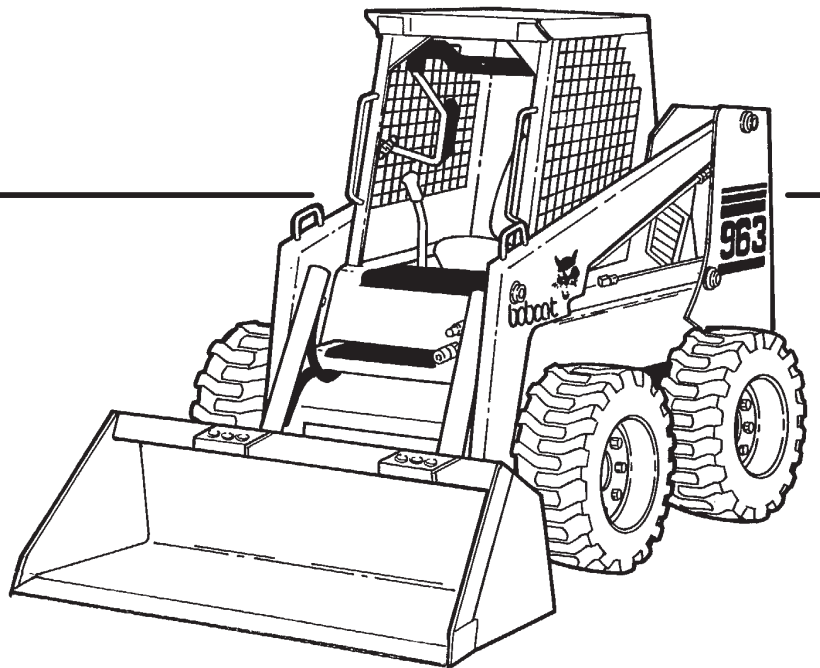


**963**



# Service Manual



EQUIPPED WITH  
BOBCAT INTERLOCK  
CONTROL SYSTEM (BICS™)

**MELROE  
INGERSOLL-RAND**

6724545 (11-97)

Printed in U.S.A.



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## FIRE PREVENTION

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

Flammable debris (leaves, straw, etc.) must be removed regularly. If flammable debris is allowed to accumulate, it will increase the fire hazard. The loader must be cleaned as often as necessary to avoid this accumulation. Flammable debris in the engine compartment is a fire hazard when the loader is parked with a hot engine.

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

- Do not use the Bobcat loader 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 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.
- Do not use ether or starting fluids on this engine. It has a glow plug. These starting aids can cause explosion and injure you or bystanders.
- Always clean the loader and disconnect the battery before doing any welding. Cover rubber hoses, battery and all other flammable parts. Keep a fire extinguisher near the loader when welding. Have good ventilation when grinding or welding painted parts. Wear dust mask when grinding painted parts. Toxic dust or gas can be produced.
- Stop the engine and let it cool before adding fuel. No smoking!
- Use the procedure in the Operation & Maintenance Manual for connecting the battery.
- Use the procedure in the Operation & Maintenance Manual for cleaning the spark arrestor muffler.
- Know where fire extinguishers and first aid kits are located and how to use them.

A fire extinguisher is available from your local dealer. The fire extinguisher can be installed in the location shown **[A]**.



## OPERATOR CAB

### Description

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

*ROPS/FOPS* – Roll Over Protective Structure per SAE J104 and ISO 3471, and Falling Object Protective Structure per SAE J1043 and ISO 3449, Level I. Level II is available.

*Level I* – Protection from falling bricks, small concrete blocks and hand tools encountered in operations such as highway maintenance, landscaping, and other construction site services.

*Level II* – Protection from falling trees, rocks; for machines involved in site clearing, overhead demolition or forestry.

## WARNING

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

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### Raising The Operator Cab

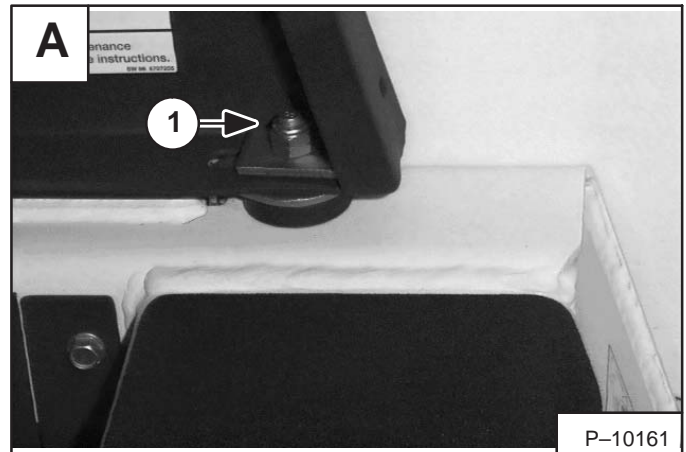
Stop the loader on a level surface. Lower the lift arms.

If the lift arms must be up while raising the operator cab, install the lift arm support device. (See Page 1-7.)

Loosen the nut (Item 1) [A] (both sides) at the front of the operator cab.

Remove the nut and plate (both sides) [B].

Stand on the safety tread. Lift on the grab handles and slowly raise the cab until the latching mechanism engages and the cab is all the way up [C].



## ALTERNATOR BELT

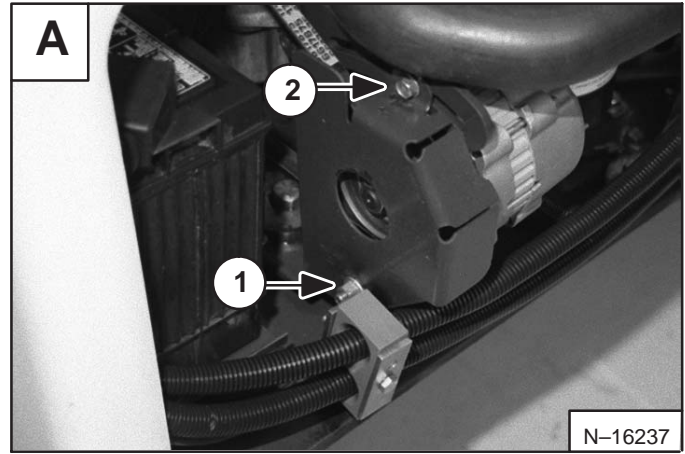
### Adjusting The Alternator Belt

Stop the engine.

Open the rear door.

Loosen the alternator mounting bolt (Item 1) **[A]**.

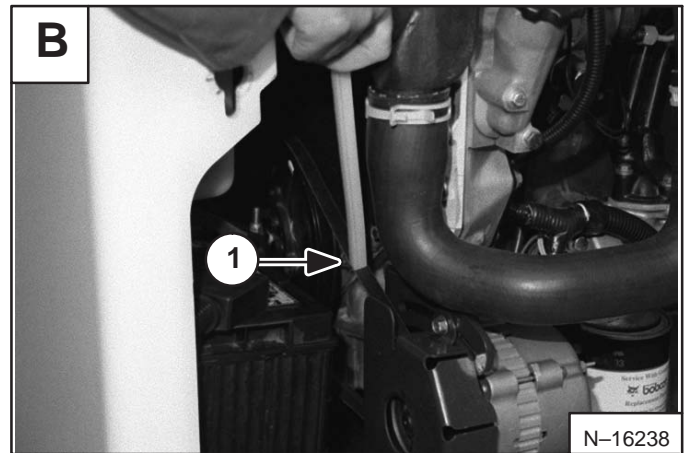
Loosen the adjustment bolt (Item 2) **[A]**.



Move the alternator until the belt has 5/16 inch (8,0 mm) movement at the middle of the belt span (Item 1) **[B]** with 15 lbs. (66 N) of force.

Tighten the adjustment bolt and mounting bolt.

Close the rear door.



## HYDRAULIC SYSTEM

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## HYDRAULIC SYSTEM

Continued On Next Page

## HYDRAULIC SYSTEM INFORMATION

# 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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### Tighten Procedures

To tightening the hydraulic fittings, tubelines etc., See Section 9. – *Hydraulic Connection Specifications*, for the correct procedure and torque.



# WARNING

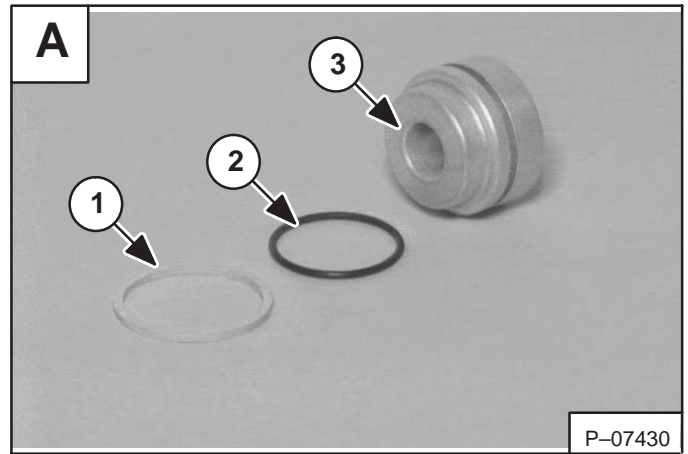
Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possibly death if proper medical treatment by a physician familiar with this injury is not received immediately.

W-2145-0290

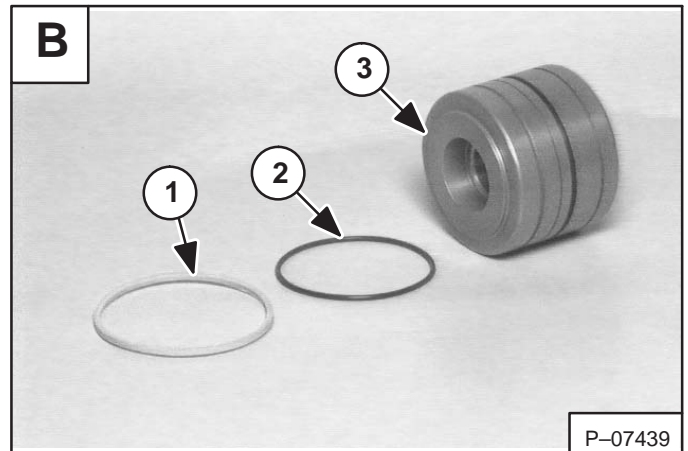
## HYDRAULIC CYLINDER (Cont'd)

### Disassembly (Cont'd)

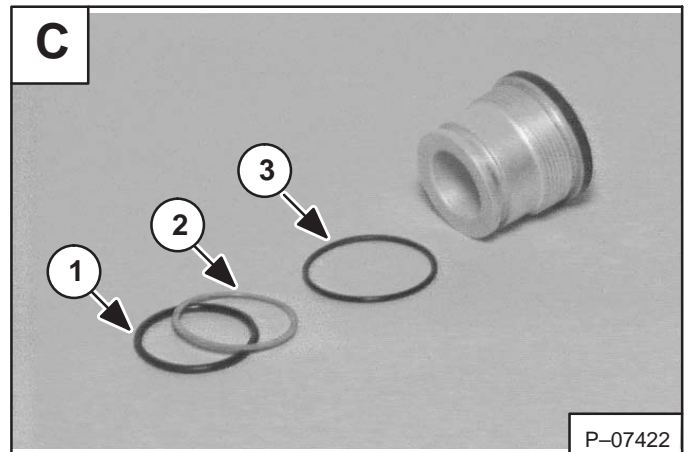
Standard Piston: Remove the seal (Item 1) **[A]**, and O-ring (Item 2) **[A]** from the piston (Item 3) **[A]**.



Cushion Piston: Remove the seal (Item 1) **[B]**, and O-ring (Item 2) **[B]** from the piston (Item 3) **[B]**.

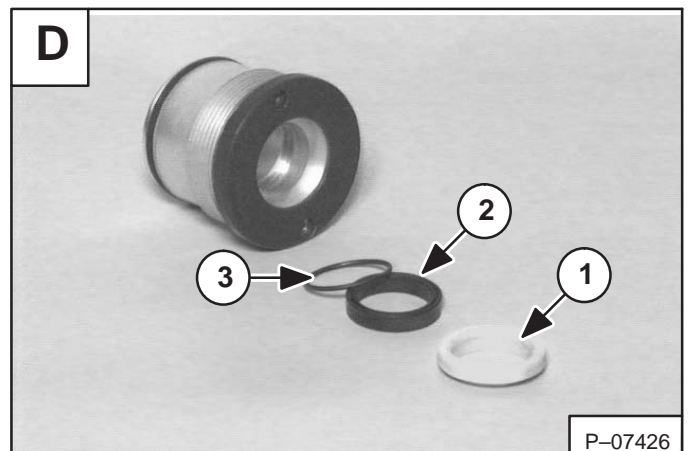


Remove the thick O-ring (Item 1) **[C]**, and the back-up washer (Item 2) **[C]** from the groove in the head. Remove the thin O-ring (Item 3) **[C]**.



Remove the wiper seat (Item 1) **[D]**, and rod seal (Item 2) **[D]**.

Remove the O-ring (Item 3) **[D]** from the rod seal.

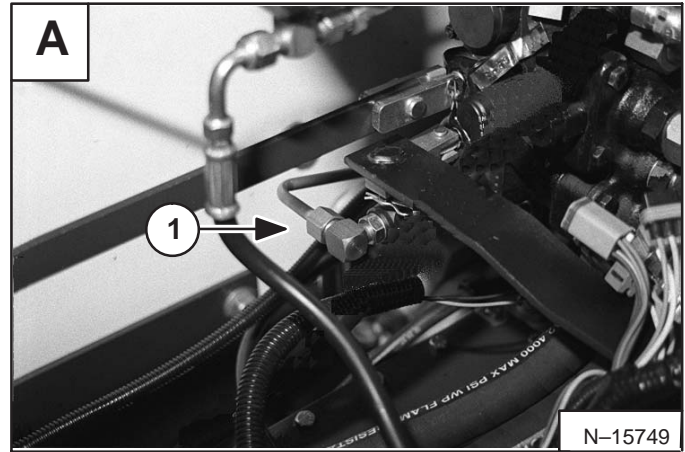


## MAIN RELIEF VALVE (Cont'd)

### Adjustment (Cont'd)

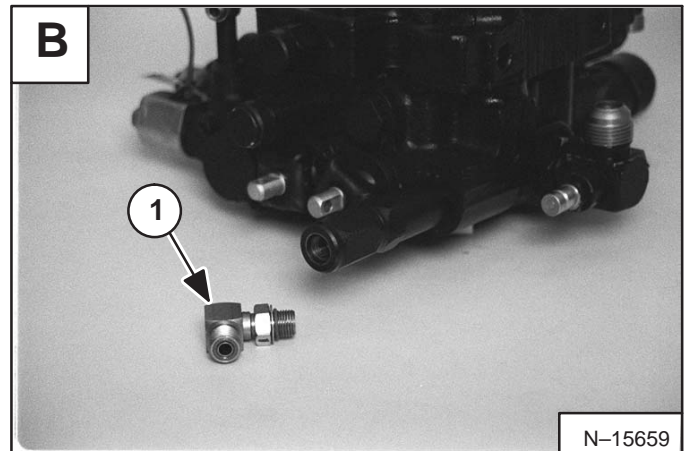
To adjust the second stage (high pressure setting):

Disconnect the charge tubeline (Item 1) [A].

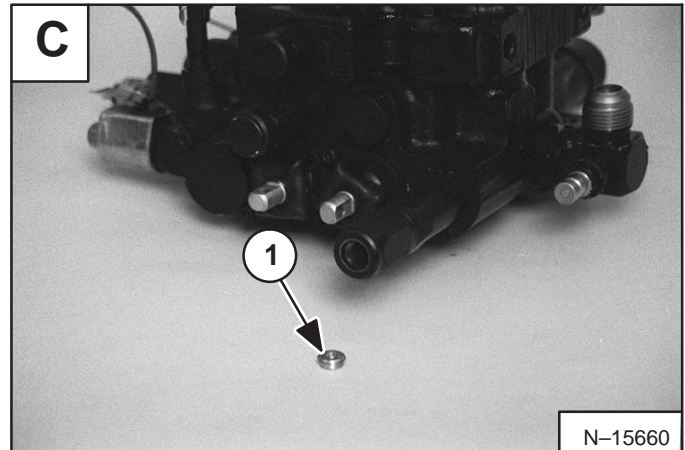


Remove the fitting (Item 1) [B].

**NOTE:** The control valve is shown removed for photo clarity.



Remove the orifice (Item 1) [C] in the end of the second stage housing, using a standard screwdriver.

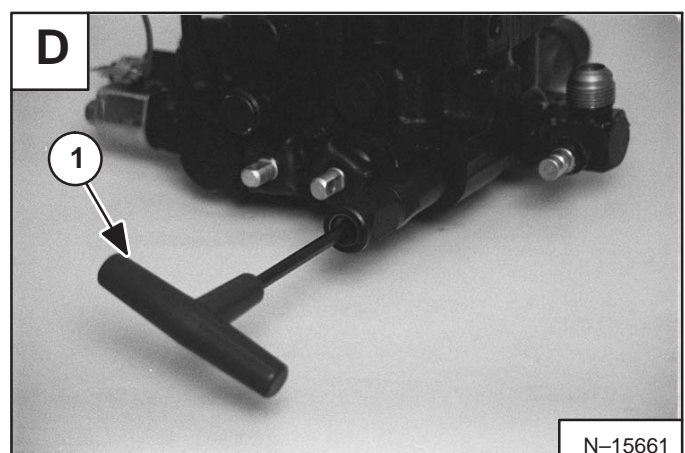


Set the pressure by adjusting the set screw, using a 1/4 inch allen wrench (Item 1) [D]. Press the allen wrench in until the set screw is bottomed out in the housing and turn. One turn is equal to 390 PSI (2689 kPa).

Install the orifice and fitting and tighten.

Connect the charge tubeline.

Check the main relief valve pressure again. (See Page 2-21 or 2-23 for the correct procedure.)

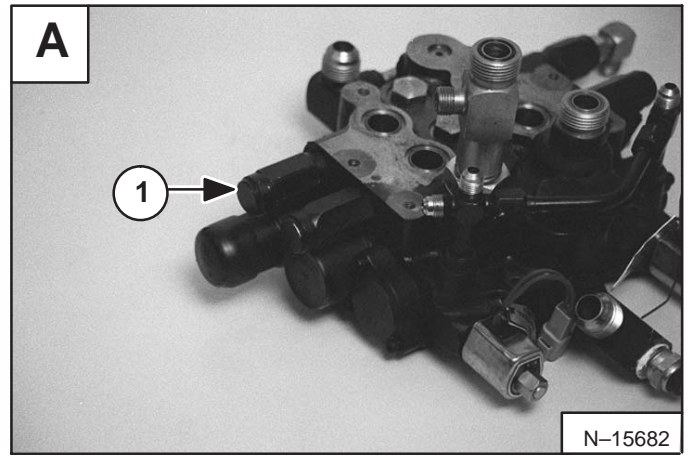


## HYDRAULIC CONTROL VALVE (Cont'd)

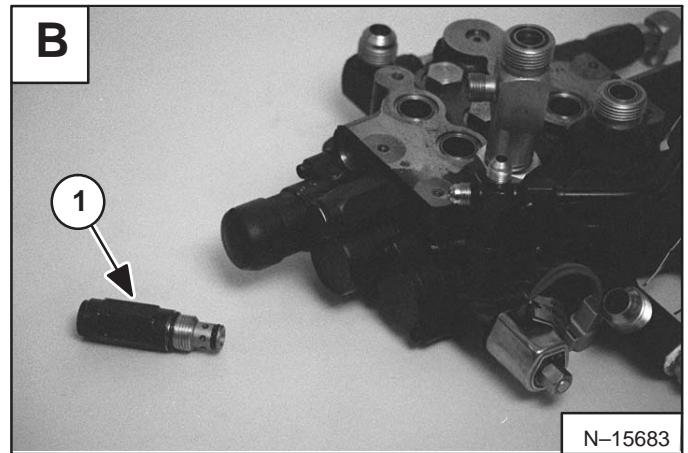
### Port Relief Valve (Lift Section)

Loosen the port relief valve (Item 1) [A].

**Installation:** Tighten port relief valve to 35–40 ft.-lbs. (47–54 Nm) torque.

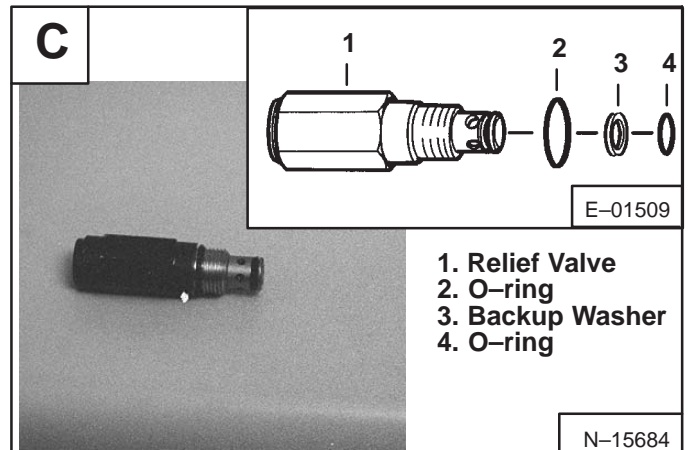


Remove the port relief valve (Item 1) [B].



Remove the O-rings and back-up washer from the port relief valve [C].

**Installation:** Always use new O-rings and back-up washers.

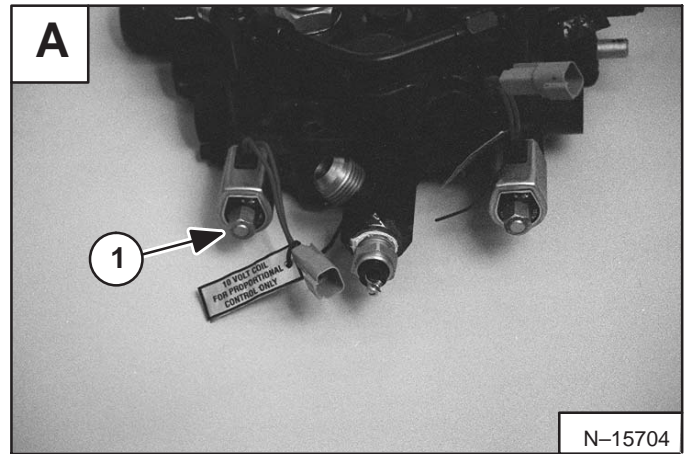


## HYDRAULIC CONTROL VALVE (Cont'd)

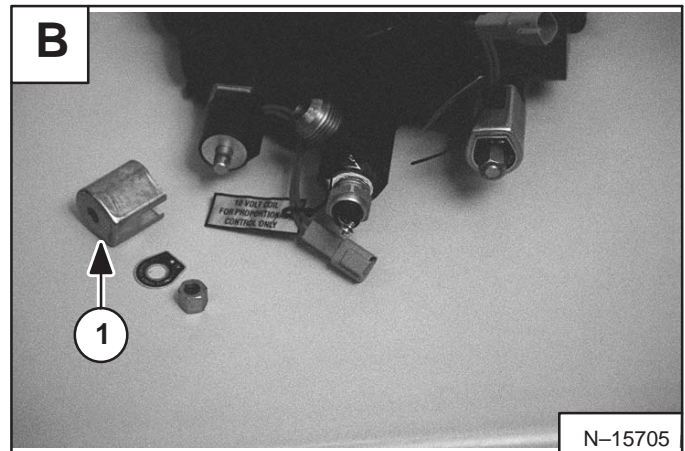
### Auxiliary Electric Solenoid

Remove the nut (Item 1) [A] from the end of the solenoid.

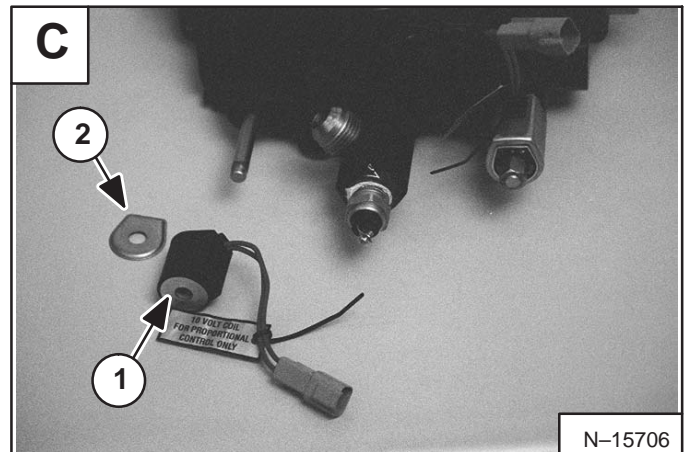
**Installation:** Tighten the nut to 9–12 in.-lbs. (1,02–1,36 Nm) torque.



Remove the solenoid metal housing (Item 1) [B].

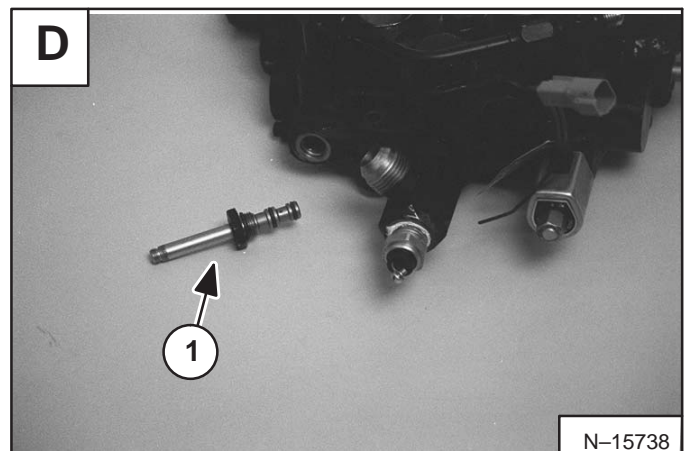


Remove the solenoid coil (Item 1) [C] and end plate (Item 2) [C].



Remove the electric solenoid valve (Item 1) [D].

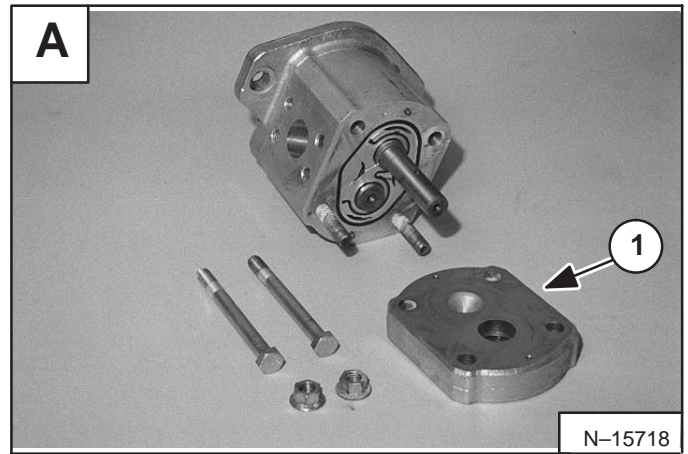
**Installation:** Tighten the electric solenoid valve to 96–144 in.-lbs. (10,8–16 Nm) torque. Always install new O-rings and back-up washers.



## HYDRAULIC PUMP (Cont'd)

### Disassembly And Assembly (Cont'd)

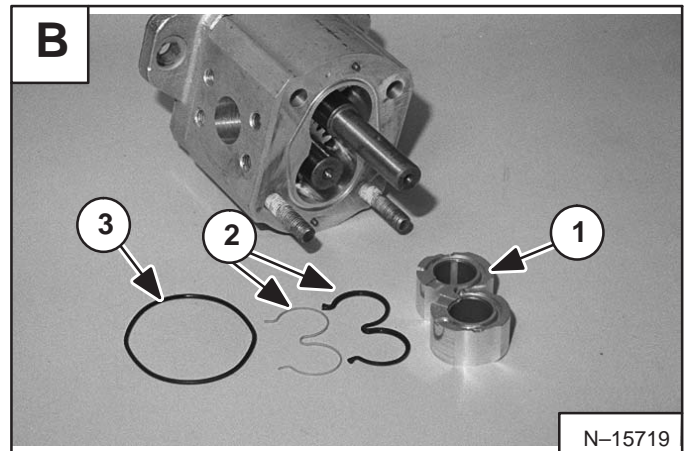
Remove the end housing (Item 1) [A].



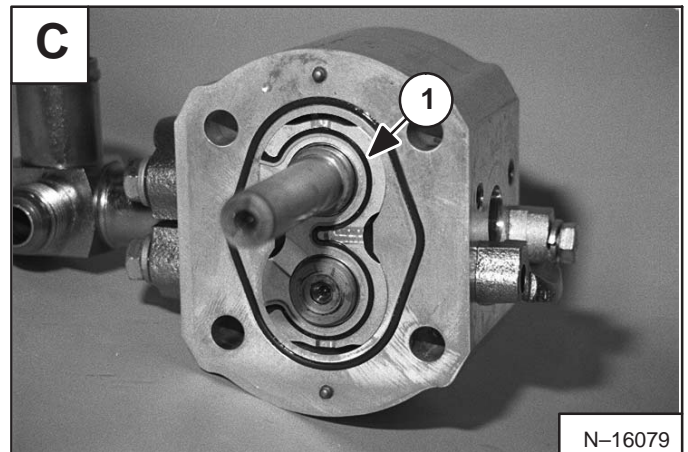
Remove the bearing housing (Item 1) [B].

Remove the back-up seal/O-ring seal (Item 2) [B] from the bearing housing.

Remove the large O-ring (Item 3) [B] from the pump housing.



**Assembly:** The O-ring and back-up washer (Item 1) [C] must be installed toward the pressure side of the pump.

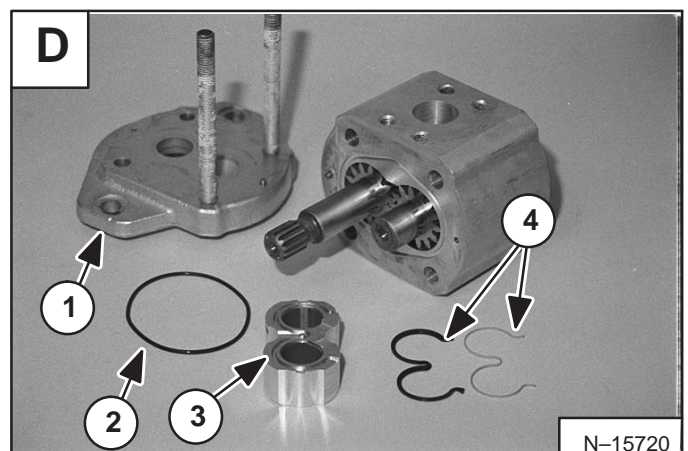


Remove the drive end housing (Item 1) [D].

Remove the large O-ring (Item 2) [D] from the pump housing.

Remove the bearing housing (Item 3) [D].

Remove the back-up seal/O-ring seal (Item 4) [D] from the bearing housing.





## STEERING LEVERS (Cont'd)

### Disassembly and Assembly (Cont'd)

#### *Advance Hand Control (A.H.C.) Loaders Only:*

Remove the bolts and nuts (Item 1) [A] if the neutral centering bracket needs to be replaced.

**Assembly:** If the neutral centering bracket is replaced, keep the bracket vertical to be sure that both cams make full contact in the pocket of the detent bracket.

Read this adjustment completely to become familiar with the procedure before beginning the adjustment.

**Assembly:** Use the following procedure to adjust the neutral bracket so both steering levers have no **free play** against the cam. To remove the **free play**, move the right cam to match the left cam so there is no **free play** between the two cams in the pocket of the detent centering bracket [B]. Use the following procedure to adjust the cam free play.

Only the right side cam is adjustable in the slotted hole in the bellcrank (Item 1) [B]. The left side cam is fixed and will not require adjustment.

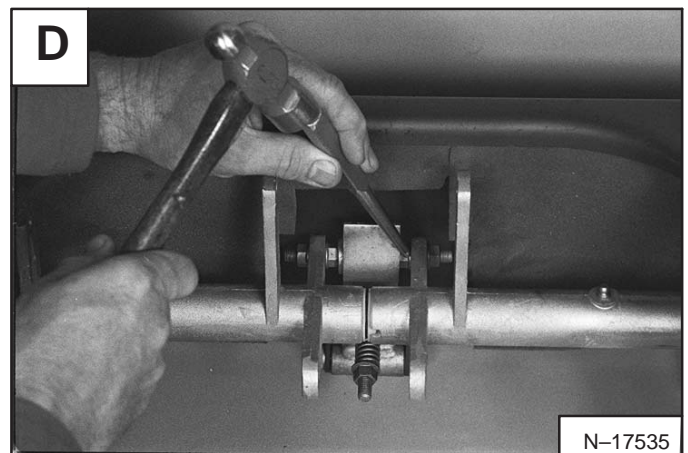
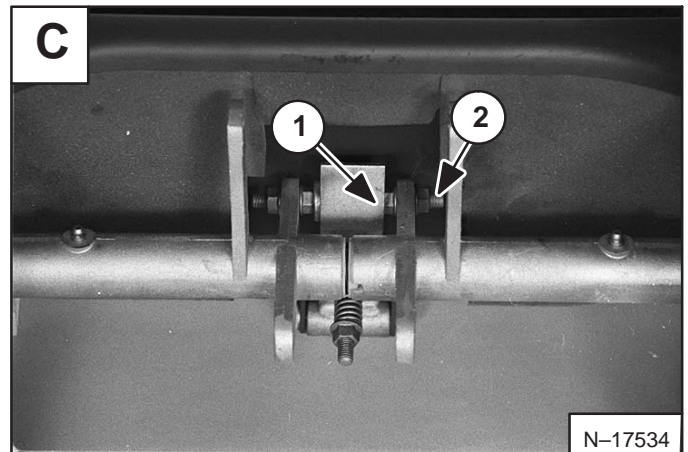
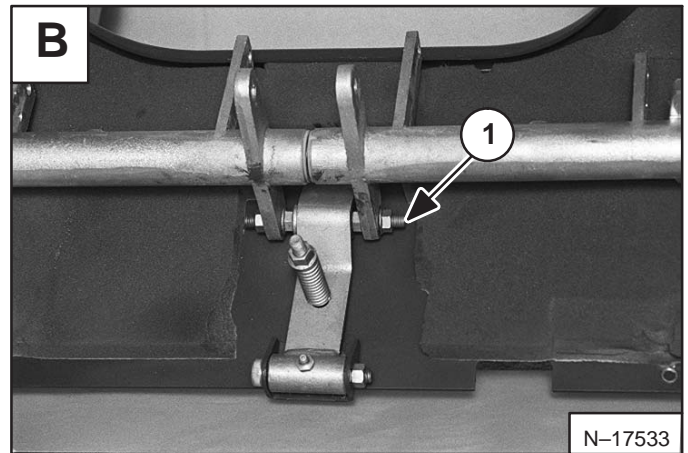
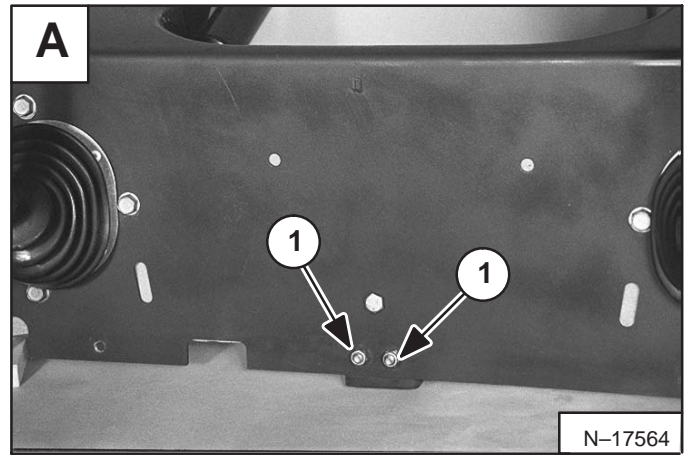
The cam should not rotate on the mounting bolt. If cam rotates, tighten the jam nut (Item 1) [C] against the cam while holding the cam mounting bolt.

Loosen the cam mounting bolt nut (Item 2) [C] and move the cam to the rear to get free play in the left steering lever.

Tighten the cam bolt. Use a punch and hammer, hit the cam nut (cam mounting bolt is still tight) until the **free play** is removed from the left steering lever [D].

The cam must be centered in the detent bracket pocket.

Recheck the torque at the cam bolt to be sure it is still tight. Check again to be sure there is no free play in the cams. **If there is any free play the neutral setting can not be obtained.**



## HYDROSTATIC MOTOR (Cont'd)

### Throttle Control

# IMPORTANT

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

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Remove the plug (Item 1) [A].

Use an allen wrench and remove the top throttle seat (Item 1) [B].

Remove the double coned throttle pin (Item 2) [B].

Remove the bottom throttle seat (Item 3) [B].

Inspect all the parts and replace as needed.

### Shuttle Check Valve

Remove the plug (Item 2) [A].

Remove the top shuttle check valve plug (Item 1) [C].

Remove the shuttle check valve (Item 2) [C].

Remove the shuttle check valve seat (Item 3) [C].

Remove the plug (Item 3) [A].

Remove the top shuttle check valve plug (Item 4) [C].

Remove the shuttle check valve (Item 5) [C].

Remove the shuttle check valve seat (Item 6) [C].

Inspect all the parts and replace as needed.

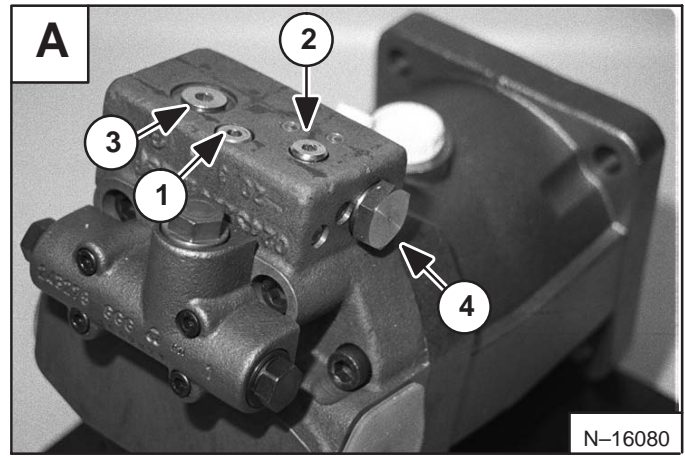
Remove the plug (Item 4) [A].

Remove the spring (Item 1) [D].

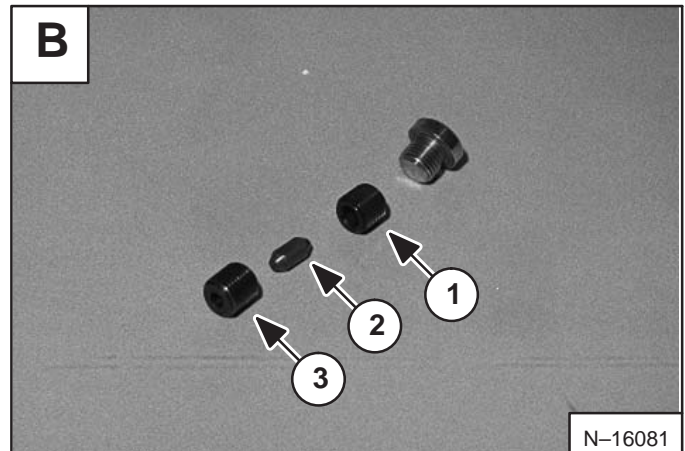
Remove the spool (Item 2) [D].

Inspect all the parts and replace as needed.

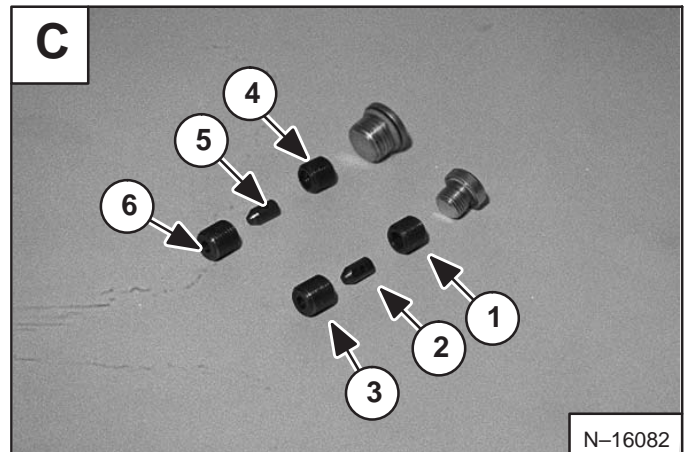
**Assembly:** Always use new O-rings before installing plugs.



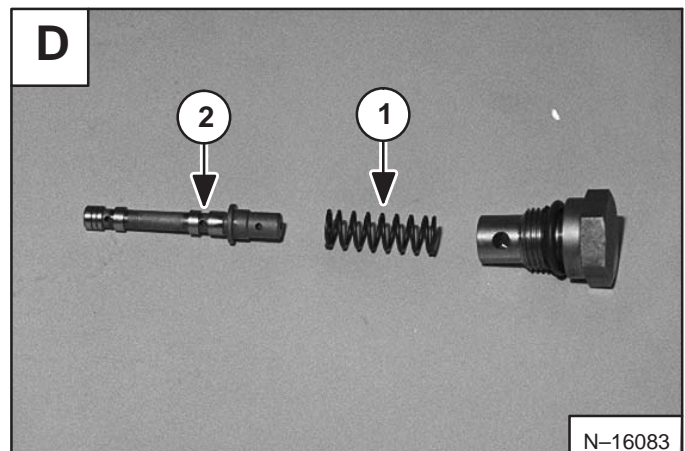
N-16080



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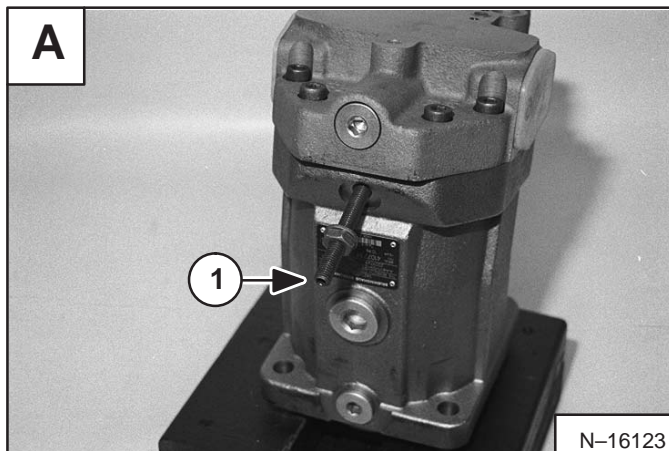
## HYDROSTATIC MOTOR (Cont'd)

### Assembly (Cont'd)

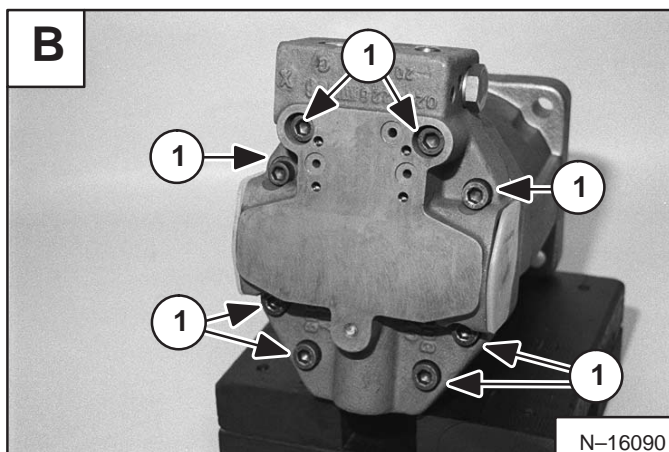
Install the adjustment screw (Item 1) **[A]** into the housing.

Adjust the adjustment screw to the correct dimension recorded when the screw was removed. (See Page 3-25; Fig. **[D]**.)

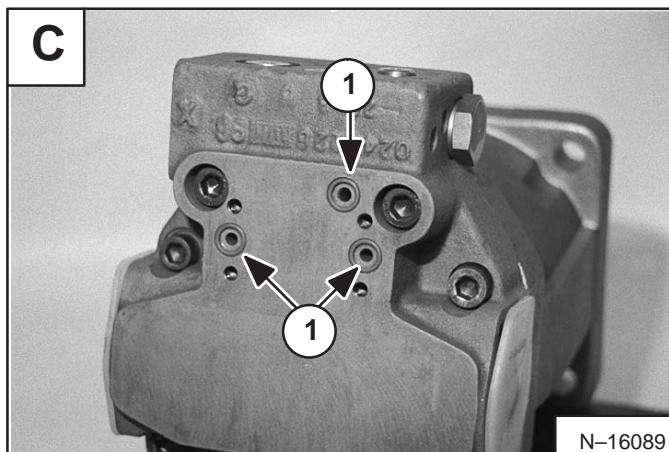
Replace the tamper proof cap on the adjustment screw.



Tighten the bolts (Item 1) **[B]** at the end plate housing to 36 ft.-lbs. (48 Nm) torque.



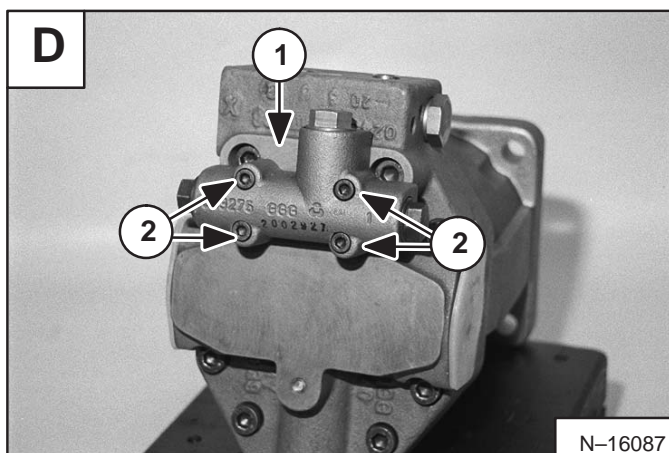
Install the new O-rings (Item 1) **[C]**.



Install the flushing valve (Item 1) **[D]**.

Install the bolts (Item 2) **[D]** and tighten to 85 in.-lbs. (9,6 Nm) torque.

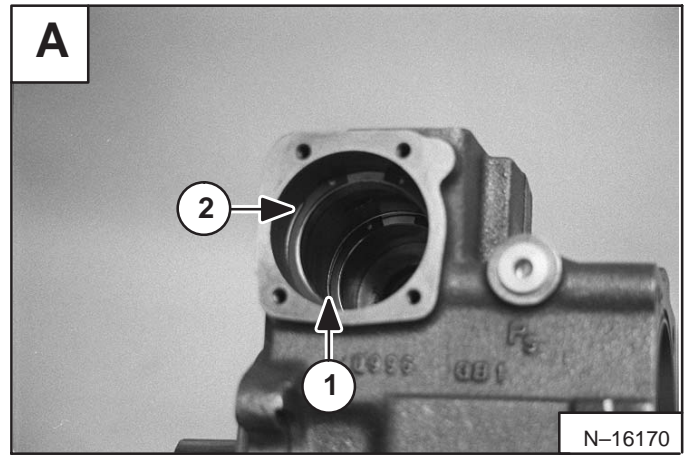
Pour about 1 qt. (0,9 L.) of hydraulic fluid into the hydrostatic motor case before installation.



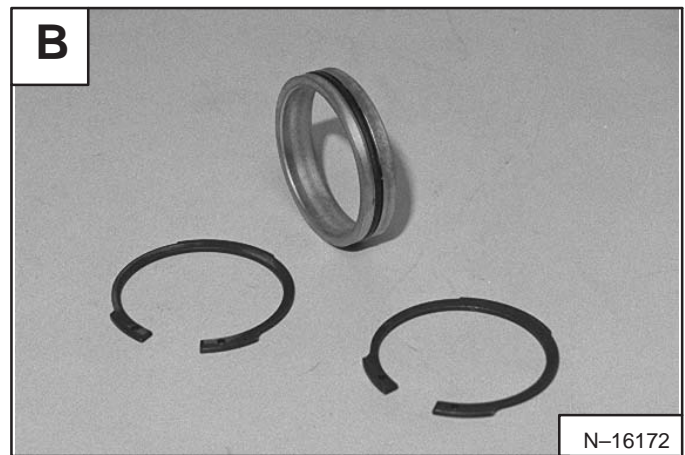
## HYDROSTATIC PUMP (Cont'd)

### Disassembly (Cont'd)

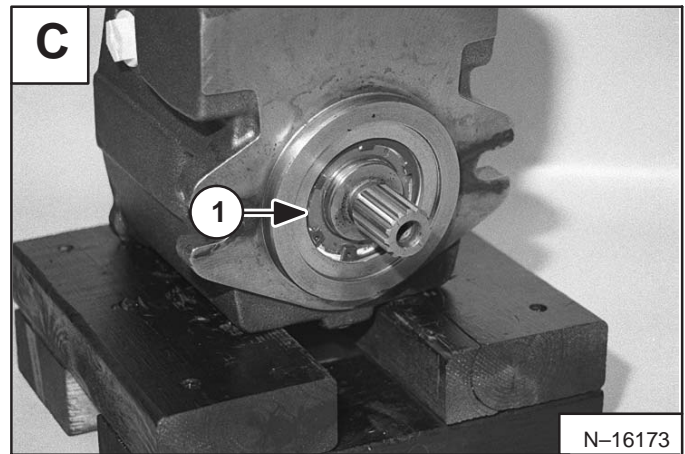
Check the piston servo bushing(s) (Item 1) [A] for wear and damage, if they need replacement, remove the snap ring (Item 2) [A].



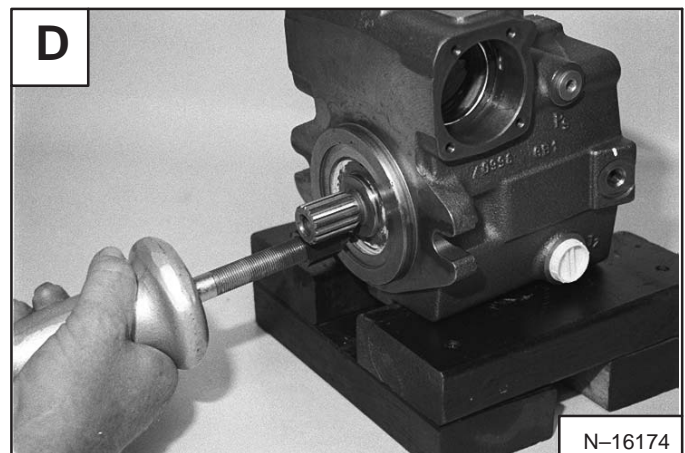
Remove the snap ring, bushing and snap ring from the housing [B].



Left Pump: Remove the snap ring (Item 1) [C] at the pump drive shaft seal.



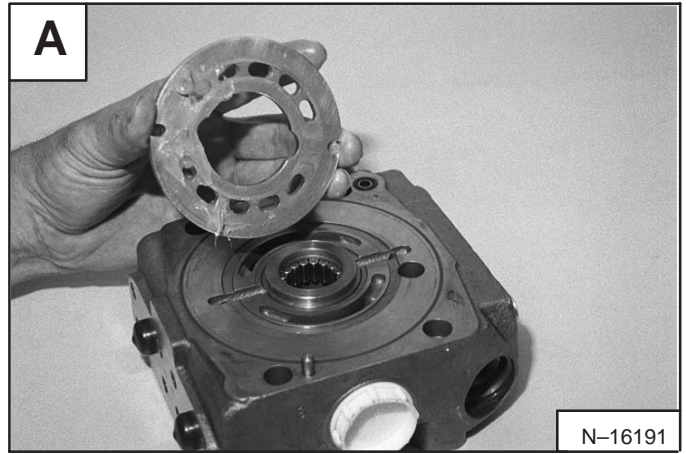
Left Pump: Use a puller with a screw tip and remove the shaft seal from the pump housing [D].



## HYDROSTATIC PUMP (Cont'd)

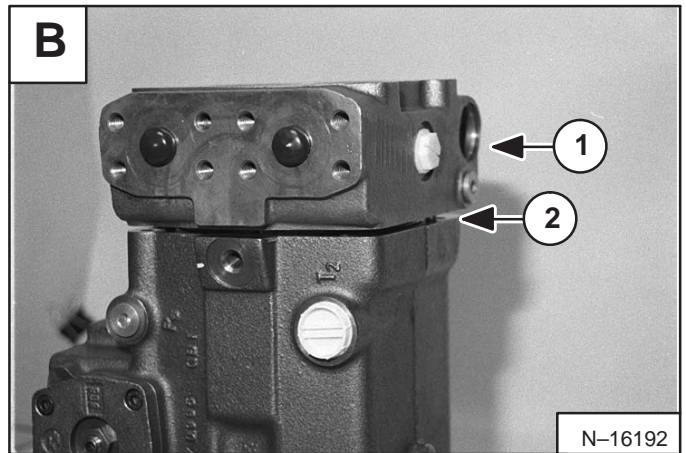
### Assembly (Cont'd)

Put grease on the valve plate and install it on the port block [A].

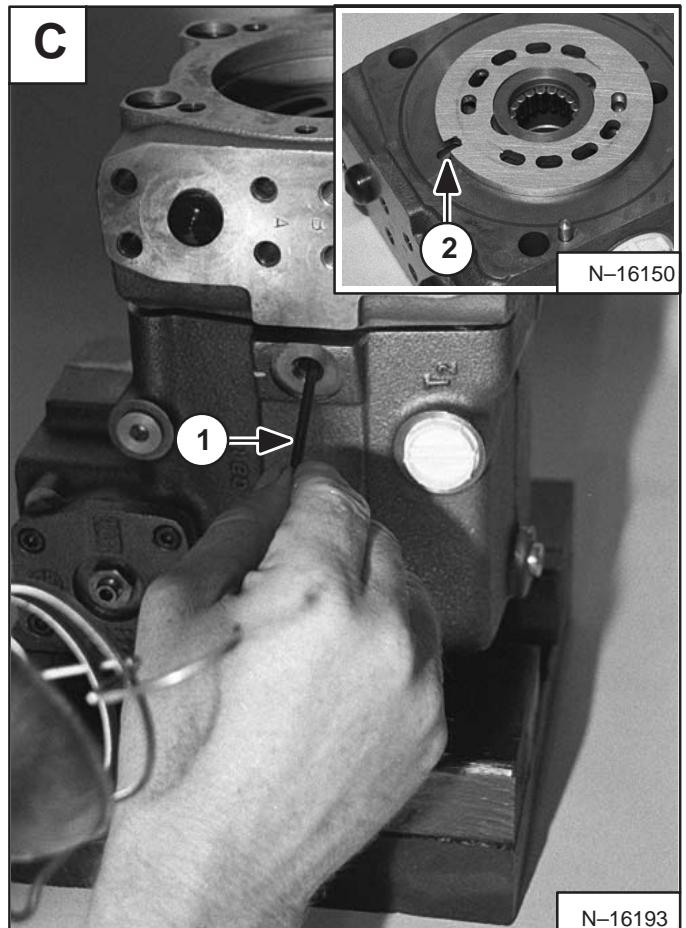


Install the port block/valve plate assembly (Item 1) [B] on the pump housing and rotating group.

Install the four bolts into the port block and tighten evenly until a small amount of space (Item 2) [B] is left between the pump housing and port block.



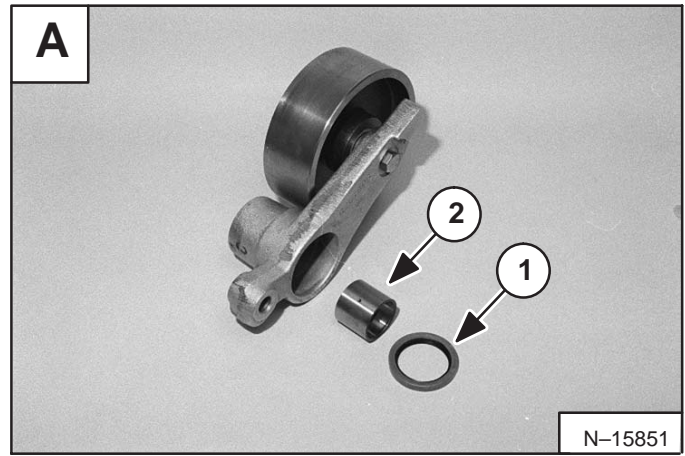
Using a small screwdriver (Item 1) [C], make alignment of the slot (Item 2) [C] in the valve plate with the hole the eccentric adjustment screw will turn into housing. The adjustment screw will turn into the slot in the valve plate.



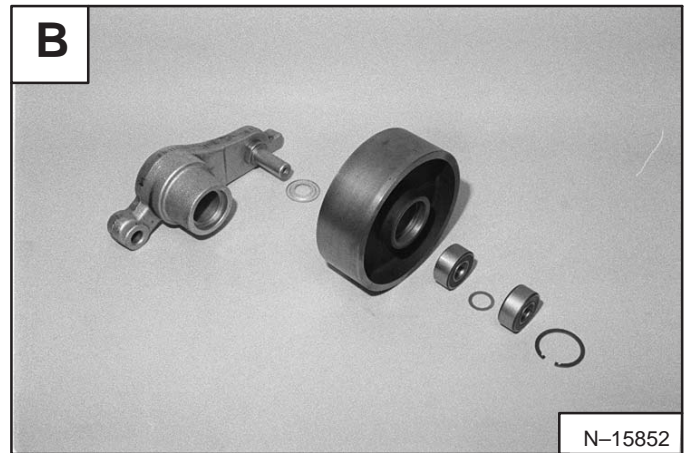
## DRIVE BELT TENSIONER PULLEY (Cont'd)

### Disassembly And Assembly

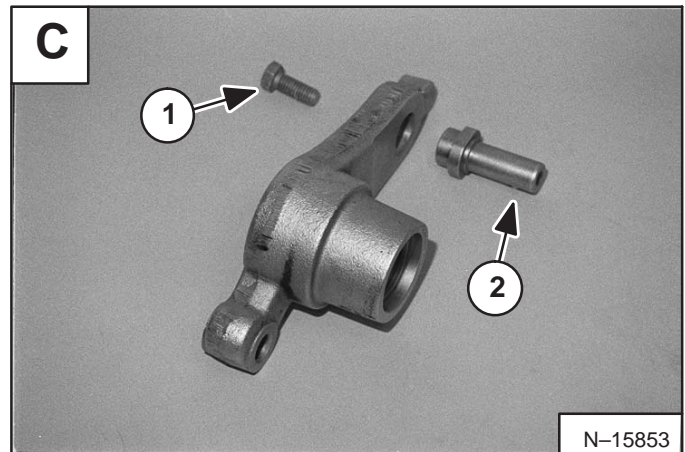
Remove the arm seal (Item 1) [A] and arm bushing (Item 2) [A]. Check for wear and replace if needed.



Disassemble the pulley and bearings as shown in figure [B]. Check the parts for wear and replace if needed.



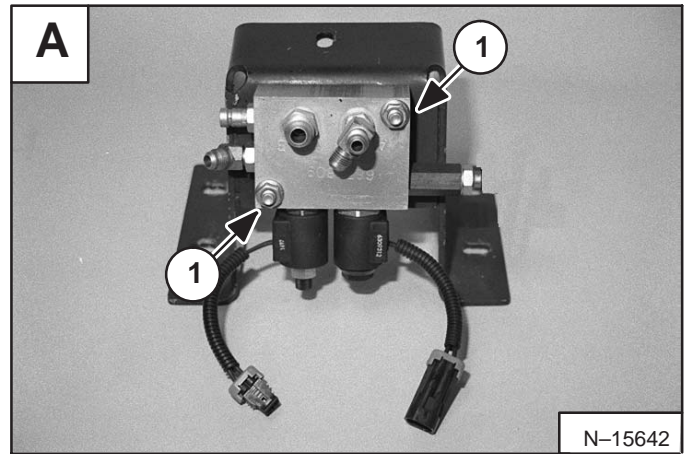
Remove the pulley mounting bolt (Item 1) [C] from the pulley spindle (Item 2) [C] and remove the spindle from the arm. Check the pulley spindle for wear and replace if needed.



## BRAKE/TWO SPEED BLOCK (Cont'd)

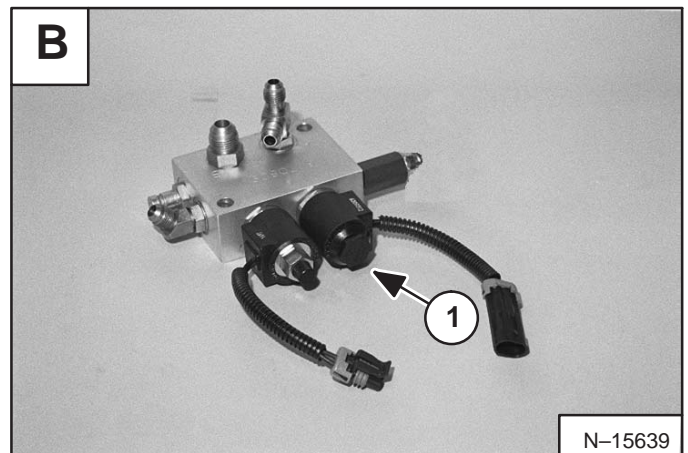
### Disassembly And Assembly

Remove the two bolts and nuts (Item 1) [A] from the block and remove the block from the mounting bracket.

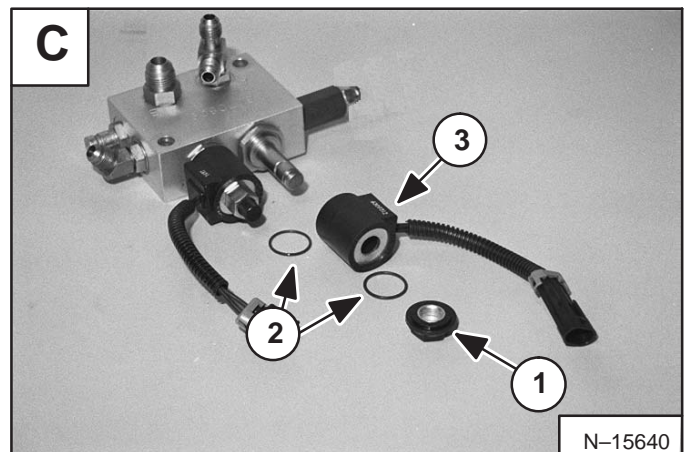


Loosen the electrical solenoid nut (Item 1) [B].

**Assembly:** Tighten the nut to 9–12 in.-lbs. (1,02–1,36 Nm) torque.

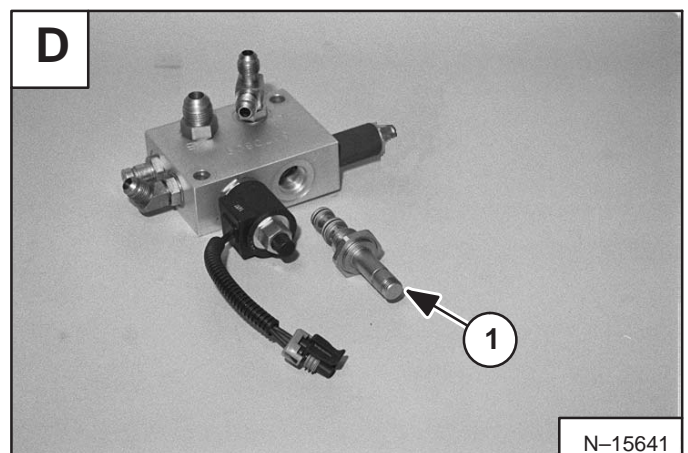


Remove the solenoid nut (Item 1) [C], O-rings (Item 2) [C], and solenoid coil (Item 3) [C].



Remove the solenoid valve (Item 1) [D] from the block.

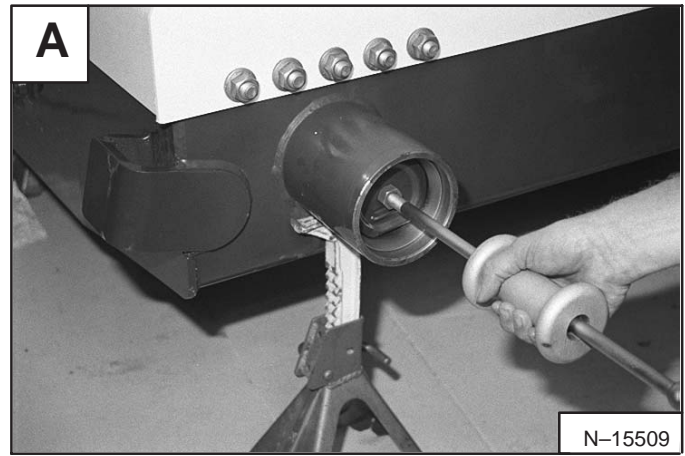
**Assembly:** Always install new O-rings and back-up washers. Tighten the solenoid valve to 96–144 in.-lbs. (10,8–16 Nm) torque.



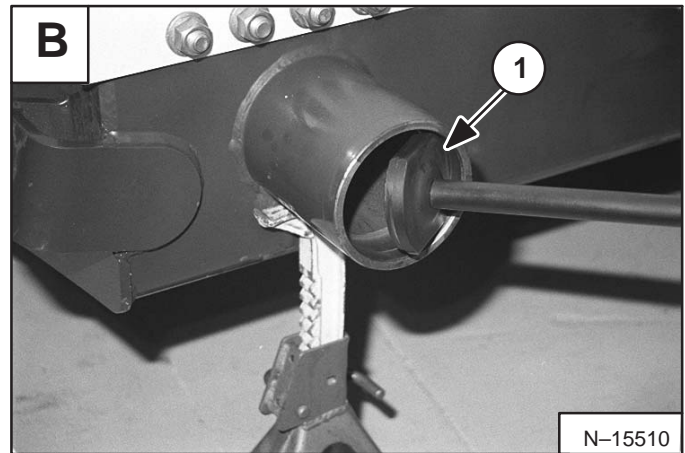
## AXLE, BEARINGS AND SPROCKET (Cont'd)

### Removal And Installation (Cont'd)

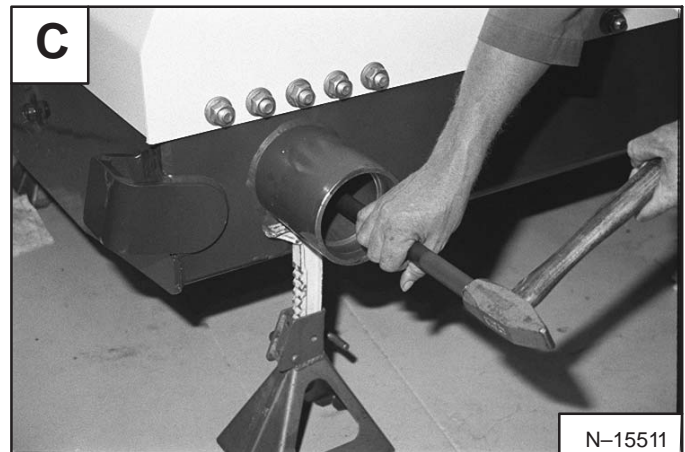
Pull the bearing cup from the axle tube [A].



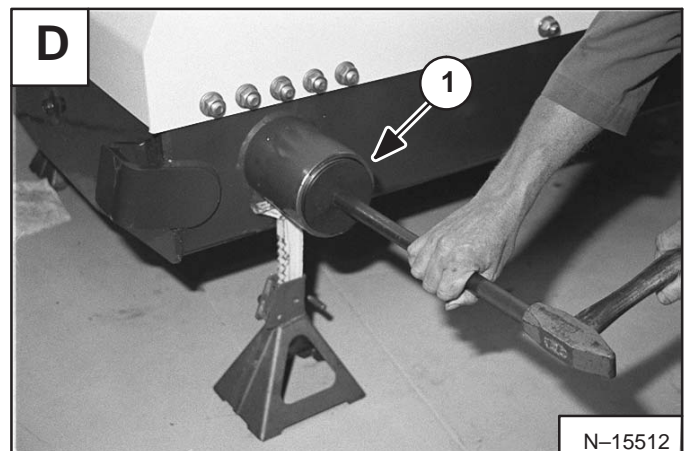
Using the long driver tool handle, install the bearing cup tool (Item 1) [B] (MEL1202-13).



Remove the inner bearing cup from the axle tube [C].

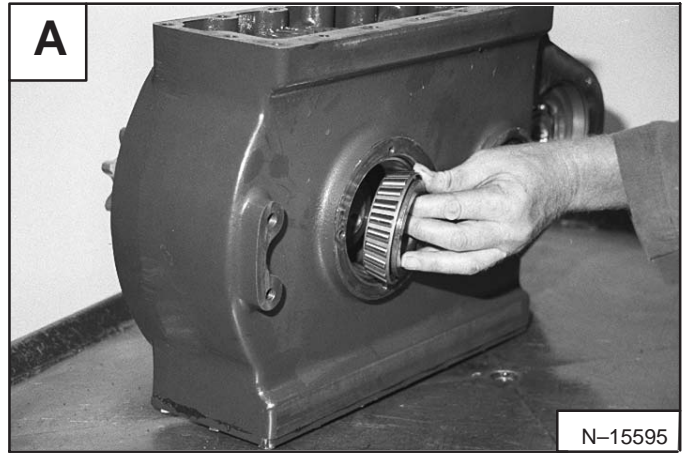


**Installation:** Using the correct size driver tool (Item 1) [D] (MEL1202-12), install the outer bearing cup.



**REDUCTION GEARCASE (Cont'd)**  
**Disassembly And Assembly (Cont'd)**

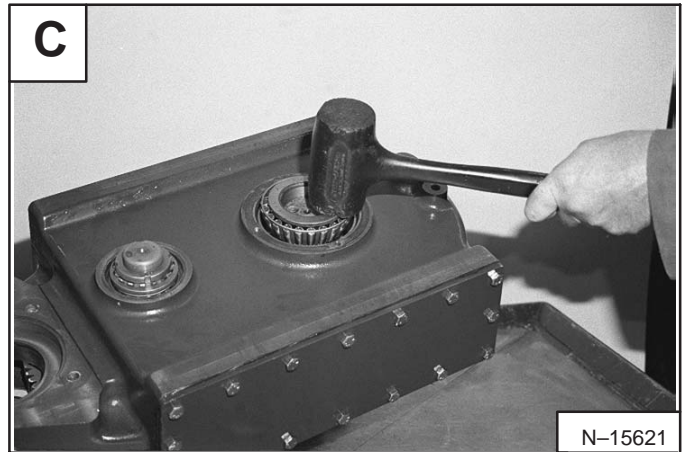
Remove the bearing [A].



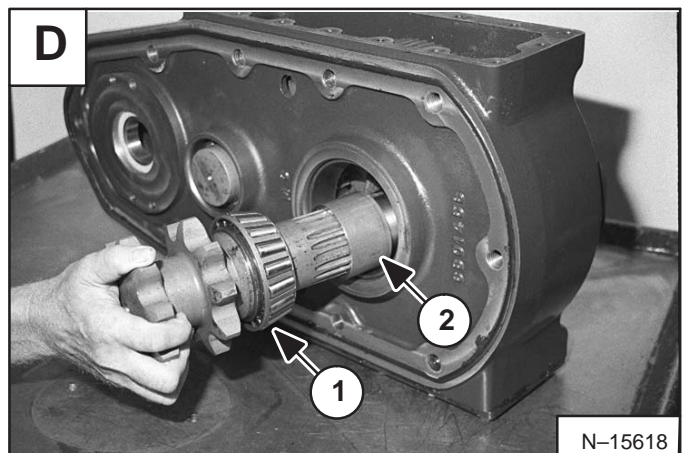
Remove the spacer [B].



**Assembly:** Install the spacer. Support the drive shaft. Install the bearing using a hammer [C].



Remove the drive shaft (Item 1) [D] and spacer (Item 2) [D] from the gearcase housing.



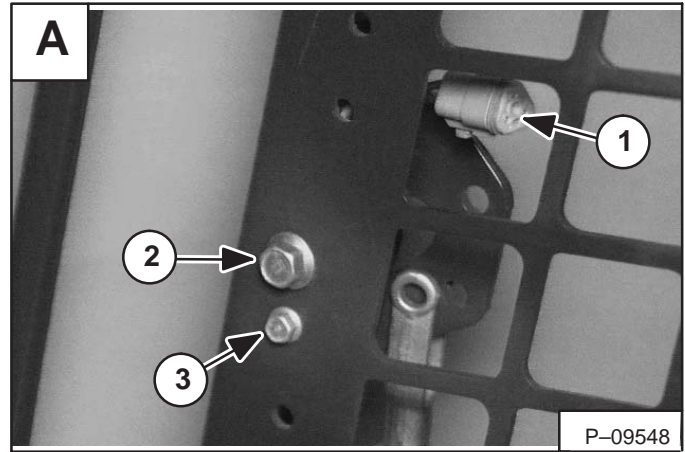
## SEAT BAR (Cont'd)

### Removal And Installation (Cont'd)

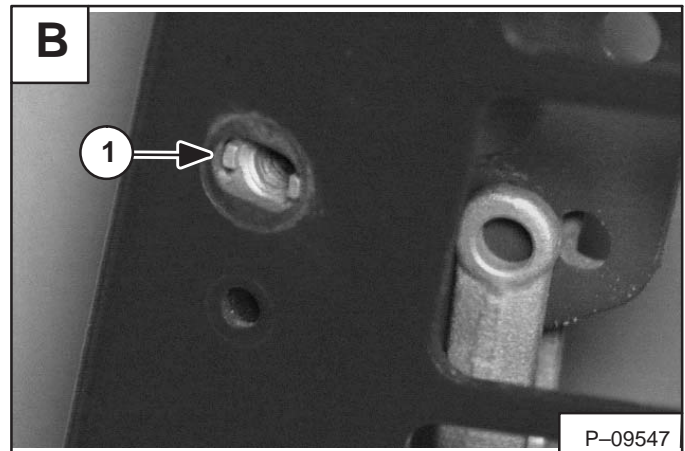
Disconnect the wiring harness connector (Item 1) [A] (left side).

Remove the seat bar mounting bolt (Item 2) [A] (both sides).

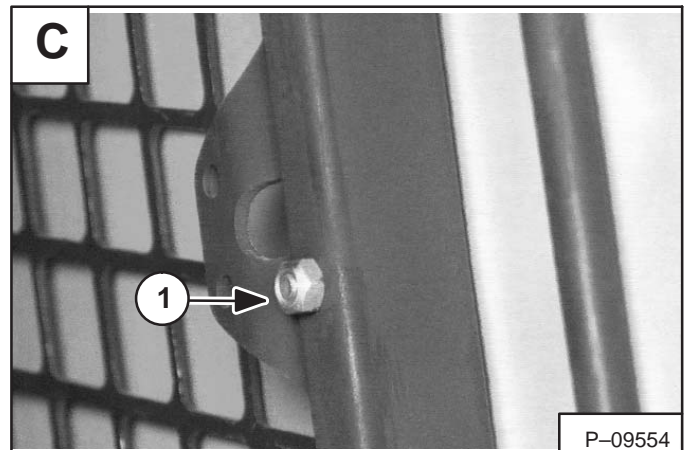
Remove the sensor mounting bolt (Item 3) [A] (left side).



**Installation:** Make sure the two tabs (Item 1) [B] are located in the slot on the operator cab.



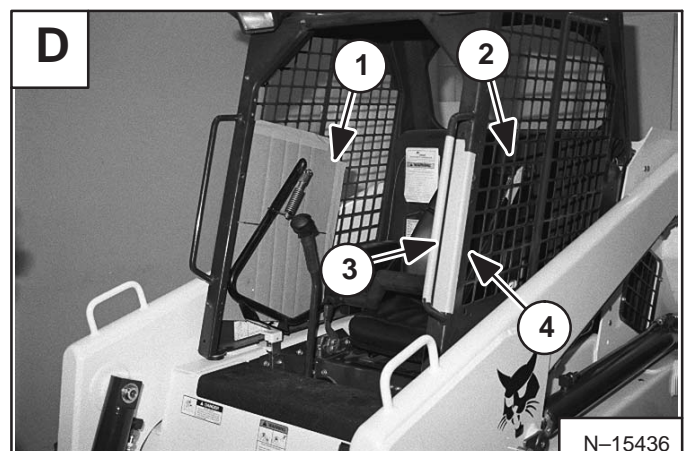
**Installation:** Tighten the mounting bolt and nut (Item 1) [C] to 180 – 200 in.-lbs. (21 – 23 Nm) torque.



To protect the paint on the operator cab from getting scratched, install cardboard (Item 1) [D] on the right side.

Wrap tape around the left pivot end (Item 2) [D] of the seat bar.

Wrap tape around the cab grab handle (Item 3) [D] and the front edge of the cab (Item 4) [D].



## BOB-TACH (Cont'd)

### Bob-Tach Lever And Wedge (Cont'd)

Put the spring/clevis assembly in a vise [A].

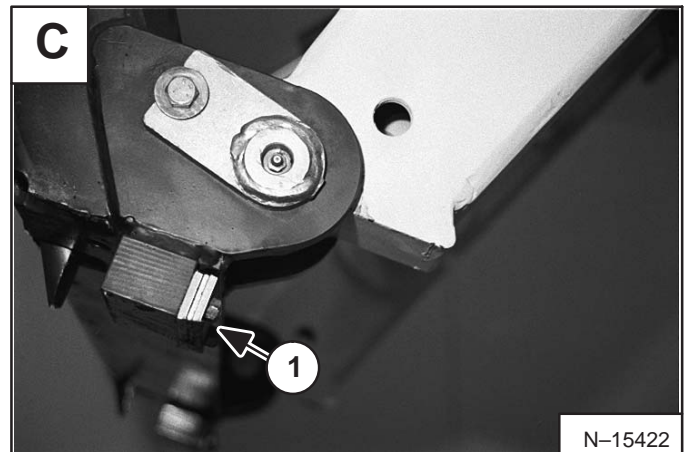
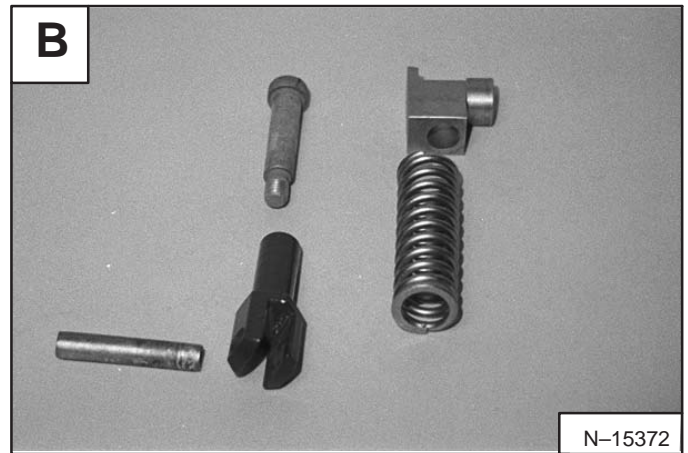
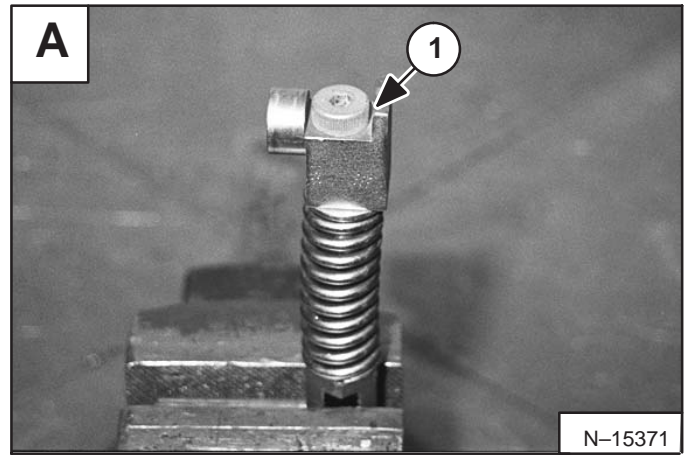
Remove the bolt (Item 1) [A] and disassemble the spring and clevis.

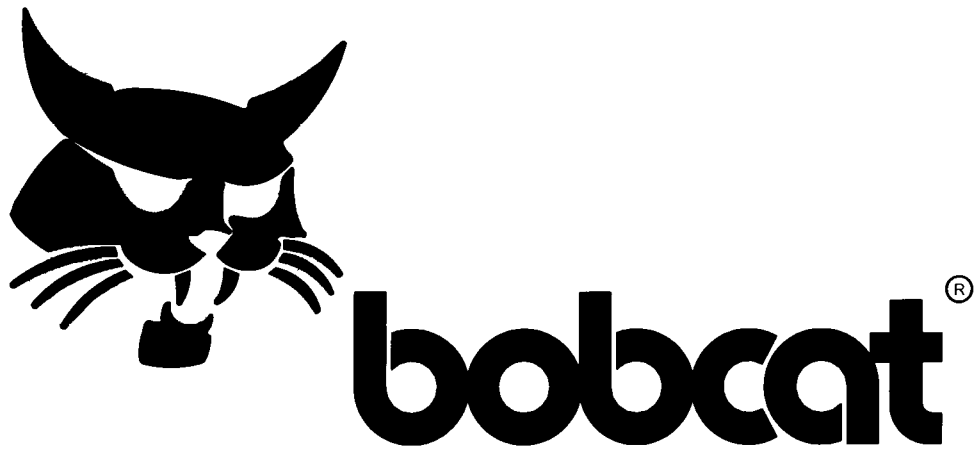
Check all parts for wear or damage. Replace the parts as needed [B].

### Bob-Tach Stops

Remove and replace the Bob-Tach stop (Item 1) [C] (both sides) if worn or damaged.

**NOTE:** The Bob-Tach stop (Item 1) [D] must contact the lift arm at the same time the tilt cylinders reaches full extension. Use available shims to adjust the Bob-Tach stop and tilt cylinder sequence as closely as possible.





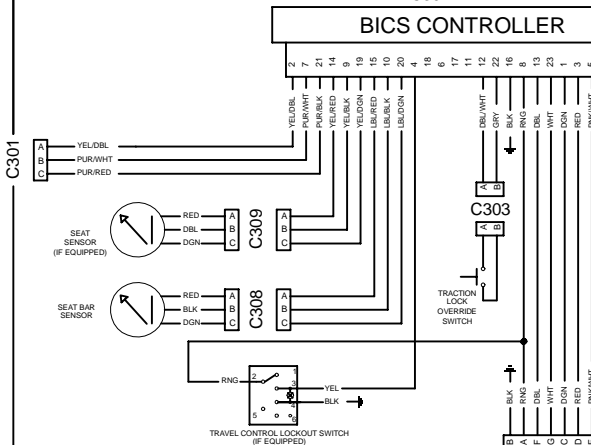
963 WITHOUT BOSS - WIRING SCHEMATIC

562211576 AND ABOVE  
516511058 AND ABOVE  
(Printed December 1998)

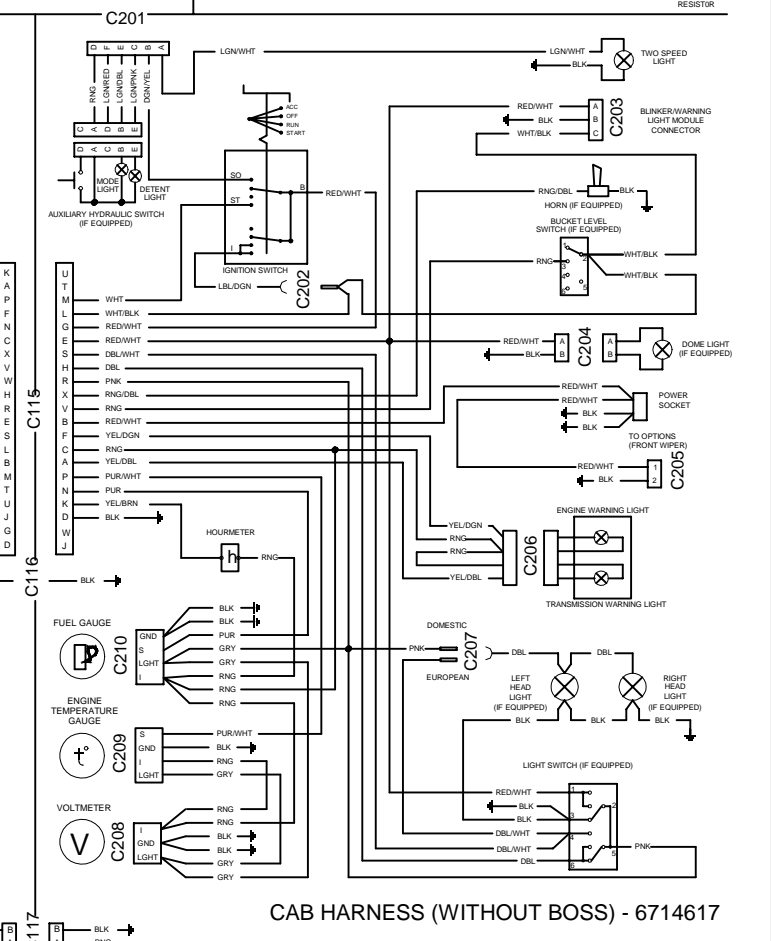
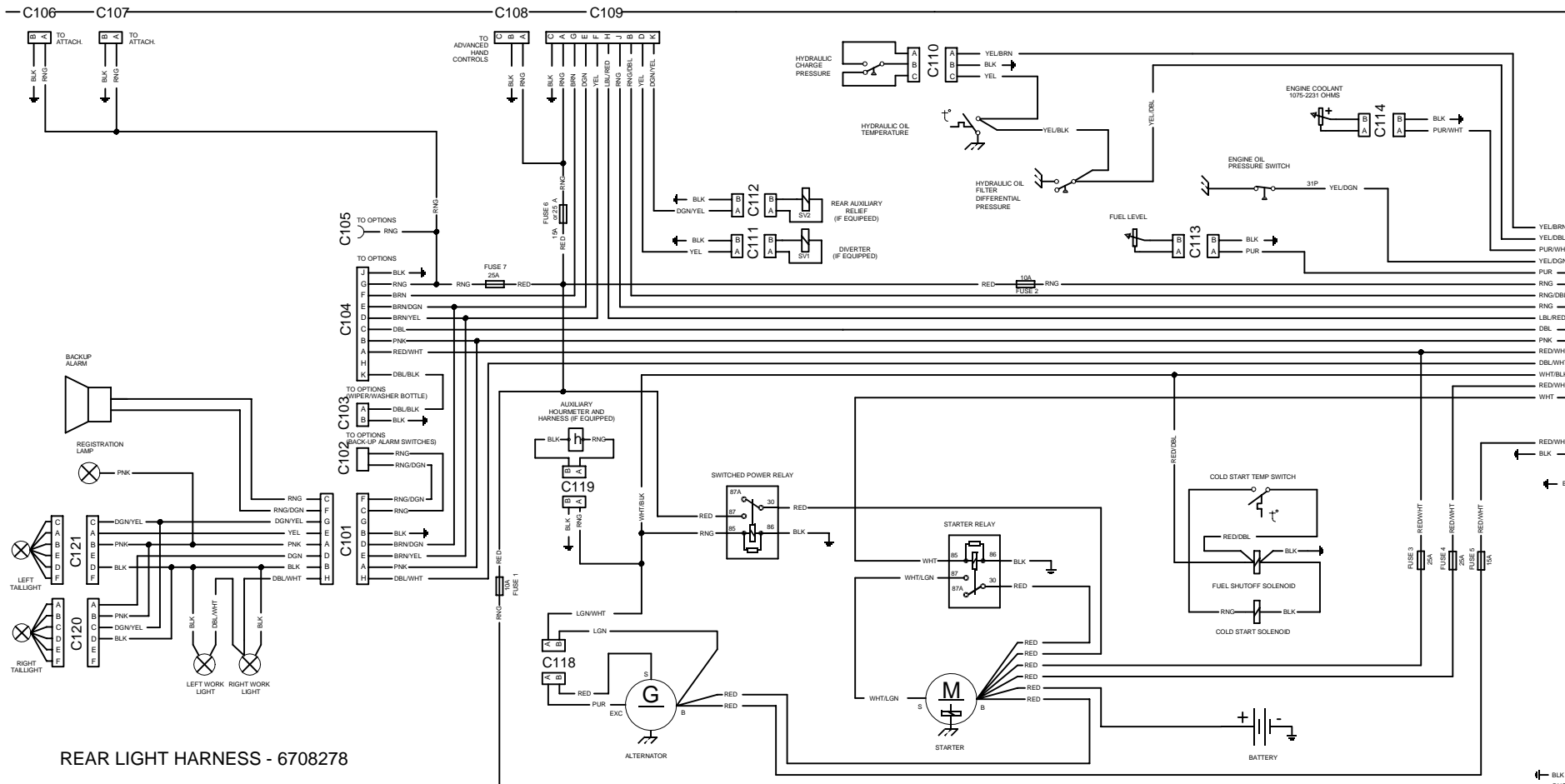
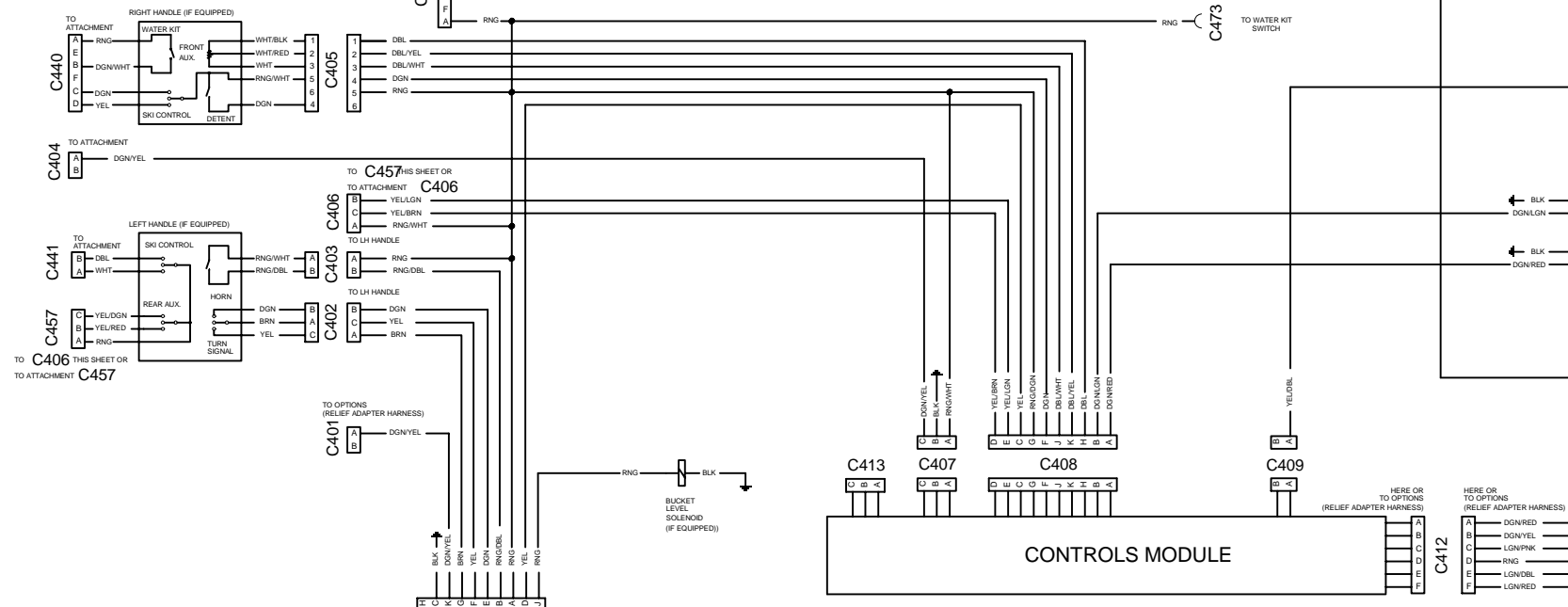
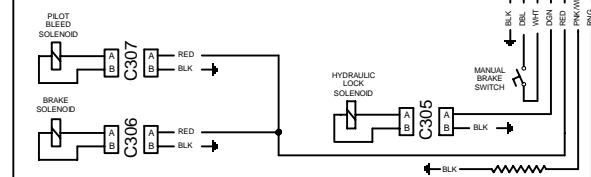
CONTROLS HARNESS - 6628374

BICS CONTROLLER HARNESS - 6712135

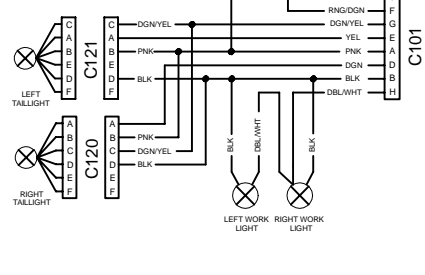
C302



MAINFRAME CONTROLLER HARNESS - 6716073



REAR LIGHT HARNESS - 6708278



ENGINE HARNESS (WITHOUT BOSS) - 6715961

FUSE 1	BICS	10	FUSE 5	15
FUSE 2	BOSS	10	FUSE 6	25
FUSE 3	LIGHT	25	OPEN	OPEN
FUSE 4	ACCESSORY	25	ACCESSORY	25

FUSE BLOCK

WIRES CONNECT BY LETTER ACROSS CONNECTORS

SOME CONNECTOR BODIES NOT SHOWN FOR DRAWING CLARITY



## ALTERNATOR (Cont'd)

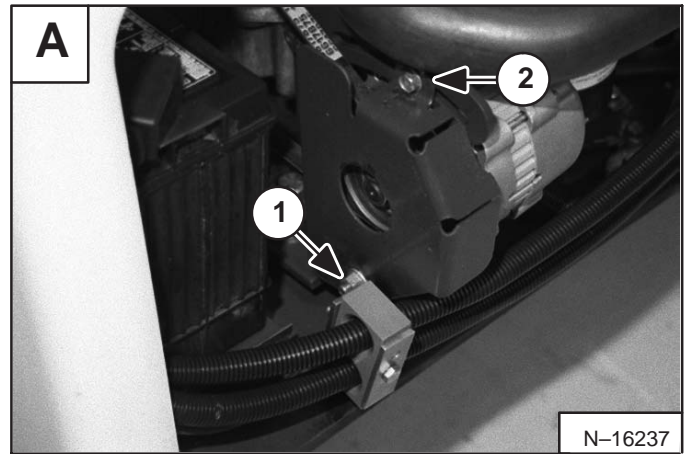
### Adjusting the Alternator Belt

Stop the engine.

Open the rear door.

Loosen the alternator mounting bolt (Item 1) [A].

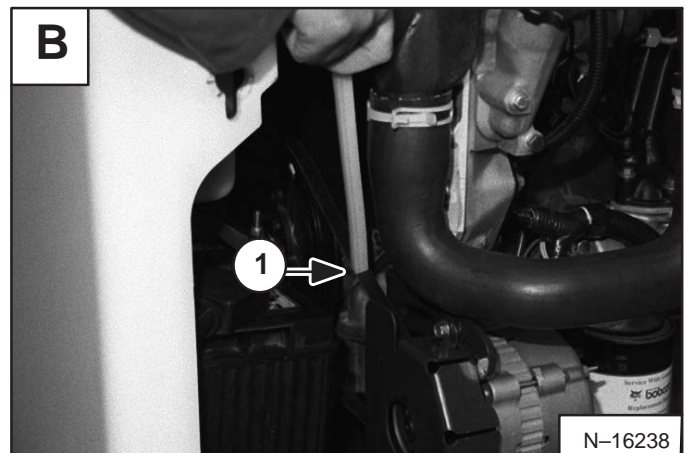
Loosen the adjustment bolt (Item 2) [A].



Move the alternator until the belt has 5/16 inch (8,0 mm) movement at the middle of the belt span (Item 1) [B] with 15 lbs. (66 N) of force.

Tighten the adjustment bolt and mounting bolt.

Close the rear door.



## STARTER (Cont'd)

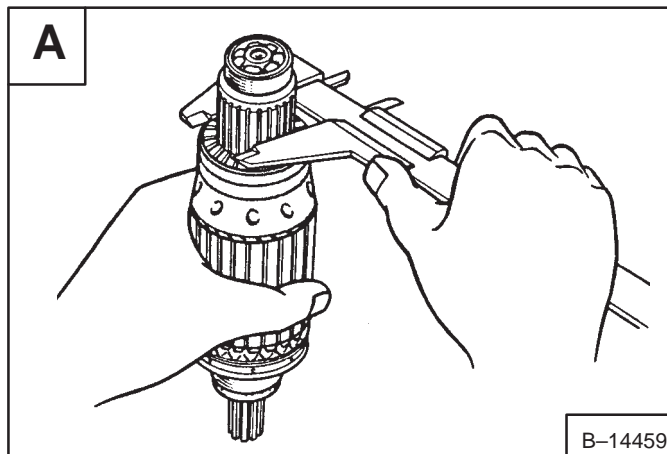
### Inspection And Repair (Cont'd)

#### ARMATURE (Cont'd)

Measure the commutator outer diameter [A].

Service Limit – 1.38 inches (35 mm)

If it is worn, replace the armature.

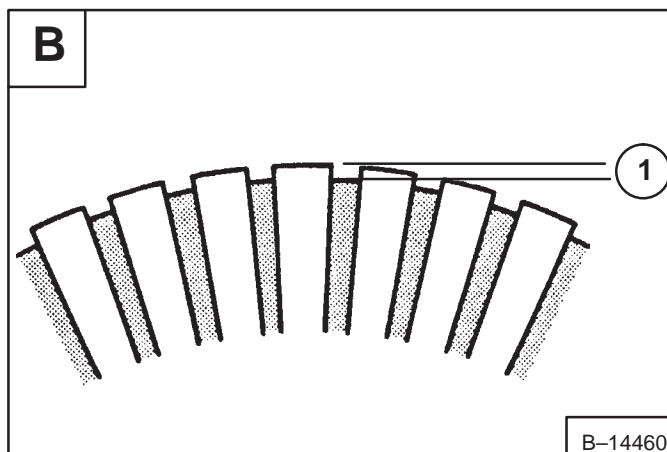


Measure the segment mica depth (Item 1) [B].

Service Limit – 0.008 inches (0,2 mm)

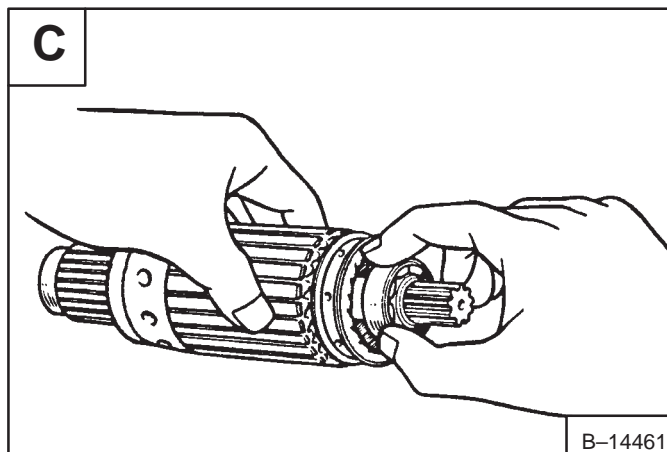
If it is worn, undercut the segment mica.

Check the commutator surface for burned spots which usually indicates an open-circuit, and correct it using #400 sand paper.

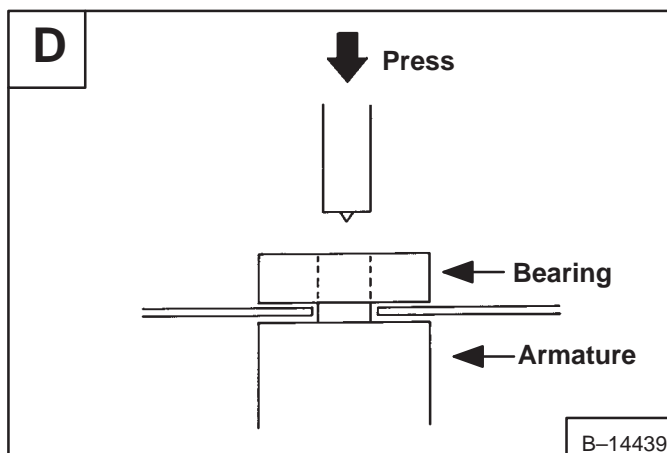


Check the bearings for wear and damage [C].

If the bearings are worn or damaged, they should be replaced.



Use a press as shown in [D], replace the worn or damaged bearing(s).



## ENGINE MUFFLER

### Removal And Installation

Open the rear door.

Lift the rear grill.

Drain the cooling system (See Page 1-1.)

Remove the hose clamps (Item 1) [A].

Remove the U-clamps (Item 2) [A].

Remove the coolant tube (Item 3) [A].

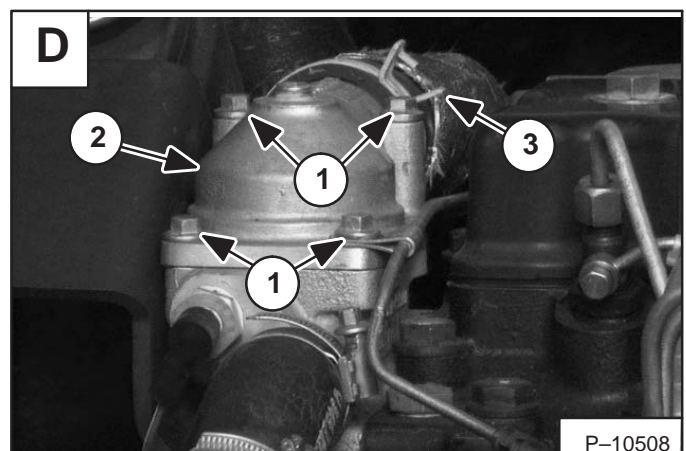
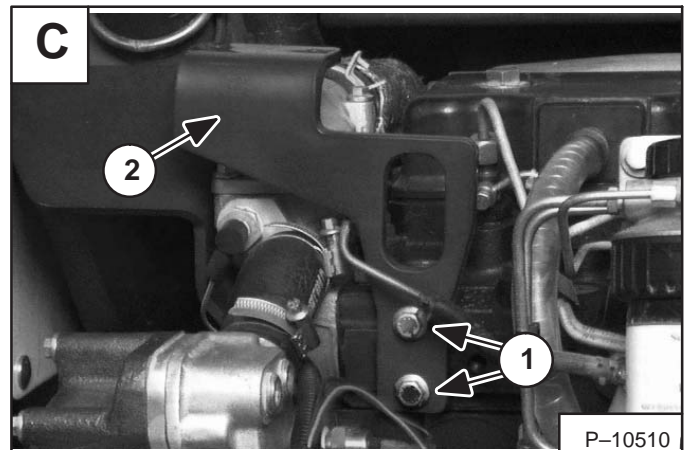
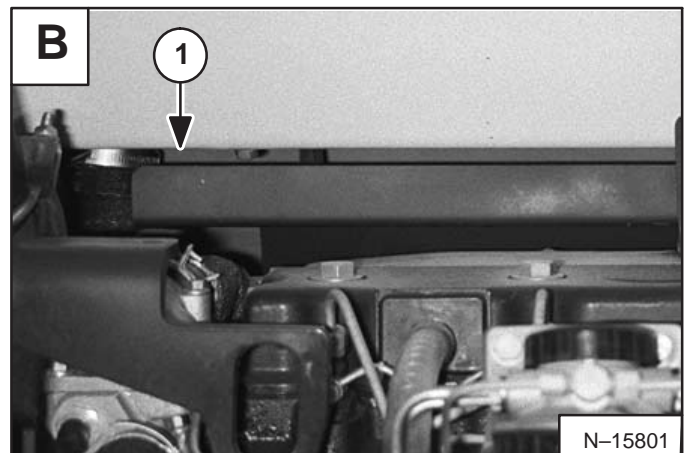
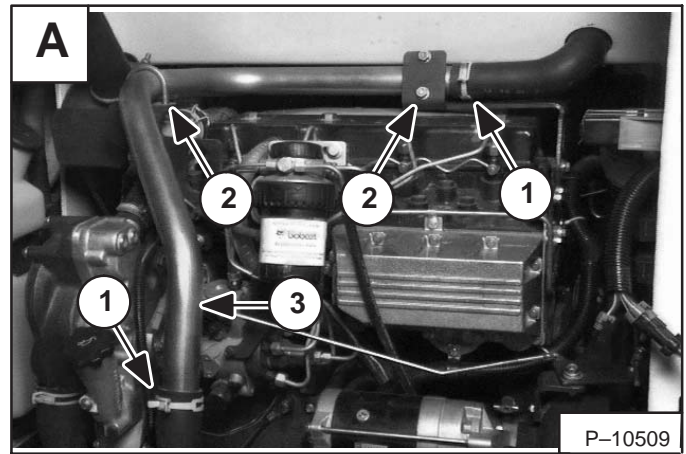
Remove the mounting bolt (Item 1) [B] on the top left side of the engine heat shield.

Remove the mounting bolts (Item 1) [C] and remove the coolant tube mounting bracket (Item 2) [C].

Remove the mounting bolts (Item 1) [D] from the thermostat housing (Item 2) [D].

Remove the hose clamp (Item 3) [D].

Remove the thermostat housing.

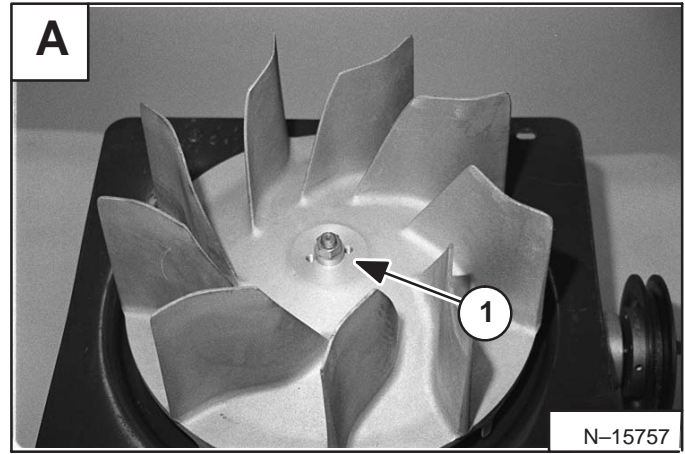


## BLOWER FAN

### Removal And Installation

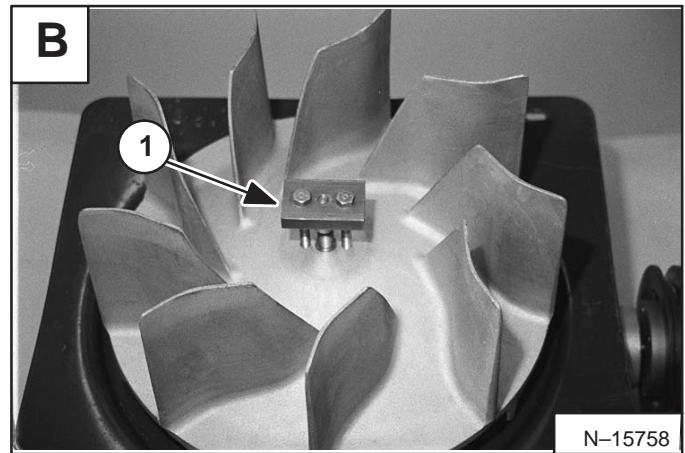
Remove the lock nut (Item 1) [A] and spacer.

**Installation:** Tighten the nut to 45–55 ft.-lbs. (61–75 Nm) torque.

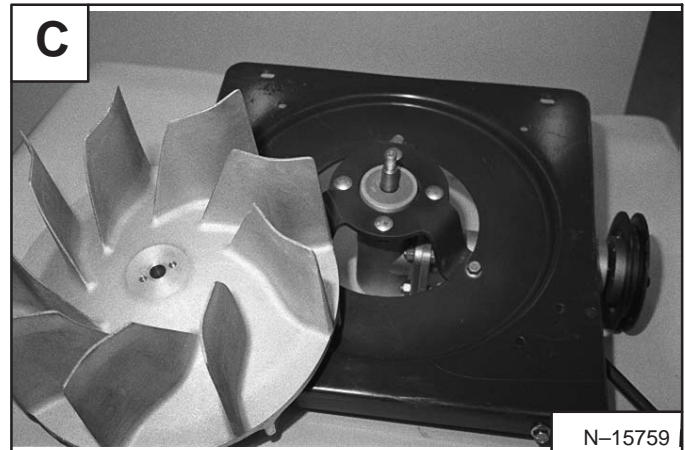


Install the puller (Item 1) [B] on the fan as shown.

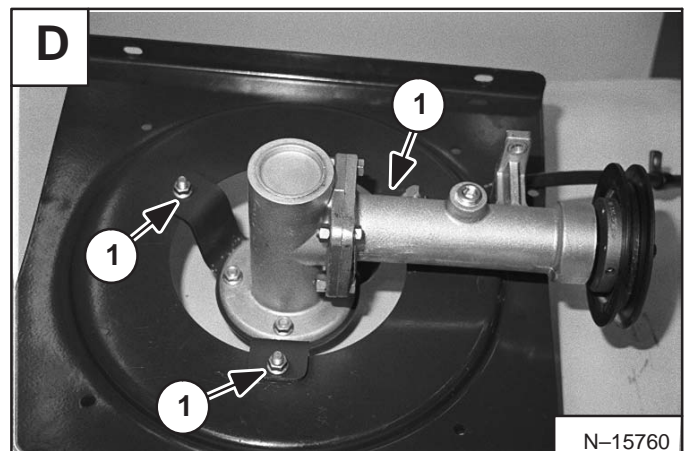
Tighten the puller bolts evenly to loosen the fan from the shaft.



Remove the fan from the tapered shaft [C].



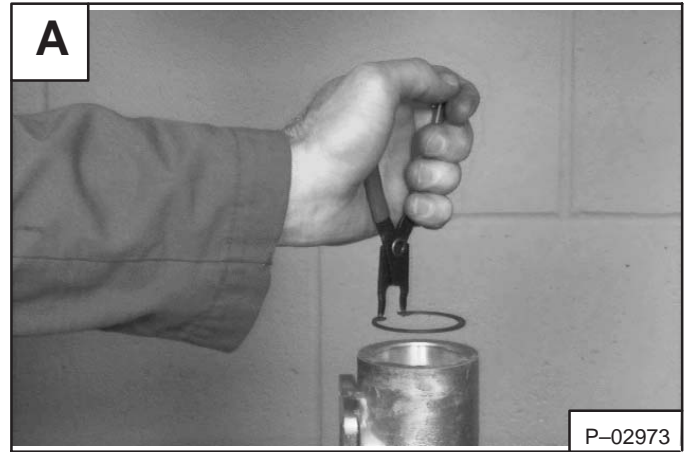
Remove the three bolts and nuts (Item 1) [D], to remove the fan gearbox from the mounting plate.



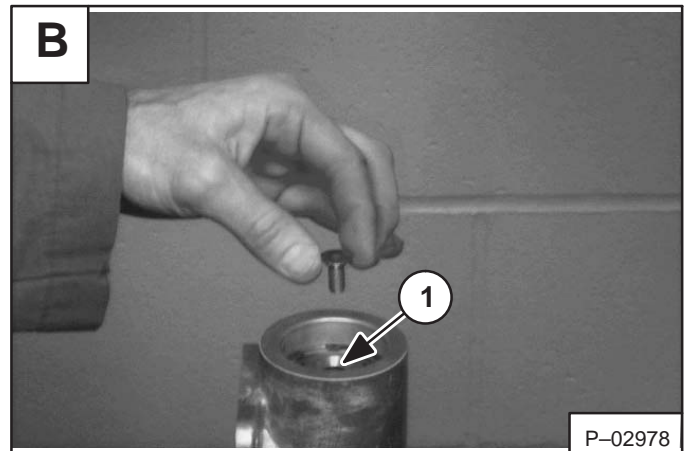
## FAN GEARBOX (Cont'd)

### Assembly (Cont'd)

Install the snap ring in the groove above the bearing **[A]**.



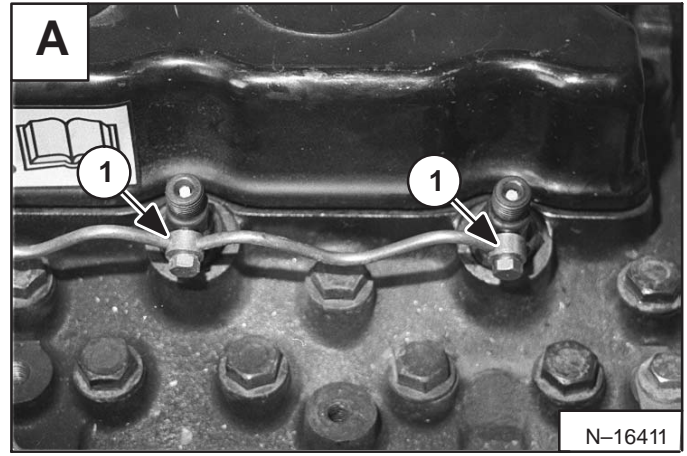
Install the washer (Item 1) **[B]** on the shaft. Put liquid adhesive (LOCTITE #242) on the screw threads and install the screw **[B]**.



## FUEL INJECTOR (Cont'd)

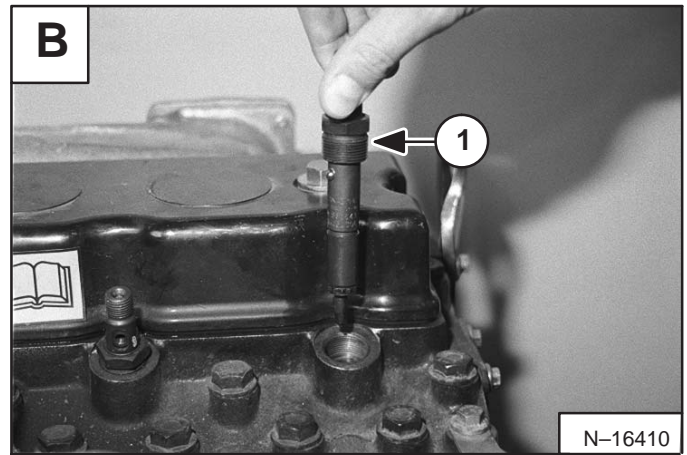
### Removal and Installation (Cont'd)

**Installation:** Always replace the copper gaskets (Item 1) [A] at the fuel return tubeline.

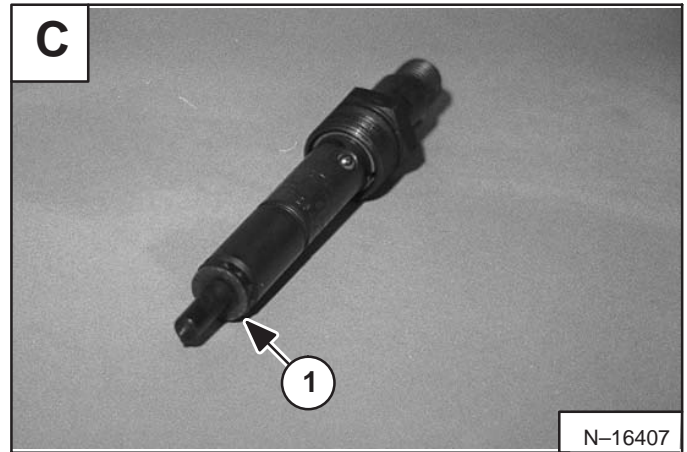


Loosen the nut (Item 1) [B] at the fuel injector and remove it from the cylinder head.

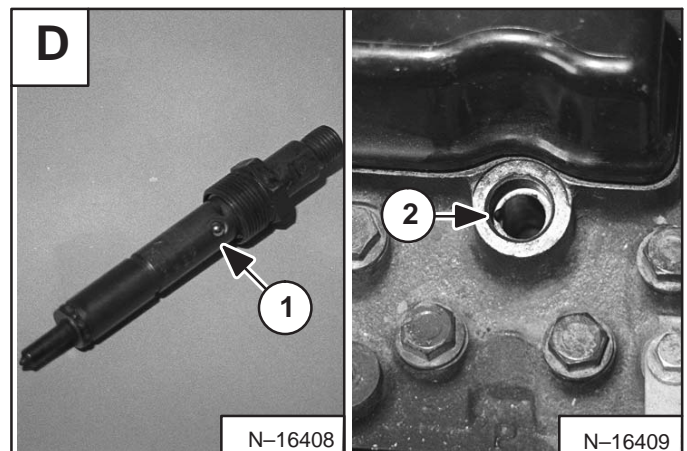
**Installation:** Tighten the nut to 23 ft.-lbs. (30 Nm) torque.



**Installation:** Always replace the copper washer (Item 1) [C] at the nozzle.



**Installation:** Make sure the ball (Item 1) [D], in the injector body, is aligned with the notch (Item 2) [D] in the cylinder head when the fuel injector is installed.



## CYLINDER HEAD (Cont'd)

### Inspection

Put a straight edge on the cylinder head as shown in [A].

Using a feeler gauge between the straight edge and head, check for warpage.

Maximum allowed (Item 1) [A] is 0.003 inches (0,08 mm), (Item 2) [A] is 0.006 inches (0,15 mm) and (Item 3) [A] is 0.006 inches (0,15 mm).

The head may be machined removing only a minimum amount. Head thickness must not be less than 4.035 inches (102,5 mm).

Completely clean the rest of the head.

Check for cracks or other damage.

### Installation

Make sure the mating surfaces of the head and block are clean.

Clean the engine block bolt bores with the correct size tap to ensure correct torque for the cylinder head bolts.

Clean any debris out of the cylinder bores.

**NOTE: The locating pins (Item 1) [B] are pressed in the engine block so the head gasket (Item 2) [B] can be positioned correctly.**

The head gasket is installed with no sealer.

Place the head gasket in position with the *Front Top* (Item 2) [A] marks in the correct position.

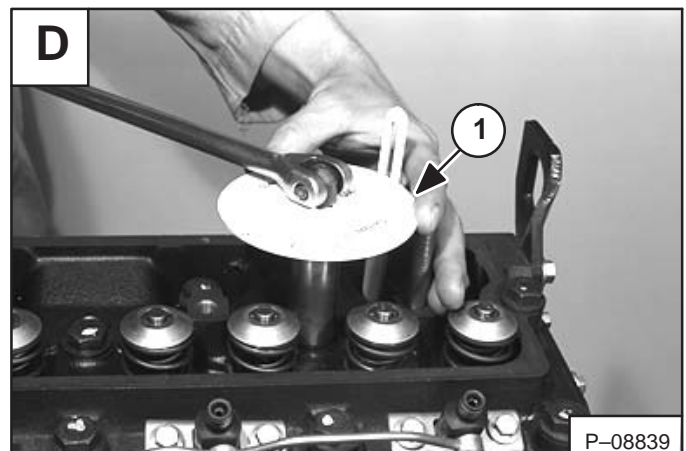
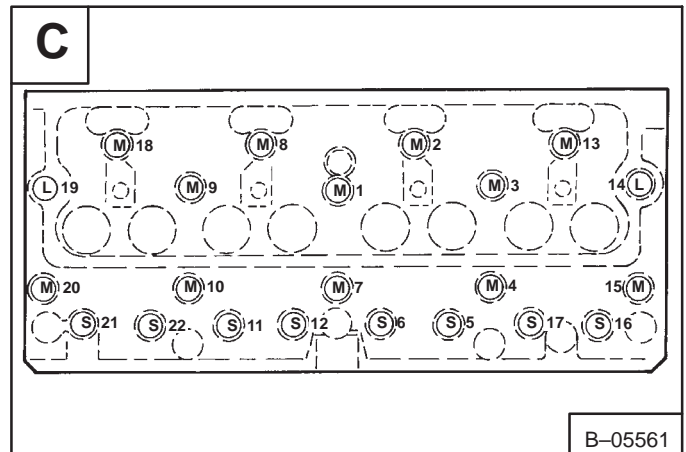
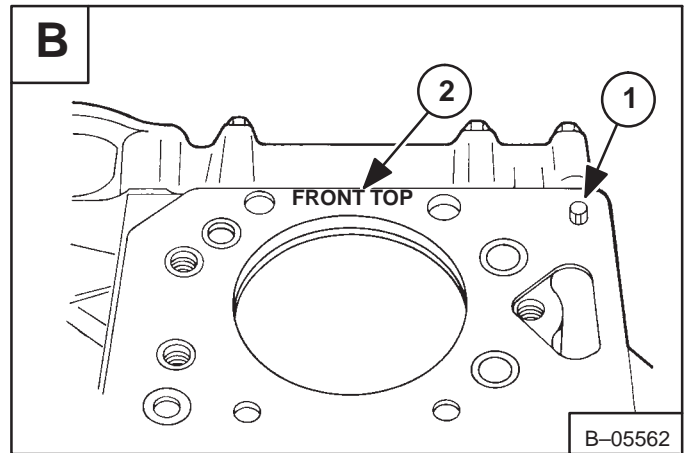
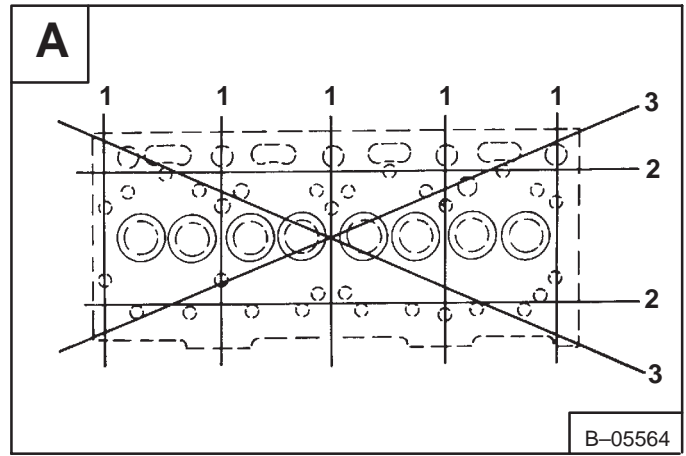
Lower the cylinder head in position.

Figure [C] shows the three different bolt lengths: S—short; M—medium and L—long.

Install all the cylinder head bolts in the correct location [C].

Following the bolt tightening sequence shown in [C]. Tighten all cylinder head bolts to 80 ft.-lbs. (108 Nm) torque.

Additional tightening of the head bolts requires the use of a torque angle gauge (Item 1) [D]. Tighten the short bolts 150°, medium bolts 180° and long bolts 210°, in the same sequence as shown in [D].



## TIMING CASE AND DRIVE ASSEMBLY (Cont'd)

### Front Oil Seal Removal

Remove the crankshaft pulley.

Remove the oil seal using a seal removal tool.

Do not damage the edge of the seal housing.

### Front Oil Seal Installation

Clean the oil seal housing.

Lubricate and place the new seal in the housing. Make sure the spring loaded lip faces toward the engine.

Place the seal tool (Item 1) [A] against the seal.

Using the three hole washer (Item 2) [A], install the crankshaft bolts and tighten evenly until the face of the seal tool is against the face of the seal housing.

**NOTE:** The standard seal is installed to a depth of 0.266/0.285 inch (6,75/7,25 mm) from the front face of the oil seal housing. If there is wear on the seal surface of the crankshaft pulley the seal can be installed to a depth of 0.366 inch (9,3 mm)

Clean and lubricate the seal surface of the crankshaft pulley before installing.

### Timing Case And Gear Removal

Remove the timing cover. (See Page 7–60.)

Rotate the crank shaft until the timing marks (Item 1) [B] are lined up.

Remove the fuel injection pump gear (Item 2) [B].

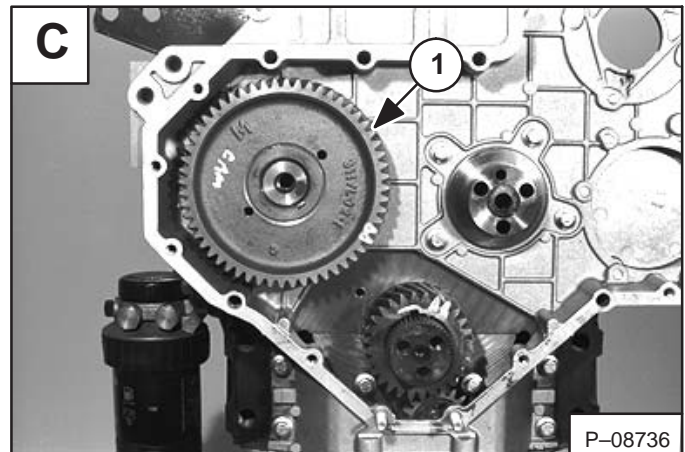
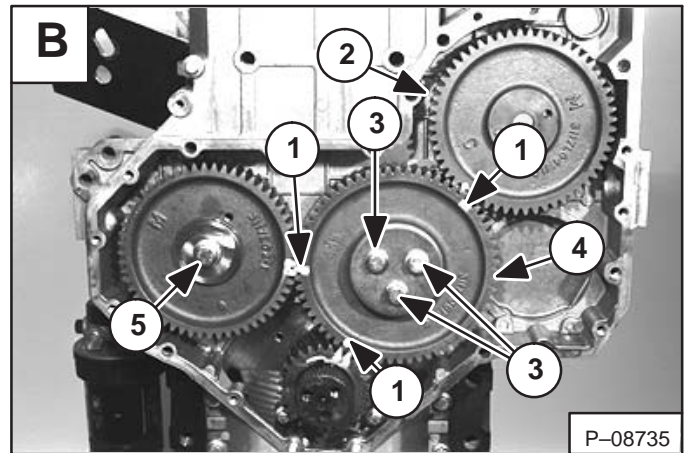
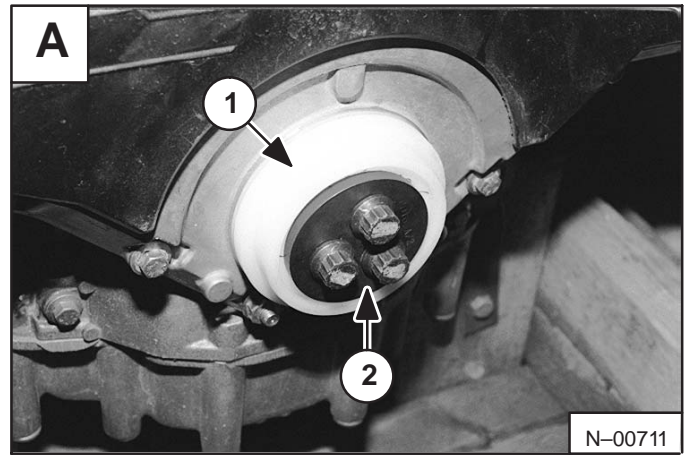
Remove the three bolts (Item 3) [B] from the idler gear (Item 4) [B].

Remove the idler gear (Item 4) [B].

**NOTE:** Do not turn the crankshaft with the idler gear removed.

Remove the cam gear retaining bolt (Item 5) [B].

Remove the cam gear (Item 1) [C].



## CRANKSHAFT AND BEARINGS (Cont'd)

### Inspection Of Crankshaft And Bearings (Cont'd)

Check the oil clearance of the bearings.

#### All Main Bearings

0.0022 – 0.0046 inch (0,057 – 0,117 mm)

#### Thrust Washer Thickness

Standard 0.089 – 0.091 inch (2,26 – 2,31 mm)

Oversize 0.096 – 0.098 inch (2,45 – 2,50 mm)

### Installation

Clean the main bearing bores and install the upper bearing shells in position. Lubricate the bearings with clean engine oil [A].

**NOTE: Only the upper half of the bearings has oil lubrication holes and must be installed in the cylinder block.**

Make sure the main journals are clean and install the crankshaft in the block [B].

Make sure the locating pins for the main caps are in position.

Clean and install the upper and lower thrust bearings on each side of the center main bearing [C].

Clean the main caps and install the bearings.

Lubricate the bearings with clean engine oil.

Install the main cap bolts and torque in steps working from the center outward.

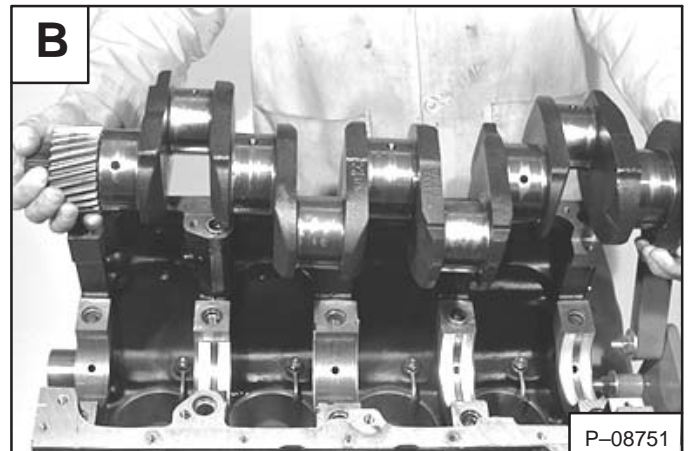
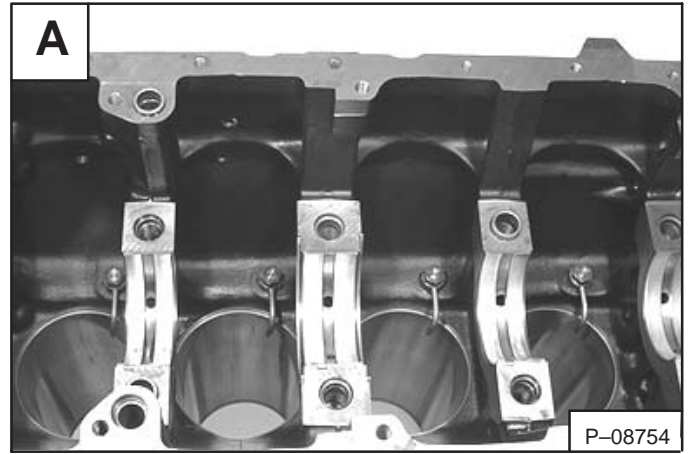
Step 1 65 ft.-lbs. (88 Nm)

Step 2 125 ft.-lbs. (170 Nm)

Step 3 185 ft.-lbs. (250 Nm)

Clean the bridge piece and apply a bead of LOCTITE #518 in the corners and around the thread holes on the block.

Install the bridge piece, and using a straight edge, align the bridge with the cylinder block [D]. Tighten the bridge retaining bolts to 12 ft.-lbs. (16 Nm) torque.



## LUBRICATION SYSTEM (Cont'd)

### Oil Screen And Pick-up Tube

Remove the bolt (Item 1) [A] that holds the bracket (Item 2) [A] to the main bearing cap.

Remove the bolts (Item 3) [A] from the pick-up tube flange.

Remove the pick-up tube (Item 4) [A] and gasket.

Wash the assembly in solvent and dry with compressed air.

Check the tube and strainer for cracks or other damage. Replace as necessary.

Loosely assemble the bracket (Item 2) [A] with the pick-up tube to the main bearing cap.

Install the pick up tube gasket and mounting bolts (Item 3) [A].

Tighten the mounting bolts to 16 ft.-lbs. (22 Nm) torque.

Tighten the bolt (Item 1) [A] for the pick-up tube bracket.

Tighten the bolt to 16 ft.-lbs. (22 Nm) torque.

### Oil Pump Removal

**NOTE:** The oil pump has a channel in the body of the pump. Oil from the front main bearing passes down the channel of the pump to an oil hole in the idler shaft for lubrication of the idler shaft bushing.

Remove the oil pan. (See Page 7-83.)

Remove the oil pressure relief valve (Item 1) [B].

Remove the oil screen and pick-up tube.

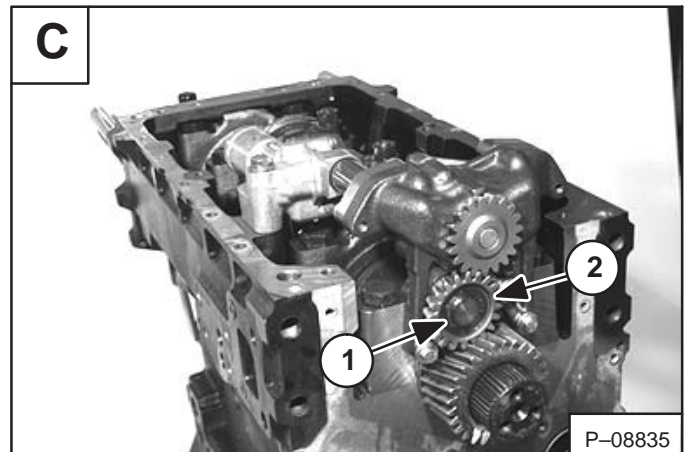
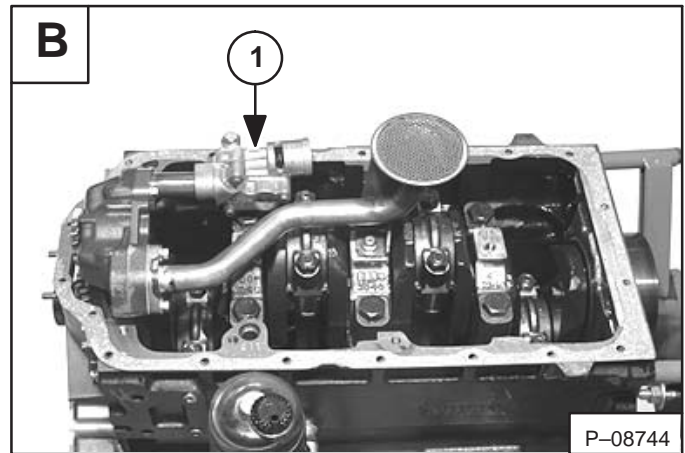
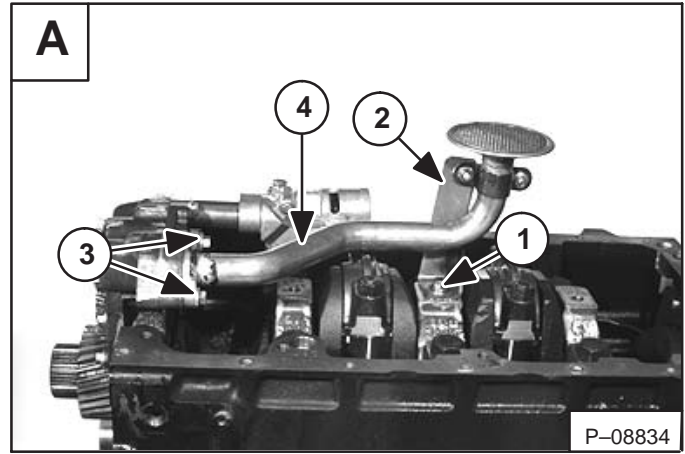
The oil pump is installed on the number 1 main bearing cap.

**NOTE:** The pump can be removed with the main bearing cap if a spanner wrench is available that will allow the torque to be applied directly to the main cap bolts.

If there is no spanner wrench, the front timing case cover must be removed. (See Page 7-60.)

Remove the snap ring (Item 1) [C], idler gear (Item 2) [C], and washer.

Remove the bolts and oil pump.



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SYSTEMS  
ANALYSIS

BICS-BOBCAT INTERLOCK CONTROL SYSTEM  
 BOSS-BOBCAT OPERATION SENSING SYSTEM  
 PWM-PULSE WITH MODULATION

## SEAT BAR SENSOR (Cont'd)

### BICS™ Controller Seat Bar Sensor Circuit Test

Sensor Tester (MEL1428) is necessary for the following procedure:

Disconnect the seat bar sensor connector (Item 1) [A].

Connect the Sensor Tester (Item 1) [B] to the seat bar sensor connectors (See Inset) [A].

Turn the key to the ON position. **DO NOT START THE ENGINE.**

No power light on the sensor tester, check the tester or wiring harness.

Power light illuminated, move the toggle switch (Item 2) [B] on the tester to the **Present** position.

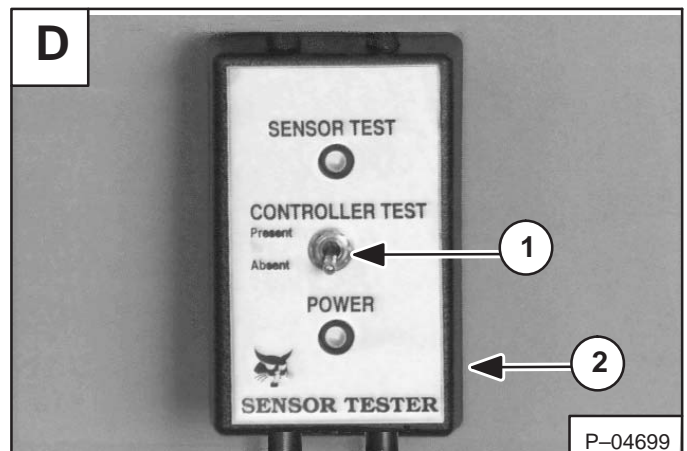
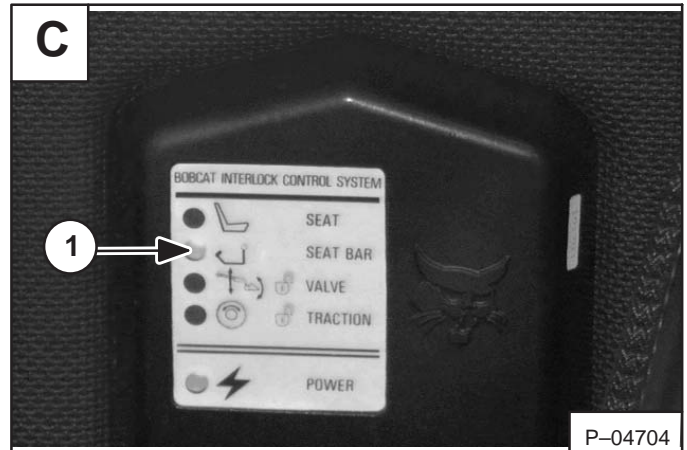
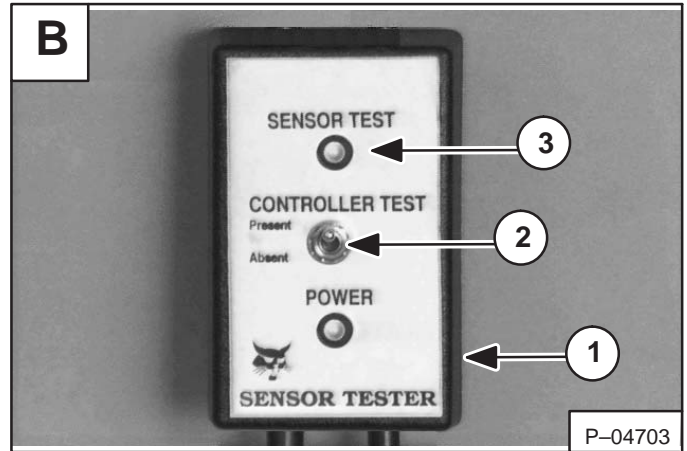
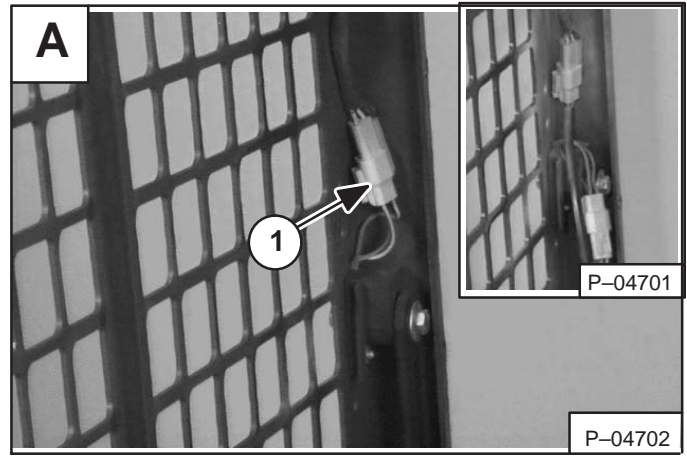
**NOTE: The sensor test light (Item 3) [B] is activated by the seat bar. It will be off with the seat bar up or ON with the seat bar down.**

The seat bar light (Item 1) [C] on the BICS controller should illuminate.

Move the toggle switch (Item 1) [D] on the sensor tester (Item 2) [D] to the **Absent** position.

The seat bar light (Item 1) [C] should go OFF.

If the tests above fail, there is a problem with the BICS system controller or the wiring harness.



## BOSS® INSTRUMENT PANEL

### Removal and Installation

Pry the rubber light mount free from the operator cab (both sides) [A].

Lower the light from the operator cab to locate the three instrument panel mounting bolts (Item 1) [B] (both sides).

Remove the three mounting bolts and pull the left panel (Item 1) [C] down from the operator cab.

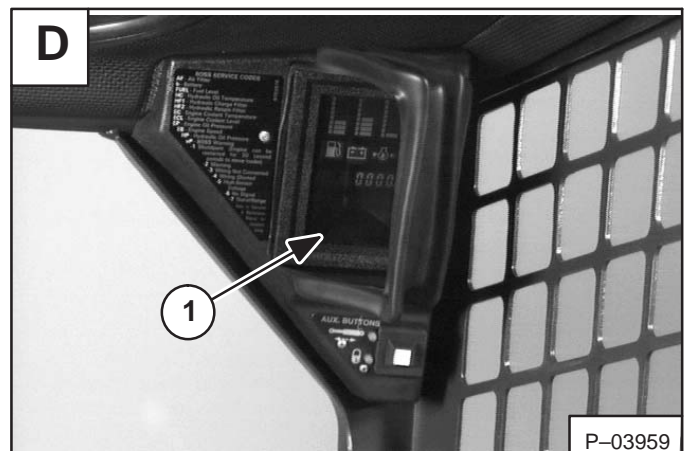
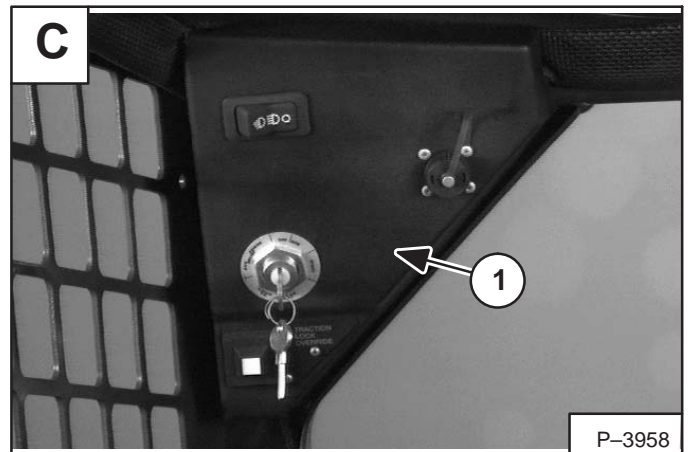
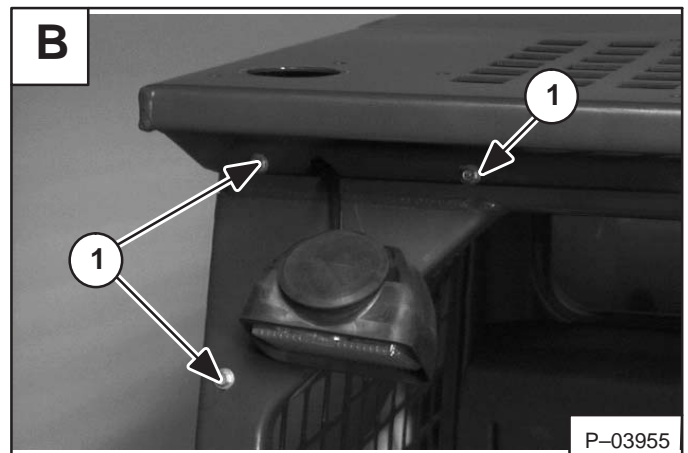
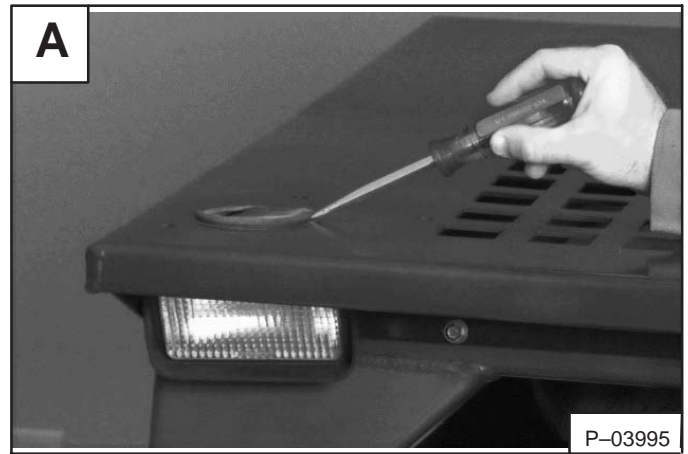
**Installation:** Be careful to not overtighten the panel mounting bolts to prevent stripping the threaded holes of the panels.

Disconnect the wire harness connectors from the panel and remove the panel.

Remove the three mounting bolts and pull the right panel (Item 1) [D] down from the operator cab.

**Installation:** Be careful to not overtighten the panel mounting bolts to prevent stripping the threaded holes of the panels.

Disconnect the wire harness connectors from the panel and remove the panel.



## ENGINE SPECIFICATIONS (Cont'd)

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

### Rocker Shaft, Rockers And Bushings

Shaft Outside Diameter	0.748–0.750 (19,01–19,04)
Rocker Arm Bushing Bore Diameter	0.875–0.876 (22,23–22,26)
Outside Diameter of the Bushing	0.877–0.8783 (22,28–22,31)
Rocker Arm Bushing Clearance	0.0008–0.0035 (0,020–0,089)
Inside Diameter of Reamed Rocker Bushing	0.750–0.752 (19,06–19,10)
Clearance Between Rocker Arm Bushing and Shaft	0.001–0.0035 (0,03–0,09)
Maximum	0.005 (0,13)

### Pistons And Piston Rings

Type	<i>Fastram</i> combustion bowl inserted top ring groove, graphite skirt
Piston Pin Bore Diameter	1.5001–1.5004 (38,103–38,109)
Piston Projection Above the Block Deck	0.006–0.014 (0,14–0,36)
Top Ring Groove Width	Tapered
Second Ring Groove Width	0.1008–0.1016 (2,56–2,58)
Third Ring Groove Width	0.1591–0.1598 (4,04–4,06)
Top Ring	Barrel Face, Molybdenum insert, Wedge
Second Ring	Taper Face, Cast Iron, Outside Bottom Step
Oil Control Ring	Coil Spring Loaded, Chromium Face
Top Ring Width	Tapered
Second Ring Width	0.097–0.098 (2,48–2,49)
Third Ring Width	0.1366–0.1374 (3,47–3,49)
Top Ring Side Clearance	Wedge
Second Ring Side Clearance	0.003–0.004 (0,07–0,10)
Third Ring Side Clearance	0.002–0.003 (0,05–0,07)
Top Ring End Gap	0.011–0.025 (0,28–0,63)
Top Ring End Gap (With Internal Step)	0.014–0.028 (0,35–0,70)
Second Ring End Gap	0.012–0.030 (0,30–0,76)
Second Ring End Gap (With External Step)	0.016–0.034 (0,40–0,85)
Third Ring End Gap	0.010–0.031 (0,25–0,75)
Piston Pin Type	Full Floating
Piston Pin Outside Diameter	1.5628–1.5630 (39,694–39,700)
Piston Boss Clearance	0.0001–0.0006 (0,003–0,015)
Bushing Type	Steel Back, Lead Bronze Tin Bearing Material
Bushing Outside Diameter	1.6972–1.6988 (43,11–43,15)
Bushing Inside Diameter (Reamed)	1.5638–1.5645 (39,723–39,738)
Piston Pin Bushing Clearance	0.0009–0.0017 (0,023–0,044)

### Connecting Rods And Bearings

Connecting Rod Type	<i>H</i> Section, Wedge Shape Small End
Connecting Rod Cap Location	Flat joint face with dowels
Crank Pin End Diameter	2.6460–2.6465 (67,21–67,22)
Piston Pin End	1.656–1.657 (42,07–42,09)
Length Between Centers	8.624–8.626 (219,05–219,10)
Bearing Type	Steel Back, Lead Bronze Bearing Material with Lead Finish
Bearing Width	1.242–1.255 (31,55–31,88)
Bearing Thickness At The Center	0.0723–0.0726 (1,835–1,844)
Bearing Clearance	0.0012–0.0032 (0,03–0,081)
Bearing Undersize Available	–0.010 (–0,25), –0.020 (–0,51), –0.030 (–0,76)

### Crankshaft

Main Journals	2.998–2.999 (76,16–76,18)
Maximum Wear And Out Of Round Of The Journals And Crank Pins	0.0016 (0,04)
Width Of Front Journal	1.454–1.484 (36,93–37,69)
Width Of Center Journal	1.738–1.741 (44,15–44,22)
Width Of Other Journals	1.545–1.549 (39,24–39,35)
Crank Pin Diameters	2.499–2.500 (63,47–63,49)
Width Of Crank Pins	1.589–1.591 (40,35–40,42)
Crankshaft End Play	0.00075 (0,019)
Thrust Washer Thickness: Std.	0.090–0.091 (2,26–2,31)
Oversize	0.096–0.098 (2,24–2,50)
Main Bearing Oil Clearance	0.0022–0.0046 (0,057–0,117)

## HYDRAULIC CONNECTION SPECIFICATIONS (Cont'd)

### O-ring Flare Fitting (Cont'd)

**NOTE:** O-ring flare fittings are not recommended in all applications. Use the standard flare fittings in these applications.

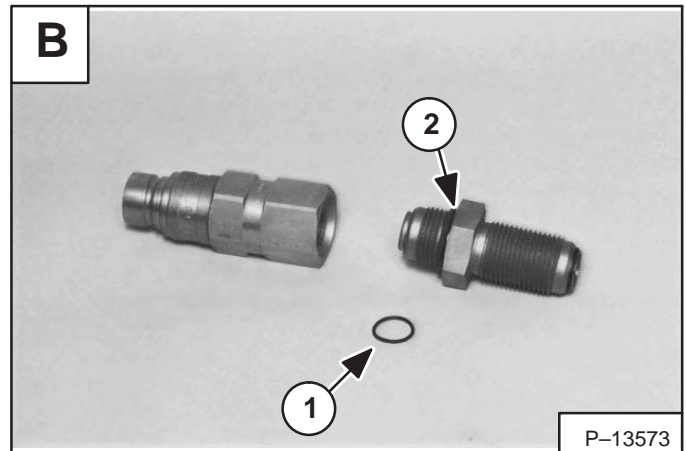
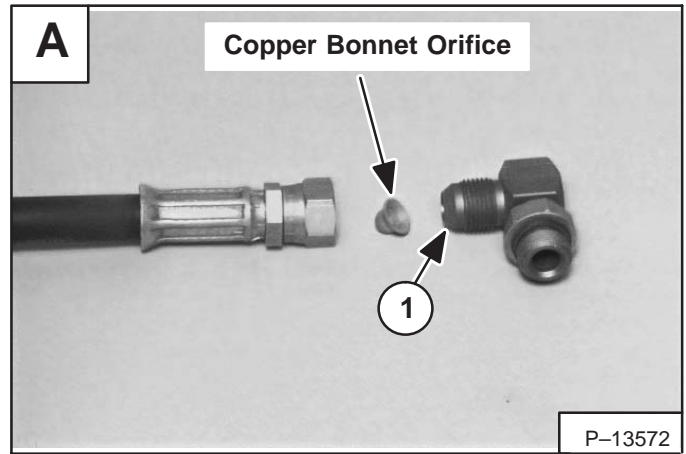
Do not use a O-ring flare fitting when a copper bonnet orifice is used. When tightened the connection at the bonnet may distort the flare face and prevent it from sealing.

Use a standard flare fitting (Item 1) [A] as shown.

When a O-ring flare fitting is used as a straight thread port adapter the O-ring flare face is not used to seal. The O-ring may come off the fitting and enter the system.

**Always remove the O-ring (Item 1) [B] from the flare face as shown.**

An O-ring (Item 2) [B] is added to the flat boss of the fitting to seal the connection in this application.



## ACTUATOR VOLTAGE TEST (Cont'd)

### Procedure (Cont'd)

#### **Diagnosis Results For Lift Actuator (bottom) Sensor Supply Voltage Test;**

If the sensor supply voltage is  $4.3 \pm 0.1$  volts, continue on and check the signal voltage.

If the sensor supply voltage is less than  $4.3 \pm 0.1$  volts or 0 volts, check the PWM fuse, check for shorts or opens in the wiring harness. If there are no apparent shorts or opens change the AHC/PWM controller. (See Page 10–13.)

If the sensor supply voltage is more than  $4.3 \pm 0.1$  volts check for a short of the power wires in the wiring harness. If there are no apparent shorts change the AHC/PWM controller. (See Page 10–13.)

#### **Diagnosis Results For Lift Actuator Signal Voltage Test;**

If the signal voltage is in the range of 1.55 to 1.85 volts, the system is functioning properly. The nominal voltage reading is 1.72 volts.

If the signal voltage is not in the range of 1.55 to 1.85 volts check the hydraulic control valve spools for a centering problem or replace the actuators. (See Page 10–27.)

#### *Handle Out (Toward Side Screen):*

1. Stop engine. Raise operator cab.
2. Connect the remote start switch (MEL1429A) to the loader.
3. Turn key to ON position with engine OFF to get a code indication from the indicator lights on the left control handle. (See Page 10–4.)
4. Check the sensor supply voltage. (See Page 10–6.)
5. Check the system to make sure it is functional, with no blinking indicator lights.
6. Move left AHC handle toward the side screen to full stroke. Hold in position and take a voltage reading.  
The voltage reading must be 0.13 volts or greater.  
If the voltage reading is less than 0.13 volts, replace the actuator. (See Page 10–27.)
7. While holding the handle toward the side screen turn the key to OFF position.
8. Wait five seconds, then put the handle to the float position. Turn the key to ON position and take a voltage reading.  
(*You will have a one blink alarm on the left indicator light.*)  
The voltage reading should be between 1.55 to 1.85 volts.  
If the voltage is above 1.85 volts, repeat steps 5 thru 8, if still above 1.85 volts, change the actuator.  
If the voltage is below 1.55 volts complete the following tests: (See Step 12 Below; Tests **a** & **b**.)

#### *Handle In (Toward Center Of Cab):*

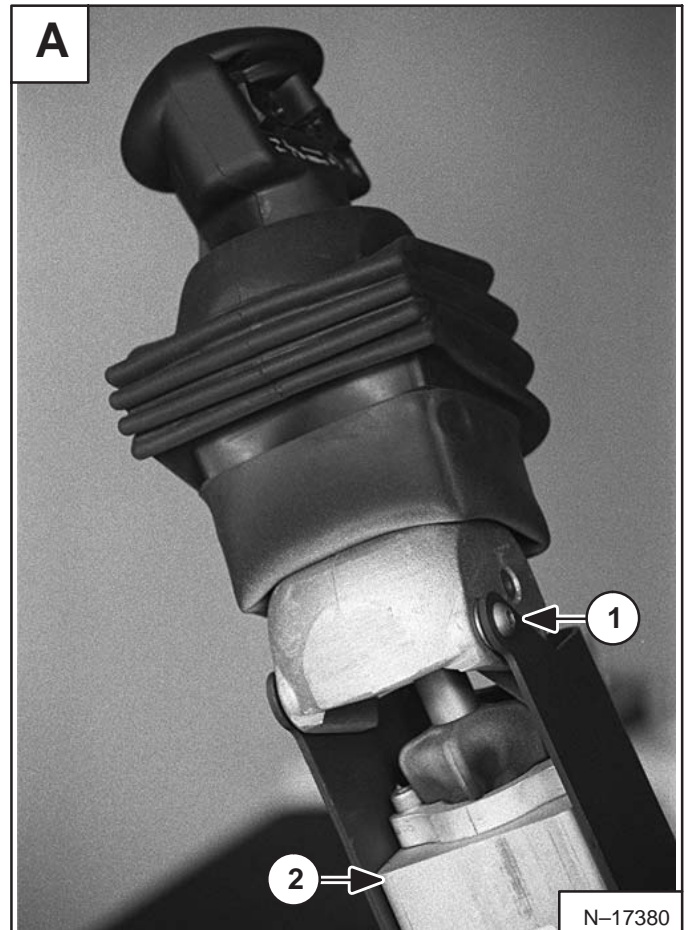
9. Turn the key to OFF position and wait five seconds, then turn key to ON position. Check the system to make sure it is functional, with no blinking indicator lights.
10. Move left AHC handle toward the center of the cab to full stroke, in float position. Take a voltage reading.  
The voltage reading must be 4.17 volts or less.  
If the voltage reading is more than 4.17 volts, check for shorts in the electrical connections, or replace the actuator. (See Page 10–27.)
11. While the handle is in float position, turn the key to OFF position. Wait for five seconds.
12. Continue to keep the handle in the float position. Turn the key to ON position. Take a voltage reading.  
(*You will have a one blink alarm on the left indicator light.*)  
The voltage reading should be between 1.55 to 1.85 volts.  
If the voltage is below 1.55 volts, repeat steps 9 thru 12, if the voltage is still below 1.55 volts change the actuator.  
If the voltage is above 1.85 volts complete the following tests:
  - a.** Remove the pin from the actuator to the control spool. Watch the spool, if the spool continues to move toward neutral after the pin is removed, replace the actuator. Also check the mounting hardware on the actuators and control valve for wear and correct torque.
  - b.** If the spool does not move, check the control valve for a sticky spool or sticky centering mechanism. Also check the mounting hardware on the actuators and control valve for wear and correct torque.

## HANDLE CONTROL UNIT (Cont'd)

### Removal and Installation (Cont'd)

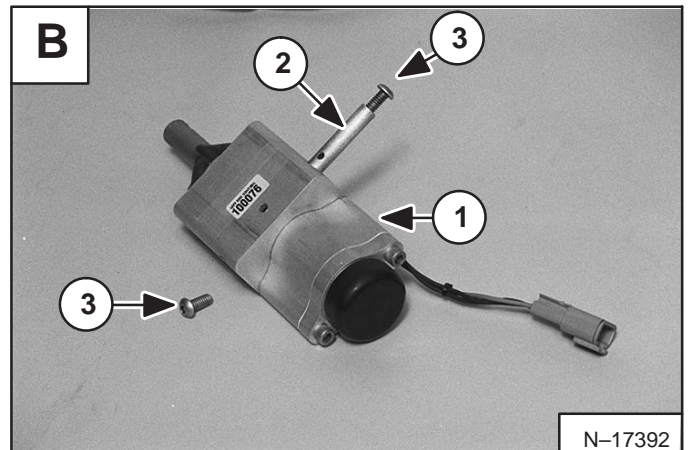
Remove the mounting bolt and nut (Item 1) [A] from the control handle and shaft.

Remove the control unit (Item 2) [A] from the control handle.

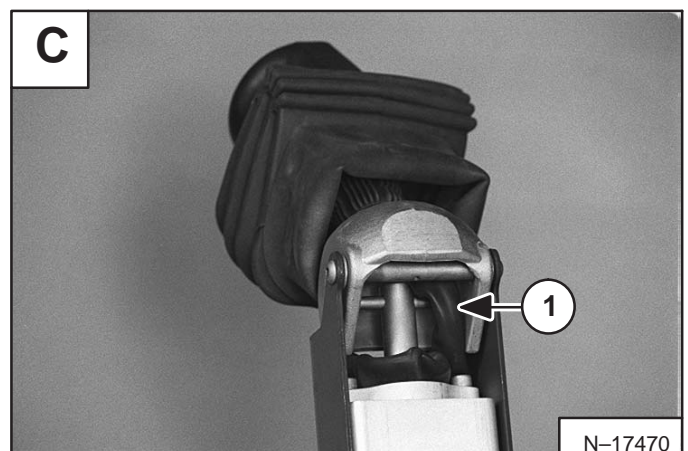


**NOTE:** The control unit (Item 1) [B] can only be replaced as a complete assembly.

Check the spacer (Item 2) [B] and screws (Item 3) [B] and replace as needed.



**Installation:** When installing the control unit into the steering handle, check the routing of the switch handle wire harness (Item 1) [C] to assure proper return of the control handle to neutral.



## BICS™ VALVE (Cont'd)

### Check Valve

Loosen and remove the check valve (Item 1) [A].

**Installation:** Tighten the check valve to 20 ft.-lbs. (27 Nm) torque.

Inspect and clean the screen (Item 1) [B] on the end of the check valve.

Inspect the check valve for damage. Replace the O-rings and back-up washers before installation.

Replace the check valve if necessary.

### Lock Valve

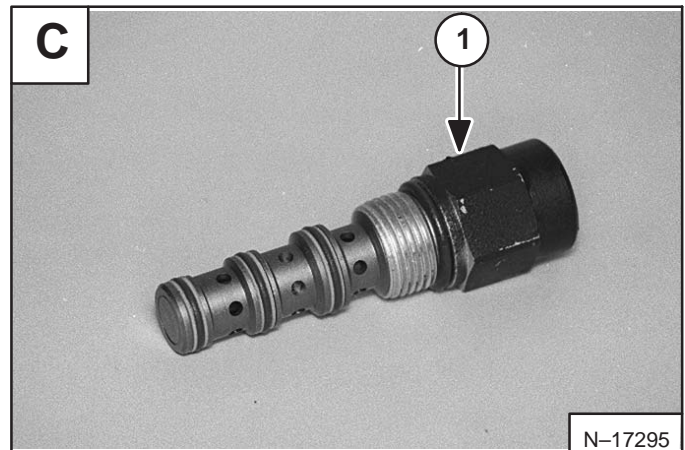
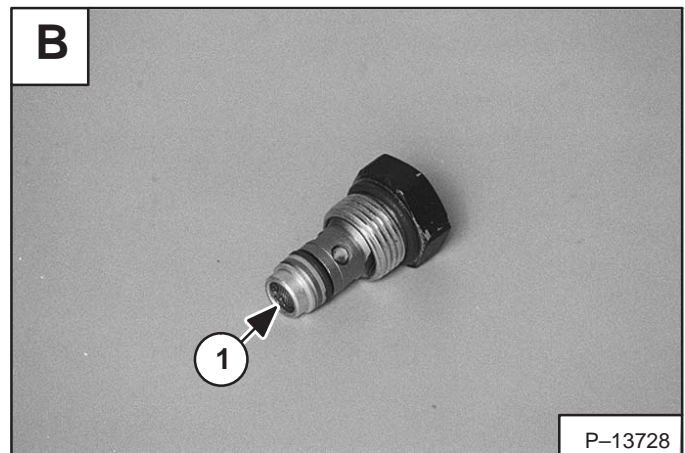
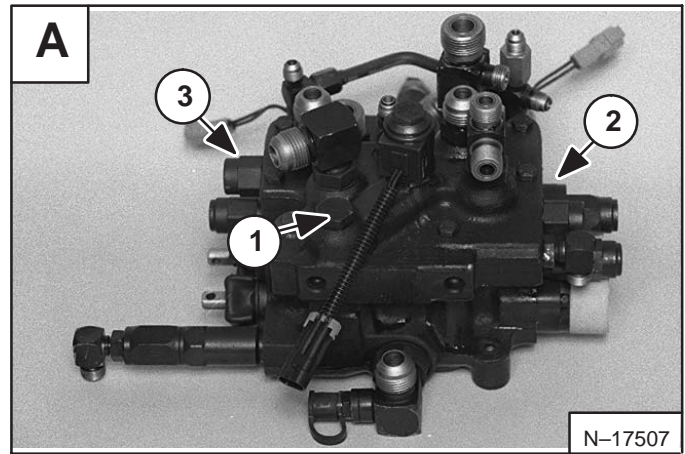
There are two lock valves on the BICS valve, lift lock valve (Item 2) [A] and tilt lock valve (Item 3) [A].

Loosen and remove the lock valve (Item 1) [C] from the valve.

**Installation:** Tighten the lock valve(s) to 25 ft.-lbs. (34 Nm) torque. Replace all the O-rings and back-up washers before installation.

Inspect the lock valve(s) for damage.

Replace the lock valve(s) if necessary.

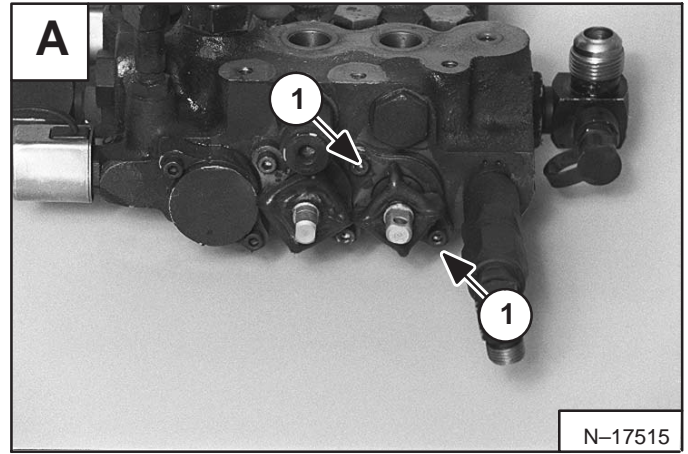


## HYDRAULIC CONTROL VALVE (Cont'd)

### Rubber Boot

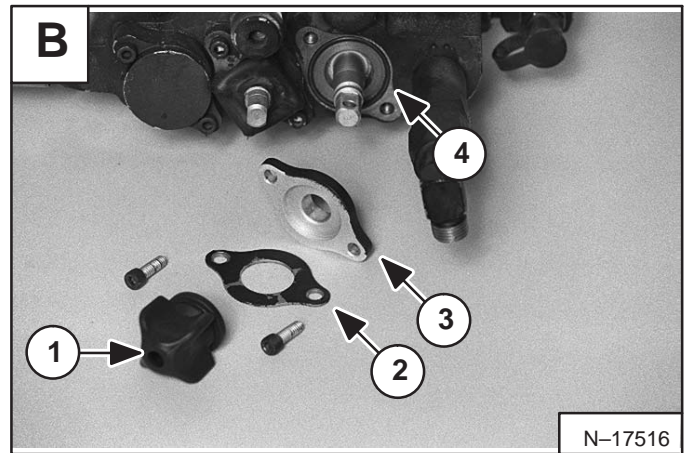
Remove the two screws (Item 1) [A] on the rubber boot retainer.

**Installation:** Tighten the screws to 90–100 in.-lbs. (10,2–11,3 Nm) torque.



Remove the rubber boot (Item 1) [B] and retainer (Item 2) [B].

Remove the seal retainer (Item 3) [B] and O-ring (Item 4) [B].





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**SAFETY &  
MAINTENANCE**

**HYDRAULIC  
SYSTEM**

**HYDROSTATIC  
SYSTEM**

**DRIVE  
SYSTEM**

**MAIN FRAME**

**ELECTRICAL  
SYSTEM &  
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## HAND-LEVER BOB-TACH

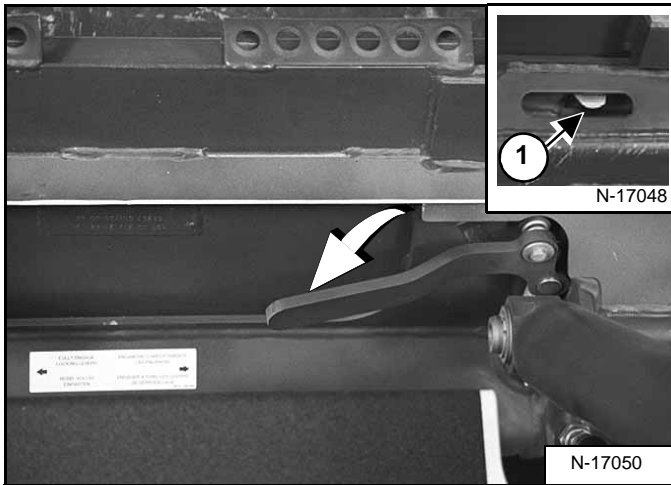
### Inspection And Maintenance



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

W-2102-0588

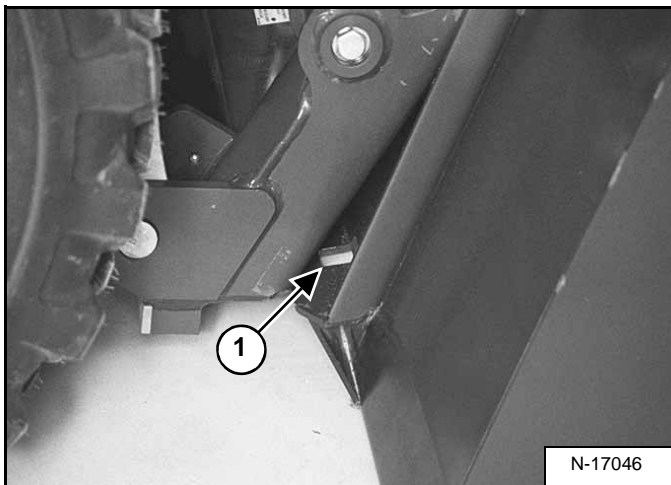
Figure 1



Move the Bob-Tach levers to engage the wedges [Figure 1]. The levers and wedges must move freely.

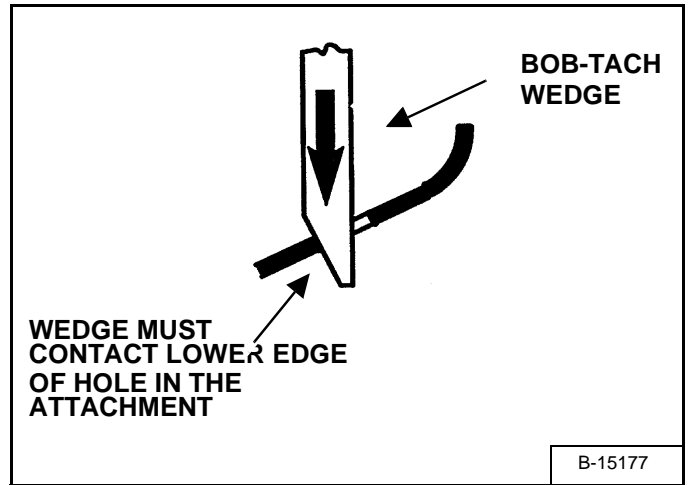
The wedges must extend through the holes in the attachment mounting frame (Item 1) [Figure 1].

Figure 10-60-2



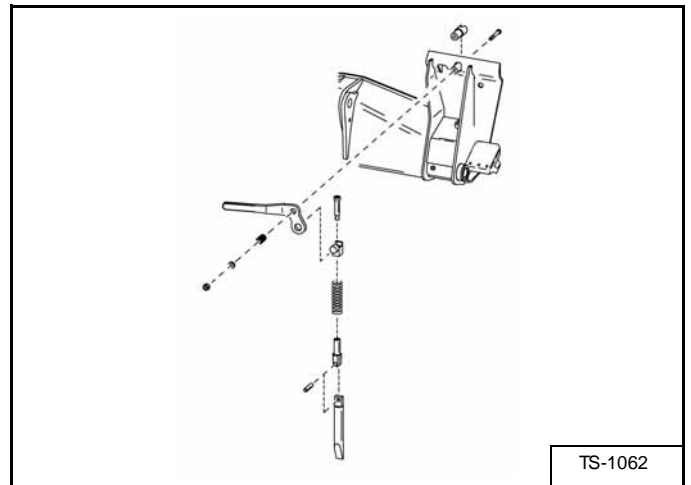
The spring loaded wedge (Item 1) [Figure 1] must contact the lower edge of the hole in the attachment (Item 1) [Figure 10-60-2] and [Figure 10-60-3].

Figure 10-60-3



If the wedge does not contact the lower edge of the hole [Figure 10-60-2] and [Figure 10-60-3], the attachment will be loose and can come off the Bob-Tach.

Figure 10-60-4



Inspect the mounting frame on the attachment and the Bob-Tach, linkages and wedges for excessive wear or damage [Figure 10-60-4]. Replace any parts that are damaged, bent, or missing. Keep all fasteners tight.

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

Lubricate the wedges. (See SERVICE SCHEDULE on Page 10-100-1 and See LUBRICATING THE BOBCAT LOADER on Page 10-170-1).



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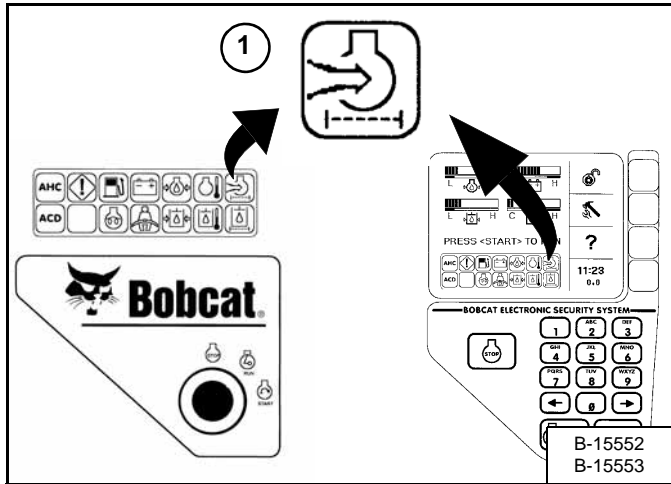
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## AIR CLEANER SERVICE

### Replacing Filter Element

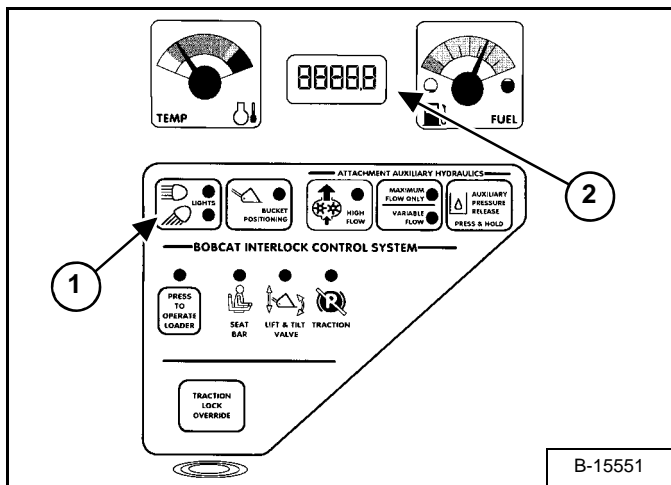
Figure 10-120-1



It is important to change the air filter element only when the Air Cleaner Icon in the right panel is ON (Item 1) [Figure 10-120-1] and you hear three beeps from the alarm.

Replace the inner filter every third time the outer filter is replaced or as indicated on (See Replacing Filter Element (Cont'd) on Page 10-120-2.)

Figure 10-120-2

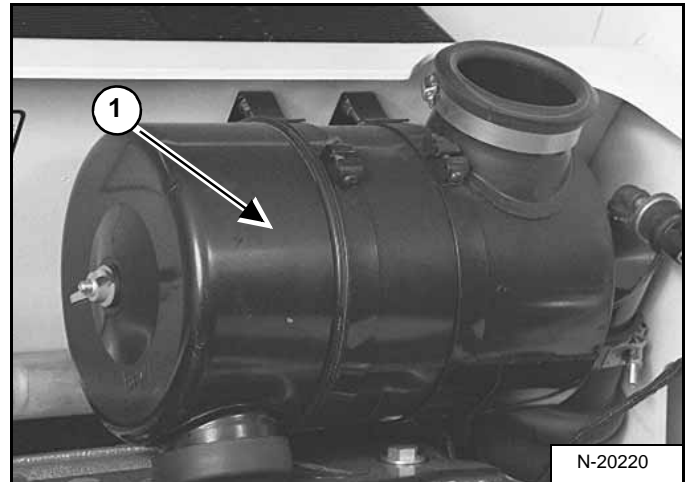


Press and hold the LIGHT Button (Item 1) [Figure 10-120-2] for two seconds.

If the filter element needs replacement, the CODE [01-17] (Air Filter Plugged) will show in the HOURMETER / CODE DISPLAY (item 2) [Figure 10-120-2].

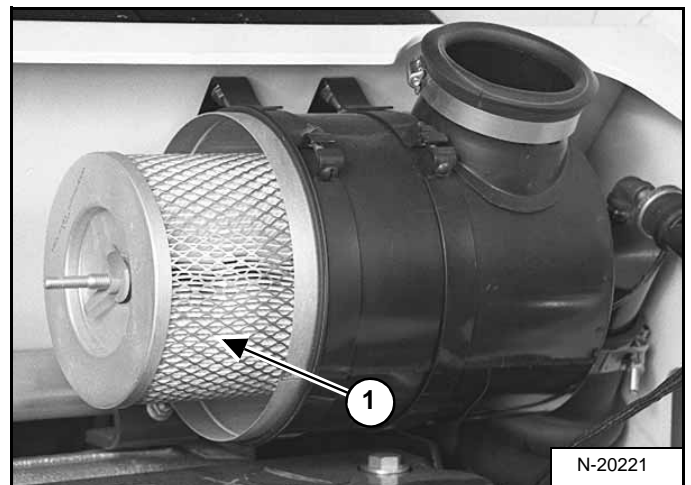
### Outer Filter

Figure 10-120-3



Remove the wing nut and remove the dust cover (Item 1) [Figure 10-120-3].

Figure 10-120-4



Remove the wing nut and remove the outer filter element (Item 1) [Figure 10-120-4].

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

Install a new outer element and the wing nut.

Install the dust cover and the wing nut [Figure 10-120-3].












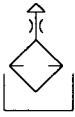



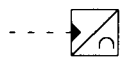
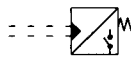
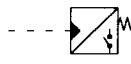
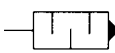
Check the air intake hose and the air cleaner housing for damage. Make sure all connections are tight.



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# HYDRAULIC SYSTEM INFORMATION

## Glossary of Hydraulic/Hydrostatic Symbols for Loaders

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

mc-2340

## CYLINDER(S) (CONT'D)

### Removal And Installation Of Tilt Cylinder(s) (Cont'd)

*Right Side*

**Figure 20-20-17**



Mark the hoses for correct installation.

Disconnect both hoses (Item 1) [Figure 20-20-17] at the tilt cylinder.

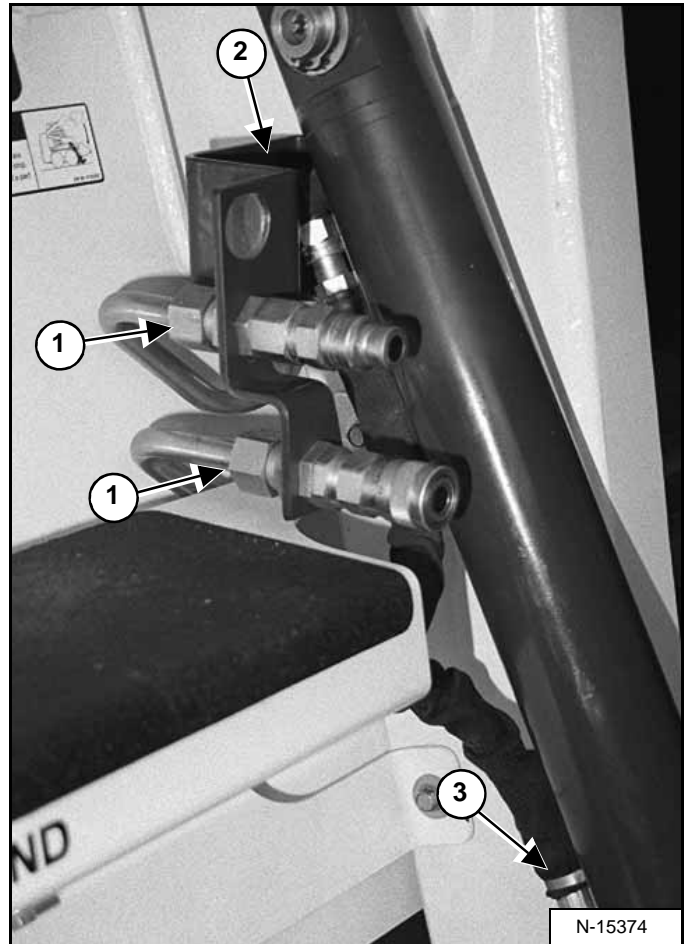
Put plugs in the ends of the hoses.

Remove the snap ring and washer from the pivot pin (Item 2) [Figure 20-20-17].

Remove the tilt cylinder by sliding off the pivot pins.

*Left Side*

**Figure 20-20-18**



Disconnect the tubelines (Item 1) [Figure 20-20-18] from the front hydraulic couplers.

Remove the mounting bolts (Item 2) [Figure 20-20-18] and remove the mounting bracket and hydraulic couplers.

Disconnect the hydraulic hose (Item 3) [Figure 20-20-18] from the rod end of the tilt cylinder. Install a cap on the hydraulic hose and tighten.

## MAIN RELIEF VALVE

### Checking Main Relief Valve At Front Auxiliary Hydraulics

# IMPORTANT

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

I-2024-0284

# ⚠ WARNING

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

W-2017-0286

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

MEL10003 - Hydraulic Tester  
MEL10006 - Hydraulic Test Kit

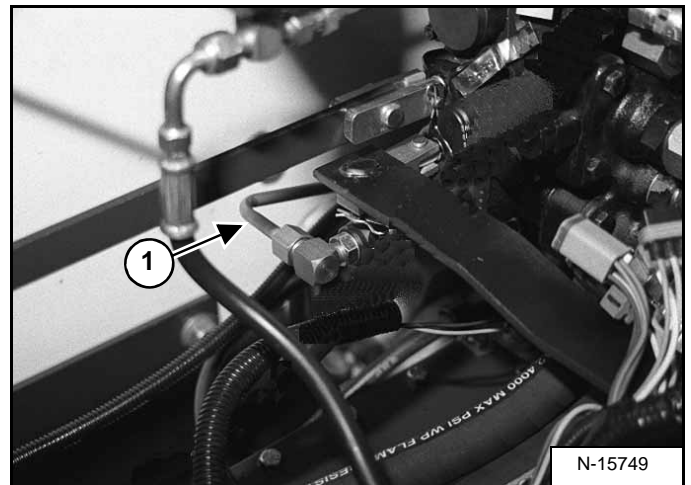
The main relief valve is a two stage pressure relief valve. When the front auxiliary hydraulics are engaged, charge pressure will activate the second stage of main relief valve and the pressure will increase.

Lift and block the loader. (See LIFTING AND BLOCKING THE LOADER on Page 10-20-1.)

Raise the operator cab. (See Raising The Operator Cab on Page 10-70-1.)

To check the first stage of the main relief valve, use the following procedure:

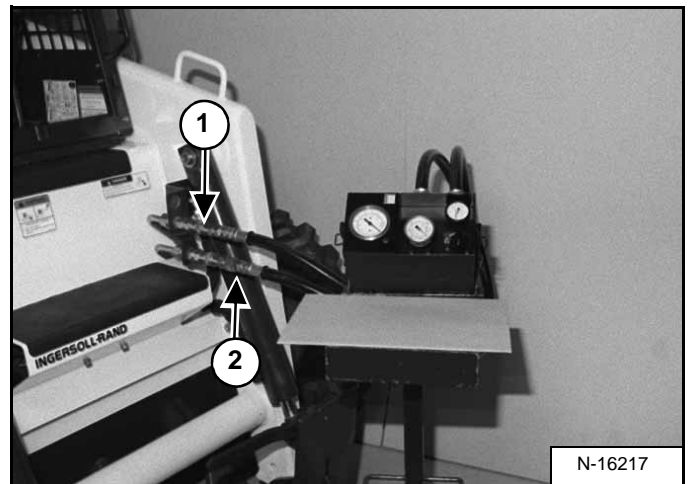
Figure 20-30-1



Disconnect the charge tubeline (Item 1) [Figure 20-30-1] at the main relief valve. Install a cap on the fitting and tighten. Install a plug in the tubeline and tighten.

Lower the operator cab.

Figure 20-30-2



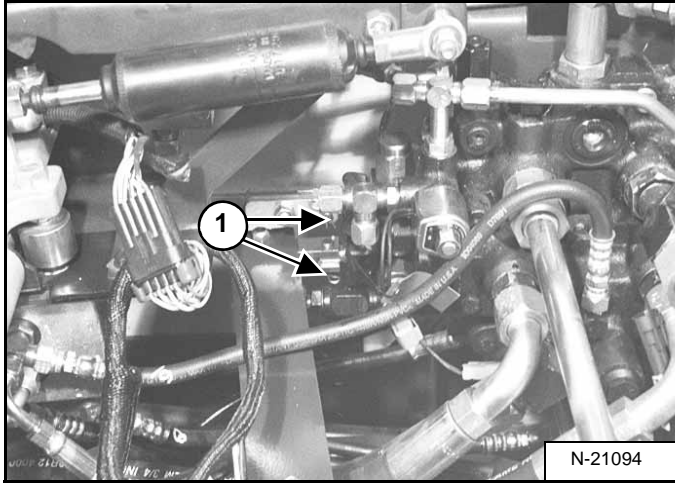
Connect the IN port of the hydraulic tester to the female quick coupler (Item 1) [Figure 20-30-2].

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

## HYDRAULIC CONTROL VALVE (FOOT CONTROL) (CONT'D)

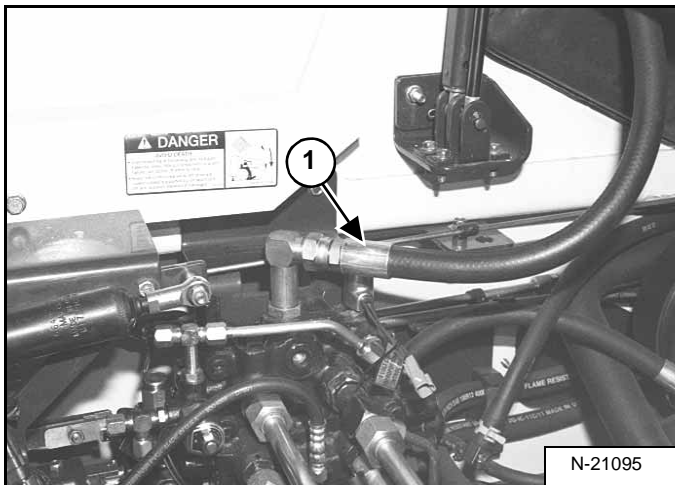
### Removal And Installation (Cont'd)

Figure 20-40-4



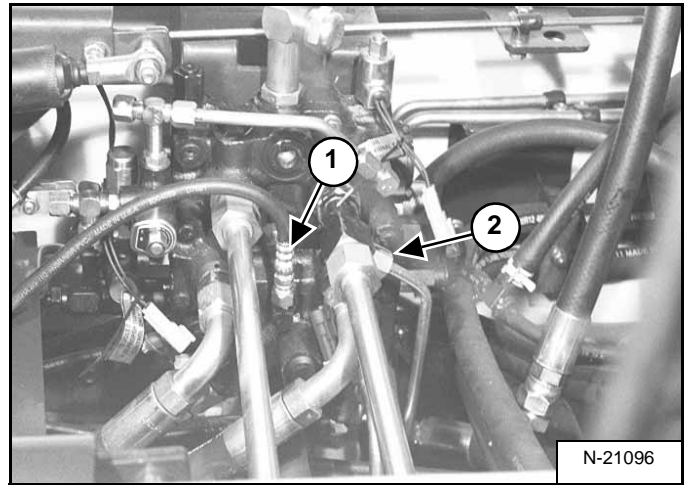
Remove the lift and tilt linkage pins and retainer clips (Item 1) [Figure 20-40-4].

Figure 20-40-5



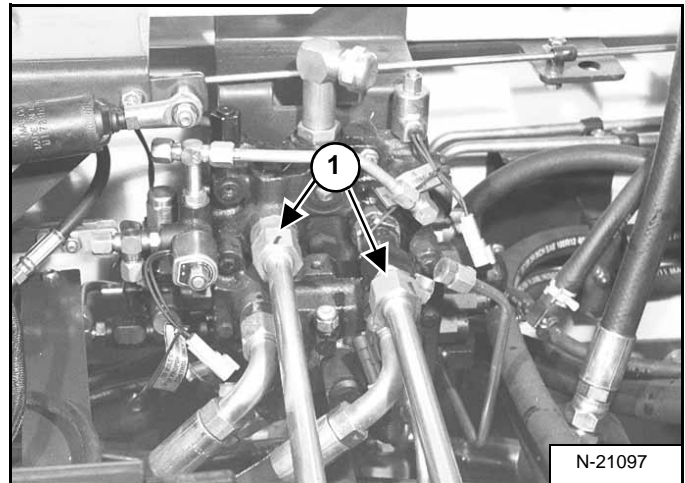
Disconnect the hose (Item 1) [Figure 20-40-5] that goes from the control valve to the hydraulic cooler.

Figure 20-40-6



Disconnect the hydraulic hose (Item 1) [Figure 20-40-6] and tubeline (Item 2) [Figure 20-40-6].

Figure 20-40-7

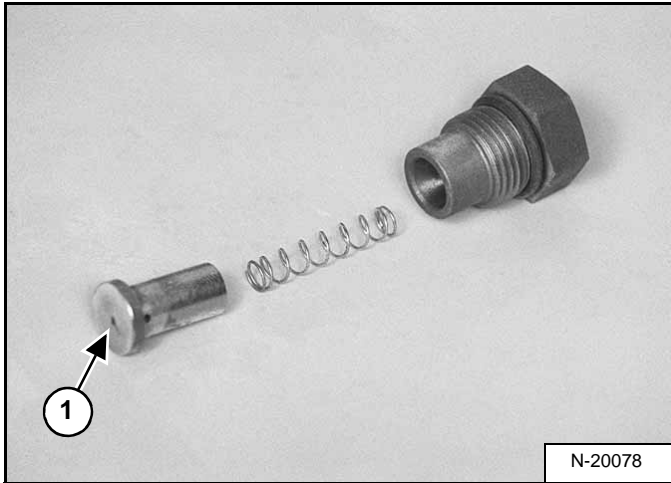


Remove the auxiliary tubelines (Item 1) [Figure 20-40-7].

# HYDRAULIC CONTROL VALVE (FOOT CONTROL) (CONT'D)

## Load Check Valve (Cont'd)

Figure 20-40-43

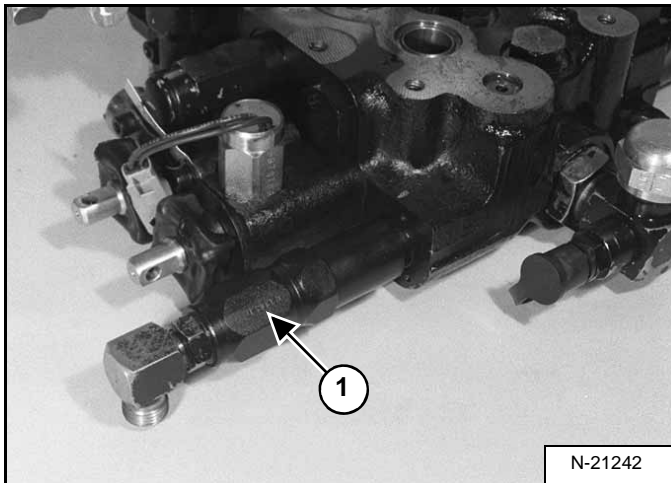


The auxiliary section uses a load check poppet with an orifice (Item 1) [Figure 20-40-43].

**NOTE:** For correct port locations and valve component 20-40-11.)

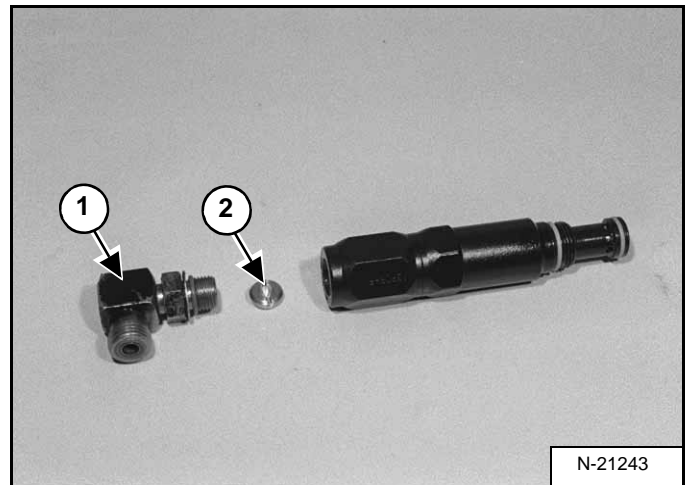
## Main Relief Valve

Figure 20-40-44



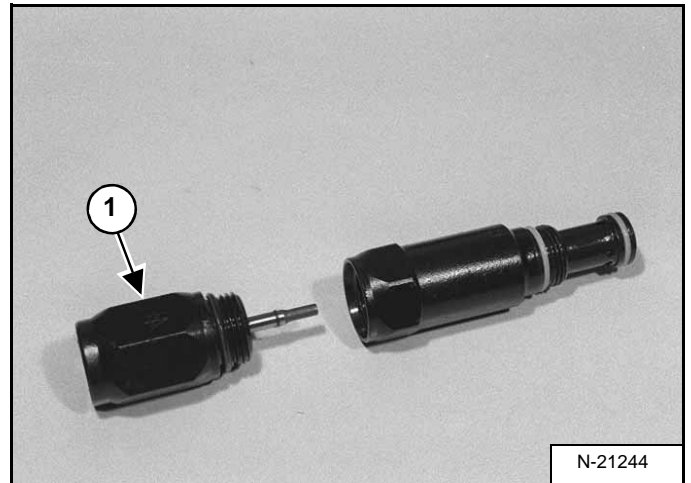
Remove the main relief valve (Item 1) [Figure 20-40-44].

Figure 20-40-45



Remove the fitting (Item 1) [Figure 20-40-45] and orifice (Item 2) [Figure 20-40-45] from the second stage housing of the main relief.

Figure 20-40-46



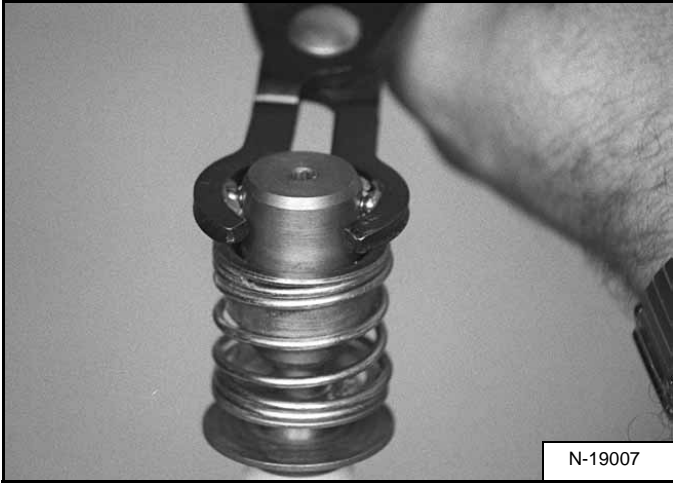
Remove the second stage housing (Item 1) [Figure 20-40-46] from the main relief valve housing.

**Installation:** Always use new O-rings and back-up washers. Tighten to 35-40 ft.-lbs. (47-54 Nm) torque.

## HYDRAULIC CONTROL VALVE (FOOT CONTROL) (CONT'D)

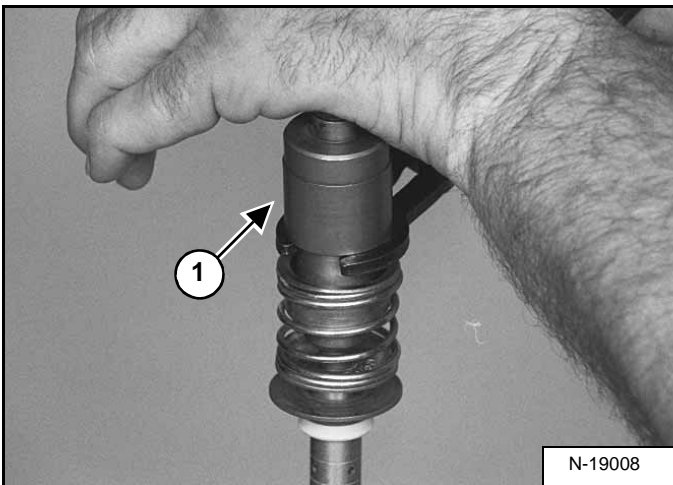
### Lift Spool and Detent (Cont'd)

Figure 20-40-87



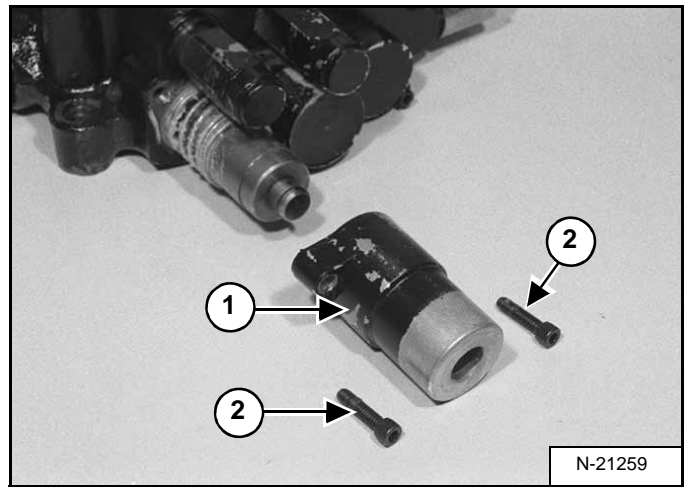
Hold the detent balls in place with the detent pliers [Figure 20-40-87].

Figure 20-40-88



Install the detent sleeve (Item 1) [Figure 20-40-88] to the detent adapter.

Figure 20-40-89



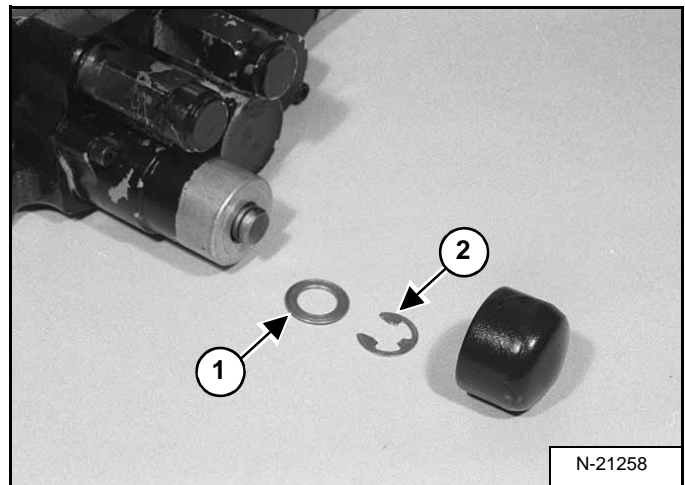
Install the lift spool assembly in the spool bore [Figure 20-40-89].

Install the detent bonnet (Item 1) [Figure 20-40-89].

Install the mounting screws (Item 2) [Figure 20-40-89].

**Installation:** Tighten the screws to 90-100 in.-lbs. (10,2-11,3 Nm) torque.

Figure 20-40-90



Install the washer (Item 1) [Figure 20-40-90] and snap ring (Item 2) [Figure 20-40-90].

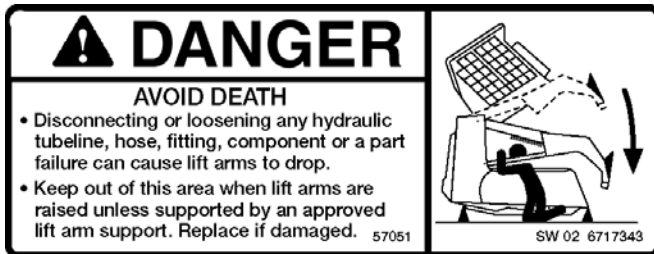
## LIFT ARM BY-PASS CONTROL VALVE

### Removal And Installation



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

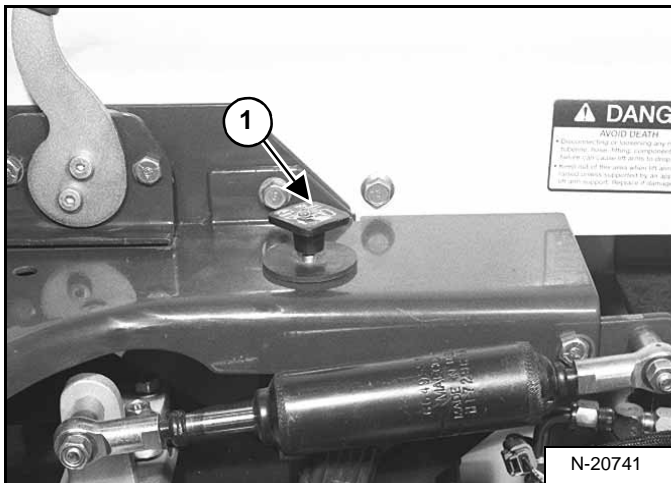
W-2059-0598



Raise the lift arms and install an approved lift arm support device. (See Engaging The Lift Arm Support Device on Page 10-50-1.)

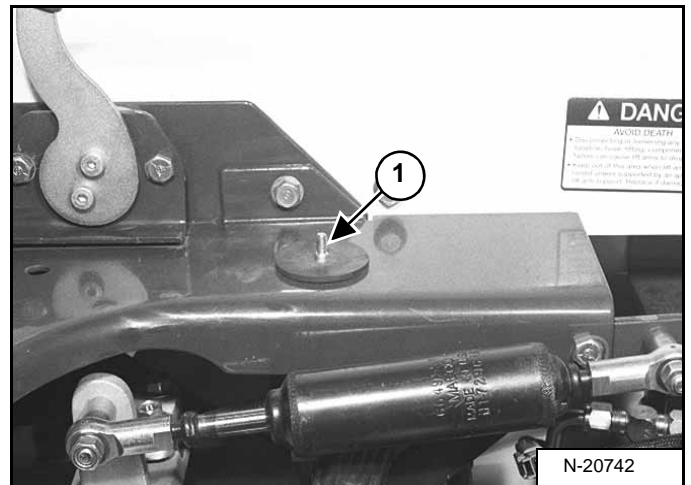
Raise the operator cab. (See Raising The Operator Cab on Page 10-70-1.)

Figure 20-50-1



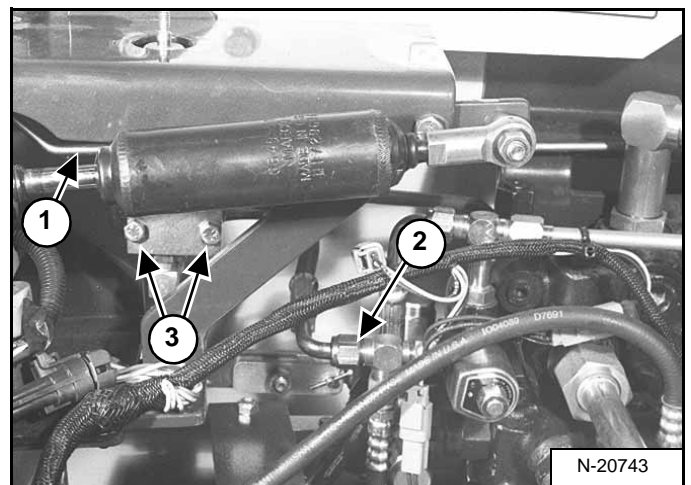
Remove the lift arm by-pass knob (Item 1) [Figure 20-50-1].

Figure 20-50-2



Remove the jam nut and rubber washer (Item 1) [Figure 20-50-2].

Figure 20-50-3



Disconnect the hydraulic tubeline (Item 1) [Figure 20-50-3] from the lift arm by-pass valve.

At the control valve, disconnect the hydraulic hose (Item 2) [Figure 20-50-3], that goes to the lift arm by-pass valve.

Remove the two mount bolts (Item 3) [Figure 20-50-3].

**Installation:** Tighten the mounting bolts to 180-200 in.-lbs. (21-23 Nm) torque.

Remove the lift arm by-pass valve from the loader.

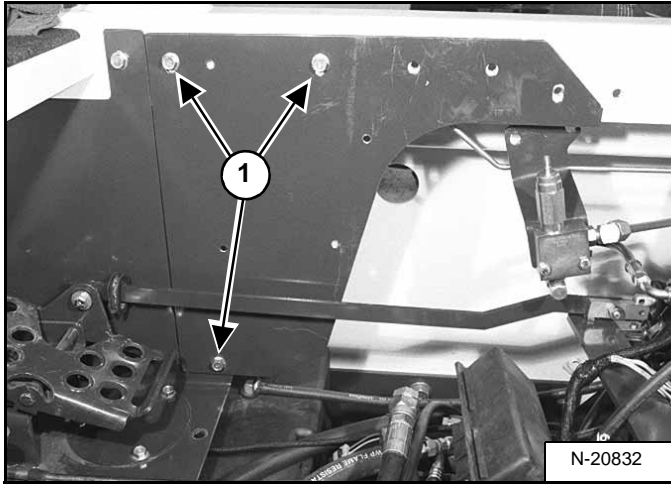


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## HYDRAULIC FLUID RESERVOIR (CONT'D)

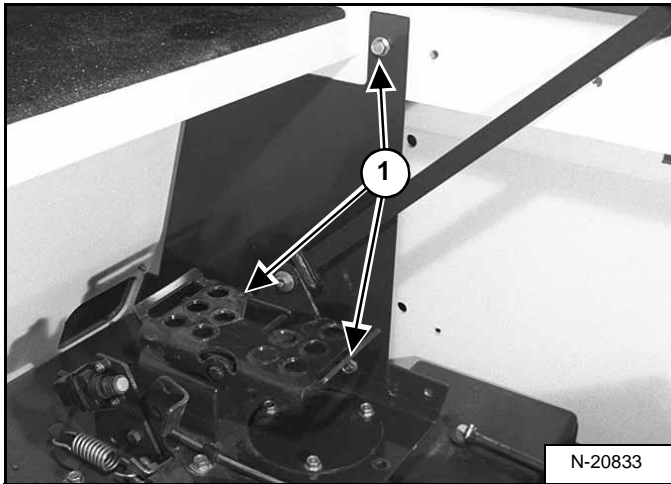
### Removal and Installation (Cont'd)

Figure 20-80-7



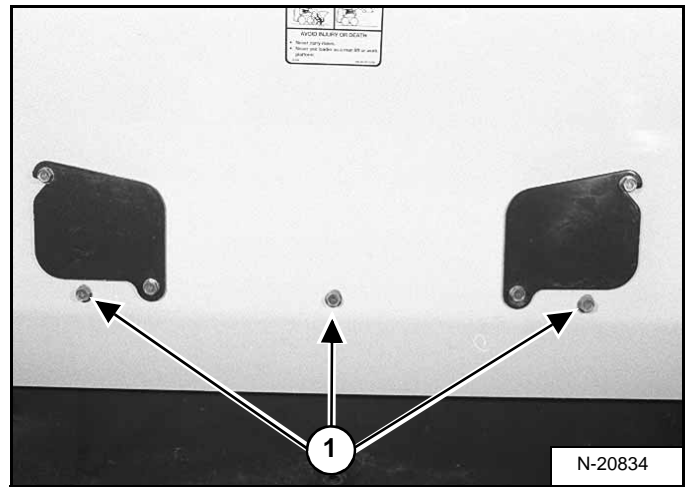
Remove the three bolts (Item 1) [Figure 20-80-7] and remove the right panel.

Figure 20-80-8



Remove the three bolts (Item 1) [Figure 20-80-8] and remove the right front panel.

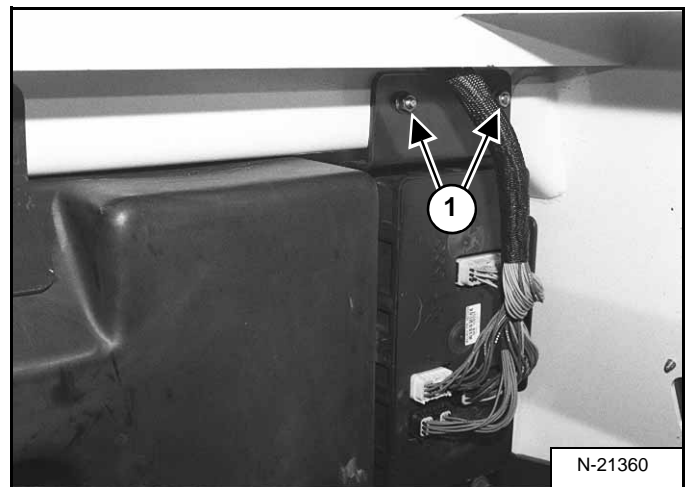
Figure 20-80-9



Remove the three bolts (Item 1) [Figure 20-80-9] from the front of the loader frame.

Remove the floor board.

Figure 20-80-10



Remove the two mount bolts and nuts (Item 1) [Figure 20-80-10] from the Bobcat Controller. Reposition the Bobcat Controller to allow clearance for the reservoir removal.



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## HYDROSTATIC SYSTEM INFORMATION

### Troubleshooting Chart

The following troubleshooting chart is provided for assistance in locating and correcting problems which are most common. Many of the recommended procedures must be done by authorized Bobcat Service Personnel only.



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

W-2004-1285

problem	Cause
No drive on one side, in one direction.	1, 2
No drive on one side in both directions.	2, 3, 4, 5
The loader does not move in a straight line.	2, 3, 5, 6, 7
The hydrostatic system is overheating.	8, 9, 10, 11
Warning light comes ON.	8, 11, 12, 13, 14

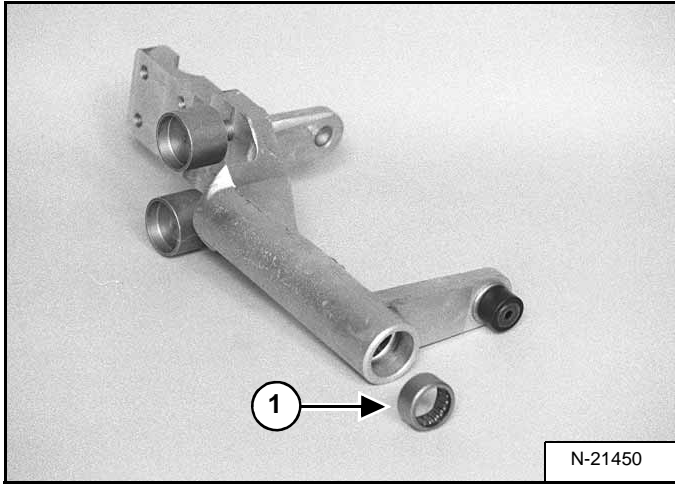
#### Key to correct the cause

1. The hydrostatic pump replenishing valves not seating.
2. The steering linkage needs adjustment.
3. The hydrostatic pump has damage.
4. The final drive chains are broken.
5. The hydrostatic motor has damage.
6. The tires do not have the correct tire pressure.
7. The tires are not the same size.
8. The hydrostatic fluid is not at the correct level.
9. The oil cooler has a restriction.
10. The temperature sending switch is not operating correctly.
11. The loader is not being operated at the correct RPM.
12. The sender is defective.
13. Pump is defective or worn hydrostatics.
14. Hydraulic filter is plugged.

## STEERING (CONT'D)

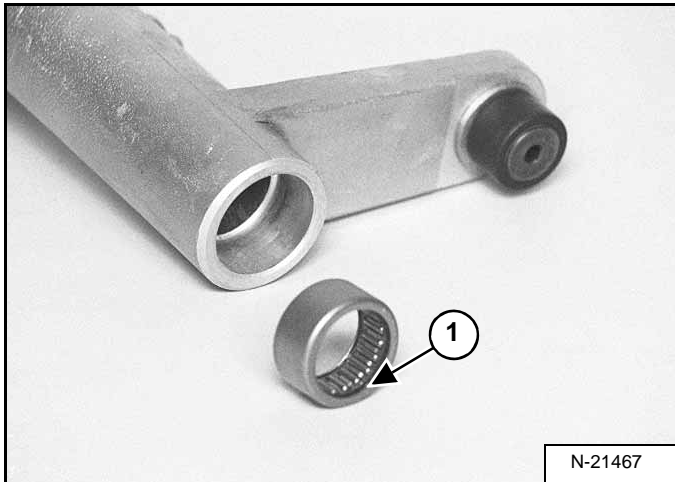
### Disassembly and Assembly (Cont'd)

Figure 30-30-21



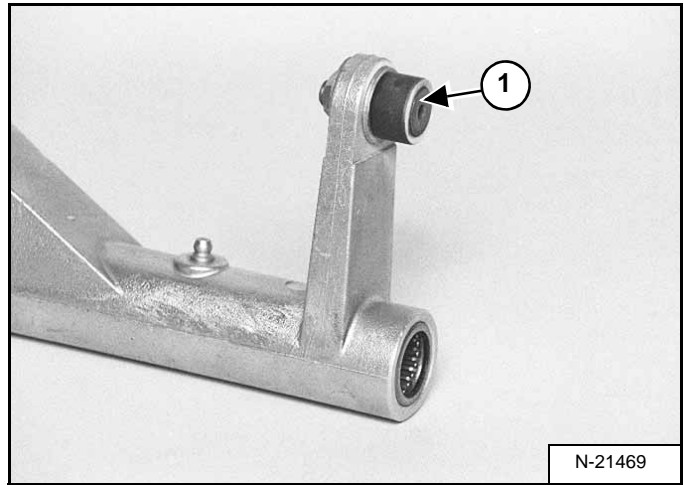
Remove the needle bearings (Item 1) [Figure 30-30-21] from each end of the bellcrank. Check for wear and replace as needed.

Figure 30-30-22



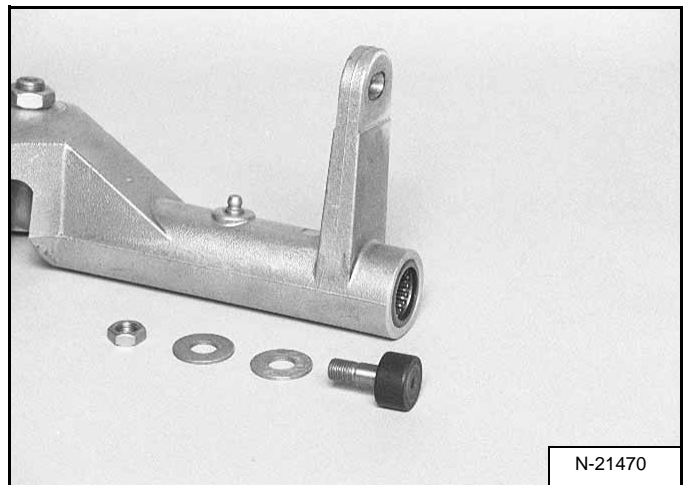
**NOTE:** Install the needle bearings with the O-ring (Item 1) [Figure 30-30-22] toward the outer end of the bellcrank.

Figure 30-30-23



Remove the steering cam/roller bearing assembly (Item 1) [Figure 30-30-23] from the bellcrank.

Figure 30-30-24



Check all parts and replace as needed [Figure 30-30-24].

## HYDROSTATIC MOTOR (CONT'D)

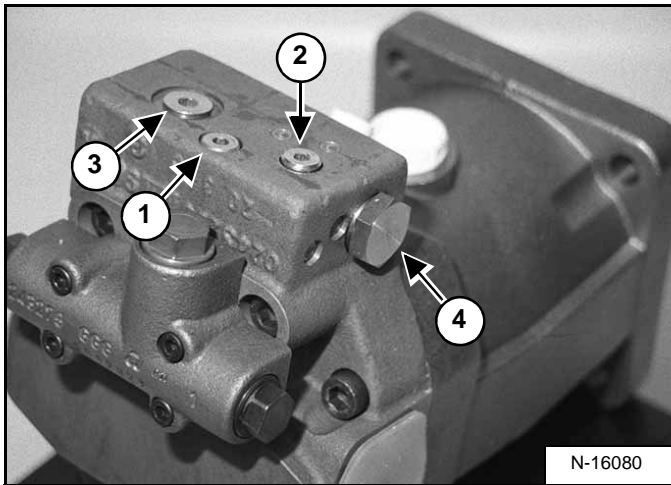
### Throttle Control

# IMPORTANT

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

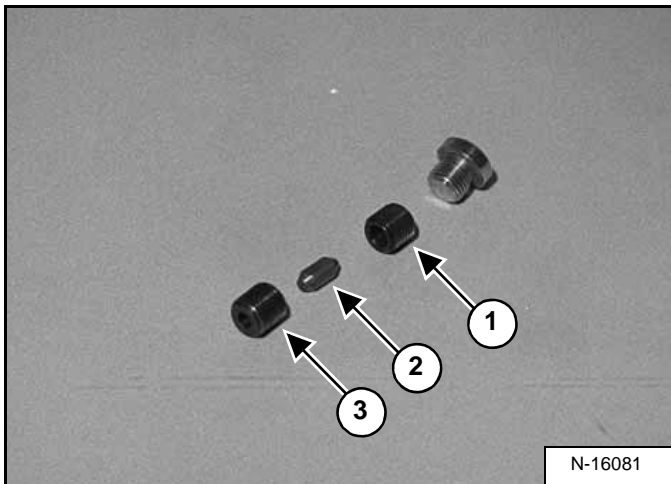
I-2003-0888

Figure 30-40-6



Remove the plug (Item 1) [Figure 30-40-6].

Figure 30-40-7



Use a allen wrench and remove the top throttle seat (Item 1) [Figure 30-40-7].

Remove the double coned throttle pin (Item 2) [Figure 30-40-7].

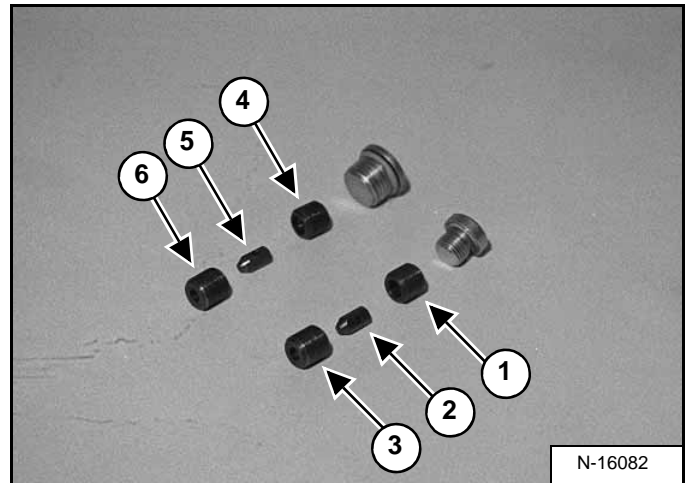
Remove the bottom throttle seat (Item 3) [Figure 30-40-7].

Inspect all the parts and replace as needed.

### Shuttle Check Valve

Remove the plug (Item 2) [Figure 30-40-6].

Figure 30-40-8



Remove the top shuttle check valve plug (Item 1) [Figure 30-40-8].

Remove the shuttle check valve (Item 2) [Figure 30-40-8].

Remove the shuttle check valve seat (Item 3) [Figure 30-40-8].

Remove the plug (Item 3) [Figure 30-40-6].

Remove the top shuttle check valve plug (Item 4) [Figure 30-40-8].

Remove the shuttle check valve (Item 5) [Figure 30-40-8].

Remove the shuttle check valve seat (Item 6) [Figure 30-40-8].

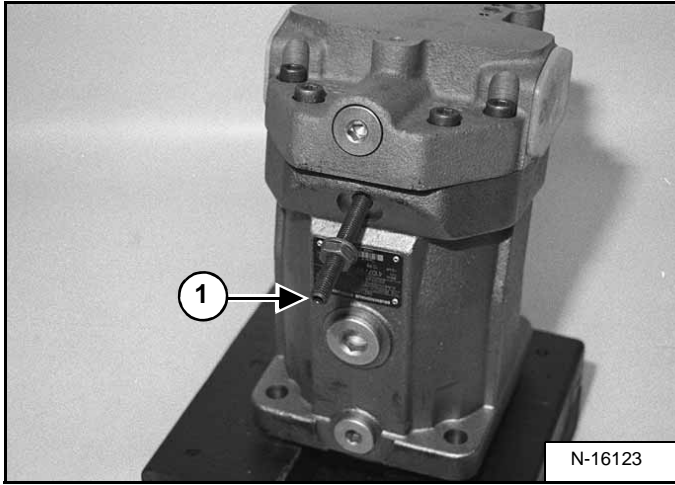
Inspect all the parts and replace as needed.

Remove the plug (Item 4) [Figure 30-40-6].

## HYDROSTATIC MOTOR (CONT'D)

### Assembly (Cont'd)

Figure 30-40-48

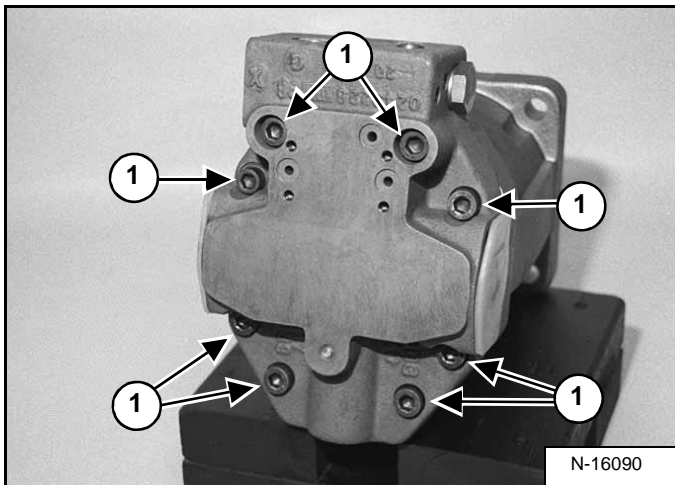


Install the adjustment screw (Item 1) [Figure 30-40-48] into the housing.

Adjust the adjustment screw to the correct dimension recorded when the screw was removed. (See Disassembly on Page 30-40-5.) [Figure 30-40-20].

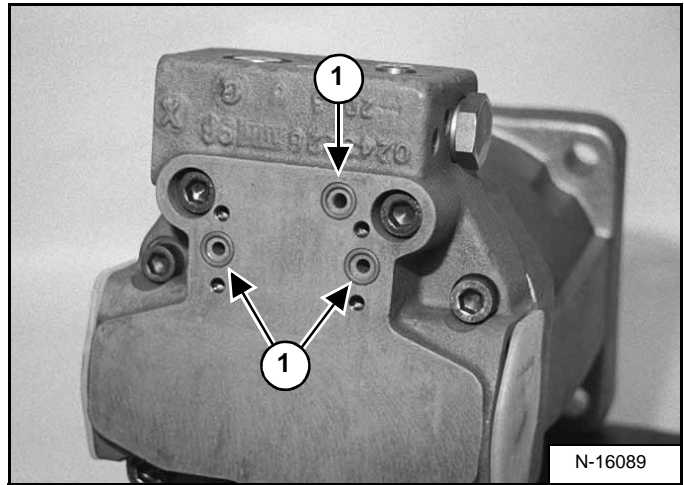
Replace the tamper proof cap on the adjustment screw.

Figure 30-40-49



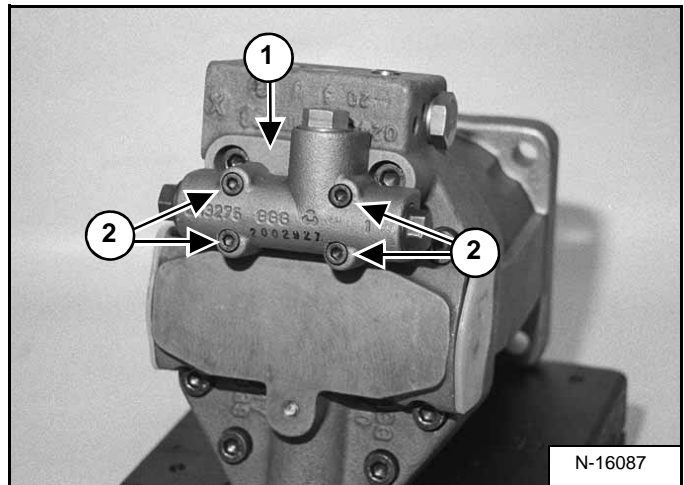
Tighten the bolts (Item 1) [Figure 30-40-49] at the end plate housing to 36 ft.-lbs. (48 Nm) torque.

Figure 30-40-50



Install the new O-rings (Item 1) [Figure 30-40-50].

Figure 30-40-51



Install the flushing valve (Item 1) [Figure 30-40-51].

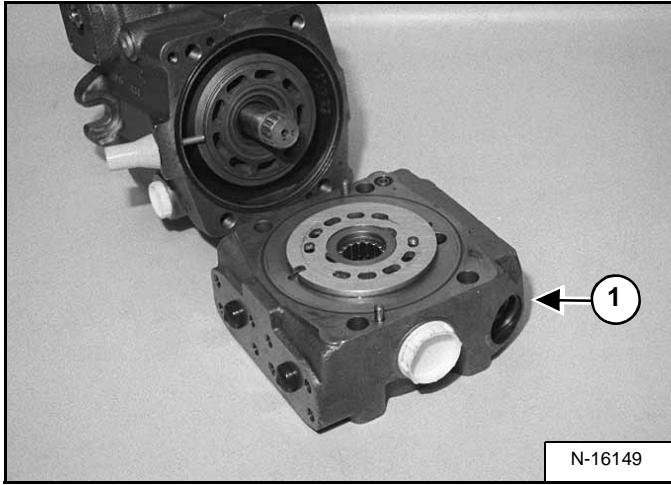
Install the bolts (Item 2) [Figure 30-40-51] and tighten to 85 in.-lbs. (9,6 Nm) torque.

Pour about 1 qt. (0,9 L.) of hydraulic fluid into the hydrostatic motor case before installation.

## HYDROSTATIC PUMP (CONT'D)

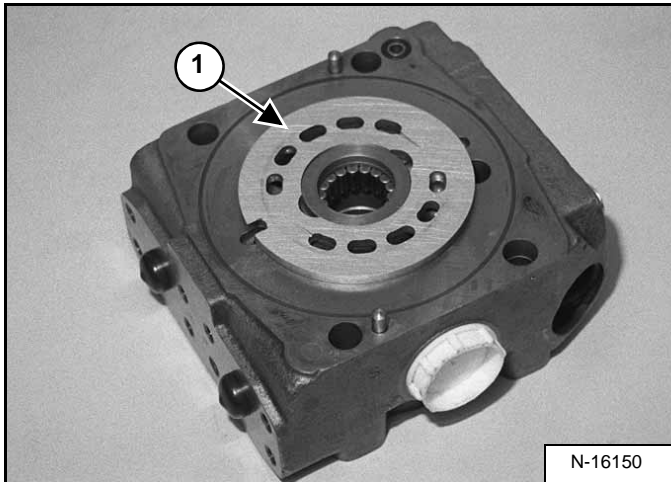
### Disassembly (Cont'd)

Figure 30-60-23



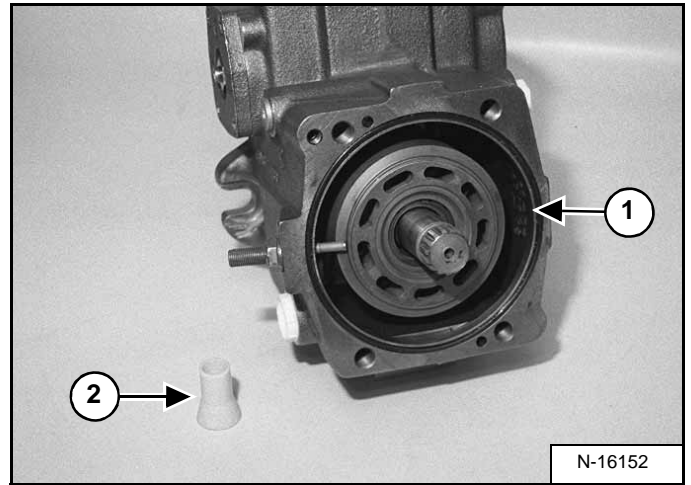
Remove the port block (Item 1) [Figure 30-60-23] from the pump housing.

Figure 30-60-24



Remove the valve plate (Item 1) [Figure 30-60-24] from the port block.

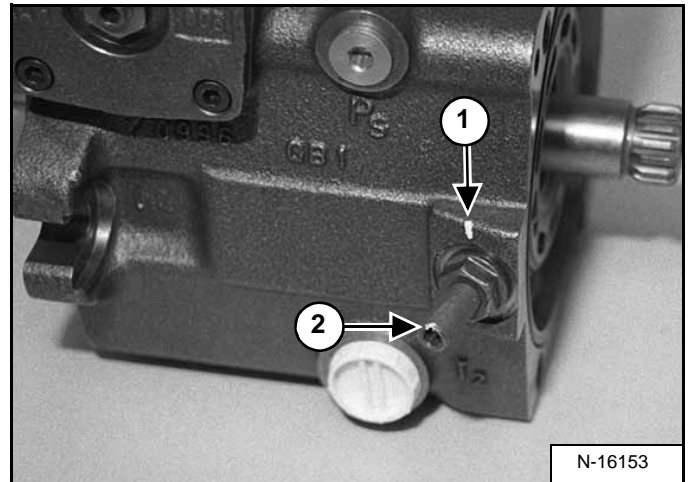
Figure 30-60-25



Remove the large O-ring (Item 1) [Figure 30-60-25] from the pump housing.

Remove the tamper proof cap (Item 2) [Figure 30-60-25] from the adjustment screw.

Figure 30-60-26

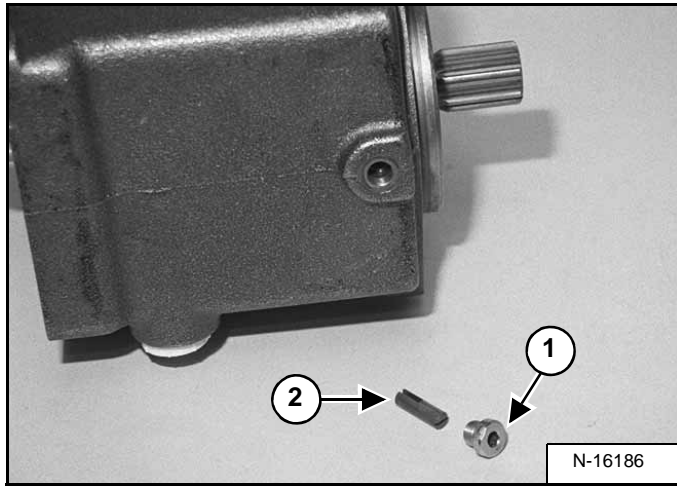


Put a mark (Item 1) [Figure 30-60-26] on the pump housing in alignment with the notch (Item 2) [Figure 30-60-26] on the adjustment screw. This mark is needed for correct installation of the adjustment screw.

## HYDROSTATIC PUMP (CONT'D)

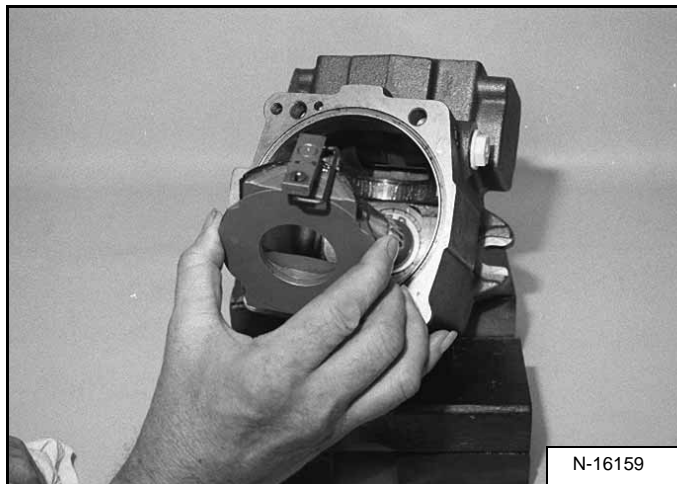
### Assembly (Cont'd)

Figure 30-60-64



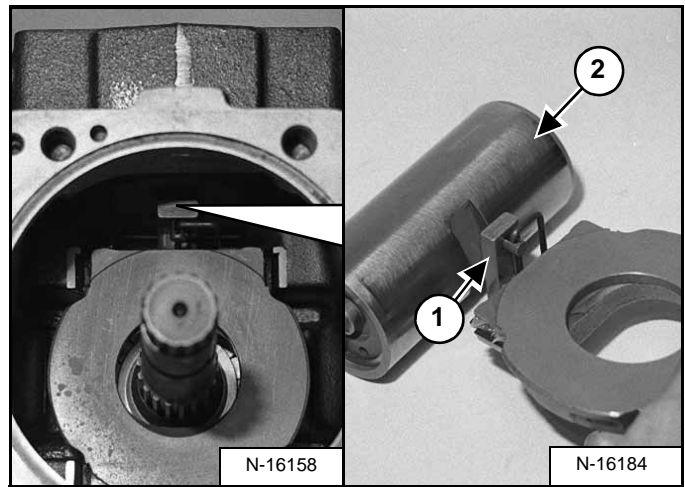
Remove the plug (Item 1) [Figure 30-60-64] and locating pin (Item 2) [Figure 30-60-64] from the housing.

Figure 30-60-65



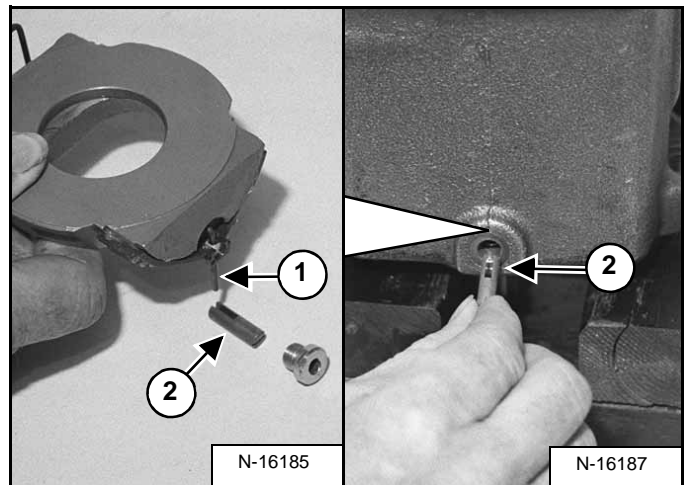
Install the swashplate/bearing assembly into the pump housing [Figure 30-60-65].

Figure 30-60-66



After the swashplate is installed, make sure the servo block (Item 1) [Figure 30-60-66] is engaged in the slot in the servo piston (Item 2) [Figure 30-60-66].

Figure 30-60-67



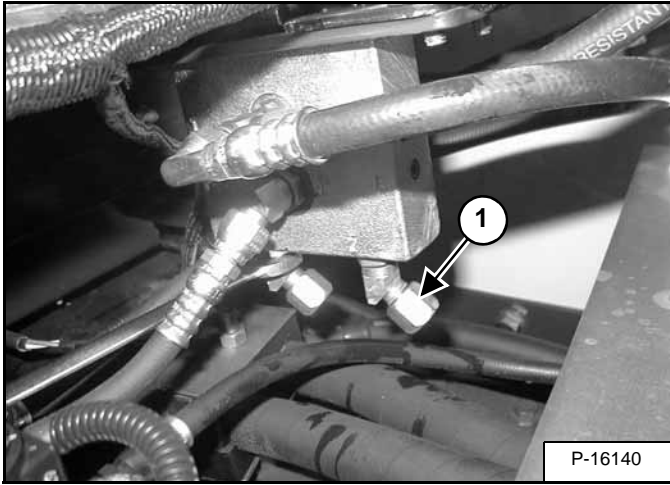
At the other side of the swashplate, align the linkage rod (Item 1) [Figure 30-60-67] so when the slotted locating pin (Item 2) [Figure 30-60-67] is installed it will go over the linkage rod. Install and tighten the plug.

To set neutral at the servo piston and swashplate, do the following procedure:

## HYDROSTATIC PUMP (CONT'D)

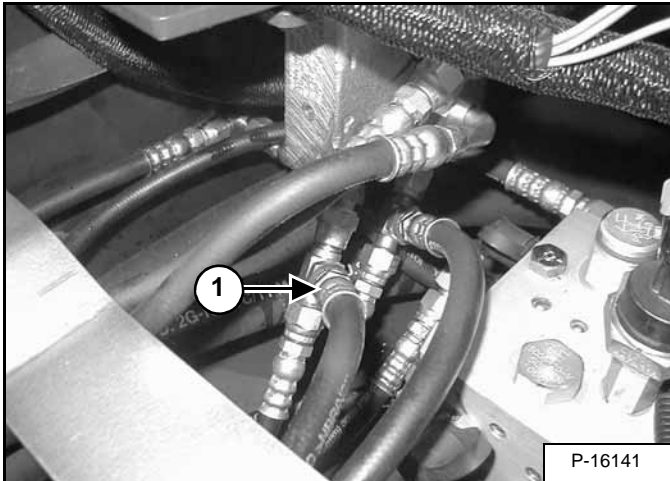
### Timing Procedure (Cont'd)

Figure 30-60-102



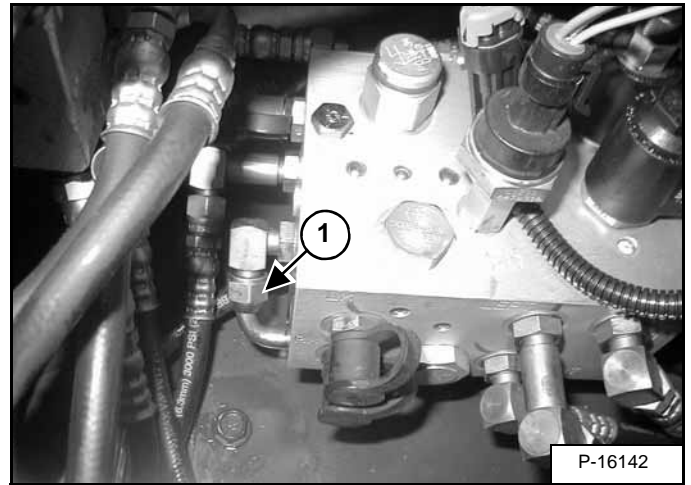
Install a cap (Item 1) [Figure 30-60-102] and tighten.

Figure 30-60-103



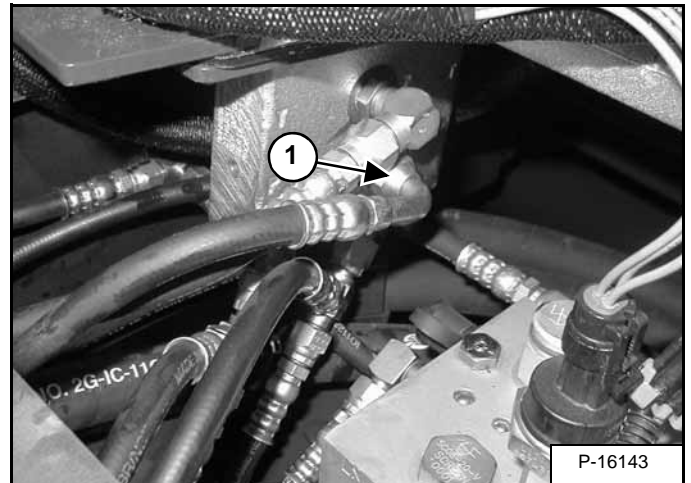
Connect the hose that was removed from the right controller, to the T-fitting at the left controller (Item 1) [Figure 30-60-103], at the port marked 1 and tighten.

Figure 30-60-104



Disconnect the hydraulic hose (Item 1) [Figure 30-60-104] that comes from the hydrostatic pump to the DA fitting on the brake/two speed block.

Figure 30-60-105



Remove the hydraulic hose (Item 1) [Figure 30-60-105] that connects to the P port on the left side controller.

Plug the hydraulic hose.

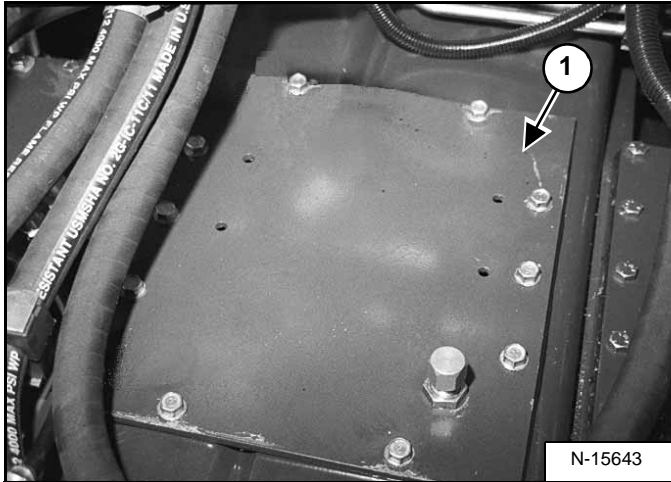


**Bobcat®**

## BRAKE (CONT'D)

### Parking Brake Removal And Installation

Figure 40-10-29



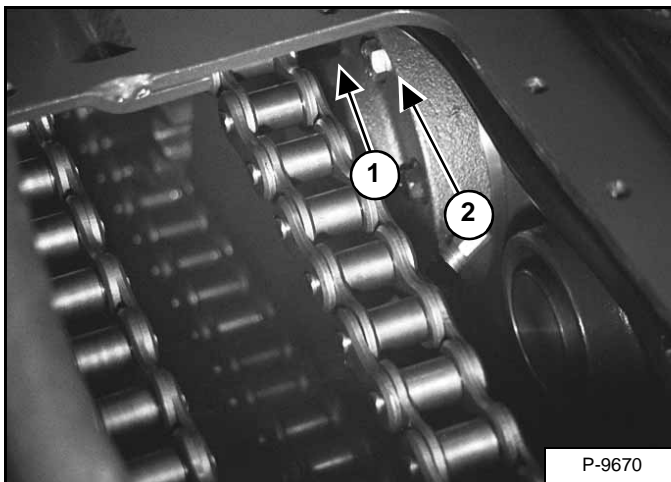
Lift and block the loader. (See LIFTING AND BLOCKING THE LOADER on Page 10-20-1.)

Raise the operator cab. (See Raising The Operator Cab on Page 10-70-1.)

Remove the brake/two speed block from the center cover on the chaincase. (See Two Speed Block Removal And Installation on Page 40-10-3.)

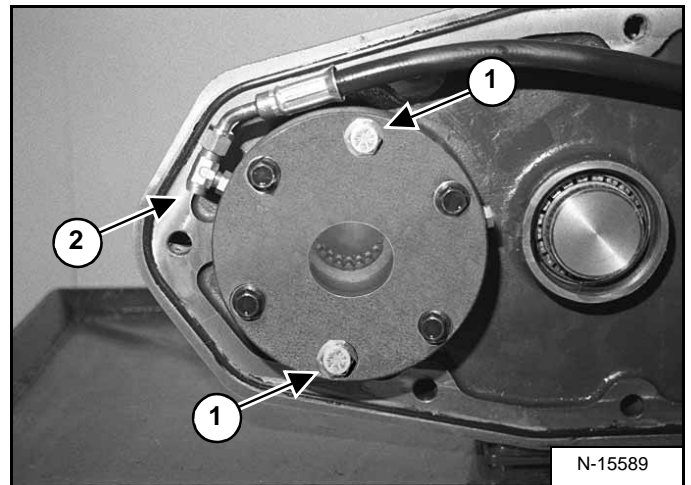
Remove the bolts from the center cover (Item 1) [Figure 40-10-29] on the chaincase.

Figure 40-10-30



Disconnect the cross-over hose (Item 1) [Figure 40-10-30] at the fitting on the brake housing.

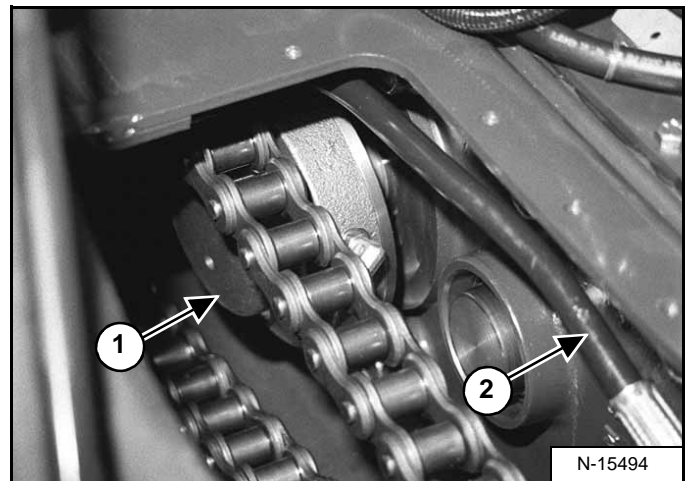
Figure 40-10-31



Remove the two mounting bolts (Item 2) [Figure 40-10-31] and (Item 1) [Figure 40-10-31].

**Installation:** Tighten the mounting bolts to 70 ft.-lbs. (95 Nm) torque.

Figure 40-10-32



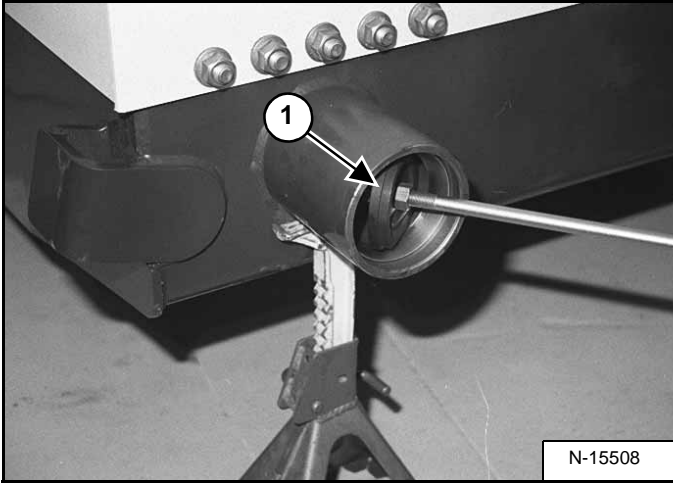
Remove the parking brake (Item 1) [Figure 40-10-32] from the reduction gearcase housing.

**Installation:** Cap the T-fitting (Item 2) [Figure 40-10-31]. Connect a Port-a-Power to the hose (Item 2) [Figure 40-10-32]. Pump the Port-a-Power until the pressure releases the brake discs so they can be aligned on the reduction gearcase splined shaft.

## DRIVE COMPONENTS (CONT'D)

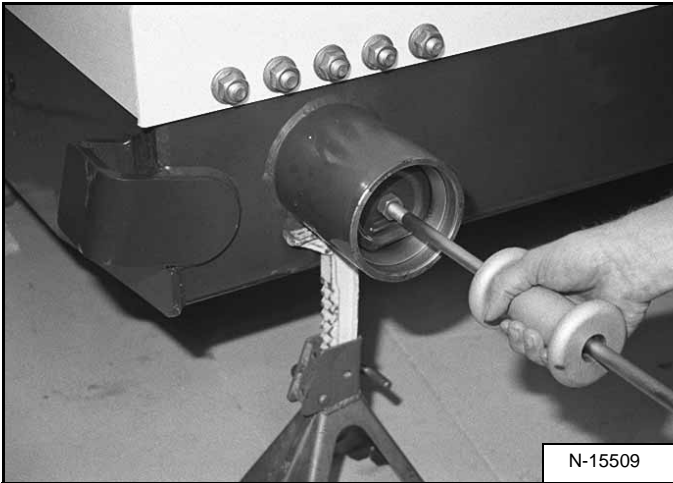
### Axle, Bearings And Sprocket Removal And Installation (Cont'd)

Figure 40-20-19



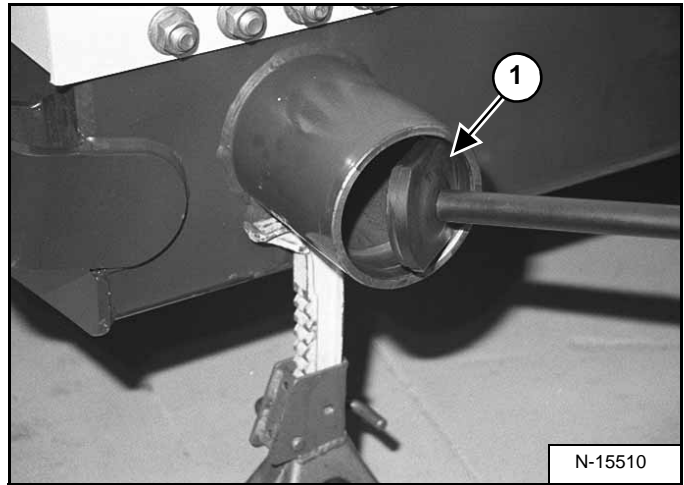
Install the bearing cup puller tool (Item 1) [Figure 40-20-19] (MEL1201-13) into the axle tube behind the bearing cup.

Figure 40-20-20



Pull the bearing cup from the axle tube [Figure 40-20-20].

Figure 40-20-21



Using the long driver tool handle, install the bearing cup tool (Item 1) [Figure 40-20-21] (MEL1202-13).

Figure 40-20-22

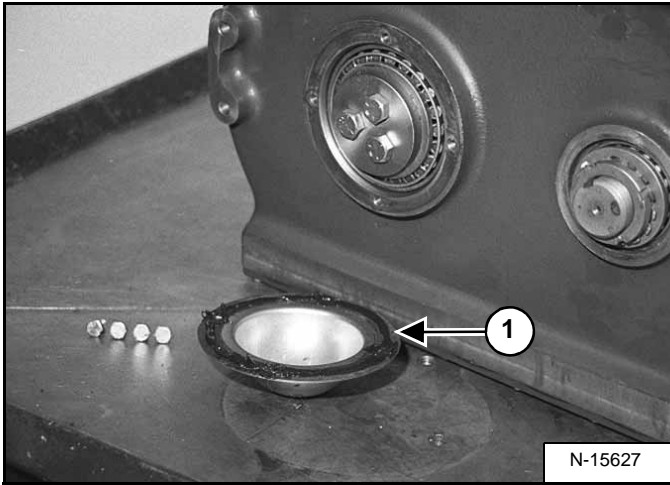


Remove the inner bearing cup from the axle tube [Figure 40-20-22].

## CHAINCASE (CONT'D)

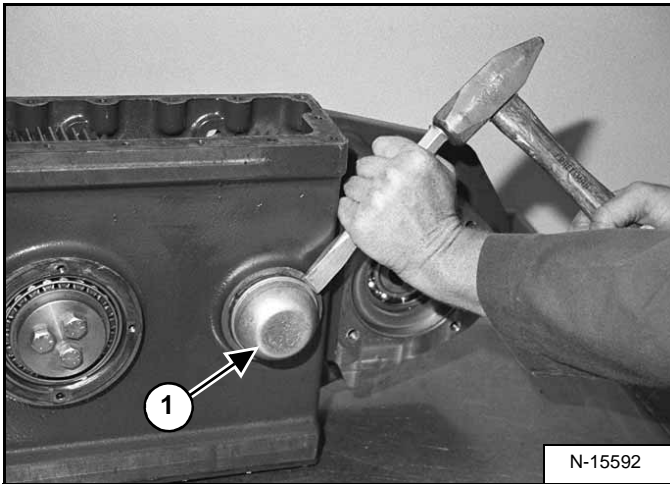
### Reduction Gearcase Disassembly And Assembly (Cont'd)

Figure 40-30-19



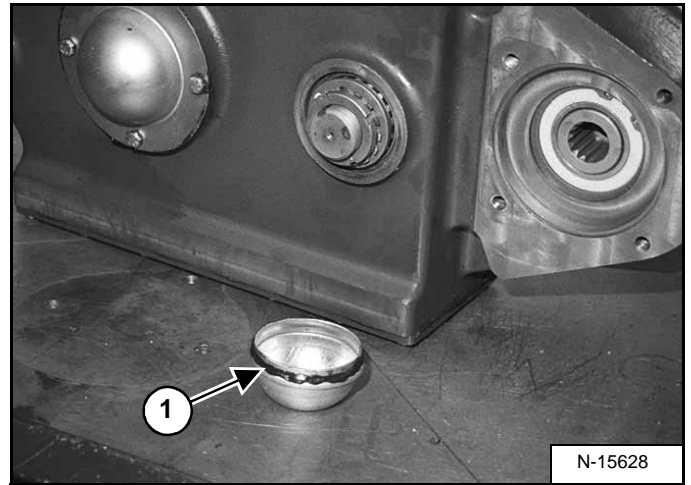
**Assembly:** Put R.T.V. sealant (Item 1) [Figure 40-30-19] on the cover before installation.

Figure 40-30-20



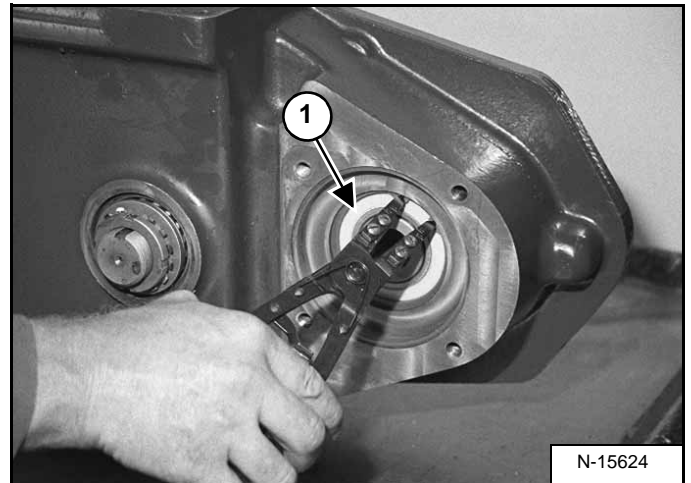
Using a chisel and hammer remove the idler shaft cover (Item 1) [Figure 40-30-20].

Figure 40-30-21



**Assembly:** Put R.T.V. sealant (Item 1) [Figure 40-30-21] on the cover before installation.

Figure 40-30-22

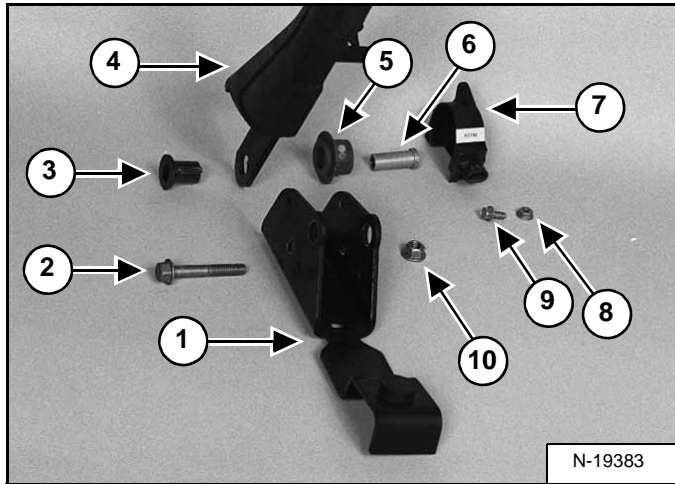


Remove the snap ring (Item 1) [Figure 40-30-22] from the input/brake shaft.

## SEAT BAR (CONT'D)

### Assembling Components

Figure 50-10-5

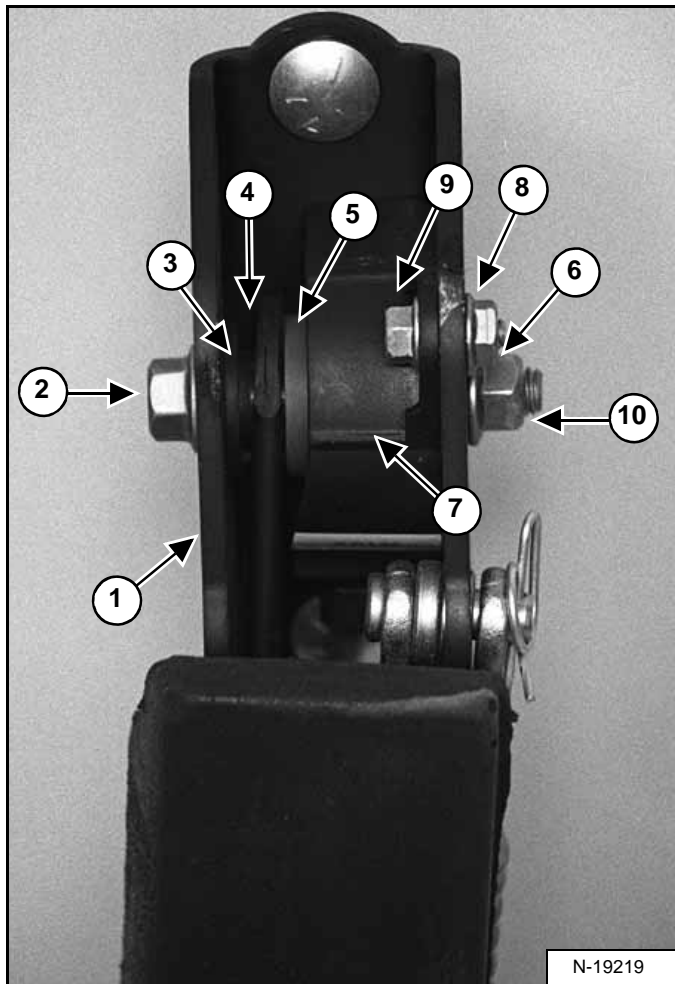


Assemble the parts as shown for the left side of the seat bar pivot assembly [Figure 50-10-5] & [Figure 50-10-6].

- Seat Bar Mount (Item 1)
- Mounting Bolt (Item 2)
- Keyed Plastic Bushing (Item 3)
- Seat Bar (Item 4)
- Magnetic Bushing Assembly (Item 5)
- Pivot Bushing (Item 6)
- Sensor Bracket (Item 7)
- Sensor Mounting Nut (Item 8)
- Sensor Mounting Bolt (Item 9)
- Mounting Nut (Item 10)

**Installation:** Tighten the mounting bolt (Item 2) [Figure 50-10-5] & [Figure 50-10-6] to 50-70 in.-lbs. (5,6-7,9 Nm) torque.

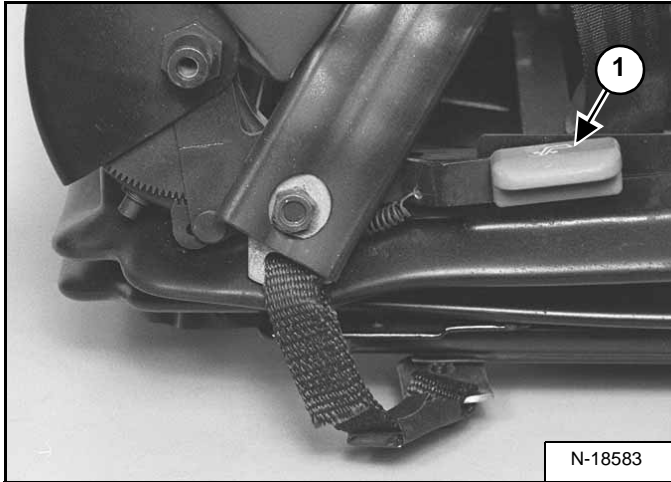
Figure 50-10-6



## OPERATOR SEAT (CONT'D)

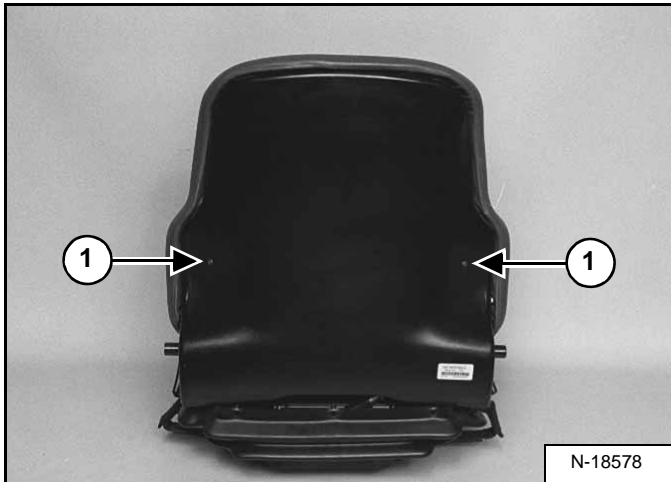
### Back Removal And Installation

Figure 50-30-7



Pull the seat back adjustment lever (Item 1) [Figure 50-30-7] and tilt the seat back all the way forward.

Figure 50-30-8



Remove the two mounting screws (Item 1) [Figure 50-30-8] from the seat back and remove the back.

Reverse the removal procedure to install the operator seat back.

## Shock Removal And Installation

Figure 50-30-9

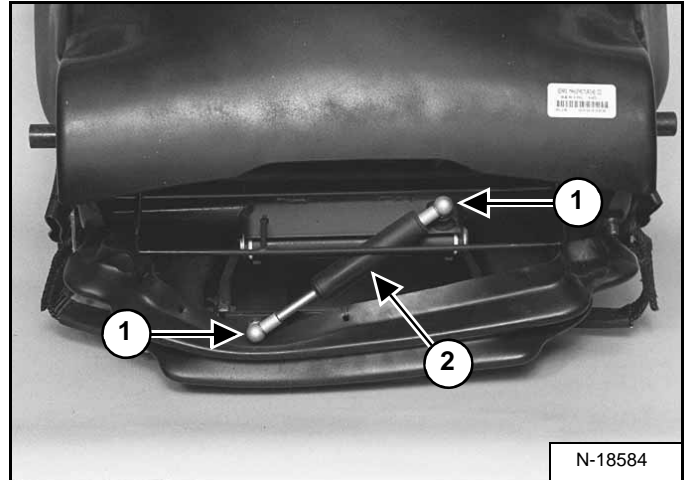
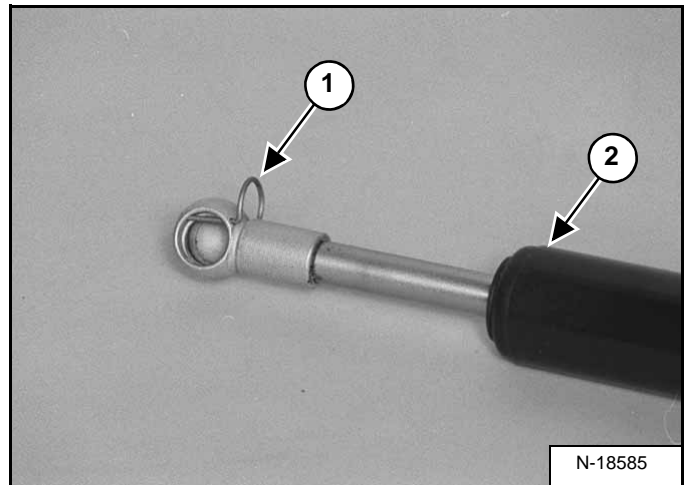


Figure 50-30-10



Raise the operator cab. (See Raising The Operator Cab on Page 10-70-1.)

Remove the operator seat. (See Removal And Installation on Page 50-30-1.)

Remove the seat shock retaining pin (Item 1) [Figure 50-30-9] & [Figure 50-30-10] (Both ends.)

Remove the seat shock (Item 2) [Figure 50-30-9] & [Figure 50-30-10].

## LIFT ARMS (CONT'D)

### Removal And Installation (Cont'd)

Figure 50-50-12

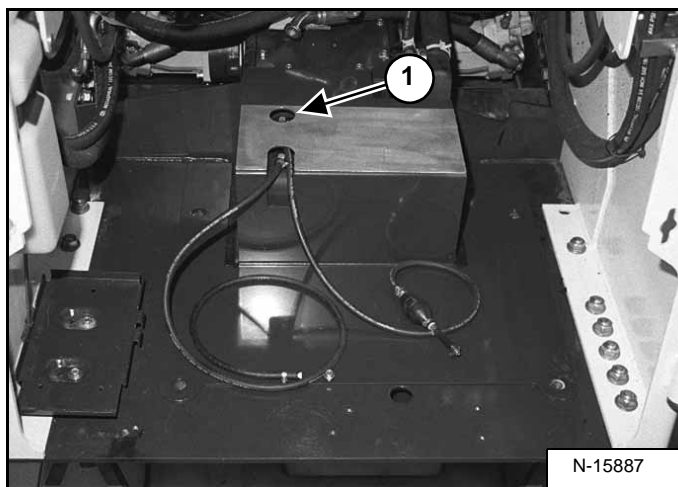


Remove the lift arms from the loader frame [Figure 50-50-12].

## FUEL TANK (CONT'D)

### Pick-up Tube Screen

Figure 50-80-15



Remove the fitting (Item 1) [Figure 50-80-15] with the pick-up tube from the fuel tank.



## ELECTRICAL SYSTEM INFORMATION (CONT'D)

### Solenoid Test

Figure 60-10-8



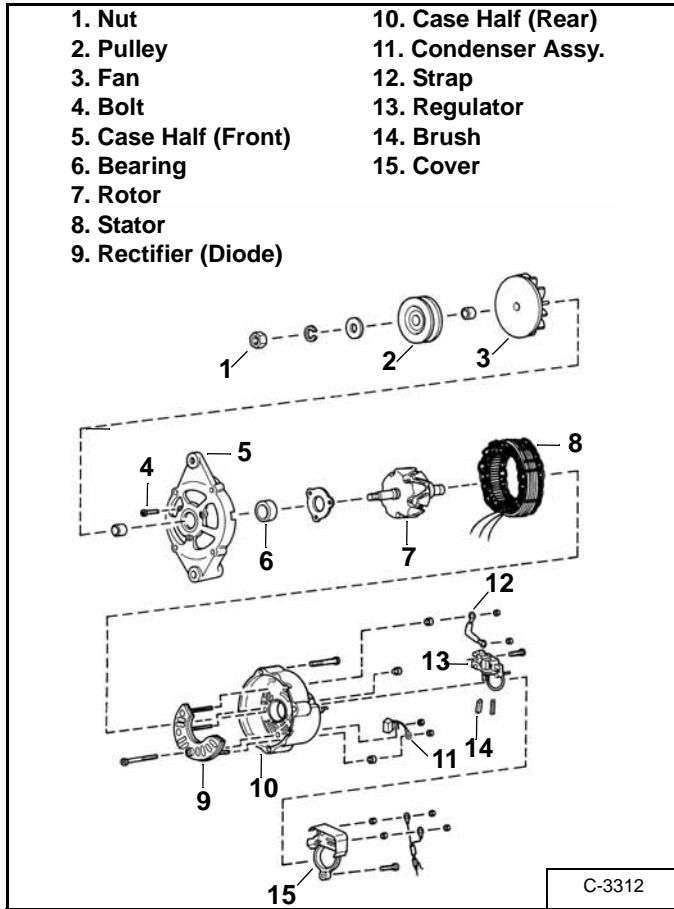
Use a test meter to measure coil resistance [**Figure 60-10-8**]. Coil wires do not have polarity. Correct resistance for the pressure relief (small) coil is 7-10 ohm and the other coils 5-8 ohms.

Replace the test meter with 12 volt power. You can see and hear the spool shift.

## ALTERNATOR (CONT'D)

### Disassembly

Figure 60-30-13



Disassemble the alternator. (See Parts Identification [Figure 60-30-13].)

Remove the regulator cover and regulator.

Remove the four bolts holding halves together.

Pry the halves apart.

Use a soft jaw vise to hold rotor while removing pulley nut.

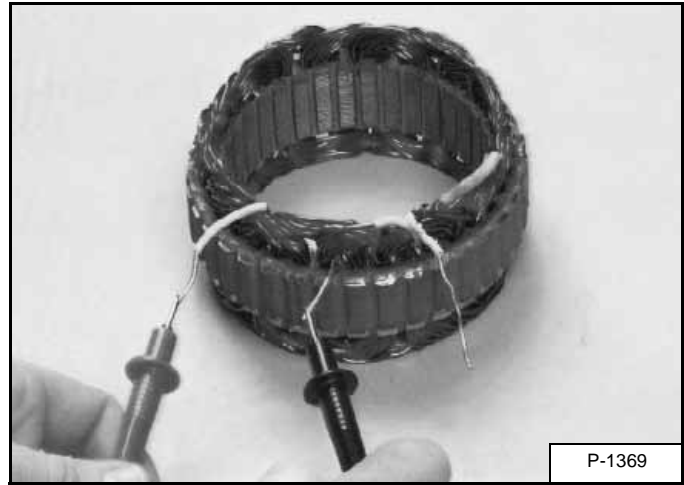
Remove front case half from the rotor using a plastic hammer.

Un-solder the stator leads from the rectifier. Remove the stator.

### Stator Continuity Test

Use an ohmmeter to test the stator.

Figure 60-30-14



Touch the probes to two of the bare stator wires [Figure 60-30-14].

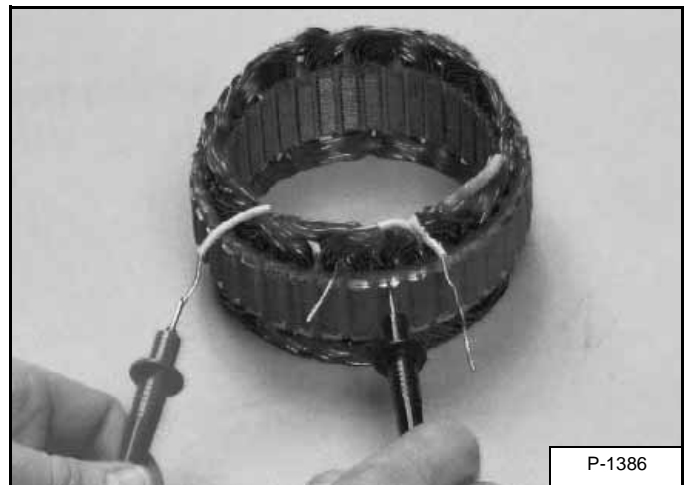
Move one of the probes to the third wire.

The readings should be the same.

If there is no continuity, replace the stator.

### Stator Ground Test

Figure 60-30-15



Touch one probe to a bare stator lead and the other probe to the bare metal surface of the stator [Figure 60-30-15].

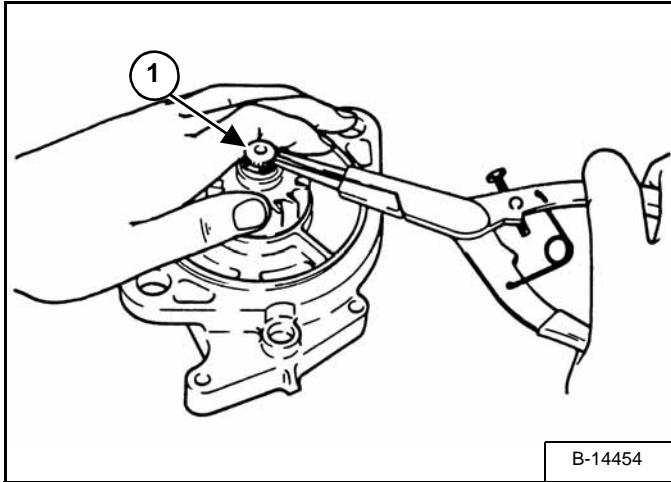
There should be no continuity.

Replace the stator if there is continuity.

## STARTER (CONT'D)

### External Pinion (Cont'd)

Figure 60-40-18



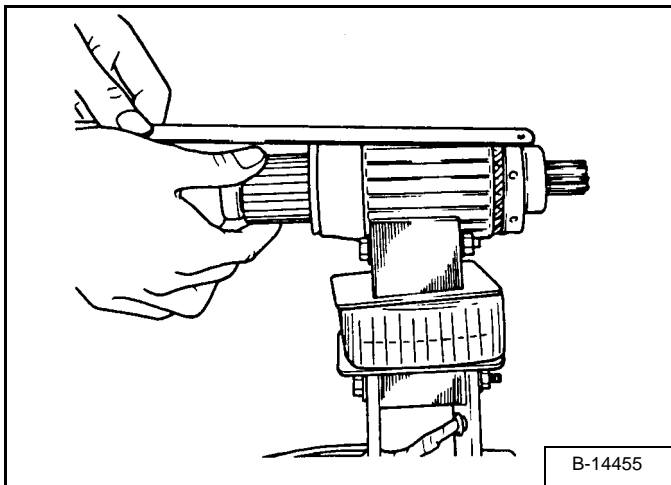
Remove the snap ring (Item 1) [Figure 60-40-18].

After the snap ring is removed, the pinion, overrunning clutch, shaft, washer, and spring can be removed.

### Inspection And Repair

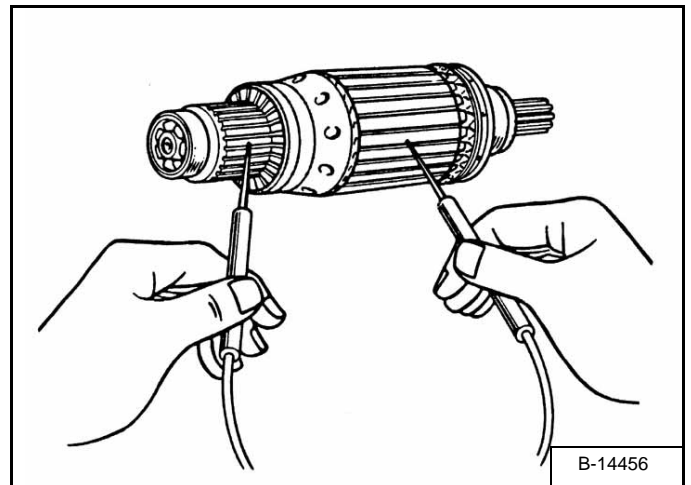
#### ARMATURE:

Figure 60-40-19



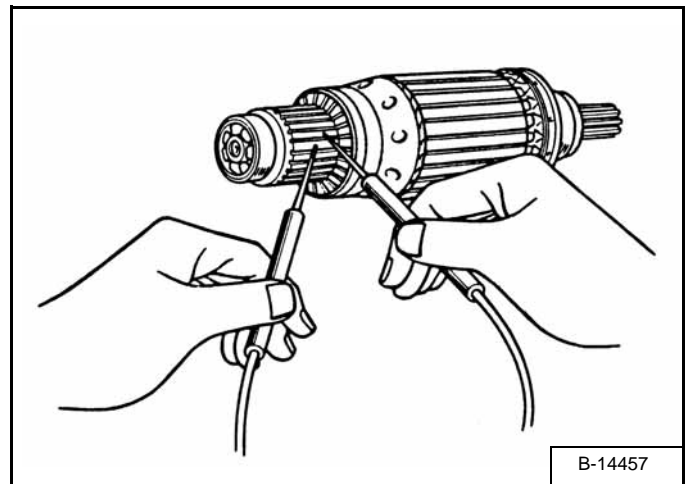
Armature Short-Circuit Test: Use a growler tester, put the armature on the growler and hold a hack saw blade against the armature core while slowly rotating the armature [Figure 60-40-19]. A short circuited armature causes the blade to vibrate and be attracted to the core. An armature which is short-circuited must be replaced.

Figure 60-40-20



Armature Winding Ground Test: Use a circuit tester, touch one probe to a commutator segment and the other probe to the armature core [Figure 60-40-20]. There should be no continuity. If there is continuity, the armature is grounded and must be replaced.

Figure 60-40-21



Armature Winding Continuity Test: Use a circuit tester, touch the probes to two commutator segments [Figure 60-40-21]. There should be continuity at any point. If there is no continuity, the winding is open-circuited, replace the armature.

## INSTRUMENTATION PANEL (CONT'D)

### Right Panel Setup Display Options (Deluxe) (Cont'd)

All new machines with Deluxe Instrumentation arrive at Bobcat Dealerships with the panel in locked mode. This means that a password must be used to start the engine.

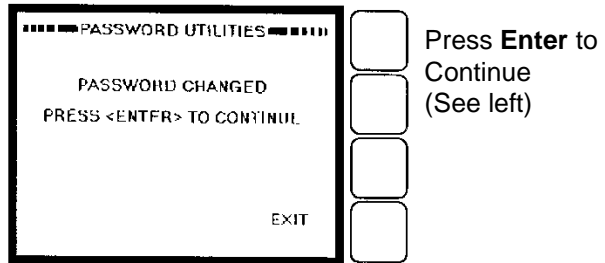
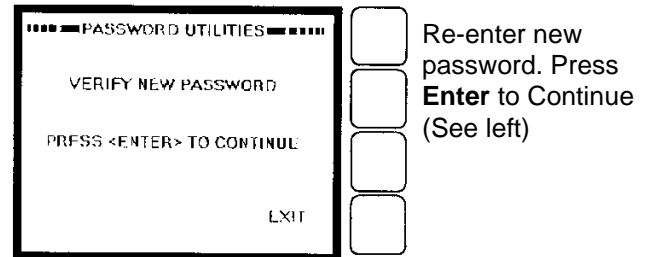
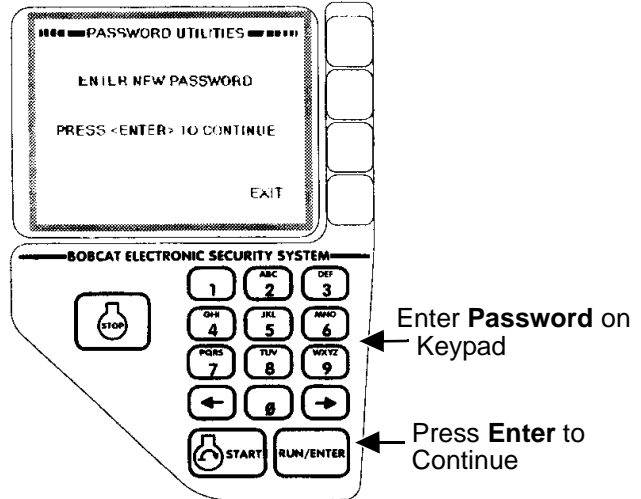
### Passwords

For security purposes, your dealer may change the password and also set it in the locked mode. Your dealer will provide you with the password.

**Owner Password:** Allows for full use of the loader and to setup the Deluxe Panel. Owner can select a password to allow starting & operating the loader and modify the setup of the Deluxe Panel. Owner should change the password as soon as possible for security of the loader.

**User Password:** Allows starting and operating the loader; cannot change password or any of the other setup features.

### Changing the Password (Cont'd)



### More EXAMPLES:

**Clocks**  
**TOOL / SETUP**  
**LOADER FEATURES**  
**DISPLAY OPTIONS**  
**CLOCKS**  
**SET CLOCK**

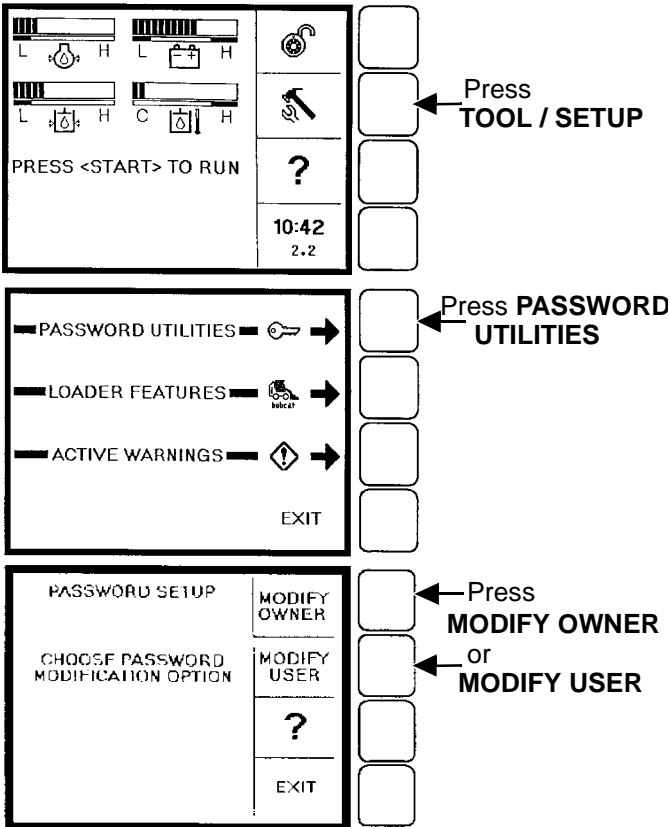
Use the keypad to set time.  
 Press **RUN / ENTER** to set clock.  
 Press **EXIT** to return to previous level menu.  
**RESET JOB CLOCK** (Password required).  
 Press **CLEAR** to reset job clock to zero.  
 Press **LOCK / UNLOCK** to unlock.  
 Enter Password and press **RUN / ENTER**.

**Languages**  
**TOOL / SETUP**  
**LOADER FEATURES**  
**DISPLAY OPTIONS**  
**LANGUAGES**

Select the language, press **RUN / ENTER**  
 Press **EXIT** to return to previous level menu.

### Changing the Password

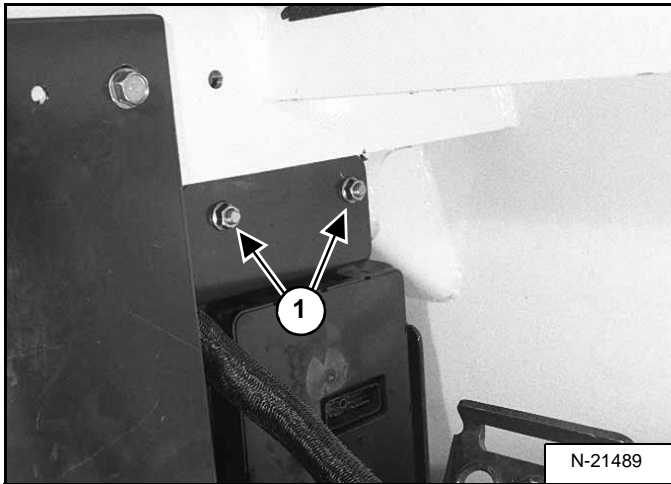
### Right Instrument Pane Display Screen



## BOBCAT CONTROLLER (CONT'D)

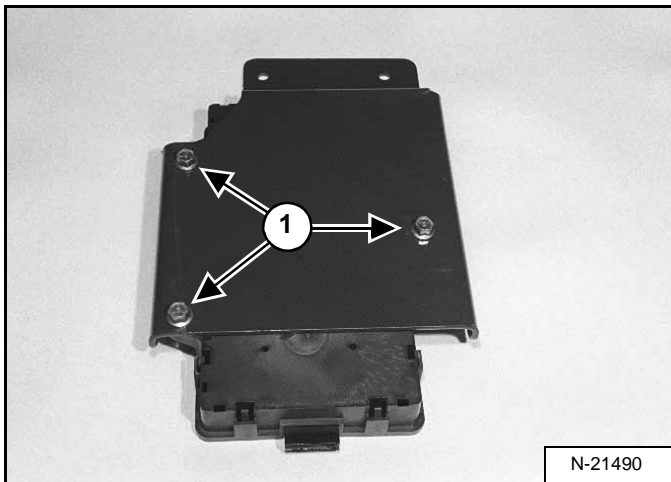
### Removal and Installation (Cont'd)

Figure 60-70-5



Remove the two mount nuts (Item 1) [Figure 60-70-5] and bolts.

Figure 60-70-6



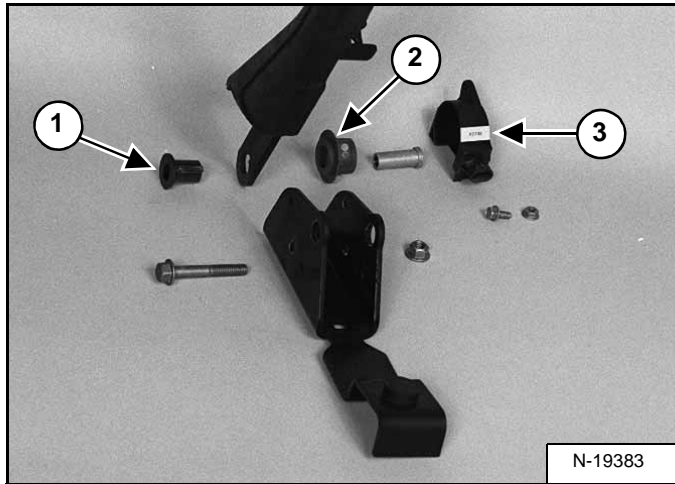
Remove the three bolts (Item 1) [Figure 60-70-6].

Remove the mount from the controller.

## SEAT BAR SENSOR (CONT'D)

### Removal And Installation (Cont'd)

Figure 60-100-7



Remove the keyed plastic bushing (Item 1) [Figure 60-100-7], magnetic bushing assembly (Item 2) [Figure 60-100-7] and sensor bracket (Item 3) [Figure 60-100-7].

**Installation:** Be sure the tabs on the pivot bushing are positioned in the slotted hole (Item 3) [Figure 60-100-7] of the seat bar

Inspect all parts for damage and wear and replace if necessary.

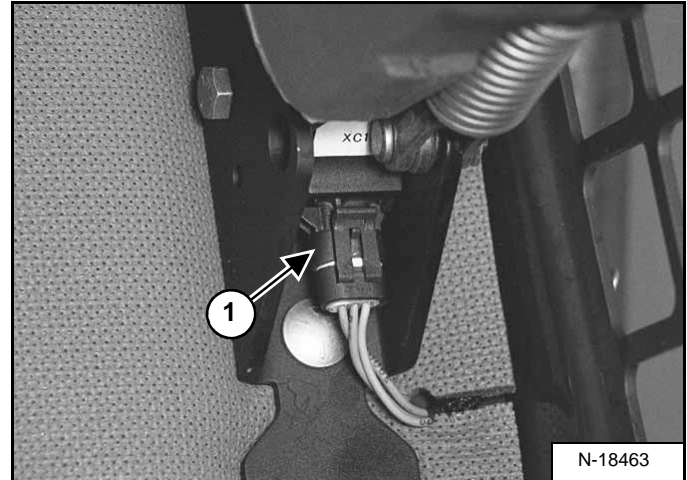
Reverse the removal procedure to install the seat bar sensor.

## BICS™ Circuit Test

Use Sensor Testers (MEL1428) and seat bar sensor tester adapter (MEL1567) for the following procedure:

Connect the seat bar sensor tester adapter MEL1567 to the sensor tester.

Figure 60-100-8

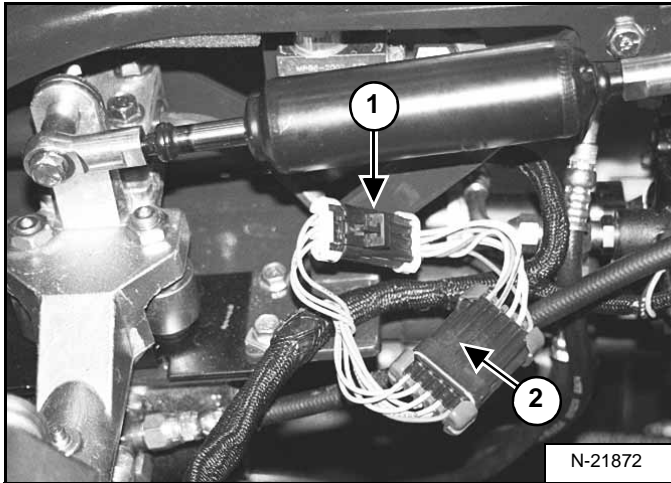


Disconnect the seat bar sensor connector (Item 1) [Figure 60-100-8].

## ADVANCED HAND CONTROL (A.H.C.) SYSTEM (CONT'D)

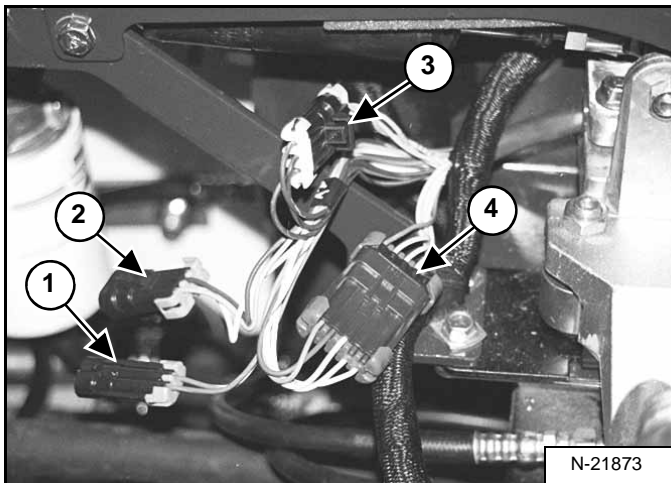
### Switch Handle Removal and Installation (Cont'd)

Figure 60-120-11



Disconnect the right switch handle connectors (Items 1 & 2) [Figure 60-120-11] from the loader wiring harness connectors.

Figure 60-120-12



Disconnect the left switch handle connectors (Items 1, 2, 3 & 4) [Figure 60-120-12] from loader wiring harness connectors.

Remove the connector locks and connectors from the wires to remove the switch handle from the steering handle.

**Installation:** The wire colors of the steering lever harness are as follows:

#### *Right Switch Handle*

##### Ten-Pin Connector

- A-Terminal - Orange
- B-Terminal - White
- C-Terminal - White/Black
- D-Terminal - White/Red
- E-Terminal - Green
- F-Terminal - White/Green
- G-Terminal - Blank
- H-Terminal - Lt. Green
- J-Terminal - Yellow
- K-Terminal - Blank

##### Three-Pin Connector

- A-Terminal - Pink/Red
- B-Terminal - Pink/Black
- C-Terminal - Pink/Lt. Green

#### *Left Switch Handle*

##### Ten-Pin Connector

- A-Terminal - Orange
- B-Terminal - Dk. Blue
- C-Terminal - White
- D-Terminal - Blank
- E-Terminal - Blank
- F-Terminal - Yellow/Red
- G-Terminal - Yellow/Green
- H-Terminal - Blank
- J-Terminal - Blank
- K-Terminal - Blank

##### Three-Pin Connector

- A-Terminal - Brown/Red
- B-Terminal - Brown/Black
- C-Terminal - Brown/Lt. Green

##### Two-Pin Connector

- A-Terminal - Orange/Blue
- B-Terminal - Orange/White

##### Five-Pin Connector

- A-Terminal - Green
- B-Terminal - Brown
- C-Terminal - Blank
- D-Terminal - Yellow
- E-Terminal - Blank

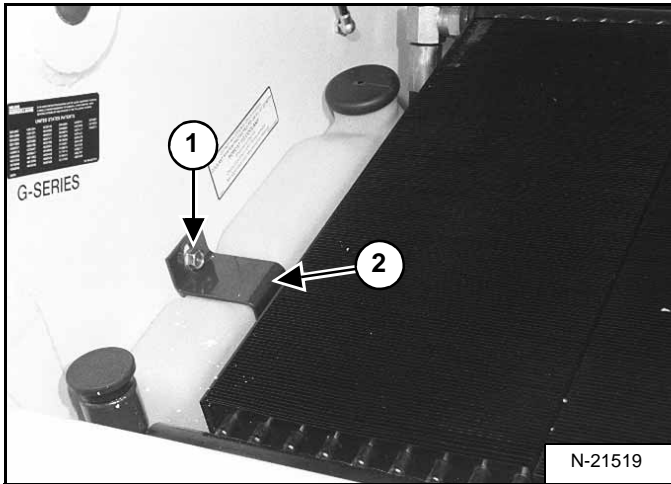


**Bobcat®**

## RADIATOR

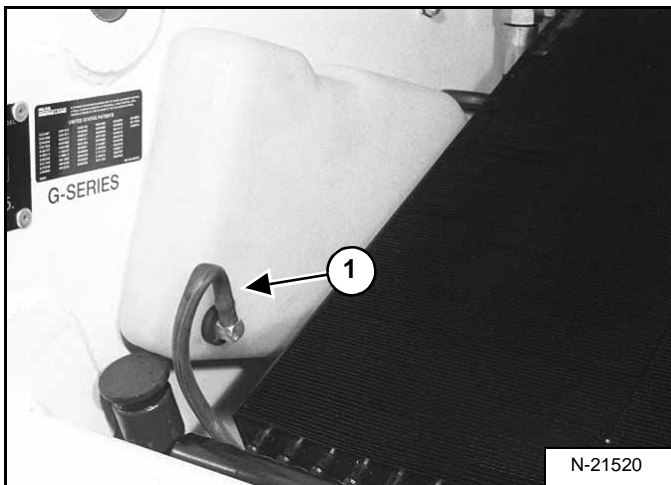
### Coolant Recovery Tank Removal And Installation

Figure 70-50-1



Remove the mounting bolt (Item 1) [Figure 70-50-1] and remove the overflow tank mounting bracket (Item 2) [Figure 70-50-1] from the loader.

Figure 70-50-2

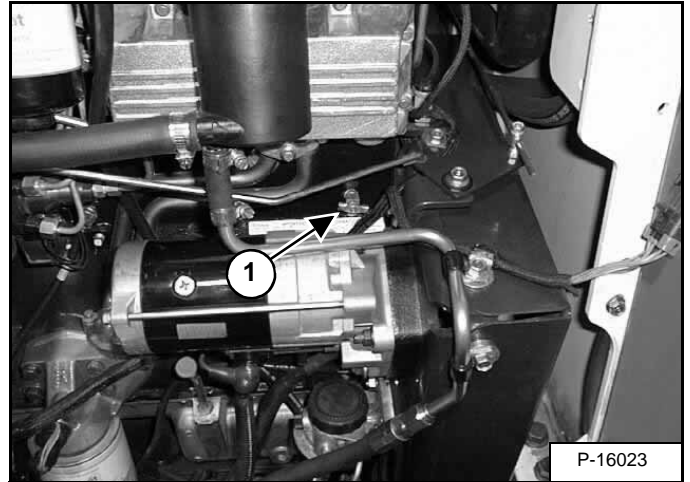


Tilt the overflow tank and remove the hose (Item 1) [Figure 70-50-2].

Remove the overflow tank from the loader.

## Removal And Installation

Figure 70-50-3



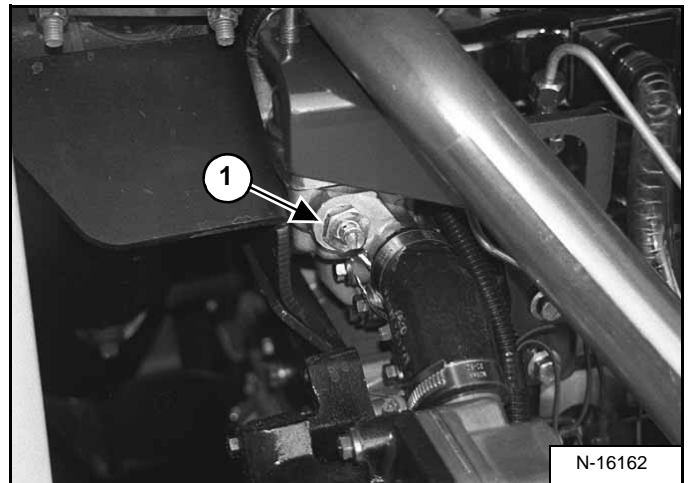
Raise the rear grill.

Remove the oil cooler. (See Removal And Installation on Page 30-80-1.)

Remove the coolant recovery tank. (See Coolant Recovery Tank Removal And Installation on Page 70-50-1.)

Connect a hose to the drain valve (Item 1) [Figure 70-50-3] on the engine block.

Figure 70-50-4



Open the drain valve and drain the coolant into a container [Figure 70-50-4].

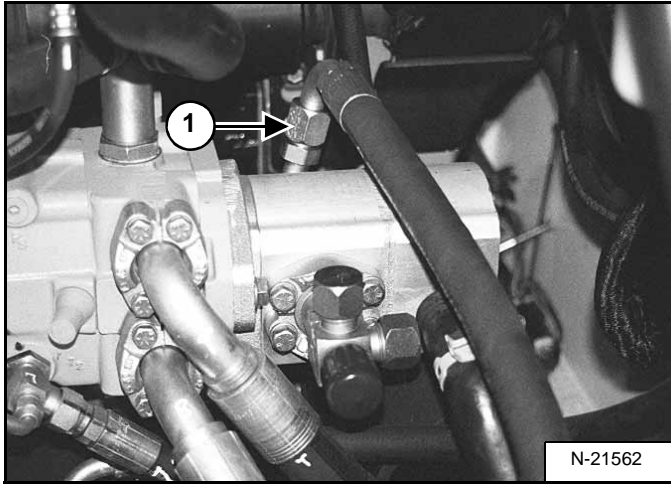


**Bobcat®**

## ENGINE AND ENGINE MOUNTS (CONT'D)

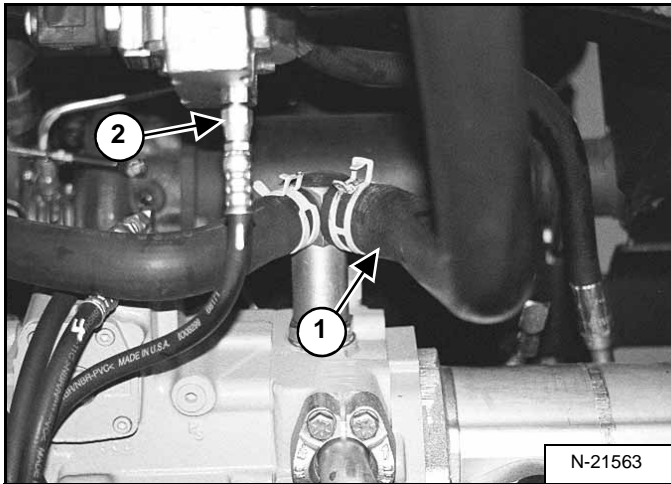
### Removal And Installation (Cont'd)

Figure 70-80-8



Disconnect the hydraulic hose (Item 1) [Figure 70-80-8] that goes from the auxiliary pump to the loader control valve.

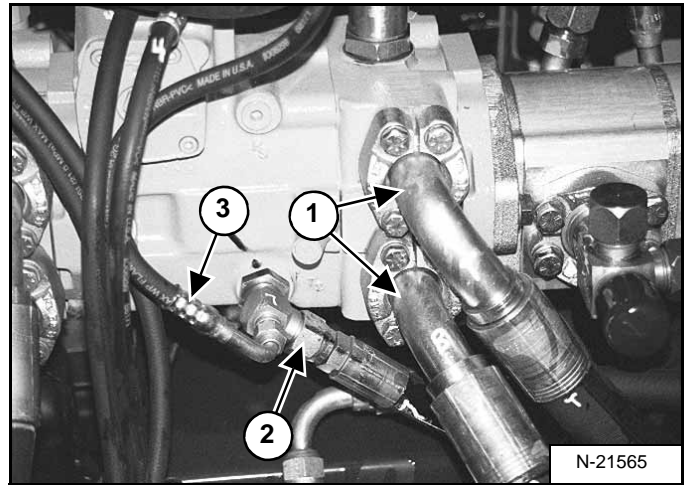
Figure 70-80-9



Disconnect the hydraulic hose (Item 1) [Figure 70-80-9] that goes from the hydrostatic pump to the filter.

Disconnect the hydraulic hose (Item 2) [Figure 70-80-9] from the hydraulic fan motor.

Figure 70-80-10



Disconnect the two left side drive motor hoses (Item 1) [Figure 70-80-10] from the hydrostatic pump.

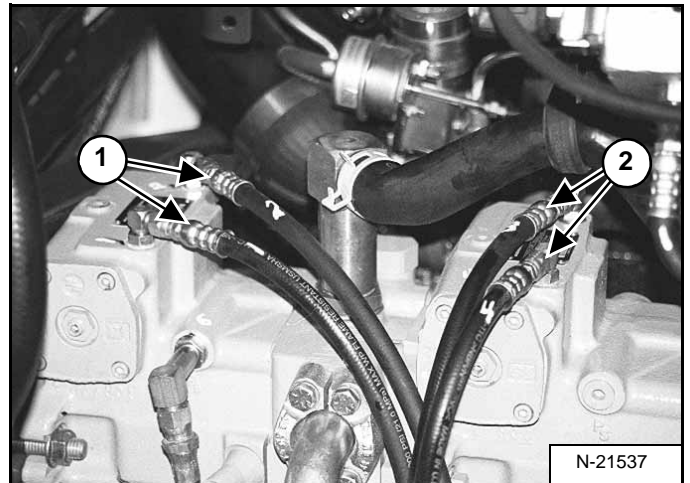
**Installation:** Tighten the eight mounting bolts to 25 ft.-lbs. (34 Nm) torque.

Disconnect the hydraulic hose (Item 2) [Figure 70-80-10] that goes from the hydrostatic pump to the hydrostatic motor.

Disconnect the hydraulic hose (Item 3) [Figure 70-80-10] that goes from the hydrostatic pump to the fan motor.

Mark the hydraulic hoses for proper installation.

Figure 70-80-11

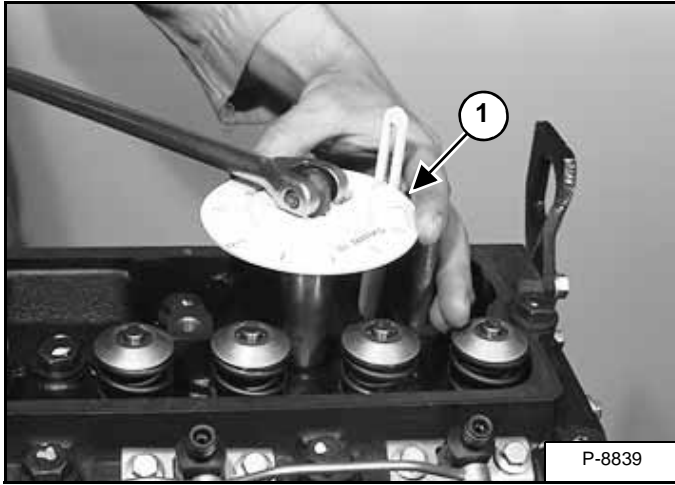


Disconnect the hydraulic hoses (Items 1 & 2) [Figure 70-80-11] from the hydrostatic pumps.

## RECONDITIONING THE ENGINE (CONT'D)

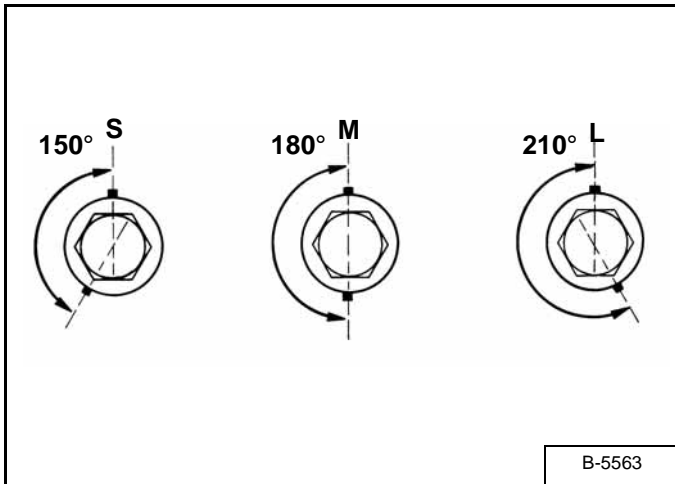
### Cylinder Head Installation (Cont'd)

Figure 70-100-16



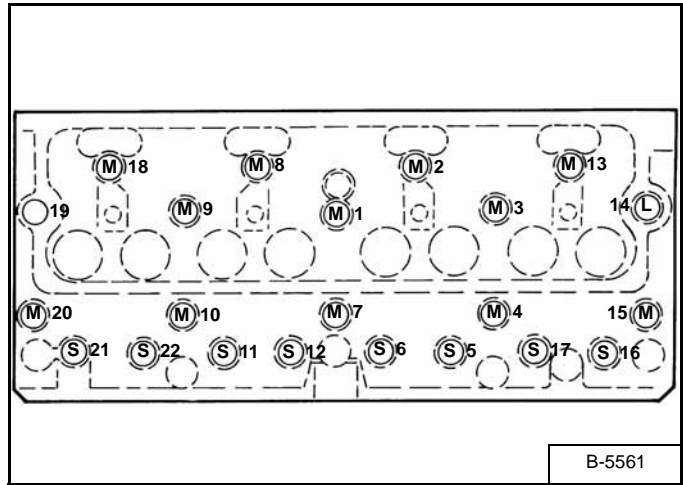
Additional tightening of the head bolts requires the use of a torque angle gauge (Item 1) [Figure 70-100-16]. Tighten the short bolts 150°, medium bolts 180° and long bolts 210°, in the same sequence as shown in [Figure 70-100-16].

Figure 70-100-17



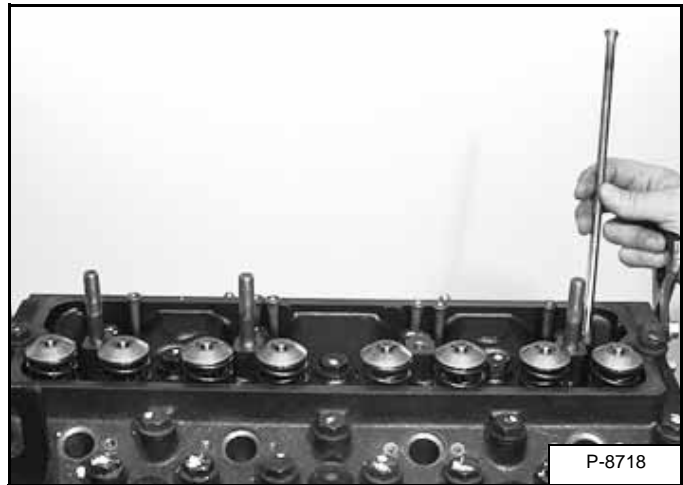
If no angle gauge is available make a suitable mark on the head bolt corner. Make another mark on the cylinder head the correct number of flats away [Figure 70-100-17]. Turn the head bolt until the lines match.

Figure 70-100-18



Tighten short bolts 2.5 flats, medium bolts 3 flats, and long bolts 3.5 flats in the same sequence as shown in [Figure 70-100-18].

Figure 70-100-19



Install the push rods [Figure 70-100-19].

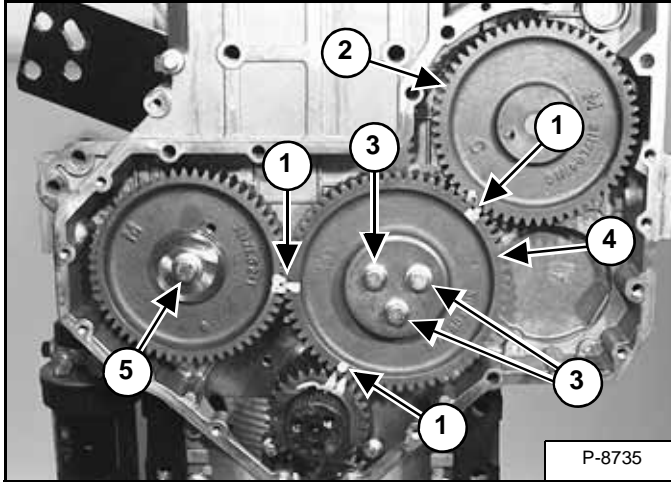
Make sure the push rods seat in the tappet sockets.

## RECONDITIONING THE ENGINE (CONT'D)

### Timing Case And Gear Removal

Remove the timing cover. (See Timing Cover Removal on Page 70-100-15.)

Figure 70-100-46



Rotate the crank shaft until the timing marks (Item 1) [Figure 70-100-46] are lined up.

Remove the fuel injection pump gear (Item 2) [Figure 70-100-46].

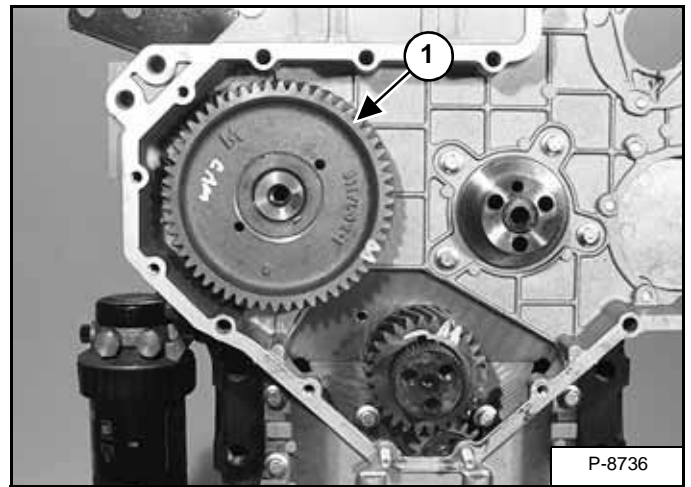
Remove the three bolts (Item 3) [Figure 70-100-46] from the idler gear (Item 4) [Figure 70-100-46].

Remove the idler gear (Item 4) [Figure 70-100-46].

**NOTE: Do not turn the crankshaft with the idler gear removed.**

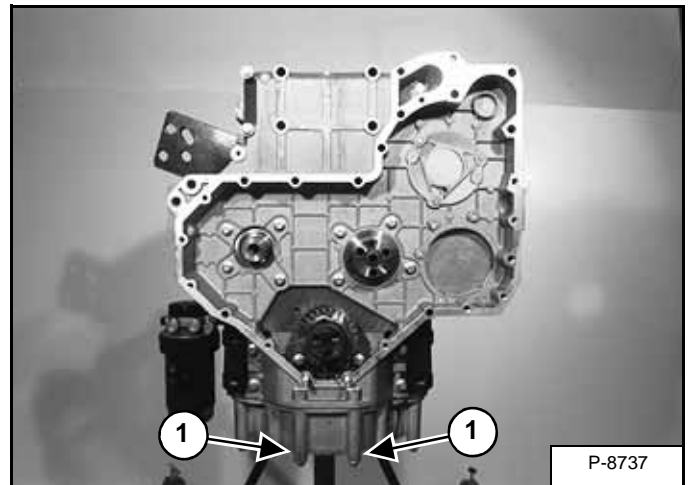
Remove the cam gear retaining bolt (Item 5) [Figure 70-100-46].

Figure 70-100-47



Remove the cam gear (Item 1) [Figure 70-100-47].

Figure 70-100-48



Remove all the timing case bolts [Figure 70-100-48].

Remove the two bolts (Item 1) [Figure 70-100-48] from the front of the oil pan.

## RECONDITIONING THE ENGINE (CONT'D)

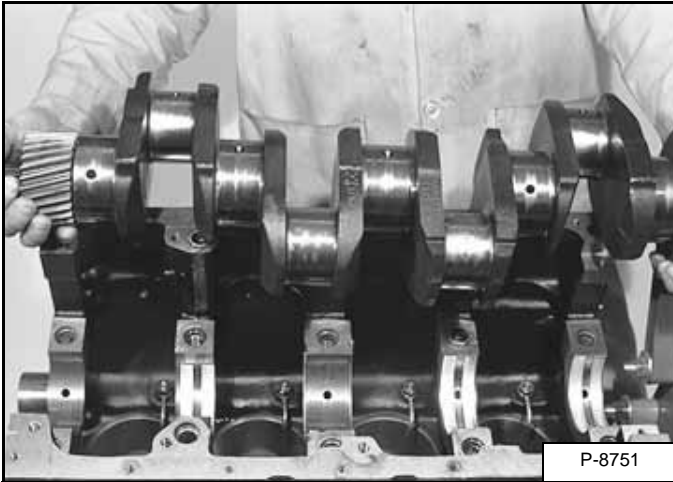
### Crankshaft And Bearings Removal (Cont'd)

Figure 70-100-82



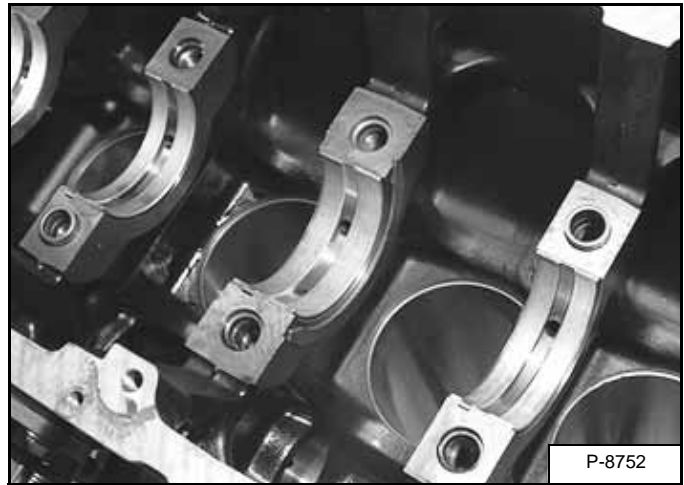
Remove the thrust washers from the sides of the center main bearing bore [Figure 70-100-82].

Figure 70-100-83



Remove the crankshaft [Figure 70-100-83].

Figure 70-100-84

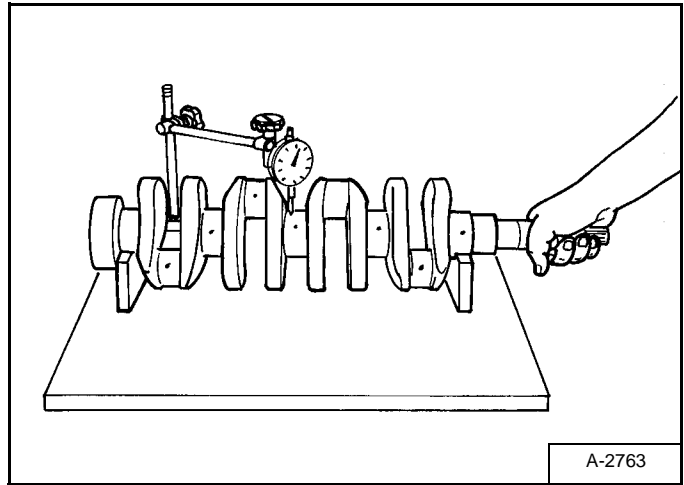


Remove the crankshaft bearings from the engine block [Figure 70-100-84].

Keep the bearings with their respective caps for installation.

### Inspection Of Crankshaft And Bearings

Figure 70-100-85



Check the crankshaft for wear [Figure 70-100-85]. The maximum wear and out of round of the crank journals is 0.0016 inch (0,04 mm).

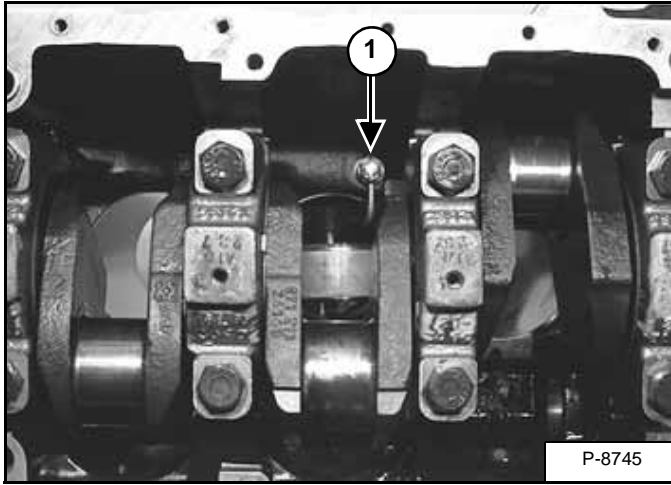
The main journals and the crank pins of standard size can be machined 0.010 inch (0,25 mm) 0.020 inch (0,50 mm) or 0.030 inch (0,75 mm).

**NOTE:** (See Crankshaft on Page SPEC-20-4.) for more crankshaft specifications.

## RECONDITIONING THE ENGINE (CONT'D)

### Engine Lubrication System Description (Cont'd)

Figure 70-100-121

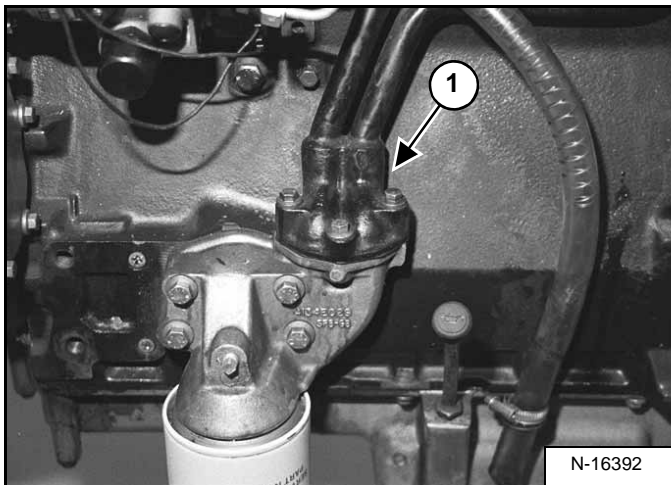


Turbocharged engines have piston cooling jets (Item 1) [Figure 70-100-121]. These jets are connected to the oil pressure rail and spray lubricating oil inside the pistons to keep them cool.

#### Oil Filter Adapter Removal

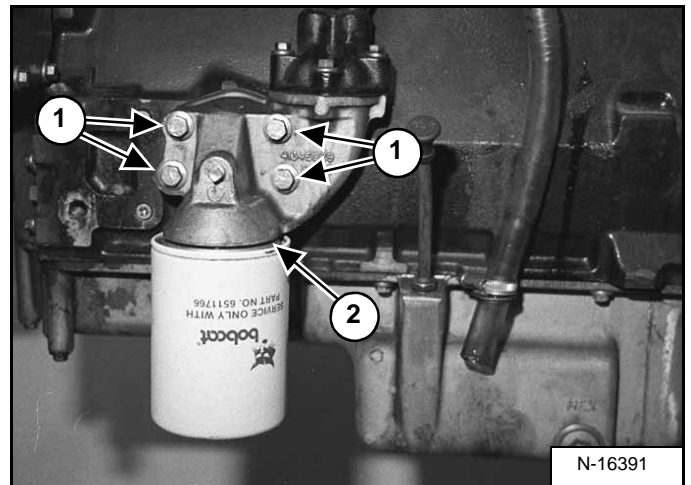
Remove the oil filter.

Figure 70-100-122



Remove the oil cooler pipes (Item 1) [Figure 70-100-122] from the filter adapter. Disconnect the turbocharger oil supply line.

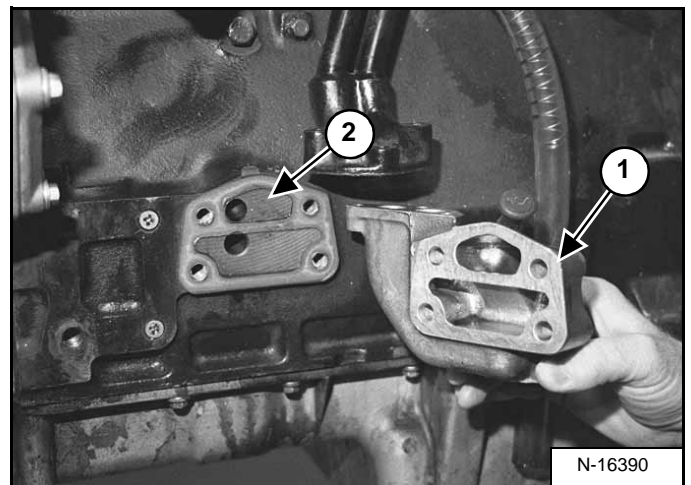
Figure 70-100-123



Remove the four bolts (Item 1) [Figure 70-100-123] and the filter adapter (Item 2) [Figure 70-100-123].

#### Oil Filter Adapter Installation

Figure 70-100-124



Clean the filter adapter (Item 1) [Figure 70-100-124] and the block mounting surfaces (Item 2) [Figure 70-100-124].

Using a new gasket, install the adapter (Item 1) [Figure 70-100-124] on the block.

Connect the turbocharger oil supply line.

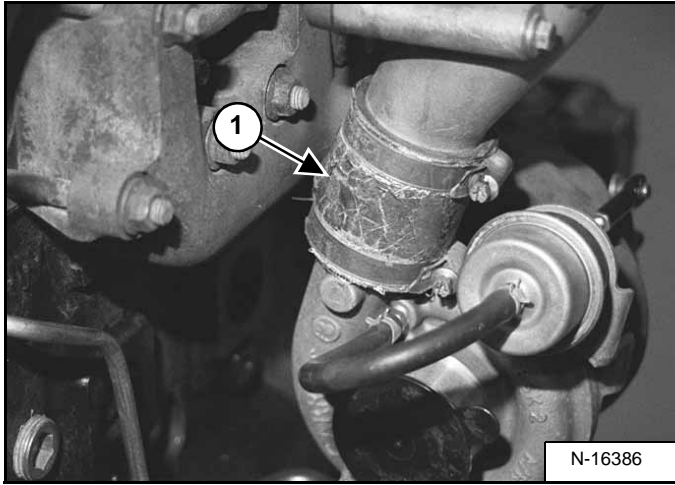
Connect the oil cooler lines to the filter adapter.

Install the oil filter.

## RECONDITIONING THE ENGINE (CONT'D)

### Turbo Charger Removal and Installation (Cont'd)

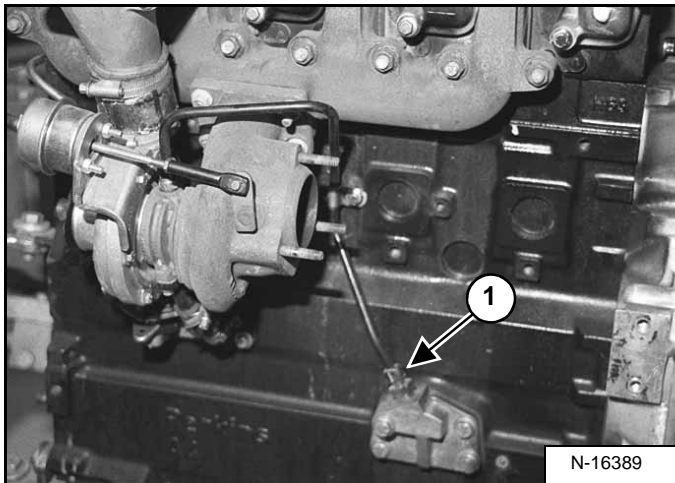
Figure 70-100-148



Thoroughly clean the turbocharger.

Loosen the hose clamps at the compressor outlet hose (Item 1) [Figure 70-100-148].

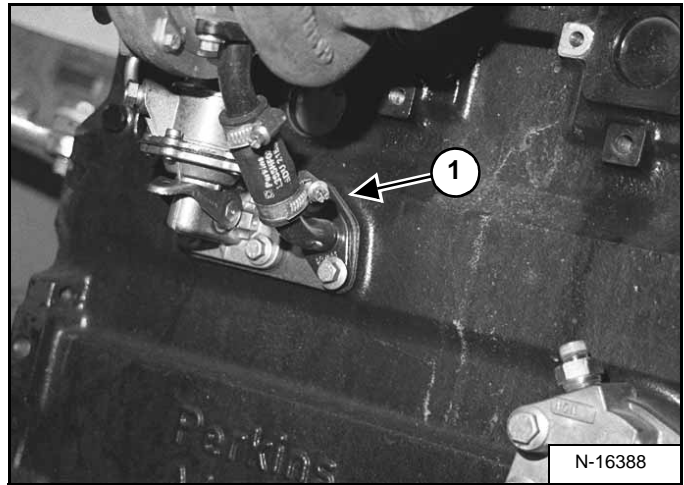
Figure 70-100-149



Disconnect the oil supply tubeline (Item 1) [Figure 70-100-149].

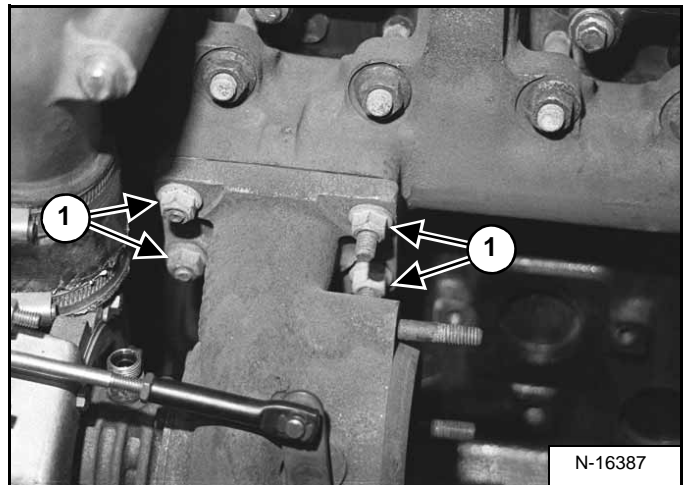
**Installation:** Fill the bearing housing with clean oil through the oil supply port.

Figure 70-100-150



Remove the oil return line (Item 1) [Figure 70-100-150].

Figure 70-100-151



Remove the four nuts (Item 1) [Figure 70-100-151] for the turbocharger to exhaust manifold flange.

**Installation:** Apply anti-seize compound to the mounting studs. Tighten the nuts to 33 ft.-lbs. (44 Nm) torque.

Remove the turbocharger and gasket from the exhaust manifold.

The turbocharger must only be serviced by an authorized repair shop.

Before starting the engine, disconnect the electrical stop control. Crank the engine until oil pressure is obtained. Stop cranking and reconnect the stop control.

## SAFETY

### Safety Equipment

# ! WARNING

In the event of a leakage, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R134a refrigerant gives a toxic gas.

W-2371-0500

Figure 80-30-1



In servicing A/C and heater systems you will be exposed to high pressures, temperatures and several chemical hazards. Moving belts and pulleys are normal shop hazards.

In addition to exercising caution in your work, **DO WEAR SAFETY GLASSES OR A FACE SHIELD [Figure 80-30-1]** when you are using R-134a or a leak detector, adjusting service valves or the manifold gage set connectors. Safety glasses or a transparent face shield are practical safety items and one or the other is absolutely required.

# ! WARNING

HFC 134A refrigerant can be dangerous if not properly handled. Liquid 134A may cause blindness if it contacts the eyes and may cause serious frostbite if it contacts the skin.

- Gaseous 134A becomes lethal (phosgene) gas when it contacts open flame or very hot substances.
- **NEVER SMOKE** when there is the possibility of even small amounts of 134A in the air.

Any servicing work that involves release or addition of 134A to the system must be done by a competent refrigeration dealer who has the proper equipment, knowledge, and experience to service refrigeration equipment.

W-2373-0500

Figure 80-30-2

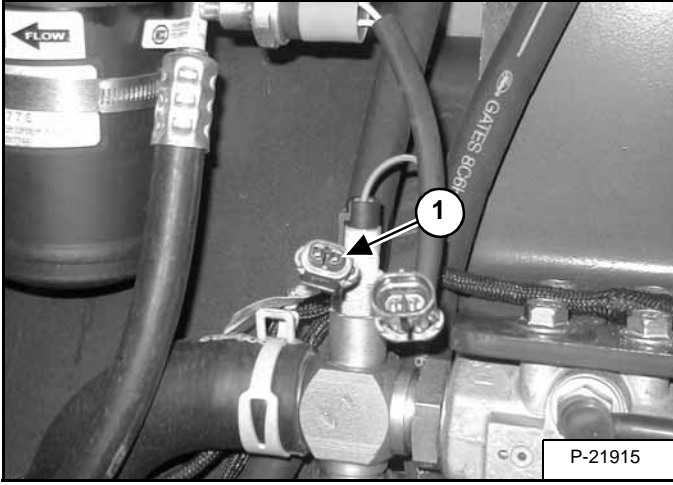


R-134a inside a canister or in an A/C system is a liquid under pressure. When it escapes or releases into the air, **ITS TEMPERATURE DROPS TO 21.6 F DEGREES "INSTANTLY"**. If it spills on your skin or in your eyes you should flood the area with cool water and **SEEK MEDICAL ATTENTION FAST!** It is a good idea to wear gloves [Figure 80-30-2] to prevent frost bite if you should get refrigerant on your hands.

## BASIC TROUBLESHOOTING (CONT'D)

### Checking The Electrical System (Cont'd)

Figure 80-50-19

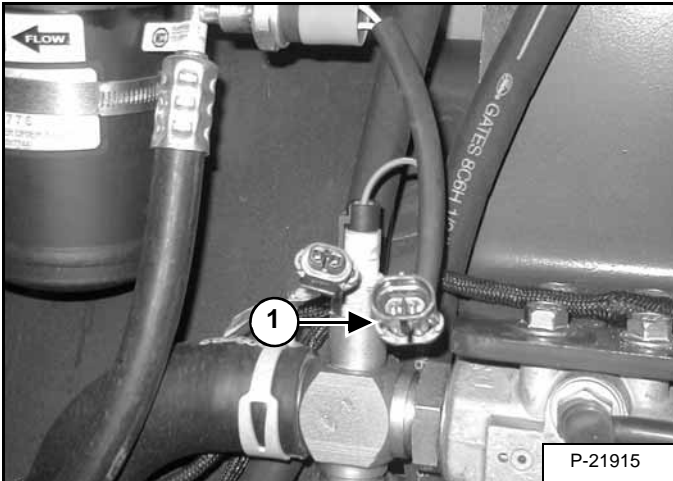


Using a multimeter check the loader wiring harness (Item 1) [Figure 80-50-19] for voltage.

The voltage should be around 12 volts.

If there is no voltage at the wiring harness, check the harness for broken wires.

Figure 80-50-20



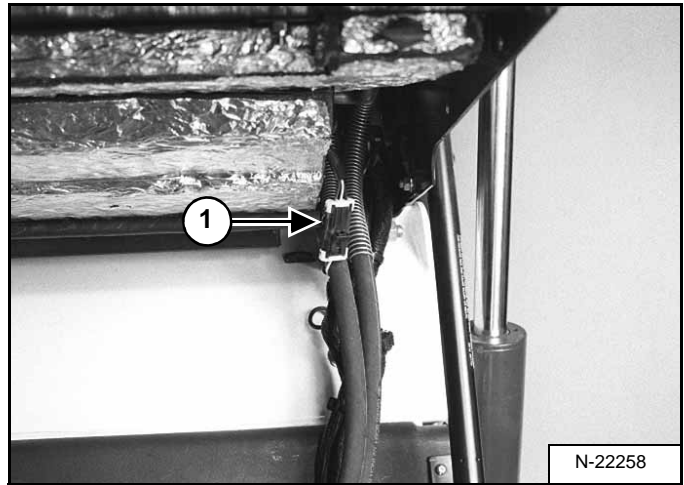
If there is voltage at the harness, check the resistance at the pressure switch (Item 1) [Figure 80-50-20].

If there is no resistance value, check for low refrigerant level. (See BASIC TROUBLESHOOTING on Page 80-50-1.)

If a resistance value is observed, the pressure switch is good.

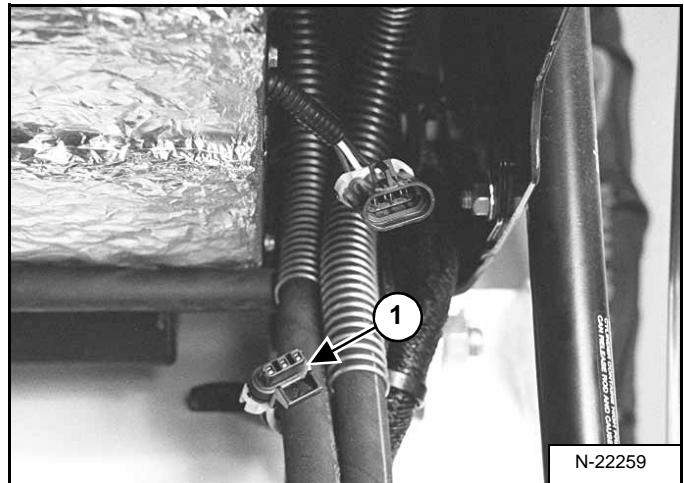
Reconnect the loader harness to the pressure switch.

Figure 80-50-21



Disconnect the thermostat wiring connector (Item 1) [Figure 80-50-21] from the loader wiring harness.

Figure 80-50-22



Check the loader harness (Item 1) [Figure 80-50-22] for voltage. The voltage should be 12 volts.

If there is no voltage at the wiring harness, check the harness for broken wires.

## SYSTEM TROUBLESHOOTING CHART

### Blower motor does not operate.

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. Blown fuse.	Inspect the fuse/wiring.	Replace fuse/repair wiring.
2. Broken wiring or bad connection.	Check the fan motor ground and connectors.	Repair the wiring or connector.
3. Fan motor malfunction.	Check the lead wires from the motor with a circuit tester.	Replace Motor.
4. Resistor malfunction.	Check resistor using a circuit tester.	Replace resistor.
5. Fan motor switch malfunction.	Check power into and out of the fan switch.	Replace Fan Switch.

### Blower motor operates normally, but air flow is insufficient.

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. Evaporator inlet obstruction.	Check evaporator for plugging.	Remove obstruction and clean evaporator fins with air or water.
2. Air leak.	Check to make sure air hoses are properly hooked to Louvers, and air ducts.	Repair or adjust.
3. Defective thermostat switch (frozen evaporator).	Check thermostat using a circuit tester.	Replace thermostat.

### Insufficient cooling although air flow and compressor operation are normal.

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. System low on refrigerant	The high side pressure will be low and bubbles may be present in sight glass on receiver drier.	Repair any leaks and recharge the refrigerant to the correct level.
2. Excessive refrigerant.	The high pressure side pressure will be high.	Use refrigerant recovery equipment to capture excess refrigerant. Charge to the correct refrigerant level.

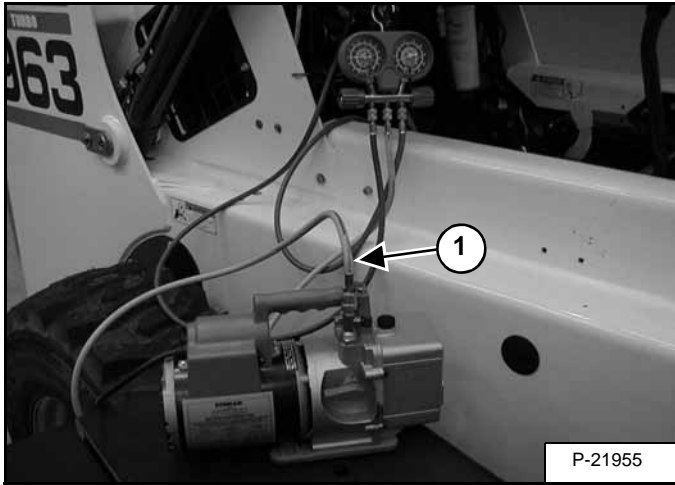
### The compressor does not operate at all, or operates improperly.

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. Loose drive belt.	The belt is vibrating or oscillating.	Adjust tension.
2. Internal compressor malfunction.	The compressor is locked up and the belt slips.	Replace compressor.
<b>Magnetic clutch related</b>		
3. Low battery voltage.	Clutch slips.	Recharge the battery.
4. Faulty coil.	Clutch slips.	Replace the magnetic clutch.
5. Oil on the clutch surface.	Clutch slips.	Replace or clean the clutch surface.
6. Open oil.	Clutch does not engage and there is not reading when a circuit tester is connected between the coil and terminals.	Replace clutch.
7. Broken wiring or poor ground.	Clutch will not engage. Inspect the ground and connections.	Repair.
8. Wiring harness components.	Test the conductance of the pressure switch, thermostat, relay, etc.	Check operation.

## SYSTEM CHARGING AND RECLAMATION (CONT'D)

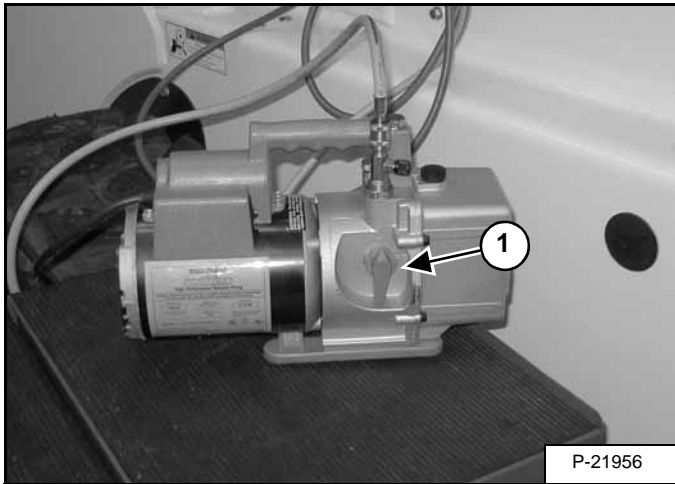
### Charging Procedure With A Manifold Gauge Set (Cont'd)

Figure 80-100-10



Connect the Yellow hose (Item 1) [Figure 80-100-10] to the vacuum pump.

Figure 80-100-11



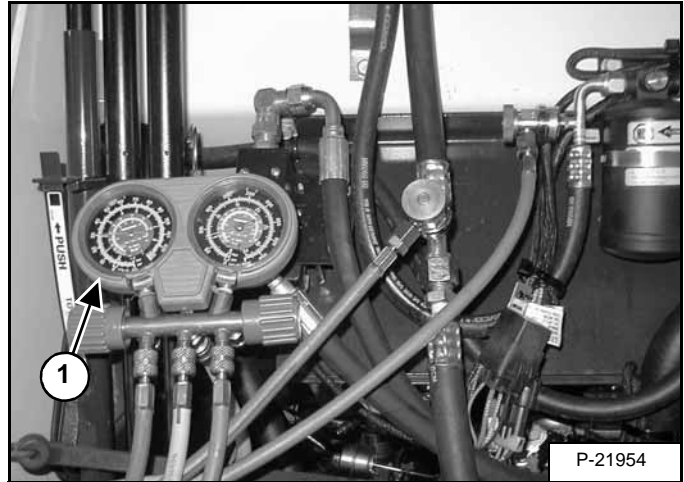
Start the vacuum pump and open ISO-valve (Item 1) [Figure 80-100-11] on the vacuum pump.

Run the vacuum pump for at least 5-10 minutes to insure that a vacuum has been pulled on the system.

Close the ISO-valve (Item 1) [Figure 80-100-11] (which isolates the vacuum pump from the A/C system) and turn OFF the vacuum pump.

## Charging Procedure

Figure 80-100-12

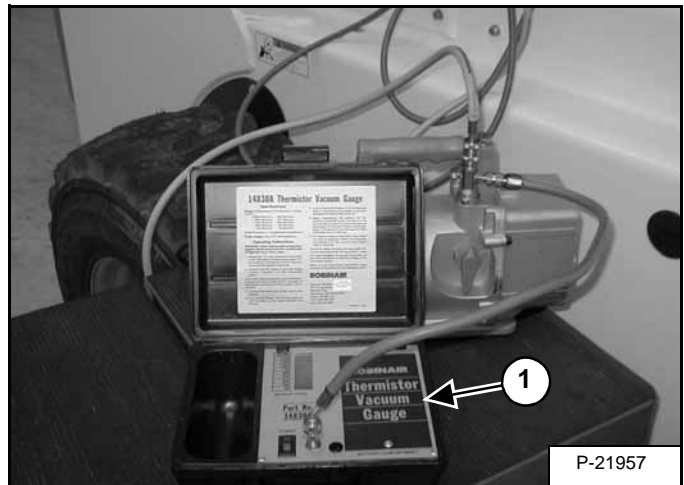


Note vacuum pressure indicated on the low pressure (Blue) gauge (Item 1) [Figure 80-100-12]. Let stand for 5-10 min. and recheck the pressure for changes.

If the pressure drops, this may be an indication of a leak in the A/C system.

Determine the problem with the A/C system and repair it.

Figure 80-100-13



A thermistor vacuum gauge (Item 1) [Figure 80-100-13] can be used to determine the critical vacuum level during evacuation. It is a solid state instrument that constantly monitors and visually indicates the vacuum level.

The thermistor vacuum gauge is used with the vacuum pump [Figure 80-100-13].

Start the vacuum pump and open ISO-valve on the vacuum pump.

## RECEIVER/DRIER

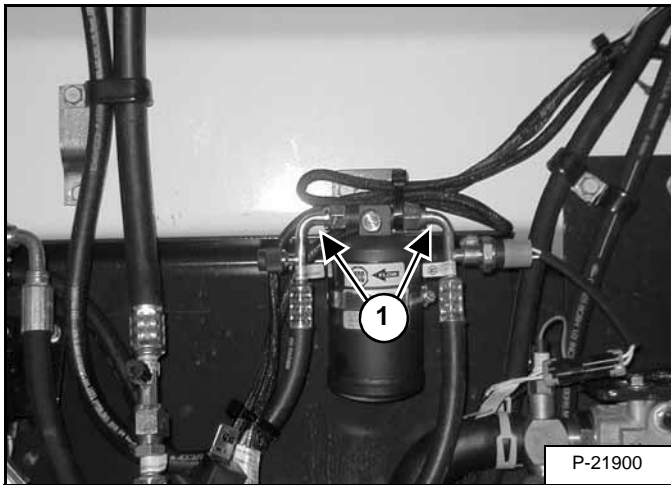
### Removal And Installation

# WARNING

In the event of a leakage, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R134a refrigerant gives a toxic gas.

W-2371-0500

Figure 80-130-1



Raise the loader lift arms and install an approved lift arm support device. (See Engaging The Lift Arm Support Device on Page 10-50-1.)

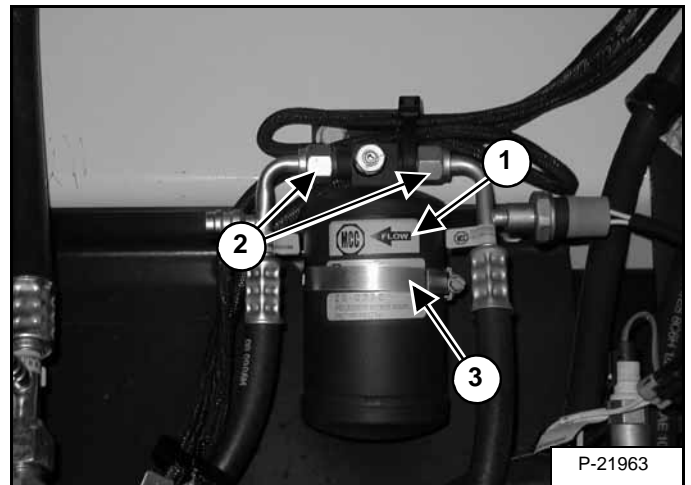
Raise the operator cab. (See Raising The Operator Cab on Page 10-70-1.)

Remove the refrigerant from the A/C system. (See SYSTEM CHARGING AND RECLAMATION on Page 80-100-1.)

Mark the A/C hoses (Item 1) [Figure 80-130-1] for proper installation.

Both fittings on the drier are the same size, so the hoses can be hooked up incorrectly.

Figure 80-130-2



Note the flow direction on the drier (Item 1) [Figure 80-130-2] for proper installation.

Remove the two A/C hoses (Item 2) [Figure 80-130-2] from the receiver/drier.

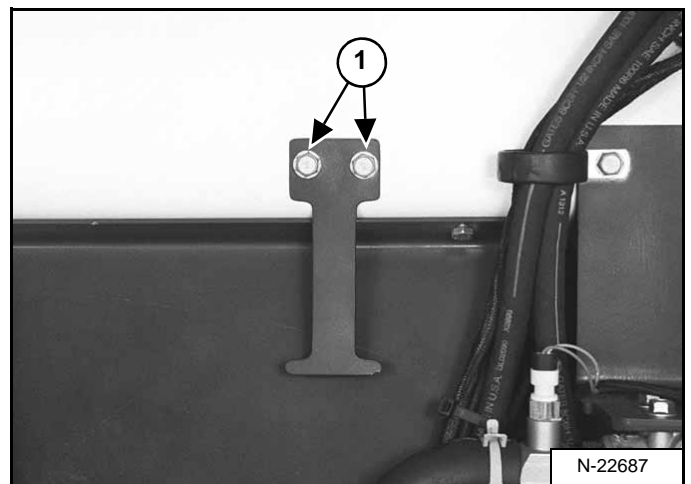
Cap and plug the hoses and the receiver/drier fittings with the proper A/C caps and plugs.

Loosen the hose clamp (Item 3) [Figure 80-130-2] that holds the receiver/drier to the mount.

Remove the receiver/drier from the loader.

**NOTE:** When replacing a receiver/drier in an A/C system 1 fl. oz. (30 cc) of PAG oil must be added to the system when recharging.

Figure 80-130-3

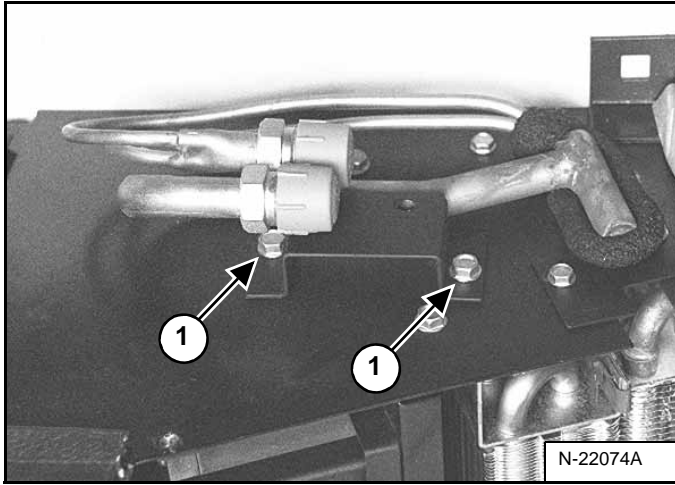


Remove the two mount bolts (Item 1) [Figure 80-130-3] from the receiver/drier mount bracket.

## EXPANSION VALVE (CONT'D)

### Removal And Installation (Cont'd)

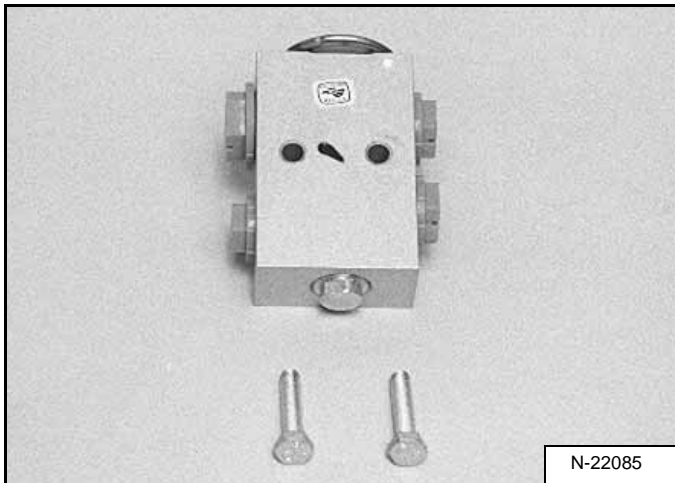
Figure 80-180-4



Remove the two mount bolts (Item 1) [Figure 80-180-4] from the expansion valve mount.

Remove the expansion valve mount from the unit.

Figure 80-180-5



The expansion valve [Figure 80-180-5] is replaced as a complete unit.

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