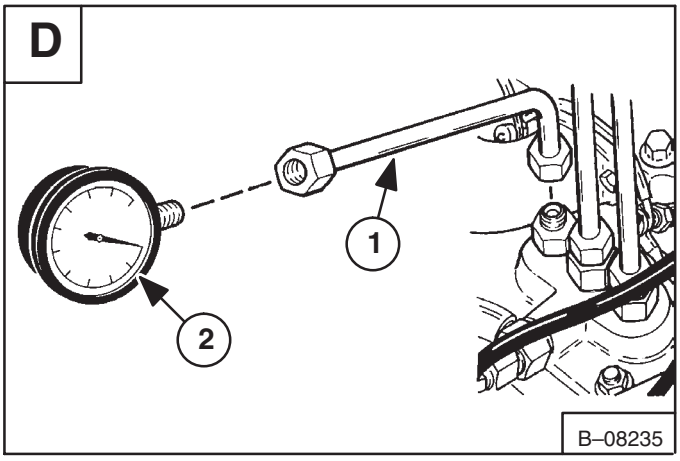


Connect the adapter fuel line (Item 1) **[D]** to the fitting.

Connect the pressure gauge (Item 2) **[D]**.

Crank the engine, with the starter , to increase the pressure to 2133 PSI (14707 kPa). Align the plunger at T.D.C.

The pressure should hold at 2133 PSI (14707 kPa), at least five seconds. If not, repair or replace the injection pump.



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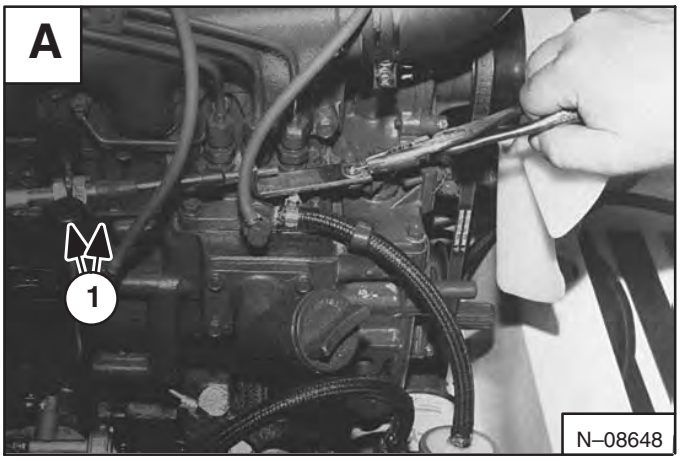
FUEL INJECTION PUMP (Cont'd)

Removal And Installation

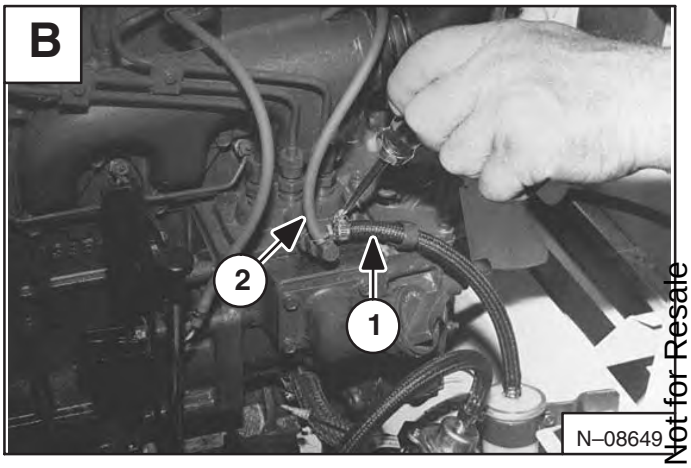
Clean the area around the fuel injection pump. Remove the high pressure fuel lines.

Disconnect the throttle linkage cable from the injection pump **[A]**.

Loosen the jam nuts (Item 1) **[A]** from the bracket to remove the throttle cable.

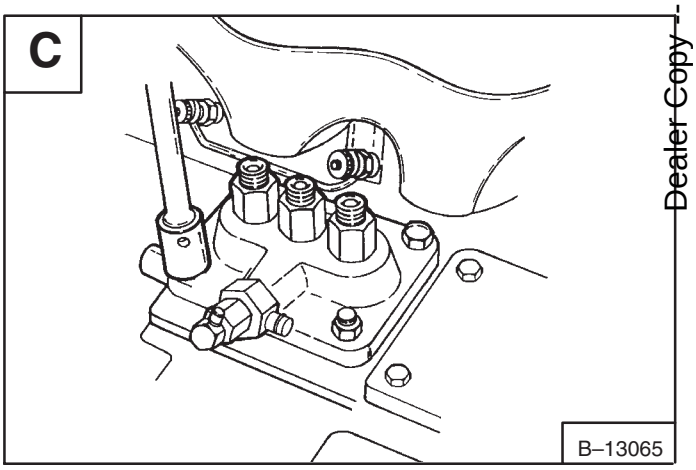


Disconnect the fuel inlet hose (Item 1) **[B]** and return hose (Item 2) **[B]**.



Remove the four nuts from the injection pump **[C]**.

Installation: Tighten the nuts to 17–20 ft.–lbs. (23–27 Nm) torque.

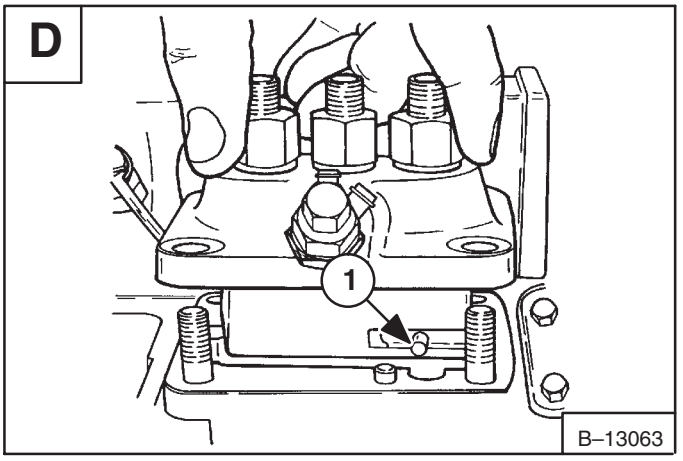


Align the pin (Item 1) **[D]** in the control rack with the slot in the engine block.

Remove the injection pump.

Installation: When the injection pump is installed, make sure the pin (Item 1) **[D]** 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.

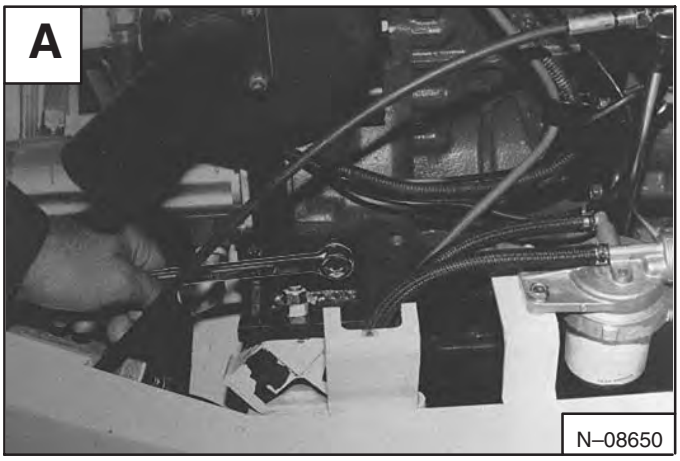


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FUEL INJECTION PUMP (Cont'd)

Timing The Injection Pump

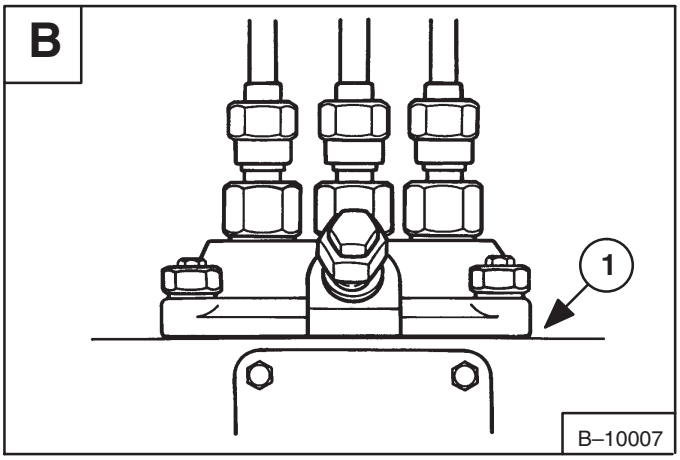
NOTE: The engine timing marks are located on the engine flywheel. Remove the left rear motor mount [A].



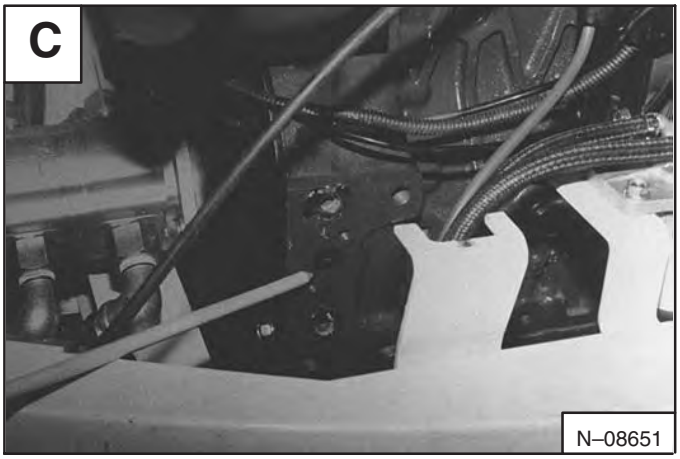
Timing the fuel injection pump is done by changing the number of shims (Item 1) **[B]** between the injection pump and engine block.

Each shim will change the timing 1.5 degrees. The timing of the pump will be later when a shim is added, and earlier when a shim is removed.

Use the following procedure to time the injection pump:



1. Remove the number one cylinder high pressure line from the injection pump.
2. Install a short pipe in the number one outlet of the pump. Point the pipe up (vertical).
3. With fuel supply to the injection pump, rotate the engine counterclockwise direction (viewed from the flywheel end of the engine). Fuel must flow from the pipe as the mark on the flywheel and the pointer are in alignment **[C]**.
4. The correct timing for the engine is 23–25 degrees B.T.D.C.. Add or subtract shim(s) as needed to adjust the delivery time of the fuel injection pump.
5. Repeat Step three several times for correct timing mark alignment before adding or removing shim(s).



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FUEL INJECTOR NOZZLES

⚠ WARNING

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–2072–0496

Some problems caused by faulty injector nozzles:

1. The engine is hard to start or will not start.
2. Rough engine operation at idle.
3. The engine will not have full power.
4. The engine exhaust smoke is black, white or blue.

Removal And Installation

IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

I–2029–0289

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

MEL1181 – Nozzle Socket

Disconnect the high pressure fuel lines from the fuel injectors **[A]**.

Disconnect the other end of the fuel lines from the injection pump. Remove the high pressure fuel lines.

Disconnect the return fuel hoses (Item 1) **[B]**.

Remove the banjo fitting from the fuel injector **[B]**.

Use the special socket and loosen the injector nozzle **[C]**.

Installation: Tighten the injector nozzle to 29–36 ft.–lbs. (39–49 Nm) torque.

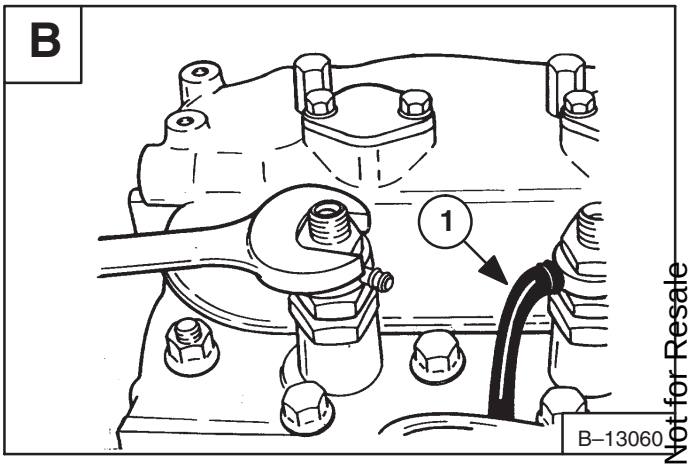
Remove the injector nozzle from the cylinder head **[D]**.

A



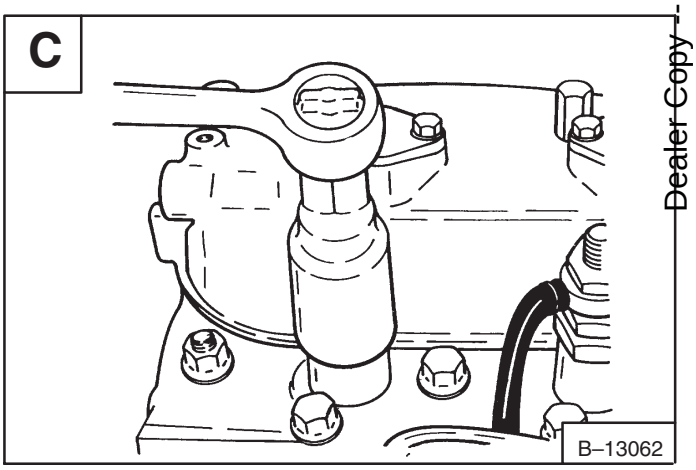
N–08645

B



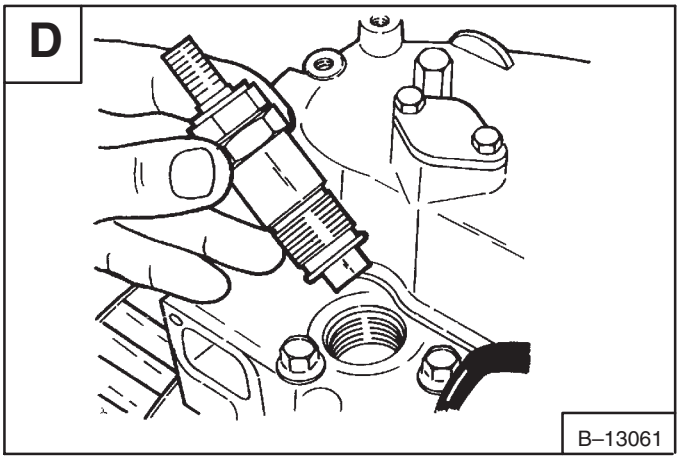
B–13060

C



B–13062

D



B–13061

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FUEL INJECTOR NOZZLES (Cont'd)

Checking The Injector Nozzle

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:

MEL10018 – Injector Nozzle Tester

You can adjust the release pressure of the injector nozzle by adding or removing spacer (s) (Item 1) **[A]** from the top of the nozzle spring (Item 2) **[A]**.

Each spacer is 0.004 inch (0,10 mm) thick and will change the release pressure by about 142 PSI (980 kPa). The release pressure should be 1920–2133 PSI (13238–14707 kPa).

Connect the injector nozzle to the tester with the nozzle down **[B]**.

Operate the hand lever slowly and note the opening pressure. If the pressure is not correct, disassemble the injector nozzle and add or remove spacer (s) (Item 1) **[A]** as needed.

Assemble the nozzle and check the pressure again. Tighten the nozzle body (Item 3) **[A]** to 43–58 ft.–lbs. (59–79 Nm) torque.

NOTE: Do not over–tighten, or slow action of the valve will occur.

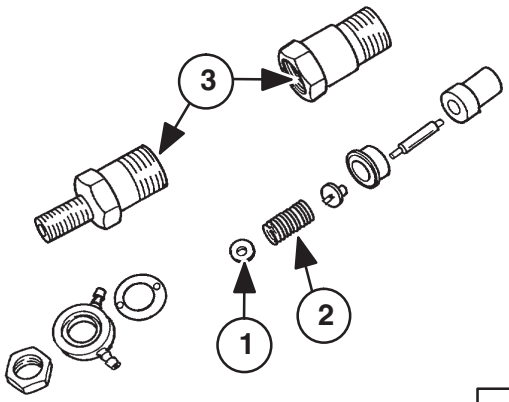
Check for internal leakage. Operate the hand lever until the pressure is almost enough to open the injector valve.

Record the pressure. Release the hand lever. check the pressure drop for 10 seconds. If the pressure drop is more than 740 PSI (5102 kPa), the nozzle is damaged.

Check that the spray pattern is correct **[C]**:

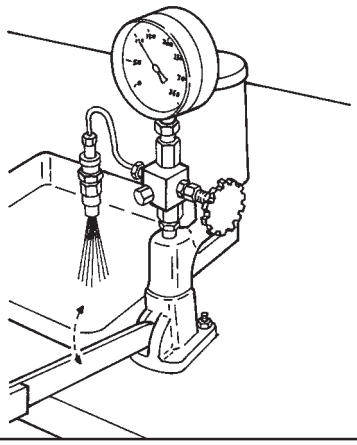
1. Fuel does not come out the side of the nozzle.
2. Drops of fuel are not present at the nozzle.
3. The nozzle has an even flow coming from the nozzle.

A



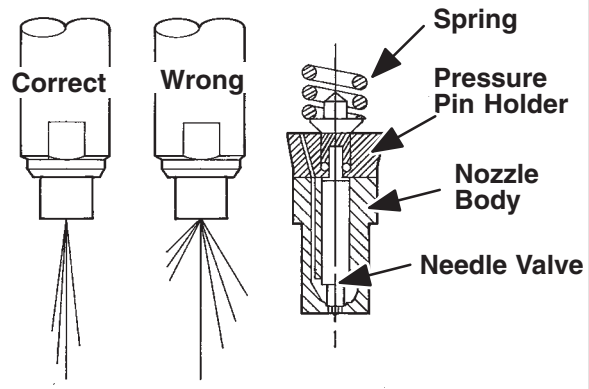
B–04103

B



A–02513

C



A–02621

WARNING

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–2072–0496

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GLOW PLUGS

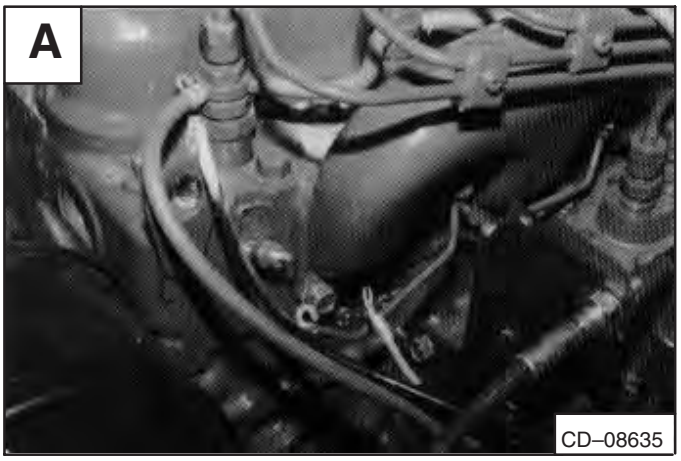
Removal And Installation

Remove the high pressure fuel lines from the injector nozzles and injection pump.

IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

I–2029–0289



Disconnect the glow plug wires **[A]**.

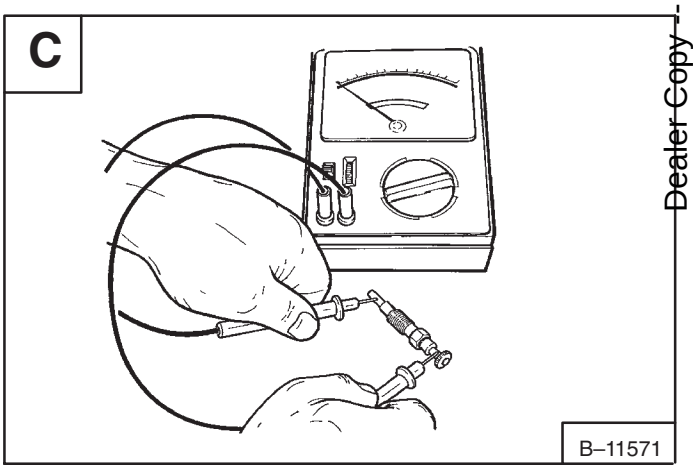
Remove the glow plugs from the cylinder head **[B]**.



Checking The Glow Plug

Connect a voltmeter to the terminal end of the glow plug, touch the other lead from the voltmeter to the heating end of the glow plug **[C]**.

The reading must be approximately 1.5 ohms. If the resistance is zero OHMS, the glow plug has a short circuit. If the resistance is infinite, the coil of the glow plug is broken.



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RADIATOR

Removal And Installation

Drain the cooling system.

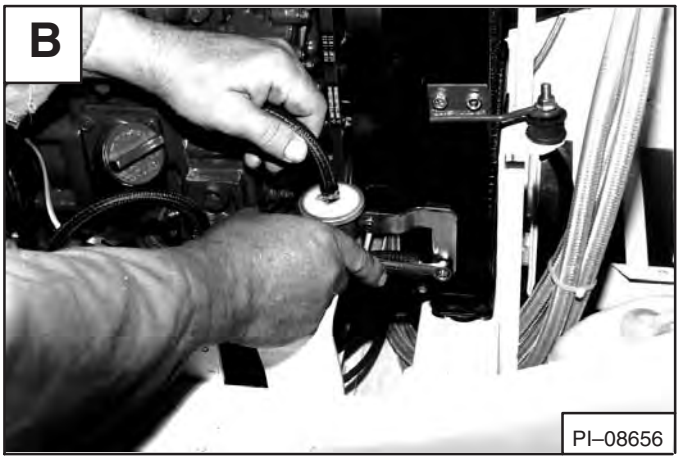
Disconnect the top radiator hose **[A]**.

Disconnect the lower radiator hose and engine block drain hose.



Remove the inline filter clamp **[B]**.

Remove the clamp and filter.



Remove the clamp from the lower radiator hose **[C]**.

Remove the hose.



Remove the clamp from the overflow hose **[D]**.



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RADIATOR (Cont'd)

Removal And Installation (Cont'd)

Remove the radiator mounting bolts and nuts **[A]**.



Remove the radiator side bracket **[B]**.



Remove the radiator drain valve **[C]**.



Remove the radiator **[D]**.

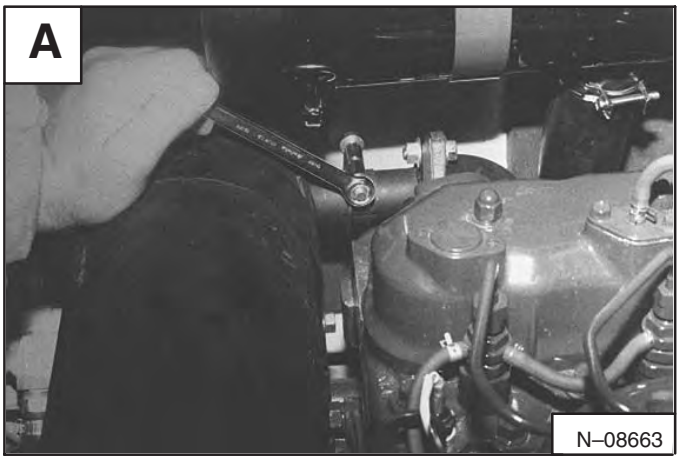


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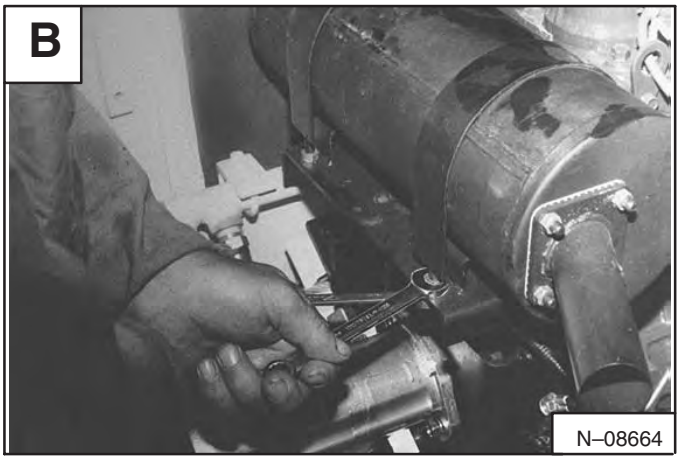
MUFFLER

Removal And Installation

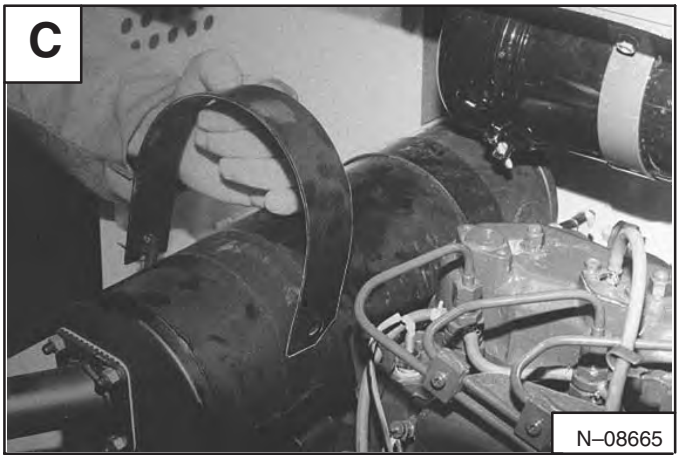
Remove the bolt from the exhaust pipe clamp **[A]**.



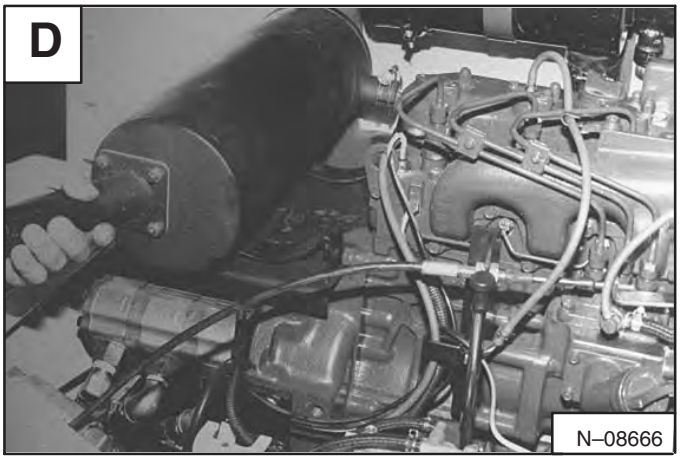
Remove the bolt from the muffler clamp **[B]**.



Remove the muffler clamp **[C]**.



Remove the muffler **[D]**.



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AIR CLEANER

Removal And Installation

Raise the engine cover.

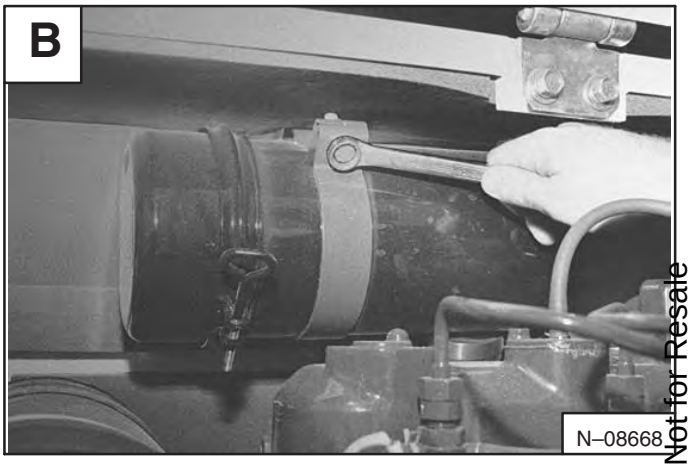
Loosen the hose clamps on the air intake hose **[A]**.

Remove the hose.



Remove the bolt from the air cleaner clamp **[B]**.

Remove the air cleaner.



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ENGINE

Removal And Installation

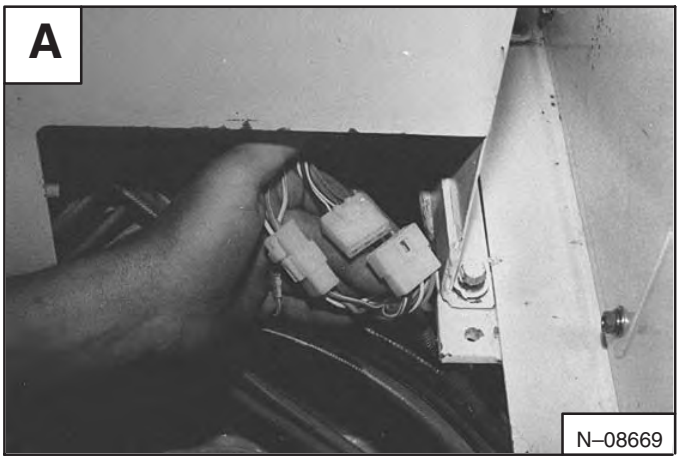
Remove the engine cover. (See Page 5–1.)

Remove the radiator. (See Page 7–12.)

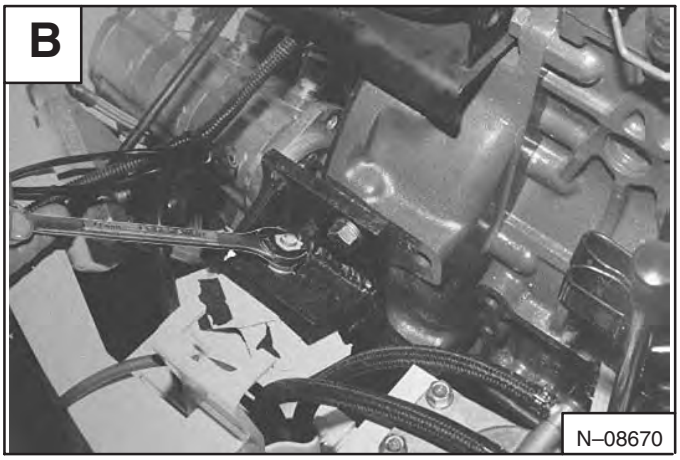
Remove the seat and swing motor cover(See Page5–1.)

Disconnect the battery cables from the battery.

Disconnect the engine harness **[A]**.



Remove the motor mount bolts **[B]**.



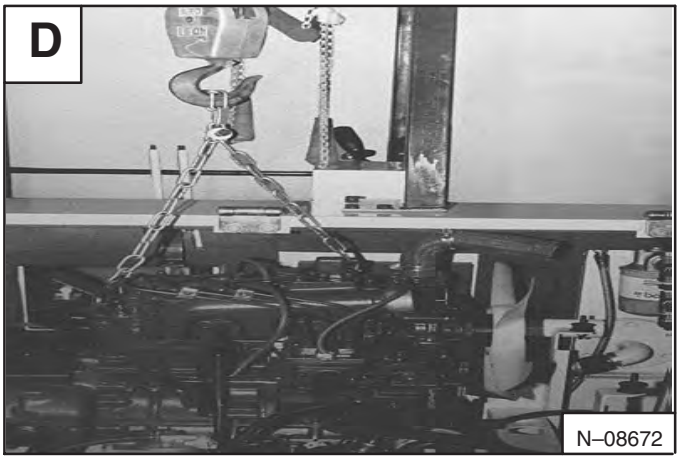
Disconnect the electric fuel pump wire **[C]**.

Remove the fuel hose from the injection pump.

Remove the hydraulic pump mounting bolts. (See Page 2–3.)



Connect a chain to the lift eyes on the engine and remove the engine using a chain hoist **[D]**.



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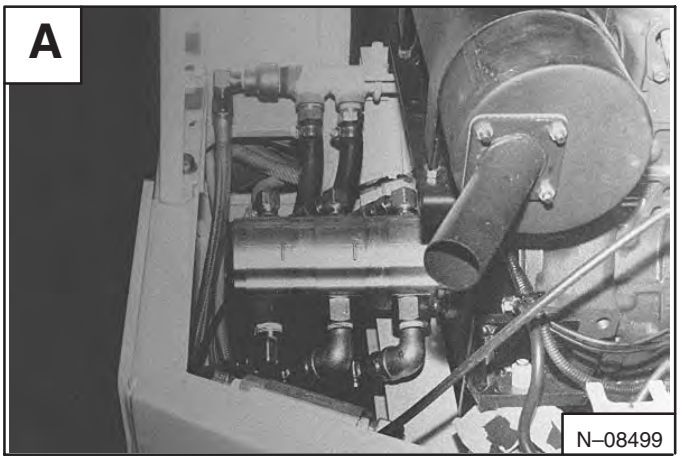
ENGINE FLYWHEEL

Removal And Installation

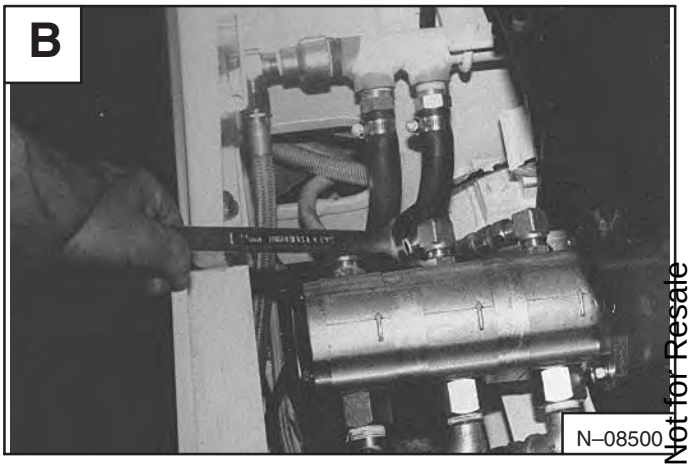
NOTE: The flywheel can be removed with the engine installed in the machine. The following photo's show the engine removed from the machine for photo clarity.

If the engine is not removed; disconnect the three inlet hoses from the hydraulic pump **[A]**.

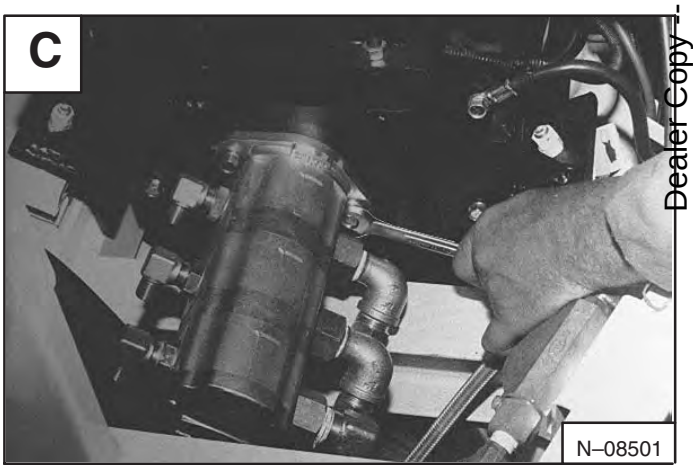
Drain the hydraulic fluid into a container.



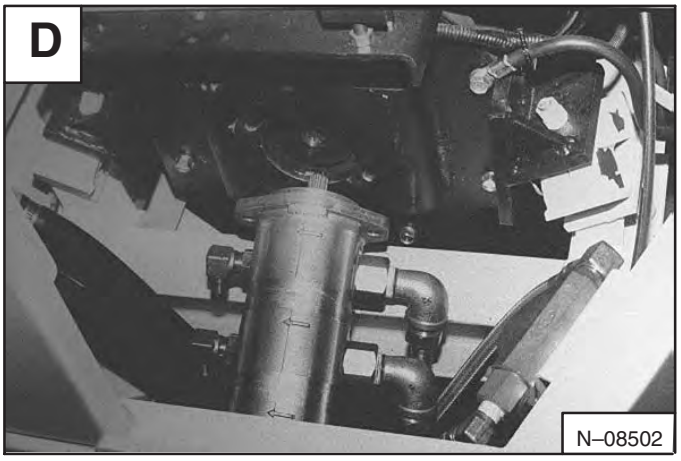
If the engine is not removed, disconnect the two high pressure hoses from the hydraulic pump **[B]**.



Remove the two mounting bolts from the hydraulicpump **[C]**.



Remove the hydraulic pump from the flywheel bell housing **[D]**.

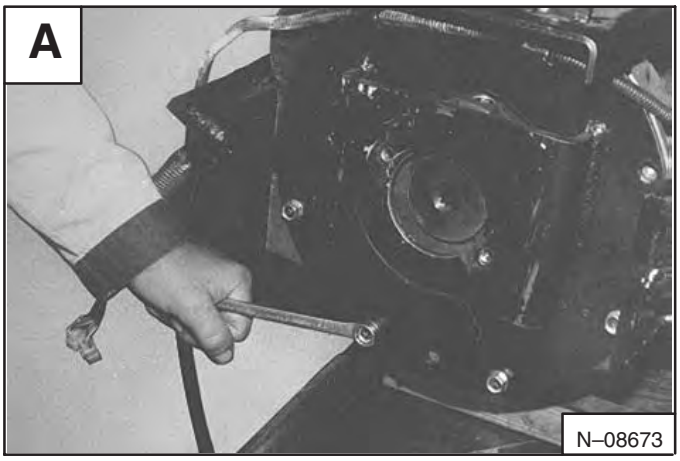


Dealer Copy -- Not for Resale

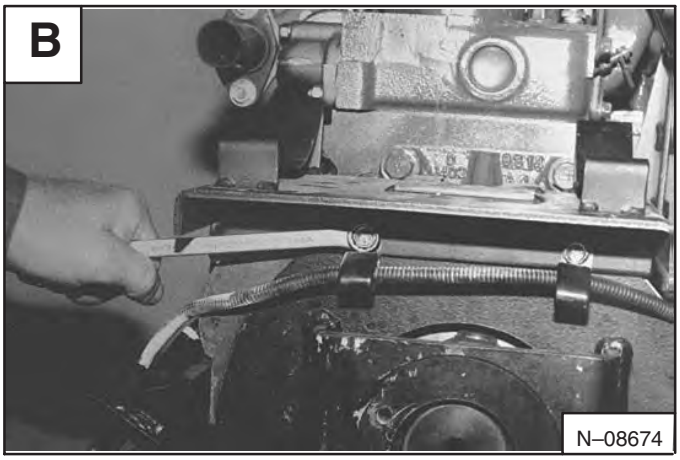
ENGINE FLYWHEEL (Cont'd)

Removal And Installation (Cont'd)

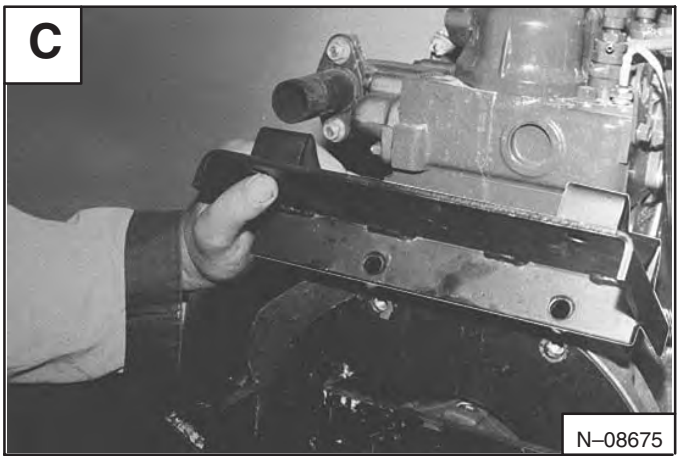
Remove the bolts from the flywheel housing **[A]**.



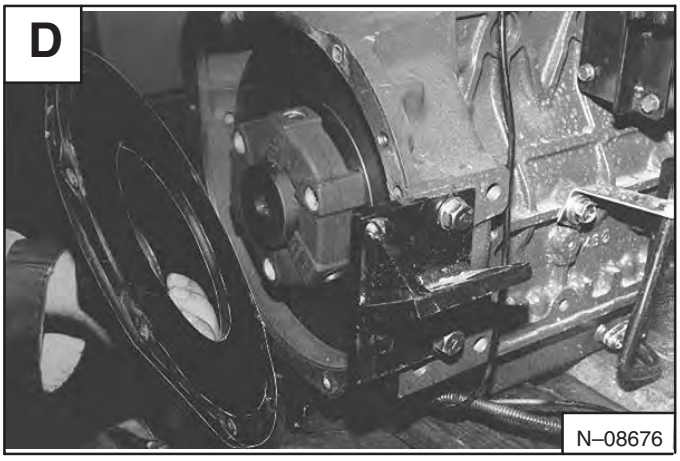
Remove the two top bolts from the muffler bracket **[B]**.



Remove the muffler bracket **[C]**.



Remove the cover from the flywheel housing **[D]**.

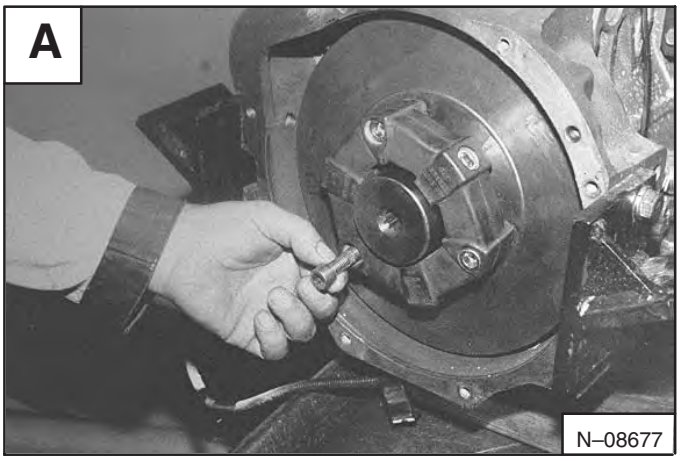


Dealer Copy -- Not for Resale

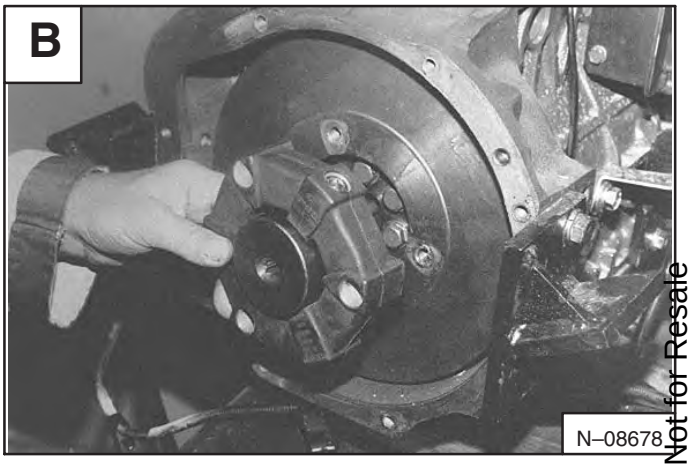
ENGINE FLYWHEEL (Cont'd)

Removal And Installation (Cont'd)

Remove the bolts from the hydraulic pump coupler **[A]**.



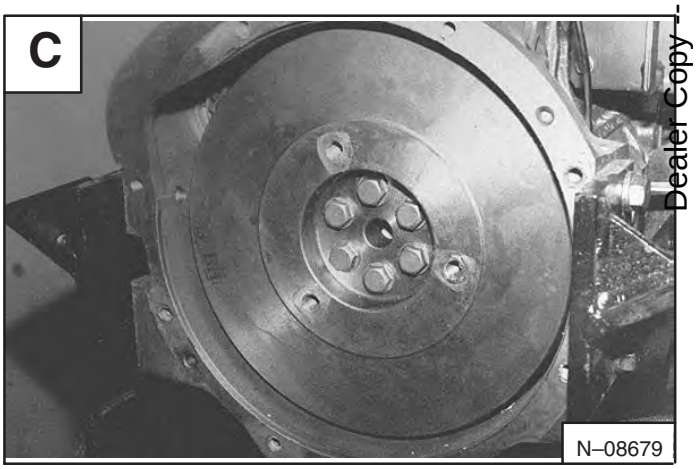
Remove the hydraulic pump coupler **[B]**.



Remove the bolts from the flywheel **[C]**.

Installation: Tighten the bolts to 40–43 ft.–lbs. (54–59 Nm) torque.

Remove the flywheel.



Flywheel Ring Gear

⚠ WARNING

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–2019–1285

The ring gear on the flywheel is an interference fit. Heat the ring gear enough to expand it and hit it with a hammer, evenly to remove it.

Clean the outer surface of the flywheel to give a smooth fit.

Clean the new ring gear and heat it to a temperature of 450–500° F (232–260° C).

Fit the ring gear over the flywheel. Make sure the gear is seated correctly.

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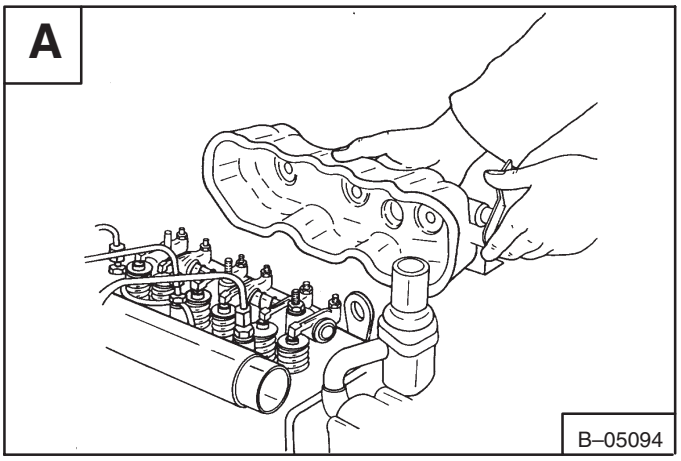
CYLINDER HEAD

Removal

Drain the cooling system.

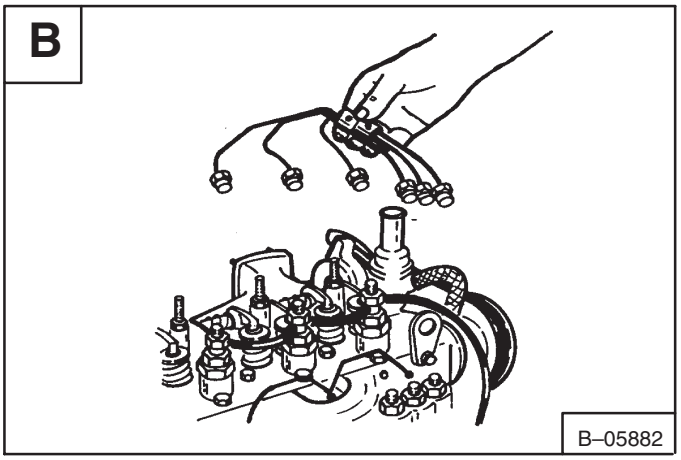
Remove the nuts from the valve cover.

Remove the valve cover and gasket **[A]**.

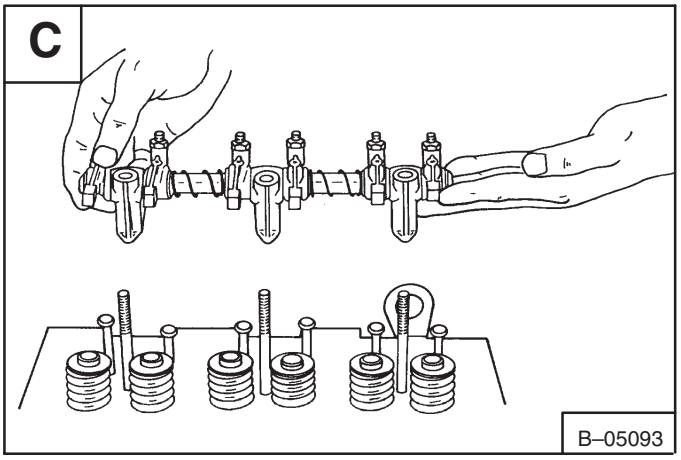


Disconnect and remove the high pressure fuel lines **[B]**.

Remove the fuel injector nozzles. (See Page 7–9.)

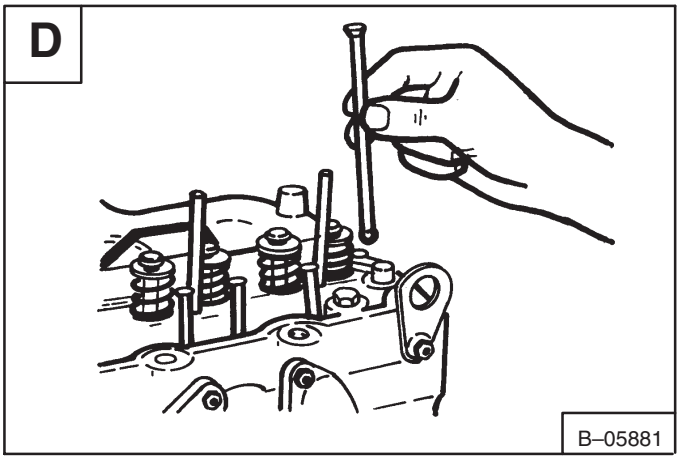


Remove the nuts from the rocker arm supports. Remove the rocker arm assembly **[C]**.



Remove the push rods **[D]**.

Mark the push rods so they will be returned to their original position.

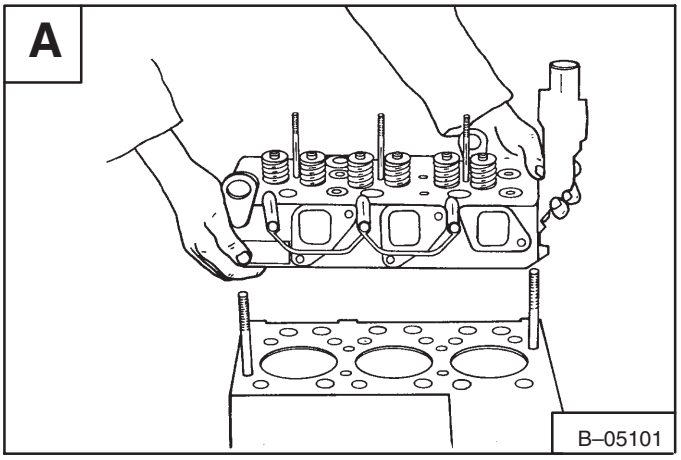


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CYLINDER HEAD (Cont'd)

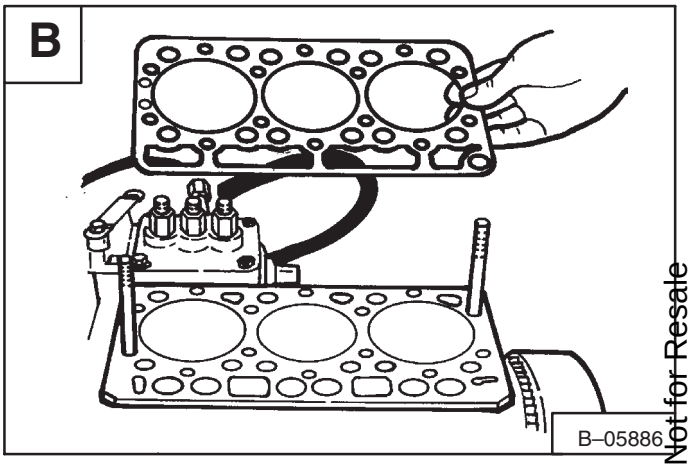
Removal (Cont'd)

Remove the cylinder head from the engine block **[A]**.



Remove the head gasket and O–ring from the engine block **[B]**.

NOTE: Some engines may use a shim and some do not. If a shim is present it must be used during reassembly. The shim (if used) must be installed between the cylinder head and gasket.

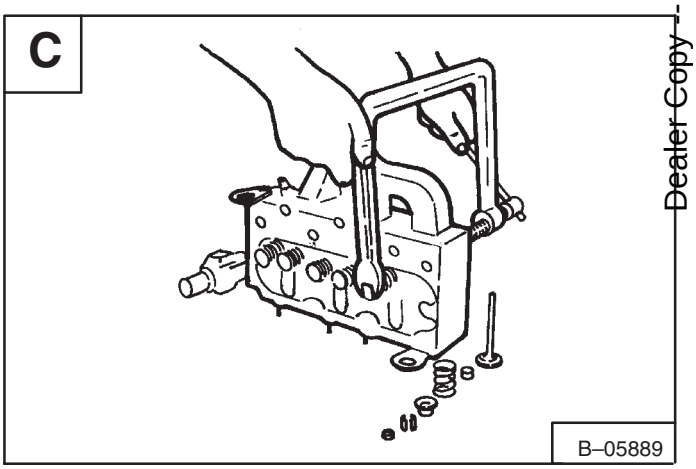


Disassembly

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

MEL 10121 – Valve Tool

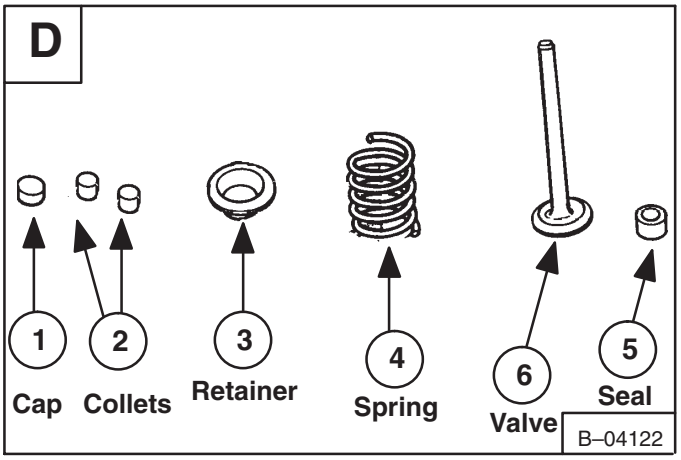
Use a valve spring compression tool to remove the valves **[C]**.



Remove the valve cap (Item 1) **[D]** and valve spring collet (Item 2) **[D]**.

Remove the valve spring retainer (Item 3) **[D]** and spring (Item 4) **[D]**.

Remove the seal (Item 5) **[D]** and the valve (Item 6) **[D]**.

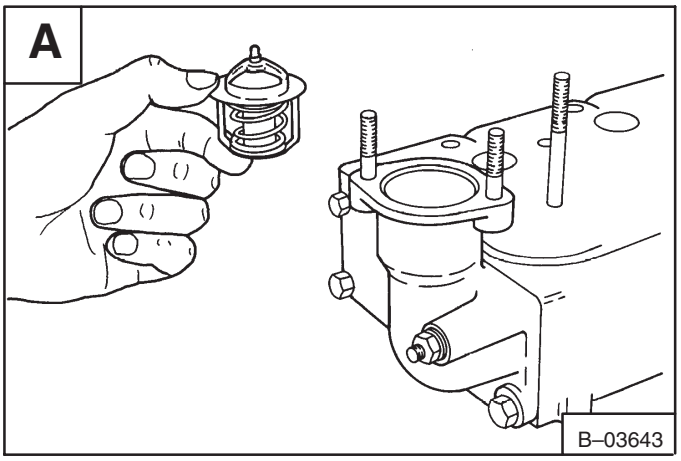


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CYLINDER HEAD (Cont'd)

Disassembly (Cont'd)

Remove the thermostat housing and thermostat **[A]**.



Servicing The Cylinder Head And Valves

Clean the surface of the cylinder head.

Put a straight edge (Item 1) **[B]** on the cylinder head.

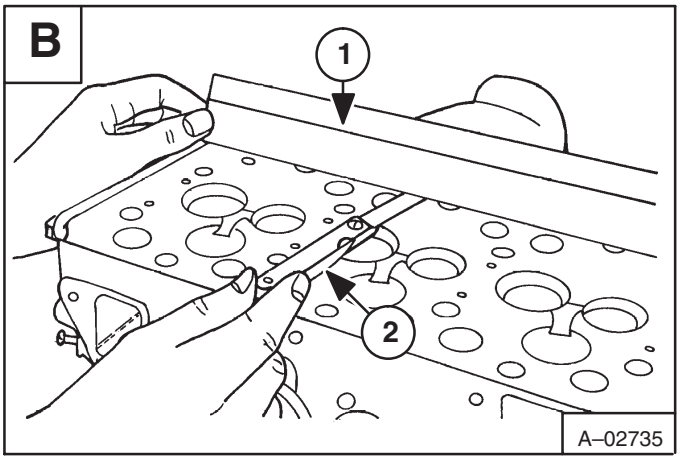
NOTE: Do not put the straight edge across the combustion chamber.

Put a feeler gauge (Item 2)**[B]** between the straight edge and the surface of the cylinder head.

The maximum distortion of the cylinder head surface is ± 0.002 inch (± 0,05 mm).

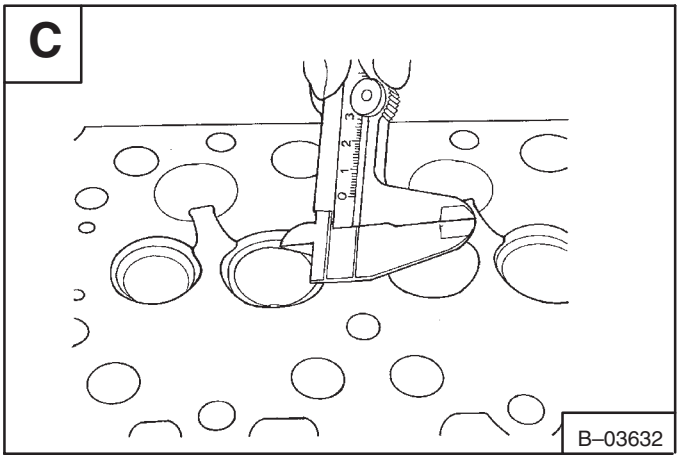
If the measurement is more than the specifications, the cylinder head must be planed.

NOTE: Place a soft brass rod through the injector hole and tap the combustion chamber out before planing the head. Plane the same amount from the bottom side of the combustion chamber before installing it back in the head.



Clean the valve surface.

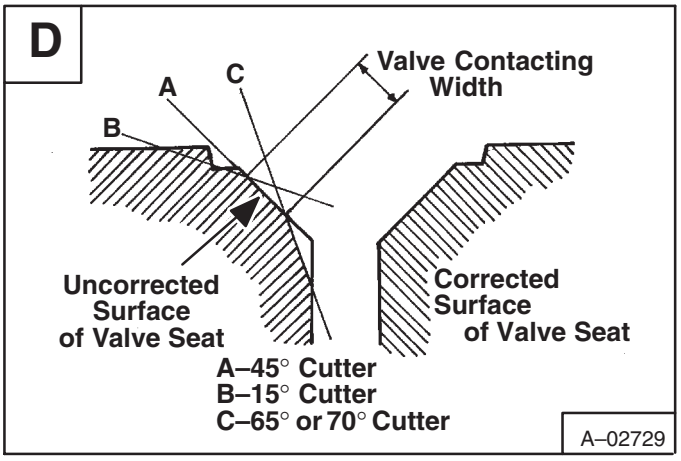
Clean the valve seat and combustion chamber. Measure the width of the valve seat **[C]**.



The correct width of the valve seat is 0.0827 inch (2,1 mm) and the seat angle is 45 degrees **[D]**.

Grind the valve seats as follows:

1. Use a 45 degree cutter to grind the surface of the valve seat.
2. Use a 15 degree cutter to grind the top surface of the valve seat.
3. Use a 65 or 70 degree cutter to grind the bottom surface of the valve seat to finish the valve seat to a 0.083 inch (2,1 mm) width.
4. Grind the valve surface to 45 degrees.



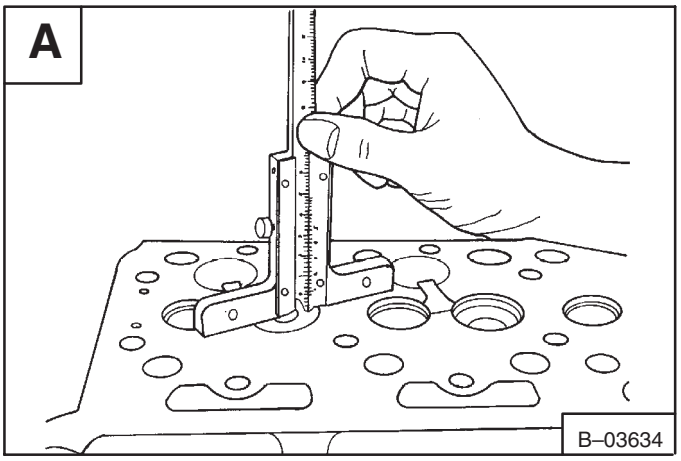
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Servicing The Cylinder Head And Valves (Cont'd)

Install the valve in the seat and check the depth **[A]**.

The specifications for the depth of the valve is 0.0430–0.0510 inch (1,1–1,3 mm).

If the measurement is more than specifications, add the correct thickness of washer under the valve spring to keep the correct spring tension.



Clean the valve guide.

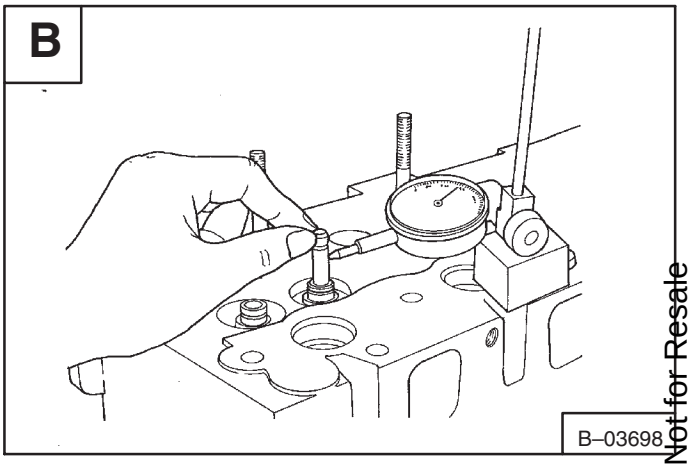
Install the valve in the cylinder head.

Install the dial indicator **[B]**.

Measure the clearance of the valve guide and the valve **[B]**.

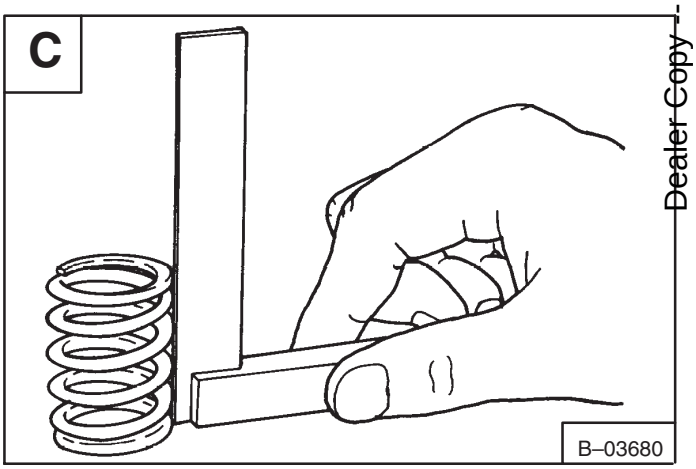
The measurement must be 0.0014–0.0026 inch (0,040–0,07 mm).

Replace the valve guide and valves as needed. Make sure to ream the inside diameter of the new guide to the correct dimension of 0.3156 – 0.3161 inch (8,01 – 8,03 mm).



Checking Valve Springs

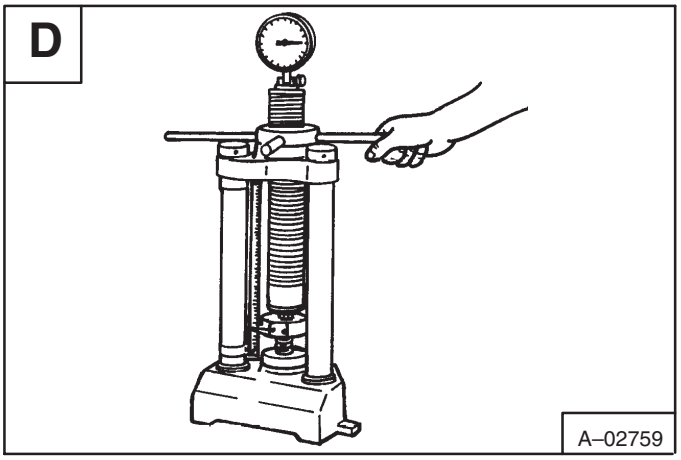
Measure the valve spring. The free length of the spring must be 1.6417 – 1.6614 inch (41,70 – 42,20 mm). Check the valve spring with a square to make sure it is straight **[C]**.



Put the valve spring in a tester **[D]**.

Push down on the spring 1.380 inch (35 mm), the compression load must be 22.5 lbs. (10,2 kg).

Replace the valve spring if it does not meet these specifications.



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CYLINDER HEAD (Cont'd)

Checking Rocker Arm And Shaft

Measure the inside diameter of the rocker arm bushing and the shaft diameter **[A]**.

The inside diameter of the rocker arm bushing is 0.5513–0.5529 inch (14,0–14,04 mm).

The shaft diameter is 0.5501–0.5506 inch (13,9–13,98 mm).

If the measurements are not within specification,replace the parts.

Assembling The Cylinder Head

Install the valves. Put oil on the valve seal and install the seal on the valve stem.

Install the valve spring and retainer . Install the spring collet and valve cap.

Install the thermostat. Install the thermostat housing and a new gasket.

Installation

Install the O–ring in the cylinder block **[B]**.

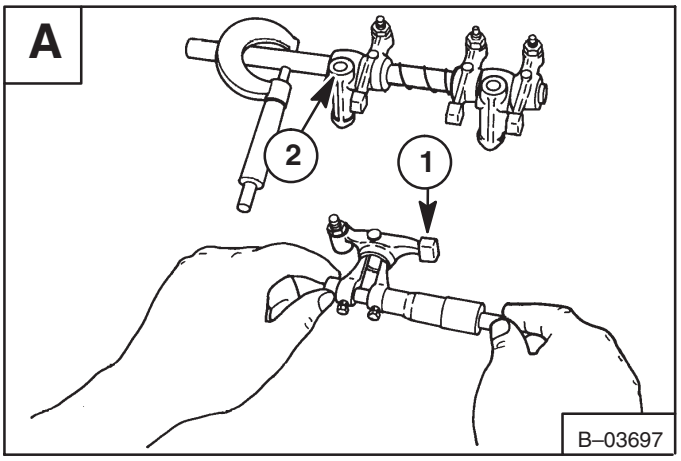
Install the new head gasket **[C]**.

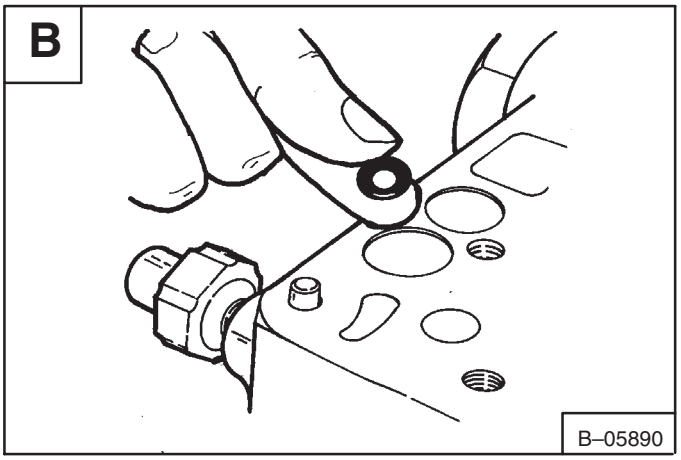
Install the shim (if present during disassembly). The shim goes between the cylinder head and gasket.

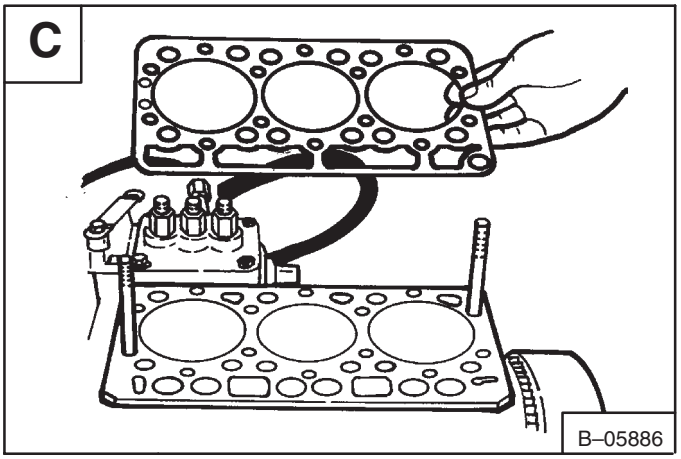
NOTE: Use the shim over again or replace it with a shim of the same thickness.

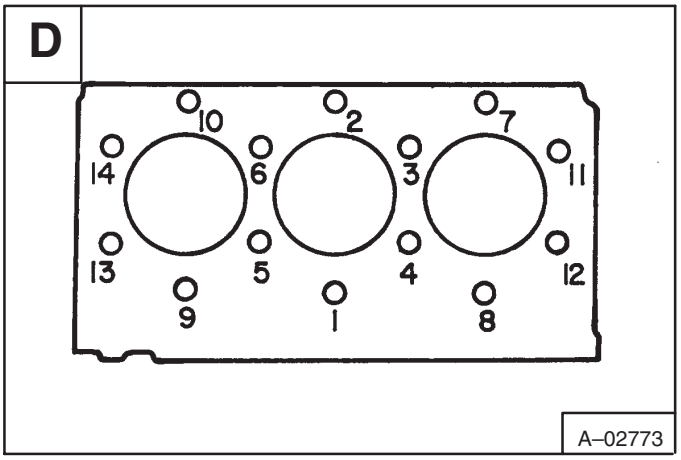
Install the cylinder head. Put oil on the cylinder head bolts.

Tighten the bolts and nuts to 65–68 ft.–lbs. (88–92 Nm) torque. Use the tighten sequence as shown in **[D]**.









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CYLINDER HEAD (Cont'd)

Installation (Cont'd)

Lower the piston to be measured for the clearance. Put a piece of solder in the injector port **[A]**. Make sure the solder does not touch the valve.

Turn the engine crankshaft (manually) until the piston goes over T.D.C..

Remove the solder and measure it. The thickness must be 0.0276–0.0354 inch (0,70–0,90 mm). If the measurement is not within this specification, remove the cylinder head. Install the correct shim between the cylinder head and gasket.

Install the cylinder head. T ighten the bolts and nuts to 65–68 ft–lbs. (88–92 Nm) torque. Use the tightening sequence on Page 7–26 **[D]**.

Install the push rods **[B]**.

Install the rocker arms **[C]**.

Install the injector nozzles. (See Page 7–9.)

Install the high pressure fuel lines.

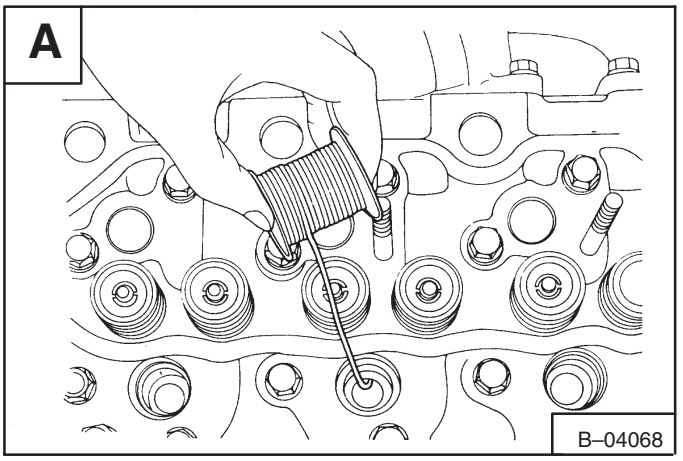
Adjust the valve clearance. (See Page 7–2.)

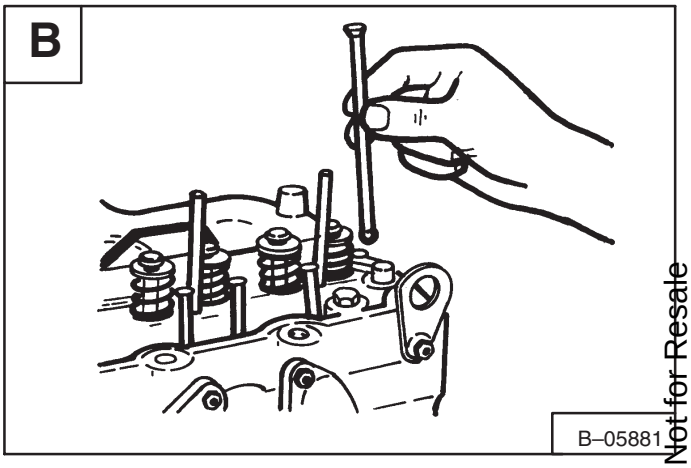
Install the valve cover with a new gasket **[D]**.

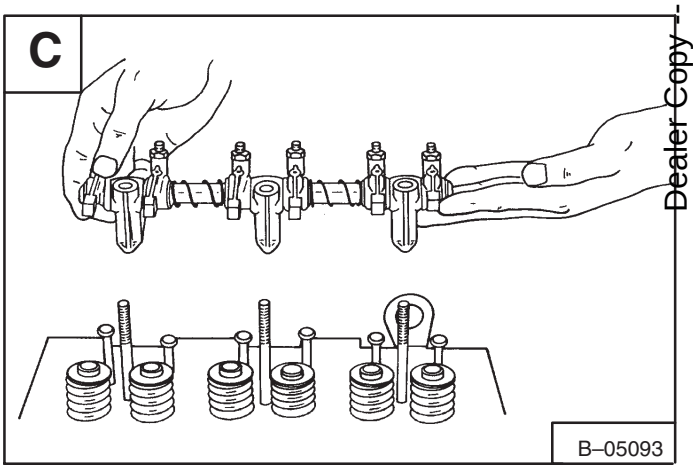
Connect the radiator hose.

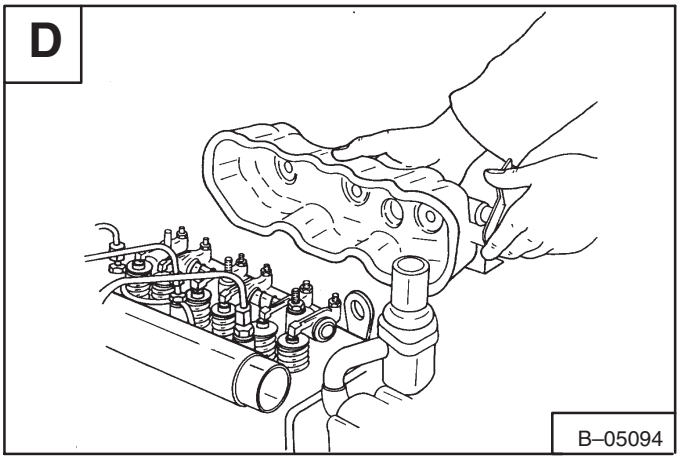
Add coolant to the cooling system.

NOTE: Make sure to tighten the cylinder head bolts and nuts to the correct torque after the engine has been operated for 30 minutes. Readjust the valve clearance.









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TIMING GEAR COVER

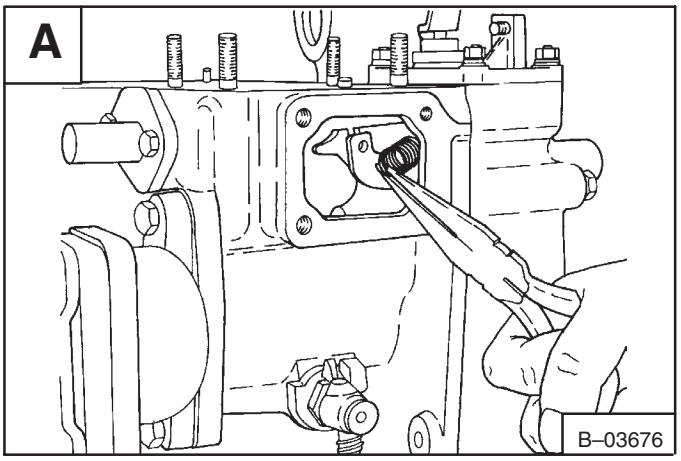
Removal And Installation

NOTE: It may be easier to remove and install the timing gear cover with the engine removed from the machine.

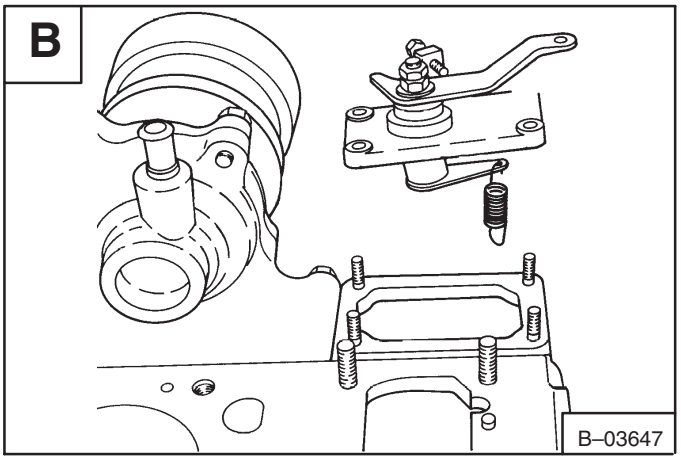
Remove the fuel injection pump. (See Page 7–7.)

Remove the side plate from the governor housing.

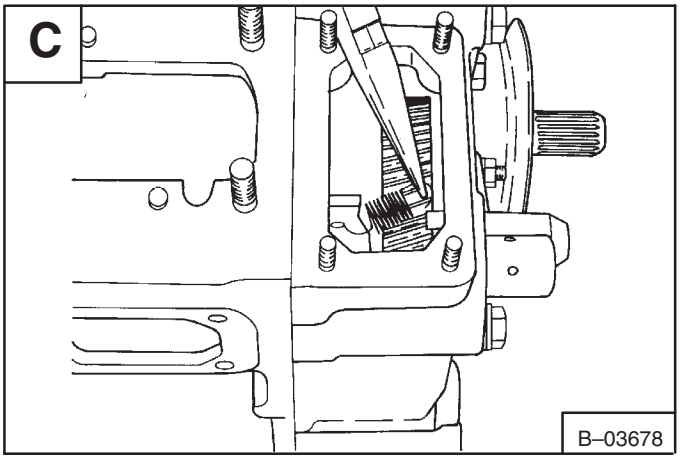
Disconnect the governor spring from the governor fork **[A]**.



Remove the plate for the speed control and governor spring **[B]**.



Remove the start spring from the gear case **[C]**.

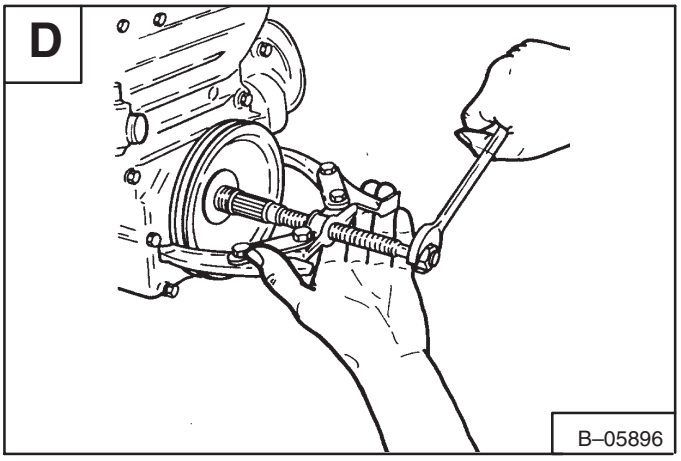


Straighten the washer on the crankshaft pulley. Remove the nut and washer.

Installation: Tighten the nut to 101–1 16 ft.–lbs. (137–157 Nm) torque.

Use a puller and remove the pulley **[D]**.

Remove the crankshaft key.



Dealer Copy -- Not for Resale

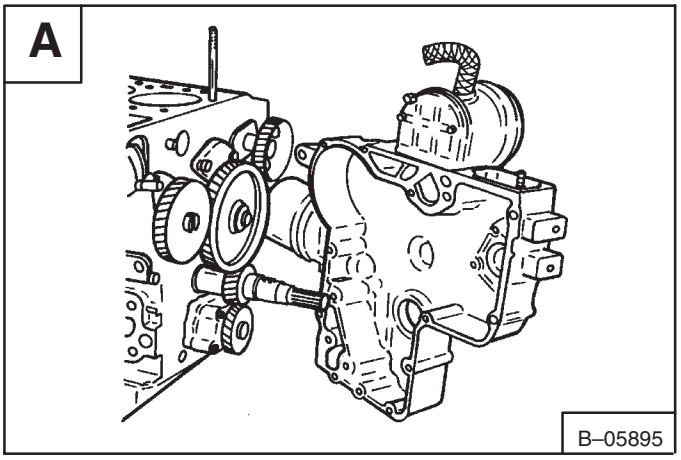
TIMING GEAR COVER (Cont'd)

Removal And Installation (Cont'd)

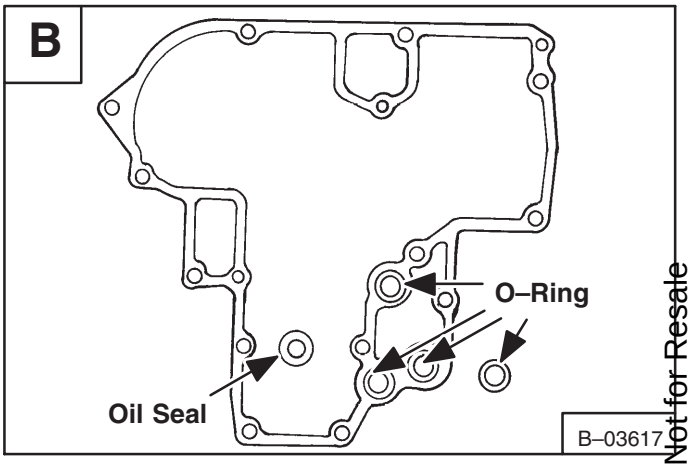
Remove the bolts from the gearcase.

Installation: Tighten the bolts to 13–15 ft.lbs. (18–21 Nm) torque.

Remove the gearcase and O–rings **[A]**.



Installation: Install new crankshaft seal. Install the three O–rings. Put non–drying adhesive on the edge of the gearcase cover **[B]**.



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TIMING GEAR, CAMSHAFT AND OIL PUMP

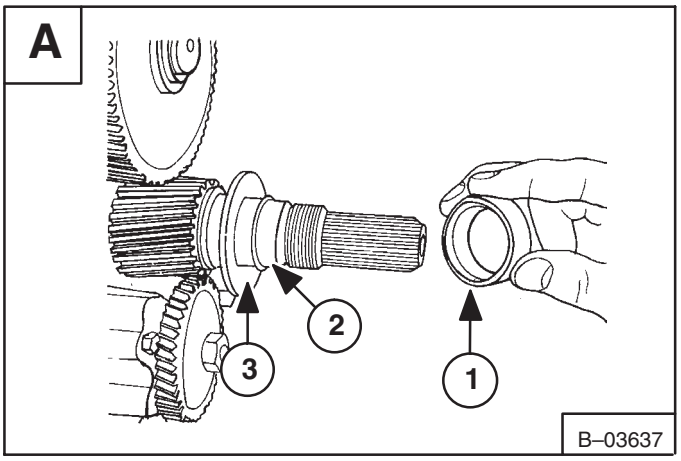
Removal And Installation

Remove the cylinder head. (See Page 7–20.)

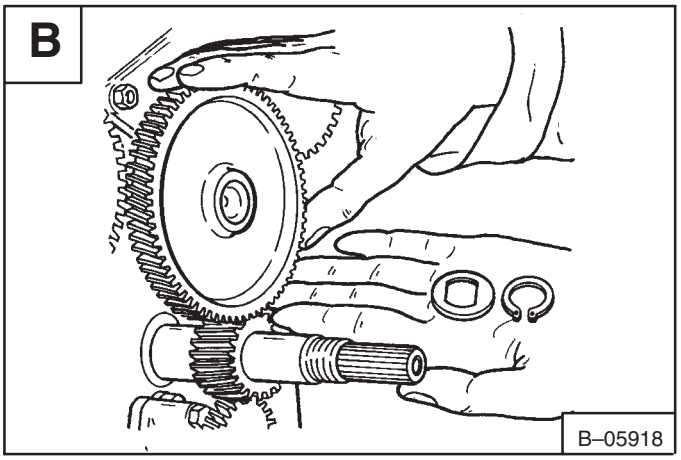
Remove the tappets.

Remove the timing gearcase cover. (See Page 7–26.)

Remove the crankshaft collar (Item 1) **[A]**, O–ring (Item 2) **[A]** and oil slinger (Item 3) **[A]**.

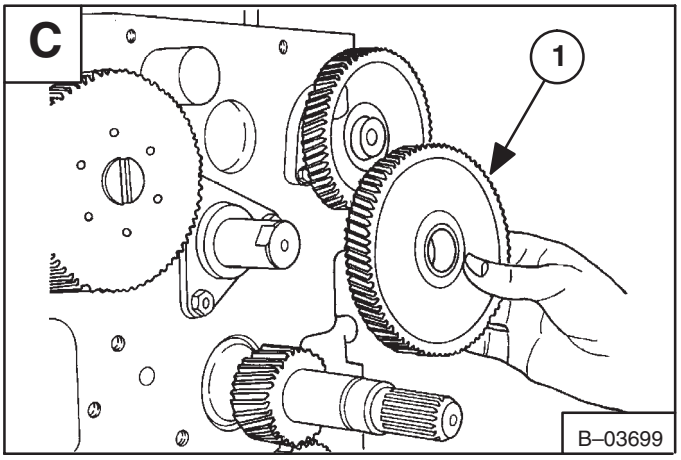


Remove the snap ring and washer from the idler gear **[B]**.



Remove the idler gear (Item 1) **[C]**.

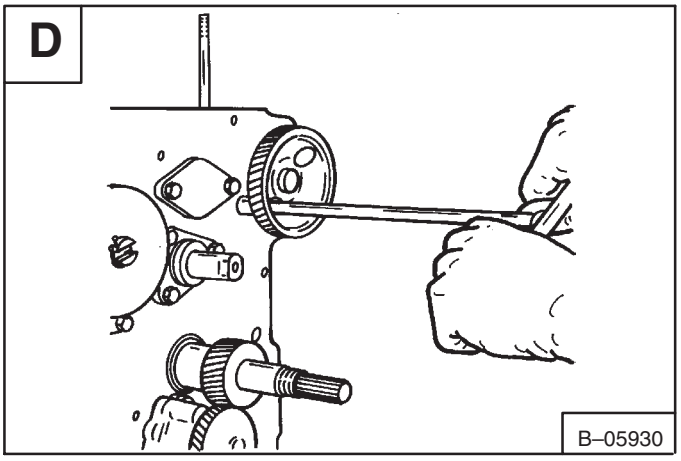
Remove the idler gear collar (Item 2) **[C]** from the shaft.



Align the holes in the camshaft gear with the stop plate bolts.

Remove the bolts from the camshaft stop plate **[D]**.

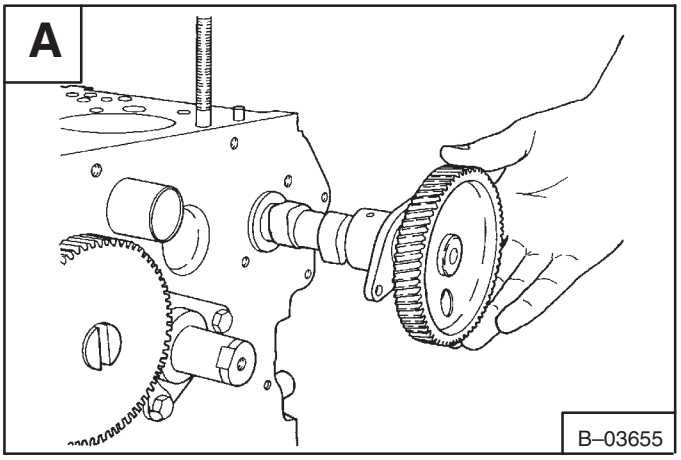
Installation: Tighten the bolts to 14–15 ft.–lbs. (18–21 Nm) torque.



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Removal And Installation (Cont'd)

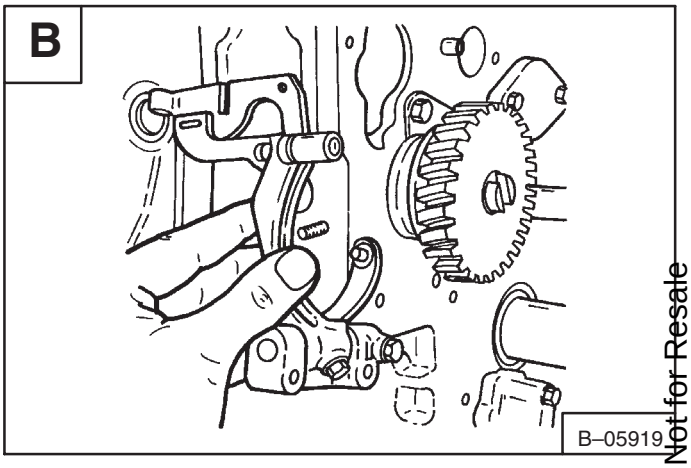
Remove the camshaft **[A]**.



Remove the two bolts that hold the fork lever on the fuel camshaft.

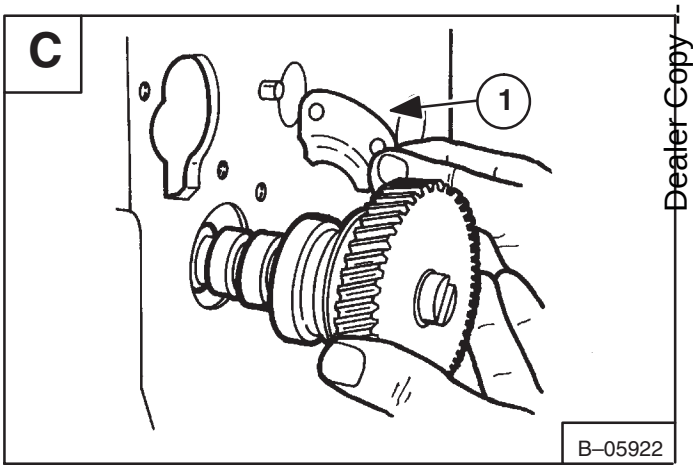
Installation: Tighten the fork lever bolts to 60–72 in.–lbs. (6,8–8,1 Nm) torque.

Remove the fork lever **[B]**.



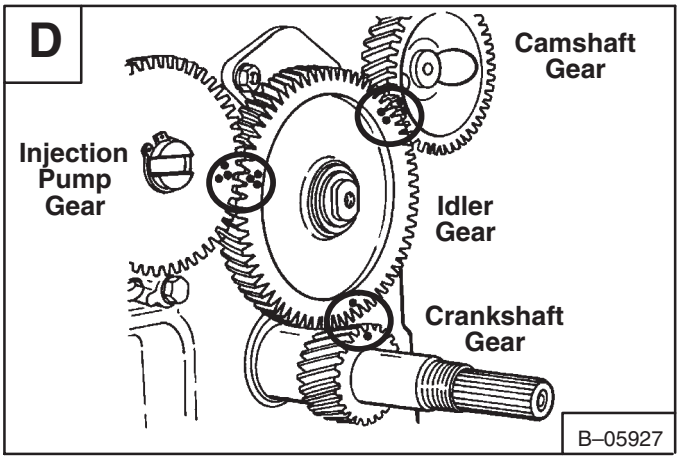
Remove the stop (Item 1) **[C]** for the fuel camshaft.

Remove the fuel camshaft **[C]**.



Installation: Make sure the timing marks on the gears are aligned when installing the gears **[D]**.

Gear backlash is 0.0017–0.0045 inch (0,043–0,114 mm). The limit permitted is 0.0079 inch (0,2 mm).

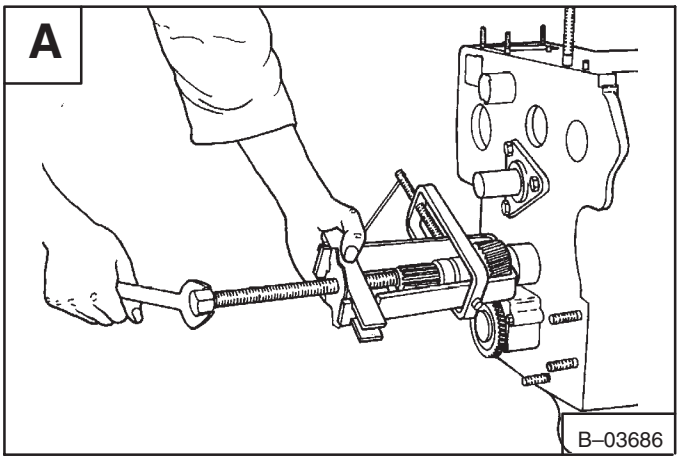


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Removal And Installation (Cont'd)

Remove the crankshaft gear with a puller **[A]**.

Remove the crankshaft key.



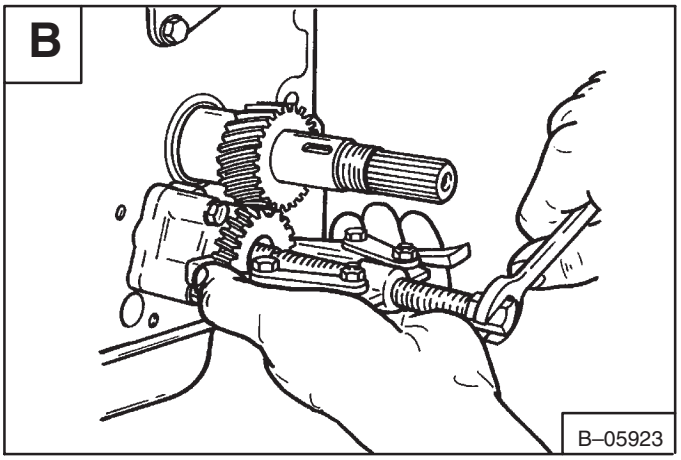
Oil Pump Service

Straighten the washer on the gear of the oil pump.

Remove the bolt from the oil pump gear.

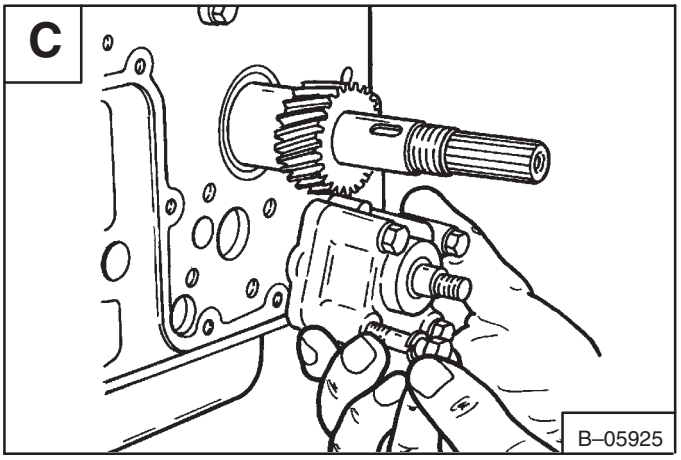
Installation: Tighten the bolt to 60–72 in.–lbs. (6,8–8,1 Nm) torque.

Remove the oil pump gear **[B]**.



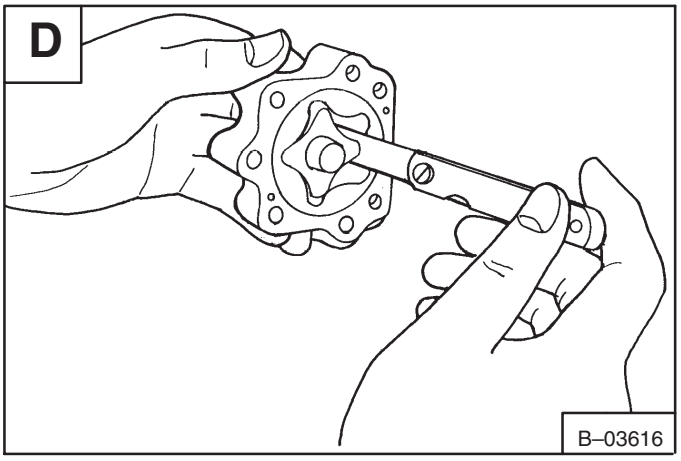
Remove the oil pump bolts and oil pump **[C]**.

Installation: Tighten the oil pump bolts to 60–72 in.–lbs. (6,8–8,1 Nm) torque.



Check the clearance between the inner and outer rotor **[D]**.

The clearance for the inner rotor is 0.004–0.006 inch (0,10–0,15 mm). The wear limit is 0.008 inch (0,20 mm).



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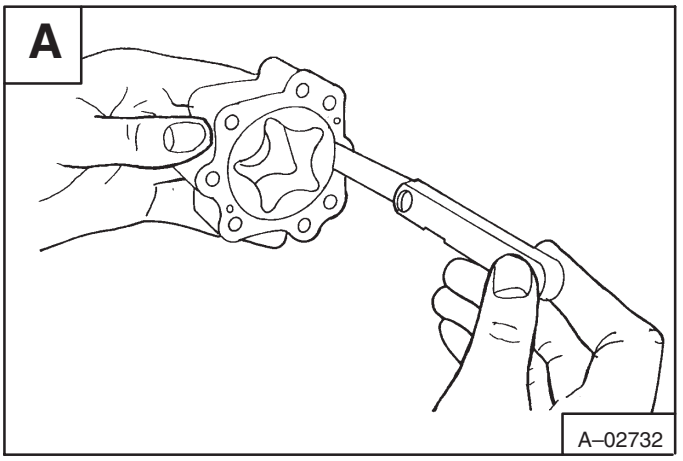
TIMING GEAR, CAMSHAFT AND OIL PUMP (Cont'd)

Removal And Installation (Cont'd)

Check the clearance between the outer rotor and the body of the oil pump **[A]**.

The clearance for the outer rotor is 0.004–0.008 inch (0,10–0,20 mm).

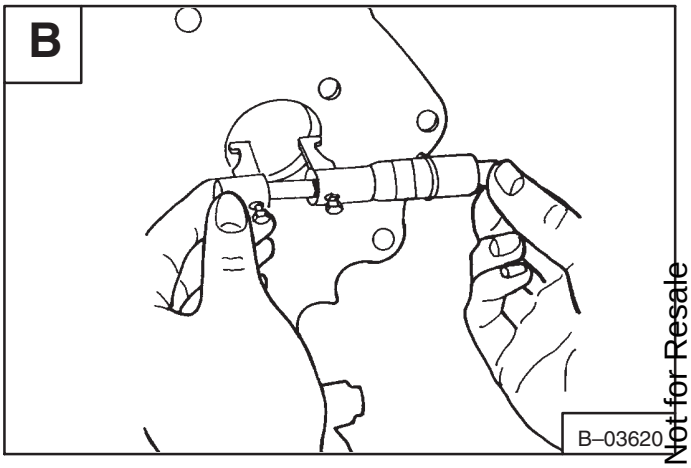
At rated engine speed, the normal oil pressure is 43–64 PSI (296–441 kPa). It must not be lower than 28 PSI (196 kPa).



Servicing The Camshaft

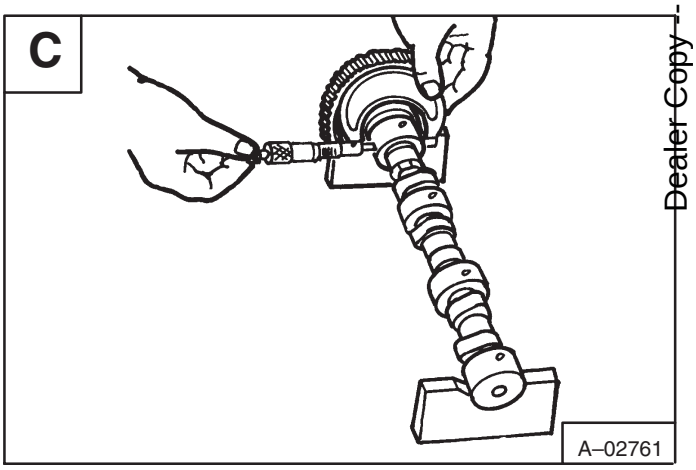
Measure the camshaft bearing in the engine block **[B]**.

The specification is 1.5748–1.5758 inch (39,9–40,0 mm). The wear limit is 0.002–0.0036 inch (0,051–0,091 mm).



Measure the camshaft journal **[C]**.

The specification is 1.5722–1.5728 inch (39,93–39,94 mm). If the measurements are not within limits, replace the parts as needed.

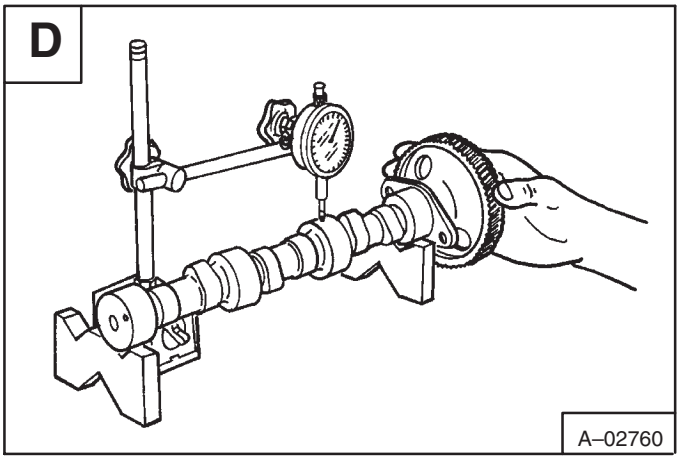


Put the camshaft in V–blocks.

Install a dial indicator on the journals **[D]**.

Turn the camshaft slowly . The wear limit is 0.002 inch (0,05 mm).

If the camshaft measurements are not within the specifications, replace the part as needed.



Dealer Copy -- Not for Resale

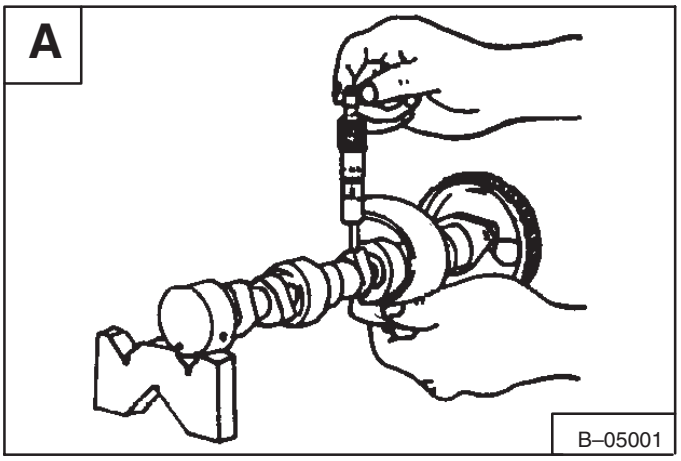
TIMING GEAR, CAMSHAFT AND OIL PUMP (Cont'd)

Removal And Installation (Cont'd)

Measure the highest point on each camshaft lobe **[A]**.

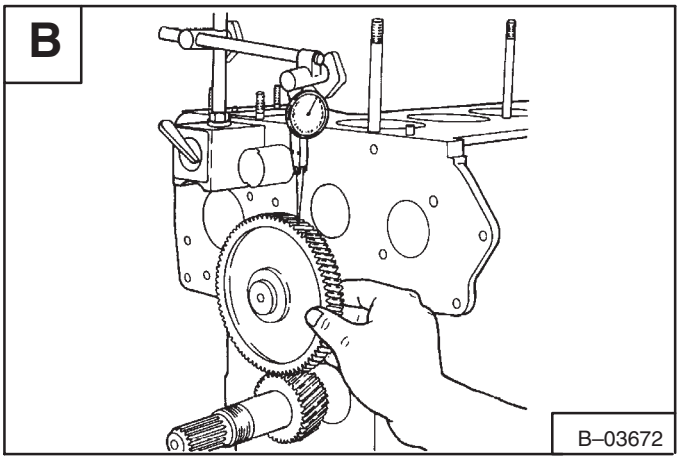
The specification is 1.3134 inch (33,36 mm).

The wear limit is 1.3114 inch (31,31 mm).



Installation: After the crankshaft is installed, check the clearance for the camshaft gear . Mount a dial indicator **[B]**.

Hold one gear while turning the other gear . The specification is 0.007–0.0045 inch (0,043–0,1 14 mm). The wear limit is 0.0079 inch (0,2 mm).



CRANKSHAFT AND PISTONS

Removal And Installation

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

MEL1063 – Ring Compcompressor
MEL1064 – Piston Ring Expander

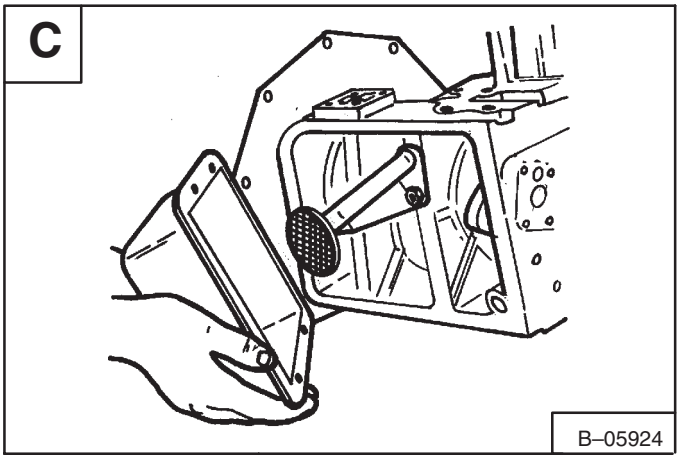
Remove the cylinder head. (See Page 7–20.)

Remove the gear case cover. (See Page 7–26.)

Remove the timing gears. (See Page 7–28.)

Remove the flywheel.

Remove the oil pan **[C]**.

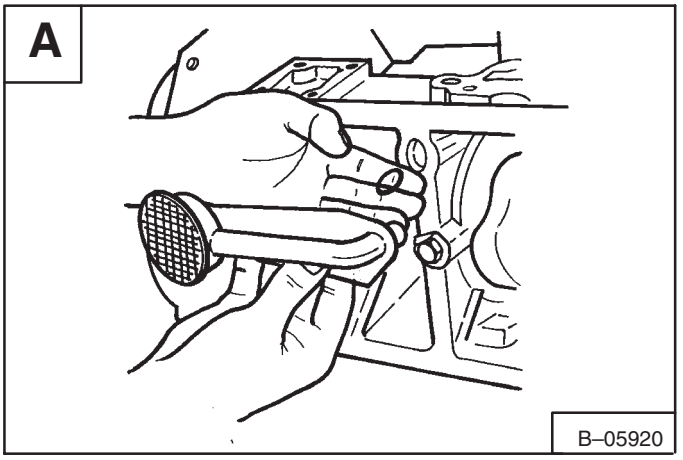


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Removal And Installation (Cont'd)

Remove the oil pump tube and screen **[A]**. Do not damage the O–ring on the tube.

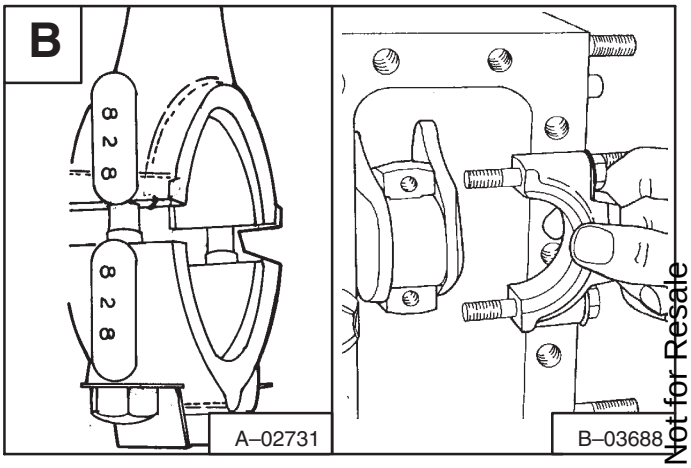
Straighten the washer on the connecting rod bolts. Remove the connecting rod nuts and bolts.



Remove the cap and bearing from the connecting rod **[B]**.

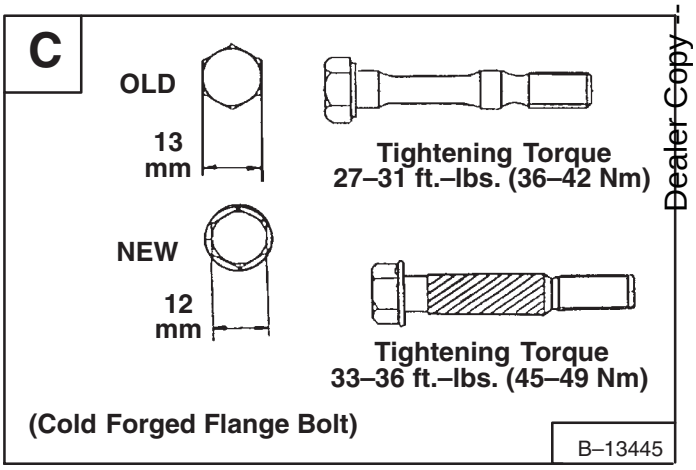
NOTE: Make sure the marks on the connecting rod and bearing cap are in alignment when installing the bearing cap [B].

Installation: Put oil on the bolts and tighten to 26–30 ft.–lbs. (35–41 Nm) torque.



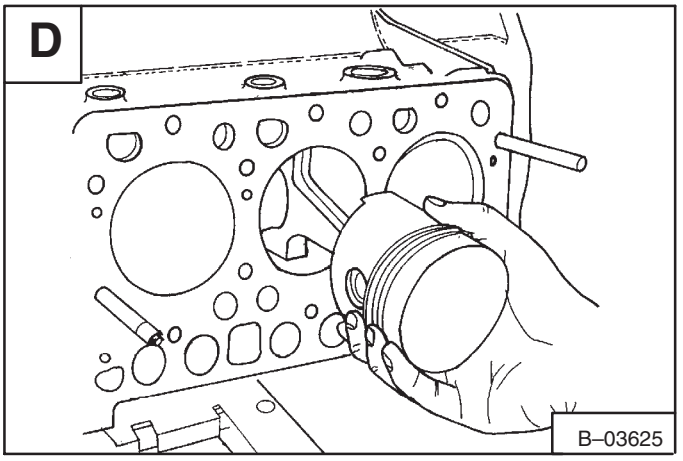
Installation: Tighten the rod cap bolts to torque as follows **[C]**.

Machine bolt (13 mm Size Head) 27–31 ft.–lbs. (36–42 Nm)
Forged bolt (12 mm Size Head) 33–36 ft.–lbs. (45–49 Nm)



Remove the piston and connecting rod assembly from the engine block **[D]**.

NOTE: Make sure the pistons are marked so they will be returned to the same cylinder bore.

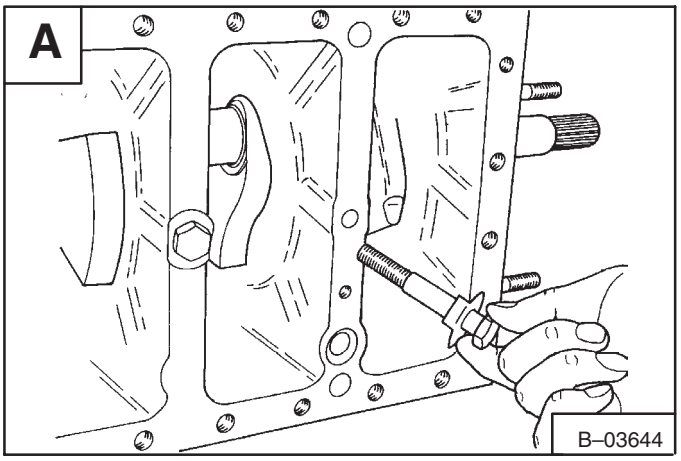


Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

Straighten the washer on the bolts that hold the main bearings in position. Remove the main bearing bolts from the engine block **[A]**.

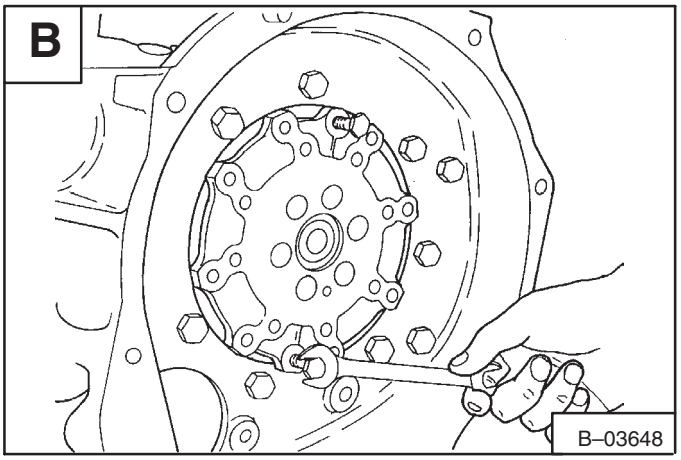
Installation: Tighten the bolts to 40–50 ft.–lbs. (64–68 Nm) torque.



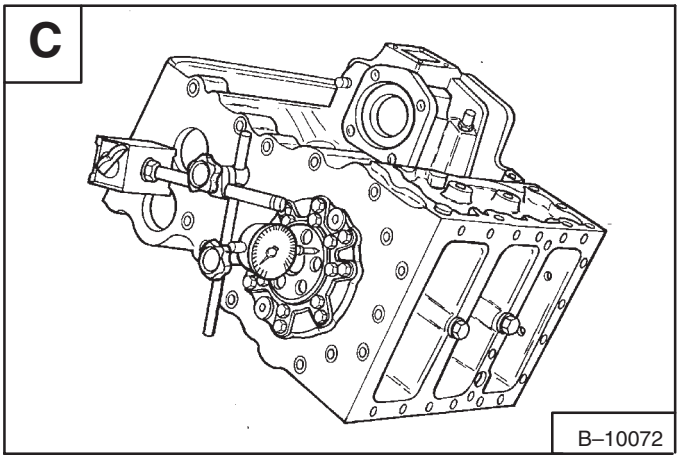
Straighten the washer on the bolts that hold the rear cover in position. Remove the bolts.

Install two bolts in the rear cover and pull the cover out **[B]**.

Installation: Install a new seal in the rear cover. Tighten the bolts to 22–25 ft.–lbs. (29–34 Nm) torque.

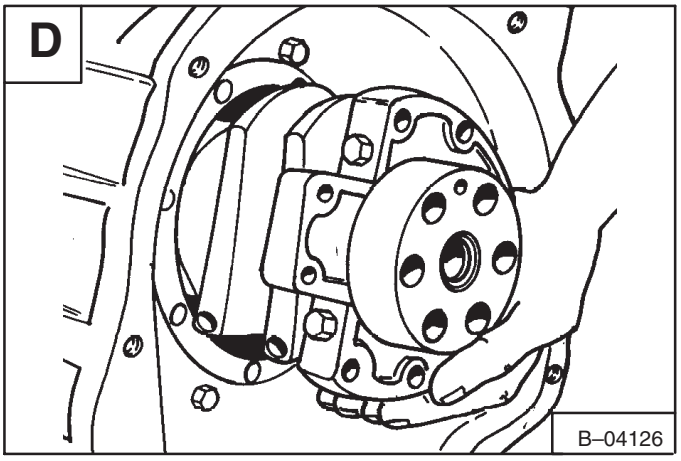


Installation: Check the crankshaft end play with a dial indicator **[C]**. The normal end play is 0.006–0.012 inch (0,15–0,30 mm). Replace the thrust bearing if the end play exceeds 0.020 inch (0,5 mm).



Remove the crankshaft from the rear of the engine block **[D]**.

NOTE: Do not damage the crankshaft when removing it from the engine block.



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CRANKSHAFT AND PISTONS (Cont'd)

Crankshaft Service

Straighten the washers on the main bearing bolts. Remove the bolts from the bearing cap halves **[A]**.

Remove the halves of the main bearings.

NOTE: When installing the bearing cap halves, make sure to position the markings on the bearing caps toward the flywheel. Thrust washers must be installed with oil grooves facing outward.

Installation: Tighten the bolts to 22–25 ft.–lbs. (29,8–33,9 Nm) torque.

NOTE: Be sure the plugs that come with a new crankshaft are installed in the crankshaft, or engine damage will occur.

Put the crankshaft on V–blocks.

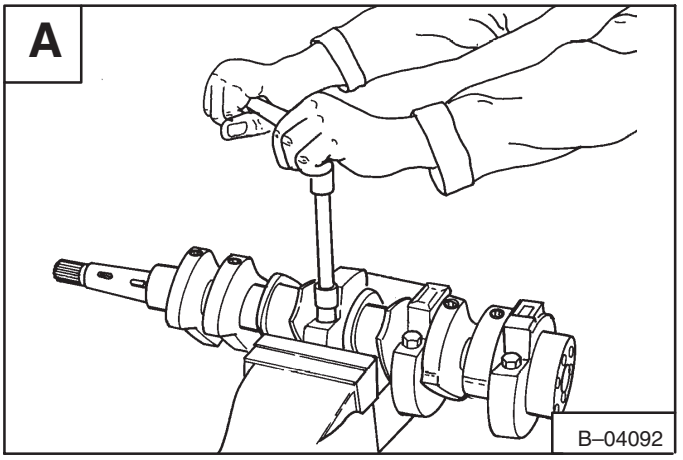
Put a dial indicator on the center journal **[B]**.

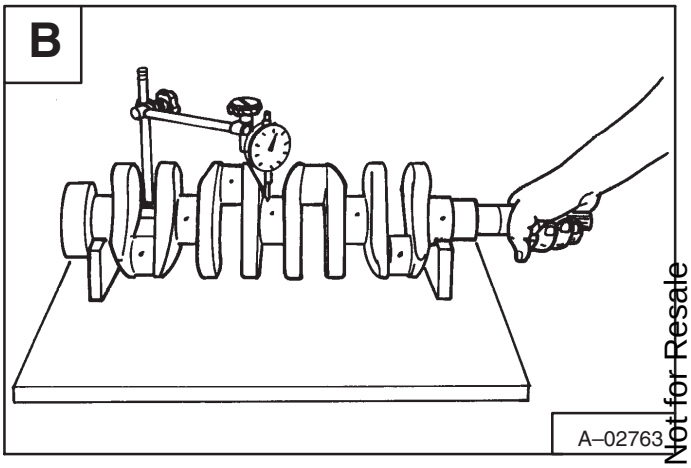
Turn the crankshaft slowly. The specifications is 0.0008 inch (0,02 mm). The wear limit is 0.003 inch (0,08 mm).

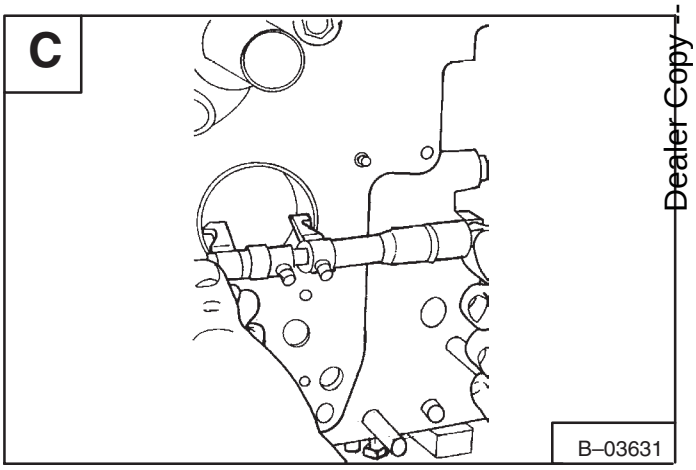
Check the inside diameter of the crankshaft bearing in the engine block **[C]**.

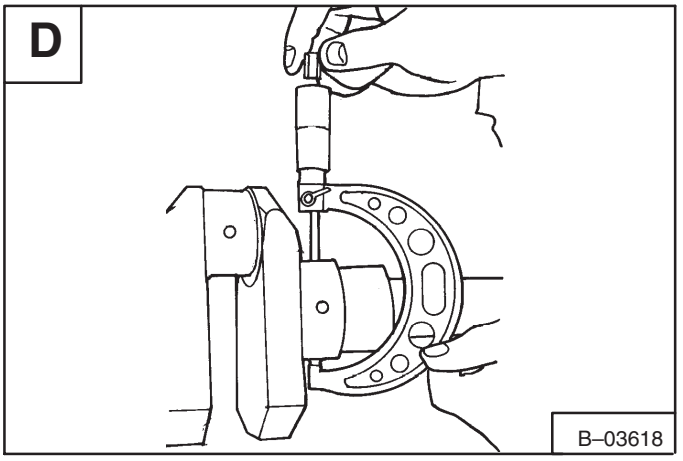
The specification is 2.0465–2.0488 inch (51,98–52,0 mm). The wear limit is 0.008 inch (0,20 mm).

Check the outside diameter of the #1 crankshaft journal **[D]**. The specification is 2.0441–2.0449 inch (51,92–51,94 mm). The wear limit is 0.008 inch (0,20 mm).







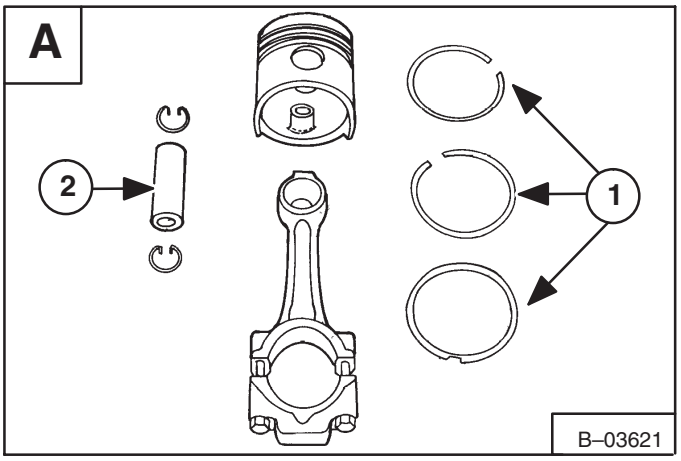


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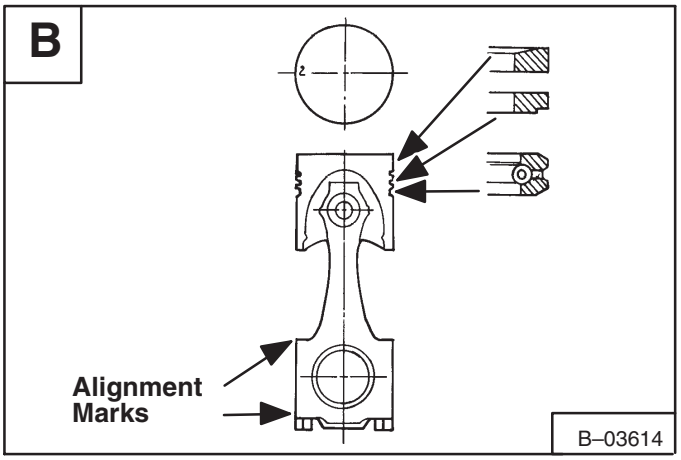
CRANKSHAFT AND PISTONS (Cont'd)

Servicing The Connecting Rods And Pistons

Remove the piston rings (Item 1) **[A]** and the piston pin (Item 2) **[A]**.

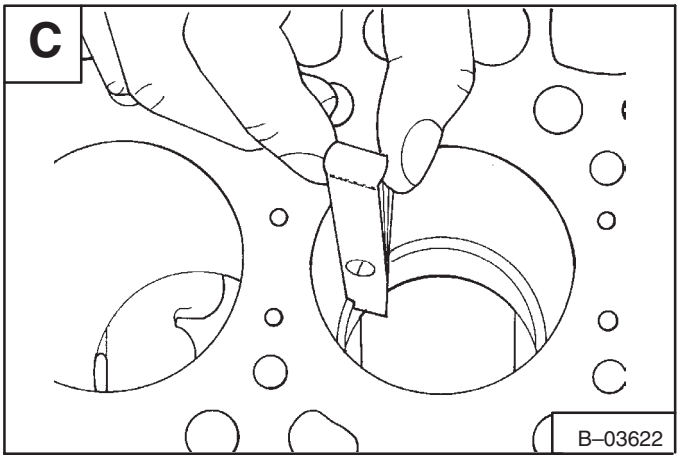


Installation: Position the top ring so the gap is not lined up with the piston pin. Position the other rings so there is a gap every 90 degrees **[B]**. Use a ring compressor to install the pistons in the engine block with the marks away from the camshaft.



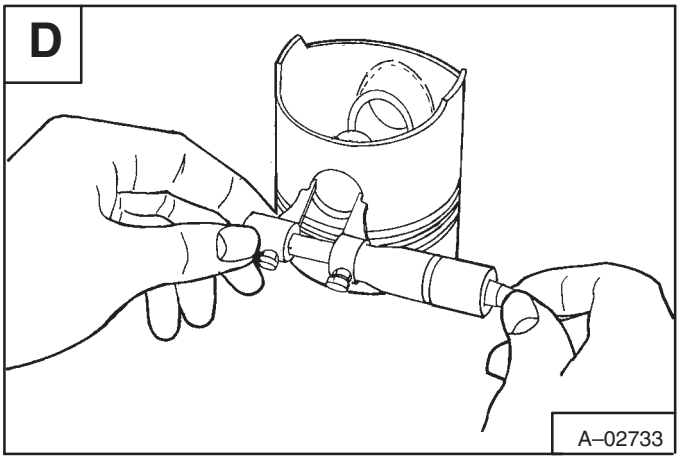
Put the piston ring on the bottom of the cylinder bore **[C]**. Check the clearance of the ring gap. The specifications are:

Top & 2nd Ring . . 0.0118–0.0177 inch (0,30–0,45 mm)
Oil Ring . . . . . 0.009–0.0177 inch (0,23–0,45 mm)
Wear Limit . . . . . 0.05 inch (1,27 mm)



Measure the piston pin hole **[D]**.

The specifications are 0.787–0.788 inch (19,98–20,02 mm). The wear limit is 0.789 inch (20,04 mm).



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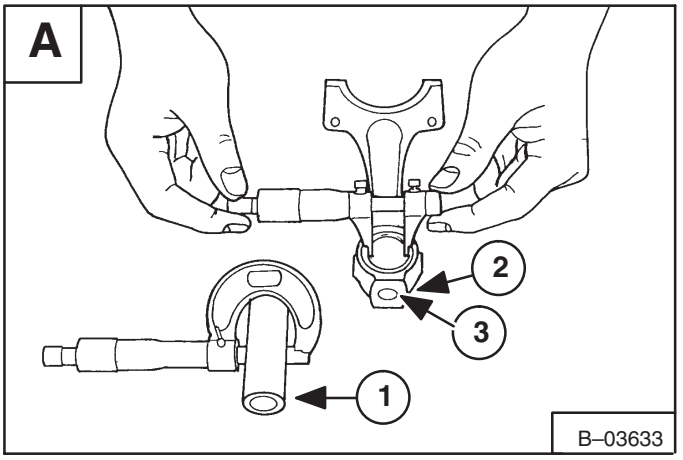
Servicing The Connecting Rods And Pistons (Cont'd)

Measure the piston pin (Item 1) **[A]** and the connecting rod bushing (Item 2) **[A]**.

The specifications are 0.9065–0.9071 inch (23,0–23,04 mm).

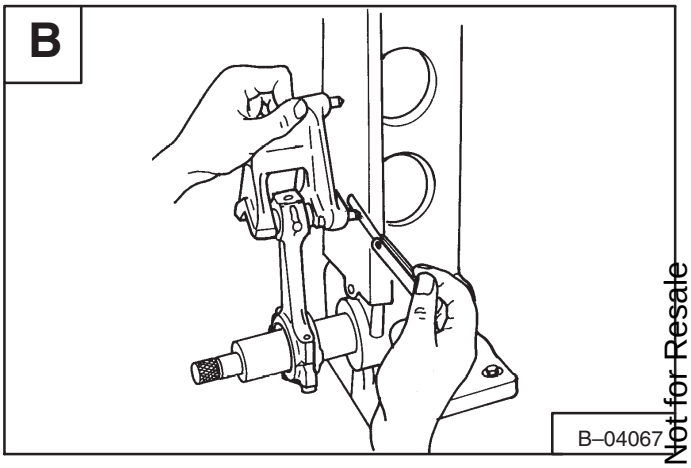
Clearance between piston pin and bushing on a new engine is 0.0006–0.0015 inch (0,015–0,04 mm). Service replacement part clearance is 0.0006–0.0026 inch (0,015–0,066 mm). The wear limit is 0.006 inch (0,15 mm).

Using connecting rod hole (Item 3) **[A]** as a guide, drill a hole through the replacement bushing and deburr the hole.



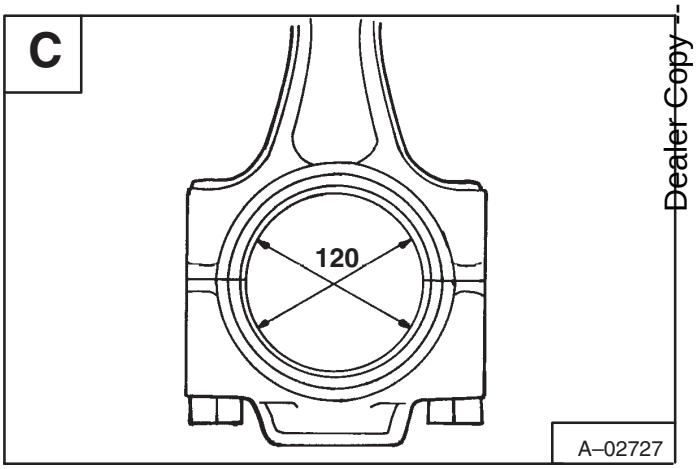
Install the connecting rod on the tool for checking connecting rod alignment **[B]**.

The specification is 0.0008" (0,020 mm). The wear limit is 0.002 inch (0,05 mm).



Check the connecting rod bearings **[C]**.

The specifications are 1.7327–1.7343 inch (44,01–44,05 mm). The wear limit is 0.008 inch (0,20 mm).

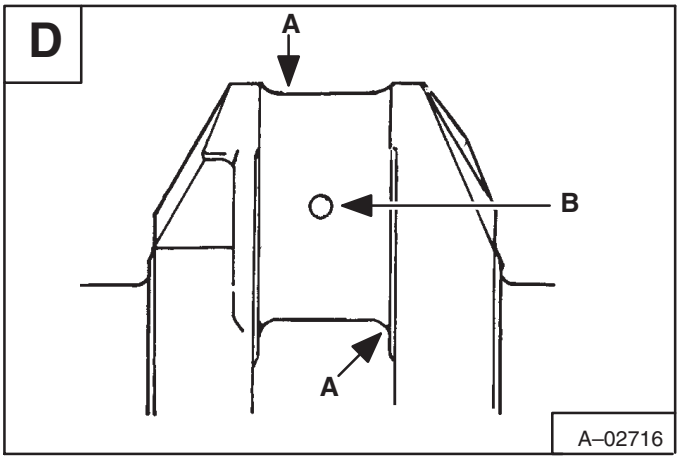


Check the O.D. of the connecting rod journals **[D]**.

The specifications are 1.7307–1.7313 inch (43,3–44,0 mm). The wear limit is 0.008 inch (0,20 mm).

If the connecting rod journals are not within specifications, grind the journals as follows **[D]**.

1. Crankshaft corner radius must be 0.138 inch ± 0.008 inch (3,5 mm ± 0,20 mm).
2. The oil hole must be chamfered to 0.039–0.059 inch (0,99–1,5 mm).



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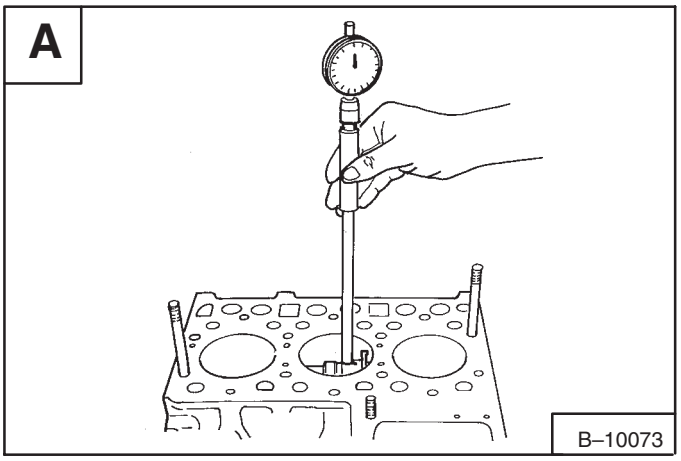
CYLINDER LINERS

Checking The Cylinder Liners

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

MEL1060 – Ridge Reamer
MEL1180 – Dry Liner Puller

Check the inside diameter of the cylinder liner **[A]**.



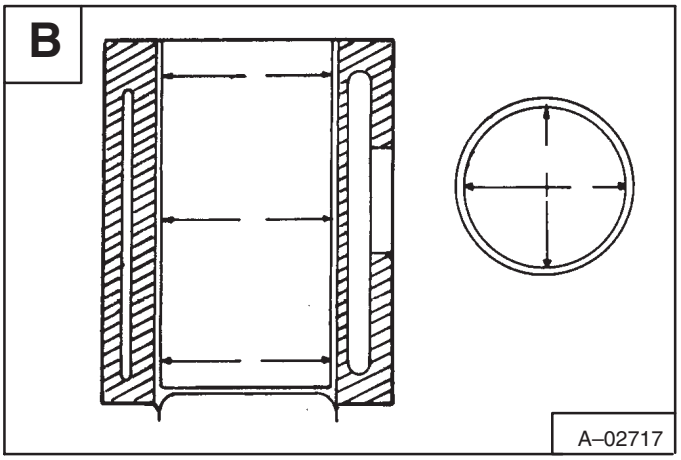
To find the maximum wear check the inside diameter in three different locations **[B]**.

The specifications are 3.3465–3.3473 inch (85,0–85,02 mm). The wear limit is +0.006 inch (+0,15 mm).

When the cylinder liner has more wear than specifications, bore and hone the cylinder to 0.020 oversize. (See Parts Fiche.)

NOTE: Make sure you use the correct oversize pistons and rings.

If the cylinder liner is not within the specifications, replace the cylinder liner. These are dry cylinder liners.



Cylinder Liner Installation

Clean and rub oil on the bores of the engine block. Clean and put oil on the outside of the cylinder liners. Install the cylinder liners into the engine block with the chamfered end down.

The top of the liner must be even with the top of the engine block machined surface.

After installation, bore and/or hone the cylinder liner to 3.3465–3.3473 inch (85,0–85,02 mm).

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WATER PUMP

Removal And Installation

Drain the cooling system.

Remove the radiator. (See Page 7–12.)

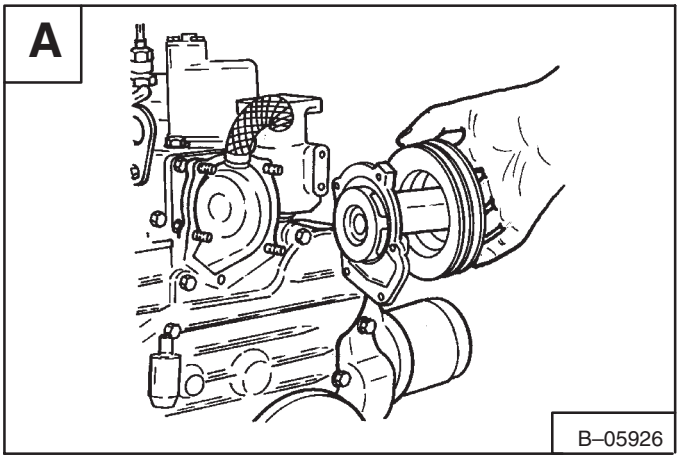
Remove the alternator belt.

Remove the fan.

Remove the water pump bolts.

Remove the water pump **[A]**.

Installation: Always use a new gasket when installing the water pump.



Disassembly And Assembly

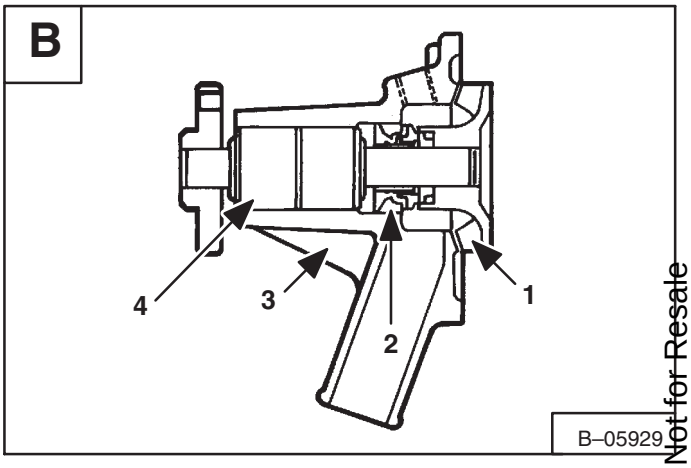
Put the water pump in a vise.

Remove the pulley.

Drive the shaft out of the impeller side of the water pump **[B]**.

Remove the seal.

Install a new seal when assembling the water pump.



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TECHNICAL DATA

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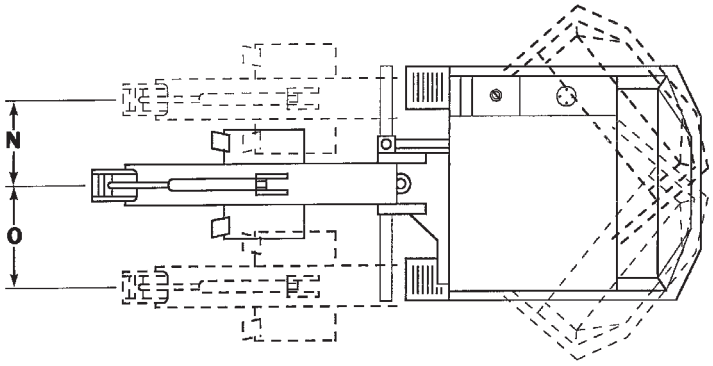


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EXCAVATOR SPECIFICATIONS

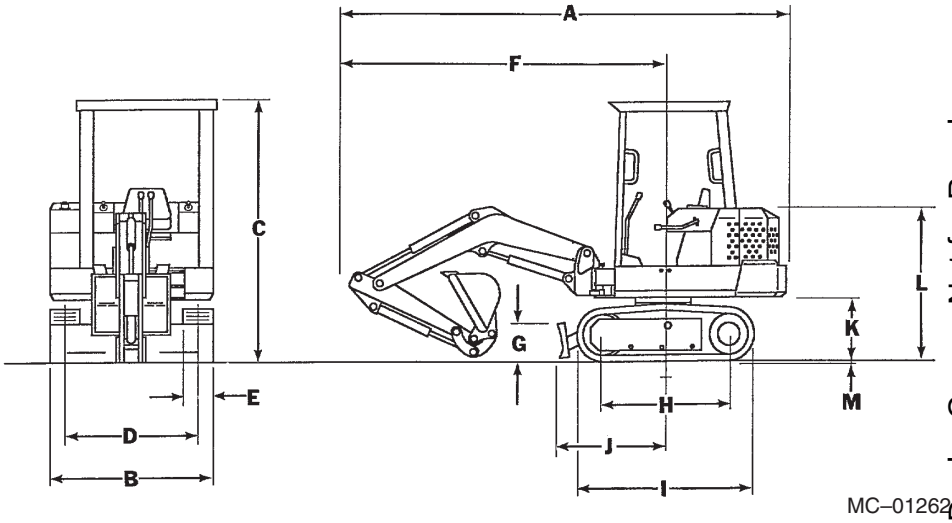
Machine Dimensions

- All dimensions are shown in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.
- Where applicable, specifications conform to SAE standards. Specifications are subject to change without notice.



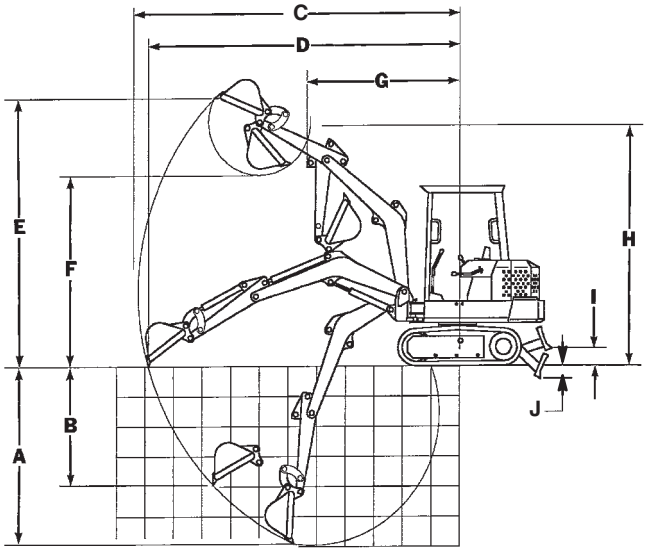
MC–01261

A – 165.7 (4210)
B – 55.1 (1400)
C – 94.1 (2390)
D – 43.3 (1100)
E – 11.8 (300)
F – 118.7 (3015)
G – 14.2 (360)
H – 53.1(1350)
I – 70.1 (1780)
J – 54.3 (1380)
K – 22.4 (570)
L – 53.9 (1370)
M – 3.3 (85)
N – 26.2 (665)
O – 15.4 (390)



MC–01262

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MC–01263

		With 32.2 (820) Dipperstick
A	Max. digging depth	92.1 (2340)
B	Max. vertical wall depth	72.8 (1850)
C	Max. digging reach	170 (4320)
D	Max. digging reach at ground level	165.1 (4195)
E	Max. digging height	146.8 (3730)
F	Max. dumping height	99.6 (2530)
G	Min. swing radius (when using boom swing)	81.9 (2080)
H	Max. height of Min. swing radius	120.5 (3060)
I	Max. lift above ground (blade)	15.5 (395)
J	Max. drop below ground blade	8.5 (215)

HYDRAULIC EXCAVATOR SPECIFICATIONS (Cont'd)

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parenthesis.

Performance And Operation

Operating Weight	5005 lbs. (2272 kg)
Travel Speed	1.1 MPH (1,8 km/hr.)
Controls:	
Vehicle	Two Hand Levers
Functions	Two joystick levers control boom, bucket, dipperstick and swing. Two separate levers control boom swing and blade.

Engine

Make	Kubota
Model	D–1402–B
Fuel	Diesel
Horsepower	23.1 HP (17 kW) @ 2500 RPM
Displacement	85.1 cu. in. (1395 cu. cm.)
Maximum Torque	62.9 ft.–lbs. (85 Nm) @ 1800 RPM
Governed RPM – Full Load	2500 RPM
No Load	2600 RPM
Low Idle Speed	1000 RPM
Number of Cylinders	Three
Bore/Stroke	3.35/3.23 (85/82)
Cooling System	Liquid
Lubrication System	Forced
Filter	Cartridge Type – Full Flow
Starter	12 Volt, Reduction Drive
Alternator	12 Volt, 25 Amp.
Battery	12 Volt, 425 Cold Crank Amps.

Hydraulic System

Pump Numbers	Three
Type	Triple Section Gear Pumps
Capacity (Implement)	2.x 7.0 GPM (26,5 L/min.)
Capacity (Servo)	4.6 GPM (17,5 L/min.)
System Relief Setting	2275.PSI (15686 kPa)
Control Valve	9 Spool
Drive Motor	Two Axial Piston
Swing Motor	Orbit.Motor with Gear Reduction

Swing System

Swing Drive	Gear Motor Connect to a Pinion
Swing Circle	Single Row Shear Type Ball Bearings with Internal Gears Gears Built Into Swing Circle.
Swing Speed	10.3 RPM
Boom Swing (Left)	40 degrees
Boom Swing (Right)	80 degrees

Hydraulic Cylinders

	Bore Dia.	Rod Dia.	Stroke
Boom	2.75 (70)	1.57 (40)	17.7 (450)
Dipperstick	2.75 (70)	1.57 (40)	19.7(500)
Bucket	2.75 (70)	1.57 (40)	15.7 (400)
Boom Swing	2.36 (60)	1.38 (35)	15.7 (400)
Blade	2.75 (70)	1.57 (40)	4.90 (125)

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All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Drive System

Final Drive	Each Track Is Independently Driven By A Hydrostatic Axial Motor
Type of Reduction	Planetary Gear Reduction
Maximum Drawbar Pull	2425 lbs. (1100 kg)
Gradeability	30 degrees

Brakes

Travel	Hydraulic Lock on Motor
Swing	Hydraulic Lock on Motor & Hold Pin Lock

Undercarriage

Type	Crawler–Tractor Design Undercarriage. Sealed Track With Reinforced Box–Section Adjusters W/Shock Absorbing Recoil System

Track Shoes

Type	Steel (Optional)	Rubber (Standard)
Width	11.8 (300)	12.6 (320)
Number of Shoes	37	Single Assembly
Number of Track Rollers	6	6
Ground Pressure	3.7 PSI (0,26 kPa)	3.9 PSI (0,27 kPa)

Capacities

Fuel Tank	7.4 Gals. (28 L)
Cooling System	6 Qts. (5,7 L)
Engine Oil and FIlter	5.75 Qts. (5,4 L)
Hydraulic Reservoir	11.6 Gals. (44 L)
Final Drive Case (Each)	Qts. (L)

Digging Force

Dipperstick	2601 lbs. (1180 kg)
Bucket	3750 lbs. (1700 kg)

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ENGINE SPECIFICATIONS

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Fuel Injection Nozzles

Opening Pressure . . . . . 1990–2130 PSI (1372,1–1468,63 kPa)
Fuel Tightness Nozzle Seat . . . . . Dry Nozzle at 1848–1990 PSI (12741,9–1372,1 kPa)

Fuel Injection Pump

Fuel Tightness of Plunger . . . . . 8 sec: initial pressure 8532–7110 PSI (58828,1–49023,4 kPa)
Limit Permitted . . . . . 4 seconds or less
Fuel Tightness of Delivery Valve . . . . . 10 sec.: initial pressure from 1422–71 PSI (9804,7–489,5 kPa)
Limit Permitted . . . . . 5 Seconds or less
Injection Timing . . . . . 25–26 degrees before T.D.C.

Cylinder Head

Cylinder Head Surface Distortion . . . . . 0.0012 in. (0,03 mm)
Thickness of Gasket . . . . . 0.0512–0.0630 in. (1,300–1,600mm)
Thickness of Gasket Shims . . . . . 0.0079 in. (0,20mm)
Top Clearance (Piston to Head) . . . . . 0.0276–0.0354 in. (0,7–0,9)
Head Bolt Torque . . . . . 65–68 ft.–lbs. (88–92 Nm)
Maximum Milling Allowed . . . . . 0.004 in. (0,1mm)

Valves

Valve Seat Width . . . . . 0.0827 in. (2,1mm)
Valve Seat Angle . . . . . 45 degrees
O.D. of Valve Stems
(Intake and Exhaust) . . . . . 0.3134–0.3140 in. (7,960–7,975mm)
I.D. of Valve Guides
(Intake and Exhaust) . . . . . 0.3156–0.3161 in. (8,015–8,030mm)
Clearance Between Valve Stem & Guide . . . . . 0.0016 to 0.0028 in. (0,04–0,07mm)
Limit Permitted 0.0039 (0,1mm)
Depth of Valve . . . . . 0.0433–0.0512 in. (1,1–1,3mm)
Valve Clearance (Old)
(Intake and Exhaust) . . . . . 0.0071–0.0087 in. (0,18–0,22mm)

Valve Springs

Free Length 1.6417–1.6614 (41,7–42,2)
Fitted Length 1.3839 (35,15)
Load to Compress to Fitted Length . . . . . 26.5 lbs. (12,03 kg)
Limit Permitted . . . . . 22.5 lbs. (10,22 kg))

Rocker Arms

O.D. of Rocker Arm Shaft . . . . . 0.5501–0.5506 in. (13,973–13,984mm)
I.D. of Rocker Arm Bushings . . . . . 0.5513–0.5529 in. (14,002–14,043mm)
Clearance Between Rocker Arm & Bushing . . . . . 0.0004–0.0028 in. (0,01–0,07mm)
Limit Permitted 0.0059 (0,15mm)

Camshaft

O.D of Camshaft Bearing Journal . . . . . 1.5722–1.5728 in. (39,934–39,950 mm)
I.D. of Camshaft Bearing . . . . . 1.5748–1.5758 in. (40–40,025 mm)
Clearance Between Camshaft Journal and Bearing . . . . . 0.002–0.0036 in.(0,50–0,091 mm)
Limit Permitted . . . . . 0.0059 in. (0,15 mm)
Alignment of Camshaft . . . . . 0.0008 in. (0,02 mm)
Cam Lobe Height (Intake and Exhaust) . . . . . 1.3134 in.(33,36 mm)
Limit Permitted . . . . . 1.3114 in. (33,31 mm)
Gear Clearance (Backlash) . . . . . 0.0016–0.0045 in. (0,0415–0,1154 mm)
Limit Permitted . . . . . 0.0118 in. (0,3 mm)

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All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Cylinder

I.D. of Cylinder Liner	3.3465–3.3473 in. (85–85,022 mm)
Limit Permitted	+0.0059 in. (+0,150 mm)
Oversize	3.366–3.3670 in. (85,5–85,5522 mm)

Piston Rings

Ring Gap (Top and 2nd Ring)	0.0118–0.0177 in. (0,30–0,45 mm)
Limit Permitted	0.0492 in. (1,25 mm)
Ring Gap (Oil Ring)	0.0098–0.0157 in. (0,25–0,40 m)
Limit Permitted	0.0492 in. (1,25 mm)
Side Clearance of Ring Groove	
Top Ring	0 Clearance
Second Ring	0.0037–0.0047 in. (0,093–0,120 mm)
Oil Ring	0.0008–0.0020 in. (0,020–0,052 mm)

Pistons

O.D. of Piston (Standard)	3.342 (84,88 mm)
O.D. of Piston (Oversized)	3.362 (85,39 mm)
I.D. of Piston Bosses	0.9055–0.9060 in. (23–23,013)
Limit Permitted	0.9076 in. (23,053 mm)
O.D. of Piston Pin	0.9056–0.9059 in. (23,002–23,011 mm)
I.D. of Connect Rod Bushing (Small End, Fitted)	0.9065–0.9071 in. (23,025–23,030 mm)
Clearance Between Piston Pin And Bushing (New)	0.0006–0.0015 in. (0,014–0,028 mm)
(Service Replacement Part)	0.0006–0.0026 in. (0,015–0,066 mm)
Limit Permitted	0.0059 in. (0,15 mm)
Connecting Rod Alignment	0.0008 in. (0,02 mm)
Limit Permitted	0.002 in. (0,05 mm)

Crankshaft

I.D. of Crankshaft Main Bearing (No. 1)	2.0465–2.0488 in. (51,98–52,039 mm)
I.D. of Crankshaft Main Bearing	2.0465–2.0482 in. (51,98–52,025 mm)
Clearance Between Crankshaft And Journal and Bearing	0.0016–0.0046 in. (0,04–0,118 mm)
Limit Permitted	0.0079 in. (0,2 mm)
O.D. of Connecting Rod Journals	1.7307–1.7313 in. (43,959–43,975 mm)
I.D. of Connecting Rod Bearings (Std.)	1.7327–1.7343 in. (44,010–44,052 mm)
I.D. of Connecting Rod	1.7228–1.7234 (43,759–43,775 mm)
(Undersizes)	1.7149–1.7156 (43,559–43,575 mm)
Clearance Between Connecting Rod Journal and Bearing	0.0014–0.0037 in. (0,035–0,93 mm)
Limit Permitted	0.0079 in. (0,2 mm)
End Play of Crankshaft	0.0059–0.0122 in. (0,15–0,21 mm)

Oil Pump

Oil Pressure @ rated RPM	42–56 PSI (289,6–3861,1 kPa)
Limit Permitted	36 PSI (248,2 kPa)
Rotor Lobe Clearance	0.0039–0.0063 in. (0,10–0,016 mm)
Limit Permitted	0.0079 in. (0,20 mm)
Clearance Between Outer Rotor And Pump Body	0.0043–0.0075 in. (0,11–0,19 mm)
Limit Permitted	0.0098 in. (0,25 mm)

Engine Oil Specifications

Check oil level every 8 hours of operation (Check oil every 4 hours on new engine during the first 50 hours of operation).

Oil level must be between the *add* and *full* marks on the dipstick. Use a good quality detergent motor oil that meets the correct API service classification. (See Chart on Page 8–8.)

Use oil of the correct SAE viscosity for expected temperature conditions.

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All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses

Engine Bolt Torque

	Ft.–Lbs.	Nm
*Cylinder Head Bolts & Nuts	29–33	39–44
*Main Bearing Bolts	15–17	20–24
*Main Bearing Case Bolts	22–25	29–34
*Flywheel bolts	40–43	54–59
*Connecting Rod Bolts	20–22	27–30
*Rocker Arm Bracket Studs	12–15	17–21
*Idler Gear Shaft Bolts	7–8	9–11
Glow Plugs	15–18	20–25
Drain Plug	30–36	39–49
Nozzle Holder	30–36	39–49
Oil Switch	11–15	15–20
Fuel Injection Tubeline Fittings	11–19	13–26
Crankshaft Nut	101–116	137–157
Injection Pump Vent Screw	10–13	14–18

*Lightly Oiled Threads

PUNCHED NUMBER	BOLT MATERIAL GRADE	
None	Standard Bolts	SS41, S20C
7	Special Bolts	S43C, 248C (Refined)
9	Special Bolts	SCM3, SCR3 (Refined)

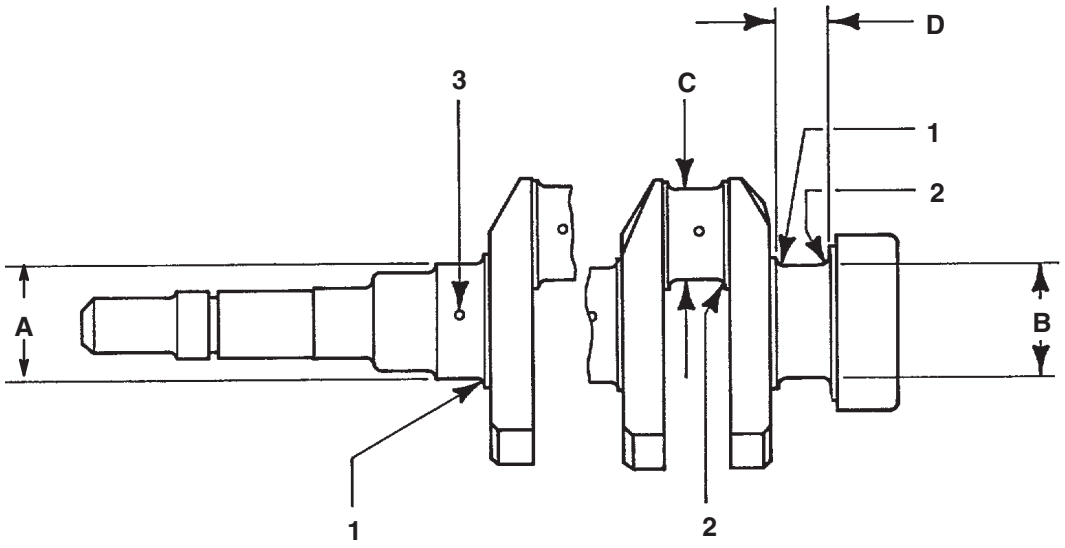
BOLT TORQUES			
MATERIAL GRADE	**STANDARD BOLT**	**SPECIAL BOLT**	**SPECIAL BOLT**
NOMINAL DIAMETER	**SS42, S20C**	**S43C, S48C (Refined)**	**SCR3, SCM3 (Refined)**
M 6	6 to 7 ft. lbs. (8 to 9 Nm)	7 to 8 ft. – lbs. (9 to 11 Nm)	9 to 11 ft.–lbs. (12 to 15 Nm)
M 8	13 to 15 ft.–lbs. (18 to 20 Nm)	17 to 20 ft.–lbs. (23 to 27 Nm)	22 to 25 ft.–lbs. (30 to 34 Nm)
M 10	29 to 33 ft.–lbs. (39 to 45 Nm)	35 to 41 ft.–lbs. (47 to 56 Nm)	45 to 52 ft.–lbs. (61 to 71 Nm)
M 12	46 to 54 ft.–lbs. (62 to 73 Nm)	57 to 67 ft.–lbs. (77 to 91 Nm)	76 to 87 ft.–lbs. (103 to 118 Nm)
M 14	80 to 93 ft.–lbs. (108 to 126 Nm)	91 to 109 ft.–lbs. (123 to 148 Nm)	123 to 145 ft.–lbs. (167 to 197 Nm)
M 16	123 to 141 ft.–lbs. (167 to 191 Nm)	145 to 166 ft.–lbs. (197 to 225 Nm)	192 to 224 ft.–lbs. (260 to 304 Nm)
M 18	181 to 210 ft.–lbs. (245 to 285 Nm)	203 to 235 ft.–lbs. (275 to 319 Nm)	253 to 297 ft.–lbs. (343 to 403 Nm)
M 20	246 to289 ft.–lbs. (334 to 392 Nm)	271 to 318 ft.–lbs. (367 to 431 Nm)	362 to 420 ft.–lbs. (491 to 578 Nm)

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All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses

Re–Grinding The Crankshaft

If the standard size bearing cannot be used due to excessive wear of the crank pin and crankshaft journals, use undersize or oversize bearings.



REF.	SIZE	CODE NO.	DESCRIPTION	DIMENSION	MARK
A	0.008 in. (0,2 mm) U/S	15261–2391–1	Crankshaft Bearing #1	1.7218–1.7224 in. (43,743–43,750 mm)	020US
	0.016 in. (0,4 mm) U/S	15261–2392–1	Crankshaft Bearing #1	1.7139–1.7146 in. (43,534–43,550 mm)	040US
B	0.008 in. (0,2 mm) U/S	15261–2393–1	Crankshaft Bearing #2	1.7218–1.7224 in. (43,734–43,750 mm)	020US
	0.016 in. (0,4 mm) U/S	15261–2394–1	Crankshaft Bearing #2	1.7139–1.7146 in. (43,534–43,550 mm)	040US
C	0.008 in. (0,2 mm) U/S	15531–297–1	Crankpin Bearing	1.4472–1.4478 in. (36,759–36,775 mm)	020US
	0.016 in. (0,4 mm) U/S	15531–2298–1	Crankpin Bearing	1.4393–1.4400 in. (36,559–36,575 mm)	040US
D	0.008 in. (0,2 mm) O/S	15261–2397–1 15261–2395–1	Crankshaft Thrust Bearing	0.9528–0.9547 in. (24,20–24,25 mm)	0.20 OS
	0.016 in. (0,4 mm) O/S	15261–2398–1 15261–2396–1	Crankshaft Thrust Bearing	0.9606–0.9626 in. (24,40–24,45 mm)	0.40 OS
1	Radius – 0.13–0.146 in. (3,3–3,7 mm)			0.130–0.146 in. (3,3–3,7 mm)	
2	Radius – 0.11–0.126 in. (2,8–3,2 mm)			0.11–0.126 in. (2,8–3,2 mm)	
3	**IMPORTANT: Oil holes must have a 0.0394–0.0591 in.(1–1,5 mm) chamfer. Use on oil stone to chamfer the oil hole.**				

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FUEL, COOLANT AND LUBRICANTS

Chart

Use this chart for correct selection of Fuel, Coolant and Lubricants.

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE	CAPACITY Refill
		F° –30 –20 –10 0 +10 +20 +30 +40 +50 +60 +70 +80 +90 +100 C° –34 –29 –23 –18 –13 –7 –1 +4 +10 +15 +21 +27 +32 +38	
Engine oil pan	Use SAE Viscosity Number as Listed With API Classification CC, CD or CE	SAE 10W–30 SAE 15W–40 SAE 5W–30 SAE 30 SAE 20W/20 SAE 10W	6.34 qts. (6,0 L)
Fuel Tank	Diesel Fuel	No. 1 No. 2	7.4 gals (28 L)
Cooling System	50/50 Water & Anti–Freeze	50/50 Water & Anti–Freeze	6.34 qts. (6,0 L)
Hydraulic Tank	6563328*		11.6 gals. (44 L)
Swing Motor Gear Reduction	90W Gear		0.32 qts. (0,3 L)
Final Drive Case (each)			0.5 qts. (0,5 L)

* If Bobcat fluid (P/N 6563328) is not available. Use Engine Oil SAE 10W–30/10W–40, Class SE

OIL SPECIFICATIONS

Description

When fuel sulphur content is less than 0.5% change the engine oil and filter as shown in the Service Schedule. (See Page 1–1.)

Change engine oil and filter according to the following chart if fuel sulphur content is above 0.5%.

Fuel Sulphur Content	Change Interval Of Engine Oil & Filter
0.5 to 1.0%	1/2 of Regular Interval
Above 1.0%	1/4 of Regular Interval

When starting the engine in a temperature of lower than 32°F (0°C) use SAE 10W engine oil.

Use API Classifications CD engine oil, if API Classification CC is used, reduce the engine oil change interval to half the hours.

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MELROE
INGERSOLL-RAND

bobcat®

225–1
Revision Number

11 July 1991
Date

SERVICE MANUAL REVISION

ROUTE TO ATTENTION

PARTS MANAGER	☐
SERVICE MANAGER	☒
SALES MANAGER	☐

AFFECTING:

Product BOBCAT EXCAVATOR

Model 225 (S/N 508311001–508311999)

Manual No. 6720347 (11–89)

NOTICE **Insert This Sheet With The Appropriate Manual For Future Reference.**

The following pages are a revision to the 225 Excavator Service Manual P/N 6720347 (11–89).

Take out the pages shown and put in the added or revised pages as follows:

TAKE OUT	PUT IN
HYDRAULIC SCHEMATIC	HYDRAULIC SCHEMATIC (Revised July 1991) HYDRAULIC SCHEMATIC W/ HIGH FLOW (Added July 1991)
HYDRAULIC FLOW CHART #6720322	HYDRAULIC FLOW CHART #6720322 (Revised July 1991)
Chart Legend #6720322	Chart Legend #6720322 (Revised July 1991)
HYDRAULIC FLOW CHART #6720532	HYDRAULIC FLOW CHART #6720532 (Revised July 1991)
Chart Legend #6720532	Chart Legend #6720532 (Revised July 1991)
Section 2 – Content Page 2–1 thru 2–14	Section 2 – Content Page (Revised July 1991) 2–1 thru 2–14 (Revised July 1991) 2–15 thru 2–21 (Added July 1991)
Section 3 – Content Page 3–1 thru 3–13	Section 3 – Content Page (Revised July 1991) 3–1, 3–2 3–3 thru 3–13 (Revised July 1991) 3–14 thru 3–16 (Added July 1991)
Section 4 – Content Page 4–1 thru 4–4	Section 4 – Content Page (Revised July 1991) 4–1, 4–2 4–3 (Revised July 1991), 4–4 (Revised July 1991)
Section 5 – Content Page 5–13	Section 5 – Content Page (Revised July 1991) 5–13, 5–14 (Added July 1991) 5–15 (Added July 1991)
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225–2
Revision Number

23 June 1992
Date

SERVICE MANUAL REVISION

ROUTE TO ATTENTION

PARTS MANAGER	☐
SERVICE MANAGER	☒
SALES MANAGER	☐

AFFECTING:

Product BOBCAT EXCAVATOR

Model 225 (S/N 508311001–508311999)

Manual No. 6720347 (11–89)

NOTICE **Insert This Sheet With The Appropriate Manual For Future Reference.**

The following pages are a revision to the 225 Excavator Service Manual P/N 6720347 (11–89).

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Section 2 – Content Page	Section 2 – Content Page (Revised June 92)
	2–12a thru 2–12r (Added June 92)

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225–3
Revision Number

27 April 1993
Date

SERVICE MANUAL REVISION

ROUTE TO ATTENTION

PARTS MANAGER	☐
SERVICE MANAGER	☒
SALES MANAGER	☐

AFFECTING:

Product BOBCAT EXCAVATOR

Model 225 (S/N 508311001–508311999)

Manual No. 6720347 (11–89)

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Section 3 – Content Page	Section 3 – Content Page (Revised April 93)
	3–17 thru 3–40 (Added April 93)

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225–4
Revision Number

25 May 1993
Date

SERVICE MANUAL REVISION

ROUTE TO ATTENTION

PARTS MANAGER	☐
SERVICE MANAGER	☒
SALES MANAGER	☐

AFFECTING:

Product BOBCAT EXCAVATOR

Model 225 (S/N 508311001–508311999)

Manual No. 6720347 (11–89)

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	TAKE OUT	PUT IN
	FOREWORD	FOREWORD (Revised May 93)
SECTION 1	1–1, 1–2	1–1, 1–2 (Revised May 93)
SECTION 5	5–11 thru 5–15	5–11 thru 5–15 (Revised May 93) 5–16 (Added May 93)
SECTION 8	8–1, 8–2	8–1, 8–2 (Revised May 93)

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Revision Number

14 September 1993
Date

SERVICE MANUAL REVISION

ROUTE TO ATTENTION

PARTS MANAGER	☐
SERVICE MANAGER	☒
SALES MANAGER	☐

AFFECTING:

Product BOBCAT EXCAVATOR

Model 225 (S/N 508311001–508311999)

Manual No. 6720347 (11–89)

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	TAKE OUT	PUT IN
SECTION 6		
	6–6, 6–8	6–6, 6–8 (Revised Sept. 93)
	6–9	6–9 (Revised Sept. 93)
		6–10 thru 6–23 (Added Sept. 93)

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Revision Number

7 February 1995
Date

SERVICE MANUAL REVISION

ROUTE TO ATTENTION

PARTS MANAGER	☐
SERVICE MANAGER	☒
SALES MANAGER	☐

AFFECTING:

Product BOBCAT EXCAVATOR

Model 225 (S/N 508311001–508311999)

Manual No. 6720347 (11–89)

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Section 5 – Content Page	Section 5 – Content Page (Revised Feb. 95)
5–13	5–13 thru 5–13m (Added Feb. 95)
5–14	5–14 thru 5–14n (Added Feb. 95)

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Revision Number

6 November 1997
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SERVICE MANUAL REVISION

ROUTE TO ATTENTION

PARTS MANAGER	☐
SERVICE MANAGER	☒
SALES MANAGER	☐

AFFECTING:

Product BOBCAT EXCAVATOR

Model 225 (S/N 508311001–508311999)

Manual No. 6720347 (11–89)

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Cover	Cover
Maintenance Safety Page	Maintenance Safety Page
Section 2 – Content Page	Section 2 – Content Page (Revised Nov. 97) Pages 2–19 thru 2–43 (Added Nov. 97)
Section 4	Section 4
Section 6 – Content Page Page 6–23 & 6–24	Section 6 – Content Page (Revised Nov. 97) Pages 6–23 thru 6–26 (Added Nov. 97)

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SERVICE MANUAL REVISION

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SERVICE MANAGER	X
SALES MANAGER	

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Revision No: **/ / 2*5**
Date: **15 June 2012**
Product: **Bobcat Excavator**
Model: **/ / 2**
Manual No: **64/ - 014 (11*56)**

The following Sections are a revision to the above Service Manual.

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